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NANOSECOND WAVEFORM ELECTRONICS
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INSTRUCTIONS

MODEL AV-1011-C 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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EC Declaration of Conformity

We

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declare that the AV-1011-C pulse generator meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

EN 50081-1 Emission

EN 50082-1 Immunity

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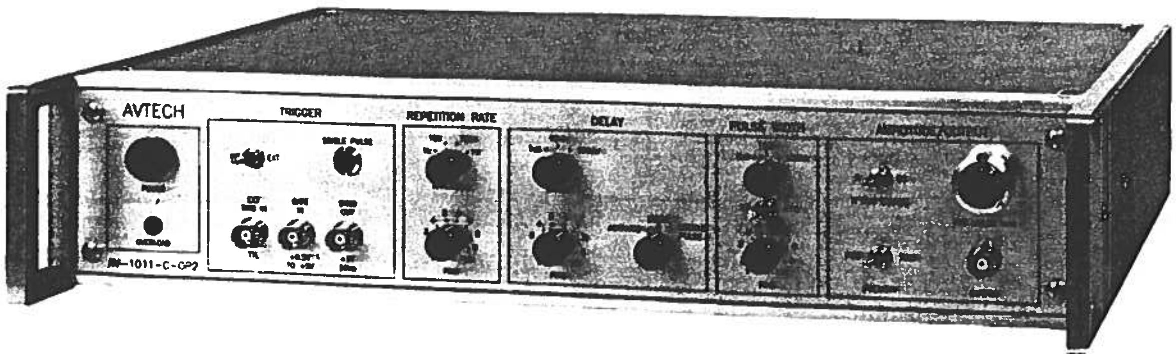


INTRODUCTION

MODEL AV-1011-C PULSE GENERATOR

The Model AV-1011-C is a high performance instrument capable of 200 W peak pulse power at repetition rates up to 1 MHz. The output polarity is selectable and the amplitude is variable up to 100 V into 50 Ohms. Pulse delay, advance and width are variable up to 1 ms. Rise and fall times are fixed at less than 15 ns. Model AV-1011-C provides single or double pulse output and can be triggered or gated by an external source. The output pulse width can be set to follow an input trigger pulse width and the output amplitude can be controlled by an externally applied 0 to +10 Volts DC control voltage.

A) SPECIFICATIONS

Pulse output amplitude[1,2]: (R_L = 50 Ohms)	0 to 100 Volts (2 Ohm Z_{out} range) 0 to 50 Volts (50 Ohm Z_{out} range) Within each range, the amplitude is controlled by a 10 turn locking dial.
Output polarity:	Positive or negative (Front panel selector switch)
Rise time, fall time:	≤ 10 ns
Pulse aberrations:	≤ ± 5 % of amplitude
Pulse width[2,3]:	x 1 Mode: 100 ns to 1 us; 1.00 us to 10 us; 10.00 us to 100 us x 10 Mode: 1 us to 10 us; 10 us to 100 us; 100 us to 1 ms 3 position range switch, 1 turn control and 2 position multiplier switch
Jitter:	Pulse width: ≤ 0.1%, (typically ≤ 0.01 %) Delay/Advance: ≤ 0.1%, + 0.5 ns Period: ≤ 0.1%, + 0.5 ns
Pulse repetition rate[2]:	100 Hz to 1.0 MHz, (4-position range switch and a one-turn fine control)
GPIB control:	Option available. Specify -OP1 or -OP2[2].
Maximum duty cycle:	≥ 25 %, for amplitudes between 0.5 V and 20 V ≥ 10 %, for amplitudes between 20 V and 100 V
Output impedance:	2 Ohms or 50 Ohms (two position selector switch)
Double pulse spacing:	100 ns to 100 us
Delayed and advanced pulse range[2]:	100 ns to 1 us 1 us to 10 us 10 us to 100 us (between sync out and main pulse output)
Sync output:	+ 3 Volts, 50 ns (R_L > 1 K)
Gated operation:	The unit will not trigger (i.e. no output) when the gate input signal is at + 5 Volts.
External trigger[2]:	The unit may be triggered by a signal source with : Amplitude: + 3 to + 5V Repetition rate: ≤ 1 MHz Pulse width: ≥ 50 ns
Minimum propagation delay external trigger modes:	Advance: 200 ns Delay: 300 ns Double pulse: 200 ns $PW_{IN} = PW_{OUT}$: 100 ns
Output protection:	The output is protected against short circuits, open circuits, and high duty cycle.
Connectors:	BNC female
Power source:	120/240 Volts, ± 10% (switchable) 48 Hz to 66 Hz, 100 VA maximum
Dimensions (H x W x D):	100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8")
Weight:	≤ 10 kg (22 lbs)
Chassis material:	Aluminum. Anodized aluminum front panel with cast aluminum side panels (with blue-gray plastic trim) and aluminum top and bottom panels with blue-gray plastic trim.
Operating temperature:	+ 10° C to + 50° C
Accessories furnished:	one detachable 6' power cord, one operation-maintenance manual
Option available:	19" rack mount kit (-R5)

