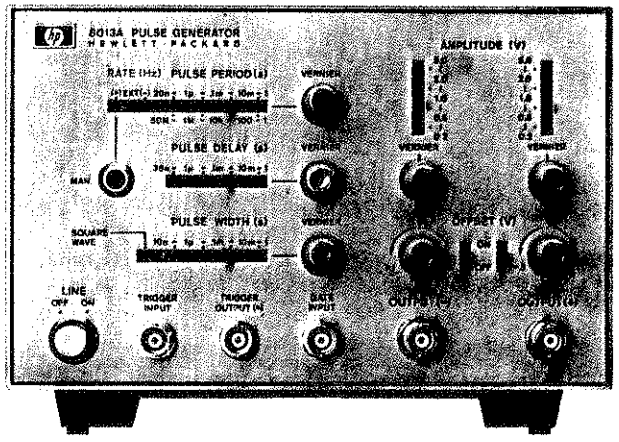
OPERATING AND SERVICE MANUAL

PULSE GENERATOR 8013A



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HP 8013A

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CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards for AC measurements and the Physikalisch Technische Bundesanstalt for DC measurements to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

For any assistance contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

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OPERATING AND SERVICE MANUAL

MODEL 8013A
PULSE GENERATOR

This manual corresponds to
instruments with the serial
prefix: 1121G

703 BÖBLINGEN, HERRENBERGER STR. 110, WEST GERMANY

08013-90001

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Table 1–1 Specifications

PULSE CHARACTERISTICS

(50Ω source and load impedance)

Transition Times: < 3.5 nS fixed

Overshoot and Ringing: < ± 5 % of pulse amplitude

Preshoot: < ± 5 % of pulse amplitude

Pulse Width: < 10 nS to 1 S in four ranges. Vernier provides continuous adjustment within ranges.

Width Jitter: < 0.1 % + 50 pS on any width setting.

Maximum Duty Cycle: > 75 % from 1 Hz to 10 MHz, decreasing to ⩾ 40 % at 50 MHz.

Maximum Output: 5 V across 50 Ω (10 V across open circuit). Output circuit protected, cannot be damaged by shorting (10V across 50Ω, when internal 50Ω load is disconnected).

Attenuator: Four-step attenuator reduces output voltage to 0.5 V. Vernier provides continuous adjustment between steps and reduces output to 0.2V.

Polarity: Dual channel, positive and negative output simultaneously.

Source Impedance: 50 Ω ± 3 % shunted by (typically) 20 pF.

DC Offset: Positive channel: variable from–5 V to + 1 V across 50 Ω load. Negative channel: variable from + 5 V to–1 V across 50 Ω load.
Offset voltage independent of attenuator and amplitude vernier setting, can be switched off. If internal 50 Ω load is disconnected, DC-Offset switches off.

Pulse Delay: < 35 nS to 1 S (with respect to trigger output) in four ranges; vernier provides continuous adjustment within ranges.

Delay Jitter: < 0.1 % + 50 pS on any delay setting.

REPETITION RATE AND TRIGGER

Repetition: 1 Hz to 50 MHz in four ranges. Vernier provides continuous adjustment within ranges.

Period Jitter: < 0.1 % + 50 pS on any repetition rate setting.

Square Wave: 0.5 Hz to 25 MHz in four ranges. Duty cycle 50% ± 5% up to 1MHz, tolerance increases to ± 15% at 25 MHz.

Trigger Output: Amplitude: > + 1 V across 50 Ω.Width: 16 nS ± 10 nS. Suitable for triggering another 8013A.

EXTERNAL OPERATION

External Triggering

Repetition Rate: 0 to 50 MHz. For square wave output, frequency divided by factor 2.

Trigger Input: Sinewaves > 1.5 Vpp (about zero) or pulses >0.8V, (positive or negative) at least 7 nS wide.

Delay: 25 nS ± 8 nS between leading edge of trigger input and trigger output signals.

Maximum Input Amplitude: ± 7V

Input Impedance: 50 Ω ± 10 %

Coupling: DC-Coupled

Manual: Front panel push button for single pulse.

Gating

Synchronous Gating: Gating signal turns generator "on". First trigger output pulse is coincident with leading edge of gate pulse. Last output pulse is always generated with normal width even if gate pulse ends during generation of output pulse.

Gate Input: DC-coupled; voltage at open circuit gate connector approximately + 1.8 V. Shorting current ⩽ 12 mA. Input impedance approximately 160Ω

Gate Input Signal: Voltage > + 1.5V or resistor > 300Ω from gate input to ground enables the repetition rate generator.
Voltage < + 0.8 V or resistor < 160 Ω disables the repetition rate generator. Gate input is TTL compatible.

Maximum Input Signal: ± 5V

External Width and RZ Modes

External Width: Output pulse width determined by the width of drive input signal. Amplitude selectable. Repetition rate generator running provides trigger output but these trigger pulses are not related to the pulses at the output connector.

RZ Mode: External drive input switched to delay generator. Pulse period determined by pulse period of drive

Table 1–1 Specifications (cont.)

input signal. Delay, width and amplitude are selectable.

Input Signal: Input Impedance 50Ω, DC-coupled. Signal > +1V, at least 7 nS wide, provides output signal.

Maximum Input Signal: ± 5V

Repetition rate generator running provides trigger output but these trigger pulses are not related to the pulses at the output connector.

GENERAL

Operating Temperature Range: 0^{o}C to + 55^{o}C

Power Requirements: 115 or 230 V + 10%, −15%, 48 to 440 Hz, 70 VA maximum.

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

Dimensions: 7.9 in. wide, 5.6 in. high, 13 in. deep. (200 x 142 x 330 mm)

SECTION I
GENERAL INFORMATION

1–1 INTRODUCTION

1–2 The Hewlett-Packard Model 8013A Pulse Generator is a dual channel, multi-purpose pulse source with variable repetition rate (PULSE PERIOD controls), pulse delay and pulse width. The dual outputs, OUTPUT (+) and OUTPUT (-), are usually developed across a 50 ohm external impedance and have independent amplitude controls. In addition, symmetrical pulse outputs, either as single pulses or pulse trains (in which the positive and negative limits of the respective pulse amplitude are an equal amount above an below ground potential), or a compliment of each pulse, can be obtained by introducing a suitable dc bias (OFFSET controls).

1–3 Three modes of operation are possible as follows:

a) Normal Mode: In this mode the 8013A repetition rate generator determines the pulse period. The generator may be triggered internally, externally, or manually; it may also be gated. Trigger pulses are available for synchronising external circuits; the delay time between the trigger and the output pulses may be varied as required.

b) RZ Mode: In this mode the external pulses determine only the repetition rate of the output pulses. All other output pulse parameters are determined by the settings of the pulse generator's front panel controls. Pulses produced by the repetition rate generator bear no time relationship to the output pulse train but can be used as an independent trigger for other equipment, if desired. It is not possible to gate the output pulses or to obtain square waves.

c) External Width Mode: Pulses applied to an input socket on the rear panel determine the width and repetition rate of the output pulses. Pulses produced by the repetition rate generator bear no time relationship to them, but can be used as an independent trigger for other equipment, if desired. Note that it is not possible to gate the output pulses and that square wave pulse forms are not available in this mode.

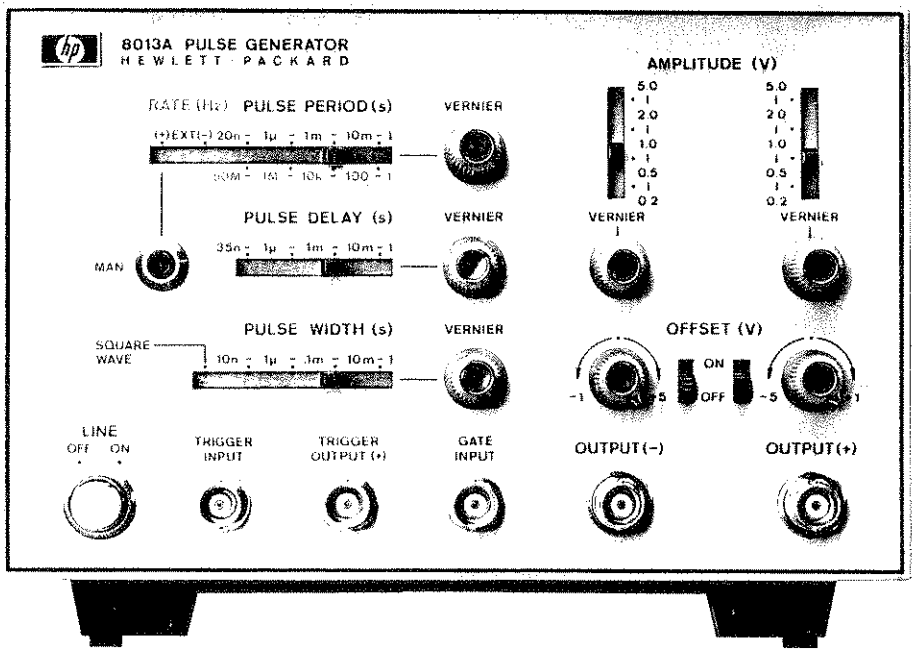


Figure 1–1 HP Model 8013A Pulse Generator

1–4 ACCESSORIES AVAILABLE

1–5 Electronic test equipment, cables, connectors, adaptors, and other accessory items are available from Hewlett-Packard. For more information on specific items consult the Hewlett-Packard Catalog or Sales/Service Office.

1–6 MANUAL IDENTIFICATION

1–7 This instrument carries a 10-character serial number on the rear panel, the first 5 characters of which are termed the serial number prefix. If the prefix does not agree with that quoted on the title page, reference should be made to the change sheets supplied with the manual. To obtain further information for any instrument, contact the nearest Hewlett-Packard Sales/Service Office, always specify the model number and complete serial number.

1–8 ORDERING ADDITIONAL MANUALS

1–9 One manual is shipped with each pulse generator. Additional manuals may be purchased from the local Hewlett-Packard field office (see list at rear of this manual for addresses). Specify the model number, complete serial number prefix, and HP stock number provided on the title page.

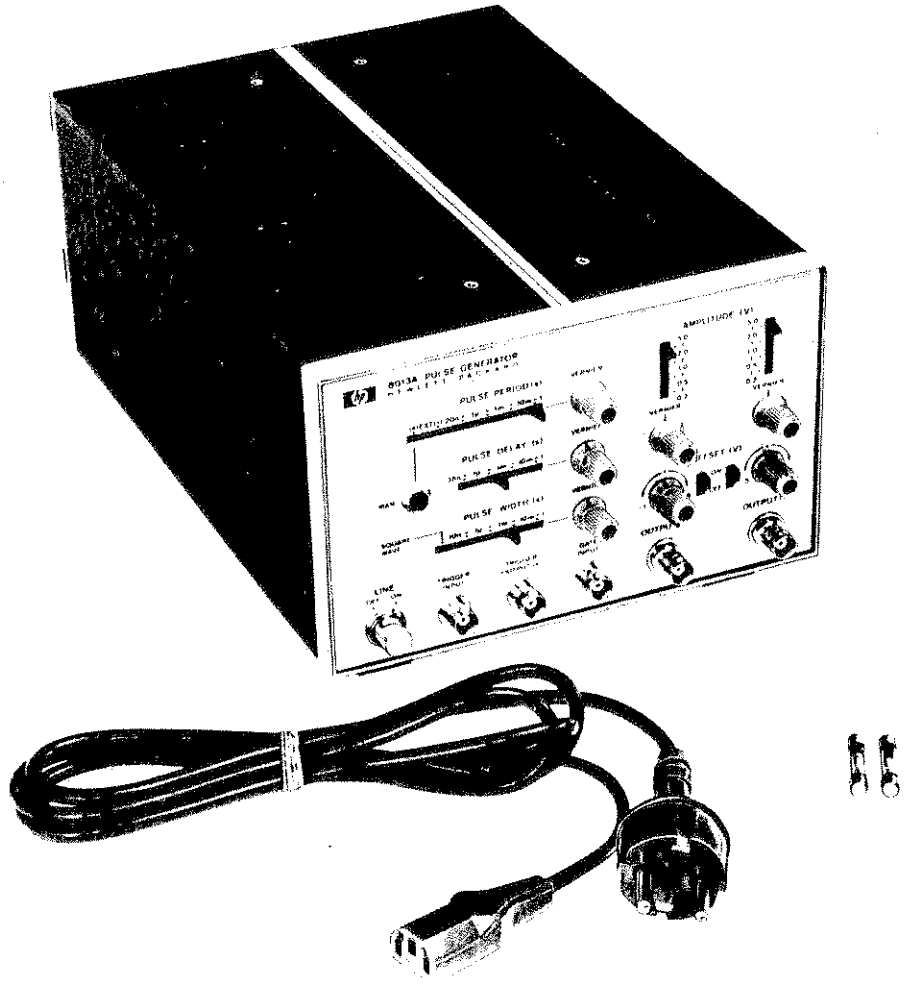


Figure 2–1 Pulse Generator and Supplied Accessories

SECTION II
INSTALLATION

2–1 INITIAL INSPECTION

2–2 Inspect the instrument for physical damage and check its operation as soon as possible after delivery. Section IV contains performance check procedures which will verify instrument operation within the published specifications. This check is suitable for incoming quality control inspection. If physical damage is evident, or the instrument does not meet specifications when received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office (see list at rear of this manual). The Sales/Service Office will arrange for repair or replacement without waiting for settlement of a claim with the carrier. The certification and warranty statement for all HP instruments are on the inside cover of this manual.

2–3 The instrument is delivered complete with the following items:

	HP Stock Numbers
Power Cord	8120–1492
Fuse, 0. 5 A for 230 V operation	2110–0202
Fuse, 1 A for 115 V operation	2110–0007

2–4 PREPARATION FOR USE

2–5 Power Source Requirements

2–6 The Model 8013A may be operated from an ac source of 115 or 230 volts + 10%, - 15%, at 48 to 440 Hz. Power dissipation is approximately 60 VA. Carry out the following procedure if it is required to change the operating voltage:

a) Disconnect the power cable from the instrument.

b) Slide the safety window to the left.

c) Remove the fuse by pulling the lever marked FUSE PULL; this also releases the voltage selector switch.

d) Slide the voltage selector switch to the position required (i. e. 115 V or 230 V).

e) Push the lever back into position and place the appropriate fuse in the fuse holder.

f) Slide the safety window to the right and insert the power cable.

CAUTION

Ensure that the number visible on the slide switch and the fuse value correspond to the line voltage used before switching the instrument ON; otherwise, the instrument may be damaged.

2–7 Power Cable

2–8 The Hewlett-Packard Model 8013A is equipped with a 3-wire power cable, which, when connected to an appropriate receptacle, grounds the instrument, cabinet and panels. To preserve this protection feature when operating the instrument from another type of outlet without ground, use an appropriate adapter and connect the ground lead to an external ground.

2–9 Temperature Requirements

2–10 The Hewlett-Packard Model 8013A uses solid-state components and requires no special cooling. The instrument operates within specifications when the ambient temperature is between $0^{\circ}C$ ($32^{\circ}F$) and $55^{\circ}C$ ($131^{\circ}F$). The pulse generator may be stored at temperatures between $-40^{\circ}C$ ($-40^{\circ}F$) and $75^{\circ}C$ ($167^{\circ}F$).

2–11 Repacking

2–12 The original shipping carton and packing material can be used for reshipment. The Hewlett-Packard Sales/Service Office will also provide information and recommendations on materials to be used if the original packing material is not available or is damaged. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office for repair, attach a tag showing owner, model, serial number, and repairs required.

SECTION III
OPERATING INSTRUCTIONS

3–1 INTRODUCTION

3–2 The operating instructions commence with a procedure to display a simple pulse train on an oscilloscope. This is followed by detailed instructions for the use of each control in the three different modes of operation and stylized waveforms are presented to make their effects clear. For ease of operation the following instructions will refer to Figure 5–1 which shows the controls identified by a reference number that also appears in the text in **bold** type. The control functions are indicated on the block diagram (Figure 5–2).

3–3 BASIC OPERATING GUIDE

3–4 The initial settings (Table 3–1) are given to obtain a 'normal' pulse waveform (Figure 3–1) for someone unfamiliar with the operation of the Model 8013A. One, or both, of the pulse output connectors – OUTPUT (+) **21** or OUTPUT (–) **20** – should be connected to a high-frequency oscilloscope via a 50 ohm coaxial cable. The oscilloscope should be terminated by a 50 ohm load and set with sweep time at 2 us/cm and with sensitivity at 1V/cm.

LINE **16**	ON
PULSE PERIOD **1**	1u – .1m
VERNIER **2**	Mid-range
PULSE DELAY **6**	35n – 1u
VERNIER **7**	CCW
PULSE WIDTH **10**	1u – .1m
VERNIER **11**	CCW
Mode Selector **22**	NORM
AMPLITUDE **3**	5.0 – 2.0
AMPLITUDE **4**	5.0 – 2.0
VERNIER **8**	CW
VERNIER **9**	CW
OFFSET **13**	OFF
OFFSET **14**	OFF

Table 3–1. 8013A Initial Settings

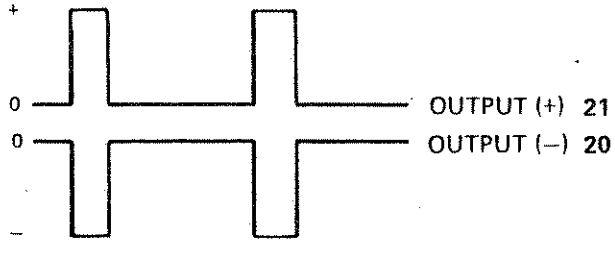


Figure 3–1. The 'normal' pulse

3–5 NORMAL MODE

3–6 There are five ways of operating the pulse generator in the normal mode:

a) Where the pulse period is determined internally.

b) As above, but with the repetition rate generator triggered externally.

c) Manual trigger

d) In each of the above, square wave output may be selected instead of the variable pulse width.
Note that the square wave output is available only in the normal mode of operation.

e) The repetition rate generator may also be gated (except in square wave mode).

All output pulses are preceded by a trigger pulse at the TRIGGER OUTPUT socket **18**. The delay is fixed at approximately 35 nS for square waves but may otherwise be varied by the PULSE DELAY switch **6** and the VERNIER **7**.

3–7 Internal Trigger

3–8 Use the following procedure to obtain pulse outputs similar to those shown in Figure 3–2.

a) Set the Mode Selector **22** to NORM.

b) Set the PULSE PERIOD switch **1** to the required range and adjust VERNIER **2** to obtain the exact pulse period.

c) Set the PULSE DELAY switch **6** to the required range and adjust VERNIER **7** until the required delay between the trigger and the output pulse is obtained. Note that the pulse delay and pulse width time must always be less than 75 % of the pulse period.

d) Set the PULSE WIDTH switch **10** to the required range and adjust VERNIER **11** to obtain the exact pulse width.

e) Set the AMPLITUDE switches **3** and **4** to the required ranges and adjust VERNIER **8** and **9** to obtain the exact amplitude.

f) If required, switch the OFFSET switches **13** and **14** to ON and adjust VERNIER **12** and **15** to the desired dc offset level.

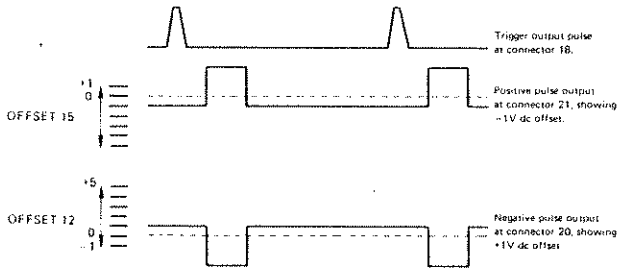


Figure 3–2. Examples of internally triggered waveforms.

3–9 External Trigger

3–10 Use the following procedure to obtain an output similar to that shown in Figure 3–3

a) Set the Mode Selector **22** to NORM

b) Apply suitable trigger pulses to the TRIGGER INPUT socket **17**.

c) Set the PULSE PERIOD switch **1** to EXT + for positive, or to EXT – for negative, input pulses.

d) Set the delay between the Trigger and output pulses as required (refer to paragraph 3–8).

e) Set the pulse width, amplitude and offset as required (refer to paragraph 3–8).

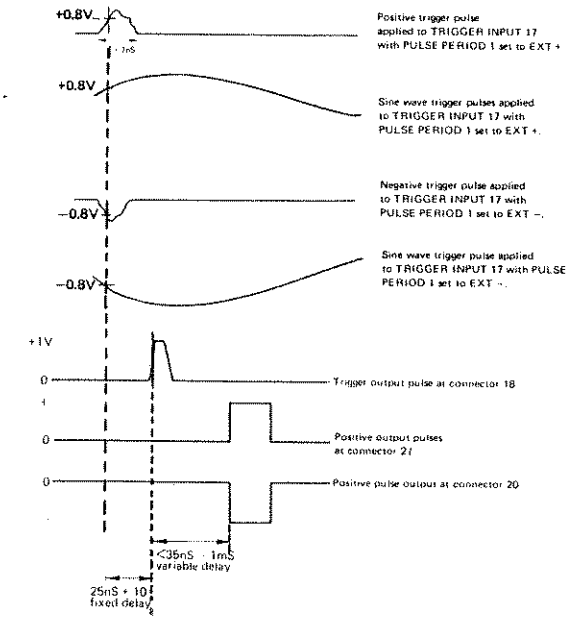


Figure 3–3. Examples of externally triggered waveforms.

3–11 Manual

3–12 Use the following procedure to obtain an output similar to that shown in Figure 3–4.

a) Set the Mode Selector **22** to NORM.

b) Set the PULSE PERIOD switch **1** to either EXT + or EXT –.

c) Set the delay between the trigger and the output pulse as described in paragraph 3–8.

d) Set the pulse width, amplitude and offset as required (refer to paragraph 3–8).

e) Press the MAN button **5** once for each output pulse required.

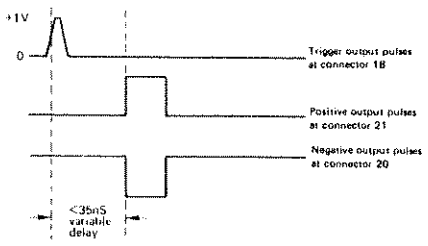


Figure 3–4. Output waveforms for manual operation.

3–13 Square Wave

3–14 Use the following procedure to obtain an output similar to that shown in Figure 3–5.

a) Set the Mode Selector **22** to NORM.

b) Set the PULSE PERIOD switch **1** to an internal range as described in paragraph 3–8 or set EXT as described in paragraph 3–9 and apply external trigger pulses in order to set the repetition rate of the output pulses.

c) Set the PULSE WIDTH switch **10** to SQUARE WAVE.

d) Set the amplitude and offset as required (refer to paragraph 3–8).

Note that, the square wave output cannot be gated.

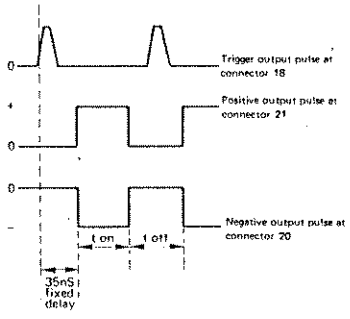


Figure 3–5. Examples of square wave output pulses.

3–15 Gating

3–16 The trigger and output pulses obtained in the normal mode may be gated (except in square wave mode) by applying a suitable gate pulse to the GATE INPUT socket **19**. In the gated operation only the repetition rate generator is affected and, therefore, all output pulse parameters are controlled in the same manner as for internal trigger as described in paragraph 3–8. Figure 3–6 illustrates samples of output obtainable when the pulse generator is gated by an external signal.

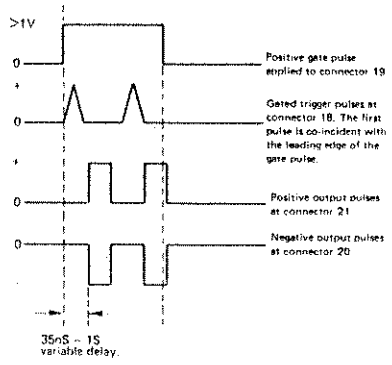


Figure 3–6. Examples of gated output waveforms.

3–17 RZ MODE

3–18 External pulses applied to the INPUT socket **23** (rear panel) trigger the delay generator directly and thus the shape of the output pulses is determined by the delay generator and the pulse-forming circuits that follow. The pulse output in this mode cannot be gated. Note that, although the repetition rate generator is on, it does not drive the pulse generator in this mode; thus, an internally generated trigger (independent of the OUTPUT at connectors **20** and **21**) is available at the TRIGGER OUTPUT connector **18**. To avoid interference between the internal repetition rate and the external signals when the TRIGGER OUTPUT **18** is not required, it is advisable to set the PULSE PERIOD switch **1** to EXT +. Square wave output is not available in the mode.

Use the following procedure to obtain an output similar to that shown in Figure 3–7.

a) Set the Mode Selector **22** to RZ.

b) Set the PULSE DELAY switch **6** to the desired range and adjust VERNIER **7**. The output pulses will be delayed with respect to the external signal.

c) Set the PULSE WIDTH switch **10** to the required range and adjust VERNIER **11** for exact pulse width.

d) Set the amplitude and offset as required (refer to paragraph 3–7).

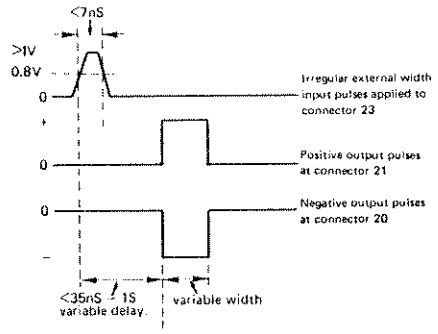


Figure 3–7. Examples of RZ Mode waveforms.

3–19 EXTERNAL WIDTH MODE

3–20 In this mode the output pulse width and pulse period is determined by the width of the input signal and the output pulses cannot be gated. Note that, although the repetition rate generator is on, it does not drive the pulse generator in this mode; thus, an internally generated trigger (independent of the OUTPUTS at connectors **20** and **21** is available at the TRIGGER OUTPUT connector **18**. To avoid interference between the internal repetition rate and the external signals when the TRIGGER OUTPUT **18** is not required, it is advisable to set the PULSE PERIOD switch **1** to EXT +. Square wave output is not available in this mode.

Use the following procedure to obtain an output similar to that shown in Figure 3–8.

a) Set the Mode Selector **22** to EXT WIDTH.

b) Set the amplitude and offset as required (refer to paragraph 3–7).

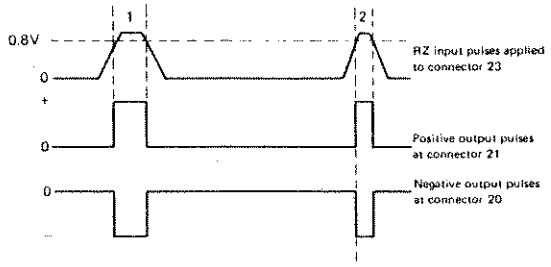


Figure 3–8. Comparison of input and output pulse widths.

SECTION IV
MAINTENANCE

4—1 INTRODUCTION

4—2 The following information is presented in this section:

a) Testing, troubleshooting and adjustment

b) Removal and replacement of cover and assemblies.

4—3 TESTING, TROUBLESHOOTING AND ADJUSTMENT

4—4 The tests have been arranged into three groups (preliminary checks, performances tests, and internal checks and adjustments) so that:

a) The instrument covers need not be removed unless repair or adjustment is required.

b. An indication of the general serviceability of the pulse generator is obtained at an early stage by the preliminary checks. In this way the bulk of troubleshooting and repair may be done before the performance tests are commenced.

A possible way in which testing and troubleshooting may be organised will now be described; a flow-charted procedure is used which will locate faults to an assembly and sometimes to a circuit within an assembly. Troubleshooting down to component level (once the faulty assembly or circuit is identified) will depend on standard techniques using the appropriate circuit diagram.

4—5 Organisation (Figure 4—1)

4—6 The instrument is prepared for use and the switching procedure completed. The preliminary checks (Tables 4—2 to 4—8) are then performed and, if these are satisfactory, the performance tests (Tables 4—9 to 4—23) are carried out. Satisfactory completion of the performance tests will establish that the instrument reaches the specification. Execute a table in the order in which it is written. Note that, only the tests for OUTPUT **21** are described; when it is necessary to check the OUTPUT **20** (as indicated by a broken-line connection), repeat the table–substituting the appropriate controls where different from those used for OUTPUT **20**.

