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Instructions

Model AVR-A-1-PW-PS-BXA1

S.N.:

Rev. 1.1

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

1. Introduction

The AVR-A-1-PW-PS-BXA1 was designed as a replacement for the N-SG-73 Dual Delay Trigger Generator. It is designed to be triggered by the NTS (Nevada Test Site) X-FIDU signal, and to trigger oscilloscope systems. It is a fully redundant unit featuring two independent delay trigger generators with cross coupling between the trigger generators to ensure coincident (within 10ns) output pulses, and to ensure continued operation in the event that one of the X-FIDU signals should fail.

Referring to the block diagram of Figure 1, the unit contains two delay trigger generators. Each has a "Trigger In" input for normal use. As well, Channel 1 has an internal Reprate signal source, and Channel 2 has an external Prebase input. Each channel has a single output (which is brought out to five BNC connectors). As well, each channel has an output LED indicator, driven by an attenuated and stretched version of the output pulse, to indicate when the unit is functioning. The two channels are cross-coupled as shown in Figure 1. Each channel is powered by a separate power supply board, but share a common 120VAC line power connection.

In the "REPRATE" mode, the unit triggers off an internal 1Hz signal of approximately 50% duty cycle. This is useful for calibration and setup purposes without using an external input signal. However, during the time in which the Reprate signal is low, the Channel 1 input can trigger the unit, since the Reprate signal and the Channel 1 input are combined with an OR function. The Channel 2 input can trigger the unit at all times, due to the cross-coupling arrangement, as can the Prebase input. In normal use, however, the Reprate signal is the sole trigger source in the REPRATE mode.

In the "LOCKOUT OFF" mode, the unit can be triggered by either one or both of the Channel 1 and 2 inputs, or by the Prebase input. The Prebase input is used for calibration purposes requiring an external signal, without disturbing the Channel 1 and 2 input connections. The Prebase input discriminator triggers at +10V ±10%, and has a maximum input amplitude of +20V. Again, since the Prebase input and the Channel 2 input are combined in an OR gate, and due to the cross-coupling with Channel 1, these inputs can trigger the unit while the Prebase input is in use. This, however, is not normally done.

In normal LOCKOUT OFF operation, the Channel 1 and 2 inputs are used. These trigger at either +25V ±10% or +50V ±10%, selectable by two front-panel switches. The maximum specified input amplitude is +100V, but the unit will safely withstand inputs as high as ±250V. Both inputs are usually triggered simultaneously, however, should one input signal fail, both outputs will continue to operate due to the cross-coupling between the two trigger generators. The input signals are limited to 50Hz. Should a trigger pulse trail another by less than approximately 15ms (67Hz), the unit will ignore the pulse.

The "LOCKOUT ON" mode is similar in operation to the LOCKOUT OFF mode with the exception that for a period of 700ms after being triggered, the unit will lockout (i.e. ignore) all input trigger pulses. The lockout periods are independently internally adjustable on the two channels, from approximately 350ms to 700ms.

A front-panel, three position switch selects the operating mode. This switch controls both channels. The input trigger signals may have a pulse width as small as 40ns. The output trigger signals have a pulse width of 100ns to 1μs, variable by a front-panel control. Rise and fall times are less than or equal to 20ns. Output amplitude is +150V, into a 50Ω load. Delay time is independently variable on the two channels by two frontpanel controls, from 4μs to 100μs. Each channel has five identical outputs on the backpanel. All input and output connectors are BNC.

AVR-A-1-PW-PS-BXA1 BLOCK DIAGRAM

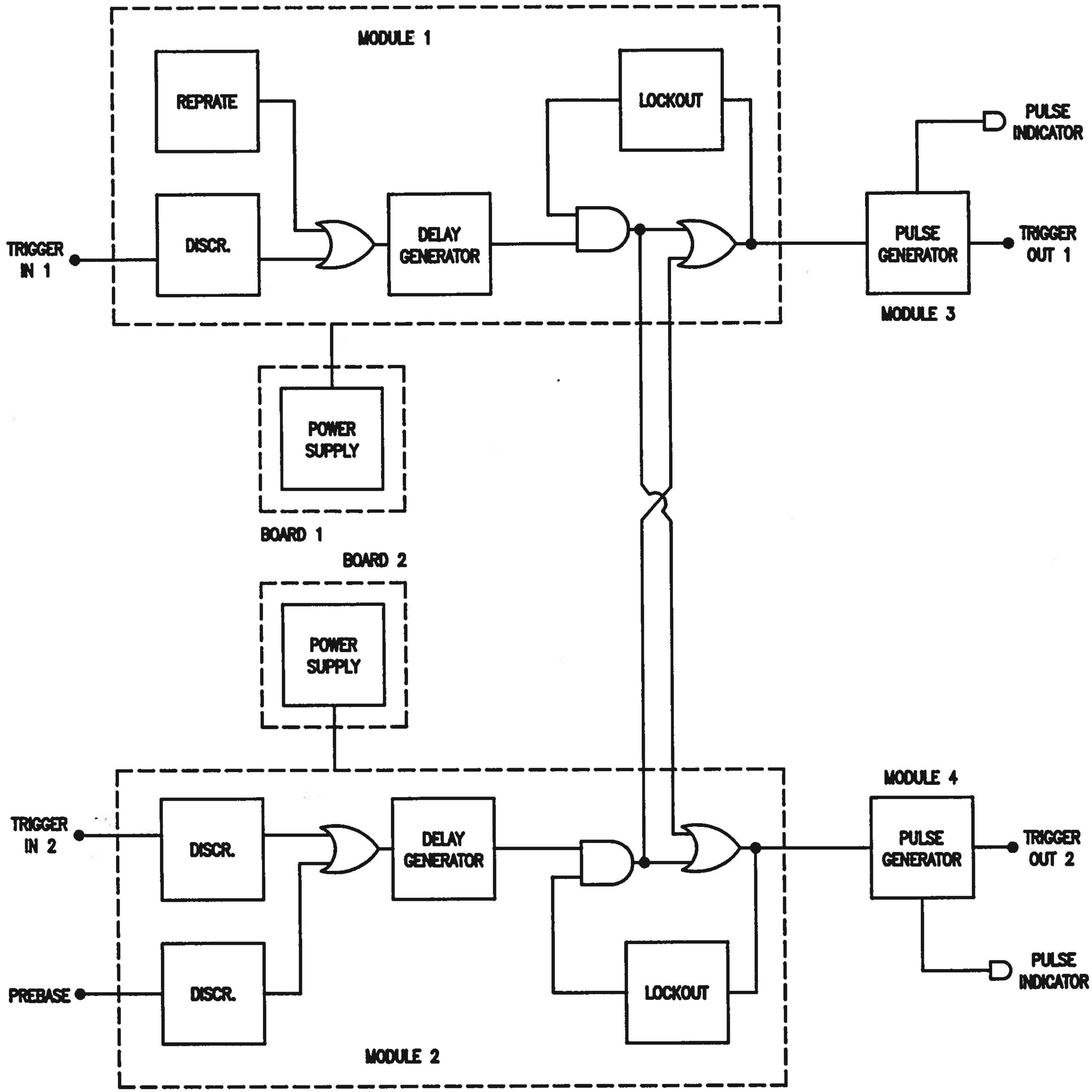

Figure 1

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Rev. 2
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2. Specifications

