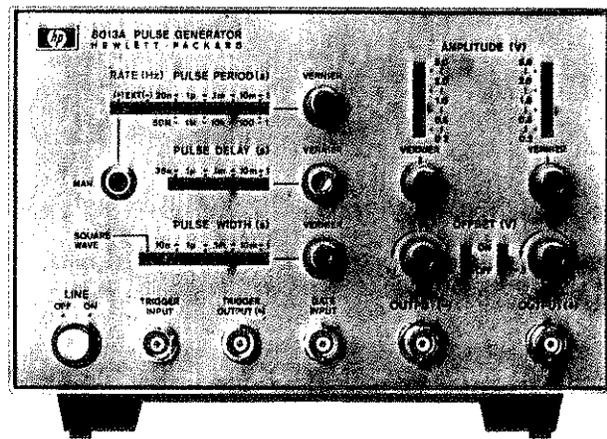


OPERATING AND SERVICE MANUAL

PULSE GENERATOR 8013A



HEWLETT  PACKARD

HEWLETT  PACKARD

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.



OPERATING AND SERVICE MANUAL

**MODEL 8013A
PULSE GENERATOR**

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

**COPYRIGHT HEWLETT-PACKARD GMBH 1971
703 BÖBLINGEN, HERRENBERGER STR. 110, WEST GERMANY**

CONTENTS

Section		Page
I	GENERAL INFORMATION	
	1-1 Introduction	1-3
	1-4 Accessories Available	1-4
	1-6 Manual Identification	1-4
1-8	Ordering Additional Manuals	1-4
II	INSTALLATION	
	2-1 Initial Inspection	2-1
	2-4 Preparation for Use	2-1
	2-7 Power Cable	2-1
	2-9 Temperature Requirements	2-1
	2-11 Repacking	2-1
III	OPERATING INSTRUCTIONS	
	3-1 Introduction	3-1
	3-3 Basic Operating Guide	3-1
	3-5 Normal Mode	3-1
	3-7 Internal Trigger	3-1
	3-9 External Trigger	3-2
	3-11 Manual	3-2
	3-13 Square Wave	3-3
	3-15 Gating	3-3
	3-17 RZ Mode	3-3
	3-19 External Width Mode	3-4
IV	MAINTENANCE	
	4-1 Introduction	4-1
	4-3 Testing, Troubleshooting and Adjustment	4-1
	4-5 Organisation	4-1
	4-9 Test Equipment	4-1
	4-11 Troubleshooting Charts	4-1
	4-13 Removal and Replacement of Covers and Assemblies	4-1
	4-14 Access to Test Points and Assemblies	4-1
	4-16 Removal of Assemblies	4-1
V	DIAGRAMS AND REPLACEABLE PARTS	
	5-1 Introduction	5-1
	5-3 Assembly and Component Referencing	5-1
	5-5 Organization of Diagrams	5-1
	5-10 Ordering Information	5-1
	5-11 General	5-1
	5-15 Assembly Exchange Programs	5-1

ILLUSTRATIONS

Number		Page
1-1	HP Model 8013A Pulse Generator	1-3
2-1	Pulse Generator and Supplied Accessories	1-4
3-1	The 'Normal' Pulse	3-1
3-2	Examples of Internally Triggered Waveforms	3-2
3-3	Examples of Externally Triggered Waveforms	3-2
3-4	Output Waveforms for Manual Operation	3-2
3-5	Examples of Square Wave Output Waveforms	3-3
3-6	Examples of Gated Output Waveforms	3-3
3-7	Examples of RZ Mode Waveforms	3-4
3-8	Comparison of Input and Output Pulse Widths	3-4
4-1	Organization of Tests and Troubleshooting	4-2
5-1	8013A Front and Rear Panels: Control Identification Diagrams	5-3
5-2	Block Diagram	5-5
5-3	Location of Assemblies	5-7
5-4	Troubleshooting Flowchart: Normal Mode - Internal Trigger	5-9
5-5	Troubleshooting Flowchart: Normal Mode - External Trigger	5-13
5-6	Troubleshooting Flowchart: Normal Mode - Gate	5-15
5-7	Troubleshooting Flowchart: Normal Mode - Square Wave	5-17
5-8	Troubleshooting Flowchart: RZ Mode	5-19
5-9	Troubleshooting Flowchart: External Width Mode	5-21
5-10	Component Layout: Assembly 1	5-22
5-11	Circuit Diagram: Assembly 1	5-25
5-12	Component Layout: Assemblies 2 and 3	5-32 5-36
5-13	Circuit Diagram: Assemblies 2 and 3	5-35 5-37
5-14	Component Layout: Assembly 4	5-38
5-15	Circuit Diagram: Assembly 4 and Power Supplies	5-39

TABLES

Number		Page
1-1	Specifications	1-1
3-1	8013A Initial Settings	3-1
4-1	Test Equipment and Accessories	4-3
4-2	Preliminary Check: Internal Operation	4-4
4-3	Preliminary Check: External Operation	4-5
4-4	Preliminary Check: High Frequency Trigger Operation	4-6
4-5	Preliminary Check: Manual Operation	4-7
4-6	Preliminary Check: External Width Operation	4-8
4-7	Preliminary Check: RZ Operation	4-9
4-8	Preliminary Check: Gate Operation	4-10
4-9	Performance Test: Preshoot, Overshoot and Ringing	4-11
4-10	Performance Test: Pulse Period	4-12
4-11	Performance Test: Pulse Period Jitter	4-13
4-12	Performance Test: Pulse Delay	4-14
4-13	Performance Test: Pulse Delay Jitter	4-15
4-14	Performance Test: Pulse Width (greater than 1uS)	4-16
4-15	Performance Test: Pulse Width (less than 10nS)	4-17
4-16	Performance Test: Pulse Width Jitter	4-18
4-17	Performance Test: Square Wave	4-19
4-18	Performance Test: Duty Cycle	4-20
4-19	Performance Test: Trigger Output	4-21
4-20	Performance Test: Amplitude	4-22
4-21	Performance Test: DC Offset	4-23
4-22	Performance Test: Baseline Position	4-24
4-23	Performance Test: Output Impedance	4-25
4-24	Initial Settings of 8013A for Internal Checks and Adjustments: Assembly 1	4-26
4-25	Internal Checks and Adjustments: Assembly 1	4-27
4-26	Internal Checks and Adjustments: Assembly 2	4-28
4-27	Internal Checks and Adjustments: Assembly 3	4-29
5-1	General Symbols and Reference Designators	5-2
5-2	Replaceable Parts: Frame	5-6
5-3	Replaceable Parts: Assembly 1	5-23
5-4	Replaceable Parts: Assembly 2	5-32
5-5	Replaceable Parts: Assembly 3	5-36
5-6	Replaceable Parts: Assembly 4	5-38

Table 1–1 Specifications

PULSE CHARACTERISTICS(50 Ω source and load impedance)**Transition Times:** < 3.5 nS fixed**Overshoot and Ringing:** < $\pm 5\%$ of pulse amplitude**Preshoot:** < $\pm 5\%$ 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 $\geq 40\%$ 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 50 Ω , when internal 50 Ω 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 $\Omega \pm 3\%$ 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% $\pm 5\%$ up to 1 MHz, tolerance increases to $\pm 15\%$ 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:** ± 7 V**Input Impedance:** 50 $\Omega \pm 10\%$ **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 160 Ω **Gate Input Signal:** Voltage > +1.5V or resistor > 300 Ω 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:** ± 5 V**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: $\pm 5V$

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: $0^{\circ}C$ to $+55^{\circ}C$

Power Requirements: 115 or 230 V $\pm 10\%$, -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 and 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 be-

tween 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.

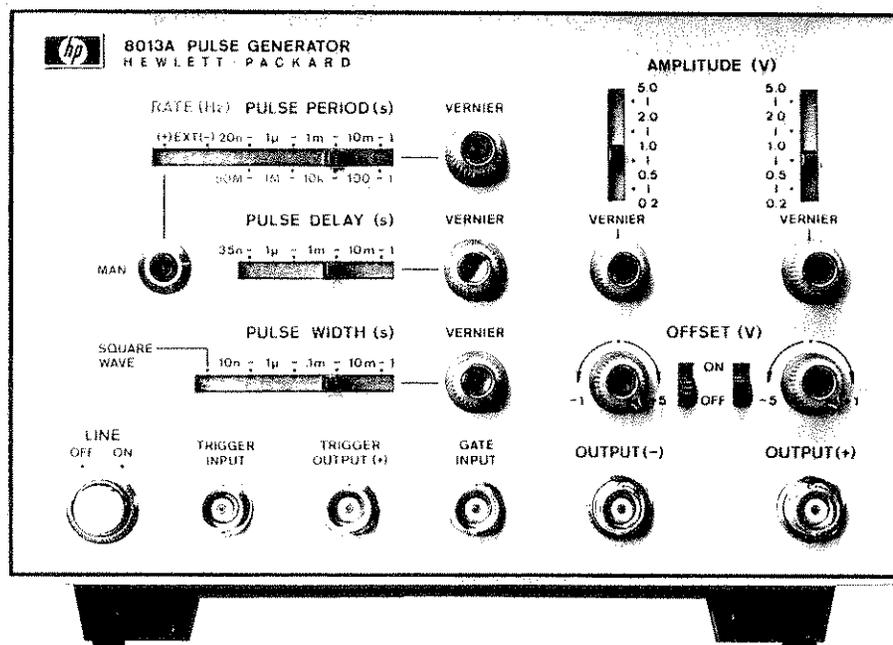


Figure 1-1 HP Model 8013A Pulse Generator

Section I

Model 8013A

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 instru-

ment, 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.

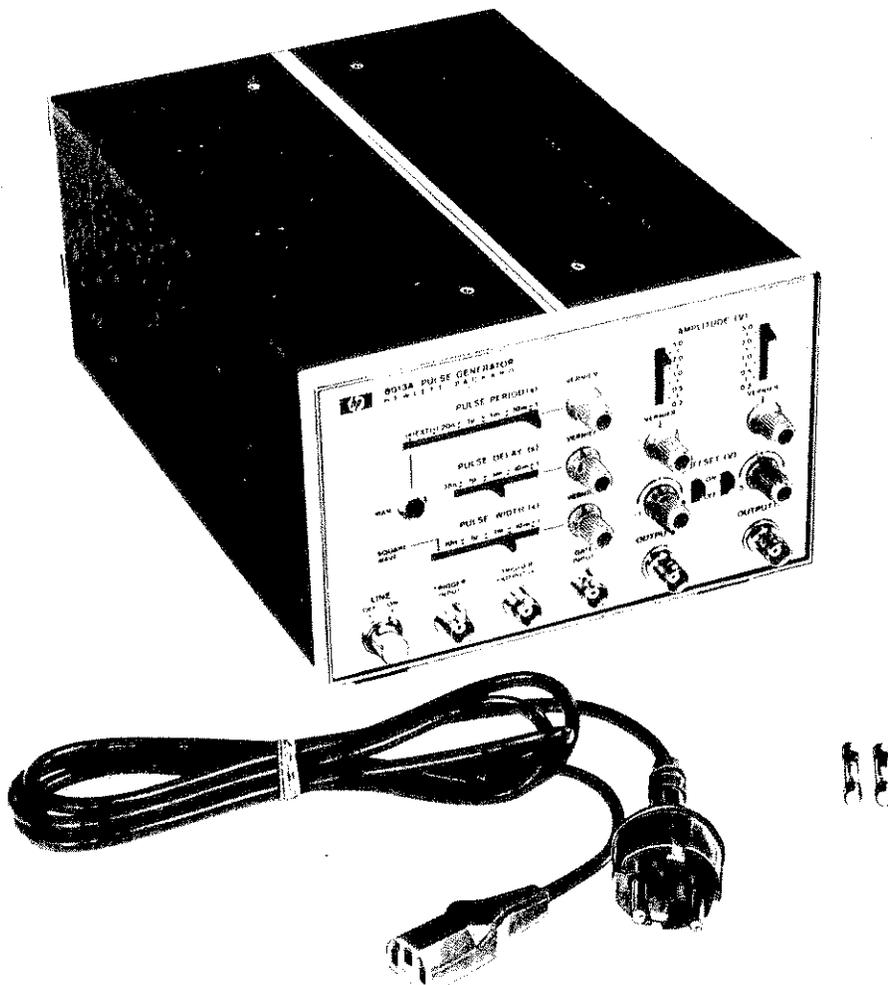


Figure 2-1 Pulse Generator and Supplied Accessories

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:

- Disconnect the power cable from the instrument.
- Slide the safety window to the left.
- Remove the fuse by pulling the lever marked FUSE PULL; this also releases the voltage selector switch.
- 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°C (32°F) and 55°C (131°F). The pulse generator may be stored at temperatures between -40°C (-40°F) and 75°C (167°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

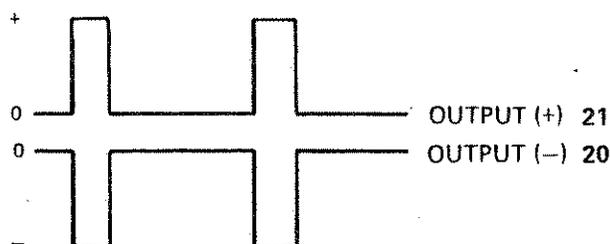


Figure 3-1. The 'normal' pulse

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.

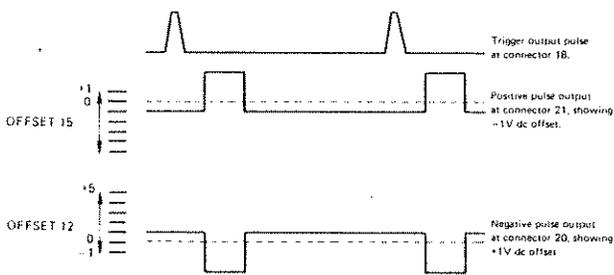


Figure 3-2. Examples of internally triggered waveforms.

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).

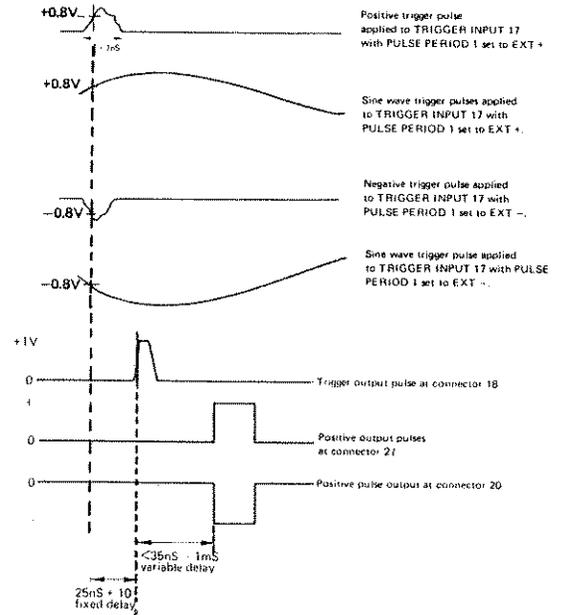


Figure 3-3. Examples of externally triggered waveforms.

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.

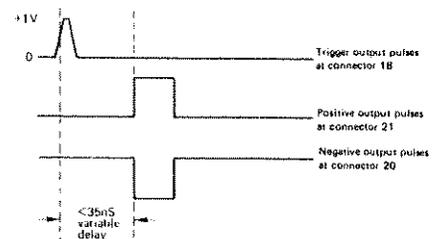


Figure 3-4. Output waveforms for manual operation.

Section III

Model 8013A

3-13 Square Wave

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

- Set the Mode Selector 22 to NORM.
- 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.
- Set the PULSE WIDTH switch 10 to SQUARE WAVE.
- Set the amplitude and offset as required (refer to paragraph 3-8).

Note that, the square wave output cannot be gated.

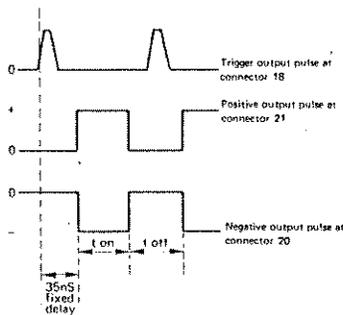


Figure 3-5. Examples of square wave output pulses.

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.

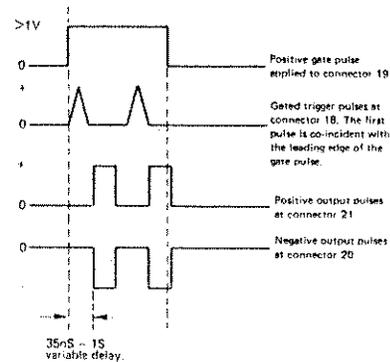


Figure 3-6. Examples of gated output waveforms.

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.

- Set the Mode Selector 22 to RZ.
- 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.
- Set the PULSE WIDTH switch 10 to the required range and adjust VERNIER 11 for exact pulse width.
- Set the amplitude and offset as required (refer to paragraph 3-7).

Model 8013A

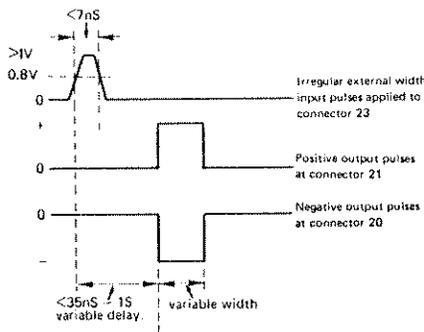


Figure 3-7. Examples of RZ Mode waveforms.

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).

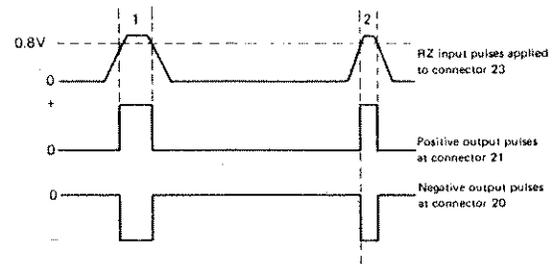


Figure 3-8. Comparison of input and output pulse widths.

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, performance 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, proceed 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.

- out of frame.
- d. Remove six securing screws.

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

Assembly 4 is removed as follows:

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

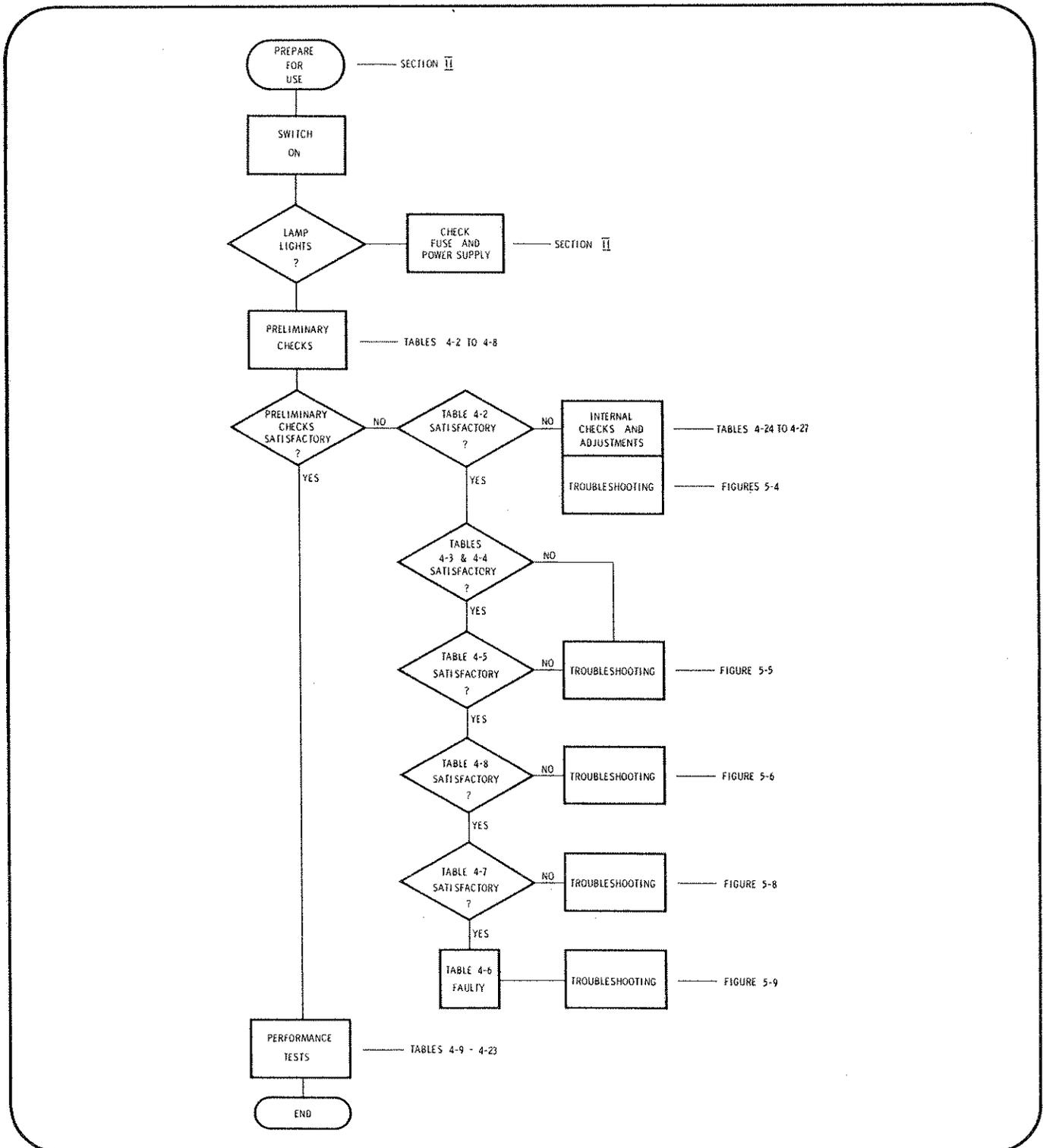


Figure 4-1 Organization of Tests and Troubleshooting

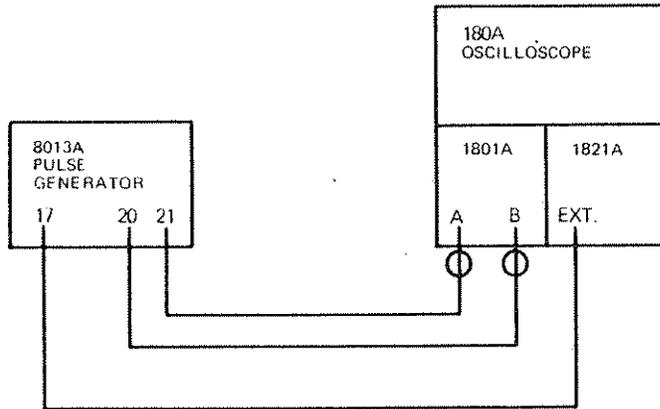
Table 4-1. Test Equipment and Accessories

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 $\pm 0.05\% \pm 1$ digit.	HP 3440A with plug-in 3444A.
Sampling Oscilloscope	Dual-channel, 1 GHz bandwidth	HP 140A with plug-ins 1410A, 1424A
AC Voltmeter	Sensitivity 100 μ V to 300V rms.	HP 403B
Voltmeter Ammeter Ohmmeter	1mV to 1000V FSD. $\pm 1\%$ of FSD. 1 μ A to 1A FSD. $\pm 2\%$ of FSD. 1ohm to 100 Mohm $\pm 5\%$ 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)		HP 10221A
10:1 Voltage Divider Probe		HP 10004B
50 Feed-through termination		HP 11048B UG-274/u 74868
Cable Assembly (2 required)		HP 1100A
Pulse Adder		HP 15104A
20 dB Attenuator, 50 (2 required)		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	1 μ – .1m
VERNIER 2	CW
PULSE DELAY 6	1 μ – .1m
VERNIER 7	CCW
PULSE WIDTH 10	1 μ – .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.

