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1333G

This manual corresponds to instruments  
with the serial number prefix

OPERATING AND SERVICE MANUAL  
MODEL 8011A  
PULSE GENERATOR





## P R E F A C E

One copy of this manual is supplied with each instrument. Additional copies may be purchased from the local Hewlett-Packard Sales and Service Office. Specify the instrument model number and serial number.

A 'microfiche' version of this manual is available under part number 08011-90051.

Reference should be made to the manual change sheets supplied with the manual for errata and technical changes.

Technical changes are indicated by the prefix (the first five characters) of the serial number which appears on the rear panel of the instrument; the title page carries the serial number prefix of the instrument to which the manual applies directly.



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**SECTION 1** GENERAL INFORMATION

duce positive, negative or symmetrical pulses in positive or negative logic make the instrument suitable for driving TTL, DTL, RTL, HTL and CMOS as well as discrete logic and linear circuits.

1-5 Serviceability is enhanced by using high quality components, and stable circuits reduce calibration adjustments to a minimum.

**1-6 PULSE BURST OPTION 001**

1-7 Thumbwheel switches on the front panel permit any number of pulses between 1 and 9999 to be preset. A "burst" starts on receipt of an electrical or manual trigger and ceases when the set number of pulses has been generated.

Table 1-1. Specifications

REPESSION RATE AND TRIGGER	
Polarity:	positive, negative or symmetrical switch selectable.
Format:	normal or complement switch selectable.
EXTERNALLY CONTROLLED OPERATION	
External input	
Input impedance:	50 ohms $\pm$ 10%
Maximum input:	$\pm$ 5V
Trigger polarity:	positive.
Repetition rate:	0.1 Hz to 20 MHz
Period jitter:	$<$ 0.1% + 50ps for any period setting.
Square wave:	0.05 Hz to 10 MHz
Trigger output:	dc coupled 50 ohm (typ) source delivering $\geq$ +1V across 50 ohm load.
Trigger pulse width:	20ns $\pm$ 10ns.

**1-1 DESCRIPTION**

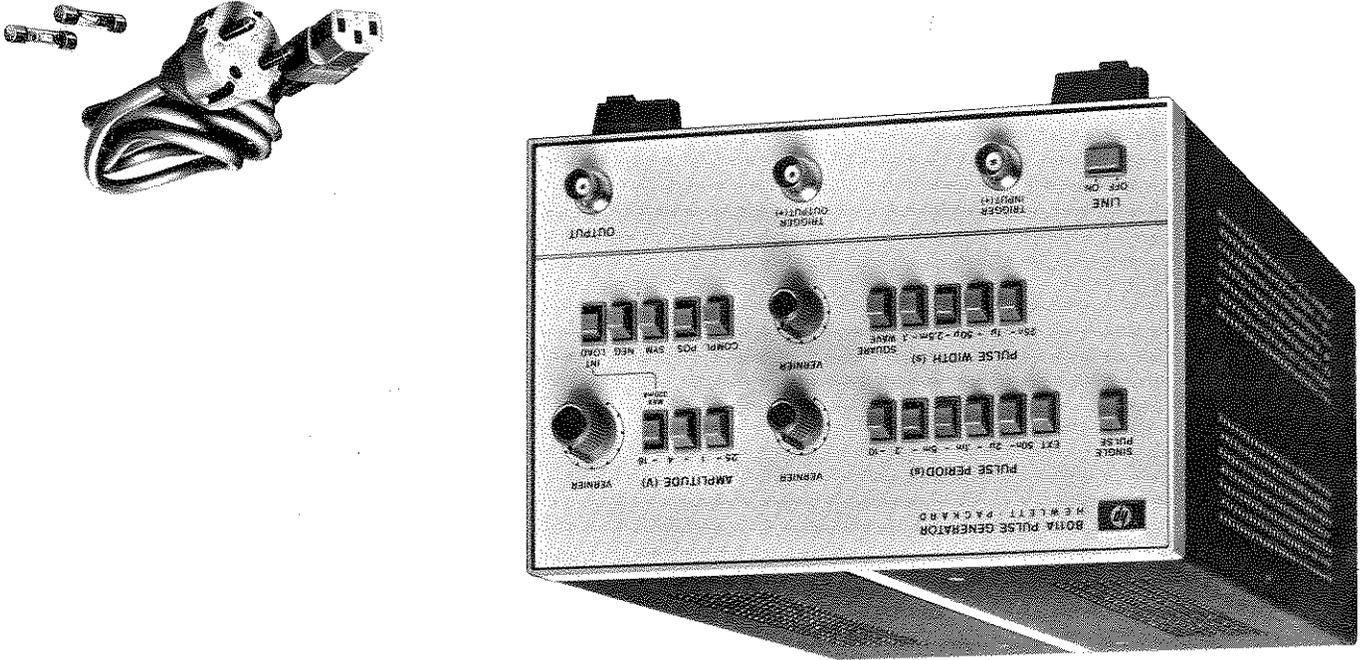
1-2 The Hewlett-Packard Model 8011A is a 20 MHz pulse source that can be externally and manually triggered. Ease of operation is ensured by logically arranged and clearly identified controls.

1-3 Pulse amplitudes up to 16V and selectable output format ensure compatibility with most logic families powered from either positive or negative supplies and using either positive or negative logic conventions. Pulse width is continuously variable from 25ns to 100ms or can be 50% of pulse period by selecting square wave mode.

1-4 Variable pulse width or square wave operation with up to 16V amplitude and the ability to pro-

PULSE CHARACTERISTICS	
Transition times:	$<$ 10ns fixed.
Overshoot, ringing and preshoot:	$<$ $\pm$ 5% of pulse amplitude. May increase to 10% at counter-clockwise positions of amplitude vernier.
Pulse width:	25ns to 100ms in four ranges. Vernier provides continuous adjustment within each range.
Width jitter:	$<$ 0.1% + 50ps for any width setting.
Maximum duty cycle:	$>$ 50% (100% using pulse complement).
Maximum output:	16V, with internal 50 ohms and external high impedance load or, with internal high impedance and external 50 $\Omega$ , 8V with 50 $\Omega$ source and load impedances.
Attenuator:	three step attenuator provides the ranges 0.25V - 1V - 4V - 16V. Vernier provides continuous adjustment within each range.
Source impedance:	0.25V - 1V - 4V ranges, 50 ohms $\pm$ 10% shunted by 30pF. 4V - 16V range, 50 ohms $\pm$ 10% or high impedance switch selectable.

Figure 2-1. 8011A and Delivered Accessories



**GENERAL**

Burst trigger source: external signal or manual. Min external signal width, 25ns.

Operating temperature: 0°C to 55°C

Power: 100V, 120V, 220V or 240V, +5%, -10%, 48 Hz to 440 Hz, 70 VA max.

Weight: net 4 kg (9 lbs), shipping 6.5 kg (14.6 lbs).

Dimensions: 200mm wide, 142mm high, 300mm deep (7.9 in. x 5.6 in. x 11.8 in.).

Sensitivity: 1V

Manual: front panel pushbutton for generating single pulse.

External Triggering

Repetition rate: 0 to 20 MHz. In square wave, output frequency is half input frequency.

Trigger source: manual or external signal. Min external signal width, 10ns.

Burst mode (optional): preselected number of pulses generated on receipt of trigger.

Table 1-1. Specifications (cont'd)

**SECTION 2** **INSTALLATION**

**2-1 GENERAL**

**2-2 Initial Inspection**

2-3 Inspect the instrument and accessories for physical damage and if damage is evident refer to paragraph 2-16 for the recommended claim procedure and repacking information.

2-4 The 8011A is supplied with the following items:

Description	HP Part Number
300mA fuse (for 220/240V operation)	2110-0044
600mA fuse (for 110/120V operation)	2110-0016

Power Cord (one of those shown in figure 2-2).

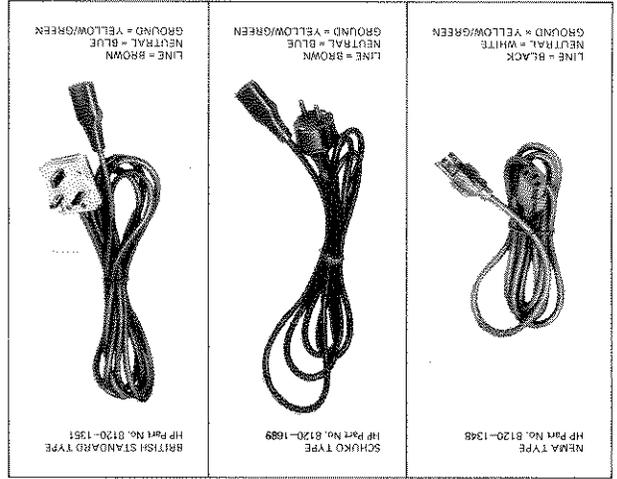


Figure 2-2. Power Cords

**2-5 INSTALLATION**

**CAUTION**

Before applying power to the instrument, check that the 8011A is set in accordance with local supply conditions. To gain access to the voltage selector switches and fuse holder remove cover adjacent to the LINE switch.

**2-6 Power Source Requirements**

2-7 The model 8011A will operate from nominal ac line supplies of 100V, 120V, 220V, or 240V (-10%, +5%) at 48 Hz to 440 Hz. Two internally mounted switches allow one of the four voltages to be selected.

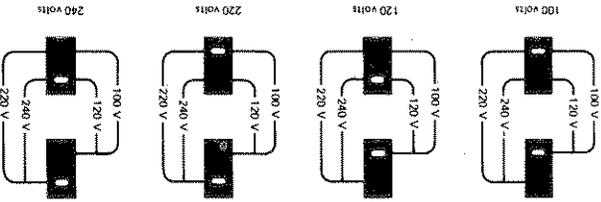


Figure 2-3. Switch Settings for the Various Nominal Powerline Voltages. The power dissipation is 70VA maximum.

2-8 To check the power requirements proceed as follows:

- Disconnect the power cable.
- Remove the fuse and check its value:
  - for 230V operation 300mA
  - for 115V operation 600mA

Check that the line selector switch position corresponds to the local supply voltage. If they do not correspond use a screwdriver to change the switch positions.

Insert the correct fuse into the fuse-holder. Connect the power cable to the rear connector.

**2-9 Power Cord**

2-10 The 3-wire power cable supplied with the 8011A when connected to the appropriate power outlet, grounds the instrument cabinet and panels. To preserve this safety feature when operating the instrument from an outlet without a ground connection use an appropriate adapter and connect the ground lead (green/yellow) to an external ground.

2-11 If the plug on the cable does not fit your power outlet then cut the cable at the plug end and connect a suitable plug. The plug should meet local safety requirements and include the following features:

Minimum current rating of 1A.

Ground connection

Cable clamp

The colour coding used in the cable will depend on the cable supplied (see Figure 2-2 above).

**2-12 Temperature Requirements**

2-13 The model 8011A operates within specifications when the ambient temperature is between 0°C (32°F) and 55°C (131°F). The pulse generator may be stored between -40°C (-40°F) and 75°C (167°F).

**2-14 CLAIMS AND REPACKAGING**

2-15 **Claims for Damage**  
2-16 If physical damage is evident or if the instrument does not meet specifications when received,

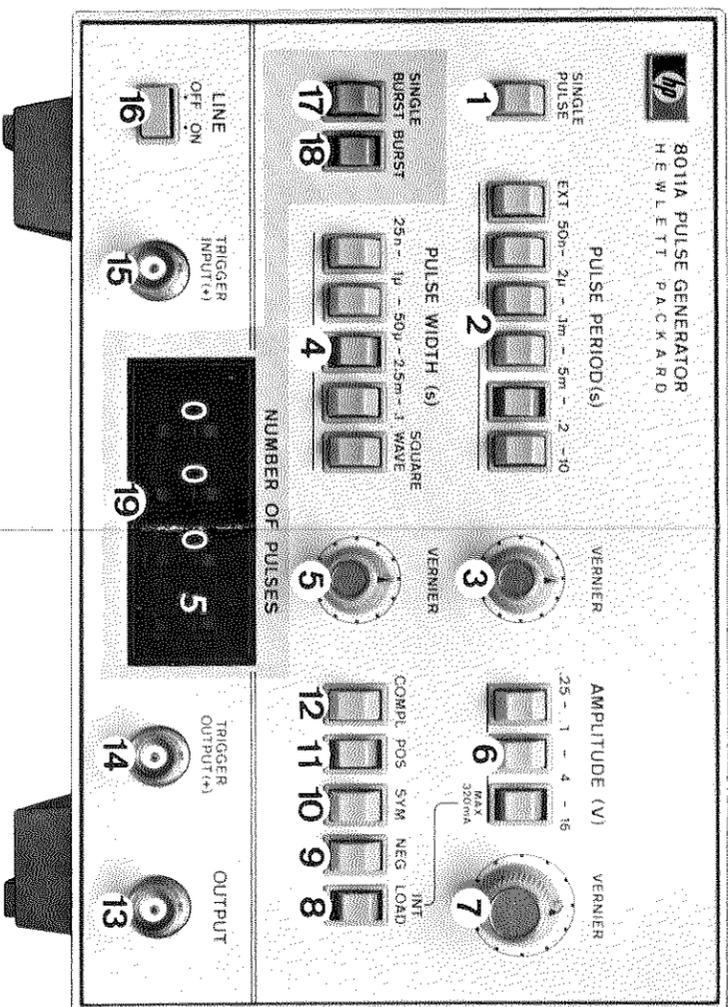
notify the carrier and the nearest Hewlett-Packard Sales/Service Office. The Sales/Service Office will arrange for repair or replacement of the unit without waiting for settlement of the claim against the carrier.

**2-17 Repackaging for Shipment and Storage**

2-18 If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag showing owner, address, model and serial number and the repair required. The original shipping carton and packing material may be re-usable but the Hewlett-Packard Sales/Service Office will also provide information and recommendations on materials to be used if the original packing is not available or re-usable.

**2-19 RACK MOUNTING**

2-20 To rack mount model 8011A, order model 15179A Adapter for rackmounting 2 units or 15179A option 001 for rackmounting 1 unit.



- 1 SINGLE PULSE: push-button for manually generating a single pulse in the EXTERNAL and Burst modes.
- 2 PULSE PERIOD: mutually exclusive push-buttons for selecting the range of pulse rate in the internal mode of operation. When EXT is selected rate controls are disabled.
- 3 Rate VERNIER: for continuous adjustment of the repetition rate between the limits of the range selected. Clockwise rotation increases the pulse period (i.e. reduces the rate).
- 4 PULSE WIDTH: mutually exclusive push-buttons for selecting pulse width range.
- 5 Pulse Width VERNIER: for continuous adjustment of pulse width between the limits of the range selected (is inoperative in SQUARE WAVE).
- 6 AMPLITUDE: mutually-exclusive push-buttons for selecting amplitude range. Note that, in the 4-16 Volt range the maximum current available is 320mA (from a current source) and in the other ranges the source impedance is 50Ω.
- 7 Amplitude VERNIER: for continuous adjustment of the amplitude between the limits of the range selected.
- 8 INT LOAD: push-button switch for connecting (pressed) and disconnecting (released) the 50Ω internal load in the 4-16 Volt range. In the other ranges the 50Ω load is always connected.
- 9 NEG: push-button for selecting negative polarity output.
- 10 SYM: push-button for selecting an output which is symmetrical about zero volt.

- 11 POS: push-button for selecting positive polarity output.
- 12 COMPL: push-button for selecting the pulse complement of the set pulse.
- 13 OUTPUT: BNC connector, 50Ω source (or, on 4-16 Volt range, current source if INT LOAD is released).
- 14 TRIGGER OUTPUT (+): BNC connector, positive trigger pulses from internal rate generator.
- 15 TRIGGER INPUT (+): BNC connector, to which external input signal is applied in EXTERNAL mode and Burst mode. Maximum input signal +5V.
- 16 LINE ON-OFF: press-for-on/press-for-off switch.
- OPTION 001
- 17 SINGLE BURST: push-button for initiating a pulse burst.
- 18 BURST: push-button switch for selecting pulse burst mode.
- 19 NUMBER OF PULSES: thumbwheel switches on which the required number of pulses in a burst is set.

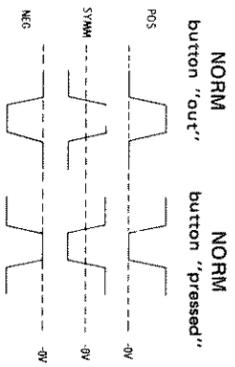


Figure 3-1. Controls and Connectors



3-1 GENERAL

3-2 The following instructions apply to model 8011A-Option 001. For the standard model, the instructions 3-7 and 3-8 for burst operation should be ignored.

3-3 MODES OF OPERATION

3-4 Internal

In this mode the 8011A requires no external signal to produce an output. Figure 3-2 shows the control which are effective in this mode.

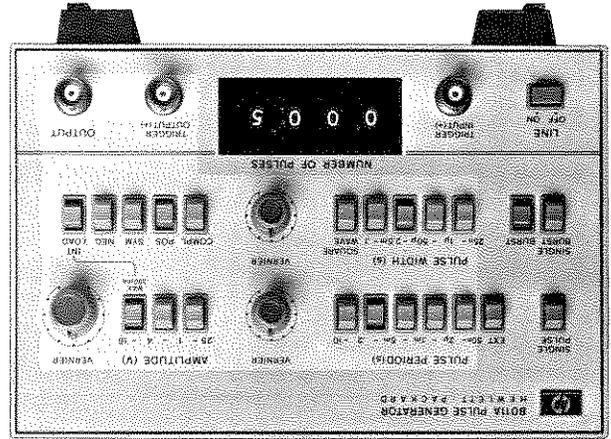


Figure 3-2. 8011A Internal Mode

3-5 External

3-6 In EXT 2 mode the repetition rate generator is externally triggered by a signal applied to the TRIGGER INPUT 15 or manually by means of the SINGLE PULSE push button 1. Figure 3-3 shows the controls which are effective in this mode.

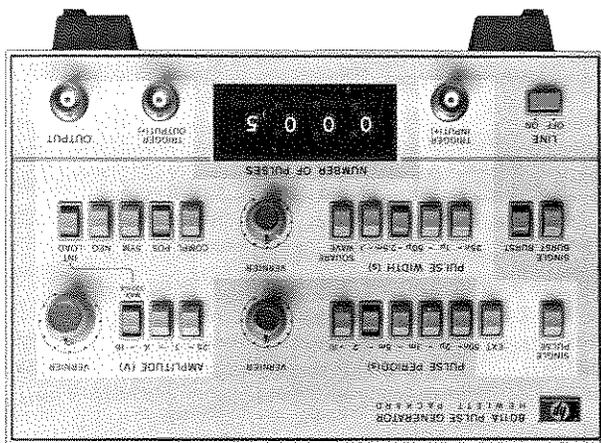


Figure 3-3. 8011A External Mode

Figure 3-4 illustrates the timing sequence between the trigger input and pulse outputs. Note that in SQUARE WAVE the trigger output frequency is half that of the external input.

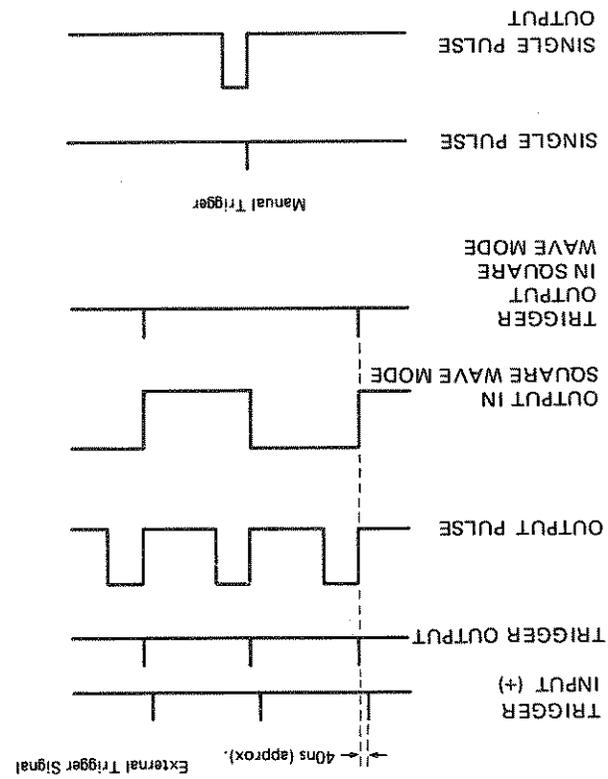


Figure 3-4. External Triggering Timing Sequence

3-7 Burst Mode

To operate the generator in BURST Mode press the BURST push-button 18, set the required NUMBER OF PULSES on the thumbwheel switches 19 and set the pulse parameters (rate, width, etc) on the front panel. A burst is started by pressing the SINGLE BURST button 17 or by applying a signal to the TRIGGER INPUT 15. At the end of a burst, single pulses can be added by pressing the SINGLE PULSE button. Figure 3-5 shows the controls which are effective in this mode and figure 3-6 illustrates examples or repetitive and single burst output.