1) The output amplitude may also be controlled by applying 0 to + 10 Volts DC to a rear panel banana connector.
2) For IEEE-488 GPIB control of amplitude, pulse width, PRF and delay, suffix model No. by -OP1 or -OP2. (see page 6 - 8).
3) The output pulse width may also be controlled externally by applying a TTL level trigger of the desired width to a rear panel banana connector ($PW_{IN} = PW_{OUT}$ mode).

B) INSTALLATION

VISUAL CHECK

After unpacking the instrument, examine to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs and the handles. Confirm that a power cord and instruction manual are with the instrument. (If the instrument has been damaged in shipment, file a claim immediately with the company that transported the instrument).

PLUGGING IN THE INSTRUMENT

Examine the rear of the instrument. There will be a male power receptacle, a fuse holder and the edge of the power selector card will be visible. Confirm that the power selector is in the correct orientation - it should be marked either 120 or 240, indicating whether it expects 120V AC or 240V AC. If it is not set for the proper voltage, remove the fuse then grasp the card with a pair of pliers and remove it. Rotate horizontally through 180 degrees. Reinstall the card and the correct fuse. In the 120V setting, a 1.0A slow blow fuse is required. In the 240V setting, a 0.5A slow blow fuse is required.

OPERATIONAL CHECK

This check is to confirm that the instrument is fully functional. Set the controls to the following values:

FRONT PANEL

INT/EXT Switch: INT position

REPETITION RATE RANGE Switch: 10 kHz

REPETITION RATE Vernier: MAX

DELAY RANGE Switch: 1 us

DELAY Vernier: MID range

ADVANCE, DELAY, DOUBLE PULSE: DELAY

PULSE WIDTH RANGE Switch: 1 us

PULSE WIDTH Vernier: MAX

POLARITY Switch: +

R OUT RANGE Switch: 50 Ohms

AMPLITUDE Vernier: 2.0

REAR PANEL

AMP: INT

PW: INT

HV: ON

Connect a cable from the SYNC OUT connector to the TRIG input of an oscilloscope. Connect a 2W (or higher) 50 Ohm load to the OUT connector and place the scope probe across this load.

Set the oscilloscope to trigger externally with the vertical setting at 5 Volts/div and the horizontal setting at 1 us/div. Then follow the instructions below and compare what is seen on the oscilloscope to what is described. Only approximate values are needed to confirm operation.

STEP	CONTROL	OPERATION	RESULTS
1	POWER	Push in (ON)	+10V pulses at the main output, with period 100 us, pulse width 1.0 us, < 15ns rise & fall times.
2	REPETITION RATE VERNIER	Rotate to MIN, then to MAX	Period rises to about 1 ms then falls to about 100 us.
3	DELAY VERNIER	Rotate to MAX, then to MIN	Pulses shift to the right on the oscilloscope by 1 us, then back.
4	PULSE WIDTH VERNIER	Rotate to MIN, then to MAX	Pulse width varies from 100 ns to 1.0 us.
5	POLARITY SWITCH	Switch to -, then to +	Pulse polarity becomes negative & then positive.
6	R OUT RANGE	Switch to 2 Ohms and then back to 50 Ohms	The output pulse amplitude will jump to 20 Volts and then to 10 Volts. The voltage will then decay slowly to 10 Volts.