4—7 If the preliminary checks are not satisfactory, the troubleshooting charts in Figures 5—4 to 5—9 should be performed. At this point it is recommended that the internal checks and adjustments (Tables 4—24 to 4—27) be performed before attempting to repair the fault as diagnosed by means of the flowcharts — in this way, the possibilities of failure due to the power supply, the timing or output circuits are eliminated.

4—8 When the internal checks and adjustments, and any repairs deemed necessary while the troubleshooting procedure was carried out, have been satisfactorily completed, procede with the performance test.

4—9 Test Equipment

4—10 A list of the test equipment and accessories required appears in Table 4—1.

4—11 Troubleshooting Charts.

4—12 The waveforms shown on the troubleshooting charts are those which should be obtained with the given control settings and these should be compared with those actually obtained. All the waveforms are shown on the Normal Mode flowchart but only the waveforms which differ from the normal are shown on the subsequent flowcharts.

4—13 REMOVAL AND REPLACEMENT OF COVERS AND ASSEMBLIES

4—14 Access to Test Points and Assemblies

4—15 To gain access to all test points and assemblies remove the top and bottom covers after first removing their fastening screws.

4—16 Removal of Assemblies (Figure 5—3)

4—17 Assembly 1 is removed as follows:

a. Disconnect coaxial cable and wire (0—4).
b. Remove three securing screws.
c. Unplug from connector XA1 on A3.

Assembly 2 is removed as follows:

a. Disconnect wire (0—4).

b. Remove three securing screws
c. Unplug from connector XA2 on A3.

Assembly 3 is removed as follows:

a. Remove assemblies 1 and 2.
b. Remove all cables and wires.
c. Push on A3 until front panel moves out of frame.
d. Remove six securing screws.

Assembly 4 is removed as follows:

a. Remove four securing screws (at rear panel).
b. Disconnect all wires.

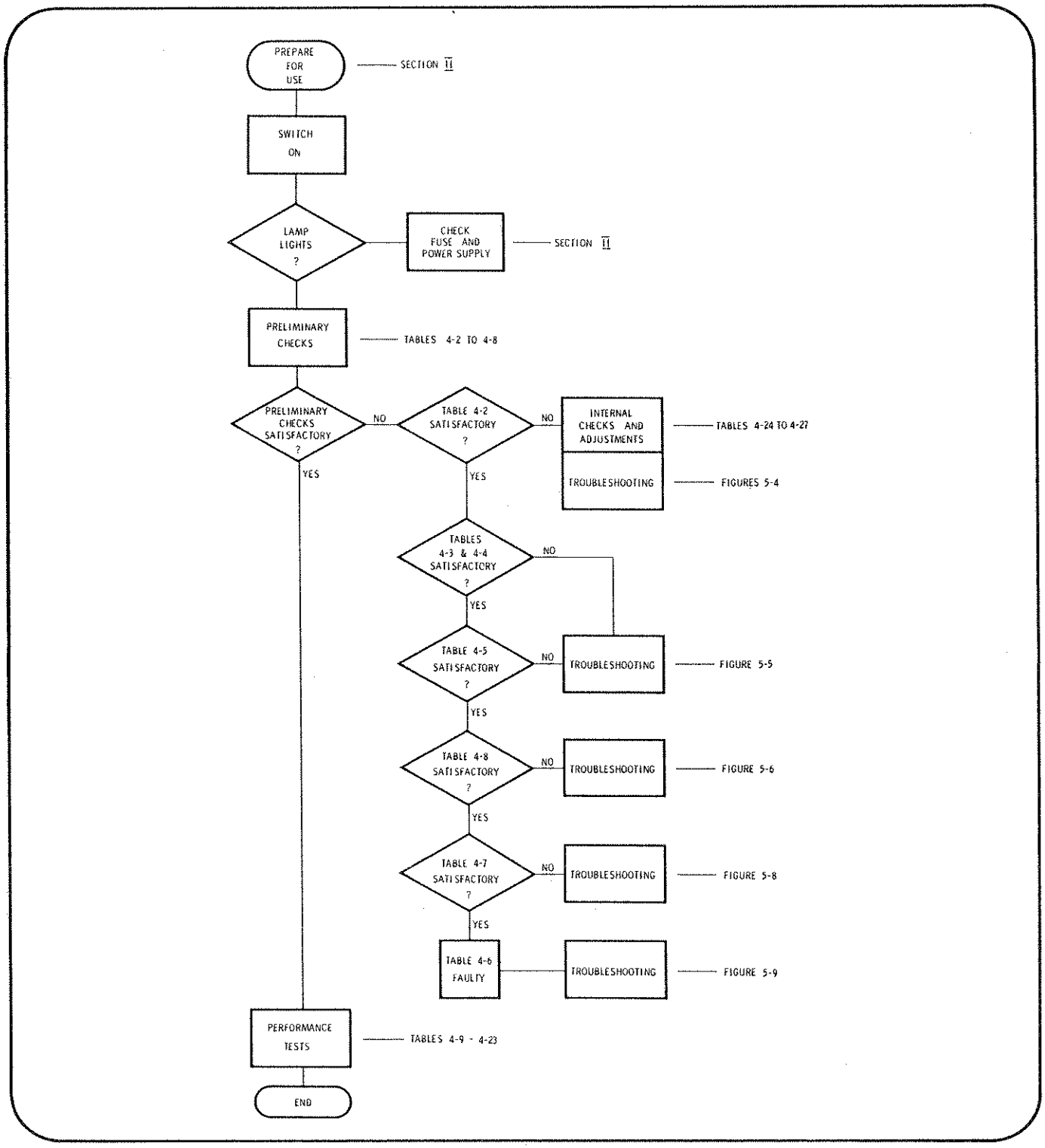


Figure 4-1 Organization of Tests and Troubleshooting

Table 4—1. Test Equipment and Accessories

INSTRUMENT	BRIEF SPECIFICATION	RECOMMENDED MODEL
Counter	Frequency range 0 — 50 MHz	HP 5245L
Oscilloscope	Dual-channel, 50 MHz bandwidth	HP 180A with plug-ins 1801A, 1821A
Digital Voltmeter	10V dc range to 4 significant figures. Accuracy ± 0.05 % ± 1 digit.	HP 3440A with plug-in 3444A.
Sampling Oscilloscope	Dual-channel, 1 GHz bandwidth	HP 140A with plug-ins 1410A, 1424A
AC Voltmeter	Sensitivity 100uV to 300V rms.	HP 403B
Voltmeter Ammeter Ohmmeter	1mV to 1000V FSD. ± 1 % of FSD. 1uA to 1A FSD. ± 2 % of FSD. 1ohm to 100 Mohm ± 5 % at center scale	HP 412A
Test Oscillator	Frequency range 10 Hz — 10 MHz	HP 651A
Test Oscillator	Frequency range 10 to 500 MHz	HP3200B
Pulse Generator	Frequency range 100 MHz with variable rise and falltime capability.	HP 8007A

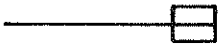
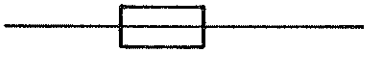
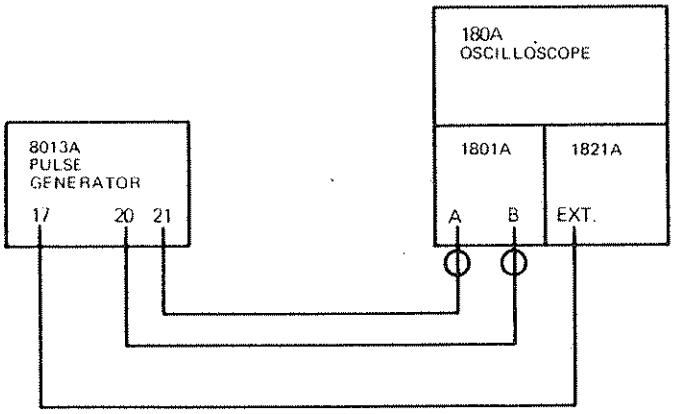
ACCESSORIES	SYMBOLS USED IN THIS SECTION	RECOMMENDED MODEL
50 cable assembly with male BNC connectors (6 required).		HP 10120A
50 Termination, type GR (2 required)		GR 874 — W50B
10:1 Divider Probe		HP 10214A
50 Tee Connector (2 required) 10:1 Voltage Divider Probe 50 Feed-through termination		HP 10221A HP 10004B HP 11048B UG—274/u 74868
Cable Assembly (2 required) Pulse Adder 20 dB Attenuator, 50 (2 required)		HP 1100A HP 15104A HP 8491A

Table 4–2. Preliminary Check: Internal Operation.

TEST SET-UP



STEP	INSTRUCTIONS	RESULTS
1	Set the 8013A controls as follows:	
	PULSE PERIOD **1** — 1u – .1m	
	VERNIER **2** — CW	
	PULSE DELAY **6** — 1u – .1m	
	VERNIER **7** — CCW	
	PULSE WIDTH **10** — 1u – .1m	
	VERNIER **11** — Mid-range	
	AMPLITUDE **3** — 5.0 – 2.0	
	VERNIER **8** — CW	
	AMPLITUDE **4** — 5.0 – 2.0	
	VERNIER **9** — CW	
	OFFSET **13** — ON	
	VERNIER **12** — Mid-range	
	OFFSET **14** — ON	
	VERNIER **15** — Mid-range	
	Mode selector **22** — NORM	
2	With reference to the diagram below, check the function of the pulse generator and compare the output from both channels.	

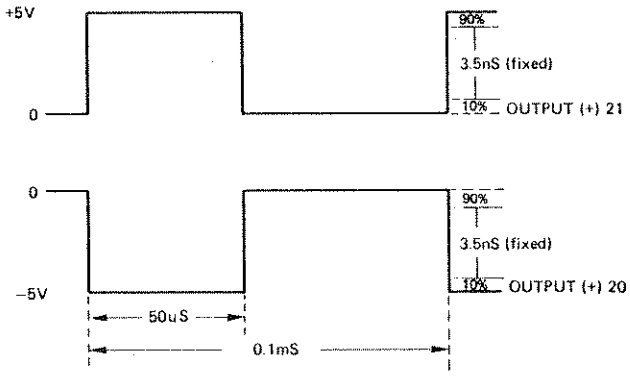
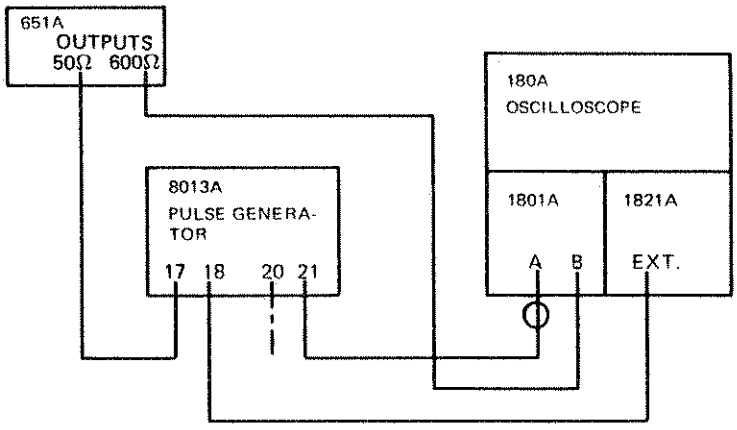


Table 4–3. Preliminary Check: External Trigger Operation

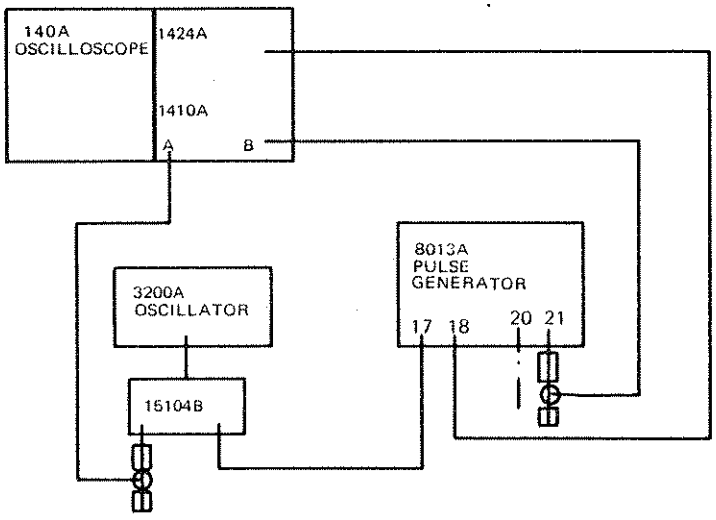
TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	PULSE PERIOD **1**	EXT (+)	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Set the 651A controls as follows:		
	Range	X10	
	Vernier	2.5	
	Attenuator	+10 dB (1. 0V)	
3	Center with vertical channels on the oscilloscope and observe the waveforms. The leading edge of the output pulse shall occur during positive slope of the sinewave.		
4	Set PULSE PERIOD **1** EXT (–): the leading edge of the output pulse shall occur during the negative slope of the sinewave.		

Table 4–4. Preliminary Check: High Frequency Trigger Operation

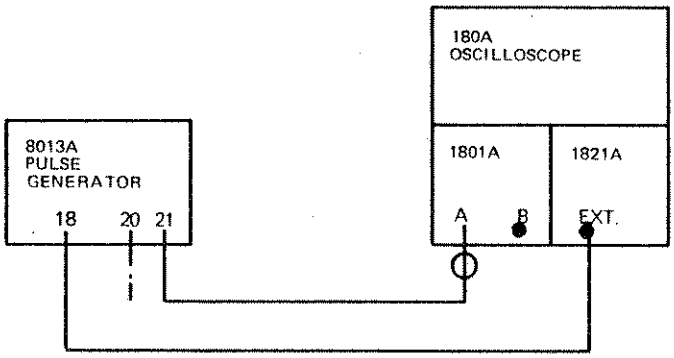
TEST SET-UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	PULSE PERIOD **1**	EXT (+)	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
2	Mode selector **22**	NORM	
	Apply a sinewave with a repetition rate of 50 MHz and amplitude of 1.5V pp. Check repetition rate of output is equal repetition rate of input i.e. 50 MHz.		
3	Set PULSE PERIOD **1** to EXT (–).		
4	Repeat step 2.		

Table 4–5. Preliminary Check: Manual Operation.

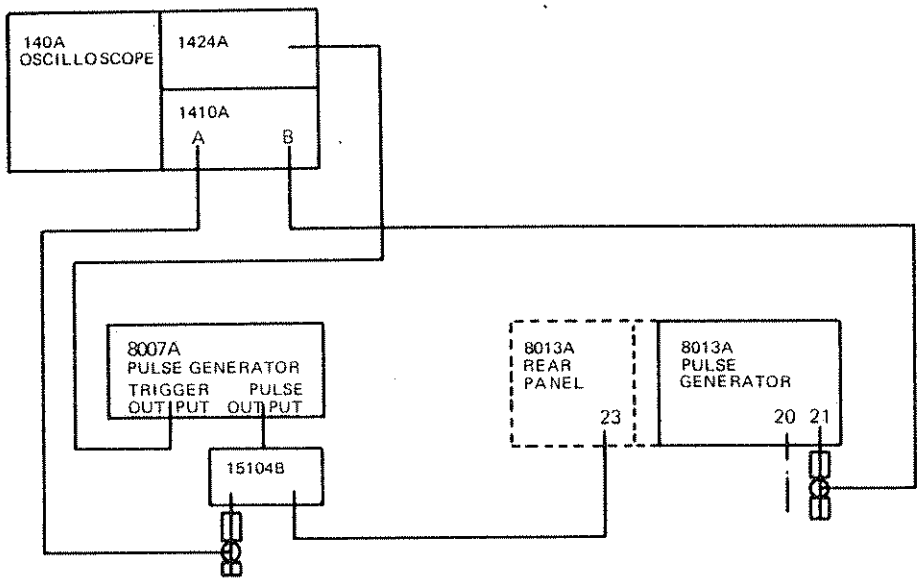
TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	PULSE PERIOD **1**	EXT (+)	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	1u – .1m	
	VERNIER **11**	CW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Press MAN button 5.		
	Only one output pulse must occur when the button is pressed, no pulse must occur when the button is released.		

Table 4–6. Preliminary Check: External Width Operation.

TEST SET–UP



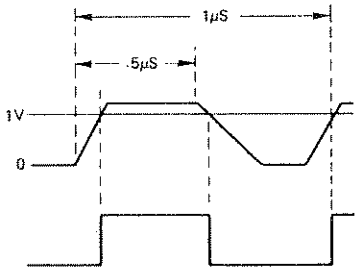
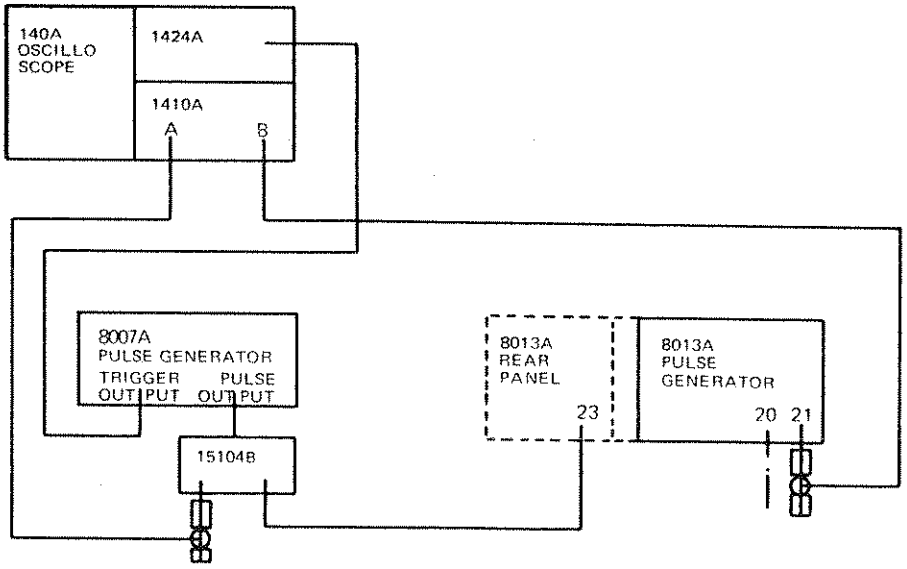
STEP	INSTRUCTIONS	RESULT
1	Set the 8013A controls as follows:	
	PULSE PERIOD **1** — EXT +	
	AMPLITUDE **3** — 5.0 – 2.0	
	VERNIER **8** — CCW	
	AMPLITUDE **4** — 5.0 – 2.0	
	VERNIER **9** — CCW	
	OFFSET **13** — OFF	
	OFFSET **14** — OFF	
	Mode selector **22** — EXT. WIDTH	
2	Apply external signals to INPUT **23**	
3	Note that, the leading and trailing edge of the output pulse is coincident with the leading and trailing edges of the input pulse. The output pulse width will be that of the input pulse at the switching level of 1V.	

Table 4–7. Preliminary Check: RZ Operation

TEST SET–UP



STEP	INSTRUCTIONS	RESULT
1	Set the 8013A controls as follows:	
	PULSE PERIOD **1** — EXT+	
	PULSE DELAY **6** — 35n – 1u	
	VERNIER **7** — CCW	
	PULSE WIDTH **10** — 10n – 1u	
	VERNIER **11** — CCW	
	AMPLITUDE **3** — 5.0 – 2.0	
	VERNIER **8** — CCW	
	AMPLITUDE **4** — 5.0 – 2.0	
	VERNIER **9** — CCW	
	OFFSET **13** — OFF	
	OFFSET **14** — OFF	
	Mode selector **22** — RZ	
2	With reference to the diagram, apply an external signal to the INTPUT connector **23** and observe the pulse output.	

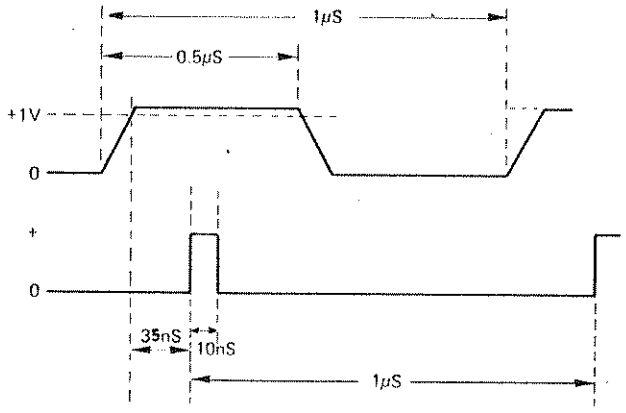
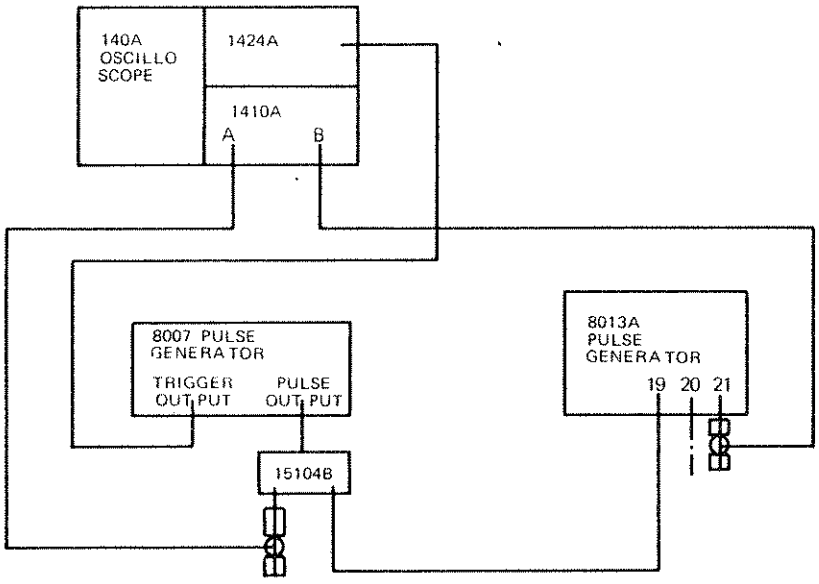


Table 4–8. Preliminary Check: Gate Operation.

TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	PULSE PERIOD **1**	20n – 1u	
	VERNIER **2**	CCW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CCW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CCW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Apply gate pulse to GATE INPUT 19.		
3	Check that output pulses only occur during on time of gate pulse: Turn pulse period VERNIER **2** slowly CW and check gate operation for all pulse periods.		
4	Check that leading edge of first trigger output pulse (TRIGGER OUTPUT **18**) coincides with leading edge of gate pulse and that trigger pulses occur only during on time of gate pulse.		
5	Check that last pulse width is correct even though gate pulse trailing edge appears during last pulse:		

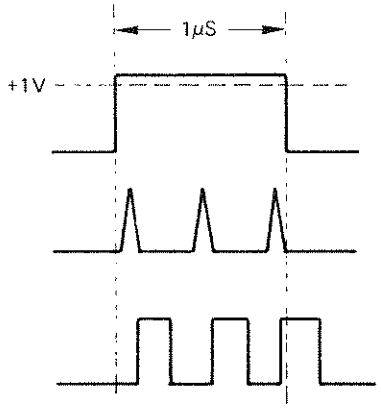
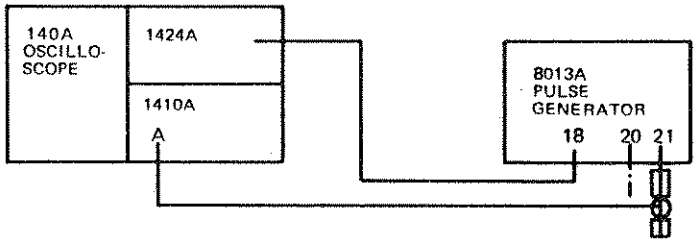


Table 4–9. Performance Test: Preshoot, Overshoot and Ringing

TEST SET–UP



STEP	INSTRUCTIONS	RESULTS
1	Set the 8013A controls as follows:	
	PULSE PERIOD **1** — 20n – 1u	
	VERNIER **2** — CCW	
	PULSE DELAY **6** — 35n – 1u	
	VERNIER **7** — CCW	
	PULSE WIDTH **10** — SQUARE WAVE	
	VERNIER **11** — CW	
	AMPLITUDE **3** — 5.0 – 2.0	
	VERNIER **8** — CW	
	AMPLITUDE **4** — 5.0 – 2.0	
	VERNIER **9** — CW	
	OFFSET **13** — OFF	
	OFFSET **14** — OFF	
	Mode selector **22** — NORM	
2	With reference to the diagram below, measure preshoot, overshoot and ringing in turn to ensure that these are $< \pm$ 5% of the pulse amplitude.	

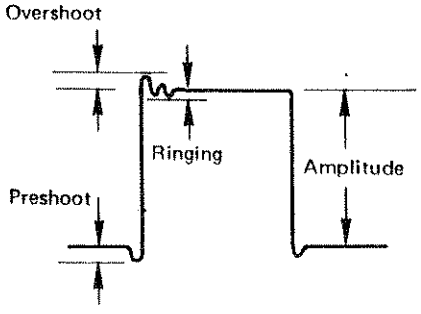
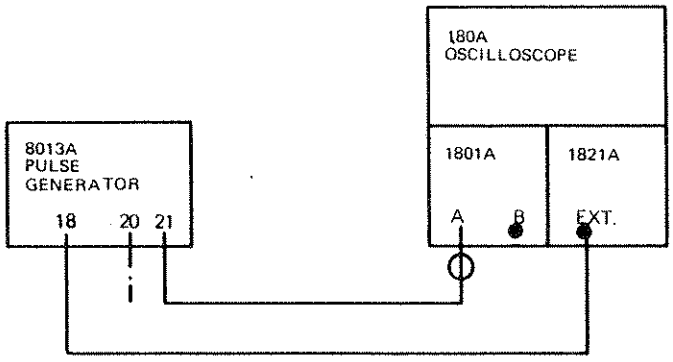


Table 4–12. Performance Test: Pulse Delay

TEST SET–UP

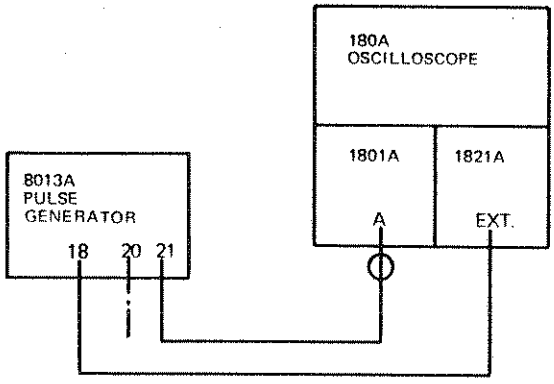


STEP	INSTRUCTIONS		RESULTS
1	Set 8013A controls as follows:		
	PULSE PERIOD **1**	1u – .1m	
	VERNIER **2**	CW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Check the pulse delay for both VERNIER **7** extremities of each range setting of the PULSE DELAY selector **6** as follows:		

PULSE DELAY **6**	VERNIER **7**	PULSE PERIOD **1**	PULSE WIDTH **10**	
35n – 1u	CW	1u – .1m	10n – 1u	> 1uS
1u – .1m	CW	,1m – 10m	1u – .1m	> 100uS
1u – .1m	CCW	10n – .1m	1u – .1m	< 1uS
.1m – 10m	CW	10m – 1	.1m – 10m	> 10us
.1m – 10m	CCW	.1m – 10m	.1u – .1m	< 100uS
10m – 1m	CW	EXT+(press MAN)	10m – 1	> 1S
10m – 1m	CCW	10m – 1m	.1m – 10m	< 10mS

Table 4–13. Performance Test: Pulse Delay Jitter.