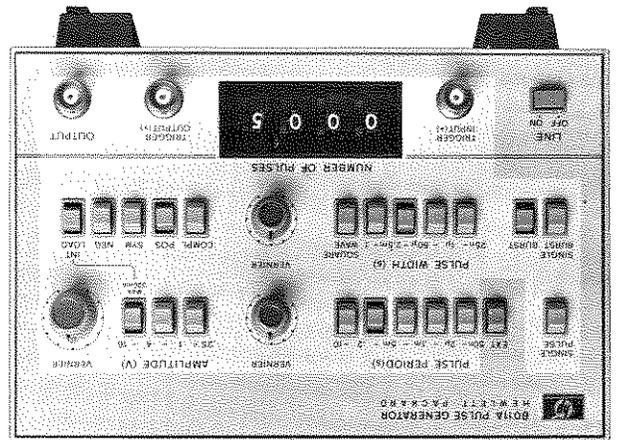
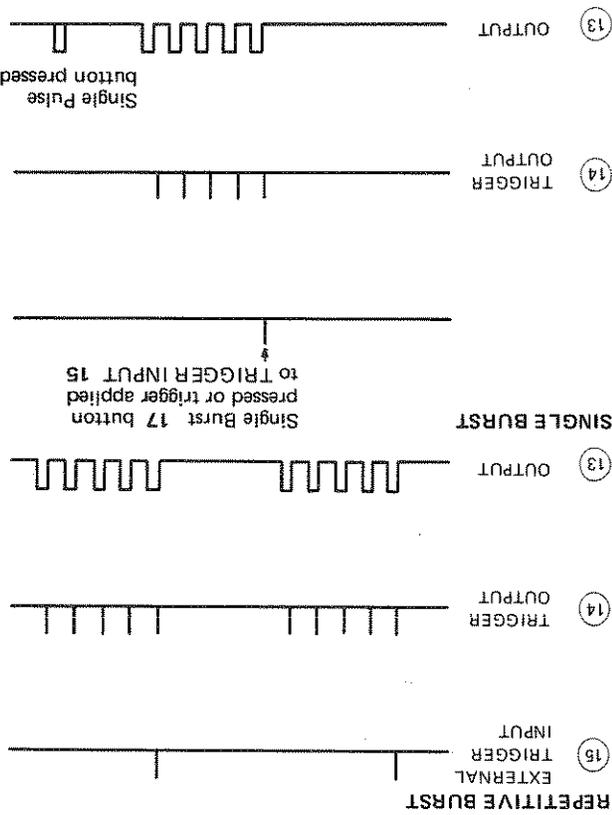


Figure 3-5. 801A Burst Mode

Figure 3-6. Examples of Repetitive and Single Burst Output.



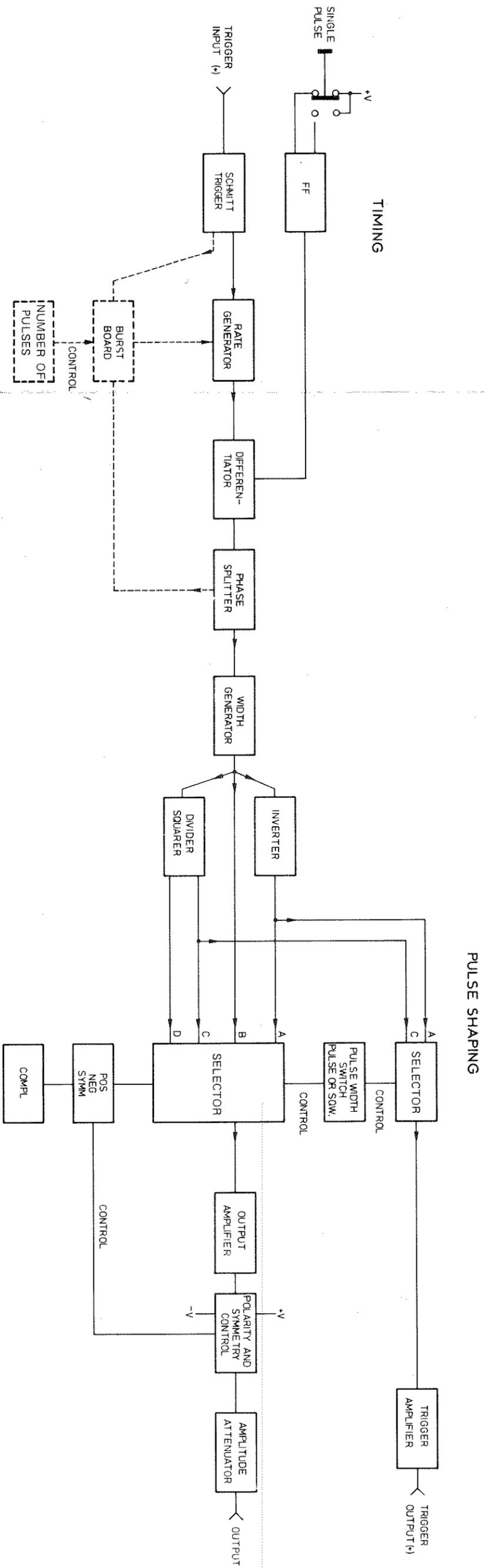


Figure 4-1. 8011A Block



4-1 INTRODUCTION (figure 4-1)

4-2 In normal mode operation, the rate generator is free-running at a rate determined by the PULSE PERIOD controls. In the external mode the disabled rate generator is turned on and off by the signal applied to the TRIGGER INPUT connector. The pulse generator can also be manually triggered by means of the SINGLE PULSE button which gives stimulus to the pulse shaping circuits via a flip-flop. When the 8011A has the Burst Option (001) the rate generator can be turned on by an external signal and turned off after a predetermined number of pulses have been generated.

4-3 In all modes of operation the pulse shaping circuits define the width (or square wave) and whether the normal or complement of the signal is to be used to drive the output stages. The conditioned signals (A,B,C

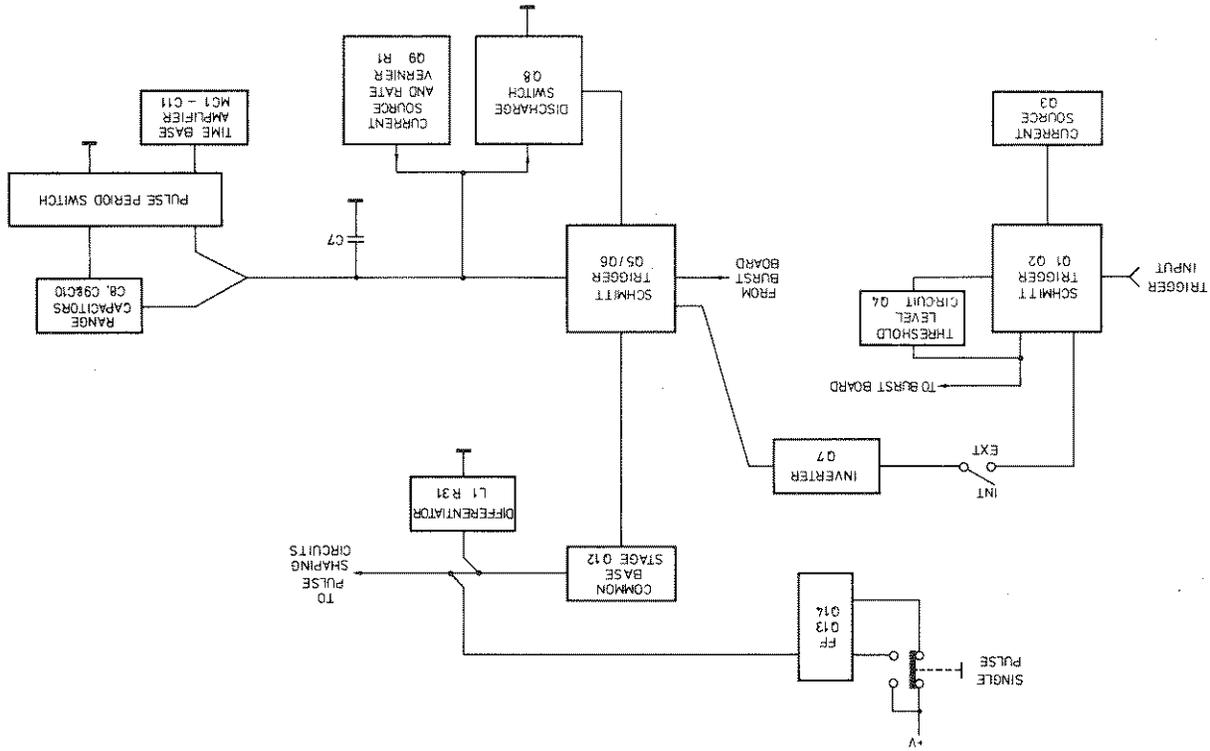
and D) are selected by a series of OR gates. Symmetry and polarity control and baseline correction take place in the output stage.

4-4 The trigger amplifier is driven by either signal A, which is the rate signal via an inverter in pulse width mode, or by signal C, which is the Q output from the divider squarer flip-flop in square wave mode.

4-5 RATE GENERATOR (Figure 4-2 and Diagram 1)

4-6 In the internal mode of operation the rate generator is free running and produces spikes at a rate determined by a multivibrator under the control of the PULSE PERIOD switch and RATE vernier. Under no-signal conditions in EXT mode, the rate generator is disabled. The pulse rate is then dependent on the frequency of the input signal which turns the multivibrator on and off.

Figure 4-2. Repetition Rate Generator



4-7 The rate generator is a Schmitt trigger (Q5 and Q6) which switches when the voltage output of a ramp generator (Q9, R1 and one or more of the range capacitors C7 to C10) reaches its threshold level. When switched it activates a switch (Q8) which rapidly discharges the ramp capacitor(s), causing the voltage to fall and reset the Schmitt trigger. This turns the switch off and the cycle repeats. Each time Q5 is turned off, a positive spike appears at differentiator (L1/R31).

4-8 In the slowest rep rate range the available ramp current is reduced in order to prolong the charge cycle. That is, the capacitance of C10 is effectively increased during the charge cycle by "bleeding-off" the ramp current and thus increasing the time taken to charge the capacitor. For this purpose, a time base amplifier (MC1) is connected in parallel with C10. This results in a division and reduction of the ramp current by an amount proportional to that drawn by the amplifier.

4-9 When the 0.2s - 10s range switch is closed, the voltage across the ramp capacitors C7 and C10 is amplified by a linear amplifier (MC1-A). The resulting signal, which is differentiated by C11, activates an operational amplifier (MC1-B) in order to equalize the IR drop across R29 with R30.

4-10 During the discharge cycle, the operational amplifier is disabled by the forward biased diode CR26 and the ramp capacitors are rapidly discharged.

4-11 The external input circuit comprises a Schmitt trigger (Q1 and Q2) a current source (Q3) and an inverter (Q7). Q4 maintains a constant voltage at the base of Q2 in spite of the changes in the supply caused by format selection. Refer to paragraph 4-43 for information concerning the power supplies.

4-12 The leading edge of a positive signal applied to the TRIGGER INPUT turns Q1 on, Q7 on and Q5 off. Each time Q5 is turned off, a positive spike appears at the differentiator (L1/R31).

4-13 When the EXT mode is selected, the Schmitt trigger (Q5/Q6) is disabled. Each time the SINGLE PULSE push button is depressed, a flip-flop (Q13/Q14) rapidly turns on and then off. Each time the flip-flop is turned on, a positive spike appears at the differentiator (L1/R31).

4-14 In all modes of operation, the phase splitter (Q15/Q16) is turned on and off by the positive spikes applied to the base of Q15. When on, it produces a positive pulse to drive the width circuit and a negative pulse which is applied to the burst counter (when fitted).

4-15 WIDTH GENERATOR

(Figure 4-3 and Diagram 2)

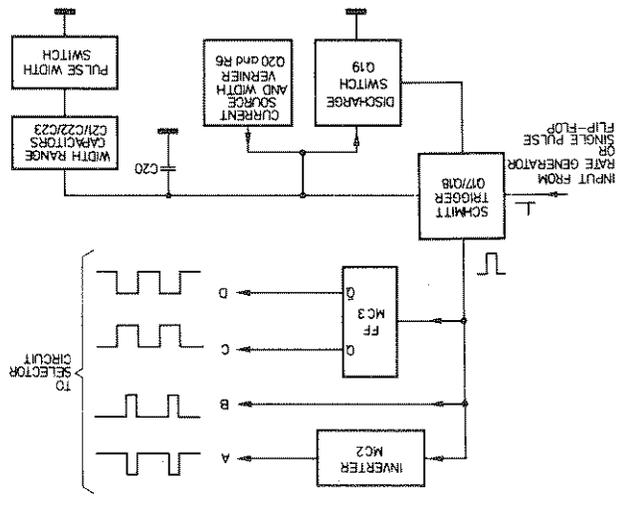


Figure 4-3. Width Generator

4-16 In the normal mode, the pulse leading edge occurs when Q17 turns on and Q18 off. The pulse width is determined by the time taken for the selected range capacitor (Q20 and C21 or C22 or C23), charged from the current source (Q20/Q21), to reach the threshold level of the Schmitt trigger. The pulse trailing edge is created when the Schmitt trigger switches and turns on the discharge switch (Q19).

4-17 In selecting SQUARE WAVE, the width vernier (R2) is shorted and the narrowest pulse width range is automatically selected. This is in order to deliver a pulse of constant width to a divider-squarer flip-flop which generates the square wave.

4-18 The Schmitt trigger output is applied directly (signal B) and via an inverter (MC2 - signal A) and via the divider squarer (signals C and D) to an array of gates which select the required output as follows:

4-21 This is an ac-coupled cascode amplifier which produces a positive output pulse for each input pulse.

4-22 Pulse Output Stage

4-23 The function of the pulse output stage is to amplify the selected input signal, to supply the voltages for base line and polarity selection and attenuate the signal voltage to the required output level. The 50Ω internal load is always connected in the lower ranges but may be switched out in the 4-16 Volt range.

4-20 Trigger Output Stage (Q35, Q36)

4-19 OUTPUT STAGES (Figure 4-4 and Diagram 3)

Output Format	Mode	Wave
Normal	Positive	B
	Symmetrical	B
	Negative	A
Complement	Positive	A
	Symmetrical	A
	Negative	B
	Positive	D
	Symmetrical	C
	Negative	C

4-24 When POS output is selected, a positive current source (Q31, Q34) drives the output amplifier output above zero volts. For NEG outputs, a negative current source is enabled. Both current sources are disabled when SYMMetrical outputs are selected. The potentiometers R81 and R84 are used for positive (R81) and negative (R84) base line calibration.

4-25 Attenuator

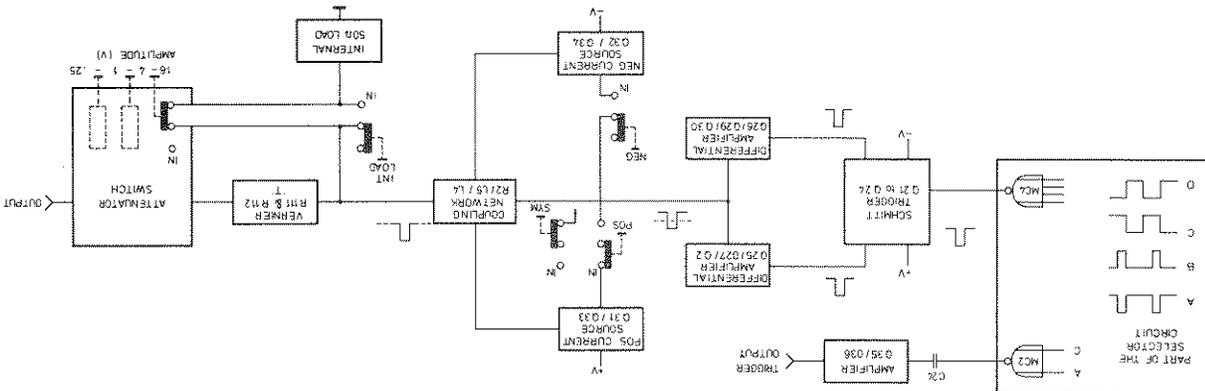
4-26 The output attenuator comprises two resistive networks which provide stepped attenuation of the output. A bridged-T vernier provides continuous overlapping adjustment between the settings of the output attenuator. The internal 50Ω-load can be disconnected in the 4-16 Volt range when the INT LOAD button is released.

4-27 POWER SUPPLY (Figure 4-5 and Diagram 4)

4-28 The positive and negative power supplies are identical monolithic voltage regulators (MC5 and MC6) with external PNP pass transistors (Q37 and Q38). The nominal output voltage with respect to the isolated PC board returns is ± 14V. The voltage levels with respect to zero volts, however, are dependent on the polarity and format switches:

POS switch closed +22.3V/-5.7V  
 NEG switch closed -22.3V/+5.7V  
 SYMM switch closed ± 14V.

Figure 4-4. Output Stages





**SECTION 5** MAINTENANCE

**5-1 INTRODUCTION**

**5-2** The Model 8011A contains reliable components mounted on gold plated PC boards. These are subjected to a series of tests and calibration procedures which ensures accuracy and long life even in hostile environments. Maintenance and servicing is made easy by a non-complicated design and a simple all "on one board" construction.

**5-3 Preventive Maintenance**

**5-4** The inherent reliability and accuracy of the pulse generator can be maintained by periodic cleaning and mechanical inspections. To gain access to the interior of the instrument remove the two panel covers. These are removed by releasing the four screws in the respective cover and sliding it away from the side of the instrument.

**5-5** Remove dust from the interior and check that all fittings, connectors and boards are firmly in place. Check that the wiring and cables – especially those of power supply and line voltage – are in good condition. Ensure correct function of the controls by checking that the switch push rods and vernier knobs are able to move freely.

**5-6 SERVICING**

**5-7 Removal of Assemblies**

**5-8** The majority of troubleshooting and repair procedures can be undertaken without removing the PC

board from the frame. If necessary, however, the board can be removed as follows:

Unsold the connections to the two verniers and BNC connectors. If the burst board (Opt. 001) is fitted, unplug the interconnecting cable and pull the board towards the rear. Remove the AMPLITUDE vernier knob.

Remove the four fixing screws at the corners of the rear panel.

Now slide the PC board(s) and rear panel towards the rear of the instrument.

**5-9 Performance Checks and Adjustment Procedures**

**5-10** After completion of a repair or periodic inspection, verify that the instrument is working to specification by carrying out the performance checks (Table 5-2 to 5-17). Rigid observance to the sequence in which the checks appear is unnecessary. Table 5-18 and 5-19 give the procedures for checking and adjusting the power supplies and pulse base line.

**5-10 Troubleshooting**

**5-11** When a fault symptom is evident, try to locate the fault to a functional block using figure 4-1. Then use table 5-20, the first page of which will indicate the direction in which troubleshooting is to proceed. The most convenient test point for the waveforms and voltages presented in the table can be located on the facing figure 5-1.

