Errata

Title & Document Type: **8012A Pulse Generator Operating and Service Manual**

Manual Part Number: **08012-90001**

Revision Date: **March 1973**

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HP References in this Manual

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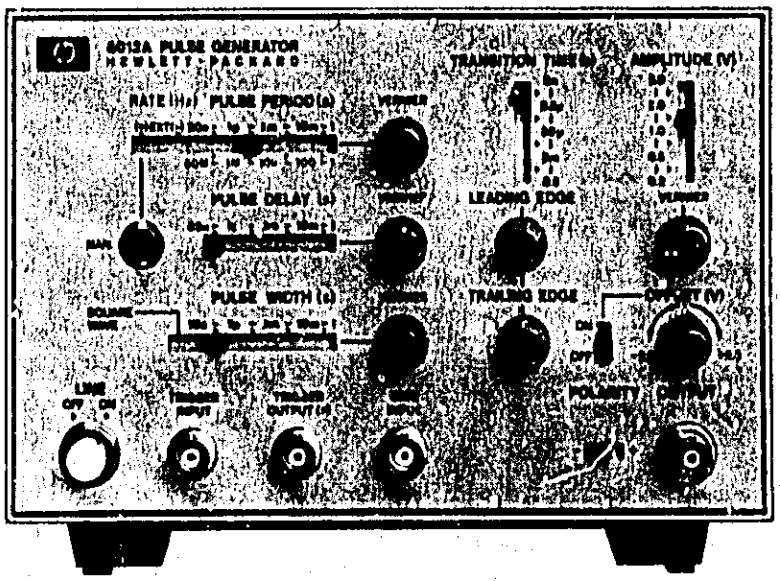
OPERATING AND SERVICE MANUAL

PULSE GENERATOR 8012A



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CERTIFICATION

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

WARRANTY AND ASSISTANCE

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

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

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OPERATING AND SERVICE MANUAL

MODEL 8012A
PULSE GENERATOR

This manual corresponds to instruments with the serial number prefix:

G1121

08012–90001

PRINTED: March 1973

PREFACE

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

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

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

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CONTENTS

ILLUSTRATIONS

TABLES

1–1 INTRODUCTION

1–2 The Hewlett-Packard Model 8012A Pulse Generator is a multi-purpose pulse source, capable of generating a wide variety of output pulse waveforms, either as single pulses or as pulse trains with repetition rates from 1 Hz to 50 MHz. The transition times, amplitude, width and polarity of the output pulse(s) may be varied as required by mean of easily identified front panel controls. The pulse width may be determined by the pulse generator's width control (normal mode), by external signals (external width mode), or by switching the width control to the square wave position. With the offset control in the off position the square wave is symmetrical above and below zero volts. All the output pulses may have their baseline shifted above and below the zero volt reference line by means of the front panel offset controls. Trigger pulses are available for synchronising external circuits and a delay control enables the delay time between the trigger and output pulses to be varied as required. Synchronous gating of the trigger and output pulses is possible by applying a pulse to the gate input socket.

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

a. Normal Mode: In this mode the internal oscillator determines the repetition rate of the output pulses. The oscillator may be triggered internally, externally, or manually; it may also be gated. A trigger pulse is generated for each output pulse and the pulse output may be delayed with respect to trigger output.

b. External Width Mode: In this mode external pulses applied to the input socket on the rear panel determine the width and repetition rate of the output pulses. Gating is not possible. Note that the pulse available at the trigger output socket, being derived from the internal oscillator, is not related to the external width output.

c. RZ Mode: In this mode external pulses applied to the input socket on the rear panel determine the repetition rate of the output pulses. All other output pulse parameters are determined by the pulse generator's front panel controls, but gating is not possible. Note that the pulse available at the trigger output socket, being derived from the internal oscillator, is not related to the RZ output.

1–4 ACCESSORIES AVAILABLE

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

Table 1–1. Specifications

PULSE CHARACTERISTICS
(50Ω source and load impedance)

Transition Times: 5ns – 0.5s in four ranges. Ranges are common for rise and fall times but independent verniers provide separate control of rise and fall time within each range up to maximum ratios of 100:1 or 1:100.

Linearity: for transition times > 30ns maximum deviation from a straight line between the 10% and 90% point is less than 5% of pulse amplitude.

Overshoot and Ringing: < ± 5% of pulse amplitude.

Preshoot: < ± 5% of pulse amplitude.

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

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

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

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

Attenuator: four-step attenuator provides the ranges: 0.2 – 0.5V, 0.5 – 1V, 1 – 2V and 2 – 5V. Vernier provides continuous adjustment between steps.

Polarity: positive or negative, selectable.

Source Impedance: 50Ω ± 10%, shunted by (typically) 20pF.

DC Offset: ± 2.5V across 50Ω load. Independent of attenuator and amplitude vernier settings and may be switched off.

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

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

REPETITION RATE AND TRIGGER

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

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

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

Trigger Output: amplitude: > +1V across 50Ω; width : 16ns ± 10ns; suitable for triggering another 8012A.

EXTERNALLY CONTROLLED OPERATION

External Triggering

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

Trigger Input: sinewaves > 1Vpp (zero dc) or pulses > 0.8V, (positive or negative) at least 7ns wide.

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

Maximum Input Amplitude: < ± 7V

Input Impedance: 50Ω ± 10%.

Coupling: dc-coupled.

Manual: front panel pushbutton 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 the gate pulse ends during the generation of the output pulse.

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

Gate Input Signal: voltage > +1.5V or resistor > 300Ω from gate input to ground enables the repetition rate generator. Voltage < + 0.8V or resistor < 150Ω disables the repetition rate generator. Gate input is TTL compatible.

Maximum Input Signal: < ± 5V

Table 1–1 Specifications (cont'd)

External Width Input

External Width: output pulse width determined by the width of drive input signal. Transition times and amplitude are 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 input (switched to delay generator) determines pulse period. Transition times, delay, width, and amplitude are selectable. Trigger output is not related to RZ Mode output.

Input Signal: Input impedance 50Ω; dc-coupled. Signal > +1V, at least 7ns wide, provides output signal.

Maximum Input Signal: < ± 5V.

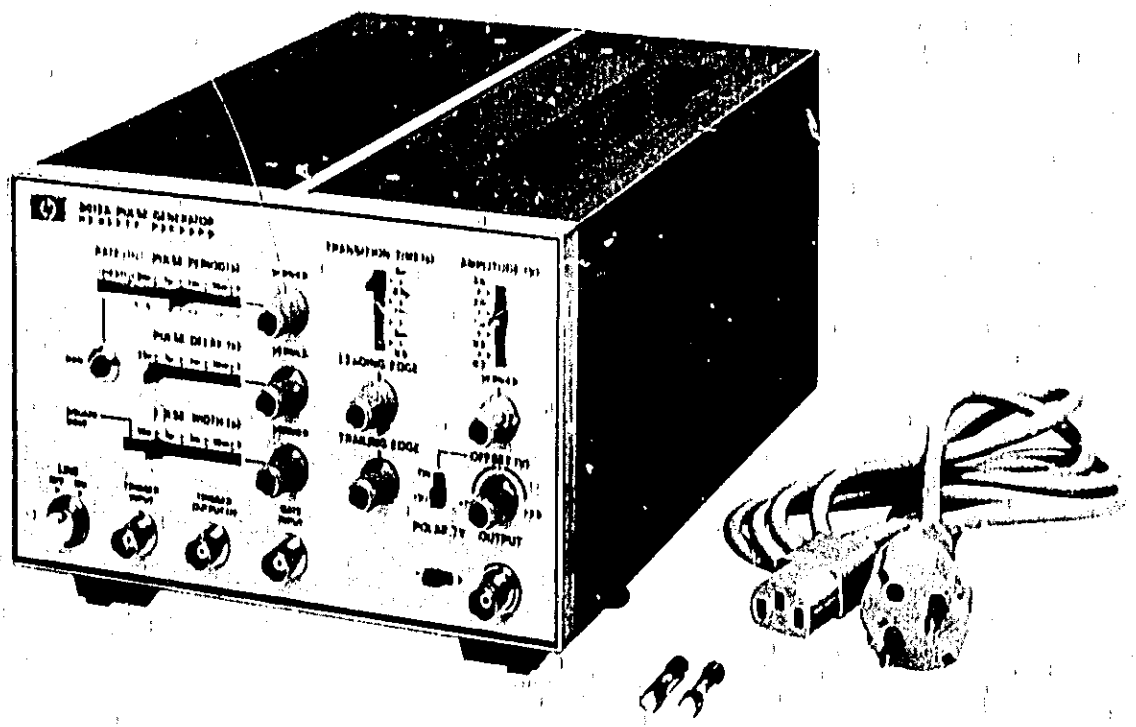
GENERAL

Operating Temperature Range: 0°C to +55°C.

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

Weight: net 9lbs. (4 kg), shipping 14,6lbs. (6.5 kg).

Dimensions: 7.9 in. wide, 5.6 in. high, 13 in. deep (200 x 142 x 312mm).



The power cable supplied will be ONE of the following:

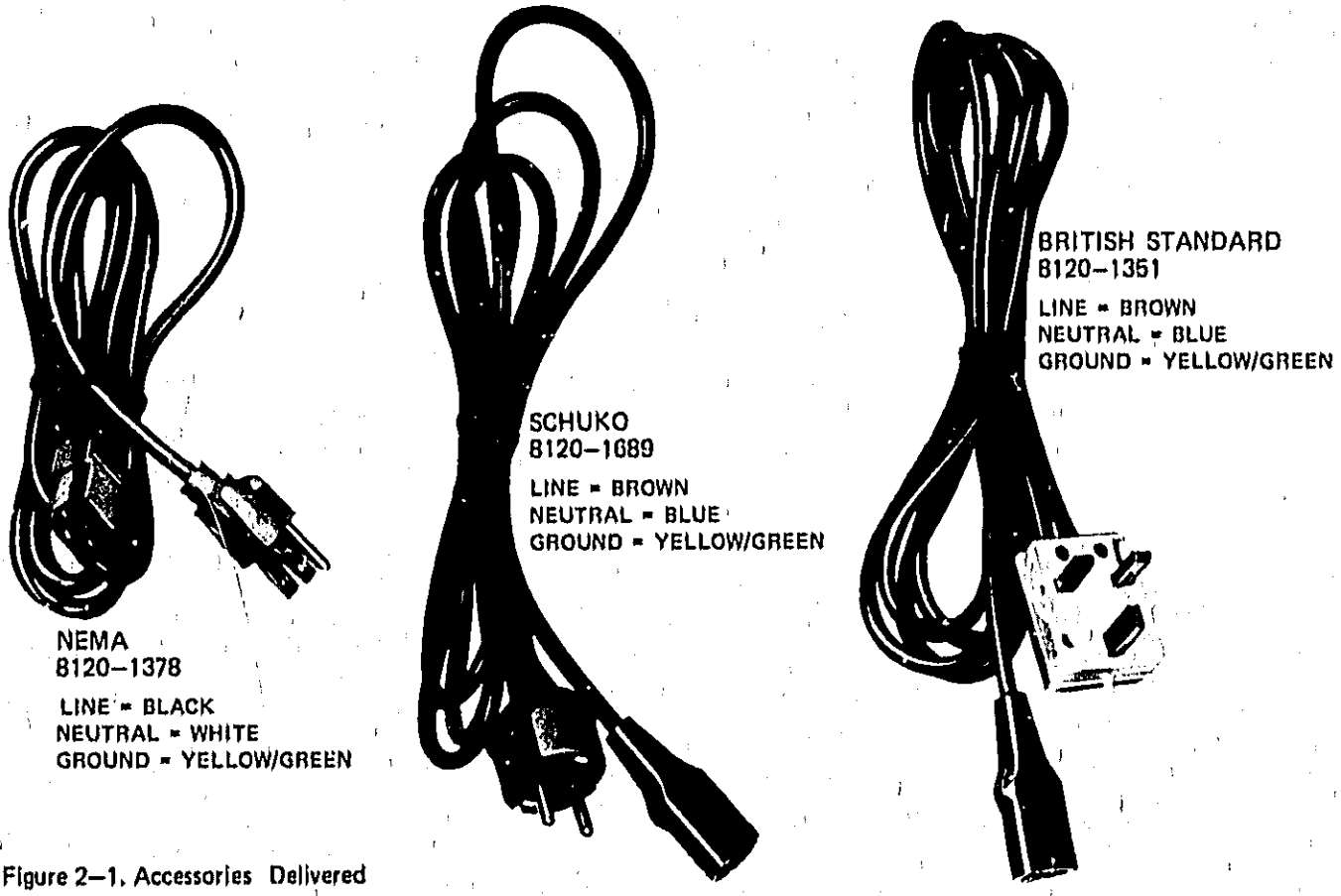


Figure 2–1. Accessories Delivered

SECTION 2

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 statements for all HP instruments are on the inside front cover of this manual.

2–3 The 8012A is delivered with the following items:

ITEMS	HP STOCK NUMBER
Power Cable (with one of the following plugs)	
NEMA*	8120–1378
or	
SCHUKO**	8120–1689
or	
BS***	8120–1351
Fuses	
0.5 amp (for 230V operation)	2110–0202
1 amp (for 115V operation)	2110–0007
Manual	08012–90001

* Used in USA
** Used in West Germany
*** Used in UK and (for 230V) in USA

2–4 PREPARATION FOR USE

2–5 Power Source Requirements

2–6 The Model 8012A may be operated from an ac source of 115 or 230 volts ±10%, ±15%, at 48 to 440 Hz. Power dissipation is 70VA maximum. Carry out the following procedure if it is required to change the operating voltage:

a. Disconnect the power cable from the instrument.

b. Slide the safety window to the left.

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

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

e. Push the lever back into position and insert the appropriate fuse.

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 8012A 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

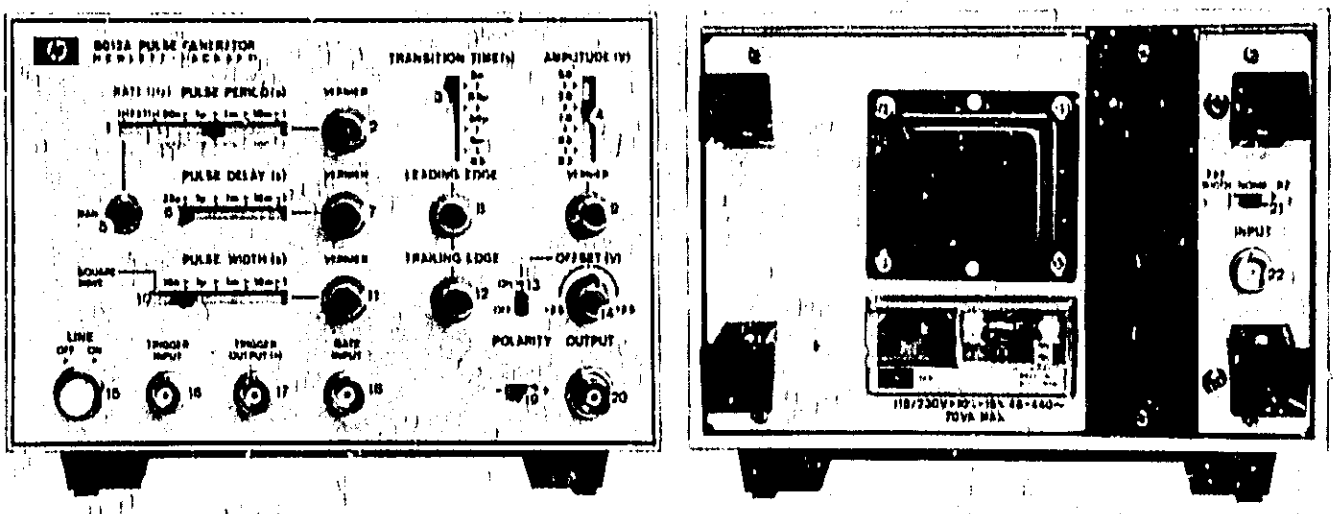
2–10 The Hewlett-Packard Model 8012A uses solid-state components and requires no special cooling. The instrument operates within specifications when the ambient temperature is between 0°C (32°F) and 55°C (131°F). The pulse generator may be stored at temperatures between −40°C (−40°F) and 75°C (167°F).

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.

OPERATION

THEORY



1 RATE switch: for selecting the range of pulse rate.

2 Rate VERNIER: for continuous adjustment of the repetition rate between the limits of the range selected on the RATE switch. Clockwise rotation increases the pulse period (i.e. reduces the rate). In the WIDTH TRIG and EXT WIDTH modes the RATE controls define the frequency of trigger output pulses only.

3 TRANSITION TIME(s) switch: for selecting one of the five pulse rise and fall ranges.

4 AMPLITUDE (V) switch: for selecting range of output pulse voltage.

5 MAN pushbutton: push to generate single pulses when the RATE switch is set to EXT (+).

6 PULSE DELAY switch: for selecting the range of pulse delay with respect to trigger in all modes except SQUARE and EXT WIDTH.

7 Pulse delay VERNIER: for continuous adjustment of pulse delay between the limits of the range selected on the PULSE DELAY switch. Clockwise rotation increases the delay.

8 LEADING EDGE vernier: for continuous adjustment of pulse leading edge transition time between limits of the range selected on the TRANSITION TIME switch. Clockwise rotation increases transition time.

9 Amplitude VERNIER: for continuous adjustment of output voltage between limits of the range selected on the AMPLITUDE (V) switch. Clockwise rotation increases the output amplitude.

10 PULSE WIDTH switch: for selecting the range of pulse width required in all modes except SQUARE and EXT WIDTH

11 Pulse width VERNIER: for continuous adjustment of pulse width between the limits of the range set on the PULSE WIDTH switch.

12 TRAILING EDGE vernier: for continuous adjustment of pulse trailing edge transition times between limits of the range selected on the TRANSITION TIME switch. Clockwise rotation increases transition time.

13 OFFSET switch: for enabling/disabling the offset VERNIER which permits the baseline of the pulse OUTPUT to be adjusted. In the OFF position, the baseline of the pulse OUTPUT is zero volts.

14 OFFSET vernier: for adjustment of baseline of pulse OUTPUT over the range −2.5V to +2.5V.

15 LINE ON-OFF switch: press-for-on-press-for-off switch. Glows red when on.

16 TRIGGER INPUT connector: BNC connector to which trigger pulses are applied when the RATE switch is set to EXT (−) or EXT (+).

17 TRIGGER OUTPUT connector: BNC connector supplies positive trigger output. Trigger output is not related to the input in EXT WIDTH and RZ modes.

18 GATE INPUT connector: BNC connector to which gate pulses are applied, when the RATE switch is set to the lowest range (20n – 1μ). The pulse output and trigger output are synchronous to the gate signal.

19 PULSE POLARITY switch: for selecting pulses of either positive or negative polarity with respect to the baseline.

20 OUTPUT connector: BNC connector.

21 EXT WIDTH, NORM, RZ switch: NORM enables synchronous pulse and trigger output. With rate switch set to EXT+ and this switch set to RZ (delay trigger) or EXT WIDTH (width trigger) the trigger output is asynchronous to signals applied to the INPUT connector.

22 INPUT connector: BNC connector to which RZ or EXT WIDTH trigger pulses are applied. Input disabled when rate switch is set to an internal range.

Figure 3–1. Front and Rear Panel Controls

3–1 INTRODUCTION

3–2 Figure 3–1 shows the location of the controls and connectors; the reference numbers used appear when appropriate in the following text in bold type. As previously explained, there are three operating modes and the necessary operating procedure for each is described below.

3–3 NORMAL MODE

3–4 There are five ways of operating in the normal mode:

1. With the repetition rate determined by the internal oscillator, internally triggered.
2. As above, but with the oscillator triggered externally.
3. Manually triggered.
4. In each of the above, square wave output (pulse width = pulse period/2) may be selected instead of the variable pulse width.
5. The outputs obtained above may be gated.

All output pulses are preceded by a trigger pulse (TRIGGER OUTPUT socket 17). The delay is fixed at 35ns for square wave but may otherwise be adjusted by the PULSE DELAY switch 6 and VERNIER 7.

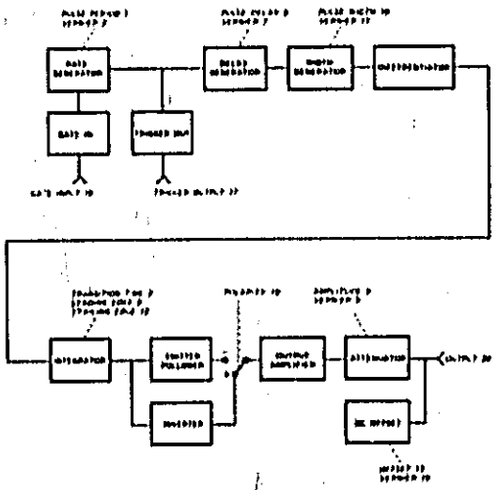


Figure 3–2. Operating Block Diagram: Normal Mode Internal Trigger

3–5 Internal Trigger

3–6 In this mode the 8012A requires no external signal to produce an output. Rate, delay, width, transition times polarity, amplitude and offset are adjustable by front panel controls. Set the range switches as illustrated in Figure 3–1 and adjust the appropriate verniers (see Figure 3–2) for an output similar to the waveforms shown in Figure 3–3;

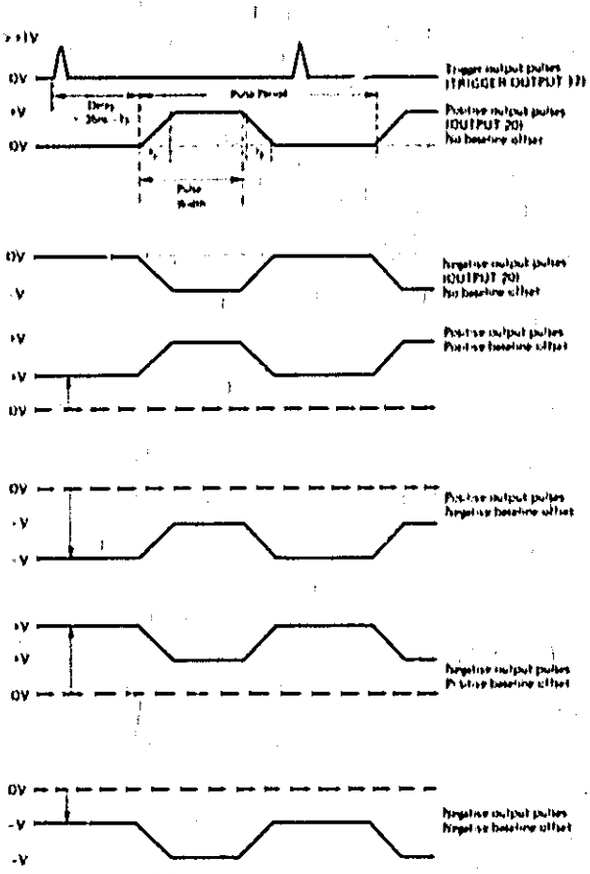


Figure 3–3. Output Waveforms: Normal Mode – Internal Mode

3–7 External Trigger

3–8 The appropriate circuits and controls are shown in figure 3–4. Use the following procedure to

obtain an output similar to that shown in figure 3–5.

a. Set the Mode Selector 21 to N.

b. Apply suitable trigger pulses to the TRIGGER INPUT socket 16.

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

d. Set the delay between the trigger and output pulses as described in paragraph 3–6.

e. Set the width, amplitude, transition times, polarity and offset of the output pulses as described in paragraph 3–6.

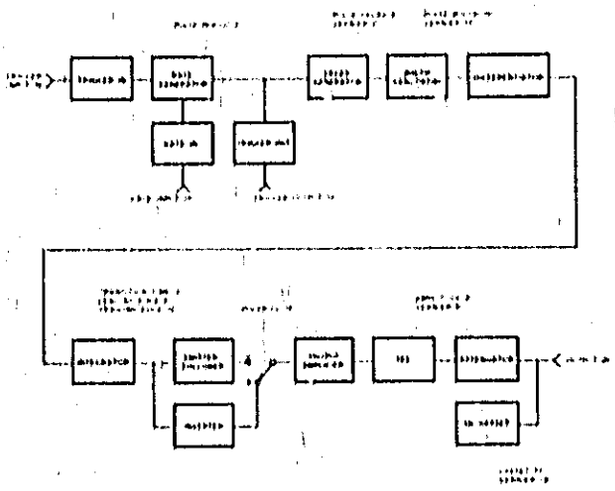


Figure 3–4. Operation Block Diagram: Normal Mode – External Trigger

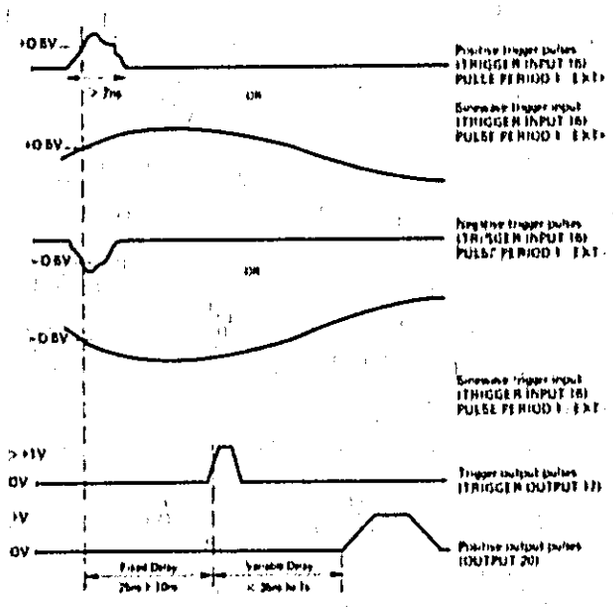


Figure 3–5. Output Waveforms: Normal Mode – External Trigger

3–9 Manual

3–10 The appropriate circuits and controls are shown in figure 3–6. Use the following procedure to obtain an output similar to that shown in figure 3–7:

a. Set the Mode Selector 21 to N.

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

c. Set the delay between the trigger and output pulse as described in paragraph 3–6.

d. Set the width, amplitude, transition times, polarity and offset of the output pulse as described in paragraph 3–6.