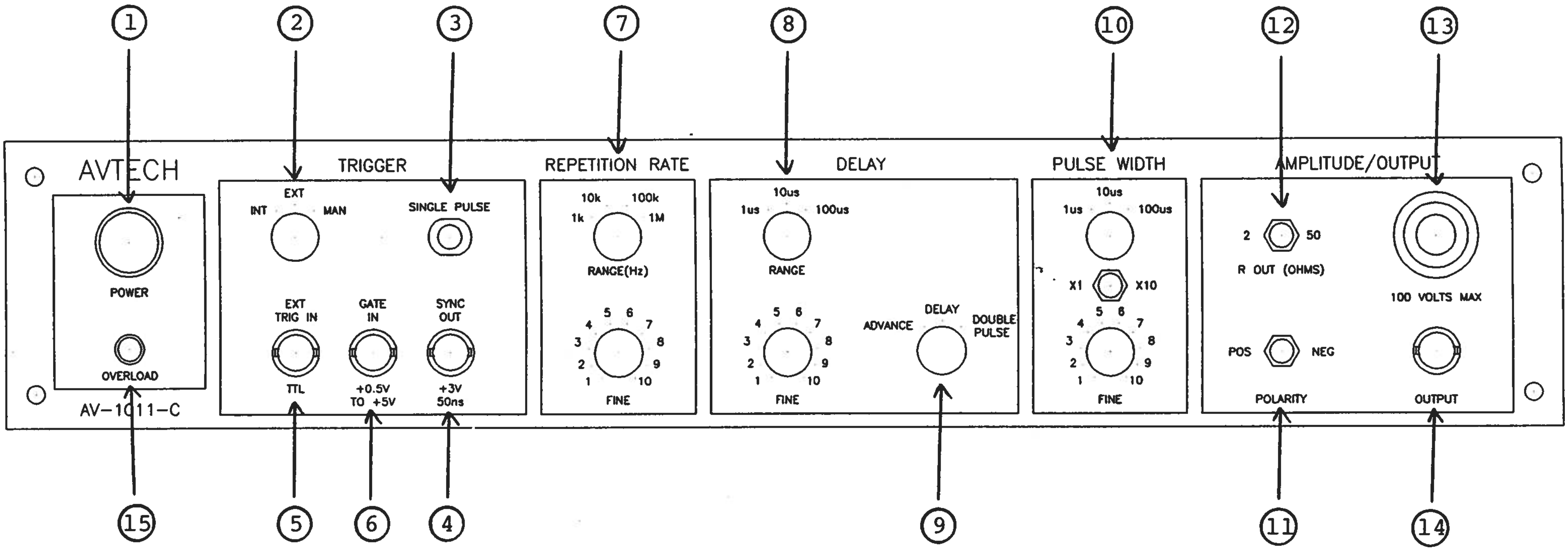


Fig. 1

FRONT PANEL CONTROLS

C) FRONT PANEL CONTROLS

(1) POWER Switch. The POWER push button switch applies AC prime power to the primaries of the transformer, turning the instrument on. The push button lamp (#382 type) is connected to the +15V DC supply.

(2) INT/EXT Switch. In the "INT" position the instrument is internally triggered and the "SYNC OUT" connector provides a SYNC output which allows one to trigger other instruments, such as oscilloscopes. In the "EXT" position the instrument is triggered by a +5 Volt 50 ns (or wider) input pulse on the "TRIG IN" connector, or by pressing the "SINGLE PULSE" push button.

(3) SINGLE PULSE Push Button. The "SINGLE PULSE" push button will trigger the instrument manually for one cycle of output, when the "INT/EXT/MAN" switch is in the "MAN" position. Otherwise, the push button has no effect.

(4) SYNC OUT. When the "INT/EXT" switch is in the "INT" position, this connector supplies a SYNC output that can be used to trigger other equipment, particularly oscilloscopes. This signal leads, or lags, the main output by a duration set by the "DELAY" controls and has an approximate amplitude of +3 Volts to R_L > 1K with a pulse width of about 50 ns.

