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INSTRUCTIONS

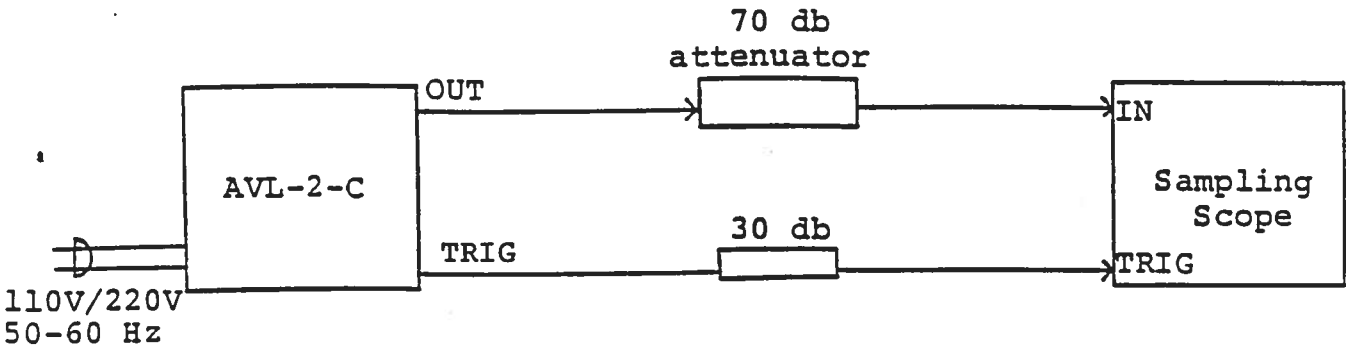
MODEL AVL-2-C-OP1 PULSE GENERATOR

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-102 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 one gigahertz.

3) The use of 70 dB attenuator at the sampling scope vertical input channel will insure a peak input signal to the sampling scope of less than one Volt. WARNING: Model AVL-2-C may provide a peak output power in excess of 2.8 KW. The peak power rating of the attenuator must exceed this limit.

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 controls on the front panel should be set mid-range. 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. The scope may then be used to set the desired PRF by rotating the PRF controls. The main output is delayed with respect to the SYNC output by about 250 to 450 ns depending on the DELAY control setting.

6) The output pulse width is controlled by means of the front panel ten turn PW control and the two-position range switch (5-50 ns, 50-100 ns). 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 ten turn potentiometer (AMP).

8) An external clock may be used to control the output PRF of the AVL 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. WARNING: Model AVL-2 may fail if triggered at a PRF greater than 5 kHz.

9) Model AVL-2 can withstand an infinite VSWR on the output port but is intended for operation with 50 Ohm loads.

10) NOTE: The lifetime of the switching elements in the pulse generator module is proportional to the running time of the instrument. For this reason the prime power to the instrument should be turned off when the instrument is not in use. In the case of failure, the switching elements are easily replaced following the procedure described in the following section.

11) The 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: (613) 226-5772
Fax: (613) 226-2802