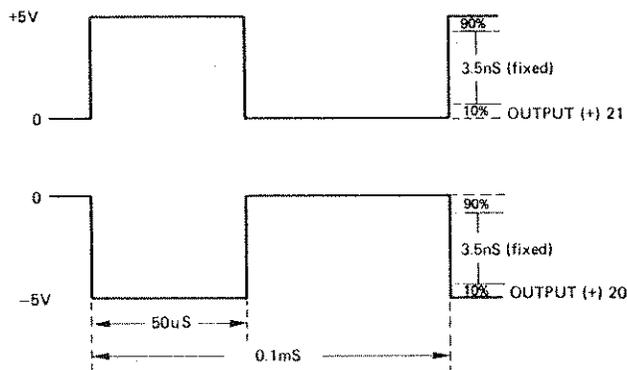
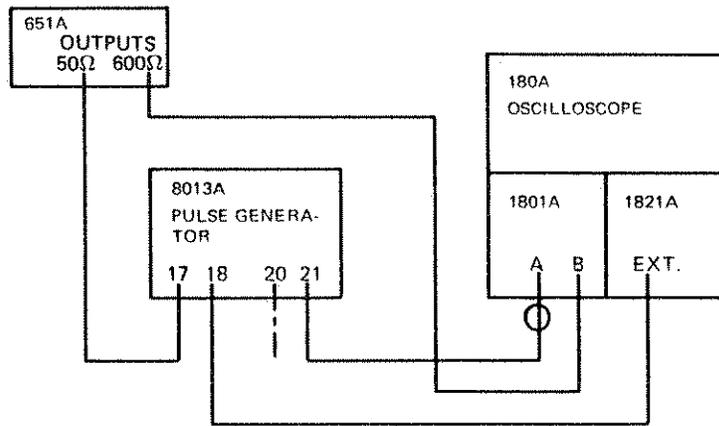


Table 4-3. Preliminary Check: External Trigger Operation

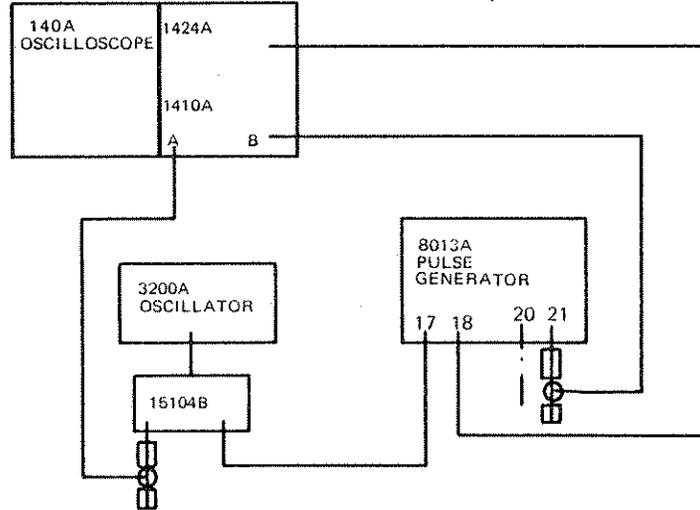
TEST SET-UP



STEP	INSTRUCTIONS	RESULTS																								
1	Set the 8013A controls as follows:																									
	<table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>EXT (+)</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n – 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>10n – 1u</td> </tr> <tr> <td>VERNIER 11</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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	
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:																									
	<table border="0"> <tr> <td>Range</td> <td>X10</td> </tr> <tr> <td>Vernier</td> <td>2.5</td> </tr> <tr> <td>Attenuator</td> <td>+10 dB (1.0V)</td> </tr> </table>	Range	X10	Vernier	2.5	Attenuator	+10 dB (1.0V)																			
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

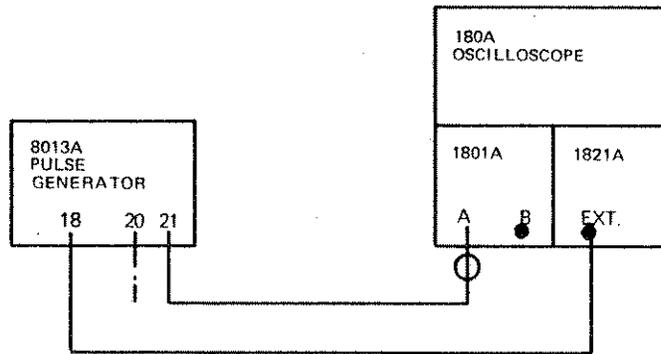
TEST SET-UP



STEP	INSTRUCTIONS	RESULTS																						
1	<p>Set the 8013A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>EXT (+)</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n - 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>10n - 1u</td> </tr> <tr> <td>VERNIER 11</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> </table>	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	
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	<p>Mode selector 22 NORM</p> <p>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.</p>																							
3	Set PULSE PERIOD 1 to EXT (-).																							
4	Repeat step 2.																							

Table 4-5. Preliminary Check: Manual Operation.

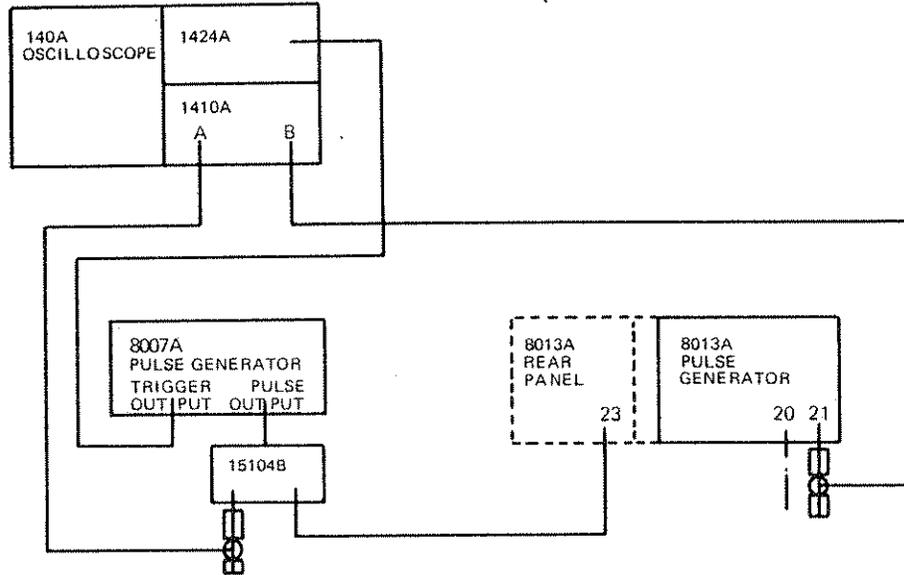
TEST SET-UP



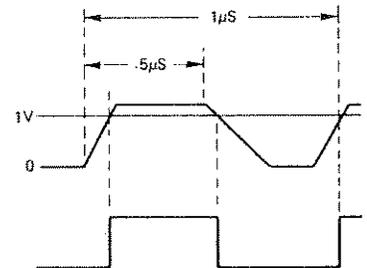
STEP	INSTRUCTIONS	RESULTS
1	PULSE PERIOD 1 PULSE DELAY 6 VERNIER 7 PULSE WIDTH 10 VERNIER 11 AMPLITUDE 3 VERNIER 8 AMPLITUDE 4 VERNIER 9 OFFSET 13 OFFSET 14 Mode selector 22	EXT (+) 35n - 1u CCW 1u - .1m CW 5.0 - 2.0 CW 5.0 - 2.0 CW OFF OFF NORM
2	Press MAN button 5. Only one output pulse must occur 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	<p>Set the 8013A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>EXT +</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CCW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>EXT. WIDTH</td> </tr> </table>	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	
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.																	

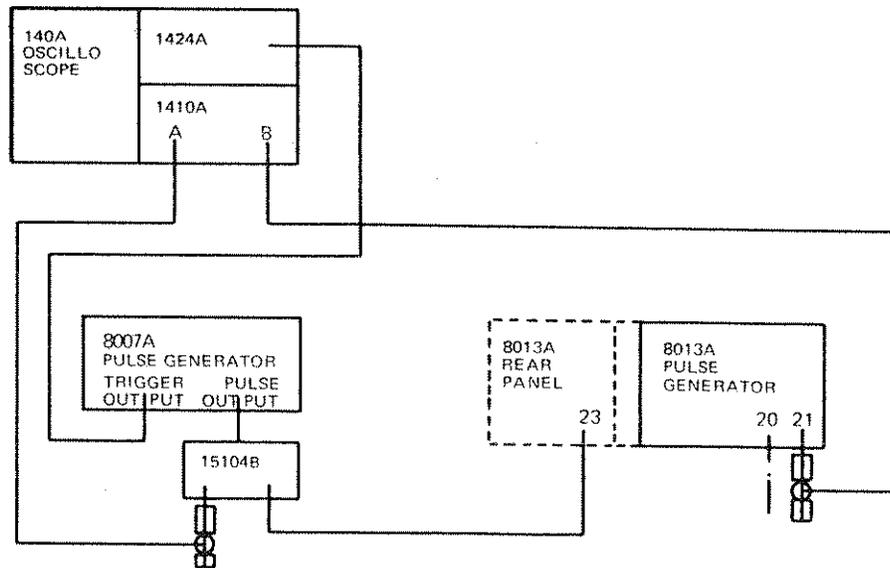


Section IV

Model 8013A

Table 4-7. Preliminary Check: RZ Operation

TEST SET-UP



STEP	INSTRUCTIONS	RESULT																								
1	<p>Set the 8013A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>EXT+</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n - 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>10n - 1u</td> </tr> <tr> <td>VERNIER 11</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CCW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>RZ</td> </tr> </table>	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	
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	<p>With reference to the diagram, apply an external signal to the INPUT connector 23 and observe the pulse output.</p>																									

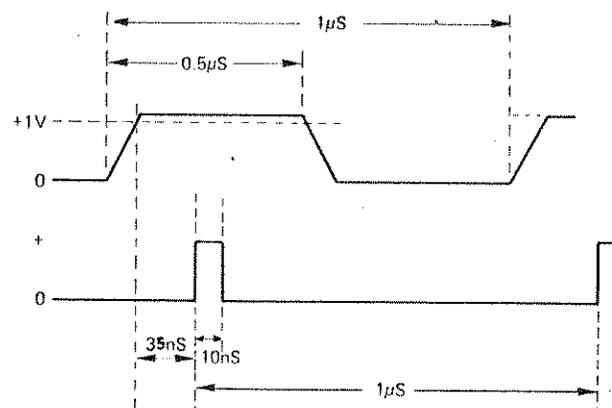
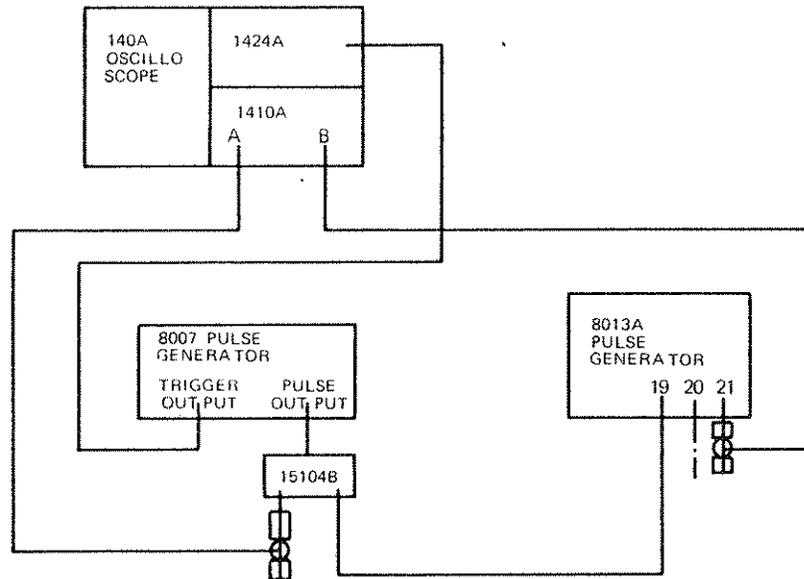


Table 4-8. Preliminary Check: Gate Operation.

TEST SET-UP



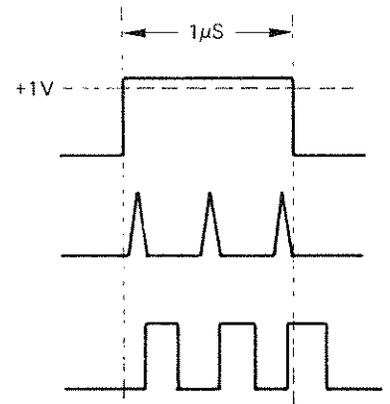
STEP	INSTRUCTIONS	RESULTS
1	PULSE PERIOD 1 20n – 1u VERNIER 2 CCW PULSE DELAY 6 35n – 1u VERNIER 7 CCW PULSE WIDTH 10 10n – 1u VERNIER 11 CCW AMPLITUDE 3 5.0 – 2.0 VERNIER 8 CCW AMPLITUDE 4 5.0 – 2.0 VERNIER 9 CCW OFFSET 13 OFF OFFSET 14 OFF Mode selector 22 NORM	

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:

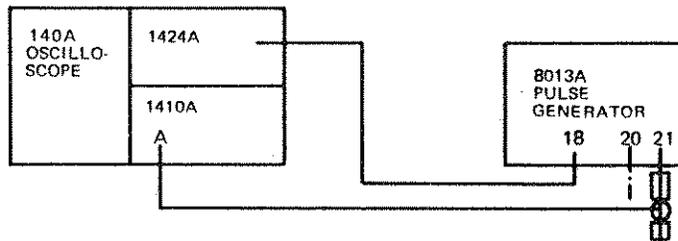


Section IV

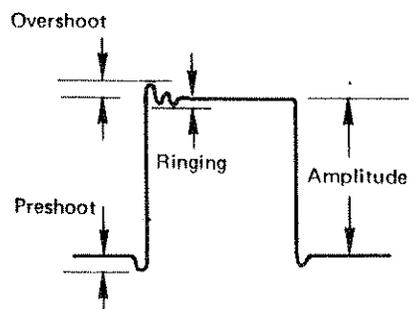
Model 8013A

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

TEST SET-UP



STEP	INSTRUCTIONS	RESULTS																										
1	<p>Set the 8013A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>20n - 1u</td> </tr> <tr> <td>VERNIER 2</td> <td>CCW</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n - 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>SQUARE WAVE</td> </tr> <tr> <td>VERNIER 11</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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	
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	<p>With reference to the diagram below, measure preshoot, overshoot and ringing in turn to ensure that these are $< \pm 5\%$ of the pulse amplitude.</p>																											

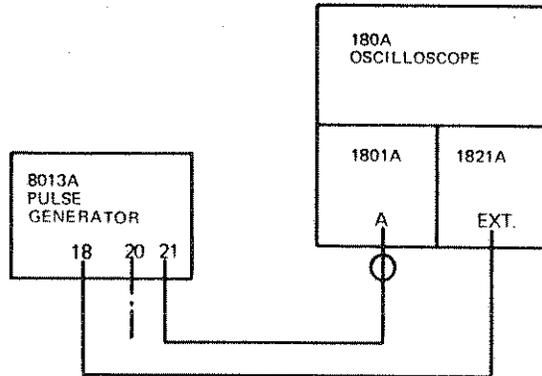


Section IV

Model 8013A

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

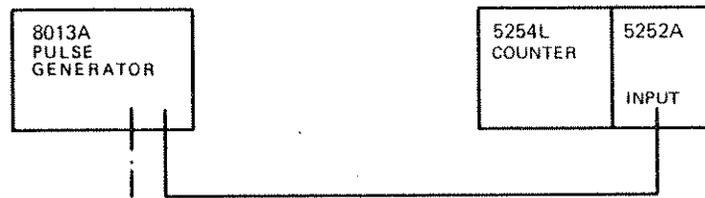
TEST SET-UP



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



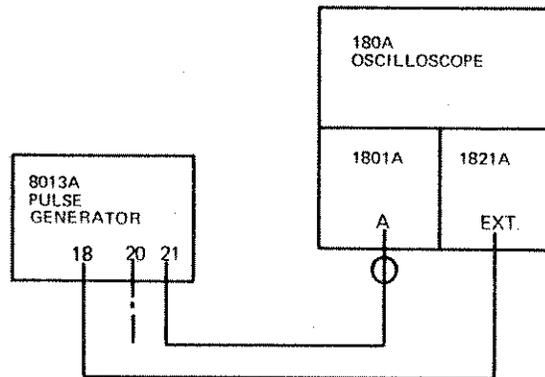
STEP	INSTRUCTIONS	RESULTS																																				
1	<p>Set the 8013A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>20n – 1u</td> </tr> <tr> <td>VERNIER 2</td> <td>CCW</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n – 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>10n – 1u</td> </tr> <tr> <td>VERNIER 11</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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											
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	<p>Check repetition rate for each set of control settings given in table:</p> <table border="0"> <thead> <tr> <th>PULSE PERIOD (1)</th> <th>VERNIER (2)</th> <th>PULSE PERIOD</th> <th>FREQUENCY</th> </tr> </thead> <tbody> <tr> <td>20n – 1u</td> <td>CCW</td> <td>< 20nS</td> <td>> 50 MHz</td> </tr> <tr> <td>20n – 1u</td> <td>CW</td> <td>> 1uS</td> <td>< 1 MHz</td> </tr> <tr> <td>1u – .1m</td> <td>CW</td> <td>> .1mS</td> <td>< 10 kHz</td> </tr> <tr> <td>1u – .1m</td> <td>CCW</td> <td>< 1uS</td> <td>> 1 MHz</td> </tr> <tr> <td>.1m – 10m</td> <td>CW</td> <td>>10mS</td> <td>< 100 Hz</td> </tr> <tr> <td>.1m – 10m</td> <td>CCW</td> <td>< .1mS</td> <td>> 10 kHz</td> </tr> <tr> <td>10m – 1</td> <td>CW</td> <td>> 1S</td> <td>< 1 Hz</td> </tr> <tr> <td>10m – 1</td> <td>CCW</td> <td><10mS</td> <td>> 100 Hz</td> </tr> </tbody> </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	
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																																			

