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INSTRUCTIONS

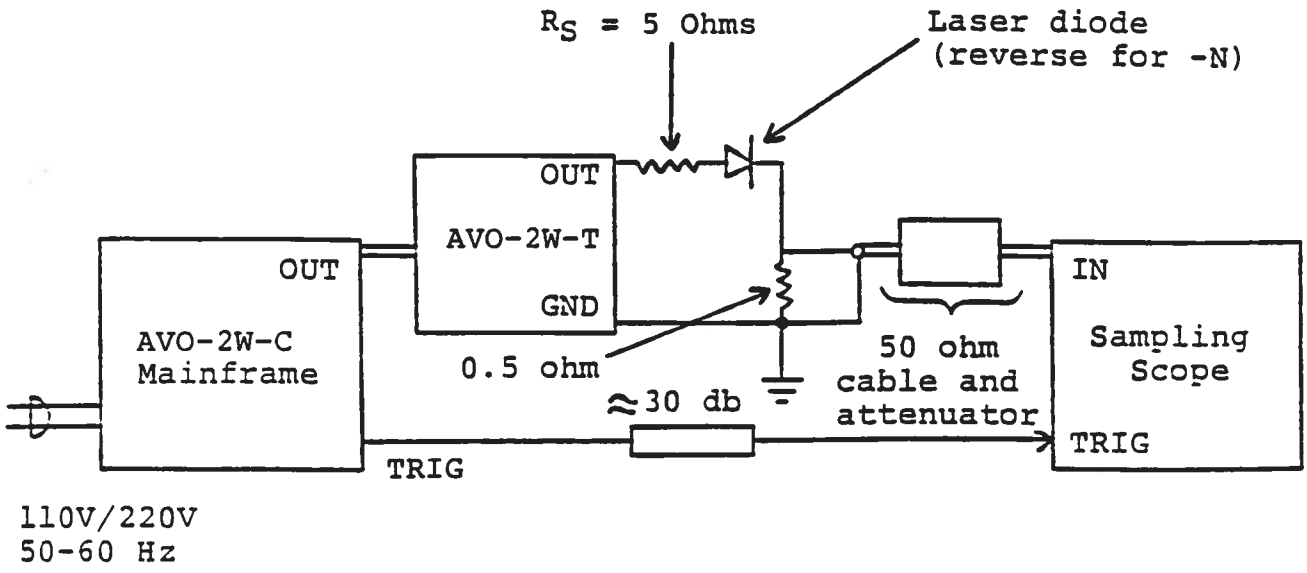
MODEL AVO-2W-C-OP1 PULSE GENERATOR

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 or liability assumed by Avtech with respect to this product and no other warranty or guarantee is either expressed or implied.

Fig. 1 PULSE GENERATOR TEST ARRANGEMENT



Notes:

1) For front panel manual control of the output parameters, the rear panel LOCAL-REMOTE switch must be in the LOCAL position. For remote control using a personal computer, the switch should be in the REMOTE position. See the AN-101-AVO-2W-C section (at the end of the manual) for the instructions for this mode of operation.

2) The bandwidth capability of components and instruments used to display the pulse generator output signal (attenuators, cables, connectors, etc.) should exceed two gigahertz.

3) The use of 30 dB attenuator at the sampling scope vertical input channel will insure a peak input signal to the sampling scope of less than one Volt.

4) The TRIG output channel provides TTL level signals. To avoid overdriving the TRIG input channel of some scopes, a 30 dB attenuator should be placed at the input to the scope trigger channel. The TRIG output precedes the main output when the front panel ADVANCE-DELAY switch is in the ADVANCE position. The TRIG output lags the main output when the switch is in the DELAY position.

