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NANOSECOND WAVEFORM ELECTRONICS
SINCE 1975

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INSTRUCTIONS

MODEL AVMN-3A-C-P-EA-EW-IBMA PULSE GENERATOR

S.N.:

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.

TECHNICAL SUPPORT

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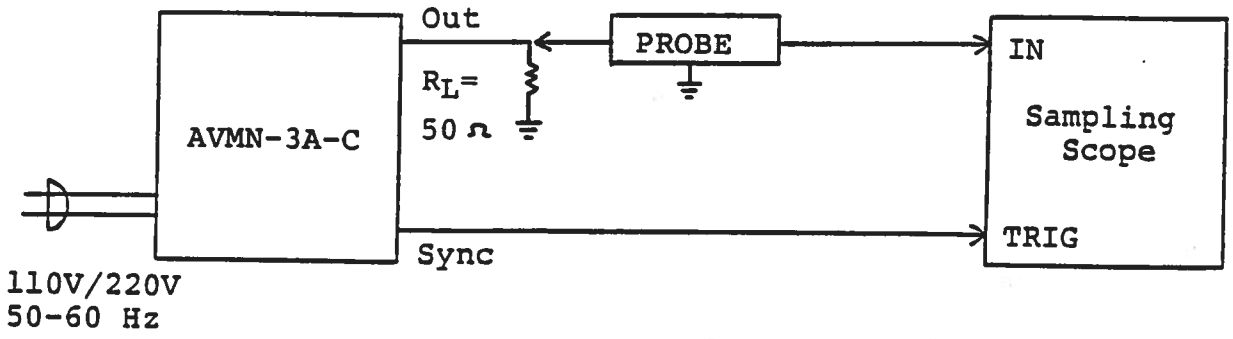
FIG. 1: PULSE GENERATOR TEST ARRANGEMENT

(AVX-S3A-IBME MODULE DISCONNECTED)



GENERAL OPERATING INSTRUCTIONS

1) The bandwidth capability of components and instruments used to display the pulse generator output signal (attenuators, cables, connectors, etc.) should exceed 200 MHz and the pulse generator should be terminated in a 50 Ohm load.

2) The sync output channel provides a +0.5 V, 10 ns pulse.

3) To obtain a stable output display the PRF and PRF FINE controls on the front panel should be set mid-range while the PRF range switch may be in either range. The front panel TRIG toggle switch should be in RANGE 3. The front panel TRIG toggle switch should be in the INT position. The front panel DELAY control and the scope triggering controls are then adjusted to obtain a stable output. It is recommended that the DELAY control first be set max counter clockwise and then turned clockwise until a stable display is obtained. The scope may then be used to set the desired PRF by rotating the PRF and PRF FINE controls and by means of the PRF range switch. CAUTION: The output duty cycle must not exceed 50%.

4) The output pulse width is controlled by means of the front panel ten turn PW control. The control should initially be set mid-range and the pulse width adjusted using an oscilloscope. Rotation of the PW pot causes the position of the falling edge of the pulse to change. CAUTION: The output duty cycle must not exceed 50%.

5) To voltage control the output pulse width, set the rear panel switch in the EXT position and apply 0 to +10V to connector A ($R_{IN} \geq 10K$). (Option).

6) The output pulse amplitude is controlled by means of the front panel ten turn AMP control.

7) To voltage control the output amplitude, set the rear panel switch in the EXT position and apply 0 to +10V to connector B ($R_{IN} \geq 10K$). (Option).

8) An external clock may be used to control the output PRF of the AVMN unit by setting the front panel TRIG toggle switch in the EXT position and applying a 10 ns (or wider) TTL level pulse to the TRIG BNC connector input. The AVMN unit triggers on the rising edge of the input trigger pulse. For operation in this mode, the scope time base must also be triggered by the external clock rather than from the SYNC output.

9) WARNING: Model AVMN-C may fail if triggered at a PRF greater than 50.0 MHz or if operated at a duty cycle exceeding 50%.

10) AVMN-C units with a serial number higher than 5600 are protected by an automatic overload protective circuit 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 short circuit), 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 another 5 seconds. If the overload condition has been removed, the instrument will turn on and resume normal operation. Overload conditions may be removed by:

    1) Reducing PRF (i.e. switch to a lower range)
    2) Reducing pulse width (i.e. switch to a lower range)
    3) Removing output load short circuit (if any)