(5) TRIG IN. When the "INT/EXT" switch is in the "EXT" position, the external trigger (+5 Volts, PW ≥ 50 ns) is applied to this connector. This input presents a high impedance (1 M Ohm).

(6) GATE Input. The GATE input will suppress the triggering of the instrument if taken to a TTL HIGH level (i.e. 0.5 to 5.0V). If it is left open or taken to a TTL LOW, normal triggering will occur (R_{IN} = 1K).

(7) REPETITION RATE Controls. The rotary switch marked "RANGE" selects the pulse repetition rate for the internally triggered mode. The venier (labeled "MIN-MAX") provides continuously variable control of each range. There are four ranges and the instrument is set to the rate indicated on the front panel when the vernier is in the "MAX" position.

100 Hz - 1 kHz
1 kHz - 10 kHz
10 kHz - 100 kHz
100 kHz - 1.0 MHz

(8) DELAY Controls. The rotary switch selects one of three ranges and the vernier provides continuously variable control of each range. The instrument is set to the delay indicated on the front panel when the vernier is in the "MAX" position.

100 ns - 1 us
1 us - 10 us
10 us - 100 us

(9) ADVANCE, DELAY, DOUBLE PULSE. With this three position switch in the ADVANCE position, the leading edge of the output pulse precedes the leading edge of the SYNC output. When in the DELAY position, the leading edge of the SYNC output precedes the leading edge of the main output. When in the DOUBLE PULSE position, the main output provides two successive output pulses having a separation determined by the DELAY (8) controls.

(10) PULSE WIDTH Controls. The rotary switch selects one of three ranges and the vernier provides continuously variable control of each range. The instrument is set to the pulse width indicated on the front panel when the vernier is in the "MAX" position.

x1 Range:	100 ns - 1 us	x10 Range:	1 us - 10 us
	1 us - 10 us		10 us -100 us
	10 us -100 us		100 us - 1 ms

Note: When switching to wider pulse width ranges at high output amplitudes, the output amplitude may drop as the duty cycle is suddenly increased. To return the amplitude to its proper value, reduce the duty cycle briefly (by rotating the pulse width vernier control counterclockwise, or reducing the repetition rate). The internal power supply will recover, and the controls can be returned to their original settings.

(11) POLARITY Switch. If the polarity switch is in the "+" position, the main output pulse will pulse upwards (i.e. to a more positive level). If it is in the "-" position, the output will pulse downwards to a more negative level. If the setting of the polarity switch is changed when the output amplitude is relatively high (eg. > 25 Volts in the 2 Ohm range or ≥ 12 Volts in the 50 Ohm range), the output pulse will vanish for several tens of seconds until the high voltage levels on the output stage decay to a safe level. At that time the output will again become active. Note that the decay-delay time may be reduced significantly by briefly setting the rear panel HV switch in the "OFF" position (and then returning it to the "ON" position).

(12) R OUT RANGE Switch. A two-position switch which sets the output resistance at 2 Ohms or 50 Ohms. In the 2 Ohm range, the unit will provide up to 100 Volts (to a 50 Ohm load) while in the 50 Ohm range, the unit will provide up to 50 Volts to a 50 Ohm load.

(13) AMPLITUDE FINE. The ten turn amplitude vernier provides continuously variable control of the peak amplitude of the main output from 0 to 50 Volts (50 Ohm range) or 0 to 100 Volts (2 Ohm range). When the unit is operating at a low duty cycle and an attempt is made to reduce the output amplitude, the amplitude will decay slowly with a time constant of several tens of seconds. If a rapid decay is required, briefly switch the rear panel HV switch to the "OFF" position (and then back to the "ON" position).