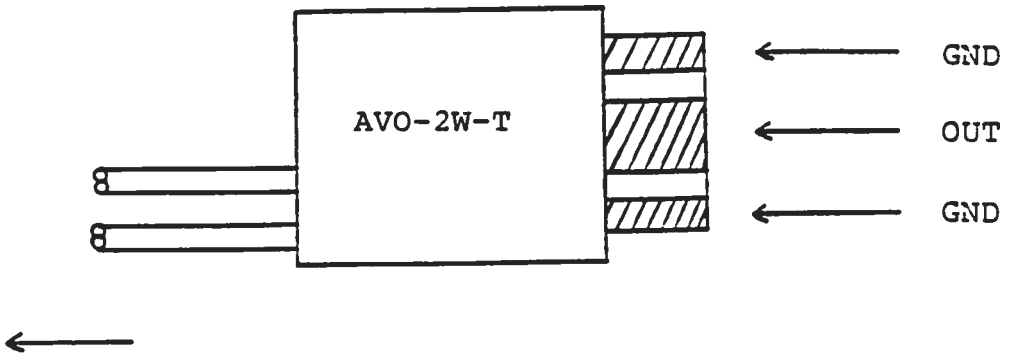
5) To obtain a stable output display the PRF control on the front panel should be set mid-range while the PRF switch may be in either range. The front panel TRIG toggle switch should be in the INT position. The front panel DELAY controls and the scope triggering controls are then adjusted to obtain a stable output. The scope may then be used to set the desired PRF by rotating the PRF control and by means of the back panel toggle switch.

6) The output pulse width is controlled by means of the front panel one turn PW control. The control should initially be set maximum clockwise and the pulse width adjusted using an oscilloscope.

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

8) <u>DUAL POLARITY Option</u>. The front panel two position polarity switch controls the polarity of the output pulse.

9) The AVO-2W-T module connects to the AVO mainframe via a 2 foot long miniature coaxial cable. The AVO-2W-T module transforms the AVO mainframe output to 60 Volts to 5 Ohm. The laser diode is connected in series with a current limiting resistor (R_s = 5 Ohm) between the GND and OUT terminals on the AVO-2W-T. 1/4 Watt carbon film or carbon composition resistors may be used but all leads must be as short as possible (< 0.1 inch). Solder leads directly to the GND and OUT terminals. CAUTION: Use moderate heat when soldering to the OUT terminal.



10) The amplitude of the diode current is determined primarily by the setting of the rear panel AMP pot control, and to a lesser extent by the limiting resistor RS and by the series resistance of the laser diode. The performance check results given in the following page were obtained using a 1N4736 diode to simulate a laser diode load. With this diode a peak current of 10 Amperes was obtained with R_s = 5 Ohm and the pot set maximum clockwise.

11) DC offset (option). The desired DC offset voltage (0 to ±6 Volts) is applied to the OS terminals on the AVO-2W-T module. This voltage appears directly at the AVO-2W-T output terminals and so with a diode series resistance of 5 Ohms this will yield a maximum DC diode current of about 1.0 Amperes.

12) An external clock may be used to control the output PRF of the AVO unit by setting the front panel TRIG toggle switch in the EXT position and applying a 0.2 us (approx) TTL level pulse to the TRIG BNC connector input. For operation in this mode, the scope time base must also be triggered by the external clock rather than from the SYNC output.

13) The unit can be converted from 120 to 240V 50-60 Hz operation by adjusting the voltage selector card in the rear panel fused voltage selector-cable connector assembly.

14) For additional assistance:

Tel: (613) 226-5772
Fax: (613) 226-2802

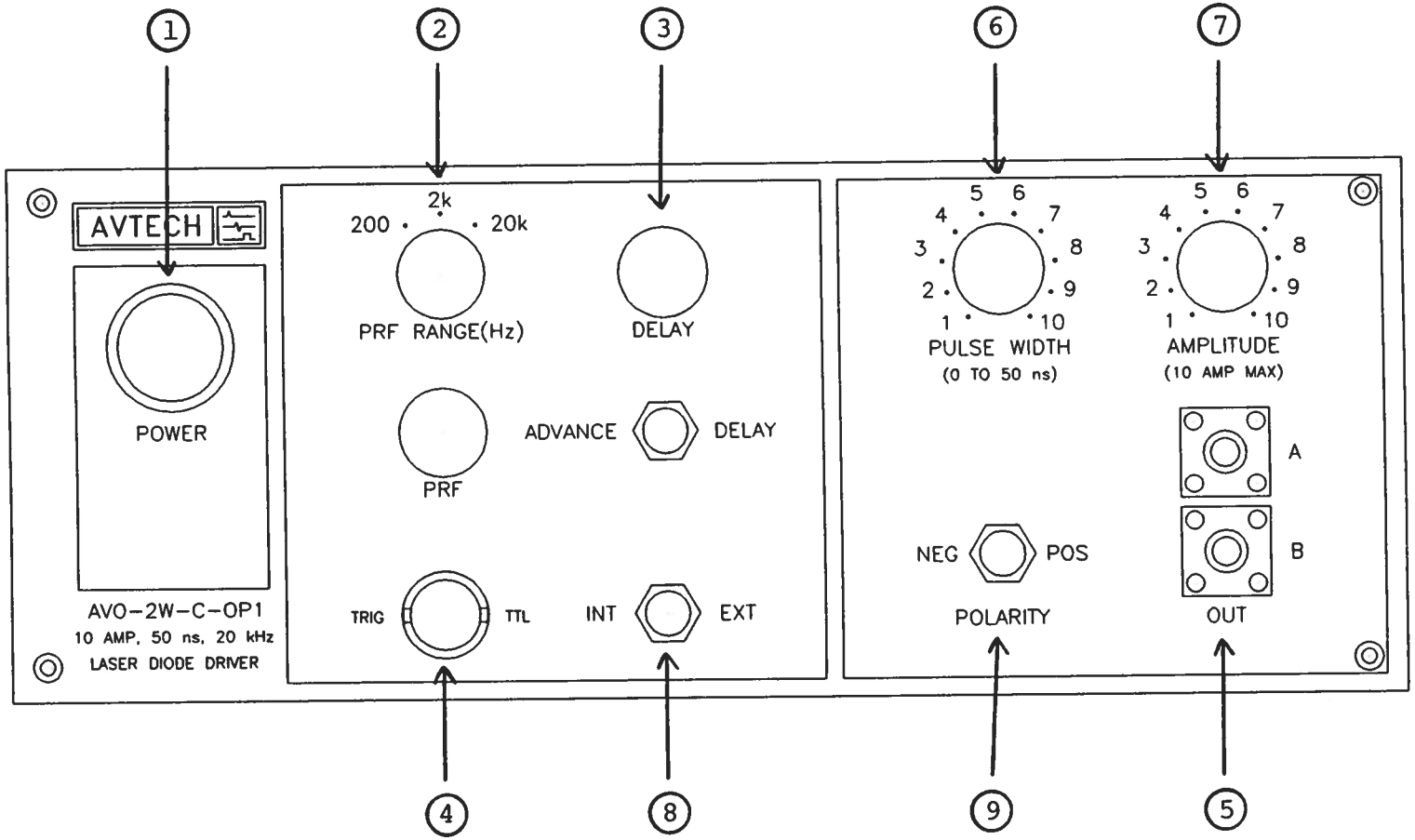


Fig. 2 FRONT PANEL CONTROLS

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

(2) PRF Control. Varies PRF as follows:

	MIN	MAX
Range 1	20 Hz	200 Hz
Range 2	200 Hz	2 kHz
Range 3	2 kHz	20 kHz

The operating PRF should be set using a scope.

(3) DELAY Control. Controls the relative delay between the reference output pulse provided at the TRIG output (4) and the main output (5). This delay is variable over the range of 0 to about 0.5 us. The TRIG output precedes the main output when the ADVANCE-DELAY switch is in the ADVANCE position and lags when the switch is in the DELAY position.

(4) TRIG Output. This output is used to trigger the scope time base. The output is a TTL level 100 ns (approx) pulse capable of driving a fifty Ohm load.

(5) OUT Connector. SMA connectors provide output to the AVO-2W-T module.