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

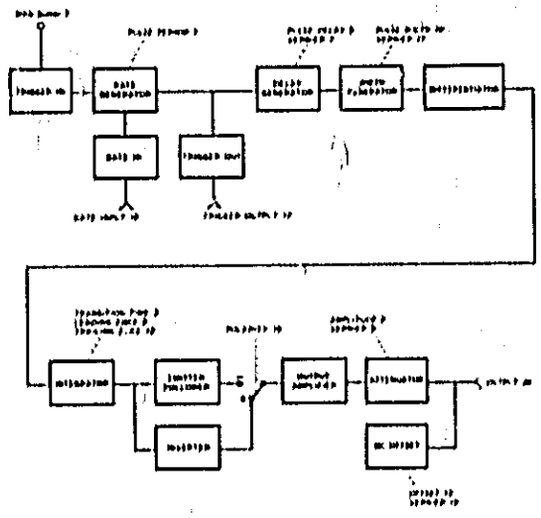


Figure 3–6. Operation Block Diagram: Normal Mode – Manual

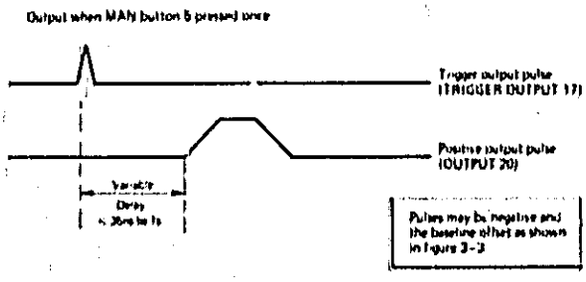


Figure 3–7. Output Waveforms: Normal Mode - Manual

3–11 Square Wave

3–12 The appropriate circuits and controls are shown in figure 3–8. Use the following procedure to obtain an output similar to that shown in figure 3–9.

a. Set the Mode Selector 21 to N.

b. Set the PULSE PERIOD switch 1 to an internal range as described in paragraph 3–6 or to EXT as described in paragraph 3–8 and apply external trigger pulses in order to set the repetition rate of the output pulses.

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

d. Set the amplitude, transition times, polarity and offset of the output pulses as described in paragraph 3–6.

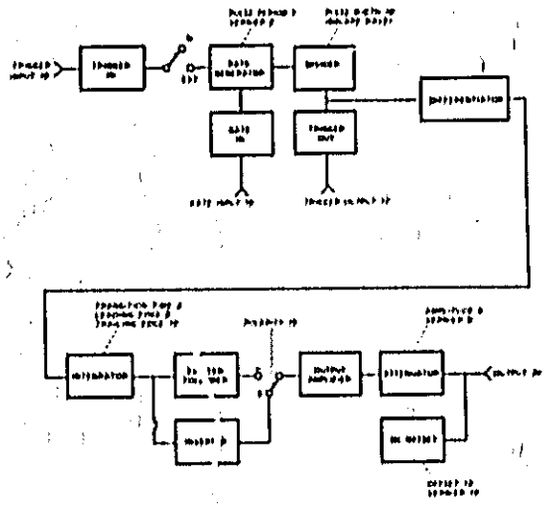


Figure 3–8. Operation Block Diagram: Normal Mode – Square Wave

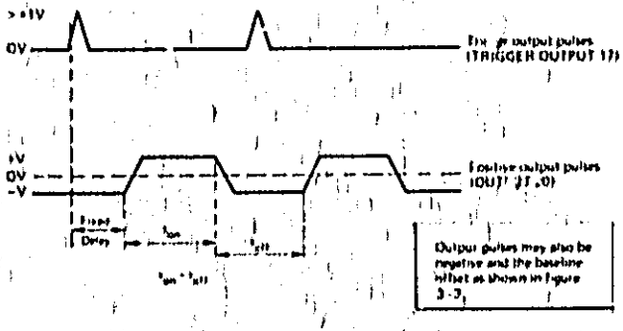


Figure 3–9. Output Waveforms: Normal Mode - Square Wave

Remember the following points about the square wave output:
Output pulse width equals half the selected pulse period,
Output pulse rate is one-half that of the rate generator (or input trigger pulse),
The delay between input trigger pulse and square wave output is fixed,
The output pulse is symmetrical above and below ground or about the offset level.

3–13 Gating

3–14 The trigger and output pulses obtained in the normal mode may be gated by applying an appropriate gate pulse (see specifications) to the GATE INPUT socket 18; the operation is indicated in figure 3–10.

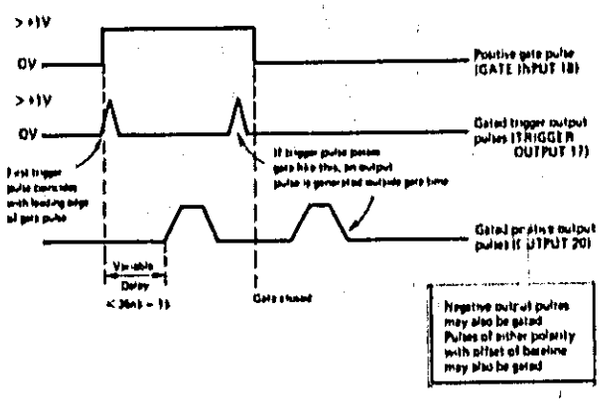


Figure 3–10. Output Waveforms: Normal Mode - Gating.

3–15 RZ MODE

3–16 External pulses (applied to the INPUT socket 22 on the rear panel) trigger the delay generator directly (figure 3–11) and the shape of the output pulses is determined by the pulse forming circuits following the delay generator.

The output pulses cannot be gated and, as explained in paragraph 3–19, are independent of the pulses at the TRIGGER OUTPUT socket 17.

The following procedure should be used to obtain outputs similar to those indicated in figure 3–12.

a. Set the Mode Selector 21 to RZ.

b. Set the delay between the external applied pulses and the resulting output pulses by selecting the range required on the PULSE DELAY switch 6 and adjusting the VERNIER 7.

c. Set the PULSE WIDTH switch 10 to the required range, then adjust the VERNIER 11 for the exact pulse width.

d. Set the amplitude, transition times, polarity and offset of the output pulses as described in paragraph 3-6.

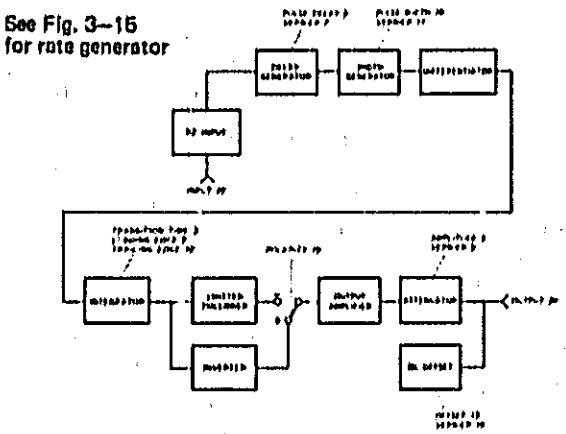


Figure 3–11. Operation Block Diagram: RZ Mode

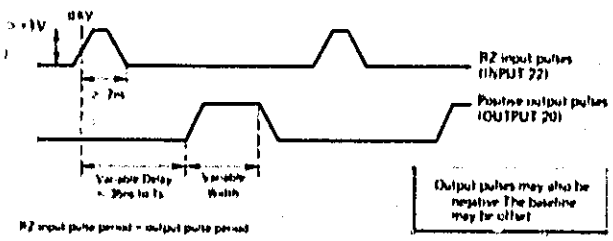


Figure 3–12. Output Waveform: RZ Mode

3–17 EXTERNAL WIDTH MODE

3–18 External pulses (applied to the INPUT connector 22 on the rear panel) trigger the transition time circuit (figure 3–13). The output thus obtained cannot be gated and, as explained in paragraph 3–19, is independent of the TRIGGER OUTPUT 17. The following procedure should be used to obtain outputs similar to those shown in figure 3–14.

a. Set the Mode Selector 21 to EXT. WIDTH.

b. Set the amplitude, transition times, polarity and offset of the output pulses as described in paragraph 3–16.

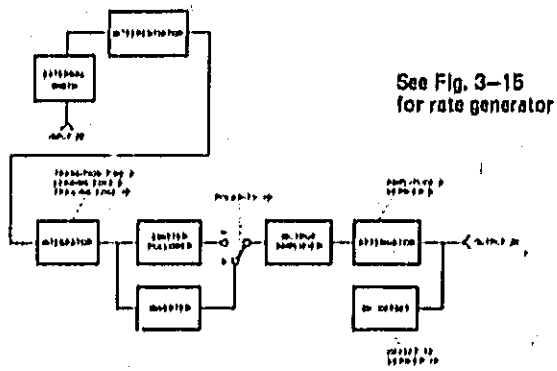


Figure 3–13. Operation Block Diagram: External Width Mode

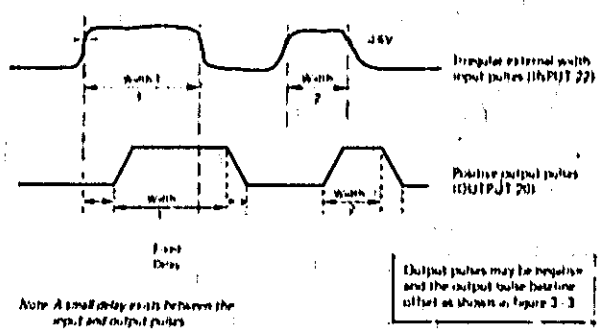


Figure 3–14. Output Waveforms: External Width Mode

3–19 ADDITIONAL FACILITIES IN THE RZ OR EXT. WIDTH MODES

3–20 When operating in the RZ or EXT WIDTH modes, the internal oscillator is available for use as an independent clock generator (figure 3–15) which provides an output at the TRIGGER OUTPUT connector 17. This output may be triggered internally, externally, or manually, and in addition, gated as described for the normal operating mode (paragraph 3–3). If this facility is not required, it may be switched off by setting the PULSE PERIOD control 1 to EXT and disconnecting the TRIGGER INPUT 16.

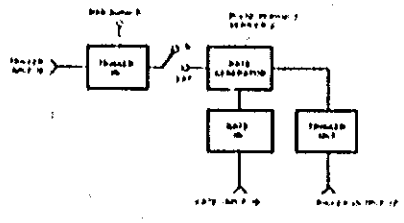


Figure 3–15. Operation Block Diagram: Additional Facilities – RZ/EXT WIDTH Mode.

4–1 GENERAL

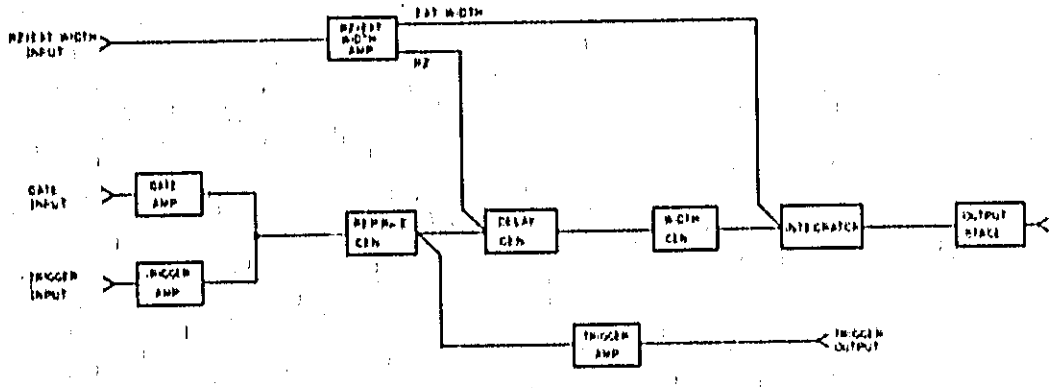


Figure 4–1. Basic Concept

4–2 The pulse repetition rate is generated either internally or by an external source. The repetition rate generator provides a stimulus for the delay generator or the divider squarer. For each pulse from the delay generator, the width generator produces a pulse of defined width or, alternatively, the divider squarer output is applied to the pulse shaping circuits to produce a pulse of fixed delay and width. The final operation involves power amplification and attenuation to achieve the desired amplitude and correct impedance. Further facilities enable direct triggering of the delay or width generators.

4–3 Each block of Figure 4–1 is dealt with in greater detail in the following descriptions. Signal flow is indicated on the circuit diagrams.

4–4 REPETITION RATE GENERATOR

4–5 The function of this unit is to provide pulses to either the delay generator or the divider squarer (SQUARE WAVE mode) and produce a trigger output.

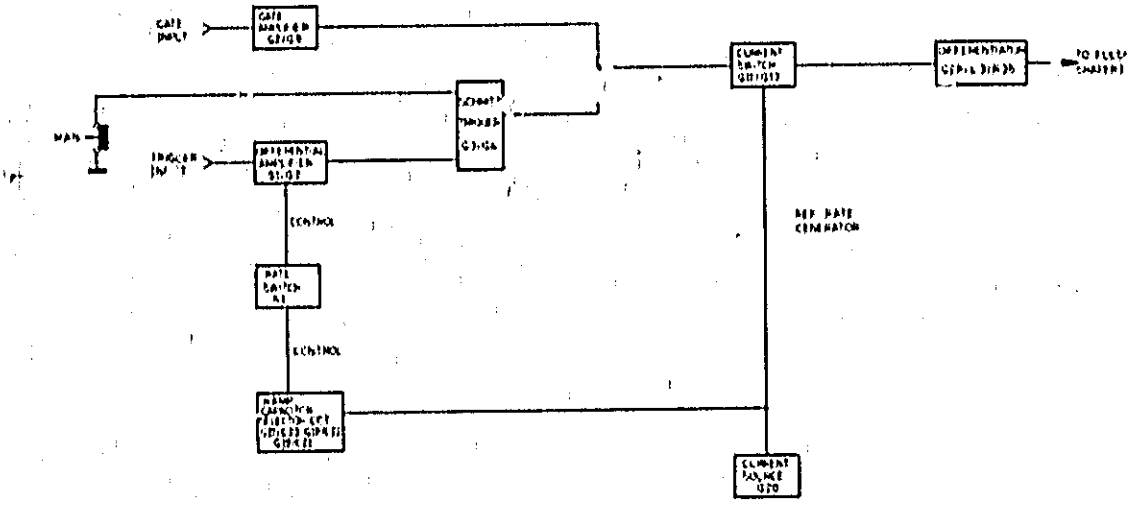


Figure 4–2. Repetition Rate Generator

4–6 The pulse repetition rate is determined by either one of two possible methods:

a. The free running rate of the repetition rate generator.

b. The frequency of trigger input pulses.

4–7 In the free running mode the repetition rate generator operates as follows:

The selected ramp capacitor discharges linearly through Q20 at a rate determined by the setting of VERNIER R1 and the value of the capacitor. As the voltage at Q20 collector approaches zero, CR17, becomes forward biassed causing Q11 and Q13 to conduct and rapidly recharge the capacitor. In order to shorten the recharge cycle the current flow through Q13 is limited by Q21 and Q10. CR17 becomes reverse biassed so that Q13 and Q11 cut off and the discharge cycle resumes. The output from Q11 is applied, via the differentiator network (Q28/L3/R35), to the delay generator and the trigger output amplifier.

4–8 In the externally triggered mode, the rate generator is disabled. Each trigger pulse enables the current switch Q11/Q13 to produce an output from Q11.

4–9 Trigger pulses are applied to the differential amplifier Q1/Q2 which in turn switches the Schmitt trigger Q3/Q4. The negative output spikes from the collector of Q4 turn Q5 on. Q13 base rises so that Q11 and Q13 turn on to produce an output pulse.

4–10 When the MANUAL pushbutton is pressed a negative spike is produced from the collector of Q4 which enables the current switch Q11/Q13. One pulse is produced from Q11 for each depression of the MANUAL pushbutton.

4–11 GATING

4–12 With the PULSE PERIOD switch set to an internal range, pulses applied to the gate amplifier Q8/Q7 either enable or disable the rate generator. The gate pulse "off" time disables and the "on" time enables the rate generator. When enabled, the rate generator will run freely at a rate determined by the settings of the controls. Thus, output pulses will be produced from Q11 only during the gate input pulse "on" time.

4–13 Q8, normally on, is turned off by the 0V level (off time) of the gate input pulse. Thus, Q6 is turned off, CR36 ceases to conduct and then the rate generator is disabled. When the level of the gate input pulse reaches approximately +1.8V (on time) Q8 turns on which in turn enables the rate generator.

4–14 CHANGE – OVER CIRCUITS

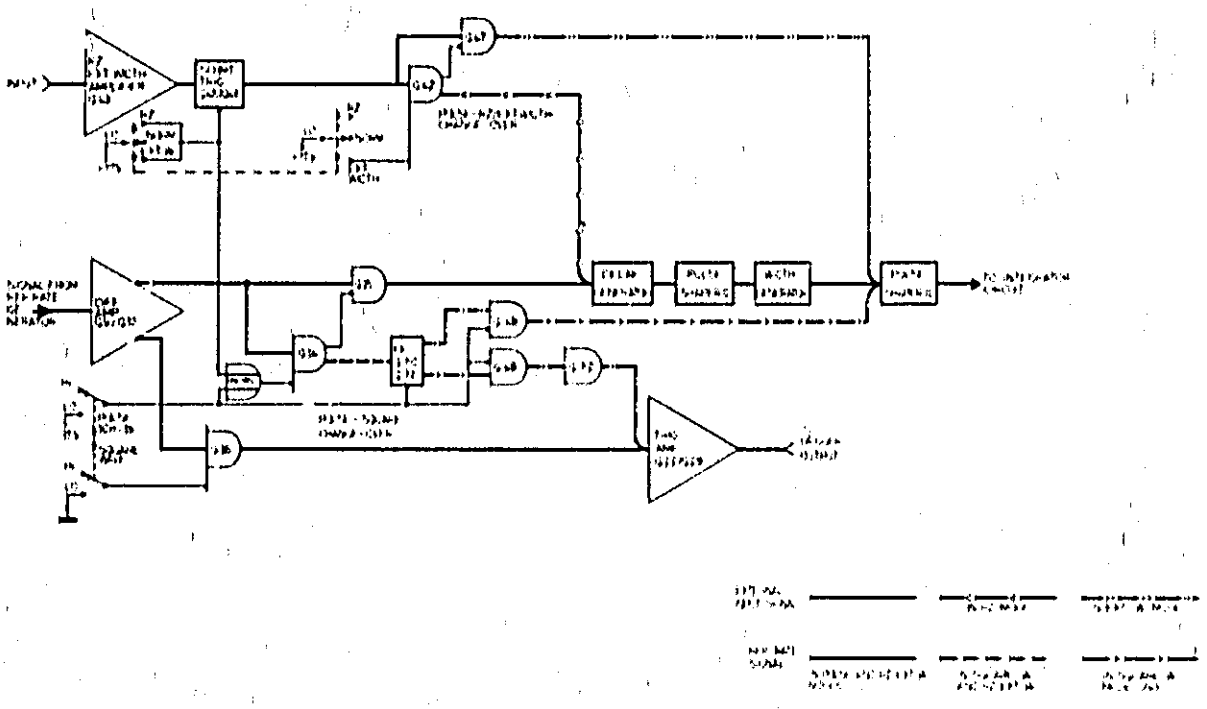


Figure 4–3. Change-over Circuits

4–15 The purpose of these circuits is, in NORM-PULSE mode, to apply the rep. rate generator output to the delay generator and trigger the output amplifier. Alternatively, the rep. rate output is effectively disconnected from the delay generator in SQUARE WAVE, RZ and EXT WIDTH modes. In the SQUARE WAVE mode the trigger is established by one output from the flip-flop, the other output is directed to a pulse shaper for the production of a fixed delay, fixed width pulse output.

4–16 In the RZ and EXT WIDTH modes, the change over circuit disables the rep. rate output and applies the external signal either to the input of the delay generator (RZ) or to the input of the pulse shaping network (EXT WIDTH).

4–17 By setting the PULSE WIDTH switch (S3) to the range 10n to 1s (PULSE) and the RZ–NORM–EXT WIDTH switch (S4) to NORM, the rep. rate signal is applied to the delay generator via Q15 and to the trigger output amplifier via Q16.

4–18 If S3 is set to SQUARE WAVE (SW), Q14 is turned on, the switching transistors Q49 and Q48 are also on but Q16 is turned off. The rep rate signal is now presented to the flip-flop (Q50/Q51) which creates two outputs. One of these outputs is used for the square output via Q48 and the pulse shaper 111 and the other to drive the trigger output amplifier via Q49 and Q52.

4–19 In the RZ or EXT WIDTH modes transistor Q14 is turned on thus the rep rate signal is effectively disconnected from the delay generator by being presented to the flip-flop. However, the flip-flop and the switching transistors (Q48/Q49) are turned off, and so the rep rate signal is blocked by the flip-flop. In these modes the trigger output is created by the rep rate signal via Q16 when the PULSE WIDTH switch is set to pulse (10n – 1s).

4–20 DELAY GENERATOR

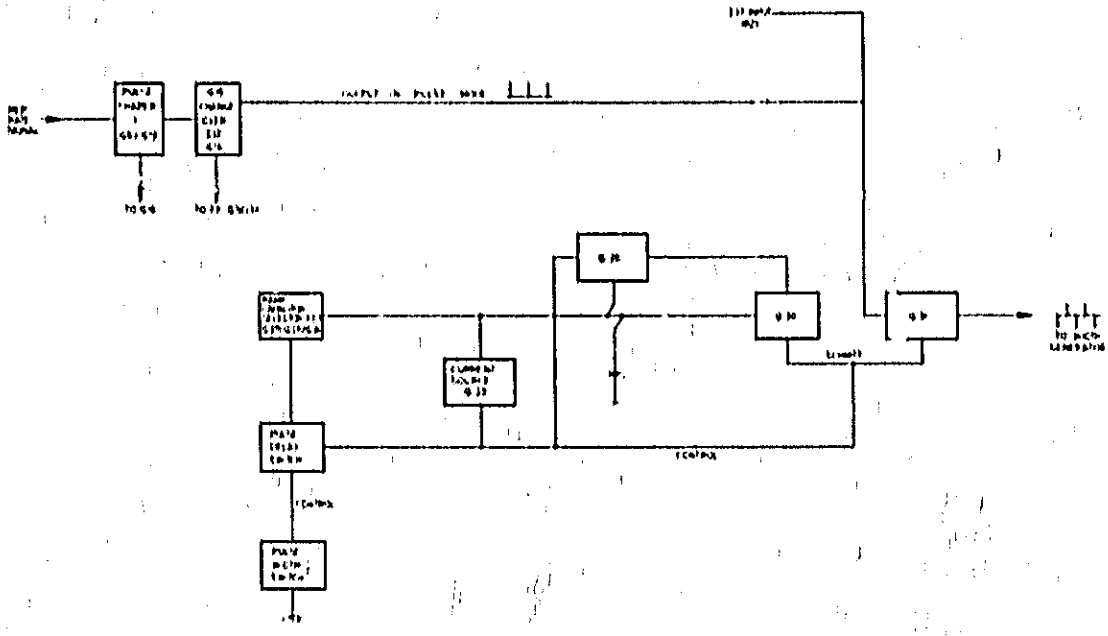


Figure 4–4. Delay Generator

4–21 The purpose of the delay generator is to delay the repetition rate signal, within the range of 35n to 1s, with respect to the trigger output. The delay generator derives its input from two separate sources, either from the internal rep. rate generator (NORM mode) or from an external source (RZ mode). For operation of the change-over circuit refer to paragraph 4–14.

4–22 The current source (Q23) and the Schmitt trigger (Q30/Q31) are controlled by the width switch. When the width switch is set to the range 10n to 1s the delay circuit is operative and when the width switch is set to SQUARE WAVE the delay circuit is disabled.

4–23 Under no-signal conditions, Q31 is off, Q30 is on and Q26 is conducting, thus the ramp generator Q23 cannot charge the capacitors. A positive signal turns Q30 off and Q31 on, Q26 follows Q30 and is thus non conducting. The selected ramp capacitor is charged by the current source (Q23) until Q30 turns on, which turns

Q31 off. The ramp capacitors are rapidly discharged by Q26 being in the conductin state. The output from the Schmitt is first a negative spike, coincident with the pulse input, and then a positive spike which occurs some time later. The time between the spikes is the time taken for the ramp to reach the threshold of the Schmitt (i.e. the delay time).

4–24 WIDTH GENERATOR

4–25 The function of the width generator is to create a pulse of defined width for each positive spike received from the delay generator.

4–26 The sections which define the pulse delay are identical to those which define the pulse width. Reference should, therefore, be made to paragraph 4–19 for the principles of operation of this circuit. Figure 4–5 illustrates the basic difference between the width and delay circuits.

