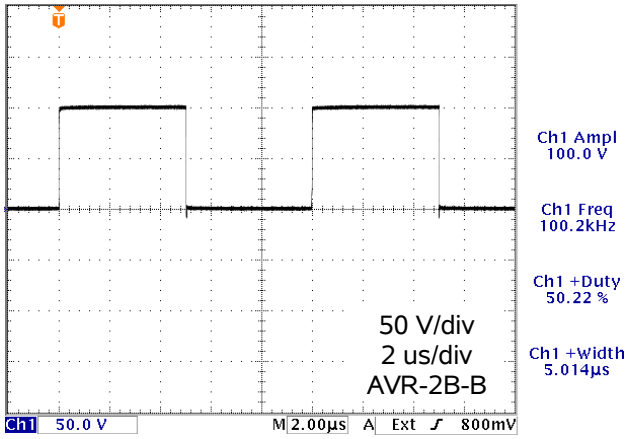
AVTECH

GPIB
IEEE-488

AVR-1, -2, -3 & -4 SERIES

MEDIUM TO HIGH VOLTAGE
GENERAL PURPOSE
PULSE GENERATORS



- **Amplitudes to 50, 100, 200, 250, or 400 Volts**
- **IEEE-488.2 GPIB and RS-232 interfaces**
- **Optional ethernet port for VXI-11.3 support**
- **10 and 15 ns rise and fall times**
- **Pulse widths variable from 0.1 to 100 us**
- **PRF to 10 kHz or 100 kHz**
- **Peak power to 3.2 kW, average power to 50W & 100 W**
- **For time-of-flight and many other applications**

The AVR models are high-voltage pulse generators capable of driving 50Ω (or higher) loads and operating over a wide pulse width range. The instruments include IEEE-488.2 GPIB and RS-232 interfaces. For diode loads, these models can be used to provide up to 1, 2, 4, 5 or 8 Amps of pulsed current if the diode is connected in series with 50Ω. All models operate over a wide pulse width range of 100 ns to 100 us.

Model AVR-1A-B provides amplitudes of up to 50 Volts with rise times of 10 ns. The pulse repetition frequency (PRF) is variable from 1 Hz to 100 kHz, provides average output powers up to 25 Watts and a maximum duty cycle of 50%.

Models AVR-2A-B and AVR-2B-B provide up to 100 Volts with rise times of 10 ns, and repetition rates up to 100 kHz. These models provide average output powers up to 50 and 100 Watts with maximum duty cycles of 25 and 50%, respectively.

The AVR-3-B provides up to 200 Volts with rise times of 10 ns. The PRF is variable from 1 Hz to 10 kHz. This model will provide peak output power of 800 Watts and average outputs of 16 Watts (i.e. 2% maximum duty cycle).

The AVR-3HE-B is similar to the AVR-3-B, but offers higher maximum PRF (to 100 kHz), higher duty cycles (to 10%), and a maximum average output power of 80 Watts.

The AVR-3HF-B offers higher amplitudes (up to 250V), at duty cycles to 4% and maximum average output power of 50 Watts.

The AVR-4-B provides up to 400 Volts out with rise times of 15 ns, and pulse widths variable from 100 ns to 100 us. The PRF is variable from 1 Hz to 10 kHz. This model will provide peak output power of 3.2 kW and average output power of 16 Watts (i.e. 0.5% maximum duty cycle).

The MOSFET output stages in all models 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. The AVR-3-B output stage will source up to 4A, and will automatically shut down if the load current exceeds 4.8A, approximately. Similarly, the AVR-3HF-B will supply 5A and shut down at 6A, and the AVR-4-B will supply up to 8A and shut down at 10A.

Aside from the internal clock, these instruments can also be triggered by a single-pulse pushbutton or an external TTL-level trigger input. When triggered externally the output pulse width can be set to track the input trigger pulse width (PW_{OUT} = PW_{IN}). A delay control and a sync output are provided for scope triggering. A gate input is also provided.

All models include 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.

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. See http://www.avtechpulse.com/options/vxi.

All models are available with positive or negative outputs. A dual-polarity option is also available. The polarity must be specified when ordering, by adding the suffix “-P”, “-N”, or “-PN” to the model number. The output polarity of units with the -PN dual-polarity option can be controlled by the front-panel settings, or by computer commands.

All models are available with a DC-voltage-controlled output amplitude option (0 to +10 V). All models require 100 - 240 Volts, 50 - 60 Hz, and are mounted in a rugged all-metal 4” x 17” x 15” chassis.

LabView drivers for these instruments are available for download at http://www.avtechpulse.com/labview.

Models in the AVR series may be suitable for replacing obsolete models from the former Velonex Corporation in many applications.

Actual test waveforms from shipped units are available from the online data pages for each model, at:

- http://www.avtechpulse.com/medium/avr-2a/#testresults
- http://www.avtechpulse.com/medium/avr-2b/#testresults
- http://www.avtechpulse.com/medium/avr-3/#testresults
- http://www.avtechpulse.com/medium/avr-3hf/#testresults
- http://www.avtechpulse.com/medium/avr-4/#testresults

For higher-voltage applications, Avtech also offers the AVR-5B (500V), AVR-7B (700V), and AVR-8A (1000V) families.

GPIB
IEEE-488

SPECIFICATIONS AVR-1, -2, -3 & -4 SERIES

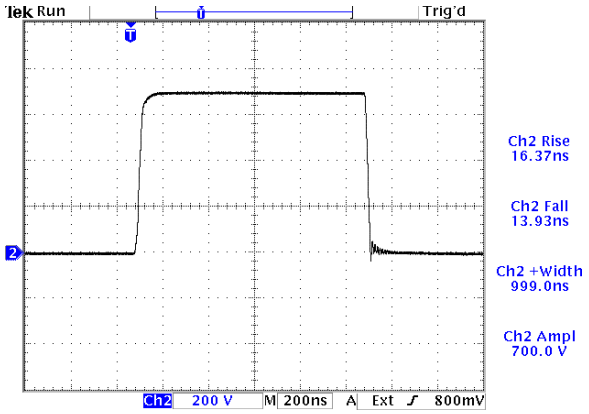
Model[1]:	AVR-1A-B	AVR-2A-B	AVR-2B-B	AVR-3-B	AVR-3HE-B	AVR-3HF-B	AVR-4-B
Amplitude[2,3]: (R_{LOAD} ≥ 50 Ohms)	2.5 to 50 V	5 to 100 V		10 to 200 V	10 to 200 V	10 to 250 V	20 to 400 V
Rise & fall times (20%-80%):	≤ 10 ns						≤ 15 ns
Pulse width (FWHM):	100 ns to 100 us				50 ns to 100 us	100 ns to 100 us	
Maximum PRF:	100 kHz			10 kHz	100 kHz	100 kHz	10 kHz
Duty cycle (max):	50%	25%	50%	2%	10%	4%	0.5%
Max. average power out:	25 Watts	50 Watts	100 Watts	16 Watts	80 Watts	50 Watts	16 Watts
Polarity[4]:	Positive or negative or both (specify)						
Output Impedance:	1.5 Ω, approximately						
Propagation delay:	≤ 150 ns (Ext trig in to pulse out)						
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)						
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 out: 0 to 1.0 seconds, for all trigger modes (including external trigger).						
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads						
Gated operation:	Synchronous or asynchronous, active high or low, switchable.						
Connectors:	Out, Trig, Sync, Gate: BNC						
GPIB & RS-232 control[1]:	Standard feature on all -B units.						
LabView drivers:	Available for download at http://www.avtechpulse.com/labview.						
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.						
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. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.						
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:	Cast aluminum frame and handles, blue vinyl on aluminum cover plates						
Mounting:	Any. Add -R5 to the model number to add a rack-mount kit.						
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) For operation at amplitudes of less than 10% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
3) For analog electronic control (0 to +10V) of amplitude, suffix the model number with -EA. These units also include the standard front-panel controls.
4) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative), or -PN for dual polarity option.
5) Add the suffix -VXI to the model number to specify the Ethernet port.

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

AVR-5, AVR-7, and AVR-8 SERIES

500, 700, 1000 VOLT OUTPUTS
IEEE-488.2 GPIB CONTROLLED
POWER PULSE GENERATORS



A 700V, 1us pulse from model AVR-7B-B

- Amplitudes to 500, 700, or 1000 Volts
- 20 or 50 ns rise and fall times
- Pulse widths variable from 0.1-100 us, or 0.2-200 us
- PRF to 1 kHz or 10 kHz
- Peak power output to 20 kW
- For time-of-flight and many other applications
- IEEE-488.2 GPIB and RS-232 interfaces
- Optional ethernet port for VXI-11.3 support

The AVR-5B, AVR-7B, and AVR-8A series of pulse generators are fast high-voltage pulse generators capable of driving load impedances of 50Ω and higher. These easy-to-use models are suitable for many different test applications, including resistor and attenuator testing, semiconductor and laser diode characterization, time-of-flight applications, and many other applications.

Model AVR-5B-B provides up to 500V out (to 50Ω) with rise times of 20 ns and pulse widths variable from 100 ns to 100 us. The pulse repetition frequency (or "PRF") is variable from 1 Hz to 10 kHz. This model will provide peak output power of 5000 Watts and average outputs of 50 Watts (i.e. 1% maximum duty cycle). The standard output connector is N-type.

Model AVR-7B-B is similar, but provides up to 700V (to 50Ω). This model will provide peak output power of 10000 Watts and average outputs of 50 Watts (i.e. 0.5% maximum duty cycle).

The AVR-8A-B provides up to 1000V out (to 50Ω) with rise times of 50 ns and pulse widths variable from 200 ns to 200 us. PRF is variable from 1 Hz to 1 kHz. This model will provide peak output power of 20000 Watts and average outputs of 40 Watts (i.e. 0.2% maximum duty cycle). The standard output connector is SHV-type.

The output stages in all models 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. The outputs will source up to 12, 16, or 23 Amps (for models AVR-5B-B, AVR-7B-B, and AVR-8A-B, respectively) and will automatically shut down if the load current exceeds this rated current.

Aside from the internal clock, all models can also be triggered by a single-pulse pushbutton or an external TTL-level trigger input. When triggered externally, the output pulse width can be set to track the input trigger pulse width ($PW_{OUT} = PW_{IN}$). A delay control and a sync output are provided for oscilloscope triggering. A gate input is also provided. Either output polarity can be provided, as well as a dual output polarity option.

All models include a computer control interface (see http://www.avtechpulse.com/gpib for details). 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 back-lit 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, and LabView drivers are available for download at http://www.avtechpulse.com/labview.

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. See http://www.avtechpulse.com/options/vxi.

All models are available with optional electronic analog control of the amplitude (the "-EA" option). With this feature, the output amplitude may be controlled by an externally applied analog DC voltage (0 to +10 V).

The amplitude is controlled by internal high-voltage DC power supplies. Standard models use a simple low-power discharge circuit to reduce the amplitude when settings are lowered. A higher-power / higher-speed active-discharge circuit is available as an option (-QD option), which reduces the discharge times significantly. This option is recommended for high-throughput production-line test applications.

The standard output connectors may optionally be changed from N (on the AVR-5 and AVR-7 series) or SHV (AVR-8) to SHV, MHV or HN by adding "-SHV", "-MHV", or "-HN" to the model number. All models require 100 - 240 V, 50 - 60 Hz, and are mounted in a rugged all-metal 3.9" x 17" x 14.8" chassis.

A burst mode option is also available, allowing a burst of 1-500 pulses to be generated in response to a single trigger event (http://www.avtechpulse.com/options/br).

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

The maximum pulse widths and duty cycles of these instruments may be extended if the intended load is high-impedance (i.e., much greater than 50Ω, such as a plate load). Contact the factory with your special requirements. A parametric search engine is available online at http://www.avtechpulse.com/pick to assist you in selecting the best instrument for your application.

Models in the AVR series may be suitable for replacing obsolete models from the former Velonex Corporation in many applications.

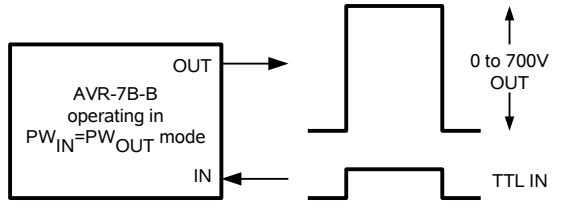
For applications requiring high-voltage pulses with faster rise times, see the AVRZ-5 series (datasheets & pricing are available at http://www.avtechpulse.com/speed), which offers 0 to 500V pulses with 9 ns rise times, and pulse widths as low as 15 ns or as high as 10 us.

See also the AVRF Series (datasheets and pricing at http://www.avtechpulse.com/medium/avrf-7a) for 600 Volt and 750 Volt units with 6 and 7.5 ns rise times.

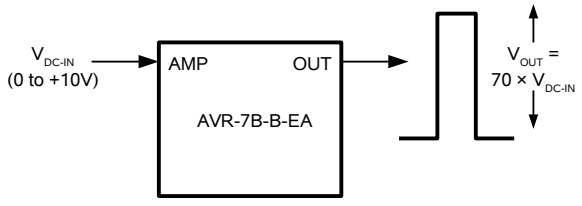
Actual test waveforms from shipped units are available from the online data pages for each model, at:

- http://www.avtechpulse.com/medium/avr-5b/#testresults
- http://www.avtechpulse.com/medium/avr-7b/#testresults
- http://www.avtechpulse.com/medium/avr-8a/#testresults

AVR-5B-B



When triggered externally, these instrument may be operated in Mode A or Mode B. For Mode A, the pulse width is controlled by the front panel controls but in Mode B the output pulse width equals the input trigger pulse width. For a 50Ω load, the pulse width may be as high as 100 us but for very high impedance loads (e.g. a parallel plate load), the pulse width may extend to DC.



The output amplitude of units with the -EA option may be controlled either by the front panel controls or by an externally applied 0 to + 10 V_{DC} control voltage. Note that when driving a 50Ω load the pulser will supply up to 14A to the load. Also note that the pulsers have an extremely low source impedance (≈ 2Ω) so the output is largely independent of the load resistance (e.g. 700V maximum for a 50Ω load and for a high impedance load).

Use the “Pick the Perfect Pulser” parametric search engine
at http://www.avtechpulse.com/pick
to find the best pulser for your application!

GPIB IEEE-488

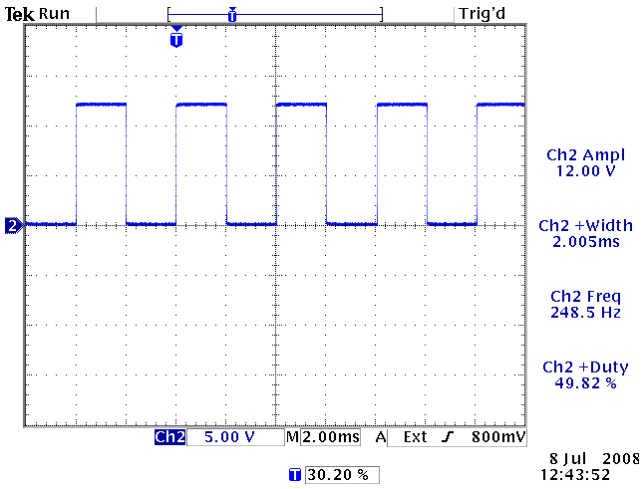
SPECIFICATIONS AVR-5B,-7B,-8A SERIES

Model[1]:	AVR-5B-B	AVR-7B-B	AVR-8A-B
Amplitude: ($R_L \geq 50\Omega$) [2,3]:	< 20 to 500 Volts	< 25 to 700 Volts	< 25 to 1000 Volts
Output impedance:	2Ω, approximately		
Rise & fall times (20%-80%):	≤ 20 ns		≤ 50 ns
Pulse width (FWHM)[4]:	100 ns to 100 us		200 ns to 200 us
PRF: external trigger mode: internal trigger:	0 to 10 kHz 1 Hz to 10 kHz		0 to 1 kHz 1 Hz to 1 kHz
Duty cycle (max):	1%	0.5%	0.2%
Average power out (max):	50 Watts		40 Watts
Max. droop at max. pulse width:	4%		6%
Amplitude discharge time constant, τ_{DIS} (typical)[12]:	2 seconds	Standard: 16 seconds With -QD option: 1 second	Standard: 30 seconds With -QD option: 1 second
Minimum time between full discharges of the HV PS[13]:	10 seconds	Standard: > 5 τ_{DIS} With -QD option: 10 seconds	
Amplitude charge-up time (typical)[14]:	< 8 seconds		
Polarity[5]:	Positive or negative or both (specify -P, -N, or -PN)		
GPIB and RS-232 control[2]:	Standard on -B units. See http://www.avtechpulse.com/gpib for more information.		
LabView Drivers:	Available at http://www.avtechpulse.com/labview.		
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Optional[6]. 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 ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.		
Burst mode:	Optional[11]. Generates 1-500 pulses per trigger event. See http://www.avtechpulse.com/options/br.		
Propagation delay:	≤ 200 ns (Ext trig in to pulse out)		
Jitter (Ext trig in to pulse out):	± 100 ps ± 0.03% of sync delay		
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 out: 0 to 1.0 seconds, for all trigger modes (including external trigger).		
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads		
Gated operation:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.		
Connectors:	OUT: N[7,8] Trig, Sync, Gate: BNC		OUT: SHV[9,10] Trig, Sync, Gate: BNC
Power requirements:	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 material:	cast aluminum frame and handles, blue vinyl on aluminum cover plates		
Temperature range:	+5°C to +40°C		

1) -B suffix indicates GPIB-equipped model.
2) For analog electronic control (0 to +10V) of amplitude, add the suffix -EA to the model number. Electronic control units also include the standard front panel controls.
3) For operation at amplitudes of less than 10% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
4) 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).
5) Indicate desired polarity by suffixing the model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option.
6) Add the suffix -VXI to the model number to specify the Ethernet port.
7) SHV, MHV or HN output connectors can also be provided. To specify, suffix the model number with -SHV, -MHV or -HN as required.
8) An N-male to BNC-female adapter (Amphenol P/N 31-216) is available. Add the suffix -ADPT2 to the model number to order this adapter.
9) An adapter kit, consisting of an SHV PLUG to MHV FEMALE adapter and an MHV MALE to BNC FEMALE adapter, is available. Add the suffix -ADPT1 to the model number to order this kit.
10) MHV, N or HN output connectors can also be provided. To specify, suffix the model number with -MHV, -NC or -HN as required.
11) 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.
12) The output amplitude is controlled by internal high-voltage DC power supplies. When the amplitude setting is reduced, the high voltage decays in an exponential fashion, with the typical time constant noted in this specification. The -QD option provides a fast active-discharge circuit.
13) More frequent discharges will cause the instrument to overheat, and may cause damage.
14) The output amplitude is controlled by internal high-voltage DC power supplies. This is the time required for the power supplies to rise from 5% to 95% of their full value in response to a change in settings from zero to the maximum setting.

AVR-9 SERIES

12 AND 20 VOLT, 1.2 TO 20 AMP
IEEE-488.2 GPIB CONTROLLED
HIGH CURRENT PULSE GENERATORS



AVR-9A-B output, 12V, 250 Hz, 50% duty cycle, into 10Ω

- IEEE-488.2 GPIB and RS-232 control
- Peak outputs to 20V into 1 Ohm, 20 Amps
- Pulse widths from 200 ns to 2 ms
- Rise times as low as 10 ns
- Ideal for solenoid and MOSFET testing
- PRF as high as 50 kHz

The AVR-9 series of pulse generators offer fast medium voltage pulsing with high current capability. These models are ideal for driving solenoids, pulse testing of MOSFETs, and other applications.