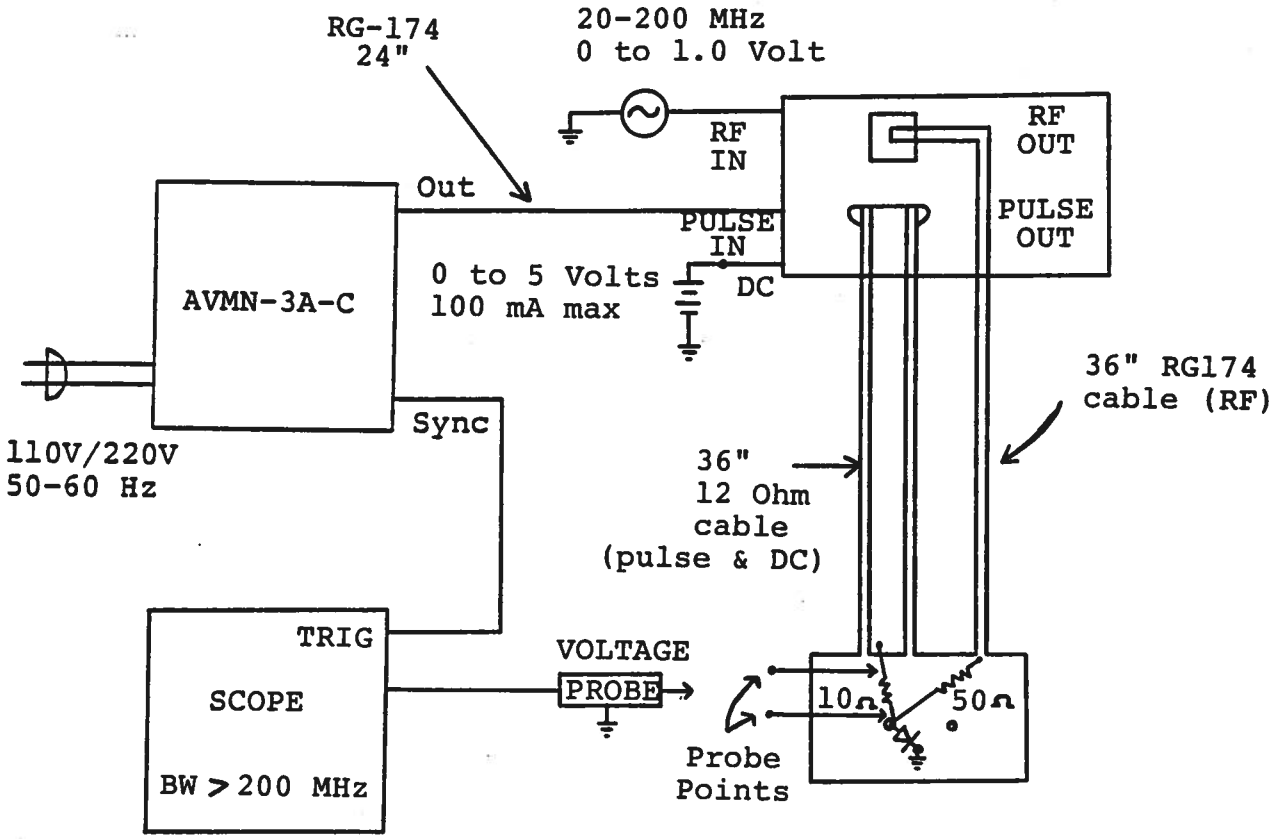
11) The AVMN-C unit can be converted from 110 to 220V 50-60 Hz operation by adjusting the voltage selector card in the rear panel fused voltage selector-cable connector assembly.

12) For additional assistance:

Tel: 1-800-265-6681
Fax: (613) 226-2802

FIG. 2: PULSE GENERATOR TEST ARRANGEMENT

(AVX-S3A-IBME MODULE CONNECTED)



PULSE GENERATOR TEST ARRANGEMENT

1) The AVMN-3A-C, the AVX-S3A-IBME, a DC power supply, a 200 MHz source and a scope should be connected as shown in Fig.2.

2) A diode should be installed in the socket. For preliminary testing, it is recommended that two series silicon high speed computer switching diodes (such as the 1N459A) be installed so as to simulate the laser diode.

3) Note that if a DC bias is not applied to the diode, then the DC port should be shorted to ground. When applying a DC bias take care to insure that the current does not exceed 100 mA. The DC current is limited by the 10 Ohm resistor and the diode resistance.

4) The RF signal applied to the RF IN port is passed directly through the AVX-S3A module (and a series DC blocking capacitor).

5) The scope probe may be used to view the voltage pulse applied to the diode by connecting the probe to the point where the 10 Ohm resistor joins the 12 Ohm line. The voltage at this point will be as high as 8 volts when the AMP pot is set fully clockwise.

6) The pulse diode current may be determined by determining the voltage across the 10 Ohm resistors (by connecting the voltage probe to both the input and output of the 10 Ohm resistors). The diode current is then given by:

$$I_D = \frac{V_R}{10}$$

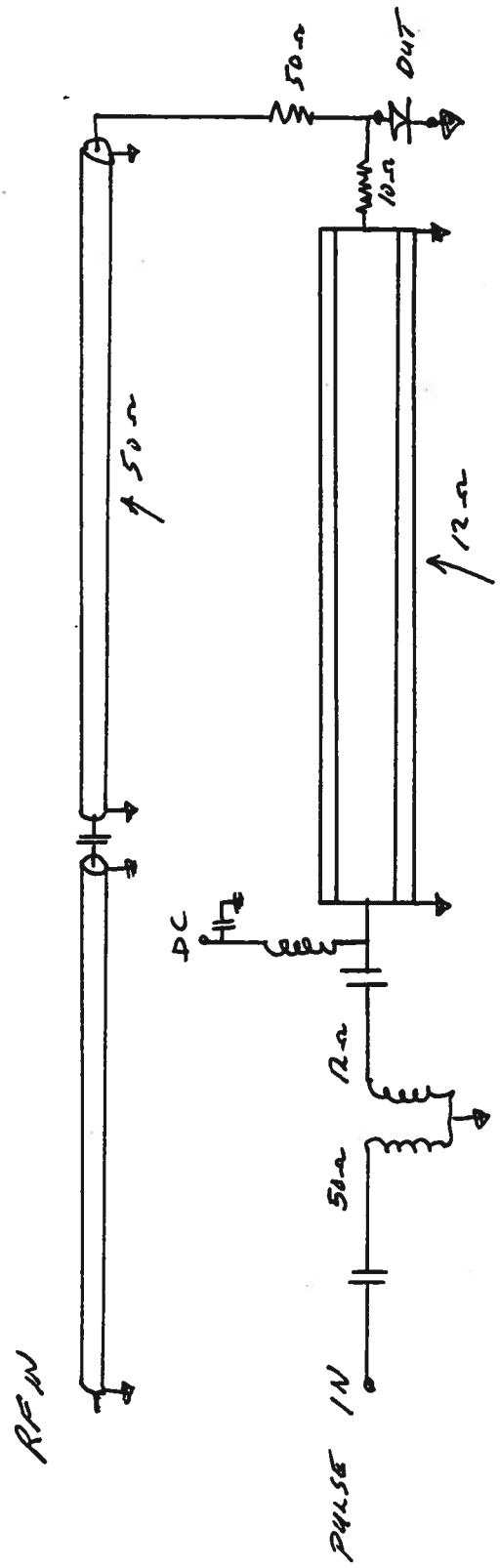
7) CAUTION: It is important to note that the AVMN-2A-C mainframe is DC coupled and will operate with duty cycles as high as 50%. However, the AVX-S3A-IBME unit is AC coupled and as a consequence, significant reverse voltages may be applied to the diode as the duty cycle is advanced to near 50%. This condition can be partially alleviated by the application of the DC bias (but do not exceed 100 mA) and by connecting a fast, low-capacitance switching diode between the output to the 10 Ohm resistor and ground (connects the cathode to the resistor). The voltage should be monitored at this port to insure that the pulse waveform is not grossly distorted as this may result in severe overloading of the AVMN-3A-C unit.

