INSTRUCTIONS

MODEL AVR-9D-B

0 TO 20 VOLTS, $R_L \geq 1\ \Omega$

PULSE GENERATOR

WITH IEEE 488.2 AND RS-232 CONTROL

SERIAL NUMBER: ____________

WARRANTY

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TECHNICAL SUPPORT

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Manual Reference: /fileserver1/officefiles/instructword/avr-9/AVR-9D-B,edition1.doc, created September 10, 2002

INTRODUCTION

The AVR-9D-B is a high performance, GPIB and RS232-equipped instrument capable of producing amplitudes of up to 20 V into ≥ 1 Ω (i.e., up to 20 Amps of current). The output voltage polarity depends on the model number:

"-P" units: 0 to +20 Volts
"-N" units: 0 to -20 Volts
"-PN" units: 0 to ±20 Volts

The output duty cycle may be as high as 10%. Pulse delay, advance and width are variable up to 200 µs. Rise and fall times are fixed at less than 50 ns. The AVR-9D-B can be triggered internally, or triggered or gated by an external source. A front-panel pushbutton can also be used to trigger the instrument. The output pulse width can also be set to follow an input trigger pulse.

The AVR-9D-B features front panel keyboard and adjust knob control of the output pulse parameters along with a four line by 40-character backlit LCD display of the output amplitude, polarity, pulse width, pulse repetition frequency and delay. The instrument includes memory to store up to four complete instrument setups. The operator may use the front panel or the computer interface to store a complete “snapshot” of all key instrument settings, and recall this setup at a later time.

The MOSFET output stages will safely withstand any combination of front panel control settings, output open or short circuits, and high duty cycles. An internal power supply monitor removes the power to the output stage for five seconds if an average power 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. The instrument will operate with duty cycles up to 10%. The output stage will source up to 20 Amps (and will automatically shut down if the load current exceeds 20 Amps).

SPECIFICATIONS

Model:	AVR-9D-B
Amplitude: -P units: -N units: -PN units:	0 to +20 Volts, $R_L \geq$ 1 Ohm, +20 Amps maximum 0 to -20 Volts, $R_L \geq$ 1 Ohm, -20 Amps maximum 0 to ±20 Volts, $R_L \geq$ 1 Ohm, ±20 Amps maximum
Pulse width:	0.2 to 200 us
Rise time, fall time:	≤ 50 ns
Duty Cycle (maximum):	10%
Average Output Power, Max:	40W
PRF:	0 to 5 kHz
Output impedance:	≤ 0.1 Ω
GPIB and RS-232 control:	Standard on -B units.
LabView Drivers:	Check 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 ± 200 μs (sync out to pulse out)
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.
Connectors:	Out: solder terminals on the end of 60 cm flexible microstrip Other: BNC
Power requirements:	120/240 Volts (switchable) 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:	+ 15° to + 40° C

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 "OP1B Interface Programming Manual") 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:

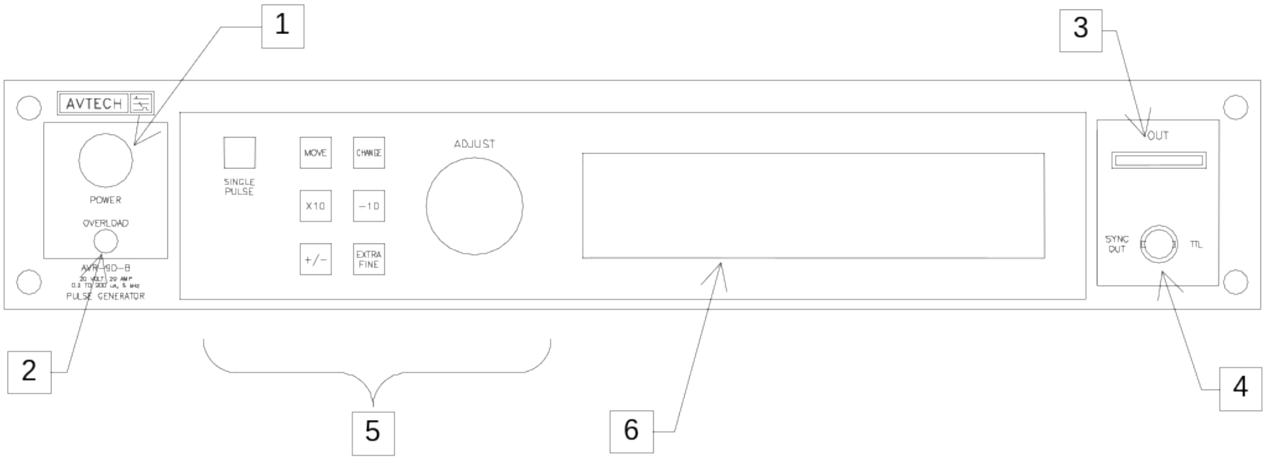
If it is not set for the proper voltage, remove the fuse and then grasp the card with a pair of pliers and remove it. Rotate horizontally through 180 degrees. Reinstall the card and the correct fuse.

In the 120V setting, a 1.5A slow blow fuse is required. In the 240V setting, a 0.75A slow blow fuse is required.

LABVIEW DRIVERS

A LabVIEW driver for this instrument is available for download on the Avtech web site, at http://www.avtechpulse.com/labview. A copy is also available in National Instruments' Instrument Driver Library at http://www.natinst.com/.

FRONT PANEL CONTROLS



1. POWER Switch. The POWER push button switch applies AC prime power to the primaries of the transformer, turning the instrument on. The push button lamp (#382 type) is connected to the internal +15V DC supply.

2. OVERLOAD. The AVR-9D-B is protected in its internal software against conflicting or dangerous settings. As an additional protective measure, an automatic overload circuit exists, which controls the front panel overload light. 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 turn the output of the instrument OFF and turn the indicator light ON. The light will stay ON (i.e. output OFF) for about 5 seconds after which the instrument will attempt to turn ON (i.e. light OFF) for about 1 second. If the overload condition persists, the instrument will turn OFF again (i.e. light ON) for another 5 seconds. If the overload condition has been removed, the instrument will turn on and resume normal operation.

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

   Note that the output stage will safely withstand a short-circuited load condition.

3. OUT CONNECTOR. This is the main output. The LZ1 transmission line (or the LZ1-to-BNC adapter) plugs into this socket. The upper side of the socket (“UP”) is the signal line. The lower side (“DOWN”) is connected to ground.

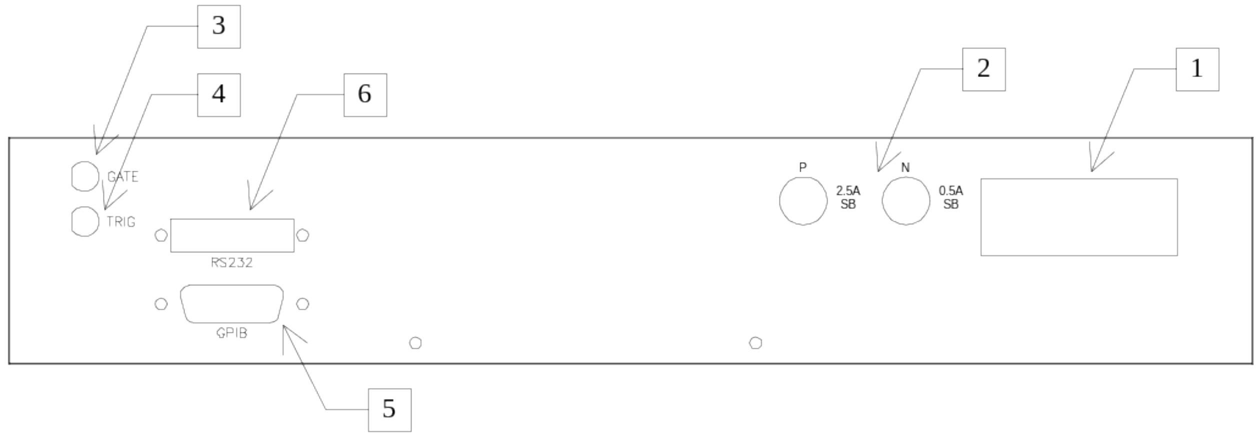
4. SYNC OUT. This connector supplies a SYNC output that can be used to trigger other equipment, particularly oscilloscopes. This signal leads (or lags) the main output by a duration set by the "DELAY" controls and has an approximate amplitude of +3 Volts to R_L > 1 kΩ with a pulse width of approximately 200 ns.

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.

6. 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 “OP1B Interface Programming Manual” describes the menus and submenus in detail.

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 1.5A slow blow fuse is required. In the 240V setting, a 0.75A slow blow fuse is required. See the “Installation” section for more details.

2. DC Slow-Blow Fuses. These fuses (2.5A and 0.5A) protect the output stage if the output duty cycle rating is exceeded.

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.)

When triggering externally, the instrument can be set such that the output pulse width tracks the pulse width on this input, or the output pulse width can be set independently.

5. GPIB Connector. A standard GPIB cable can be attached to this connector to allow the instrument to be computer-controlled. See the “OP1B Interface Programming Manual” 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 “OP1B Interface Programming Manual” for more details on RS-232 control.

GENERAL INFORMATION

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 load. 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. When the delay is set to a negative value the SYNC pulse follows the OUT pulse.

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

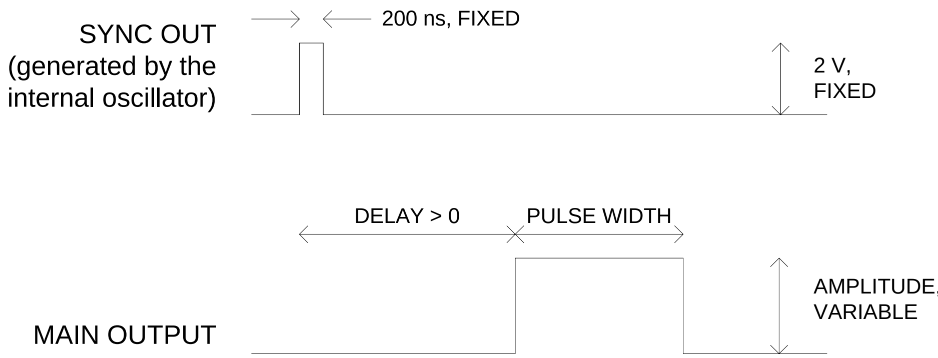


Figure A

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

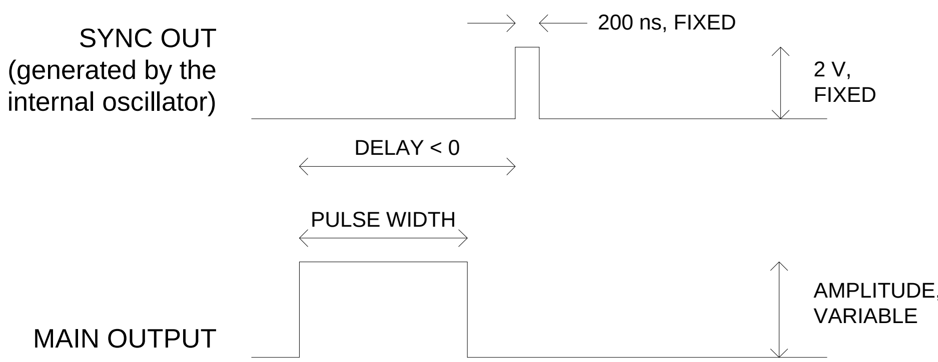


Figure B

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

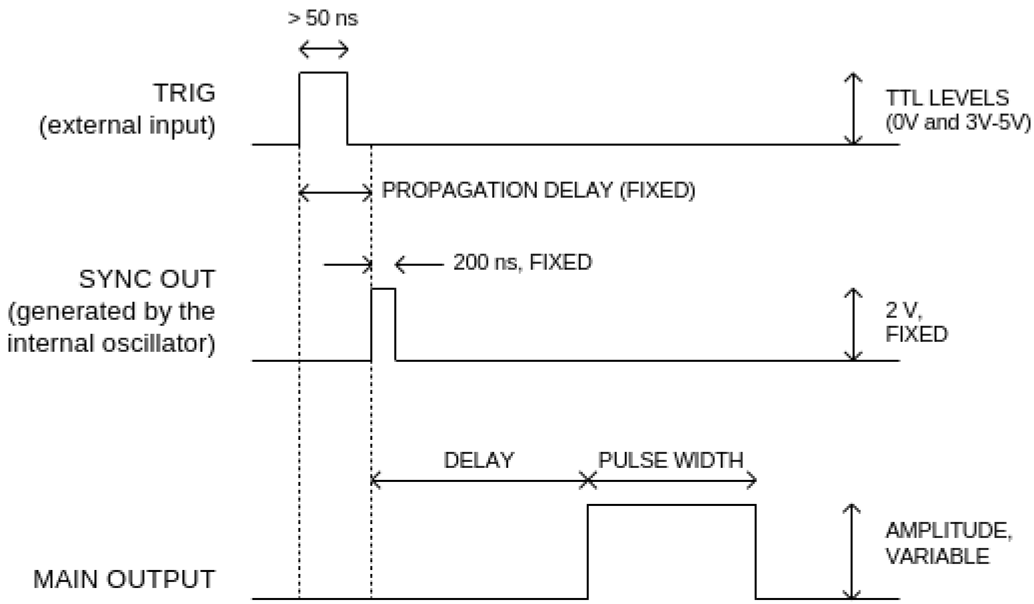


Figure C

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

The last figure illustrates the relationship between the signal when an external TTL-level trigger is used in the $PW_{IN}=PW_{OUT}$ mode. In this case, the output pulse width equals the external trigger's pulse width (approximately), and the delay circuit is bypassed:

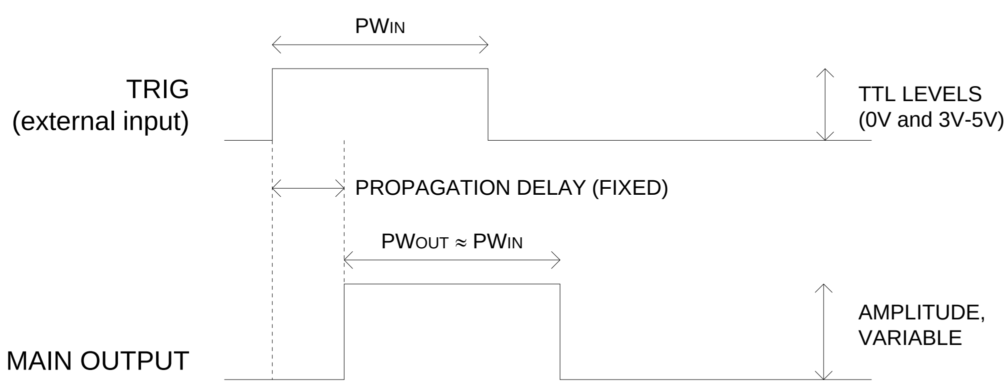


Figure D

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 “OP1B Interface Programming Manual” for more details.)

PULSE WIDTH MODES

This instrument has two pulse width modes:

- Normal: the instrument controls the output pulse width.
- PW_{IN}=PW_{OUT}: the output pulse width equals the pulse width of the trigger signal on the “TRIG” connector. The instrument must be in the external trigger mode.

These modes can be selected using the front panel pulse width menu, or by using the appropriate programming commands. (See the “OP1B Interface Programming Manual” 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.

TOP COVER REMOVAL

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).

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 BNC terminators or with shielded BNC dust caps, to prevent unintentional electromagnetic radiation. All cords and cables should be less than 3m in length.

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.

GENERAL INFORMATION - OPERATING INTO A LOAD

AMPLITUDE CONTROL

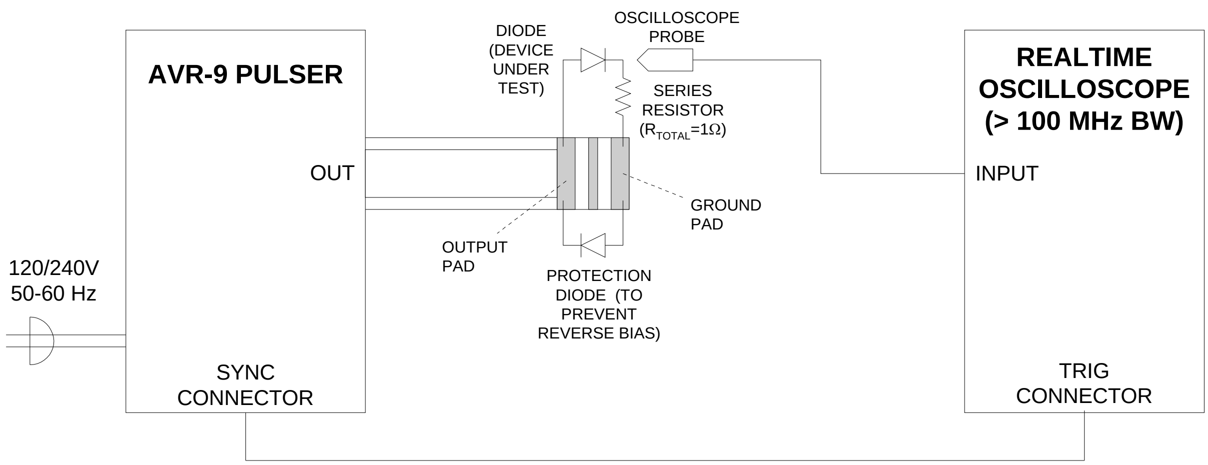
The AVR-9D-B pulse generator is a voltage pulser. The current amplitude is determined by Ohm's Law. That is, the current is the output voltage divided by the load resistance.

More specifically, $I_{OUT} = \frac{V_{SETTING} - V_{DIODE}}{R}$,

where $V_{SETTING}$ is the set amplitude, V_{DIODE} is the diode voltage (if present), and R is the series resistance (including any series resistance in the diode itself). R is normally 1Ω; it should not be smaller than this.

TEST ARRANGEMENT

The recommended test arrangement is shown below, assuming that the device under test is a diode:



NOTE: BOTH DIODES ARE SHOWN ORIENTED FOR A POSITIVE OUTPUT. REVERSE BOTH DIODES FOR NEGATIVE OPERATION.

There are several key points to note. As explained above, a resistance should be added in series with the diode load, to limit the maximum current. This resistance may also be used to monitor the current through the diode current. If connected as shown above, the resistor voltage displayed on the oscilloscope is directly proportional to the diode current. It is essential the low-inductance resistors be used. Several non-inductive, medium power resistors should be used in parallel (for instance, five 4.7 Ohm 2W resistors). The Ohmite OY series (www.ohmite.com) or the RCD RSF2B series (www.rcd-comp.com) are appropriate.

It is also recommended that a low-capacitance, high-voltage, ultra-fast Schottky rectifier diode be connected for reverse-bias protection, especially for sensitive or costly devices under test. Note, however, that the capacitance added by the protection diode may degrade the output rise time slightly.

CONNECTING THE LOAD

The AVR-9D-B generates waveforms with relatively fast rise and fall times (< 50 ns) and high current amplitudes (to 20 Amps). Because of this, some care must be taken when connecting the load to the instrument if waveforms distortions (ringing, overshoot, degraded rise time) are to be avoided.

CONNECTING TO 1 OHM LOADS USING THE LZ1 OUTPUT LINE

The AVR-9D-B is optimized for use with 1Ω loads. A flexible, 1Ω-characteristic-impedance transmission line is supplied with this instrument. One end plugs into the front-panel OUT connector, and the other end is terminated with a 1.0 × 2.5 cm section of glass epoxy circuit board. The end that plugs into the front panel is marked with an “UP” side and a “DOWN” side. (The UP side is the signal output, and the DOWN side is ground.) It is critically important that the “UP” side of the line be visible.

The load may be soldered to the circuit board end. The circuit board layout is illustrated below:

Error! Not a valid link.

The length of leads used to connect the load to the circuit board should be kept extremely short (< 0.5 cm), as discussed below.

CONNECTING TO 1 OHM LOADS USING THE LZ1-to-BNC ADAPTER

An adapter is provided with this instrument to allow BNC cables to be attached to the LZ output socket. However, due to the non-trivial inductance present in the adapter and the transmission line mismatch that will be caused by using 50Ω cables, use of the adapter is only recommended if the user is not concerned about degraded rise and fall times and ringing on the output waveform.

CONNECTING TO HIGHER IMPEDANCE LOADS

As noted above, the AVR-9D-B is optimized for use with 1Ω loads. The AVR-9D-B can be used to drive loads with impedance greater than 1Ω, but some waveforms distortions (ringing, overshoot, degraded rise time) may be observed. If this causes difficulties, better performance may be obtained by adding a resistor in parallel with the load to reduce the effective load impedance to 1 Ohm.

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: $V_{SPIKE} = L\frac{dI_{LOAD}}{dt}$.

For this reason, the length of leads used to connect the load to the circuit board should be kept extremely short (< 0.5 cm).

OPERATIONAL CHECK

This section describes a sequence to confirm the basic operation of the instrument. It should be performed after receiving the instrument. It is a useful learning exercise as well.

Before proceeding with this procedure, finish reading this instruction manual thoroughly. Then read the “Local Control” section of the “OP1B Interface Programming Manual” thoroughly. The “Local Control” section describes the front panel controls used in this operational check - in particular, the MOVE, CHANGE, and ADJUST controls.

1. Connect a cable from the SYNC OUT connector to the TRIG input of an oscilloscope. Connect a 40W (or higher) 1Ω load to the OUT connector and place the scope probe across this load. (See the “CONNECTING THE LOAD” section for appropriate methods of attaching the load.) Set the oscilloscope to trigger externally with the vertical setting at 5 Volts/div and the horizontal setting at 1 us/div.

2. Turn on the AVR-9D-B. The main menu will appear on the LCD.

3. To set the AVR-9D-B to trigger from the internal clock at a PRF of 1 kHz:

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

   b) Press the CHANGE button. The frequency submenu will appear. Rotate the ADJUST knob until the frequency is set at 1 kHz.

   c) The arrow pointer should be pointing at the “Internal” choice. If it is not, press MOVE until it is.

   d) Press CHANGE to return to the main menu.

4. To set the delay to 1 μs:

   a) Press the MOVE button until the arrow pointer is pointing at the delay menu item.

   b) Press the CHANGE button. The delay submenu will appear. Rotate the ADJUST knob until the delay is set at 1 μs.

c) The arrow pointer should be pointing at the “Normal” choice. If it is not, press MOVE until it is.

d) Press CHANGE to return to the main menu.

5. To set the pulse width to 1 μs:

   a) Press the MOVE button until the arrow pointer is pointing at the pulse width menu item.

   b) Press the CHANGE button. The pulse width submenu will appear. Rotate the ADJUST knob until the pulse width is set at 1 μs.

   c) The arrow pointer should be pointing at the “Normal” choice. If it is not, press MOVE until it is.

   d) Press CHANGE to return to the main menu.

6. At this point, nothing should appear on the oscilloscope.

7. To enable the output:

   a) Press the MOVE button until the arrow pointer is pointing at the output menu item.

   b) Press the CHANGE button. The output submenu will appear.

   c) Press MOVE until the arrow pointer is pointing at the “ON” choice.

   d) Press CHANGE to return to the main menu.

8. To change the output amplitude:

   a) Press the MOVE button until the arrow pointer is pointing at the amplitude menu item.

   b) Press the CHANGE button. The amplitude submenu will appear. Rotate the ADJUST knob until the amplitude is set at 20V (-20V for “-N” units).

   c) Observe the oscilloscope. You should see 1 μs wide, 20V pulses.

   d) Rotate the ADJUST knob. The amplitude as seen on the oscilloscope should vary. Set it at 20V.

   e) Press CHANGE to return to the main menu.

9. Try varying the pulse width, by repeating step (5). As you rotate the ADJUST knob, the pulse width on the oscilloscope will change. It should agree with the displayed value. Stay below 10% duty cycle.

This completes the operational check.

