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INSTRUCTIONS

MODEL AV-106C-B

0 to 15 AMP, 0 to 20 V, 50 ns RISE TIME
LASER DIODE DRIVER
WITH IEEE 488.2 AND RS-232 CONTROL

SERIAL NUMBER: _____

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Manual Reference: /fileserver1/officefiles/instructword/av-106/AV-106C-B-P,ed3.sxw.
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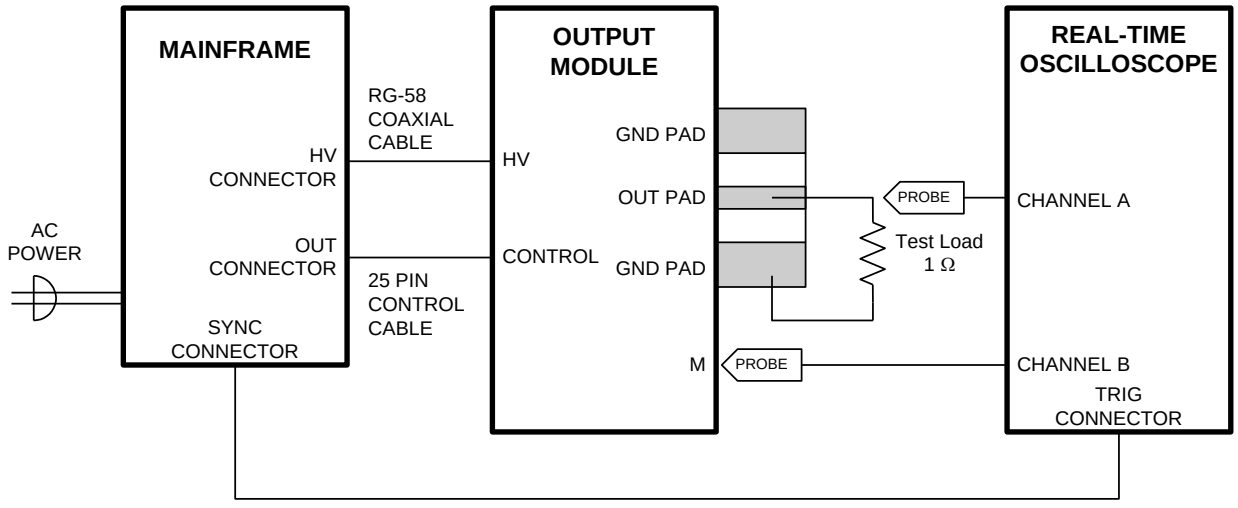
INTRODUCTION

The Model AV-106C-B pulse generator is designed for pulsing laser diode and other low impedance loads with rectangular pulses as high as 15 Amperes into load voltages up to 20V, with 50 ns rise and fall times. The pulse repetition frequency can vary from 1 Hz to 1 kHz, and pulse widths can vary from 1 us to 1 ms. The maximum duty cycle is 1%. The current and voltage polarities depend on the model number:

"-P" units: 0 to +15 A amplitude, 0 to +20V compliance
"-N" units: 0 to -15 A amplitude, 0 to -20V compliance
"-PN" units: 0 to 15 A amplitude, 0 to +20V compliance for positive output, and 0 to -20V compliance for negative output.

The Model AV-106C-B pulse generator is a current pulser. The current amplitude is largely independent of the load voltage. The load voltage must not exceed 20V.

The AV-106C-B system consists of an instrument mainframe and an output module (the AV-106C-P-PG for positive units, the AV-106C-N-PG for negative units. Dual polarity units have both output modules.) The output module connects to the mainframe using two cables: a 25-conductor detachable cable that carries the control signals, and a single-conductor shielded detachable RG-58 cable carries the high voltage power supply (+50V or -50V).



The loads can be connected (soldered) to the microstrip transmission line that protrudes from the output module. The lead lengths must not exceed several centimeters or severe inductive voltage spikes will result (as predicted by Lenz's Law.)

For instruments with the "-M" option, a current monitor output is present on the output module.

The AV-106C-B has two amplitude ranges, of 0 to 5A and 5 to 15A, allowing the instrument to be used at both moderate and high current levels. (The instrument automatically selects the appropriate range based on the amplitude setting.)

The AV-106C-B can be controlled from the front panel, or via a computer connected to the IEEE 488.2-compliant GPIB port, or the RS-232 serial port.

AVAILABLE OPTIONS

The AV-106C-B is available with several options:

-BR Option: This optional feature allows a burst of 1-500 pulses to be generated in response to each trigger event.

-EA Option: Allows to the amplitude to be controlled by an externally generated 0 to +10V analog control voltage.

-M Option: A monitor output is provided.

-R5 Option: This is the optional rack-mounting kit. The R5 rack-mount kit may also be ordered separately.