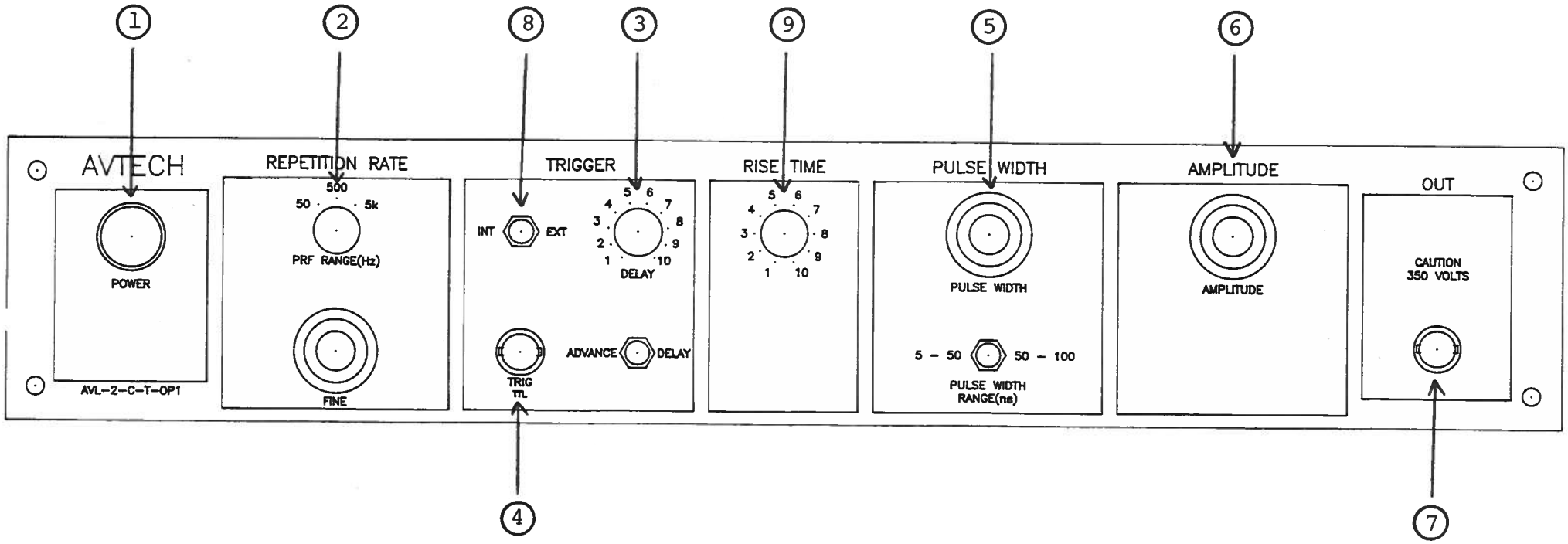


Fig. 2 FRONT PANEL CONTROLS

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

(2) PRF Control. Varies PRF from about 5 Hz to about 5 kHz. The operating PRF should be set using a sampling 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 100 ns to about 250 ns. 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 sampling scope time base. The output is a TTL level 100 ns (approx.) pulse capable of driving a fifty Ohm load.

(5) PW Control. A ten turn control and two-position range switch which vary the output pulse width from 5 to 100 ns as follows:

5 - 50 ns
50 - 100 ns

(6) AMP Control. The output pulse amplitude is controlled by means of the ten turn potentiometer (AMP).

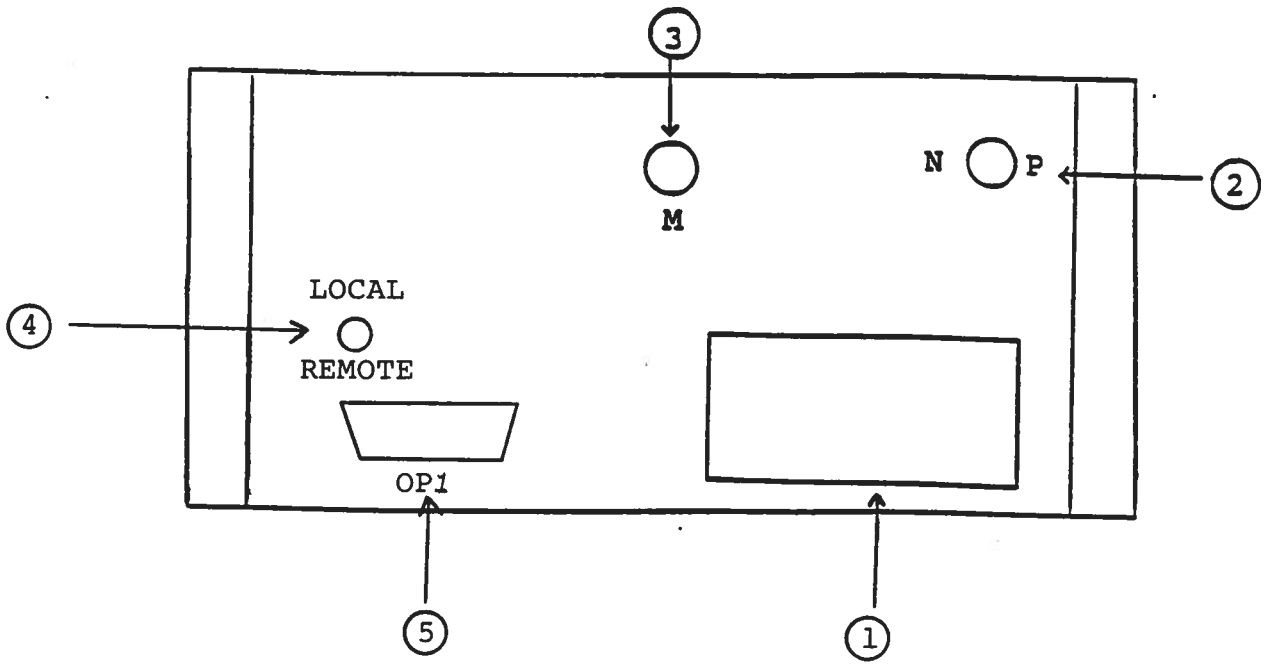
(7) OUT Connector. BNC connector provides output to a fifty Ohm load.