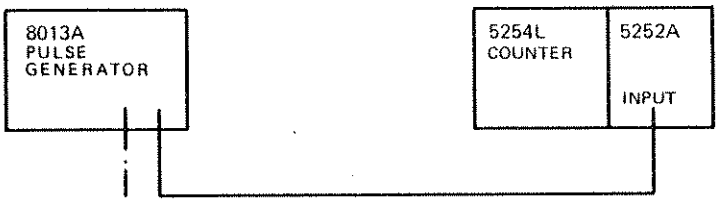
TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	PULSE PERIOD **1**	.1m – 10m	
	VERNIER **2**	CW	
	PULSE DELAY **6**	1u – .1m	
	VERNIER **7**	CW	
	PULSE WIDTH **10**	1u – .1m	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Adjust pulse period VERNIER **2** to obtain 0.4mS pulse period on display.		
3	Adjust pulse delay VERNIER **7** to obtain 0.1mS pulse delay.		
4	Adjust 1821A Delay (Div) vernier until intensified spot coincides with leading edge of first pulse.		
5	Switch Mode switch on 1821A to MIXED.		
6	Measure the pulse delay jitter		$<.1\%$

Table 4–10. Performance Test: Pulse Period

TEST SET–UP

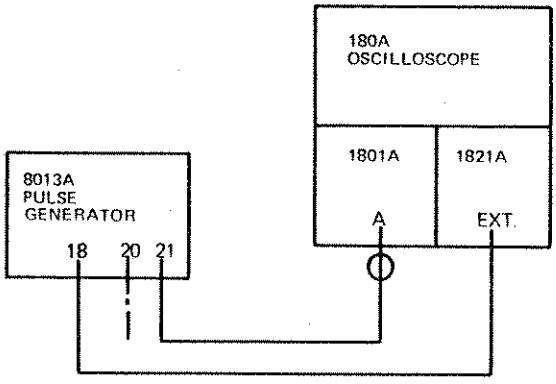


STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	PULSE PERIOD **1**	20n – 1u	
	VERNIER **2**	CCW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Check repetition rate for each set of control settings given in table:		

PULSE PERIOD (1)	VERNIER (2)	PULSE PERIOD	FREQUENCY
20n – 1u	CCW	< 20nS	> 50 MHz
20n – 1u	CW	> 1uS	< 1 MHz
1u – .1m	CW	> .1mS	< 10 kHz
1u – .1m	CCW	< 1uS	> 1 MHz
.1m – 10m	CW	>10mS	< 100 Hz
.1m – 10m	CCW	< .1mS	> 10 kHz
10m – 1	CW	> 1S	< 1 Hz
10m – 1	CCW	<10mS	> 100 Hz

Table 4—11. Performance Test: Pulse Period Jitter.

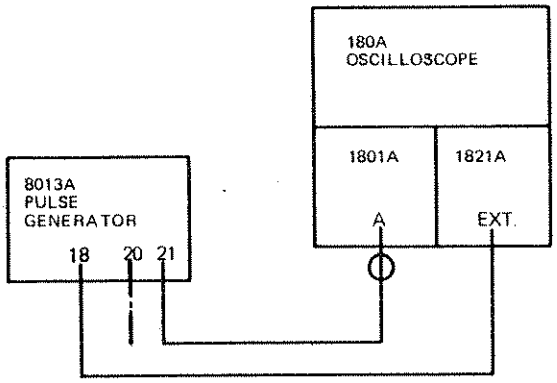
TEST SET—UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8012A controls as follows:		
	PULSE PERIOD **1**	1u — .1m	
	PULSE DELAY **6**	35n — 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	1u — .1m	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 — 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 — 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
3	Set the 1821A controls as follows:		
	Main Sweep	0.1mS/div	
	Delayed Sweep	0.1uS/div	
	Sweep Mode	Norm.	
	Delayed Trigger	Auto.	
	CM Delay	2.0	
4	Adjust pulse period VERNIER **2** to obtain 0.1mS pulse period on display.		
5	Adjust 1821A Delay (Div) vernier until intensified spot coincides with leading edge of second pulse on display.		
6	Switch Mode switch on 1821A to MIXED.		
7	Measure pulse period jitter:		$<.1\%$

Table 4–14 Performance Test: Pulse Width (greater than 1uS).

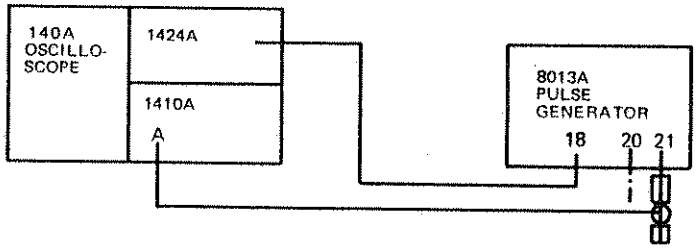
TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	Set 8012A controls as follows:		
	PULSE PERIOD **1**	1u – .1m	
	VERNIER **2**	CW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Check the pulse width for both VERNIER **11** extremities of each range setting of the PULSE WIDTH selector **10** as follows:		
	PULSE WIDTH **10**	VERNIER **11**	PULSE PERIOD **1**	
	10n – 1u	CW	1u – .1m	> 1uS
	1u – .1m	CW	.1m – 10m	> .1mS
	1u – .1m	CCW	1u – .1m	< 1uS
	.1m – 10m	CW	10m – 1	> 10mS
	.1m – 10m	CCW	.1m – 10m	< .1mS
	10m – 1	CW	EXT+ (Press MAN)	> 1S
	10m – 1	CCW	10m – 1	> 10mS

Table 4—15. Performance Test: Pulse Width (less than 10nS).

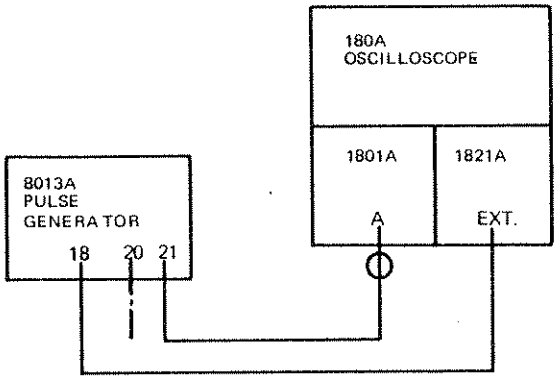
TEST SET—UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8012A controls as follows:		
	PULSE PERIOD **1**	20n — 1u	
	VERNIER **2**	CCW	
	PULSE DELAY **6**	35n — 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n — 1u	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 — 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 — 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Measure the pulse width:		< 10nS

Table 4–16. Performance Test: Pulse Width Jitter.

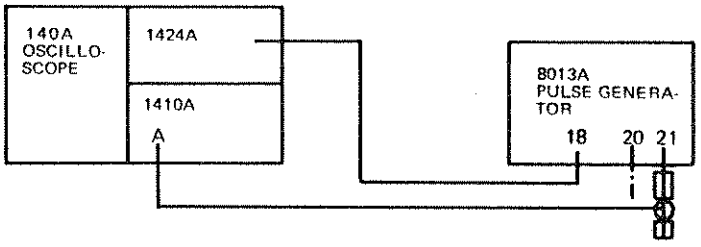
TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	PULSE PERIOD **1**	.1m – 10m	
	VERNIER **2**	CW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	1u – .1m	
	VERNIER **11**	CW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
4	Adjust pulse period VERNIER **2** to obtain 0.4mS pulse period on display.		
5	Adjust pulse width VERNIER **11** to obtain 0.1mS pulse width.		
6	Adjust 1821A Delay (Div) vernier until intensified spot coincides with trailing edge of first pulse.		
7	Switch Mode switch on 1821A to MIXED.		
8	Measure pulse width jitter:		$<.1\%$

Table 4–17. Performance Test: Square Wave

TEST SET–UP



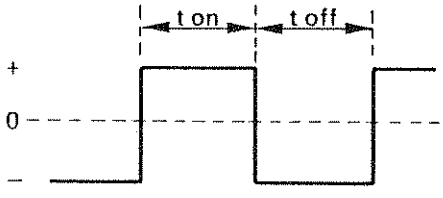
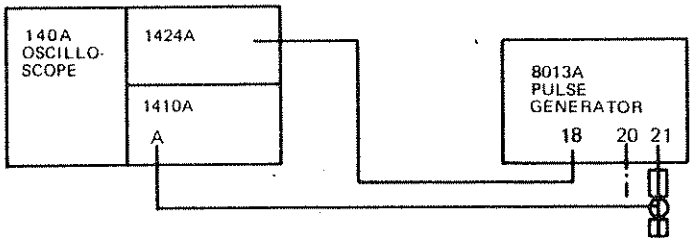
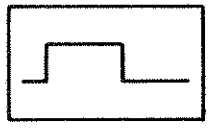
STEP	INSTRUCTIONS	RESULTS
1	Set the 8013A controls as follows:	
	PULSE PERIOD **1** — 20n – 1u VERNIER **2** — CW PULSE DELAY **6** — 35n – 1u VERNIER **7** — CW PULSE WIDTH **10** — SQUARE WAVE VERNIER **11** — CW AMPLITUDE **3** — 5.0 – 2.0 VERNIER **8** — CW AMPLITUDE **4** — 5.0 – 2.0 VERNIER **9** — CW OFFSET **13** — OFF OFFSET **14** — OFF Mode selector **22** — NORM	
2	For each setting of the PULSE PERIOD control **1**, given in the table below, turn the VERNIER **2** slowly from fully CCW to fully CW and check that the PULSE DELAY **6** and VERNIER **7** controls have no effect on the position of the displayed pulse. PULSE PERIOD **1** 20n – 1u 1u – .1m .1m – 10m 10m – 1	
3	For all settings of the pulse period control, check that the pulse width (t on) equals the pulse off time (t off)	
4	Check that the square wave output pulse is symmetrically above and below zero volts.	

Table 4—18. Performance Test: Duty Cycle.

TEST SET—UP



STEP	INSTRUCTIONS		RESULTS
1	PULSE PERIOD **1**	1u — .1m	
	VERNIER **2**	CW	
	PULSE DELAY **6**	35n — 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	1u — .1m	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 — 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 — 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	For each set of control settings given in table below, display the output pulse so that it occupies half of the display (see diagram):		

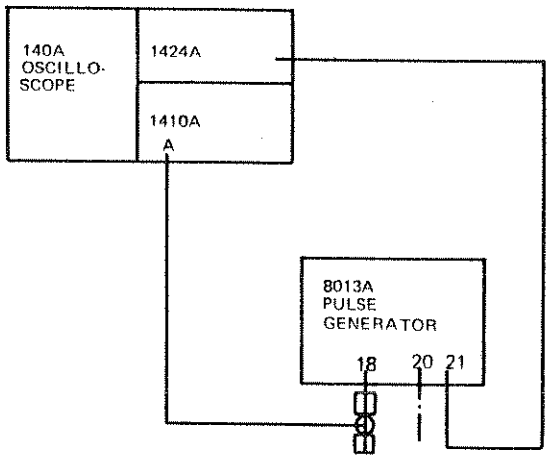
Starting with the pulse period VERNIER **2** fully CW turn VERNIER **2** slowly CCW until the trailing edge of the pulse begins to move or the pulse divides. When this happens measure the pulse period (Tp) and use in the formula:

$$\text{Duty Cycle}_{\text{Max}} = \frac{\text{Pulse Width (Tw)}}{\text{Pulse Period (Tp)}} \cdot 100\%$$

PULSE PERIOD (1)	PULSE WIDTH (10)	VERNIER (11)	
1u — .1m	1u — .1m	Adjust for 1uS	> 75 %
.1m — 10m	.1m — 10m	Adjust for 0.1mS	> 75 %
10m — 1	10m — 1	Adjust for 10mS	> 75 %

Table 4–19. Performance Test: Trigger Output.

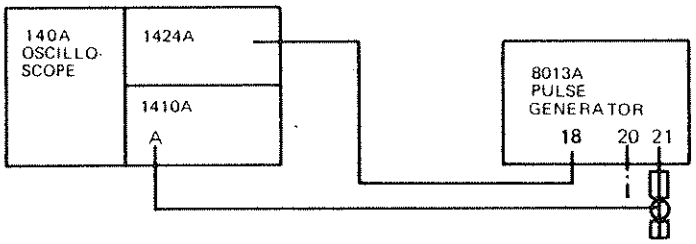
TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	PULSE PERIOD **1**	20n – 1u	
	VERNIER **2**	CCW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	2.5 – 1.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	2.5 – 1.0	
	VERNIER **9**	CW	
	OFFSETT **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Measure amplitude of trigger output pulse (TRIGGER OUTPUT **18**).		> 1.0 V
3	Measure width of trigger output pulse:		> 5nS < 20nS
4	Turn VERNIER **2** slowly from CCW to CW, the amplitude and width limits given must be true for the whole range.		
5	Switch PULSE PERIOD **1** to range 1u – .1m and repeat steps 2 to 4.		
6	Switch PULSE WIDTH **10** to SQUARE WAVE and repeat steps 2 to 5.		

Table 4-20. Performance Test: Amplitude.

TEST SET-UP

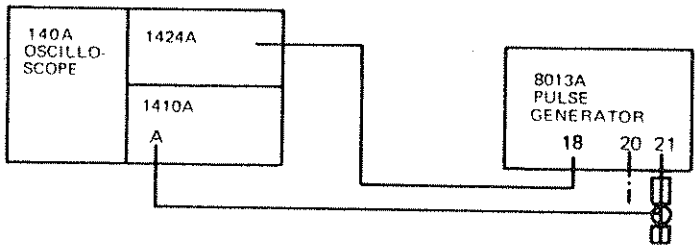


STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	PULSE PERIOD **1**	20n – 1u	
	VERNIER **2**	CW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	Mid-range	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Check the amplitude for both VERNIER **8** and **9** extremities of each setting of the AMPLITUDE selector **3** and **4** as follows:		

AMPLITUDE **3** (**4**)	VERNIER **8** (**9**)	
5.0 – 2.0	CW	>5.0
5.0 – 2.0	CCW	<2.0
2.5 – 1.0	CW	>2.5
2.5 – 1.0	CCW	<1.0
1.0 – 0.4	CW	>1.0
1.0 – 0.4	CCW	<0.4
0.5 – 0.2	CW	>0.5
0.5 – 0.2	CCW	<0.2

Table 4-21. Performance Test: DC Offset.

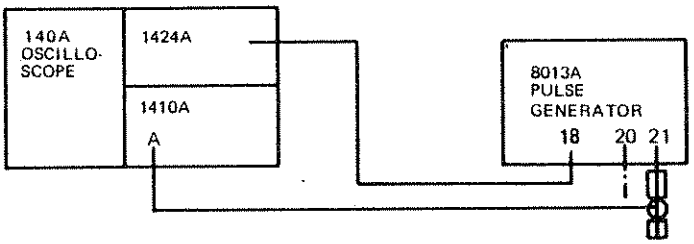
TEST SET-UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8012A controls as follows:		
	PULSE PERIOD **1**	20n – 1u	
	VERNIER **2**	CCW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	CCW	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM	
2	Set the output pulse baseline to the center of the oscilloscope display.		
3	Set OFFSET **14** to ON.		
4	Turn VERNIER **15** fully CCW		
5	Measure negative offset:		>–5V
6	Turn VERNIER **15** fully CW.		
7	Measure positive offset:		> +1V
8	Turn OFFSET **14** to OFF.		
9	Output pulse baseline should be at center of oscilloscope display.		
10	Repeat steps 2 to 9 for OFFSET **13** and VERNIER **12** but with the following limits:		
	VERNIER **12** fully CCW		> –1V
	VERNIER **12** fully CW		> +5V

Table 4–22. Performance Test: Baseline Position.

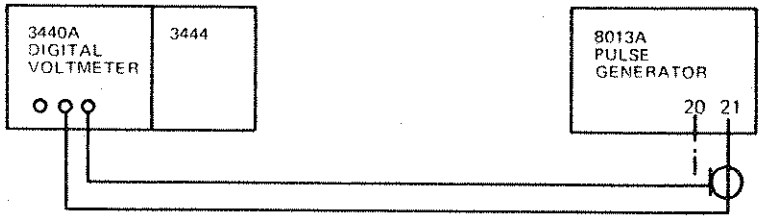
TEST SET–UP



STEP	INSTRUCTIONS		RESULTS
1	Set the 8012A controls as follows:		
	PULSE PERIOD **1**	20n – 1u	
	VERNIER **2**	CW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	Adjust for a duty cycle of 50%.	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSET **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM.	
2			
3	Disconnect 8012A from oscilloscope		
4	Center the oscilloscope display trace.		
5	Reconnect 8013A to oscilloscope.		
6	Check that output pulse baseline is in center of display.		

Table 4–23. Performance Test: Output Impedance.

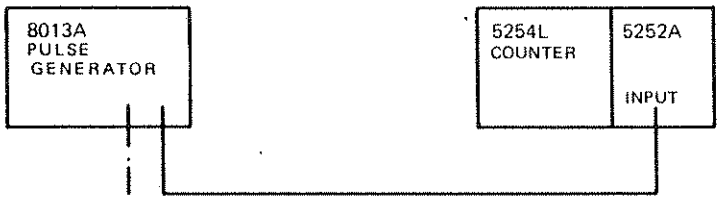
TEST SET–UP



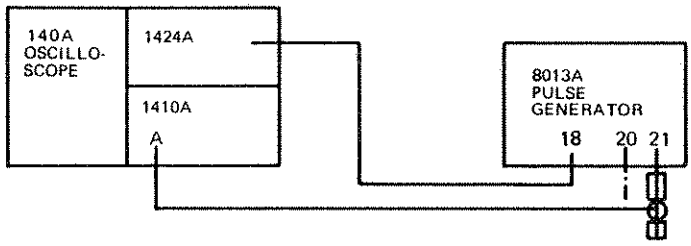
STEP	INSTRUCTIONS		RESULTS
1	Set the 8013A controls as follows:		
	LINE **15**	OFF	
	PULSE PERIOD **1**	20n – 1u	
	VERNIER **2**	CW	
	PULSE DELAY **6**	35n – 1u	
	VERNIER **7**	CCW	
	PULSE WIDTH **10**	10n – 1u	
	VERNIER **11**	SQUARE WAVE	
	AMPLITUDE **3**	5.0 – 2.0	
	VERNIER **8**	CW	
	AMPLITUDE **4**	5.0 – 2.0	
	VERNIER **9**	CW	
	OFFSETT **13**	OFF	
	OFFSET **14**	OFF	
	Mode selector **22**	NORM.	
2	Turn amplitude VERNIER 9 from fully CW to fully CCW and check resistance:		50 Ω ± 4 Ω

Table 4–24. Initial Settings of 8013A for Internal Checks and Adjustments: Assembly 1.

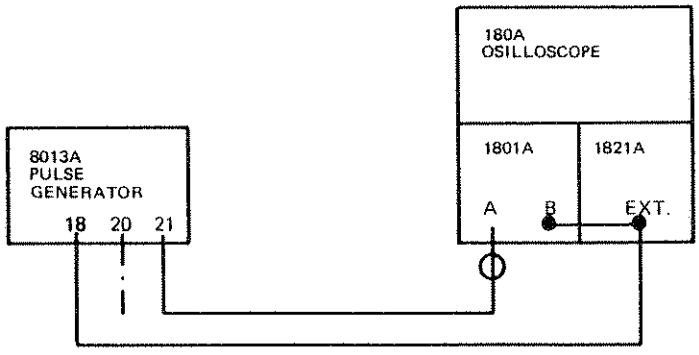
TEST SET–UP 1



TEST SET–UP 2



TEST SET–UP 3



Set the 8013A controls as follows:

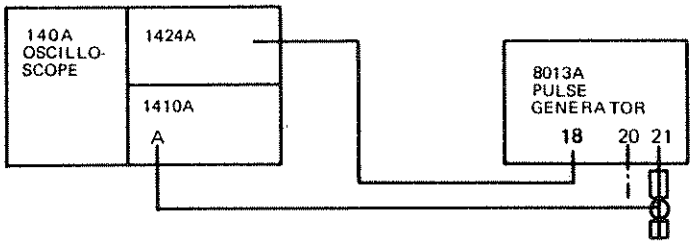
PULSE PERIOD **1**	20n – 1u
VERNIER **2**	CW
PULSE DELAY **6**	35n – 1u
VERNIER **7**	CCW
PULSE WIDTH **10**	10n – 1u
VERNIER **11**	CW
AMPLITUDE **3**	5.0 – 2.0
VERNIER **8**	CW
AMPLITUDE **4**	5.0 – 2.0
VERNIER **9**	CW
OFFSET **13**	OFF
OFFSET **14**	OFF
Mode selector **22**	NORM

Table 4–25. Internal Checks and Adjustments: Assembly 1
Refer to Table 4–24 for the test set–up and initial settings.

Step	INSTRUCTIONS	ADJUST	RESULT
	Pulse Period		
1	Connect equipment as shown in TEST SET–UP 1		
2	Turn VERNIER 2 fully CCW		
3	Measure the pulse period:	A1C24	51 MHz.
	Pulse Width		
4	Connect equipment as shown in TEST SET–UP 2.		
5	Turn VERNIER 11 fully CCW		
6	Measure the pulse width:	A1C45	9nS
	Pulse Delay		
7	Connect equipment as shown in TEST SET–UP 3 and reset the controls as follows: PULSE PERIOD 1 — 1u – 0.1m VERNIER 2 — CW VERNIER 7 — CW VERNIER 11 — CW		
8	Measure the delay between the trigger pulse and the output pulse:	A1C35	< 35nS

Table 4–26. Internal Checks and Adjustments: Assembly 2

TEST SET–UP



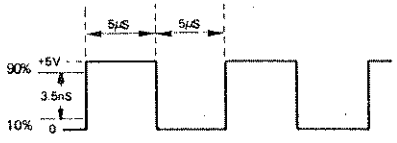
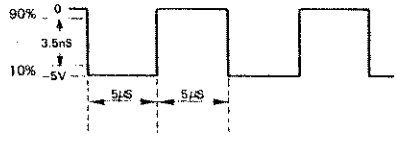
STEP	INSTRUCTIONS		ADJUST	RESULT
1	Set the 8013 controls as follows:			
	PULSE PERIOD **1**	10n – 1u		
	VERNIER **2**	CCW		
	PULSE DELAY **6**	35n – 1u		
	VERNIER **7**	CCW		
	PULSE WIDTH **10**	SQUARE WAVE		
	VERNIER **11**			
	AMPLITUDE **3**	5.0 – 2.0		
	VERNIER **8**	CW		
	AMPLITUDE **4**	5.0 – 2.0		
	VERNIER **9**	CW		
	OFFSET **13**	OFF		
	OFFSET **14**	OFF		
	Mode selector **22**	NORM.		
	Pulse shape: OUTPUT (+)			
2	Observe the pulse for correct shape while turning VERNIER **9** from fully CW to fully CCW		A2C5 A2R19	
	Pulse shape: OUTPUT (–)			
3	Observe the pulse for correct shape while turning VERNIER **8** from fully CW to fully CCW		A2C16 A2R50	

Table 4–27. Internal Checks and Adjustments: Assembly 3

STEP	INSTRUCTIONS		ADJUST	RESULT
1	Set the 8013A controls as follows:			
	PULSE PERIOD **1**	EXT+		
	VERNIER **2**	CW		
	PULSE DELAY **6**	1u – 0.1m		
	VERNIER **7**	CCW		
	PULSE WIDTH **10**	1u – 0.1m		
	VERNIER **11**	CCW		
	AMPLITUDE **3**	5.0 – 2.0		
	VERNIER **8**	CW		
	AMPLITUDE **4**	5.0 – 2.0		
	VERNIER **9**	CW		
	OFFSET **13**	ON		
	VERNIER **12**	Mid–range		
	OFFSET **14**	ON		
	VERNIER **15**	Mid-range		
	Mode selector **22**	NORM.		
	Voltages are measured with respect to chassis.			
2	Connect the digital voltmeter to TP1 on board A3.		A3R15	+17V ± 100mV
3	Connect the ac voltmeter to TP1 on board A3 and observe the ripple.			2mV rms
4	Connect the digital voltmeter to TP 2 on board A3.		A3R16	–17V ± 100mV
5	Connect the ac voltmeter to TP2 on board A3 and observe the ripple.			2mV rms

SECTION V
DIAGRAMS AND REPLACEABLE PARTS

5–1 INTRODUCTION

5–2 This section provides the block, functional, circuit, component location and troubleshooting diagrams and replaceable parts information necessary for servicing the pulse generator.

5–3 ASSEMBLY AND COMPONENT REFERENCING

5–4 The pulse generator consists of four assemblies (A1 ot A4) mounted in a frame; assemblies 3 and 4 are attached directly to the frame and assemblies 1 and 2 plug into connectors on assembly 3. Components mounted on an assembly are identified by prefixing the reference designator by the appropriate assembly reference, thus, for example, diode 7 on assembly 2 becomes A2CR7. Components mounted directly on the frame have no prefix.

5–5 ORGANIZATION OF DIAGRAMS

5–6 A block diagram (figure 5–2) indicates the way in which the instrument functions and shows circuit location by means of the assembly reference.

5–7 Electrical parts, and some mechanical parts, belonging to the frame are shown in the assembly location diagram (figure 5–3) and the facing parts table.

5–8 Detailed information for each assembly is presented by a component location diagram, a parts table and a circuit diagram. When necessary, the parts table includes a grid reference so that a component can be located on circuit and component location diagrams. Circuit diagrams include interconnections to the next assembly.

5–9 Exceptionally, no separate circuit diagram is provided for assembly 3. This is because the assembly is essentially an interconnector and contains only a few components. The information, however, is presented on the circuit diagrams of other assemblies, as appropriate.

5–10 ORDERING INFORMATION

5–11 General

5–12 The replaceable parts tables list parts in alpha-numerical order of their reference designators and indicates the description and HP stock number of each part, together with any applicable notes.

5–13 To order a replacement part, address order of inquiry 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 S.A.
Rue du Bois–du–Lan 7
1217 Meyrin 2
Geneva
Switzerland

5–14 Specify the following information for each part:

a) Model and complete serial number of instrument.
b) Hewlett–Packard stock number.
c) Circuit reference designator.
d) Description.

To order a part not listed, give a complete description of the part and include its function and location.