SPECIFICATIONS

Model:	AV-106C-B[1]
Amplitude[2,3]:	0 to 15 Amperes
Pulse width:	1 us to 1 ms
Rise time, fall time:	≤ 50 ns
PRF:	0 to 1 kHz
Duty cycle: (max)	1%
Output impedance:	≥ 50 Ohms
Output regulation:	≤ ±5% change in current for a load voltage change from 0 Volts to maximum rated load voltage
Load voltage range:	0 to 20 Volts
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
Controls:	Keypad and adjust knob, and GPIB / RS-232 control.
Propagation delay, (Jitter):	≤ 100 ns, (± 100 ps ± 0.03% of sync delay, Ext trig in to pulse out)
Ext. trigger in:	Mode A: + 5 Volts, 50 ns or wider (TTL), Mode B: + 5 Volts, $PW_{IN} = PW_{OUT}$ (TTL)
Sync to pulse out delay:	0 to ± 1 ms
Sync output:	+ 3 Volt, 200 ns, will drive 50 Ohm loads
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.
Monitor output option[5]:	Provides an attenuated coincident replica of output current pulse.
Connectors:	Out: Solder terminals Trig, Sync, Gate, Monitor: BNC
Power requirements:	120/240 Volts (switchable) 50 - 60 Hz
Dimensions:	Mainframe: 100 x 430 x 375 mm (3.9" x 17" x 14.8") Output module: 152 x 152 x 229 mm (6" x 6" x 9")
Temperature range:	+5 to +40 C

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay.
2) For analog electronic control (0 to + 10 V) of amplitude, suffix model the model number with -EA. Electronic control units also include standard front-panel controls and computer control capability.
3) The minimum useful amplitude is 3% of the maximum amplitude.
4) Indicate desired polarity by suffixing the model number with -P or -N (i.e. positive or negative) or -PN for dual polarity option.
5) For monitor option add suffix -M.

INSTALLATION

VISUAL CHECK

After unpacking the instrument, examine to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs, liquid crystal displays (LCDs), and the handles. Confirm that a power cord, a GPIB cable, and two instrumentation manuals (this manual and the “Programming Manual for -B Instruments”) are with the instrument. If the instrument has been damaged, file a claim immediately with the company that transported the instrument.

PLUGGING IN THE INSTRUMENT

Examine the rear of the instrument. There will be a male power receptacle, a fuse holder and the edge of the power selector card visible. Confirm that the power selector card is in the correct orientation.

For AC line voltages of 110-120V, the power selector card should be installed so that the “120” marking is visible from the rear of the instrument, as shown below:

For AC line voltages of 220-240V, the power selector card should be installed so that the “240” marking is visible from the rear of the instrument, as shown below:

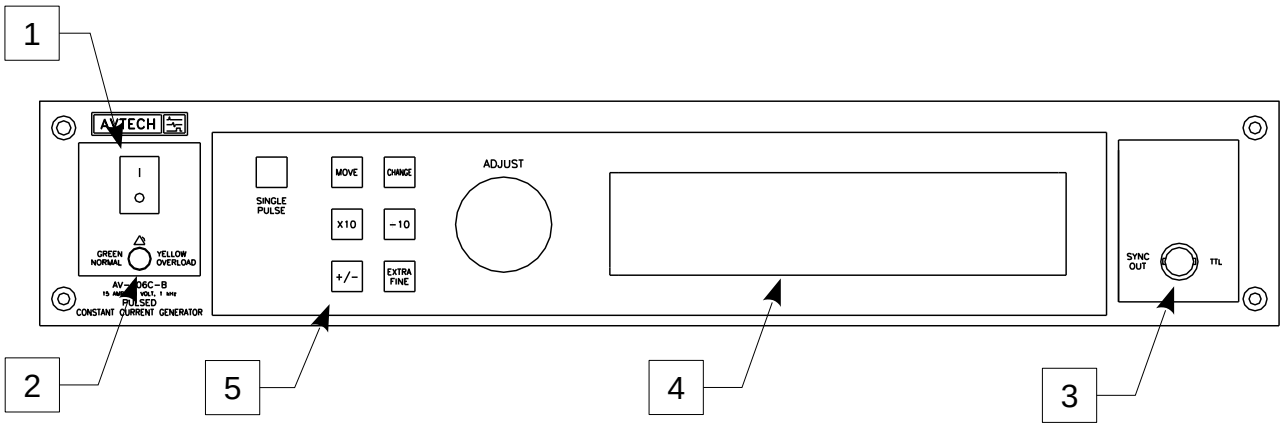
If it is not set for the proper voltage, remove the fuse and then grasp the card with a pair of pliers and remove it. Rotate horizontally through 180 degrees. Reinstall the card and the correct fuse.

In the 120V setting, a 1.0A slow blow fuse is required. In the 240V setting, a 0.5A slow blow fuse is required.

CONNECTING THE OUTPUT MODULE TO THE MAINFRAME

The output module and the mainframe should be connected together as shown on page 13. One end of the gray cable mates to the multi-pin “OUT” connector on the rear panel of the mainframe, and the other end mates to the “CONTROL” connector on the output module. The black RG-58 cable connects to the “HV” BNC connectors.