Model AVR-9A-B provides up to 12 Volts into load impedances of 10 Ω or greater, with rise times of 10 ns and pulse widths from 200 ns to 2 ms. The pulse repetition frequency (PRF) is variable from 0 to 50 kHz, and the maximum output duty cycle is 50%.

Model AVR-9B-B is similar, but provide higher amplitudes of up to 20V into 10 Ω. The rise and fall times are 15 ns.

Model AVR-9C-B can drive even lower load impedances, providing up to 12 Volts into a load of 1Ω or higher (i.e., up to 12 Amps of current). The rise and falls times are 50 ns, and the pulse width is variable from 200 ns to 200 us. The PRF is variable from 0 to 5 kHz, and the maximum output duty cycle is 10%.

Model AVR-9D-B has the highest current rating, providing amplitudes of up to 20V into 1Ω (i.e., up to 20 Amps of current). The rise and falls times are 80 ns, and the pulse width is variable from 200 ns to 200 us. The PRF is variable from 0 to 5 kHz, and the maximum output duty cycle is 10%.

The AVR-9A and AVR-9B series both provide a front-panel BNC connector for the main output.

The higher-current AVR-9C and AVR-9D models have a rear-panel DB-37 output connector to which a unique 100 cm long high-current transmission line may be attached. This line has a characteristic impedance of 1 Ohm. A medium-power test load (5 Watts) is provided with these models for the convenience of initial testing purposes. See http://www.avtechpulse.com/transmission/av-clz1 and http://www.avtechpulse.com/accessories/av-ctl1 for additional information about cables and test loads.

All models are available with positive or negative outputs. The polarity must be specified when ordering, by adding "-P" or "-N" to the model number.

In all models, 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. The output stage will source up to 120% of the maximum rated current, and will automatically shut down if the load current exceeds this amount.

Aside from the internal clock, all models can also be triggered by a single-pulse pushbutton or an external TTL-level trigger input. When triggered externally, the output pulse width can be set to track the input trigger pulse width (PW_{OUT} = PW_{IN}). A delay control and a sync output are provided for oscilloscope triggering. A gate input is also provided.

All models include 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 back-lit 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, and LabView drivers are available for download at the Avtech web site (http://www.avtechpulse.com/labview).

Some parameters can be modified to suit particular requirements. Contact the Avtech factory with your special requirement (info@avtechpulse.com)!

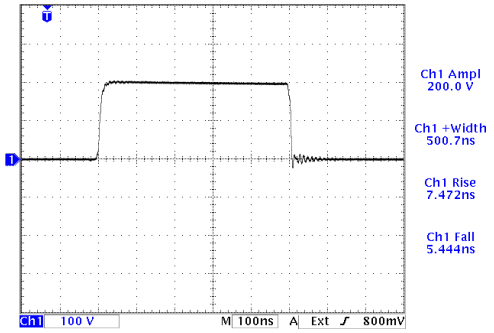
Model:	AVR-9A-B	AVR-9B-B	AVR-9C-B	AVR-9D-B
Amplitude:	0 to 12V, $R_L \geq 10\ \Omega$, 1.2 Amps maximum	0 to 20V, $R_L \geq 10\ \Omega$, 2.0 Amps maximum	0 to 12V, $R_L \geq 1\ \Omega$, 12 Amps maximum	0 to 20V, $R_L \geq 1\ \Omega$, 20 Amps maximum
Pulse width (FWHM)[1]:	0.2 to 2000 us		0.2 to 200 us	
Rise time, fall time (20%-80%):	≤ 10 ns	≤ 15 ns	≤ 50 ns	≤ 80 ns
Duty cycle (maximum):	50%		10%	
Average output power (max):	7.2W	20W	14.4W	40W
PRF:	0 to 50 kHz		0 to 5 kHz	
Output impedance:	≤ 0.5 Ω		≤ 0.1 Ω	
Polarity[2]:	Positive or negative (specify -P or -N)			
GPIB and RS-232 control[3]:	Standard on -B units.			
LabView Drivers:	Check http://www.avtechpulse.com/labview for availability and downloads			
Propagation delay:	≤ 150 ns, Ext Trig in to pulse out			
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)			
Trigger required (for Ext Trig mode)	Mode A: +5 Volt, 50 ns or wider (TTL) Mode B: +5 Volt, $PW_{IN} = PW_{OUT}$ (TTL)			
Sync delay:	Variable 0 to ± 1 s (sync out to pulse out)			
Sync output:	+ 3 Volt, 100 ns, will drive 50 Ohm loads			
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.			
Connectors, output:	BNC		DB-37 female, to mate with the provided AV-CLZ1-100 cable. Pins 1-19 = signal, pins 20-37 = ground.	
Supplied output transmission line:	N/A		AV-CLZ1-100[4]	
Supplied test load:	N/A		AV-CTL1-ENC[5]	
Connectors, other:	BNC			
Power requirements:	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 material:	cast aluminum frame and handles, blue vinyl on aluminum cover plates			
Mounting:	Any			
Temperature range:	+5°C to +40°C			

1) 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).
2) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative).
3) Provides IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, polarity, PRF and delay. (See http://www.avtechpulse.com/gpib).
4) See http://www.avtechpulse.com/transmission/av-clz1 for details.
5) See http://www.avtechpulse.com/accessories/av-ctl1 for details.

AVR-9A-B

AVR-A & AVR-S SERIES

200 & 250 V, 3 & 10 ns RISE TIME
PULSE GENERATORS
PULSE WIDTHS 10 ns TO 5 us



AVR-A-1-PW-C-P Output

- Amplitudes to 200V or 250V
- PRF to 100 kHz
- 3 or 10 ns rise and fall times
- Pulse widths from 10 ns to 5 us
- IEEE-488.2 GPIB control available
- Optional ethernet port for VXI-11.3 support

The AVR series provides peak outputs to 200 Volts, with rise and fall times of 2 or 10 ns. Pulse widths as narrow as 10 ns and as wide as 5 us can be provided.

The AVR-A-1-PW family provides 200 Volt pulses with 10 ns rise and fall times. The pulse width may be varied from 50 ns to 500 ns. The maximum pulse repetition frequency (PRF) is 100 kHz, and the maximum duty cycle is 0.5%.

The AVR-S3 family is similar, except it offers faster rise and fall times of 3 ns. The maximum PRF is 10 kHz, and the pulse width is variable from 100 ns to 5 us (subject to a 0.5% duty cycle limit). The maximum amplitude is 200 Volts. A 50 Ohm load is required.

For applications requiring narrow pulses or fast response times, the AVR-A-1-S2 family offers pulse widths of 10 to 200 ns, with a minimal 30 ns propagation delay (when externally triggered).

For higher voltage, higher power applications, the AVR-AHF-1-B generates amplitudes to 250 Volts, with PRF to 100 kHz, duty cycles to 4%, and average output powers to 50 Watts. The pulse width is adjustable from 50 ns to 500 ns. (For wider pulse widths, consider the AVR-3HF-B as well – http://www.avtechpulse.com/medium/avr-3hf.)

Instruments with the -B suffix include a complete computer control interface. This provides GPIB and RS-232 computer-control, as well as front panel keypad and adjust knob control of the output pulse parameters. (See http://www.avtechpulse.com/gpib for details.) 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, and LabView drivers are available (http://www.avtechpulse.com/labview).

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, please see http://www.avtechpulse.com/options/vxi.

The -C versions provide output pulse parameters similar to those of the -B models, but do not include the GPIB or RS-232 interfaces (i.e. no computer control or LCD display). The output parameters are controlled by front-panel range switches and one-turn controls. All models require 100-240V, 50-60 Hz AC power.

A delay control and a sync output are provided on all models for oscilloscope triggering purposes. The units can also be triggered externally using a TTL-level pulse.

These models are protected from overload conditions (such as excessively high duty cycle or short circuited load) by an automatic control feature that limits the output power for as long as the overload condition persists.

Either output polarity or an optional dual output polarity can be provided. Polarity inversion in dual polarity -C units is accomplished by means of a two-position switch. -B units provide keypad / computer control of the polariy.

A DC offset or bias insertion option is available. Units with this option include a circuit similar to Model AVX-TC (see http://www.avtechpulse.com/bias/avx-tc) at the output.

All models can also be supplied with voltage-controlled output amplitude options (0 to +10V). Units with the analog electronic control option also include the standard front-panel controls.

-B STYLE UNIT

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

SPECIFICATIONS

AVR SERIES

Model:	AVR-AHF-1-B[2]	AVR-A-1-PW-C[1] AVR-A-1-PW-B[2]	AVR-S3-B[2]	AVR-A-1-S2-C[1]
Amplitude[3,4,5]: (50 Ohm load)	< 10 to 250 Volts	< 10 to 200 Volts		
Pulse width (FWHM)[3,5]:	50 to 500 ns	50 to 500 ns	100 ns to 5 us	10 ns to 200 ns
PRF:	0 to 100 kHz	0 to 100 kHz	0 to 10 kHz	0 to 10 kHz
Rise & fall times (20%-80%):	≤ 10 ns	≤ 10 ns	≤ 3 ns	≤ 3 ns
Maximum duty cycle:	4%	0.5%		0.2%
Maximum avg. output power:	50 Watts	4 Watts		1.6 Watts
Required load:	≥ 50 Ω		50 Ω ± 10%[8]	
Polarity[6]:	Positive or negative or both (specify)			
Front-panel controls:	-B units: keypad and adjust knob, and GPIB / RS-232 control -C units: decade range switches & one-turn dials for PRF, pulse width & delay; one-turn dial for amplitude.			
GPIB and RS-232 control[2]:	Standard on -B units. Not available on -C.			
LabView drivers:	-B units only: check http://www.avtechpulse.com/labview for availability and downloads			
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	-B units only: Optional[9]. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.			
Settings resolution (-B units only):	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 (-B units only):	Typically ± 3% (plus ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.			
Propagation delay:	≤ 100 ns (Ext trig in to pulse out)			
Jitter:	± 100 ps ± 0.03% of sync delay, Ext trig in to pulse out			
DC offset or bias insertion:	Option available. Apply required DC offset or bias in the range of ± 50 Volts, (250 mA max) to back panel solder terminal. See note 7.			
Trigger modes: -B units:	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.			
-C units:	Internal trigger, or external trigger (TTL level pulse, > 50 ns, 1 kΩ input impedance).			
Variable delay: -B units:	0 to 1.0 seconds, for all trigger modes (including external trigger).			
(Sync to main out) -C units:	0 to 200 ns, for internal trigger mode only. No variable delay in external trigger mode.			
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads			
Gate input: (-B units only)	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.			
Connectors:	Out, Trig, Sync, Gate (-B only): BNC			
Dimensions:	100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8")			
Power requirements:	100 - 240 Volts, 50 - 60 Hz			
Chassis material:	Cast aluminum frame & handles, blue vinyl on aluminum cover plates			
Mounting:	Any			
Temperature range:	+5°C to +40°C			

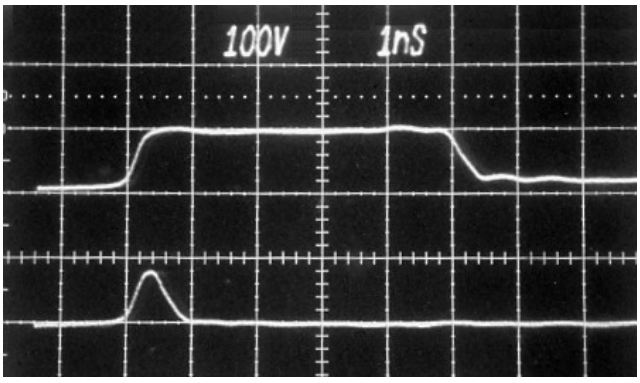
1) -C suffix indicates stand-alone lab instrument with internal clock and line powering. No suffix indicates miniature module requiring DC power and external trigger. (See http://www.avtechpulse.com/formats for details of the four basic instrument formats).
2) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (See http://www.avtechpulse.com/gpib).
3) For analog electronic control (0 to +10V) of the amplitude, suffix model number with -EA. Electronic control units also include standard front-panel controls.
4) For operation at amplitudes of less than 10% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
5) For 10-turn dial control of pulse width (or amplitude) suffix model number with -PWT (or -AT). For -C units only.
6) Indicate desired polarity by suffixing model No. by -P or -N (i.e. positive or negative) or -PN for dual polarity option. Polarity reversal is achieved by means of a two-position switch on -C units and by keypad control on -B units.
7) For DC offset option suffix model number with -OS.
8) The instrument may be damaged by load impedances outside this range.
9) Add the suffix -VXI to the model number to specify the Ethernet port.

-C STYLE UNIT

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

AVR-E SERIES

20 - 100 VOLT
0.3 - 1.0 ns RISE AND FALL TIME
1 ns - 5 us PULSE WIDTH



AVR-E4-B-P, at maximum & minimum pulse widths.
100 V/div, 1 ns/div, 100 kHz.

- 20, 50 or 100 Volt peak outputs
- 0.3 ns rise times
- 1 ns to 5 us pulse widths
- PRF to 1 MHz
- IEEE-488.2 GPIB control available (-B units)

The AVR-E family offers medium-to-high voltage pulses with very fast rise and fall times.

The AVR-E1 series provides peak outputs to 20V, with pulse widths variable from 10 to 200 ns, pulse repetition frequencies to 200 kHz, and rise times of 300 ps. The minimum pulse width can optionally be reduced to 1 ns. The maximum pulse width can optionally be increased to 5 us, with a reduction in the maximum PRF to 20 kHz.

The AVR-E2 series has similar pulse width ratings, but offers a higher maximum amplitude of 50V, with 500 ps rise times and 1 ns fall times.

The AVR-E3 series offers a maximum amplitude of 100V, with 500 ps rise time, 1 ns fall time, and a maximum PRF of 100 kHz (or 20 kHz with the wider pulse width options).

The AVR-E3A series also provides a maximum amplitude of 100 V but with a 1.2 ns rise, a 10 to 500 ns pulse width range and a maximum PRF of 200 kHz.

The narrow-pulse AVR-E4 series can generate 100V pulses with pulse widths variable from 1 to 5 ns, at repetition rates to 100 kHz. The AVR-E5 series covers the pulse width range of 1 to 10 ns, with 50V maximum amplitude and a maximum repetition rate of 1 MHz.

The AVR-E6 series covers the pulse width range of 8 to 30 ns, with 100V maximum amplitude and a maximum repetition rate of 2 MHz.

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

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

All models are protected from overload conditions (such as excessively high duty cycle or short circuited load) by an automatic control feature that limits the output power for as long as the overload condition exists.

A delay control and a sync output are provided for scope triggering purposes. The units can also be triggered externally using a TTL-level pulse. Either output polarity or an optional dual output polarity can be provided. A DC offset or bias insertion option is available. Units with this option include a circuit similar to Model AVX-TC (see http://www.avtechpulse.com/bias/avx-tc for details) at the output. The required DC offset or bias is applied directly to rear panel solder terminals.

Visit http://www.avtechpulse.com for application notes, data sheets, LabView drivers, pricing, and more!

Many models can be customized to meet specific requirements. Contact Avtech engineers at info@avtechpulse.com for details.

Typical waveforms from actual production units are available online. See the individual product pages at:

http://www.avtechpulse.com/speed
http://www.avtechpulse.com/medium

SPECIFICATIONS

AVR-E SERIES

Model[1]:	AVR-E1-B	AVR-E2-B	AVR-E3-B	AVR-E3A-B	AVR-E4-B	AVR-E5-B	AVR-E6-B
Maximum amplitude[2]: (50Ω load[7])	20V	50V	100V	100V	100V	50V	100V
Rise time (20%-80%):	≤ 0.3 ns	≤ 0.5 ns	≤ 0.5 ns	≤ 1.2 ns	≤ 0.4 ns	≤ 0.5 ns	≤ 2.0 ns
Fall time (80%-20%):	≤ 0.6 ns	≤ 1.0 ns	≤ 1.0 ns	≤ 2.0 ns[6]	≤ 0.6 ns	≤ 1.0 ns	≤ 2.0 ns
Pulse width (FWHM):	standard units: 10 ns to 200 ns with -W1 option: 1 ns to 200 ns with -W2 option: 50 ns to 5 us with -W3 option: 1 ns to 5 us			10 to 500 ns	1 to 5 ns	1 to 10 ns	8 to 30 ns
Maximum PRF: Standard units, or with -W1 option: Units with -W2 or -W3 options:	200 kHz 20 kHz		100 kHz 20 kHz	200 kHz	100 kHz	1 MHz	2 MHz
Maximum duty cycle:	5%			2%	N/A		
Polarity:	Positive or negative or both (specify[3])						
DC offset or bias insertion:	Option available[4]. Apply required DC offset or bias in the range of ± 25 Volts, (250 mA max) to back panel solder terminals.						
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.						
Variable delay (Sync to main out):	0 to 1.0 seconds, for all trigger modes (including external trigger).						
Propagation delay:	≤ 160 ns (Ext trig in to pulse out)						
Jitter: (Ext trig in to pulse out)	± 35ps ± 0.015% of sync delay						
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads						
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.						
Connectors:	Out: SMA, Other: BNC						
Power requirements:	100 - 240 Volts, 50 - 60 Hz						
GPIB and RS-232 control[1]:	Standard on -B units.						
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[5]. 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, after 10 minute warm-up:	Amplitude: Typically ± (3% of setting) ± (2% of maximum). Delay, Period: Typically ± (3% of setting) ± (5 ns) Pulse width: Typically ± (3% of setting) ± (2 ns), at maximum amplitude. As the amplitude is reduced, the pulse width may shift ± 5 ns. For high-accuracy applications requiring traceable calibration, verify the output with a calibrated oscilloscope.						
Dimensions (H x W x D):	100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8")						
Chassis material:	cast aluminum frame and handles, blue vinyl on aluminum cover plates						
Temperature range:	+5°C to +40°C						

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (see http://www.avtechpulse.com/gpib).
2) For operation at amplitudes of less than 10% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
3) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option. The -PN option is not available on -W3 units.
4) For DC offset option suffix model number with -OS.
5) Add the suffix -VXI to the model number to specify the Ethernet port..
6) Fall time increases to < 3 ns for pulse widths less than 15 ns.
7) A 50Ω load is required. Other loads may damage the instrument. Consult Avtech (info@avtechpulse.com) if you need to drive other load impedances.