(8) EXT-INT Control. With this toggle switch in the INT position, the PRF of the AVL 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 AVL unit requires a 0.2 us 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) RISE TIME Control (Option). Varies rise and fall times in one nanosecond increments from about one to ten nanoseconds.

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) OUTPUT POLARITY CONTROL (Option). With switch in (P) position, output is positive. With switch in (N) position, output pulse is negative.

(3) MONITOR Output. The back monitor output provides an attenuated replica (20 dB down) of the output less DC offset. The monitor output is designed to operate into a 50 Ohm load. (Option).

(4) 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.

(5) 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).

2) The -R5 rack mount kit may be installed after first removing the one Phillips screw on the side panel adjacent to the front handle.

REPAIR PROCEDURE

1) WARNING: Before attempting any repairs, note that potentials as high as 400 Volts are employed in the chassis structure.

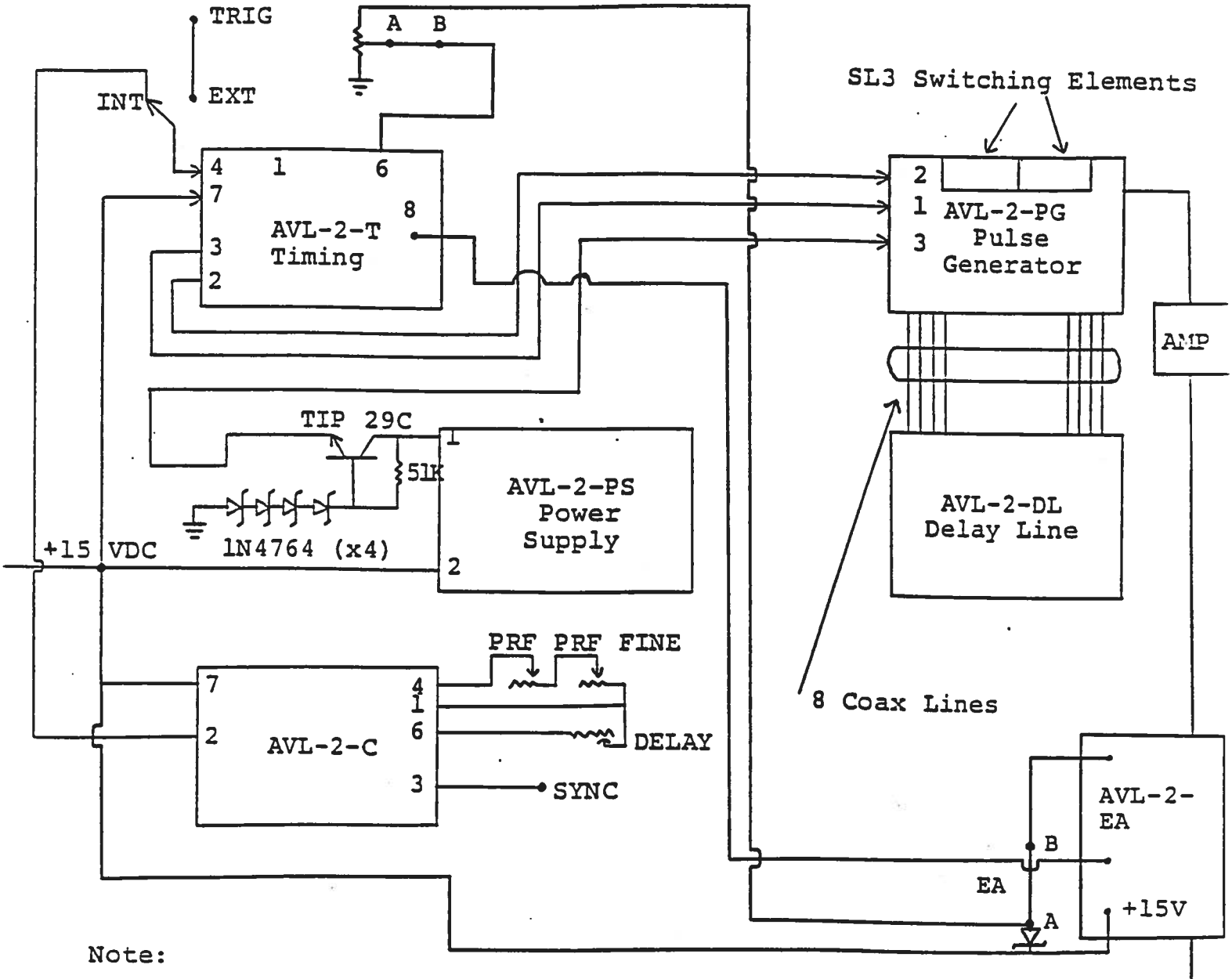
2) The pulse generator is constructed from the following basic subsystems or modules:

   a) Metal chassis
   b) Pulse generator module (AVL-2-PG)
   c) Delay line module (AVL-2-DL)
   d) Timing module (AVL-2-T)
   e) Power supply module (AVL-2-PS)
   f) Clock module (AVL-2-C)

   The five modules are interconnected as shown in Fig. 4.

3) If no output pulse is provided by the AVL-2 unit, turn off the prime power supply and remove the top cover panel by removing the four Phillips screws on the top of the instrument. Apply a scope probe or voltmeter to pin 3 of the AVL-2-PG unit. With the unit untriggered, turn on the prime power supply. A voltage of about 360 to 380 Volts should be read at pin 3. Alternatively, the voltage may be measured on the cases of the SL3 switching elements. If the voltage is zero or much less than 360 Volts, then one of the switching transistors (Part No. SL3) in the AVL-2-PG module has probably failed. With the prime power supply off remove one of the transistors by removing the two 2-56 screws which secure the transistor in its socket. CAUTION: Before touching or removing the transistor, the cases should be briefly shorted to the instrument case to discharge charged capacitors (as high as 400 Volts). Pull the transistor out of the socket. With the unit untriggered turn on the prime power supply and measure the voltage from the case of the remaining transistor to ground. If this voltage is about 360 to 380 Volts then the transistor which was removed is defective and should be replaced. If the voltage which is measured is less than 360 Volts then the transistor still in position is defective and should be replaced. Note that the two transistors are completely interchangeable (Order Avtech Part No. SL3). Note that with both transistors removed, the voltage at pin 3 on the AVL-2-PG module should be in the range of 360 to 380 Volts. If the voltage is less then the AVL-2-PS module must be replaced. If both the AVL-2-PS module and the AVL-2-PG module are not found to be defective then the AVL-2-T module is suspect.

Fig. 4 System Block Diagram With Wiring And Pin Connections



Note:

1) All interconnect lines are ribbon cable.

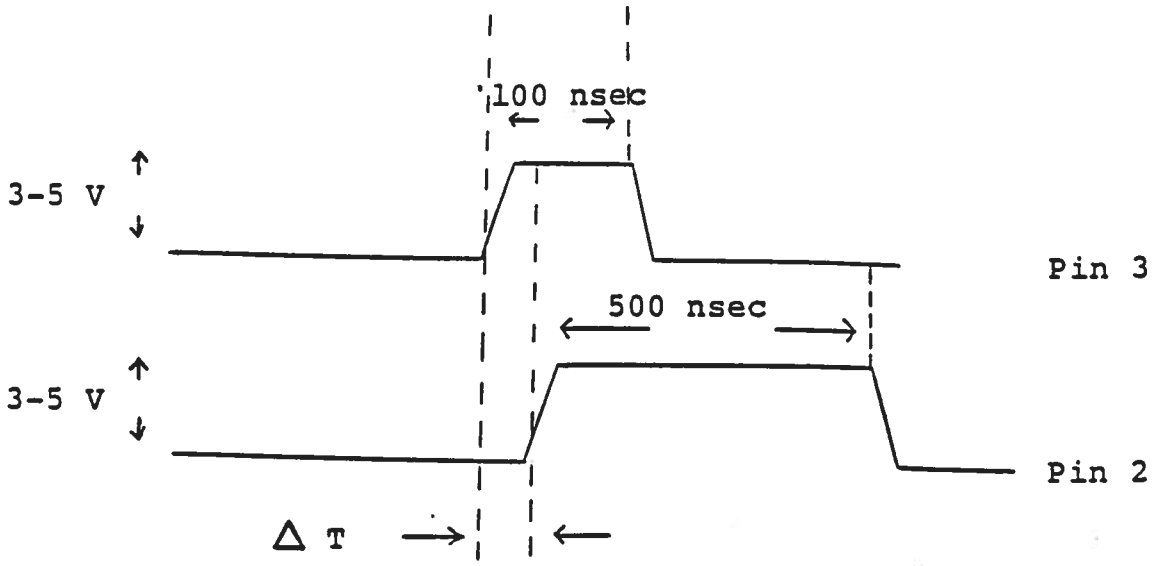
2) All module chassis are grounded to main chassis and to each other via separate ground lines.