Model designation:	AVR-A-1-PW-PS-BXA1
Power requirement:	120/240 Volts (switchable) 50-60 Hz, 50 W
Trigger input (two):	
Impedance:	>5.1 K
Trigger level:	Two fixed discriminator levels: a) +25 Volts (±10%) b) +50 Volts (±10%)
Maximum Specified Trigger Amplitude:	+100 Volts
Maximum Transient Amplitude:	+250 Volts
Prebase trigger input:	
Impedance:	≥2 K
Trigger level:	+10 Volts (±10%), fixed
Maximum Amplitude:	+20 Volts
Output (two):	
Amplitude:	≥ +150 Volts (R_L = 50Ω)
Rise, fall time: (10 - 90 %)	≤20 nsec
Pulse width: (FWHM)	100 nsec to 1.0 usec via two 10 turn locking dial controls.
Coincidence of Output Pulses:	≤10nsec
Delay:	
Range:	4 µsec to 100 µsec via 10T locking dial control.
Jitter:	≤0.15% of delay setting (typically less than 1 nsec at min delay and less than 10 nsec at max delay).
Drift:	≤3% of delay setting over temperature range.
Operating temperature range:	0°C to +60°C.
Trigger mode:	
Lockout off:	May be triggered externally up to 50 Hz.
Lockout on:	The output trigger generator is inhibited to limit output pulses to one every 700 msec. This lockout time may be adjusted to as low as 350 msec using an internally accessible pot.
Reprate:	The trigger generators are triggered from an internal source at an internally adjustable rate of approximately 1 Hz.
Indicators:	
Power on:	Red.
Trigger output:	Amber (2).
Connectors:	
Trigger input:	BNC (2).
Prebase input:	BNC (1).
Trigger output	BNC (10). Five parallel connectors for each channel located on back panel.
Dimensions:	4" x 16" x 12" but supplied with wings for standard 19" rack mounting.

Weight:	Approx. 10 lbs.
Chassis material:	Extruded anodized aluminum with blue plastic trim.

3. Operating Procedure

1. Turn on power and allow the system to stabilize for several minutes.

2. Select the appropriate mode of operation by setting the mode switch to REPRATE, LOCKOUT ON, or LOCKOUT OFF.

3. If the mode is LOCKOUT ON or LOCKOUT OFF, connect the input trigger cables and terminators to the Channel 1, Channel 2, and Prebase inputs as desired, and select the appropriate Channel 1 and 2 discriminator levels.

4. Then, for all modes, set the front-panel delay controls to the appropriate levels. To obtain a precise delay, use the setup of Figure 2, and adjust the delay controls until the Time Interval Meter displays the correct delay. Both output pulse generators will trigger on the earlier delay setting for simultaneous input pulses.

5. Lastly, set the output pulse width controls to the required pulse width. This can be measured on an oscilloscope.

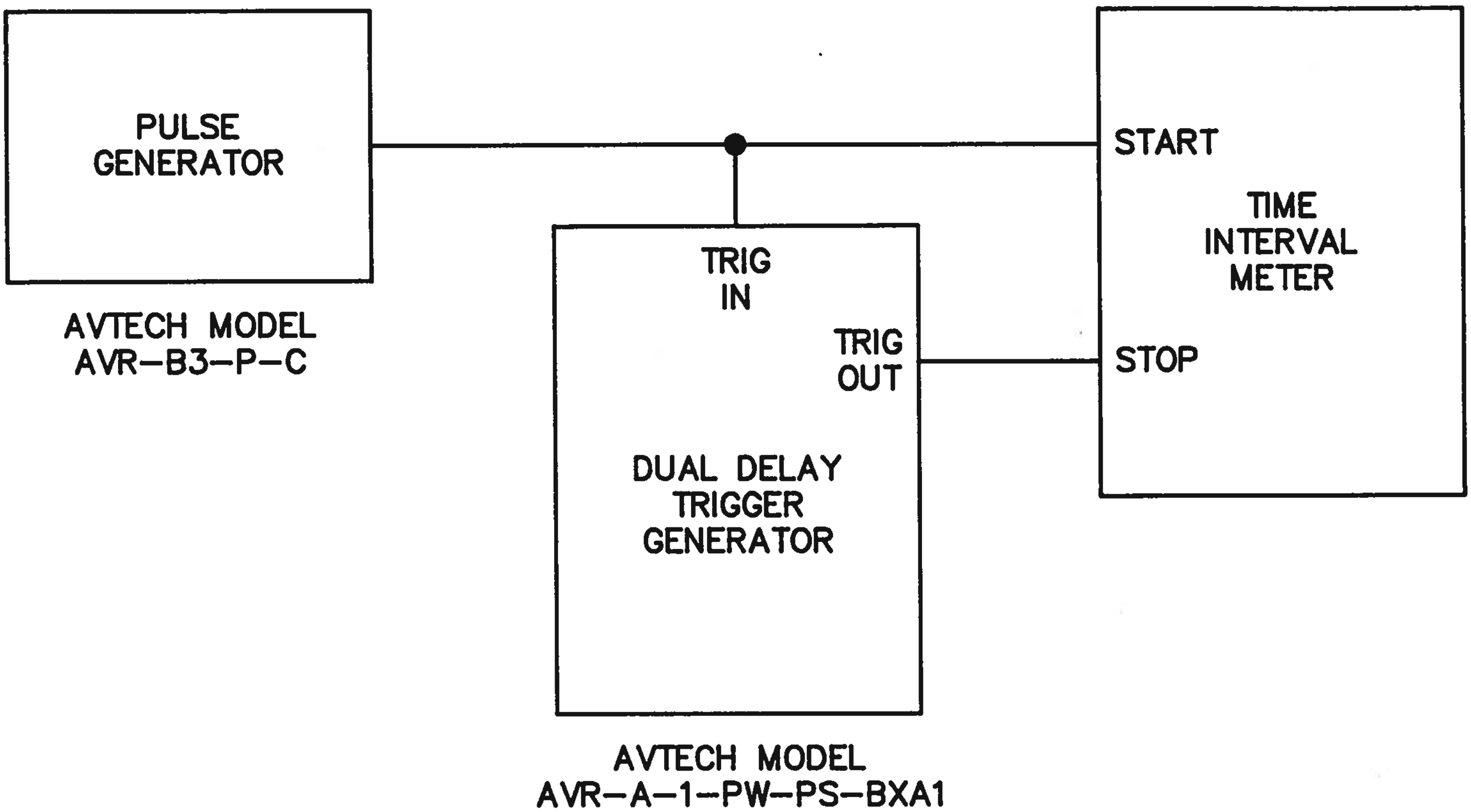

Figure 2 — Delay Measurement Setup

4. Circuit Description

4.1 General

Figure 3 is a block diagram of the Dual Delay Trigger Generator. The Delay Trigger Generator Modules 1 and 2 are identical except for the fact that Module 1 contains the Reprate circuitry, and Module 2 contains the Prebase circuit. All input trigger connectors, controls, and indicators are located on the frontpanel, with the exception of the Reprate adjust control, which is located on Module 1, and the lockout time adjust controls, which are located on Modules 1 and 2. The output connectors are on the backpanel.