AVR-E3-B

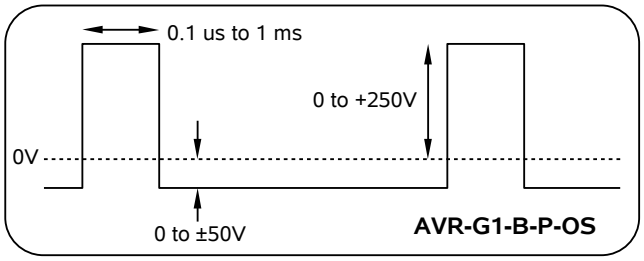
(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

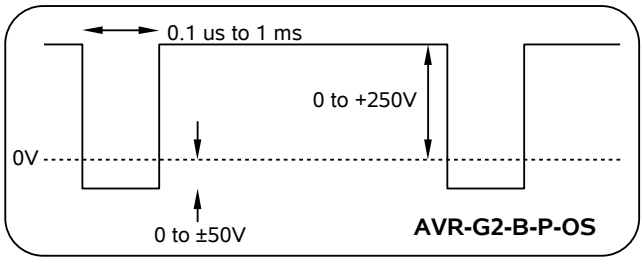
AVTECH

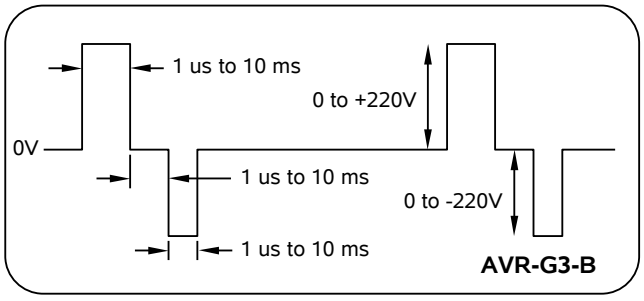
GPIB
IEEE-488

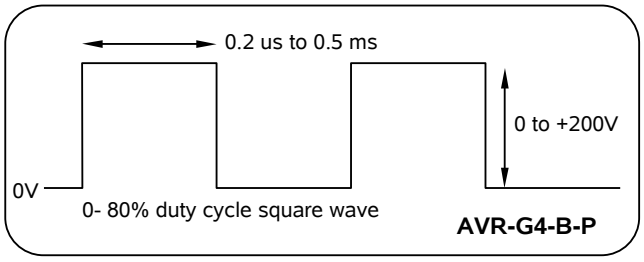
AVR-G SERIES

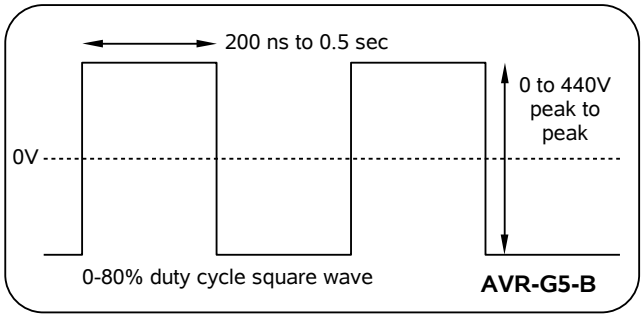
MEDIUM VOLTAGE BLANKING AND GATING GENERATORS AND EOM DRIVERS











- Amplitudes to ± 250 Volts
- Pulse width from 100 ns to 0.5 sec
- Rise, fall times as low as 10 ns
- PRF to 1 MHz
- IEEE-488.2 GPIB / RS-232 standard
- Ethernet optional

The AVR-G series is specifically designed for gating and beam blanking applications requiring amplitudes up to ± 250 Volts, pulse widths from 100 ns to 0.5 sec and duty cycles as high as 50%. This series is designed to drive high impedance loads such as microchannel plates, grids and beam deflection plates. This series is also suitable for driving certain high-impedance electro-optic modulators (EOMs). Typical output waveforms provided by each of the five standard models in this series are shown on this page. It should be noted that the versatile AVR-G technology can be readily adapted to provide a wide variety of other waveforms (e.g., higher voltages, dual outputs, alternating polarity, etc). Contact Avtech if your particular requirement is not covered by the five standard models.

Model AVR-G1-B provides up to 250 Volts out, pulse widths from 100 ns to 1 ms, PRF to 10 kHz and duty cycles to 80%. An option is available which allows the inter-pulse baseline to be offset by 0 to ± 50 Volts. A switchable output polarity option is also available. Another option allows the polarity to invert with each pulse, to generate a bipolar waveform.

Model AVR-G2-B provides an output which is basically the complement of the AVR-G1-B output - that is, the output potential is high (and variable) during the inter-pulse interval. The amplitude during this interval is variable from 0 to 250 Volts (via a one-turn control) while the amplitude during the pulse is fixed at 0 Volts. However, the OS option allows the voltage during the pulse to be varied from 0 to ± 50 Volts.

Model AVR-G3-B provides a bipolar waveform - each trigger event generates a positive output pulse followed by a negative pulse. The amplitudes and pulse widths for the two pulses are independently variable (from 0 to 220 Volts and 1 us to 10 ms respectively). The pulse separation (from the trailing positive edge to the leading negative edge) is variable from 1 us to 10 ms.

Model AVR-G4-B generates a unipolar pulse with amplitudes of 0 to 200V. The pulse width is adjustable from 200 ns to 500 us, subject to a maximum duty cycle limit of 50%. The PRF is variable from 1 Hz to 1 MHz. A dual polarity option is available.

Model AVR-G5-B generates a bipolar waveform. The output swings between +V and -V (equal but opposite voltages), for a total peak-to-peak amplitude of up to 440V. The pulse repetition frequency is variable from 1 Hz to 100 kHz, and the pulse width (of the positive portion) is variable from 200 ns to 500 ms.

For all models, the pulse repetition frequency is variable using the internal clock oscillator. A delay control and a sync output are provided for scope triggering purposes. The units can also be triggered externally using a TTL-level pulse. A manual push button is provided for one shot operation. Models are protected from overload conditions (such as excessively high duty cycle or short circuited load) by an automatic control feature which limits the output power for as long as the overload condition persists.

All models with the "-B" suffix include a complete computer control interface (see http://www.avtechpulse.com/gpib for details). 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 back-lit LCD displays the output amplitude, polarity, frequency, pulse width or duty cycle as appropriate, and delay. 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 at the Avtech web site (http://www.avtechpulse.com/labview). An Ethernet port for Telnet-based control is optional on all -B units (-TNT option, for details see http://www.avtechpulse.com/options/tnt).

For operation at higher voltages (up to 800V peak-to-peak), consider using the new AVR-GHV series instead.

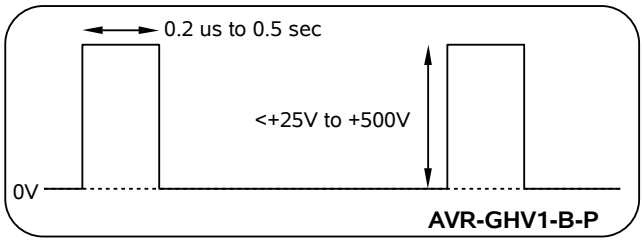
AVTECH

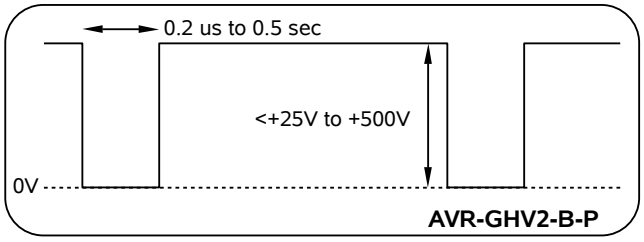
GPIB
IEEE-488

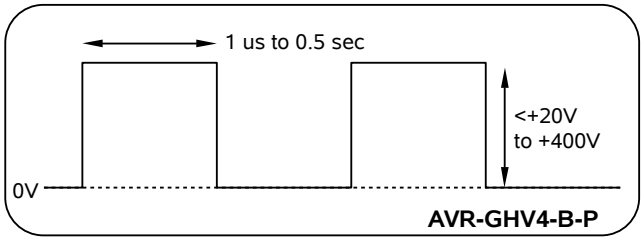
AVR-GHV SERIES

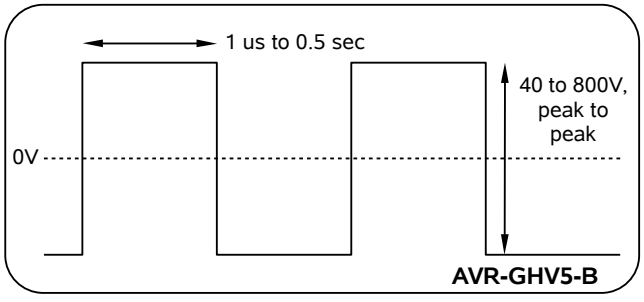
400, 500 & 800 VOLT TIME-OF-FLIGHT BLANKING AND GATING GENERATORS

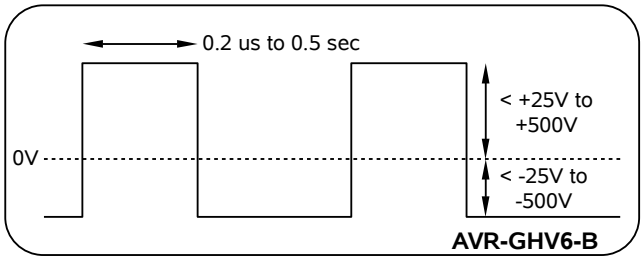
- Amplitudes to ±500 Volts
- Pulse widths from 200 ns to 0.5 sec
- Rise, fall times as low as 30 ns
- PRF to 100 kHz
- Adaptable technology - easily customized
- Variety of pulsing styles (bipolar, inverted, etc)
- IEEE-488.2 GPIB / RS-232 standard
- Ethernet optional











The AVR-GHV series is specifically designed for gating and beam blanking applications requiring amplitudes up to ±500V, pulse widths from ≤ 1 us to 0.5 seconds and duty cycles as high as 80%. This series is designed to drive high impedance loads such as microchannel plates, grids and beam deflection plates. The versatile AVR-GHV technology can be adapted to provide a wide variety of waveforms (e.g., higher voltages, dual outputs, alternating pulse polarity, capacitive loads, etc). Contact Avtech if your particular requirement is not covered by the standard models.

Model AVR-GHV1-B provides up to 500 Volts out, pulse widths from 200 ns to 0.5 sec, PRF to 1 kHz and duty cycles to 80%. Positive, negative, and dual polarity units are available. (Dual polarity units generate one polarity at a time. The polarity can be switched from the front panel, or by computer command. Contact Avtech if you require polarity that alternates with every pulse, or dual outputs.)

Model AVR-GHV2-B provides an output which is the logical complement of the AVR-GHV1-B output - that is, the output potential is high (and variable) during the inter-pulse interval, and zero during the pulse.

Model AVR-GHV4-B is similar to the AVR-GHV1-B, but has a much higher maximum PRF (100 kHz), with a slightly lower maximum amplitude (400V).

Model AVR-GHV5-B offers a bipolar output. The peak-to-peak output amplitude is variable from < 40 to 800V, and swings between negative and positive voltage levels of approximately equal magnitude. The pulse repetition frequency is variable from 1 Hz to 50 kHz.

Model AVR-GHV6-B swings from a negative adjustable voltage (between pulses) to a positive adjustable voltage (during pulsers). The two voltage levels are independently adjustable from <25V to 500V in magnitude.

For all models, the pulse timing may be set in terms of pulse width or duty cycle, as desired. The pulse repetition frequency is variable using the internal clock oscillator. A delay control and a sync output are provided for scope triggering purposes. The units can also be triggered externally using a TTL-level pulse. A manual push button is provided for one-shot operation. Models are protected from overload conditions (such as a short-circuited load) by an automatic control feature which limits the output power for as long as the overload condition persists. All models require 100 - 240V, 50 - 60 Hz prime power.

The output impedance of all models (i.e., the internal resistance in series with the output) is 50Ω, providing back-matching of systems that use coaxial cable on the output. This impedance will absorb transmission line reflections. It also provides passive short-circuit protection, in addition to the active short-circuit protection sensing circuits.

A burst mode option is also available, allowing a burst of 1-500 pulses to be generated in response to a single trigger event. See http://www.avtechpulse.com/options/br for details.

All instruments with the "-B" suffix include a complete computer control interface. (Visit http://www.avtechpulse.com/gpib for details.) 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 back-lit LCD displays the output amplitude, polarity, frequency, pulse width or duty cycle as appropriate, and delay. To allow easy integration into automated test systems, the programming command set is based on the SCPI standard. An Ethernet port is optional (see http://www.avtechpulse.com/options/vxi for details).

For operation at lower voltages, see the related AVR-G series.

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

GPIB
IEEE-488

SPECIFICATIONS AVR-GHV SERIES

Model:	AVR-GHV1-B[1]	AVR-GHV2-B[1]	AVR-GHV4-B[1]	AVR-GHV5-B[1]	AVR-GHV6-B[1]
Amplitude:	<25 to 500 Volts	<25 to 500 Volts	<20 to 400 Volts	<40 to 800 Volts	<25 to 500 Volts
Number of adjustable voltages:	1 (V_{SET})	1 (V_{SET})	1 (V_{SET})	1 (V_{SET})	2 (V_{SETPOS}, V_{SETNEG})
Waveform style (in terms of the set amplitude):	At V_{SET} during pulse, zero between pulses.	At V_{SET} between pulses, zero during pulses.	At V_{SET} during pulse, zero between pulses.	At $+V_{SET}/2$ during pulse, $-V_{SET}/2$ between pulses.	At $+V_{SETPOS}$ during pulse, $-V_{SETNEG}$ between pulses.
Pulse width (FWHM)[2]:	200 ns to 0.5 sec		1 us to 0.5 sec		200 ns to 0.5 sec
Load impedance:	≥ 100 kΩ				
Output impedance:	50 Ω (i.e., internal resistance in series with the output).				
Rise time (20%-80%)[7]:	≤ 40 ns	≤ 40 ns	≤ 30 ns	≤ 100 ns	≤ 100 ns
Fall time (80%-20%)[7]:	≤ 40 ns	≤ 40 ns	≤ 30 ns	≤ 100 ns	≤ 100 ns
PRF:	1 Hz to 1 kHz		1 Hz to 100 kHz	1 Hz to 50 kHz	1 Hz to 10 kHz
Duty cycle:	0 - 80 %				
Polarity[3]:	V_{SET} may be positive or negative or switchable (specify)			Bipolar waveform (standard)	
GPIB and RS-232 control[1]:	Standard on -B units				
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[4]. 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 ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.				
Burst mode:	Optional[5]. Generates 1-500 pulses per trigger event. See http://www.avtechpulse.com/options/br.				
Propagation delay:	≤ 100 ns (Ext trig in to pulse out)				
Jitter (Ext trig in to pulse out):	± 100 ps ± 0.03% of sync delay				
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.				
Variable delay:	Sync to Out: 0 to 1.0 seconds, for all trigger modes (including external trigger).				
Sync output:	+3 Volts, 100 ns, will drive 50 Ohm loads				
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.				
Connectors (OUT)[6]:	Type N				
Connectors (Trig, Sync, Gate):	BNC				
Power requirements:	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 material:	cast aluminum frame and handles, blue vinyl on aluminum cover plates				
Mounting:	Any. Add the suffix -R5 to the model number to include a rack-mount kit.				
Temperature range:	+5°C to +40°C				

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width or duty cycle (as appropriate), pulse repetition frequency, and delay (See http://www.avtechpulse.com/gpib).
2) When triggered externally, the pulse width can be set by the pulse instrument controls, or it may be set to track the input trigger pulse width.
3) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option (controlled by a two-position switch which controls the polarity of the signal output port). Keypad polarity control on -B units.
4) Add the suffix -VXI to the model number to specify the Ethernet port.
5) 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.
6) HV, MHV or HN output connectors can also be provided. To specify, suffix the model number by -SHV, -MHV or -HN as required.
7) Valid when the load is connected with zero cable length (for instance, on a binding post adapter). The rise and fall times will degrade for non-zero lengths of cable, due to the product of the 50 Ohm output impedance and the cable capacitance. The maximum cable length for operation (with degraded rise and fall times) is 2 meters (6 feet). If your application requires longer cable lengths, contact Avtech for appropriate modifications or applications assistance.

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

GPIB IEEE-488

SPECIFICATIONS AVR-G SERIES

Model:	AVR-G1-B[1]	AVR-G2-B[1]	AVR-G3-B[1]	AVR-G4-B[1]	AVR-G5-B[1]
Amplitude[10]:	0 to 250 Volts	0 to 250 Volts	0 to ±220 Volts	0 to 200 Volts	0 to 440 Volts (peak to peak)
Basic waveform (see diagrams):	Normal pulse	Complemented	Bipolar doublet	Normal pulse	Bipolar pulse
Pulse width (FWHM):	100 ns to 1 ms[2]		1 us to 10 ms	0.2 us to 0.5 ms	200 ns to 0.5 s
Load impedance:	≥ 10 kΩ		≥ 10 kΩ		≥ 100 kΩ
Output impedance[7]:	50 Ω				
Rise, fall times (20%-80%)[8]:	≤ 20 ns		≤ 100 ns	≤ 10 ns	≤ 20 ns
PRF:	1 Hz - 10 kHz		1 Hz - 5 kHz	1 Hz - 1 MHz	1 Hz - 100 kHz
Duty cycle:	0 - 80 %		0 - 50 %	0 - 80%	
Polarity[3]:	Positive or negative or both (specify)		Positive and negative	Positive, negative or both (specify)	Positive and negative
Alternating polarity mode:	Optional[6]	N/A	N/A	N/A	N/A
Pulse separation:	N/A	N/A	1 us - 10 ms	N/A	N/A
GPIB and RS-232 control[1]:	Standard on -B units.				
LabView Drivers:	Check http://www.avtechpulse.com/labview for availability and downloads				
Telnet / Ethernet control[4]:	Optional. See http://www.avtechpulse.com/options/tnt for details.				
Burst mode:	Optional[9]. Generates 1-500 pulses per trigger event. See http://www.avtechpulse.com/options/br.				
Propagation delay:	≤ 100 ns (Ext trig in to pulse out)				
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)				
DC offset:	Option available[5]		N/A		
Trigger required:	External trigger mode: TTL logic-level pulse (LOW = 0V, HIGH = +3V to +5V), > 50 ns				
Sync delay:	Variable, 0 to ± 1 sec		Variable 0 to + 1 sec	Variable 0 to ± 1 sec	Variable 0 to ± 1 sec
Sync output:	+ 3 Volts, 200 ns, will drive 50 Ohm loads				
Gate input:	Synchronous or asynchronous (except no async mode on AVR-G3-B), active high or low, switchable. Suppresses triggering when active.				
Connectors:	Out, Trig, Sync, Gate: BNC				
Power requirements:	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 material:	cast aluminum frame and handles, blue vinyl on aluminum cover plates				
Rack-mount kit:	Optional. Add -R5 to the model number.				
Temperature range:	+5°C to +40°C				

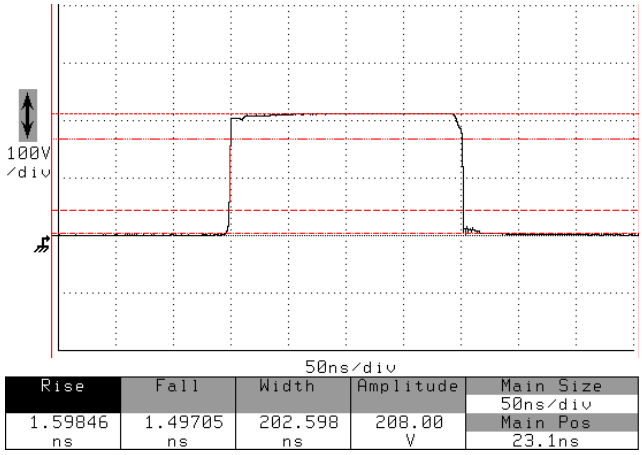
1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width or duty cycle (as appropriate), pulse repetition frequency, and delay (See http://www.avtechpulse.com/gpib).
2) When triggered externally, the pulse width can be set by the pulse instrument controls, or it may be set to track the input trigger pulse width.
3) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option (controlled by a two-position switch which controls the polarity of the signal output port). Keypad polarity control on -B units.
4) Add the suffix -TNT to the model number to specify the Telnet / Ethernet control option.
5) To generate a 0 to ±50V offset internally, add the suffix -OT to the model number. (Not available for -G3, -G4 and -G5 series). When generating a pulse with positive amplitude, the offset plus amplitude must remain between 0 and +250V, and when generating a pulse with negative amplitude, the offset plus amplitude must remain between 0 and -250V.
6) Add the suffix -ALT to the model model to specify the alternating polarity mode option. In this mode, the polarity inverts with each pulse. In other words, every second pulse is negative; the remainder are positive. Must be ordered with the -PN option. The instrument can also be operated in the normal positive and negative modes, where the polarity does not change from pulse to pulse.
7) This is the resistance in series with the output, internally. The 50 Ohm series resistance provides transmission line back-matching to absorb reflections from the load. This is not the same as the load impedance. The AVR-G series can not drive 50 Ohm loads.
8) For a non-capacitive load. The 50 Ohm output impedance will cause rise and fall time degradation if the load has capacitance, governed by the RC time constant.
9) 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. Not available on the AVR-G3-B or AVR-G5-B models.
10) The minimum useful amplitude is 5% of the maximum amplitude. For lower amplitudes, consider using an external resistor divider.