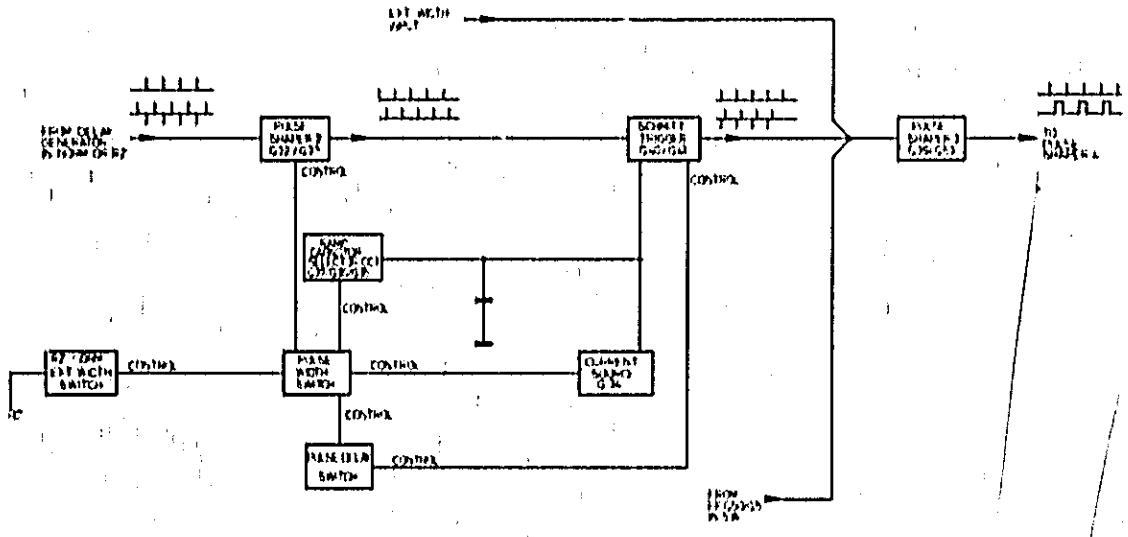


Figure 4–5. Width Generator

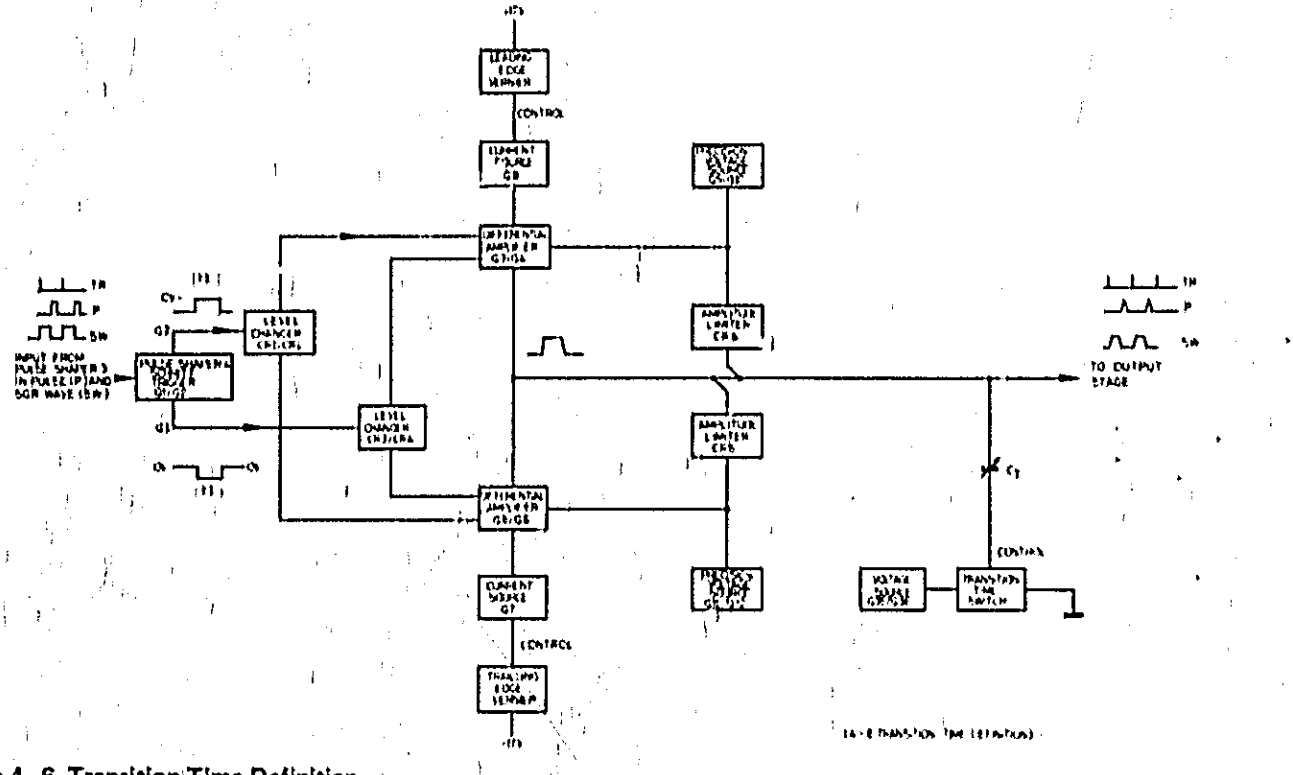


Figure 4–6. Transition Time Definition

4–27 TRANSITION TIME

4–28 The purpose of the integrator circuit is, in all modes of operation, to vary the rise and fall times of the pulse LEADING EDGE and TRAILING EDGE within a selected range (TRANSITION TIME).

4–29 Figure 4–6 and the following paragraphs define the theory of operation in the pulse mode only.

4–30 The leading and trailing edges of the pulse from the width generator turns the Schmitt trigger (Q1/Q2) on and off respectively. When Q1 is on (t_1) Q2 is off (t_2). The transistors Q4/Q5 are turned on and Q6/Q3 off for the duration of t_1. Conversely, Q6/Q3 are turned on and Q4/Q5 off for the duration t_2. The selected transition capacitor (C_T) is charged from the current source (Q8) when Q4 is on (t_1) and discharged through the current source (Q7) when Q6 is on (t_2).

4–31 Initially Q1 is on, turning Q4 on. The current flow from Q8, limited by R27, linearly charges C_T. Charging continues until CR6 conducts and the pulse top is clamped at a potential defined by the voltage source Q9/Q10. At the end of t_1, Q1 turns off and Q2 turns on (t_2); thus, Q4 is turned off and Q6 is turned on. The current drawn by the current source Q7, limited by R28, linearly discharges C_T until CR5 conducts clamping the pulse base at a potential defined by the voltage source Q11/Q12. The cycle is repeated when Q2 is turned off and Q1 is turned on.

4–32 The voltage source (Q35/Q36) supplies the reference voltage for the charge and discharge of C_T.

4–33 The range capacitor C14 and R41/R42 constitute a low pass filter which is active in the ranges between 0.6μ and 0.6s. The filter is turned on and off via CR13/CR14 and CR24 to CR22.

4–34 OUTPUT STAGE

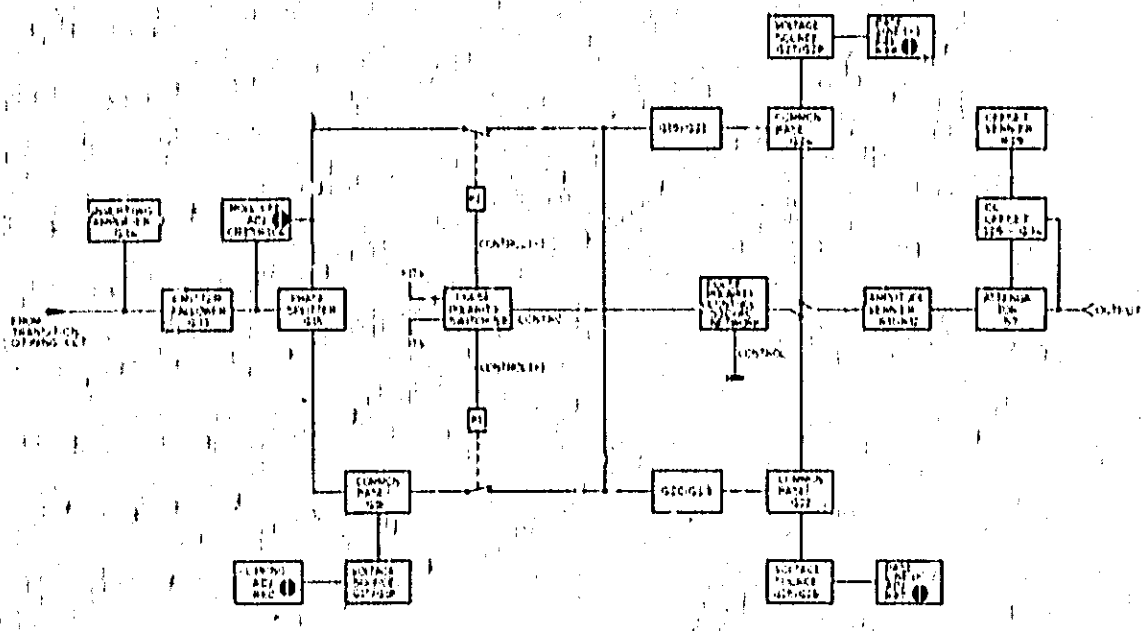


Figure 4–7. Output Stage

4–35 The function of this stage is to create a pulse output with the correct polarity, amplitude, impedance and offset. The circuits concerned can be broken down into five basic parts; polarity selection, amplification, polarity control, impedance and amplitude control and dc offset control.

4–36 The signal from the integrator is buffered and inverted by Q14 before being applied to the phase splitter (Q15) via the emitter follower (Q13).

4–37 Polarity Selection

4–38 Either the in-phase or anti-phase output from Q15 is used to drive the amplifier. When positive polarity is selected (S8(+)), the in-phase output is applied to the amplifier via the impedance matching circuit (Q16) and the closed contacts of relay K1. Pulse clipping correction is accomplished by adjusting the voltage source (Q17/Q18/R60) supplying the common base stage. For negative polarity, S8 (–) opens the contacts of K1 and closes the

contacts of K2, thus, the anti-phase output of Q15 is applied to the amplifier. Pulse roll-off correction is accomplished by adjusting the current drawn by the diode (CR17) connected to the base of Q15, via R104.

4–39 Amplification

4–40 The push-pull amplifier (Q19 to Q26) has an output which is symmetrical about the base line. Positive baseline correction is accomplished by adjusting the voltage source (Q27/Q28/R88) supplying the common base stage (Q24) and negative baseline correction is accomplished in a simular manner by means of the adjustable voltage source (Q25/Q26/R87) supplying the common base stage (Q22).

4–41 Polarity Control

4–42 In SQUARE WAVE, the PULSE WIDTH switch (S3D) applies a ground potential to the RC network to maintain the symmetrical output of the amplifier and to correct the loading impedance of 50 ohms.

4–43 With S3D set to any one of the pulse width ranges (10n to 1s) either +17V or −17V is applied to the RC network in order to shift the pulse baseline asymmetrically above or below zero.

4–44 Impedance and Amplitude Controls

4–45 In order to adjust the amplitude and maintain the correct output impedance level, a four step attenuator (S7) is used in conjuction with a ganged potentiometer network (R11/R12).

4–46 Offset Amplifier

4–47 With the OFFSET switch (S9) set to OFF, Q29 and Q31 hold off Q32 and Q30 respectively and no output occurs from the emitters of Q33/Q34. In the ON position, the bias potentials of Q29 and Q31 are dependent on the position of the offset VERNIER (R29). As the vernier is moved towards +17V, current flows from Q33 to the OUTPUT load (L1 to L4/R8 to R10) to give a positive offset. Similarly, as the vernier moves toward −17V, current is drawn from the output load by Q34 to give a negative offset.

4–48 POWER SUPPLY

4–50 The +17V and −17V power supplies are identical series regulated types. An error amplifier compares a sample of the output with a zener diode and the resulting output controls the series regulator to compensate for any variations.

MAINTENANCE

5–1 GENERAL

5–2 This section contains information on the removal of covers and assemblies, performance verification and recalibration (internal checks and adjustments) procedures.

5–3 Before attempting removal of covers, assemblies or components, disconnect the instrument from the ac line supply. It is advisable also to leave the instrument for a few minutes after disconnecting from the line, to enable capacitors to discharge.

5–4 REMOVAL OF COVERS

5–5 Access to Test Points and Assemblies

5–6 To gain access to all test points and assemblies remove the top and bottom covers after first removing the respective fastening screw.

5–7 REMOVAL OF ASSEMBLIES

5–8 Reference to the Assembly Location diagram (6–3) should be made before attempting to remove assemblies.

5–9 Timing Board – Assembly 1

5–10 Disconnect coaxial cable (W1) and wire 93. Remove the three long securing screws and unplug the board from connector XA1 on A3.

5–11 Output Board – Assembly 2

5–12 Disconnect the coaxial cables (W2) and wire 93. Remove the three short securing screws and unplug from the connect or XA2 on A3.

5–13 Mother Board – Assembly 3

5–14 Remove assemblies 1 and 2. Disconnect the coaxial cables W2 and W3. Unplug the six wires 7(1) to 9,1 and unsolder the wires attached to J1, J2 and J3. All other wires which are internally connected to Assembly 3 do not affect the removal of that assembly. Push on A3 until the front panel moves out of the frame. To gain access to the switch contacts, remove the six securing screws.

5–15 Power Supply Board – Assembly 4

5–16 Remove four securing screws (at rear panel and disconnect all wires between 9,2(2) and 9,7(2); the board can now be removed from frame.

5–17 PERFORMANCE CHECKS

5–18 Tables 5–2 to 5–29 give the procedures for verifying that the instrument is working to the specifications. Rigid observance of the sequence in which the checks appear is unnecessary. Note that, only the tests for OUTPUT 21 are described; when it is necessary to check the OUTPUT 22 (as indicated by a broken line connection), repeat the table substituting the appropriate controls where different from those used for OUTPUT 20.

5–19 INTERNAL CHECK AND ADJUSTMENTS

5–20 As an aid to troubleshooting and eventual repair of a faulty assembly, set the controls as described in tables 5–28, 5–29 and 5–30 and check the function and calibration of assembly 1. Tables 5–31 and 5–33 supply similar calibration information for assemblies 2 and 4.

Table 5–1. Test Equipment and Accessories

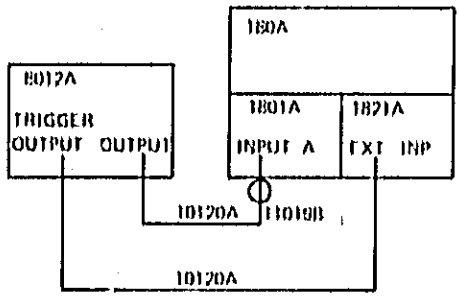
INSTRUMENT	BRIEF SPECIFICATION	RECOMMENDED MODEL
Counter	Frequency range 0 – 50 MHz	HP 5245L
Oscilloscope	Dual-channel, 50 MHz bandwidth	HP 180A with plug-ins 1801A, 1821A
Digital Voltmeter	10V dc range to 4 significant figures, Accuracy ± 0.05% ± 1 digit.	HP 3440A with plug-in 3444A.
Sampling Oscilloscope.	Dual-channel, 1 GHz bandwidth	HP 140A with plug-ins 1410A, 1424A
AC Voltmeter	Sensitivity 100uV to 300V rms.	HP 403B
Voltmeter Ammeter Ohmmeter	1mV to 1000V FSD. ± 1% of FSD. 1uA to 1A FSD. ±2% of FSD. 1ohm to 100 Mohm ±5% at center scale	HP 412A
Test Oscillator	Frequency range 10 Hz – 10 MHz	HP 651A
Test Oscillator	Frequency range 10 to 500 MHZ	HP 3200B
Pulse Generator	Frequency range 100 MHz with variable rise and falltime capability.	HP 8007A

ACCESSORIES	
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

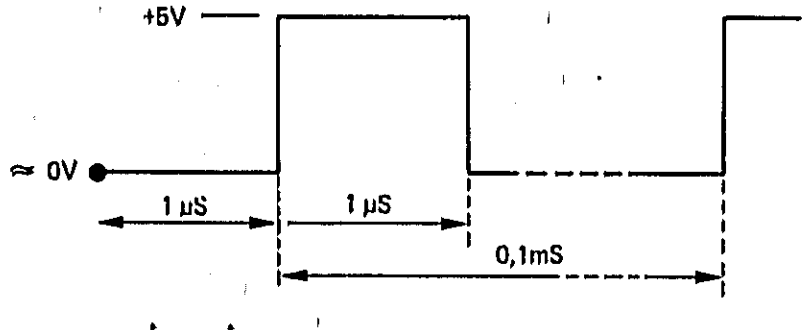
Table 5–2. Performance Test: Internal Operation

INITIAL CONTROL SETTINGS

PULSE PERIOD 1	1u – .1m
VERNIER 2	CW
PULSE DELAY 6	1u – .1m
VERNIER 7	CCW
PULSE WIDTH 10	1u – .1m
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.6u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
POLARITY 19	+
OFFSET 13	ON
VERNIER 14	Center
Mode Selector 21	NORM.

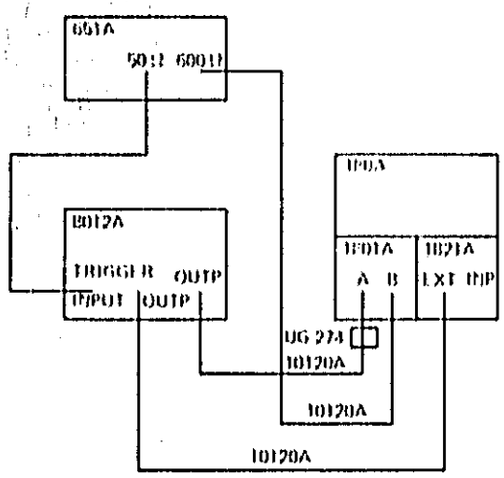


STEP	INSTRUCTIONS	RESULTS
1	The pulse output should be as shown:	



$t_{rise} = t_{fall} = 5$ nS

Table 5–3. Performance Test: External Trigger Operation



INITIAL CONTROL SETTINGS

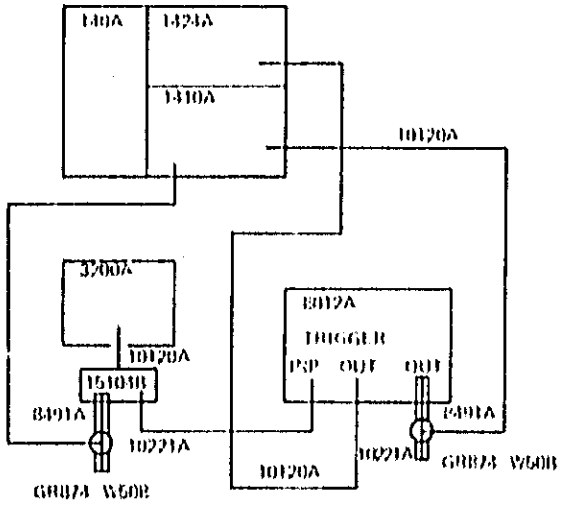
PULSE PERIOD 1	EXT+
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10m – 1
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
POLARITY 19	+
OFFSET 13	OFF
Mode Selector 21	NORM.

STEP	INSTRUCTIONS	RESULTS
1	Set the 651A controls as follows:	
	Range X10 Vernier 2.5 Attenuator +10 dB (1.0V) Amplitude 0.45 V (RMS)	
2	Center both vertical channels on the oscilloscope and observe the waveforms. The leading edge of the output pulse shall occur during positive slope of the sinewave.	
3	Set PULSE PERIOD 1 to EXT– : the leading edge of the output pulse shall occur during negative slope of the sinewave.	

Table 5–4. Performance Test: High Frequency Trigger Operation

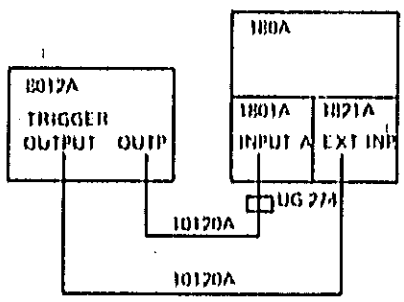
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	EXT+
PULSE DELAY 6	65n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.6u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Apply sinewave with repetition rate of 50 MHz and amplitude of 1.5V pp. Check repetition rate of output is equal to repetition rate of input i.e. 50 MHz.	
2	Set PULSE PERIOD 1 to EXT– .	
3	Repeat step 2.	

Table 5–5. Performance Test: Manual Operation



INITIAL CONTROL SETTINGS

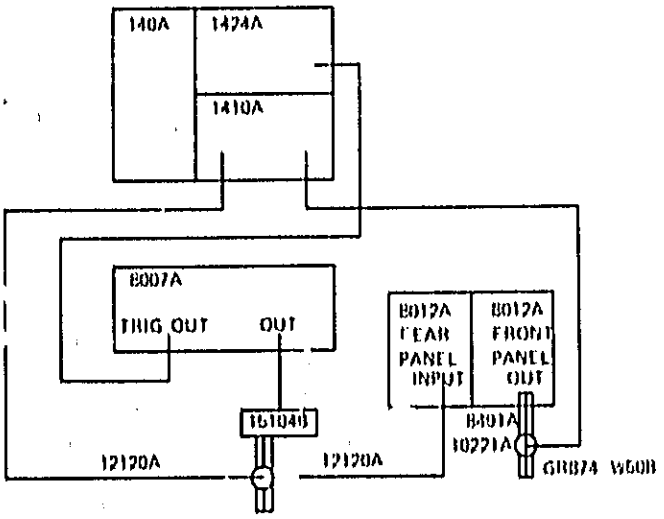
PULSE PERIOD 1	EXT
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	1u – .1m
VERNIER 11	CW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CW
TRAILING EDGE 12	CW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 15	OFF
POLARITY 19	+
Mode Selector 21	NORM.

STEP	INSTRUCTIONS	RESULTS
1	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 5–6, Performance Test: External Width Operation

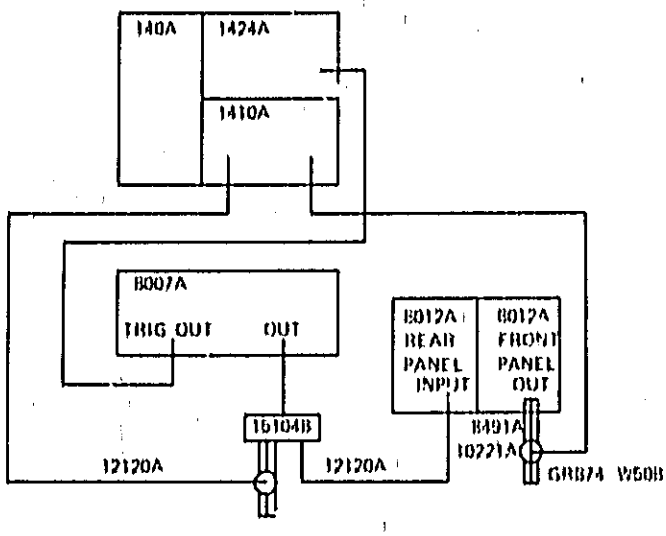
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	EXT+
TRANSITION TIME 3	5n – 0.6u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CCW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	EXT. WIDTH



STEP	INSTRUCTIONS	RESULTS
1	Apply external width pulses to INPUT 22:	
2	Output should be: Note leading and trailing edges of output pulses are coincident with leading and trailing edges of input pulse:	
3	Apply external width pulses to INPUT 22:	
4	Output should be:	

Table 5–7. Performance Test: RZ Operation



INITIAL CONTROL SETTINGS

PULSE PERIOD 1	EXT+
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 5	CCW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	RZ.

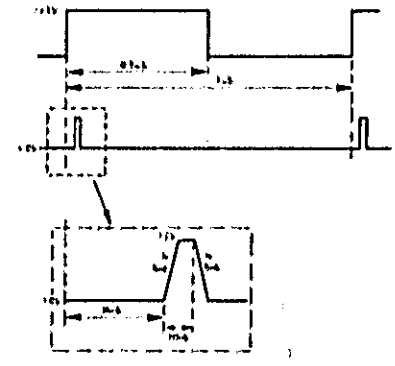
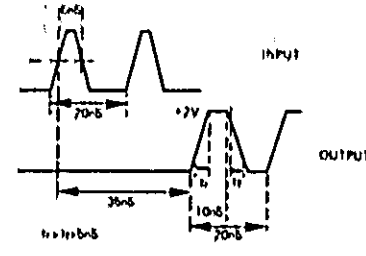
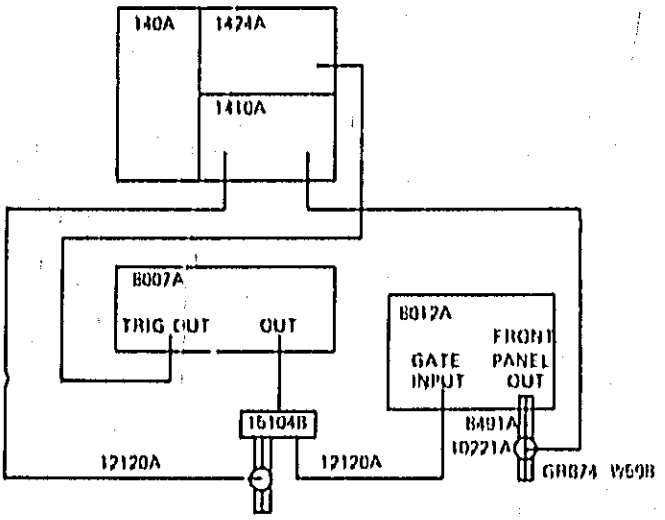
STEP	INSTRUCTIONS	RESULTS
1	Apply RZ pulses to INPUT 22:	
2	Output should be:	
3	Check pulse delay VERNIER 7 and pulse width VERNIER 11 vary the pulse delay and pulse width.	
4	Apply RZ pulses to INPUT 22:	
5	Output should be:	

Table 5–8. Performance Test: Gate Operation

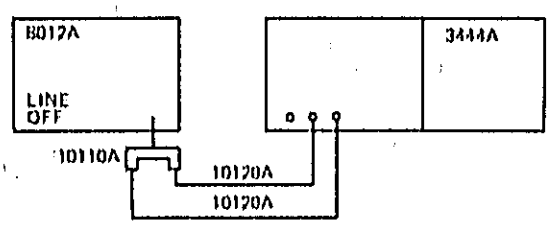
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CCW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Apply gate pulse to GATE INPUT 18:	
2	Check that output pulses at OUTPUT 20 only occur during ON time of gate pulse: Turn pulse period VERNIER 2 slowly CW and check gate operation for all pulse periods.	
3	Check that leading edge of first trigger output pulse (TRIGGER OUTPUT 17) coincides with leading edge of gate pulse:	
4	Check that last pulse width is correct even though gate pulse trailing edge appears during last pulse:	

Table 5–9. Performance Test: Output Impedance



INITIAL CONTROL SETTINGS

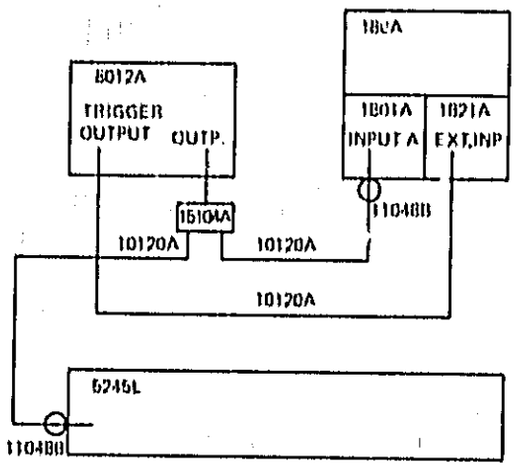
LINE 15	OFF
PULSE PERIOD 1	20n – 1u
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	SQUARE WAVE
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

STEP	INSTRUCTIONS	RESULTS
1	Turn amplitude VERNIER 9 from fully CW to fully CCW and check resistance:	50Ω±4.5Ω

Table 5–10. Performance Test: Repetition Rate

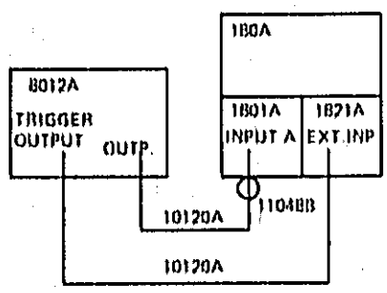
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTION				RESULTS
1	Check repetition rate for each set of control setting given in table.				
2	PULSE PERIOD (1)	VERNIER (2)	PULSE WIDTH (10)	VERNIER (11)	
	20n – 1u	CW	10n – 1u	CCW	> 1uS
	1u – .1m	CW	1u – .1m	CCW	> .1mS
	1u – .1m	CCW	10n – 1u	CCW	< 1uS
	.1m – 10m	CW	.1m – 10m	CCW	> 10mS
	.1m – 10m	CCW	1u – .1m	CCW	< .1mS
	10m – 1	CW	10m – 1	CCW	> 1S
	10m – 1	CCW	.1m – 10m	CCW	< 10mS
3	Set PULSE PERIOD 1 to range 20n – 1u Turn VERNIER 2 fully CCW Set PULSE WIDTH 10 to range 10n – 1u Turn VERNIER 11 fully CCW				
4	Measure frequency on counter				> 50 MHz

Table 5–11, Performance Test: Pulse Period Jitter



INITIAL CONTROL SETTINGS

PULSE PERIOD 1	1u – 1m
VERNIER 2	See step 4
PULSE DELAY 6	36n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	1u – 1m
VERNIER 11	CCW
TRANSITION TIME 3	6n – 0.6u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

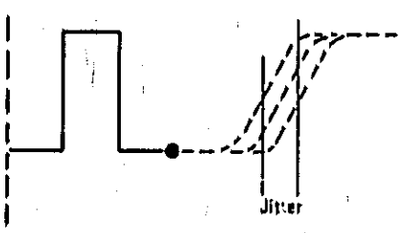
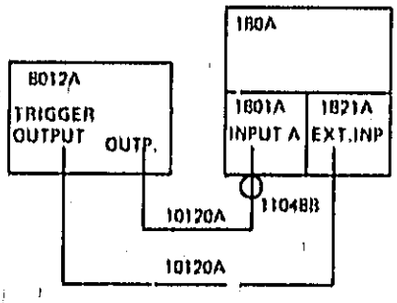
STEP	INSTRUCTIONS		RESULTS
1	Set the 1821A controls as follows:		
	Main Sweep	0.1mS/div	
	Delayed Sweep	0.1uS/div	
	Sweep Mode	Norm.	
	Delayed Trigger	Auto.	
	CM Delay	2.0	
2	Adjust pulse period VERNIER 2 to obtain 0.1mS pulse period on display.		
3	Adjust 1821A Delay (Div) vernier until intensified spot coincides with leading edge of second pulse on display.		
4	Switch Mode switch on 1821A to MIXED.		
5	Display should be:		
6	Measure pulse period jitter:	<.1 %	

Table 5–12. Performance Test: Pulse Delay

INITIAL CONTROL SETTINGS

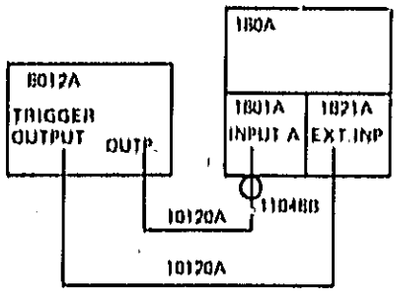
PULSE PERIOD 1	See Step 2
VERNIER 2	See Step 2
PULSE DELAY 6	See Step 2
VERNIER 7	See Step 2
PULSE WIDTH 10	See Step 2
VERNIER 11	See Step 2
TRANSITION TIME 3	5n – 0.5n
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	For each of the control settings given in the table, measure the delay time between the leading edge of the trigger output pulse and the leading edge of the output pulse.	