FRONT PANEL CONTROLS



1. POWER Switch. This is the main power switch. When turning the instrument on, there may be a delay of several seconds before the instrument appears to respond.

2. OVERLOAD Indicator. When the instrument is powered, this indicator is normally green, indicating normal operation. If this indicator is yellow, an internal automatic overload protection circuit has been tripped. If the unit is overloaded (by operating at an exceedingly high duty cycle or by operating into a very low impedance), the protective circuit will disable the output of the instrument and turn the indicator light yellow. The light will stay yellow (i.e. output disabled) for about 5 seconds after which the instrument will attempt to re-enable the output (i.e. light green) for about 1 second. If the overload condition persists, the output will be disabled again (i.e. light yellow) for another 5 seconds. If the overload condition has been removed, the instrument will resume normal operation.

   This overload indicator may flash yellow briefly at start-up. This is not a cause for concern.

   Note that the output circuit can withstand an infinite VSWR on the output port but is intended for operation with 50Ω loads.

3. SYNC OUT. This connector supplies a SYNC output that can be used to trigger other equipment, particularly oscilloscopes. This signal leads (or lags) the main output by a duration set by the "DELAY" controls and has an approximate amplitude of +3 Volts to R_L > 1kΩ with a pulse width of approximately 50 ns.

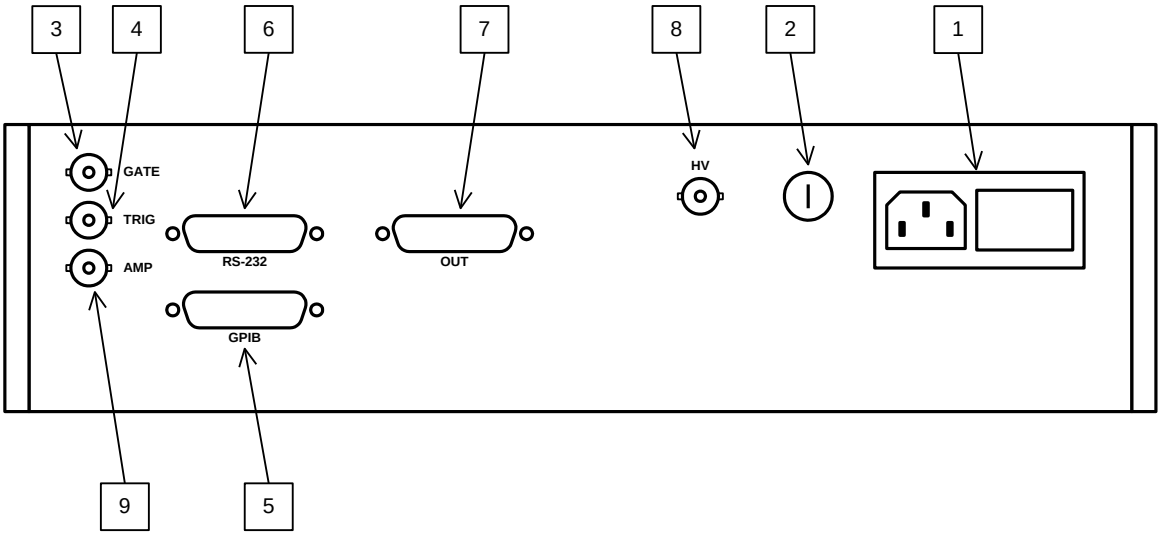
4. LIQUID CRYSTAL DISPLAY (LCD). This LCD is used in conjunction with the keypad to change the instrument settings. Normally, the main menu is displayed, which lists the key adjustable parameters and their current values. The “Programming Manual for -B Instruments” describes the menus and submenus in

detail.

5. KEYPAD.

Control Name	Function
MOVE	This moves the arrow pointer on the display.
CHANGE	This is used to enter the submenu, or to select the operating mode, pointed to by the arrow pointer.
×10	If one of the adjustable numeric parameters is displayed, this increases the setting by a factor of ten.
÷10	If one of the adjustable numeric parameters is displayed, this decreases the setting by a factor of ten.
+/-	If one of the adjustable numeric parameters is displayed, and this parameter can be both positive or negative, this changes the sign of the parameter.
EXTRA FINE	This changes the step size of the ADJUST knob. In the extra-fine mode, the step size is twenty times finer than in the normal mode. This button switches between the two step sizes.
ADJUST	This large knob adjusts the value of any displayed numeric adjustable values, such as frequency, pulse width, etc. The adjust step size is set by the "EXTRA FINE" button. When the main menu is displayed, this knob can be used to move the arrow pointer.

MAINFRAME REAR PANEL CONTROLS



1) AC POWER INPUT. A three-pronged recessed male connector is provided on the back panel for AC power connection to the instrument. Also contained in this assembly is a slow blow fuse and a removable card that can be removed and repositioned to switch between 120V AC in and 240V AC in.