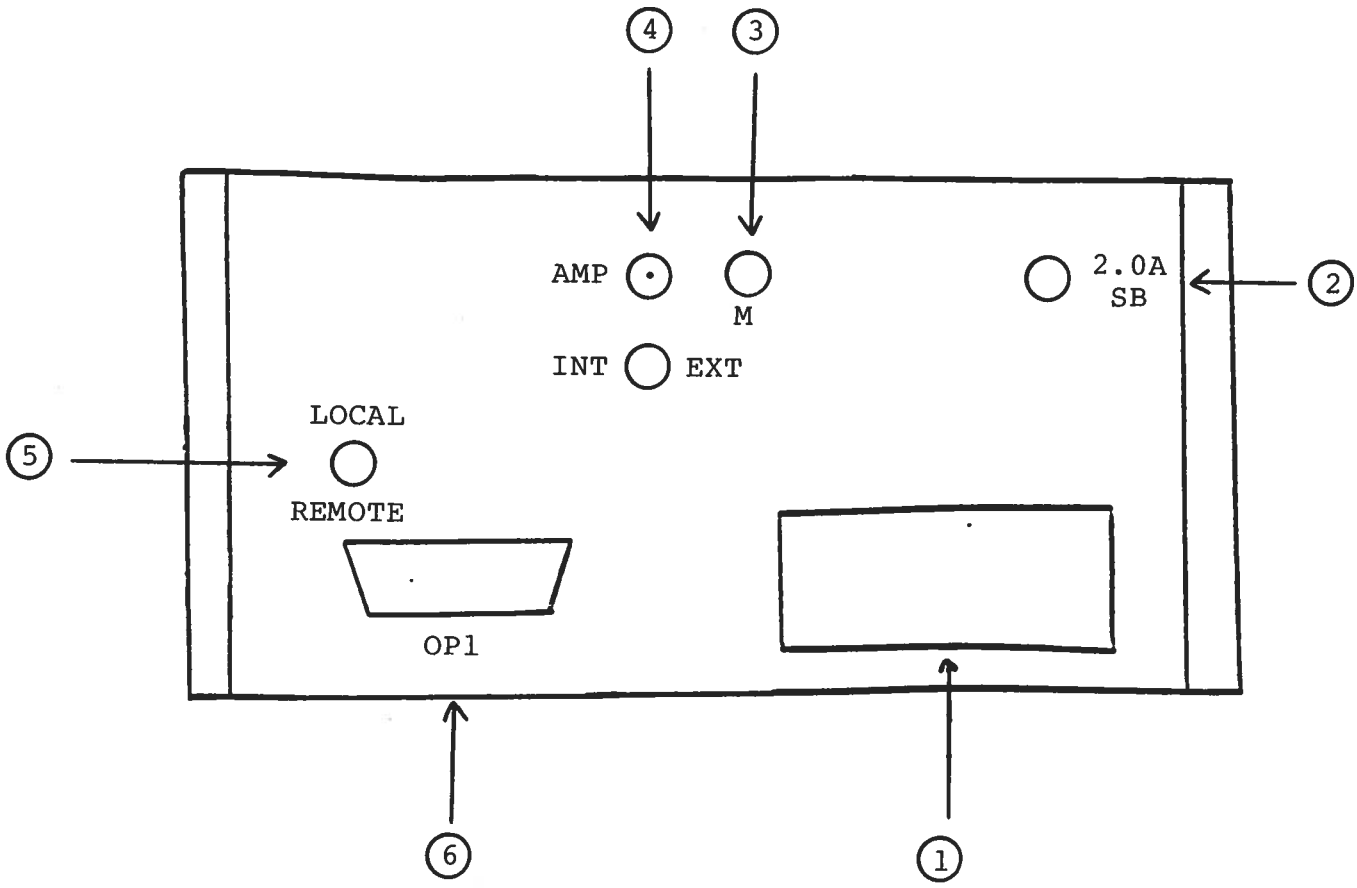
(6) PW Control. A one turn control which varies the output pulse width.

(7) AMP Control. A one turn control which varies the output pulse amplitude.

(8) EXT-INT Control. With this toggle switch in the INT position, the PRF of the AVO 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 AVO unit requires a 50 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.

(9) POLARITY. The polarity of the output pulse is controlled by this two-position switch.

Fig. 3 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 (0.5A SB).

(2) 2.0A SB. This fuse limits the DC current supplied to the unit.