PULSE PERIOD (1)	VERNIER (2)	PULSE DELAY (6)	VERNIER (7)	PULSE WIDTH (10)	VERNIER (11)
1u – 0.1m	CW	35n – 1u	CW	10n – 1u	CW > 1 uS
.1m – 10m	CW	1u – .1m	CW	1u – .1m	CW > 100 uS
1u – .1m	CW	1u – .1m	CCW	1u – .1m	CCW < 1 uS
10m – 1	CW	.1m – 10m	CW	.1m – 10m	CW > 10 mS
.1m – 10m	CW	.1m – 10m	CCW	.1m – 10m	CCW < 100 uS
EXT+ (Press MAN)		10m – 1	CW	10m – 1	CW > 1 S
10m – 1	CW	10m – 1	CCW	10m – 1	CCW < 10 mS

Table 5–13. Performance Test: Pulse Delay Jitter



INITIAL CONTROL SETTINGS

PULSE PERIOD 1	.1m – 10m
VERNIER 2	See step 4
PULSE DELAY 6	1u – .1m
VERNIER 7	See step 5
PULSE WIDTH 10	1u – .1m
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

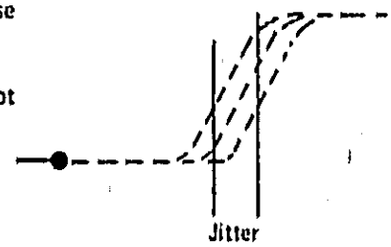
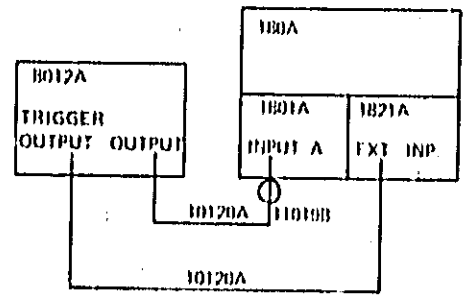
STEP	INSTRUCTIONS	RESULTS
1	Set the 1821A controls as follows:	
	Main sweep 0.1mS/div Delayed Sweep 0.1uS/div Sweep Mode Norm. Delayed Trigger Auto. CM Delay 10.0	
2	Adjust pulse period VERNIER 2 to obtain 0.4mS pulse period on display.	
3	Adjust pulse delay VERNIER 7 to obtain 0.1mS pulse delay.	
4	Adjust 1821A Delay (Div) vernier until intensified spot coincides with leading edge of first pulse.	
5	Switch Mode switch on 1821A to MIXED.	
6	Display should be:	
7	Measure pulse delay jitter:	<.1%

Table 5–14. Performance Test: Pulse Width

INITIAL CONTROL SETTINGS

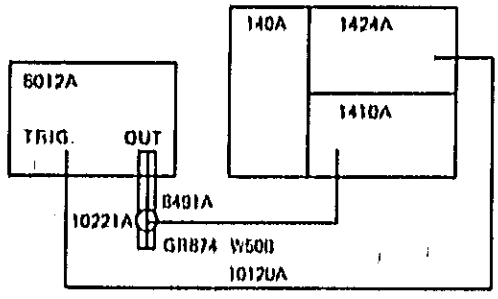
PULSE PERIOD 1	See Step 2
VERNIER 2	See Step 2
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	See Step 2
VERNIER 11	See Step 2
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Measure the pulse width for each of the control settings given in table.	

PULSE PERIOD (1)	VERNIER (2)	PULSE WIDTH (10)	VERNIER (11)	
1u – .1m	CW	10n – 1u	CW	> 1uS
.1m – 10m	CW	1u – .1m	CW	> .1mS
1u – .1m	CW	1u – .1m	CCW	< 1uS
10m – 1	CW	.1m – 10m	CW	> 10mS
.1m – 10m	CW	.1m – 10m	CCW	< .1mS
EXT+ (Press MAN Button)		10m – 1	CW	> 1S
10m – 1	CW	10m – 1	CCW	< 10mS

Table 5–15. Performance Test: Minimum Pulse Width



INITIAL CONTROL SETTINGS

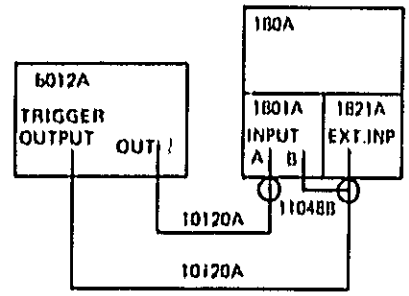
PULSE FERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	–
Mode Selector 21	NORM.

STEP	INSTRUCTION	RESULTS
1	Adjust amplitude VERNIER 9 to obtain full-screen display of pulse amplitude.	
2	Measure pulse width:	< 10nS
3	Set POLARITY to +	
4	Measure pulse width:	< 10nS
5	Set PULSE WIDTH 10 to SQUARE WAVE	
6	Adjust pulse period VERNIER 2 until the output pulse starts to move or the pulse divides.	
7	Measure the pulse period and use the formula below to calculate the maximum duty cycle. $\text{Duty Cycle}_{\text{Max}} = \frac{\text{Pulse Width (Tw)}}{\text{Pulse Period (Tp)}} \cdot 100\%$	
8	Maximum duty cycle:	> 40%

Table 5–16. Performance Test: Pulse Width Jitter

INITIAL CONTROL SETTINGS

PULSE PERIOD 1	.1m – 10m
VERNIER 2	See step 4
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	1u – .1m
VERNIER 11	See step 5
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



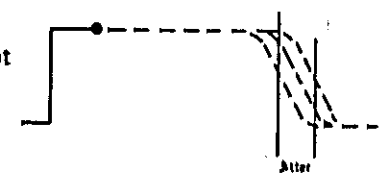
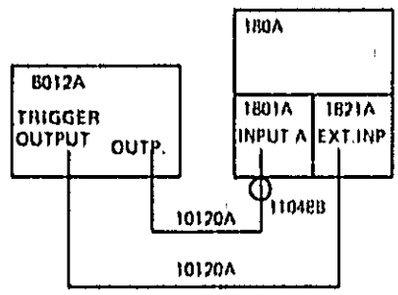
STEP	INSTRUCTIONS	RESULTS
1	Set 1821A controls as follows:	
	Main Sweep 0.1mS/div Delayed Sweep 0.1uS/div Sweep Mode Norm. Delayed Trigger Auto. CM Delay 10	
2	Adjust pulse period VERNIER 2 to obtain 0.4mS pulse period on display.	
3	Adjust pulse width VERNIER 11 to obtain 0.1mS pulse width.	
4	Adjust 1821A Delay (Div) vernier until intensified spot coincides with trailing edge of first pulse.	
5	Switch Mode switch on 1821A to MIXED.	
6	Display should be:	
7	Measure pulse width jitter:	<.1%

Table 5–17. Performance Test: Square Wave



INITIAL CONTROL SETTINGS

PULSE PERIOD 1	See step 2
VERNIER 2	See step 2
PULSE DELAY 6	See step 2
VERNIER 7	See step 2
PULSE WIDTH 10	SQUARE WAVE
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

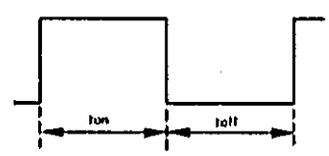
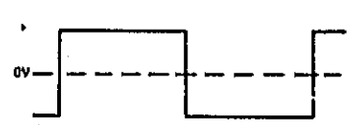
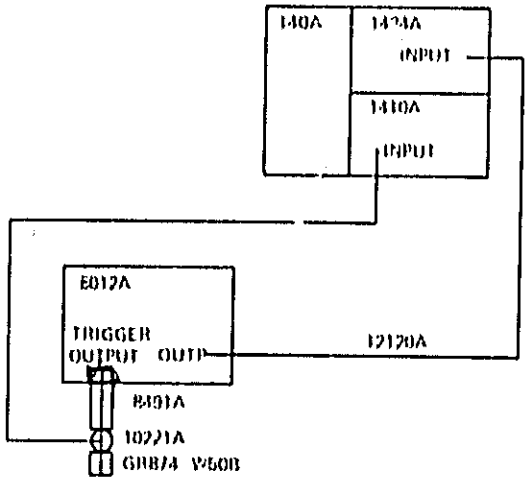
STEP	INSTRUCTIONS	RESULTS
1	For each setting of the PULSE PERIOD 1 control given in table below, turn VERNIER 2 slowly from fully CCW to fully CW and check that the PULSE DELAY 6 has no effect on the position of the displayed pulse.	
	PULSE PERIOD (1) / VERNIER (2): 20n – 1u: CCW to CW; 1u – .1m: CCW to CW; .1m – 10m: CCW to CW; 10m – 1: CCW to CW	
2	For all settings of the pulse period control check that the pulse width equals pulse OFF time.	
3	Check that the output squarewave is symmetrical about zero volts.	
4	Set PULSE PERIOD 1 to range 20n – 1u Adjust VERNIER 2 until the pulse starts to move or the pulse divides. Measure the pulse period and use in formula given below to calculate maximum duty cycle. $\text{Duty Cycle}_{\text{Max}} = \frac{\text{Pulse Width (Tw)}}{\text{Pulse Period (Tp)}} \cdot 100\%$ Maximum duty cycle:	  >45%

Table 5–18. Performance Test: Trigger Output

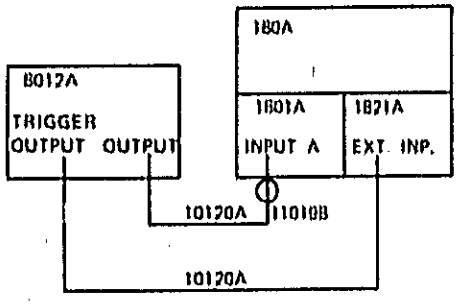
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.6u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	2.5 – 1.0
VERNIER 9	CW
POLARITY 19	+
OFFSET 13	OFF
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Measure amplitude of trigger output pulse (TRIGGER OUTPUT 17).	>1.0 V
2	Measure width of trigger output pulse	>5nS <20nS
3	Turn VERNIER 2 slowly from CCW to CW, the amplitude and width limits given must be true for the whole range.	
4	Switch PULSE PERIOD 1 to range 1u – .1m and repeat steps 2 to 4.	
5	Switch PULSE WIDTH 10 to SQUARE WAVE and repeat steps 2 to 5.	

Table 5–19. Performance Test: Rise and Fall Times (Slow ranges)



INITIAL CONTROL SETTINGS

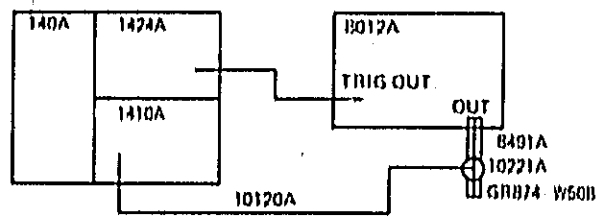
PULSE PERIOD 1	1u – .1m
VERNIER 2	CCW
PULSE WIDTH 10	SQUARE WAVE
TRANSITION TIME 3	0.5u – 50u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

STEP	INSTRUCTIONS			RESULTS
1	Adjust oscilloscope sensitivity for full screen pulse display and measure rise and fall times between 10% and 90% of amplitude for each of the following control settings.			
PULSE PERIOD (1)	VERNIER (2)	TRANSITION TIME (3)	LEADING EDGE 8 TRAILING EDGE 12	
1u – .1m	CCW	0.5u – 50u	CCW	< 0.5u
.1m – 10m	CCW	50u – 5m	CCW	< 50uS
10m – 1	CCW	5m – 0.5	CCW	< 5mS
1u – .1m	CW	0.5u – 50u	CW	> 50uS
.1m – 10m	CW	50u – 5m	CW	> 5mS
10m – 1	CW	5m – 0.5	CW	> 0.5S

Table 5–20, Performance Test: Rise and Fall Times (Fast ranges)

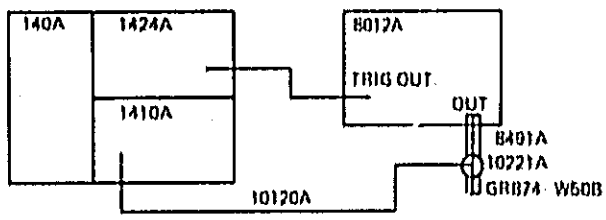
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	SQUARE WAVE
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Adjust amplitude VERNIER 9 to obtain full screen display of pulse amplitude.	
2	Adjust pulse period VERNIER 2 to obtain full screen pulse period display.	
3	Measure rise and fall times: <	<5nS
4	Set POLARITY 19 to – and repeat steps 2 to 4.	<5nS
5	Turn LEADING EDGE 8 and TRAILING EDGE 12 verniers fully CW and measure rise and fall times between 10% and 90% of amplitude	>0.5uS
6	Set POLARITY 19 to + and repeat step 6:	>0.5uS

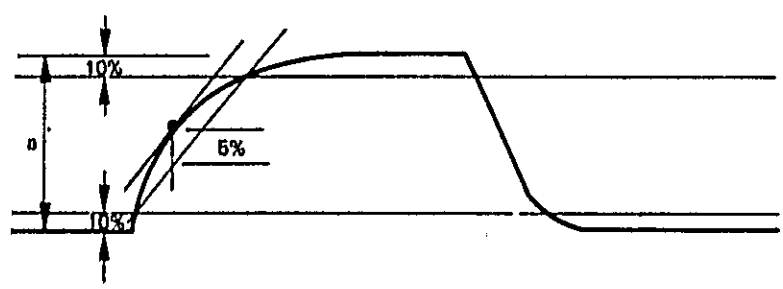
Table 5–21. Performance Test: Transition Time Linearity



INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	See Step 2
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	See Step 3
TRANSITION TIME 3	5n – 0,5u
LEADING EDGE 8	See Step 4
TRAILING EDGE 12	See Step 4
AMPLITUDE 4	5,0 – 2,0
VERNIER 9	See Step 5
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

STEP	INSTRUCTIONS	RESULTS
1	Adjust pulse period VERNIER 2 to obtain a pulse period of 100nS.	
2	Adjust pulse width VERNIER 11 to obtain a pulse width of 50nS.	
3	Adjust LEADING EDGE 8 and TRAILING EDGE 12 verniers to obtain rise and fall times of 30nS.	
4	Adjust amplitude VERNIER 9 to obtain full screen display of pulse amplitude.	
5	Refer to diagram:	

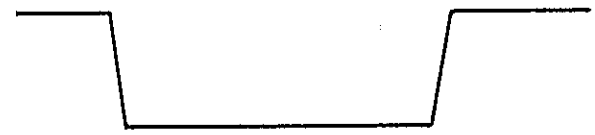


6	Measure risetime and falltime linearity:	< 5%
7	Repeat steps 2 to 7 with POLARITY 19 set to – :	< 5%

Table 5–22. Performance Test: Clipping and Roll-Off

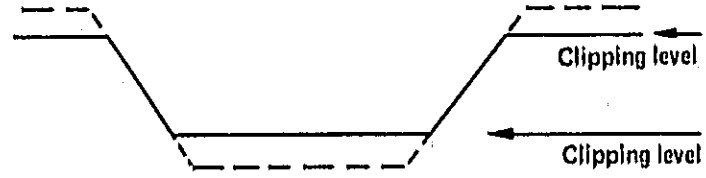
Before proceeding with these tests a brief description of clipping and roll-off may be in order.

1. Clipping: The pulse generator first produces a pulse as shown below:



2. The pulse then goes to the transition time circuit which enables the rise and fall times of the pulse to be varied:

3. The pulse is then clipped to remove spurious noise on the upper and lower levels of the pulse:



4. Roll-Off: It can be seen that as the risetime and fall-time are increased, the beginning of the output pulse shifts in relation to its original position. The quantity of shift is termed the roll-off.

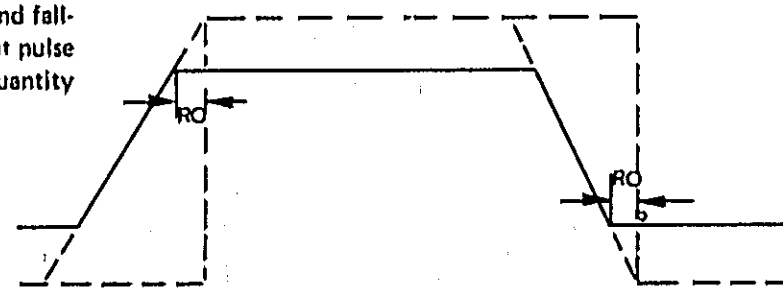
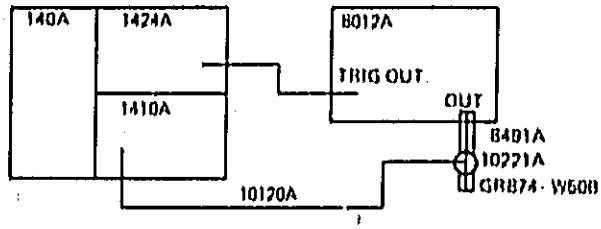


Table 5–22, Performance Test: Clipping and Roll-Off (continued)

INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	Adjust for 50% Duty Cycle
TRANSITION TIME 3	5n – 0,5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5,0 – 2,0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	–
Mode Selector 21	NORM

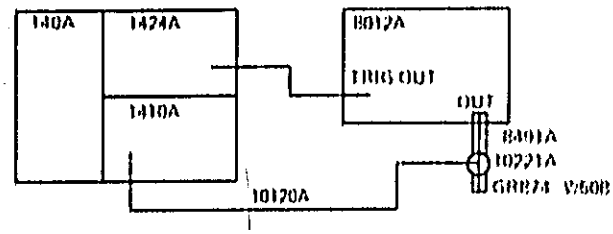


STEP	INSTRUCTIONS	RESULTS
1	Turn LEADING EDGE 8 from fully CCW to fully CW and measure roll-off:	ca. 40nS
2	Turn TRAILING EDGE 12 from fully CCW to fully CW and measure roll-off:	ca. 40ns
3	Set POLARITY 19 to +	
4	Repeat steps 2 and 3:	ca. 40nS

Table 5–23. Performance Test: Attenuator Calibration

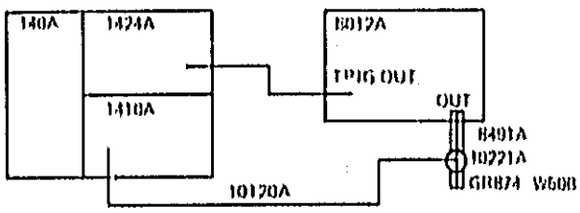
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	Center
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Measure pulse amplitude:	5.0V
2	Turn amplitude VERNIER 9 fully CCW	
3	Measure pulse amplitude:	< 2.0V
4	Set AMPLITUDE 4 to range 2.5 – 1	
5	Turn amplitude VERNIER 9 fully CW	
6	Measure pulse amplitude:	> 2.0V
7	Turn amplitude VERNIER 9 fully CCW	
8	Measure pulse amplitude:	< 1.0V
9	Set AMPLITUDE 4 to range 1.0 – 0.4	
10	Turn amplitude VERNIER 9 fully CW	
11	Measure pulse amplitude:	> 1.0V
12	Turn amplitude VERNIER 9 fully CCW	
13	Measure pulse amplitude:	< 0.5V
14	Set AMPLITUDE 4 to range 0.5 – 0.2	
15	Turn amplitude VERNIER 9 fully CW	
16	Measure pulse amplitude:	> 0.5V
17	Turn amplitude VERNIER 9 fully CCW	
18	Measure pulse amplitude:	< 0.2V

Table 5–24. Performance Test: DC Offset



INITIAL CONTROL SETTINGS

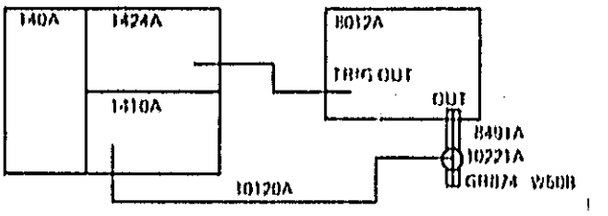
PULSE PERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.6u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

STEP	INSTRUCTIONS	RESULTS
1	Set the output pulse baseline to the center of the oscilloscope display.	
2	Set OFFSET 13 to ON.	
3	Turn VERNIER 14 fully CW	
4	Measure positive offset:	> 2.5V
5	Turn VERNIER 14 fully CCW	
6	Measure negative offset:	> –2.5V
7	Turn OFFSET 13 to OFF.	
8	Output pulse baseline should be at center of oscilloscope display.	

Table 5–25, Performance Test: Pulse Shaping

INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	SQUARE WAVE
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Measure preshoot, overshoot, ringing and rounding of both leading and trailing edges. Refer to diagram below:	< 5%
2	Set POLARITY 19 to –	
3	Repeat step 2:	< 5%
4	Turn amplitude VERNIER 9 for 2V pulse amplitude.	
5	Repeat step 2:	< 5%
6	Set POLARITY 19 to +	
7	Repeat step 2:	< 5%
8	Set AMPLITUDE 4 to range 0.5 – 0.2	
9	Remove 20dB attenuator	
10	Repeat step 2:	< 5%
11	Repeat steps 3 and 4:	< 5%
12	Turn amplitude VERNIER 9 for 0.5V pulse amplitude.	
13	Repeat steps 7 and 8:	< 5%

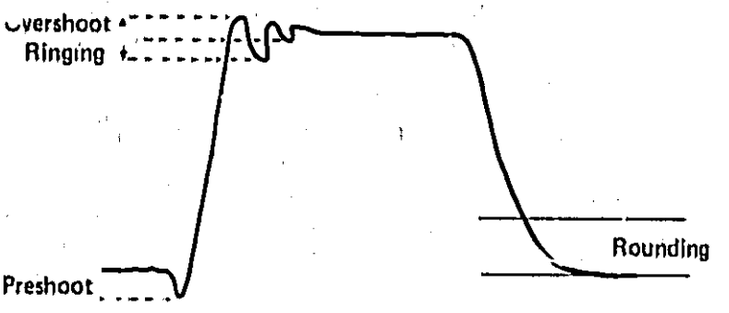
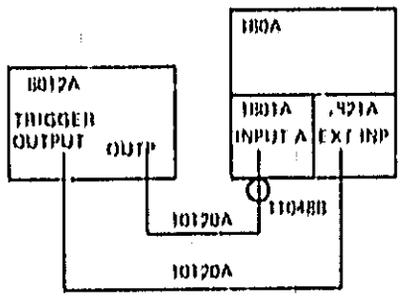
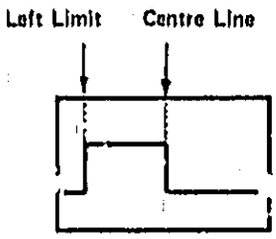


Table 5–26, Performance Test: Duty Cycle



INITIAL CONTROL SETTINGS

PULSE PERIOD 1	See step 2
VERNIER 2	See step 2
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

STEP	INSTRUCTIONS	RESULTS
1	For each set off control settings given in table below, display the output pulse so that it occupies half of the display (see diagram):	Graticule Left Limit Centre Line 

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:

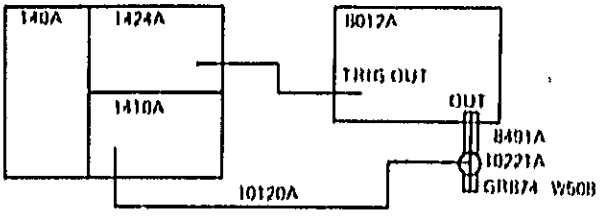
$$\text{Duty Cycle}_{\text{Max}} = \frac{\text{Pulse Width (Tw)}}{\text{Pulse Period (Tp)}} \quad 100\%$$

PULSE PERIOD (1)	VERNIER (2)	PULSE WIDTH (10)	VERNIER (11)	
1u – .1m	CW	1u – .1m	Adjust for 1uS	>75%
.1m – 10m	CW	.1m – 10m	Adjust for 0.1mS	>75%
10m – 1	CW	10m – 1	Adjust for 10mS	>75%

Table 5–27. Performance Test: Baseline Position

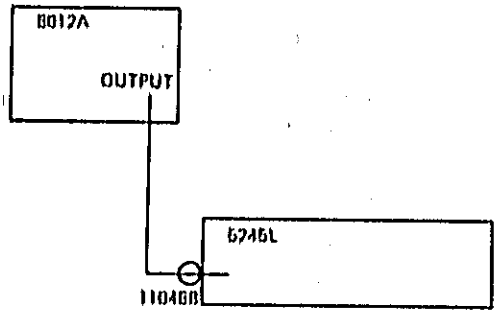
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	Adjust for 50% duty cycle.
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	–
Mode Selector 21	NORM.