AVR-G4-B

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

AVIR SERIES

200 VOLT, 20 AND 50 kHz
PULSE GENERATORS
PULSE WIDTHS 2 ns TO 1 us



- 200 Volt series
- Pulse widths as low as 2 ns, as high as 1 us
- Rise time as low as 1 ns
- PRF to 50 kHz
- IEEE-488.2 GPIB & RS-232 control ports
- Optional ethernet port for VXI-11.3 support

The AVIR series is designed for 200V applications requiring pulse widths from 2 to 1000 ns, at repetition rates up to 50 kHz.

The AVIR-1 family provides output amplitudes continuously variable from < 20 Volts up to 200 Volts (into 50 Ohms), pulse widths variable from 2 ns to 5 ns, with 1 ns rise times. The maximum pulse repetition frequency is 50 kHz.

The AVIR-2 family is similar, but features pulse widths from 3 to 10 ns, with 1.5 ns rise times, and operation to 20 kHz.

For wider pulse width applications, the AVIR-3 family offers 10 to 200 ns pulse widths with 2 ns rise times.

The AVIR-4 family essentially combines the AVIR-2 and AVIR-3 technologies to offer pulse widths from 4 to 200 ns, in two ranges (4 to 10 ns, and 10 to 200 ns). The AVIR-4D-B offers wider pulses, to 1 us.

All models include an internal oscillator variable up to 50 kHz (AVIR-1 family) or 20 kHz (all other families) using the front-panel controls. A delay control and a sync output are provided for scope triggering. All models can also be triggered externally with a TTL-level pulse.

Positive, negative, and dual polarity models can be provided. The polarity in dual-polarity units is controlled by a front-panel switch.

All AVIR units are available with a monitor output option that provides an attenuated coincident replica of the main output pulse.

All instruments with the -B suffix include a complete computer control interface. 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 voltage amplitude, polarity, pulse repetition frequency, pulse width, and delay. (Visit http://www.avtechpulse.com/gpib for additional details). 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.

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. See http://www.avtechpulse.com/options/vxi.

All models require 100 - 240V, 50 - 60 Hz prime power.

Contact Avtech for your special requirements, such as different output connector or pulse widths.

For assistance in selecting the ideal model for your application, visit our online parametric search engine at http://www.avtechpulse.com/pick.

AVIR-3-B

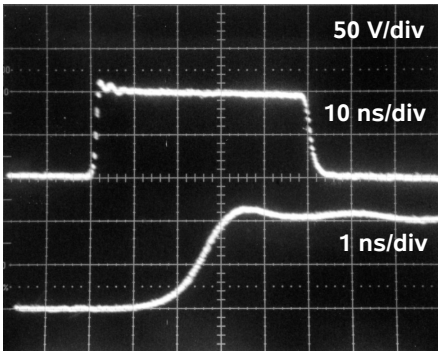
(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

Model[1]:	AVIR-1-B	AVIR-2-B	AVIR-3-B	AVIR-4-B	AVIR-4D-B
Amplitude[2,3,7]:	< 20 to 200 Volts				
Required load impedance:	50Ω[8]				
Pulse width (FWHM):	2 - 5 ns	3 - 10 ns	10 - 200 ns	4 - 200 ns	4 - 1000 ns
Rise time (20%-80%):	≤ 1 ns	≤ 1.5 ns	≤ 2 ns	≤ 2 ns	≤ 2 ns
Fall time (80%-20%):	≤ 1.8 ns	≤ 2.5 ns			
PRF:	0 to 50 kHz	0 to 20 kHz			
Maximum duty cycle:	N/A				0.4%
Polarity[4]:	Positive or negative or both (specify)				
GPIB & RS-232 control[1]:	Standard on -B units				
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[5]. 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 ± 5% (plus ±2 V or ± 2 ns) after 10 minute warmup. For pulse widths below ~10 ns, the amplitude accuracy degrades to ± 10% ± 10 V. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.				
DC offset or bias insertion:	Optional[6]. Apply required DC offset or bias in the range of ± 50 Volts (250 mA max) to back panel solder terminal.				
Propagation delay:	≤ 100 ns (Ext trig in to pulse out)				
Jitter:	± 35ps ± 0.015% of sync delay (Ext trig in to pulse out)				
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.				
Variable delay:	Sync to Out: 0 to 1.0 seconds, for all trigger modes (including external trigger).				
Sync output	+3 Volts, 100 ns, will drive 50 Ohm loads				
Connectors:	Out: SMA, Trig, Sync, Gate: BNC				
Power requirement:	100 - 240 Volts, 50 - 60 Hz				
Dimensions:	H x W x D: 100 × 430 × 375 mm (3.9 × 17 × 14.8”)				
Rack-mount kit:	Optional. To specify, add the -R5 suffix to the model number.				
Temperature range:	+5°C to +40°C				

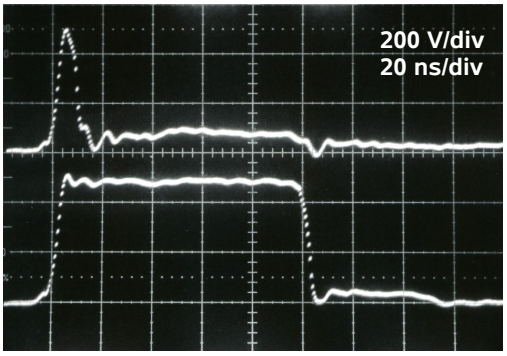
1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (see http://www.avtechpulse.com/gpib for details).
2) For analog electronic control (0 to +10V) of amplitude, suffix the model number with -EA. Includes standard front-panel controls. Not available on AVIR-4 models.
3) For operation at amplitudes of less than 10% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
4) Indicate desired polarity by suffixing model number with -P or -N (i.e. achieved by means of a two-position switch.
5) Add the suffix -VXI to the model number to specify the Ethernet port.
6) For externally-applied DC offset option suffix model number with -OS. For internally-generated DC offset option (0 to ±5V) add suffix -OT.
7) The maximum amplitude decreases by 15% for repetition rates above 30 kHz. The maximum amplitude also decreases by an additional 15% for pulse widths below 3 ns.
8) 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.

AVL SERIES

100, 160, 240, 450 VOLT
1, 2, 4 ns RISE TIME
PULSE GENERATORS



AVL-AV-1-B



AVL-5-B (Min and max pulse width)

- Amplitudes to 450 Volts
- Rise times of 1, 2, or 4 ns
- PRF to 2 or 5 kHz

- Pulse widths to 100 or 400 ns
- IEEE-488.2 GPIB and RS-232 control
- Optional ethernet port for VXI-11.3 support

The AVL series provides high amplitude (to 450V) pulse outputs with rise times as low as 1 ns and fall times of 2 ns, pulse repetition frequencies as high as 50 kHz, and maximum pulse widths variable from 3 to 400 ns.

The AVL-AV-1-B provides peak amplitudes of 100 Volts with pulse widths variable from 3 to 100 ns (and to 400 ns with a wide pulse option). The rise time is 1 ns, the fall time is 2 ns, and the maximum pulse repetition frequency (PRF) is 50 kHz. The AVL-AV-1-W-B offers operation at wider pulse widths (5-400 ns), with 2 ns rise times.

The AVL-2A-B provides peak amplitudes of 160 Volts with pulse widths variable from 3 to 100 ns. Rise times are 2 ns, with PRFs to 20 kHz. The AVL-2A-W-B offers wider pulses (3-400 ns).

The AVL-2D-B operates to 240V, with pulse widths of 10 to 100 ns, rise times of 1 ns, and fall times of 2 ns. The maximum PRF is 20 kHz.

The AVL-5 family provides output amplitudes variable from up to 450 Volts, with pulse widths variable from 8 to 100 ns, with 4 ns rise time and 5 ns fall times, and repetition rates to 2 kHz. (The AVL-5 has a small "back-porch" transient which is < 15% of the set amplitude, and may last as long as 150 ns after the rising edge. It is most noticeable at narrow pulse width settings. See the waveform photo above for an example.) The rise time can be reduced to 2 ns with the -TR option, with a slightly reduction in the maximum amplitude to 400V.

Either output polarity or optional dual output polarity can be provided. The output polarity of dual-polarity units can be switched from the front panel or by computer command.

All instruments with the -B suffix include a complete computer control interface. This provides GPIB and RS-232 computer-control, as well as front panel keypad and adjust knob control of the output pulse parameters. (See http://www.avtechpulse.com/gpib for details.) 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, and LabView drivers are available online at http://www.avtechpulse.com/labview.

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. See http://www.avtechpulse.com/options/vxi for details.

All models may be triggered externally using a TTL-level pulse. The propagation delay in the externally triggered mode is typically 350 ns. All models include a delay control and sync output for oscilloscope triggering purposes.

A DC offset or bias insertion option is available. Units with this option include a circuit similar to the AVX-TB (see http://www.avtechpulse.com/bias) bias tee at the output. The required DC offset is applied directly to rear panel solder terminals. AVL units are also available with a monitor output option that provides an attenuated (20 dB or ÷10) coincident replica of the main output pulse. All models are also available with analog electronic control (0 to +10V) of output amplitude.

The AVL series may be combined with the AVX transformer series to obtain higher peak currents into low impedance loads, or higher peak voltages into high impedance loads.

The AVL models are optimized for fast rise times, and not necessarily for pulse top flatness. See the waveforms above for typical results. Customers who require extremely flat topped pulses (e.g., for particle beam gating) should consult with Avtech (info@avtechpulse.com) before selecting an appropriate model.

All models require 100-240V, 50-60 Hz AC power.

GPIB IEEE-488

SPECIFICATIONS

AVL SERIES

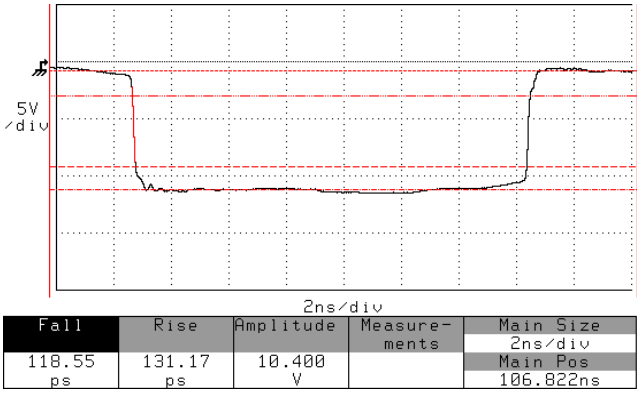
Model[1]:	AVL-AV-1-W-B	AVL-AV-1-B	AVL-2A-W-B	AVL-2A-B	AVL-2D-B	AVL-5-B	AVL-5-B-TR
Maximum amplitude[2]: (50Ω load required[8])	100 V	100 V	160 V	160 V	240 V	450 V	400 V
Rise time (20%-80%):	≤ 2 ns	≤ 1 ns	≤ 2 ns	≤ 2 ns	≤ 1 ns	≤ 4 ns	≤ 2 ns
Fall time (80%-20%):	≤ 3 ns	≤ 2 ns	≤ 3 ns	≤ 3 ns	≤ 2 ns	≤ 5 ns	
Pulse width (FWHM):	5 - 400 ns	3 - 100 ns	3 - 400 ns	3 - 100 ns	10 - 100 ns	8 - 100 ns	
PRF:	0 to 50 kHz		0 to 20 kHz			0 to 2 kHz	
Polarity[3]:	Positive or negative or both (specify)						
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)						
GPIB & RS-232 control[1]:	Standard on -B units.						
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[4]. 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 ± 4% (± 2 ns or ± 4% of max. amplitude) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.						
DC offset or bias insertion[5]:	Option available. Apply required DC offset or bias in the range of ± 50 Volts (250 mA max) to back panel solder terminal.						
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.						
Variable delay[6]:	Sync to main out: 0 to 1.0 seconds, for all trigger modes (including external trigger).						
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads						
Propagation delay:	≤ 350 ns (Ext trig in to pulse out)						
Gate input:	Synchronous. Active high or low, switchable. Suppresses triggering when active.						
Monitor output option[7]:	Provides a 20 dB attenuated coincident replica of the main output						
Connectors:	BNC						
Power requirements:	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 material:	Cast aluminum frame & handles, blue vinyl on aluminum cover plates						
Mounting:	Any						
Temperature range:	+5°C to +40°C						

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (see http://www.avtechpulse.com/gpib).
2) For operation at amplitudes of less than 20% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
3) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option. Polarity reversal is achieved via keypad or computer control.
4) Add the suffix -VXI to the model number to specify the Ethernet port.
5) For DC offset option suffix model number with -OS.
6) Delay must be less than the period (1 / PRF).
7) For monitor option add suffix -M. The monitor, when used, will load down the main output slightly, causing a 10% drop in the maximum main output amplitude.
8) 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.

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

AVMR SERIES

10, 20, 50 VOLT
PULSE GENERATORS
WITH DUTY CYCLES TO 10%



Fall	Rise	Amplitude	Measure-ments	Main Size 2ns/div
118.55 ps	131.17 ps	10.400 V		Main Pos 106.822ns

AVMR-1A-C-N Output (-10V)

- Rise times as fast as 150 ps
- PRF to 3 or 10 MHz
- Pulse widths variable from 0.5 to 200 ns
- 10, 20, and 50V models
- IEEE-488.2 GPIB and RS-232 interfaces
- Optional ethernet port for VXI-11.3 support

The AVMR series offers medium-voltage operation at relatively high pulse repetition frequencies.

Model AVMR-1A-B provides pulses with amplitudes variable to 10 Volts, and pulse widths variable from 6 ns to 200 ns. The maximum pulse repetition frequency is 10 MHz. The rise times are less than 150 ps (see waveform above).

The higher-voltage AVMR-2A-B provides pulses with amplitudes variable to 20 Volts, and pulse widths variable from 6 ns to 200 ns. The maximum pulse repetition frequency (PRF) is 10 MHz. The rise and fall times are 200 ps or less.

The AVMR-2D-B is similar, but with an extended pulse width range of of 0.5 to 200 ns.

Model AVMR-3-B offers amplitude to 50V, with pulse widths variable from 10 to 100 ns, and pulse repetition frequencies to 3 MHz. The rise and fall times are 2.5 ns.

All models include a complete computer control interface (see http://www.avtechpulse.com/gpib for details). 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, frequency, pulse width, and delay. To allow easy integration into automated test systems, the programming command set is based on the SCPI standard.

LabView drivers are available for download at:
http://www.avtechpulse.com/labview.

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, please see http://www.avtechpulse.com/options/vxi.

A delay control and a sync output are provided on all models for sampling scope triggering purposes. All models can also be triggered externally using a TTL-level pulse. All models are protected from overload conditions (such as excessively high duty cycle or short circuited load) by an automatic control feature that limits the output power for as long as the overload condition exists.

Either output polarity can be provided. A dual-polarity option is available as well. The polarity is controlled by a front-panel menu or by a computer command.

All models include an output DC offset function (similar to Model AVX-T, see http://www.avtechpulse.com/bias/avx-t). The required DC offset or bias is applied directly to rear panel solder terminals. An available option (-OT) provides an internally generated DC offset (0 to ±5V) which is controlled by front-panel settings or computer commands.

AVMR units are available with a monitor option that provides an attenuated (20 dB or X10) coincident replica of the main output pulse.

All models require 100 - 240V, 50 - 60 Hz prime power.

AVMR-1A-B

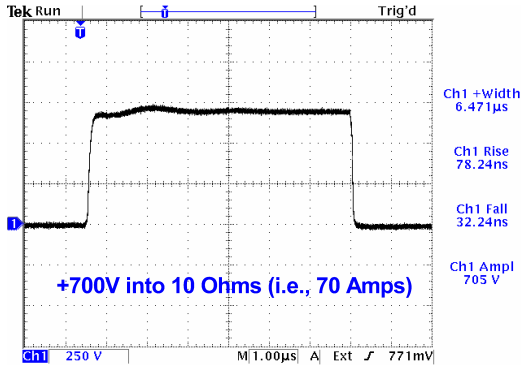
(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

Model[1]:	AVMR-1A-B	AVMR-2A-B	AVMR-2D-B	AVMR-3-B
Amplitude[2]: (50 Ohm load)	< 2 to 10 Volts	< 4 to 20 Volts		< 10 to 50 Volts
Pulse width: (FWHM)	6 to 200 ns	6 to 200 ns	0.5 to 200 ns	10 to 100 ns
PRF:	0 to 10 MHz			0 to 3 MHz
Duty cycle:	10% maximum			30% maximum
Rise time (20%-80%):	≤ 150 ps	≤ 200 ps		≤ 2.5 ns
Fall time (80%-20%):	≤ 200 ps for pulse widths > 6 ns ≤ 250 ps for pulse widths < 6 ns			
Polarity[3]:	Positive or negative or both (specify)			
Required load impedance:	50 Ohms[7]			
Propagation delay:	< 150 ns. Ext trig in to pulse out.			
Jitter:	± 35 ps ± 0.015% of sync delay.			
DC offset or bias insertion[4]:	Apply required externally-generated DC offset to back panel solder terminals (± 50 Volts, 250 mA max)			
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.			
Variable delay:	Sync to main out: 0 to 1.0 seconds, for all trigger modes (including external trigger).			
Sync output:	> +3 Volts, > 40 ns, will drive 50 Ohm loads			
Monitor output option[5]:	Provides a 20 dB attenuated coincident replica of main output.			
GPIB and RS-232 control[1]:	Standard on -B units			
LabView drivers:	Available for download at http://www.avtechpulse.com/labview.			
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Optional[6]. 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 ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.			
Connectors:	Out, Monitor: SMA. Trig, Sync, Gate: BNC			
Optional accessory kit: (attenuators and terminators)	For -1A, -2A, -2D models: 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.			
	For -3 models: Add the suffix "-AK2" to the model number to include the recommended accessory kit. Consists of one SMA 12 GHz 20 Watt attenuator (20 dB) and two SMA 18 GHz 2 Watt attenuators (10 & 20 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.			
Optional accessory kit: (coaxial cables and adapters)	Add the suffix "-AK8" to the model number to include the recommended accessory kit. Consists of one 12-inch SMA-M/SMA-M PE-SR405FL coaxial cable, one 12-inch SMA-M/SMA-MRG-316 coaxial cable, one 36-inch SMA-M/SMA-M RG-316 coaxial cable, one 24-inch SMA-M/BNC-M RG-316 coaxial cable, one 36-inch BNC-M/BNC-M RG58C/U coaxial cable, one SMA-F to BNC-M adapter, one SMA-M to BNC-F adapter, one SMA-F to SMA-F adapter, and one SMA-F to solder cup adapter			
Power, Temperature:	100 - 240 V, 50 - 60 Hz. +5°C to +40°C.			
Dimensions (H x W x D):	100 x 430 x 375 mm (3.9” x 17” x 14.8”)			

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (See http://www.avtechpulse.com/gpib).
2) For operation at amplitudes of less than 20% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
4) For internally generated DC offset option (0 to ± 5V) add the suffix -OT to model number.
5) For monitor option add suffix -M.
6) Add the suffix -VXI to the model number to specify the Ethernet port.
7) A 50 Ohm load is required. Other loads may damage the instrument.