4.2 Module 1

The channel 1 input trigger is applied to pin 12 of module 1 (point A of Figure 3). The positive pulse reaches the discriminator, essentially a comparator whose reference levels, 25V and 50V, are determined by resistors R1 and R2 on discriminator switch S2. The discriminator generates a positive pulse if the input trigger exceeds the selected reference level. This pulse is combined with the Reprate signal (point B), which will be active only in the REPRATE mode. (The Reprate signal is always available from pin 4 of Module 1.) The resultant signal (point C) fires a one-shot, giving a pulse whose width is equal to the delay period. Potentiometer R5 controls this pulse width. The falling edge of this pulse triggers a second one-shot, giving a narrow, positive pulse. Together these two one-shots comprise the delay generator.

The delayed trigger (point D) is applied to an AND gate. If a lockout is in effect, the other input (point E) will be low, and the trigger signal will not pass. Otherwise, it will be high, and the delayed triggered will flow through (point F), to be combined in an OR function with the equivalent delayed signal from Module 2 (point G), entering on pin 3, if it is active. This is the cross-coupling connection. Ideally, these two OR gate inputs will be coincident, yielding an unchanged output (point H) identical to both inputs. If either delay generator or original input signal has failed, the one remaining active OR gate input will pass through the gate unchanged.

The OR gate output will trigger the lockout circuit. On the rising edge of this output, a one-shot will be triggered, giving a 100ns wide positive pulse. The falling edge of this pulse will trigger a second one-shot, giving an inverted pulse, whose width is equal to the lockout time. The lockout time is selected by switch S1-2, which chooses an appropriate timing resistor. In the LOCKOUT ON mode, a large potentiometer, R9, is chosen, giving a lockout period of 350ms to 700ms. In the LOCKOUT OFF mode, a small resistor giving a lockout time of 15ms is chosen. The inverted pulse from this last one-shot is applied to the previously mentioned AND gate (point E).

The 100ns pulse width of the first lockout one-shot output effectively limits the output of the final OR gate, hence the module, to 100ns in width. This output appears at pin 2 of the module, with TTL logic levels.

4.3 Module 2

Module 2 operates in a nearly identical fashion to Module 1, with the exception that the Reprate signal is replaced by the Prebase circuit.

4.4 The Reprate Circuit

The Reprate circuit is a low frequency oscillator, giving a signal of approximately 1Hz and 50% duty cycle. The frequency can be varied by approximately $\pm 30\%$ or so, by varying internal potentiometer R11. The output signal of the oscillator is combined in an AND gate with a control voltage from switch S1-1, which is high in the REPRATE mode, and low otherwise. Thus the Reprate signal is only present at point B to be combined with the input trigger signal during the Reprate mode.

4.5 The Prebase Circuit

The Prebase circuit consists solely of a discriminator circuit which triggers at +10V ±10%. The discriminator output goes through an OR gate with the Channel 2 input signal.

4.6 Modules 3 and 4

Modules 3 and 4 are identical in function. Module 3 operates on Module 1's output, and Module 4 operates on Module 2's output. Each essentially acts as a high-voltage one-shot, giving a +150V output, with the pulse widths varied by potentiometers R7 and R8 between 100ns and 1.0μs. The input TTL signal is applied to pin 1 of the module.

The output pulse is generated by two high voltage VMOS power transistors (Avtech part number SL4) providing a source impedance of about 2Ω. The output stage is designed to operate into a 50Ω load, but will withstand a short circuit or open circuit load conditions. If necessary, the output SL4 transistors may be replaced in the field by removing the cover plate on the bottom of the instrument and extracting the SL4 transistors from their sockets using needle-nose pliers. When replacing the SL4 devices ensure that the short lead on the SL4 is adjacent to the black dot on the instrument case.

The 150V output signal appears on the SMA connectors. This drives the back-panel BNC connectors. An attenuated version of the output pulse is used to drive another one-shot, which gives a pulse having an amplitude of approximately +1.8V, and a pulse width of 250ms, appearing on pin 6. This is used to drive an amber LED on the frontpanel, used to indicate the presence of output pulses.

4.7 Boards 1 and 2

Board 1 is a power supply that supplies +24V to Module 3 and +15V to Module 1. Each module generates any other required DC levels internally.

Board 2 is a power supply that supplies +24V to Module 4 and +15V to Module 2.