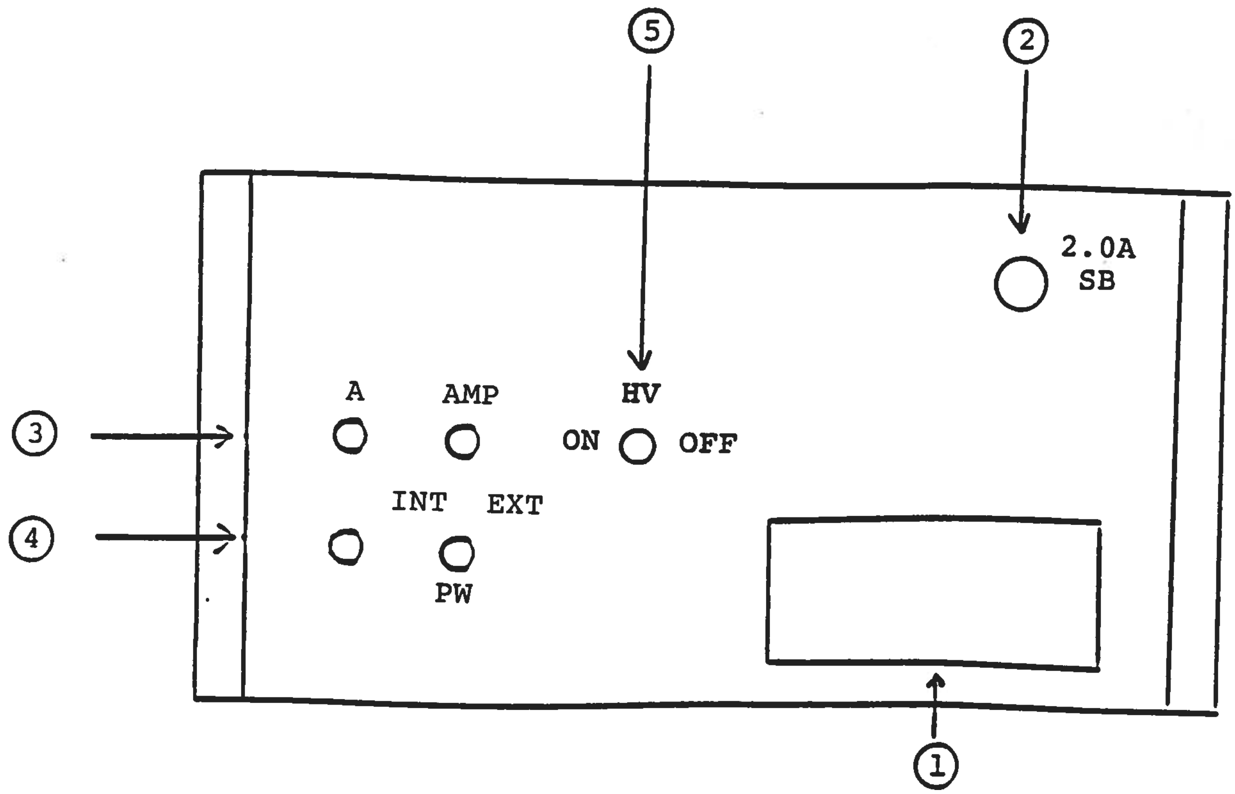
(14) OUT. BNC connector provides output to load impedance of 50 Ohms or higher.

(15) OVERLOAD. An automatic overload protective circuit controls the front panel overload light. If the unit is overloaded (by operating at an exceedingly high duty cycle or by operating into a very low impedance), 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 about 1 second. If the overload condition persists, the instrument will turn OFF again (i.e. light ON) 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 low load impedance (if any)
4) Reducing the output amplitude (i.e. switch to a lower range)

Note that the output stage will safely withstand a short circuited load condition.

FIG. 2 REAR PANEL



D) REAR PANEL CONTROLS

(1) AC POWER INPUT. A three-pronged recessed male connector is provided on the back panel for AC power connection to the instrument. Also contained in this assembly is a 1.0A slow blow fuse and a removable card that can be removed and repositioned to switch between 120V AC in and 240V AC in.

(2) 2.0A SB. This fuse protects the output stage if the output duty cycle rating is exceeded.

(3) AMP. To voltage control the output amplitude, set the switch in the EXT position and apply 0 to +10 Volts to the "A" BNC connector ($R_{IN} \geq 10K$).

(4) PW. The pulse generator may be triggered externally in a $PW_{OUT} = PW_{IN}$ mode by setting this switch in the EXT position and the front panel INT/EXT/MAN switch in the EXT position and applying a TTL level pulse of the desired pulse width to the A BNC connector.