   For AC line voltages of 110-120V, the power selector card should be installed so that the “120” marking is visible from the rear of the instrument.

   For AC line voltages of 220-240V, the power selector card should be installed so that the “240” marking is visible from the rear of the instrument.

   If it is not set for the proper voltage, remove the fuse and then grasp the card with a pair of pliers and remove it. Rotate horizontally through 180 degrees. Reinstall the card and the correct fuse.

   In the 120V setting, a 1A slow blow fuse is required. In the 240V setting, a 0.5A slow-blow fuse is required. See the “Installation” section for more details.

2) DC FUSE. This 0.8A slow-blow fuse protects the internal DC power supply.

3) GATE. This TTL-level (0 and +5V) logic input can be used to gate the triggering of the instrument. This input can be either active high or active low, depending on the front panel settings or programming commands. (The instrument triggers normally when this input is unconnected). When set to active high mode, this input is pulled-down to ground by a 1 kΩ resistor. When set to active low mode, this input is pulled-up to +5V by a 1 kΩ resistor.

4) TRIG. This TTL-level (0 and +5V) logic input can be used to trigger the instrument, if the instrument is set to triggering externally. The instrument triggers on the rising edge of this input. The input impedance of this input is 1 kΩ. (Depending on the length of cable attached to this input, and the source driving it, it may be desirable to add a coaxial 50 Ohm terminator to this input to provide a proper transmission line termination. The Pasternack (www.pasternack.com) PE6008-50 BNC feed-thru 50 Ohm terminator is suggested for this purpose.)

5) GPIB Connector. A standard GPIB cable can be attached to this connector to allow the instrument to be computer-controlled. See the “Programming Manual for -B Instruments” for more details on GPIB control.

6) RS-232 Connector. A standard serial cable with a 25-pin male connector can be attached to this connector to allow the instrument to be computer-controlled. See the “Programming Manual for -B Instruments” for more details on RS-232 control.

7) OUT. The 25-pin cable from the output module is connected to this connector.

8) HV BNC Connector. The shielded RG-58 cable from the output module is connected to this connector. This carries the high-voltage power supply (+50V or -50V, depending on the output polarity) to the output module.

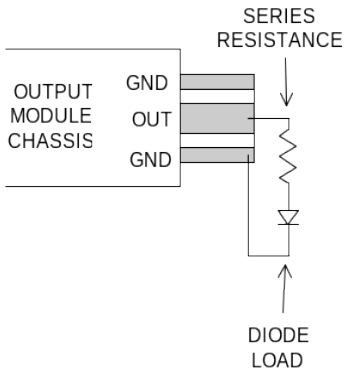
9) AMP Connector. (Optional feature. Present on -EA units only.) The output amplitude can be set to track the voltage on the rear-panel “AMP” input. Zero Volts in corresponds to zero amplitude output, and +10V in corresponds to maximum amplitude out (for the range selected by the RANGE input). This mode is activated by selecting "Ext Control" on the front-panel amplitude menu, or with the "source:voltage external" command. The input impedance is greater than 1 kilohm.

OUTPUT MODULE CONTROLS AND CONNECTORS

OUT Microstrip Line

The main output is provided on the center conductor of the microstrip board protruding from the output module. The outer two conductors, as well as the reverse side of the microstrip board are connected to ground.

A typical connection scheme (for positive output current) is shown below:

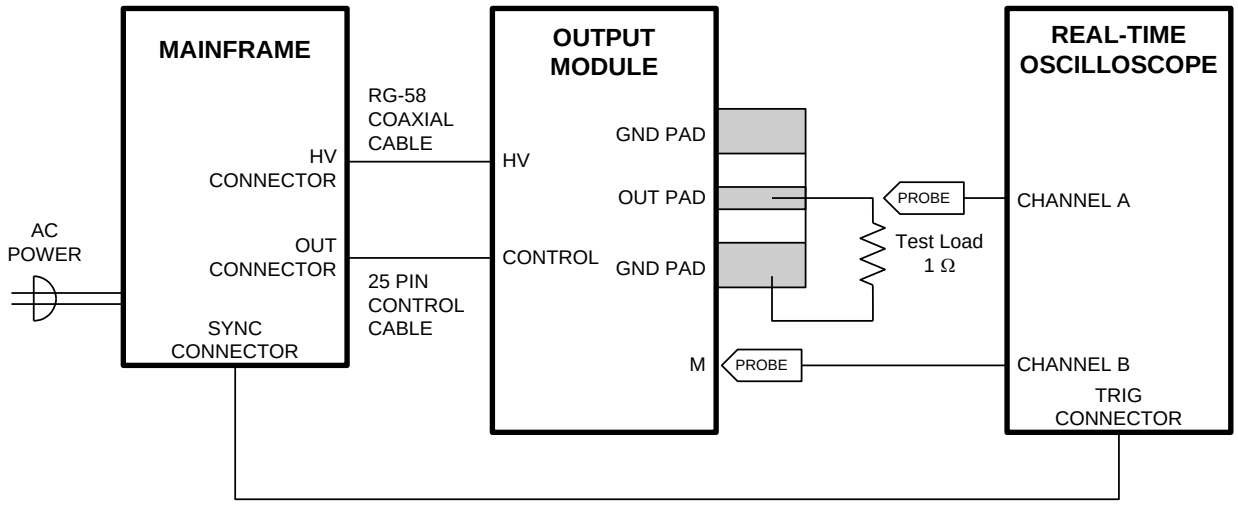


The load should be connected between the OUT and GND terminals using very short leads (<5.0 cm, and preferably < 0.5 cm). Severe inductive voltage spikes will result from any series inductance (Lenz's Law). Take care to ensure that during soldering the OUT conductor is not shorted to the chassis. Use minimal heat when soldering to avoid delaminating the metal pads.

If the load cannot be placed directly on the output terminals of the -PG module, the AV-LZ1 transmission line should be used between the -PG module and the load (see the Avtech AV-LZ1 data sheet, available at www.avtechpulse.com).

GENERAL INFORMATION

BASIC TEST ARRANGEMENT



The equipment should be connected in the general fashion shown above. For dual-polarity instruments, both output modules should be connected, with the positive output module connected to the "OUT P" connector, and the negative output module connected to the "OUT N" connector. Only one of the HV cables can be connected to the HV connector at a time. Connect the HV cable for the polarity that will be used.

Output modules should always be connected to the mainframe **BEFORE power is applied**.

Proper choice of test resistance is important. It is essential that the resistive test load be low-inductance. (Wirewound resistors are not acceptable, unless many are connected together in parallel.) The power dissipated in the resistor is given by

$$P_{AVERAGE} = I^2 \times R \times PW / T$$

$$P_{PEAK} = I^2 \times R$$

where “I” is the current, “R” is the resistance, “PW” is the pulse width, and “T” is the pulse period (1/frequency).

The power rating of the resistance should exceed this average power rating by a large margin. Beware that some low-value resistors exhibit a significant temperature-dependence, even when the average power dissipated is below the resistor’s power rating. This is particularly true if the peak power exceeds the resistor’s power rating.

Factory tests are conducted with a 1Ω load capable of dissipating at least 5 W. Higher load resistance values may be used but the output voltage must be limited to 20V or less.

BASIC PULSE CONTROL

This instrument can be triggered by its own internal clock or by an external TTL trigger signal. In either case, two output channels respond to the trigger: OUT and SYNC. The OUT channel is the signal that is applied to the device under test. Its amplitude and pulse width are variable. The SYNC pulse is a fixed-width TTL-level reference pulse used to trigger oscilloscopes or other measurement systems. When the delay is set to a positive value the SYNC pulse precedes the OUT pulse.

These pulses are illustrated below, assuming internal triggering, positive delay, and a positive output:

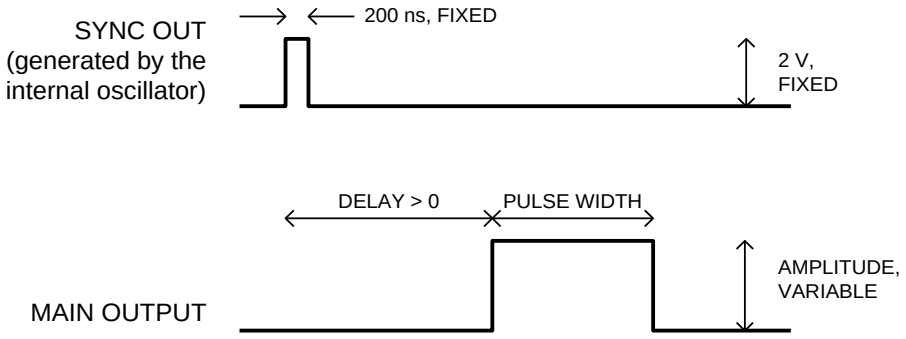


Figure A

If the delay is negative, the order of the SYNC and OUT pulses is reversed:

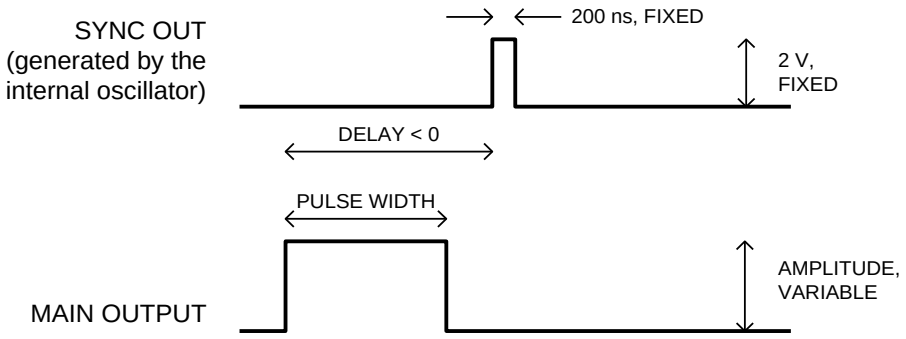


Figure B

The next figure illustrates the relationship between the signal when an external TTL-level trigger is used:

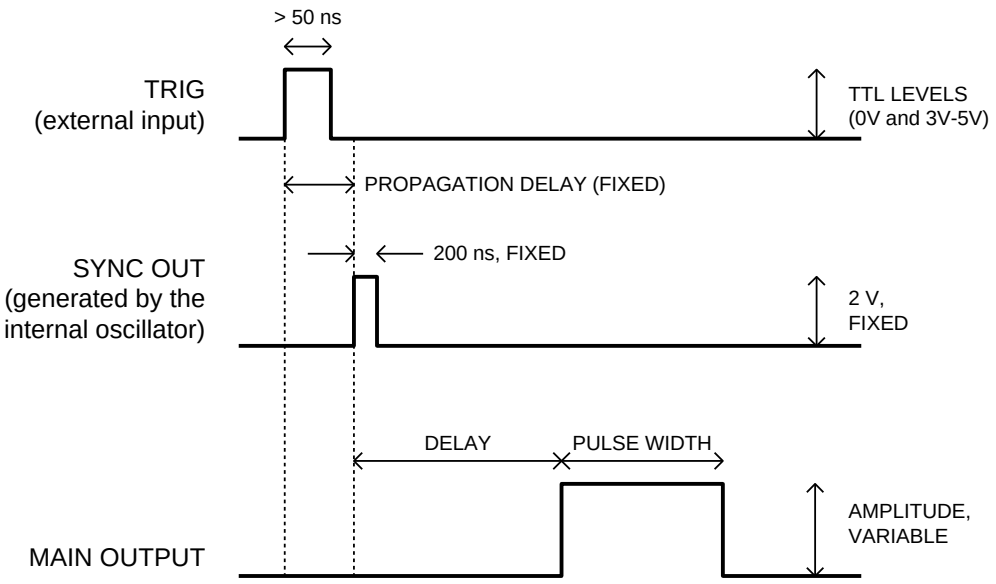


Figure C

As before, if the delay is negative, the order of the SYNC and OUT pulses is reversed.

The delay, pulse width, and frequency (when in the internal mode), of the OUT pulse can be varied with front panel controls or via the GPIB or RS-232 computer interfaces.

TRIGGER MODES

This instrument has four trigger modes:

Internal Trigger: the instrument controls the trigger frequency, and generates the clock internally.

External Trigger: the instrument is triggered by an external TTL-level clock on the back-panel TRIG connector.

Manual Trigger: the instrument is triggered by the front-panel “SINGLE PULSE” pushbutton.

Hold Trigger: the instrument is set to not trigger at all.

These modes can be selected using the front panel trigger menu, or by using the appropriate programming commands. (See the “Programming Manual for -B Instruments” for more details.)

GATING MODES

Triggering can be suppressed by a TTL-level signal on the rear-panel GATE connector. The instrument can be set to stop triggering when this input high or low, using the front-panel gate menu or the appropriate programming commands. This input can also be set to act synchronously or asynchronously. When set to asynchronous mode, the GATE will disable the output immediately. Output pulses may be truncated. When set to synchronous mode, the output will complete the full pulse width if the output is high, and then stop triggering. No pulses are truncated in this mode.

CURRENT MONITOR

Instruments with the -M option include a current monitor output. The voltage on this output is proportional to the output current, according to this relation, approximately:

$$V_{MON} = k \times I_{OUT}$$

When the monitor output is connected to a high impedance load (>> 50Ω), k = 0.11 Volts/Amp. When the monitor output is driving a 50Ω load, k = 0.055 Volts/Amp. The monitor output is short-circuit protected.

The current monitor is not as fast as the main output. It is not useful for pulse widths below 5 us. For faster measurements, use a high-performance current transformer, such as a Pearson 2878 (http://www.pearsonelectronics.com/). The output voltage of the transformer is proportional to the sensed current. Note that because of the relatively large size of the 2878, it is necessary to introduce a significant lead length (i.e., inductance) to pass the conductor through the transformer.

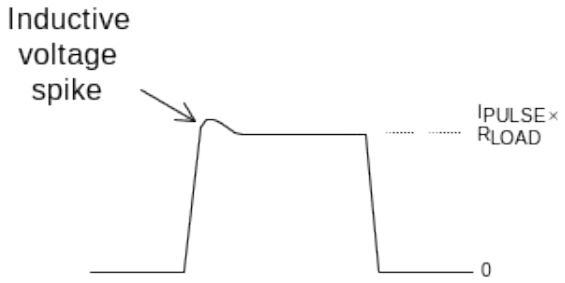
LOAD PROTECTION

LENZ'S LAW AND INDUCTIVE VOLTAGE SPIKES

This instrument is designed to pulse resistive and diode loads and will exhibit a large output spike when used to drive a load with significant inductance (as predicted by LENZ'S LAW). For this reason the load should be connected to the output using low inductance leads (as short as possible and as heavy a gauge as possible).