Section IV

Model 8013A

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

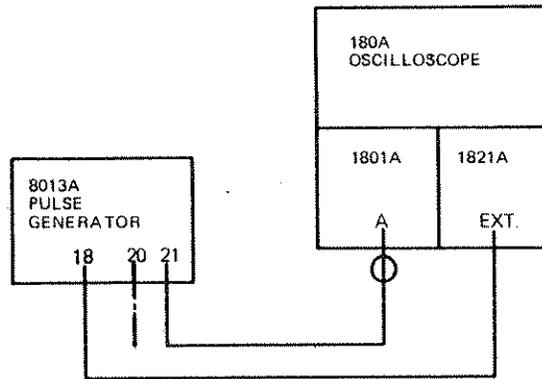
TEST SET-UP



STEP	INSTRUCTIONS	RESULTS																								
1	<p>Set the 8012A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>1u - .1m</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n - 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>1u - .1m</td> </tr> <tr> <td>VERNIER 11</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 - 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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	
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	<p>Set the 1821A controls as follows:</p> <table border="0"> <tr> <td>Main Sweep</td> <td>0.1mS/div</td> </tr> <tr> <td>Delayed Sweep</td> <td>0.1uS/div</td> </tr> <tr> <td>Sweep Mode</td> <td>Norm.</td> </tr> <tr> <td>Delayed Trigger</td> <td>Auto.</td> </tr> <tr> <td>CM Delay</td> <td>2.0</td> </tr> </table>	Main Sweep	0.1mS/div	Delayed Sweep	0.1uS/div	Sweep Mode	Norm.	Delayed Trigger	Auto.	CM Delay	2.0															
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



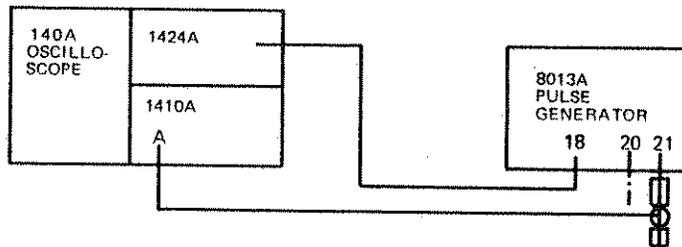
STEP	INSTRUCTIONS	RESULTS																																
1	<p>Set 8012A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>1u – .1m</td> </tr> <tr> <td>VERNIER 2</td> <td>CW</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n – 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>10n – 1u</td> </tr> <tr> <td>VERNIER 11</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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							
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	<p>Check the pulse width for both VERNIER 11 extremities of each range setting of the PULSE WIDTH selector 10 as follows:</p> <table border="0"> <thead> <tr> <th>PULSE WIDTH 10</th> <th>VERNIER 11</th> <th>PULSE PERIOD 1</th> <th>RESULTS</th> </tr> </thead> <tbody> <tr> <td>10n – 1u</td> <td>CW</td> <td>1u – .1m</td> <td>> 1uS</td> </tr> <tr> <td>1u – .1m</td> <td>CW</td> <td>.1m – 10m</td> <td>> .1mS</td> </tr> <tr> <td>1u – .1m</td> <td>CCW</td> <td>1u – .1m</td> <td>< 1uS</td> </tr> <tr> <td>.1m – 10m</td> <td>CW</td> <td>10m – 1</td> <td>> 10mS</td> </tr> <tr> <td>.1m – 10m</td> <td>CCW</td> <td>.1m – 10m</td> <td>< .1mS</td> </tr> <tr> <td>10m – 1</td> <td>CW</td> <td>EXT+ (Press MAN)</td> <td>> 1S</td> </tr> <tr> <td>10m – 1</td> <td>CCW</td> <td>10m – 1</td> <td>> 10mS</td> </tr> </tbody> </table>	PULSE WIDTH 10	VERNIER 11	PULSE PERIOD 1	RESULTS	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	
PULSE WIDTH 10	VERNIER 11	PULSE PERIOD 1	RESULTS																															
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																															

Section IV

Model 8013A

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

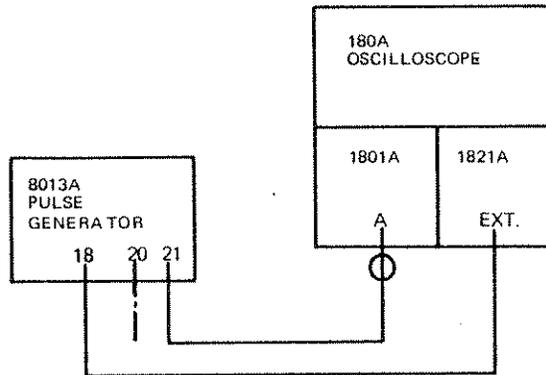
TEST SET-UP



STEP	INSTRUCTIONS	RESULTS																										
1	Set the 8012A controls as follows:																											
	<table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>20n – 1u</td> </tr> <tr> <td>VERNIER 2</td> <td>CCW</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n – 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>10n – 1u</td> </tr> <tr> <td>VERNIER 11</td> <td>CCW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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	
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.

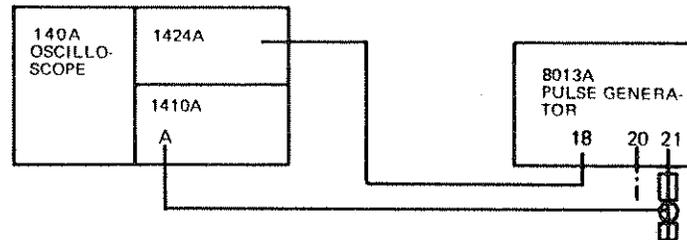
TEST SET-UP



STEP	INSTRUCTIONS	RESULTS																										
1	Set the 8013A controls as follows:																											
	<table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>.1m – 10m</td> </tr> <tr> <td>VERNIER 2</td> <td>CW</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n – 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CCW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>1u – .1m</td> </tr> <tr> <td>VERNIER 11</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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	
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

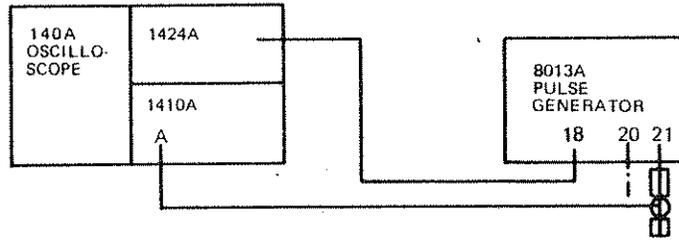
TEST SET-UP



STEP	INSTRUCTIONS	RESULTS																										
1	<p>Set the 8013A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>20n – 1u</td> </tr> <tr> <td>VERNIER 2</td> <td>CW</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n – 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>SQUARE WAVE</td> </tr> <tr> <td>VERNIER 11</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM</td> </tr> </table>	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	
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	<p>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.</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td></td> </tr> <tr> <td>20n – 1u</td> <td></td> </tr> <tr> <td>1u – .1m</td> <td></td> </tr> <tr> <td>.1m – 10m</td> <td></td> </tr> <tr> <td>10m – 1</td> <td></td> </tr> </table>	PULSE PERIOD 1		20n – 1u		1u – .1m		.1m – 10m		10m – 1																		
PULSE PERIOD 1																												
20n – 1u																												
1u – .1m																												
.1m – 10m																												
10m – 1																												
3	<p>For all settings of the pulse period control, check that the pulse width (t on) equals the pulse off time (t off)</p>																											
4	<p>Check that the square wave output pulse is symmetrically above and below zero volts.</p>																											

Table 4-18. Performance Test: Duty Cycle.

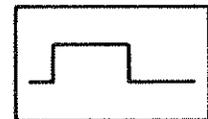
TEST SET-UP



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:

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

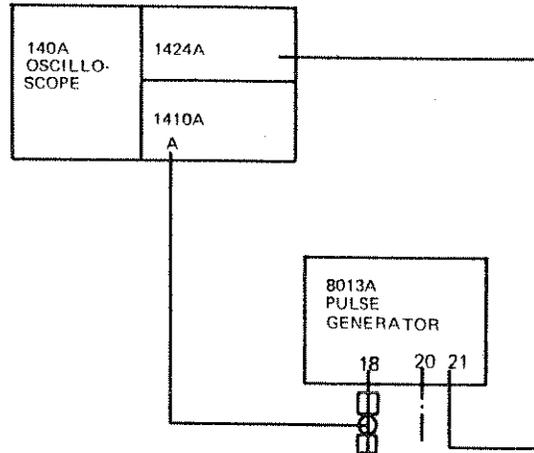
PULSE PERIOD (1)	PULSE WIDTH (10)	VERNIER (11)	
1u - .1m	1u - .1m	Adjust for 1uS	> 75 %
.1m - 10m	.1m - 10m	Adjust for 0.1mS	> 75 %
10m - 1	10m - 1	Adjust for 10mS	> 75 %

Section IV

Model 8013A

Table 4-19. Performance Test: Trigger Output.

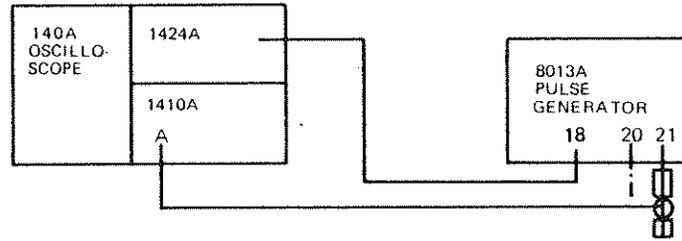
TEST SET-UP



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:

<table border="0" style="width: 100%;"> <tr><td>PULSE PERIOD 1</td><td>20n – 1u</td></tr> <tr><td>VERNIER 2</td><td>CW</td></tr> <tr><td>PULSE DELAY 6</td><td>35n – 1u</td></tr> <tr><td>VERNIER 7</td><td>CCW</td></tr> <tr><td>PULSE WIDTH 10</td><td>10n – 1u</td></tr> <tr><td>VERNIER 11</td><td>Mid-range</td></tr> <tr><td>AMPLITUDE 3</td><td>5.0 – 2.0</td></tr> <tr><td>VERNIER 8</td><td>CW</td></tr> <tr><td>AMPLITUDE 4</td><td>5.0 – 2.0</td></tr> <tr><td>VERNIER 9</td><td>CW</td></tr> <tr><td>OFFSET 13</td><td>OFF</td></tr> <tr><td>OFFSET 14</td><td>OFF</td></tr> <tr><td>Mode selector 22</td><td>NORM</td></tr> </table> | 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 | |
| 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 extremes of each setting of the AMPLITUDE selector 3 and 4 as follows: | | | | | | | | | | | | | | | | | | | | | | | | | | | |

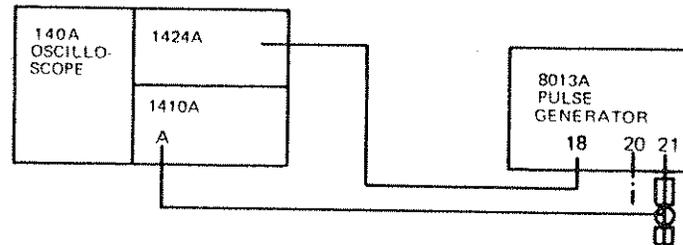
AMPLITUDE 3 (4)	VERNIER 8 (9)	
5.0 – 2.0	CW	> 5.0
5.0 – 2.0	CCW	< 2.0
2.5 – 1.0	CW	> 2.5
2.5 – 1.0	CCW	< 1.0
1.0 – 0.4	CW	> 1.0
1.0 – 0.4	CCW	< 0.4
0.5 – 0.2	CW	> 0.5
0.5 – 0.2	CCW	< 0.2

Section IV

Model 8013A

Table 4-21. Performance Test: DC Offset.

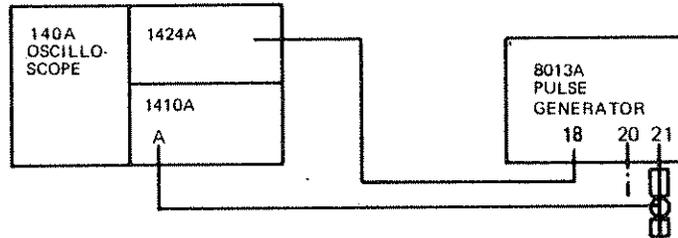
TEST SET-UP



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 VERNIER 12 fully CW	> -1V > +5V

Table 4-22. Performance Test: Baseline Position.

TEST SET-UP



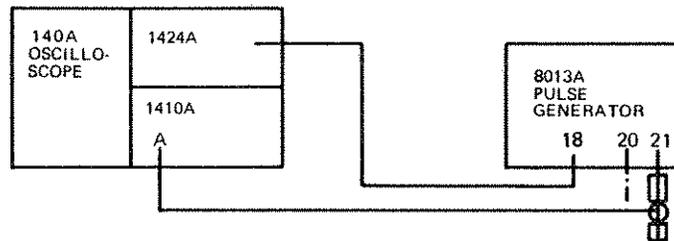
STEP	INSTRUCTIONS	RESULTS																										
1	<p>Set the 8012A controls as follows:</p> <table border="0"> <tr> <td>PULSE PERIOD 1</td> <td>20n – 1u</td> </tr> <tr> <td>VERNIER 2</td> <td>CW</td> </tr> <tr> <td>PULSE DELAY 6</td> <td>35n – 1u</td> </tr> <tr> <td>VERNIER 7</td> <td>CW</td> </tr> <tr> <td>PULSE WIDTH 10</td> <td>10n – 1u</td> </tr> <tr> <td>VERNIER 11</td> <td>Adjust for a duty cycle of 50%.</td> </tr> <tr> <td>AMPLITUDE 3</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 8</td> <td>CW</td> </tr> <tr> <td>AMPLITUDE 4</td> <td>5.0 – 2.0</td> </tr> <tr> <td>VERNIER 9</td> <td>CW</td> </tr> <tr> <td>OFFSET 13</td> <td>OFF</td> </tr> <tr> <td>OFFSET 14</td> <td>OFF</td> </tr> <tr> <td>Mode selector 22</td> <td>NORM.</td> </tr> </table>	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.	
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 4-24. Initial Settings of 8013A for Internal Checks and Adjustments: Assembly 1.

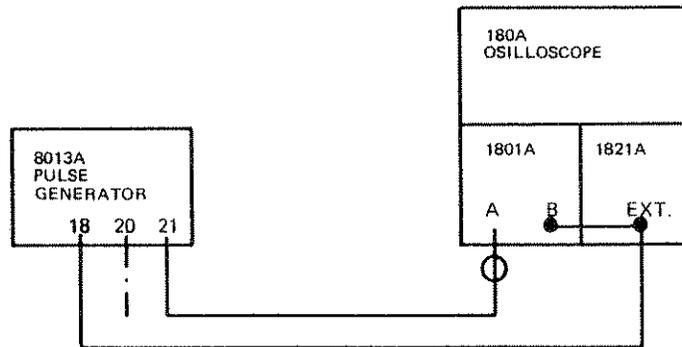
TEST SET-UP 1



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

Section IV

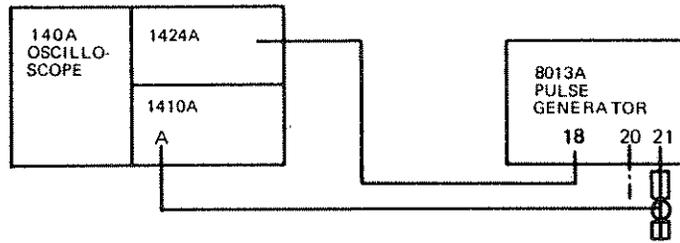
Model 8013A

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 1 μ – 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

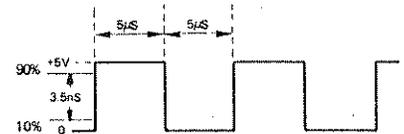


STEP	INSTRUCTIONS	ADJUST	RESULT
1	Set the 8013 controls as follows:		
	PULSE PERIOD 1	10n – 1u	
	VERNIER 2	CCW	
	PULSE DELAY 6	35n – 1u	
	VERNIER 7	CCW	
	PULSE WIDTH 10	SQUARE WAVE	
	VERNIER 11		
	AMPLITUDE 3	5.0 – 2.0	
	VERNIER 8	CW	
	AMPLITUDE 4	5.0 – 2.0	
	VERNIER 9	CW	
	OFFSET 13	OFF	
	OFFSET 14	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

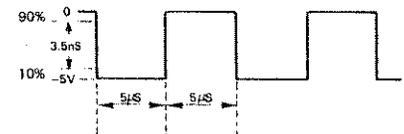
A2C5
A2R19



Pulse shape: OUTPUT (-)

- 3 Observe the pulse for correct shape while turning VERNIER 8 from fully CW to fully CCW

A2C16
A2R50



Section IV

Model 8013A

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	1 μ – 0.1m	
	VERNIER 7	CCW	
	PULSE WIDTH 10	1 μ – 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 \pm 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 \pm 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 to 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	VR	= voltage regulator
BT	= battery	HR	= heater	R	= resistor	W	= cable
C	= capacitor	J	= jack	RT	= thermistor	X	= socket
CP	= coupler	K	= relay	S	= switch	Y	= crystal
CR	= diode	L	= inductor	T	= transformer		
DL	= delay line	M	= meter	TB	= terminal board		
DS	= lamp	MC	= micro-circuit	TP	= test point		

Typical Front Panel Legend

(a) (b)

9 · 7 · 5

Typical Rear Panel Legend

115 - 230

a. Typical edge connector showing pin number

b. Typical spring contact connector showing pin number.

Insulated wire with colours White, Violet, Green.

9 · 7 · 5

Transistor
Pin Identification From Top

Centre Conductor
Screen
Screened Lead

Zener Diode

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

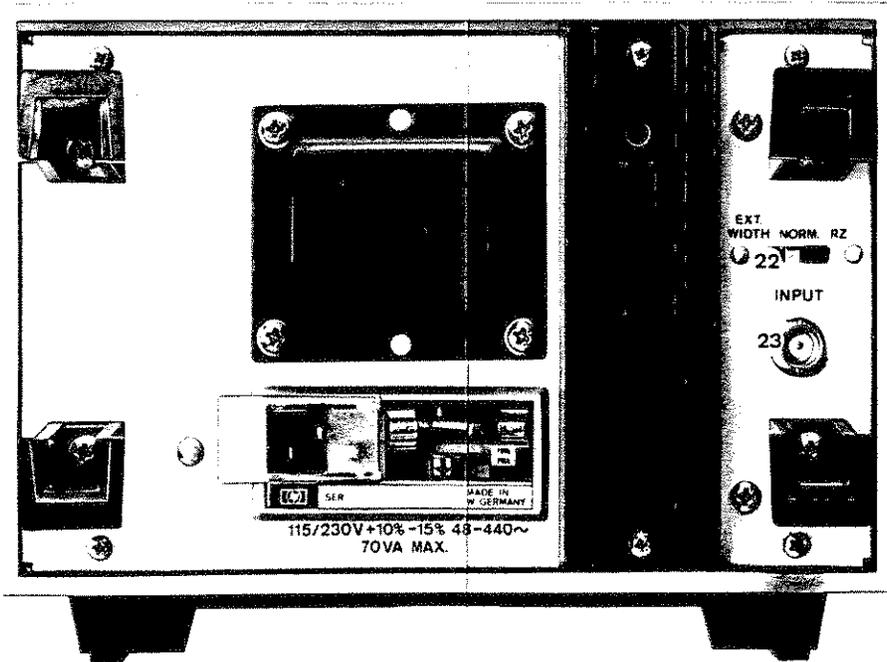
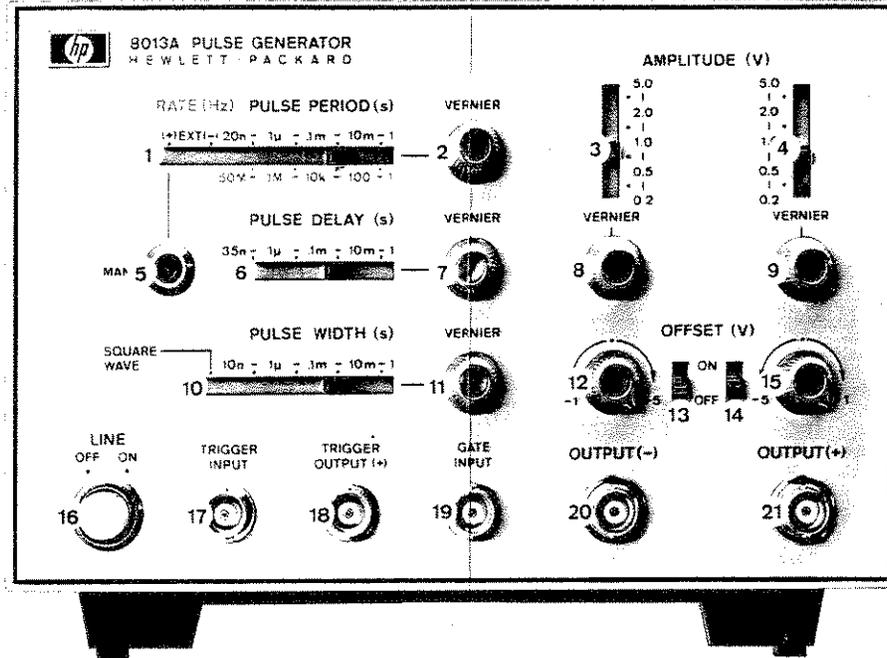