(5) HV SWITCH. This switch must be in the "ON" position to obtain an output pulse. Note when the unit is operating at a low duty cycle and an attempt is made to reduce the output amplitude, the amplitude will decay slowly with a time constant of several tens of seconds. If a rapid decay is required, briefly switch the rear panel HV switch to the "OFF" position (and then back to the "ON" position). Also note that if the output pulse vanishes due to a changing of the position of the polarity (see paragraph 12, Front Panel Controls), the pulse recovery time may be reduced significantly by briefly setting the HV switch in the "OFF" position (and then returning it to the "ON" position).

E) 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.

F) ELECTROMAGNETIC INTERFERENCE

To prevent electromagnetic interference with other equipment, all used outputs should be connected to shielded 50 Ohm loads using shielded 50 Ohm coaxial cables. Unused outputs should be terminated with shielded 50 Ohm BNC terminators or with shielded BNC dust caps, to prevent unintentional electromagnetic radiation. All cords and cables should be less than 3m in length.

F) THEORY OF OPERATION AND BASIC CIRCUITS

BLOCK DIAGRAM DESCRIPTION

Refer to the Block Diagram (Fig. 3) for the following explanation.

The instrument is triggered by either an internal oscillator or an external source.

The INT/EXT switch controls a gate that selects either the internal oscillator or the EXT trigger input. The output of this gate leads to an AND gate. The second input of the AND gate is the TTL complement of the GATE input, so that when the GATE input is TTL low (0V), the AND gate passes the trigger pulses and inhibits them when the GATE input is high.

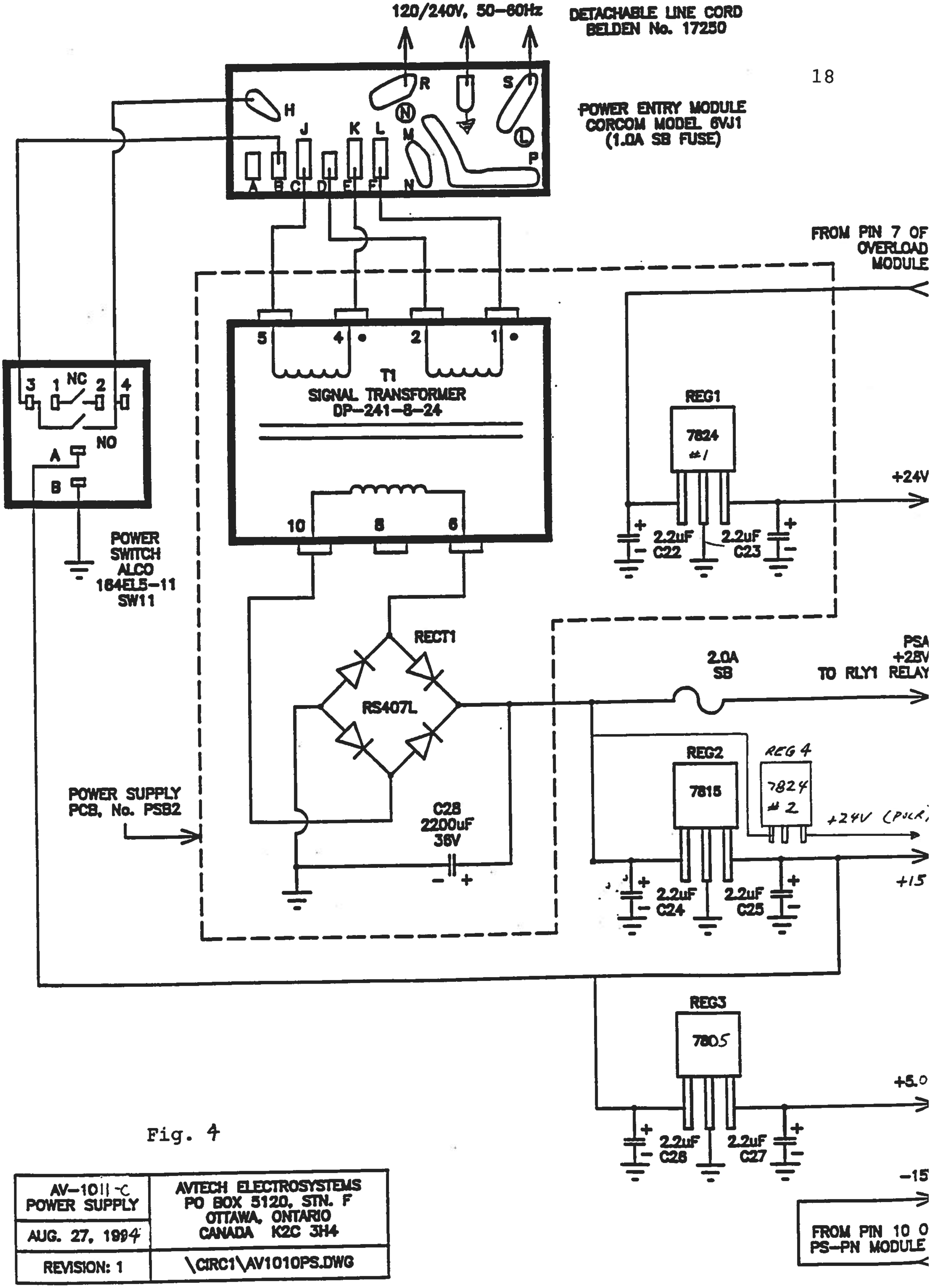
At this point, the trigger signal is split into two parts. The lower channel drives a one-shot circuit, which delays the pulse, which is then buffered. The upper channel is buffered only. When in the DELAY or DOUBLE PULSE modes, the upper channel is connected, by a switch, to the front panel SYNC output. In the ADVANCE mode, the lower channel is connected instead.