INSTRUMENT	BRIEF SPECIFICATION	RECOMMENDED MODEL
Oscilloscope	Dual Channel, 50 MHz bandwidth, 5mV/div. sensitivity, sweep speeds 5ns/div. to 2s/div. with sweep delay.	HP 180A with plug-ins 1801A and 1821A
Oscilloscope	Dual Channel, 1 GHz bandwidth, 1mV/div. sensitivity, sweep speeds 10ns/div. to 2s/div.	HP 140A with plug-ins 1401A and 1424A.
Counter	Frequency Range 0 to 50 MHz	HP 5245L
VHF Test Oscillator	Frequency Range 10 MHz to 500MHz	3200B
Test Oscillator	Frequency Range 10 Hz to 10 MHz	651B
Pulse Source	Frequency Range 0.1 Hz to 20 MHz	8011A
Digital Voltmeter	100V range to 4 significant figures. Accuracy $\pm 0.05\%$ $\pm 1$ digit.	HP 3440A with plug-in 3444A
AC Voltmeter	Sensitivity 100 $\mu$ V to 300V rms.	HP 3400A
ACCESSORIES	RECOMMENDED MODEL	
50 $\Omega$ co-axial cable terminated with BNC male connectors (2 required)		HP 10120A
50 $\Omega$ termination type GR (2 required)		GR 874-W50B
50 $\Omega$ Tee connector (2 required)		HP 10221A
50 $\Omega$ Feed-through		HP 11048B
20dB Attenuator		RS RBU 100.8654.25 30W and appropriate adapters
Adder		HP 15104A
10:1 Divider Probe Tip		HP 10214A

Table 5-1. Test Equipment and Accessories Required

5m - 0.2	CCW	<5ms
0.2 - 10	CCW	<200ms
	CW	>200ms
	CW	>10s

For the following ranges set the counter for period measurement:

50n - 2μ	CCW	>20MHz
2μ - 0.1m	CCW	<500kHz
0.1m - 5m	CCW	>500kHz
	CW	<10kHz
	CW	>10kHz
	CW	<200Hz

1 Check the repetition rate for each setting of the controls listed below.

STEP INSTRUCTION RESULT

- PULSE PERIOD 2 50n - 2μ
- VERNIER 3 CCW
- PULSE WIDTH 4 25n - 1μ
- VERNIER 5 CCW
- AMPLITUDE 6 4 - 16
- VERNIER 7 CW
- POLARITY 11 POS
- INT LOAD 8 ON

INITIAL CONTROL SETTINGS

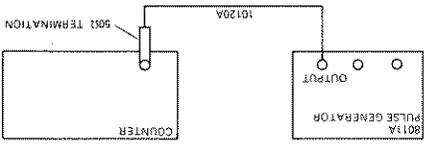
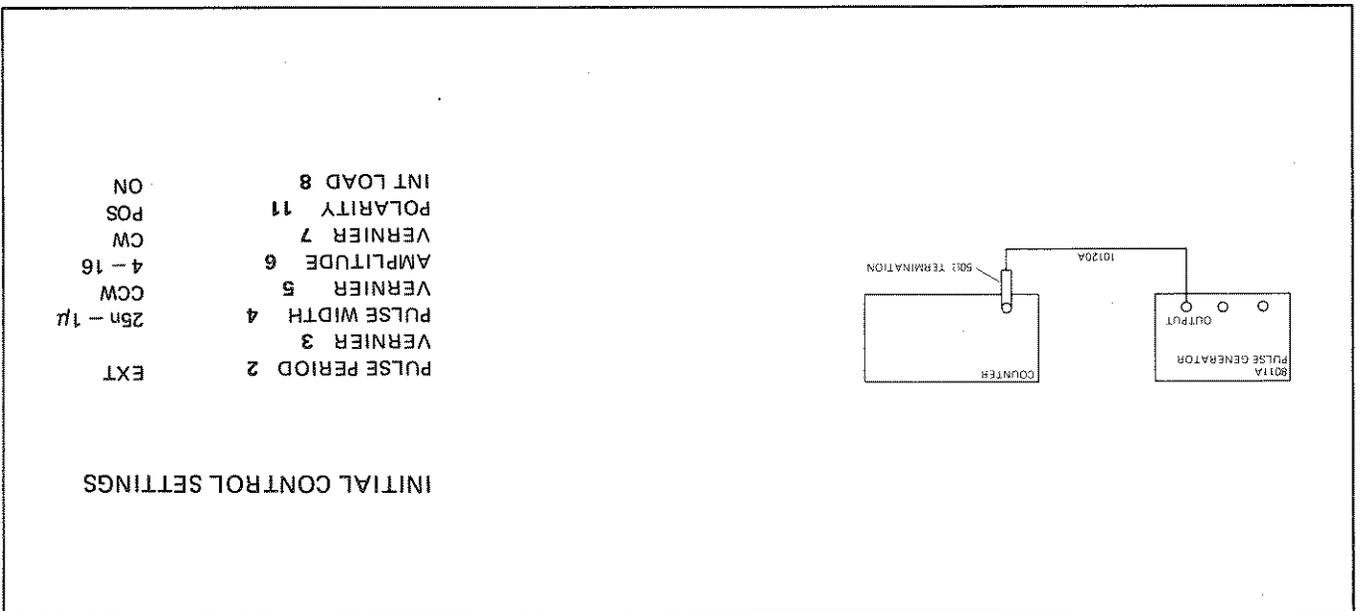


Table 5-2. Performance Check - Repetition Rate

*MAY use Storage Oscilloscope*

STEP	INSTRUCTION	RESULT
1	Set the counter for manual start.	
2	Press the SINGLE PULSE button once only:	1 pulse



INITIAL CONTROL SETTINGS

EXT	PULSE PERIOD	2	VERNIER	3
	PULSE WIDTH	4	VERNIER	4
	CCW	25n - 1μ	VERNIER	5
	4 - 16	AMPLITUDE	6	VERNIER
	CW	VERNIER	7	
POS	POLARITY	11		
ON	INT LOAD	8		

Table 5-3. Performance Check - Manual Trigger



STEP	INSTRUCTION	RESULTS
1	Set the counter function to measure frequency.	> 10 MHz > 250 KHz > 5 KHz
2	Check the square wave pulse for each control setting listed below:	> 10ms > 400ms
3	Set counter function to period average	

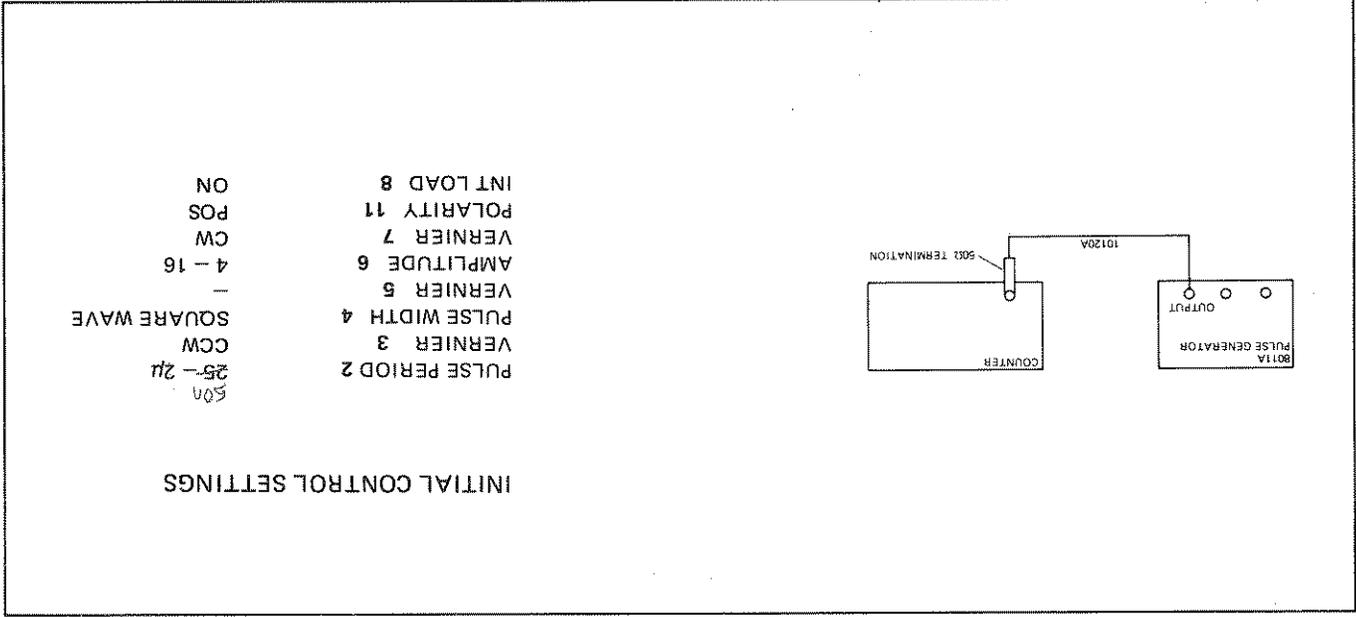


Table 5-5. Performance Check - Square Wave

STEP INSTRUCTIONS      1      Press SINGLE BURST button:  
 RESULTS      8011 pulses

*Opt. 001*

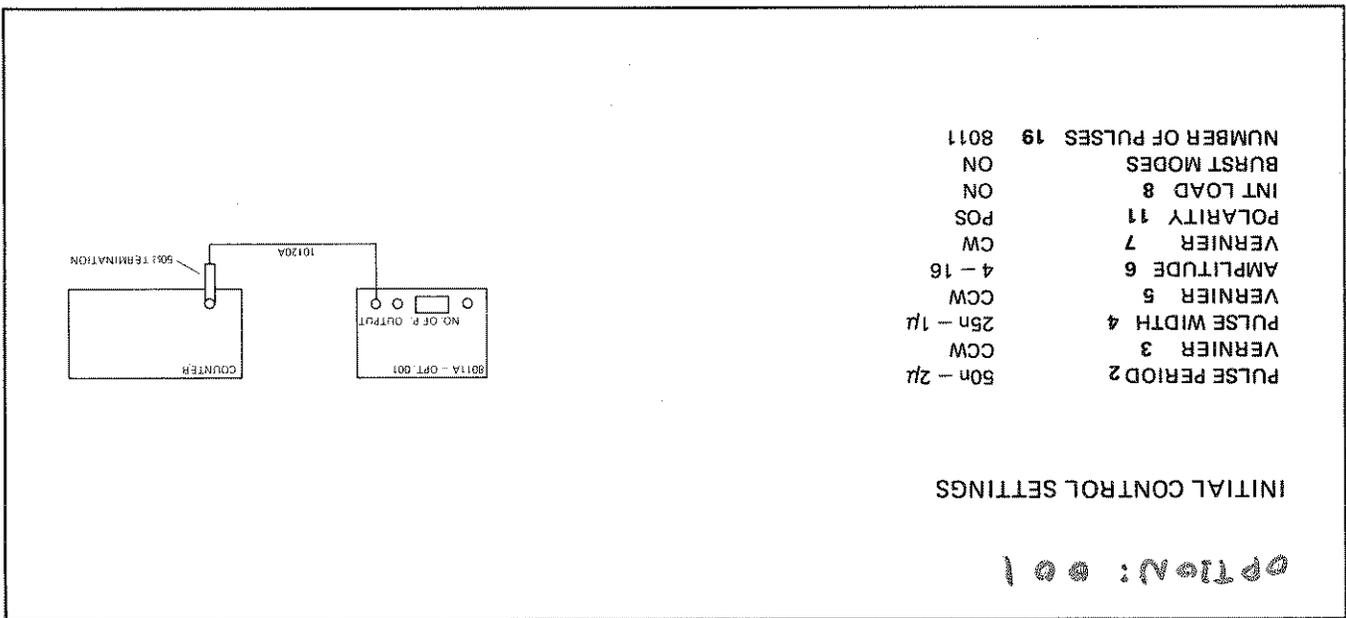
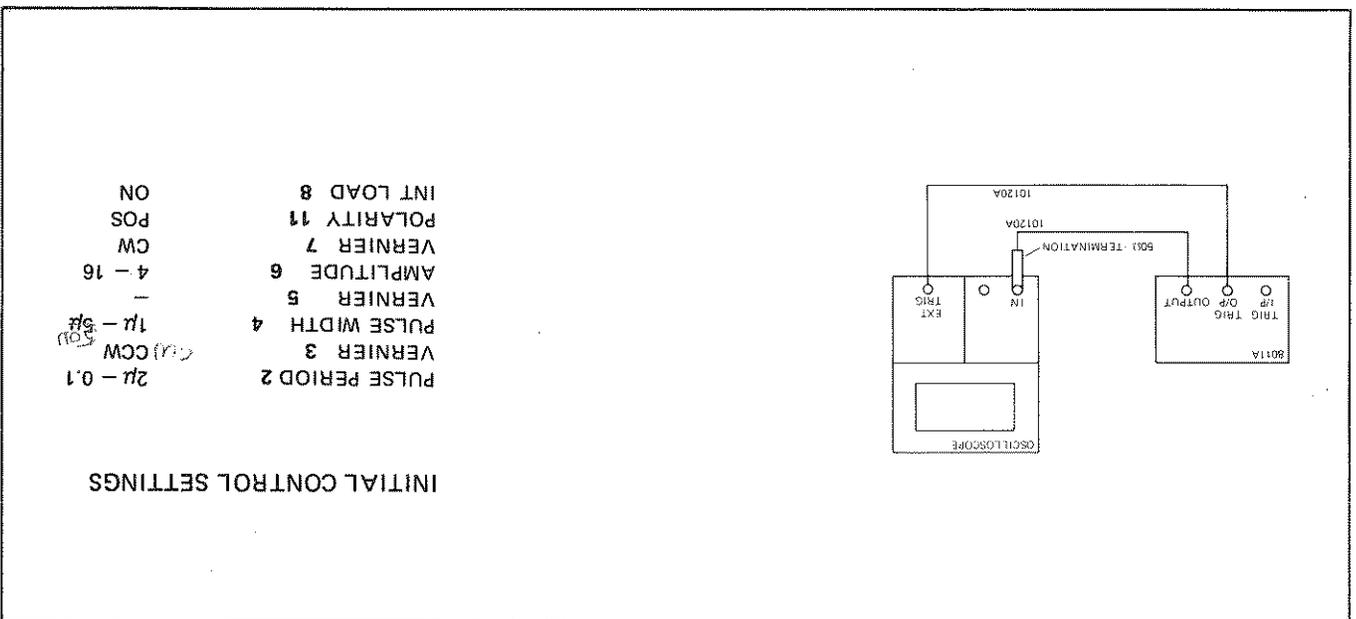


Table 5-6. Performance Check - Single Burst (8011A - Opt. 001)

Table 5-7. Performance Check – Duty Cycle



INITIAL CONTROL SETTINGS

- PULSE PERIOD 2 2μ – 0.1
- VERNIER 3 50μ CCW
- PULSE WIDTH 4 1μ – 5μ
- VERNIER 5
- AMPLITUDE 6 4 – 16
- VERNIER 7 CW
- POLARITY 11 POS
- INT LOAD 8 ON

STEP INSTRUCTIONS RESULTS

- 1 By means of the pulse width VERNIER 5. Set the pulse leading edge on the first line of the oscilloscope screen and the trailing edge on the centre line (5 cm).
- Turn the pulse period VERNIER 3 slowly CW until the trailing edge moves an the pulse is divided.
- 3 Measure the distance between the both pulse leading edges for each setting of the controls listed below:

PULSE PERIOD 2	PULSE WIDTH 4	VERNIER 5
2μ – 0.1 m	1μ – 5μ	as in
0.1 – 5m	50μ – 2.5m	step 1
5m – 0.2	2.5m – 0.1	< 10 = 50%

Table 5-8. Performance Check — Pulse Period Jitter

STEP	INSTRUCTIONS	RESULTS
1	Main Sweep 1ms/CW Delayed Sweep 1μs/CW Sweep Display MAIN	
2	Adjust the pulse period VERNIER ( 3 ) to obtain a 1ms pulse period.	
3	Adjust the oscilloscope delay (div.) until the intensified Spot coincides with the leading edge of the second pulse on the display.	
4	Switch to MIXED sweep display on oscilloscope.	
5	Measure pulse period jitter $t_j$ .	

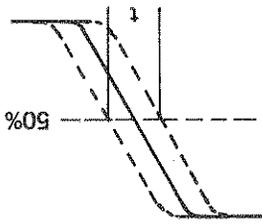
  

INITIAL CONTROL SETTINGS	
PULSE PERIOD	2 0.1m — 5m
VERNIER	3 CCW
PULSE WIDTH	4 50μ — 2.5m
VERNIER	5 CCW
AMPLITUDE	6 4 — 16
VERNIER	7 CCW
POLARITY	11 POS
INT LOAD	8

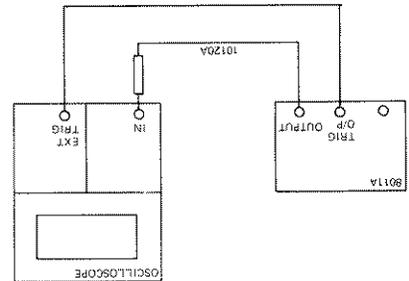
Table 5-9. Performance Check - Pulse Width Jitter

STEP	INSTRUCTIONS	RESULTS
1	Set the controls of the oscilloscope as follows Main Sweep 1ms/cm Delayed Sweep 1μs/cm Sweep Display MAIN	
2	Adjust the pulse width vernier to obtain a 1ms pulse width.	
3	Using the delay VERNIER (6), move the trailing edge of the pulse to the centre of the display.	
4	Adjust the Delay (Div.) until the intensified spot coincides with the trailing edge.	
5	Switch to delayed sweep.	
6	Set magnifier X5 and measure the width jitter $t$ .	

$$t = < 1\mu = < 0.01\%$$



- INITIAL CONTROL SETTINGS**
- PULSE PERIOD 2
  - VERNIER 3
  - CW
  - PULSE WIDTH 4
  - 50μ - 2.5m
  - VERNIER 5
  - CCW
  - AMPLITUDE 6
  - 4 - 16
  - VERNIER 7
  - CW
  - POLARITY 11
  - POS
  - INT LOAD 8
  - ON



- STEP INSTRUCTIONS**
- 1 Adjust the oscillator output amplitude to 2.0Vpp and frequency to 1 kHz.
  - 2 On the oscilloscope, center both channels vertically.
  - 3 Observe pulse, ensure that pulse occurs during positive slope of the input sine wave.

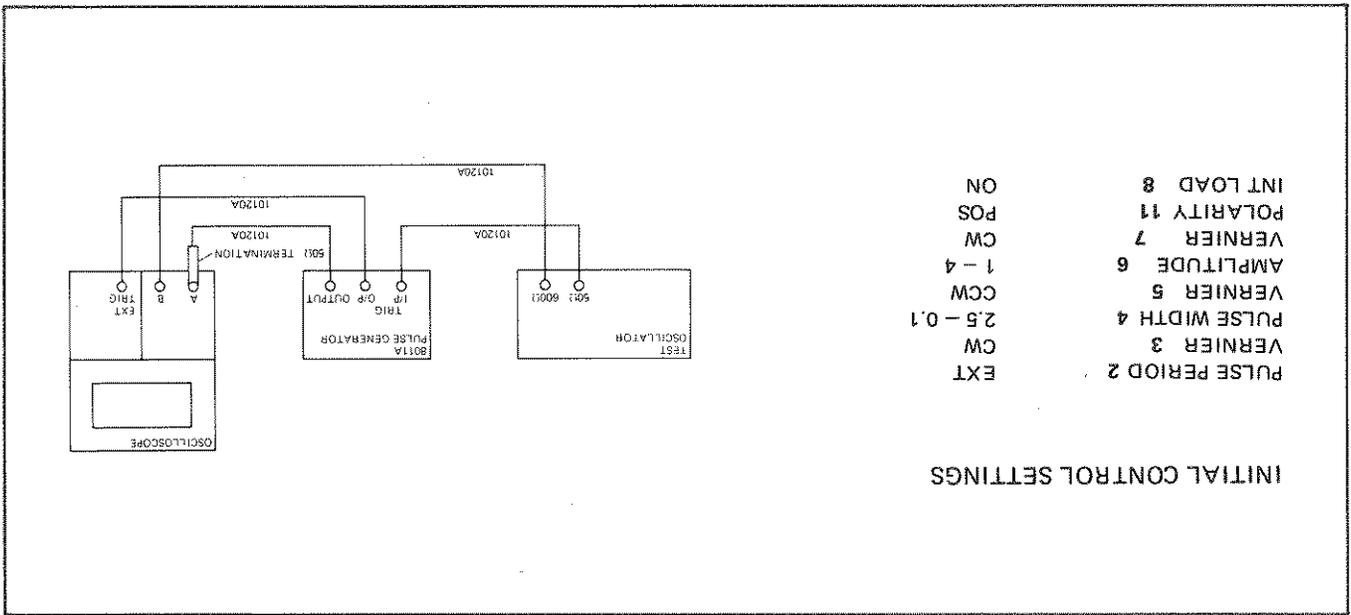


Table 5-10. Performance Check – External Trigger

- STEP INSTRUCTIONS**
- 1 Adjust the oscillator output amplitude to 2.0Vpp (3.6 cm on sampling scope). Set Frequency to 20 MHz.
  - 2 Check that the 8011A output pulse has the same pulse period as the external signal.
  - 3 Set the 8011A to NEG and repeat steps 2 and 3.
  - 4 Set the 8011A to SYMM and repeat steps 2 and 3.

