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SINCE 1975

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INSTRUCTIONS

MODEL AVO-1-C

25 TO 100 AMP, 1 kHz, 20 ns

LASER DIODE DRIVER

SERIAL NUMBER: _____

WARRANTY

Avtech Electrosystems Ltd. warrants products of its manufacture to be free from defects in material and workmanship under conditions of normal use. If, within one year after delivery to the original owner, and after prepaid return by the original owner, this Avtech product is found to be defective, Avtech shall at its option repair or replace said defective item. This warranty does not apply to units which have been dissembled, modified or subjected to conditions exceeding the applicable specifications or ratings. This warranty is the extent of the obligation assumed by Avtech with respect to this product and no other warranty or guarantee is either expressed or implied.

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INTRODUCTION

The AVO-1-C is a high performance instrument capable of generating 25 to 100 Amps of pulsed current into low-impedance loads, at repetition rates up to 1 kHz. The pulse width is fixed at 20 ns ± 5 ns (measured at half-power) on standard units. It is variable from 5 to 25 ns on units with the -WH option.

The AVO-1-C consists of a mainframe unit and an output module. The diode load is connected in series with a low-value current limiting resistor (R_L) between two output solder terminals (OUT and GND). The maximum amplitude is set by the series resistance. On standard units, a resistance of R_L=1 Ω corresponds to a maximum amplitude of 100 Amps, and a resistance of R_L=6 Ω corresponds to a maximum amplitude of 25 Amps, approximately. The output amplitude may be varied from 50% to 100% of the maximum amplitude set by the resistance by varying a one-turn dial on the front-panel.

On units with the -WH option, the half-power pulse width may be varied from 5 ns to 25 ns by varying the capacitance (C_L) between the W and GND terminals on the output module, from 500 pF to 10000 pF approximately. The capacitors should be rated for 400V. Silver mica capacitors are recommended. Amplitude control is slightly different for -WH units. For -WH units, R_L varies from 0.22 to 2.2 Ω. The amplitude is also affected by the value of C_L. A 100 Amp, 5 ns pulse is obtained using $C_L \approx$ 500 pF and $R_L \approx$ 0.22 Ω. A 100 Amp, 25 ns pulse is obtained using $C_L \approx$ 10000 pF and $R_L \approx$ 2.2 Ω. Some tweaking of C_L and R_L may be required to obtain the ideal waveshape.

This instrument is intended for use in research and development laboratories.

SPECIFICATIONS

Model:	AVO-1-C[1]
Amplitude:	25 - 100 Amps (variable by an external series resistor R[2] and one-turn control)
Pulse width: (at half-power)	20 ± 5 ns (5 to 25 ns option)[3]
PRF:	0 to 1 kHz
Polarity[4]:	Positive or negative or both (specify)
Propagation delay:	≤ 50 ns (Ext trig in to pulse out)
Jitter:	± 100 ps (Ext trig in to pulse out)
Trigger required:	Ext trig mode: +5 Volt, 50 to 500 ns (TTL)
Sync delay:	Sync out to pulse out: Variable 0 to 200 ns
Sync output:	+5 Volts, 200 ns, will drive 50 Ohm loads
Connectors:	Out: Solder terminals Trig: BNC
Power requirements:	100 - 240 Volts, 50 - 60 Hz
Dimensions: Mainframe: (H x W x D) Output module:	100 mm x 215 mm x 375 mm (3.9" x 8.5" x 14.8") 28 mm x 36 mm x 58 mm (1.1" x 1.4" x 2.3")
Chassis material: Mainframe: Output module:	anodized aluminum, with blue plastic trim cast aluminum, blue enamel

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 page 112 for additional details of the basic instrument formats).
2) 1 Ohm < R < 6 Ohm for standard units. 0.22 Ohm < R < 2.2 Ohm for units with the -WH option.
3) For the variable pulse width option add suffix -WH. Pulse width is controlled by soldering silver mica capacitors (500 to 10000 pF, 400V) to solder terminals on the output module.
4) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative).

INSTALLATION

VISUAL CHECK

After unpacking the instrument mainframe and the transformer module, examine to ensure that they have not been damaged in shipment. Visually inspect all connectors, knobs, and handles. Confirm that a power cord and an instrumentation manual (this manual), are with the instrument. If the instrument has been damaged, file a claim immediately with the company that transported the instrument.

POWER RATINGS

This instrument is intended to operate from 100 - 240 V, 50 - 60 Hz.

The maximum power consumption is 57 Watts. Please see the “FUSES” section for information about the appropriate AC and DC fuses.

This instrument is an “Installation Category II” instrument, intended for operation from a normal single-phase supply.

CONNECTION TO THE POWER SUPPLY

An IEC-320 three-pronged recessed male socket is provided on the back panel for AC power connection to the instrument. One end of the detachable power cord that is supplied with the instrument plugs into this socket. The other end of the detachable power cord plugs into the local mains supply. Use only the cable supplied with the instrument. The mains supply must be earthed, and the cable used to connect the instrument to the mains supply must provide an earth connection. (The supplied cable does this.)

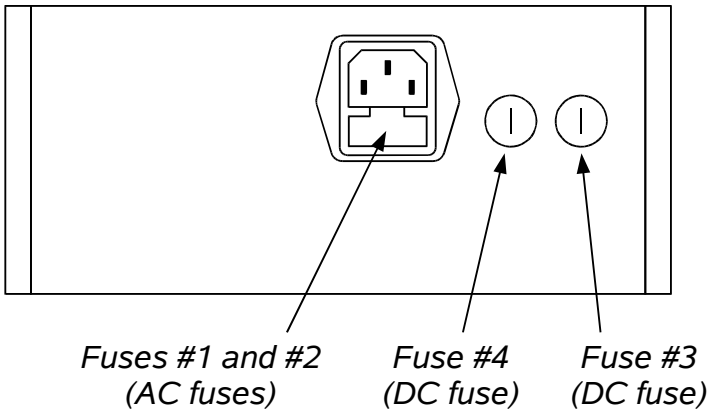
ENVIRONMENTAL CONDITIONS

This instrument is intended for use under the following conditions:

a) indoor use;
b) altitude up to 2 000 m;
c) temperature 5 °C to 40 °C;
d) maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
e) Mains supply voltage fluctuations up to ±10 % of the nominal voltage;
f) no pollution or only dry, non-conductive pollution.

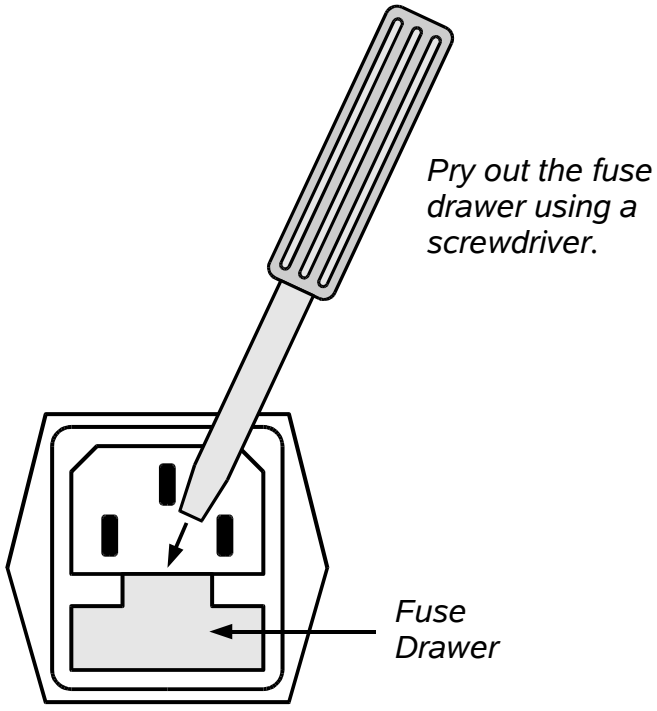
FUSES

This instrument contains four fuses. All are accessible from the rear-panel. Two protect the AC prime power input, and two protect the internal DC power supplies. The locations of the fuses on the rear panel are shown in the figure below:



AC FUSE REPLACEMENT

To physically access the AC fuses, the power cord must be detached from the rear panel of the instrument. The fuse drawer may then be extracted using a small flat-head screwdriver, as shown below:



DC FUSE REPLACEMENT

The DC fuses may be replaced by inserting the tip of a flat-head screwdriver into the fuse holder slot, and rotating the slot counter-clockwise. The fuse and its carrier will then pop out.

FUSE RATINGS

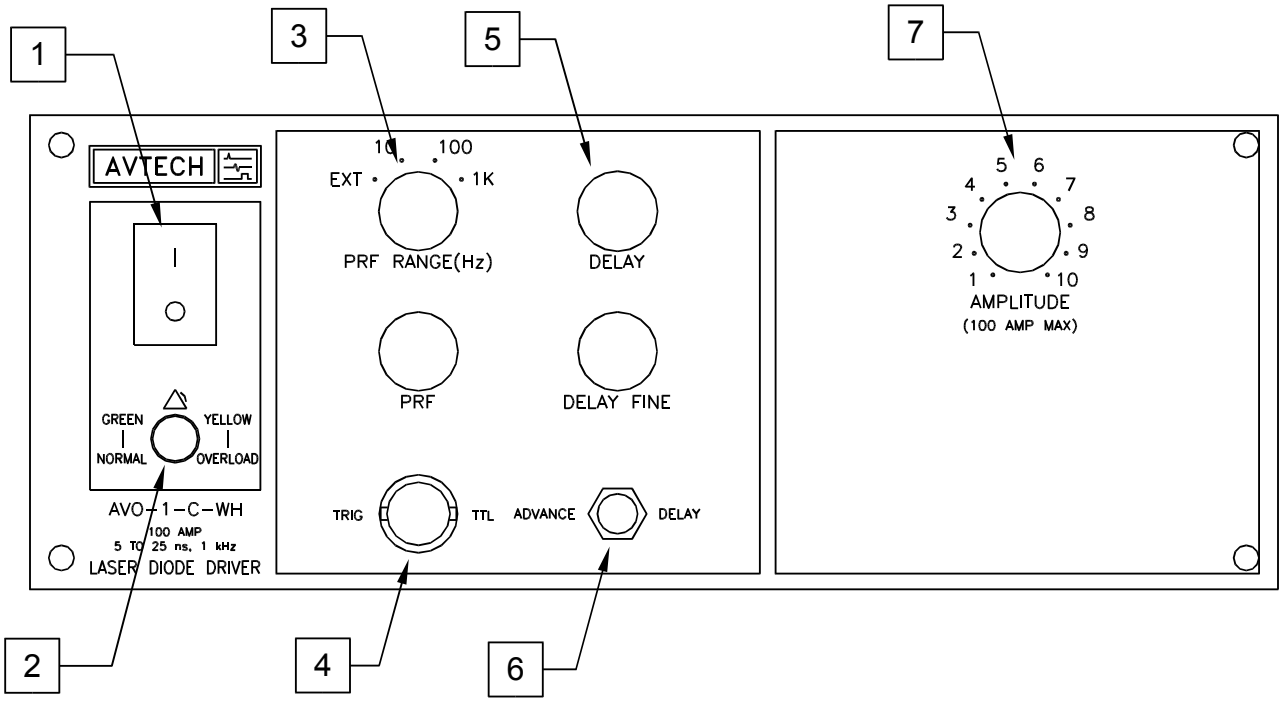
The following table lists the required fuses:

Fuses	Nominal Mains Voltage	Rating	Case Size	Manufacturer's Part Number (Wickmann)	Distributor's Part Number (Digi-Key)
#1, #2 (AC)	100-240V	0.25A, 250V, Time-Delay	5×20 mm	1950250000	WK5035-ND
#3 (DC)	N/A	0.5A, 250V, Time-Delay	5×20 mm	1950500000	WK5041-ND
#4 (DC)	N/A	Not used. A spare 0.5A fuse is installed here.			

The fuse manufacturer is Wickmann (http://www.wickmann.com/).

Replacement fuses may be easily obtained from Digi-Key (http://www.digikey.com/) and other distributors.

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.

3) PRF Range Switch. This switch sets the pulse repetition frequency (PRF) range of the internal oscillator. The marked value of each position is the upper limit of the 10:1 range, approximately. The vernier dial directly below the switch varies the PRF within the set range.

If this switched is set to the “EXT” position, the instrument is triggered by a signal applied to the TRIG connector, rather than by the internal oscillator.

4) TRIG Connector. When the PRF Range Switch is set to one of the four internal oscillator ranges, this connector is an output, which supplies a 2V, 200 ns wide pulse for each trigger event. This output may be used to trigger oscilloscopes or other equipment.

   When the PRF Range Switch is set to “EXT”, the instrument is triggered by a TTL pulse applied to this connector. The pulse must be at least 50 ns wide. 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. For systems using SMA connectors, the PE6026 SMA feed-thru 50 Ohm terminator is suggested.

5) Delay Controls. When the PRF Range Switch is set to one of the four internal oscillator ranges, the main output is advanced or delayed relative to the TRIG output pulse (item 3). The delay is variable up to 500 ns, approximately, using the DELAY and DELAY FINE dials.

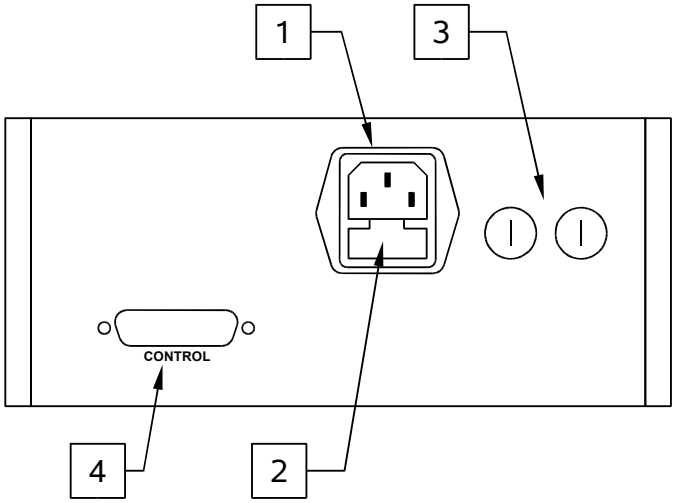
6) Advance/Delay Switch. When the PRF Range Switch is set to one of the four internal oscillator ranges, this switch determines whether the TRIG output precedes the main output (ADVANCE mode), or whether the TRIG output occur after the main output (DELAY mode).

7) Amplitude Control. This dial controls the pulse amplitude, over a 2:1 range approximately.

   The maximum amplitude is set by the series resistance. On standard units, a resistance of R_L=1 Ω corresponds to a maximum amplitude of 100 Amps, and a resistance of R_L=6 Ω corresponds to a maximum amplitude of 25 Amps, approximately. The output amplitude may be varied from 50% to 100% of the maximum amplitude set by the resistance by varying this dial on the front-panel.

   Amplitude control is slightly different for units for the -WH option. For -WH units, R_L varies from 0.22 to 2.2 Ω. The amplitude is also affected by the value of C_L. A 100 Amp, 5 ns pulse is obtained using $C_L \approx 500$ pF and $R_L \approx 0.22$ Ω. A 100 Amp, 25 ns pulse is obtained using $C_L \approx 10000$ pF and $R_L \approx 2.2$ Ω. The output amplitude may be varied from 50% to 100% of the maximum amplitude set by the resistance by varying this dial on the front-panel.

REAR PANEL CONTROLS



1. AC POWER INPUT. An IEC-320 C14 three-pronged recessed male socket is provided on the back panel for AC power connection to the instrument. One end of the detachable power cord that is supplied with the instrument plugs into this socket.

2. AC FUSE DRAWER. The two fuses that protect the AC input are located in this drawer. Please see the “FUSES” section of this manual for more information.

3. DC FUSES. These two fuses protect the internal DC power supplies. Please see the “FUSES” sections of this manual for more information.

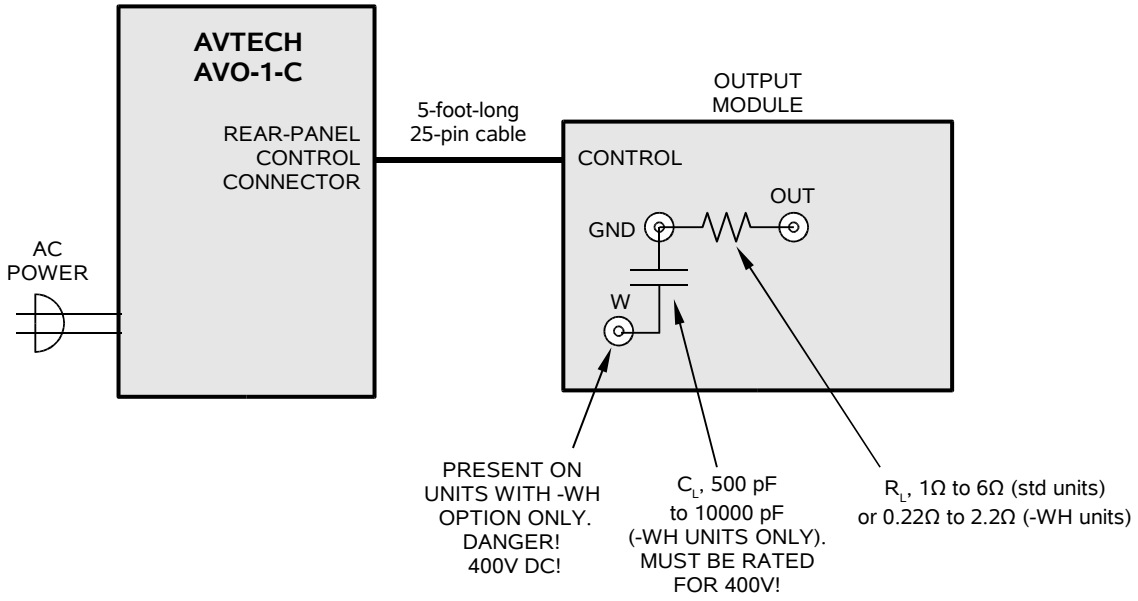
4. CONTROL CONNECTOR. The 5-foot-long 25-pin cable to the output module is connected to the mainframe at this point. The cable must always be connected before power is turned on.

GENERAL INFORMATION

BASIC TEST ARRANGEMENT

The AVO-1-C output module must be connected to the mainframe, using the supplied 5-foot-long 25-pin cable. (If this cable is lost, any 5-foot-long 25-pin "straight-through" cable will do.) Always connect this cable when the instrument is turned off.

The basic test arrangement is shown below:



To access the OUT, GND, and W (for -WH units) terminals, the aluminum cover plate must be removed, by unscrewing it from the bottom of the output module. The unit must be turned off and unplugged when the cover plate is removed.

⚠ Caution: Voltages as high as 400V may be present on the OUT and W terminals. Avoid touching these terminals. Do not operate the instrument without the output module cover plate installed. Only changed R_L and C_L when the unit is turned off.

A diode may be installed in series with R_L.

PULSE WIDTH CONTROL

On standard units, the output pulse width is not adjustable. On units with the -WH option, the pulse width may be varied from 5 ns to 25 ns by adjusting C_L from 500 pF to 10000 pF. The capacitors should be rated for 400V. Silver mica capacitors are

recommended. Varying C_L also affects the pulse amplitude. The pulse width, maximum amplitude, C_L and R_L are roughly related as follows:

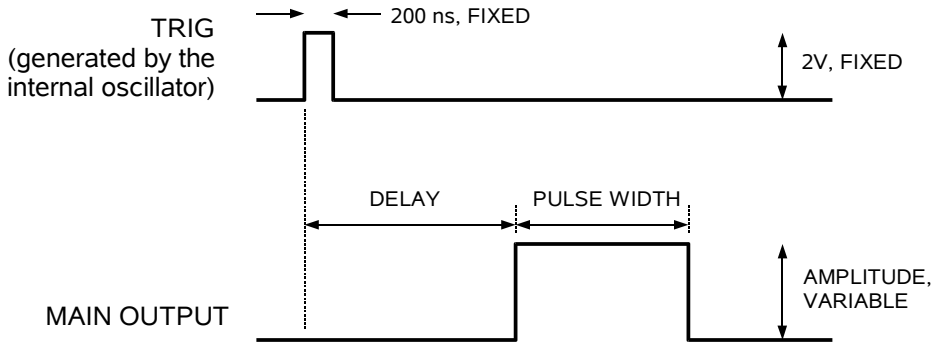
Desired output:	5 ns, 100 Amps	25 ns, 100 Amps
$C_{L:}$	500 pF	10000 pF
$R_{L:}$	0.22 Ω	2.2 Ω

TRIGGERING METHODS

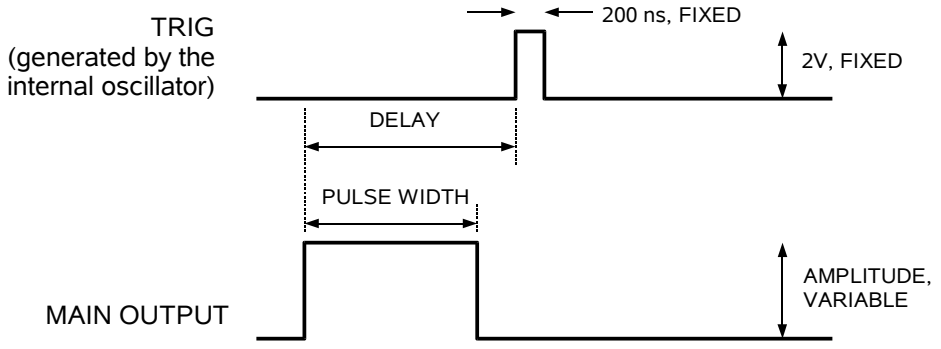
This instrument can be triggered by its own internal clock or by an external TTL trigger signal. When triggered internally, two output channels respond to the trigger: OUT and SYNC.

- OUT. This is the main output.
- TRIG. The TRIG pulse is a fixed-width TTL-level reference pulse used to trigger oscilloscopes or other measurement systems.

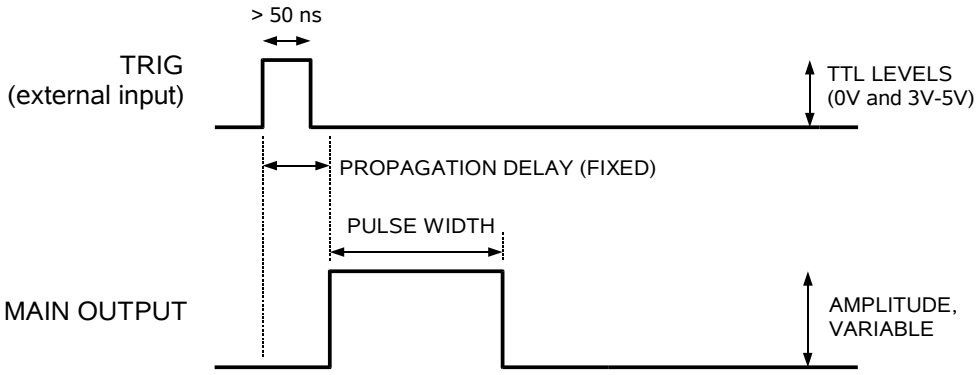
When the ADVANCE/DELAY switch is set to “ADVANCE”, the TRIG output precedes the main output. These pulses are illustrated below:



When the ADVANCE/DELAY switch is set to “DELAY”, the TRIG output occurs after the main output. This illustrated below:



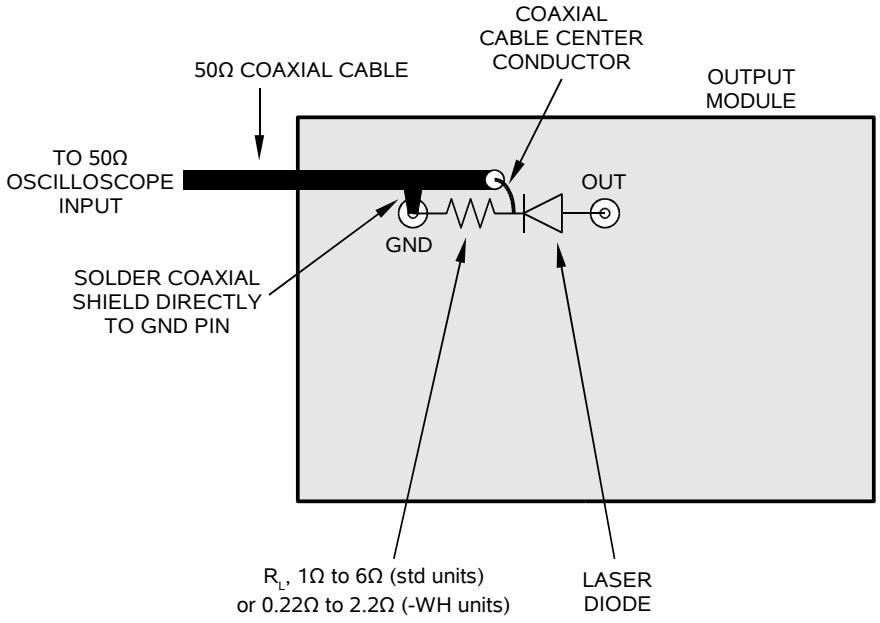
When triggered externally, the TRIG connector acts as an input. The delay controls do not function in this mode. This illustrated below:



MEASURING CURRENT WAVEFORMS

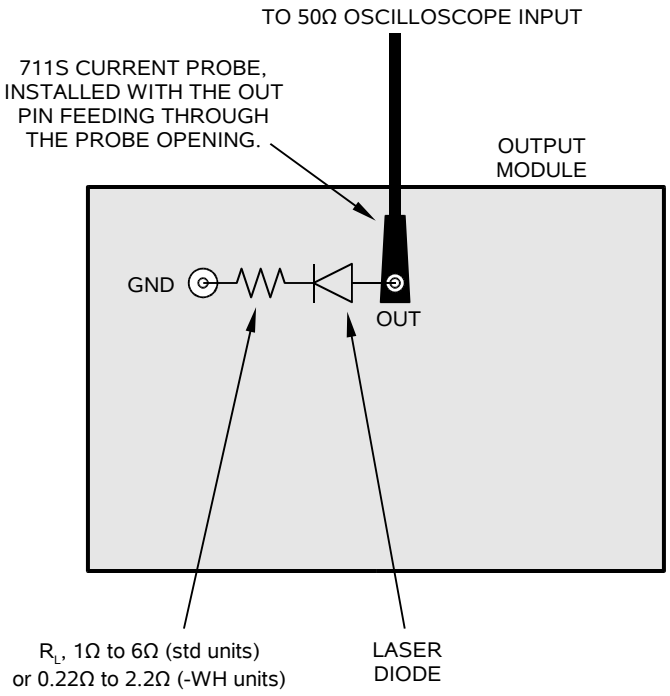
Two methods are recommended for observing the output current waveforms.

The first method is to use a 50Ω coaxial cable connected to an oscilloscope with 50Ω input impedance. The 50Ω input impedance is significantly larger than the typical load impedance (0.22 to 2.2Ω, or 1 to 6Ω), so it will not introduce significant distortions. This method is illustrated below:



The second method is to use an ultra-miniature current probe, such as the Integrated Sensor Technologies Model 711S (http://www.isensortech.com/). This probe can be

conveniently slid onto the OUT terminal, leaving ample room for the devices under test to be connected. This method is illustrated below:



PROTECTING YOUR INSTRUMENT

DO NOT EXCEED 1 kHz

The output stage may be damaged if triggered by an external signal at a pulse repetition frequency greater than 1 kHz.

ONLY INSTALL THE OUTPUT MODULE WHEN THE POWER IS OFF

Always connect the cable between the two CONTROL connectors when the instrument is turned off.

USE THE COVER PLATE

To access the OUT, GND, and W (for -WH units) terminals, the aluminum cover plate must be removed, by unscrewing it from the bottom of the output module. The unit must be turned off and unplugged when the cover plate is removed.

 Caution: Voltages as high as 400V may be present on the OUT and W terminals. Avoid touching these terminals. Do not operate the instrument without the output module cover plate installed. Only changed R_L and C_L when the unit is turned off.

USE LOW-INDUCTANCE LOADS

Lenz's Law predicts that for an inductive voltage spike will be generated when the current through an inductance changes. Specifically, $V_{SPIKE} = L \times dI_{LOAD}/dt$, where L is the inductance, I_{LOAD} is the load current change, and t is time. For this reason, it is important to keep any parasitic inductance in the load low. This means keeping wiring short (i.e., a few millimeters), and using low inductance components. In particular, wire-wound resistors should be avoided.

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.

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 CHECKSHEET