The voltage developed across an inductance L (in Henries), when the current is changing at a rate given by dI_{LOAD}/dt (in Amps/sec), is: $V_{SPIKE} = L\frac{dI_{LOAD}}{dt}$.

Some load inductance is unavoidable. As a result, the output voltage waveform (measured across a resistance) will have some distortion on the leading edge, as shown:



Attaching a current transformer (for measuring current waveforms) can add significant inductance, because of the necessary wire length that must be fed through the transformer. (The Pearson 2878 requires approximately 1.5".) For this reason it is recommended that the optional self-contained current transformer ("M") be used.

ATTACHING AND DETACHING LOADS

To avoid damaging the loads connected to main outputs, the loads should only be connected to or removed from the instrument when the instrument is off. Do not connect loads when the instrument is on and the output amplitude is not zero. This can cause sparking.

CHANGING PARAMETERS WHEN A LOAD IS ATTACHED

If your load is easily damaged, the amplitude should be reduced to zero before changing the trigger source, frequency, pulse width, or other pulse parameters. This protects the loads from possible short transient effects.

START-UP CHECK-LIST FOR LOCAL CONTROL

1) The instruction manual has been studied thoroughly.

2) The “Local Control” section of the “Programming Manual for -B Instruments” has been studied thoroughly.

3) The output module is connected to the mainframe as shown in the “Basic Test Arrangement” section. (The output module should always be connected to the mainframe BEFORE power is applied.)

4) The load is connected to the output module microstrip output. The center conductor is the output line, and the two outer conductors are connected to ground. For initial testing, it is recommended that a resistive load be used. Factory tests are conducted using a 1 Ohm, 5 Watt resistive load.

   These tests may also be conducted using a diode load. In this case, for -P units (or when using the positive output module of a “-PN” unit), the diode anode should be connected to the wide center microstrip on the output circuit board, and the cathode should be connected to either of the narrow outer microstrips. For -N units (or when using the negative output module of a “-PN” unit), the diode cathode should be connected to the wide center microstrip on the output circuit board, and the anode should be connected to either of the narrow outer microstrips.

5) Attach an oscilloscope probe to the load.

6) Turn on the prime power to the mainframe. The main menu will appear.

7) The arrow pointer should be pointing at the frequency menu item. If it is not, press the MOVE button until it is.

8) Press the CHANGE button. The frequency submenu will appear. Rotate the ADJUST knob until the frequency is set at the desired setting. The arrow pointer should be pointing at the “Internal” choice. If it is not, press MOVE until it is.

9) Press CHANGE to return to the main menu.

10) Press the MOVE button to move the arrow pointer to the pulse width menu item. Press CHANGE to bring up the pulse width submenu, and rotate the ADJUST knob until the pulse width is set at the desired setting. The arrow pointer should be pointing at the “Normal” choice. If it is not, press MOVE until it is. Press CHANGE to return to the main menu.

11) Press the MOVE button to move the arrow pointer is pointing at the output item. Press CHANGE to bring up the output submenu. The arrow pointer should be initially be pointing at the “Output Off” choice. Press MOVE so that the arrow

pointer is pointing at the “Output On” choice. (The mainframe is now supplying a trigger to the output module.) Press CHANGE to return to the main menu.

12) Press the MOVE button to move the arrow pointer to the amplitude menu item. Press CHANGE to bring up the amplitude submenu, and rotate the ADJUST knob until the amplitude is set at the desired setting. A rectangular pulse should appear on the scope and the amplitude should increase as the ADJUST knob is rotated.

13) Observe the pulse width and pulse period on the scope and confirm that the peak current does not exceed 15 Amps.

14) Adjust pulse width, pulse period (i.e. PRF) and amplitude to obtain the desired settings.

15) If additional assistance is required:

Tel: (613) 226-5772, Fax: (613) 226-2802
Email: info@avtechpulse.com

PROGRAMMING YOUR PULSE GENERATOR

KEY PROGRAMMING COMMANDS

The “Programming Manual for -B Instruments” describes in detail how to connect the pulse generator to your computer, and the programming commands themselves. A large number of commands are available; however, normally you will only need a few of these. Here is a basic sample sequence of commands that might be sent to the instrument after power-up:

```
*rst                    (resets the instrument)
trigger:source internal (selects internal triggering)
frequency 10 Hz         (sets the frequency to 10 Hz)
pulse:width 10 us       (sets the pulse width to 1 us)
pulse:delay 200 ns      (sets the delay to 200 ns)
output on               (turns on the output)
source:current 14 A     (sets the current amplitude to 14 amperes)
```