AVOZ-D SERIES

HIGH-VOLTAGE, HIGH-CURRENT PULSE GENERATORS FOR ATTENUATOR TESTING & LASER DIODE ARRAYS



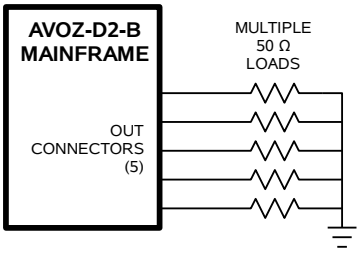
- High voltage, high current pulsers
- Currents of 4, 20, 40, 50, 70, 100, or 200 Amps
- Voltages to 40, 50, 200, 500, 700, or 1000 Volts
- Load resistances as low as 2.5, 5 or 10 Ohms, or as high as open circuits (∞)
- Can drive a single low-impedance load, or multiple 50 Ohm loads
- Peak powers to 200 kW, average powers to 100 W
- Pulse widths of 200 ns to 10 us
- Rise times of 30, 50, 70, 100, or 200 ns
- IEEE-488.2 GPIB and RS-232 interfaces

The AVOZ-D models are high-voltage, high-current pulsers that feature five, ten, or twenty identical outputs. These outputs can either be combined to drive a single low-impedance (2.5, 5 or 10 Ohm) load, or can be used separately to drive multiple 50 Ohm loads simultaneously. This unique flexibility makes the AVOZ-D series ideal for testing high-current laser diode arrays, as well as testing multiple identical lower-current devices (for instance, production testing of attenuators).

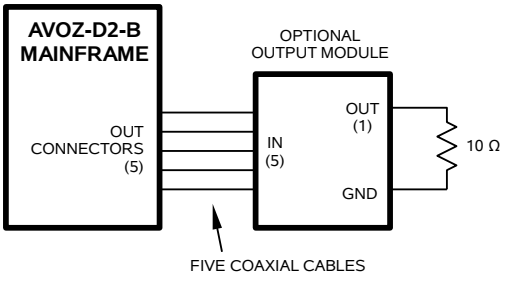
The 50V AVOZ-D5-B can drive up to twenty 50Ω loads, or a single 2.5Ω load, or a combination in between. The maximum total current output is 20A. Similarly, the 200V AVOZ-D4-B can drive up to five 50Ω loads (20A total), and the AVOZ-D3-B can drive up to ten (40A total). The 500V AVOZ-D1-B can drive up to five 50Ω loads (50A), the AVOZ-D2-B can operate to 700V (70A), and the AVOZ-D7-B can operate to 1000V (100A). The 1000V AVOZ-D6-B can drive ten 50Ω loads (200 Amps!).

All models offer pulse widths from 200 ns to 10 us, except for the AVOZ-D6-B which operates from 1 to 10 us.

To drive multiple 50Ω loads, simply attach one load per output connector, using a coaxial cable for each load. No output module is required in this configuration:



When used to drive loads with impedances less than 50 Ohms, two or more outputs can be combined at the load in an optional output module:



If used, the output module is connected to the mainframe using as many as five, ten, or twenty (depending on the model) identical coaxial cables connected in parallel. (The cables are available in an optional accessory kit, or user-supplied coaxial cables may be used.) The mainframe rear-panel and the output module each have a matching number of connectors for this purpose. This allows the effective characteristic impedance of the cabling (Z_0) to be "tuned" to the load impedance, to provide excellent impedance matching and minimal waveform distortion. For instance, when five cables are used, Z_0 = 50Ω / 5 = 10Ω, allowing proper transmission matching to 10Ω loads. If two cables are used, Z_0 = 50Ω / 2 = 25Ω, allowing proper transmission line matching to 25 Ω loads. And if one cable is used, the instrument can be used to drive conventional 50Ω loads. This provides enormous versatility. This arrangement allows the load to be placed away from the instrument without degrading rise time or the pulse shape. The load is connected to the type-N output connector on the output module. An adapter may be required to mate to the user's load. See the next page for possible sources of appropriate adapters.

Internally, all outputs are wired in parallel to a common point (the output switching transistors).

All models in the AVOZ-D series are voltage pulsers. For purely resistive loads, the output current can be calculated using Ohm's Law:

$$I_{OUT} = V_{OUT} / R_{LOAD}$$

When driving diode loads, a resistor must be connected in series with the diode under test to limit the current to the maximum rated current (or less). The output current (I_{OUT}) can be related to the pulser output voltage (V_{OUT}), the diode forward voltage drop (V_D) and the required series resistance (R_{SERIES}):

$$I_{OUT} = (V_{OUT} - V_D) / R_{SERIES}$$

Because of the extremely high output voltages of these instruments (up to 1000V), diodes or diode arrays with large forward voltage drops can be accommodated.

For all models, either output polarity can be provided. A dual polarity option is available on some models. Dual polarity units have two sets of output connectors on the mainframe rear panel, one for each polarity. Only one set is active at a time.

A delay control and a sync output are provided for scope triggering purposes. The units can also be triggered externally using a TTL-level pulse.

All models include a complete computer control interface (see http://www.avtechpulse.com/gpib for details). 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

available at http://www.avtechpulse.com/labview.

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

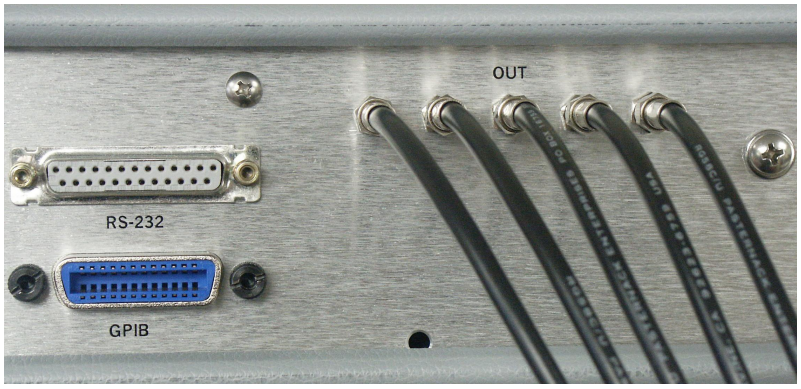
All models require 100 - 240 Volt, 50 - 60 Hz prime power. All models are protected against overload conditions such as excessively high duty cycles or a short-circuited load.

For 50Ω applications, see also the AVR-5B and AVR-7B families (see http://www.avtechpulse.com/medium/avr-5b, and http://www.avtechpulse.com/medium/avr-7b). These also high voltages with higher maximum duty cycles.

If the user prefers to use a single output and cable to drive a test jig which contains a splitter arrangement to drive multiple 50Ω loads, the Avtech AVOZ-A and AVOZ-B models may be more appropriate. These models normally use a single specially-designed composite cable which has Z_0=1Ω (instead of the more conventional Z_0=50Ω). Thus, a jig with fifty 50Ω devices could be accommodated.

Avtech can customize models (including single quantities) to meet your particular test requirements. Contact Avtech (info@avtechpulse.com) with your requirement!

AVOZ-D2-B, with -CK5 option (cables) and -OM5 option (output module)



OUTPUT CABLES ON THE REAR PANEL OF AN THE AVOZ-D2-B MAINFRAME.

The cables can be connected to five separate 50Ω loads, or they can be connected to the output module (shown on the right) to drive a single load as small as 10Ω. The cables can be ordered as an option, or be provided by the customer.

OUTPUT MODULE (-OM5 OPTION)

The following adapters may be useful if your load does not have a type-N connector. Be careful not to exceed any voltage ratings!

BNC adapter: Pasternack PE9002 or PE9127, www.pasternack.com

Breakout box: Pomona 2420, www.pomonaelectronics.com

NUMBERS OF CABLES TO USE WITH THE OUTPUT MODULE FOR A SINGLE LOAD

Load Impedance (R_L)	Number of Cables Used to Connect Mainframe to Output Module (N)	Effective Z_0 of Cabling (Z_0 = 50Ω / N)
2.5 Ohms	20 (AVOZ-D5-B only)	2.5 Ohms
3.3 Ohms	15 (AVOZ-D5-B only)	3.3 Ohms
5.0 Ohms	10 (-D3, -D5, and -D6 only)	5.0 Ohms
7.0 Ohms	7 (-D3, -D5, and -D6 only)	7.1 Ohms
10 Ohms	5	10.0 Ohms
11 to 14 Ohms	4	12.5 Ohms
14 to 20 Ohms	3	16.7 Ohms
20 to 35 Ohms	2	25.0 Ohms
35 to ∞ Ohms	1	50.0 Ohms

GPIB IEEE-488

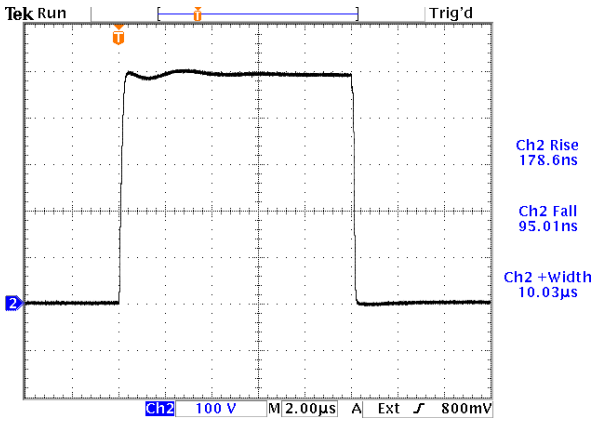
SPECIFICATIONS AVOZ-D SERIES

Model[1]:	AVOZ-D5-B	AVOZ-D3-B	AVOZ-D8-B	AVOZ-D4-B	AVOZ-D1-B	AVOZ-D2-B	AVOZ-D7-B	AVOZ-D6-B
Amplitude[2]: voltage (each output): current (sum of all outputs):	2.5 - 50V 0 - 20A	10 - 200V 0 - 40A	2 - 40V 0 - 4A	10 - 200V 0 - 20A	20 - 500V 0 - 50A	25 - 700V 0 - 70A	30 - 1000V 0 - 100A	30 - 1000V 0 - 200A
Minimum load impedance: (parallel combination of loads on all outputs)	2.5 Ω	5 Ω	10 Ω					5 Ω
Max. number of 50Ω loads (if outputs used separately):	20	10	5					10
Load impedance notes:	The load must be non-inductive[3]							
Pulse width:	200 ns - 10 us							1 us - 10 us
Rise time (20%-80%):	< 25 ns	< 50 ns	< 20 ns	< 50 ns	< 70 ns	< 100 ns	< 120 ns	< 200 ns
Fall time (80%-20%):	< 25 ns	< 50 ns	< 20 ns	< 50 ns	< 70 ns	< 100 ns	< 120 ns	< 200 ns
Maximum PRF:	5 kHz	5 kHz	20 kHz	5 kHz	5 kHz	2.5 kHz	1 kHz	500 Hz
Duty cycle: (max)	1 %	0.3 %	15.6 %	0.6 %	0.1 %	0.05 %	0.025%	0.05 %
Output impedance (approx.):	0.1 Ohms	0.1 Ohms	0.1 Ohms	0.1 Ohms	0.2 Ohms	0.4 Ohms	0.3 Ohms	0.2 Ohms
Max. average output power:	10W	25W						100W
Droop:	< 5%, at maximum pulse width and maximum amplitude							
Polarity[4]:	Positive or negative (specify)		Positive or negative or dual polarity (specify)					Pos or neg (specify)
GPIB & RS-232 control[1]:	Standard on -B units. 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[5]. 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 ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.							
Propagation delay:	< 200 ns (Ext trig in to pulse out)							
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)							
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.							
Variable delay:	Sync to main out: 0 to 1.0 seconds, for all trigger modes (including external trigger).							
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads							
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.							
Output connectors: (see above for quantity)	Mainframe: Multiple SMA female connectors, for connection to an equal number of separate 50 Ohm loads, or for connection to the output module. Output module (if ordered): Multiple SMA female connectors for connection to mainframe, and one Type-N female connector for connection to a low impedance load.							
Number of output connectors:	20	10	5					10
Optional cable kit: (RG58C/U cables, 5 feet / 152 cm)	20 cables. Add -CK20 to model.	10 cables. Add -CK10 to model.	5 cables. Add -CK5 to model number.					10 cables. Add -CK10 to model.
Optional output module (for combining multiple outputs on to a single Type-N connector):	Add -OM20 to model.	Add -OM10 to model.	Add -OM5 to the model number.					Add -OM10 to model.
Other connectors:	Trig, Gate, Sync: BNC							
Power, temperature:	100 - 240 Volts, 50 - 60 Hz.							
Dimensions:	Mainframe: 100 x 430 x 375 mm (3.9 x 17 x 14.8”), -OM5 optional output module: 28 x 36 x 58 mm (1.1 x 1.4 x 2.3”) -OM10 and -OM20 optional output modules: 43 mm x 66 mm x 107 mm (1.7” x 2.6” x 4.2”)							
Chassis material:	Anodized aluminum, with blue plastic trim							
Temperature range:	+5°C to +40°C							

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of pulse amplitude, pulse width, delay and PRF. (See http://www.avtechpulse.com/gpib).
2) For operation at voltage amplitudes of less than 10% of full-scale, better results may be obtained by setting the amplitude near full-scale and increasing the load impedance accordingly. This will provide lower output currents.
3) For applications where additional resistance must be added in series with the device under test, Avtech recommends connecting multiple Ohmite (www.ohmite.com) OY series ceramic composition resistors in parallel to create a high-power, low-inductance effective resistance. These resistors can be purchased readily at http://www.digi-key.com.
4) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option.
5) Add the suffix -VXI to the model number to specify the Ethernet port.

AVOZ-E SERIES

HIGH-VOLTAGE,
HIGH-CURRENT
PULSE GENERATORS



- High voltage, high current pulsers
- Maximum currents of 50 to 250 Amps
- Maximum voltages of 50 to 500 Volts
- Load resistances as low as 1 or 2 Ohms, or as high as open circuits (∞)
- Convenient 1 or 2 Ohm connectorized output cable and adapters
- Average output powers to 100 W
- Pulse widths of 0.5 to 10 us
- IEEE-488.2 GPIB and RS-232 interfaces
- Optional ethernet port for VXI-11.3 support

The AVOZ-E models are high-voltage, high-current pulsers ideal for testing high-current laser diode arrays, as well as testing multiple identical lower-current devices (for instance, production testing of attenuators).

All models offer pulse widths adjustable from 0.5 to 10 us, and average output powers of up to 100 Watts.

The AVOZ-E1-B generates up to 50V into a 1 Ohm load, for a maximum current of 50 Amps, at repetition rates of up to 10 kHz.

The AVOZ-E2-B generates up to 100V into a 1 Ohm load, providing up to 100 Amps, at repetition rates up to 10 kHz.

The AVOZ-E3-B generates up to 250V into a 1 Ohm load, providing up to 250 Amps, at repetition rates up to 1 kHz.

The AVOZ-E4-B generates up to 250V into a 2 Ohm load, providing up to 125 Amps, at repetition rates up to 3 kHz.

The AVOZ-E5-B generates up to 500V into a 2 Ohm load, for a maximum current of 250 Amps, at repetition rates of up to 500 Hz.

All models in the AVOZ-E series are voltage pulsers. For purely resistive loads, the output current can be calculated using Ohm's Law:

$$I_{OUT} = V_{OUT} / R_{LOAD}$$

When driving diode loads, a resistor must be connected in series with the diode under test to limit the current to the maximum rated current (or less). The output current (I_{OUT}) can be related to the pulser output voltage (V_{OUT}), the diode forward voltage drop (V_D) and the required series resistance (R_{SERIES}):

$$I_{OUT} = (V_{OUT} - V_D) / R_{SERIES}$$

Because of the extremely high output voltages of these instruments (up to 500V), diodes or stacked diode arrays with large forward voltage drops can be accommodated.

Avtech can construct suitable low-inductance, high-power, water-coolable series resistors for use with the AVOZ-E models, at additional charge. Contact the Avtech factory (info@avtechpulse.com) with the electrical and mechanical details of your special application!

For all models, either output polarity can be provided (positive or negative).

A delay control and a sync output are provided for scope triggering purposes. The units can also be triggered externally using a TTL-level pulse.

The output signal is provided on a high-voltage, high-current rear-panel safety connector. An included 1 meter / 3 foot long accessory transmission line cable mates to this rear-panel connector. The transmission line cable is specially designed to match to the specified 1 or 2 Ohm minimum load impedance, without degrading the signal rise and fall times. An adapter is included which mates to the end of this cable, and provides the output on two identical contact posts into which M6x1 threaded screws may be screwed. Two similar posts are provided for the ground line.

All models include a complete computer control interface (see http://www.avtechpulse.com/gpib for details). 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, and LabView drivers are available for download at http://www.avtechpulse.com/labview.

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, please see http://www.avtechpulse.com/options/vxi.

All models require 100 - 240 Volt, 50 - 60 Hz prime power. All models are protected against overload conditions such as excessively high duty cycles or a short-circuited load.

A burst mode option is also available, allowing a burst of 1-500 pulses to be generated in response to a single trigger event. Please see http://www.avtechpulse.com/options/br for details.

For lower average power applications, consider the AVOZ-A and AVOZ-D series instead.

Avtech can customize models (including single quantities) to meet your particular test requirements. Contact Avtech (info@avtechpulse.com) with your requirement!