8) The functional equivalent circuit of the AVX-S3A-IBME unit is shown on the following page.

9) Repeated flexing of the 12 Ohm flexible transmission line relative to the pin socket PCB should be avoided as this may result in reversing of the line next to the PCB. Similarly, the connection between the 12 Ohm line and the aluminum chassis should not be stressed.

10) Mounting of the pin socket PCB section on a translation stage can be facilitated by soldering to the bare areas of the PCB or by the drilling of holes.

FIG. 3: AVX-S3A-IBME FUNCTIONAL EQUIVALENT CIRCUIT



AVTECH

1, 2, 3, 6 and 12 OHM TRANSMISSION LINES FOR LASER DIODE DRIVERS AND RF IMPEDANCE MATCHING

NF
PR

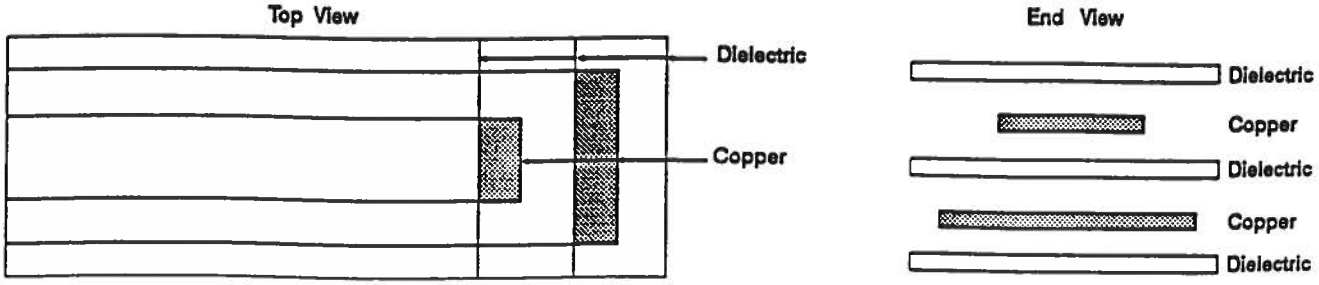
The LZ series of very low impedance microstrip transmission lines is designed for transmitting high current (to 100 Amperes), fast rise time (to one nanosecond) pulses in low impedance applications such as laser diode driving and RF impedance matching. This exciting new product solves the traditional difficult problem of connecting very low impedance loads to broadband sources (or lab instruments) without resorting to unrealistically short hook-up leads. These unique lines are available with characteristic impedance values of 1, 2, 3, 6 and 12 Ohms and a standard length of one meter. Longer lengths and other impedances in the range of 1 to 50 Ohms are available on special order.

LZ transmission lines comprise a sandwich structure of 3 layers of 0.071 mm polyimide film and 2 layers of 0.034 mm copper foil which results in a highly flexible flat transmission line with an exceptionally low characteristic impedance. Connection to the ends of the line is normally via soldering and the lines are normally supplied with one end soldered to a small piece of 1/16" glass epoxy circuit board (approx. 1.0 cm x LINE WIDTH) with accessible output and ground solder pad areas. The ground conductor and top conductor on the other end of the line are exposed for convenient solder connection. Scissors or a sharp knife may be used to cut the line to shorter lengths as required.

Characteristic impedance is measured using the fast rise time reflected pulse method shown on the following pages. The AVTECH AVMP-2-C pulse generator outputs a 50 ns wide pulse with a 100 ps rise time. The fast pulse is introduced to the LZ line via a 500 Ohm series resistor which serves to reflect pulses which are reflected from the load RL. RL is varied until the displayed waveform indicates that the incident pulse is not reflected by the load RL. This value of RL is taken to be equal to the characteristic impedance of the line. The rise time of the displayed waveform defines the rise time of the transmission line. The effective dielectric constant is derived from the propation delay while a reading of the loss is given by the ratio of the received to incident pulse amplitudes.

This new series of transmission lines is ideal for high current pulse applications where the load impedance is in the approximate range of 1 to 12 Ohms. A detailed listing of the AVTECH AVO and AV-107 series of laser diode drivers (and pulsed constant current sources) which are compatible with the LZ series of lines is given on the following page. The lines may also be used with other laser diode drivers and in RF circuit impedance matching applications.

MODEL	AV-LZ1	AV-LZ2	AV-LZ3	AV-LZ6	AV-LZ12
Impedance (Ohms)	1	2	3	6	12
Maximum width	25.4 mm (1")	25.4 mm (1")	25.4 mm (1")	13 mm (0.52")	13 mm (0.52")
Capacitance/ft	2042 pfd	1055 pfd		374 pfd	188 pfd
Capacitance/meter	6700 pfd	3460 pfd	2480 pfd	1225 pfd	617 pfd
Effective dielectric constant	3.00	2.98	2.96	2.66	2.62
Pulse current rating (1 us)	100 Amp	50 Amp	30 Amp	15 Amp	8 Amp
Rise time	≤1 ns	≤1 ns	≤1 ns	≤0.5 ns	≤0.5 ns
Loss (V_{OUT}/V_{IN})	≥ 0.95 (one meter)				
Standard length	1 meter				
Dielectric material	Polyimide film (0.071 mm, 2.8 mil)				
Conductor material	Copper (0.034 mm, 1.4 mil)				
Jacket material	Polyimide film (0.071 mm, 2.8 mil)				
Temperature range	+10°C to +50°C				
Bend radius (min)	1 cm				