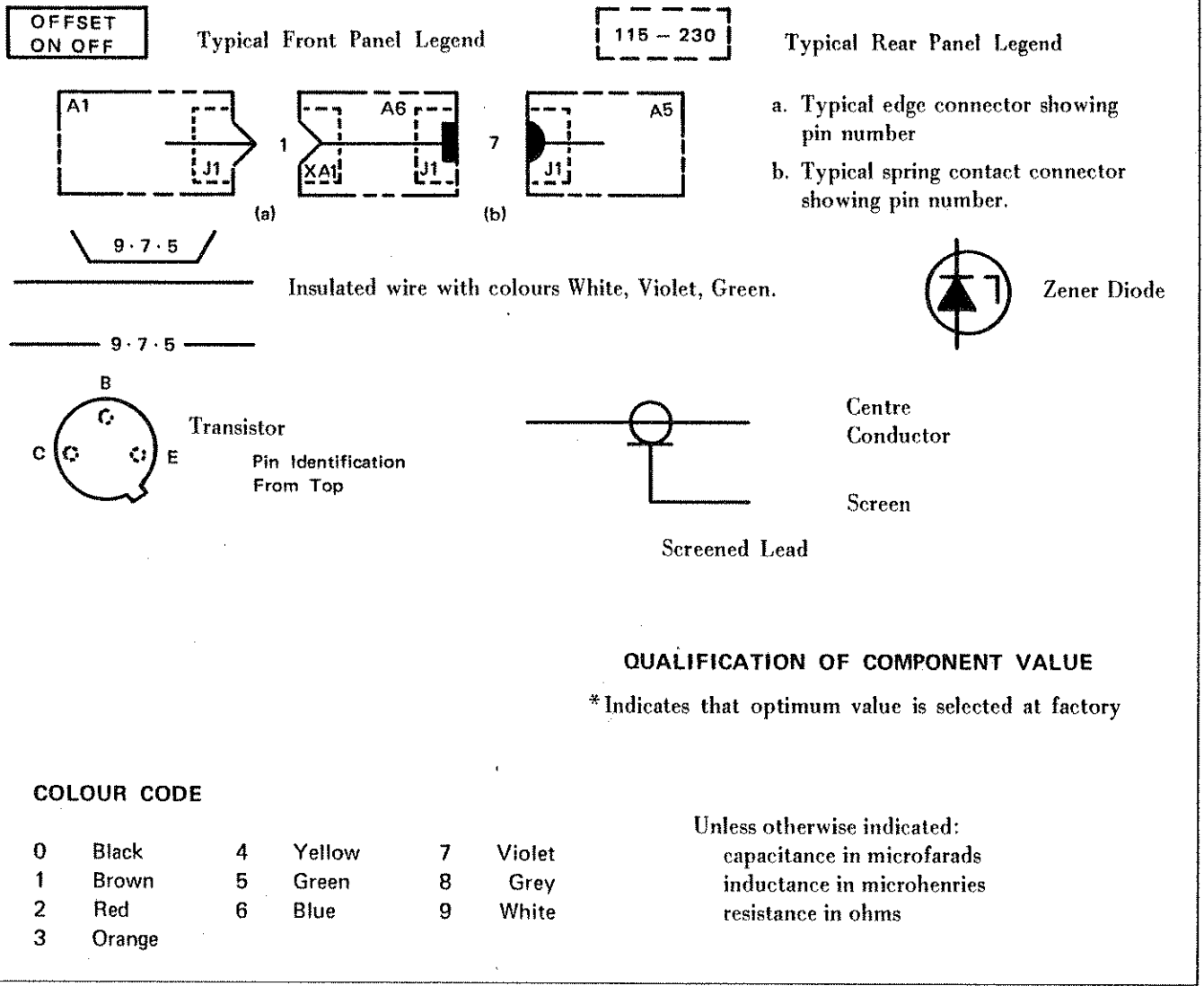
5–15 Assembly Exchange Programs

5–16 Assembly exchange programs, in which rebuilt and fully-tested assemblies are delivered in exchange for faulty assemblies, are available for some instruments. When ordering an exchange assembly it must be remembered that the seventh digit of the stock number changes from 6 as quoted in the replaceable parts table to 9, for example:
New assembly A4, stock number XXXXX–66504
Exchange assembly A4, stock number XXXXX–69504

Table 5—1. General Symbols and Reference Designators

REFERENCE DESIGNATORS

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



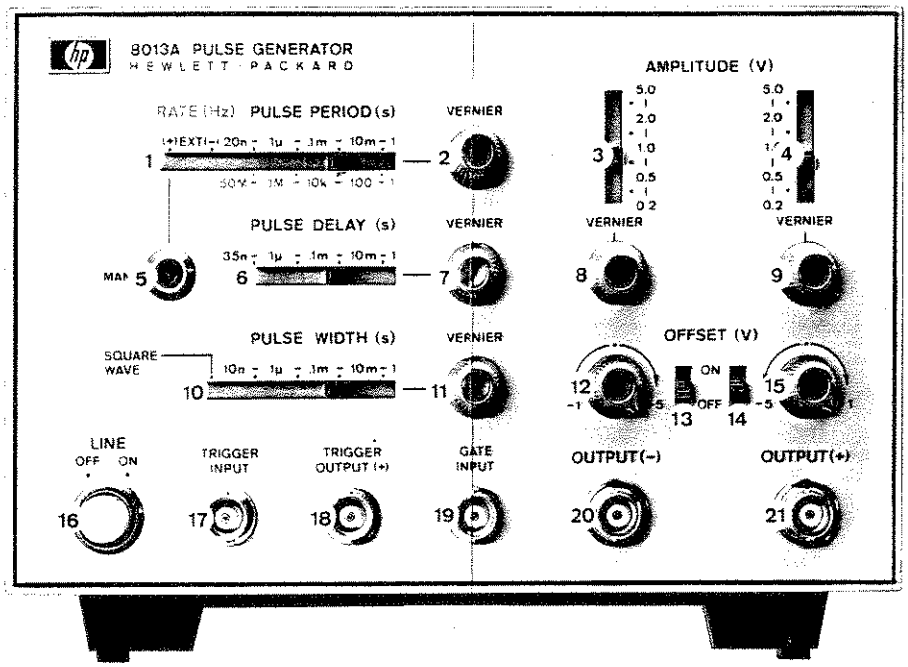
QUALIFICATION OF COMPONENT VALUE

*Indicates that optimum value is selected at factory

COLOUR CODE

0	Black	4	Yellow	7	Violet
1	Brown	5	Green	8	Grey
2	Red	6	Blue	9	White
3	Orange				

Unless otherwise indicated:
capacitance in microfarads
inductance in microhenries
resistance in ohms



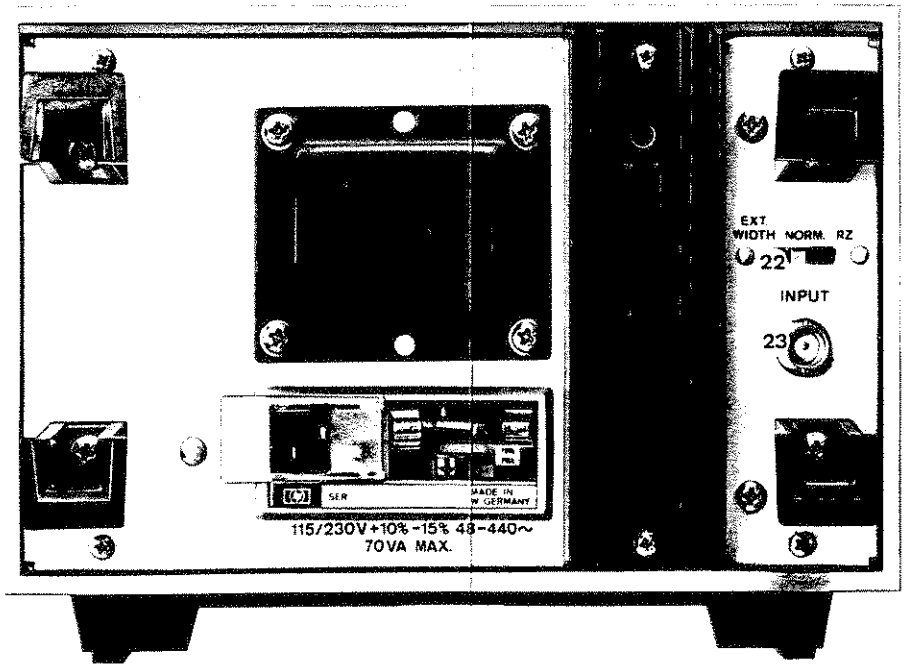


Figure 5–1 8013A Front and Rear Panels: Control Identification Diagrams

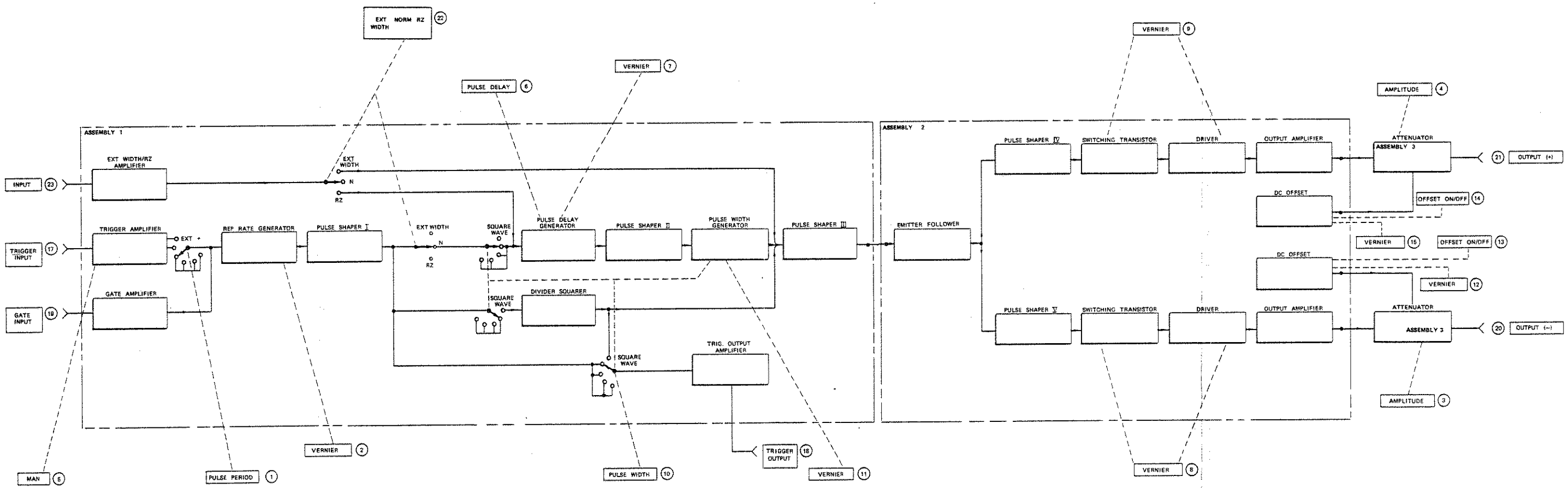


Figure 5–2 Block Diagram

Table 5–2 Replaceable Parts: Frame

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM		COMPONENT LAYOUT
			SHEET NUMBER	GRID REFERENCE	
A1	08012-66501	BD AY TIMG			
A2	08013-66502	BD AY PULSAMPL			
A3	08013-66503	BD AY WDTH			
A4	08012-66504	BD AY PWR SPLY			
J1	1250-0118	CONN BNC BLKHD			
J2	1250-0118	SAME AS J 1			
J3	1250-0118	SAME AS J 1			
J4	1250-0083	CONN BNC BLKHD			
Q1	1854-0063	XSTR 2N3055 SI			
Q2	1854-0063	SAME AS Q 1			
R1	2100-3081	R-VAR 50K.25W CC			
R2	2100-3081	SAME AS R 1			
R3	2100-3081	SAME AS R 1			
R4	0758-0024	R-F 100 5% .25W			
R5	0758-0126	R-F 51 5% .25W F			
R6	0758-0049	R-F 33K5% .25W F			
R25	2100-2635	R-VAR 50K .5W			
R26	2100-2635	SAME AS R 25			
R33	2100-2146	R-VAR 10K .75W			
R34	2100-2146	SAME AS R 33			
S5	3101-0124	SW-P-BTN SPST			
S10	3101-1248	SW P-BTN SPDT			
S4	3101-0903	SW-P-BTN-SPST			
X1	5060-1189	PWR LINE MDL			
T1	5080-0948	XFMRPWR			
W1	08012-61605	CABLE-COAXIAL			
W2	08013-61601	COAXIAL CABLES (SET OF 2)			
W3	08013-61602	COAXIAL CABLES AND PLUG ASSY. (SET OF 2)			
W4	08012-61602	SCREENED POWER CABLE			

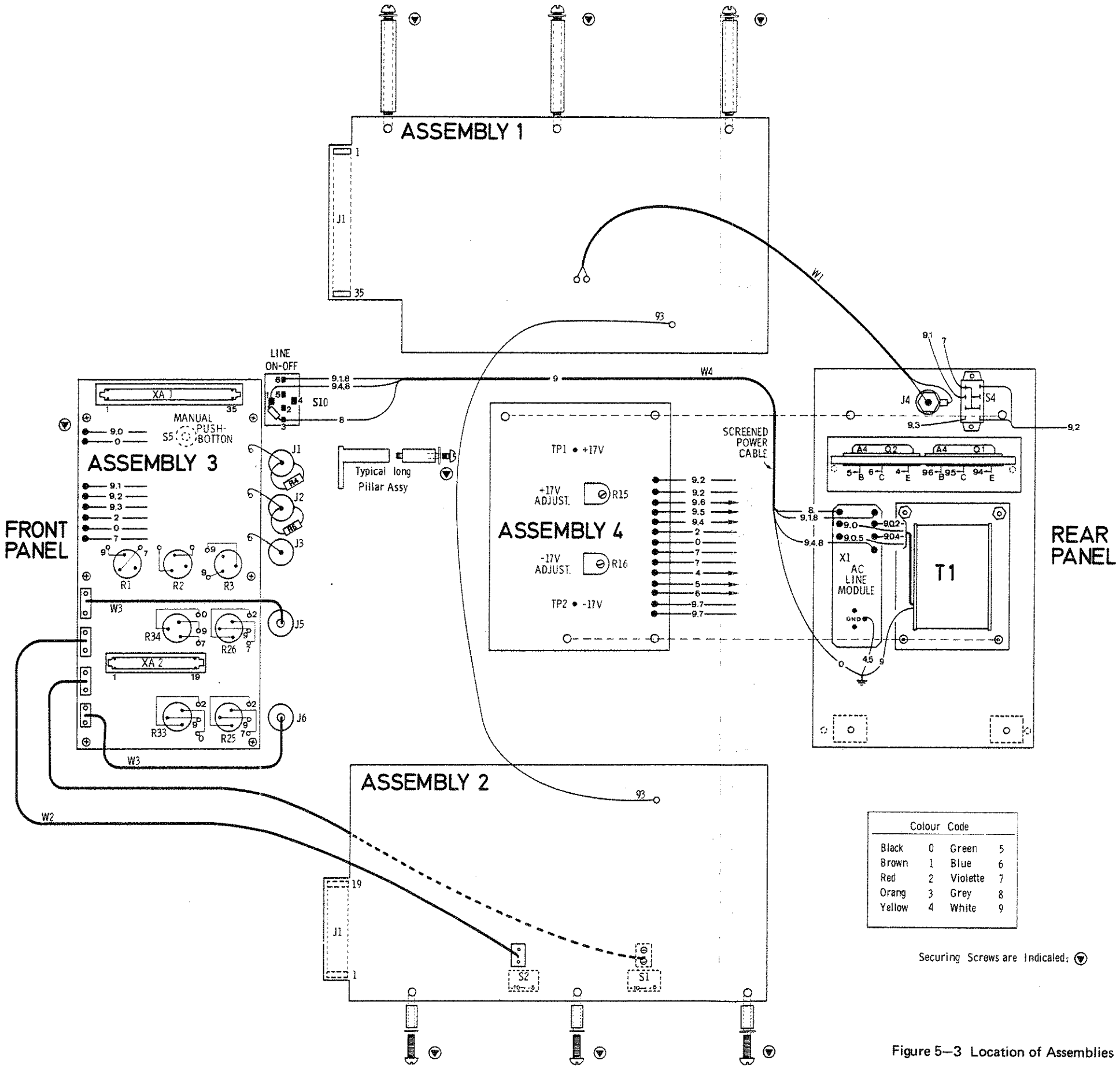


Figure 5—3 Location of Assemblies

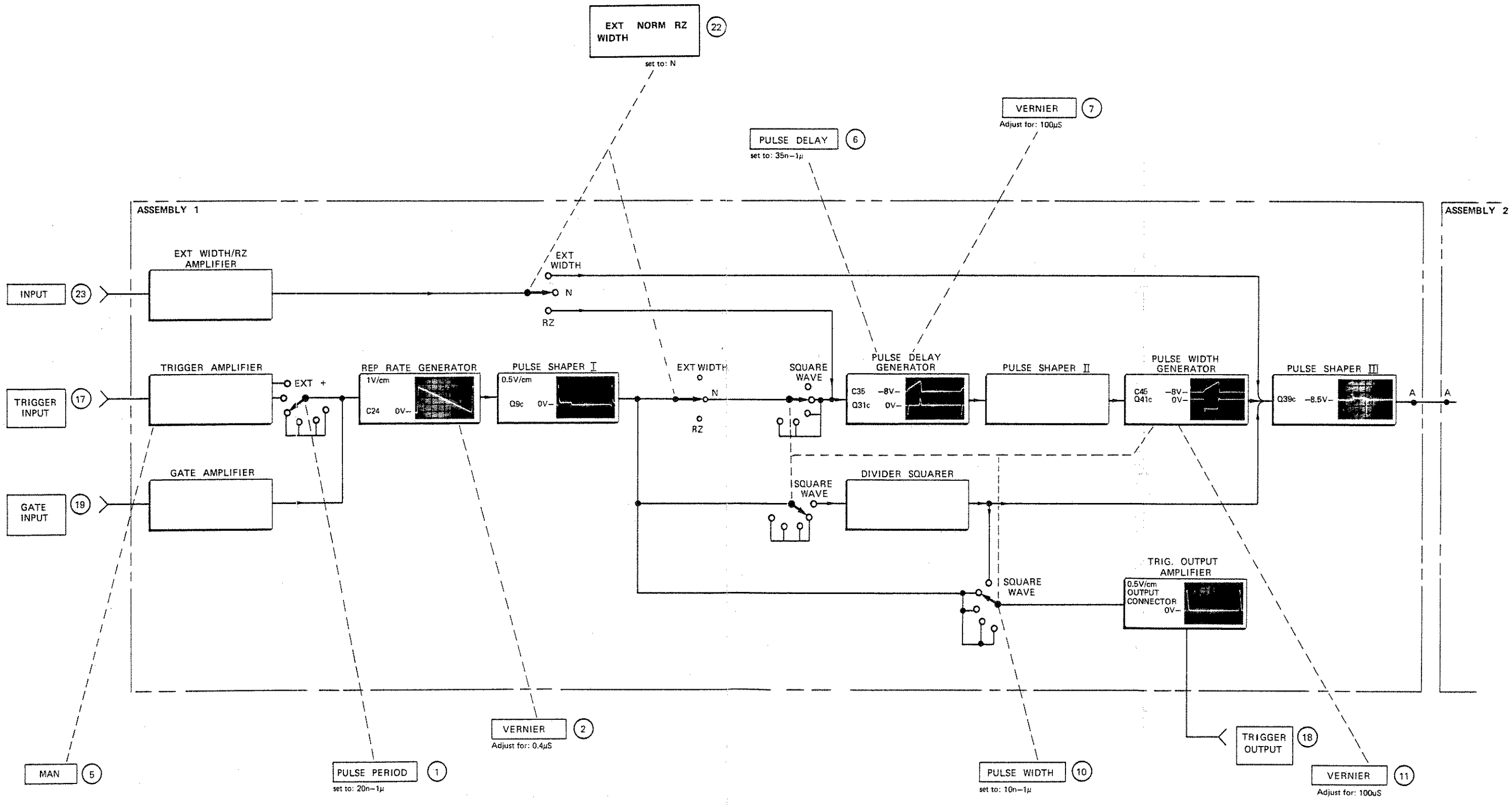


Figure 5–4 Troubleshooting Flowchart: Normal Mode – Internal Trigger Sheet 1 of 2

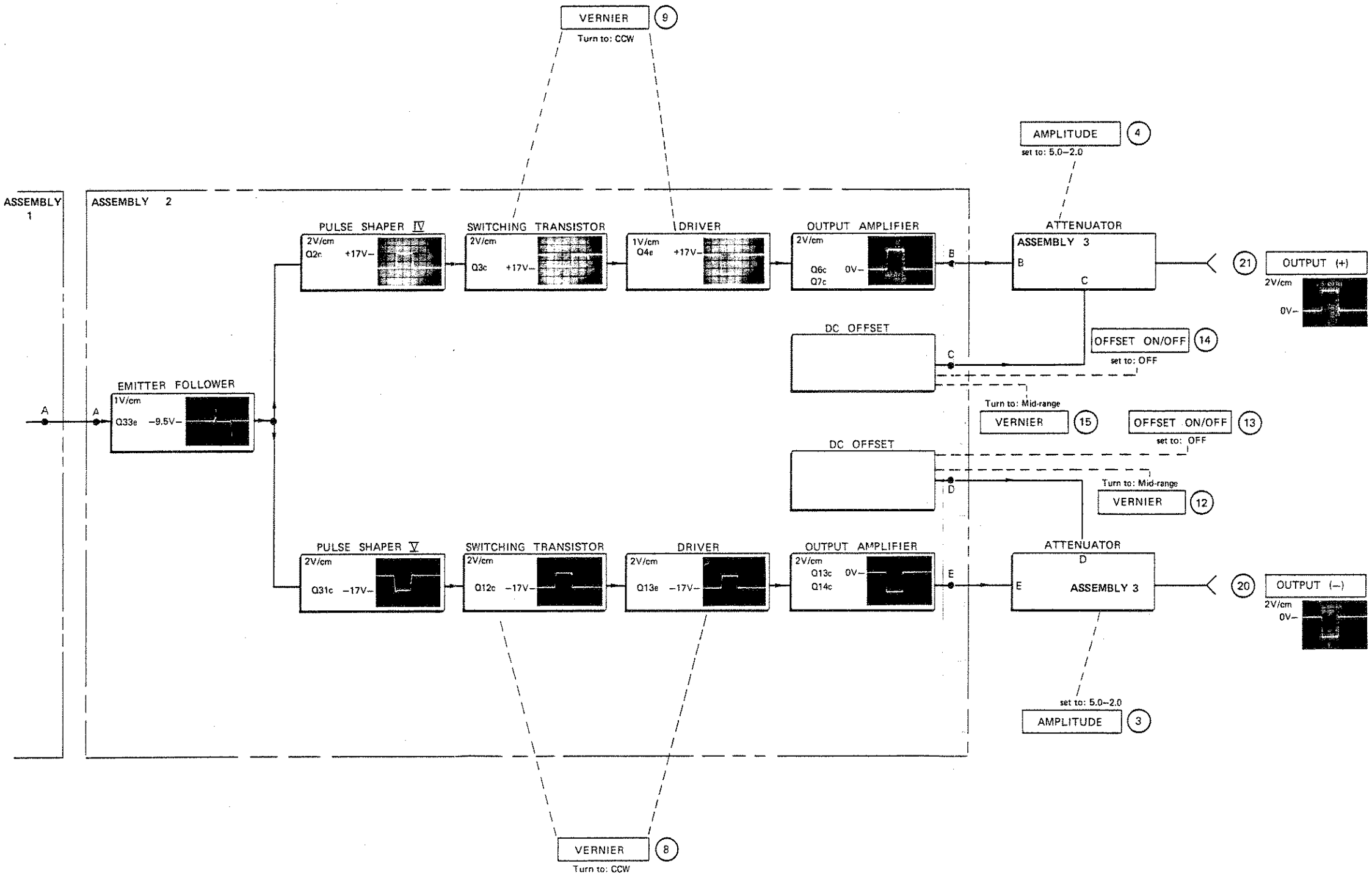


Figure 5–4 Troubleshooting Flowchart: Normal Mode – Internal Trigger Sheet 2 of 2