STEP	INSTRUCTIONS	RESULTS
1	Set oscilloscope sensitivity to 10mV/div.	
2	Disconnect 8012A from oscilloscope	
3	Center the oscilloscope display trace.	
4	Reconnect 8012A to oscilloscope.	
5	Check that output pulse baseline is in center of display.	
6	Repeat steps 2 to 6 with POLARITY 19 set to + .	

Table 5–28. Internal Clocks and Adjustments: Timing Board A1 – Repetition Rate



INITIAL CONTROL SETTINGS

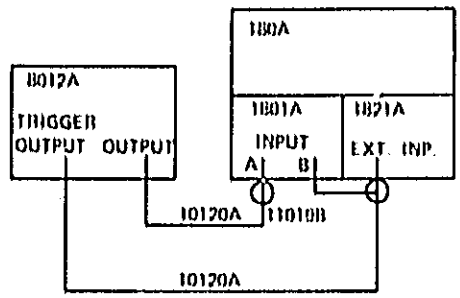
PULSE PERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CCW
TRAILING EDGE 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	NORM.

STEP	INSTRUCTIONS	RESULTS
1	Adjust trimming capacitor C24 for 51.5 MHz on counter.	

Table 5–29. Internal Checks and Adjustments: Timing Board A1 – Pulse Delay

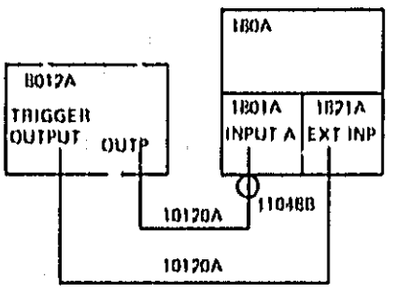
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	1u – 0.1m
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CW
TRANSITION TIME 3	5n – 0.5u
RISETIME 8	CCW
FALLTIME 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	N.



STEP	INSTRUCTIONS	RESULTS
1	Adjust trimming capacitor C35 to obtain pulse delay between trigger pulse and output pulse of 1.2uS.	

Table 5–30, Internal Checks and Adjustments: Timing Board A1 – Pulse Width



INITIAL CONTROL SETTINGS

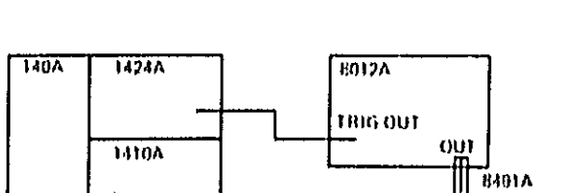
PULSE PERIOD 1	20n – 1u
VERNIER 2	CCW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
RISETIME 8	CCW
FALLTIME 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	+
Mode Selector 21	N.

STEP	INSTRUCTIONS	RESULTS
1	Adjust trimming capacitor C45 to obtain pulse w'dth of 9nS.	

Table 5–31. Internal Checks and Adjustments: Output Board A2 – Baseline Adjustment

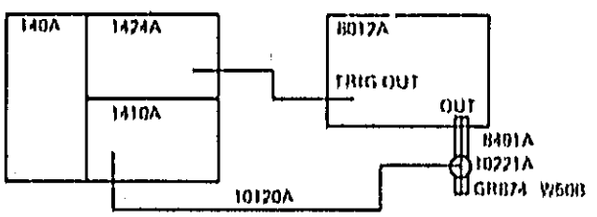
INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	Adjust for 50% Duty Cycle.
TRANSITION TIME 3	5n – 0.6u
RISETIME 8	CCW
FALLTIME 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	–
Mode Selector 21	N.



STEP	INSTRUCTIONS	RESULTS
1	Set oscilloscope sensitivity to 10mV/div.	
2	Disconnect 8012A output from oscilloscope.	
3	Center trace on oscilloscope.	
4	Reconnect 8012A output to oscilloscope	
5	Adjust R88 until baseline of pulses is in center of screen.	
6	Set POLARITY 19 to +	
7	Repeat steps 2 to 5.	
8	Adjust R87 until baseline of pulses is in center of screen.	

Table 5–32, Internal Checks and Adjustments: Output Board A2 – Clipping Adjustment



INITIAL CONTROL SETTINGS

PULSE PERIOD 1	20n – 1u
VERNIER 2	CW
PULSE DELAY 6	35n – 1u
VERNIER 7	CCW
PULSE WIDTH 10	10n – 1u
VERNIER 11	Adjust for 50% Duty Cycle.
TRANSITION TIME 3	5n – 0.5u
LEADING EDGE 8	CW
TRAILING EDGE 12	CW
AMPLITUDE 4	5.0 – 2.0
VERNIER 9	CW
OFFSET 13	OFF
POLARITY 19	–
Mode Selector 21	N.

STEP	INSTRUCTIONS	RESULTS
1	Adjust R135 to obtain an equal rise and falltime.	
2	Turn RISETIME 8 from fully CW to fully CCW and measure roll-off.	
3	Turn FALLTIME 12 from fully CW to fully CCW and measure roll-off.	
4	If risetime roll-off and falltime roll-off are not equal, adjust R104 until they are equal.	
5	Measure roll-off.	
6	Adjust R130 to obtain roll-off: 40nS	
7	Set POLARITY 19 to +	
8	Repeat steps 3 and 4	
9	If risetime and falltime roll-off are not equal, adjust R60 until they are equal.	

Table 5–33. Internal Checks and Adjustments: Power Supply Board A4

INITIAL CONTROL SETTINGS

PULSE PERIOD 1	EXT+
VERNIER 2	CW
PULSE DELAY 6	1u – 0.1m
VERNIER 7	CCW
PULSE WIDTH 10	1u – 0.1m
VERNIER 11	CCW
TRANSITION TIME 3	5n – 0.5u
RISETIME 8	CCW
FALLTIME 12	CCW
AMPLITUDE 4	5.0 – 2.0
VERNIER 0	CW
OFFSET 13	ON
VERNIER 14	Center
POLARITY 19	+
Mode Selector 21	N.

STEP	INSTRUCTIONS	RESULTS
1	Turn 8012A OFF and measure resistance from chassis to following test points:	
	a. TP1 +17V	80 Ω
	b. TP2 –17V	140 Ω
2	Turn 8012A ON, measure and if necessary correct, the voltage between chassis and the following test points:	
	a. TP1 +17V Adjust R15	+17V ± 100mV
	b. TP2 –17V Adjust R16	–17V ± 100mV

PARTS LIST

SECTION VI

DIAGRAMS AND REPLACEABLE PARTS

6–1 INTRODUCTION

6–2 This section contains the circuits, component location diagrams and the lists of replaceable parts. Waveforms shown with the circuits are included for guidance only and failure to observe identical results should not be automatically taken as indication of a fault. Tables 6–1 and 6–2 provide information relating to the replaceable parts lists and the circuit diagrams.

6–3 ORDERING INFORMATION

6–4 General

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

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

CUSTOMER SERVICE
Hewlett-Packard Company,
333 Logue Avenue,
Mountain View, California 94040

or, in Western Europe, to:

Hewlett-Packard (Schweiz) AG
Rue du Bois-du-Lan 7
1217 Meyrin 2
Geneva

6–7 Specify the following information for each part:

a) Model and complete serial number of instrument.

b) Hewlett-Packard stock number.

c) Circuit reference stock number.

d) Description.

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

Table 6–1 Reference Designators

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

Table 6–2, Diagram Notes

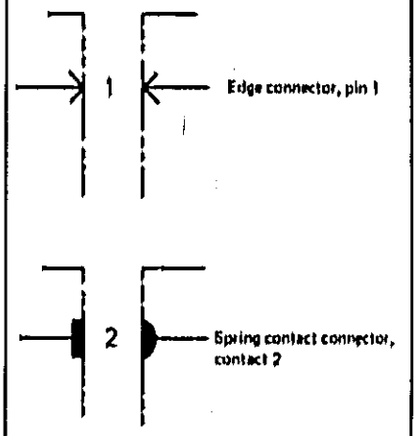
Refer to MIL-STD-15-1 for schematic symbols not listed in this table.

Unless other indicated: capacitance in microfarads inductance in microhenries resistance in ohms	
	Front panel marking
	Rear panel marking
*	Optimum value selected at factory
	Screwdriver adjustment
P/O	Part of
	Primary signal path
	Feedback path
9·7·5	Insulated wire, white, violet, green
4·5	Insulated wire, yellow, green
Center conductor / Screen	Screened lead
	Chassis ground

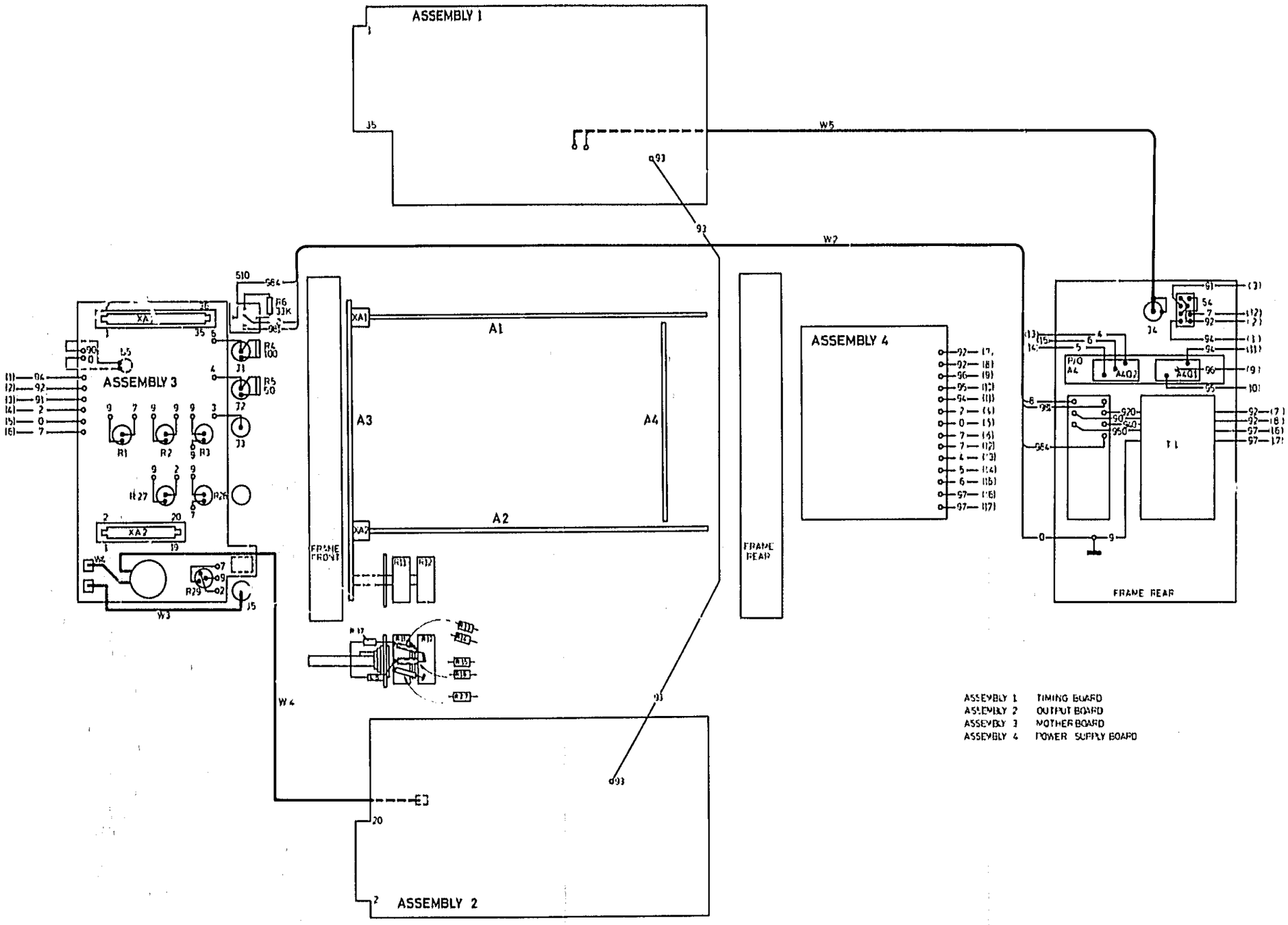
ASSEMBLY AND COMPONENT REFERENCING

The pulse generator consists of seven assemblies (A1 to A7) mounted in a frame. Components mounted on the assemblies are prefixed by the appropriate assembly number, thus A7CR2 is diode 2 mounted on A7. Components mounted directly on the frame have no prefix number.

Waveform test point (with number)	1
Voltage test point	+15
Avalanche (zener) diode	
Color Code	0 – Black 1 – Brown 2 – Red 3 – Orange 4 – Yellow 5 – Green 6 – Blue 7 – Violet 8 – Gray 9 – White

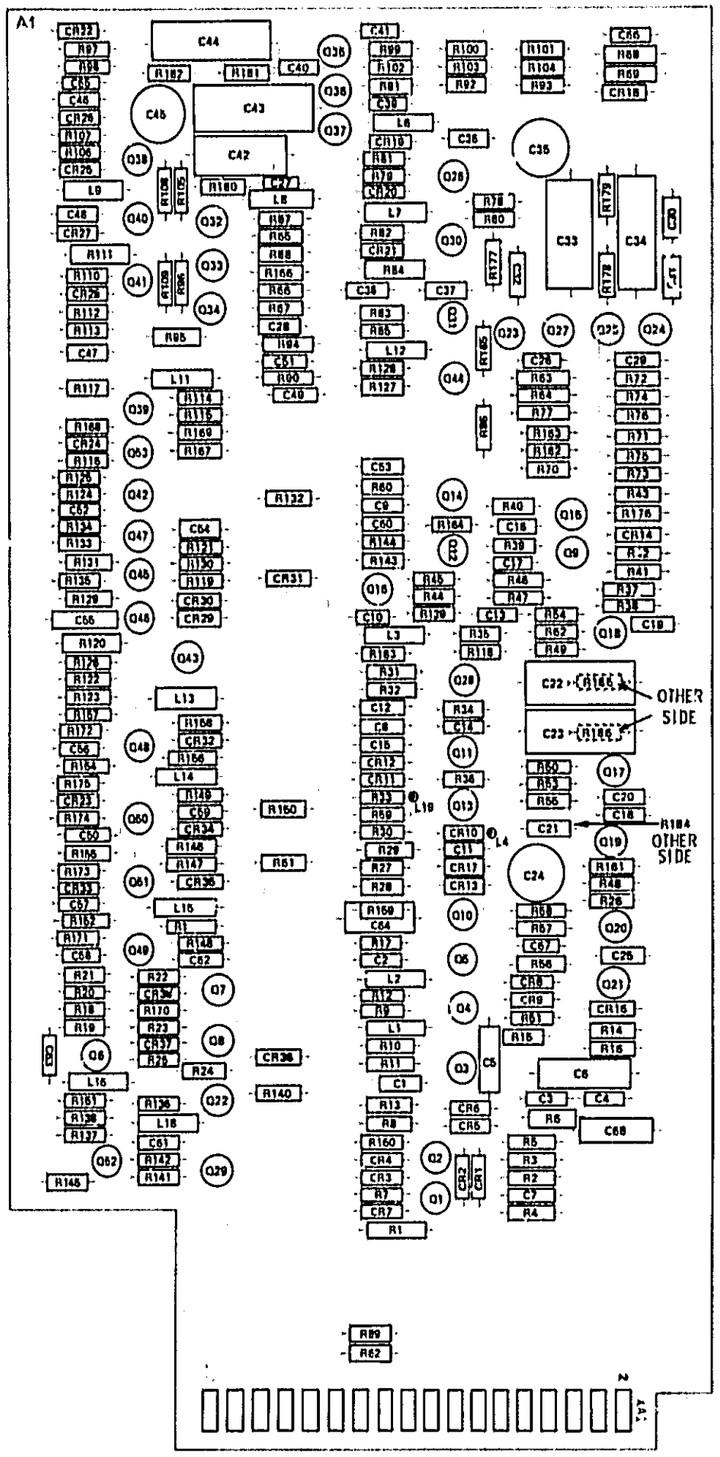


REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION
A1	08012-66501	BD AY TIMING
A2	08012-66502	BD AY INTG AMPL
A3	08012-66503	BD AY MOTHER
A4	08012-66504	BD AY PWR SPLY
F1	2110-0007	FUSE 1 FER
F2	2110-0202	FUSE .5 FER
J1	1250-0118	CONN BNC BLKHD
J2	1250-0118	CONN BNC BLK HD
J3	1250-0118	CONN BNC BLK HD
J4	1250-0083	CONN BNC BLKHD
Q1	1854-0063	XSTR 2N3055 SI
Q2	1854-0063	XSTR 2N3055 SI
P1	2100-3081	R-VAR 50K,25W CC
P2	2100-3081	R-VAR 50K ,25W CC
R3	2100-3081	R-VAR 50L ,25W CC
R4	0758-0024	R-F 100 5% ,25W
R5	0758-0126	R-F 51 5% ,25W F
R6	0758-0049	R-F 33K5% ,25W F
R27	2100-3081	R-VAR 50K ,25W CC
R28	2100-3081	R-VAR 50K ,25W CC
R29	2100-2635	R-VAR 50K ,5W
S5	3101-0124	SW-P-BTN SPST
S10	3101-1248	SW P-BTN SPDT
T1	5080-0948	XFMRPWR
W1	8120-1692	PWR CORD SET
W2	08012-61602	SCREENED POWER CABLE
W3	08012-61603	CBL COAX AY
W4	08012-61604	CBL COAXSET AY
W5	08012-61605	CBL AY COAX 2



ASSEMBLY 1 TIMING BOARD
ASSEMBLY 2 OUTPUT BOARD
ASSEMBLY 3 MOTHER BOARD
ASSEMBLY 4 POWER SUPPLY BOARD

Figure 6–1. Frame Diagram



REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1 C1	0150-0121	C=F .1UF 50V
A1 C2	0150-0093	C=F .01UF 100V
A1 C3	0150-0093	C=F .01UF 100V
A1 C4	0150-0093	C=F .01UF 100V
A1 C5	0160-3194	C=F 39PF 500V
A1 C6	0180-0374	C=F 10UF 20V
A1 C7	0160-3107	C=F 47PF 500V
A1 C8	0150-0121	C=F .1UF 50V
A1 C9	0150-0121	C=F .1UF 50V
A1 C10	0150-0093	C=F .01UF 100V
A1 C11	0150-0093	C=F .01UF 100V
A1 C12	0150-0093	C=F .01UF 100V
A1 C13	0160-2198	C=F 20PF 500V
A1 C14	0160-2197	C=F 10PF 500V
A1 C15	0150-0093	C=F .01UF 100V
A1 C16	0150-0093	C=F .01UF 100V
A1 C17	0150-0093	C=F .01UF 100V
A1 C18	0150-0093	C=F .01UF 100V
A1 C19	0150-0093	C=F .01UF 100V
A1 C20	0150-0093	C=F .01UF 100V
A1 C21	0160-3194	C=F 39PF
A1 C22	0121-0048	C=VAR 9-94PF
A1 C23	0121-0048	C=VAR 9-94PF
A1 C24	0150-0093	C=F .01UF 100V
A1 C25	0150-0093	C=F .01UF 100V
A1 C26	0150-0093	C=F .01UF 100V
A1 C27	0150-0093	C=F .01UF 100V
A1 C28	0150-0093	C=F .01UF 100V
A1 C29	0150-0093	C=F .01UF 100V
A1 C30	0150-0093	C=F .01UF 100V
A1 C31	0160-3194	C=F 39PF
A1 C32	0160-3220	C=F 22PF 500V
A1 C33	0160-3225	C=F 25PF 500V
A1 C34	0180-0374	C=F 10UF 20V
A1 C35	0121-0048	C=VAR 9-94PF
A1 C36	0150-0121	C=F .1UF 50V
A1 C37	0150-0121	C=F .1UF 50V
A1 C38	0150-0121	C=F .1UF 50V
A1 C39	0150-0121	C=F .1UF 50V
A1 C40	0180-0093	C=F .01UF 100V
A1 C41	0150-0093	C=F .01UF 100V
A1 C42	0160-3220	C=F 22PF 500V
A1 C43	0160-3225	C=F 25PF 500V
A1 C44	0180-0374	C=F 10UF 20V
A1 C45	0121-0048	C=VAR 9-94PF
A1 C46	0150-0093	C=F .01UF 100V
A1 C47	0150-0093	C=F .01UF 100V
A1 C48	0150-0093	C=F .01UF 100V
A1 C49	0150-0121	C=F .1UF 50V
A1 C50	0160-0191	C=F 56PF 500V
A1 C51	0150-0093	C=F .01UF 100V
A1 C52	0150-0093	C=F .01UF 100V
A1 C53	0150-0093	C=F .01UF 100V
A1 C54	0150-0093	C=F .01UF 100V
A1 C55	0160-2198	C=F 20PF 500V
A1 C56	0150-0093	C=F .01UF 100V
A1 C57	0150-0093	C=F .01UF 100V
A1 C58	0150-0093	C=F .01UF 100V
A1 C59	0150-0093	C=F .01UF 100V
A1 C60	0160-2198	C=F 20PF 500V
A1 C61	0150-0093	C=F .01UF 100V
A1 C62	0180-0093	C=F .01UF 100V
A1 C63	0150-0093	C=F .01UF 100V
A1 C64	0160-2198	C=F 20PF 500V
A1 C65	0150-0093	C=F .01UF 100V
A1 C66	0150-0093	C=F .01UF 100V
A1 C67	0180-0374	C=F 10UF 20V
A1 CR1	1901-0040	DIO SI 30V .03A
A1 CR2	1901-0040	DIO SI 30V .03A
A1 CR3	1901-0040	DIO SI 30V .03A
A1 CR4	1901-0040	DIO SI 30V .03A
A1 CR5	1901-0040	DIO SI 30V .03A
A1 CR6	1901-0040	DIO SI 30V .03A
A1 CR7	1902-0037	DIO RKDN 4.69 V
A1 CR8	1901-0040	DIO SI 30V .03A
A1 CR9	1901-0040	DIO SI 30V .03A
A1 CR10	1901-0179	DIO SI 15V .75MA
A1 CR11	1901-0040	DIO SI 30V .03A
A1 CR12	1901-0040	DIO SI 30V .03A
A1 CR13	1901-0040	DIO SI 30V .03A
A1 CR14	1901-0040	DIO SI 30V .03A
A1 CR15	1901-0040	DIO SI 30V .03A
A1 CR17	1910-0022	DIO-GE 5V 3.5MA
A1 CR18	1901-0040	DIO SI 30V .03A
A1 CR19	1902-0049	DIO RKDN 6.19 V
A1 CR20	1901-0040	DIO SI 30V .03A
A1 *CR21	1902-0126	DIO RKDN 7.87 V

REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1 CR22	1902-0040	DIO SI 30V .03A
A1 CR23	1902-0025	DIO RKDN 10.0 V
A1 CR24	1902-0025	DIO RKDN 10.0 V
A1 CR25	1902-0040	DIO SI 30V .03A
A1 CR26	1902-0049	DIO RKDN 6.19 V
A1 CR27	1902-0126	DIO RKDN 7.87 V
A1 CR28	1910-0016	DIO SI 30V .03A
A1 CR29	1902-0040	DIO SI 30V .03A
A1 CR30	1902-0040	DIO SI 30V .03A
A1 CR31	1902-0032	DIO RKDN 5.49 V
A1 CR32	1902-0032	DIO RKDN 5.49 V
A1 CR33	1902-0025	DIO RKDN 10.0 V
A1 CR34	1902-0040	DIO SI 30V .03A
A1 CR35	1901-1149	DIO SI 30V .03A
A1 L1	9100-1811	COIL CHOKE .22UH
A1 L2	9100-1814	COIL CHOKE .82 UH
A1 L3	9100-1813	COIL CHOKE .47 UH
A1 L4	9170-0029	FERRITE BEAD
A1 L5	9140-0179	COIL-FXD 22 UH
A1 L7	9100-1813	COIL CHOKE .47 UH
A1 L8	9140-0094	COIL-FXD CHOKE .68UH
A1 L9	9140-0179	COIL-FXD 22 UH
A1 L12	9140-0096	COIL-CHOKE 1UH
A1 L13	9140-0096	COIL-CHOKE 1UH
A1 L14	9100-1813	COIL CHOK .47 UH
A1 L15	9100-1813	COIL CHOK .47 UH
A1 L16	9140-0112	COIL CHOKE 4.7UH
A1 L17	9170-0029	FERRITE BEAD
A1 L18	9100-1814	COIL CHOK .82 UH
A1 L19	9170-0029	FERRITE BEAD
A1 MP28	1205-0317	HT-SINK 5STP
A1 MP29	1205-0317	HT-SINK 5STP
A1 Q1	1853-0278	2STP SI NPN
A1 Q2	1854-0296	2STP SI NPN
A1 Q3	1854-0092	2STP 2N3563 SI
A1 Q4	1854-0092	2STP 2N3563 SI
A1 Q5	1854-0096	2STP SI PNP
A1 Q6	1854-0019	2STP SI NPN
A1 Q7	1853-0014	2STP SI PNP
A1 Q8	1853-0014	2STP SI PNP
A1 Q9	1853-0203	2STP SI PNP
A1 Q10	1853-0040	2STP SI PNP
A1 Q11	1853-0203	2STP SI PNP
A1 Q12	1853-0203	2STP SI PNP
A1 Q13	1854-0345	2STP 2N5179 SI
A1 Q14	1853-0203	2STP SI PNP
A1 Q15	1853-0203	2STP SI PNP
A1 Q16	1854-0009	2STP 2N709 SI
A1 Q17	1854-0215	2STP SI NPN
A1 Q18	1854-0215	2STP SI NPN
A1 Q19	1854-0215	2STP SI NPN
A1 Q20	1854-0019	2STP SI NPN
A1 Q21	1853-0040	2STP SI PNP
A1 Q22	1854-0019	2STP SI NPN
A1 Q23	1853-0040	2STP SI PNP
A1 Q24	1853-0036	2STP SI PNP
A1 Q25	1853-0036	2STP SI PNP
A1 Q26	1853-0203	2STP SI PNP
A1 Q27	1853-0036	2STP SI PNP
A1 Q28	1854-0019	2STP SI NPN
A1 Q29	1853-0014	2STP SI PNP
A1 Q30	1854-0345	2STP 2N5179 SI
A1 Q31	1854-0345	2STP 2N5179 SI
A1 Q32	1853-0018	2STP SI PNP
A1 Q33	1853-0203	2STP SI PNP
A1 Q34	1855-0390	FET, SI PNP
A1 Q35	1853-0036	2STP SI PNP
A1 Q36	1853-0036	2STP SI PNP
A1 Q37	1853-0036	2STP SI PNP
A1 Q38	1853-0218	2STP SI PNP
A1 Q39	1853-0203	2STP SI PNP
A1 Q40	1854-0345	2STP 2N5179 SI
A1 Q41	1854-0345	2STP 2N5179 SI
A1 Q42	1854-0009	2STP 2N709 SI
A1 Q43	1853-0203	2STP SI PNP
A1 Q44	1853-0015	2STP [illegible] SI
A1 Q45	1854-0345	2STP 2N5179 SI
A1 Q46	1854-0345	2STP 2N5179 SI
A1 Q47	1854-0009	2STP 2N709 SI
A1 Q48	1854-0215	2STP SI NPN
A1 Q49	1854-0215	2STP SI NPN
A1 Q50	1854-0092	2STP 2N3563 SI
A1 Q51	1854-0092	2STP 2N3563 SI
A1 Q52	1854-0009	2STP 2N709 SI
A1 Q53	1853-0203	2STP SI PNP

REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1 R1	0698-0024	F=F 100 5% .25W
A1 R2	0698-0083	F=F 1.96K1%
A1 R3	0698-0083	F=F 1.96K1%
A1 R4	0698-4726	F=F 47.5% .125W
A1 R5	0698-3443	F=F 287 1% .125W
A1 R6	0698-3443	F=F 287 1% .125W
A1 R7	0698-4284	F=F 1.69K% .125W
A1 R8	0757-1094	F=F 1.47K1%
A1 R9	0698-0084	F=F 100 5% .125W
A1 R10	0757-0400	F=F 90.9 1%
A1 R11	0757-0421	F=F 825 1% .125W
A1 R12	0698-4759	F=F 220 5% .125W
A1 R13	0757-0470	F=F 750 1% .125W
A1 R14	0698-4757	F=F 1.3K5% .125W
A1 R15	0698-4696	F=F 1.5K1%
A1 R16	0698-4238	F=F 200 5% .125W
A1 R17	0698-4725	F=F 56 5% .125W
A1 R18	0698-4278	F=F 10K5% .125W
A1 R19	0698-4710	F=F 82 5% .125W
A1 R20	0698-4761	F=F 270 5% .125W
A1 R21	0698-4255	F=F 1.1K5% .125W
A1 R22	0698-4284	F=F 1.8K5% .125W
A1 R23	0698-4761	F=F 2K5% .125W F
A1 R24	0698-4259	F=F 1.6K5% .125W
A1 R25	0698-4737	F=F 180 5% .125W
A1 R26	0698-4279	F=F 11K5% .125W
A1 R27	0698-4278	F=F 10K5% .125W
A1 R28	0698-4778	F=F 10K5% .125W
A1 R29	0757-0274	F=F 1.21K1%
A1 R30	0698-4765	F=F 1K5% .125W F
A1 R31	0757-0428	F=F 1.62K1%
A1 R32	0698-0085	F=F 2.05K1%
A1 R33	0698-4714	F=F 130 5% .125W
A1 R34	0698-0086	F=F 100 5% .125W
A1 R35	0698-4231	F=F 91 5% .125W
A1 R36	0698-4714	F=F 130 5% .125W
A1 R37	0698-3151	F=F 2.87K1%
A1 R38	0698-0084	F=F 2.15K1%
A1 R39	0698-4271	F=F 5.1K5% .125W
A1 R40	0698-4251	F=F 750 5% .125W
A1 R41	0698-4732	F=F 820 5% .125W
A1 R42	0698-0086	F=F 100 5% .125W
A1 R43	0698-0086	F=F 100 5% .125W
A1 R44	0698-0086	F=F 100 5% .125W
A1 R45	0698-4238	F=F 200 5% .125W
A1 R46	0698-0084	F=F 2.15K1%
A1 R47	0757-0274	F=F 1.21K1%
A1 R48	0698-4271	F=F 5.1K5% .125W
A1 R49	0698-4271	F=F 5.1K5% .125W
A1 R50	0698-4721	F=F 5.1K5% .125W
A1 R51	0698-4774	F=F 6.8K5% .125W
A1 R52	0698-4279	F=F 11K5% .125W
A1 *R53	0698-4279	F=F 11K5% .125W
A1 R54	0698-4256	F=F 1.2K5% .125W
A1 R55	0698-4256	F=F 1.2K5% .125W
A1 R56	0757-0417	F=F 562 1% .125W
A1 R57	0757-0418	F=F 5.11K1%
A1 R58	0757-0443	F=F 3.32K1%
A1 R59	0698-4258	F=F 1.5K5% .125W
A1 R60	0698-4285	F=F 2K5% .125W F
A1 R61	0698-4285	F=F 2K5% .125W F
A1 R62	0698-3705	F=F 39 5% .125W
A1 R63	0698-3439	F=F 178 1% .125W
A1 R64	0698-0094	F=F 2.15K1%
A1 R65	0698-4740	F=F 1.8K5% .125W
A1 R66	0698-4283	F=F 1.8K5% .125W
A1 R67	0698-4742	F=F 820 5% .125W
A1 R68	0698-4752	F=F 820 5% .125W
A1 R69	0757-0278	F=F 1.78K1%
A1 R70	0698-0084	F=F 2.15K1%
A1 R71	0698-4284	F=F 2.7K5% .125W
A1 R72	0698-3697	F=F 49.5% 1W MO
A1 R73	0698-4284	F=F 2.7K5% .125W
A1 R74	0698-4287	F=F 24K5% .125W
A1 R75	0698-4287	F=F 24K5% .125W
A1 R76	0698-4771	F=F 5.1K5% .125W
A1 R77	0698-4273	F=F 5.1K5% .125W
A1 R78	0757-0290	F=F 6.19K1%
A1 R79	0698-3704	F=F 36 5% .125W
A1 R80	0683-4705	F=F 47 5% .25W
A1 R81	0698-3704	F=F 36 5% .125W
A1 R82	0698-4258	F=F 1.5K5% .125W
A1 R83	0698-4741	F=F 270 5% .125W
A1 R84	0698-4214	F=F 110 5% .125W
A1 R85	0757-0002	F=F 560 5% .25W
A1 R86	0698-4740	F=F 1.8K5% .125W

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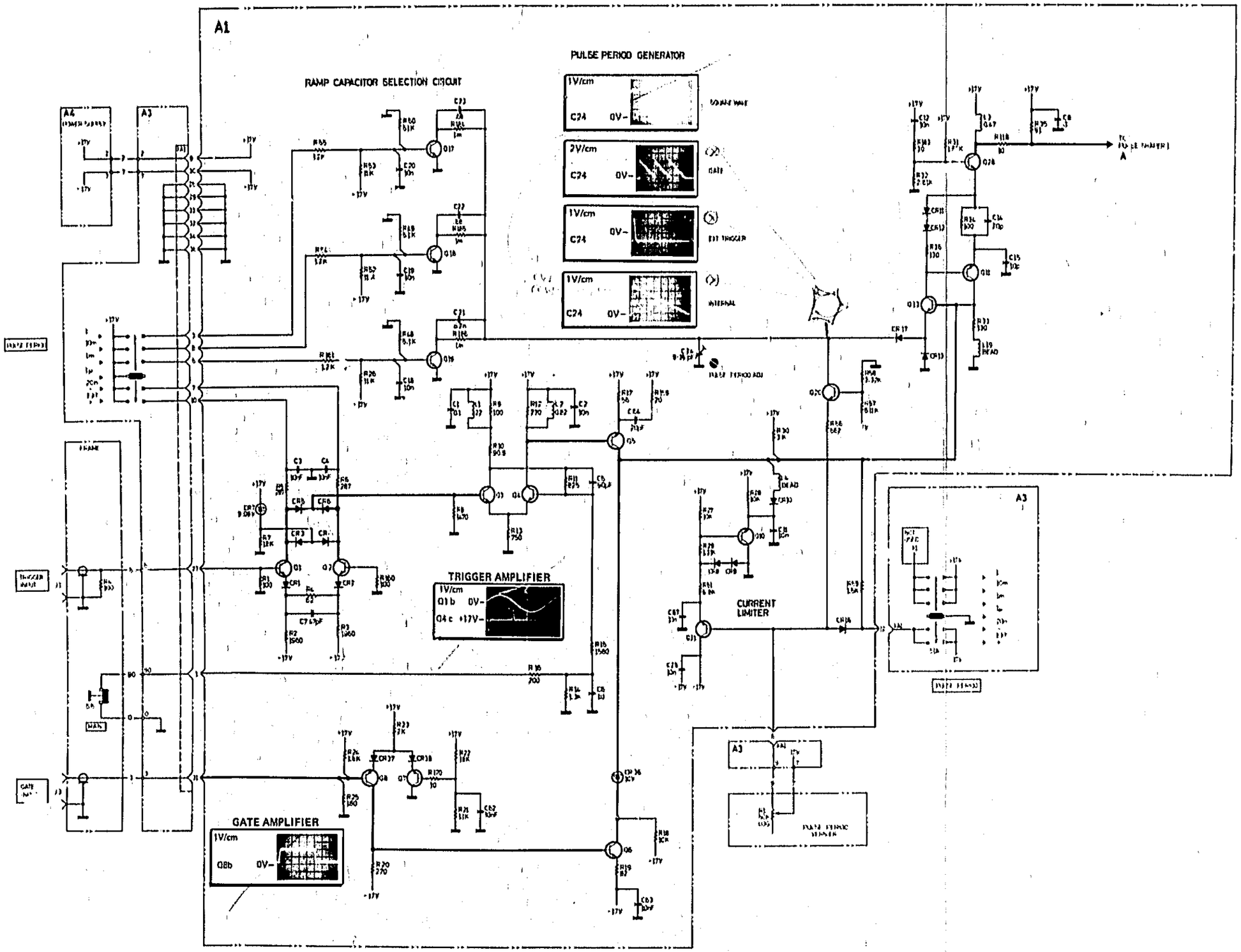
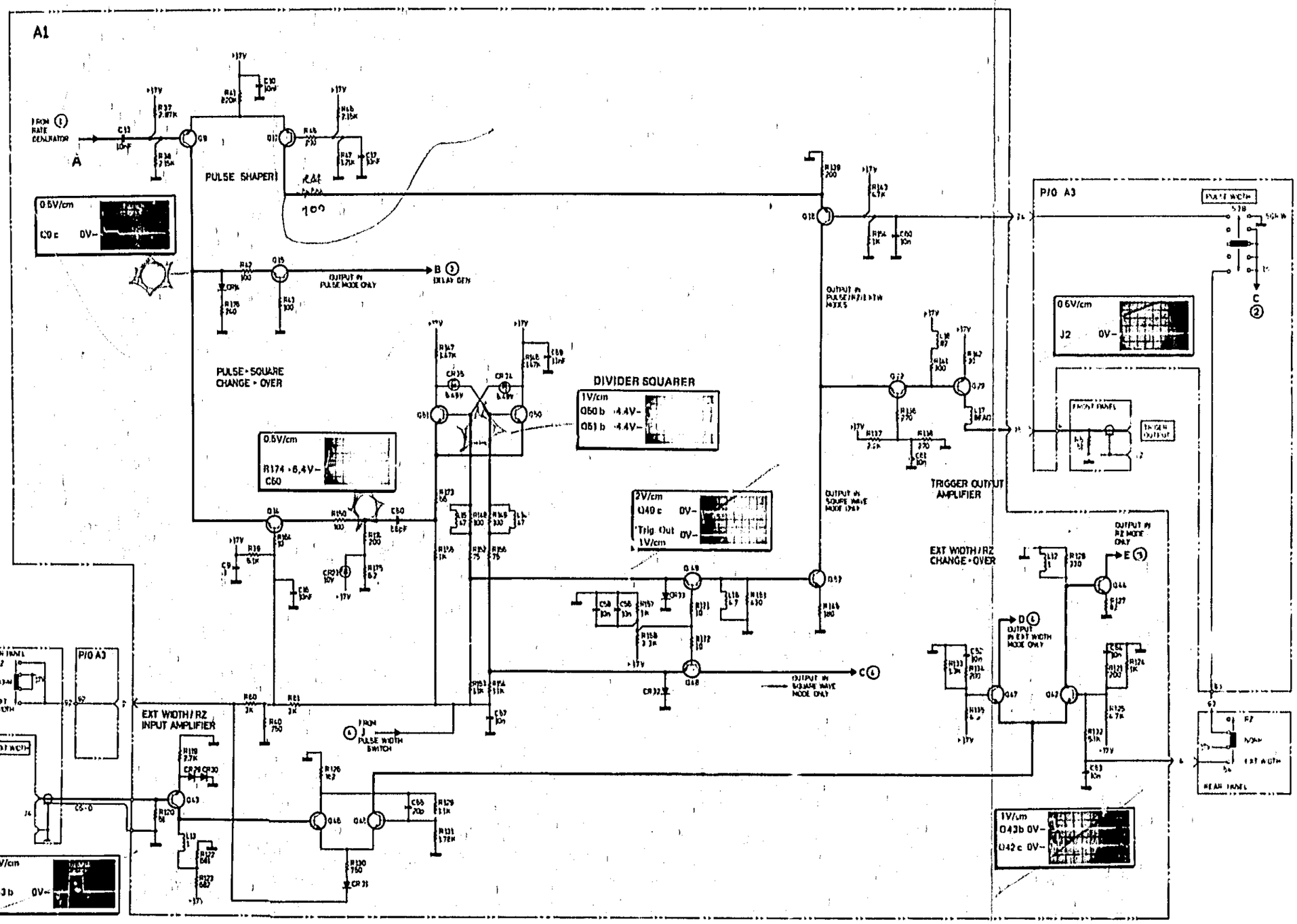
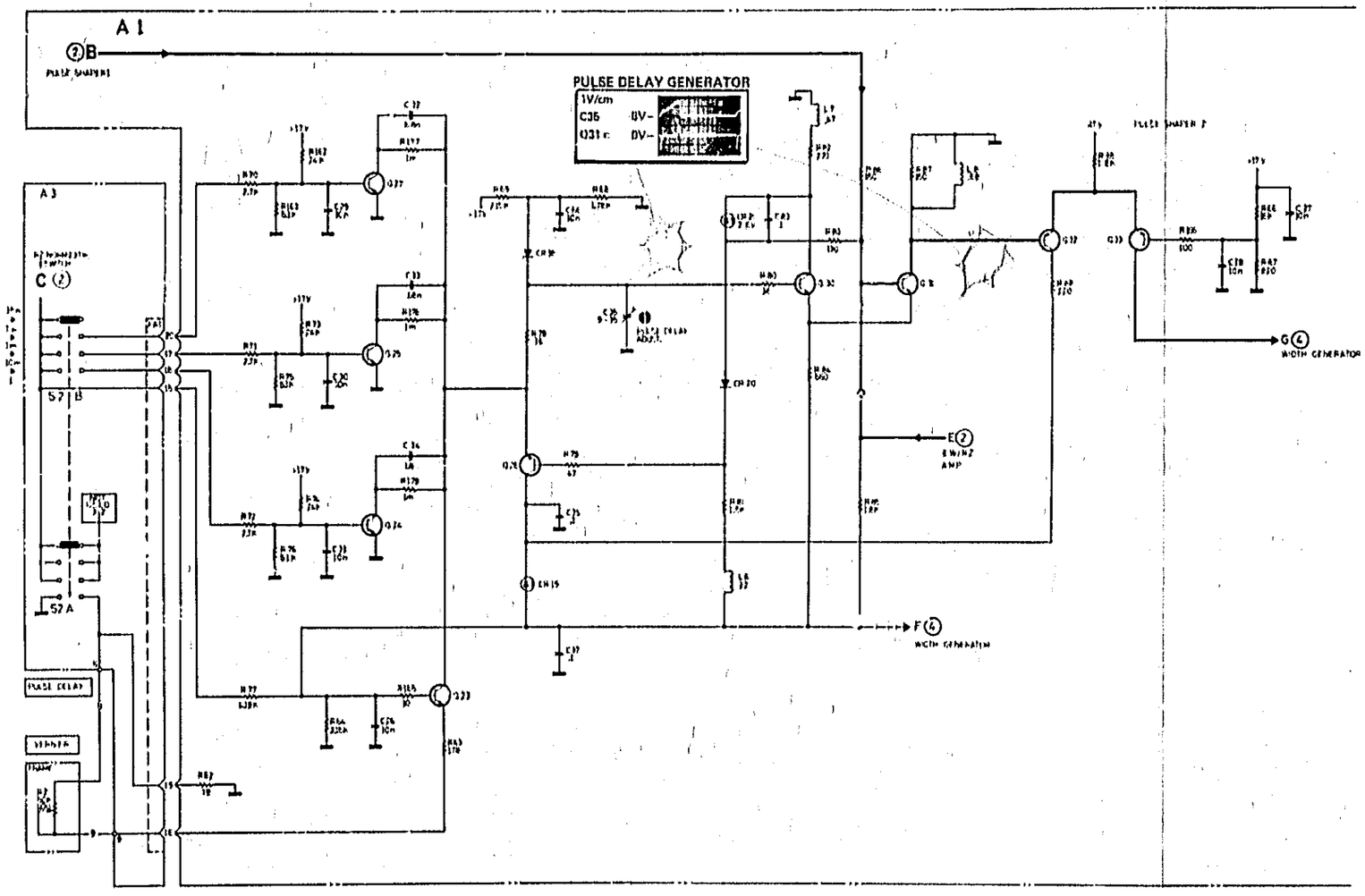
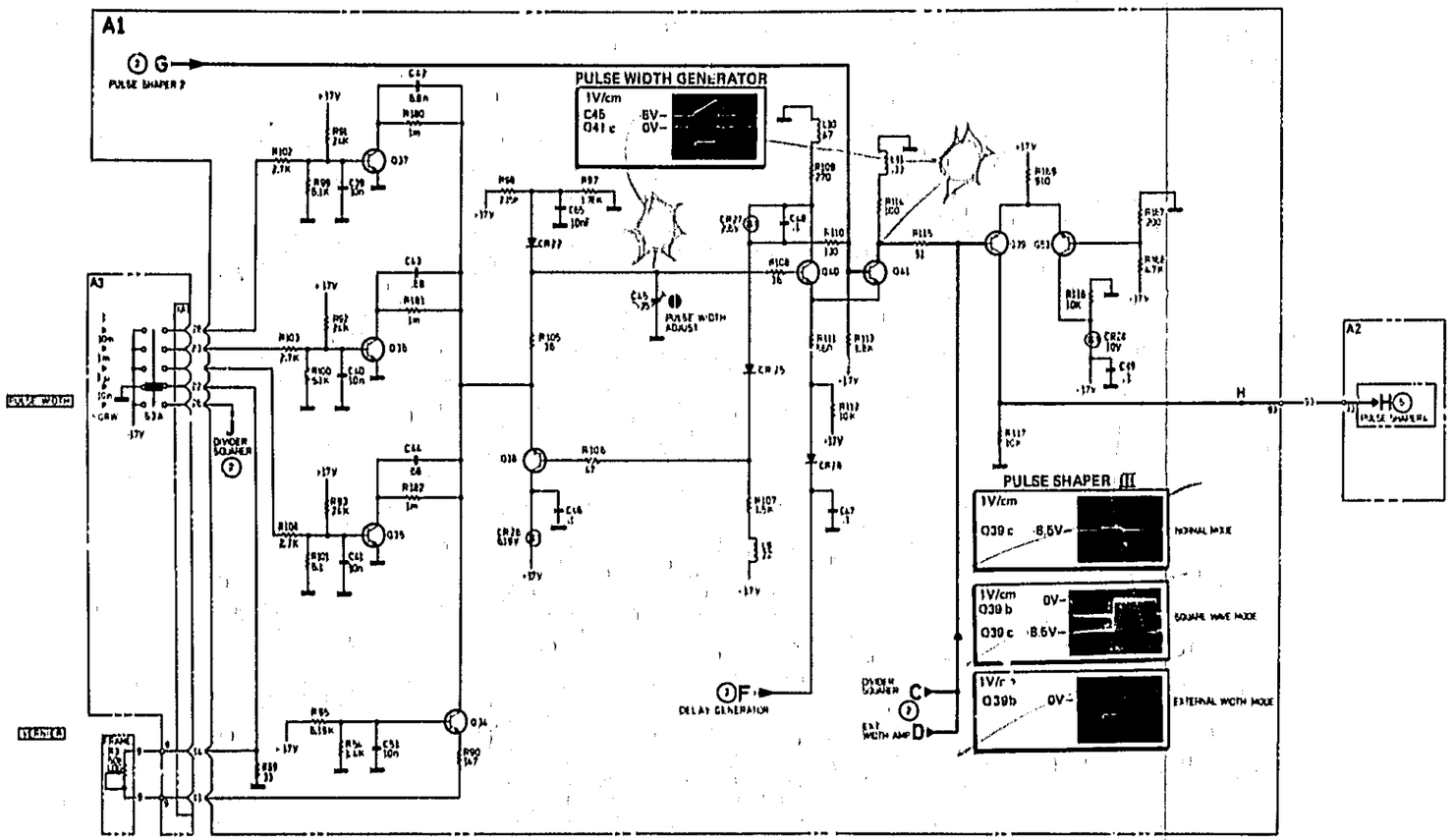


REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1 R86	0698-4235	R=F 150 5% .125W
A1 R87	0698-4235	R=F 150 5% .125W
A1 R88	0698-4219	R=F 220 5% .125W
A1 R89	0698-5703	R=F 15 5% .125W
A1 R90	0698-3438	R=F 147 1% .125W
A1 R91	0698-4287	R=F 2.49K 5% .125W
A1 R92	0698-4287	R=F 2.49K 5% .125W
A1 R93	0698-4287	R=F 2.49K 5% .125W
A1 R94	0698-4474	R=F 1.44K 1% .125W
A1 R95	0757-0290	R=F 6.19K 1%
A1 R96	0758-0084	R=F 100 5% .125W
A1 R97	0757-0278	R=F 1.78K 1%
A1 R98	0698-0084	R=F 2.15K 1%
A1 R99	0698-4271	R=F 5.11K 5% .125W
A1 R100	0698-4271	R=F 5.11K 5% .125W
A1 R101	0698-4271	R=F 5.11K 5% .125W
A1 R102	0698-4284	R=F 2.74K 5% .125W
A1 R103	0698-4284	R=F 2.74K 5% .125W
A1 R104	0698-4284	R=F 2.74K 5% .125W
A1 R105	0698-5704	R=F 16 5% .125W
A1 R106	0683-4705	R=F 47 5% .25W
A1 R107	0698-4258	R=F 1.43K 1% .125W
A1 R108	0698-5704	R=F 16 5% .125W
A1 R109	0698-4741	R=F 270 5% .125W
A1 R110	0698-4234	R=F 130 5% .125W
A1 R111	0698-0002	R=F 560 5% .25W
A1 R112	0698-4278	R=F 10K 5% .125W
A1 R113	0698-4280	R=F 1.8K 5% .125W
A1 R114	0758-0084	R=F 100 5% .125W
A1 R115	0758-0124	R=F 51 5% .125W
A1 R116	0698-4278	R=F 10K 5% .125W
A1 R117	0698-4278	R=F 10K 5% .125W
A1 R118	0698-8802	R=F 10 5% .125W
A1 R119	0698-4284	R=F 2.74K 5% .125W
A1 R120	0698-0126	R=F 51 5% .25W F
A1 R121	0698-4238	R=F 200 5% .125W
A1 R122	0757-0439	R=F 681 1% .125W
A1 R123	0757-0439	R=F 681 1% .125W
A1 R124	0698-4254	R=F 1.43K 1% .125W F
A1 R125	0698-4770	R=F 4.75K 5% .125W
A1 R126	0757-0405	R=F 147 1% .125W
A1 R127	0698-4230	R=F 82 5% .125W
A1 R128	0698-4263	R=F 330 5% .125W
A1 R129	0757-0424	R=F 1.1K 1% .125W
A1 R130	0698-4291	R=F 750 5% .125W
A1 R131	0757-0278	R=F 1.78K 1%
A1 R132	0698-4271	R=F 5.11K 5% .125W
A1 R133	0698-4257	R=F 1.3K 5% .125W
A1 R134	0698-4238	R=F 200 5% .125W
A1 R135	0698-4269	R=F 4.3K 5% .125W
A1 R136	0698-4741	R=F 270 5% .125W
A1 R137	0698-4267	R=F 2.2K 5% .125W

REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1 R138	0698-4236	R=F 1.65K 1% .125W
A1 R139	0698-4238	R=F 200 5% .125W
A1 R140	0758-0084	R=F 100 5% .125W
A1 R141	0698-4262	R=F 500 5% .125W
A1 R142	0698-5702	R=F 10 5% .125W
A1 R143	0698-4270	R=F 4.7K 5% .125W
A1 R144	0698-4754	R=F 1K 5% .125W F
A1 R145	0698-4237	R=F 150 5% .125W
A1 R146	0757-1094	R=F 1.47K 1%
A1 R147	0757-1094	R=F 1.47K 1%
A1 R148	0758-0084	R=F 100 5% .125W
A1 R149	0758-0084	R=F 100 5% .125W
A1 R150	0698-8807	R=F 10 5% .125W
A1 R151	0757-0915	R=F 430 2% .125W
A1 R152	0757-0198	R=F 75 1% .125W
A1 R153	0757-0424	R=F 1.1K 1% .125W
A1 R154	0757-0424	R=F 1.1K 1% .125W
A1 R155	0757-0280	R=F 1K 1% .125W F
A1 R156	0757-0198	R=F 75 1% .125W
A1 R157	0757-0280	R=F 1K 1% .125W F
A1 R158	0698-4266	R=F 1.1K 5% .125W
A1 R159	0698-8744	R=F 20 5% .125W
A1 R160	0758-0084	R=F 100 5% .125W
A1 R161	0698-4256	R=F 1.27K 5% .125W
A1 R162	0698-4287	R=F 2.49K 5% .125W
A1 R163	0698-4271	R=F 5.11K 5% .125W
A1 R164	0698-8802	R=F 10 5% .125W
A1 R165	0698-8802	R=F 10 5% .125W
A1 R166	0758-0084	R=F 100 5% .125W
A1 R167	0698-4238	R=F 200 5% .125W
A1 R168	0698-4270	R=F 4.7K 5% .125W
A1 R169	0698-4293	R=F 910 5% .125W
A1 R170	0698-8802	R=F 10 5% .125W
A1 R171	0698-8802	R=F 10 5% .125W
A1 R172	0698-8802	R=F 10 5% .125W
A1 R173	0698-4225	R=F 56 5% .125W
A1 R174	0698-4238	R=F 200 5% .125W
A1 R175	0698-4273	R=F 6.2K 5% .125W
A1 R176	0698-4260	R=F 240 5% .125W
A1 R177	0683-1055	R=F 1M 5% .25W CC
A1 R178	0683-1055	R=F 1M 5% .25W CC
A1 R179	0683-1055	R=F 1M 5% .25W CC
A1 R180	0683-1055	R=F 1M 5% .25W CC
A1 R181	0683-1055	R=F 1M 5% .25W CC
A1 R182	0683-1055	R=F 1M 5% .25W CC
A1 R183	0698-5702	R=F 10 5% .125W
A1 R185	0683-1055	R=F 1M 5% .25W CC
A1 R186	0683-1055	R=F 1M 5% .25W CC
A1 R184	0683-1055	R=F 1M 5% .25W CC
A1 T11	9100-1612	COIL CHOKE .33UH







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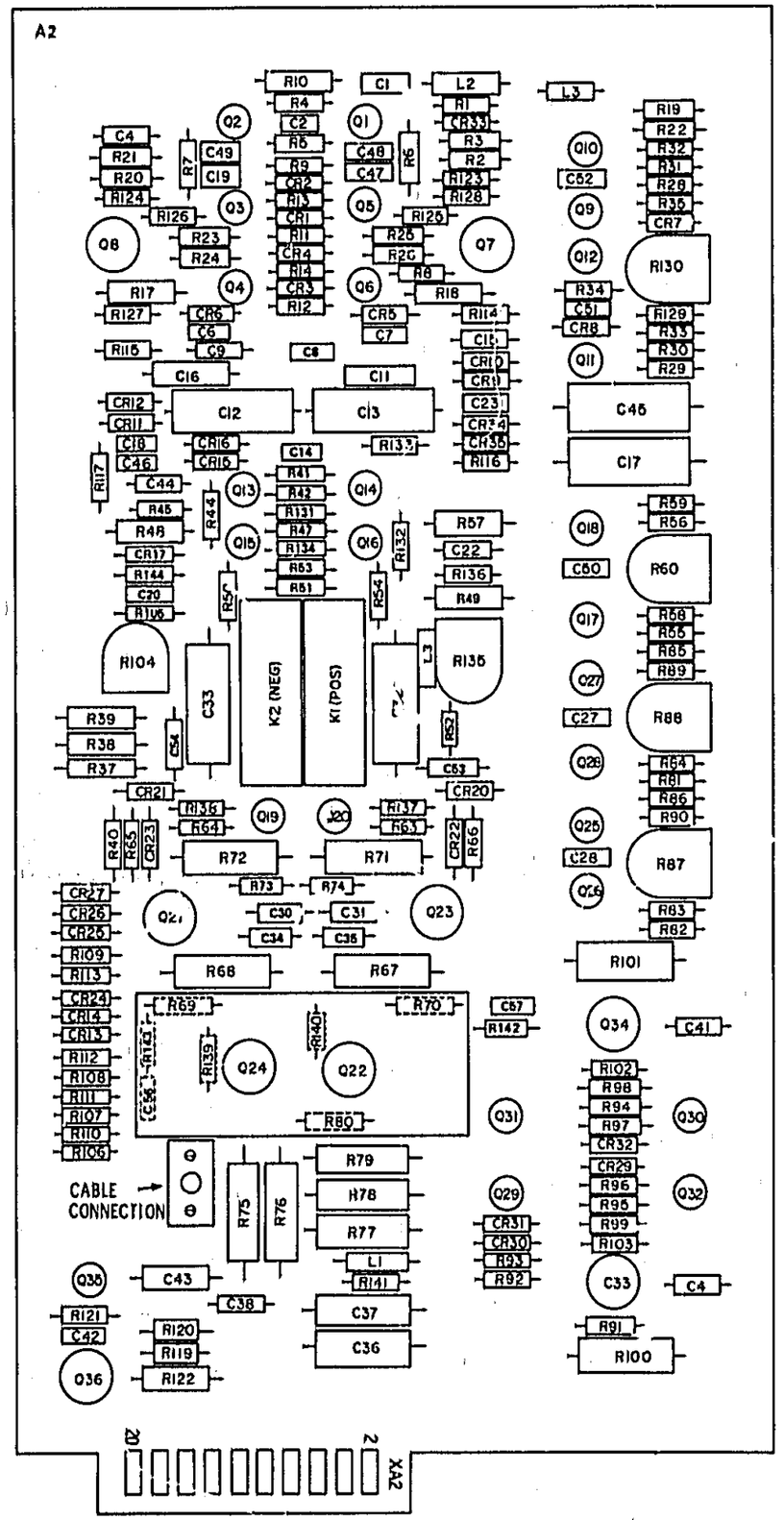
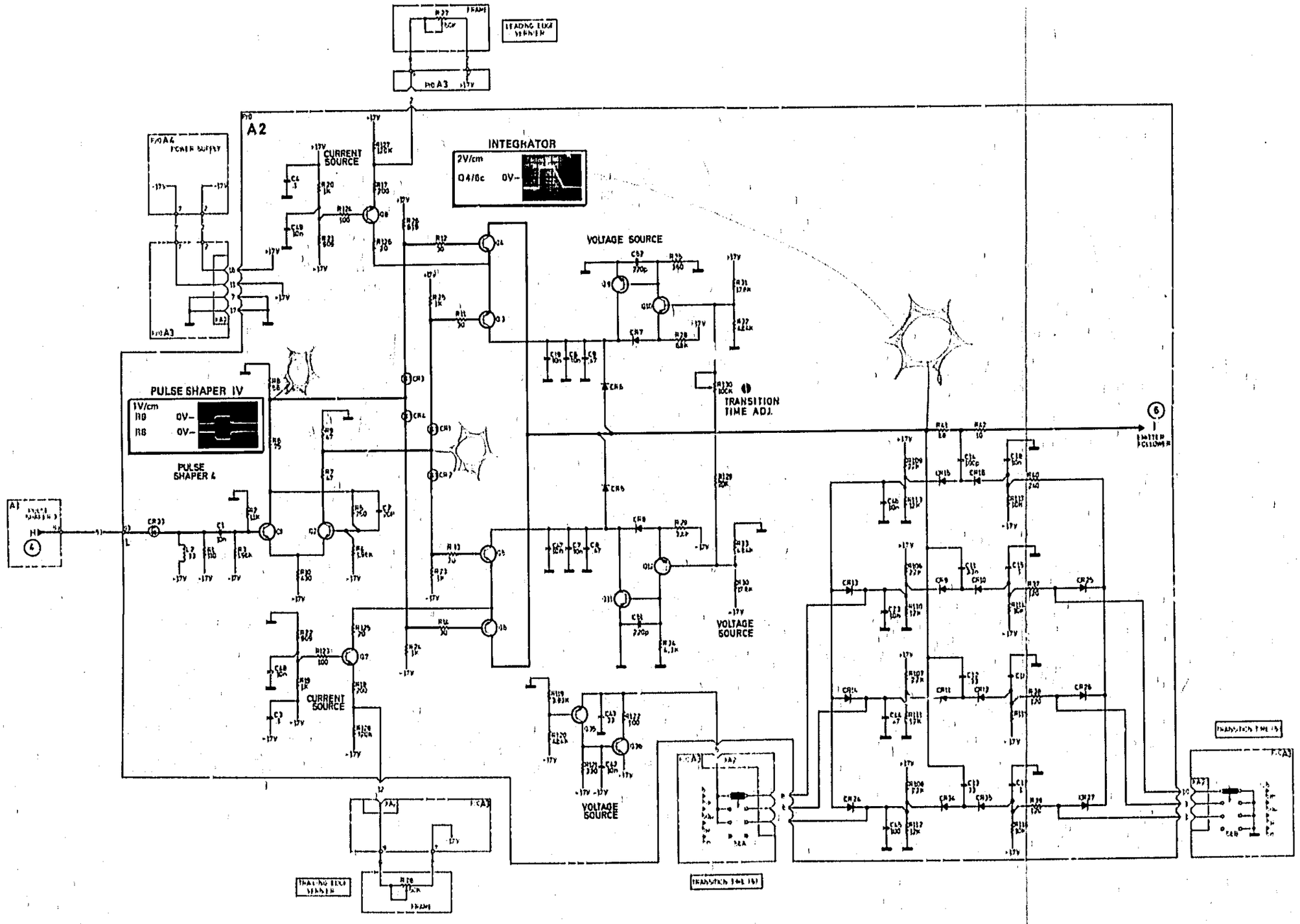
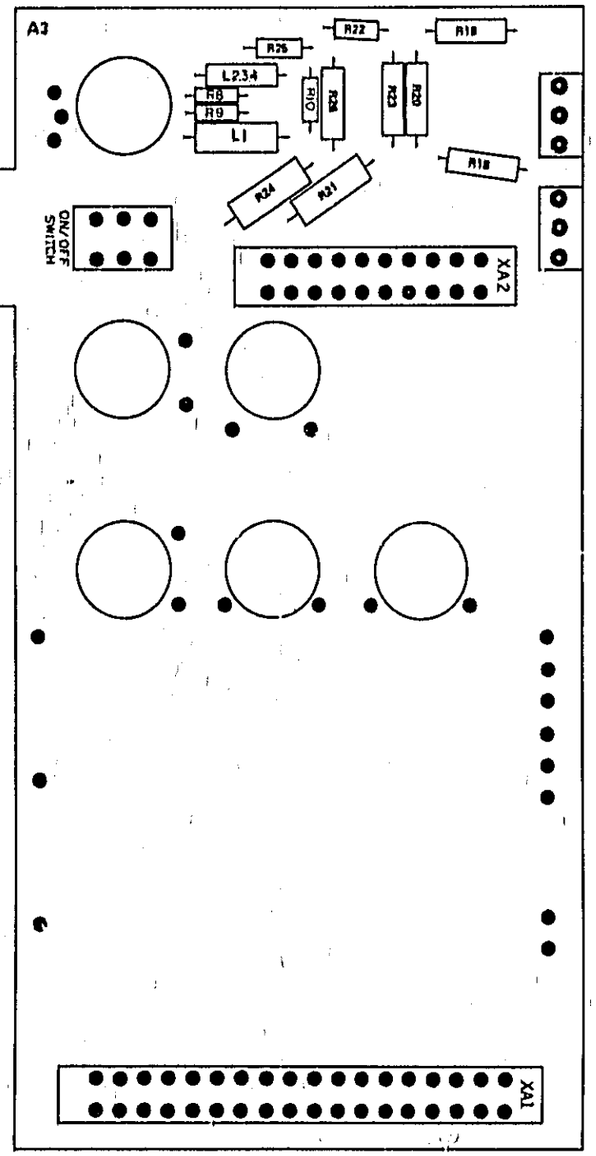


REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A2 C1	0150-0093	C=F .01UF 100V
A2 C2	0160-2198	C=F 270PF 1KV
A2 C3	0150-0121	C=F .1UF 50V
A2 C4	0150-0121	C=F .1UF 50V
A2 C5	0150-0093	C=F .01UF 100V
A2 C7	0150-0093	C=F .01UF 100V
A2 C8	0160-0174	C=F 4.7UF 25V
A2 C9	0160-0174	C=F 4.7UF 25V
A2 C11	0160-3712	C=F 330PF 400V
A2 C12	0160-3723	C=F .033UF 100V
A2 C13	0180-2111	C=F 33UF 35V
A2 C14	0160-2204	C=F 1000PF 300V
A2 C15	0150-0121	C=F .1UF 50V
A2 C16	0180-0374	C=F 10UF 20V
A2 C17	0180-0098	C=F 1000UF 20V
A2 C18	0150-0093	C=F .01UF 100V
A2 C19	0150-0093	C=F .01UF 100V
A2 C20	0150-0121	C=F .1UF 50V
A2 C22	0150-0121	C=F .1UF 50V
A2 C23	0150-0093	C=F .01UF 100V
A2 C27	0160-2139	C=F 22CPF 1KV
A2 C28	0160-2139	C=F 22CPF 1KV
A2 C30	0150-0121	C=F .1UF 50V
A2 C31	0150-0121	C=F .1UF 50V
A2 C32	0180-0098	C=F 1000UF 20V
A2 C33	0180-0098	C=F 1000UF 20V
A2 C34	0150-0121	C=F .1UF 50V
A2 C35	0150-0121	C=F .1UF 50V
A2 C36	0180-0374	C=F 10UF 20V
A2 C37	0180-0374	C=F 10UF 20V
A2 C38	0150-0121	C=F .1UF 50V
A2 C40	0180-0309	C=F 4.7UF 10V
A2 C41	0180-0309	C=F 4.7UF 10V
A2 C42	0150-0093	C=F .01UF 100V
A2 C43	0180-0229	C=F 33UF 10V
A2 C44	0160-0174	C=F 4.7UF 25V
A2 C45	0180-0097	C=F 47UF 35V
A2 C46	0150-0093	C=F .01UF 100V
A2 C47	0150-0093	C=F .01UF 100V
A2 C48	0150-0093	C=F .01UF 100V
A2 C49	0150-0093	C=F .01UF 100V
A2 C50	0160-2139	C=F 22CPF 1KV
A2 C51	0160-2139	C=F 22CPF 1KV
A2 C52	0160-2139	C=F 22CPF 1KV
A2 C53	0150-0093	C=F .01UF 100V
A2 C54	0150-0093	C=F .01UF 100V
A2 C55	0160-2139	C=F 22CPF 1KV
A2 C56	0160-2199	C=F 30PF 300V
A2 C57	0160-2199	C=F 30PF 300V
A2 CR1	1902-3105	DIO BRDN 5.62 V
A2 CR2	1902-3105	DIO BRDN 5.62 V
A2 CR3	1902-3105	DIO BRDN 5.62 V
A2 CR4	1902-3105	DIO BRDN 5.62 V
A2 CR5	1901-0533	DIO HOT CARR
A2 CR6	1901-0533	DIO HOT CARR
A2 CR7	1901-0040	DIO SI 30V .05A
A2 CR8	1901-0040	DIO SI 30V .05A
A2 CR9	1901-0179	DIO SI 15V .75W5
A2 CR10	1901-0179	DIO SI 15V .75W5
A2 CR11	1901-0179	DIO SI 15V .75W5
A2 CR12	1901-0179	DIO SI 15V .75W5
A2 CR13	1901-0040	DIO SI 30V .05A
A2 CR14	1901-0040	DIO SI 30V .05A
A2 CR15	1901-0179	DIO SI 15V .75W5
A2 CR16	1901-0179	DIO SI 15V .75W5
A2 CR17	1910-0022	DIO-RF 5V 1.2W5
A2 CR20	1902-3139	DIO BRDN 8.25 V
A2 CR21	1902-3139	DIO BRDN 8.25 V
A2 CR22	1902-0126	DIO BRDN 2.61 V
A2 CR23	1902-0126	DIO BRDN 2.61 V
A2 CR24	1901-0040	DIO SI 30V .05A
A2 CR25	1901-0040	DIO SI 30V .05A
A2 CR26	1901-0040	DIO SI 30V .05A
A2 CR27	1901-0040	DIO SI 30V .05A
A2 CR29	1901-0040	DIO SI 30V .05A
A2 CR30	1901-0040	DIO SI 30V .05A
A2 CR31	1901-0040	DIO SI 30V .05A
A2 CR32	1901-0040	DIO SI 30V .05A
A2 CR33	1902-3139	DIO BRDN 8.25 V
A2 CR34	1901-0179	DIO SI 15V .75W5
A2 CR35	1901-0179	DIO SI 15V .75W5
A2 E1	0490-0733	RELAY-REED SPST
A2 E2	0490-0733	RELAY-REED SPST
A2 L1	9100-1812	COIL CHOKE 330UH
A2 L2	9100-1812	COIL CHOKE 330UH
A2 L3	9100-2267	COIL-CHOKE 10UH
A2 MP33	1205-0033	HT-SINK TO-5
A2 MP34	1205-0033	HT-SINK TO-5
A2 Q1	1854-0240	BSTR 2N3227 SI
A2 Q2	1854-0240	BSTR 2N3227 SI
A2 Q3	1853-0203	BSTR SI PNP

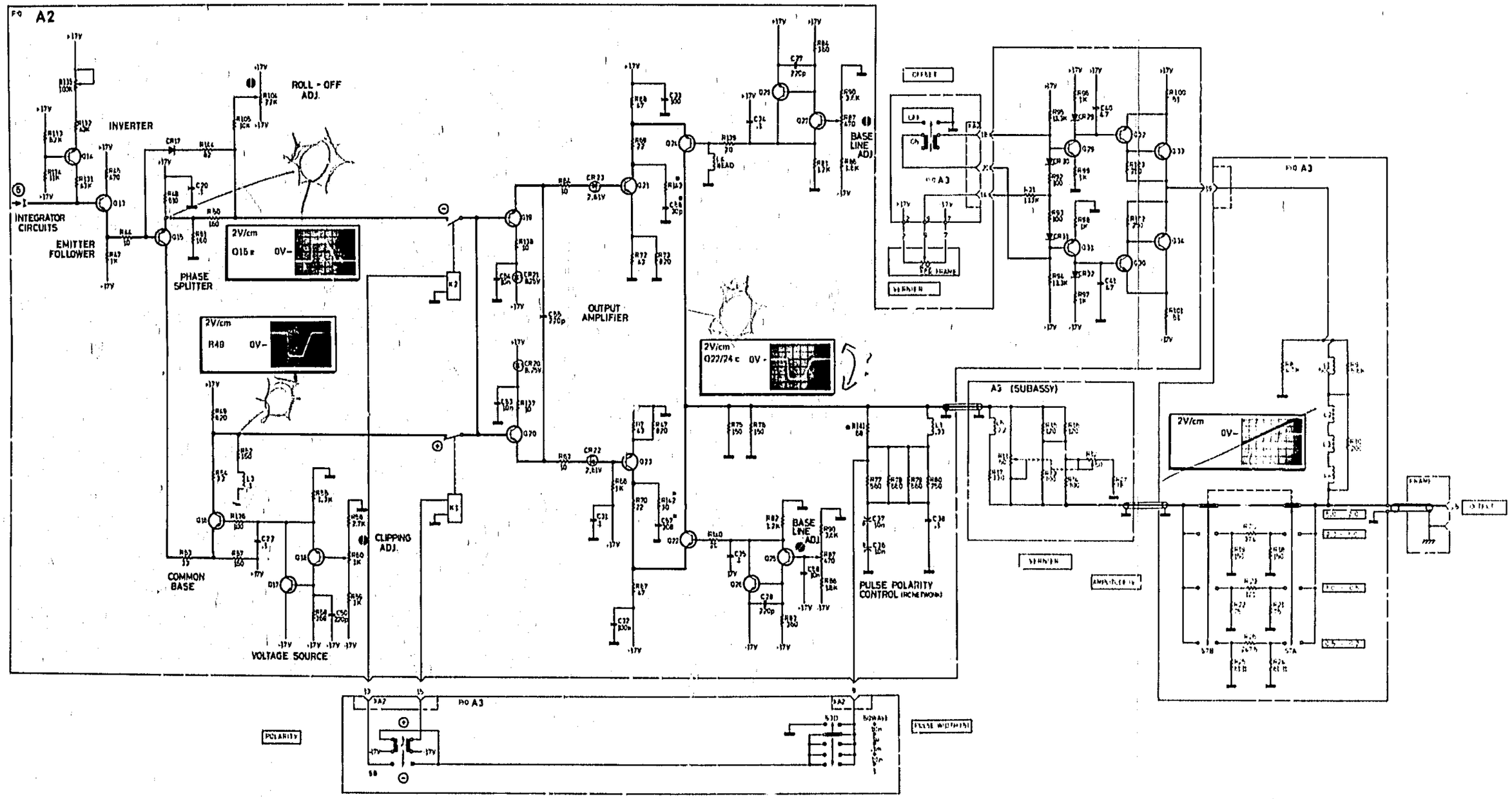
REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A2 Q4	1853-0203	BSTR SI PNP
A2 Q5	1854-0351	BSTR 2N3261 SI
A2 Q6	1854-0310	BSTR 2N3261 SI
A2 Q7	1854-0213	BSTR 2N3227A SI
A2 Q8	1853-0012	BSTR PNP SI
A2 Q9	1854-0307	BSTR SI NPN
A2 Q10	1853-0090	BSTR SI PNP
A2 Q11	1853-0090	BSTR SI PNP
A2 Q12	1854-0307	BSTR SI NPN
A2 Q13	1854-0247	BSTR 2N3227 SI
A2 Q14	1853-0090	BSTR SI PNP
A2 Q15	1205-0037	HT-SINK BSTR
A2 Q16	1853-0210	BSTR SI PNP
A2 Q17	1205-0037	HT-SINK BSTR
A2 Q18	1854-0260	BSTR 2N3227 SI
A2 Q27	1854-0307	BSTR SI NPN
A2 Q28	1853-0090	BSTR SI PNP
A2 Q29	1853-0203	BSTR SI PNP
A2 Q30	1854-0345	BSTR 2N5179 SI
A2 Q31	1205-0011	HT-SINK BSTR
A2 Q32	1854-0332	BSTR SI NPN
A2 Q33	1205-0237	HEAT DISSIP
A2 Q34	1854-0332	BSTR SI NPN
A2 Q35	1205-0011	HT-SINK BSTR
A2 Q36	1853-0701	BSTR SI PNP
A2 Q37	1205-0237	HEAT DISSIP
A2 Q38	1853-0201	BSTR SI PNP
A2 R1	0698-4232	R=F 110K 1% .125W
A2 R2	0757-0424	R=F 1.1K1% .125W
A2 R3	0698-0083	R=F 1.96K1%
A2 R4	0698-0083	R=F 1.96K1%
A2 R5	0757-0420	R=F 750 1% .125W
A2 R6	0757-0398	R=F 75 1% .125W
A2 R7	0683-4705	R=F 47 5% .25W
A2 R8	0698-4225	R=F 56 5% .125W
A2 R9	0683-4705	R=F 47 5% .25W
A2 R10	07 R-0127	R=F 430 5% .25W
A2 R11	0683-5705	R=F 30 5% .125W
A2 R12	0683-5705	R=F 30 5% .125W
A2 R13	0683-5705	R=F 30 5% .125W
A2 R14	0683-5705	R=F 30 5% .125W
A2 R17	0758-0042	R=F 200 5% .25W
A2 R18	0757-0280	R=F 1K1% .125W F
A2 R19	0757-0280	R=F 1K1% .125W F
A2 R20	0757-0422	R=F 909 1% .125W
A2 R21	0757-0422	R=F 909 1% .125W
A2 R22	0757-0280	R=F 1K1% .125W F
A2 R23	0757-0280	R=F 1K1% .125W F
A2 R24	0757-0280	R=F 1K1% .125W F
A2 R25	0757-0418	R=F 619 1% .125W
A2 R26	0757-0418	R=F 619 1% .125W
A2 R28	0698-4267	R=F 3.83K1% .125W
A2 R29	0698-4267	R=F 3.83K1% .125W
A2 R30	0698-4285	R=F 20K1% .125W
A2 R31	0698-4285	R=F 20K1% .125W
A2 R32	0698-4269	R=F 4.32K1% .125W
A2 R33	0698-4269	R=F 4.32K1% .125W
A2 R34	0698-4244	R=F 340 1% .125W
A2 R35	0698-4244	R=F 340 1% .125W
A2 R37	0758-0015	R=F 120 5% .25W
A2 R38	0758-0015	R=F 120 5% .25W
A2 R39	0758-0015	R=F 120 5% .25W
A2 R40	0698-4240	R=F 240 1% .125W
A2 R41	0698-4227	R=F 68 1% .125W
A2 R42	0698-4802	R=F 10 1% .125W
A2 R44	0698-4802	R=F 10 1% .125W
A2 R45	0698-4246	R=F 470 1% .125W
A2 R47	0698-4254	R=F 1K1% .125W F
A2 R48	0758-0030	R=F 510 5% .25W
A2 R49	0758-0026	R=F 470 5% .25W
A2 R50	0698-4233	R=F 120 1% .125W
A2 R51	0698-4254	R=F 1K1% .125W F
A2 R52	0698-4235	R=F 150 1% .125W
A2 R53	0698-5703	R=F 33 1% .125W
A2 R54	0698-5703	R=F 33 1% .125W
A2 R55	0698-4257	R=F 1.33K1% .125W
A2 R56	0698-4264	R=F 2.74K1% .125W
A2 R57	0758-0007	R=F 150 5% .25W