Figure 5-1 8013A Front and Rear Panels: Control Identification Diagrams

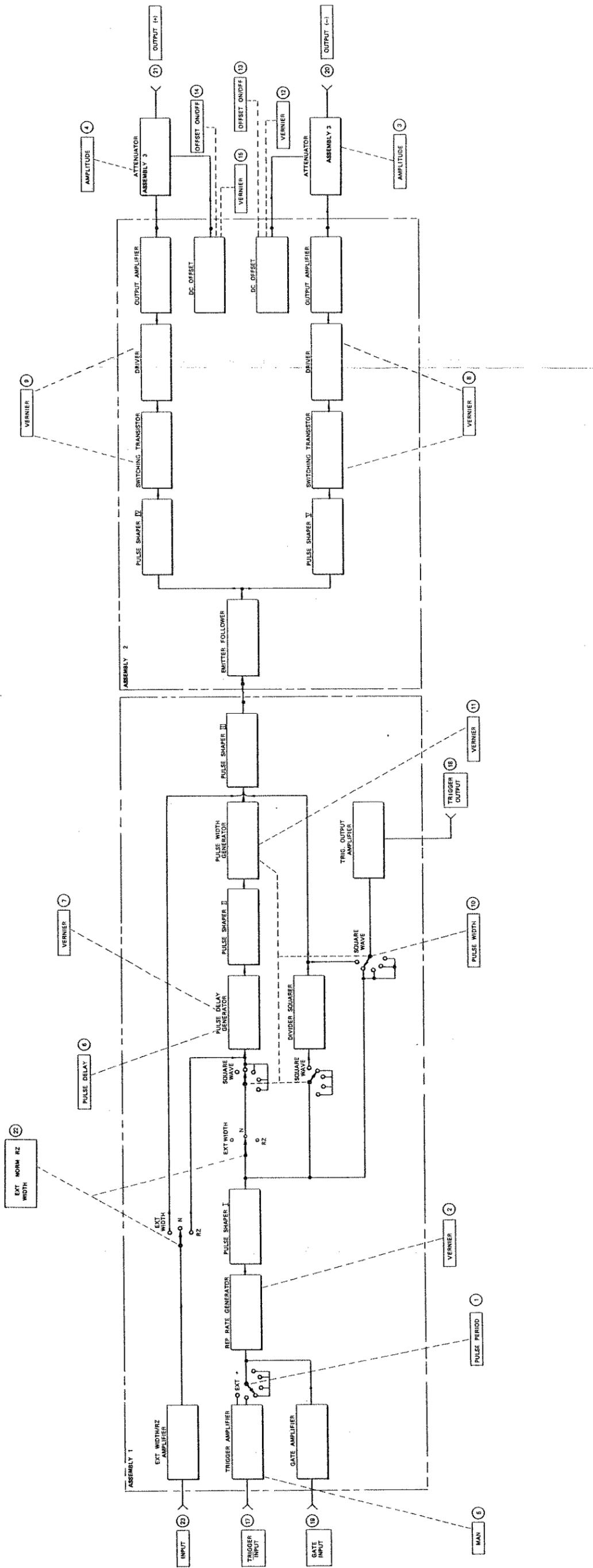


Table 5-2 Replaceable Parts: Frame

REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM		COMPONENT LAYOUT
			SHEET NUMBER	GRID REFERENCE	
A1	08012-66501	RD AY TIMC			
A2	08013-66502	RD AY PULSAMPL			
A3	08013-66503	RD AY WITH			
A4	08012-66504	RD AY PWR SPLY			
J1	1250-0118	CONN RNC BLKHD			
J2	1250-0118	SAME AS J 1			
J3	1250-0118	SAME AS J 1			
J4	1250-0083	CONN RNC BLKHD			
Q1	1854-0063	XSTR 2N3055 SI			
Q2	1854-0063	SAME AS Q 1			
R1	2100-3081	R-VAR 50K-25M 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	0758-0048	R-F 3K5% .25W F			
R25	2100-2435	R-VAR 10K .75W			
R26	2100-2435	SAME AS R 25			
P33	2100-2146	R-VAR 10K .75W			
R34	2100-2146	SAME AS R 33			
S5	3101-0124	SW-P-RTN SPST			
S10	3101-1248	SW P-BTN SPDT			
S4	3101-0903	SW-P-BTN-SPST			
X1	5080-1189	PWR LINE MDL			
T1	5080-0948	XFRMRPWR			
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			

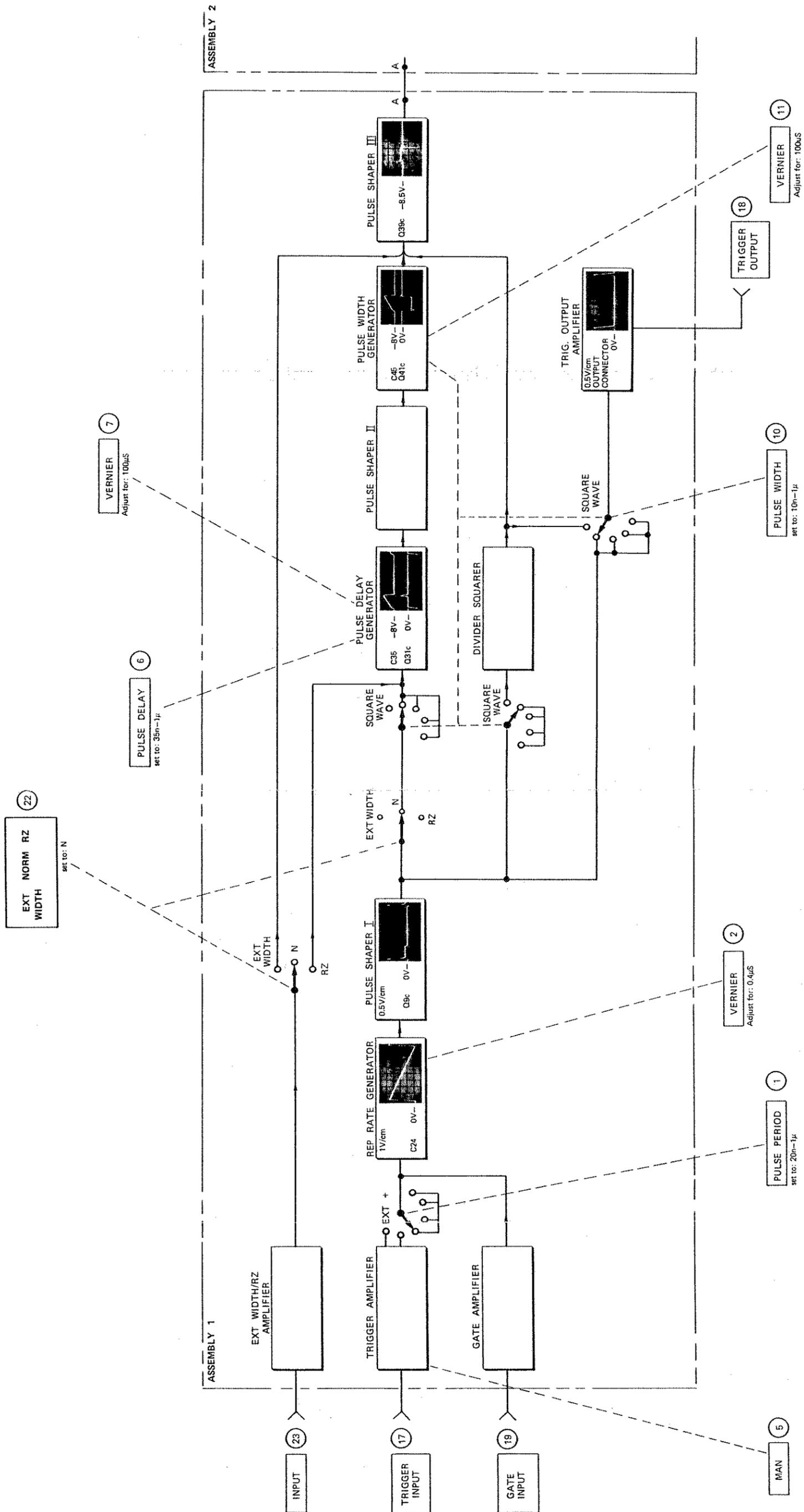


Figure 5-4 Troubleshooting Flowchart: Normal Mode — Internal Trigger Sheet 1 of 2

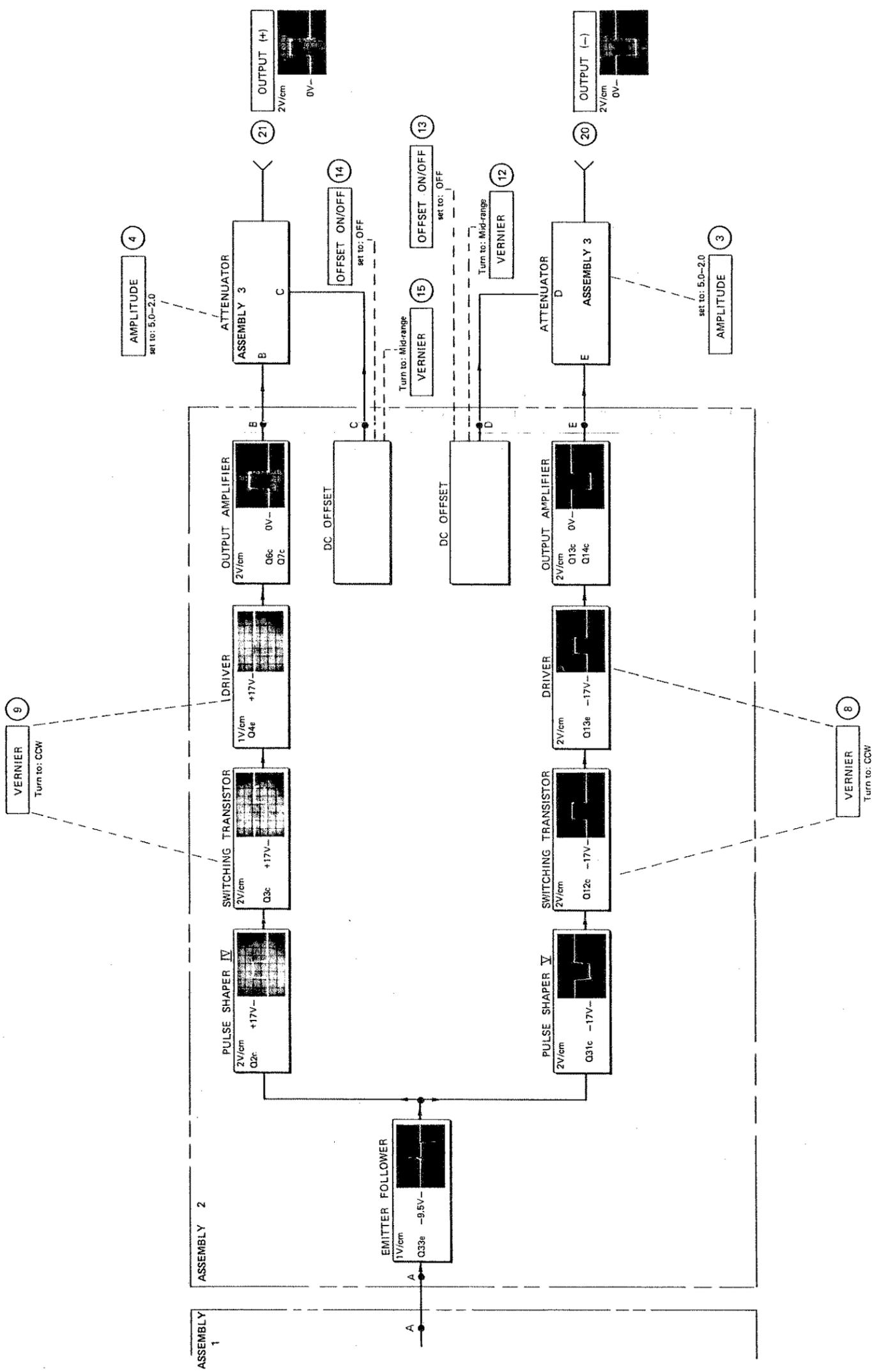


Figure 5-4 Troubleshooting Flowchart: Normal Mode - Internal Trigger Sheet 2 of 2