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LZ SERIES LOW IMPEDANCE LINES FOR AVTECH LASER DIODE DRIVERS

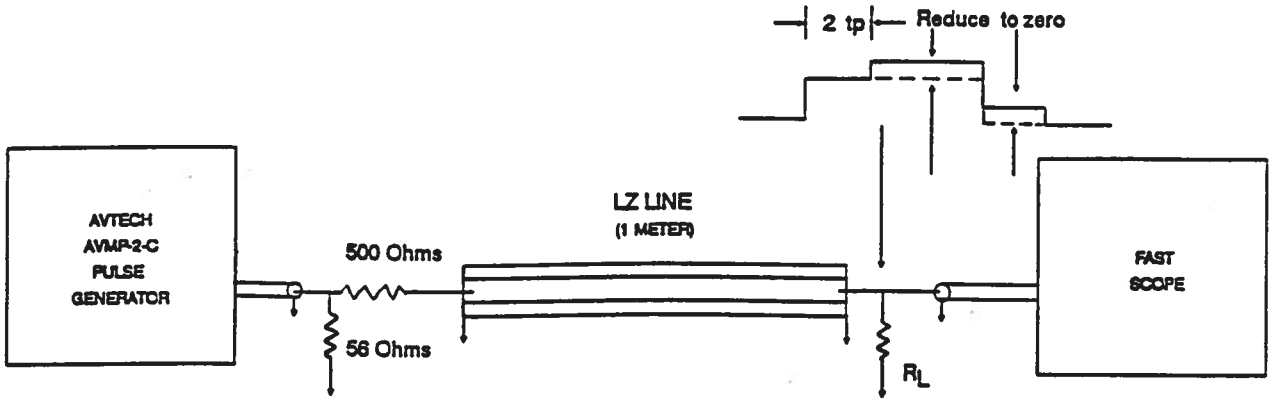
The following AVTECH laser diode drivers (and pulsed constant current sources) may be used with the new LZ series of low impedance lines. The recommended pulser-line combinations are shown below. Note that the line length should be kept as short as possible in order to avoid pulse degradation (because the line to load impedance match is not exact in all cases).

To order an AVTECH pulser with an LZ series line installed on the output, add the suffix -LZN-L to the pulser model number (where N represents the impedance value given in the table below and -L repr sents the desired length in centimeters). See Cat N 8 for the full details on our laser diode drivers ar pulse generators. Note that for constant current puls generator applications the line impedance should b equal to the load impedance (R_L), which may chang from application to application.

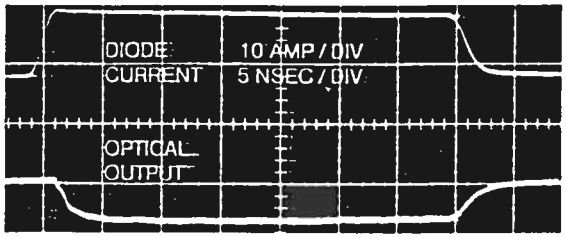
Please contact AVTECH directly for more detailed a plications assistance.

AVO-2-C	AV-LZ6
AVO-2W-C	AV-LZ6
AVO-2A-C	AV-LZ12
AVO-5-C	AV-LZ3
AVO-5A-C	AV-LZ1
AVO-5B-C	AV-LZ1
AVO-5D-C	AV-LZ3
AVO-7A-C	AV-LZ1
AVO-7B-C	AV-LZ1
AVO-7B2-C	AV-LZ1
AVO-7C-C	AV-LZ1RL

AVO-7D-C	AV-LZ1-RL
AVO-7E-C	AV-LZ1-RL
AVO-8A-C	AV-LZ1
AVO-8B-C	AV-LZ1
AVO-8C-C	AV-LZ1
AVO-C	AV-LZ1
AVO-1-C	AV-LZ1
AV-107A-C	AV-LZ1-RL
AV-107B-C	AV-LZ1-RL
AV-107C-C	AV-LZ1-RL
AV-107D-C	AV-LZ1-RL



FOR MORE INFORMATION OR ASSISTANCE
WITH YOUR RESEARCH OR OEM APPLICATIONS
CALL
1-800-265-6681



- Socket mounting of laser diodes
- Peak currents from 100 mA to 40 Amps
- Pulse widths from 0.4 to 200 nsec
- Rise times from 0.2 to 2.0 nsec
- Pulse or CW RF
- Diode current and voltage monitor options

The AVX-S series of bias insertion units is designed for applying pulse or RF CW signals and DC bias to laser diodes which insert into a high quality socket included on the mount. The bias insertion module includes the necessary networks to match the laser diode to the pulse or RF source as well as networks for applying DC bias to the diode. Optional outputs allow for monitoring of the laser diode current, voltage and a photo detector diode output. Readily available socket configurations (TO-18, TO-5, TO-3, OP-3) are shown on the following page. Note that the laser diodes are not supplied with the AVX-S series.

The AVX-S series includes 3 basic models namely the AVX-S1, AVX-S2 and the AVX-S3. The basic functional equivalent circuit for the three models are shown below. Model AVX-S1 is specifically designed for ultra high-speed, low current applications (rise times as low as 200 psec, bandwidths to 1 GHz, $I < 1.0$ ampere). Model AVX-S1 is employed in the AVO-9-C series of diode drivers. Model AVX-S2 is intended for application with rise times greater than 2 nsec and currents above 1 ampere. Model AVX-S3 is specifically designed for use with the AVO-2 and AVO-5 series pulse generators (which provide currents in the range of 5 to 50 amperes).