3) WARNING: The line connecting pin 1 of AVL-2-PS to pin 3 of AVL-2-PG is at a potential of 360 to 380 volts.

Connect one scope probe to pin 3 of the -T module and a second probe to pin 2 of the -T module. With the scope triggered externally by the pulse generator providing the trigger input signal to the AVL unit, the waveform at pins 2 and 3 of the -T module should resemble:

Fig. 5

T MODULE WAVEFORMS



As the PW pot is varied over its full range Δ T should vary from about 0 to approximately 100 ns. If the waveforms at pins 2 and 3 do not resemble the above, then the -T module is defective and should be replaced. If the waveforms do resemble the above then the -PG module is at fault and should be replaced.

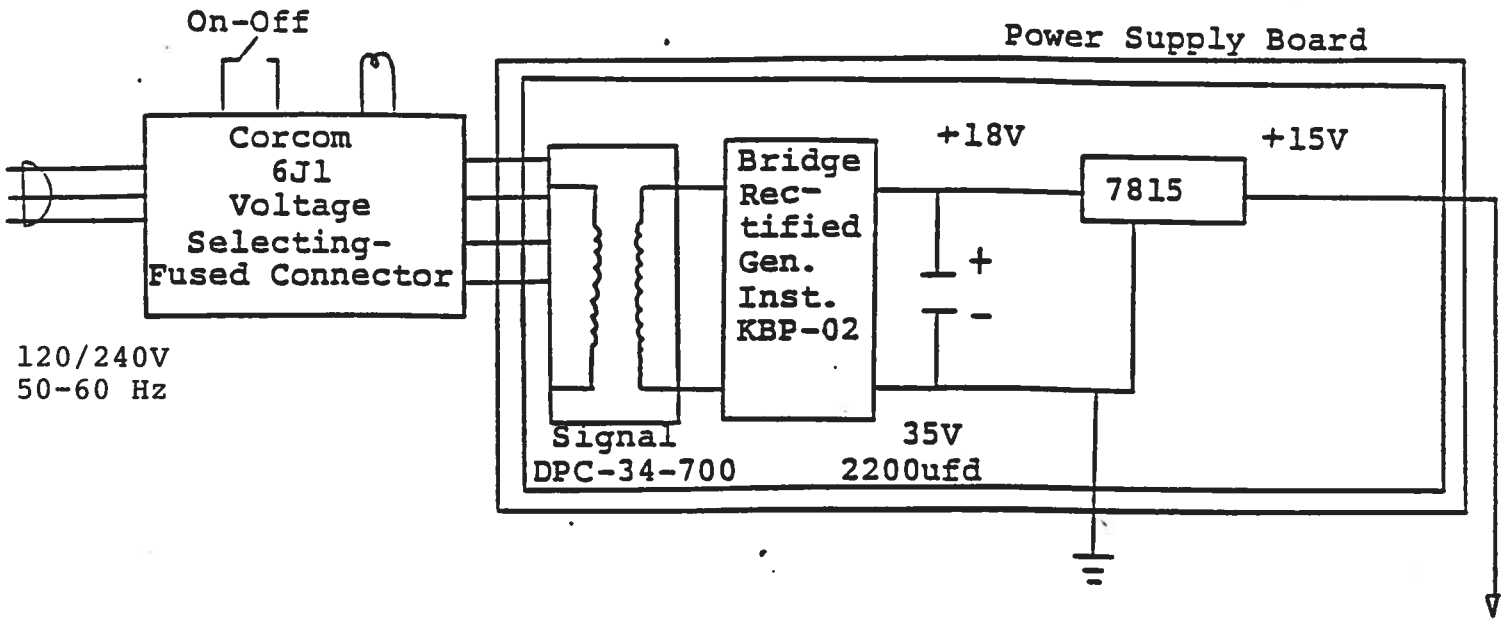
Replacement modules should be ordered by part No. (eg. AVL-2-PG) from Avtech.