AVR-A-1-PW-PS-BXA1 BLOCK DIAGRAM

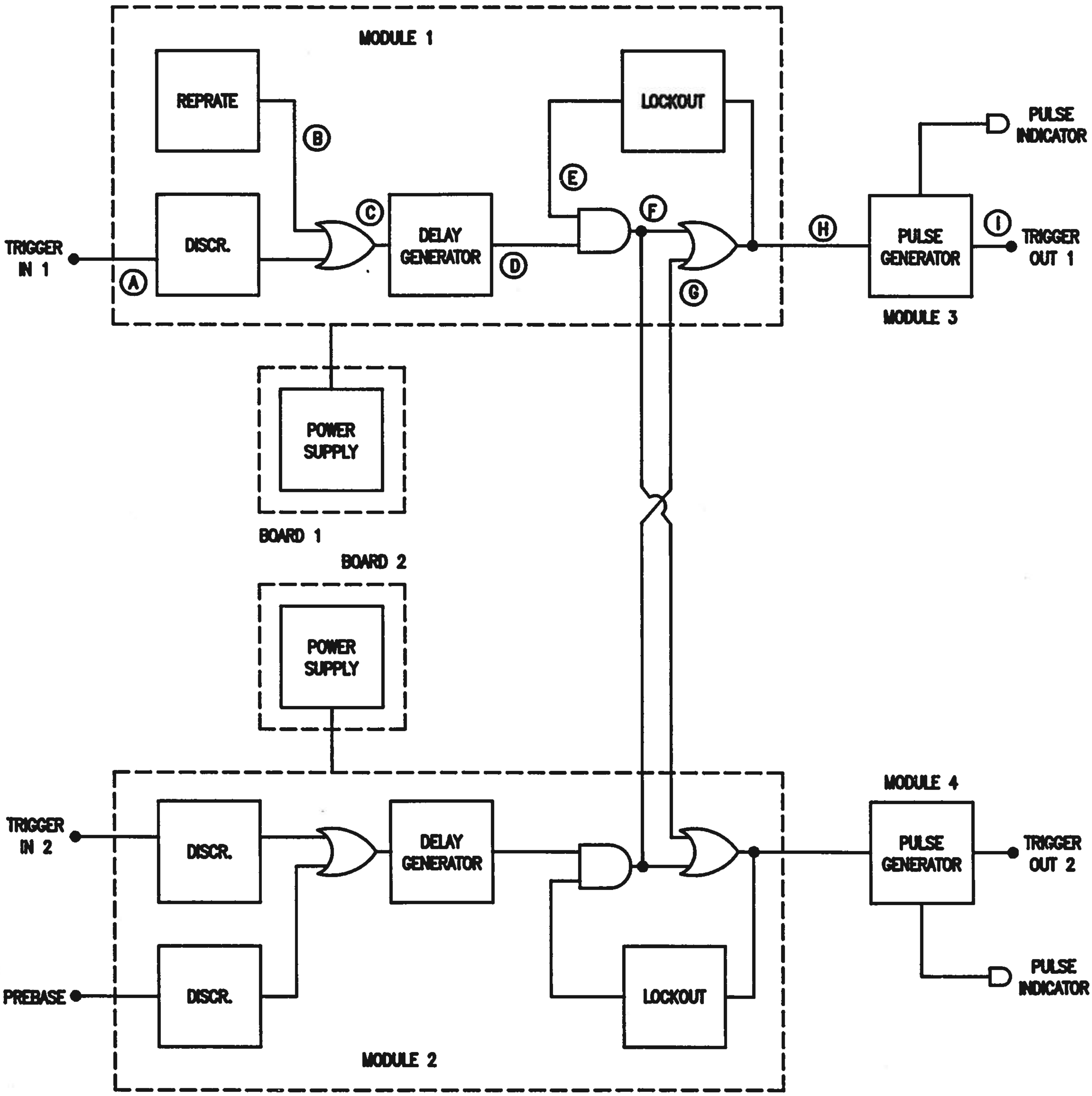

Figure 3

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FIG. 