PROGRAMMING YOUR PULSE GENERATOR

KEY PROGRAMMING COMMANDS

The “OP1B Interface Programming Manual” 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 1000 Hz	(sets the frequency to 1000 Hz)
pulse:width 1 us	(sets the pulse width to 1 us)
pulse:delay 1 us	(sets the delay to 1 us)
volt 20	(sets the amplitude to +20 V)
output on	(turns on the output)

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

*rst	(resets the instrument)
trigger:source hold	(turns off all triggering)
pulse:width 500 ns	(sets the pulse width to 500 ns)
output on	(turns on the output)
volt:ampl +20	(sets the amplitude to +20 V)
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 500 ns	(sets the pulse width to 500 ns)
pulse:delay 1 us	(sets the delay to 1 us)
volt:ampl 19V	(sets the amplitude to +19 V)
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 “OP1B Interface Programming Manual”. (Note: this manual also includes some commands that are not implemented in this instrument. They can be ignored.)

Keyword	Parameter	Notes
LOCAL		
OUTPut:		
:[STATe]	<boolean value>	
:PROTection		
:TRIPped?		[query only]
REMOTE		
[SOURce]:		
:FREQuency		
[:CW | FIXed]	<numeric value>	
[SOURce]:		
:PULSe		
:PERiod	<numeric value>	
:WIDTh	<numeric value> | IN	
:DCYCle	<numeric value>	
:HOLD	WIDTh | DCYCle	
:DELay	<numeric value>	
:GATE		
:TYPE	ASYNC | SYNC	
:LEVel	HIgh | LOw	
[SOURce]:		
:VOLTage		
[:LEVel]		
[:IMMediate]		
[:AMPLitude]	<numeric value> | EXTernal	
:PROTection		
:TRIPped?		[query only]
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]
```

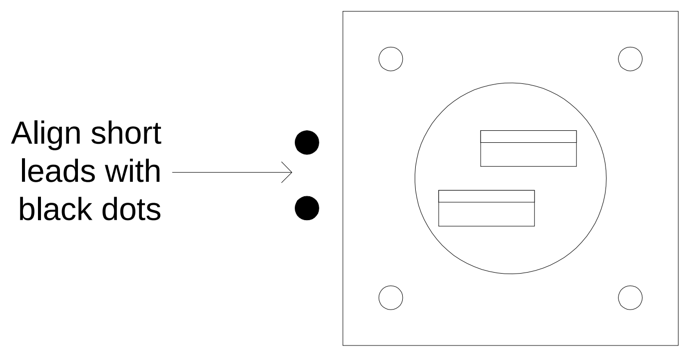
REPAIR PROCEDURE

In the event of an instrument malfunction, it is most likely that the DC slow-blow fuses or the main AC power fuse on the rear panel have failed. Replace if necessary.

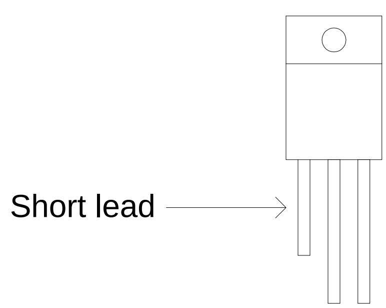
If the unit still does not function, it is most likely that some of the output switching elements (SL32T) may have failed due to an output short circuit condition or to a high duty cycle condition. The switching elements may be accessed by removing the cover plate on the bottom side of the output module. The cover plate is removed by removing the four countersunk 6-32 Phillips screws.

NOTE: First turn off the prime power. Briefly ground the SL32T tabs to discharge the 24V power supply potential.

Bottom view of instrument, with cover plate removed



SL32T transistor



The elements may be removed from their sockets by means of a needle nosed pliers after removing the four counter sunk 2-56 Phillips screws which attach the small copper heat sink to the body of the output module. The SL32T is a selected MOSFET power transistor in a TO-220 package and may be checked on a curve tracer. If defective, replacement units should be ordered directly from Avtech. When replacing the SL32T switching elements, take care to ensure that the short lead (of the three leads) is adjacent to the black dots. (See the above illustration). The SL32T elements are electrically isolated from the small copper heat sink but are bonded to the heat sink using Wakefield Type 155 Heat Sink Adhesive.

PERFORMANCE CHECK SHEET