For triggering a single event, this sequence would be more appropriate:

```
*rst                    (resets the instrument)
trigger:source hold     (turns off all triggering)
pulse:width 10 us       (sets the pulse width to 1 us)
output on               (turns on the output)
source:current 14 A     (sets the current amplitude to 14 amperes)
trigger:source immediate (generates a single non-repetitive trigger event)
trigger:source hold     (turns off all triggering)
output off              (turns off the output)
```

To set the instrument to trigger from an external TTL signal applied to the rear-panel TRIG connector, use:

```
*rst                    (resets the instrument)
trigger:source external (selects internal triggering)
pulse:width 10 us       (sets the pulse width to 1 us)
pulse:delay 200 ns      (sets the delay to 200 ns)
source:current 14 A     (sets the current amplitude to 14 amperes)
output on               (turns on the output)
```

These commands will satisfy 90% of your programming needs.

ALL PROGRAMMING COMMANDS

For more advanced programmers, a complete list of the available commands is given below. These commands are described in detail in the “Programming Manual for -B Instruments”. (Note: this manual also includes some commands that are not implemented in this instrument. They can be ignored.)

Keyword	Parameter	Notes
DIAGnostic:		
:AMPLitude		
:CALibration:	<numeric value>	[no query form]
LOCAL		
OUTPut:		
:[STATe]	<boolean value>	
:PROTection		
:TRIPped?		[query only]
REMOTE		
[SOURce]:		
:FREQuency		
[:CW | FIXed]	<numeric value>	
[SOURce]:		
:CURRent		
[:LEVel]		
[:IMMediate]		
[:AMPLitude]	<numeric value>	
:PROTection		
:TRIPped?		[query only]
[SOURce]:		
:PULSe		
:PERiod	<numeric value>	
:WIDTh	<numeric value>	
:DCYCle	<numeric value>	
:HOLD	WIDTh | DCYCle	
:DELay	<numeric value>	
:GATE		
:TYPE	ASYNC | SYNC	
:LEVel	HIgh | LOw	
STATUS:		
:OPERation		
:[EVENt]?		[query only, always returns "0"]
:CONDition?		[query only, always returns "0"]
:ENABle	<numeric value>	[implemented but not useful]
:QUEStionable		
:[EVENt]?		[query only, always returns "0"]
:CONDition?		[query only, always returns "0"]
:ENABle	<numeric value>	[implemented but not useful]
SYSTem:		
:COMMunicate		
:GPIB		
:ADDRess	<numeric value>	
:SERial		
:CONTrol		
:RTS	ON | IBFull | RFR	
:[RECeive]		

:BAUD	1200 | 2400 | 4800 | 9600	
:BITS	7 | 8	
:ECHO	<boolean value>	
:PARity		
:[TYPE]	EVEN | ODD | NONE	
:SBITS	1 | 2	
:ERRor		
:[NEXT]?		[query only]
:COUNT?		[query only]
:VERSion?		[query only]
TRIGger:		
:SOURce	INTernal | EXTernal | MANual | HOLD | IMMediate	
*CLS		[no query form]
*ESE	<numeric value>	
*ESR?		[query only]
*IDN?		[query only]
*OPC		
*SAV	0 | 1 | 2 | 3	[no query form]
*RCL	0 | 1 | 2 | 3	[no query form]
*RST		[no query form]
*SRE	<numeric value>	
*STB?		[query only]
*TST?		[query only]
*WAI		[no query form]

MECHANICAL INFORMATION

TOP COVER REMOVAL

If necessary, the interior of the instrument may be accessed by removing the four Phillips screws on the top panel. With the four screws removed, the top cover may be slid back (and off).

Always disconnect the power cord before opening the instrument.

There are no user-adjustable internal circuits. For repairs other than fuse replacement, please contact Avtech (info@avtechpulse.com) to arrange for the instrument to be returned to the factory for repair.

⚠ Caution: High voltages are present inside the instrument during normal operation. Do not operate the instrument with the cover removed.

RACK MOUNTING

A rack mounting kit is available. The -R5 rack mount kit may be installed after first removing the one Phillips screw on the side panel adjacent to the front handle.

ELECTROMAGNETIC INTERFERENCE

To prevent electromagnetic interference with other equipment, all used outputs should be connected to shielded 50Ω loads using shielded 50Ω coaxial cables. Unused outputs should be terminated with shielded 50Ω coaxial terminators or with shielded coaxial dust caps, to prevent unintentional electromagnetic radiation. All cords and cables should be less than 3m in length.

MAINTENANCE

REGULAR MAINTENANCE

This instrument does not require any regular maintenance.

On occasion, one or more of the four rear-panel fuses may require replacement. All fuses can be accessed from the rear panel. See the “FUSES” section for details.

CLEANING

If desired, the interior of the instrument may be cleaned using compressed air to dislodge any accumulated dust. (See the “TOP COVER REMOVAL” section for instructions on accessing the interior.) No other cleaning is recommended.

PERFORMANCE CHECK SHEET