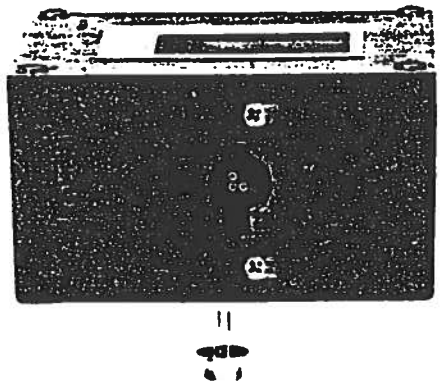
The input series blocking capacitor in Models AVX-S1 and AVX-S2 presents a low impedance to RF CW signals and to baseband pulses while the shunt indicator presents a high impedance to RF (or pulse) signals but an extremely low impedance to the DC bias. The resistor in series with the laser diode is selected to insure that the impedance at the IN port is 50 ohms. Normally a laser diode resistance of 3 ohms is assumed.

The optional diode current monitor (M_I) provides an output waveform (to 50 ohms) which is an attenuated replica of the laser diode current. The output amplitude (V_{MI}, volts) and diode current (I_D, Amps) are related as follows:

-S1: $I_D = 0.2V_{MI}$ -S2: $I_D = V_{MI}$

The optional diode voltage monitor (MV) provides an output waveform that may be related to the voltage across the laser diode (V_D, volts) as follows:

-S1: $V_D = 10\,(V_{MV} - V_{MI})$ - S2: $V_D = 10\,V_{MV}$



Model AVX-S3 is available in four different versions (AVX-S3A, AVX-S3B, AVX-S3C and AVX-S3D) all of which include a matching transformer which effectively boosts the laser diode current beyond that provided by the pulse source.

Model AVX-S3A is designed to match 50 ohm pulse generators such as Model AVO-2-C to 12 ohm loads with peak currents of 5 amperes. Consequently, the resistor R_S in the equivalent circuit for this model is 12 ohm. This resistor is accessible in all AVX-S3 models and may be changed by the user (by desoldering). The series resistance of the laser diode and the resistor R_S must equal the pulse generator source impedance divided by N^2. Consequently, if the series resistance of the laser diode is relatively high, it then may be necessary to reduce the value of R_S. Model AVX-S3B is designed to match 50 ohm pulse generators such as Model AVO-5-C to 3 ohms and will provide peak diode currents up to 28 amperes. Model AVX-S3C is designed to match Models AVO-2W-C and AVO-2-C (25 ohm source impedance) to load resistance of about 5 ohms and will provide peak diode currents as high as 10 amperes. Model AVX-S3D is designed for use with Model AVO-5B-C and will provide up to 48 amperes of diode current.

Two optional SMA output connectors provide attenuated coincident replicas of the diode current (-MI option) and diode voltage (-MV option) as per the following relationships (Amps, Volts):

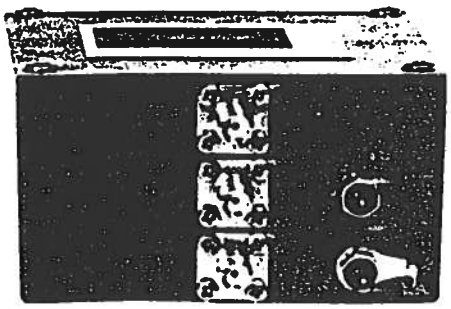
$$I_D = \frac{10\,V_{MI}}{R_S} \qquad V_D = 10\,(V_{MV} - V_{MI})$$

All AVX-S3 units include two foot long input cables with SMA male connectors.

When ordering members of the AVX-S family, the customer must specify the basic model number (eg. AVX-S1) and the following additional information.

a) Diode package type (eg. TO-18) and the required pin connections (eg. anode, cathode, ground etc). See the following page for readily available package mounting. Contact Avtech for special or different packages.
b) Desired options (eg. -MI, -MV, -MD).

Contact Avtech for your special requirements.



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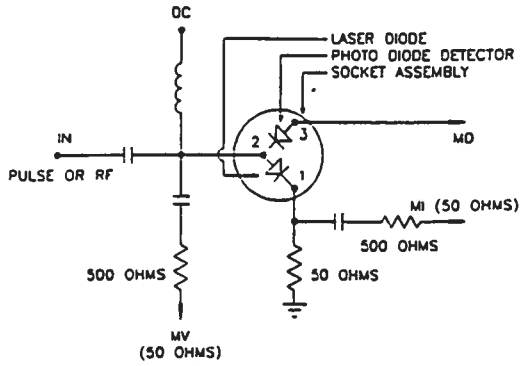
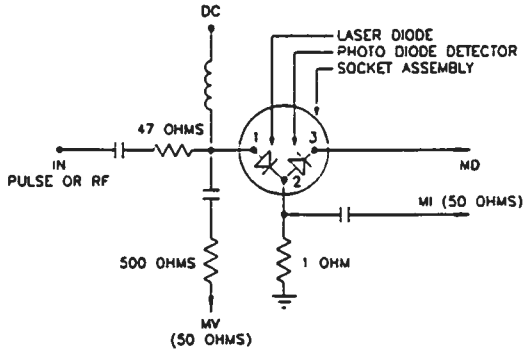
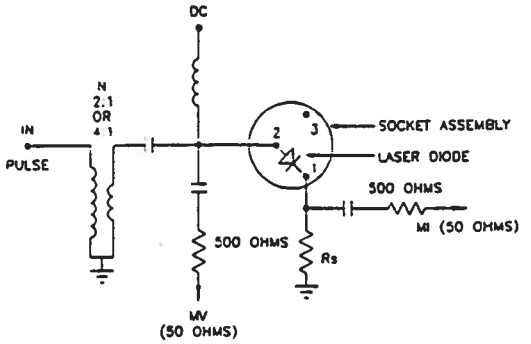
Model:	AVX-S1	AVX-S2	AVX-S3A	AVX-S3B	AVX-S3C	AVX-S3D
Peak diode current:	400 mA	2 Amps	5 Amps	28 Amps	10 Amps	48 Amps
Max. input amplitude:	20 volts	100 volts	150 volts	350 volts	150 volts	150 volts
Pulse width (nsec):	0.4 - 200	1 - 1000	2 - 100	2 - 100	2 - 100	5 - 500
Rise time (nsec):	0.2	0.5	0.5	1.0	0.5	2.0
Pulse PRF range:	DC - 0.5 GHz	DC - 100 MHz	DC - 10 MHz	DC-10 MHz	DC - 10 MHz	DC - 1 MHz
CW frequency range:	10 MHz - 1.0 GHz	1 - 200 MHz	-	-	-	-
Max. bias current:	100 mA	100 mA	100 mA	100 mA	100 mA	100 mA
Max. bias voltage:	50 volts	50 volts	50 volts	50 volts	50 volts	50 volts
Input impedance:	50 ohms	50 ohms	50 ohms	50 ohms	25 ohms	12 ohms
N:	-	-	2	4	2	4
R_S (ohms):	-	-	10	3	5	0.7
IN connector:	SMA					
Monitor connector:	SMA					
Bias connector:	Solder pin					
Size (in):	1.6 x 2.6 x 3.0					
Material:	Cast aluminum, blue enamel					
Mounting:	Any					