(3) MONITOR Output (option). The back panel monitor output port provides an output voltage to 50 Ohms which is twice the amplitude appearing at the AVO-2W-T output terminals. The diode load current can be computed as follows:

$$I_{DIODE} = \frac{0.5V_M - V_{DIODE}}{R_{SERIES}}$$

where V_M = M output port voltage to 50 Ohm

V_{DIODE} = voltage across the laser diode

R_{SERIES} = resistance placed in series between AVO-2W-T output and laser diode

(4) To voltage control the output amplitude (in the LOCAL mode), set the rear panel switch in the EXT position and apply 0 to +10V to the AMP BNC connector ($R_{IN} \geq$ 10K). (EA option).

(5) LOCAL REMOTE SWITCH. This two-position switch must be in the LOCAL position to operate the instrument from the front panel controls. To control the instrument using your personal computer, the switch must be in the REMOTE position.

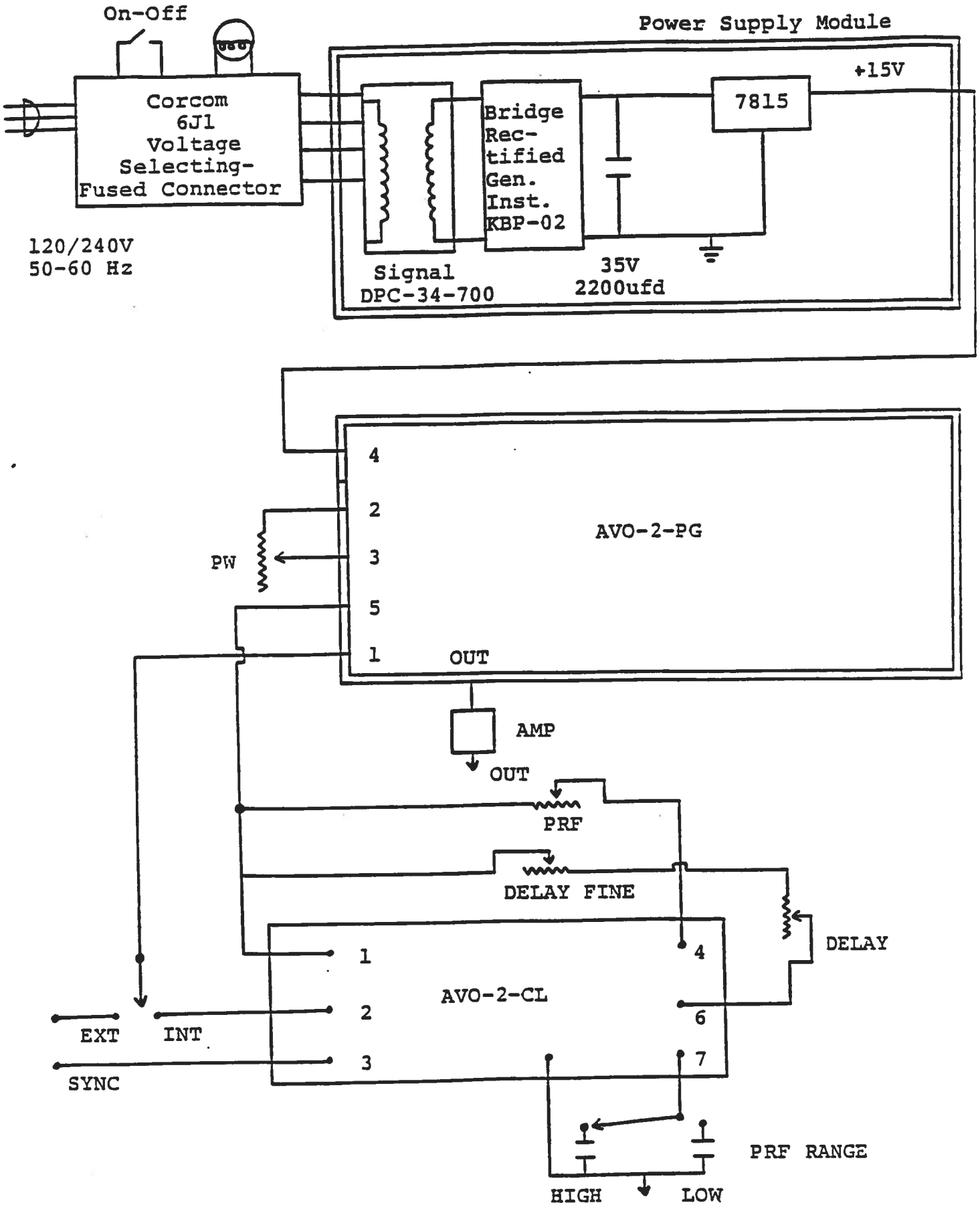
(6) OP1 CONNECTOR. GPIB cable (supplied) connects between this connector and your personal computer.