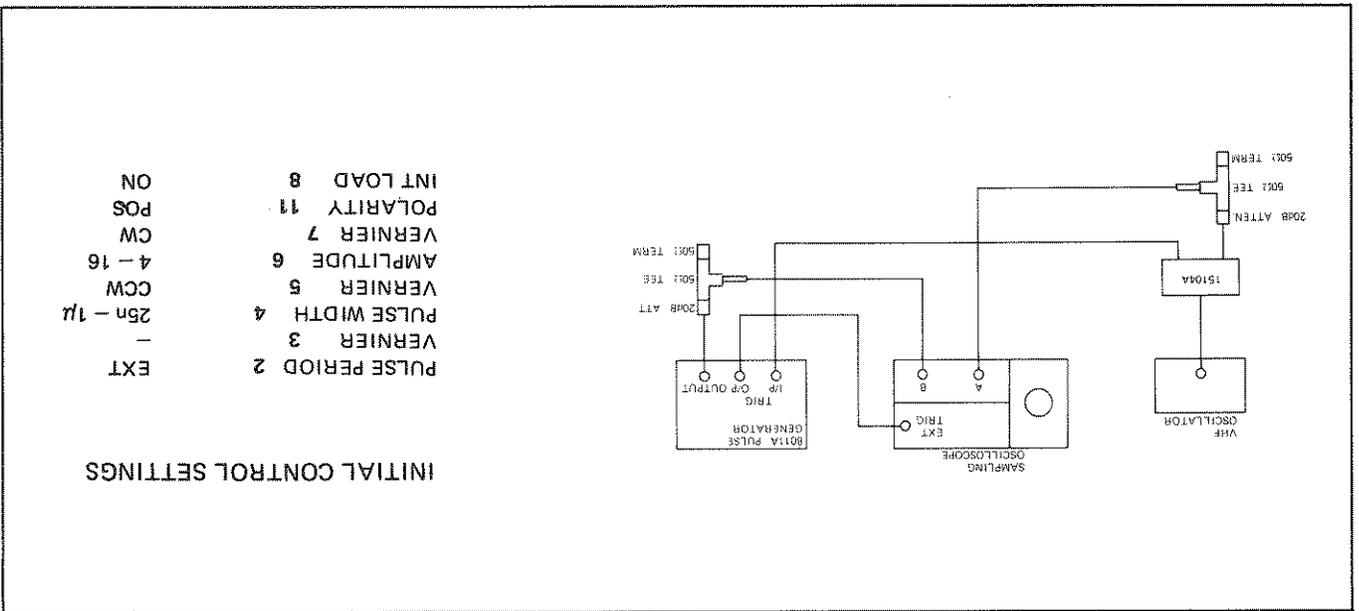


Table 5-11. Performance Check - High Frequency Triggering

STEP	INSTRUCTIONS	RESULTS
1	Set the oscilloscope to obtain the following: (1) a full-screen pulse amplitude display (2) expanded pulse centralized on screen.	
2	Measure pulse width	< 25ns
3	Set 8011A controls to NEG and repeat steps 2 and 3	> 25ns

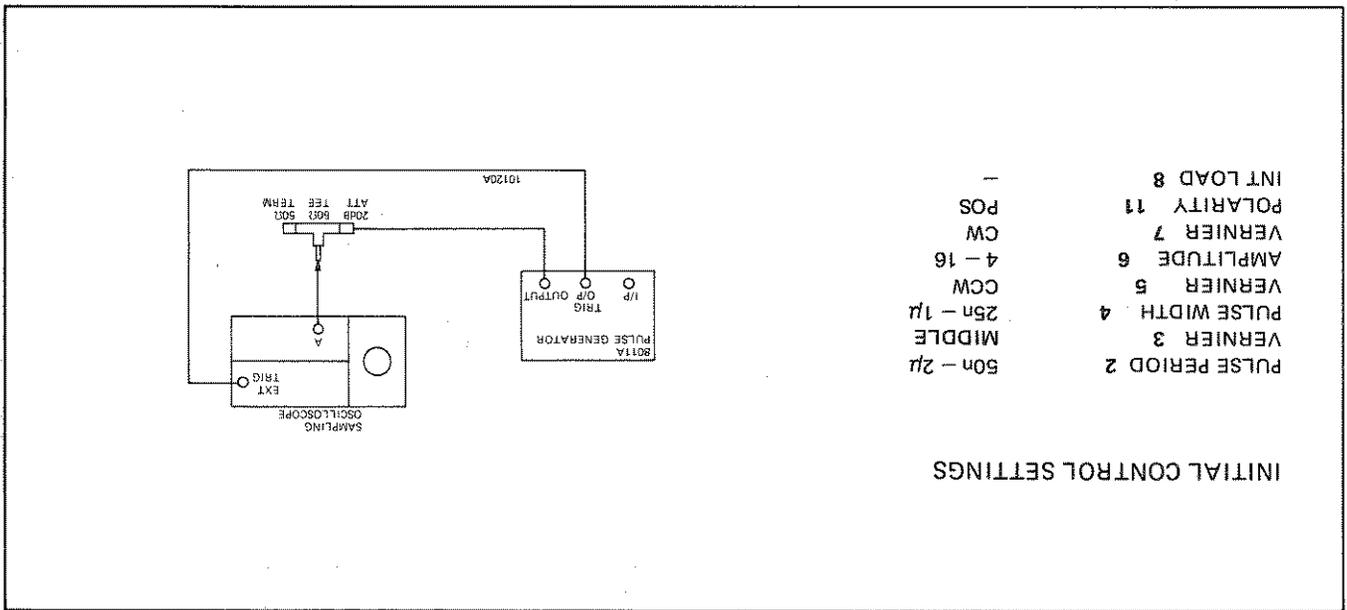


Table 5-12. Performance Check - Minimum Width

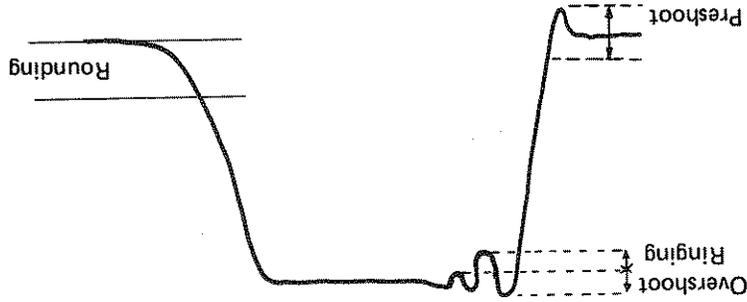
Table 5-13. Performance Check - Preshoot, Overshoot and Ringing

STEP	INSTRUCTIONS	RESULTS
1	Set the oscilloscope to obtain the following: (1) full-screen amplitude display (2) center amplitude expanded pulse on screen	
2	With reference to the diagram below, measure preshoot, overshoot and ringing. All should be $\leq 5\%$ of pulse* amplitude	

**INITIAL CONTROL SETTINGS**

PULSE PERIOD	50n - 2u
VERNIER	CCW
PULSE WIDTH	SOR WAVE
VERNIER	-
AMPLITUDE	4 - 16
VERNIER	CW
POLARITY	POS
INT LOAD	OFF



\*Overshoot may increase to 10% with Amplitude vernier CCW.

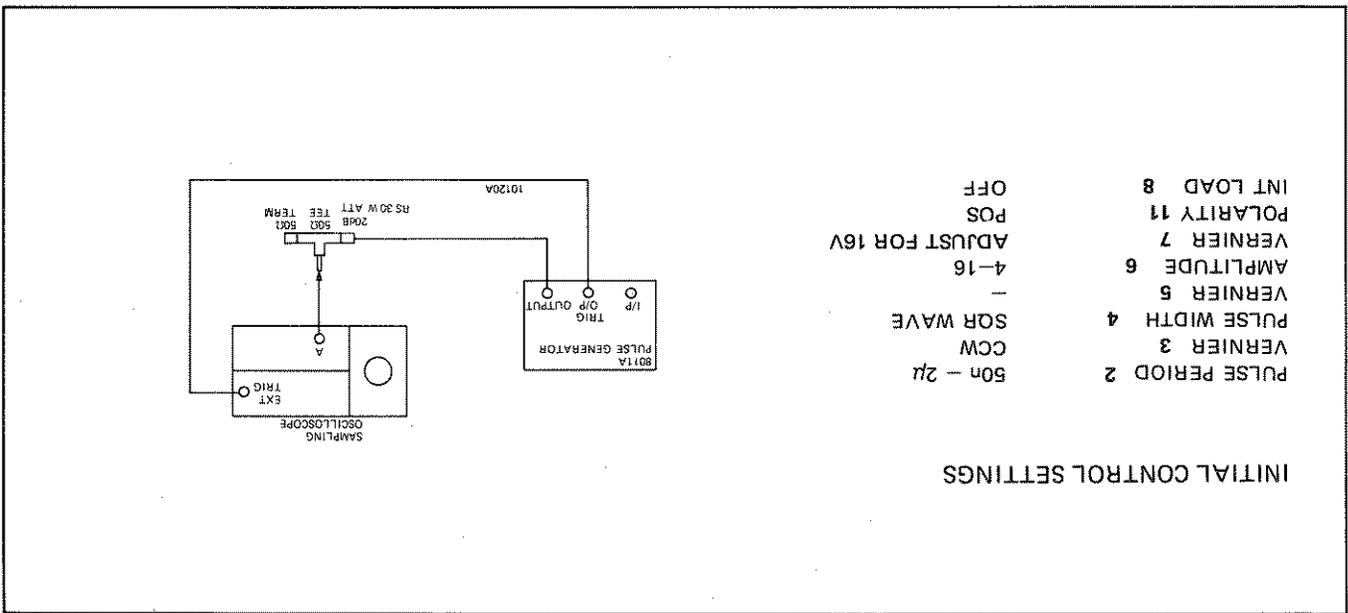


Table 5-14. Performance Check - Transition Times

STEP	INSTRUCTIONS	RESULTS
1	Set the oscilloscope to obtain the following: (1) full screen amplitude display (2) expanded sweep (3) leading edge of pulse at centre of screen	
2	Measure pulse rise time	< 10ns
3	Centralize trailing edge on screen	
4	Measure pulse fall time	> 10ns

STEP	INSTRUCTIONS	RESULTS
1	Check the amplitude for each setting of the controls listed below	
	AMPLITUDE 6	
	VERNIER 7	
	CW	> 16V
	CCW	< 4V
	CW	> 4V
	CCW	< 1V
	CW	> 1V
	CCW	< 0.25V

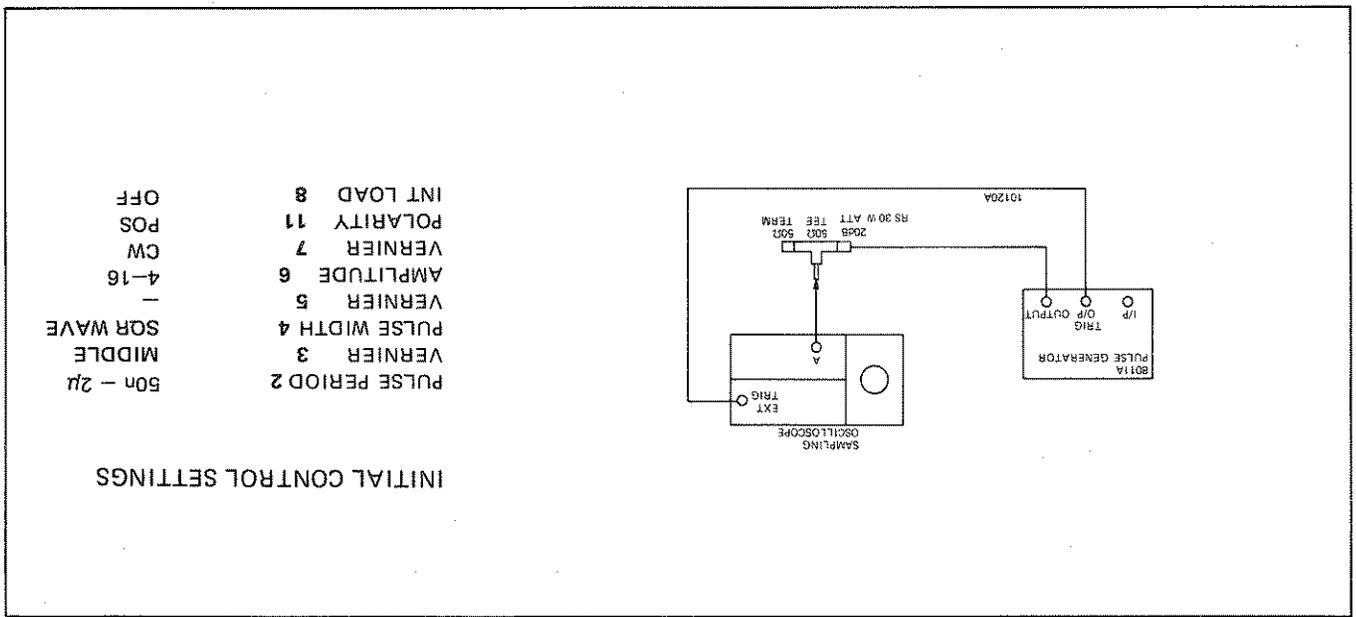


Table 5-15. Performance Check - Output Amplitude

STEP	INSTRUCTIONS	RESULTS
1	Check trigger output (1) Amplitude: (2) Width:	< 1V > 10ns
2	Turn 8011A pulse period vernier slowly clockwise and check that trigger output is as above	
3	Set the 8011A to SQR WAVE and repeat step 2.	

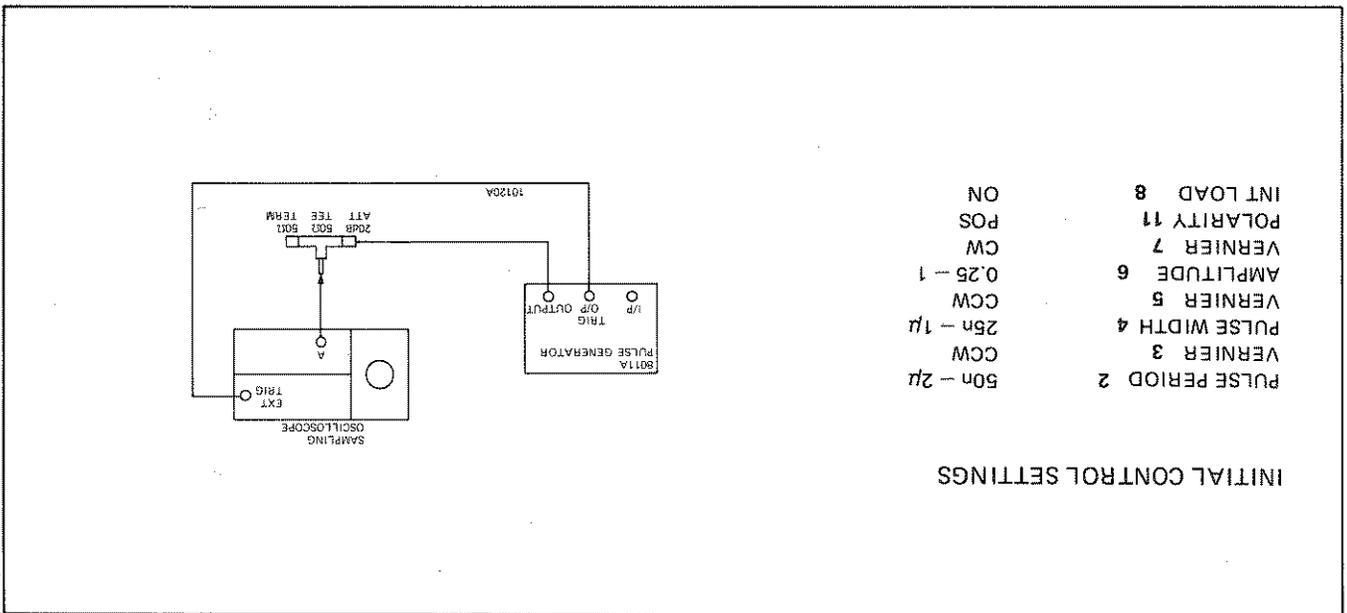
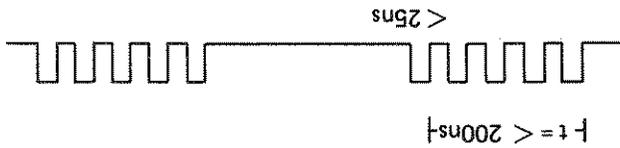
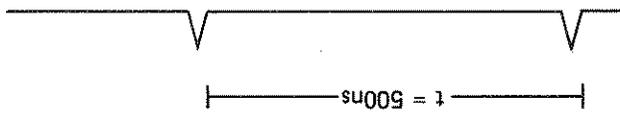


Table 5-16. Performance Check - Trigger Output



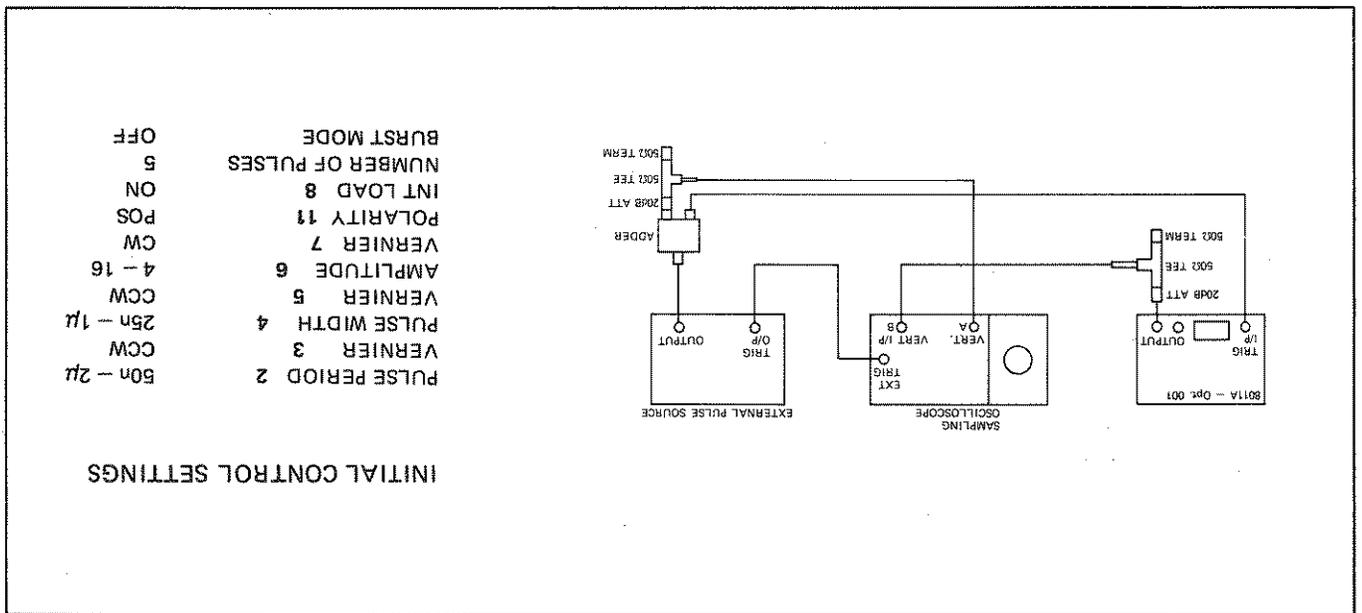
2 Select BURST MODE and observe pulses on the oscilloscope



1 Set rep. rate of external signal to 2 MHz:

RESULTS

STEP INSTRUCTIONS



INITIAL CONTROL SETTINGS

- PULSE PERIOD 2 50n - 2μ
- VERNIER 3 CCW
- PULSE WIDTH 4 25n - 1μ
- VERNIER 5 CCW
- AMPLITUDE 6 4 - 16
- VERNIER 7 CW
- POLARITY 11 POS
- INT LOAD 8 ON
- NUMBER OF PULSES 5
- BURST MODE OFF

Table 5-17. Performance Check - Repetitive Burst (8011A - Opt. 001)

Table 5-18. Adjustment Procedure: Power Supplies

INITIAL CONTROL SETTINGS		
PULSE PERIOD 2	EXT	
VERNIER 3	CW	
PULSE WIDTH 4	1 $\mu$ - 50 $\mu$	
VERNIER 5	CCW	
AMPLITUDE 6	1 - 4	
VERNIER 7	CW	
POLARITY 11	SYMM	
INT LOAD 8	ON	
BURST MODE	OFF	
(if fitted)		

STEP	INSTRUCTIONS	ADJUST	RESULTS
1	The following measurement are with respect to zero volts using a digital voltmeter.		
2	Measure voltage at the +14V test point	A1R125	+14V $\pm$ 100mV
3	Measure voltage at the -14V test point	A1R128	-14V $\pm$ 100mV
4	If the Burst option (001) is fitted measure voltage at the +5V test pin on assembly 1		+5V $\pm$ 200mV
5	The following measurements are with respect to zero volts using an AC voltmeter.		
6	Measure the ripple on the following supplies		< 1mV rms +14V < 1mV rms -14V < 1mV rms +5V

Table 5-19. Adjustment Procedure - Base Line

INITIAL CONTROL SETTINGS		
PULSE PERIOD 2	EXT	
VERNIER 3	-	
PULSE WIDTH 4	1 $\mu$ - 50 $\mu$	
VERNIER 5	CCW	
AMPLITUDE 6	4 - 16	
VERNIER 7	CW	
POLARITY 11	POS	
INT LOAD 8	OFF	

STEP	INSTRUCTIONS
1	With the oscilloscope set to Ground, center the trace on the graticule.
2	Switch to DC operation and check that the pulse base remains center of the graticule.
3	If necessary, adjust R81 accordingly.
4	Select NEG on the 8011A.
5	Repeat step 2.
6	If necessary, adjust R84 accordingly.