4A – TYPICAL OPERATION, LOCKOUT ON

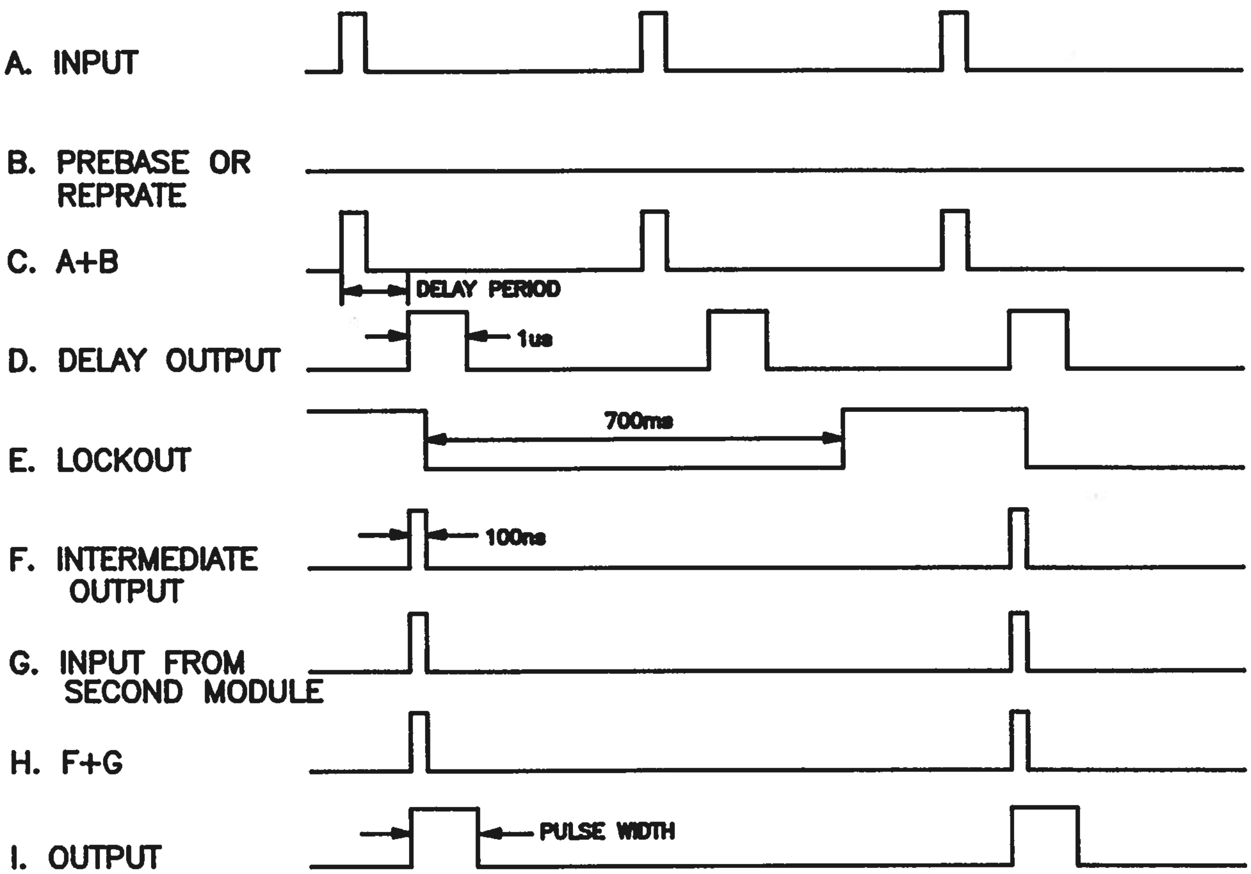
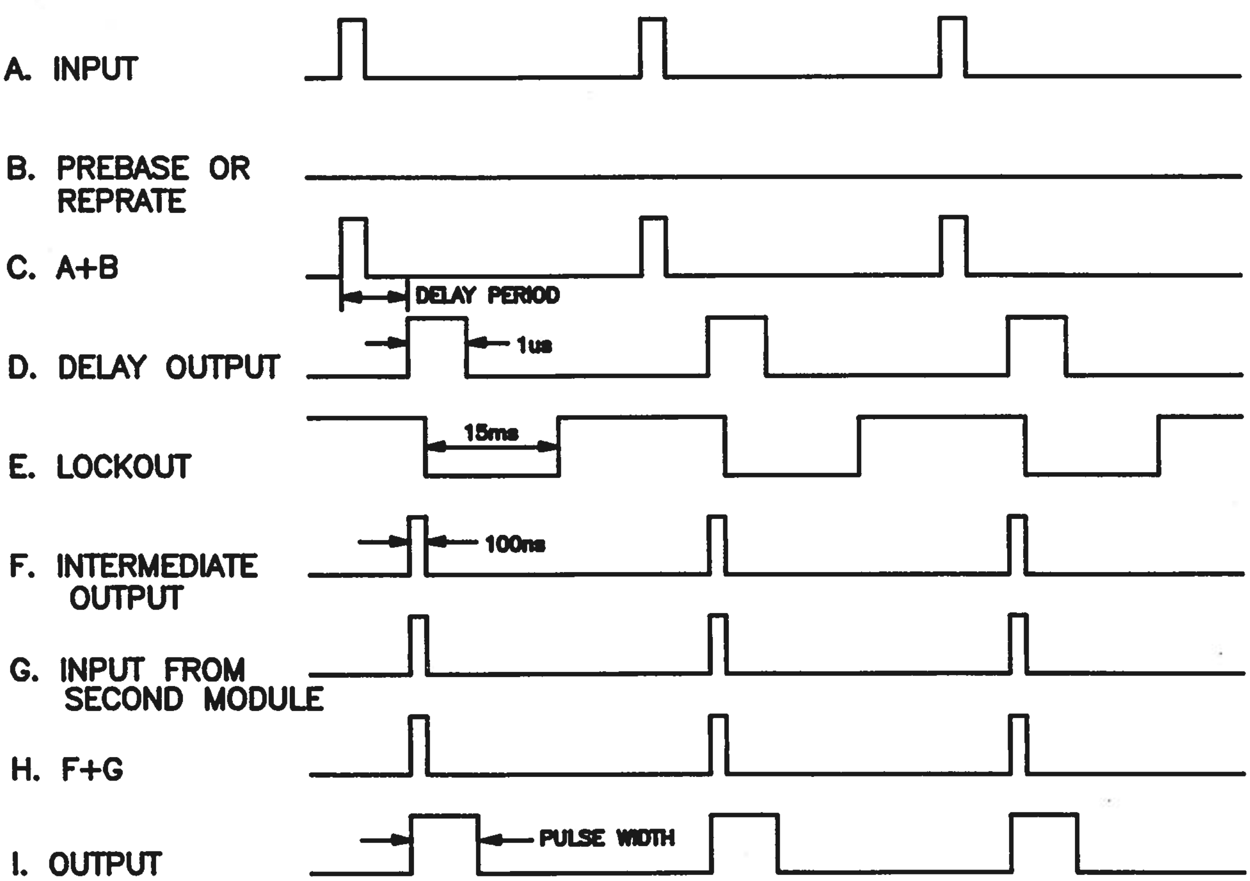


FIG. 4B – TYPICAL OPERATION, LOCKOUT OFF



5. Normal Calibration Procedure

Turn on the power supply, and allow several minutes for the unit to warm up.

5.1 Delay Generators

Use a Time Interval Meter (TIM) to measure the delay periods (see Figure 2). Connect a cable from one output trigger input to the TIM start input. Connect a second cable from the trigger output to the TIM stop input. Adjust the appropriate frontpanel delay potentiometer for $30\mu s$ as indicated by the TIM. The dial on the delay potentiometer should read 30 ± 0.3. If it does not, remove the dial, set it to 30.0 and reinstall it. Repeat the procedure for the other delay generator. (The set delay can be read directly off the dial. It reads from approximately 0.3us to 100.3us.)

5.2 Discriminators

To test the input discriminator level, the following test setup may be used. Connect a pulse generator to one of the unit's trigger inputs and monitor the pulse on an oscilloscope. The pulse generator should provide a flat topped pulse of 40 to 200 ns width and 0 to 100 Volt variable pulse amplitude, such as the Avtech model AVR-B3-P-C pulse generator.

Set the mode switch to LOCKOUT OFF. Set the pulse generator trigger rate to 50Hz, and pulse width to 200ns, and observe it on the test oscilloscope. Set the pulse amplitude to minimum. Set the delay trigger discriminator switch to 25V. The increase the pulse generator amplitude slowly until the delay trigger generator just triggers as indicated by its trigger indicator LED. The pulse amplitude observed on the test scope should be 25 ± 2.5 Volts.

Set the discriminator switch to 50V and increase the pulse amplitude until the trigger generator again triggers. The pulse amplitude indicated on the test scope should be 50 ± 5 Volts. Repeat these checks on the other trigger input.

To test the prebase discriminator, follow the same procedure outlined above. The trigger level should be 10 ± 1 Volt. Then set the pulse generator amplitude to 70V, and the pulse width to 40ns. Test each input for triggering. The indicators should light.

5.3 Reprate

To test the Reprate signal, set the mode switch to Reprate, and remove all other input signals. Observe the output trigger on an oscilloscope. It should have a period of 1.0sec. The Reprate signal can also be measured directly by observing pin 4 of Module 1. This has a higher duty cycle than the trigger output, and may be easier to see. If the signal does not have the desired frequency, it may be adjusted by turning R11, the potentiometer protruding from Module 1, labeled "REP". (Accessing Module 1 requires removing the instrument's top cover. This can be done by removing the four screws on the back-panel, that hold the two side-bars. Remove the side-bars, and pull the top cover back.)

5.4 Lockout Period

To determine the lockout period, set the mode switch to LOCKOUT ON, and apply an input trigger signal of approximately 100Hz to the channel whose lockout period is to be measured. Remove any input signal to the second channel and the Prebase input. Observe the output signal on an oscilloscope. The time between pulses will be equal to the lockout period. In order to change the lockout period, the top cover must be removed as outlined in 5.3. If channel 1's lockout is to be varied, turn R9, the potentiometer on Module 1 marked "LCK". For channel 2, turn R10, on Module 2.

5.5 Pulse Width Control

The pulse width setting can be read off of the pulse width dial. The dial will be installed to go from approximately 60ns to 1μs. It is not highly calibrated, and is specified to be accurate within $\pm$10%.

6. Parts List

Item	Quan	Manufacturer	Model	Description
1	1	Avtech	AVR-BXA1-PG	Module 3, Pulse Generator
2	1	Avtech	AVR-BXA1-PG	Module 4, Pulse Generator
3	2		RG174	Cable
4	2	AEP	9201-9553-003	SMA Connector
5	1	Avtech	AVR-BXA1-DG2	Module 2, Delay Generator
6	2	Motorola	7824CT	Voltage Regulator
7	2	United Chemi-con	SM35T222	Capacitor, 2200μF, 35V
8	1	Avtech	PSB2	Board 2, Power Supply for Channel 2
9	2	Signal Transformer	DP-241-7-24	Transformer
10	2	Motorola	7815CT	Voltage Regulator
11	1	Avtech	PSB2	Board 1, Power Supply for Channel 1
12	2	General Instruments	KBL04	Rectifier
13	1	Schroff	10214 012	Metal Chassis and Covers
14	1	Avtech	R4	Rack Mount Option
15	2	Schroff	20214 029	Handles
16	2	Philips	030 36229	Capacitor, 22μF, 25V
17	1	Avtech	AVR-BXA1-DG1	Module 1, Delay Generator
18	1	IDI	1050C1	Power Indicator Light
19	1	Grayhill Engineering	71AD36-02-2-AJN	Mode Switch
20	1	Alcoknob	KN-500B1/8"	Switch Knob
21	2	Lenlite	LLL-4294	Output Indicator Light Emitting Diode
22	2	Dialight	515-0004	Mounting Grommet for LEDs
23	3	Microswitch	8A1011	Power and Discriminator switch
24	2	Bourns	35405-001-203	20K, 10 turn potentiometer
25	4	Clarostat	462	Counting Dial
26	2	Bourns	35405-001-502	5K, 10 turn potentiometer
27	1	Corcom	6VJ1	Line power interface, 1/2A Slow Blow Fuse
28	13	Amphenol	31-221 (Mil. no. UG1094)	BNC connectors
29	2	Littlefuse	342 004A	Fuse holders
30	2		1/2A	Slow Blow Fuse
31	1	Belden	17250	Line Cord (not shown)
32	2	Philips	369-51682	C1, C2 6800pF capacitor (Fig. 7)*
33	2	Philips	CR25-1.1K	1.1K resistor, R12, R13 (Fig. 7)**
34	3	Philips	CR25-3.9K	3.9K resistor, R1, R3, R19 (Fig. 7)
35	3	Philips	CR25-12K	12K resistor, R2, R4, R18 (Fig. 7)
36	2	Philips	CR25-6.2K	6.2K resistor, R15, R17 (Fig. 7)
37	2	Philips	CR25-330	330Ω resistor, R14, R16 (Fig. 7)

