

Specification for Model 101, IEEE488 GPIB Interface

This specification describes the characteristics of the EILDAN Model ED-101 GPIB Interface board, required to provide an IEEE 488 interface for AVTECH pulse generator products.

1. Electrical.

i) Analog outputs

- 4 outputs
- 0 to 10 volts dc
- accuracy +/-1 % Full Scale
- resolution 8 bits
- load > 1K ohms

ii) Digital outputs

- quantity 11
- decade range control for analog outputs, grouped as follows:
O/P #1 (V) - 1 range, O/P #2 (R)- 4 ranges, O/P #3 (W) - 3 ranges, O/P #4 (D)- 3 ranges
plus advance/delay select
- CMOS/LSTTL compatible, fan-out 1, active high o/p
- load >5K ohms

iii) input

- IEEE 488 compatible, Bus listener
- Functions - SH0, AH1, T0, TE0, L2, LE0, SR0, RL0, PP0, DC1, DT0, C0.

2. Commands

Configured as Bus listener, for programming of Avtech Model AVR-3-PW-C generator pulse repetition rate, pulse width, amplitude and delayed trigger outputs. Input commands as follows:

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

3. Connectors

- Output: 40 pin Header, Pin numbers/function as follows:

4	DELAY 1	5	PW	6	DELAY 2	8	DELAY 3
9	PW 1	10	LEAD/LAG	11	PW 2	13	PW 3
17	AMPL	21	PRF	25	PRF		
27	PRF 2	29	PRF 3	31	PRF 4		
35	DELAY	2	GND	3	GND	36	GND

- Input: 4 pin Header, Pin numbers/function as follows:

1	GND	2	NC	3	+15 volts	4	+5 volts
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4. Other

- Power requirements : +5 vdc, 25 ma and +15 vdc, 10 ma
- Board size - 2.9 x 3.9 in (7.4 x 10 cm)
- +10 to +40 deg C

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1.0 GPIB Interface for Avtech Pulse generators

The IEEE 488 General Purpose Interface Bus (GPIB) allows the outputs of the pulse generator to be controlled remotely by means of a computer link. This section describes the available commands and their functions, provides a "first-time" operating example and describes how the GPIB address of the pulse generator can be changed.

The IEEE 488 compatible Bus functions available to the user for GPIB control are listed below. The listed functions define a listen-only capability:

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

1.1 Available Commands

The GPIB user interface permits programming of the Avtech generator to remotely control pulse repetition rate, pulse width, pulse amplitude and delayed (or advanced) trigger outputs. The available commands, their acronyms, range of acceptable values and units required to be used, are listed below:

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

The acronym used may consist of one of the single letters listed, or may be expanded to a longer word to make the control program easier to understand. 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 the first letter of each command must be one of the five acceptable 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.

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Units used must be as specified. For example, a Delay "D" input of 184 nanosec must be input as "D 0.184" to be interpreted correctly. An input of "w= 0.09 sec " will be instead interpreted as 0.09 micro-sec.

Trailing text may be added to make the control program easier to understand if desired, since it will be ignored. For example, a command of "w 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 actual output pulse occurring. 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 be retained. Similarly, if an "out-of-range" value is sent, the unit will ignore the command.

1.2 First-Time Operation

For the first time user it is recommended the following commands be prepared and sent by means of the computer GPIB controller. This will increase user confidence and demonstrate command structure.

The unit is connected to the GPIB bus by means of the supplied IEEE 488 cable to the connector on the rear of the unit. The rear panel switch is switched to select Remote operation.

The GPIB data bus address for the pulse generator has been preset to "8" in the factory, therefore commands are to be sent to this address. Once this test is completed, the user may wish to change the default address to any address in the allowed range of 0 to 30. The address may be changed by following the procedure described in section 1.5.

The following commands should be prepared and sent using the computer command structure as specified for the user's GPIB controller. Refer to your controller manual for details.

R=1000

W=3

V= 30

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 should be attached to the generator output to 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.

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If you have a GPIB controller from National Instruments, the following set of commands should be sent:

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

1.3 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 1;V", 30  
PRINT #1, "OUTPUT 1;W", 3  
PRINT #1, "OUTPUT 1;R", 1000  
PRINT #1, "OUTPUT 1;A", 1  
END
```

1.4 Duty Cycle Limits

The pulse generator is limited because of thermal constraints, to a maximum duty cycle, where duty cycle is the ratio of Pulse Width to Repetition Rate. While protection against an excessive duty cycle is automatic, this protection inhibits the generator output. Consideration should be given to calculating the duty ratio within the control computer and generating a warning message to the user if the limits are exceeded. This message could caution the user either to reduce the repetition rate or to reduce the pulse width, to avoid thermal overload. While this calculation is not necessary, it could avoid automatic inhibiting of the generator output.

1.5 Changing the Unit GPIB Address

The unit GPIB Address is set to a default value of 8 at the factory. This address may be changed, if necessary, by removing the unit top cover and re-setting the GPIB Address switch on the GPIB Interface board, which is located inside the generator chassis near the center rear of the enclosure.

The Address is set by means of a 5 position "Dipswitch " located on the top of the printed circuit board. The switch may observed to be set to the default address by noting the switch positions. Dipswitch position 2 will be in the open position, defining a binary value of 8.

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The switch setting is calculated as the sum of the switch weights calculated as follows: (for a switch in the open position; an closed switch has a value of zero)

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

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

1.6 Trouble-Shooting Aids

Should difficulties be encountered communicating via the GPIB interface, two communications status indicators have been included on the GPIB interface card, located near the GPIB Address switch described in section 1.5. These status indicators are small LED lamps, one of which will flash briefly whenever a properly addressed command is received. The second LED will light whenever an out-of-range value is received, and will remain lit until a valid in-range value is subsequently received. It would be advantageous to monitor the state of these two indicators prior to calling the factory to request assistance.

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from Dan Ball

The green setting is calculated as follows: for a switch in the open position, an address value of zero is assigned; for a switch in the closed position, a value of 255 is assigned.

Switch Number	Weight
1	128
2	64
3	32
4	16
5	8
6	4
7	2
8	1

For example, a switch with positions 1, 2 and 5 open will result in an address setting of 16 plus 64 plus 1, or 81.

1 to 16 (Double-Shooting Axis)

Should difficulties be encountered communicating via the GPR interface, two communication status indicators have been included on the GPR interface card, located near the GPR A address, which is defined in section 1.5. These status indicators are an LED lamp, one of which will flash briefly whenever a properly addressed command is received. The second LED will light whenever an out-of-range value is received, and will remain lit until a valid in-range value is subsequently received. It would be advantageous to monitor the state of these two indicators prior to calling the factory to request assistance.