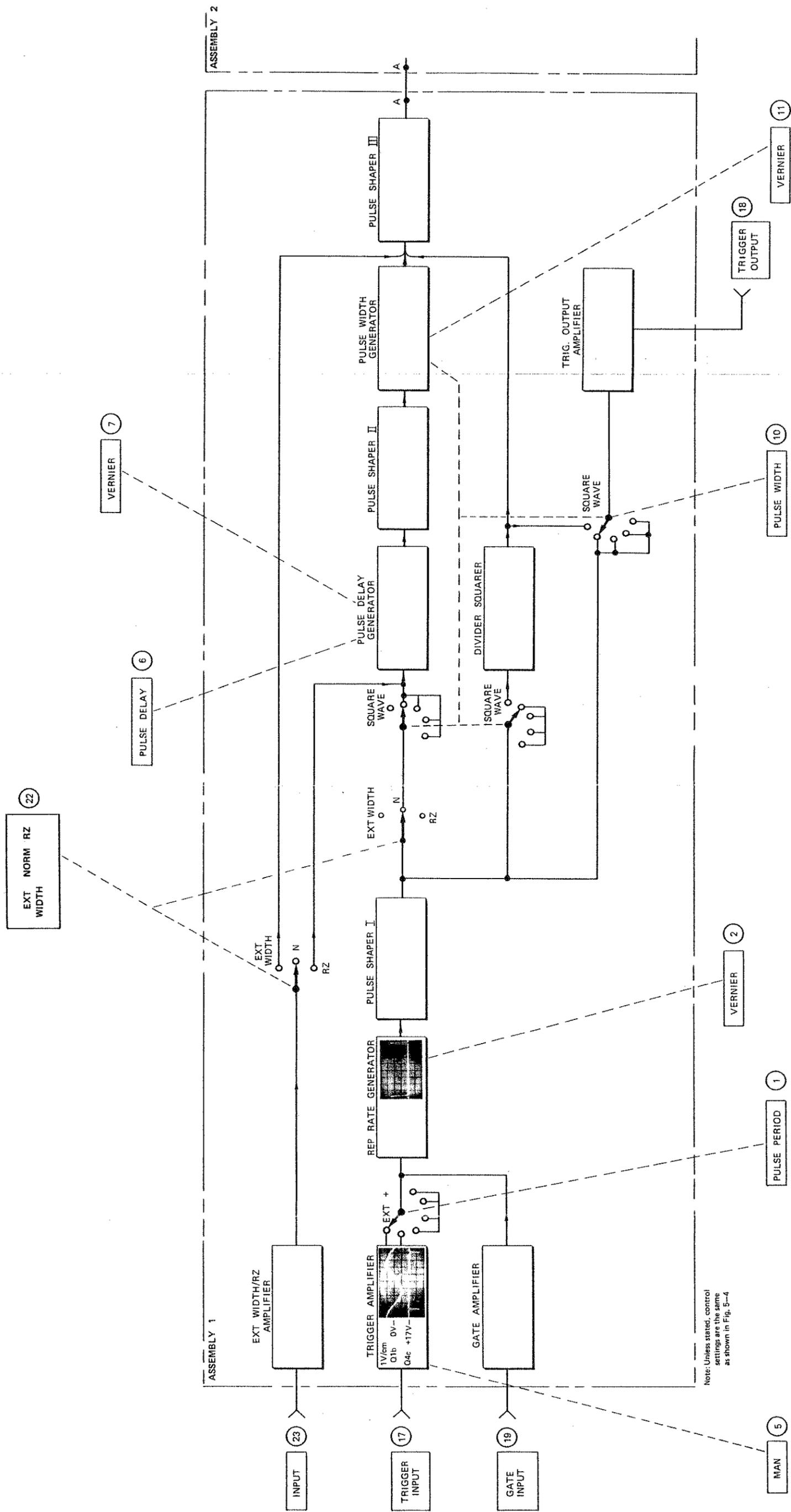


Figure 5-5 Troubleshooting Flowchart: Normal Mode - External Trigger

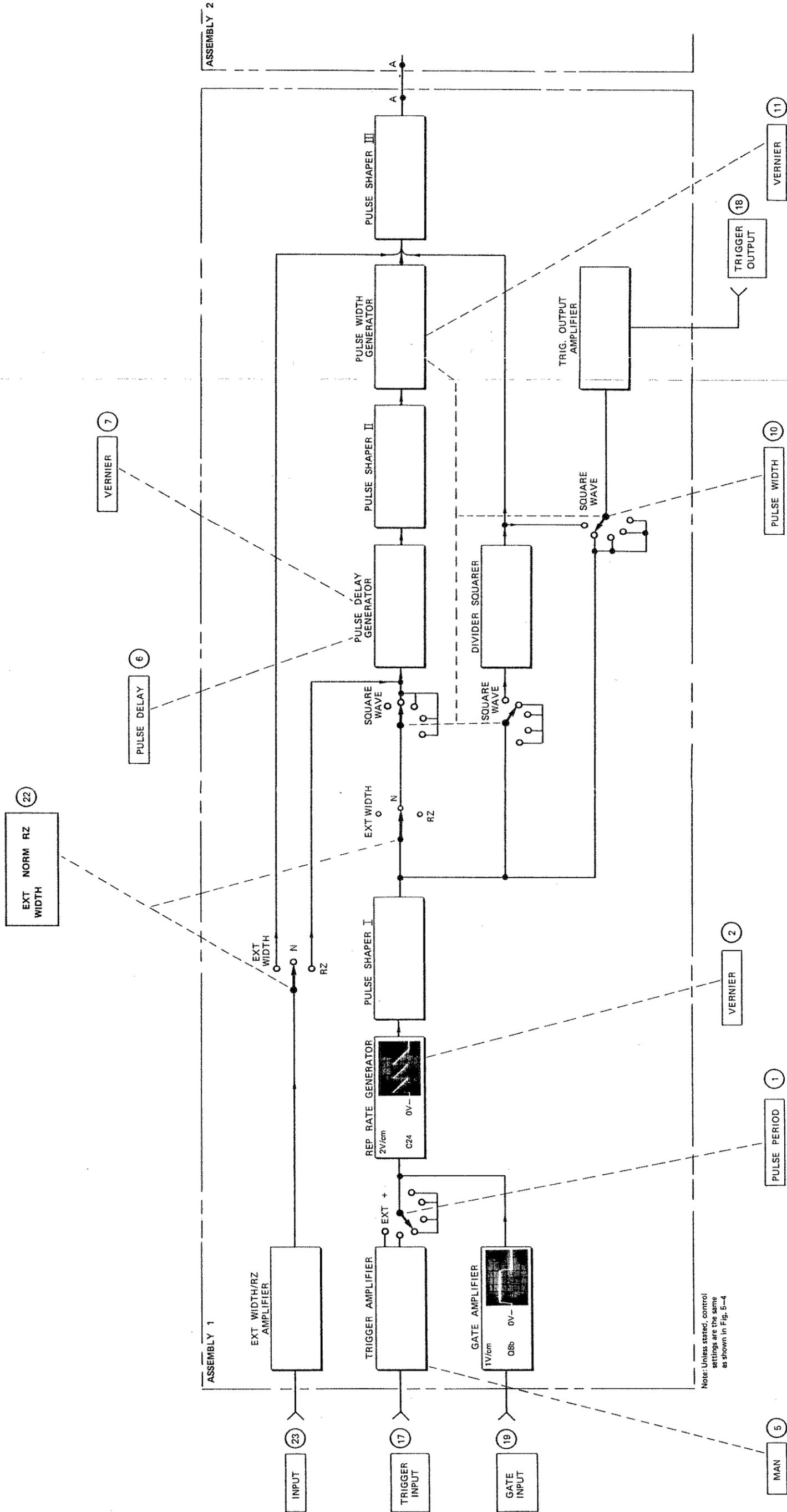


Figure 5-6 Troubleshooting Flowchart: Normal Mode — Gate

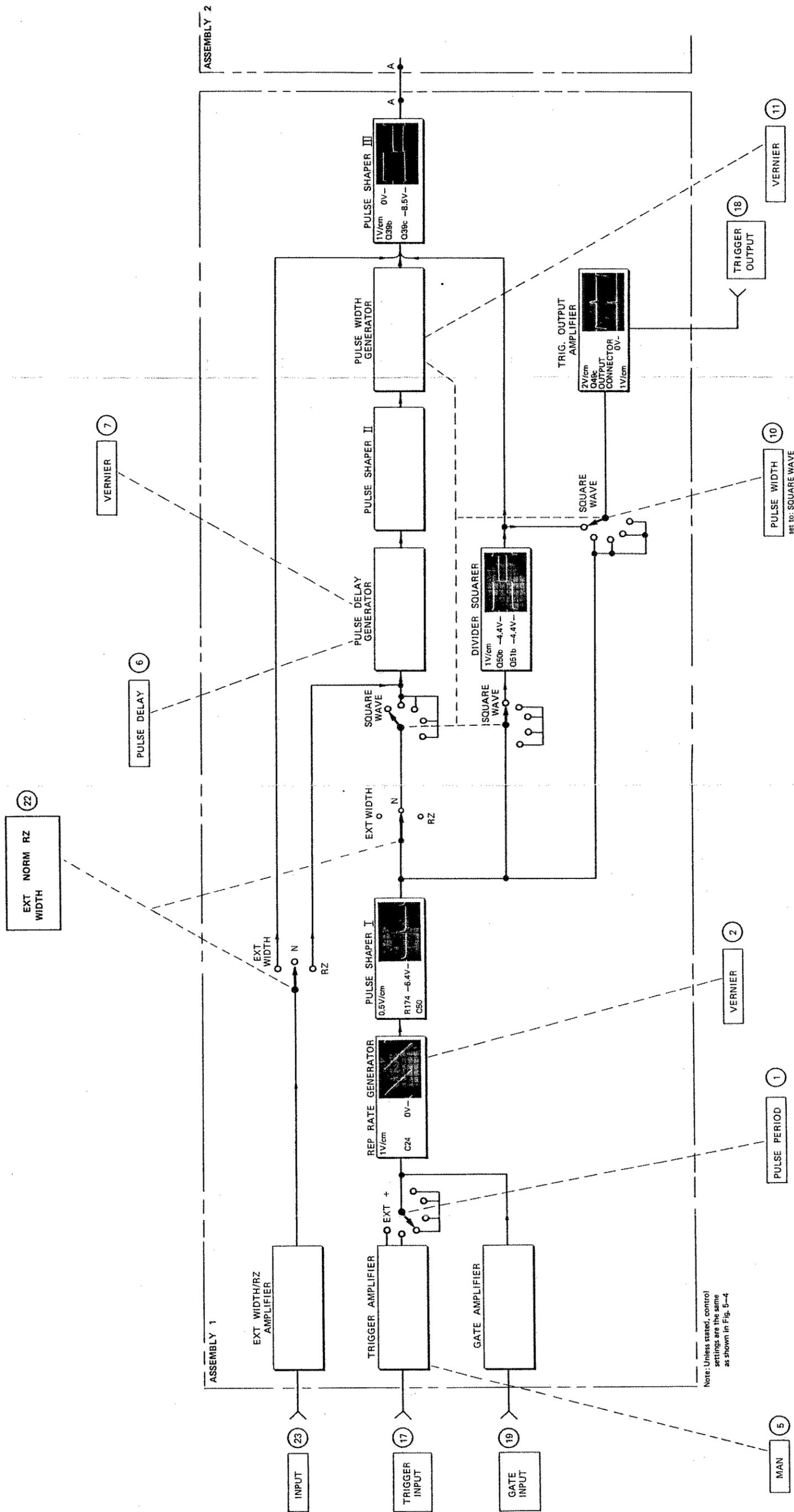


Figure 5-7 Troubleshooting Flowchart: Normal Mode - Square Wave

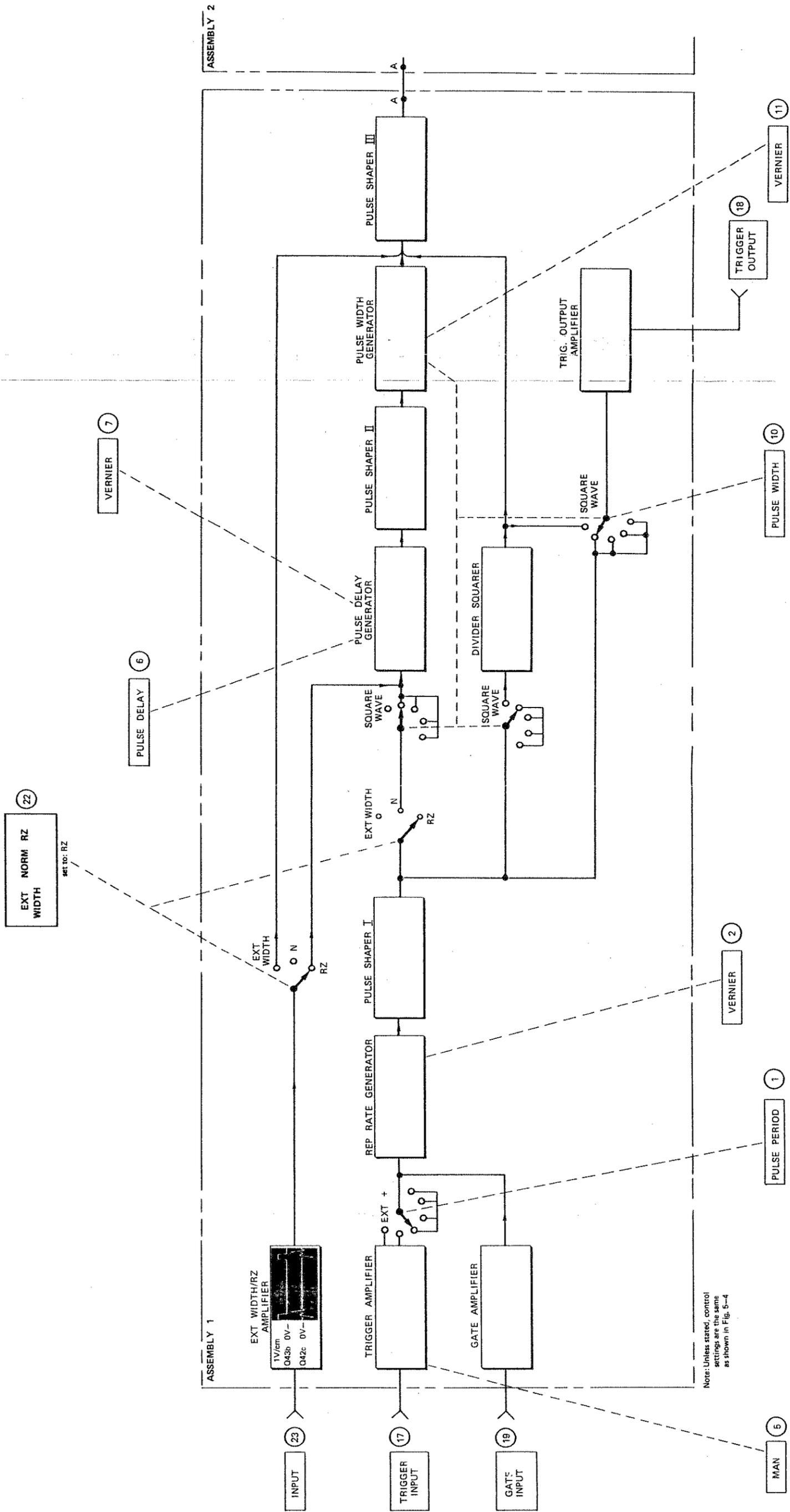


Figure 5-8 Troubleshooting Flowchart: RZ Mode

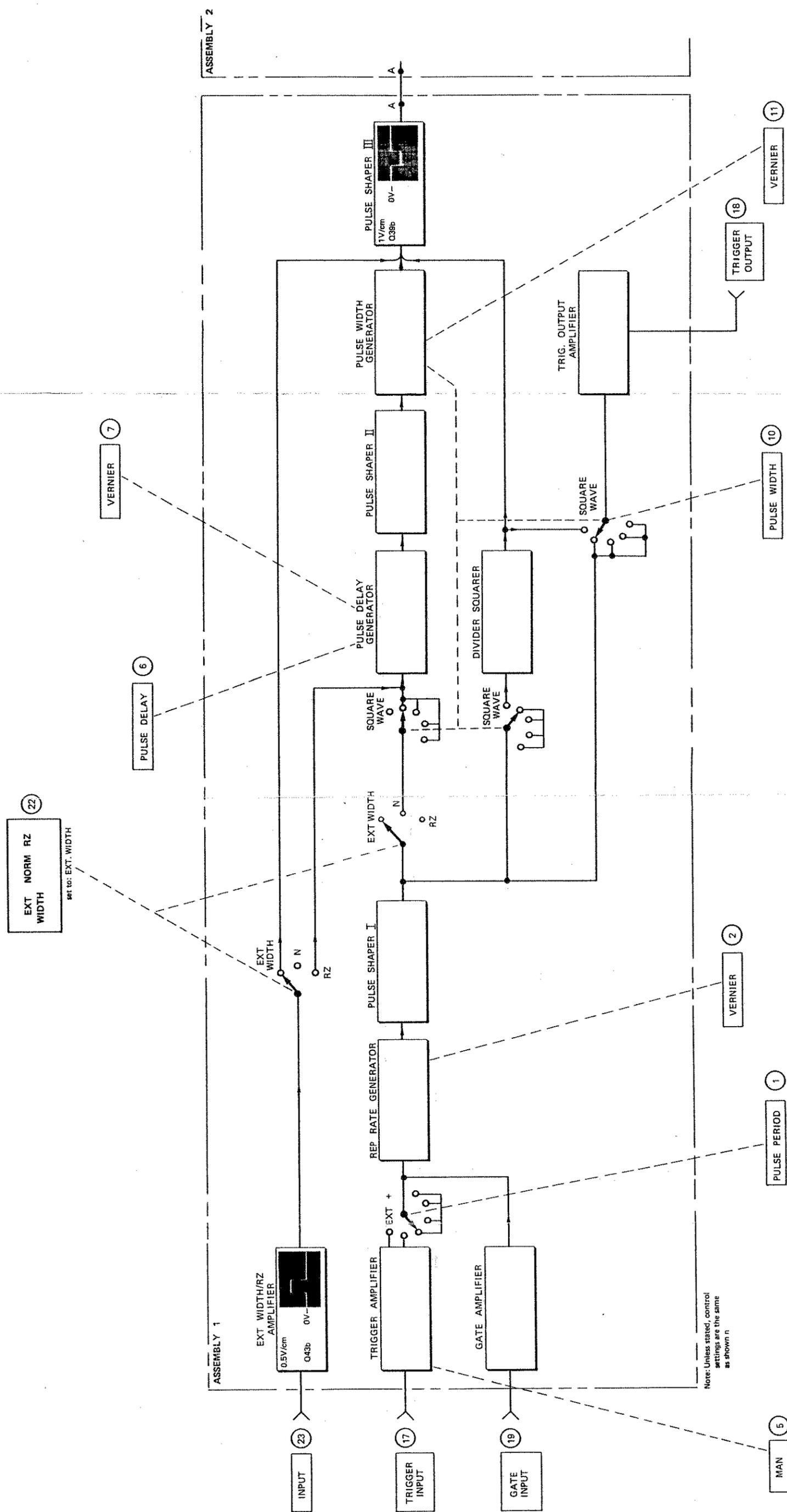


Figure 5-9 Troubleshooting Flowchart: External Width Mode

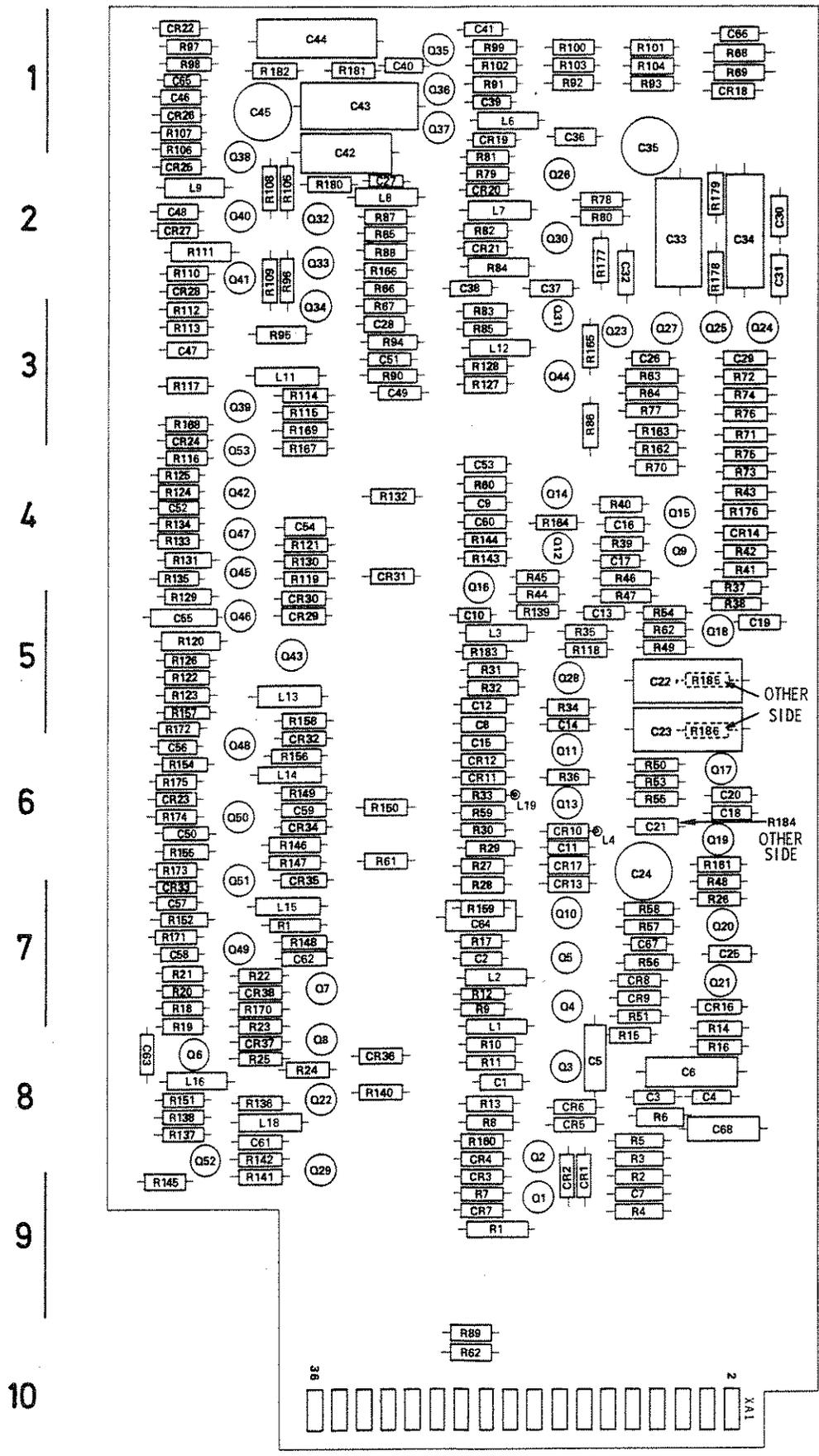


Figure 5-10 Component Layout: Assembly 1

Model 8013A

Section V

Table 5-3 Replaceable Parts: Assembly 1

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM		COMPONENT LAYOUT	REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM		COMPONENT LAYOUT
			SHEET NUMBER	GRID REFERENCE					SHEET NUMBER	GRID REFERENCE	
A1 C1	0150-0121	C-F .01UF 50V	1	E3	C8	A1 CR25	1902-0040	DIO SI 3PV .03A	3	J4	A2
A1 C2	0150-0093	C-F .01UF 100V	1	F3	C7	A1 CR26	1902-0049	DIO AKDN 4.10 V	3	H5	A1
A1 C3	0150-0093	C-F .01UF 100V	1	D4	D6	A1 CR27	1902-0126	DIO AKDN 2.61 V	3	J3	A2
A1 C4	0150-0093	C-F .01UF 100V	1	E4	E6	A1 CR28	1902-0134	DIO-GF 25V .1A	3	K6	A2
A1 C5	0160-2198	C-F 30PF 300V	1	G4	D6	A1 CR29	1901-0040	DIO SI 30V .03A	4	L5	B5
A1 C6	0180-0374	C-F 10UF 20V	1	H5	E8	A1 CR30	1901-0040	DIO SI 30V .03A	4	L6	B5
A1 C7	0160-2307	C-F 47PF 300V	1	D7	D9	A1 CR31	1901-0040	DIO SI 30V .03A	4	M6	C4
A1 C8	0150-0121	C-F .01UF 50V	1	P4	C5	A1 CR32	1901-0040	DIO SI 30V .03A	4	H5	B6
A1 C9	0150-0121	C-F .01UF 50V	2	A3	C4	A1 CR33	1901-0040	DIO SI 30V .03A	4	E5	A7
A1 C10	0150-0093	C-F .01UF 100V	2	C1	C5	A1 CR34	1902-0032	DIO AKDN 5.40 V	4	G4	B6
A1 C11	0150-0093	C-F .01UF 100V	1	N5	D6	A1 CR35	1902-0032	DIO AKDN 5.40 V	4	F4	B7
A1 C12	0150-0093	C-F .01UF 100V	1	N4	C5	A1 CR36	1902-0025	DIO AKDN 10.0 V	1	H8	B8
A1 C13	0150-0093	C-F .01UF 100V	2	A2	D5	A1 CR37	1901-0040	DIO SI 30V .03A	1	E8	B8
A1 C14	0160-2198	C-F 20PF 300V	1	O5	D5	A1 CR38	1901-0040	DIO SI 30V .03A	1	F8	B7
A1 C15	0160-2197	C-F 10PF 300V	1	O5	D6	A1 L1	9100-1611	COIL CMOKE .20UH	1	E3	C8
A1 C16	0150-0093	C-F .01UF 100V	2	A3	D4	A1 L2	9100-1614	COIL CMOKE .47UH	1	F3	C7
A1 C17	0150-0093	C-F .01UF 100V	2	D2	D4	A1 L3	9100-1613	COIL CMOKE .47UH	1	O4	C5
A1 C18	0150-0093	C-F .01UF 100V	1	K9	E5	A1 L4	9170-0029	COPE FERRI BEAD	1	N4	B5
A1 C19	0150-0093	C-F .01UF 100V	1	K8	E5	A1 L6	9140-0096	COIL-FXD 22 UH	2	K6	C1
A1 C20	0150-0093	C-F .01UF 100V	1	K6	E6	A1 L7	9100-1613	COIL CMOKE .47UH	2	L3	C2
A1 C21	0160-3714	C-F 6200PF	1	L10	D6	A1 L8	9140-0094	COIL-CMOKE .68UH	2	M4	C2
A1 C22	0160-3725	C-F 0.68UF	1	L8	E5	A1 L9	9140-0179	COIL-FXD 22 UH	3	J5	A2
A1 C23	0180-0375	C-F 68UF 20V	1	L7	E5	A1 T11	9100-1612	COIL CMOKE .33UH	3	L3	B3
A1 C24	0121-0046	C-VAR 9-35PF	1	L7	D2	A1 L12	9140-0096	COIL-CMOKE 1UH	4	M3	C3
A1 C25	0150-0093	C-F .01UF 100V	1	L8	E7	A1 L13	9140-0096	COIL-CMOKE 1UH	4	L6	B5
A1 C26	0150-0093	C-F .01UF 100V	2	H5	D3	A1 L14	9100-1613	COIL CMOKE .47UH	4	G4	B6
A1 C27	0150-0093	C-F .01UF 100V	3	C1	B2	A1 L15	9140-0112	COIL CMOKE 4.7UH	4	F4	B7
A1 C28	0150-0093	C-F .01UF 100V	3	C2	B3	A1 L17	9170-0029	COPE FERRI BEAD	4	E4	A8
A1 C29	0150-0093	C-F .01UF 100V	2	F5	E3	A1 L18	9100-1614	COIL CMOKE .82UH	4	C3	D2
A1 C30	0150-0093	C-F .01UF 100V	2	F6	E2	A1 L19	9170-0016	BEAD SHLD	4	C2	B8
A1 C31	0150-0093	C-F .01UF 100V	2	F8	E2	A1 Q1	1854-0296	XSTR SI NPN	1	D6	O9
A1 C32	0160-3220	C-F 6800PF 400V	2	F5	D2	A1 Q2	1854-0296	XSTR SI NPN	1	E6	D6
A1 C33	0160-3725	C-F 0.68UF	2	F7	E2	A1 Q3	1854-0092	XSTR 2N3563 SI	1	E4	D6
A1 C34	0180-0375	C-F 68UF 20V	2	F8	E2	A1 Q4	1854-0092	XSTR 2N3563 SI	1	F4	D7
A1 C35	0121-0046	C-VAR 9-35PF	2	K5	D1	A1 Q5	1853-0096	XSTR SI PNP	1	H4	D7
A1 C36	0150-0121	C-F .01UF 50V	2	K6	D1	A1 Q6	1854-0019	XSTR SI NPN	1	H9	A8
A1 C37	0150-0121	C-F .01UF 50V	2	J7	D2	A1 Q7	1853-0034	XSTR SI PNP	1	F8	B7
A1 C38	0150-0121	C-F .01UF 50V	2	L4	C2	A1 Q8	1853-0034	XSTR SI PNP	1	E8	B8
A1 C39	0150-0093	C-F .01UF 100V	3	F5	C1	A1 Q9	1853-0203	XSTR SI PNP	2	B2	E4
A1 C40	0150-0093	C-F .01UF 100V	3	F6	C1	A1 Q10	1853-0090	XSTR SI PNP	1	M5	D7
A1 C41	0150-0093	C-F .01UF 100V	3	F7	C1	A1 Q11	1853-0203	XSTR SI PNP	1	O5	D6
A1 C42	0160-3220	C-F 6800PF 400V	3	F5	B1	A1 Q12	1853-0203	XSTR SI PNP	2	C2	D4
A1 C43	0160-3725	C-F 0.68UF	3	F6	B1	A1 Q13	1854-0345	XSTR 2N5170 SI	1	O6	D6
A1 C44	0180-0375	C-F 68UF 20V	3	F7	B1	A1 Q14	1853-0203	XSTR SI PNP	2	B3	D4
A1 C45	0121-0046	C-VAR 9-35PF	3	J4	B1	A1 Q15	1853-0203	XSTR SI PNP	2	C3	E4
A1 C46	0150-0121	C-F .01UF 50V	3	H5	A1	A1 Q16	1854-0009	XSTR 2N709 SI	4	C5	C4
A1 C47	0150-0121	C-F .01UF 50V	3	K6	A3	A1 Q17	1854-0215	XSTR SI NPN	1	L6	E6
A1 C48	0150-0121	C-F .01UF 50V	3	J3	A2	A1 Q18	1854-0215	XSTR SI NPN	1	L8	E5
A1 C49	0150-0121	C-F .01UF 50V	3	L3	C3	A1 Q19	1854-0215	XSTR SI NPN	1	L9	E6
A1 C50	0140-0191	C-F 56PF 300V	4	E6	A6	A1 Q20	1854-0019	XSTR SI NPN	1	M7	E7
A1 C51	0150-0093	C-F .01UF 100V	4	G4	C3	A1 Q21	1853-0090	XSTR SI PNP	1	M8	E7
A1 C52	0150-0093	C-F .01UF 100V	4	N3	A4	A1 Q22	1854-0019	XSTR SI NPN	4	C3	B8
A1 C53	0150-0093	C-F .01UF 100V	4	J4	C4	A1 Q23	1853-0090	XSTR SI PNP	2	F5	D3
A1 C54	0150-0093	C-F .01UF 100V	4	J3	B4	A1 Q24	1853-0036	XSTR SI PNP	2	F8	E3
A1 C55	0160-2198	C-F 20PF 300V	4	M6	A5	A1 Q25	1853-0036	XSTR SI PNP	2	F6	E3
A1 C56	0150-0093	C-F .01UF 100V	4	H5	A6	A1 Q26	1853-0203	XSTR SI PNP	2	K5	D2
A1 C57	0150-0093	C-F .01UF 100V	4	F6	A7	A1 Q27	1853-0036	XSTR SI PNP	2	F5	E3
A1 C58	0150-0093	C-F .01UF 100V	4	E5	A7	A1 Q28	1205-0037	HT-SHM XSTR	1	O4	D5
A1 C59	0150-0093	C-F .01UF 100V	4	G3	B6	A1 Q28	1854-0019	XSTR SI NPN	1	O4	D5
A1 C60	0150-0093	C-F .01UF 100V	4	C5	C4	A1 Q29	1205-0037	HT-SHM XSTR	4	C3	B9
A1 C61	0150-0093	C-F .01UF 100V	4	B3	B8	A1 Q29	1853-0034	XSTR SI PNP	4	C3	B9
A1 C62	0150-0093	C-F .01UF 100V	1	G8	B7	A1 Q30	1854-0345	XSTR 2N5170 SI	2	L5	D2
A1 C63	0150-0093	C-F .01UF 100V	1	H10	A8	A1 Q31	1854-0345	XSTR 2N5170 SI	2	M5	D3
A1 C64	0160-2198	C-F 20PF 300V	1	H3	C7	A1 Q32	1853-0016	XSTR SI PNP	3	B2	B2
A1 C65	0150-0093	C-F .01UF 100V	3	H4	A1	A1 Q33	1853-0203	XSTR SI PNP	3	B2	B2
A1 C66	0150-0093	C-F .01UF 100V	2	J5	E1	A1 Q34	1853-0090	XSTR SI PNP	3	F4	B3
A1 C67	0150-0093	C-F .01UF 100V	1	M8	D7	A1 Q35	1853-0036	XSTR SI PNP	3	F6	C1
A1 C68	0180-0374	C-F 10UF 20V	1	M8	E8	A1 Q36	1853-0036	XSTR SI PNP	3	F5	C1
A1 CR1	1901-0040	DIO SI 30V .03A	1	D6	D9	A1 Q37	1853-0036	XSTR SI PNP	3	F4	C1
A1 CR2	1901-0040	DIO SI 30V .03A	1	E6	D9	A1 Q38	1853-0218	XSTR SI PNP	3	H5	A2
A1 CR3	1901-0040	DIO SI 30V .03A	1	D5	C9	A1 Q39	1853-0203	XSTR SI PNP	3	H3	A3
A1 CR4	1901-0040	DIO SI 30V .03A	1	D5	C8	A1 Q40	1854-0345	XSTR 2N5170 SI	3	K4	A2
A1 CR5	1901-0040	DIO SI 30V .03A	1	D5	D8	A1 Q41	1854-0345	XSTR 2N5170 SI	3	K4	A2
A1 CR6	1901-0040	DIO SI 30V .03A	1	D5	D8	A1 Q42	1854-0009	XSTR 2N709 SI	4	M4	A4
A1 CR7	1902-0037	DIO AKDN 4.10 V	1	C5	C9	A1 Q43	1853-0203	XSTR SI PNP	4	L5	B5
A1 CR8	1901-0040	DIO SI 30V .03A	1	H5	D7	A1 Q44	1853-0015	XSTR L-5 1 SI	4	L3	D3
A1 CR9	1901-0040	DIO SI 30V .03A	1	H5	D7	A1 Q45	1854-0345	XSTR 2N5170 SI	4	M6	A6
A1 CR10	1901-0170	DIO SI 15V .75MS	1	N5	D6	A1 Q46	1854-0345	XSTR 2N5170 SI	4	L6	A5
A1 CR11	1901-0040	DIO SI 30V .03A	1	O5	C6	A1 Q47	1854-0009	XSTR 2N709 SI	4	M4	A4
A1 CR12	1901-0040	DIO SI 30V .03A	1	O5	C6	A1 Q48	1854-0215	XSTR SI NPN	4	H5	A6
A1 CR13	1901-0040	DIO SI 30V .03A	1	O7	D7	A1 Q49	1854-0215	XSTR SI NPN	4	E5	A7
A1 CR14	1901-0040	DIO SI 30V .03A	2	C2	E4	A1 Q50	1854-0092	XSTR 2N3563 SI	4	G4	A6
A1 CR15	1901-0040	DIO SI 30V .03A	1	N8	E7	A1 Q51	1854-0092	XSTR 2N3563 SI	4	F4	A7
A1 CR16	1901-0040	DIO SI 30V .03A	1	N8	E7	A1 Q52	1854-0009	XSTR 2N709 SI	4	D4	A6
A1 CR17	1910-0022	DIO-GF 5V 3.5MS	1	N7	D6	A1 Q53	1853-0203	XSTR SI PNP	3	L2	A4
A1 CR18	1901-0040	DIO SI 30V .03A	2	K5	E1	A1 R1	0698-3424	R-F 100 5K .25W	1	D6	C9
A1 CR19	1902-0049	DIO AKDN 6.19 V	2	K6	C1	A1 R2	0698-0083	R-F 1.0K1% 1W	1	D7	D8
A1 CR20	1901-0040	DIO SI 30V .03A	2	K5	C2	A1 R3	0698-0083	R-F 1.0K1% 1W	1	E7	D9
A1 CR21	1902-0126	DIO AKDN 2.61 V	2	K4	C2	A1 R4	0698-4226	R-F 62 5K .125W	1	D6	D9