TOP COVER REMOVAL AND RACK MOUNTING

1) 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).

Fig. 4

SYSTEM BLOCK DIAGRAM



SYSTEM DESCRIPTION AND REPAIR PROCEDURE

The AVO-2-C consists of a pulse generator module (AVO-2-PG), a clock module (AVO-2-CL) and a power supply board which supplies +15 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 of the unit. The top cover may then be slid off. Measure the voltage at the +15V pin of the PG module. If this voltage is substantially less than +15 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 +15 V DC. If this voltage is substantially less than 15 Volts the PS module is defective and should be repaired or replaced. If the voltage across the resistor is near 15 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 0.1 us TTL level trigger pulse at pin 2 to trigger the PG module and a 0.1 us TTL level sync pulse at pin 3 to trigger the sampling scope display device. The output at pin 3 precedes the output at pin 2 by almost 0 to 500 ns 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) 0.1 us TTL level outputs are observed at pins 2 and 3.

b) The PRF of the outputs can be varied over the range of 0.05 kHz to 20 kHz using the PRF and PRF RANGE controls.

c) The relative delay between the pin 2 and 3 outputs can be varied by at least 500 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.

1.0 Introduction

This section describes how to use the OP-1 GPIB Bus Listener interface for remote computer control of the Avtech pulse generator, by means of the IEEE 488 General Purpose Interface Bus (GPIB).

The available commands and their structure, a typical command sequence and a sample program are included.

In addition, possible methods of incorporating remote duty cycle limit checking and instructions on how to change the GPIB address are provided

2.0 Interface to the GPIB

The IEEE 488 compatible Bus functions available to the user for GPIB control are as follows: The listed functions define a Bus Listener capability:

- SH0, AH1, T0, TE0, L2, LE0, SR0, RL0, PP0, DC1, DT0, C0.

2.1 Available Commands

The OP-1 GPIB user interface is designed to be used to remotely program the Avtech pulse generator to control the pulse repetition rate, pulse amplitude and delayed (or advanced) trigger output.

The available command acronyms, outputs, units and range of acceptable values for the AVO-2W-C generator are defined in the table below:

Acronym	Output	Units	Range	Decades
I	I (current amplitude)	amps	0 to 10	
R	Repetition rate	Hertz	20 to 20000	3
D	Delay (trigger)	nano-sec	25 to 250	1
A	Advance (trigger)	nano-sec	25 to 250	1
W	Width of pulse	nano-sec	3 to 50	1

2.2 Command Interpretation

The command may utilize the defined single letter acronym, or may be expanded to a longer word to make the control program easier to understand. This is because letters following the defined acronym letter are ignored. For example, a command of "I=0.2" will result in exactly the same result if the command is sent as "I (current) level of output pulse = 0.2". However, it is mandatory that the first letter of each command be one of the five defined acronyms.

Acronyms are case insensitive, for example, "R" or "r" are the same.

The number following the acronym letter may be any number in the range specified, however, the number of significant digits are limited to one part in 255 (for 8 bits of output resolution). For example, rep rate values of 128.2, 128.3 or 128.2145 will all result in the same output. (Note that output resolution and accuracy are not necessarily the same).

Leading or trailing zeros in numbers will be ignored.

Numbers expressed in "exponential" format will NOT be interpreted correctly. For example, 3e+2 will be interpreted as 3, not as 300.