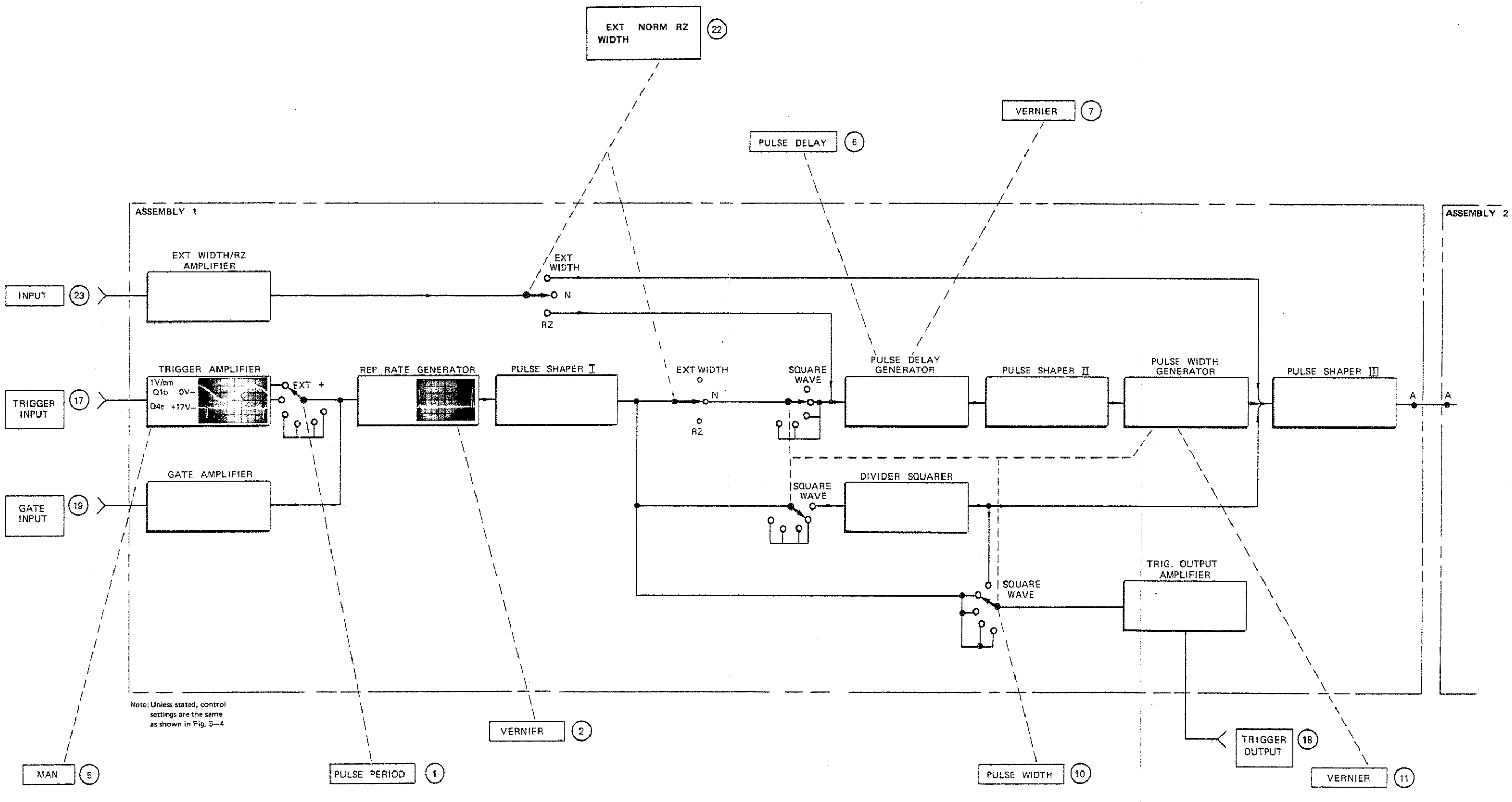


Figure 5–5 Troubleshooting Flowchart: Normal Mode – External Trigger

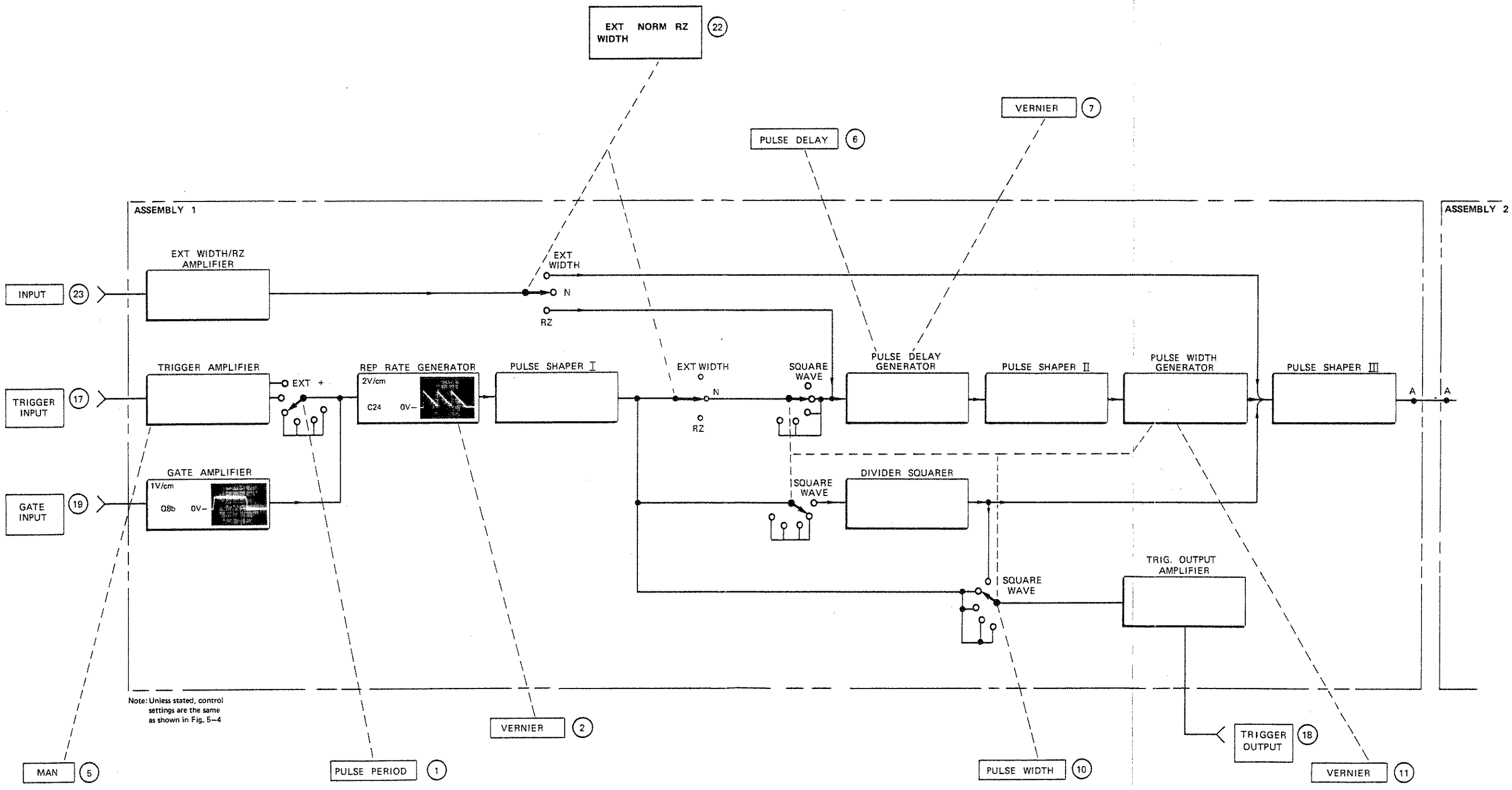


Figure 5–6 Troubleshooting Flowchart: Normal Mode — Gate

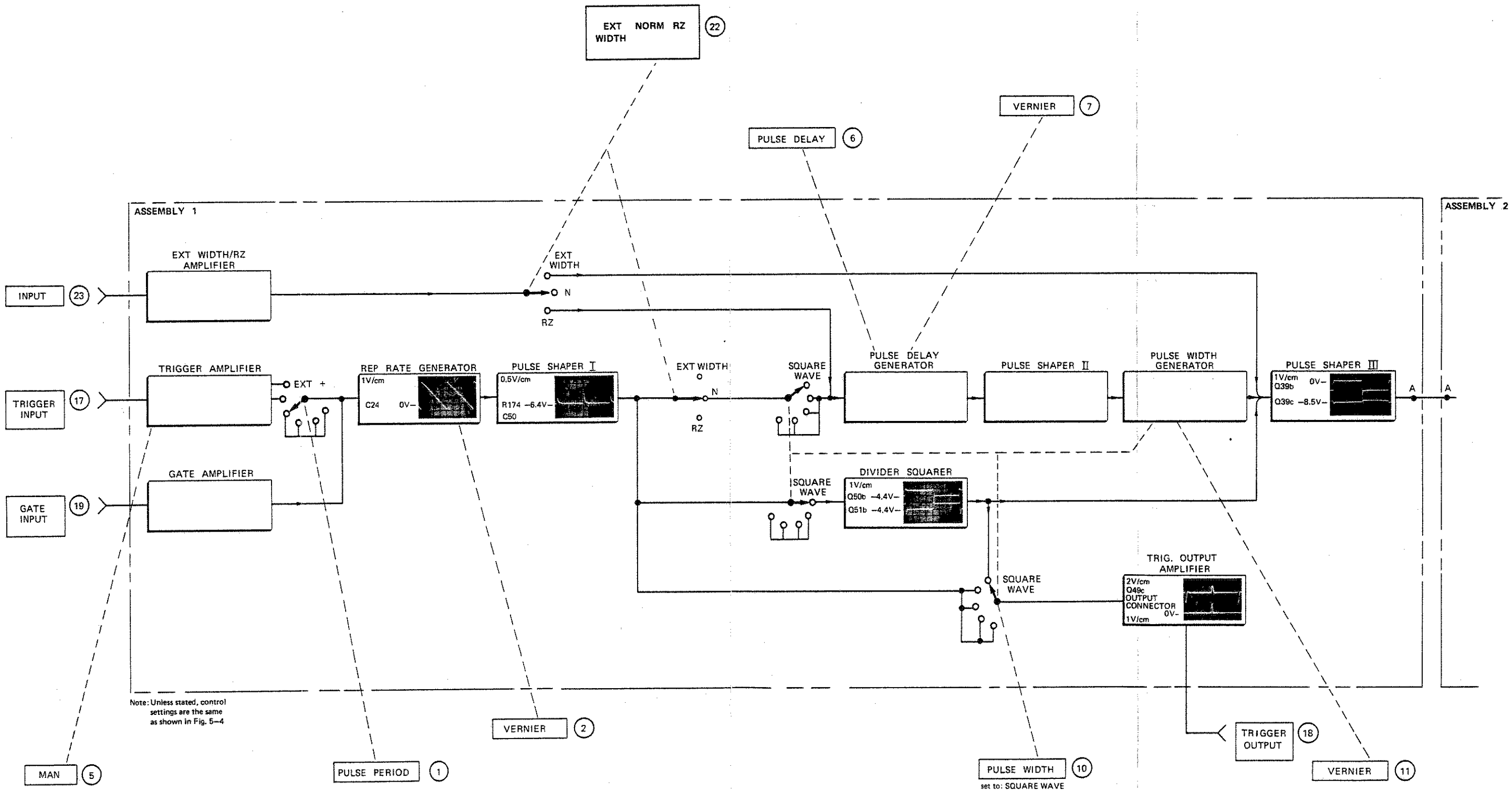


Figure 5–7 Troubleshooting Flowchart: Normal Mode – Square Wave

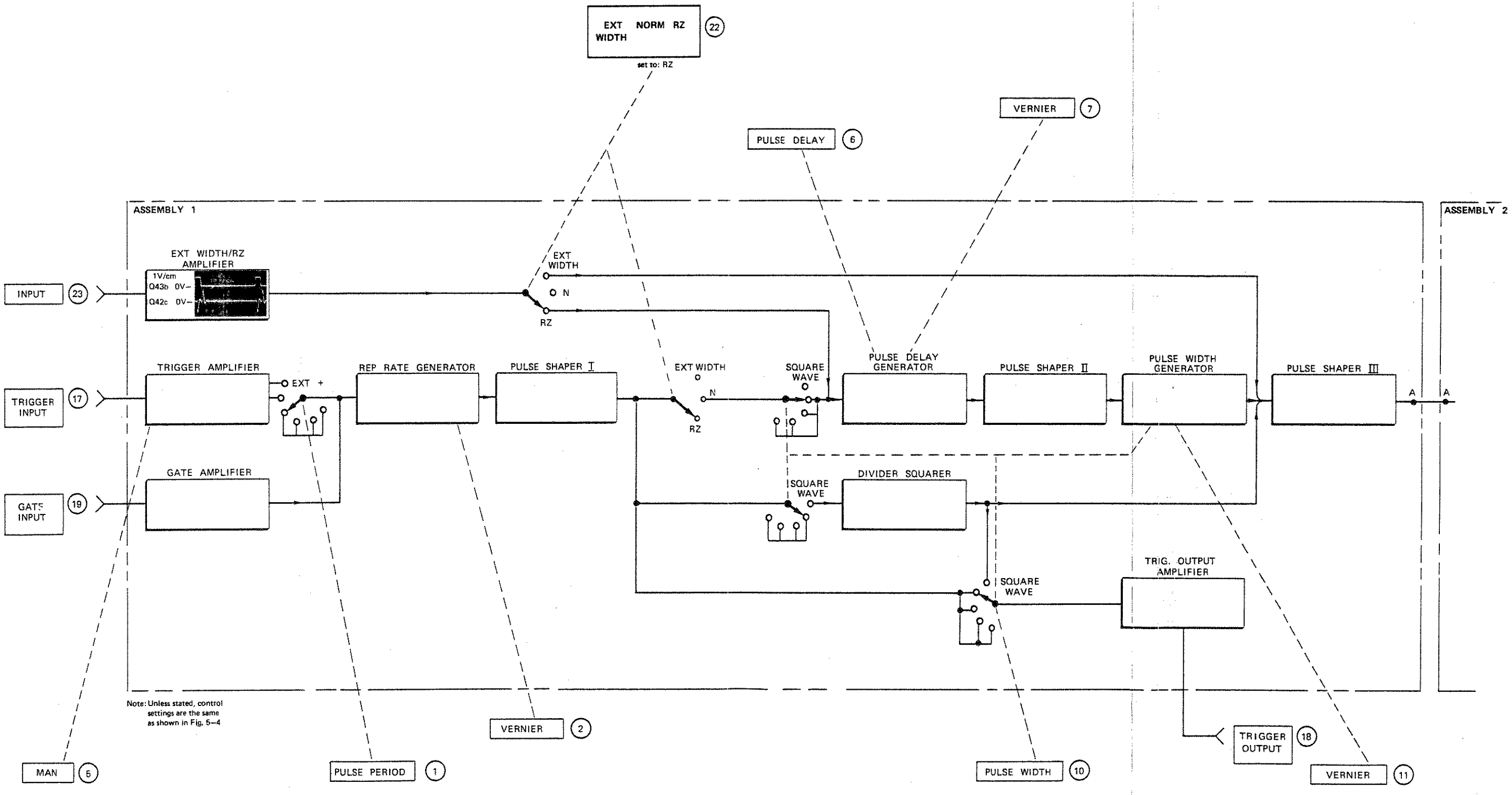


Figure 5—8 Troubleshooting Flowchart: RZ Mode

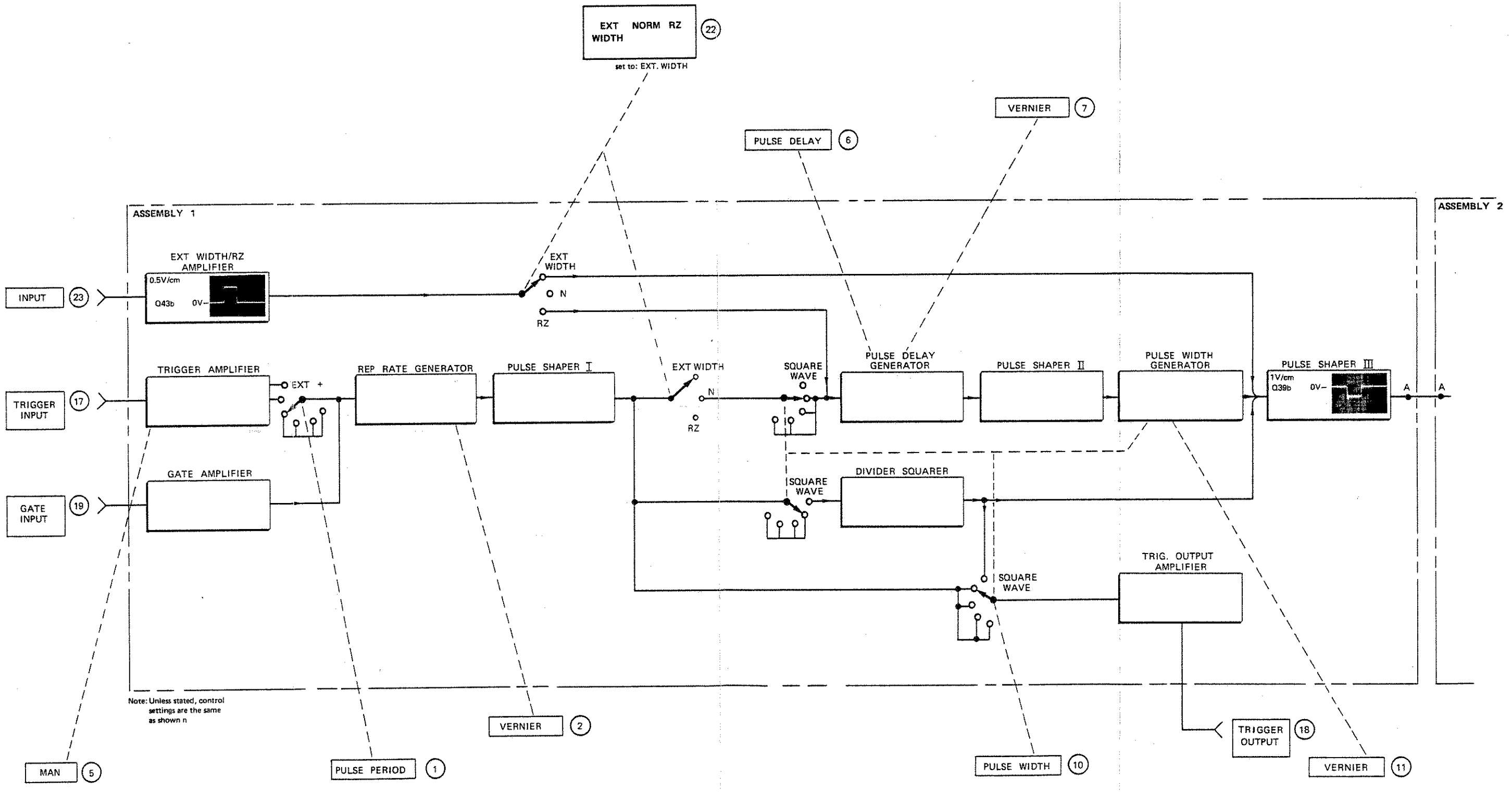


Figure 5–9 Troubleshooting Flowchart: External Width Mode

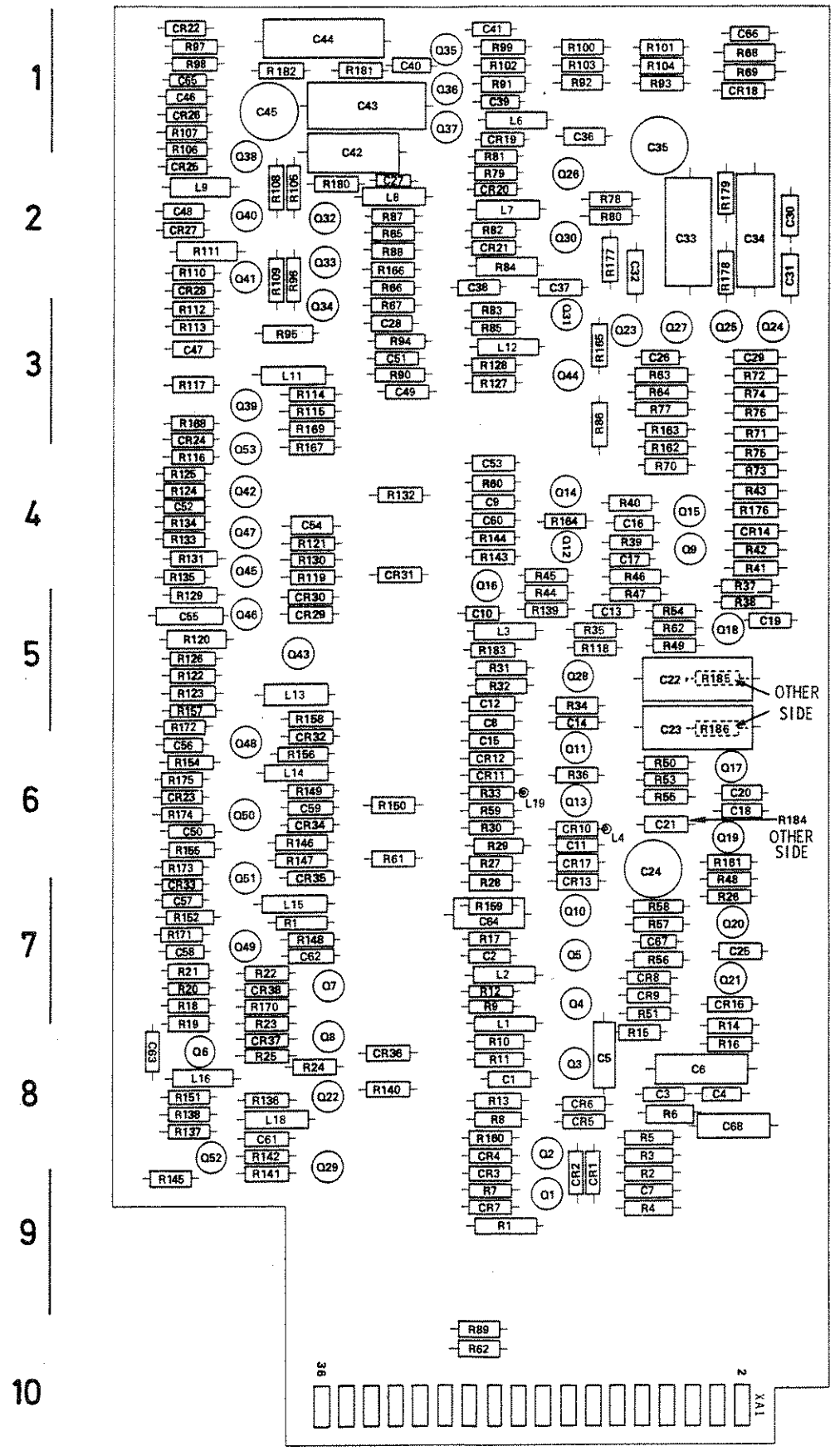


Figure 5–10 Component Layout: Assembly 1

Table 5–3 Replaceable Parts: Assembly 1

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A1	C1	0150-0121	C-F .1UF 50V	1	E3	C8
A1	C2	0150-0093	C-F .01UF 100V	1	F3	C7
A1	C3	0150-0093	C-F .01UF 100V	1	D4	D8
A1	C4	0150-0093	C-F .01UF 100V	1	E4	E8
A1	C5	0160-2199	C-F 30PF 300V	1	G4	D8
A1	C6	0180-0374	C-F 10UF 20V	1	H5	E8
A1	C7	0160-2307	C-F 47PF 300V	1	D7	D9
A1	C8	0150-0121	C-F .1UF 50V	1	F4	C5
A1	C9	0150-0121	C-F .1UF 50V	2	A3	C4
A1	C10	0150-0093	C-F .01UF 100V	2	C1	C5
A1	C11	0150-0093	C-F .01UF 100V	1	N5	D6
A1	C12	0150-0093	C-F .01UF 100V	1	N4	C5
A1	C13	0150-0093	C-F .01UF 100V	2	A2	D5
A1	C14	0160-2198	C-F 20PF 300V	1	O5	D5
A1	C15	0160-2197	C-F 10PF 300V	1	O5	C6
A1	C16	0150-0093	C-F .01UF 100V	2	A3	D4
A1	C17	0150-0093	C-F .01UF 100V	2	D2	D4
A1	C18	0150-0093	C-F .01UF 100V	1	K9	E6
A1	C19	0150-0093	C-F .01UF 100V	1	K8	E5
A1	C20	0150-0093	C-F .01UF 100V	1	K6	E6
A1	C21	0160-3714	C-F 6200PF	1	L10	D6
A1	C22	0160-3725	C-F 0.68UF	1	L8	E5
A1	C23	0180-0375	C-F 68UF 20V	1	L7	E5
A1	C24	0121-0046	C-VAR 9-35PF	1	L7	D6
A1	C25	0150-0093	C-F .01UF 100V	1	L8	E7
A1	C26	0150-0093	C-F .01UF 100V	2	H5	D3
A1	C27	0150-0093	C-F .01UF 100V	3	C1	B2
A1	C28	0150-0093	C-F .01UF 100V	3	C2	B3
A1	C29	0150-0093	C-F .01UF 100V	2	F5	E3
A1	C30	0150-0093	C-F .01UF 100V	2	F6	E2
A1	C31	0150-0093	C-F .01UF 100V	2	F8	E2
A1	C32	0160-3220	C-F 680PF 400V	2	F5	D2
A1	C33	0160-3725	C-F 0.68UF	2	F7	E2
A1	C34	0180-0375	C-F 68UF 20V	2	F8	E2
A1	C35	0121-0046	C-VAR 9-35PF	2	K5	D1
A1	C36	0150-0121	C-F .1UF 50V	2	K6	D1
A1	C37	0150-0121	C-F .1UF 50V	2	J7	D2
A1	C38	0150-0121	C-F .1UF 50V	2	L4	C2
A1	C39	0150-0093	C-F .01UF 100V	3	F5	C1
A1	C40	0150-0093	C-F .01UF 100V	3	F6	C1
A1	C41	0150-0093	C-F .01UF 100V	3	F7	C1
A1	C42	0160-3220	C-F 680PF 400V	3	F5	B1
A1	C43	0160-3725	C-F 0.68UF	3	F6	B1
A1	C44	0180-0375	C-F 68UF 20V	3	F7	B1
A1	C45	0121-0046	C-VAR 9-35PF	3	J4	B1
A1	C46	0150-0121	C-F .1UF 50V	3	H5	A1
A1	C47	0150-0121	C-F .1UF 50V	3	K6	A3
A1	C48	0150-0121	C-F .1UF 50V	3	J3	A2
A1	C49	0150-0121	C-F .1UF 50V	3	L3	C3
A1	C50	0140-0191	C-F 56PF 300V	4	E6	A6
A1	C51	0150-0093	C-F .01UF 100V	3	G4	C3
A1	C52	0150-0093	C-F .01UF 100V	4	N3	A4
A1	C53	0150-0093	C-F .01UF 100V	4	J4	C4
A1	C54	0150-0093	C-F .01UF 100V	4	J3	B4
A1	C55	0160-2198	C-F 20PF 300V	4	M6	A5
A1	C56	0150-0093	C-F .01UF 100V	4	H5	A6
A1	C57	0150-0093	C-F .01UF 100V	4	F6	A7
A1	C58	0150-0093	C-F .01UF 100V	4	E5	A7
A1	C59	0150-0093	C-F .01UF 100V	4	G3	B6
A1	C60	0150-0093	C-F .01UF 100V	4	C5	C4
A1	C61	0150-0093	C-F .01UF 100V	4	B3	B8
A1	C62	0150-0093	C-F .01UF 100V	1	G8	B7
A1	C63	0150-0093	C-F .01UF 100V	1	H10	A8
A1	C64	0160-2198	C-F 20PF 300V	1	H3	C7
A1	C65	0150-0093	C-F .01UF 100V	3	H4	A1
A1	C66	0150-0093	C-F .01UF 100V	2	J5	E1
A1	C67	0150-0093	C-F .01UF 100V	1	M8	D7
A1	C68	0180-0374	C-F 10UF 20V			E8
A1	CR1	1901-0040	DIO SI 30V .03A	1	D6	D9
A1	CR2	1901-0040	DIO SI 30V .03A	1	E6	D9
A1	CR3	1901-0040	DIO SI 30V .03A	1	D5	C9
A1	CR4	1901-0040	DIO SI 30V .03A	1	D5	C8
A1	CR5	1901-0040	DIO SI 30V .03A	1	D5	D8
A1	CR6	1901-0040	DIO SI 30V .03A	1	D5	D8
A1	CR7	1902-0037	DIO BKDN 9.09 V	1	C5	C9
A1	CR8	1901-0040	DIO SI 30V .03A	1	M5	D7
A1	CR9	1901-0040	DIO SI 30V .03A	1	M5	D7
A1	CR10	1901-0179	DIO SI 15V .75NS	1	N5	D6
A1	CR11	1901-0040	DIO SI 30V .03A	1	O5	C6
A1	CR12	1901-0040	DIO SI 30V .03A	1	O5	C6
A1	CR13	1901-0040	DIO SI 30V .03A	1	O7	D7
A1	CR14	1901-0040	DIO SI 30V .03A	2	C2	E4
A1	CR16	1901-0040	DIO SI 30V .03A	1	N8	E7
A1	CR17	1910-0022	DIO-GE 5V 3.5NS	1	N7	D6
A1	CR18	1901-0040	DIO SI 30V .03A	2	K5	E1
A1	CR19	1902-0049	DIO BKDN 6.19 V	2	K6	C1
A1	CR20	1901-0040	DIO SI 30V .03A	2	K5	C2
A1	CR21	1902-0126	DIO BKDN 2.61 V	2	K4	C2
A1	CR22	1901-0040	DIO SI 30V .03A	3	H4	A1
A1	CR23	1902-0025	DIO BKDN 10.0 V	4	A6	A6
A1	CR24	1902-0025	DIO BKDN 10.0 V	3	M3	A3
A1	CR25	1901-0040	DIO SI 30V .03A	3	J4	A2
A1	CR26	1902-0049	DIO BKDN 6.19 V	3	H5	A1
A1	CR27	1902-0126	DIO BKDN 2.61 V	3	J3	A2
A1	CR28	1910-0034	DIO-GE 25V .1A	3	K6	A2
A1	CR29	1901-0040	DIO SI 30V .03A	4	L5	B5
A1	CR30	1901-0040	DIO SI 30V .03A	4	L6	B5
A1	CR31	1901-0040	DIO SI 30V .03A	4	M6	C4
A1	CR32	1901-0040	DIO SI 30V .03A	4	H5	B6
A1	CR33	1901-0040	DIO SI 30V .03A	4	E5	A7
A1	CR34	1902-0032	DIO BKDN 5.49 V	4	G4	B6
A1	CR35	1902-0032	DIO BKDN 5.49 V	4	F4	B7
A1	CR36	1902-0025	DIO BKDN 10.0 V	1	H8	B8
A1	CR37	1901-0040	DIO SI 30V .03A	1	E8	B8
A1	CR38	1901-0040	DIO SI 30V .03A	1	F8	B7
A1	L1	9100-1611	COIL CHOKE .22UH	1	E3	C8
A1	L2	9100-1614	COIL CHOKE .82 UH	1	F3	C7
A1	L3	9100-1613	COIL CHOKE .47 UH	1	O4	C5
A1	L4	9170-0029	CORE FERRI BEAD	1	N4	B5
A1	L6	9140-0179	COIL-FXD 22 UH	2	K6	C1
A1	L7	9100-1613	COIL CHOKE .47 UH	2	L3	C2
A1	L8	9140-0094	COIL-CHOKE .68UH	2	M4	C2
A1	L9	9140-0179	COIL-FXD 22 UH	3	J5	A2
A1	L11	9100-1612	COIL CHOKE .33UH	3	L3	B3
A1	L12	9140-0096	COIL-CHOKE 1UH	4	M3	C3
A1	L13	9140-0096	COIL-CHOKE 1UH	4	L6	B5
A1	L14	9100-1613	COIL CHOKE .47 UH			
A1	L15	9100-1613	COIL CHOKE .47 UH	4	G4	B6
A1	L16	9140-0112	COIL CHOKE 4.7UH	4	F4	B7
A1	L17	9170-0029	CORE FERRI BEAD	4	E4	A8
A1	L18	9100-1614	COIL CHOKE .82 UH	4	C3	D2
A1	L19	9170-0016	BEAD SHLD	4	C2	B8
A1	Q1	1854-0296	XSTR SI NPN	1	D6	D9
A1	Q2	1854-0296	XSTR SI NPN	1	E6	D8
A1	Q3	1854-0092	XSTR 2N3563 SI	1	E4	D8
A1	Q4	1854-0092	XSTR 2N3563 SI	1	F4	D7
A1	Q5	1853-0096	XSTR SI PNP	1	H4	D7
A1	Q6	1854-0019	XSTR SI NPN	1	H9	A8
A1	Q7	1853-0034	XSTR SI PNP	1	F8	B7
A1	Q8	1853-0034	XSTR SI PNP	1	E8	B8
A1	Q9	1853-0203	XSTR SI PNP	2	B2	E4
A1	Q10	1853-0090	XSTR SI PNP	1	M5	D7
A1	Q11	1853-0203	XSTR SI PNP	1	O5	D6
A1	Q12	1853-0203	XSTR SI PNP	2	C2	D4
A1	Q13	1854-0345	XSTR 2N5179 SI	1	O6	D6
A1	Q14	1853-0203	XSTR SI PNP	2	B3	D4
A1	Q15	1853-0203	XSTR SI PNP	2	C3	E4
A1	Q16	1854-0009	XSTR 2N709 SI	4	C5	C4
A1	Q17	1854-0215	XSTR SI NPN	1	L6	E6
A1	Q18	1854-0215	XSTR SI NPN	1	L8	E5
A1	Q19	1854-0215	XSTR SI NPN	1	L9	E6
A1	Q20	1854-0019	XSTR SI NPN	1	M7	E7
A1	Q21	1853-0090	XSTR SI PNP	1	M8	E7
A1	Q22	1854-0019	XSTR SI NPN	4	C3	B8
A1	Q23	1853-0090	XSTR SI PNP	2	F5	D3
A1	Q24	1853-0036	XSTR SI PNP	2	F8	E3
A1	Q25	1853-0036	XSTR SI PNP	2	F6	E3
A1	Q26	1853-0203	XSTR SI PNP	2	K5	D2
A1	Q27	1853-0036	XSTR SI PNP	2	F5	E3
A1	Q28	1205-0037	HT-SINK XSTR	1	O4	D5
A1	Q28	1854-0019	XSTR SI NPN	1	O4	D5
A1	Q29	1205-0037	HT-SINK XSTR	4	C3	B9
A1	Q29	1853-0034	XSTR SI PNP	4	C3	B9
A1	Q30	1854-0345	XSTR 2N5179 SI	2	L5	D2
A1	Q31	1854-0345	XSTR 2N5179 SI	2	M5	D3
A1	Q32	1853-0018	XSTR SI PNP	3	B2	B2
A1	Q33	1853-0203	XSTR SI PNP	3	B2	B2
A1	Q34	1853-0090	XSTR SI PNP	3	F4	B3
A1	Q35	1853-0036	XSTR SI PNP	3	F6	C1
A1	Q36	1853-0036	XSTR SI PNP	3	F5	C1
A1	Q37	1853-0036	XSTR SI PNP	3	F4	C1
A1	Q38	1853-0218	XSTR SI PNP	3	H5	A2
A1	Q39	1853-0203	XSTR SI PNP	3	M3	A3
A1	Q40	1854-0345	XSTR 2N5179 SI	3	K4	A2
A1	Q41	1854-0345	XSTR 2N5179 SI	3	K4	A2
A1	Q42	1854-0009	XSTR 2N709 SI	4	M4	A4
A1	Q43	1853-0203	XSTR SI PNP	4	L5	B5
A1	Q44	1853-0015	XSTR 1.5 1 SI	4	L3	D3
A1	Q45	1854-0345	XSTR 2N5179 SI	4	M6	A4
A1	Q46	1854-0345	XSTR 2N5179 SI	4	L6	A5
A1	Q47	1854-0009	XSTR 2N709 SI	4	M4	A4
A1	Q48	1854-0215	XSTR SI NPN	4	H5	A6
A1	Q49	1854-0215	XSTR SI NPN	4	E5	A7
A1	Q50	1854-0092	XSTR 2N3563 SI	4	G4	A6
A1	Q51	1854-0092	XSTR 2N3563 SI	4	F4	A7
A1	Q52	1854-0009	XSTR 2N709 SI	4	D4	A8
A1	Q53	1853-0203	XSTR SI PNP	3	L2	A4
A1	R1	0758-3724	R-F 100 5% .25W	1	D6	C9
A1	R2	0698-0083	R-F 1.96K1%	1	D7	D9
A1	R3	0698-0083	R-F 1.96K1%	1	E7	D8
A1	R4	0698-4226	R-F 62 5% .125W	1	D6	D9
A1	R5	0698-3443	R-F 287 1% .125W	1	D4	D8
A1	R6	0698-3443	R-F 287 1% .125W	1	E4	D8
A1	R7	0698-4284	R-F 18K5% .125W	1	C5	C9