GPIB IEEE-488

SPECIFICATIONS AVOZ-E SERIES

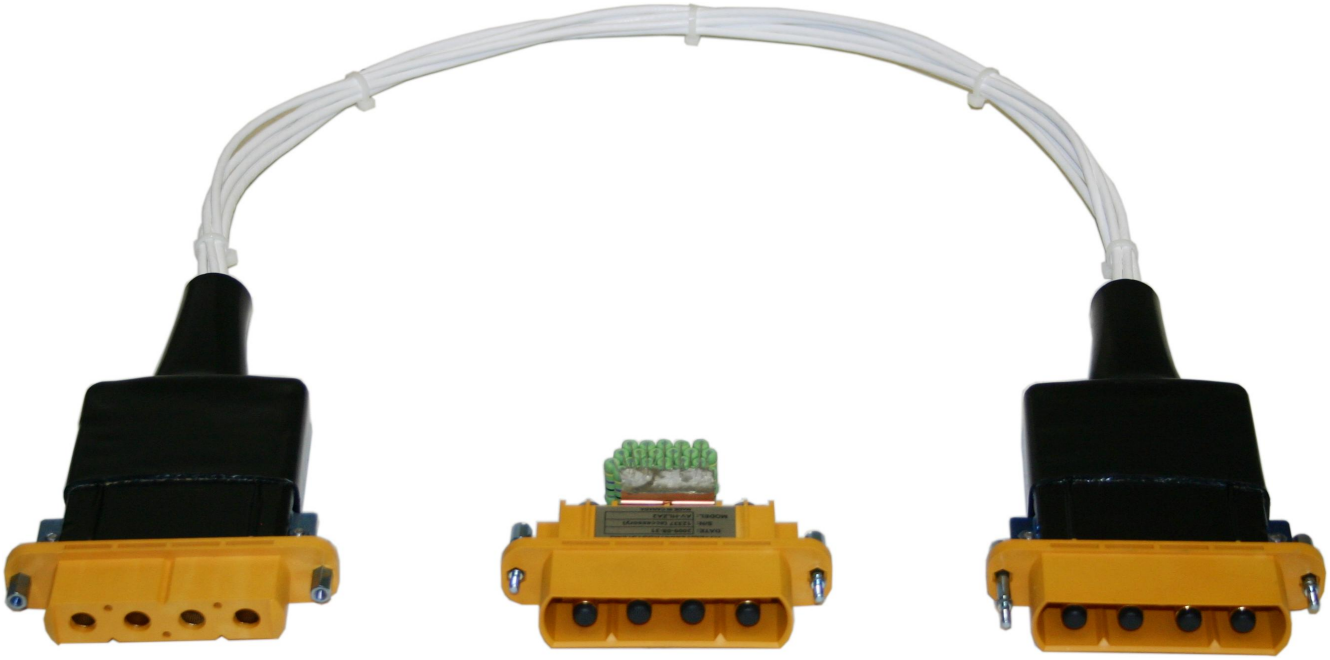
Model[1]:	AVOZ-E1-B	AVOZ-E2-B	AVOZ-E3-B	AVOZ-E4-B	AVOZ-E5-B
Amplitude[2,8,9]: set voltage: resulting current:	1 to 50V 0 to 50A	1 to 100V 0 to 100A	5 to 250V 0 to 250A	5 to 250V 0 to 125A	10 to 500V 0 to 250A
Minimum load impedance:	1.0 Ω (Must be non-inductive[3].)			2.0 Ω (Must be non-inductive[3].)	
Pulse width[9]:	200 ns - 10 us				
Rise & fall times (20%-80%)	< 150 ns	< 150 ns	< 200 ns	< 100 ns	< 200 ns
Maximum PRF:	10 kHz	10 kHz	1 kHz	3 kHz	500 Hz
Duty cycle: (max)	4 %	1 %	0.16 %	0.32 %	0.08 %
Output impedance (approx.):	0.05 Ohms				
Average output power:	100W maximum[8]				
Droop:	< 5%, at maximum pulse width and maximum amplitude				
Polarity[4]:	Positive or negative (specify)				
GPIB & RS-232 control[1]:	Standard on -B units. See http://www.avtechpulse.com/gpib for details.				
LabView drivers:	Check http://www.avtechpulse.com/labview for availability and downloads				
Ethernet port:	Optional[10], for remote control using VXI-11.3, ssh, telnet, & web. 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 ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.				
Burst mode:	Optional[5]. Generates 1-500 pulses per trigger event. See http://www.avtechpulse.com/options/br.				
Propagation delay:	< 200 ns (Ext trig in to pulse out)				
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)				
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.				
Variable delay:	Sync to main out: 0 to 1.0 seconds, for all trigger modes (including external trigger).				
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads				
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.				
Output connector, rear-panel:	Positronic (www.positronic.com) female connector[6]				
Output cable description:	An included 1 meter / 3 foot long accessory transmission line cable mates to the rear-panel connector. The transmission line cable matches the specified 1 or 2 Ohm minimum load impedance without degrading the signal rise and fall times significantly. The chassis end of the cable is terminated with a Positronic male connector[7], and the load end is terminated with a Positronic female connector[6]. An adapter[7] is included which mates to the end of this cable, and provides the output on two identical contact posts into which M6x1 threaded screws may be screwed (to a maximum depth of 15 mm).				
Output cable model:	AV-HLZ1-100			AV-HLZ2-100	
Output cable characteristic impedance (Z_0):	1 Ohm, approximately			2 Ohms, approximately	
Other connectors:	Trig, Gate, Sync: BNC				
Power, temperature:	100 - 240 Volts, 50 - 60 Hz.				
Dimensions (H x W x D):	138 x 430 x 425 mm (5.5 x 17 x 16.8"),				
Chassis material:	Anodized aluminum, with blue plastic trim				
Temperature range:	+5°C to +40°C				

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of pulse amplitude, pulse width, delay and PRF. (See http://www.avtechpulse.com/gpib).
2) For operation at voltage amplitudes of less than 10% of full-scale, better results may be obtained by setting the amplitude near full-scale and increasing the load impedance accordingly. This will provide lower output currents.
3) For applications where additional resistance must be added in series with the device under test, Avtech recommends connecting multiple Ohmite (www.ohmite.com) OY-series ceramic composition resistors in parallel to create a high-power, low-inductance effective resistance. These resistors can be purchased readily at http://www.digi-key.com.
4) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option.
5) 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.
6) Positronic part number GG8888F1, with four GGFIT00MS/AA high-current contacts. The inner two contacts carry the signal, and the outer two carry the ground lines.
7) Positronic part number GG8888M1, with four GGMIT00MS/AA high-current contacts. The inner two contacts carry the signal, and the outer two carry the ground lines.
8) The maximum voltage & current amplitudes will be reduced by 10%, approximately, when the average output power exceeds 75 Watts.
9) The maximum voltage & current amplitudes will be reduced by 20%, approximately, when the pulse width is less than 2 × rise time.
10) Add the suffix -VXI to the model number to specify the Ethernet port.

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

AVOZ-E4-B, with AV-HLZ2-100 output cable and mating AV-HLZA2 Adapter / Test Load

AVOZ-E4-B Rear Panel

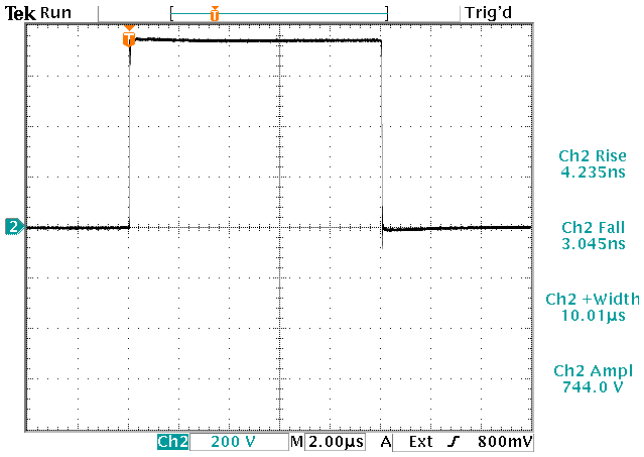


AV-HLZ2-100 output cable and mating AV-HLZA2 Adapter / Test Load

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

AVRF SERIES

1 - 7 ns RISE AND FALL TIME
100 - 750 VOLT PULSE GENERATORS
PULSE WIDTHS TO 1 us OR 100 us



- Amplitude / rise time combinations of 100V / 1 ns up to 750 V / 5 ns
- Pulse widths to 10 or 100 us
- PRF to 5 or 10 kHz
- Switchable polarity optional
- IEEE-488.2 GPIB / RS-232 control

The AVRF series offers high-voltage outputs (to 750 Volts) with fast rise times (1 - 5 ns) and wide pulse width ranges (0.1 us up to 10 or 100 us).

The AVRF-1-B model provides amplitudes of up to 100V, with rise and fall times of 1 ns. The pulse width may be adjusted from 0.1 to 100 us, with a maximum duty cycle of 1%. The maximum pulse repetition frequency (PRF) is 10 kHz. Model AVRF-2-B is similar, except that the maximum amplitude is 200V, with 2.7 ns rise and fall times, and the maximum duty cycle is 0.5%.

Model AVRF-4A-B generates up to 400 Volts, with 4 ns rise and fall times. The pulse width is variable from 0.15 to 10 us. The maximum duty cycle is 0.5%.

Model AVRF-6A-B generates up to 600 Volts, with 5 ns rise and fall times. The pulse width is variable from 0.15 to 10 us. The maximum PRF is 5 kHz, and the maximum duty cycle is 0.1%.

Model AVRF-7A-B generates up to 750 Volts, with 5 ns rise and fall times. The pulse width is variable from 0.15 to 10 us. The maximum duty cycle is 0.1%.

All models may be ordered in positive, negative, or dual-polarity configurations. The polarity of dual-polarity models may be controlled from the front-panel or by computer command. The maximum pulse width of the AVRF-6A-B and AVRF-7A-B is reduced to 5 us when operating in a negative output mode.

All models with the "-B" suffix include a complete computer control interface (for additional details, 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 back-lit LCD displays the output amplitude, polarity, frequency, pulse width or duty cycle as appropriate, and delay. 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 at the Avtech web site (http://www.avtechpulse.com/labview).

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

All models are protected from overload conditions (such as excessively high duty cycle or short circuited loads) by an automatic control feature that limits the output power for as long as the overload condition exists. A push button is provided for one-shot operation. A delay control and a sync output are provided for scope triggering purposes.

When triggered externally by a TTL-level pulse, the output pulse width may be controlled by the front-panel settings, or it may be set to track the input pulse width.

All models require 100-240 Volts, 50-60 Hz.

AVRF-1-B

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

GPIB IEEE-488

SPECIFICATIONS

AVRF SERIES

Model:	AVRF-1-B[1]	AVRF-2-B[1]	AVRF-4A-B[1]	AVRF-6A-B[1]	AVRF-7A-B[1]
Maximum amplitude[2]: (50 Ohm load required)	100 Volts	200 Volts	400 Volts	600 Volts	750 Volts
Rise and fall times: (20%-80%)	≤ 1 ns	≤ 2.7 ns	≤ 4 ns[3]	≤ 5 ns[3]	
Pulse width (FWHM):	0.1 to 100 us		0.15 to 10 us	0.15 to 10 us (for positive outputs), 0.15 to 5 us (for negative outputs)	
PRF:	0 to 10 kHz			0 to 5 kHz	
Duty cycle (max):	1.0%	0.5%		0.1%	
Average power out (max):	4 Watts	4 Watts	16 Watts	7 Watts	11 Watts
Polarity:	Positive (-P option), negative (-N option), or both (-PN option)				
Propagation delay:	≤ 150 ns (Ext trig in to pulse out)				
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)				
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.				
Variable delay:	0 to 1.0 seconds (Sync to main out), for all trigger modes (including external trigger).				
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads				
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.				
Monitor output:	Optional[6]. Provides a 20 dB attenuated coincident replica of the main output on a rear-panel connector. Requires a 50 Ohm load, if used.				
Connectors:	Out: BNC[4] Trig, Sync, Gate: BNC				
GPIB and RS-232 control[1]:	Standard on -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.				
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, after 10 minute warm-up:	Amplitude: Typically ± (3% of setting) ± (2% of maximum). Delay, Period: Typically ± (3% of setting) ± (5 ns) Pulse width: Typically ± (3% of setting) ± (2 ns), at maximum amplitude. As the amplitude is reduced, the pulse width may shift ± 5 ns. For high-accuracy applications requiring traceable calibration, verify the output with a calibrated oscilloscope.				
Power requirements:	100 - 240 Volts, 50 - 60 Hz				
Dimensions: (H x W x D)	100 mm x 430 mm x 475 mm (3.9” x 17” x 18.8”)				
Rack-mount kit:	Optional. Add -R5 to the model number.				
Temperature range:	+5°C to +40°C				

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay. (See http://www.avtechpulse.com/gpib).
2) For operation at amplitudes of less than 20% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
3) For units with the -N or -PN options, the rise and fall times in the negative mode will increase to 8 ns.
4) Add the suffix -NC, -HN, -MHV, or -SHV to the model number to replace the standard BNC output connector with N, HN, MHV, or SHV connectors, respectively.
5) Add the suffix -VXI to the model number to specify the Ethernet port.
6) Add the suffix -M to the model number to specify the monitor output.

See our application notes at
http://www.avtechpulse.com/appnote!

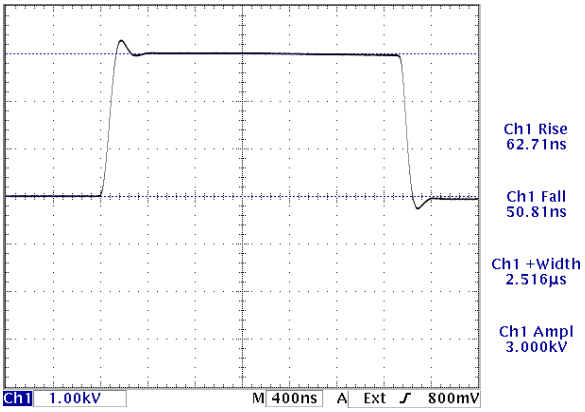
Use the “Pick the Perfect Pulser” parametric search engine
at http://www.avtechpulse.com/pick
to find the best pulser for your application!

AVTECH

GPIB
IEEE-488

AVRH SERIES

1 / 2 / 3 KILOVOLT PULSE GENERATORS WITH 50 / 80 / 100 ns RISE TIMES, 200 ns TO 5 us PULSE WIDTHS



- Amplitudes to 1000, 2000 or 3000 Volts
- 50, 80 and 100 ns rise and fall times
- Pulse widths variable from 0.2 to 2.5 us
- PRF to 1 kHz
- IEEE-488.2 GPIB and RS-232 ports
- Optional ethernet port for VXI-11.3 support

The AVRH series of pulse generators consists of three basic models providing output amplitudes in the range of 1000 to 3000 Volts into high impedance loads.

Model AVRH-3-B provides up to 3000 Volts out (to R ≥ 10 kΩ) with rise and fall times of 100 ns and pulse widths variable from 200 ns to 2.5 us. The pulse repetition frequency (PRF) is variable from 0 to 1.0 kHz, with a 0.25% duty cycle limit.

Model AVRH-2-B is similar but provides a maximum output of 2000 Volts (to R ≥ 10 kΩ) with a rise time of 80 ns. The pulse width is variable from 200 ns to 2.5 us, and the pulse repetition frequency is variable from 1 Hz to 1 kHz.

Model AVRH-1-B provide output amplitudes of up to 1000 Volts (to R ≥ 1 kΩ) at pulse widths variable from 200 ns to 5.0 us. The unit features a rise time of 50 ns and a PRF variable to 1.0 kHz with a 0.5% duty cycle limit.

The MOSFET output stage for all models 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. Models AVRH-2-B and AVRH-3-B will source 0.25 and 0.35 Amps, respectively, and will shut down if the load current exceeds these values.

Aside from the internal clock, the units can also be triggered by a single-pulse pushbutton or an external TTL-level trigger input. When triggered externally the output pulse width can be set to track the input trigger pulse width ($PW_{OUT} = PW_{IN}$). A delay control and a sync output are provided for scope triggering. A gate input is also provided. Either (or both) output polarity can be provided.

All models include a complete computer control interface (see http://www.avtechpulse.com/gpib for details). 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.

Free LabView drivers for these instruments are available for download at http://www.avtechpulse.com/labview.

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. See http://www.avtechpulse.com/options/vxi.

The output connector on standard units is an SHV jack. MHV or HN output connectors are optionally available. An adapter kit, consisting of an SHV plug to MHV female adapter and an MHV male to BNC female adapter, is also available.

All AVRH units operate from 100 - 240 Volts, 50 - 60 Hz AC power, and are enclosed in a rugged all-metal 2U-height rack-mountable chassis.

Models in the AVRH series may be suitable for replacing obsolete models from the former Velonex Corporation in many applications.

For ≤ 1 kV applications, consider the related AVR-8A-B series. The AVR-8A-B will drive 50Ω (and higher) loads with amplitudes up to 1 kV, rise times less than 50 ns, and a wide pulse width range of 200 ns to 200 us. See http://www.avtechpulse.com/medium/avr-8a for details.

Alternatively, the Avtech AVRZ-5 pulse generator family (http://www.avtechpulse.com/medium/avrz-5w) provides 500V pulses into 50Ω loads, with rise and fall times below 10 ns.

Contact Avtech (info@avtechpulse.com) if you need help selecting an appropriate model for your application!

Actual test waveforms from shipped units are available from the online data pages for each model, at:

- http://www.avtechpulse.com/medium/avrh-1/#testresults
- http://www.avtechpulse.com/medium/avrh-2/#testresults
- http://www.avtechpulse.com/medium/avrh-3/#testresults

SPECIFICATIONS

AVRH SERIES

Model[1]:	AVRH-1-B	AVRH-2-B	AVRH-3-B
Amplitude:	< 10 to 1000 Volts (to R ≥ 1 kΩ)	< 20 to 2000 Volts (to R ≥ 10 kΩ)	< 30 to 3000 Volts (to R ≥ 10 kΩ)
Rise / fall times (20%-80%):	≤ 50 ns	≤ 80 ns	≤ 100 ns
Pulse width (FWHM):	200 ns to 5 us	200 ns to 2.5 us	
Duty cycle (maximum):	0.5 %	0.25 %	
PRF:	Internal trigger: 1 Hz to 1 kHz. External trigger: 0 Hz to 1 kHz.		
Polarity[2]:	Positive or negative or both (specify)		
GPIB and RS-232 control[1]:	Yes (standard on -B units)		
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 ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.		
Propagation delay:	≤ 200 ns (Ext trig in to pulse out)		
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)		
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 out: 0 to 1.0 seconds, for all trigger modes (including external trigger).		
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads		
Gated operation:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.		
Connectors:	Out: SHV[4,5] Trig, Sync, Gate: BNC		
Power requirements:	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 material:	cast aluminum frame and handles, blue vinyl on aluminum cover plates		
Mounting:	Any		
Temperature range:	+5°C to + 40°C		

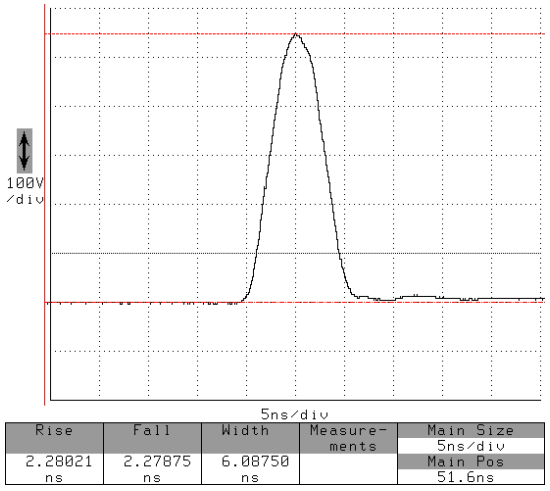
1) Provides IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, polarity, PRF and delay. (See http://www.avtechpulse.com/gpib for details).
2) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option.
3) Add the suffix -VXI to the model number to specify the Ethernet port.
4) MHV or HN output connectors can also be provided. To specify, suffix the model number with -MHV or -HN as required.
5) An adapter kit, consisting of an SHV PLUG to MHV FEMALE adapter and an MHV MALE to BNC FEMALE adapter, is available. Add the suffix -ADPT1 to the model number to order this kit.

AVRH-3-B

Use the "Pick the Perfect Pulser" parametric search engine at http://www.avtechpulse.com/pick to find the best pulser for your application!

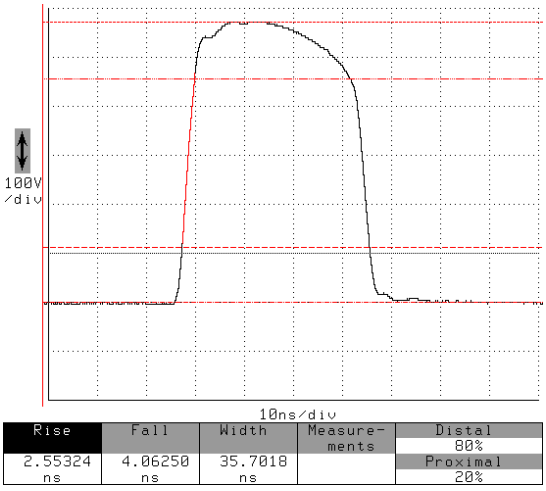
AVRK SERIES

3 OR 4 ns RISE TIMES
300 - 750 VOLT PULSE GENERATORS
PULSE WIDTHS OF 5 ns TO 100 ns



Rise	Fall	Width	Measure-ments	Main Size
				5ns/div
2.28021 ns	2.27875 ns	6.08750 ns		Main Pos 51.6ns

AVRK-3-B-P, 550V amplitude, 6 ns pulse width



Rise	Fall	Width	Measure-ments	Distal
				80%
2.55324 ns	4.06250 ns	35.7018 ns		Proximal 20%

AVRK-3-B-P, 550V amplitude, 35 ns pulse width

The AVRK series offers high-voltage outputs (to 750 Volts) with fast rise times, and pulse widths of up to 100 ns. All models operate at pulse repetition frequencies (PRF) of up to 1 kHz.