The two channels then pass through the double-pulse circuitry. When in the ADVANCE or DELAY modes, both signal pass unaltered. In the DOUBLE PULSE mode, the upper channel is unaltered, but the two input channels are combined to create a new signal on the lower channel, yielding a series of double pulses.

When in the ADVANCE mode, the upper channel is switched in to drive the next circuit stage, the pulse width controller. In the DELAY or DOUBLE PULSE mode, the delayed lower channel drives the pulse width circuit. The output of the pulse width stage is a TTL pulse whose pulse width is equal to the pulse width of the instrument's front panel output.

At this stage, the user has the option of completely bypassing the instrument's timing circuitry by using the back panel PW switch and input connector. When the switch is in the INT position, the output of the pulse width stage is connected to the output stages of the instrument. In the EXT position, the output stages can be driven by TTL pulses on the back panel connector.

The output stages are all-solid-state, MOSFET totem pole circuits. There is a positive output and a negative output stage and the polarity switch selects one of the two outputs. The pulse width of the output pulse is equal to the pulse width of the input pulse and the amplitude of the output pulse is controlled by the DC voltage applied to the circuit.


120/240V, 50-60Hz
DETACHABLE LINE CORD
BELDEN No. 17250
POWER ENTRY MODULE
CORCOM MODEL 6VJ1
(1.0A SB FUSE)
H
J
K
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C
D
E
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FROM PIN 7 OF
OVERLOAD
MODULE
5
4
2
1
T1
SIGNAL TRANSFORMER
DP-241-8-24
10
8
6
3
1
NC
2
4
NO
A
B
POWER
SWITCH
ALCO
164EL5-11
SW11
REG1
7824
#1
+24V
2.2uF
C22
2.2uF
C23
RECT1
RS407L
2.0A
SB
PSA
+28V
TO RLY1 RELAY
REG2
7815
REG 4
7824
#2
+24V (PULR
POWER SUPPLY
PCB, No. PSB2
C28
2200uF
36V
2.2uF
C24
2.2uF
C25
+15
REG3
7805
+5.0
2.2uF
C26
2.2uF
C27
-15
FROM PIN 10 O
PS-PN MODULE
AV-1011-C
POWER SUPPLY
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Fig. 4