A1 CR22	1901-0040	DIO SI 30V .03A	3	H4	A1	A1 R5	0698-3443	R-F 200 1K .125W	1	D4	D8
A1 CR23	1902-0025	DIO AKDN 10.0 V	4	A6	A6	A1 R6	0698-3443	R-F 200 1K .125W	1	E4	D8
A1 CR24	1902-0025	DIO AKDN 10.0 V	3	M3	A3	A1 R7	0698-4244	R-F 10K 5K .125W	1	C5	C9

Table 5-3 Replaceable Parts: Assembly 1

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM		COMPONENT LAYOUT	REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM		COMPONENT LAYOUT
			SHEET NUMBER	GRID REFERENCE					SHEET NUMBER	GRID REFERENCE	
A1 R8	0757-1094	R-F 1.47K1K	1	E5	C8	A1 R98	0698-0084	R-F 2.15K1K	3	H4	A1
A1 R9	0758-0086	R-F 100 5K .125W	1	E3	C7	A1 R99	0698-4271	R-F 5.1K5K .125W	3	E5	C1
A1 R10	0757-0400	R-F 90.0 1K	1	E4	C8	A1 R100	0698-4271	R-F 5.1K5K .125W	3	E6	D1
A1 R11	0757-0421	R-F 825 1K .125W	1	G4	C8	A1 R101	0698-4271	R-F 5.1K5K .125W	3	E7	D1
A1 R12	0698-4239	R-F 220 5K .125W	1	F3	C7	A1 R102	0698-4264	R-F 2.7K5K .125W	3	E4	C1
A1 R13	0757-0420	R-F 750 1K .125W	1	F5	C8	A1 R103	0698-4264	R-F 2.7K5K .125W	3	E5	D1
A1 R14	0698-4257	R-F 1.3K5K .125W	1	G5	E8	A1 R104	0698-4264	R-F 2.7K5K .125W	3	E6	D1
A1 R15	0698-4426	R-F 1.9K1K	1	H5	O6	A1 R105	0698-5704	R-F 36 5K .125W	3	H4	B2
A1 R16	0698-4238	R-F 270 5K .125W	1	G6	E8	A1 R106	0698-4278	R-F 47 5K .25W	3	J5	A1
A1 R17	0698-4225	R-F 5A 5K .125W	1	H3	C7	A1 R107	0698-4258	R-F 1.5K5K .125W	3	J5	A1
A1 R18	0698-4278	R-F 10K5K .125W	1	H5	A7	A1 R108	0698-5704	R-F 36 5K .125W	3	J4	B2
A1 R19	0698-4230	R-F 82 5K .125W	1	H9	A8	A1 R109	0698-4261	R-F 270 5K .125W	3	K3	B2
A1 R20	0698-4241	R-F 270 5K .125W	1	E9	A7	A1 R110	0698-4234	R-F 130 5K .125W	3	K3	A2
A1 R21	0698-4255	R-F 1.1K5K .125W	1	G8	A7	A1 R111	0758-0002	R-F 560 5K .25W	3	K4	A2
A1 R22	0698-4294	R-F 10K5K .125W	1	F8	B7	A1 R112	0698-4278	R-F 10K5K .125W	4	J5	A3
A1 R23	0698-4261	R-F 20K5K .125W F	1	GB	B8	A1 R113	0698-4260	R-F 1.9K5K .125W	3	K4	A3
A1 R24	0698-4259	R-F 1.6K5K .125W	1	EB	B8	A1 R114	0758-0086	R-F 100 5K .125W	3	L3	B3
A1 R25	0698-4237	R-F 180 5K .125W	1	EB	B8	A1 R115	0758-0124	R-F 51 5K .125W	3	L3	B3
A1 R26	0698-4279	R-F 11K5K .125W	1	K9	E7	A1 R116	0698-4278	R-F 10K5K .125W	3	M2	A4
A1 R27	0698-4278	R-F 10K5K .125W	1	M5	C6	A1 R117	0698-4278	R-F 10K5K .125W	3	M4	A3
A1 R28	0698-4278	R-F 10K5K .125W	1	M5	C7	A1 R118	0698-6802	R-F 10 5K .125W	1	O4	D5
A1 R29	0757-0274	R-F 1.21K1K	1	M5	C6	A1 R119	0698-4264	R-F 2.7K5K .125W	4	L5	B4
A1 R30	0698-4265	R-F 3K5K .125W F	1	N4	C6	A1 R120	0758-0126	R-F 51 5K .25W F	4	K6	A5
A1 R31	0757-0424	R-F 1.62K1K	1	O4	C5	A1 R121	0698-4239	R-F 200 5K .125W	4	J3	B4
A1 R32	0698-0085	R-F 2.61K1K	1	N4	C5	A1 R122	0757-0419	R-F 681 1K .125W	4	K6	A5
A1 R33	0698-4232	R-F 110 5K .125W	1	O6	C6	A1 R123	0757-0419	R-F 681 1K .125W	4	K7	A5
A1 R34	0758-0096	R-F 130 5K .125W	1	O7	D5	A1 R124	0698-4254	R-F 1K5K .125W F	4	J3	A4
A1 R35	0698-4231	R-F 80 5K .125W	1	O4	D5	A1 R125	0698-4270	R-F 4.7K5K .125W	4	J4	A4
A1 R36	0698-4234	R-F 130 5K .125W	1	O5	D5	A1 R126	0757-0405	R-F 167 1K .125W	4	L5	A5
A1 R37	0698-3151	R-F 2.47K1K	2	E2	O6	A1 R127	0698-4230	R-F 82 5K .125W	4	L3	C3
A1 R38	0698-0084	R-F 2.1K1K	2	B2	E5	A1 R128	0698-4243	R-F 330 5K .125W	4	M3	C3
A1 R39	0698-4271	R-F 5.1K5K .125W	2	A3	D4	A1 R129	0757-0424	R-F 1.1K1K .125W	4	M6	A5
A1 R40	0698-4251	R-F 750 5K .125W	2	A4	D4	A1 R130	0698-4251	R-F 750 5K .125W	4	M6	B4
A1 R41	0698-4252	R-F 820 5K .125W	2	C1	E4	A1 R131	0757-0278	R-F 1.78K1K	4	M6	A4
A1 R42	0758-0086	R-F 100 5K .125W	2	C2	E4	A1 R132	0698-4271	R-F 5.1K5K .125W	4	J4	C4
A1 R43	0758-0086	R-F 100 5K .125W	2	B3	E4	A1 R133	0698-4257	R-F 1.3K5K .125W	4	N3	A4
A1 R44	0758-0086	R-F 100 5K .125W	2	O2	D2	A1 R134	0698-4238	R-F 200 5K .125W	4	N3	A4
A1 R45	0698-4238	R-F 200 5K .125W	2	D2	D4	A1 R135	0698-4269	R-F 4.3K5K .125W	4	N4	A4
A1 R46	0698-0084	R-F 2.15K1K	2	D2	O4	A1 R136	0698-4241	R-F 270 5K .125W	4	B3	B8
A1 R47	0757-0274	R-F 1.21K1K	2	D2	O5	A1 R137	0698-4262	R-F 2.2K5K .125W	4	B3	A8
A1 R48	0698-4271	R-F 5.1K5K .125W	1	K9	E1	A1 R138	0698-4256	R-F 1.2K5K .125W	4	B3	A8
A1 R49	0698-4271	R-F 5.1K5K .125W	1	K8	O5	A1 R139	0698-4256	R-F 1.2K5K .125W	4	B3	A8
A1 R50	0698-4271	R-F 5.1K5K .125W	1	K6	O6	A1 R140	0698-4238	R-F 200 5K .125W	4	C5	D5
A1 R51	0698-4274	R-F 6.8K5K .125W	1	M7	O7	A1 R141	0758-0086	R-F 100 5K .125W	4	C4	B8
A1 R52	0698-4279	R-F 11K5K .125W	1	K8	O6	A1 R142	0698-4242	R-F 300 5K .125W	4	C3	B9
A1 R53	0698-4279	R-F 11K5K .125W	1	K6	E5	A1 R143	0698-5702	R-F 30 5K .125W	4	C2	B8
A1 R54	0698-4256	R-F 1.2K5K .125W	1	K8	O5	A1 R144	0698-4270	R-F 4.7K5K .125W	4	C4	C4
A1 R55	0698-4256	R-F 1.2K5K .125W	1	K6	O6	A1 R145	0698-4254	R-F 1K5K .125W F	4	C5	C4
A1 R56	0757-0417	R-F 562 1K .125W	1	M8	O7	A1 R146	0698-4237	R-F 180 5K .125W	4	D5	A9
A1 R57	0757-0438	R-F 5.11K1K	1	M8	O7	A1 R147	0757-1094	R-F 1.47K1K	4	G3	B6
A1 R58	0757-0433	R-F 3.32K1K	1	M7	O7	A1 R148	0757-1094	R-F 1.47K1K	4	F3	B6
A1 R59	0698-4258	R-F 1.9K5K .125W	1	N6	C6	A1 R149	0758-0086	R-F 100 5K .125W	4	F4	B7
A1 R60	0698-4265	R-F 3K5K .125W F	2	A5	C4	A1 R150	0758-0086	R-F 100 5K .125W	4	A5	B6
A1 R61	0698-4265	R-F 3K5K .125W F	2	A5	B6	A1 R151	0757-0915	R-F 430 2K .125W	4	E4	A8
A1 R62	0698-5705	R-F 39 5K .125W	2	E3	C10	A1 R152	0757-0398	R-F 75 1K .125W	4	F5	B7
A1 R63	0698-3639	R-F 178 1K .125W	2	F4	O3	A1 R153	0757-0424	R-F 1.1K1K .125W	4	F6	A7
A1 R64	0698-0084	R-F 2.15K1K	2	H5	D3	A1 R154	0757-0424	R-F 1.1K1K .125W	4	G6	A6
A1 R65	0698-4260	R-F 1.8K5K .125W	3	B1	B2	A1 R155	0757-0280	R-F 1K1K .125W F	4	F6	A6
A1 R66	0698-4283	R-F 16K5K .125W	3	C1	B2	A1 R156	0757-0398	R-F 75 1K .125W	4	G5	B6
A1 R67	0698-4252	R-F 820 5K .125W	3	C2	B3	A1 R157	0757-0280	R-F 1K1K .125W F	4	H5	A5
A1 R68	0757-0278	R-F 1.78K1K	2	J4	E1	A1 R158	0698-4266	R-F 3.3K5K .125W	4	H5	B5
A1 R69	0698-0084	R-F 2.15K1K	2	J5	E1	A1 R159	0698-6744	R-F 20 5K .125W	1	H3	C7
A1 R70	0698-4264	R-F 2.7K5K .125W	2	E5	D4	A1 R160	0758-0086	R-F 100 5K .125W	1	E6	C8
A1 R71	0698-4264	R-F 2.7K5K .125W	2	E6	E3	A1 R161	0698-4256	R-F 1.2K5K .125W	1	K9	E6
A1 R72	0698-4264	R-F 2.7K5K .125W	2	E6	E3	A1 R162	0698-4287	R-F 24K5K .125W	2	E5	D4
A1 R73	0698-4287	R-F 24K5K .125W	2	E6	E4	A1 R163	0698-4271	R-F 5.1K5K .125W	2	E5	D3
A1 R74	0698-4287	R-F 24K5K .125W	2	E8	E3	A1 R164	0698-6802	R-F 10 5K .125W	2	B3	D4
A1 R75	0698-4271	R-F 5.1K5K .125W	2	E6	E4	A1 R165	0698-6802	R-F 10 5K .125W	2	H5	D3
A1 R76	0698-4271	R-F 5.1K5K .125W	2	E8	E3	A1 R166	0758-0086	R-F 100 5K .125W	3	C2	B2
A1 R77	0757-0290	R-F 6.19K1K	2	H5	D3	A1 R167	0698-4238	R-F 200 5K .125W	3	L2	B4
A1 R78	0698-5704	R-F 36 5K .125W	2	K5	D2	A1 R168	0698-4270	R-F 4.7K5K .125W	3	L3	A3
A1 R79	0683-4705	R-F 47 5K .25W	2	K5	C2	A1 R169	0698-4253	R-F 910 5K .125W	3	M2	B3
A1 R80	0698-5704	R-F 36 5K .125W	2	K6	D2	A1 R170	0698-6802	R-F 10 5K .125W	1	F8	B7
A1 R81	0698-4258	R-F 1.5K5K .125W	2	K5	C2	A1 R171	0698-6802	R-F 10 5K .125W	4	H5	A7
A1 R82	0698-4261	R-F 270 5K .125W	2	L4	C2	A1 R172	0698-6802	R-F 10 5K .125W	4	E5	A5
A1 R83	0698-4234	R-F 130 5K .125W	2	L4	C3	A1 R173	0698-4225	R-F 56 5K .125W	4	F4	A6
A1 R84	0758-0002	R-F 560 5K .25W	2	L5	C2	A1 R174	0698-4238	R-F 200 5K .125W	4	A6	A6
A1 R85	0698-4260	R-F 1.8K5K .125W	2	L5	C3	A1 R175	0698-4273	R-F 6.2K5K .125W	4	A6	A6
A1 R86	0698-4235	R-F 150 5K .125W	2	L4	D3	A1 R176	0698-4240	R-F 240 5K .125W	2	C2	E4
A1 R87	0698-4235	R-F 150 5K .125W	2	M4	B2	A1 R177	0683-1055	R-F 1M5K .25W CC	2	F5	D2
A1 R88	0698-4239	R-F 220 5K .125W	3	B3	B2	A1 R178	0683-1055	R-F 1M5K .25W CC	2	F7	E2
A1 R89	0698-5703	R-F 33 5K .125W	3	F4	C10	A1 R179	0683-1055	R-F 1M5K .25W CC	2	F8	E2
A1 R90	0698-3438	R-F 147 1K .125W	3	D4	C3	A1 R180	0683-1055	R-F 1M5K .25W CC	3	F5	B2
A1 R91	0698-4287	R-F 24K5K .125W	3	E4	D1	A1 R181	0683-1055	R-F 1M5K .25W CC	3	F6	B1
A1 R92	0698-4287	R-F 24K5K .125W	3	E5	C1	A1 R182	0683-1055	R-F 1M5K .25W CC	3	F7	B1
A1 R93	0698-4287	R-F 24K5K .125W	3	E6	D1	A1 R183	0698-5702	R-F 36 5K .125W	1	N4	C5
A1 R94	0698-4424	R-F 1.4K1K .125W	3	G4	C3	A1 R184	0683-1055	R-F 1M5K .25W CC	1	L10	D6
A1 R95	0757-0290	R-F 6.19K1K	4	G4	C3	A1 R185	0683-1055	R-F 1M			