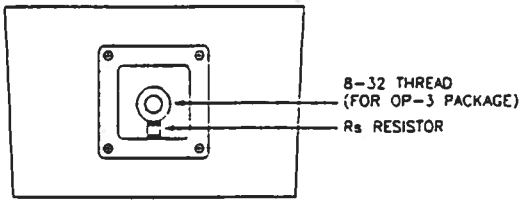
AVX-S1 FUNCTIONAL EQUIVALENT CIRCUIT



AVX-S2 FUNCTIONAL EQUIVALENT CIRCUIT

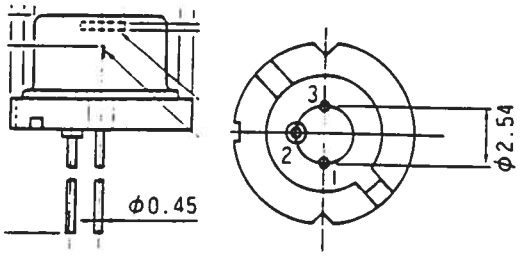


AVX-S3 FUNCTIONAL EQUIVALENT CIRCUIT

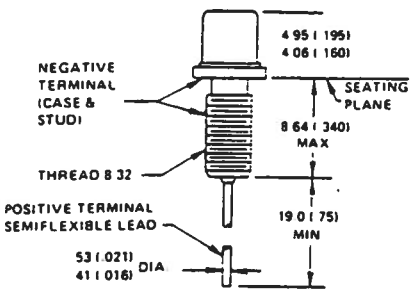


AVX-S3 INPUT ASSEMBLY (FOR OP-3 PACKAGE)