The AVRK-1-B model provides amplitudes of up to 300V, with a rise time of 3 ns or less. The fall time varies with the pulse width and amplitude. The pulse width is adjustable from 5 to 100 ns.

The AVRK-2-B is similar, except that the maximum amplitude is increased to 400V, and the pulse width range is reduced to 7 to 65 ns.

The AVRK-3-B model provides amplitudes of up to 550V, with 4 ns rise times. The pulse width is adjustable from 6 to 35 ns.

The AVRK-4-B model provides amplitudes of up to 750V, with 4 ns rise times. The FWHM pulse width is adjustable from 6 to 20 ns.

All models include a complete computer control interface (see http://www.avtechpulse.com/gpib for details). 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 back-lit LCD displays the output amplitude, polarity, frequency, pulse width or duty cycle as appropriate, and delay. To allow easy integration into automated test systems, the programming command set is based on the SCPI standard, and LabView drivers are available for free download at http://www.avtechpulse.com/labview.

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. See http://www.avtechpulse.com/options/vxi.

A manual push button is provided for one-shot operation. A delay control and a sync output are provided for scope triggering purposes.

Either output polarity can be provided. A dual-polarity option is also available, which allows the polarity to be switched from the front panel, or by computer command.

A DC offset or bias insertion option is available with most units. Units with this option include a circuit similar to Model AVX-T at the output. The required DC offset or bias is applied directly to rear-panel solder terminals.

All models require 100-240 Volts, 50-60 Hz.

Contact Avtech (info@avtechpulse.com) with your special requirement! Many units can be customized for particular applications.

AVRK-1-B

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

Model:	AVRK-1-B[1]		AVRK-2-B[1]		AVRK-3-B[1]		AVRK-4-B[1]	
Amplitude[2,3,9]: (50Ω load required)	< 60 to 300 Volts		< 80 to 400 Volts		< 110 to 550 Volts		< 150 to 750 Volts	
Rise time (20%-80%): (for all amplitudes and pulse widths)	≤ 3 ns		≤ 3 ns		≤ 4 ns		≤ 4 ns	
Fall time[10] (80%-20%):	*At 60V*	*At 300V*	*At 80V*	*At 400V*	*At 110V*	*At 550V*	*At 150V*	*At 750V*
At minimum PW:	≤ 6 ns	≤ 4 ns	≤ 6 ns	≤ 4 ns	≤ 6 ns	≤ 4 ns	≤ 6 ns	≤ 4 ns
At maximum PW:	≤ 40 ns	≤ 15 ns	≤ 25 ns	≤ 15 ns	≤ 15 ns	≤ 7 ns	≤ 10 ns	≤ 6 ns
Pulse width (FWHM):	5 – 100 ns		7 – 65 ns		6 – 35 ns		6 – 20 ns	
PRF:	1 Hz to 1 kHz							
Required load impedance:	50 Ohms[8]							
Output impedance[5]:	Low (much less than 50 Ohms)							
Polarity[4]:	Positive or negative or both (specify)							
Propagation delay:	≤ 150 ns (Ext trig in to pulse out)							
Jitter:	± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)							
DC offset:	-OS option[7]: Apply required DC offset (± 50 Volts, 250 mA DC max) to rear-panel solder terminals							
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.							
Variable delay: (sync out to main out)	0 to 1.0 seconds, for all trigger modes (including external trigger).							
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads							
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.							
Monitor output:	Included. Provides a 20 dB attenuated coincident replica of the main output. Requires a 50 Ohm load, if used.							
Connectors:	BNC							
GPIB & RS-232 control[1]:	Standard on -B units.							
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Optional[6]. 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:	Not specified. The pulse width setting experiences some thermal drift and interaction with the amplitude setting. For this reason, the actual output characteristics should be verified by measuring the main output or the monitor output. For high-accuracy applications requiring traceable calibration, verify the output with a calibrated oscilloscope.							
Power requirements:	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")							
Rack-mount kit:	Optional. Add -R5 to the model number.							
Temperature range:	+5°C to +40°C							

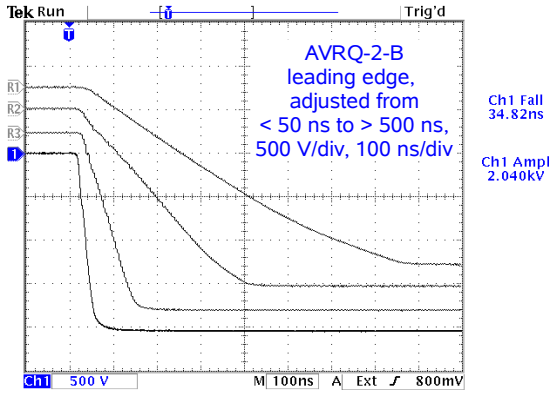
1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay. (See http://www.avtechpulse.com/gpib).
2) For operation at amplitudes of less than 20% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.
3) For analog electronic control (0 to +10V) of amplitude, suffix model number with -EA. Electronic control units also include the standard front-panel controls.
4) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for the dual-polarity option (one output with switchable polarity).
5) This is the input in series with the output, internally. Since the output transmission line reflections will occur.
6) Add the suffix -VXI to the model number to specify the Ethernet port.
7) For DC offset option suffix model number with -OS.
8) 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.
9) The maximum amplitude may fall by up to 10% at minimum pulse width, as the rise and fall times become comparable to the pulse width.
10) The fall time varies with amplitude (higher amplitudes produce faster fall times) and pulse width (wider pulse widths produce slower fall times). These values are the limits for operation at minimum and maximum specified amplitudes and pulse widths. Fall times for other

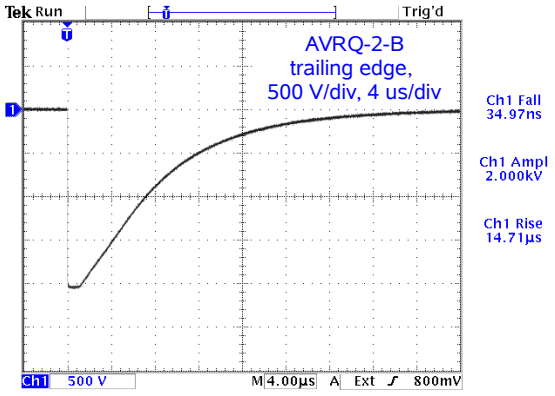
AVTECH

GPIB
IEEE-488

AVRQ SERIES

KILOVOLT PULSE GENERATORS WITH ADJUSTABLE TRANSITION TIMES FOR TRANSIENT IMMUNITY TESTS





- Ideal for CMTI testing of optocouplers, optoisolators, and isolated gate drivers
- Linear rise to ±1, ±1.5, or ±2 kV
- Transition times down to 10 ns, rates up to 120 kV/us
- Includes IEEE-488.2 GPIB, RS-232 ports
- Optional ethernet port for VXI-11.3 support

The AVRQ series is suitable for generating the high-speed, high-voltage waveforms necessary for transient immunity testing of opto-couplers and other semiconductor devices. The AVRQ series is also suitable for a range of other applications requiring a high-voltage "sweep" waveform, such as sweep-control of particle beam systems.

The simplest model, the AVRQ-2-B, generates a fixed-amplitude -2 kV pulse with a linear leading edge, followed by a slower exponential decay back to zero. The transition time (10%-90%) of the leading edge is variable from 50 ns to 500 ns. The high-voltage pulse is provided on a rear-panel SHV connector. The load connected to this output should have a high DC resistance (> 10 MΩ), and a capacitance of approximately 40 pF (including the capacitance of any cabling).

The AVRQ-4-B is specifically designed for optocoupler testing, and offers four pulse amplitudes (-1.5kV, -1kV, +1kV and +1.5 kV), with the transition time (10%-90%) of the leading edge variable from less than 25 ns to more than 250 ns. At its highest amplitude and fastest transition time, the AVRQ-4-B provides transition rates of 1.5 kV × (90%-10%) / 25 ns = 48 kV/us.

Rather than connecting a load using a rear-panel connector, the AVRQ-4-B provides a daughterboard arrangement for the user's opto-couplers. The high-voltage pulse is applied between the floating ground on the input side (GND1) and the chassis-ground on the output side (GND2). A replaceable 9V battery is installed on the rear panel to power a floating regulated 5V power source (VCC1), which may be used to power a voltage-drive device directly, or it may be connected through a series resistance to drive current-biased devices. A chassis-ground-referenced power supply (VCC2) is provided on the output side, and is adjustable from +3V to +8V (or +3V to +43V with the -SCHB option).

The AVRQ-4-B provides a pattern of pin sockets into which a daughterboard may be plugged. Several daughterboards are included with each AVRQ-4-B, to accommodate common test configurations for common 8-pin DIP voltage-drive and current-drive optocouplers. The logic inputs on voltage-drive opto-couplers are jumpered to VCC1 or GND1, as appropriate. For current-drive optocouplers, the LED anode is connected to GND1 directly or to VCC1 through a series resistor. The output side of the daughterboard includes provision for installing a pull-up resistor to VCC2, if required. To perform tests with different logic-level inputs or values of pull-up resistance, different daughterboards must be plugged in. Jumpers are provided to configure the daughterboards for single or dual-channel pinouts.

The high-voltage pulse and the opto-coupler logic output of the AVRQ-4-B are accessible for measurement with high-impedance probes on rear-panel connectors.

The AVRQ-5-B is similar, but achieves faster switching speeds by making some trade-offs with convenience. The standard model offers two amplitude settings (-1.5 kV and +1.5 kV). The unloaded switching time is fixed at ≤ 10 ns, 10%-90%. The transition time may be increased up to 50 ns by adding high-voltage capacitors across the device under test (by soldering it to the DUT daughterboard). This corresponds to transition rates of 24 – 120 kV/us. Unlike the AVRQ-4-B, the transition time is not controlled from the front panel. The ground-referenced output-side power (VCC2) is adjustable (+3V to +43V), but the floating input-side power is not provided by the mainframe. Instead, an A23-style 12V battery should be installed on the DUT daughterboard to provide an isolated floating power source, along with a basic low-dropout regulator circuit to provide the necessary regulated power (VCC1). Sample daughterboards suitable for testing typical 5V DIP8 devices are included.

For both the AVRQ-4-B and AVRQ-5-B, the -AHV option provides greater flexibility in the amplitude setting, permitting adjustment from 1.0 to 1.5 kV (+ or -) in ≤ 1V steps. The -XHV option provides a different amplitude range of 1.5 to 2.0 kV (+ or -) in ≤ 1V steps, but the minimum switching time increases by 5ns.

The DUT daughterboard socket area is normally located behind a safety door on the rear panel. The DUT area may optionally be moved to the front panel of the AVRQ-4-B or AVRQ-5-B by specifying the -FPD option. This is more convenient for the user, but it increases the height of the instrument from 3U to 5U (in rack units) and higher

shipping costs may apply. An ATA-style shipping case is required for the taller units.

CAM files for the AVRQ-4-B and AVRQ-5-B sample daughterboards are available for download from the Avtech web site, so that users may modify the designs to accommodate other package styles. It may be necessary to solder the DUTs directly to the PCB, rather than using a socket. Sockets may introduce unhelpful pin-to-pin signal coupling that can noticeably degrade the measured CMTI performance, particularly for small-pitch devices.

For all models, the high voltage pulse starts to decay back to zero approximately 1 microsecond after the start of the leading transition. The fall time of this decay is at least ten times greater than the rise time of the leading edge. The pulse repetition frequency is adjustable from 1 Hz to 10 Hz, using the front panel controls or by computer command. This instrument may also be triggered by an external TTL trigger pulse (10 Hz maximum), by a computer command, or by a front-panel pushbutton.

On all models, the output will "time-out" after 90 seconds of command inactivity. After that time, the output will be disabled. The output must be re-enabled from the front panel or by computer command for the next test.

A delay control and a sync output are provided for oscilloscope triggering purposes. The sync output (a BNC connector located on front panel) provides a TTL pulse with 100 ns pulse width, and will drive 50 Ohms. The delay between the main output and the sync output is variable from 0 to 1.0 seconds.

These models require a high-impedance load. They will not operate correctly into lower resistances, or into loads with more than the rated capacitance (including the cabling and oscilloscope probe capacitance). The rise time is NOT a calibrated value due to the influence of the load capacitance – it must be measured with an appropriate high-voltage oscilloscope probe system.

Both models include a complete computer control interface (see http://www.avtechpulse.com/gpib for details). 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 back-lit LCD displays the output amplitude, frequency, pulse width, and delay. To allow easy integration into automated test systems, the programming command set is based on the SCPI standard, and LabView drivers are available at http://www.avtechpulse.com/labview.

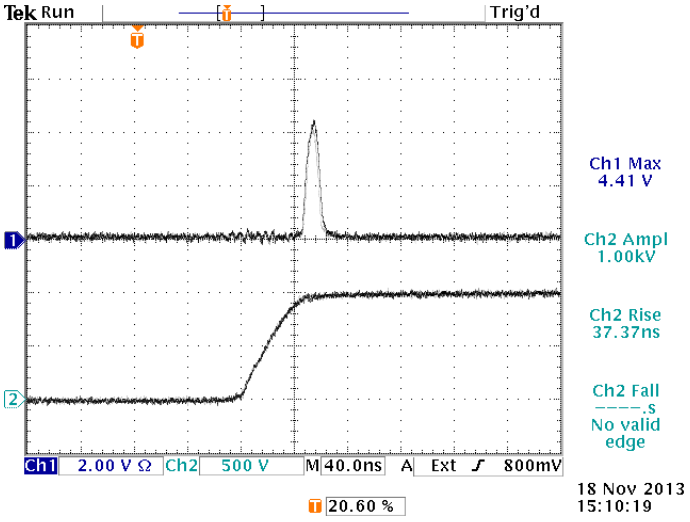
The -VXI option adds a rear-panel Ethernet connector, allowing an instrument to be remotely controlled using the VXI-11.3, ssh, telnet, and web protocols. In particular, the VXI-11.3 features allows software like LabView to control an instrument using standard VISA communications drivers and network cabling, instead of using older-style GPIB cabling and GPIB controller cards. See http://www.avtechpulse.com/options/vxi for additional details.

Extensive test results, and details of the daughterboard arrangement used in the AVRQ-4-B and AVRQ-5-B are provided in the operating manuals at:

http://www.avtechpulse.com/cmti/avrq-4/#manuals

http://www.avtechpulse.com/cmti/avrq-5/#manuals

AVRQ-2-B FRONT PANEL



Top: Logic output of an optocoupler installed in the AVRQ-4-B, 2V/div, 40 ns/div. A transient glitch is observed.

Bottom: +1 kV common-mode pulse with 37.37 ns transition time (10%-90%) applied across the optocoupler.

GPIB IEEE-488

SPECIFICATIONS

AVRQ SERIES

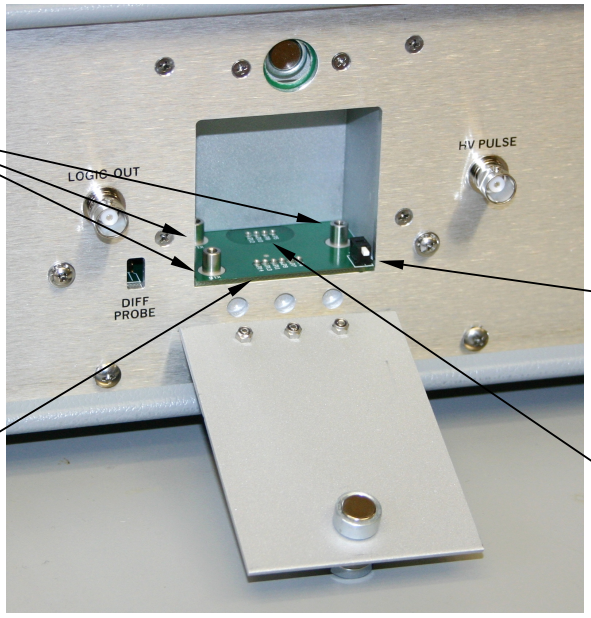
Model:	AVRQ-2-B[1]	AVRQ-4-B[1]	AVRQ-5-B[1]
High-Voltage Pulse Amplitude: (HV pulse / GND1)	-2 kV	Standard: -1.5, -1, +1, or +1.5 kV -AHV[9] option: -1 kV to -1.5 kV, +1 kV to +1.5 kV, in ≤ 1V steps -XHV[10] option: -1.5 kV to -2 kV, -1.5 kV to -2 kV, in ≤ 1V steps	Standard: -1.5 or +1.5 kV -AHV[9] option: -1 kV to -1.5 kV, +1 kV to +1.5 kV, in ≤ 1V steps -XHV[10] option: -1.5 kV to -2 kV, -1.5 kV to -2 kV, in ≤ 1V steps
Load resistance:	> 10 Megohms (this is not a 50 Ohm system.)		
Load capacitance (C_{LOAD}):	~4pF total, including DUT, cabling[5] and probes.	~15 pF total, including DUT capacitance and probes.	0 to ~300 pF. Must be adjusted to obtained the desired transition time.
Load connection style:	Connect to your load using a short length (0 - 30 cm) of user-supplied coaxial cabling connected to the rear-panel output connector.	A pattern of pin sockets into which a daughterboard may be plugged is provided. Sample daughterboards with 8-pin DIP sockets are included. The user may also user their own custom-made daughterboards.	
Leading edge rise time[2]: (10% - 90%):	< 50 ns to > 500 ns, adjustable using front-panel settings or computer command.	< 25 ns (< 30 ns with -XHV option[10]) up to > 250 ns, adjustable using front-panel settings or computer command.	≤ 10 ns (≤ 15 ns with -XHV option[10]) for C_{LOAD} = 0. Up to 50 ns, by increasing C_{LOAD}.
Leading edge shape:	Approximately linear. See the typical waveform photos on the preceding and following pages.		
Trailing edge fall time[3] (90%-10%):	At least ten times greater than the leading edge rise time. Not adjustable.		
Trailing edge shape:	Exponential decay, approximately. See the typical waveform photos on the preceding and following pages.		
Pulse width (measured between the start of the leading edge and the start of the falling edge):	1 us, not adjustable.	1 - 20 us, adjustable.	
PRF:	10 Hz maximum		
VCC1 power supply (input side, floating, referenced to HV pulse / GND1):	N/A	+5V, fixed[6]. Generated by the mainframe and provided to the daughterboard socket. (The user may install a low-dropout voltage regulator on the daughterboard if a lower voltage is required.)	Not provided by the mainframe. The input side of the daughterboards must be self-powered. The included sample boards use an A23-type battery with a low-dropout regulator.
VCC2 power supply (output side, referenced to GND2 chassis ground):	N/A	Std: +3 to +8V, adjustable Optional[7]: +3 to +43V, adj. 150 mA maximum	+3V to +43V, adjustable 150 mA maximum
Logic output pull-up resistance:	N/A	User-installed, on daughterboard as appropriate	
Output connector, HV PULSE:	SHV female	BNC female, suitable for use with the Tektronix P5100 high-voltage probe and 013-0291-00 probe-tip-to-BNC adapter	
Output connector, logic output:	N/A	A two-pin header suitable for use with the Tektronix P6246 differential probe[8]. Other probes may be used by installing a matching two-pin socket as an extender.	
Output enable timer:	The output will only remain active for 90 seconds after the last output parameter update. After that time, the output will be disabled. The output must be re-enabled from the front panel or by computer command for the next test sequence.		
Propagation delay:	≤ 200 ns (Ext trig in to start of output pulse)		
Jitter (Ext trig in to pulse out):	± 200 ps ± 0.03% of sync delay		
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.		
Variable delay:	Sync to Out: 0 to 1.0 seconds, for all trigger modes (including external trigger).		
Sync output:	+3 Volts, 100 ns, will drive 50 Ohm loads		
Gate input:	Synchronous, active high or low, switchable. Suppresses triggering when active.		
Other connectors:	Trig, Sync, Gate: BNC		
GPIB and RS-232 control:	Yes. (Visit http://www.avtechpulse.com/labview for LabView drivers.)		
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Optional[4]. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.		
Settings accuracy:	Not calibrated. Verify the output parameters with a calibrated oscilloscope.		
Power requirements:	100 - 240 Volts, 50 - 60 Hz		
Dimensions: (H x W x D)	100×430×475mm (3.9×17×18.8”)	145 x 430 x 475 mm (5.7” x 17” x 18.8”)	
Chassis material:	cast aluminum frame and handles, blue vinyl on aluminum cover plates		
Temperature range:	+5°C to +40°C		

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (See http://www.avtechpulse.com/gpib/).
2) The rise time is affected by the load capacitance. A high-voltage high-bandwidth oscilloscope probe such as the Tektronix P5100 should always be used to verify the actual output rise time, rather than relying on the programmed value.
3) Refers to the trailing edge, which swings from -1000V or -2000V to 0V
4) Add the suffix -VXI to the model number to specify the Ethernet port.
5) Note that coaxial cabling typically adds 30 pF/ft.
6) The user must install a standard 9V battery in the provided holder, in order to power the floating power supply. The battery is not included, due to shipping regulations.
7) To specify the extended VCC2 range, add the -SCHB option suffix to the model number.
8) A differential probe is suggested to reduce the possibility of interference from the high-voltage pulse. Note that the P6246 is only suitable for values of VCC2 up to +7V. A non-differential probe may be more suitable if VCC2 > 7V, or if parasitic inductances or capacitances in the test circuit cause differential voltage spikes exceeding ±7V. The P6246 can saturate under those conditions, which can generate apparent glitch-like transients that are not due to the DUT. Some experimentation may be required by the user in order to identify the best probing arrangement.
9) Add the suffix -AHV to the model number to specify the +/- 1 to 1.5 kV (in ≤ 1V steps) operating range.
10) Add the suffix -XHV to the model number to specify the +/- 1.5 to 2 kV (in ≤ 1V steps) operating range. This optiion increases the minimum switching time by 5 ns.