A B C D E F G H J K L M N O P R

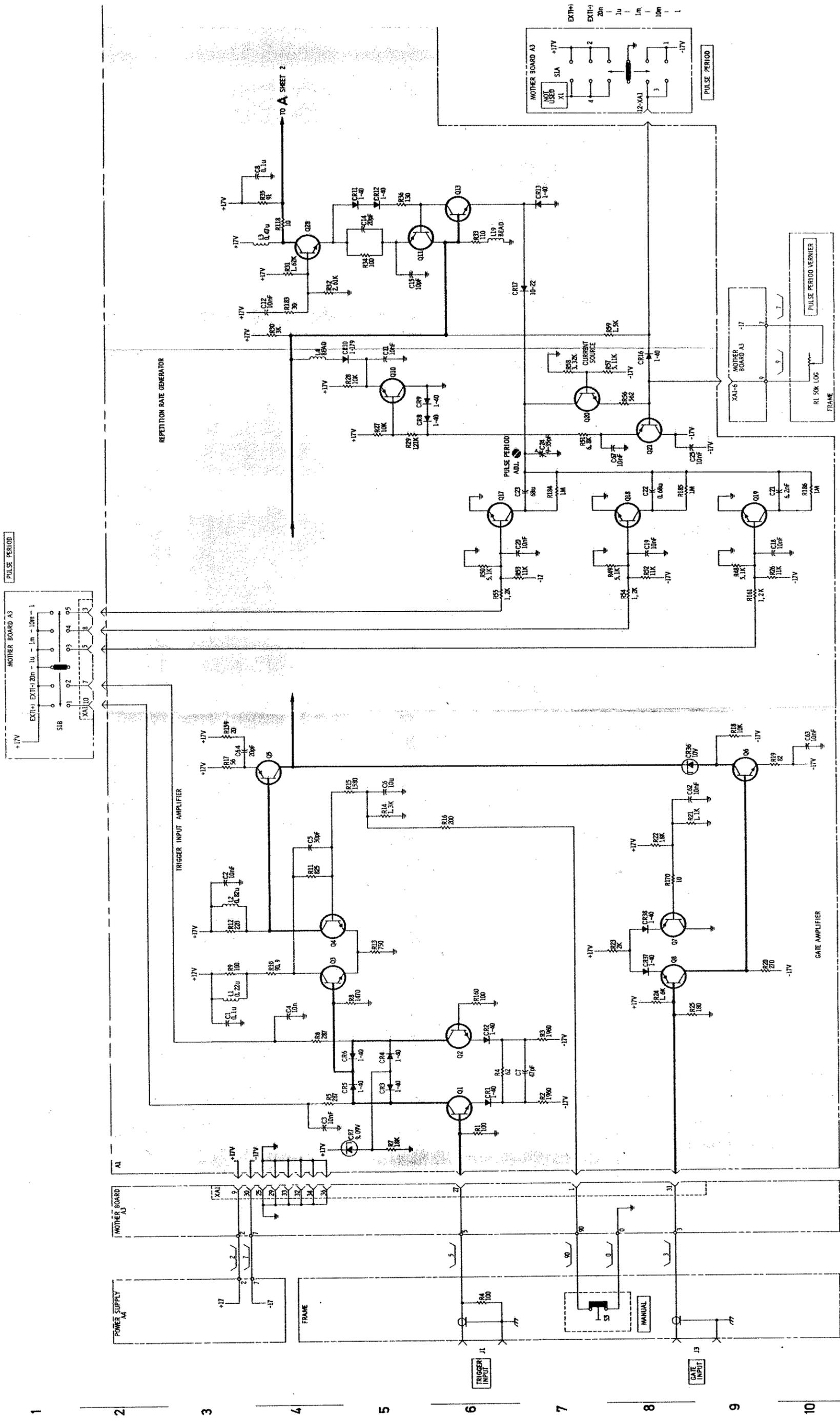


Figure 5-11 Circuit Diagram: Assembly 1 Sheet 1 of 4

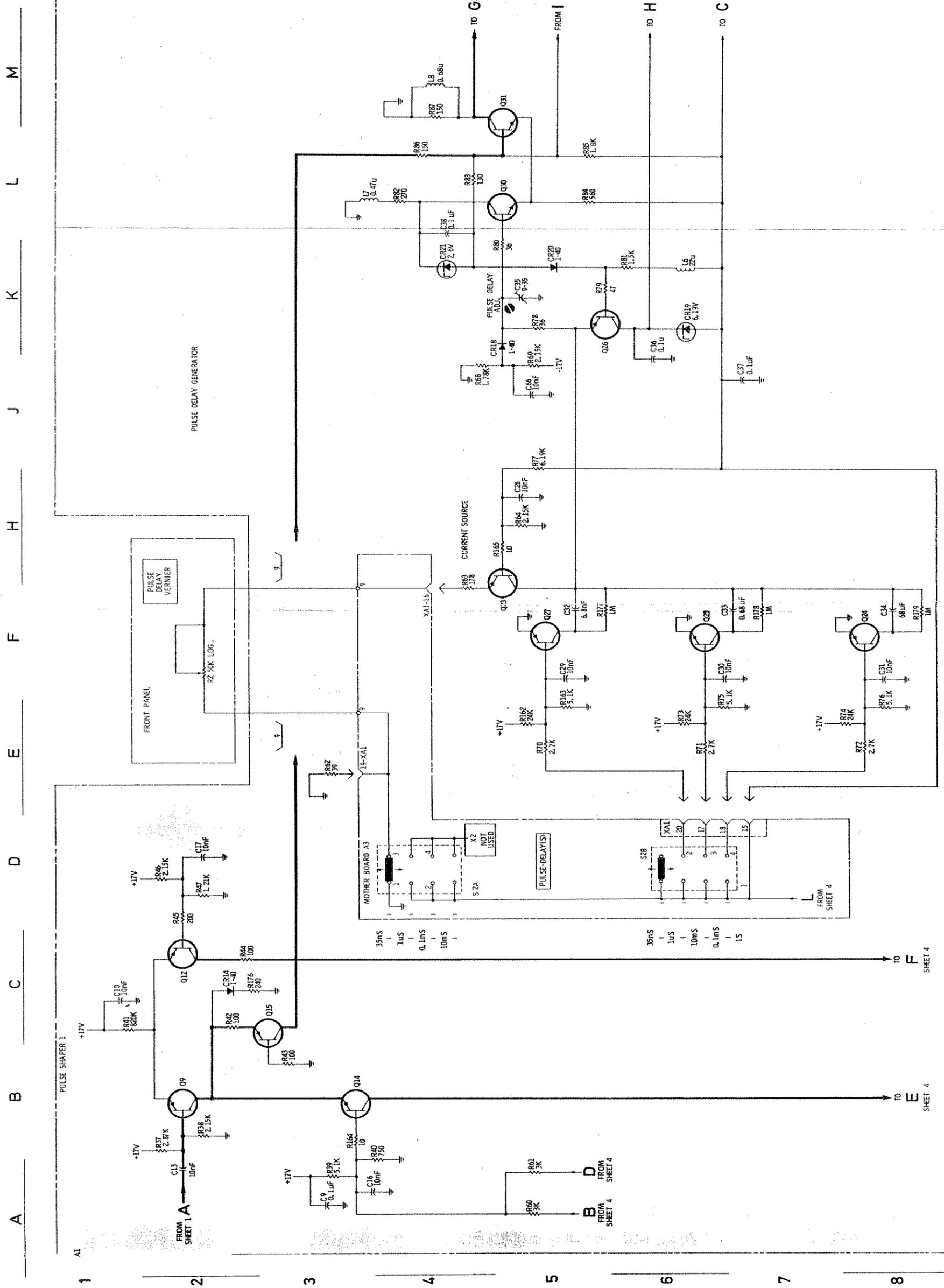


Figure 5-11 Circuit Diagram: Assembly 1 Sheet 2 of 4

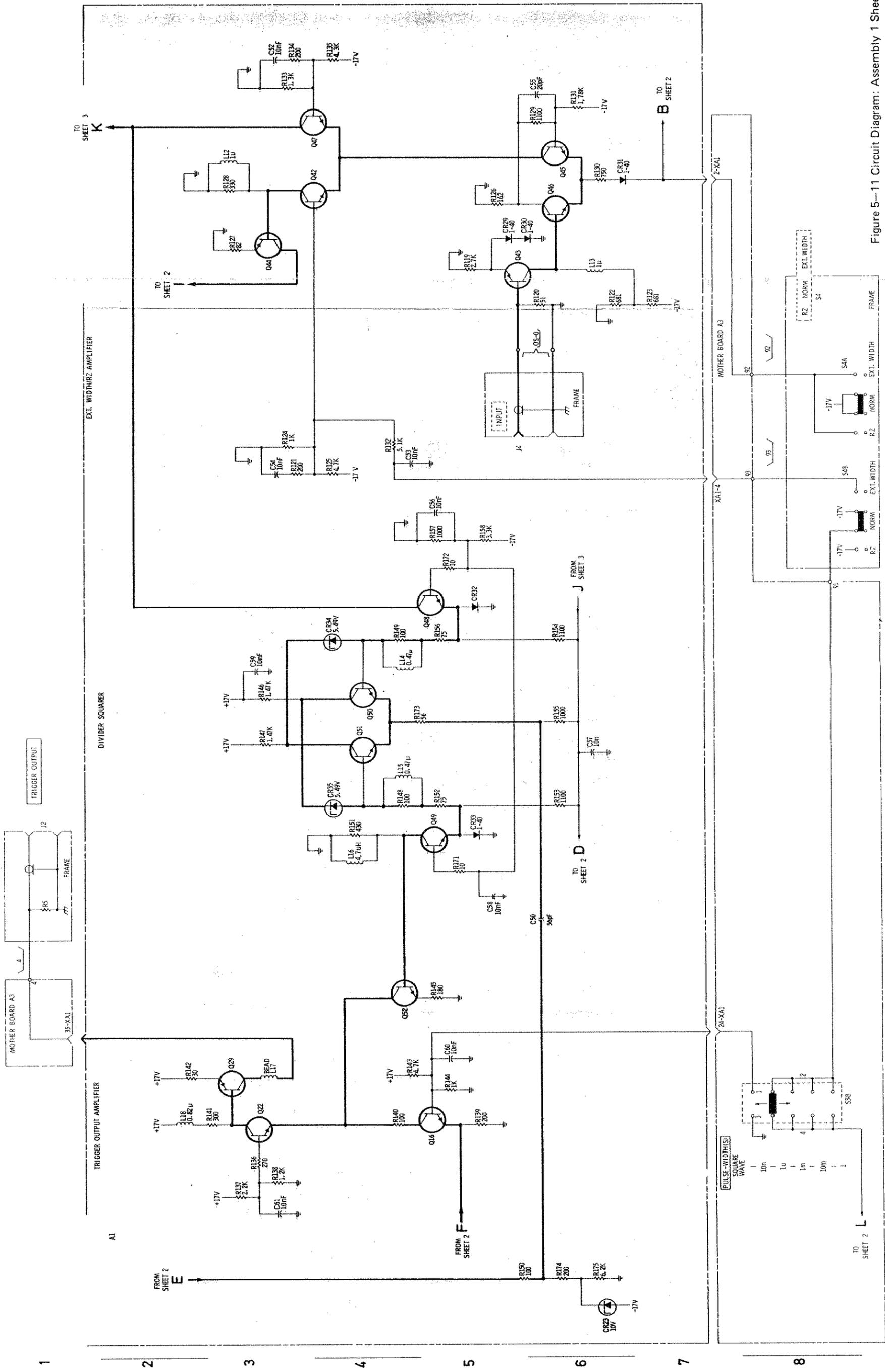


Figure 5-11 Circuit Diagram: Assembly 1 Sheet 4 of 4

Section V

Model 8013A

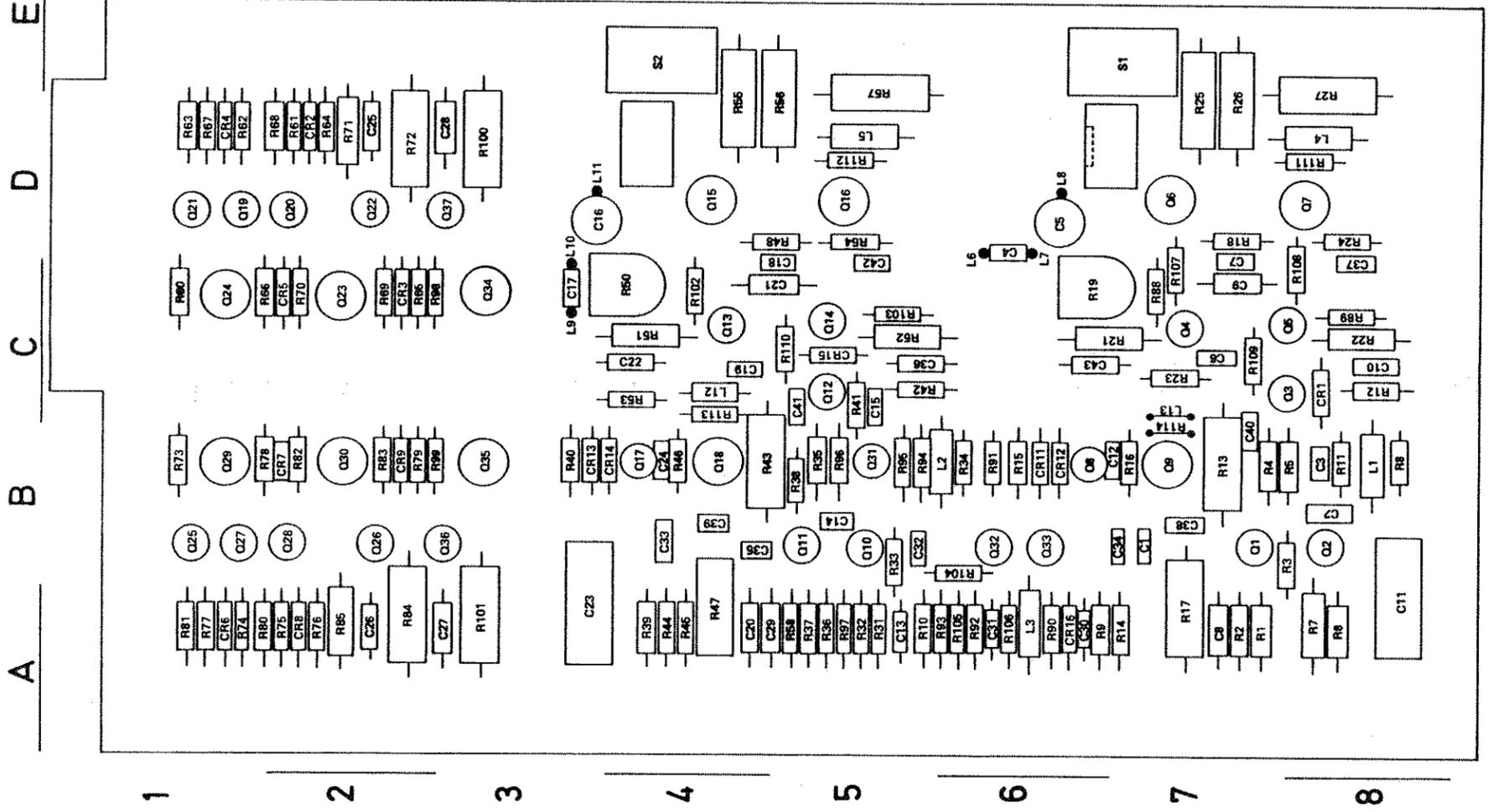


Figure 5-12 Component Layout: Assemblies 2 and 3

Model 8013A

Section V

Table 5-4 Replaceable Parts: Assembly 2

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT SHEET NUMBER	DIAGRAM GRID REFERENCE	COMPONENT LAYOUT	REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT SHEET NUMBER	DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A2 1	034C-0720	INSUL PAD XSTR				A2 MP17	1200-0185	PAD XSTR			
A2 2	034C-0720	INSUL PAD XSTR				A2 MP18	1200-0185	PAD XSTR			
A2 3	034C-0720	INSUL PAD XSTR				A2 MP19	1200-0185	PAD XSTR			
A2 4	034C-0720	INSUL PAD XSTR				A2 MP20	1200-0185	PAD XSTR			
A2 5	034C-0720	INSUL PAD XSTR				A2 MP21	1200-0185	PAD XSTR			
A2 6	034C-0720	INSUL PAD XSTR				A2 MP22	1200-0185	PAD XSTR			
A2 7	034C-0720	INSUL PAD XSTR				A2 MP23	1200-0185	PAD XSTR			
A2 8	034C-0720	INSUL PAD XSTR				A2 MP23	1205-0033	HT-SINK TO-5			
A2 9	034C-0720	INSUL PAD XSTR				A2 MP30	1205-0033	HT-SINK TO-5			
A2 10	034C-0720	INSUL PAD XSTR				A2 MP34	1205-0033	HT-SINK TO-5			
A2 11	034C-0720	INSUL PAD XSTR				A2 MP35	1205-0033	HT-SINK TO-5			
A2 12	034C-0720	INSUL PAD XSTR				A2 Q1	1854-0345	XSTR 2N5179 SI	1	E3	B7
A2 13	034C-0720	INSUL PAD XSTR				A2 Q2	1854-0345	XSTR 2N5179 SI	1	F3	B8
A2 C1	0150-0050	C-F .001UF 1KV	1	D4	B7	A2 Q3	1853-0214	XSTR SI PNP	1	H3	C8
A2 C2	0160-2306	C-F 27PF 300V	1	E3	B8	A2 Q4	1205-0037	HT-SINK XSTR	1	J2	C7
A2 C3	0160-0356	C-F 18PF 300V	1	G3	B8	A2 Q4	1853-0214	XSTR SI PNP	1	J2	C7
A2 C4	0160-2263	C-F 18PF 500V	1	I3	D6	A2 Q5	1205-0037	HT-SINK XSTR	1	J2	C8
A2 C5	0121-0046	C-VAR 9-35PF	1	I3	D6	A2 Q5	1853-0218	XSTR SI PNP	1	J2	C8
A2 C6	0150-0093	C-F .01UF 100V	1	J2	C7	A2 Q6	1853-0201	XSTR SI PNP	1	J4	D7
A2 C7	0150-0093	C-F .01UF 100V	1	J3	D7	A2 Q7	1853-0201	XSTR SI PNP	1	J4	D8
A2 C8	0180-0291	C-F 1UF 35V	1	H4	A7	A2 Q8	1853-0090	XSTR SI PNP	1	H2	B6
A2 C9	0180-0291	C-F 1UF 35V	1	K4	C7	A2 Q9	1205-0011	HT-SINK XSTR	1	I2	B7
A2 C10	0160-0174	C-F .47UF 25V	1	J1	C8	A2 Q9	1854-0003	XSTR SI NPN	1	I2	B7
A2 C11	0180-0098	C-F 100UF 20V	1	J1	A8	A2 Q10	1853-0015	XSTR 1.5 1 SI	1	E6	B5
A2 C12	0150-0093	C-F .01UF 100V	1	H1	B7	A2 Q11	1853-0015	XSTR 1.5 1 SI	1	F7	B5
A2 C13	0150-0050	C-F .001UF 1KV	1	D6	A5	A2 Q12	1854-0301	XSTR 2N3261 SI	1	H8	C5
A2 C14	0140-0190	C-F 39PF 300V	1	E7	B5	A2 Q13	1205-0037	HT-SINK XSTR	1	J8	C4
A2 C15	0160-0356	C-F 18PF 300V	1	G8	C5	A2 Q13	1854-0301	XSTR 2N3261 SI	1	J8	C4
A2 C16	0121-0046	C-VAR 9-35PF	1	I8	D3	A2 Q14	1205-0037	HT-SINK XSTR	1	J8	C5
A2 C17	0160-2263	C-F 18PF 500V	1	I8	C3	A2 Q14	1854-0301	XSTR 2N3261 SI	1	J8	C5
A2 C18	0150-0093	C-F .01UF 100V	1	J8	D4	A2 Q15	1854-0332	XSTR SI NPN	1	J7	D4
A2 C19	0150-0093	C-F .01UF 100V	1	J9	C4	A2 Q16	1854-0332	XSTR SI NPN	1	J7	D5
A2 C20	0180-0291	C-F 1UF 35V	1	H7	A4	A2 Q17	1854-0307	XSTR SI NPN	1	H9	D6
A2 C21	0180-0291	C-F 1UF 35V	1	K7	C4	A2 Q18	1205-0011	HT-SINK XSTR	1	H9	B4
A2 C22	0160-0174	C-F .47UF 25V	1	I10	C4	A2 Q18	1853-0012	XSTR 2.6 1 SI	1	H9	B4
A2 C23	0180-0098	C-F 100UF 20V	1	K10	A3	A2 Q19	1854-0215	XSTR SI NPN	2	D5	D1
A2 C24	0150-0093	C-F .01UF 100V	1	H10	B4	A2 Q20	1854-0215	XSTR SI NPN	2	D7	D2
A2 C25	0150-0121	C-F .1UF 50V	2	D7	D2	A2 Q21	1853-0036	XSTR SI PNP	2	D7	D1
A2 C26	0150-0121	C-F .1UF 50V	2	D1	A2	A2 Q22	1853-0036	XSTR SI PNP	2	D5	D2
A2 C27	0180-0309	C-F 4.7UF 10V	2	D4	A3	A2 Q23	1854-0039	XSTR 2N3053 SI	2	E5	C2
A2 C28	0180-0309	C-F 4.7UF 10V	2	D4	D3	A2 Q24	1853-0027	XSTR SI PNP	2	E7	C1
A2 C29	0180-0197	E-F2.2UF 20V	1	C7	A4	A2 Q25	1854-0215	XSTR SI NPN	2	D2	B1
A2 C30	0150-0093	C-F .01UF 100V	1	B7	A6	A2 Q26	1854-0215	XSTR SI NPN	2	D3	B2
A2 C31	0150-0093	C-F .01UF 100V	1	C6	A6	A2 Q27	1853-0036	XSTR SI PNP	2	D3	B1
A2 C32	0150-0093	C-F .01UF 100V	1	D8	B5	A2 Q28	1853-0036	XSTR SI PNP	2	D2	B2
A2 C33	0150-0093	C-F .01UF 100V	1	G10	B4	A2 Q29	1854-0039	XSTR 2N3053 SI	2	E2	B1
A2 C34	0150-0093	C-F .01UF 100V	1	H2	B7	A2 Q30	1853-0027	XSTR SI PNP	2	E3	B2
A2 C35	0160-0174	C-F .47UF 25V	1	F7	B4	A2 Q31	1853-0203	XSTR SI PNP	1	E7	B5
A2 C36	0160-0174	C-F .47UF 25V	1	K10	C5	A2 Q32	1853-0203	XSTR SI PNP	1	B6	B6
A2 C37	0150-0093	C-F .01UF 100V	1	H4	D8	A2 Q33	1854-0345	XSTR 2N5179 SI	1	B5	B3
A2 C38	0150-0093	C-F .01UF 100V	1	K4	B7	A2 Q34	1854-0039	XSTR 2N3053 SI	2	F5	C6
A2 C39	0150-0093	C-F .01UF 100V	1	K7	B4	A2 Q35	1853-0027	XSTR SI PNP	2	F2	B3
A2 C40	0160-2243	C-F 2.7PF 500V	1	I3	B7	A2 Q36	1854-0215	XSTR SI NPN	2	F3	B3
A2 C41	0160-2236	C-F 1PF 500V	1	I7	C5	A2 Q37	1853-0036	XSTR SI PNP	2	E4	D3
A2 C42	0150-0093	C-F .01UF 100V	1	H9	C5	A2 R1	0757-0280	R-F 1K1% .125W F	1	D3	A7
A2 CR1	1901-0040	DIO-GE 25V .1A	1	H3	C8	A2 R2	0757-0317	R-F 1.33K1%	1	D4	A7
A2 CR2	1901-0040	DIO SI 30V .03A	2	C6	D2	A2 R3	0698-4225	R-F 56 5% .125W	1	D3	B8
A2 CR3	1901-0040	DIO SI 30V .03A	2	D5	C2	A2 R4	0698-3438	R-F 147 1% .125W	1	E3	B7