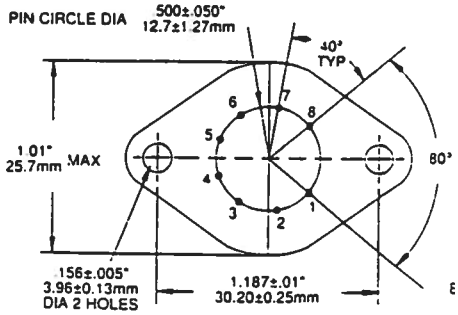
TO-18



OP-3

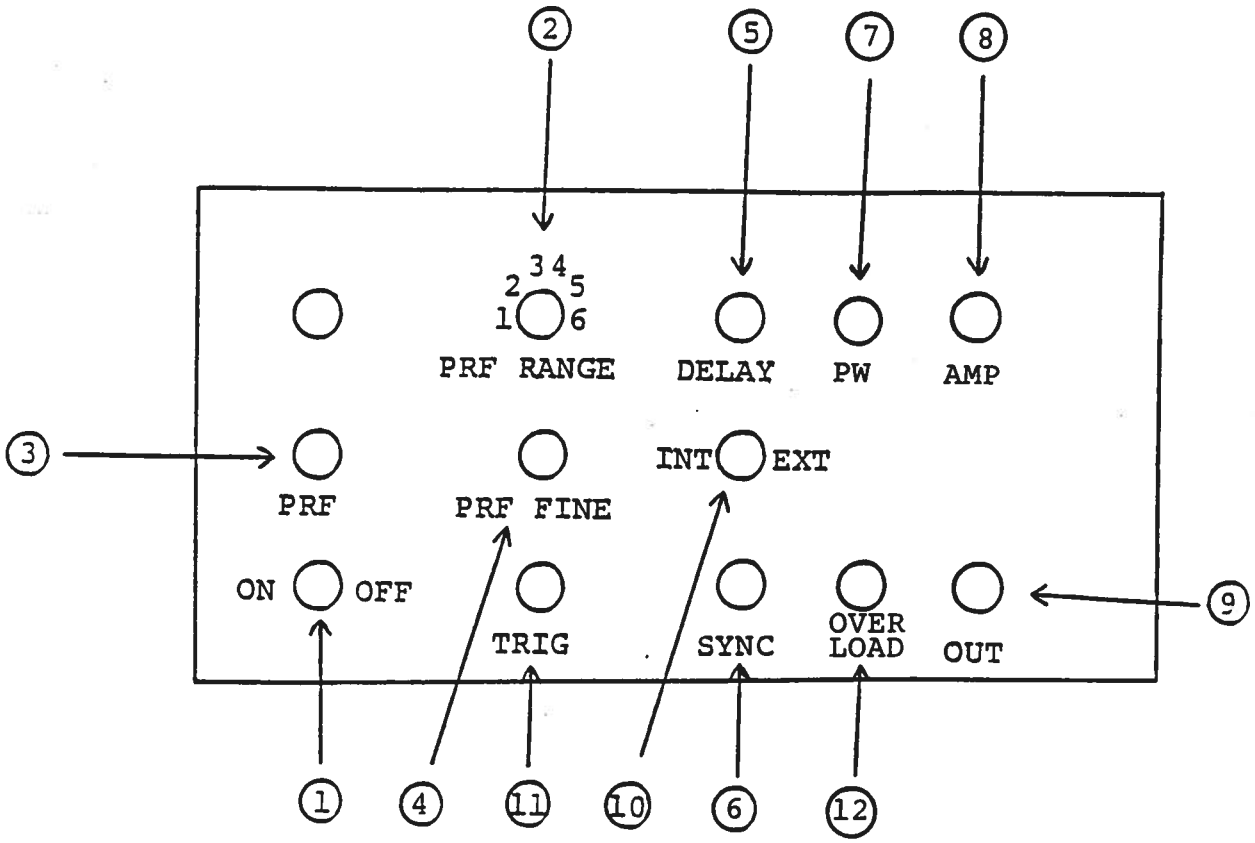


TO-3 8 PIN



TYPICAL PACKAGES

FIG. 4: FRONT PANEL CONTROLS



FRONT PANEL CONTROLS

(1) ON-OFF Switch. Applies basic prime power to all stages.

(2) PRF Control. PRF RANGE, PRF and PRF FINE controls
(3) determine output PRF as follows:

	PRF MIN	PRF MAX
Range 1	10 Hz	50 KHz
Range 2	500 KHz	250 KHz
Range 3	185 KHz	650 KHz
Range 4	650 KHz	3.3 MHz
Range 5	3.3 MHz	10 MHz
Range 6	14 MHz	50 MHz

(4) PRF FINE Control. This control varies PRF but is about 10 times less sensitive than the main PRF control.

(5) DELAY Control. Controls the relative delay between the reference output pulse provided at the SYNC output (6) and the main output (9). This delay is variable over the range of 0 to at least 100 nS.

(6) SYNC Output. This output precedes the main output (9) and is used to trigger the sampling scope time base. The output is a 500 mV 20 nS (approx) pulse capable of driving a fifty ohm load.

(7) PW Control. A one turn control which varies the output pulse width.

(8) AMP Control. A one turn control which varies the output pulse amplitude from 0 to max output to a fifty ohm load.

(9) OUT Connector. SMA connector provides output to a fifty ohm load.

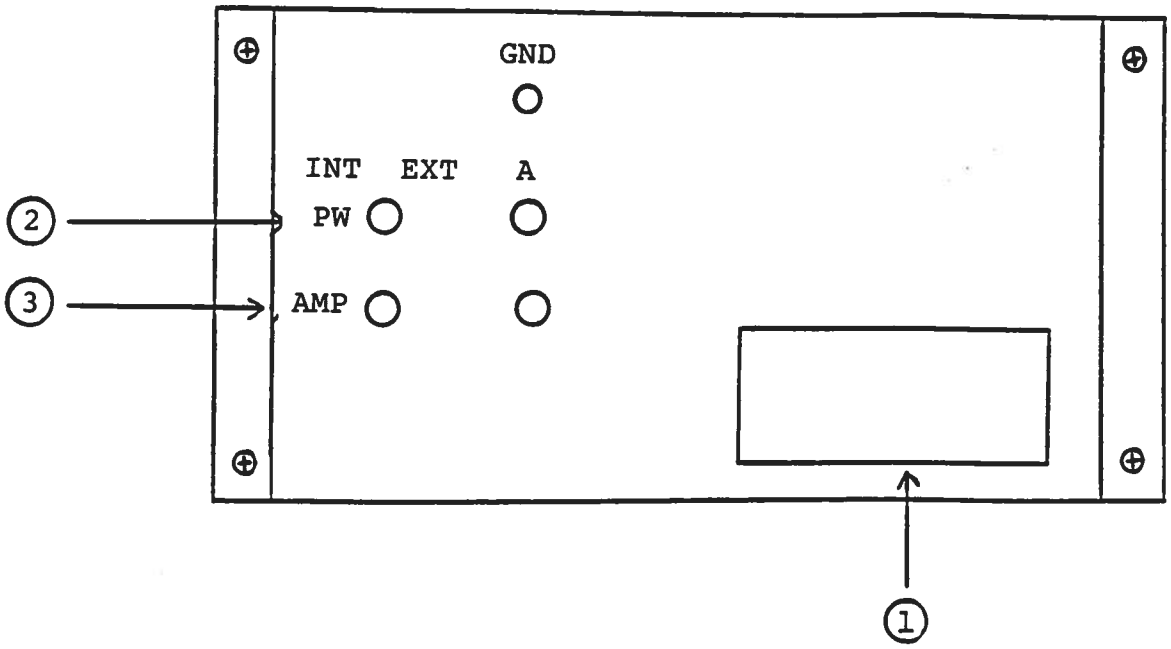
(10) EXT-INT Control. With this toggle switch in the INT position, the PRF of the AVMN unit is controlled via an internal clock which in turn is controlled by the PRF and PRF FINE controls. With the toggle switch in the EXT position, the AVMN unit requires a 10 nsec TTL level pulse applied at the TRIG 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.

(11) TRIG Input. The external trigger signal is applied at this input when the EXT-INT toggle switch is in the EXT position.