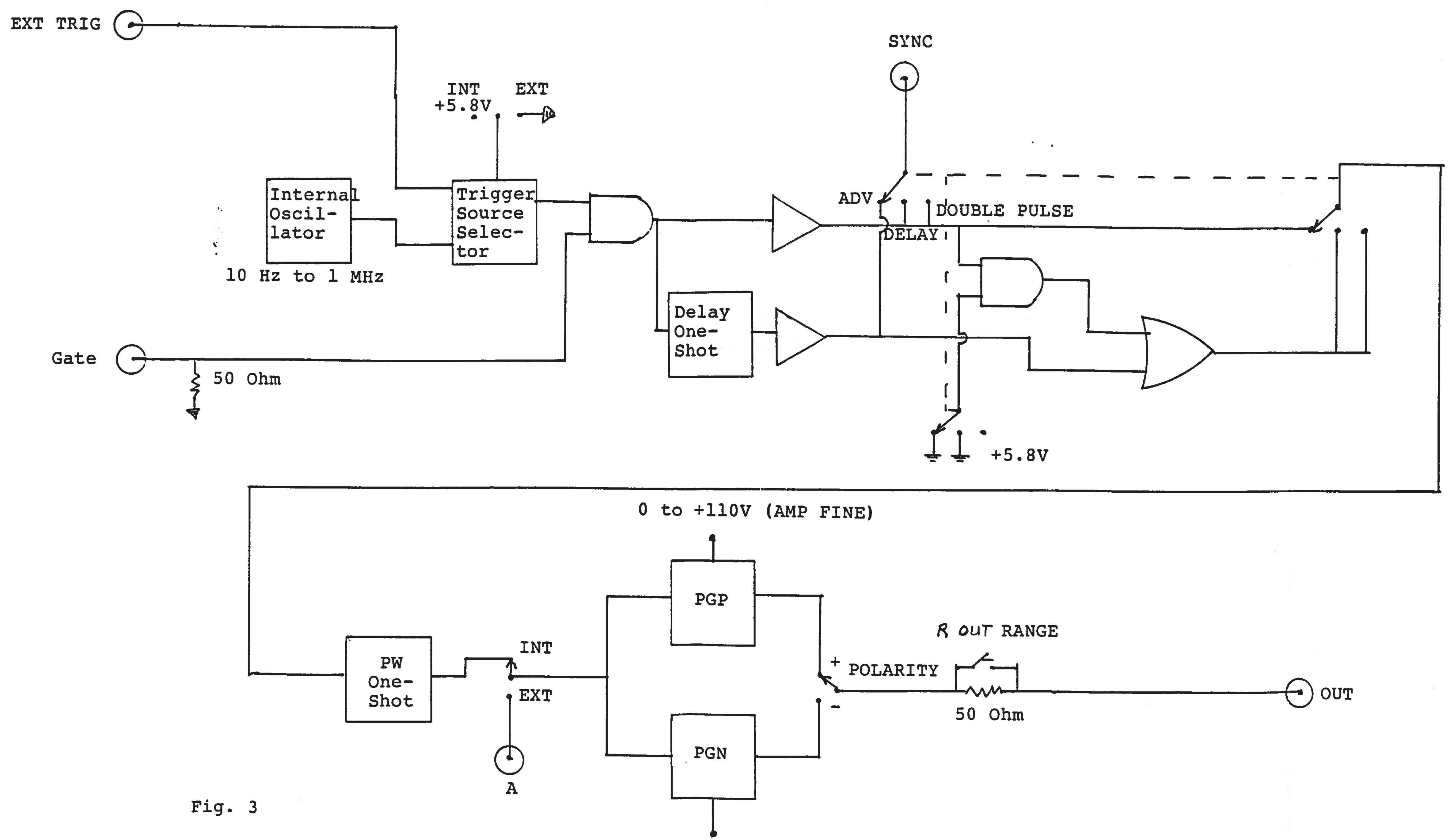

Fig. 3

BLOCK DIAGRAM	AVTECH ELECTROSYSTEMS PO BOX 5120, STN. F OTTAWA, ONTARIO CANADA K2C 3H4
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MODEL AV-1011-C BLOCK DIAGRAM

March 24/97 - New (use this set)
Saved in Word
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