* May be tweaked to a greater value
** May be tweaked to a lesser value

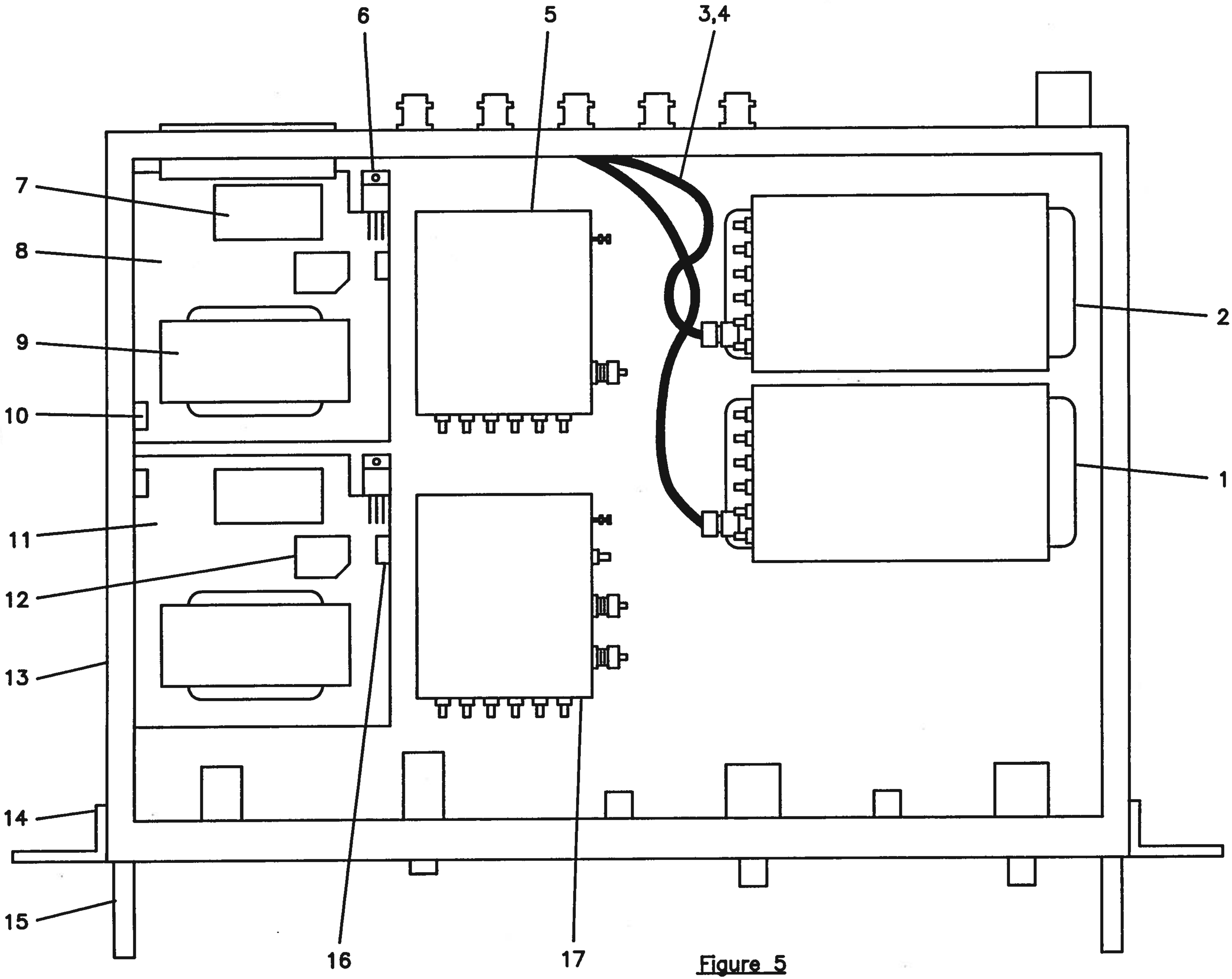


Figure 5

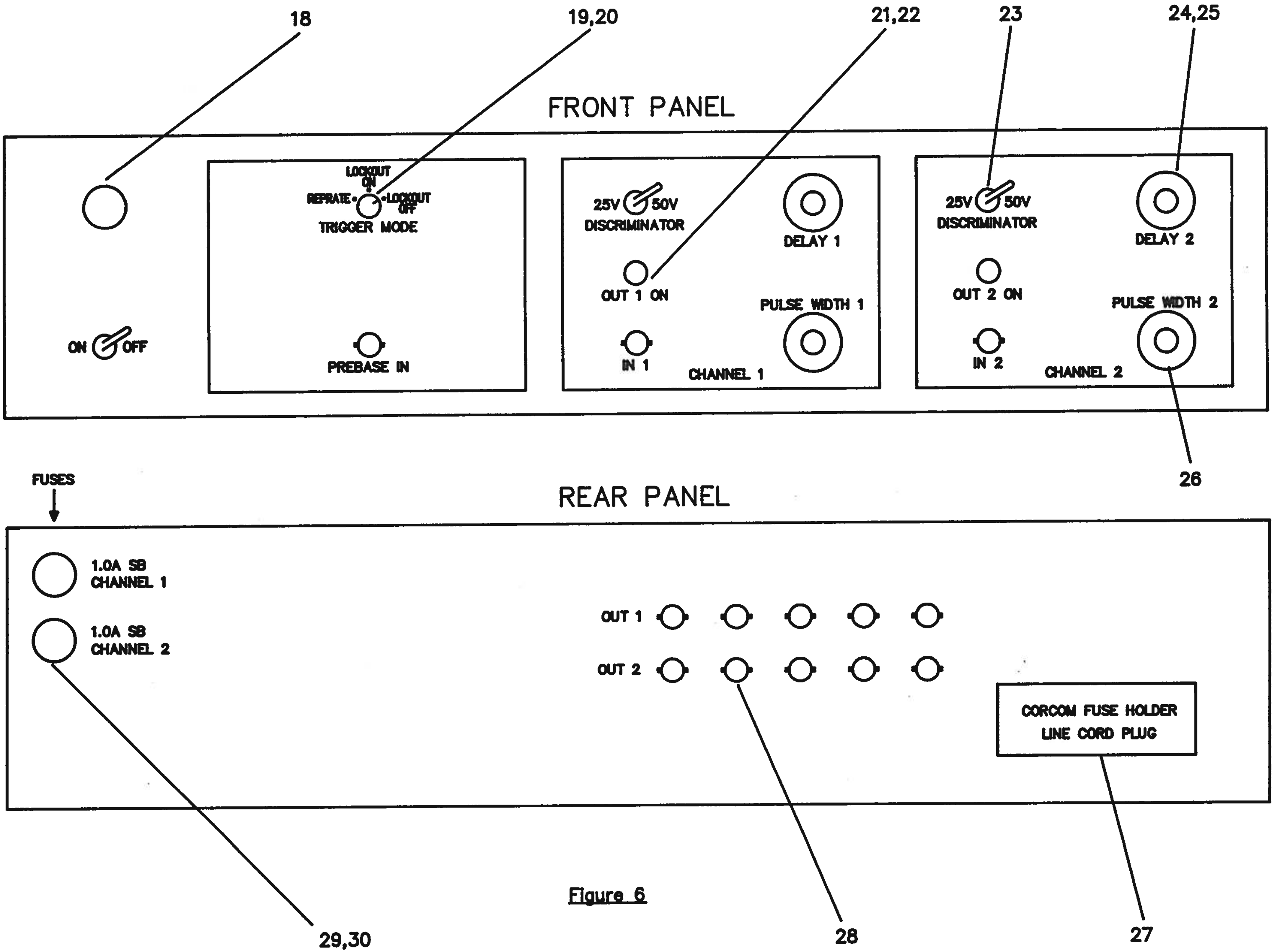

18
19,20
21,22
23
24,25
FRONT PANEL
LOCKOUT ON
REPRATE
LOCKOUT OFF
TRIGGER MODE
25V
50V
DISCRIMINATOR
DELAY 1
OUT 1 ON
PULSE WIDTH 1
IN 1
CHANNEL 1
DELAY 2
OUT 2 ON
PULSE WIDTH 2
IN 2
CHANNEL 2
ON
OFF
PREBASE IN
26
FUSES
REAR PANEL
1.0A SB
CHANNEL 1
1.0A SB
CHANNEL 2
OUT 1
OUT 2
CORCOM FUSE HOLDER
LINE CORD PLUG
29,30
28
27

Figure 6

7. Wiring and Pin Functions

Module 1

Pin 1 - CAP - The delay timing capacitor(s) is placed between this pin and pin 7. If the delay dial does not give a 1:1 correspondence to the delay time, this capacitance may be tweaked.
Pin 2 - REPRATE CONTROL - A +5V level on this pin enables the Reprate input, 0V disables it.
Pin 3 - OUT - Output of module 1. Corresponds to point H in Fig. 3.
Pin 4 - IN2 - Cross coupling input from Module 2.
Pin 5 - REPRATE - The REPRATE signal is available at this pin at all times for calibration and testing.
Pin 6 - DISCRIMINATOR - This connects to switch S2 to set the discriminator levels.
Pin 7 - DELAY - The delay capacitor is placed across this pin and pin 1, and this pin connects to R5, the delay potentiometer.
Pin 8 - +5V - This pin supplies an internally generated +5V level to power Channel 1's controls.
Pin 9 - LOCKOUT OUT - This connects to switch S1-2. The switches selects between +5V, for lockout off, and pin 10 for lockout on. Pin 10 - LOCKOUT IN - This pin connects to the internal LCK pot, R9.
Pin 11 - +15V - Board 1 supplies +15V to this point.
Pin 12 - IN - The Channel 1 input is applied here.
Pin 13 - OUT2 - This is module 1's cross coupling output to module 2.

Module 2

Pin 1 - CAP - The delay timing capacitor(s) is placed between this pin and pin 7. If the delay dial does not give a 1:1 correspondence to the delay time, this capacitance may be tweaked.
Pin 2 - PREBASE - This is where this Prebase input is applied to.
Pin 3 - OUT - Output of module 2.
Pin 4 - Cross coupling input from module 1.
Pin 5 - OUT2 - This is module 2's cross coupling output to module 1.
Pin 6 - DISCRIMINATOR - This connects to switch S3 to set the discriminator levels.
Pin 7 - DELAY - The delay capacitor is placed across this pin and pin 1, and this pin connects to R6, the delay potentiometer.
Pin 8 - +5V - This pin supplies an internally generated +5V level to power Channel 2's controls.
Pin 9 - LOCKOUT OUT - This connects to switch S1-3. The switches selects between +5V, for lockout off, and pin 10 for lockout on.
Pin 10 - LOCKOUT IN - This pin connects to the internal LCK pot, R10.
Pin 11 - +15V - Board 2 supplies +15V to this point.
Pin 12 - IN - The Channel 2 input is applied here.