The range of the specified values must be as specified for the equipment. Numbers outside the range will be ignored.

If desired, trailing text may be added to make the control program easier to understand, since it will be ignored. For example, a command of "delay=77" will result in the same output as the command "delay = 77 nanoseconds".

The term "Delay" is used to specify the duration of the delay between the trigger output pulse and the occurrence of the actual output pulse. The term "Advance" similarly refers to the amount of time the trigger pulse will occur prior to the output pulse.

If an invalid command is sent, the unit will ignore the command and the previous value will remain unchanged. If an "out-of-range" value is sent, the unit will also ignore the command.

2.3 Typical Command Sequence Interpretation

Assume the following commands are sent using the computer, using the appropriate command structure as specified for the user's GPIB controller. Note that the default GPIB address is eight.

R=100
I= 1
A=50
W=20

For example, for a GPIB controller from National Instruments, the following set of commands would be sent:

```
ibwrt "r=100"
ibwrt "i=1"
ibwrt "a=50"
ibwrt "w=20"
```

This command sequence will cause the generator to produce an output pulse of width 20 nano-sec and an amplitude of 1 amp peak, repeated at a rate of 100 pulses per second. An oscilloscope attached to the generator output will confirm the result. If the generator output trigger port is used, it will be noted that each output pulse will occur 50 nano-sec after the trigger pulse occurs.

2.4 Sample Program

To illustrate the remote control process by means of the GPIB, a sample program written in BASIC is provided. While this example is prepared for use with the B&C MicroSystems PC488 circuit card, the general principles of control apply to any IEEE 488 GPIB Controller.

```
'TEST of Pulser Controller
OPEN "PC488" FOR OUTPUT AS #1
PRINT #1, "ABORT"
PRINT #1, "CLEAR"
PRINT #1, "OUTPUT 8;I", 1
PRINT #1, "OUTPUT 8;R", 100
PRINT #1, "OUTPUT 8;A", 50
PRINT #1, "OUTPUT 8;W",20
END
```

3.0 Duty Cycle Limits

Typically, Avtech pulse generators are limited to a maximum duty cycle because of thermal constraints, where duty cycle is the ratio of Pulse Width to the reciprocal of the Repetition Rate (i.e.; R times W). Although the generator contains automatic protection against an excessive duty cycle, whenever this protection is activated, the output is inhibited. Therefore, it may be desirable to have the control computer calculate the duty ratio, then generate a warning message to the operator whenever the limits are exceeded (preferably prior to actually sending the command sequence).

This message could caution the user either to reduce the repetition rate or the pulse width, to avoid thermal overload.

While this calculation is not mandatory, it could avoid the annoyance of automatic inhibiting of the generator output.

4.0 Changing the Unit GPIB Address

Since the GPIB data bus address for the pulse generator has been preset to "8" in the factory, commands are required to be sent to this address. However, the user may wish to change the address to any address in the allowed range of 0 to 30. This address may be easily changed by re-setting the GPIB address switch on the GPIB Interface board located inside the pulse generator chassis.

The address is set by means of a five position "Dipswitch " located on the top of a small circuit card located inside the enclosure near the top rear. The switch may observed to be set to the default address by noting that the Dipswitch position 4 is set in the OFF position, defining a binary address of 8.

The switch setting is calculated as the sum of the switch weights in the OFF position, calculated as follows: (a switch in the ON position it has a weight of zero):

Switch Number	OFF Weight
1	1
2	2
3	4
4	8
5	16

For example, a switch with positions 1, 4 and 5 set to OFF will result in an address setting of 25 (16 plus 8 plus 1 = 25).

5.0 Trouble-Shooting Aid

In the event that difficulties are encountered communicating via the GPIB interface, two auxiliary communications status indicators have been included on the GPIB interface circuit card. These status indicators are small LED lamps, one which flashes briefly whenever a properly addressed command is received. The second LED will light whenever an out-of-range value or invalid command is received, and will remain lit until a valid command with a valid in-range value is subsequently received.

Dec. 11/96

Disk: AVO, AVO-1, AVO-2

Name: 2WCOP1.INS

-PN

-OS

-M

-EA