Table 5-3 Replaceable Parts: Assembly 1

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A1	R8	0757-1094	R-F 1.47K1%	1	E5	C8
A1	R9	0758-0086	R-F 100 5% .125W	1	E3	C7
A1	R10	0757-0439	R-F 90.9 1%	1	E4	C8
A1	R11	0757-0421	R-F 825 1% .125W	1	G4	C8
A1	R12	0698-4239	R-F 220 5% .125W	1	F3	C7
A1	R13	0757-0420	R-F 750 1% .125W	1	F5	C8
A1	R14	0698-4257	R-F 1.3K5% .125W	1	G5	E8
A1	R15	0698-4426	R-F 1.58K1%	1	H5	D8
A1	R16	0698-4238	R-F 200 5% .125W	1	G6	E8
A1	R17	0698-4225	R-F 56 5% .125W	1	H3	C7
A1	R18	0698-4278	R-F 10K5% .125W	1	H9	A7
A1	R19	0698-4230	R-F 82 5% .125W	1	H9	A8
A1	R20	0698-4241	R-F 270 5% .125W	1	E9	A7
A1	R21	0698-4255	R-F 1.1K5% .125W	1	G8	A7
A1	R22	0698-4284	R-F 18K5% .125W	1	G8	B7
A1	R23	0698-4261	R-F 3K5% .125W F	1	F8	B8
A1	R24	0698-4269	R-F 1.6K5% .125W	1	E8	B8
A1	R25	0698-4237	R-F 180 5% .125W	1	E8	B8
A1	R26	0698-4279	R-F 11K5% .125W	1	K9	E7
A1	R27	0698-4278	R-F 10K5% .125W	1	M5	C6
A1	R28	0698-4278	R-F 10K5% .125W	1	M5	C7
A1	R29	0757-0274	R-F 1.21K1%	1	M5	C6
A1	R30	0698-4265	R-F 3K5% .125W F	1	N4	C6
A1	R31	0757-0428	R-F 1.62K1%	1	O4	C5
A1	R32	0698-0085	R-F 2.61K1%	1	N4	C5
A1	R33	0698-4232	R-F 110 5% .125W	1	O6	C6
A1	R34	0758-0096	R-F 100 5% .175W	1	O4	D5
A1	R35	0698-4231	R-F 91 5% .125W	1	O4	D5
A1	R36	0698-4234	R-F 130 5% .125W	1	O5	D6
A1	R37	0698-3151	R-F 2.87K1%	2	B2	E5
A1	R38	0698-0084	R-F 2.15K1%	2	B2	E5
A1	R39	0698-4271	R-F 5.1K5% .125W	2	A3	D4
A1	R40	0698-4251	R-F 750 5% .125W	2	A4	D4
A1	R41	0698-4252	R-F 820 5% .125W	2	C1	E4
A1	R42	0758-0086	R-F 100 5% .125W	2	C2	E4
A1	R43	0758-0086	R-F 100 5% .125W	2	B3	E4
A1	R44	0758-0086	R-F 100 5% .125W	2	C2	D5
A1	R45	0698-4238	R-F 200 5% .125W	2	D2	D4
A1	R46	0698-0084	R-F 2.15K1%	2	D2	D4
A1	R47	0757-0274	R-F 1.21K1%	2	D2	D5
A1	R48	0698-4271	R-F 5.1K5% .125W	1	K9	E1
A1	R49	0698-4271	R-F 5.1K5% .125W	1	K8	D5
A1	R50	0698-4271	R-F 5.1K5% .125W	1	K6	D6
A1	R51	0698-4274	R-F 6.8K5% .125W	1	M7	D7
A1	R52	0698-4279	R-F 11K5% .125W	1	K8	E5
A1	R53	0698-4279	R-F 11K5% .125W	1	K6	D6
A1	R54	0698-4256	R-F 1.2K5% .125W	1	K8	D5
A1	R55	0698-4256	R-F 1.2K5% .125W	1	K6	D6
A1	R56	0757-0417	R-F 562 1% .125W	1	M8	D7
A1	R57	0757-0438	R-F 5.11K1%	1	M8	D7
A1	R58	0757-0433	R-F 3.32K1%	1	M7	D7
A1	R59	0698-4258	R-F 1.5K5% .125W	1	N8	C6
A1	R60	0698-4265	R-F 3K5% .125W F	2	A5	C4
A1	R61	0698-4265	R-F 3K5% .125W F	2	A5	B6
A1	R62	0698-5705	R-F 39 5% .125W	2	E3	C10
A1	R63	0698-3439	R-F 178 1% .125W	2	F4	D3
A1	R64	0698-0084	R-F 2.15K1%	2	H5	D3
A1	R65	0698-4260	R-F 1.8K5% .125W	3	B1	B2
A1	R66	0698-4283	R-F 16K5% .125W	3	C1	B2
A1	R67	0698-4252	R-F 820 5% .125W	3	C2	B3
A1	R68	0757-0278	R-F 1.78K1%	2	J4	E1
A1	R69	0698-0084	R-F 2.15K1%	2	J5	E1
A1	R70	0698-4264	R-F 2.7K5% .125W	2	E5	D4
A1	R71	0698-4264	R-F 2.7K5% .125W	2	E6	E3
A1	R72	0698-4264	R-F 2.7K5% .125W	2	E6	E3
A1	R73	0698-4287	R-F 24K5% .125W	2	E6	E4
A1	R74	0698-4287	R-F 24K5% .125W	2	E8	E3
A1	R75	0698-4271	R-F 5.1K5% .125W	2	E6	E4
A1	R76	0698-4271	R-F 5.1K5% .125W	2	E8	E3
A1	R77	0757-0290	R-F 6.19K1%	2	H5	D3
A1	R78	0698-5704	R-F 36 5% .125W	2	K5	D2
A1	R79	0683-4705	R-F 47 5% .25W	2	K5	C2
A1	R80	0698-5704	R-F 36 5% .125W	2	K5	D2
A1	R81	0698-4258	R-F 1.5K5% .125W	2	K6	C2
A1	R82	0698-4241	R-F 270 5% .125W	2	L4	C2
A1	R83	0698-4234	R-F 130 5% .125W	2	L4	C3
A1	R84	0758-0002	R-F 560 5% .25W	2	L5	C2
A1	R85	0698-4260	R-F 1.8K5% .125W	2	L5	C3
A1	R86	0698-4235	R-F 150 5% .125W	2	L4	D3
A1	R87	0698-4235	R-F 150 5% .125W	2	M4	B2
A1	R88	0698-4239	R-F 220 5% .125W	3	B3	B2
A1	R89	0698-5703	R-F 33 5% .125W	3	D4	C10
A1	R90	0698-3438	R-F 147 1% .125W	3	F4	C3
A1	R91	0698-4287	R-F 24K5% .125W	3	E4	C1
A1	R92	0698-4287	R-F 24K5% .125W	3	E5	D1
A1	R93	0698-4287	R-F 24K5% .125W	3	E6	D1
A1	R94	0698-4424	R-F 1.4K1% .125W	3	G4	C3
A1	R95	0757-0290	R-F 6.19K1%	4	G4	B3
A1	R96	0758-0086	R-F 100 5% .125W	3	K3	B2
A1	R97	0757-0279	R-F 1.78K1%	3	H4	A1

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A1	R98	0698-0084	R-F 2.15K1%	3	H4	A1
A1	R99	0698-4271	R-F 5.1K5% .125W	3	E5	C1
A1	R100	0698-4271	R-F 5.1K5% .125W	3	E6	D1
A1	R101	0698-4271	R-F 5.1K5% .125W	3	E7	D1
A1	R102	0698-4264	R-F 2.7K5% .125W	3	E4	C1
A1	R103	0698-4264	R-F 2.7K5% .125W	3	E5	D1
A1	R104	0698-4264	R-F 2.7K5% .125W	3	E6	D1
A1	R105	0698-5704	R-F 36 5% .125W	3	H4	B2
A1	R106	0683-4705	R-F 47 5% .25W	3	J5	A1
A1	R107	0698-4259	R-F 1.6K5% .125W	3	J5	A1
A1	R108	0698-5704	R-F 36 5% .125W	3	J4	B2
A1	R109	0698-4241	R-F 270 5% .125W	3	K3	B2
A1	R110	0698-4234	R-F 130 5% .125W	3	K3	A2
A1	R111	0758-0002	R-F 560 5% .25W	3	K4	A2
A1	R112	0698-4278	R-F 10K5% .125W	4	J5	A3
A1	R113	0698-4260	R-F 1.8K5% .125W	3	K4	A3
A1	R114	0758-0086	R-F 100 5% .125W	3	L3	B3
A1	R115	0698-0124	R-F 51 5% .125W	3	L3	B3
A1	R116	0698-4278	R-F 10K5% .125W	3	M2	A4
A1	R117	0698-4278	R-F 10K5% .125W	3	M4	A3
A1	R118	0698-6802	R-F 10 5% .125W	1	O4	D5
A1	R119	0698-4264	R-F 2.7K5% .125W	4	L5	B4
A1	R120	0758-0126	R-F 51 5% .25W F	4	K6	A5
A1	R121	0698-4238	R-F 200 5% .125W	4	J3	B4
A1	R122	0757-0419	R-F 681 1% .125W	4	K6	A5
A1	R123	0757-0419	R-F 681 1% .125W	4	K7	A5
A1	R124	0698-4254	R-F 1K5% .125W F	4	J3	A4
A1	R125	0698-4270	R-F 4.7K5% .125W	4	J4	A4
A1	R126	0757-0405	R-F 147 1% .125W	4	L5	A5
A1	R127	0698-4230	R-F 82 5% .125W	4	L3	C3
A1	R128	0698-4243	R-F 330 5% .125W	4	M3	C3
A1	R129	0757-0424	R-F 1.1K1% .125W	4	M6	A5
A1	R130	0698-4251	R-F 750 5% .125W	4	M6	B4
A1	R131	0757-0278	R-F 1.78K1%	4	M6	A4
A1	R132	0698-4271	R-F 5.1K5% .125W	4	J4	C4
A1	R133	0698-4257	R-F 1.3K5% .125W	4	N3	A4
A1	R134	0698-4238	R-F 200 5% .125W	4	N3	A4
A1	R135	0698-4269	R-F 4.3K5% .125W	4	N4	A4
A1	R136	0698-4241	R-F 270 5% .125W	4	B3	B8
A1	R137	0698-4262	R-F 2.2K5% .125W	4	B3	A8
A1	R138	0698-4256	R-F 1.2K5% .125W	4	B3	A8
A1	R139	0698-4238	R-F 200 5% .125W	4	C5	D5
A1	R140	0758-0086	R-F 100 5% .125W	4	C4	B8
A1	R141	0698-4242	R-F 300 5% .125W	4	C3	B9
A1	R142	0698-5732	R-F 30 5% .125W	4	C2	B8
A1	R143	0698-4270	R-F 4.7K5% .125W	4	C4	C4
A1	R144	0698-4254	R-F 1K5% .125W F	4	C5	C4
A1	R145	0698-4237	R-F 180 5% .125W	4	D5	A9
A1	R146	0757-1094	R-F 1.47K1%	4	G3	B6
A1	R147	0757-1094	R-F 1.47K1%	4	F3	B6
A1	R148	0758-0086	R-F 100 5% .125W	4	F4	B7
A1	R149	0758-0086	R-F 100 5% .125W	4	G4	B6
A1	R150	0758-0086	R-F 100 5% .125W	4	A5	B6
A1	R151	0757-0915	R-F 430 2% .125W	4	E4	A8
A1	R152	0757-0398	R-F 75 1% .125W	4	F5	B7
A1	R153	0757-0424	R-F 1.1K1% .125W	4	F6	A7
A1	R154	0757-0424	R-F 1.1K1% .125W	4	G6	A6
A1	R155	0757-0280	R-F 1K1% .125W F	4	F6	A6
A1	R156	0757-0398	R-F 75 1% .125W	4	G5	B6
A1	R157	0757-0280	R-F 1K1% .125W F	4	H5	A5
A1	R158	0698-4266	R-F 3.3K5% .125W	4	H5	B5
A1	R159	0698-6744	R-F 20 5% .125W	1	H3	C7
A1	R160	0758-0086	R-F 100 5% .125W	1	E6	C8
A1	R161	0698-4256	R-F 1.2K5% .125W	1	K9	E6
A1	R162	0698-4287	R-F 24K5% .125W	2	E5	D4
A1	R163	0698-4271	R-F 5.1K5% .125W	2	E5	D3
A1	R164	0698-6802	R-F 10 5% .125W	2	B3	D4
A1	R165	0698-6802	R-F 10 5% .125W	2	H5	D3
A1	R166	0758-0086	R-F 100 5% .125W	3	C2	B2
A1	R167	0698-4238	R-F 200 5% .125W	3	L2	B4
A1	R168	0698-4270	R-F 4.7K5% .125W	3	L3	A3
A1	R169	0698-4253	R-F 910 5% .125W	3	M2	B3
A1	R170	0698-6802	R-F 10 5% .125W	1	F8	B7
A1	R171	0698-6802	R-F 10 5% .125W	4	E5	A7
A1	R172	0698-6802	R-F 10 5% .125W	4	H5	A5
A1	R173	0698-4225	R-F 56 5% .125W	4	F4	A6
A1	R174	0698-4238	R-F 200 5% .125W	4	A6	A6
A1	R175	0698-4273	R-F 6.2K5% .125W	4	A6	A6
A1	R176	0698-4240	R-F 240 5% .125W	2	C2	E4
A1	R177	0683-1055	R-F 1M5% .25W CC	2	F5	D2
A1	R178	0683-1055	R-F 1M5% .25W CC	2	F7	E2
A1	R179	0683-1055	R-F 1M5% .25W CC	2	F8	E2
A1	R180	0683-1055	R-F 1M5% .25W CC	3	F5	B2
A1	R181	0683-1055	R-F 1M5% .25W CC	3	F6	B1
A1	R182	0683-1055	R-F 1M5% .25W CC	3	F7	B1
A1	R183	0698-5702	R-F 30 5% .125W	1	N4	C5
A1	R185	0683-1055	R-F 1M5% .25W CC	1	L10	D6
A1	R186	0683-1055	R-F 1M5% .25W CC	1	L8	E5
A1	R184	0683-1055	R-F 1M5% .25W CC	1	L7	E5