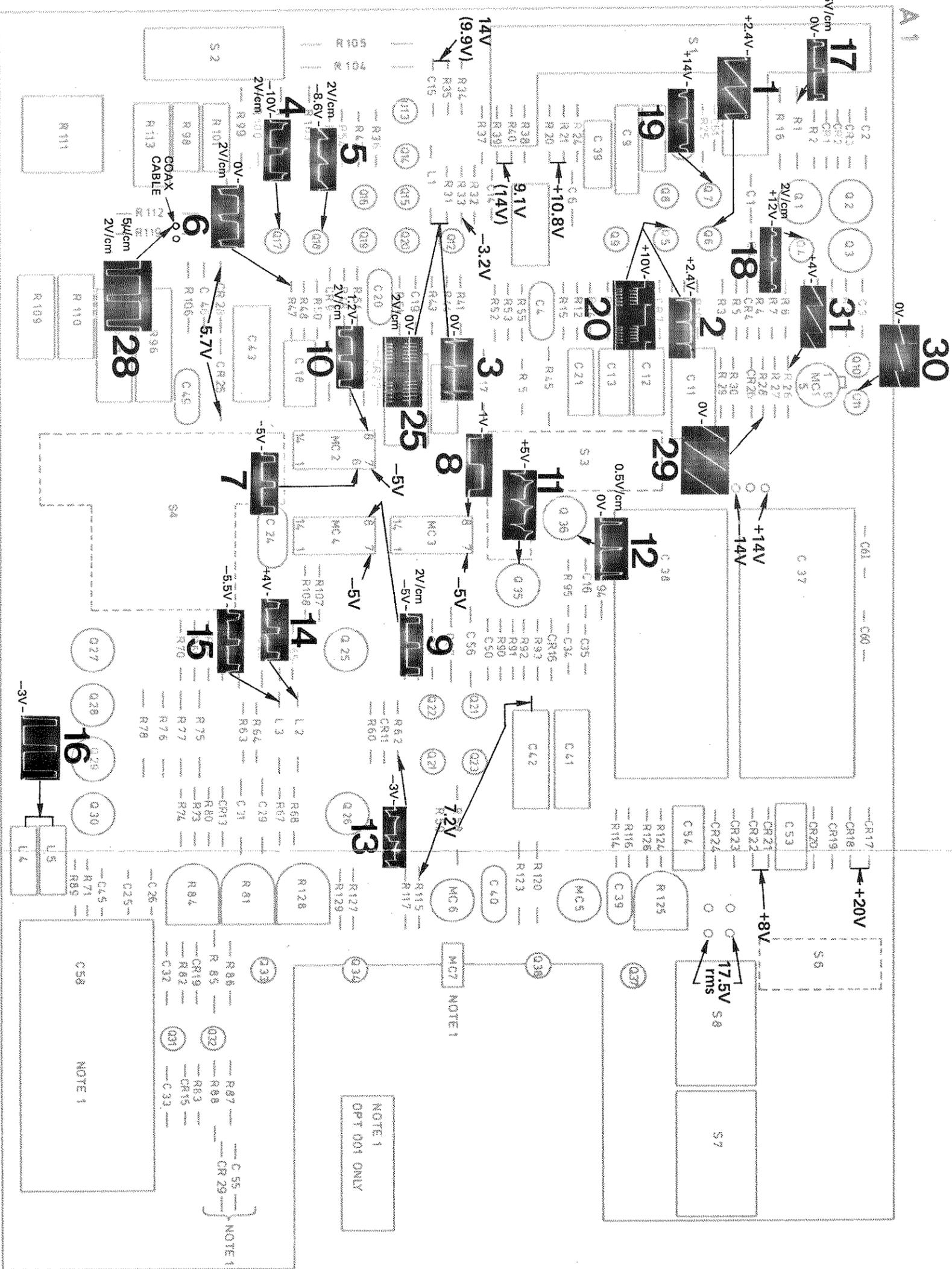


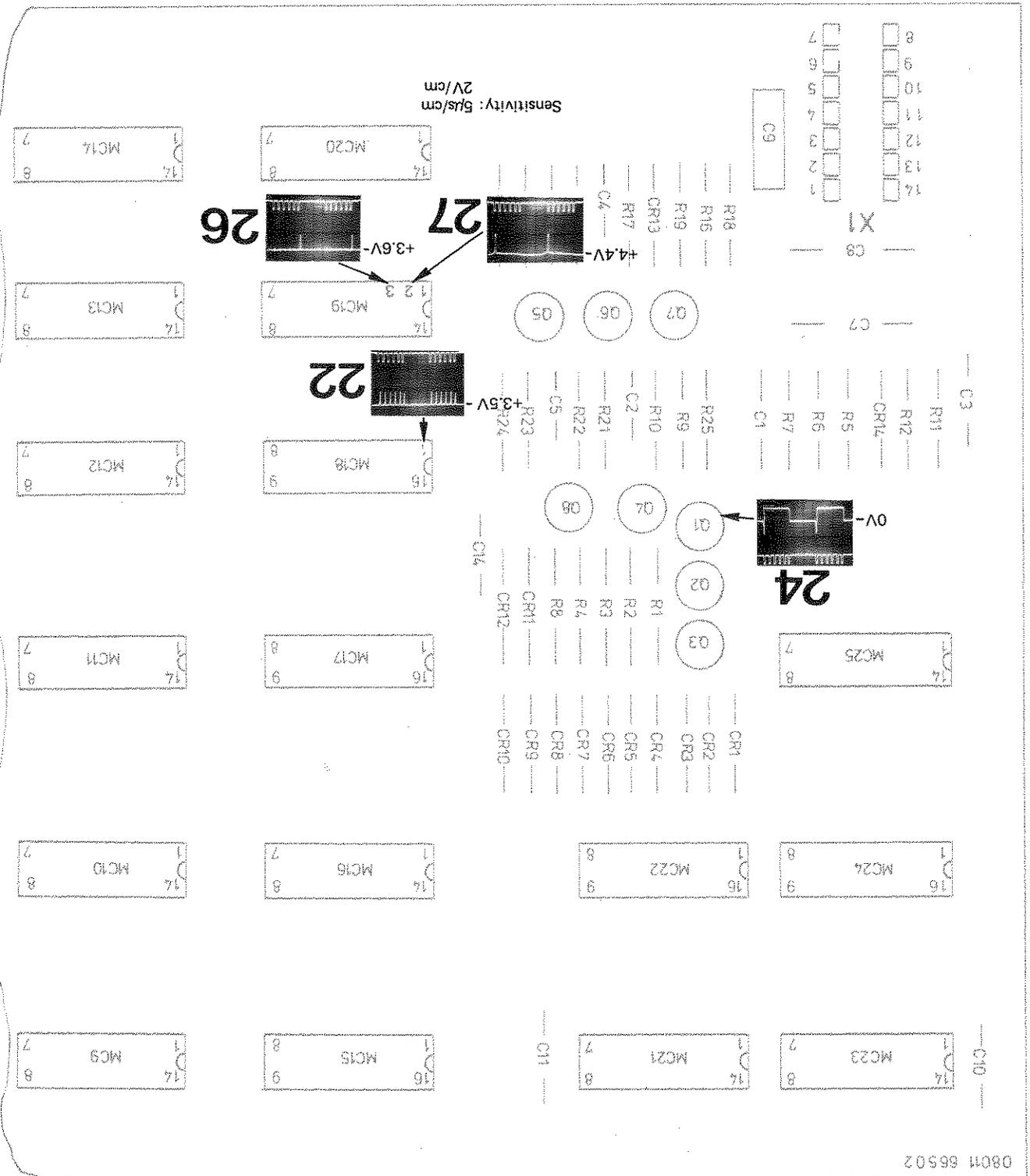
Figure 5-1. Assembly 1: Troubleshooting Aid

Table 5-20. Troubleshooting Procedures

<b>INITIAL CONTROL SETTINGS</b>	
<b>PULSE PERIOD</b>	50n - 2μ
<b>VERNIER</b>	Mid-range
<b>PULSE WIDTH</b>	25n - 1μ
<b>VERNIER</b>	Mid-range
<b>AMPLITUDE</b>	1 - 4
<b>VERNIER</b>	CW
<b>SYMM</b>	ON
<b>COMPL</b>	OFF

- |             |   |                |
|-------------|---|----------------|
| <b>STEP</b> | <b>INSTRUCTIONS</b>   | <b>RESULTS</b> |
| 1           | Set the oscilloscope as follows:<br>EXT TRIGGER<br>1V/cm<br>0.1μs/cm  |                |
| 2           | Start the troubleshooting procedure by checking all functions.  |                |
| 3           | The illustrated waveforms and voltages can be readily located by referring to Figure 5-1 or the appropriate circuit diagram for assembly 1. |                |

Figure 5-1. Assembly 2: Troubleshooting Aid





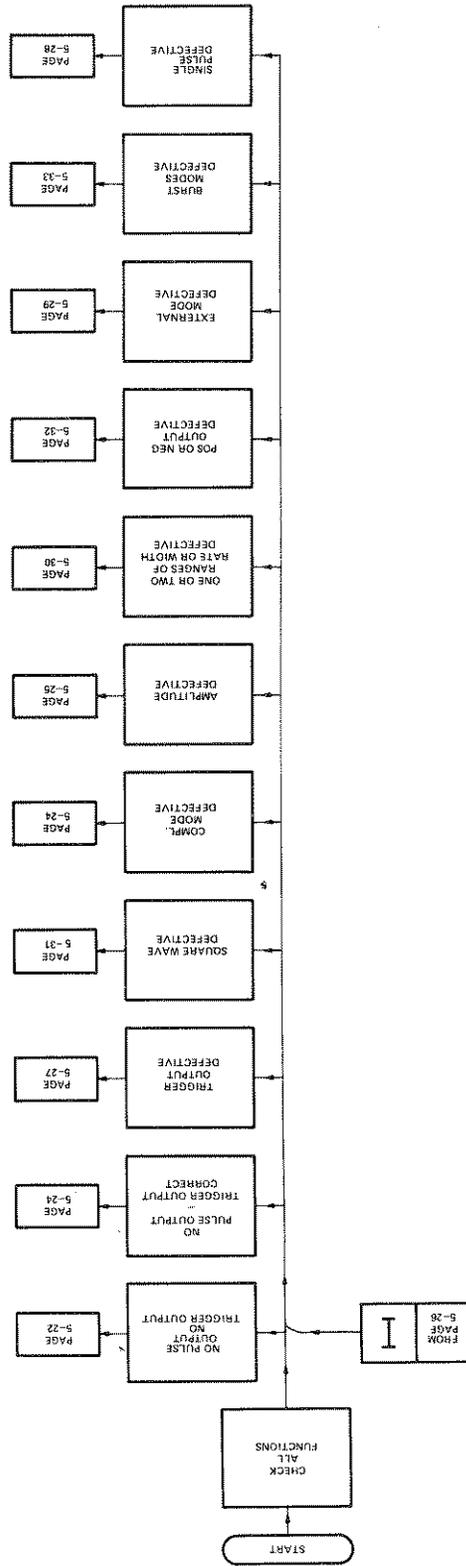
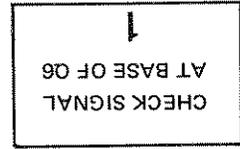


Table 5-20 cont'd.

the signal at the base of Q6 is to be found at photograph 1 on Figure 5-1.



Numbers in the boxes identify waveforms illustrated in Figure 5-1. For example

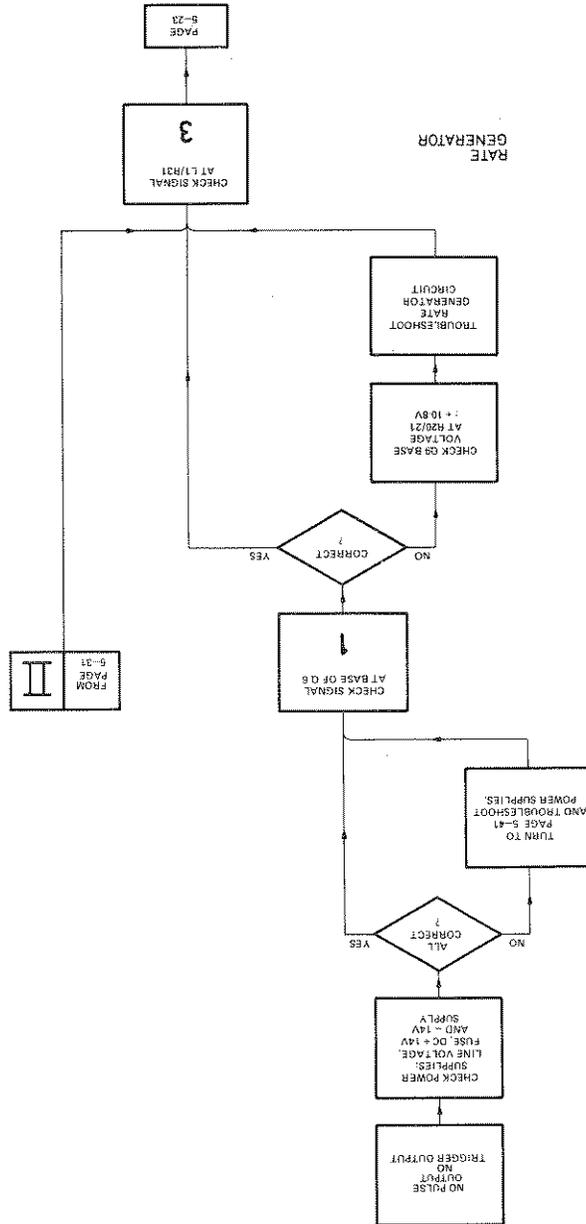


Table 5-20. cont'd

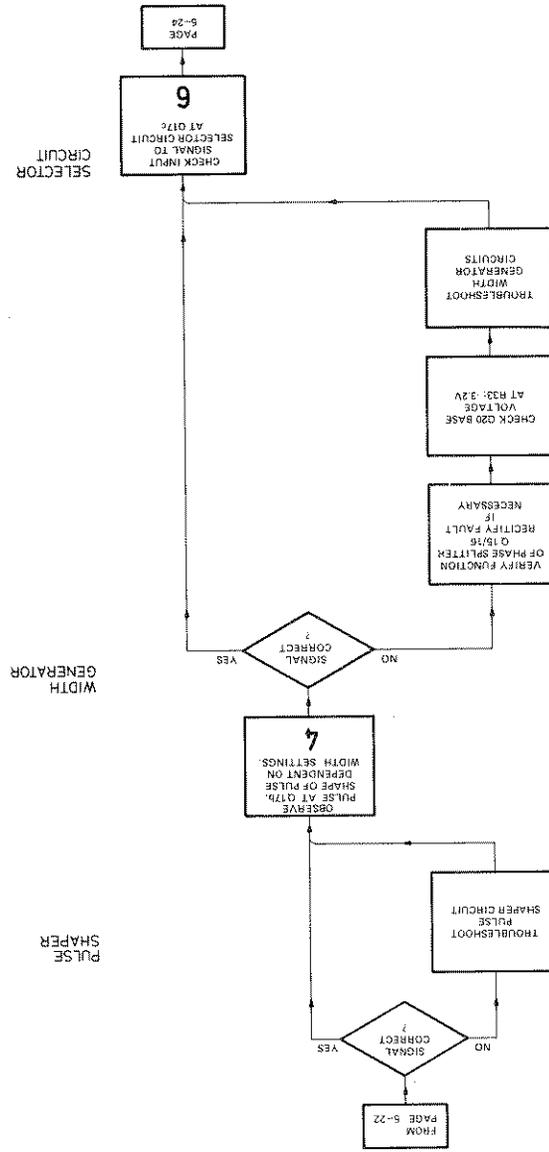
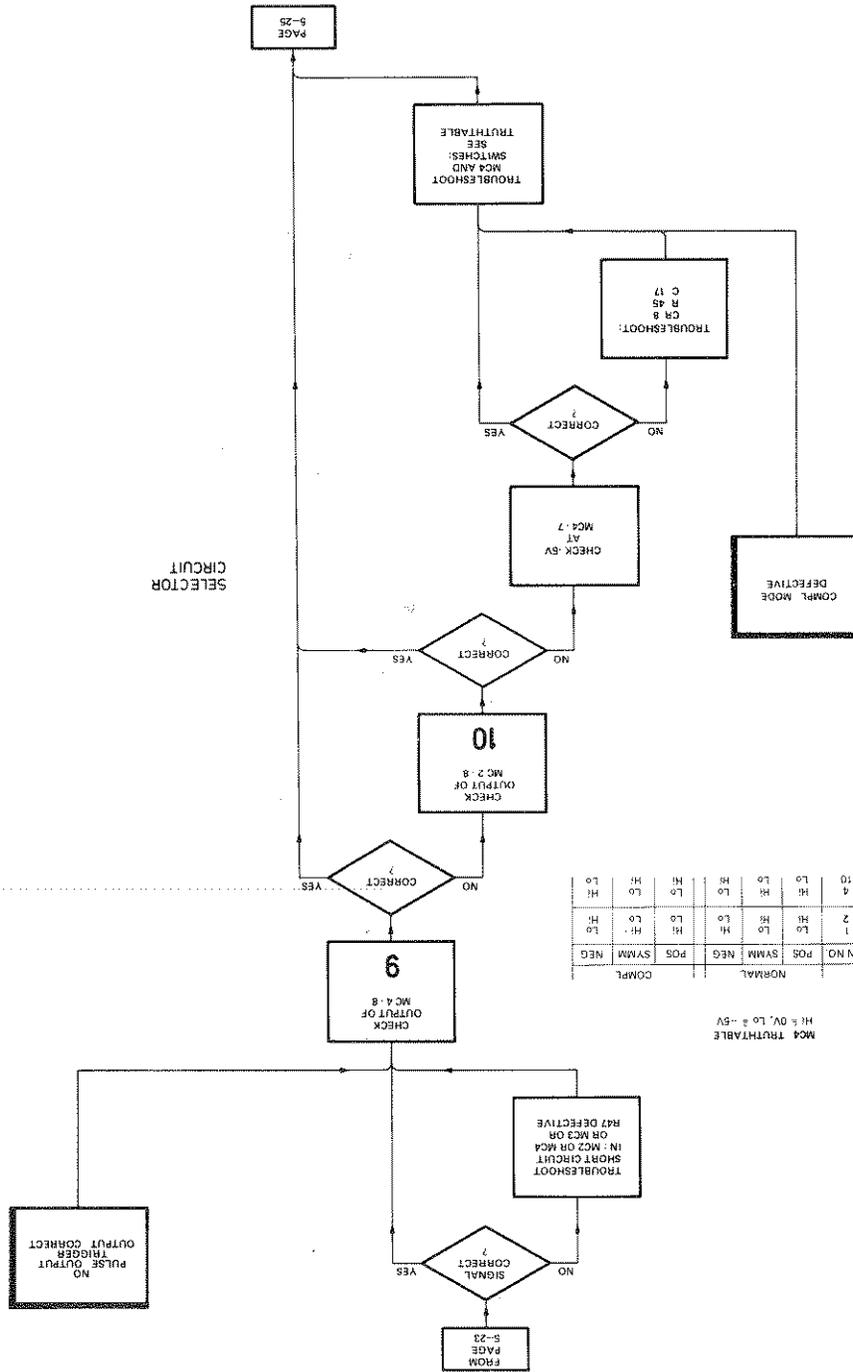


Table 5-20, cont'd.

SELECTOR  
CIRCUIT



PIN NO	NORMAL		COMPL.	
	POS	SYM	NEG	SYM
1	Lo	Hi	Lo	Hi
2	Lo	Hi	Lo	Hi
4	Hi	Lo	Hi	Lo
10	Lo	Hi	Lo	Hi

MCA TRUTHABLE  
HI = 0V, LO = -5V

Table 5-20, cont'd

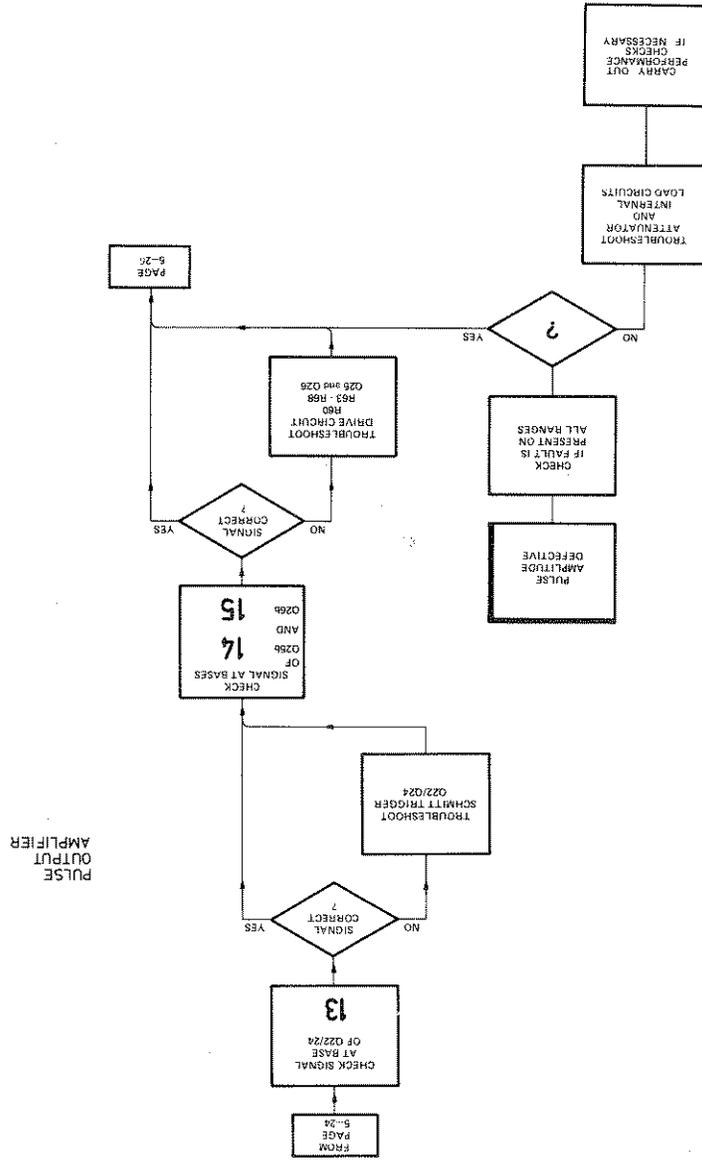


Table 5-20, cont'd

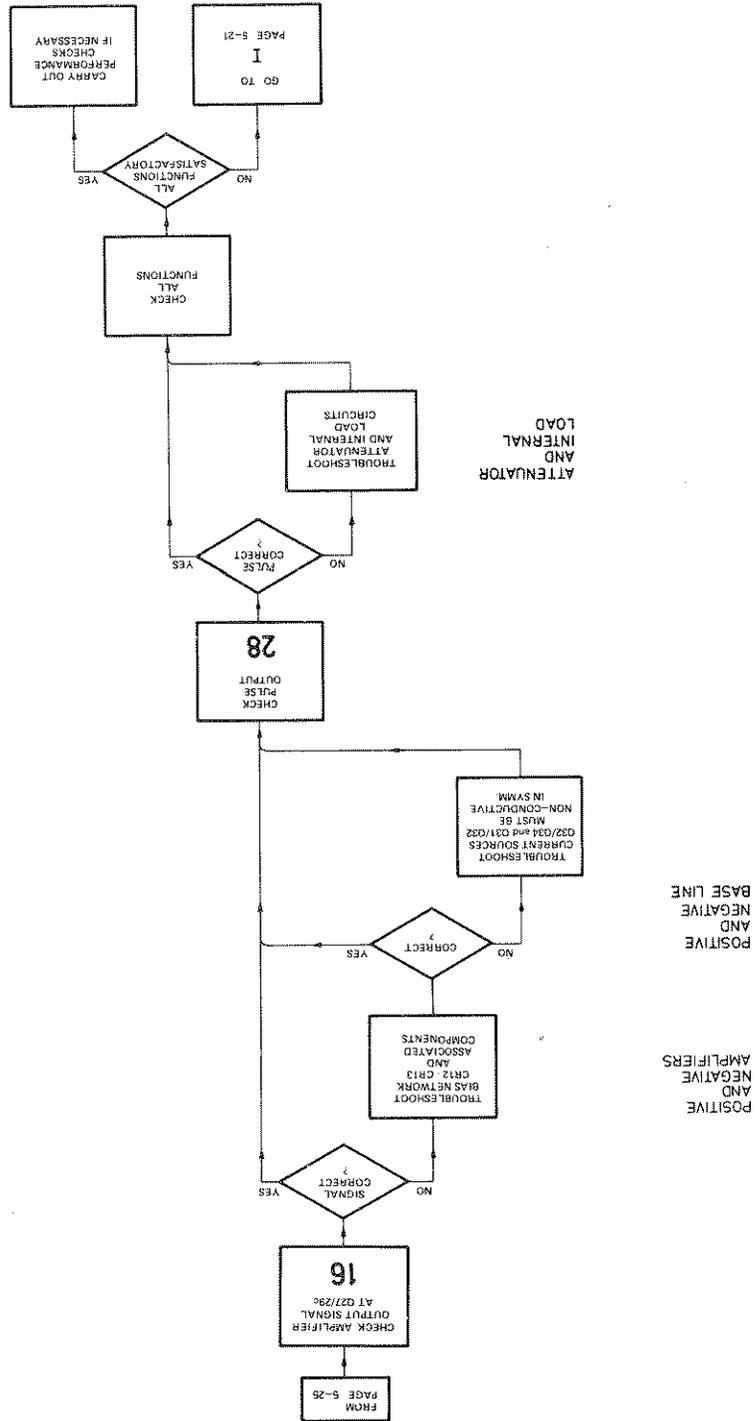
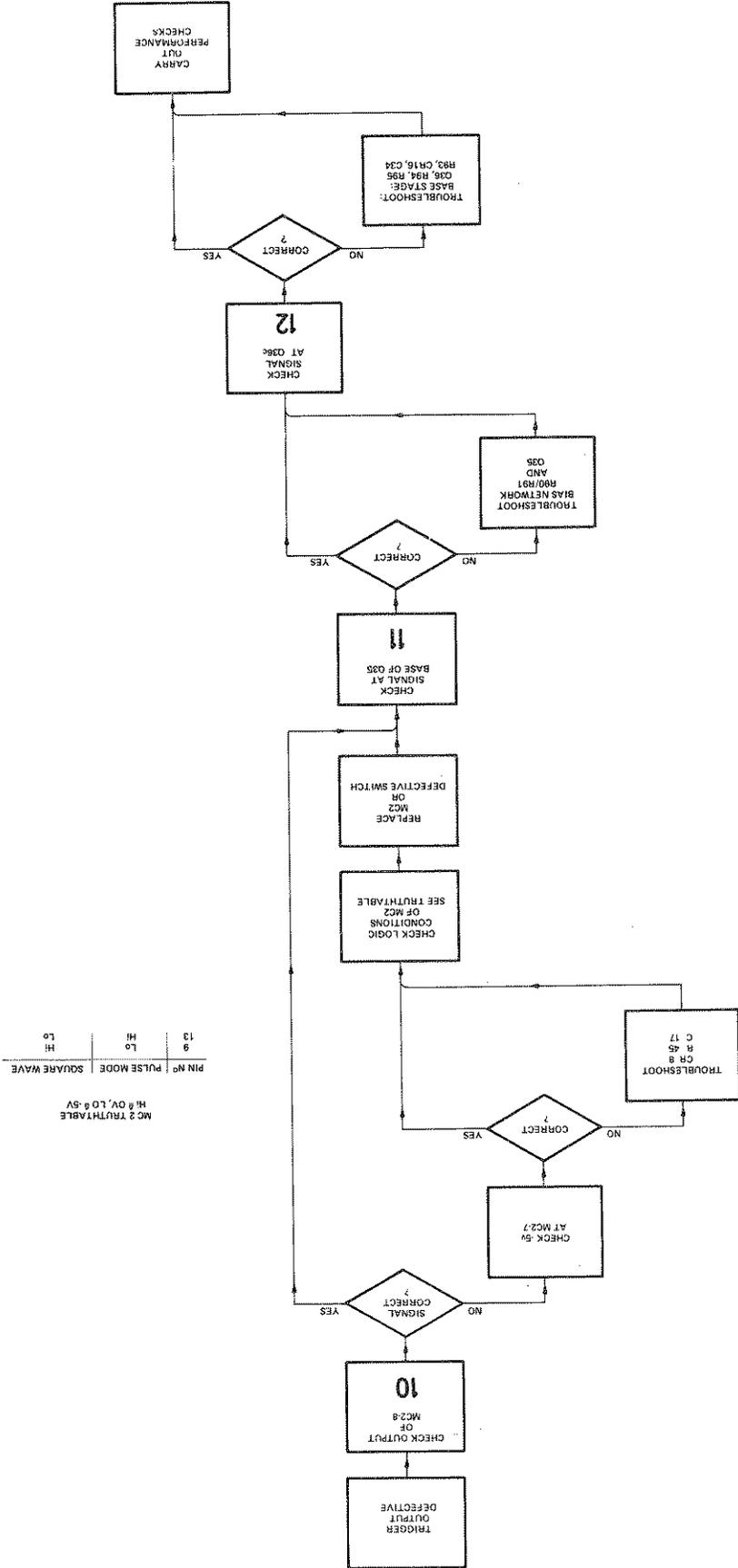


Table 5-20, cont'd



M2 TRUTHTABLE  
M 2 OV, L0.6 5V

PIN N°	PULSE MODE	SQUARE WAVE
9	Lo	Hi
13	Hi	Lo

Table 5-20. cont'd

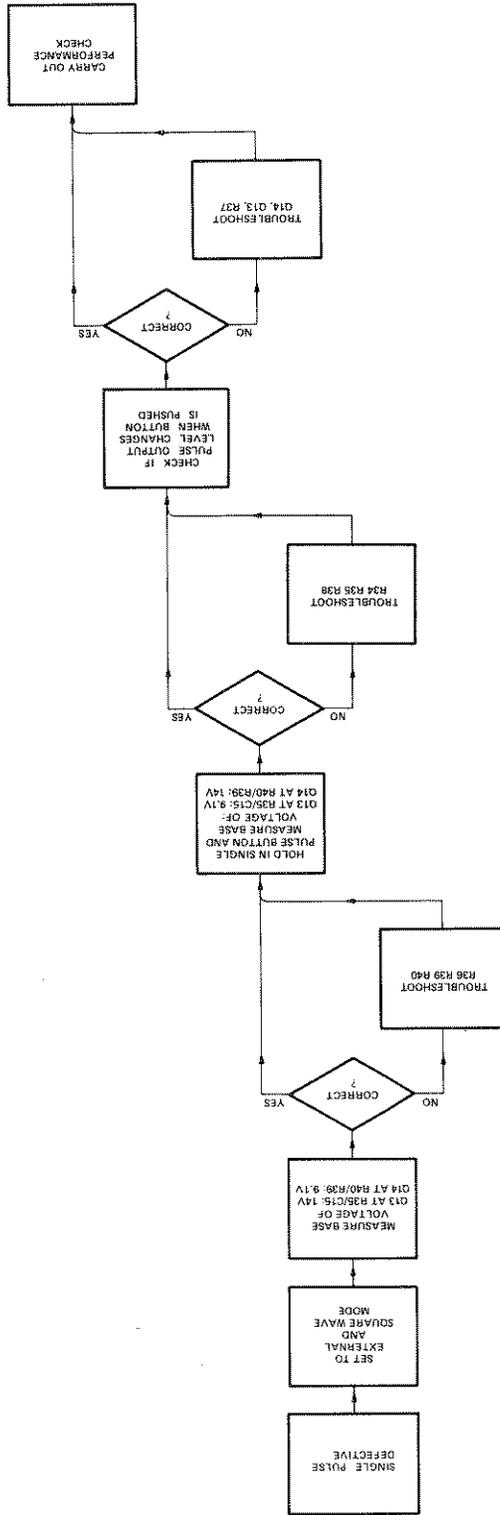


Table 5-20, cont'd.

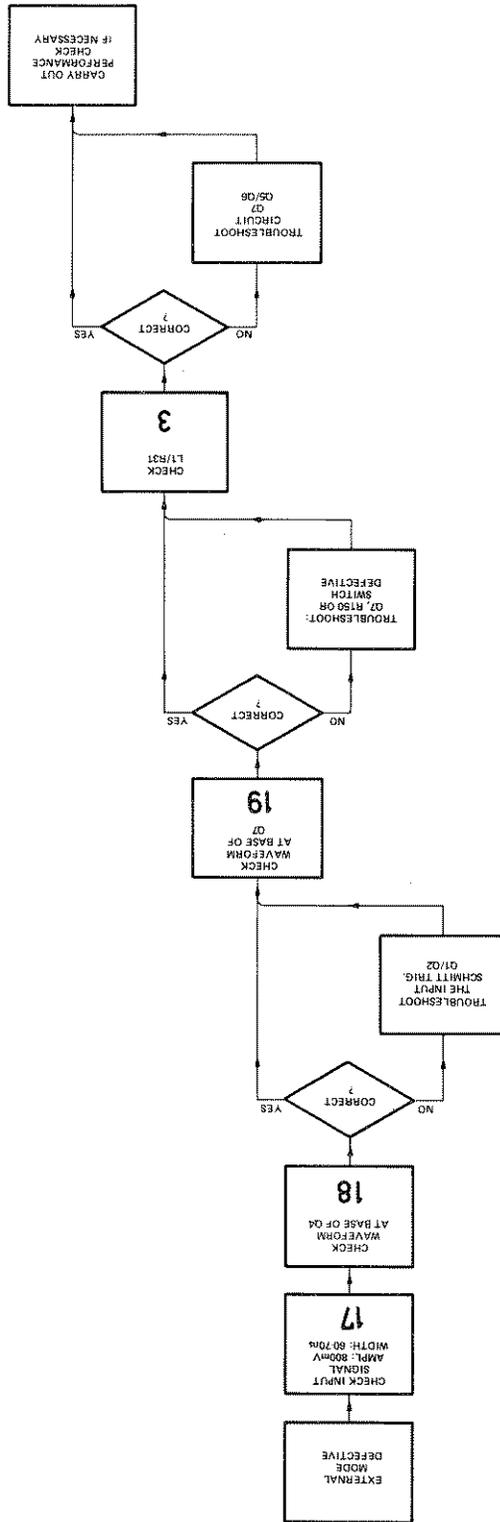


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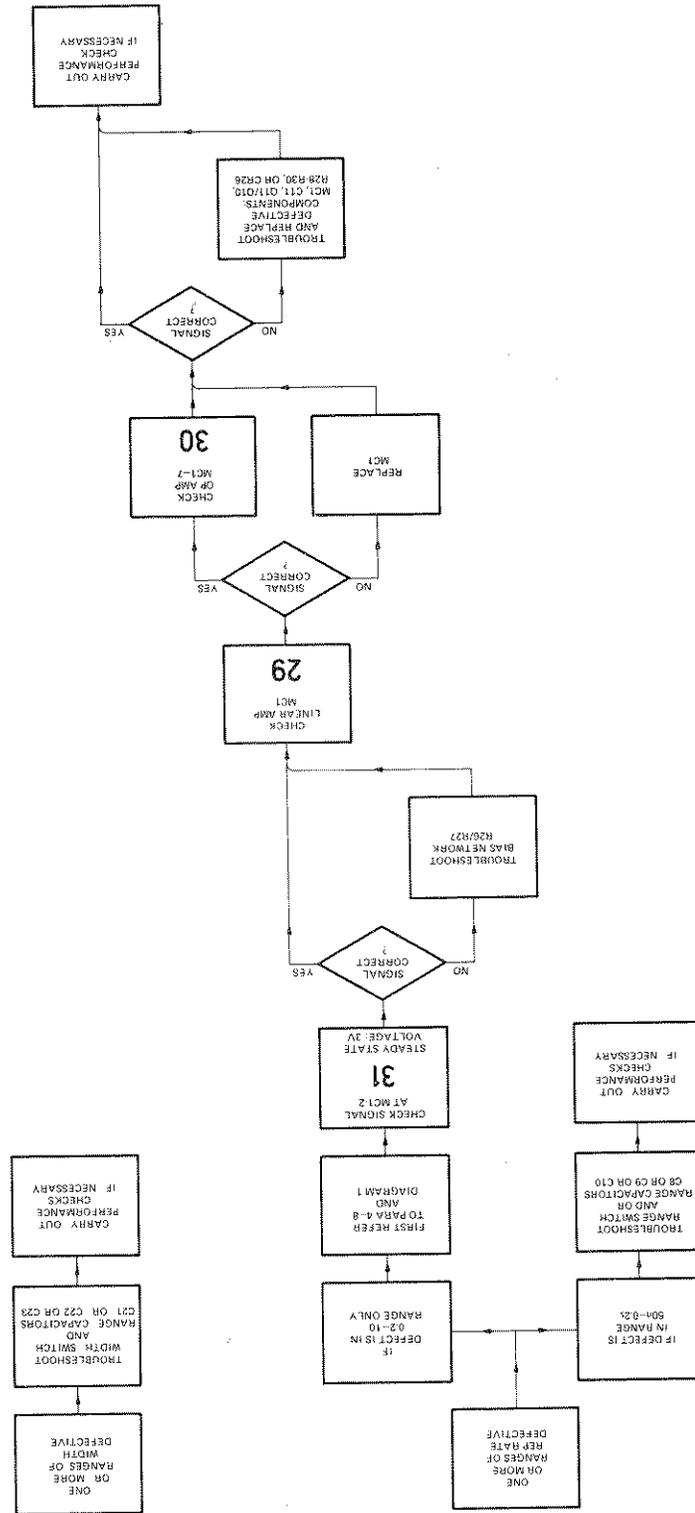


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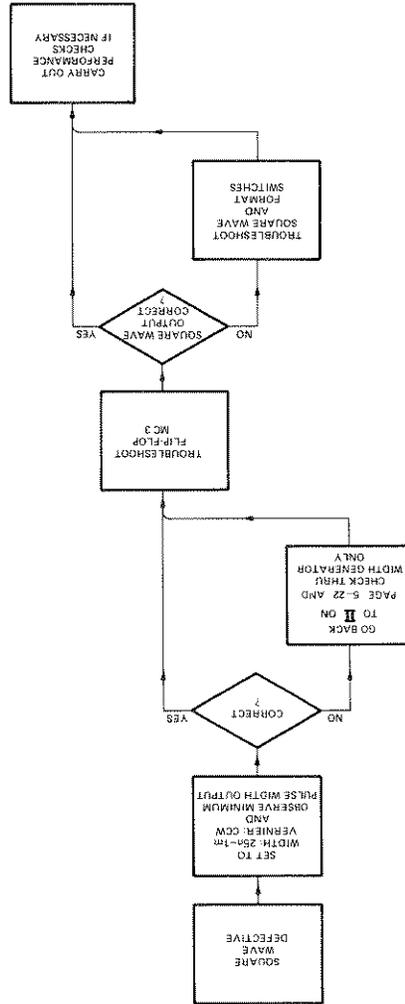


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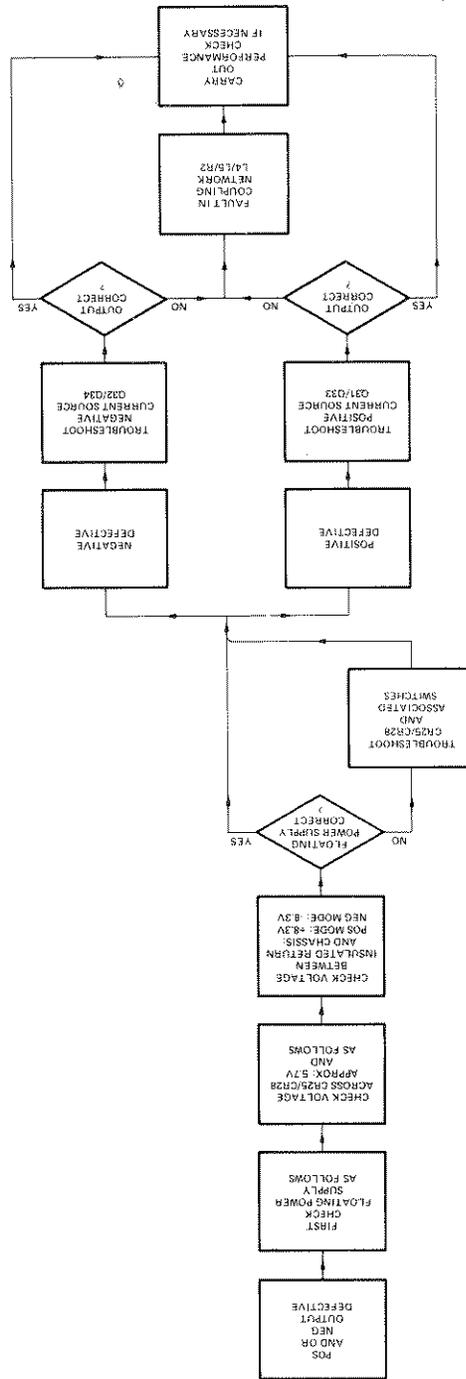