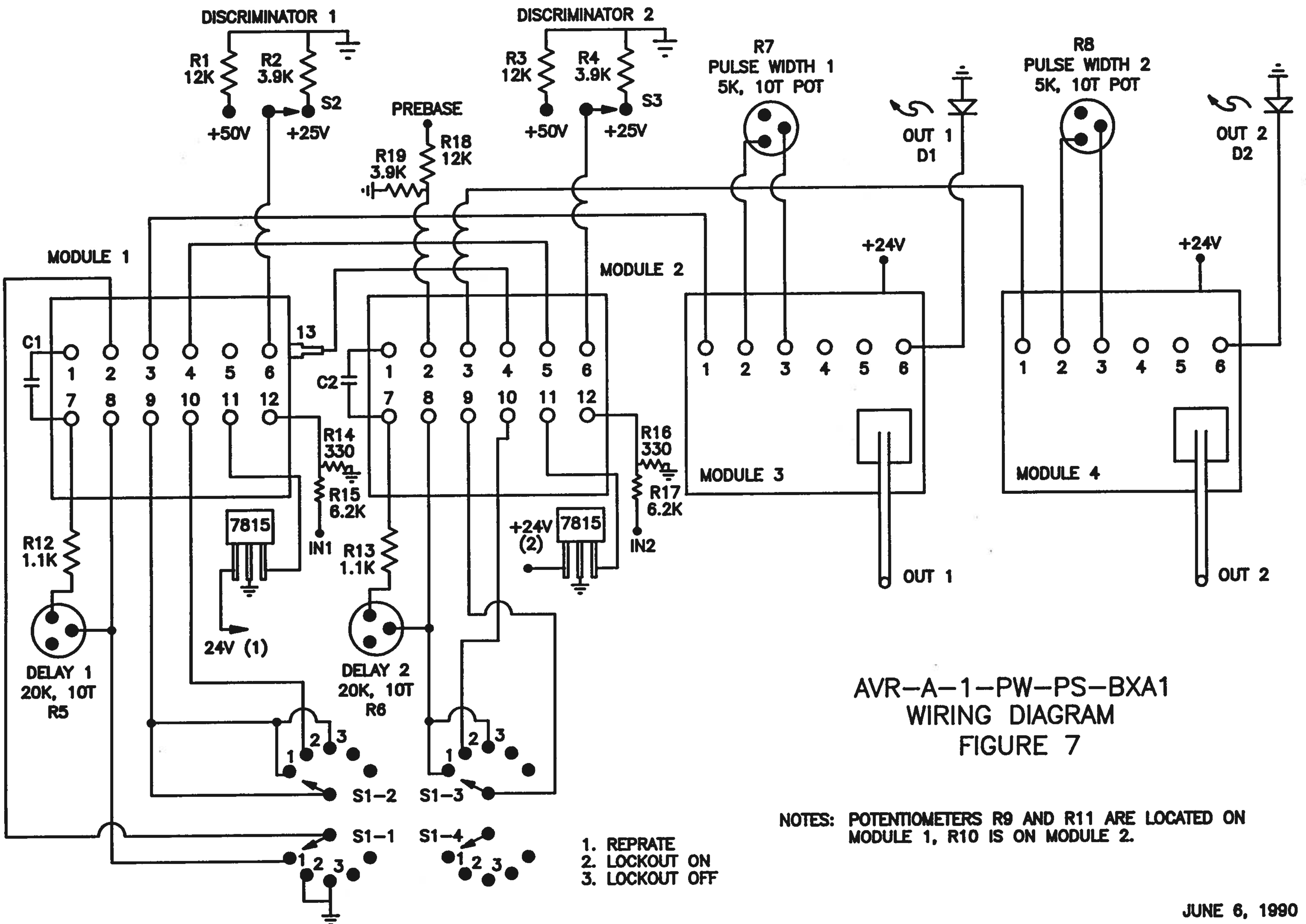
Module 3

Pin 1 - Input from module 1.
Pin 2 - Connects to potentiometer R7 to set pulse width.
Pin 3 - Connects to potentiometer R7 to set pulse width.
Pin 4 - N/C
Pin 5 - N/C
Pin 6 - This supplies a +1.8V, 250ms pulse to the LED indicator, D1, each time the unit is triggered, if it is not already doing so.

Module 4

Pin 1 - Input from module 2.

Pin 2 - Connects to potentiometer R8 to set pulse width.
Pin 3 - Connects to potentiometer R8 to set pulse width.
Pin 4 - N/C
Pin 5 - N/C
Pin 6 - This supplies a +1.8V, 250ms pulse to the LED indicator, D2, each time the unit is triggered, if it is not already doing so.



AVR-A-1-PW-PS-BXA1
WIRING DIAGRAM
FIGURE 7

NOTES: POTENTIOMETERS R9 AND R11 ARE LOCATED ON MODULE 1, R10 IS ON MODULE 2.

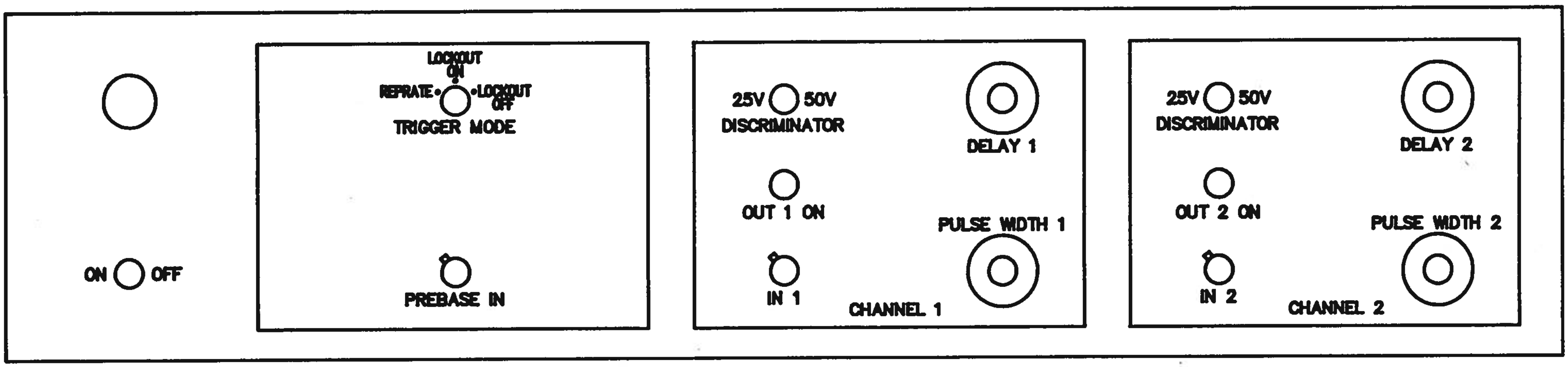
JUNE 6, 1990

FIGURE 8

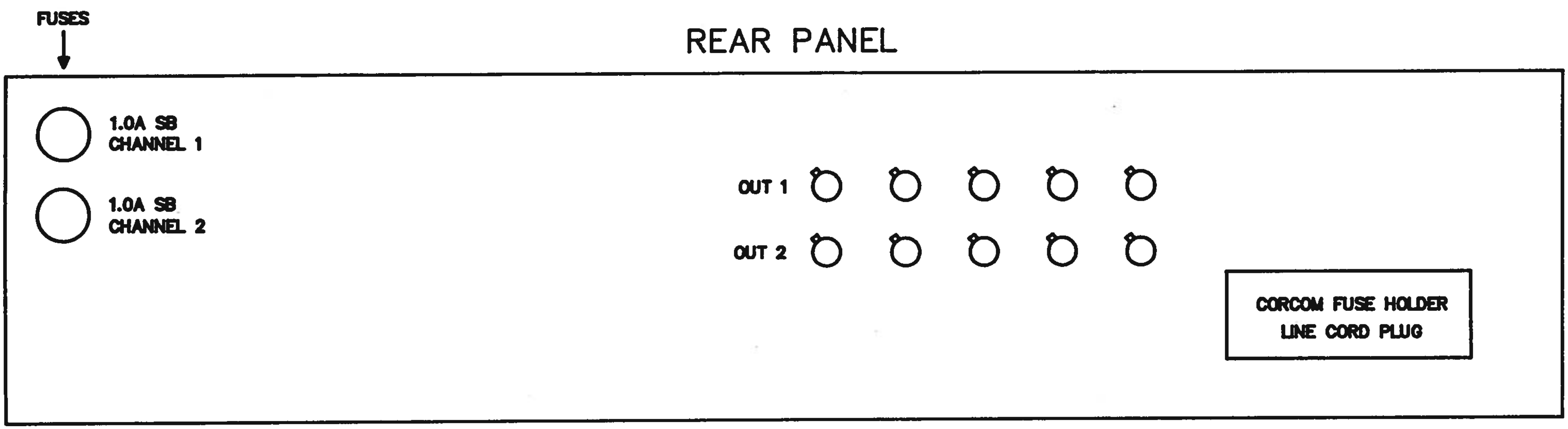
AVTECH AVR-A-1-PW-PS-BXA1

FEBRUARY 16, 1990

FRONT PANEL



REAR PANEL



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