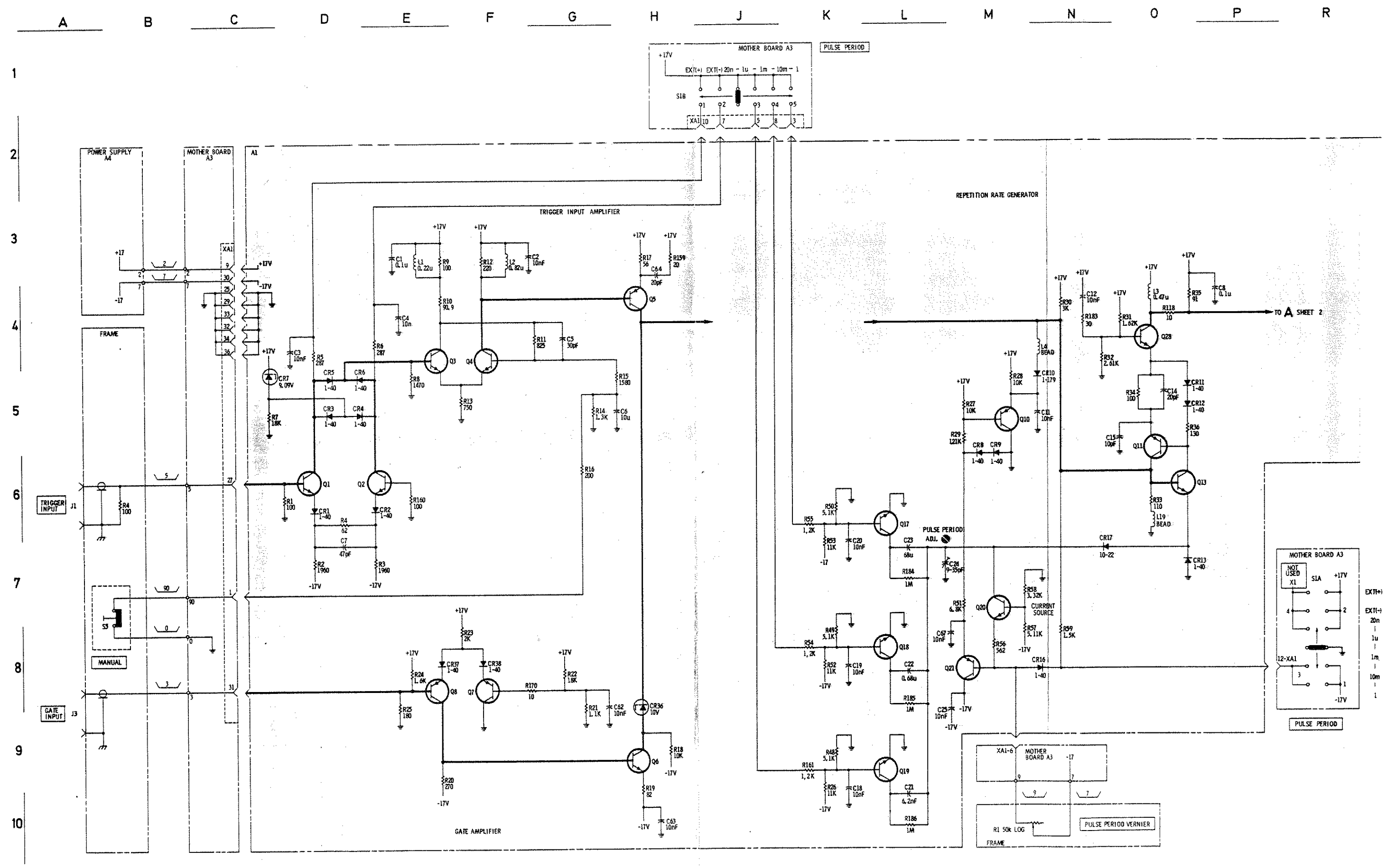


Figure 5–11 Circuit Diagram: Assembly 1 Sheet 1 of 4

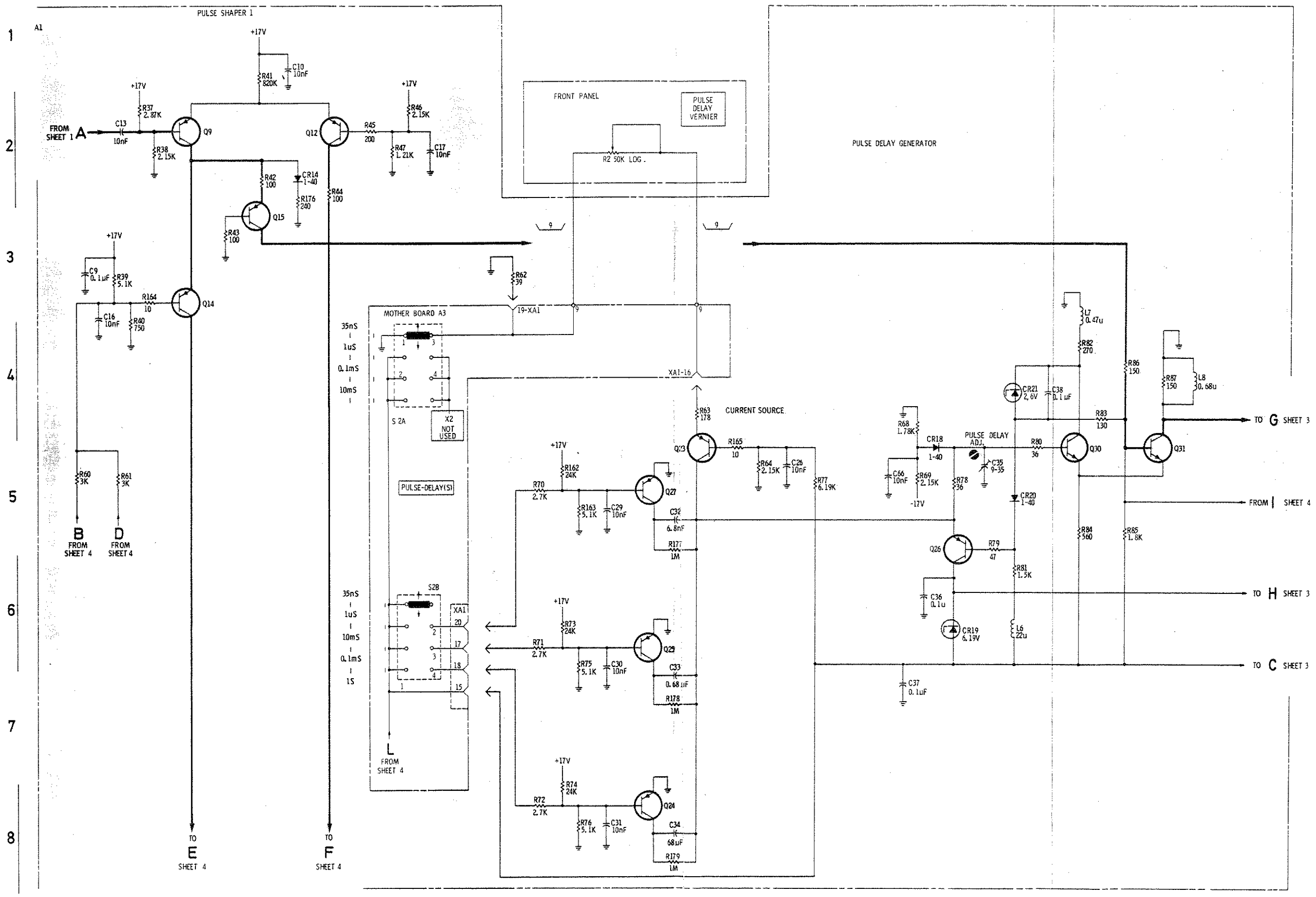


Figure 5–11 Circuit Diagram: Assembly 1 Sheet 2 of 4

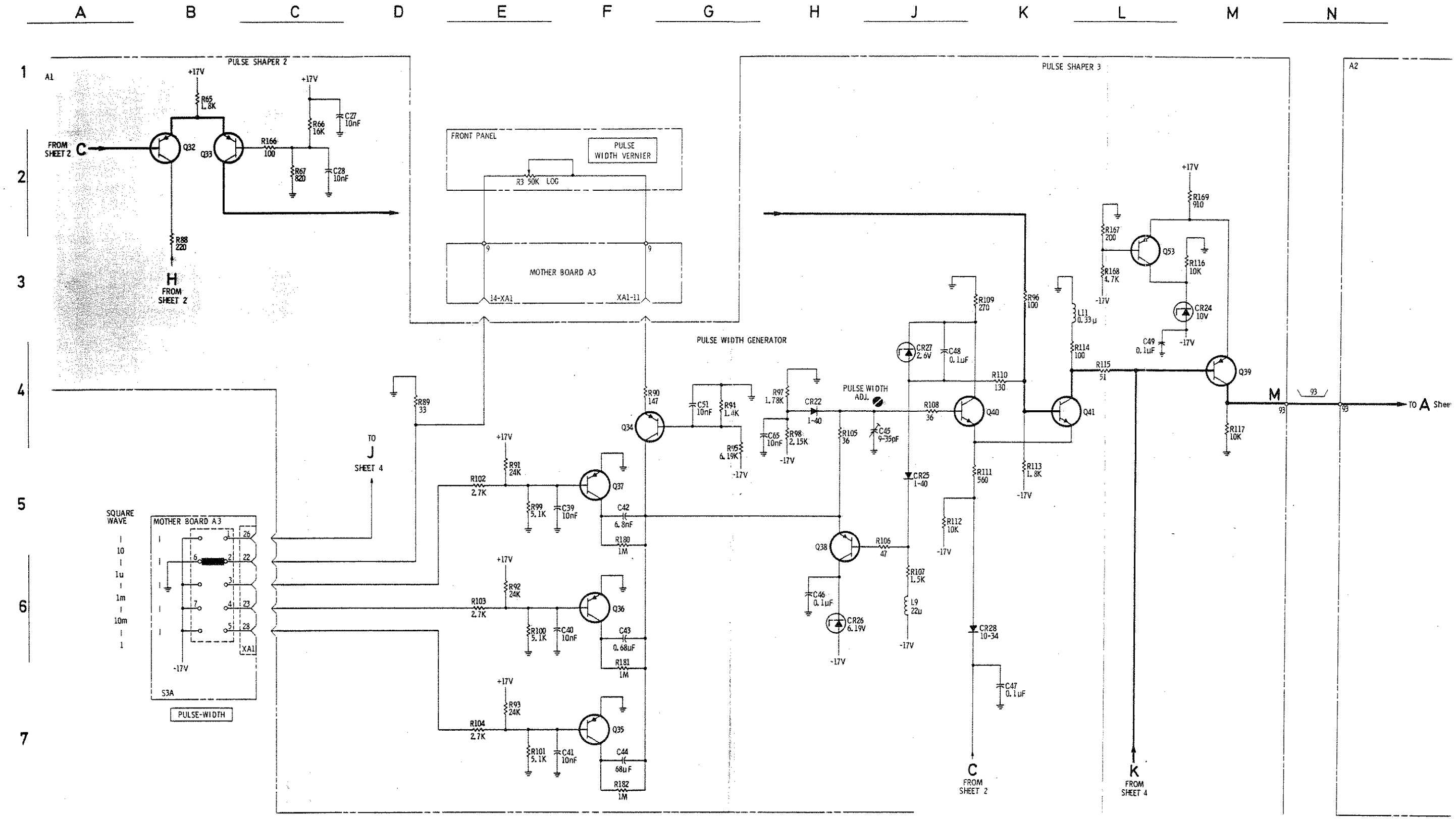


Figure 5–11 Circuit Diagram: Assembly 1 Sheet 3 of

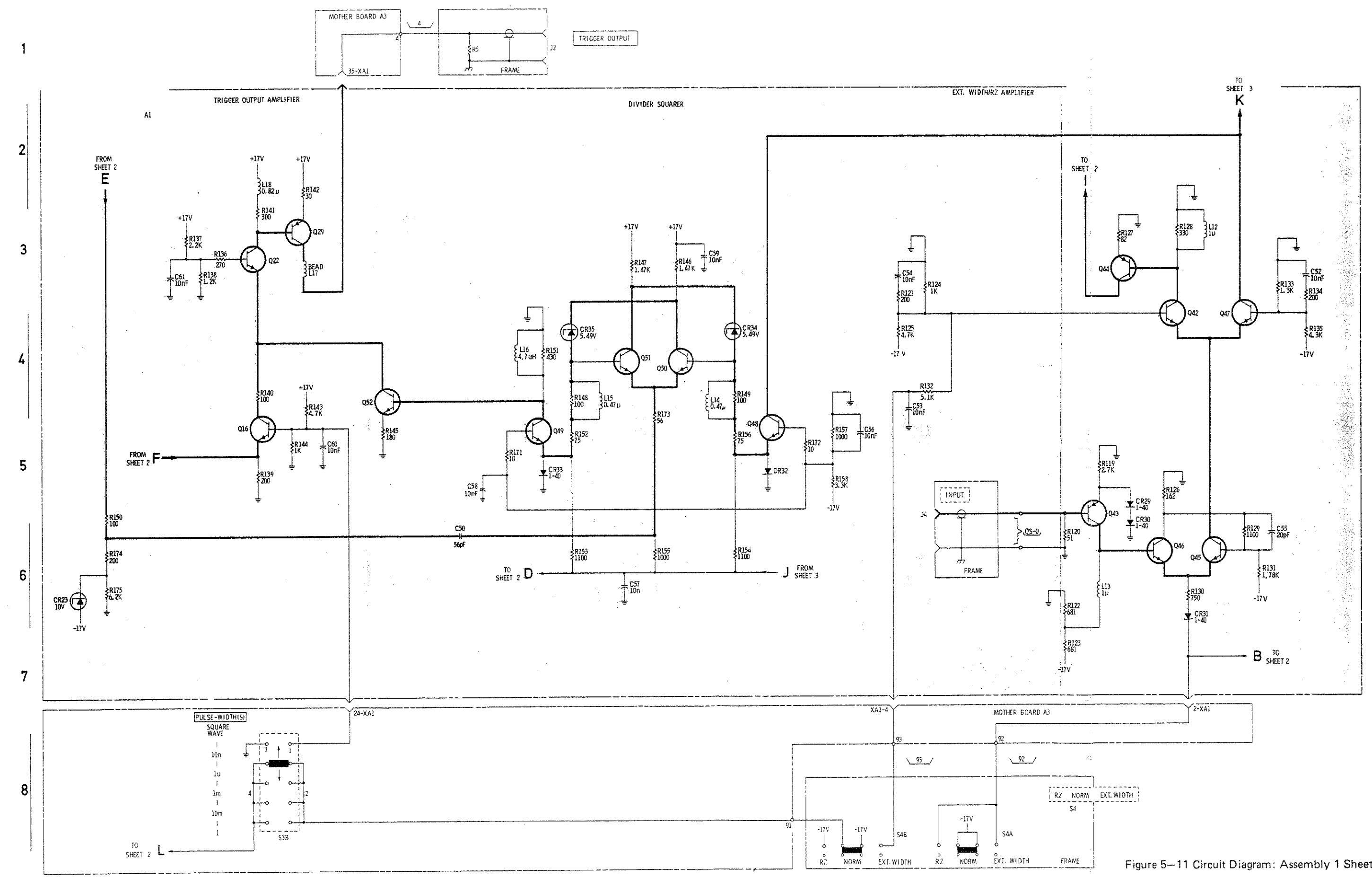


Figure 5—11 Circuit Diagram: Assembly 1 Sheet 4 of 4

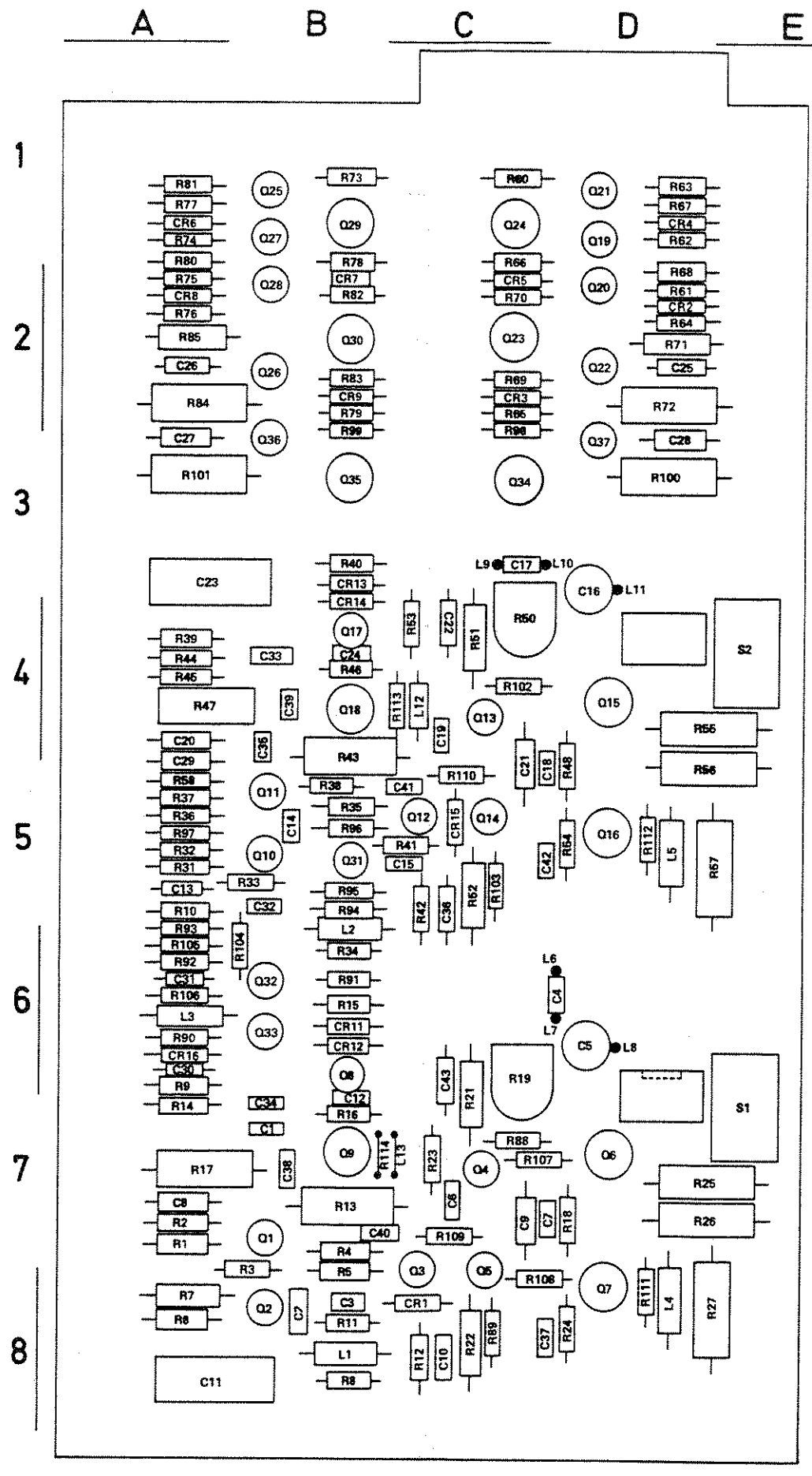


Figure 5–12 Component Layout: Assemblies 2 and 3

Table 5—4 Replaceable Parts: Assembly 2

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A2	1	0340-0720	INSUL PAD XSTR			
A2	2	0340-0720	INSUL PAD XSTR			
A2	3	0340-0720	INSUL PAD XSTR			
A2	4	0340-0720	INSUL PAD XSTR			
A2	5	0340-0720	INSUL PAD XSTR			
A2	6	0340-0720	INSUL PAD XSTR			
A2	7	0340-0720	INSUL PAD XSTR			
A2	8	0340-0720	INSUL PAD XSTR			
A2	9	0340-0720	INSUL PAD XSTR			
A2	10	0340-0720	INSUL PAD XSTR			
A2	11	0340-0720	INSUL PAD XSTR			
A2	12	0340-0720	INSUL PAD XSTR			
A2	13	0340-0720	INSUL PAD XSTR			
A2	C1	0150-0050	C-F .001UF 1KV	1	D4	B7
A2	C2	0160-2306	C-F 27PF 300V	1	E3	B8
A2	C3	0160-0356	C-F 18PF 300V	1	G3	B8
A2	C4	0160-2263	C-F 18PF 500V	1	I3	D6
A2	C5	0121-0046	C-VAR 9-35PF	1	I3	D6
A2	C6	0150-0093	C-F .01UF 100V	1	J2	C7
A2	C7	0150-0093	C-F .01UF 100V	1	J3	D7
A2	C8	0180-0291	C-F 1UF 35V	1	H4	A7
A2	C9	0180-0291	C-F 1UF 35V	1	K4	C7
A2	C10	0160-0174	C-F .47UF 25V	1	J1	C8
A2	C11	0180-0098	C-F 100UF 20V	1	J1	A8
A2	C12	0150-0093	C-F .01UF 100V	1	H1	B7
A2	C13	0150-0050	C-F .001UF 1KV	1	D6	A5
A2	C14	0140-0190	C-F 39PF 300V	1	E7	B5
A2	C15	0160-0356	C-F 18PF 300V	1	G8	C5
A2	C16	0121-0046	C-VAR 9-35PF	1	I8	D3
A2	C17	0160-2263	C-F 18PF 500V	1	I8	C3
A2	C18	0150-0093	C-F .01UF 100V	1	J8	D4
A2	C19	0150-0093	C-F .01UF 100V	1	J9	C4
A2	C20	0180-0291	C-F 1UF 35V	1	H7	A4
A2	C21	0180-0291	C-F 1UF 35V	1	K7	C4
A2	C22	0160-0174	C-F .47UF 25V	1	I10	C4
A2	C23	0180-0098	C-F 100UF 20V	1	K10	A3
A2	C24	0150-0093	C-F .01UF 100V	1	H10	B4
A2	C25	0150-0121	C-F .1UF 50V	2	D7	D2
A2	C26	0150-0121	C-F .1UF 50V	2	D1	A2
A2	C27	0180-0309	C-T 4.7UF 10V	2	D4	A3
A2	C28	0180-0309	C-T 4.7UF 10V	2	D4	D3
A2	C29	0180-0197	C-F2.2UF 20V	1	C7	A4
A2	C30	0150-0093	C-F .01UF 100V	1	B7	A6
A2	C31	0150-0093	C-F .01UF 100V	1	C6	A6
A2	C32	0150-0093	C-F .01UF 100V	1	D8	B5
A2	C33	0150-0093	C-F .01UF 100V	1	G10	B4
A2	C34	0150-0093	C-F .01UF 100V	1	H2	B7
A2	C35	0160-0174	C-F .47UF 25V	1	F7	B4
A2	C36	0160-0174	C-F .47UF 25V	1	K10	C5
A2	C37	0150-0093	C-F .01UF 100V	1	H4	D8
A2	C38	0150-0093	C-F .01UF 100V	1	K4	B7
A2	C39	0150-0093	C-F .01UF 100V	1	K7	B4
A2	C40	0160-2243	C-F 2.7PF 500V	1	I3	B7
A2	C41	0160-2236	C-F 1PF 500V	1	I7	C5
A2	C42	0150-0093	C-F .01UF 100V		H9	C5
A2	CR1	1910-0034	DIO-GE 25V .1A	1	H3	C8
A2	CR2	1901-0040	DIO SI 30V .03A	2	C6	D2
A2	CR3	1901-0040	DIO SI 30V .03A	2	D5	C2
A2	CR4	1901-0040	DIO SI 30V .03A	2	C7	D1
A2	CR5	1901-0040	DIO SI 30V .03A	2	D7	C2
A2	CR6	1901-0040	DIO SI 30V .03A	2	C2	A1
A2	CR7	1901-0040	DIO SI 30V .03A	2	D1	B2
A2	CR8	1901-0040	DIO SI 30V .03A	2	C3	A2
A2	CR9	1901-0040	DIO SI 30V .03A	2	D3	B2
A2	CR11	1901-0040	DIO SI 30V .03A	1	G2	B6
A2	CR12	1901-0040	DIO SI 30V .03A	1	G2	B6
A2	CR13	1901-0040	DIO SI 30V .03A	1	G9	B3
A2	CR14	1901-0040	DIO SI 30V .03A	1	G9	B4
A2	CR15	1910-0034	DIO-GE 25V .1A	1	H8	C5
A2	CR16	1902-3139	DIO BKDN 8.25 V	1	B7	A6
A2	L1	9100-1616	COIL COKE 1.5 UH	1	F3	B8
A2	L2	9100-1616	COIL COKE 1.5 UH	1	E8	B5
A2	L3	9100-1613	COIL COKE .47 UH	1	B8	A6
A2	L4	9100-1611	COIL CHOKE .22UH	1	J5	D8
A2	L5	9100-1611	COIL CHOKE .22UH	1	J6	D5
A2	L6	9170-0029	CORE FERRI BEAD	1	I3	D6
A2	L7	9170-0029	CORE FERRI BEAD	1	I3	D6
A2	L8	9170-0029	CORE FERRI BEAD	1	I3	D6
A2	L9	9170-0029	CORE FERRI BEAD	1	I8	C3
A2	L10	9170-0029	CORE FERRI BEAD	1	I8	C3
A2	L11	9170-0029	CORE FERRI BEAD	1	I8	D3
A2	*L12	*9100-2249	*COIL-CHOKE 15 UH	1	K8	C4
A2	*L13	*	*	1	K2	B7
A2	MP6	1205-0033	HT-SINK TO-5			
A2	MP7	1205-0033	HT-SINK TO-5			
A2	MP14	1200-0185	PAD XSTR			
A2	MP15	1200-0185	PAD XSTR			
A2	MP15	1205-0033	HT-SINK TO-5			
A2	MP16	1200-0185	PAD XSTR			
A2	MP16	1205-0033	HT-SINK TO-5			
A2	MP17	1200-0185	PAD XSTR			
A2	MP18	1200-0185	PAD XSTR			
A2	MP19	1200-0185	PAD XSTR			
A2	MP20	1200-0185	PAD XSTR			
A2	MP21	1200-0185	PAD XSTR			
A2	MP22	1200-0185	PAD XSTR			
A2	MP23	1200-0185	PAD XSTR			
A2	MP23	1205-0033	HT-SINK TO-5			
A2	MP30	1205-0033	HT-SINK TO-5			
A2	MP34	1205-0033	HT-SINK TO-5			
A2	MP35	1205-0033	HT-SINK TO-5			
A2	Q1	1854-0345	XSTR 2N5179 SI	1	E3	B7
A2	Q2	1854-0345	XSTR 2N5179 SI	1	F3	B8
A2	Q3	1853-0218	XSTR SI PNP	1	H3	C8
A2	Q4	1205-0037	HT-SINK XSTR	1	J2	C7
A2	Q4	1853-0218	XSTR SI PNP	1	J2	C7
A2	Q5	1205-0037	HT-SINK XSTR	1	J2	C8
A2	Q5	1853-0218	XSTR SI PNP	1	J2	C8
A2	Q6	1853-0201	XSTR SI PNP	1	J4	D7
A2	Q7	1853-0201	XSTR SI PNP	1	J4	D8
A2	Q8	1853-0090	XSTR SI PNP	1	H2	B6
A2	Q9	1205-0011	HT-SINK XSTR	1	I2	B7
A2	Q9	1854-0003	XSTR SI NPN	1	I2	B7
A2	Q10	1853-0015	XSTR 1.5 1 SI	1	E6	B5
A2	Q11	1853-0015	XSTR 1.5 1 SI	1	F7	B5
A2	Q12	1854-0301	XSTR 2N3261 SI	1	H8	C5
A2	Q13	1205-0037	HT-SINK XSTR	1	J8	C4
A2	Q13	1854-0301	XSTR 2N3261 SI	1	J8	C4
A2	Q14	1205-0037	HT-SINK XSTR	1	J8	C5
A2	Q14	1854-0301	XSTR 2N3261 SI	1	J8	C5
A2	Q15	1854-0332	XSTR SI NPN	1	J7	D4
A2	Q16	1854-0332	XSTR SI NPN	1	J7	D5
A2	Q17	1854-0307	XSTR SI NPN	1	H9	D6
A2	Q18	1205-0011	HT-SINK XSTR	1	H9	B4
A2	Q18	1853-0012	XSTR 2.6 1 SI	1	H9	B4
A2	Q19	1854-0215	XSTR SI NPN	2	D5	D1
A2	Q20	1854-0215	XSTR SI NPN	2	D7	D2
A2	Q21	1853-0036	XSTR SI PNP	2	D7	D1
A2	Q22	1853-0036	XSTR SI PNP	2	D5	D2
A2	Q23	1854-0039	XSTR 2N3053 SI	2	E5	C2
A2	Q24	1853-0027	XSTR SI PNP	2	E7	C1
A2	Q25	1854-0215	XSTR SI NPN	2	D2	B1
A2	Q26	1854-0215	XSTR SI NPN	2	D3	B2
A2	Q27	1853-0036	XSTR SI PNP	2	D3	B1
A2	Q28	1853-0036	XSTR SI PNP	2	D2	B2
A2	Q29	1854-0039	XSTR 2N3053 SI	2	E2	B1
A2	Q30	1853-0027	XSTR SI PNP	2	E3	B2
A2	Q31	1853-0203	XSTR SI PNP	1	E7	B5
A2	Q32	1853-0203	XSTR SI PNP	1	B6	B6
A2	Q33	1854-0345	XSTR 2N5179 SI	1	B5	B6
A2	Q34	1854-0039	XSTR 2N3053 SI	2	F5	C3
A2	Q35	1853-0027	XSTR SI PNP	2	F2	B3
A2	Q36	1854-0215	XSTR SI NPN	2	F3	B3
A2	Q37	1853-0036	XSTR SI PNP	2	E4	D3
A2	R1	0757-0280	R-F 1K1% .125W F	1	D3	A7
A2	R2	0757-0317	R-F 1.33K1%	1	D4	A7
A2	R3	0698-4225	R-F 56 5% .125W	1	D3	B8
A2	R4	0698-3438	R-F 147 1% .125W	1	E3	B7
A2	R5	0757-0419	R-F 681 1% .125W	1	E3	B8
A2	R6	0757-0317	R-F 1.33K1%	1	F3	A8
A2	R7	0758-0029	R-F 470 5% .25W	1	E4	A8
A2	R8	0698-4242	R-F 300 5% .125W	1	F2	B8
A2	R9	0698-3151	R-F 2.87K1%	1	G1	A6
A2	R10	0757-0441	R-F 8.25K1%	1	G2	A5
A2	R11	0698-4247	R-F 510 5% .125W	1	G3	B8
A2	R12	0698-4239	R-F 220 5% .125W	1	G2	C8
A2	R13	0761-0042	R-F 68 5% 1W MO	1	H2	B7
A2	R14	0698-4477	R-F 10.5K1%	1	G2	A7
A2	R15	0698-4236	R-F 160 5% .125W	1	H1	B6
A2	R16	0698-4249	R-F 620 5% .125W	1	H1	B7
A2	R17	0760-0024	R-F 100 5% 1W MO	1	I2	A7
A2	R18	0683-4705	R-F 47 5% .25W	1	I4	D7
A2	R19	2100-2796	R-VAR 100 .5W	1	I3	C6
A2	P21	0698-5887	R-F 30 5% .25W F	1	J1	C6
A2	R22	0698-5887	R-F 30 5% .25W F	1	J1	C8
A2	R23	0698-4236	R-F 160 5% .125W	1	K1	C7
A2	R24	0683-4705	R-F 47 5% .25W	1	J4	D8
A2	R25	0761-0035	R-F 150 5% 1W MO	1	J5	E7
A2	R26	0761-0035	R-F 150 5% 1W MO	1	J4	E7
A2	R27	0761-0035	R-F 150 5% 1W MO	1	J5	E8
A2	R31	0698-0083	R-F 1.96K1%	1	C7	A5
A2	R32	0757-0421	R-F 825 1% .125W	1	D7	A5
A2	R33	0698-4225	R-F 56 5% .125W	1	D6	B5
A2	R34	0698-4242	R-F 300 5% .125W	1	E8	B6
A2	R35	0757-0280	R-F 1K1% .125W F	1	E7	B5
A2	R36	0698-3155	R-F 4.64K1%	1	F7	A5
A2	R37	0757-0407	R-F 200 1% .125W	1	E6	A5
A2	R38	0698-4239	R-F 220 5% .125W	1	F7	B5
A2	R39	0698-3151	R-F 2.87K1%	1	G9	A4
A2	R40	0757-0441	R-F 8.25K1%	1	G9	B3

Table 5—4 Replaceable Parts: Assembly 2

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A2	R41	0698-4247	R-F 510 5% .125W	1	G8	C5
A2	R42	0698-4239	R-F 220 5% .125W	1	G8	C5
A2	R43	0761-0042	R-F 68 5% 1W MO	1	H8	B4
A2	R44	0757-0443	R-F 11K1% .125W	1	G10	A4
A2	R45	0698-4236	R-F 160 5% .125W	1	H10	A5
A2	R46	0698-4249	R-F 620 5% .125W	1	H9	B4
A2	R47	0760-0024	R-F 100 5% 1W MO	1	H9	A4
A2	R48	0683-4705	R-F 47 5% .25W	1	I7	D4
A2	R50	2100-2796	R-VAR 100 .5W	1	I8	C4
A2	R51	0698-5887	R-F 30 5% .25W F	1	J9	C4
A2	R52	0698-5887	R-F 30 5% .25W F	1	J9	C5
A2	R53	0698-4236	R-F 160 5% .125W	1	K9	C4
A2	R54	0683-4705	R-F 47 5% .25W	1	J7	D5
A2	R55	0761-0035	R-F 150 5% 1W MO	1	J6	D4
A2	R56	0761-0035	R-F 150 5% 1W MO	1	J6	D4
A2	R57	0761-0035	R-F 150 5% 1W MO	1	J6	E5
A2	R58	0698-4254	R-F 1K5% .125W F	1	C7	A5
A2	R60	0757-0289	R-F 13.3K1%	2	C6	C1
A2	R61	0698-4239	R-F 220 5% .125W	2	C6	D2
A2	R62	0698-4239	R-F 220 5% .125W	2	C6	D1
A2	R63	0757-0289	R-F 13.3K1%	2	C7	D1
A2	R64	0757-0289	R-F 13.3K1%	2	C5	D2
A2	R65	0757-0280	R-F 1K1% .125W F	2	D5	C2
A2	R66	0757-0280	R-F 1K1% .125W F	2	D7	C1
A2	R67	0757-0280	R-F 1K1% .125W F	2	D6	D1
A2	R68	0757-0280	R-F 1K1% .125W F	2	D6	D1
A2	R69	0698-4251	R-F 750 5% .125W	2	D6	C2
A2	R70	0698-4251	R-F 750 5% .125W	2	D6	C2
A2	R71	0758-0096	R-F 110 5% .25W	2	E7	D2
A2	R72	0760-0012	R-F 51 2% 1W MO	2	E5	D2
A2	R73	0757-0289	R-F 13.3K1%	2	C2	B1
A2	R74	0698-4239	R-F 220 5% .125W	2	C2	A1
A2	R75	0698-4239	R-F 220 5% .125W	2	C3	A2
A2	R76	0757-0289	R-F 13.3K1%	2	C3	A2
A2	R77	0757-0289	R-F 13.3K1%	2	C1	A1
A2	R78	0757-0280	R-F 1K1% .125W F	2	D1	B1
A2	R79	0757-0280	R-F 1K1% .125W F	2	D4	B2
A2	R80	0757-0280	R-F 1K1% .125W F	2	D3	A1
A2	R81	0757-0280	R-F 1K1% .125W F	2	D2	A1
A2	R82	0698-4251	R-F 750 5% .125W	2	D2	B2
A2	R83	0698-4251	R-F 750 5% .125W	2	D3	B2
A2	R84	0760-0012	R-F 51 2% 1W MO	2	E4	A2
A2	R85	0758-0096	R-F 110 5% .25W	2	E1	A2
A2	R88	0698-4258	R-F 1.5K5% .125W	1	I2	C7
A2	R89	0698-4258	R-F 1.5K5% .125W	1	J2	C8
A2	R90	0698-4231	R-F 91 5% .125W	1	B8	A6
A2	R91	0758-0086	R-F 100 5% .125W	1	B7	B6
A2	R92	0698-4254	R-F 1K5% .125W F	1	B6	A6
A2	R93	0698-4254	R-F 1K5% .125W F	1	C6	A5
A2	R94	0698-0083	R-F 1.96K1%	1	D7	B5
A2	R95	0757-0421	R-F 825 1% .125W	1	D8	B5
A2	R96	0757-0400	R-F 90.9 1%	1	E7	B5
A2	R97	0698-4258	R-F 1.5K5% .125W	1	E7	A5
A2	R98	0698-4251	R-F 750 5% .125W	2	E5	C2
A2	R99	0698-4251	R-F 750 5% .125W	2	F3	B2
A2	R100	0760-0012	R-F 51 2% 1W MO	2	F4	D3
A2	R101	0760-0012	R-F 51 2% 1W MO	2	F4	A3
A2	R102	0698-4258	R-F 1.5K5% .125W	1	I9	C4
A2	R103	0698-4258	R-F 1.5K5% .125W	1	K9	C5
A2	R104	0698-5702	R-F 30 5% .125W	1	D7	B6
A2	R105	0698-5702	R-F 30 5% .125W	1	C6	A6
A2	R106	0698-5702	R-F 30 5% .125W	1	B5	A6
A2	R107	0683-0475	R-F 4.7 5% .25W	1	J4	C7
A2	R108	0683-0475	R-F 4.7 5% .25W	1	J4	C8
A2	R109	0683-4705	R-F 47 5% .25W	1	I3	C7
A2	R110	0683-4705	R-F 47 5% .25W	1	I7	C5
A2	R111	0698-4239	R-F 220 5% .125W	1	I4	D7
A2	R112	0698-4239	R-F 220 5% .125W	1	I6	D5
A2	*R113	*0698-6744	*R-F 20 5% .125W	1	K8	C4
A2	*R114	*	*	1	K1	B7
A2	S1	3101-0973	SW SLIDE DPDT			
A2	S2	3101-0973	SW SLIDE DPDT			