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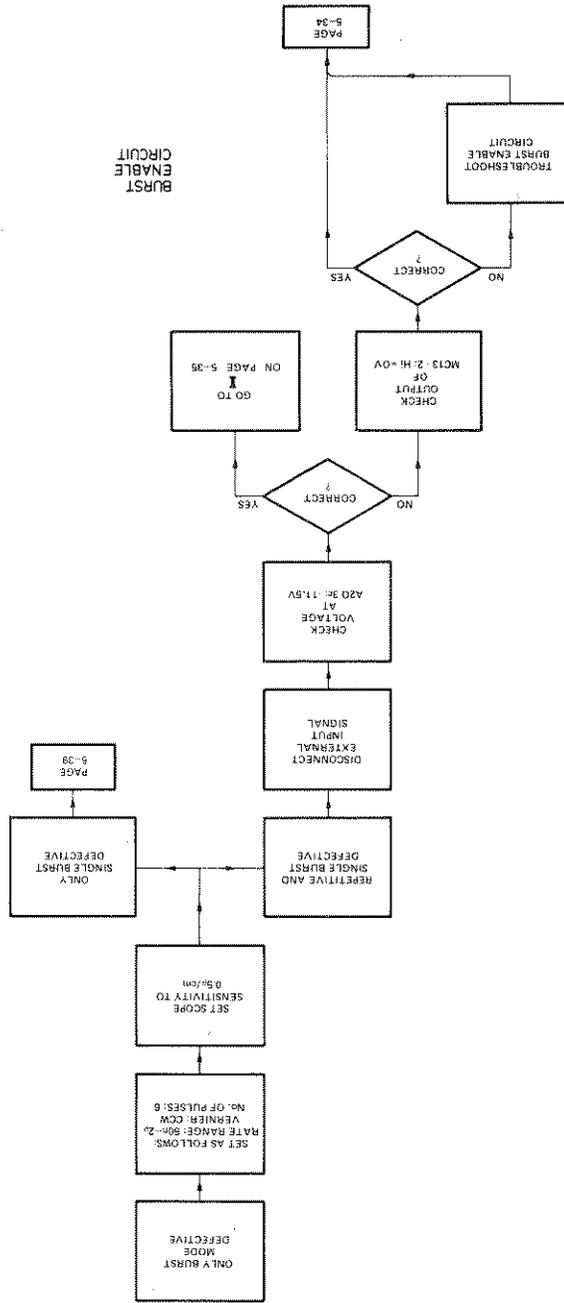


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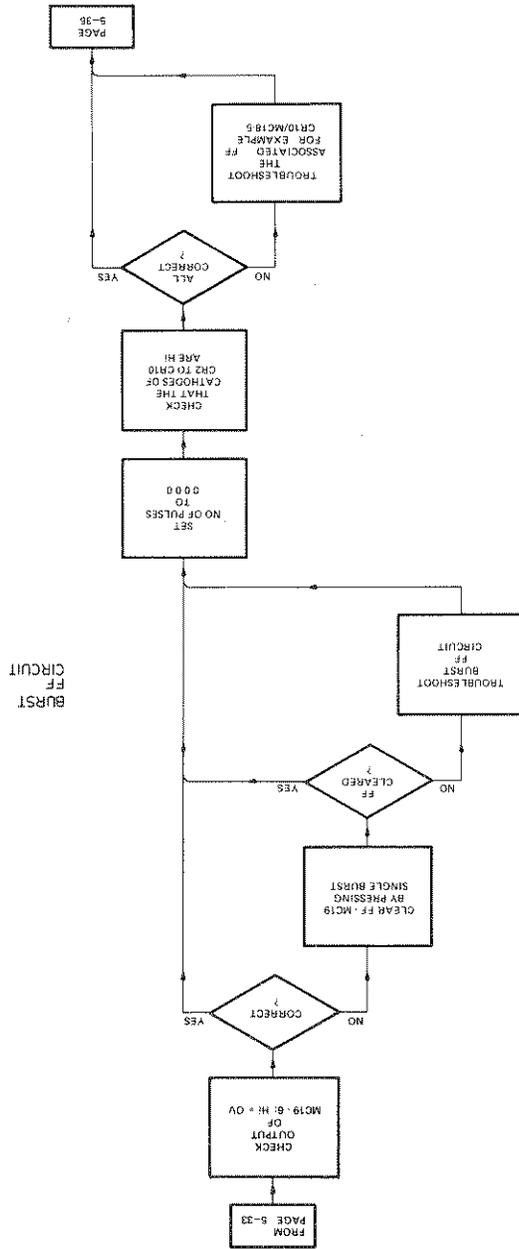


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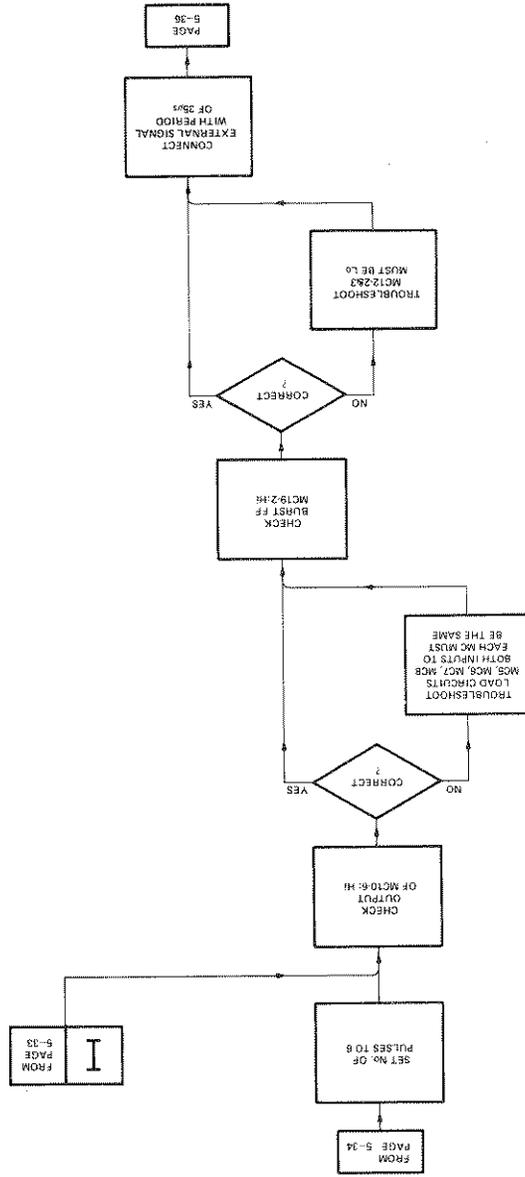


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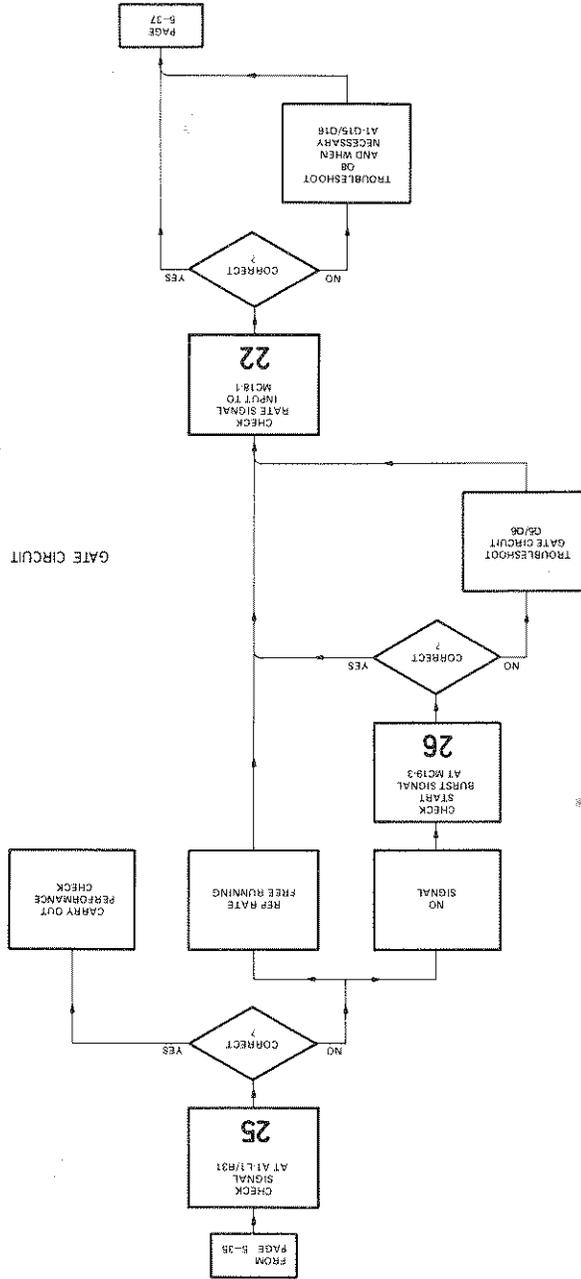


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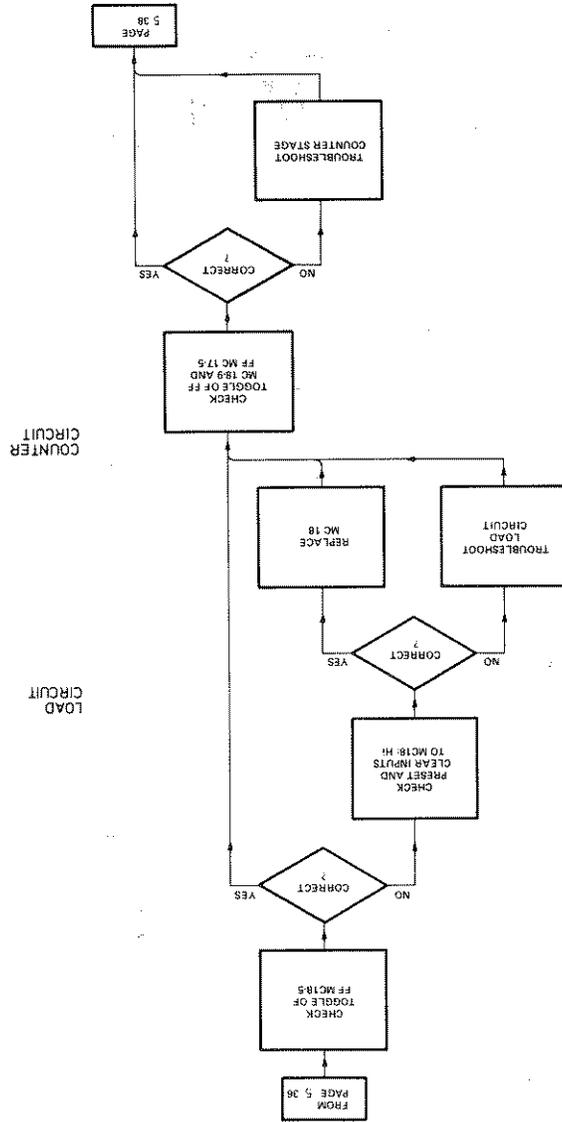


Table 5-20, cont'd



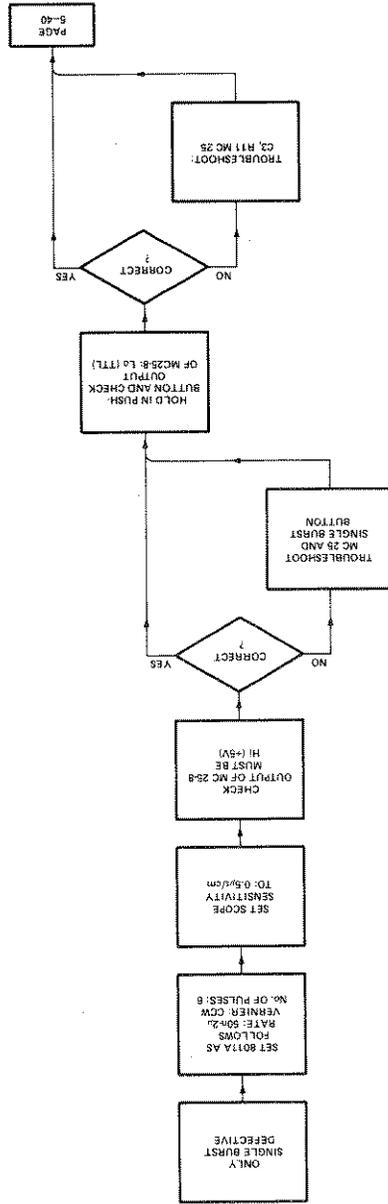


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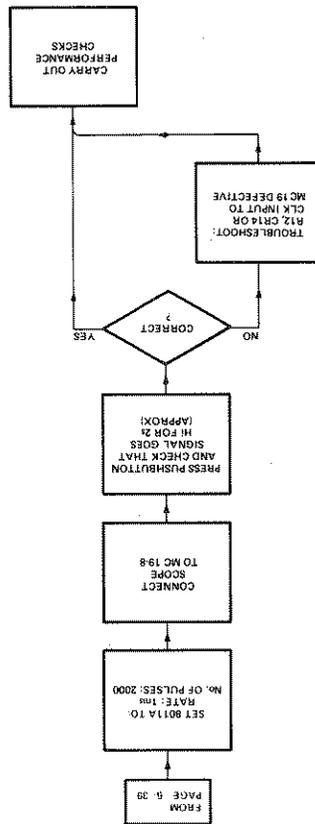


Table 5-20. cont'd

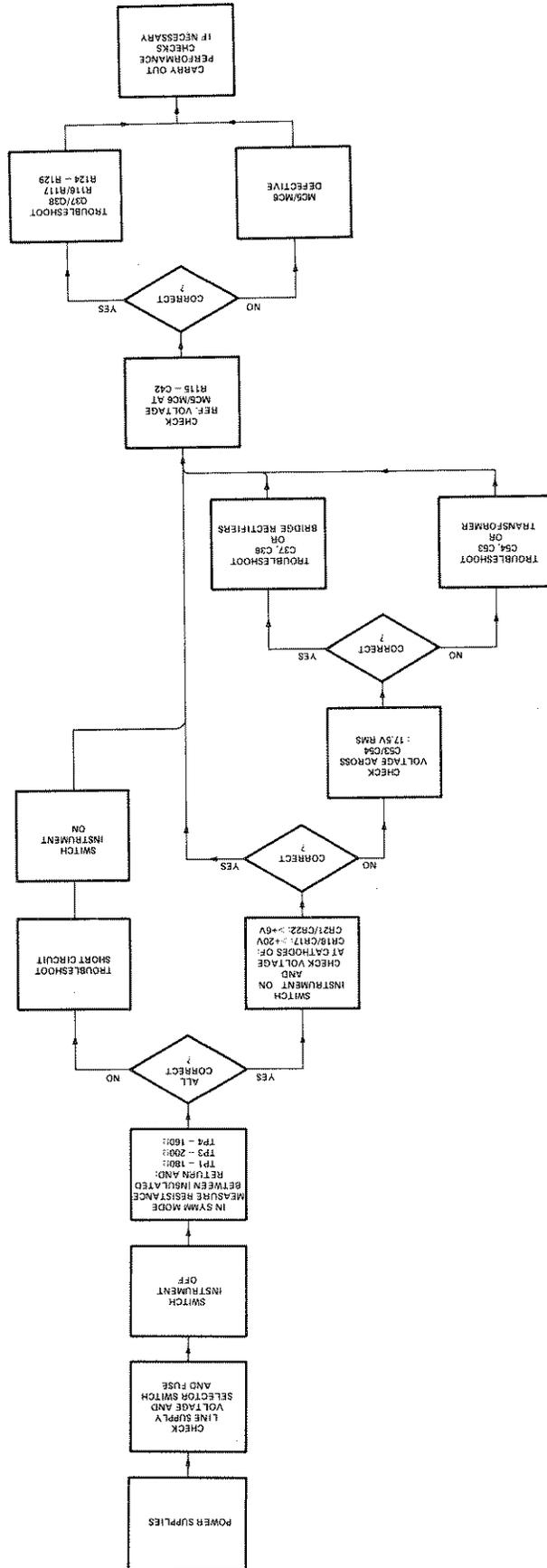


Table 5-20, cont'd.



SECTION VI  
 DIAGRAMS AND REPLACEABLE PARTS

6-1 INTRODUCTION

6-2 This section contains the circuits, component location diagrams and the lists of replaceable parts. Waveforms shown with the circuits are included for guidance only and failure to observe identical results should not be automatically taken as indication of a fault.

6-3 ORDERING INFORMATION

6-4 General

6-5 The replaceable parts tables list parts in alphanumeric order of their reference designators and indicate the description and HP stock number of each part, together with any applicable notes.

6-6 To order a replacement part, address order of enquiry either to your authorized Hewlett-Packard sales representative or to:

CUSTOMER SERVICE  
 Hewlett-Packard Company,  
 333 Logue Avenue,  
 Mountain View, California 94040  
 or, in Western Europe, to:  
 Hewlett-Packard (Schweiz) SA  
 Rue du Bois-du-Lan 7  
 1217 Meyrin 2  
 Geneva

6-7 Specify the following information for each part:  
 a) Model and complete serial number of instrument.  
 b) Hewlett-Packard stock number.  
 c) Circuit reference stock number.  
 d) Description.  
 To order a part not listed, give a complete description of the part and include its function and location.

A = assembly	MC = micro-circuit
B = motor	P = plug
BT = battery	Q = transistor
C = capacitor	R = resistor
CP = coupler	RT = thermistor
CR = diode	S = switch
DL = delay line	T = transformer
DS = lamp	TB = terminal board
F = fuse	V = vacuum, tube, neon
FL = filter	VR = voltage regulator
HR = heater	W = cable
J = jack	X = socket
K = relay	Y = crystal
L = inductor	TP = test point
M = meter	

Table 6-1. Reference Designators

Table 6-2. Diagram Notes

Resistance in ohms, capacitance in microfarads, inductance in microhenries unless other noted	
Part of	P/O
denotes a factory selected value. Values shown are typical.	*
Screwdriver adjustment	
Encloses front panel nomenclature	
Encloses rear panel nomenclature	
Zener diode	
Chassis ground (0 volts)	
Isolated ground	
Wire colour e.g. white, black, brown.	901
Part of push-button switch	
Signal input/output connectors	

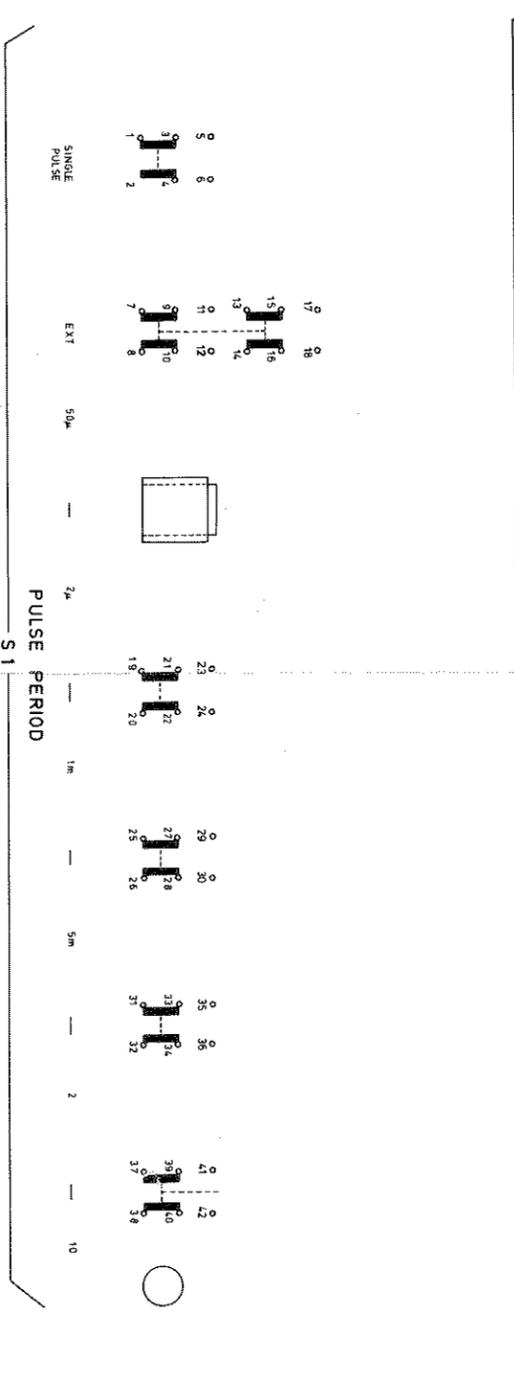
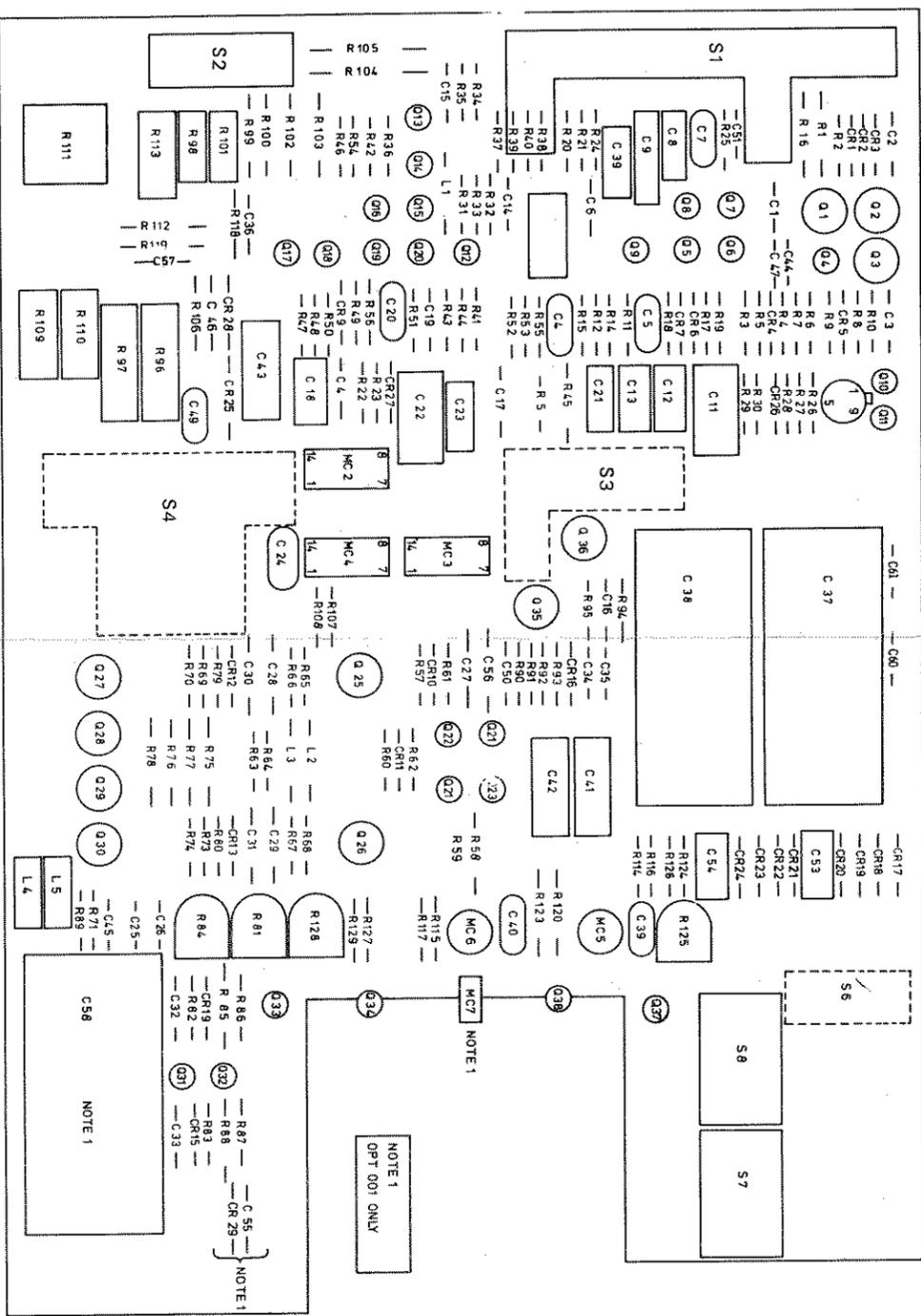
**6-8 CIRCUIT DIAGRAM WAVEFORMS**

6-9 Waveforms shown on the circuit diagrams 1 to 3 were taken with the 8011A set as follows, changes in time base and sensitivity are noted on the waveform concerned:

PULSE PERIOD	50n - .2 $\mu$
VERNIER	Mid-range
PULSE WIDTH	25n - 1 $\mu$
VERNIER	Mid-range
AMPLITUDE	1V - 4V
VERNIER	CW
SYM	ON
COMPL	OFF
BURST	OFF

To obtain waveforms shown on diagram 5 select BURST MODE.