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

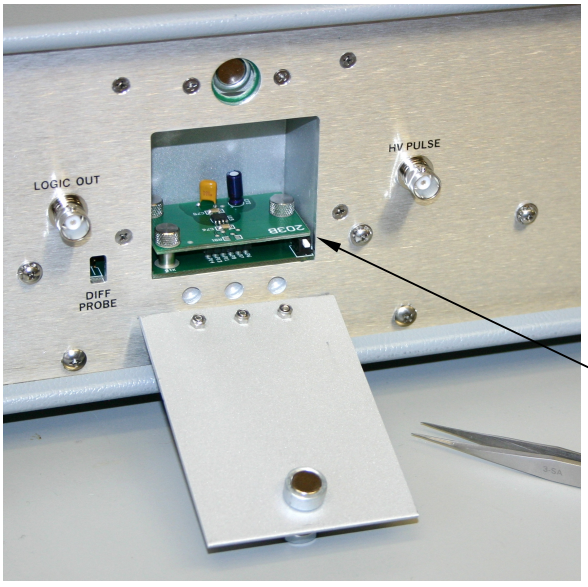
DAUGHTERBOARD ARRANGEMENT FOR THE AVRQ-4-B

The DUT area is located on the rear panel, behind a hinged door:



The outputs are automatically disabled when the DUT door is open (as sensed by the safety interlock switch).

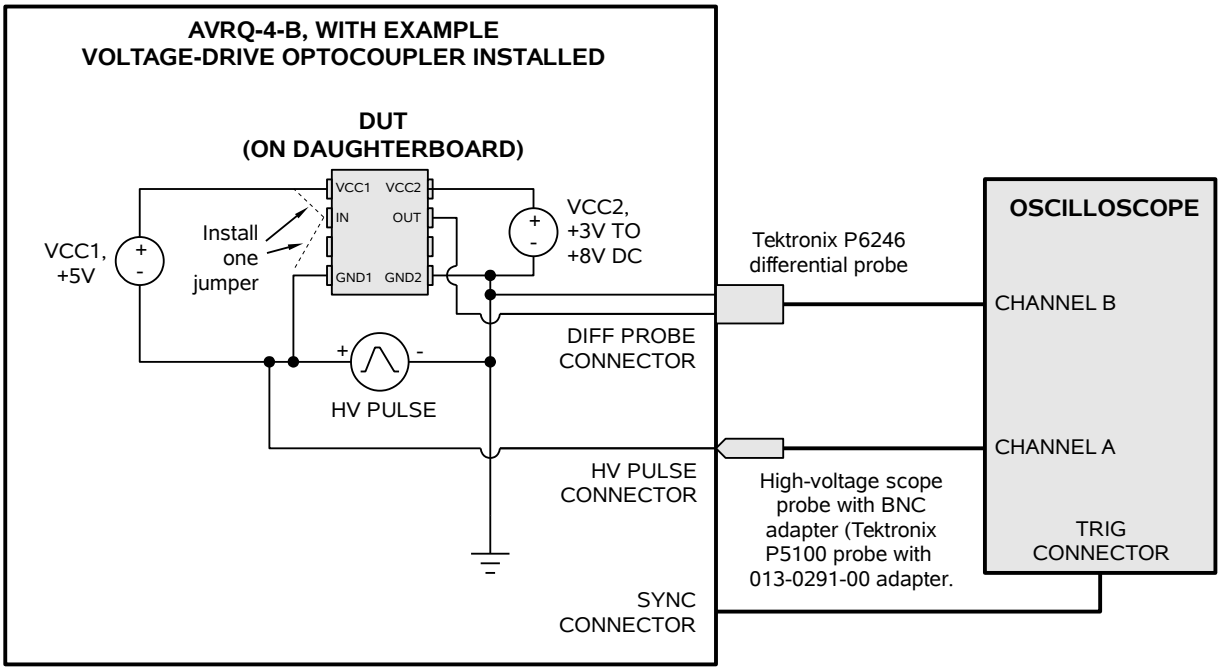
To install a different daughterboard, unscrew the three screws that secure the board to the three mounting posts, and gently pull the board upwards, out of the pin sockets. Insert the new PCB by carefully aligning the bottom-side pins with the ten matching pin sockets. Gently push the new board down into the pin sockets. Secure the board with the three 4-40 thumbscrews. A tweezer should be used to guide the thumbscrews into position. Do not over tighten the screws.

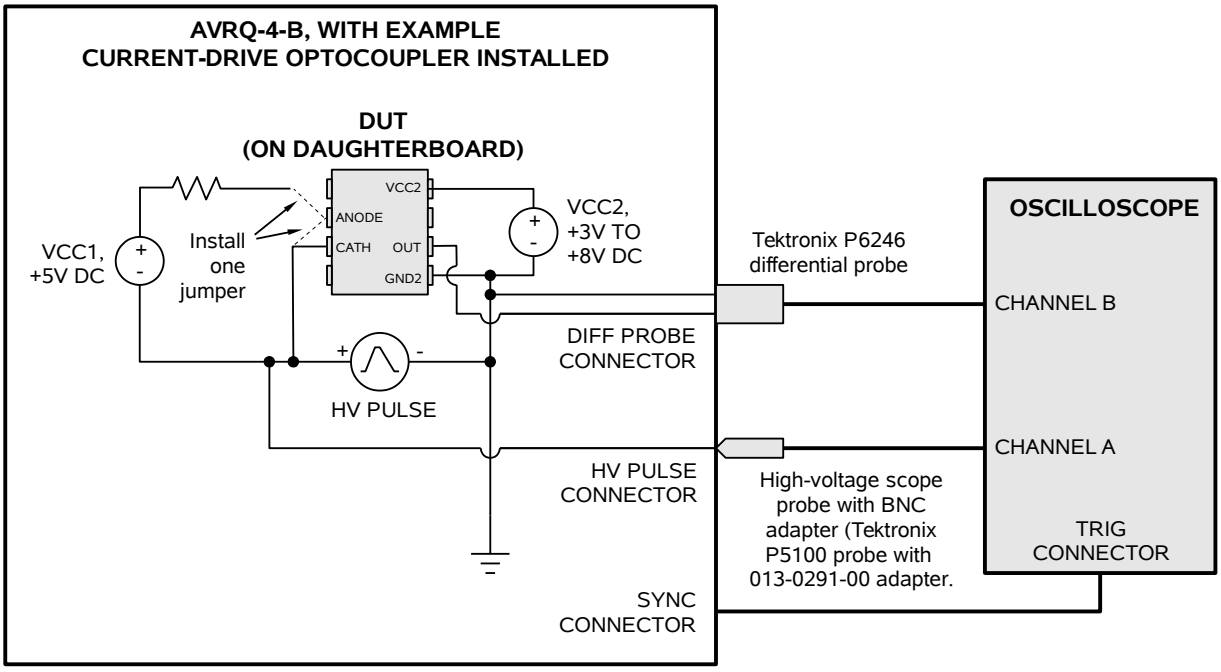


DAUGHTERBOARD ARRANGEMENT FOR THE AVRQ-5-B

The AVRQ-5-B uses a similar arrangement, except that the daughterboard is somewhat larger, to provide space for the required floating-side battery and regulator circuit (to generate VCC1, if used). The AVRQ-5-B DUT area may be moved to the front panel by specifying the -FPD option. This increases the height of the instrument from 3U to 5U, in rack units.

BASIC TEST ARRANGEMENT FOR THE AVRQ-4-B



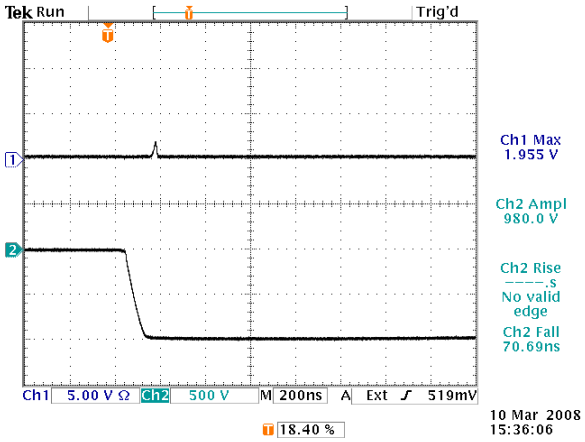


CUSTOMIZATIONS

The AVRQ-4-B and AVRQ-5-B may be customized to accept particular package types and pinouts, and to provided daughterboards configured appropriately for the required tests. Contact Avtech (info@avtechpulse.com) with your requirement.

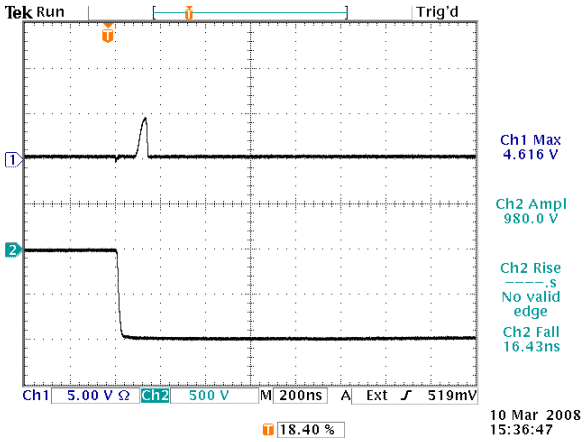
TYPICAL WAVEFORMS FOR THE AVRQ-4-B

Testing CH A of an Avago HCPL-2630 dual-channel opto-coupler, with a -1 kV pulse, V_{CC2} = +5V, LED bias = +7.5 mA, and a pull-up resistance of 350 Ohms shows that a logic glitch starts to occur when the HV pulse transition time is 70.69 ns. The glitch increases in amplitude as the rise time decreases:



Top: HCPL-2630 logic output, 5V/div, 200 ns/div. Bottom: -1 kV pulse with 70.69 ns transition time applied across the HCPL-2630 input/output sides.

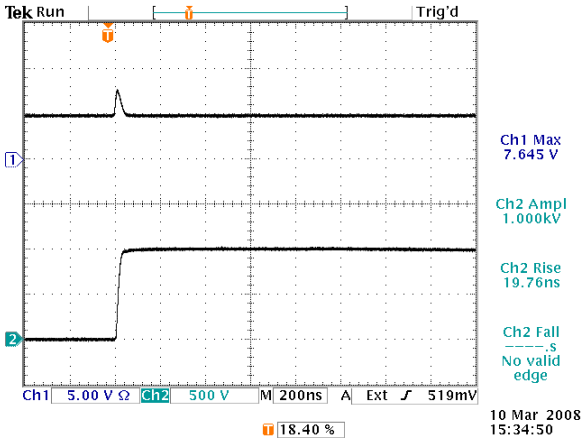
The logic glitch is just starting. The estimated CMTI under these conditions is thus 1 kV / (0.9-0.1) / 70.69 ns = 17.7 kV/us. The manufacturer's specification is 5 kV/us.



Top: HCPL-2630 logic output, 5V/div, 200 ns/div. Bottom: -1 kV pulse with 16.43 ns transition time applied across the HCPL-2630 input/output sides.

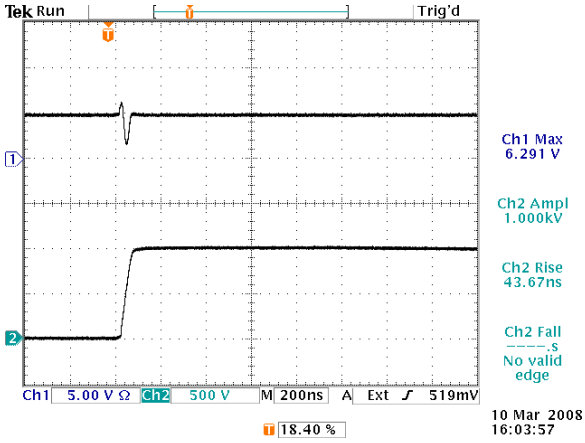
The logic glitch has increased with the decreased HV pulse transition time.

Testing HCPL-2601 single-channel opto-couplers from two different manufacturers with a +1 kV pulse, V_{CC2} = +5V, LED bias = 0 mA, and a pull-up resistance of 350 Ohms shows a difference in performance:



Top: Avago HCPL-2601 logic output, 5V/div. Bottom: +1 kV pulse with 19.76 ns transition time applied across the HCPL-2601 input/output sides.

Some of the HV pulse capacitively couples to the logic output, causing a positive spike, but the logic state does not change. No glitch is observed. The CMTI thus exceeds 1 kV / (0.9-0.1) / 19.76 ns = 63.2 kV/us, which is the limit of this test system.

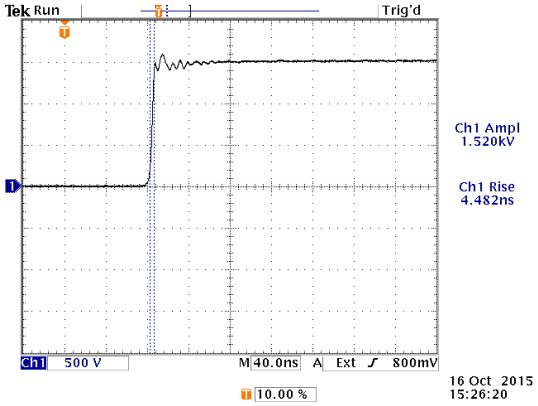


Top: QTC HCPL-2601 logic output, 5V/div. Bottom: +1 kV pulse with 43.67 ns transition time applied across the HCPL-2601 input/output sides.

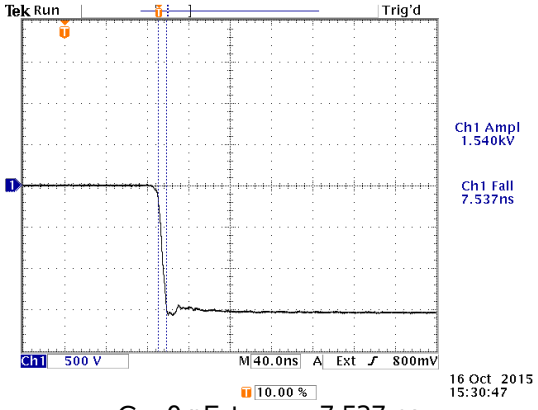
With this device, a negative-going glitch is observed. (It is not caused by capacitive coupling, since it is opposite in polarity to the HV pulse slope.) The observed CMTI is thus 1 kV / (0.9-0.1) / 43.67 ns = 28.6 kV/us.

TYPICAL WAVEFORMS FOR THE AVRQ-5-B

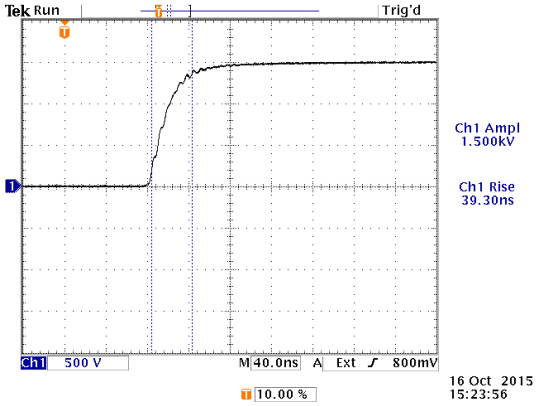
The AVRQ-5-B provides faster switching times than the AVRQ-4-B, with the switching time controlled by a user-installed capacitance. Typical positive and negative waveforms with 0 and 150 pF capacitances are shown below:



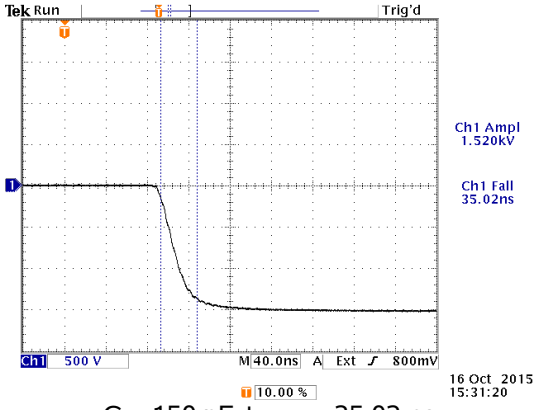
C = 0 pF, t_{R10-90} = 4.482 ns



C = 0 pF, t_{R10-90} = 7.537 ns



C = 150 pF, t_{R10-90} = 39.30 ns



C = 150 pF, t_{R10-90} = 35.02 ns

ALTERNATIVE MECHANICAL STYLE, -FPD OPTION

The AVRQ-4-B and AVRQ-5-B are normally provided in a 3U-rack-height chassis with the DUT area located on the rear panel. This provides the most compact use of space, but it is not necessarily convenient for the user. The DUT area may optionally be moved to the front panel of the by specifying the -FPD option. This increases the height of the instrument from 3U to 5U (in rack units) and higher shipping costs may apply. An ATA-style shipping case is required for the taller units. An example of an AVRQ-5-B-FPD is shown below: