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SINCE 1975

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## INSTRUCTIONS

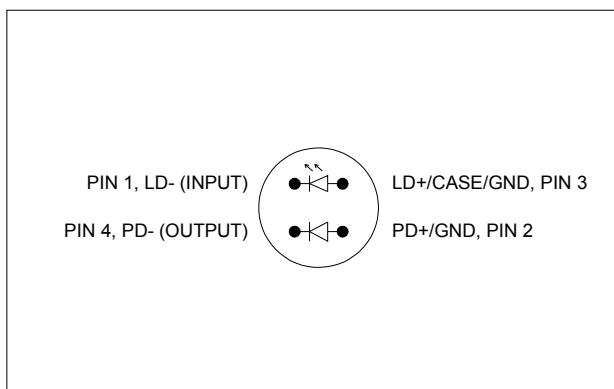
MODEL AVO-9C-C-HC-N-P2-MSHB-MD

0 TO 200 mA, 300 ps RISE TIME

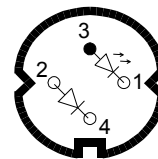
HIGH PERFORMANCE LASER DIODE DRIVER

WITH PLUG-IN SOCKET OUTPUT MODULE

SERIAL NUMBER: \_\_\_\_\_



**AVX-S1-HC OUTPUT MODULE, SOCKET VIEW**



**MATCHING USER-SUPPLIED  
DIODE PACKAGE  
(BOTTOM VIEW)**

### 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 disassembled, 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.

### TECHNICAL SUPPORT

Phone: 613-226-5772 or 1-800-265-6681

Fax: 613-226-2802 or 1-800-561-1970

E-mail: [info@avtechpulse.com](mailto:info@avtechpulse.com)

World Wide Web: <http://www.avtechpulse.com>

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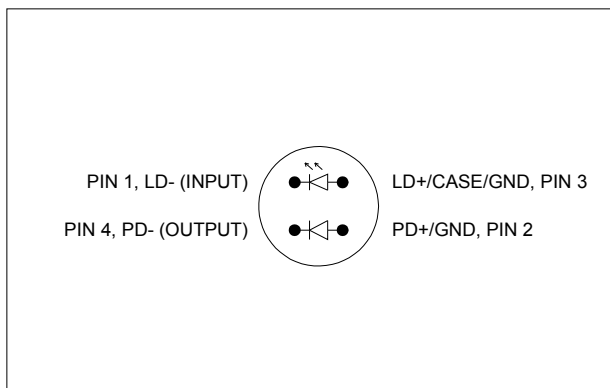
Manual Reference: T:\instructword\avo-9\AVO-9C-C-HC-N-P2-MSHB-MD,edition1.sxw.  
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## INTRODUCTION

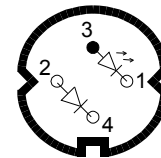
The AVO-9C-C-HC-N-P2-MSHB-MD is a high performance instrument capable of generating up to 200 mA of current into diode loads, at repetition rates up to 25 MHz.

The AVO-9C-C-HC-N-P2-MSHB-MD consists of a mainframe unit and an AVX-S1-HC series output module, which provides a socket into which the user's laser diode may be inserted. The mainframe generates voltage pulses of between 0 and -7V. The output module connects to the instrument mainframe via a detachable 2 foot long coaxial cable. The output module contains a current-boosting transformer (which provides current outputs of up to 200 mA), and an impedance-matching network to match the output module to the mainframe. A DC bias current of 0 to  $\pm 100$  mA may be applied to the laser diode by applying the desired DC current to a solder terminal on the output module. The output modules include an SMA output connector that provides an attenuated coincident replica of the diode current.

The AVX-S1-HC output module supplied with the AVO-9C-C-HC-N-P2-MSHB-MD is specifically designed to accommodate a Mitsubishi ML976H6F diode with the pinout illustrated below:



**AVX-S1-HC OUTPUT MODULE, SOCKET VIEW**



**MATCHING USER-SUPPLIED  
DIODE PACKAGE  
(BOTTOM VIEW)**

Note: the AVO-9C-C-HC-N-P2-MSHB-MD generates a negative voltage at the mainframe output. The output module drives the cathode of the laser diode; the anode is grounded.

## SPECIFICATIONS

Model:	AVO-9C-C-HC-N-P2-MSHB-MD <sup>2</sup>
Amplitude:	0 to -200 mA
Allowed load voltage range:	0 to 3V
Pulse width:	0.5 to 10 ns
PRF:	0 to 25 MHz
Rise time:	≤ 300 ps
Fall time:	≤ 300 ps
Related 50 Ohm model:	AVMM-2
Propagation delay:	≤ 30 ns (Ext trig in to pulse out)
Jitter:	± 15 ps (Ext trig in to pulse out)
DC offset or bias insertion:	Apply required DC bias current in the range of ± 100 mA to solder terminal on output module.
Sync delay:	Variable 0 to 200 ns (sync out to pulse out)
Sync output:	+0.5 Volts, 20 ns (to 50 Ohms)
Trigger required:	+ 5 V (TTL), ≥ 50 ns (ext trig mode)
Connectors:       OUT: TRIG / SYNC:	see diagram for appropriate diode pinout BNC
Power requirements:	100 - 240 Volts, 50 - 60 Hz
Dimensions:       Mainframe: (H x W x D)       Output module:	100 mm x 430 mm x 375 mm   (3.9" x 7.5" x 14.8") 41 mm x 66 mm x 76 mm   (1.6" x 2.6" x 3.0")
Chassis material: Mainframe: Output module:	anodized aluminum, with blue plastic trim cast aluminum, blue enamel

EC DECLARATION OF CONFORMITY

We

Avtech Electrosystems Ltd.  
P.O. Box 5120, LCD Merivale  
Ottawa, Ontario  
Canada K2C 3H4

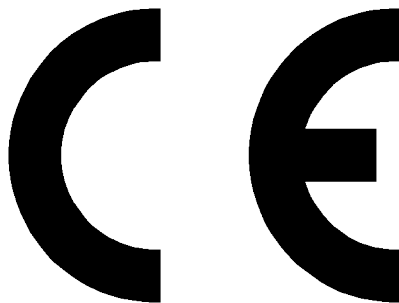
declare that this pulse generator meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

EN 50081-1 Emission

EN 50082-1 Immunity

and that this pulse generator meets the intent of the Low Voltage Directive 72/23/EEC as amended by 93/68/EEC. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use



## 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 115 / 230 V  $\pm$  10%, 50-60 Hz. The instrument automatically switches between these two levels. Note, however, that different fuses are required for the two ranges, as described in the "FUSES" section.

The maximum power consumption is 57 Watts. 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

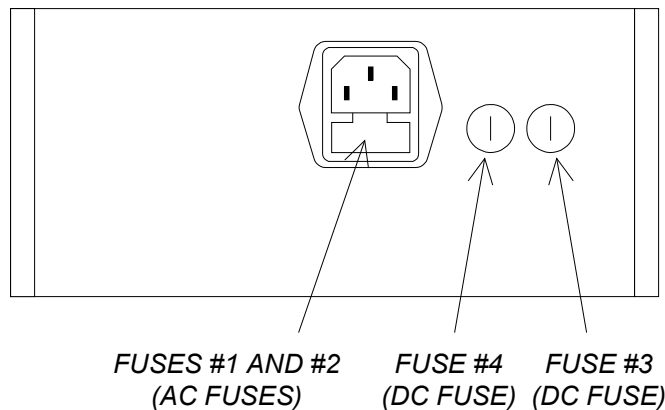
This instrument is intended for use under the following conditions:

- 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  $\pm$ 10 % of the nominal voltage;
- f) no pollution or only dry, non-conductive pollution.



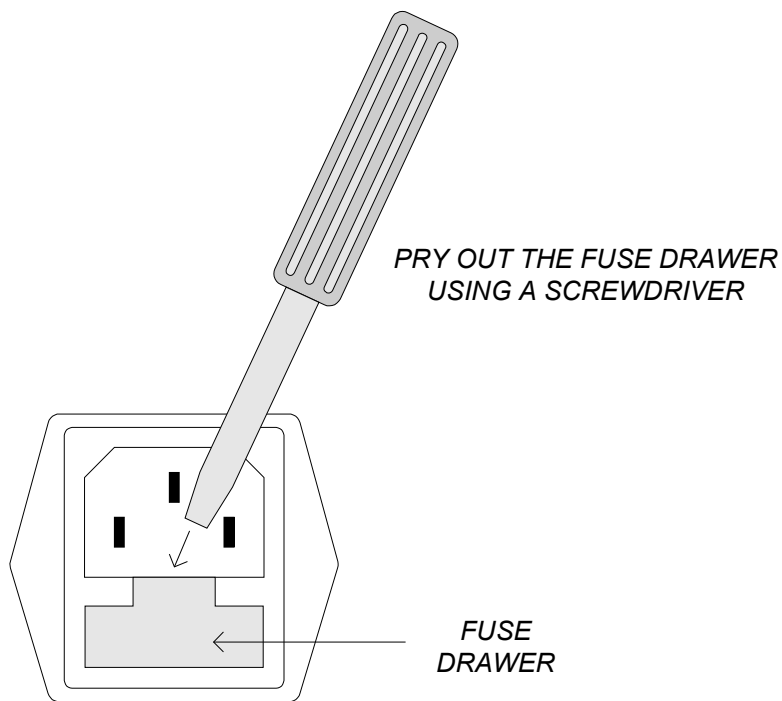
## FUSES

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

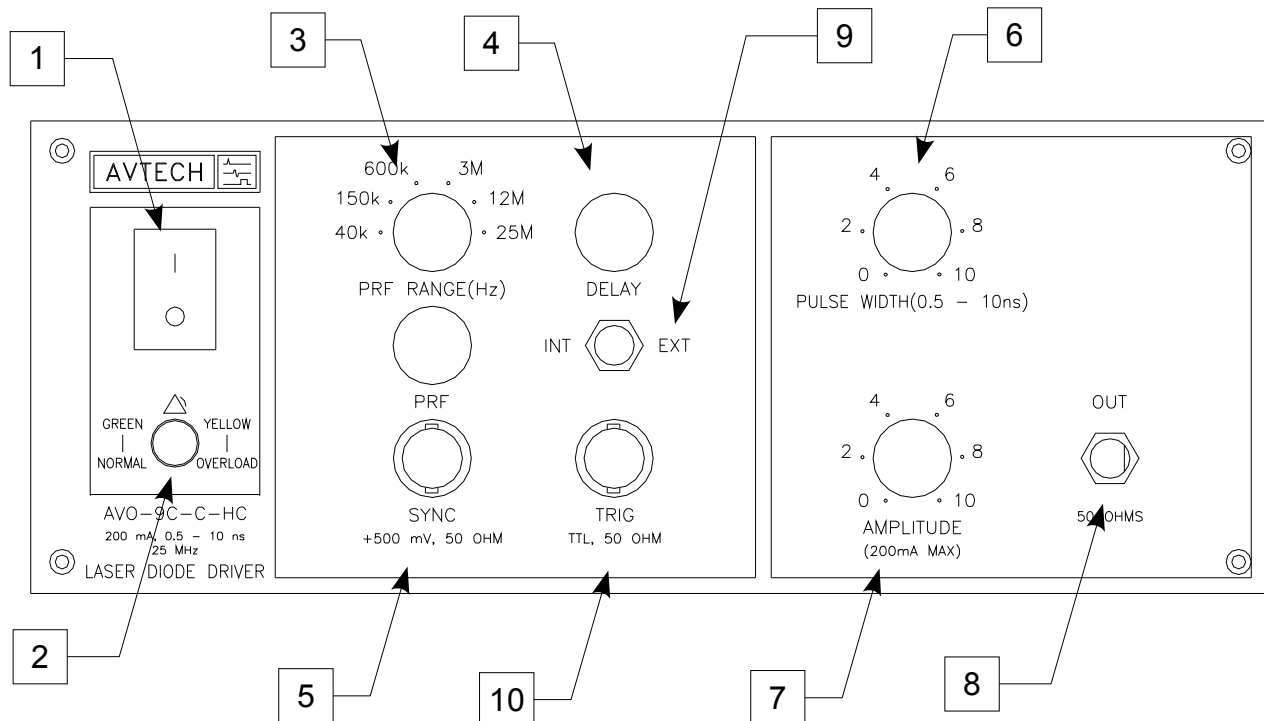
The following table lists the required fuses:

Fuses	Mains Voltage	Rating	Case Size	Manufacturer's Part Number (Wickmann)	Distributor's Part Number (Digi-Key)
#1, #2 (AC)	115 V	0.5A, 250V, Time-Delay	5 x 20 mm	1950500000	WK5041-ND
	230 V	0.25A, 250V, Time-Delay	5 x 20 mm	1950250000	WK5035-ND
#3 (DC)	115/230V	0.8A, 250V, Time-Delay	5 x 20 mm	1950800000	WK5046-ND
#4 (DC)	115/230V	0.8A, 250V, Time-Delay	5 x 20 mm	1950800000	WK5046-ND

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



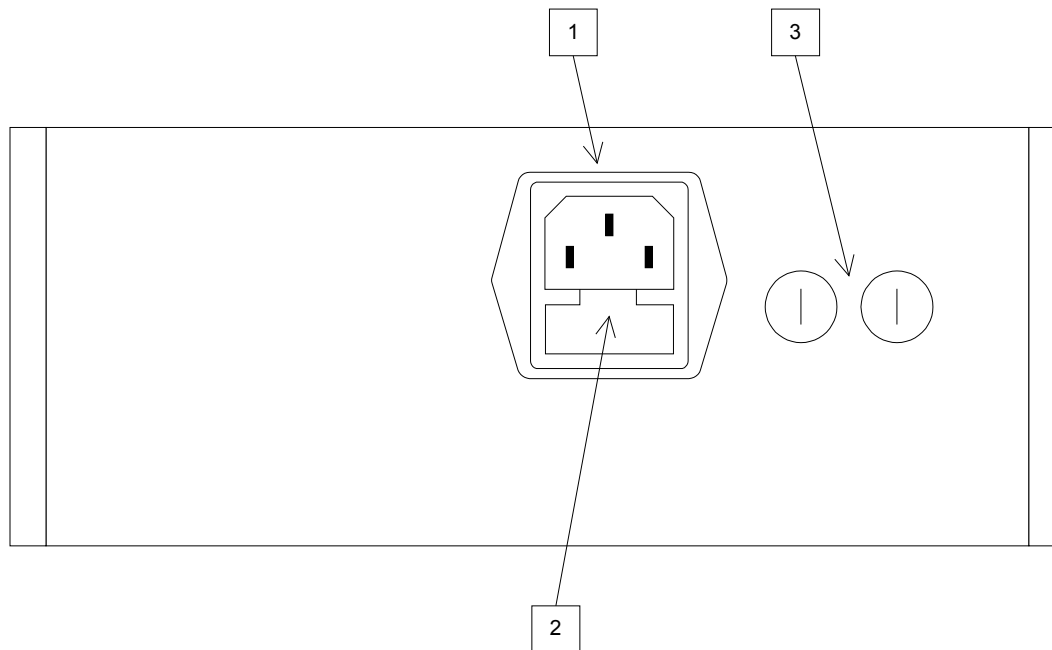
1. POWER Switch. This is the main power switch.
2. OVERLOAD Indicator. When the instrument is powered, this indicator is normally green, indicating normal operation. If this indicator is yellow, an internal automatic overload protection circuit has been tripped. If the unit is overloaded (by operating 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 and Vernier. This switch sets the pulse repetition frequency (PRF) range of the internal oscillator. The internal oscillator triggers the instrument when the INT/EXT switch is in the "INT" position. The marked value of each position is the upper limit range, approximately. The vernier dial directly below the switch varies the PRF within the set range.

4. DELAY Control. Controls the relative delay between the reference output pulse provided at the SYNC output (5) and the main output (8). This delay is variable over the range of 0 to 200 ns, approximately.
5. SYNC Output. This output precedes the main output (8) and is used to trigger the sampling scope time base. The output is a 200 mV, 10 ns (approx) pulse capable of driving a 50 Ohm load.
6. Pulse Width Control. This dial controls the pulse width.
7. Amplitude Control. This dial controls the pulse amplitude.
8. OUT Connector. This SMA connector is connected to the output module, when the output module is used to drive a diode load. If the output module is not used, this output will generate up to -7V into a load impedances of 50Ω. (NOTE: when the output module is not used, this output *requires* a 50Ω load to function properly).
9. EXT-INT Control. With this toggle switch in the INT position, the PRF of the unit is controlled via an internal clock, which in turn is controlled by the PRF controls. With the toggle switch in the EXT position, the AVM unit requires a 15 ns (or wider) TTL level pulse applied at the TRIG input in order to trigger the output stages. In addition, in this mode, the scope time base must be triggered by the external trigger source.
10. TRIG Input. The external trigger signal is applied at this input when the EXT-INT toggle switch is in the EXT position.

## REAR PANEL CONTROLS

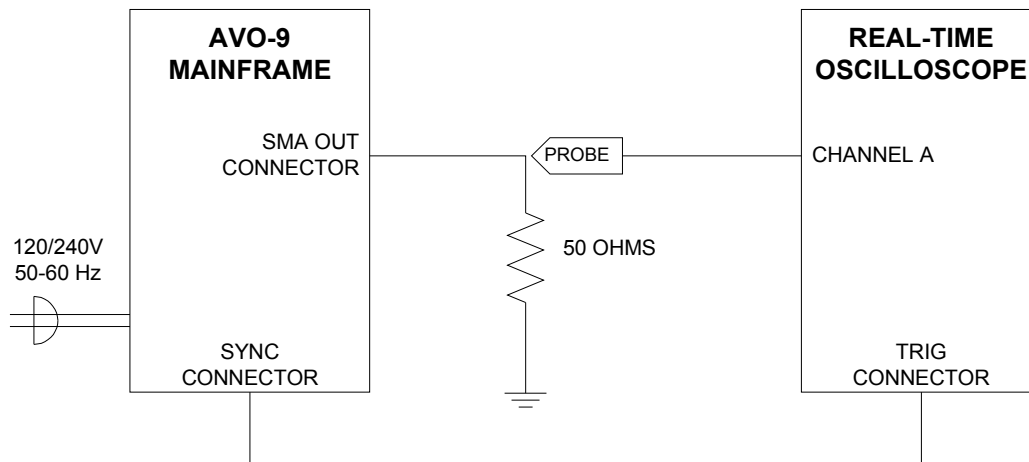


1. AC POWER INPUT. An IEC-320 C14 three-pronged recessed male socket is provided on the back panel for AC power connection to the instrument. One end of the detachable power cord that is supplied with the instrument plugs into this socket.
2. AC FUSE DRAWER. The two fuses that protect the AC input are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

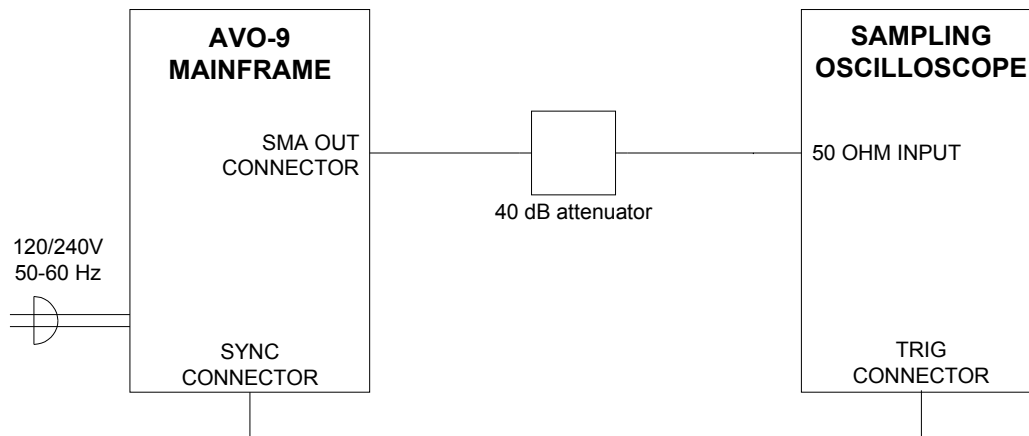
## GENERAL INFORMATION

### MINIMAL TEST ARRANGEMENT - WITHOUT OUTPUT MODULE

The AVO-9C-C-HC-N-P2-MSHB-MD can be tested initially without the supplied output module. If the output module is not used, the mainframe output generates 0 to -7V into a 50 Ohm load, as illustrated below:



Since the AVO-9C-C-HC-N-P2-MSHB-MD can generate pulses with rise times as low as 300 ps, it may be necessary to use a sampling oscilloscope, rather than a real-time oscilloscope. In this case, the test arrangement should be altered as shown below:

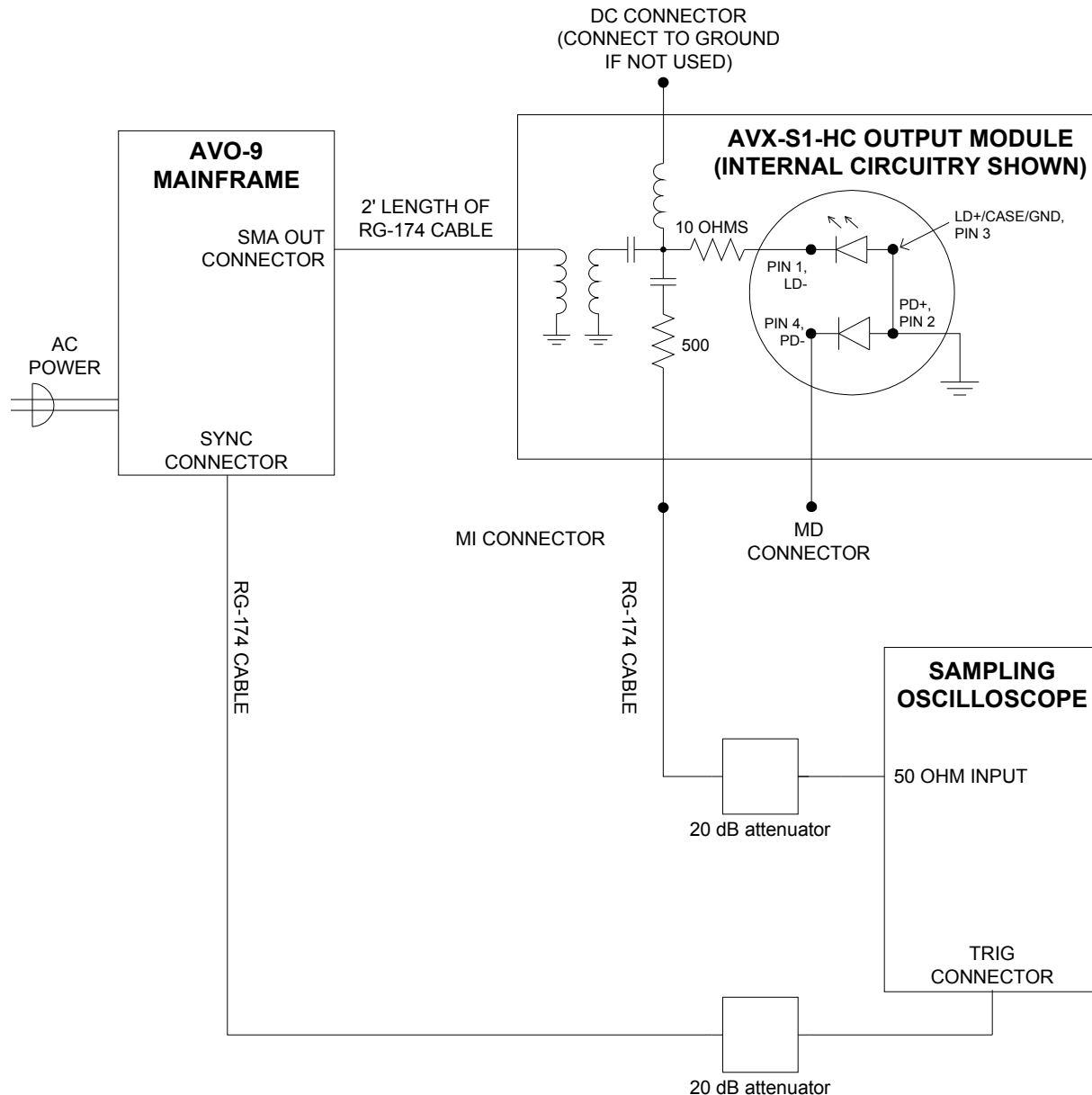


Since most sampling oscilloscopes have limited input amplitude ranges, an attenuator on the AVO-9 output is normally required.

When the output module is not used, a 50 Ohm load impedance is *required* for proper test operation.

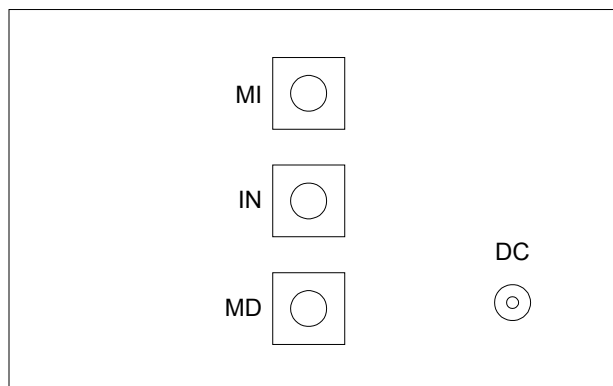
## NORMAL TEST ARRANGEMENT

To fully test the instrument, and for normal operation, the output module must be connected as shown below:



The diode load is inserted into the socket on the output module, as shown above.


An oscilloscope may be used to monitor the MI and MD outputs, the locations of which are shown in the figure above. A forward DC bias may be applied to the laser diode by connecting a DC potential of 0 to -1 Volts to the DC solder terminal. The application of a small forward bias often yields a more ideal diode current waveform (as observed on the MI port). The DC port must be shorted to ground if a bias is not applied.

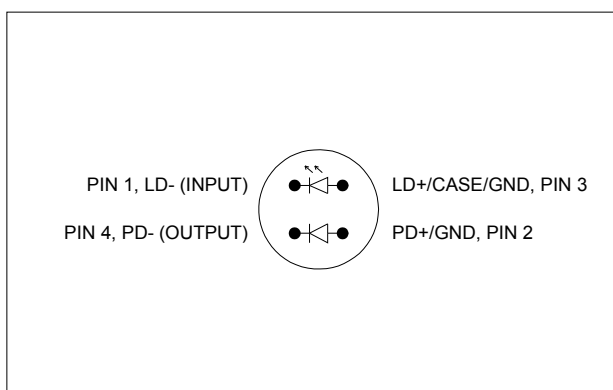


**AVX-S1-HC OUTPUT MODULE, CONNECTOR VIEW**

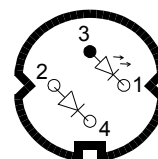
### INSTALLING THE DIODE

To install the diode in the output module socket, align the diode so that the pins of the diode are aligned with the matching pin sockets on the output module. Gently and slowly insert the diode into the socket.