A2 CR4	1901-0040	DIO SI 30V .03A	2	C7	D1	A2 R5	0757-0419	R-F 681 1% .125W	1	E3	B8
A2 CR5	1901-0040	DIO SI 30V .03A	2	D7	C2	A2 R6	0757-0317	R-F 1.33K1%	1	F3	A8
A2 CR6	1901-0040	DIO SI 30V .03A	2	C2	A1	A2 R7	0758-0029	R-F 470 5% .25W	1	E4	A8
A2 CR7	1901-0040	DIO SI 30V .03A	2	D1	B2	A2 R8	0698-4242	R-F 300 5% .125W	1	F2	B8
A2 CR8	1901-0040	DIO SI 30V .03A	2	C3	A2	A2 R9	0698-3151	R-F 2.87K1%	1	G1	A6
A2 CR9	1901-0040	DIO SI 30V .03A	2	D3	B2	A2 R10	0757-0441	R-F 8.25K1%	1	G2	A5
A2 CR11	1901-0040	DIO SI 30V .03A	1	G2	B6	A2 R11	0698-4247	R-F 510 5% .125W	1	G3	B8
A2 CR12	1901-0040	DIO SI 30V .03A	1	G2	B6	A2 R12	0698-4239	R-F 220 5% .125W	1	G3	C8
A2 CR13	1901-0040	DIO SI 30V .03A	1	G9	B3	A2 R13	0761-0042	R-F 68 5% .125W	1	H2	B7
A2 CR14	1901-0040	DIO SI 30V .03A	1	G9	B4	A2 R14	0698-4477	R-F 10.5K1%	1	G2	A7
A2 CR15	1901-0034	DIO-GE 25V .1A	1	H8	C5	A2 R15	0698-4236	R-F 160 5% .125W	1	H1	B6
A2 CR16	1902-3139	DIO BKDN 8.25 V	1	B7	A6	A2 R16	0698-4249	R-F 620 5% .125W	1	H1	B7
A2 L1	9100-1616	COIL COKE 1.5 UH	1	F3	B8	A2 R17	0760-0024	R-F 100 5% 1W MO	1	I2	A7
A2 L2	9100-1616	COIL COKE 1.5 UH	1	E8	B5	A2 R18	0683-4705	R-F 47 5% .25W	1	I4	D7
A2 L3	9100-1613	COIL COKE .47 UH	1	B8	A6	A2 R19	2100-2796	R-VAP 100 .5W	1	I3	C6
A2 L4	9100-1611	COIL CHOKE .22UH	1	J5	D8	A2 P21	0698-5887	R-F 30 5% .25W F	1	J1	C6
A2 L5	9100-1611	COIL CHOKE .22UH	1	J6	D5	A2 R22	0698-5887	R-F 30 5% .25W F	1	J1	C8
A2 L6	9170-0029	CORE FERRI BEAD	1	I3	D6	A2 R23	0698-4236	R-F 160 5% .125W	1	K1	C7
A2 L7	9170-0029	CORE FERRI BEAD	1	I3	D6	A2 R24	0683-4705	R-F 47 5% .25W	1	J4	D8
A2 L8	9170-0029	CORE FERRI BEAD	1	I3	D6	A2 R25	0761-0035	R-F 150 5% 1W MO	1	J5	E7
A2 L9	9170-0029	CORE FERRI BEAD	1	I8	C3	A2 R26	0761-0035	R-F 150 5% 1W MO	1	J4	E7
A2 L10	9170-0029	CORE FERRI BEAD	1	I8	C3	A2 R27	0761-0035	R-F 150 5% 1W MO	1	J5	E8
A2 L11	9170-0029	CORE FERRI BEAD	1	I8	D3	A2 R31	0698-0083	R-F 1.96K1%	1	C7	A5
A2 *L12	*9100-2249	*COIL-CHOKE 15 UH	1	K8	C4	A2 R32	0757-0421	R-F 825 1% .125W	1	D7	A5
A2 *L13	*9100-2249	*COIL-CHOKE 15 UH	1	K2	B7	A2 R33	0698-4225	R-F 56 5% .125W	1	D6	B5
A2 MP6	1205-0033	HT-SINK TO-5				A2 R34	0698-4242	R-F 300 5% .125W	1	E8	B6
A2 MP7	1205-0033	HT-SINK TO-5				A2 R35	0757-0280	R-F 1K1% .125W F	1	E7	B5
A2 MP14	1200-0185	PAD XSTR				A2 R36	0698-3155	R-F 4.64K1%	1	F7	A5
A2 MP15	1200-0185	PAD XSTR				A2 R37	0757-0407	R-F 200 1% .125W	1	E6	A5
A2 MP15	1205-0033	HT-SINK TO-5				A2 R38	0698-4239	R-F 220 5% .125W	1	F7	B5
A2 MP16	1200-0185	PAD XSTR				A2 R39	0698-3151	R-F 2.87K1%	1	G9	A4
A2 MP16	1205-0033	HT-SINK TO-5				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 SHEET NUMBER	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% .125W	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% .125W	2	C7	D1
A2	R64	0757-0289	R-F 13.3K1% .125W	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% .125W	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% .125W	2	C3	A2
A2	R77	0757-0289	R-F 13.3K1% .125W	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% .125W	1	D7	B5
A2	R95	0757-0421	R-F 825 1% .125W	1	D8	B5
A2	R96	0757-0400	R-F 90.9 1% .125W	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			

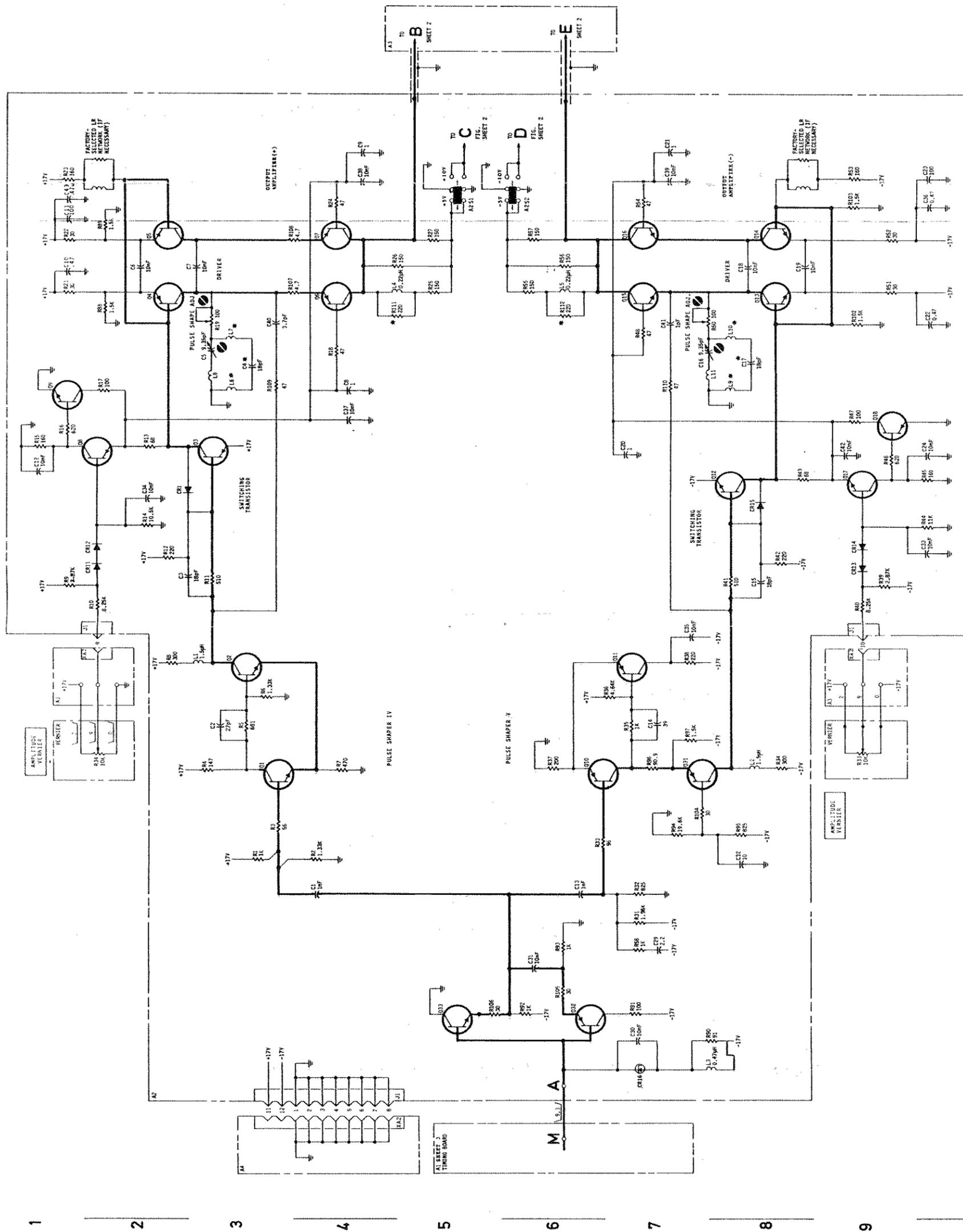


Figure 5-13 Circuit Diagram: Assemblies 2 and 3 Sheet 1 of 2

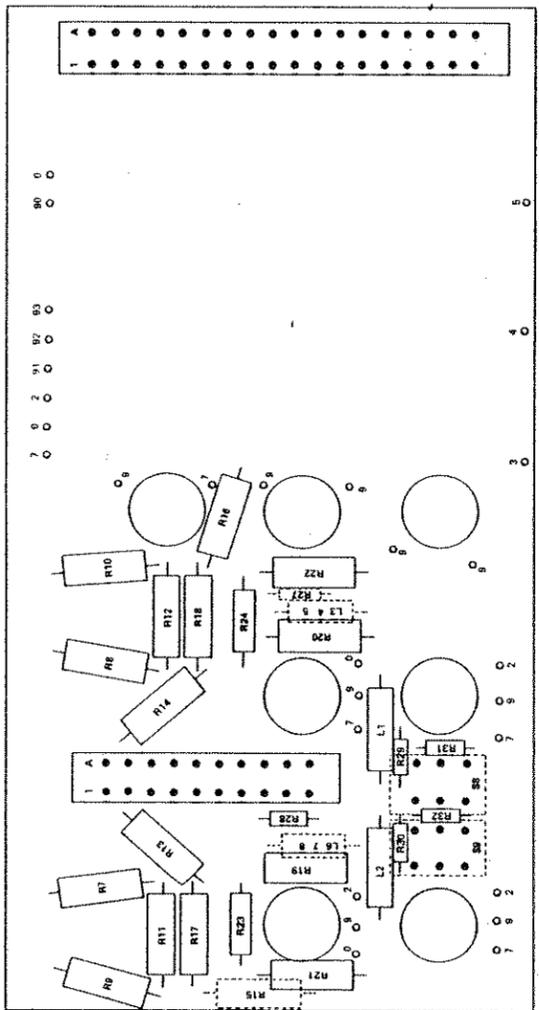


Figure 5-12 Component Layout: Assemblies 2 and 3

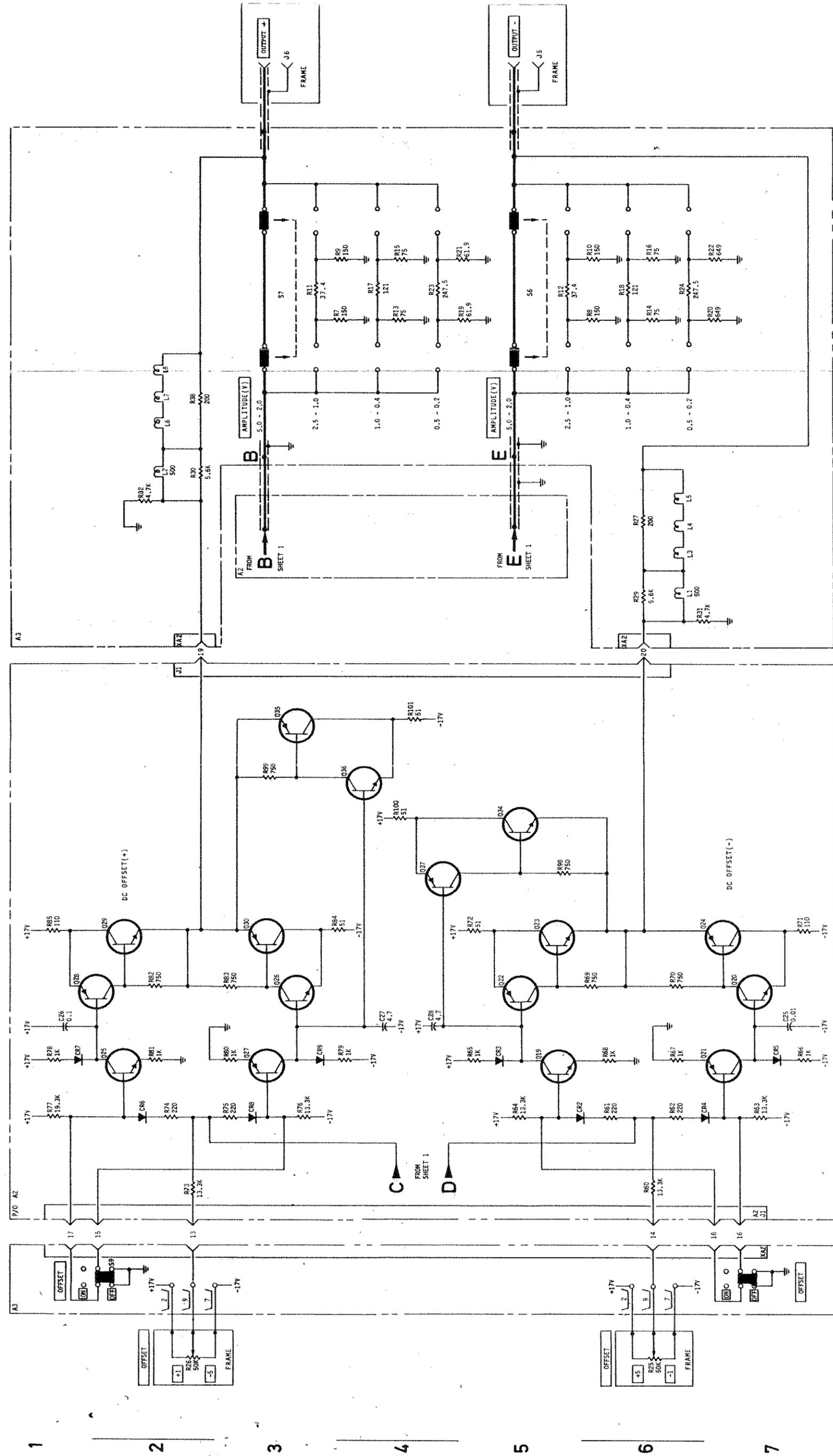
Table 5-5 Replaceable Parts: Assembly 3

REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	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 2X 1W MO			
A3 R8	0761-0027	R-F 150 2X 1W MO			
A3 R9	0760-0027	R-F 150 2X 1W MO			
A3 R10	0760-0027	R-F 150 2X 1W MO			
A3 R11	0757-0172	R-F 37.4 1 1/2W			
A3 R12	0757-0172	R-F 37.4 1 1/2W			
A3 R13	0760-0026	R-F 75 2X 1W MO			
A3 R14	0760-0026	R-F 75 2X 1W MO			
A3 R15	0760-0026	R-F 75 2X 1W MO			
A3 R16	0760-0026	R-F 75 2X 1W MO			
A3 R19	0761-0003	R-F 62 5X 1W MO			
A3 R20	0761-0003	R-F 62 5X 1W MO			
A3 R21	0761-0003	R-F 62 5X 1W MO			
A3 R22	0761-0003	R-F 62 5X 1W MO			
A3 R23	0757-0071	R-F 247.5 1 1/2W			
A3 R24	0757-0071	R-F 247.5 1 1/2W			
A3 R27	0698-4238	R-F 200 5X 1/25W			
A3 R28	0698-4238	R-F 200 5X 1/25W			
A3 R29	0698-4272	R-F 5.6K5% 1/25W			
A3 R30	0698-4272	R-F 5.6K5% 1/25W			
A3 P31	0698-4270	R-F 4.7K5% 1/25W			
A3 R32	0698-4270	R-F 4.7K5% 1/25W			
A3 S1	504C-1109	SLIDAY			
A3 S2	504C-1109	SLIDAY			
A3 S3	504C-1110	SLIDAY			
A3 S6	504C-1112	SLIDAY			
A3 S7	504C-1112	SLIDAY			
A3 S8	3101-1311	SW SLIDE DPDT			
A3 S9	3101-1311	SW SLIDE DPDT			

Model 8013A

Section 1

A B C D E F G H I J K L



1 2 3 4 5 6 7



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		

△ 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% 1/8W.

July 24, 1972

△ = Latest additions to this change sheet.

This change sheet supersedes all prior change sheets for this manual.

Supplement A for
08013-90001

△ 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% 1/8W.

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
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.