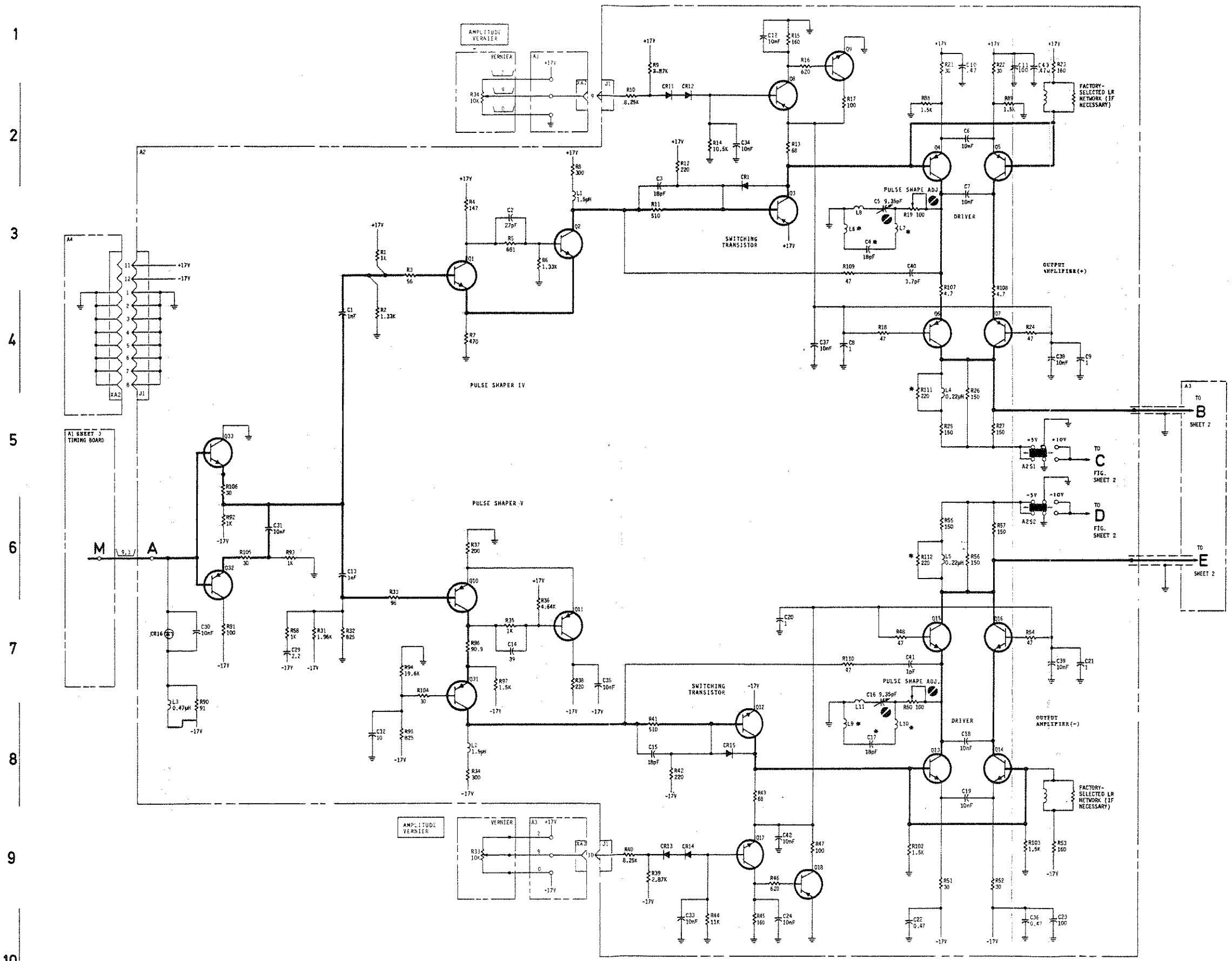


Figure 5–13 Circuit Diagram: Assemblies 2 and 3 Sheet 1 of 2

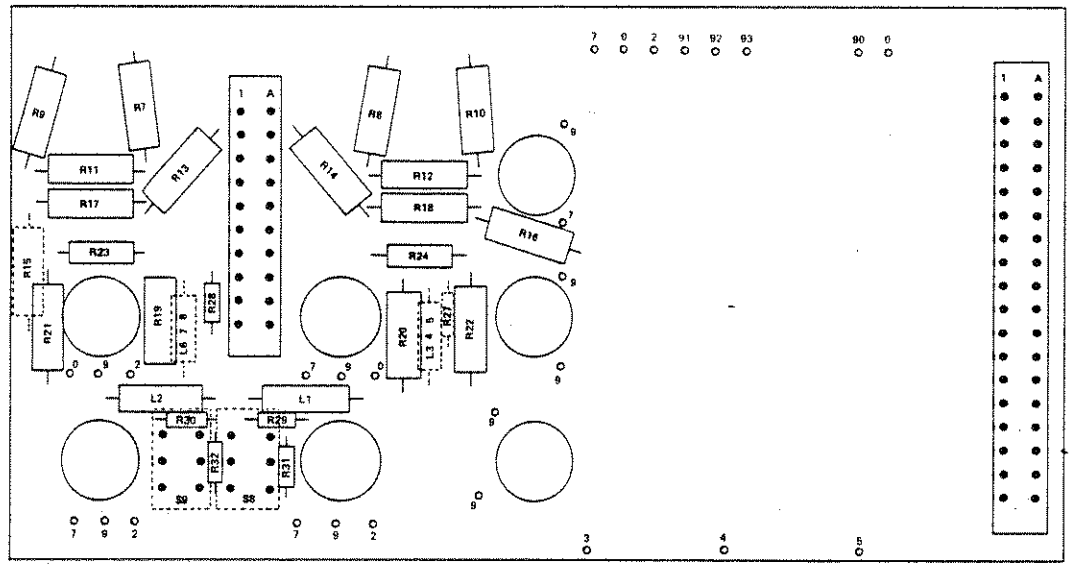


Figure 5–12 Component Layout: Assemblies 2 and 3

Table 5–5 Replaceable Parts: Assembly 3

REFERENCE DESIGNATOR		HP PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A3	17	0757-0799	R-F 121 1% 1/2W			
A3	18	0757-0799	R-F 121 1% 1/2W			
A3	L1	9140-0118	COIL-CHOKE 500UH			
A3	L2	9140-0118	COIL-CHOKE 500UH			
A3	L3	9170-0029	CORE FERRI BEAD			
A3	L4	9170-0029	CORE FERRI BEAD			
A3	L5	9170-0029	CORE FERRI BEAD			
A3	L6	9170-0029	CORE FERRI BEAD			
A3	L7	9170-0029	CORE FERRI BEAD			
A3	L8	9170-0029	CORE FERRI BEAD			
A3	R7	0760-0027	R-F 150 2% 1W MO			
A3	R8	0760-0027	R-F 150 2% 1W MO			
A3	R9	0760-0027	R-F 150 2% 1W MO			
A3	R10	0760-0027	R-F 150 2% 1W MO			
A3	R11	0757-0172	R-F 37.4 1% .5W			
A3	R12	0757-0172	R-F 37.4 1% .5W			
A3	R13	0760-0026	R-F 75 2% 1W MO			
A3	R14	0760-0026	R-F 75 2% 1W MO			
A3	R15	0760-0026	R-F 75 2% 1W MO			
A3	R16	0760-0026	R-F 75 2% 1W MO			
A3	R19	0761-0003	R-F 62 5% 1W MO			
A3	R20	0761-0003	R-F 62 5% 1W MO			
A3	R21	0761-0003	R-F 62 5% 1W MO			
A3	R22	0761-0003	R-F 62 5% 1W MO			
A3	R23	0757-0071	R-F 247.5 1%			
A3	R24	0757-0071	R-F 247.5 1%			
A3	R27	0698-4238	R-F 200 5% .125W			
A3	R28	0698-4238	R-F 200 5% .125W			
A3	R29	0698-4272	R-F 5.6K5% .125W			
A3	R30	0698-4272	R-F 5.6K5% .125W			
A3	R31	0698-4270	R-F 4.7K5% .125W			
A3	R32	0698-4270	R-F 4.7K5% .125W			
A3	S1	5040-1109	SLIDAY			
A3	S2	5040-1109	SLIDAY			
A3	S5	5040-1110	SLIDAY			
A3	S6	5040-1112	SLIDAY			
A3	S7	5040-1112	SLIDAY			
A3	S8	3101-1311	SW SLIDE DPDT			
A3	S9	3101-1311	SW SLIDE DPDT			

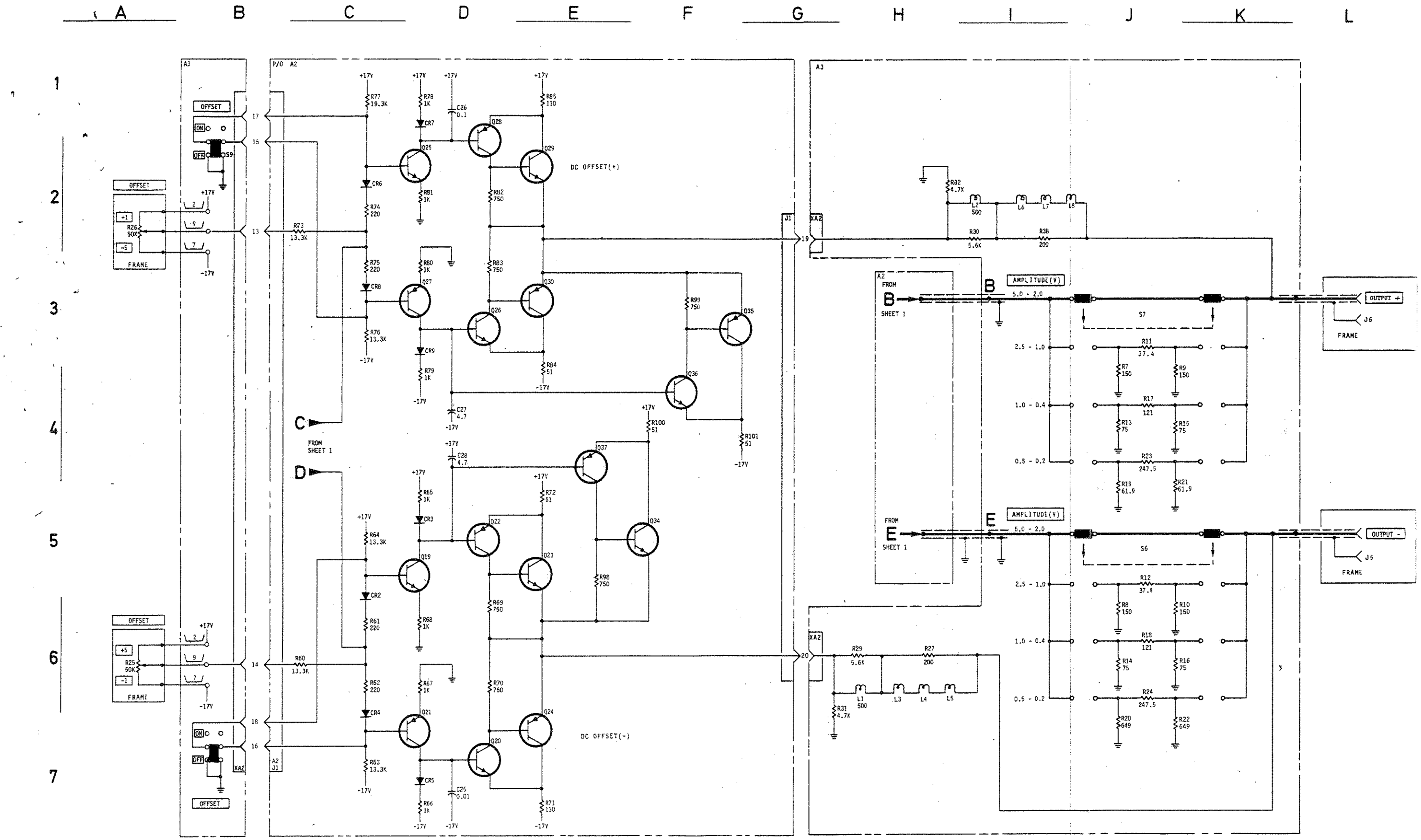


Figure 5–13 Circuit Diagram: Assemblies 2 and 3 Sheet 2 of 2

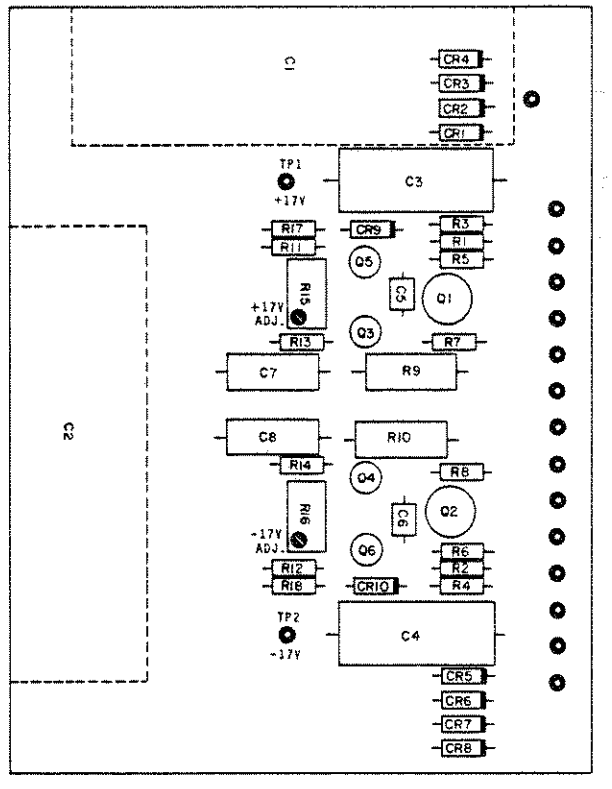


Figure 5–14 Component Layout: Assembly 4

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A4	C1	0180-1784	C-F 1000UF 40V			
A4	C2	0180-1784	C-F 1000UF 40V			
A4	C3	0180-0050	C-F 47UF 50V			
A4	C4	0180-0050	C-F 47UF 50V			
A4	C5	0160-2930	C-F .01UF 100V			
A4	C6	0160-2930	C-F .01UF 100V			
A4	C7	0180-0228	C-F 22UF 15V			
A4	C8	0180-0228	C-F 22UF 15V			
A4	CR1	1901-0049	DIO SI 50V .75A			
A4	CR2	1901-0049	DIO SI 50V .75A			
A4	CR3	1901-0049	DIO SI 50V .75A			
A4	CR4	1901-0049	DIO SI 50V .75A			
A4	CR5	1901-0049	DIO SI 50V .75A			
A4	CR6	1901-0049	DIO SI 50V .75A			
A4	CR7	1901-0049	DIO SI 50V .75A			
A4	CR8	1901-0049	DIO SI 50V .75A			
A4	CR9	1902-0049	DIO BKDN 6.19 V			
A4	CR10	1902-0049	DIO BKDN 6.19 V			
A4	Q1	1854-0613	XSTR 2N2218A SI			
A4	Q2	1854-0613	XSTR 2N2218A SI			
A4	Q3	1854-0307	XSTR SI NPN			
A4	Q4	1854-0307	XSTR SI NPN			
A4	Q5	1854-0307	XSTR SI NPN			
A4	Q6	1854-0307	XSTR SI NPN			
A4	R1	0698-4265	R-F 3K5% .125W F			
A4	R2	0698-4265	R-F 3K5% .125W F			
A4	R3	0698-4271	R-F 5.1K5% .125W			
A4	R4	0698-4271	R-F 5.1K5% .125W			
A4	R5	0698-4276	R-F 8.2K5% .125W			
A4	R6	0698-4276	R-F 8.2K5% .125W			
A4	R7	0698-4261	R-F 2K5% .125W F			
A4	R8	0698-4261	R-F 2K5% .125W F			
A4	R9	0811-0929	R-F .51 5% 2W PW			
A4	R10	0811-0929	R-F .51 5% 2W PW			
A4	R11	0698-4261	R-F 2K5% .125W F			
A4	R12	0698-4261	R-F 2K5% .125W F			
A4	R13	0698-4262	R-F 2.2K5% .125W			
A4	R14	0698-4262	R-F 2.2K5% .125W			
A4	R15	2100-2741	R-VAR 470 2W CER			
A4	R16	2100-2741	R-VAR 470 2W CER			
A4	R17	0698-4257	R-F 1.3K5% .125W			
A4	R18	0698-4257	R-F 1.3K5% .125W			

Table 5–6 Replaceable Parts: Assembly 4

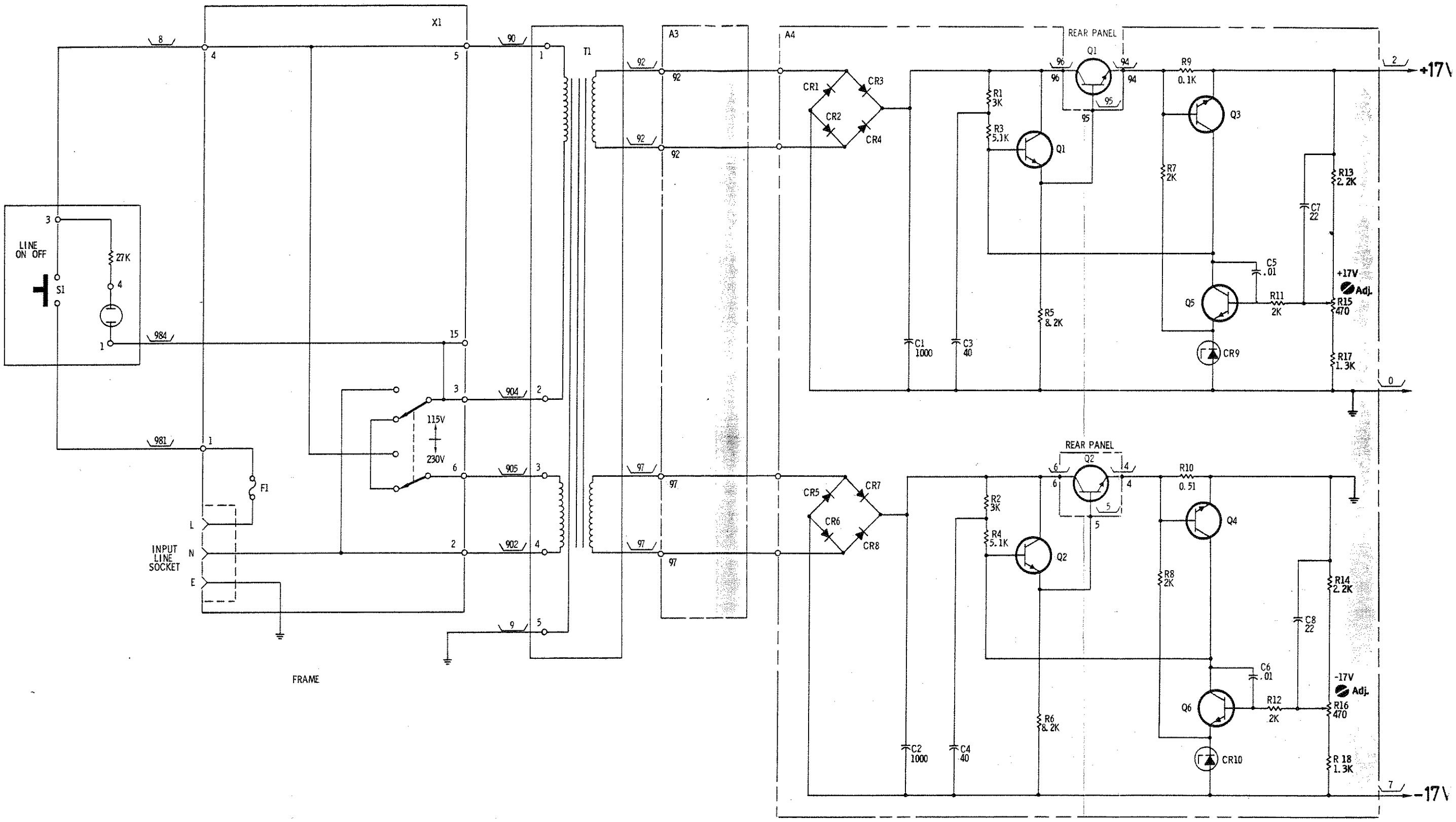


Figure 5–15 Circuit Diagram: Assembly 4 and Power Supplies

MANUAL CHANGES

MODEL 8013A

Manual Serials Prefixed: 1121G
Manual Printed: NOV 1971

Make all changes listed below as Errata. Check the following table for your instrument serial prefix and/or serial number and make listed change(s) to the manual:

Serial Prefix or Number	Make Changes	Serial Prefix or Number	Make Changes
1131A, 1148A	1		
1230A	1, 2		

Δ ERRATA

Table 5-2,
Add MP1: HP Part No. 1460-1300; TILT STAND.

Table 5-3,
A1C5: Change to HP Part No. 0140-0203, C-F 30PF 5%.
A1C11: Change to HP Part No. 0160-3650, C-F .018UF 10% 50V.
A1R4: Change to HP Part No. 0757- 0895, R-F 63 2% 1/8W.
A1R7, A1R22: Change to HP Part No. 0757-0954, R-F 18K 2% 1/8W.
A1R12, A1R88: Change to HP Part No. 0757-0908, R-F 220 2% 1/8W.
A1R14, A1R133: Change to HP Part No. 0757-0927, R-F 1.3K 2% 1/8W.
A1R16, A1R45, A1R121, A1R134, A1R139: Change to HP Part No. 0757-0907, R-F 200 2% 1/8W.
A1R17, A1R73: Change to HP Part No. 0757-0894, R-F 56 2% 1/8W.
A1R18, A1R27, A1R28, A1R112, A1R116, A1R117: Change to HP Part No. 0757-0948, R-F 10K 2% 1/8W.
A1R19, A1R127: Change to HP Part No. 0757-0898, R-F 82 2% 1/8W.
A1R20, A1R82, A1R106, A1R109: Change to HP Part No. 0757-0910, R-F 270 2% 1/8W.
A1R21: Change to HP Part No. 0757-0925, R-F 1.1K 2% 1/8W.
A1R23: Change to HP Part No. 0757-0931, R-F 2K 2% 1/8W.
A1R24: Change to HP Part No. 0757-0929, R-F 2K 2% 1/8W.

Table 5-2 (cont'd)
A1R25, A1R145: Change to HP Part No. 0757-0906, R-F 180 2% 1/8W.
A1R26, A1R52, A1R53: Change to HP Part No. 0757-0949, R-F 11K 2% 1/8W.
A1R30: Change to HP Part No. 0757-0937, R-F 3.6K 2% 1/8W.
A1R33: Change to HP Part No. 0757-0903, R-F 130 2% 1/8W.
A1R35: Change to HP Part No. 0757-0400, R-F 90.9 1% 1/8W.
A1R39, A1R48, A1R49, A1R50, A1R75, A1R76, A1R99, A1R100, A1R101, A1R132, A1R163: Change to HP Part No. 0757-0941, R-F 5.1K 2% 1/8W.
A1R40, A1R130: Change to HP Part No. 0757-0420, R-F 750 1% 1/8W.
A1R51: Change to HP Part No. 0757-0944, R-F 6.8K 2% 1/8W.
A1R54, A1R55, A1R138, A1R161: Change to HP Part No. 0757-0926, R-F 1.2K 2% 1/8W.
A1R59: Change to HP Part No. 0757-0930, R-F 1.8K 2% 1/8W.
A1R60, A1R61: Change to HP Part No. 0757-0935, R-F 3K 2% 1/8W.
A1R62: Change to HP Part No. 0698-7029, R-F 39 2% 1/8W.
A1R65, A1R85, A1R113: Change to HP Part No. 0757-0930, R-F 1.8K 2% 1/8W.
A1R66: Change to HP Part No. 0757-0953, R-F 16K 2% 1/8W.
A1R70, A1R71, A1R72, A1R102, A1R103, A1R119: Change to HP Part No. 0698-4264, R-F 2.7K 2% 1/8

July 24, 1972

Supplement A for
08013-90001

Δ = Latest additions to this change sheet.
This change sheet supersedes all prior change sheets for this manual.

Δ ERRATA (Cont'd)

Table 5-3 (cont'd)
- A1R73, A1R74, A1R91, A1R92, A1R93: Change to HP Part No. 0757-0957, R-F 24K 2% 1/8W.
- A1R78, A1R80, A1R105, A1R108: Change to HP Part No. 0757-0390, R-F 36.5 1% 1/8W.
- A1R81, A1R107: Change to HP Part No. 0757-0928, R-F 1.5K 2% 1/8W.
- A1R84: Change to HP Part No. 0757-0076, R-F 166K 1% 1W.
- A1R86, A1R87: Change to HP Part No. 0757-0904, R-F 150 2% 1/8W.
- A1R89: Change to HP Part No. 0757-0389, R-F 33.2 1% 1/8W.
- A1R125, A1R143, A1R168: Change to HP Part No. 0757-0940, R-F 4700 2% 1/8W.
- A1R128: Change to HP Part No. 0757-0912, R-F 330 2% 1/8W.
- A1R135: Change to HP Part No. 0757-0939, R-F 4.3K 2% 1/8W.
- A1R137: Change to HP Part No. 0757-0932, R-F 2.2K 2% 1/8W.
- A1R141, A1R174: Change to HP Part No. 0757-0911, R-F 300 2% 1/8W.
- A1R141, A1R183: Change to HP Part No. 0698-6994, R-F 30 2% 1/8W.
- A1R150: Change to HP Part No. 0698-6802, R-F 100 2% 1/8W.
- A1R158: Change to HP Part No. 0757-0936, R-F 3.3K 2% 1/8W.
- A1R159: Change to HP Part No. 0757-0384, R-F 20 1% 1/8W.
- A1R169: Change to HP Part No. 0757-0923, R-F 910 2% 1/8W.
- A1R174: Change to HP Part No. 0698-4242, R-F 300 5% 1/8W.
- A1R175: Change to HP Part No. 0757-0943, R-F 6.2K 2% 1/8W.
- A1R176: Change to HP Part No. 0757-0909, R-F 240 2% 1/8W.

Table 5-4
- A2R3, A2R33: Change to HP Part No. 0757-0894, R-F 56 2% 1/8W.
- A2R8, A2R34: Change to HP Part No. 0757-0911, R-F 300 2% 1/8W.

Table 5-4 (cont'd)
- A2R11, A2R41: Change to HP Part No. 0757-0917, R-F 510 2% 1/8W.
- A2R12, A2R111, A2R112: Change to HP Part No. 0757-0908, R-F 220 2% 1/8W.
- A2R15, A2R23, A2R45, A2R53: Change to HP Part No. 0757-0905, R-F 160 2% 1/8
- A2R16, A2R46: Change to HP Part No. 0757-0919, R-F 620 2% 1/8W.
- A2R88, A2R89, A2R97, A2R102, A2R103 Change to HP Part No. 0757-0928, R-F 1.5K 2% 1/8W.
- A2R90: Change to HP Part No. 0757-0400, R-F 90.9 1% 1/8W.

Table 5-5,
- A3R27, A3R28: Change to HP Part No. 0747-0907, R-F 200 2% 1/8W.

Table 5-6,
- A4R1, A4R2: Change to HP Part No. 0757-0935, R-F 3K 2% 1/8W.
- A4R3, A4R4: Change to HP Part No. 0757-0941, R-F 5.1K 2% 1/8W.
- A4R5, A4R6: Change to HP Part No. 0757-0946, R-F 8.2K 2% 1/8W.
- A4R7, A4R8, A4R11, A4R12: Change to HP Part No. 0757-0931, R-F 2K 2% 1/8W.
- A4R13, A4R14: Change to HP Part No. 0757-0932, R-F 2.2K 2% 1/8W.
- A4R17, A4R18: Change to HP Part No. 0757-0927, R-F 1.3K 2% 1/8W.

Figure 5-11, Sheet 1, Page 5-25,
- C11: Change value to .018UF.
- R30: Change value to 3.6K.
- R33: Change value to 130.
- R59: Change value to 1.8K.

Figure 5-11, Sheet 2, Page 5-27,
- R15, R16: Change value to 121.
- R27: Change value to 17.8.
- R78, R80: Change value to 36.5.

Figure 5-11, Sheet 3, Page 5-29,
- R89: Change value to 33.2.
- R105, R108: Change value to 36.5.

Figure 5-11, Sheet 4, Page 5-31,
- R150: Change value to 10.
- R-174: Change value to 300.

CHANGE 1

Page 5-6, Table 5-2,
Add F1: HP Part No. 2110-0007; FUSE 1 AMP SLOW-BLOW 250V (115V LINE VOLTAGE).
Add F1: HP Part No. 2110-0202; FUSE 0.5 AMP SLOW-BLOW 250V (230V LINE VOLTAGE).
Page 5-6,
Add Table 5-2a.

Page 5-23, Table 5-3,
A1C11: Change to HP Part No. 0160-3650; C-F .018 UF 50V.
A1R150: Change to HP Part No. 0698-6802; R-F 10 5% .125W.
A1R174: Change to HP Part No. 0698-4242; R-F 300 5% .125W.

Table 5-2a. Miscellaneous Replaceable Parts: FRAME

HP Part No.	DESCRIPTION
0370-1005	KNOB, JADE-GRAY (OFFSET)
0370-2048	KNOB, JADE-GRAY (VERNIER)
5000-8867	XFMR COVER
5040-0445	FOOT, BOTTOM
5040-0447	FOOT, REAR (LONG)
00180-61103	TRANSISTOR HEAT SINK
08012-10201	REAR PANEL
08012-74101	COVER ASSEMBLY
08012-74401	CABINET ASSEMBLY
08013-10201	FRONT PANEL
08013-10203	SUB PANEL
8120-1545	POWER CORD

Δ CHANGE 2

Table 5-2,
T1: Change to HP Part No. 9100-3255, XFMR PWR.

Table 5-3,
A1R59: Change to HP Part No. 0757-0929, R-F 1.6K 2% 1/8W.
Figure 5-11, Sheet 1, Page 5-25,
R59: Change value to 1600.