 The diode leads must be trimmed to less than 1 cm in length. If they are longer, they may damage the internal circuitry in the output module when they are inserted.



**AVX-S1-HC OUTPUT MODULE, SOCKET VIEW**



**MATCHING USER-SUPPLIED  
DIODE PACKAGE  
(BOTTOM VIEW)**

### AMPLITUDE CONTROL

When using the output module, the pulse current through the diode load is given by:

$$I_{\text{DIODE}} = (V_{\text{IN}}/2 - V_{\text{DIODE}}) \div (10\Omega + R_{\text{DIODE}})$$



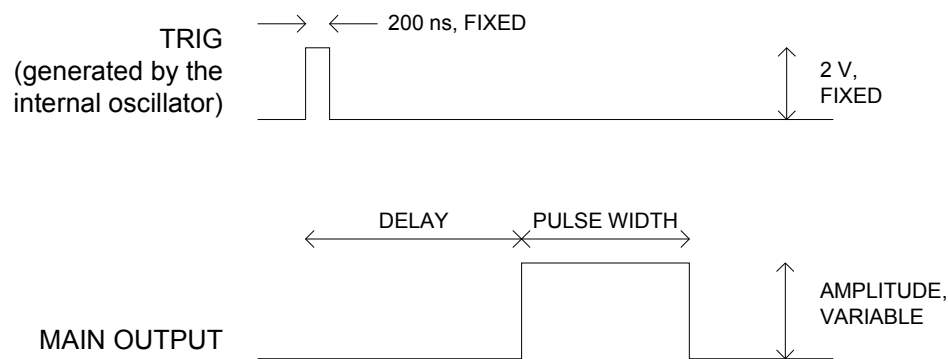
where  $V_{IN}$  is the amplitude setting on the mainframe (between 0 and 7V),  $V_{DIODE}$  is the forward voltage drop across the laser diode (typically 2V to 3V), and  $R_{DIODE}$  is the parasitic resistance of the laser diode (typically 1 $\Omega$  to 3 $\Omega$ ).

### BASIC PULSE CONTROL

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

- OUT. This is the main output. The maximum output voltage is -7V.
- TRIG. The TRIG pulse is a fixed-width TTL-level reference pulse used to trigger oscilloscopes or other measurement systems.

These pulses are illustrated below:



*Figure A*

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

### PULSE WIDTH / AMPLITUDE INTERACTION

The pulse width and delay of the output pulse may vary slightly with the amplitude setting, particularly at lower amplitudes. For some demanding applications, it may be desirable to use external attenuators in conjunction with the AVO-9C-C-HC-N-P2-MSHB-MD, instead of generating a low-amplitude pulse directly.

## PROTECTING YOUR INSTRUMENT

### DO NOT EXCEED 25 MHz

The output stage may be damaged if triggered by an external signal at a pulse repetition frequency greater than 25 MHz.

### TERMINATE THE MAINFRAME OUTPUT PROPERLY

The mainframe output stage may be damaged if the output is not terminated into the output module or a 50 $\Omega$  dummy load.

### INSTALL THE DIODE CORRECTLY



Please note that care must be taken to insert the diode in the correct orientation. It is possible to insert it incorrectly, which may cause damage to the diode and the output module.



The diode leads must be trimmed to less than 1 cm in length. If they are longer, they may damage the internal circuitry in the output module when they are inserted.

## 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