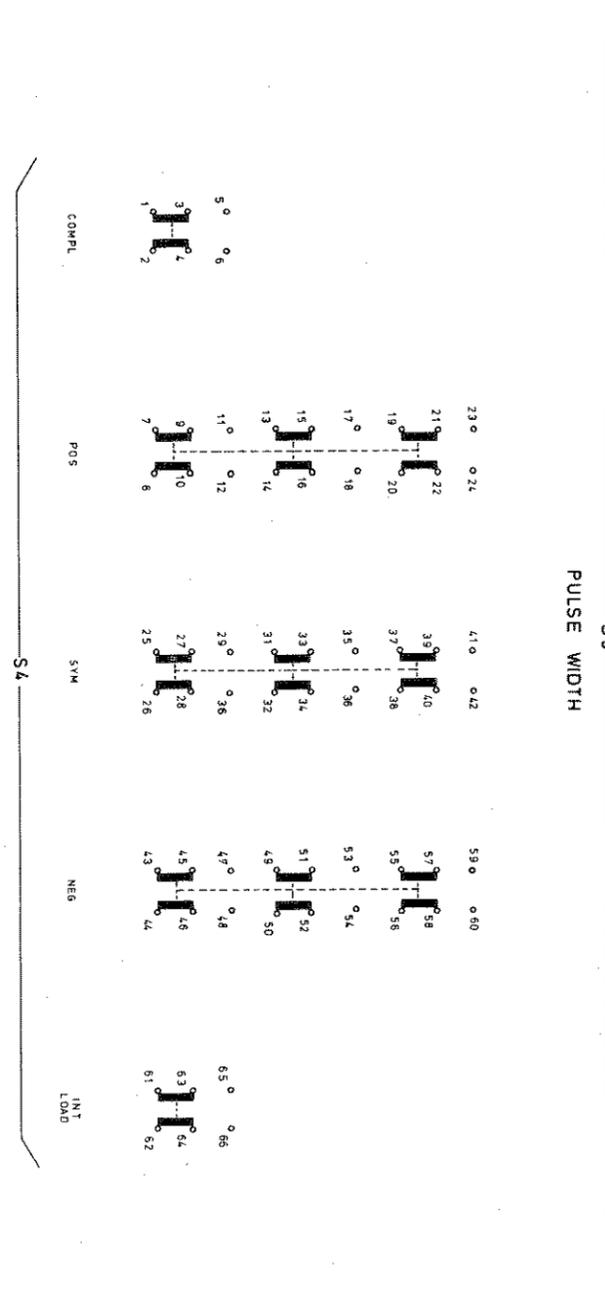
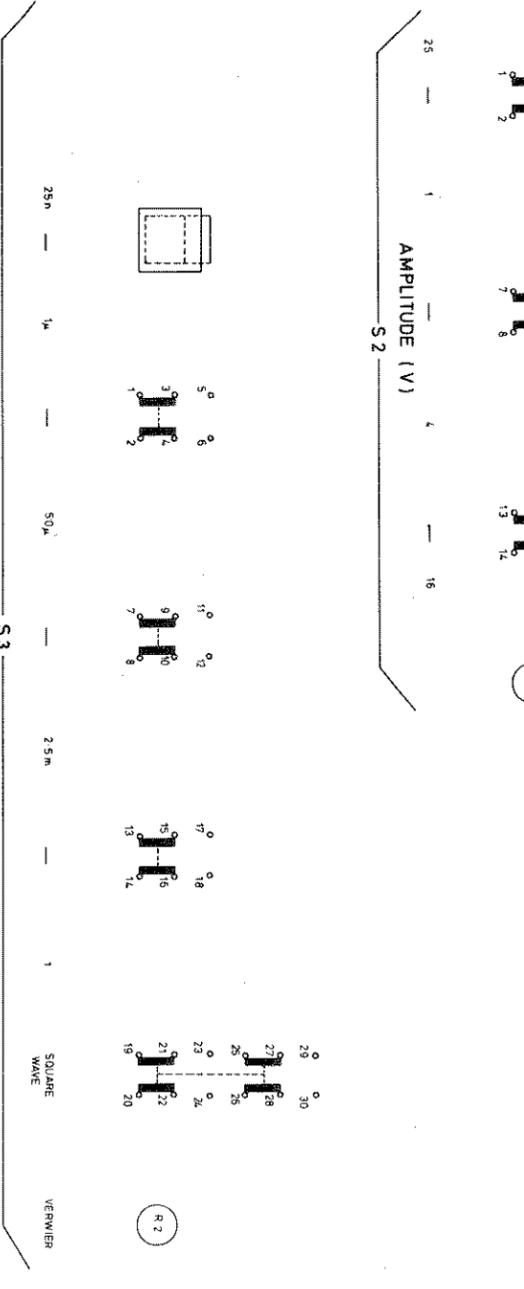
A1



MUTUALLY EXCLUSIVE PUSH-BUTTON SWITCHES

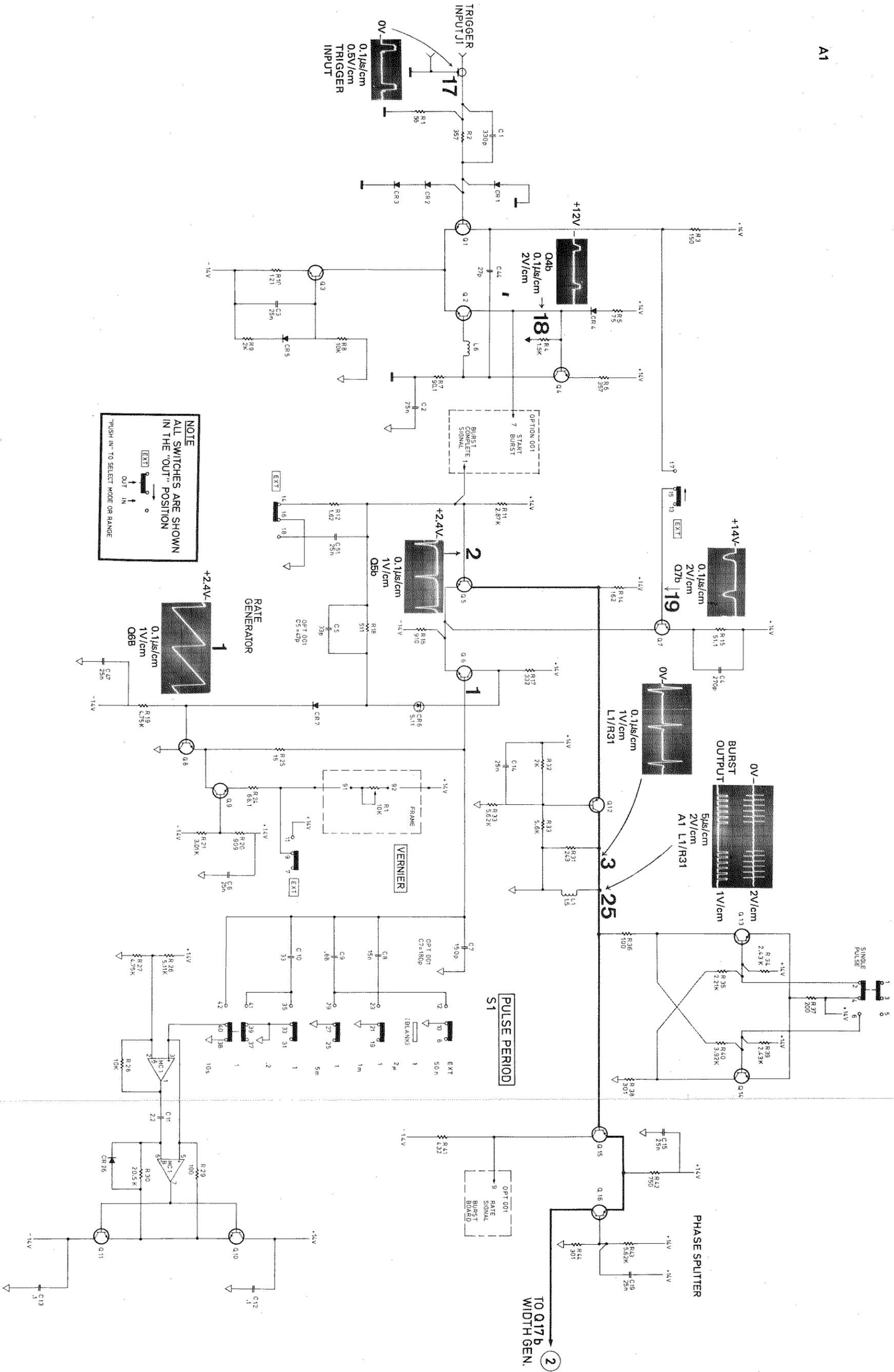
8011A Frame

REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1	2811-66501	RC 4V-PULSE GEN
F1	311C-C16	FUSE .6 FER
F2	211C-544	FUSE .3 FER
F.L1	410C-2121	FILTER LINE 2A
J1	125C-1118	CFM BNC PLK-P2
MP1	C37C-1C05	KNCR-SAMPLE RATE
MP2	437C-1C57	KNCR-PB JADE RATE
MP3	137C-2466	PANEL PRECNT-STC
MP4	0611-CC201	PANEL-FEED
MP5	0611-CC202	PANEL-FEED
MP6	0911-241C1	COVER-SAFETY
MP7	3547-1124	FOOT-DECIM
MP8	1847-1300	STAND-TILT
MP9	2831-20301	FRAME-RECKNT
MP10	1811-0552	FRAME-FEED
MP11	0611-437C1	RCF-OCMER. 5W
MP12	0611-441C1	RCF-OCMER. 5W
MP13	0611-437C2	RCF-4WPL 5W
N1	0911-241C1	COVER-SAFETY
N2	210C-2551	C-VAR 10K .25W
N3	210C-2551	C-VAR 10K .25W
N4	555C-578	3FMS-PCMR





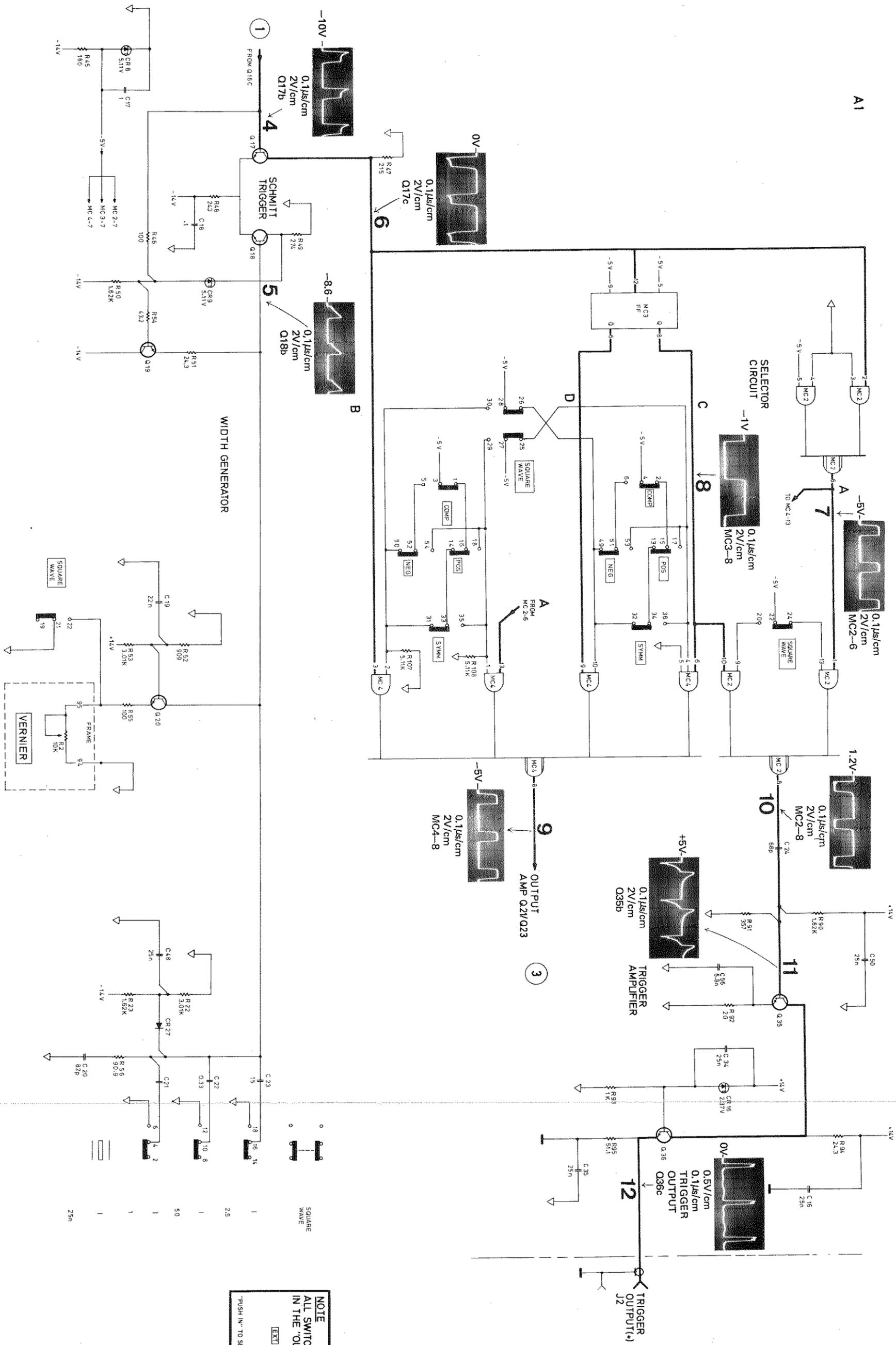




**NOTE**  
ALL SWITCHES ARE SHOWN  
IN THE "OUT" POSITION  
"PUSH IN" TO SELECT MODE OR RANGE

**RATE GENERATOR**





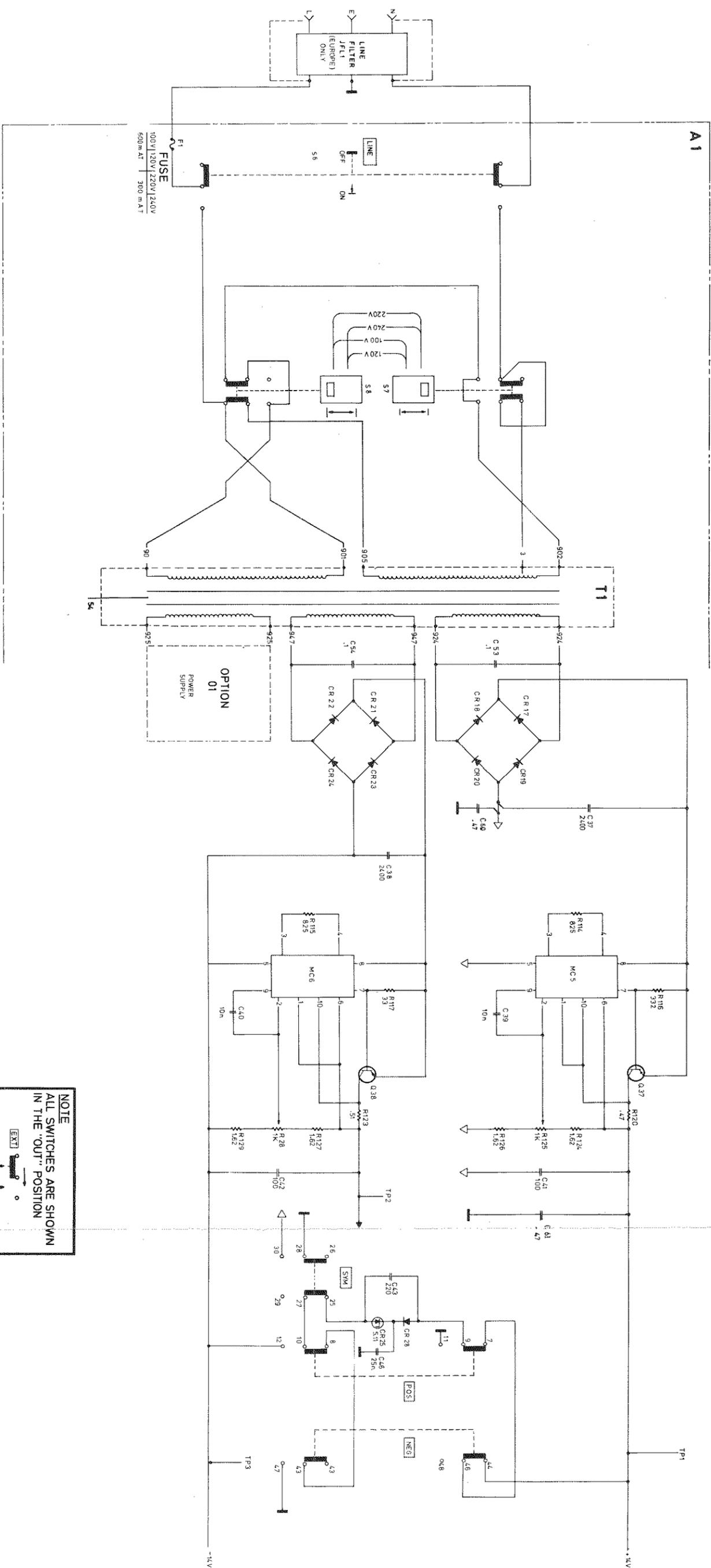
**NOTE**  
 ALL SWITCHES ARE SHOWN  
 IN THE "OUT" POSITION  
 "PUSH IN" TO SELECT MODE OR RANGE

**WIDTH GENERATOR AND  
 SELECTOR CIRCUIT**











NOTE:  
Outputs from the exclusive OR gates MC6 to MC8 are given in the Boolean Algebra Form, e.g. (80 + C80 + 80 · C80) means that the output is "true" when either 80 is present and C80 is not present or when 80 is not present and C80 is present.