+15 VOLT POWER SUPPLY

The AVL-2-C consists of the five standard modules and a power supply board which supplies +15 Volts (600 mA max) to the pulse generator modules. In the event that the AVL-2-C unit malfuctions, remove the instrument cover by removing the two screws on each side of the unit, thereby exposing the modules. Measure the voltage at the +15 V pin of the PS module. If this voltage is substantially less than +15 Volts, unsolder the line connecting the power supply board output and connect a 50 Ohm 10 W load to the power supply output. The voltage across this load should be about 15 V DC. If this voltage is substantially less than 15 Volts the power supply board is defective and should be repaired or replaced. If the voltage is near +15V then see instructions in preceding section.

Fig. 6

POWER SUPPLY BOARD



To Fig. 4

1.0 Introduction

This application note describes how to use the Eildan Model E/D-101 GPIB Interface Card Assembly for remote computer control of the Avtech product line of pulse generators, by means of the IEEE 488 General Purpose Interface Bus (GPIB). Commands sent from a computer with an IEEE 488 Controller Card can be used to change the outputs of the generator. The Avtech Model AVR-3-PW-C pulse generator is used as a typical example.

This application note describes the available commands, their structure, a typical command sequence and provides a sample program. In addition suggestions are made on incorporating duty cycle limit checking and how the GPIB address of the Interface (hence the pulse generator) can be changed.

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 listen-only capability:

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

2.1 Available Commands

The GPIB user interface can be used to program the Avtech generator to remotely control pulse repetition rate, pulse width, pulse amplitude and delayed (or advanced) trigger outputs. The available command acronyms, suggested outputs, range of acceptable values and suggested units for this application are:

Acronym	Typ. Output	Suggested Units	Range	Decades
V	Voltage amplitude	Volts	0 to 200	
R	Repetition rate	Hertz	1 to 10000	4
W	Width of pulse	micro-sec	0.1 to 100	3
D	Delay (trigger)	micro-sec	0.1 to 100	3
A	Advance (trigger)	micro-sec	0.1 to 100	3

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 "V 70.2" will result in exactly the same result if the command is sent as "Voltage of output pulse = 70.2". 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, amplitude values of 12.82, 12.83 or 12.82145 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+3 will be interpreted as 3, not as 3000.

The range of the specified values must be as specified. Numbers outside the range will be ignored. The suggested units are those selected for the Avtech AVR-3-PW-C generator.

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 "width =177" will result in the same output as the command " width = 177 microseconds".

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=1000
W=3
V= 30
A=1
```

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

```
ibwrt "r=1000"
ibwrt "w=3"
ibwrt "v=30"
ibwrt "a=1"
```

This command sequence will cause the generator to produce a series of output pulses of width 3 micro-sec and an amplitude of 30 volts peak, repeated at a rate of 1000 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 be delayed 1 micro-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;V", 30
PRINT #1, "OUTPUT 8;W", 3
PRINT #1, "OUTPUT 8;R", 1000
PRINT #1, "OUTPUT 8;A", 1
END
```

3.0 Duty Cycle Limits

Typically, the Avtech pulse generators are limited, because of thermal constraints, to a maximum duty cycle, where duty cycle is the ratio of Pulse Width to the reciprocal of the Repetition Rate (i.e.; R*W). Although the generator contains automatic protection against an excessive duty cycle, whenever this protection is activated, the output is inhibited. Therefore, it is 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 sending the command sequence.

This message should 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

The address is set by means of a five position "Dipswitch " located on the top of the circuit card assembly.. The switch may observed to be set to the default address by noting that the Dipswitch position 4 is in the OFF position, defining a binary value 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 value of zero)

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

For example, a switch with positions 1, 2 and 5 OFF will result in an address setting of 16 plus 8 plus 1 = 25.

6.0 Trouble-Shooting Aids

To aid in resolving any difficulties encountered communicating via the GPIB interface, two auxiliary communications status indicators have been included on the GPIB interface 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.

July 24/95

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Disk: AVL-2

Name: 2COP1.INS