(12) AVMN-C units with a serial number higher than 5600 are protected by an automatic overload protective circuit 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 short circuit), 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 another 5 seconds. If the overload condition has been removed, the instrument will turn on and resume normal operation. Overload conditions may be removed by:

1) Reducing PRF (i.e. switch to a lower range)
2) Reducing pulse width (i.e. switch to a lower range)
3) Removing output load short circuit (if any)

FIG. 5: BACK PANEL CONTROLS



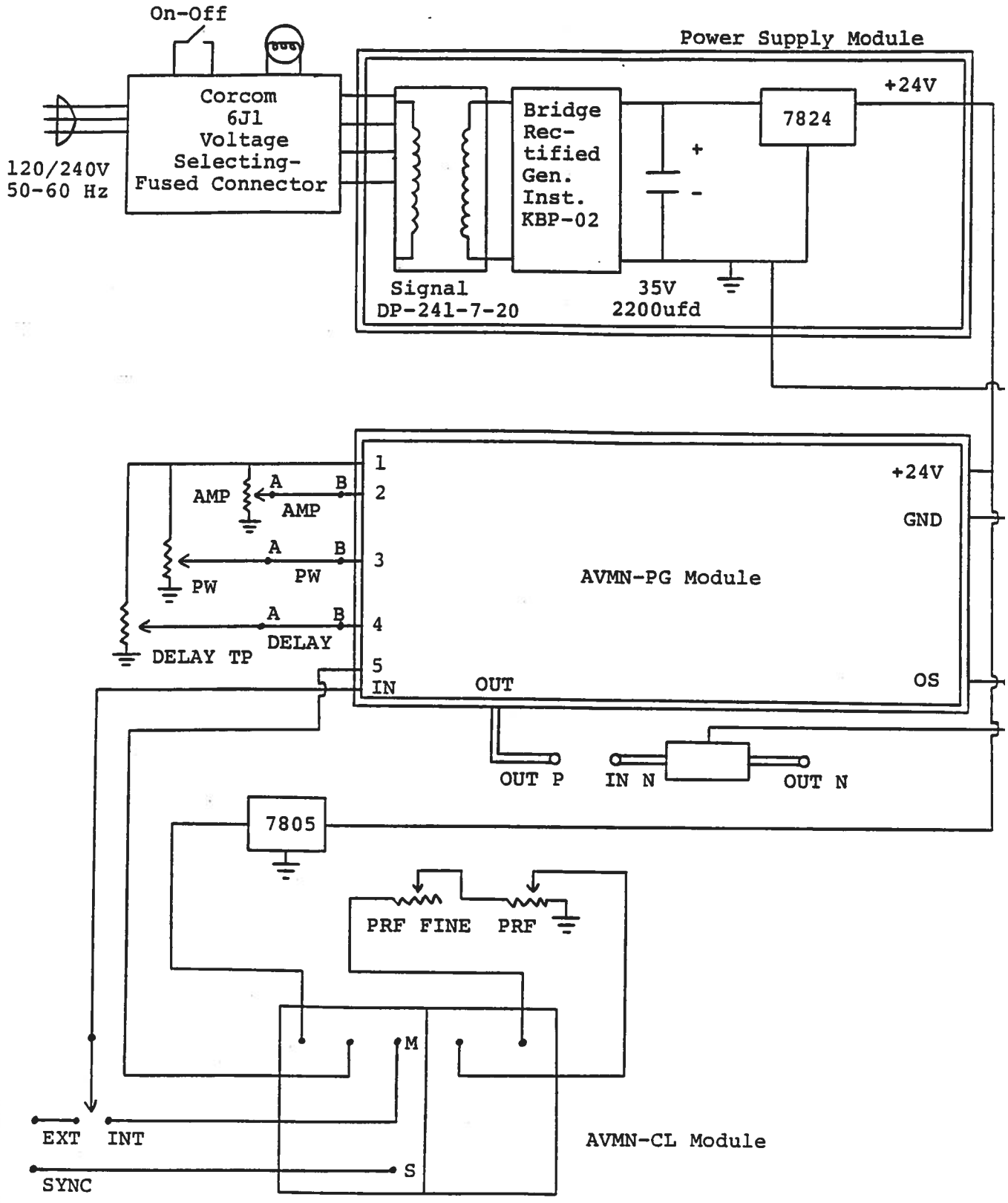
BACK PANEL CONTROLS

(1) FUSED CONNECTOR, VOLTAGE SELECTOR. The detachable power cord is connected at this point. In addition, the removable cord is adjusted to select the desired input operating voltage. The unit also contains the main power fuse.

(2) EW. To voltage control the output pulse width, set the switch in the EXT position and apply 0 to +10 Volts between terminal A and ground (R_{IN} > 10K). (Option).

(3) EA. To voltage control the output amplitude, set the switch in the EXT position and apply 0 to +10 Volts between terminal A and ground (R_{IN} > 10K). (Option).

FIG. 6: SYSTEM BLOCK DIAGRAM (WITH EA, EW, ED OPTIONS)



SYSTEM DESCRIPTION AND REPAIR PROCEDURE

The AVMN-C consists of a pulse generator module (AVMN-PG), a clock module (AVMN-CL) and a power supply board which supplies +24 volts (600 mA max) to the pulse generator module. In the event that the unit malfunctions, remove the instrument cover by removing the four Phillips screws on the back panel of the unit. The top cover may then be slid off. Measure the voltage at the +24 V pin of the PG module. If this voltage is substantially less than +24 volts, unsolder the line connecting the power supply and PG modules and connect 50 ohm 10 W load to the PS output. The voltage across this load should be about +24 V DC. If this voltage is substantially less than 24 volts the PS module is defective and should be repaired or replaced. If the voltage across the resistor is near 24 volts, then the PG module should be replaced or repaired. The sealed PG module must be returned to Avtech for repair (or replacement). The clock module provides a 10 to 120 nsec TTL level trigger pulse at pin M to trigger the PG module and a 10 nsec 0.5 V sync pulse at pin S to trigger the sampling scope display device. The AVMN-PG triggers on the rising edge of the pulse provided by the M pin. The rising edge at pin S precedes the rising edge at pin M by 0 to 100 nsec depending on the DELAY control setting. With the INT-EXT switch in the EXT position, the clock module is disconnected from the PG module. The clock module is functioning properly if:

a) 10 ns, or wider, outputs are observed at pins M and S.

b) The PRF of the outputs can be varied over the range of 10 KHz to 50 MHz using the PRF, PRF FINE and PRF RANGE controls.

c) The relative delay between the pin M and S outputs can be varied by at least 100 ns by the DELAY control.

The sealed clock module must be returned to Avtech for repair or replacement if the above conditions are not observed.

PERFORMANCE CHECK SHEET

02.16.93

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-EW

-EA