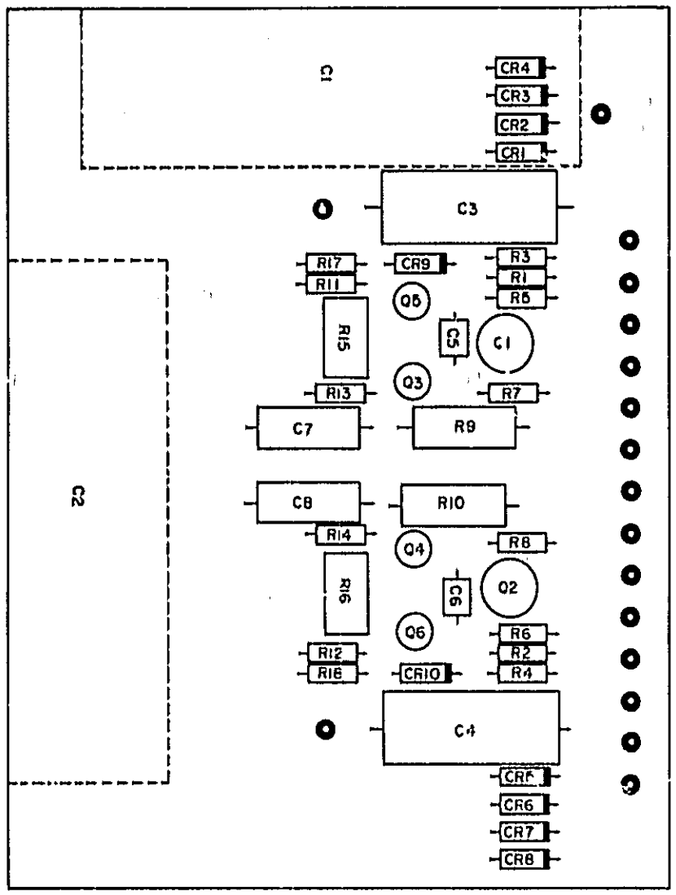
REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION
A2 R58	0698-4244	R=F 340 1% .125W
A2 R59	0698-4255	R=F 1.5K1% .125W F
A2 R60	2100-2795	R-VAR 1K .5W
A2 R61	0698-4802	R=F 10 1% .125W
A2 R64	0698-4254	R=F 1K1% .125W F
A2 R65	0698-4254	R=F 1K1% .125W F
A2 R66	0698-4254	R=F 1K1% .125W F
A2 R67	0698-3698	R=F 47 1% 1W MF
A2 R68	0698-3698	R=F 47 1% 1W MF
A2 R69	0698-3814	R=F 22 1% .25W F
A2 R70	0698-3814	R=F 22 1% .25W F
A2 R71	0698-3697	R=F 43 1% 1W MF
A2 R72	0698-3697	R=F 43 1% 1W MF
A2 R73	0698-4252	R=F 825 1% .125W
A2 R74	0698-4252	R=F 825 1% .125W
A2 R75	0761-0035	R=F 150 5% 1W MF
A2 R76	0761-0035	R=F 150 5% 1W MF
A2 R77	0761-0057	R=F 560 5% 1W MF
A2 R78	0761-0057	R=F 560 5% 1W MF
A2 R79	0761-0057	R=F 560 5% 1W MF
A2 R80	0758-0047	R=F 750 5% .25W
A2 R81	0698-4256	R=F 1.37K1% .125W
A2 R82	4[illegible]-4256	R=F 1.37K1% .125W
A2 R83	[illegible]-4244	R=F 340 1% .125W
A2 R84	0698-4244	R=F 340 1% .125W
A2 R85	0698-4259	R=F 1.6K1% .125W
A2 R86	0698-4259	R=F 1.6K1% .125W
A2 R87	2100-2795	R-VAR 1K .5W
A2 R88	2100-2795	R-VAR 1K .5W
A2 R89	0698-4267	R=F 3.83K1% .125W
A2 R90	0698-4267	R=F 3.83K1% .125W
A2 R91	0757-0289	R=F 13.3K1%
A2 R92	0758-0086	R=F 100 5% .125W
A2 R93	0758-0086	R=F 100 5% .125W
A2 R94	0757-0289	R=F 13.3K1%
A2 R95	0757-0289	R=F 13.3K1%
A2 R96	0757-0280	R=F 1K1% .125W F
A2 R97	0757-0280	R=F 1K1% .125W F
A2 R98	0757-0280	R=F 1K1% .125W F
A2 R99	0757-0280	R=F 1K1% .125W F
A2 R100	0760-0012	R=F 51 2% 1W MO
A2 R101	0760-0012	R=F 51 2% 1W MO
A2 R102	0698-4231	R=F 750 5% .125W
A2 R103	0698-4231	R=F 750 5% .125W
A2 R104	2100-2740	R-VAR 20K .5W CE
A2 R105	0698-4278	R=F 10K5% .125W
A2 R106	0698-4286	R=F 22K5% .125W
A2 R107	0698-4286	R=F 22K5% .125W
A2 R108	0698-4286	R=F 22K5% .125W
A2 R109	0698-4286	R=F 22K5% .125W
A2 R110	0698-4280	R=F 12K5% .125W
A2 R111	0698-4280	R=F 12K5% .125W
A2 R112	0698-4280	R=F 12K5% .125W
A2 R113	0698-4280	R=F 12K5% .125W
A2 R114	0698-4278	R=F 10K5% .125W
A2 R115	0698-4278	R=F 10K5% .125W
A2 R116	0698-4278	R=F 10K5% .125W
A2 R117	0698-4278	R=F 10K5% .125W
A2 R119	0698-3153	R=F 3.83K1%
A2 R120	0698-3155	R=F 4.64K1%
A2 R121	0698-4243	R=F 330 5% .125W
A2 R122	0758-0024	R=F 100 5% .25W
A2 R123	0758-0026	R=F 150 5% .125W
A2 R124	0758-0026	R=F 150 5% .125W
A2 R125	0698-4744	R=F 20 5% .125W
A2 R126	0698-4744	R=F 20 5% .125W
A2 R127	0698-4304	R=F 121K5% .125W
A2 R128	0698-4304	R=F 121K5% .125W
A2 R129	0698-4285	R=F 20K5% .125W
A2 R130	2100-2782	R-VAR 100K .5W
A2 R131	0698-4293	R=F 432K5% .125W
A2 R132	0698-4293	R=F 432K5% .125W
A2 R133	0698-4279	R=F 6.25K5% .125W
A2 R134	0698-4279	R=F 6.25K5% .125W
A2 R135	2100-2782	R-VAR 100K .5W
A2 R136	0758-0026	R=F 150 5% .125W
A2 R137	0698-4802	R=F 10 1% .125W
A2 R138	0698-4802	R=F 10 1% .125W
A2 R139	0698-4744	R=F 20 5% .125W
A2 R140	0698-4744	R=F 20 5% .125W
A2 R141	0698-4227	R=F 68 1% .125W
A2 R142	0698-5702	R=F 30 5% .125W
A2 R143	0698-5702	R=F 30 5% .125W
A2 R144	0698-4230	R=F 82 5% .125W





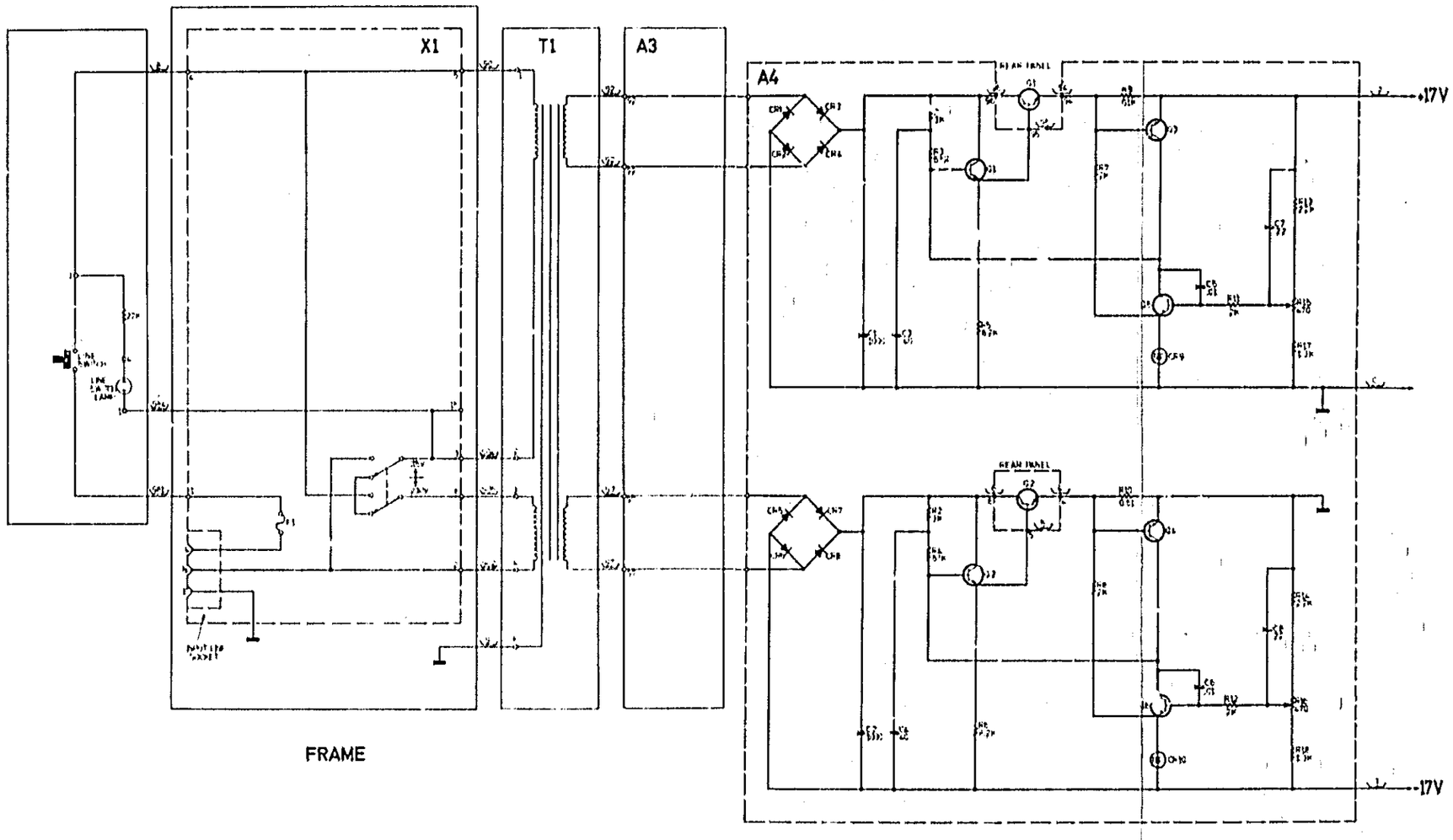
REFERENCE DESIGNATOR		H·P PART NUMBER	DESCRIPTION
A3	A3	08012-63401	AY BRIDGE ATT
A3	L1	9140-0118	COIL-CHOKE 500UH
A3	L2	9170-0029	FERRITE BEAD
A3	L3	9170-0029	FERRITE BEAD
A3	L4	9170-0029	FERRITE BEAD
A3	L5	9140-0098	COIL-CHOKE 2.2UH
A3	R8	0698-4270	R-F 4.7K5% .125W
A3	R9	0698-4272	R-F 5.6K5% .125W
A3	R10	0698-4238	R-F 200 5% .125W
A3	R11	2100-3104	R-VAR 50 10% 5W
A3	R12	2100-3104	R-VAR 50 10% 5W
A3	R13	0758-0024	R-F 100 5% .25W
A3	R14	0758-0024	R-F 100 5% .25W
A3	R15	0758-0013	R-F 120 5% .25W
A3	R16	0758-0013	R-F 120 5% .25W
A3	R17	0698-4243	R-F 330 5% .125W
A3	R18	0757-0715	R-F 150 1% .25W
A3	R19	0757-0715	R-F 150 1% .25W
A3	R20	0698-6213	R-F 37.4 1% 1/4W
A3	R21	0757-0710	R-F 75 1% .25W F
A3	R22	0757-0710	R-F 75 1% .25W F
A3	R23	0757-0403	R-F 121 1% .125W
A3	R24	0757-0067	R-F 61.11 1%
A3	R25	0757-0067	R-F 61.11 1%
A3	R26	0757-0071	R-F 247.5 1%
A3	R27	0698-5802	R-F 18 5% 1/4W
A3	S1	5040-1109	SLIDAY
A3	S2	5040-1109	SLIDAY
A3	S3	5040-1110	SLIDAY
A3	S4	5040-1111	SLIDAY
A3	S5	5040-1112	SLIDAY
A3	S8	3101-1311	SW SLIDE DPDT
A3	S9	3101-1311	SW SLIDE DPDT
A3	X1	1251-2026	CONN PC 36CONT R
A3	X2	1251-2034	CONN PC 20CONT R





REFERENCE DESIGNATOR		HP PART NUMBER	DESCRIPTION
A4	C1	0180-1784	C-F 1000UF 40V
A4	C2	0180-1784	C-F 1000UF 40V
A4	C3	0180-0050	C-F 40UF 50V
A4	C4	0180-0050	C-F 40UF 50V
A4	C5	0160-2930	C-F .01UF 100V
A4	C6	0160-2930	C-F .01UF 100V
A4	C7	0180-0228	C-F 22UF 15V
A4	C8	0180-0228	C-F 22UF 15V
A4	CR1	1901-0049	DIO SI 50V .75A
A4	CR2	1901-0049	DIO SI 50V .75A
A4	CR3	1901-0049	DIO SI 50V .75A
A4	CR4	1901-0049	DIO SI 50V .75A
A4	CR5	1901-0049	DIO SI 50V .75A
A4	CR6	1901-0049	DIO SI 50V .75A
A4	CR7	1901-0049	DIO SI 50V .75A
A4	CR8	1901-0049	DIO SI 50V .75A
A4	CR9	1902-0049	DIO BKDN 6.19 V
A4	CR10	1902-0049	DIO BKDN 6.19 V
A4	Q1	1854-0013	XSTR 2N2218A SI
A4	Q2	1854-0013	XSTR 2N2218A SI
A4	Q3	1854-0307	XSTR SI NPN
A4	Q4	1854-0307	XSTR SI NPN
A4	Q5	1854-0307	XSTR SI NPN
A4	Q6	1854-0307	XSTR SI NPN
A4	R1	0698-4265	R-F 3K5% .125W F
A4	R2	0698-4265	R-F 3K5% .125W F
A4	R3	0698-4271	R-F 5.1K5% .125W
A4	R4	0698-4271	R-F 5.1K5% .125W
A4	R5	0698-4276	R-F 8.2K5% .125W
A4	R6	0698-4276	R-F 8.2K5% .125W
A4	R7	0698-4261	R-F 2K5% .125W F
A4	R8	0698-4261	R-F 2K5% .125W F
A4	R9	0811-0929	R-F .51 5% 2W PW
A4	R10	0811-0929	R-F .51 5% 2W PW
A4	R11	0698-4261	R-F 2K5% .125W F
A4	R12	0698-4261	R-F 2K5% .125W F
A4	R13	0698-4262	R-F 2.2K5% .125W
A4	R14	0698-4262	R-F 2.2K5% .125W
A4	R15	2100-2741	R-VAR 470 2W CER
A4	R16	2100-2741	R-VAR 470 2W CER
A4	R17	0698-4257	R-F 1.3K5% .125W
A4	R18	0698-4257	R-F 1.3K5% .125W

PARTS LIST CON'T



MANUAL CHANGES

MANUAL CHANGES

MODEL 8012A

PULSE GENERATOR

Manual Serials Prefixed: G1121
Manual Printed: MARCH 1973

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
1228A	Manual applies		

ERRATA

Page 6-1,
Add the following paragraph:

6-6a: An asterisk (*) following the HP Part No. in a parts list indicates that the value shown is a nominal value. The actual value may be different as selected at the factory.

Page 6-4, Parts List Table,
R3: Change description to read R-VAR 50K .25W CC.
T1: Change to HP Part No. 9100-3255, XFMR PWR.
W2: Change to HP Part No. 08012-71606, SCREENED PWR CABLE.
W3: Change to HP Part No. 08012-71603, CABLE COAX AY.
W4: Change reference designator to W4A and W4B. List as follows:
W4A: HP Part No. 08012-71601, CBL COAX AY.
W4B: HP Part No. 08012-71602, CBL COAX AY.
W5: Change to HP Part No. 08012-71605, CBL AY COAX 2.

Page 6-5, Parts List Table,
A1C5: Change to HP Part No. 0140-0203, C-F 30 PF 5%.
A1C11: Change to HP Part No. 0160-3650, C-F .018 UF 10% 50V.
Delete: A1L19.
A1R4: Change to HP Part No. 0757-0895, R-F 62 2% .125W.
A1R7: Change to HP Part No. 0757-0954, R-F 18K 2% .125W.
A1R12: Change to HP Part No. 0757-0908, R-F 220 2% .125W.
A1R14: Change to HP Part No. 0757-0927, R-F 1300 2% .125W.
A1R16: Change to HP Part No. 0757-0907, R-F 200 2% .125W.

Page 6-6, Parts List Table, (Cont'd)
A1R17: Change to HP Part No. 0757-0894, R-F 56 2% .125W.
A1R18: Change to HP Part No. 0757-0948, R-F 10K 2% .125W.
A1R19: Change to HP Part No. 0757-0898, R-F 82 2% .125W.
A1R20: Change to HP Part No. 0757-0910, R-F 270 2% .125W.
A1R21: Change to HP Part No. 0757-0925, R-F 1100 2% .125W.
A1R22: Change to HP Part No. 0757-0954, R-F 18K 2% .125W.
A1R23: Change to HP Part No. 0757-0931, R-F 2000 2% .125W.
A1R24: Change to HP Part No. 0757-0929, R-F 1600 2% .125W.
A1R25: Change to HP Part No. 0757-0906, R-F 180 2% .125W.
A1R26: Change to HP Part No. 0757-0949, R-F 11K 2% .125W.
A1R27: Change to HP Part No. 0757-0948, R-F 10K 2% .125W.
A1R28: Change to HP Part No. 0757-0948, R-F 10K 2% .125W.
A1R30: Change to HP Part No. 0757-0937, R-F 3600 2% .125W.
A1R33: Change to HP Part No. 0757-0903, R-F 130 2% .25W.
A1R35: Change to HP Part No. 0757-0400, R-F 90.9 1% .125W.
A1R36: Change to HP Part No. 0757-0903, R-F 130 2% .125W.
A1R39: Change to HP Part No. 0757-0941, R-F 5100 2% .125W.

20 June 1973
Δ = Latest additions to this change sheet.
This change sheet supersedes all prior change sheets for this manual.

Supplement A for
08012-90001

ERRATA (Cont'd)

Page 6-6, Parts List Table, (Cont'd)

A1R40: Change to HP Part No. 0757-0420, R-F 750 1% ,125W.
A1R45: Change to HP Part No. 0757-0907, R-F 200 2% ,125W.
A1R48: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R49: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R50: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R51: Change to HP Part No. 0757-0944, R-F 6800 2% ,125W.
A1R52: Change to HP Part No. 0757-0949, R-F 11K 2% ,125W.
A1R53: Change to HP Part No. 0757-0949, R-F 11K 2% ,125W.
A1R54: Change to HP Part No. 0757-0926, R-F 1200 2% ,125W.
A1R55: Change to HP Part No. 0757-0926, R-F 1200 2% ,125W.
A1R59: Change to HP Part No. 0757-0929, R-F 1600 2% ,125W.
A1R60: Change to HP Part No. 0757-0935, R-F 3000 2% ,125W.
A1R61: Change to HP Part No. 0757-0935, R-F 3000 2% ,125W.
A1R62: Change to HP Part No. 0698-7029, R-F 39 2% ,125W.
A1R65: Change to HP Part No. 0757-0930, R-F 1800 2% ,125W.
A1R66: Change to HP Part No. 0757-0953, R-F 16K 2% ,125W.
A1R68: Change to HP Part No. 0757-0278, R-F 1780 1% ,125W. (FACTORY-SELECTED VALUE, NOMINAL VALUE SHOWN).
A1R70: Change to HP Part No. 0757-0934, R-F 2700 2% ,125W.
A1R71: Change to HP Part No. 0757-0934, R-F 2700 2% ,125W.
A1R71: Delete entry for 43 ohms.
A1R72: Change to HP Part No. 0757-0934, R-F 2700 2% ,125W.
A1R72: Delete entry for 43 ohms.
A1R73: Change to HP Part No. 0757-0957, R-F 24K 2% ,125W.
A1R74: Change to HP Part No. 0757-0957, R-F 24K 2% ,125W.
A1R75: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R76: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R78: Change to HP Part No. 0757-0390, R-F 36.5 1% ,125W.
A1R80: Change to HP Part No. 0757-0390, R-F 36.5 1% ,125W.
A1R81: Change to HP Part No. 0757-0928, R-F 1600 2% ,125W.

Page 6-6, Parts List Table, (Cont'd)

A1R82: Change to HP Part No. 0757-0910, R-F 270 2% 125W.
A1R83: Change to HP Part No. 0757-0903, R-F 130 2% ,125W.
A1R84: Change to HP Part No. 0757-0076, R-F 560 2% ,125W.
A1R85: Change to HP Part No. 0757-0930, R-F 1800 2% ,125W.

Page 6-8, Parts List Table,

A1R86: Change to HP Part No. 0757-0904, R-F 150 2% ,125W.
A1R87: Change to HP Part No. 0757-0904, R-F 150 2% ,125W.
A1R88: Change to HP Part No. 0757-0908, R-F 220 2% ,125W.
A1R89: Change to HP Part No. 0757-0389, R-F 33.2 1% ,125W.
A1R91: Change to HP Part No. 0757-0957, R-F 24K 2% ,125W.
A1R92: Change to HP Part No. 0757-0957, R-F 24K 2% ,125W.
A1R93: Change to HP Part No. 0757-0957, R-F 24K 2% ,125W.
A1R99: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R100: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R101: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R102: Change to HP Part No. 0757-0934, R-F 2700 2% ,125W.
A1R103: Change to HP Part No. 0757-0934, R-F 2700 2% ,125W.
A1R104: Change to HP Part No. 0757-0934, R-F 2700 2% ,125W.
A1R105: Change to HP Part No. 0757-0390, R-F 36.5 1% ,125W.
A1R106: Change to HP Part No. 0683-4705, R-F 47 5% ,25W.
A1R107: Change to HP Part No. 0757-0928, R-F 1600 2% ,125W.
A1R108: Change to HP Part No. 0757-0390, R-F 36.5 1% ,125W.
A1R109: Change to HP Part No. 0757-091C, R-F 270 2% ,125W.
A1R110: Change to HP Part No. 0757-0903, R-F 130 2% ,125W.
A1R112: Change to HP Part No. 0757-0948, R-F 10K 2% ,125W.
A1R113: Change to HP Part No. 0757-0930, R-F 1800 2% ,125W.
A1R116: Change to HP Part No. 0757-0948, R-F 10K 2% ,125W.
A1R117: Change to HP Part No. 0757-0948, R-F 10K 2% ,125W.
A1R119: Change to HP Part No. 0757-0934, R-F 2700 2% ,125W.

ERRATA (Cont'd)

Page 6-8, Parts List Table, (Cont'd)
A1R121: Change to HP Part No. 0757-0907, R-F 200 2% ,125W.
A1R125: Change to HP Part No. 0757-0940, R-F 4700 2% ,125W.
A1R127: Chang to HP Part No. 0757-0898, R-F 82 2% ,125W.
A1R128: Change to HP P t No. 0757-0912, R-F 330 2% ,125W.
A1R130: Change to HP Part No. 0757-0420, R-F 750 1% ,125W.
A1R132: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R133: Change to HP Part No. 0757-0927, R-F 1300 2% ,125W.
A1R134: Change to HP Part No. 0757-0907, R-F 200 2% ,125W.
A1R135: Change to HP Part No. 0757-0939, R-F 4300 2% ,125W.
A1R136: Change to HP Part No. 0757-0910, R-F 270 2% ,125W.
A1R137: Change to HP Part No. 0757-0932, R-F 2200 2% ,125W.
A1R138: Change to HP Part No. 0757-0926, R-F 1200 2% ,125W.
A1R139: Change to HP Part No. 0757-0907, R-F 200 2% ,125W.
A1R141: Change to HP Part No. 0757-0911, R-F 300 2% ,125W.
A1R142: Change to HP Part No. 0698-6994, R-F 30 2% ,125W.
A1R143: Change to HP Part No. 0757-0940, R-F 4700 2% ,125W.
A1R145: Change to HP Part No. 0757-0906, R-F 180 2% ,125W.
A1R158: Change to HP Part No. 0757-0936, R-F 3300 2% ,125W.
A1R159: Change to HP Part No. 0757-0384, R-F 20 1% ,125W.
A1R161: Change to HP Part No. 0757-0926, R-F 1200 2% ,125W.
A1R162: Change to HP Part No. 0757-0957, R-F 24K 2% ,125W.
A1R163: Change to HP Part No. 0757-0941, R-F 5100 2% ,125W.
A1R167: Change to HP Part No. 0757-0907, R-F 200 2% ,125W.
A1R168: Change to HP Part No. 0757-0940, R-F 4700 2% ,125W.
A1R169: Change to HP Part No. 0757-0923, R-F 910 2% ,125W.
A1R173: Change to HP Part No. 0757-0894, R-F 56 2% ,125W.
A1R174: Change to HP Part No. 0757-0911, R-F 300 2% ,125W.
A1R175: Change to HP Part No. 0757-0943, R-F 6200 2% ,125W.

Page 6-8, Parts List Table, (Cont'd)
A1R176: Change to HP Part No. 0757-0909, R-F 240 2% ,125W.
A1R183: Change to HP Part No. 0698-6994, R-F 30 2% ,125W.
A1T11: Change reference designator to A1L11.

Page 6-14, Part List Table,
A2C56: Change to HP Part No. 0160-2139, C-F 220 PF +80-20% 1000V.
A2C57: Change to HP Part No. 0160-2139, C-F 220 PF +80-20% 1000V.
A2C58: Change to HP Part No. 0150-0069, C-F .001 UF 500V.
A2C59: Change to HP Part No. 0160-0174, C-F .47 UF 25V.
A2CR20: Change to HP Part No. 1902-3104, DIO BKDN 5.62V.
A2CR21: Change to HP Part No. 1902-3104, DIO BKDN 5.62V.
A2CR22: Change to HP Part No. 1902-3126, DIO BKDN 7.15V.
A2CR23: Change to HP Part No. 1902-3126, DIO BKDN 7.15V.
Add: A2CR36, HP Part No. 1901-0533, DIO HOT CARR.
Add: A2CR37, HP Part No. 1901-0533, DIO HOT CARR.
Add: A2CR38, HP Part No. 1902-0049, DIO BKDN 6.19V.
Add: A2CR39, HP Part No. 1902-0049, DIO BKDN 6.19V.
A2K1: Change to HP Part No. 0490-1079, RELAY-REED SPST.
A2K2: Change to HP Part No. 0490-1079, RELAY-REED SPST.
Add: A2MP37, HP Part No. 1205-0037, HT-SINK XSTR.
A2Q5: Change to HP Part No. 1854-0354, XSTR SI NPN.
A2Q6: Change to HP Part No. 1854-0354, XSTR SI NPN.
A2Q20: Add to description, May be 1854-0354 (chosen to meet rise time requirements).
A2Q21: Change to HP Part No. 1205-0033, HT-SINK XSTR.
A2Q21: Change to HP Part No. 1853-0201, XSTR SI PNP.
A2Q23: Change to HP Part No. 1205-0033, HT-SINK XSTR.
A2Q23: Change to HP Part No. 1854-0332, XSTR SI NPN.
Add: A2Q37, HP Part No. 1853-0036, XSTR SI PNP 2N3906.
Add: A2Q38, HP Part No. 1854-0215, XSTR SI NPN 2N3904.
A2R1: Change to HP Part No. 0757-0901, R-F 110 2% ,125W.

ERRATA (Cont'd)

Page 6-14, Parts List Table,

A2R8: Change to HP Part No. 0757-0394, R-F 66 2% .125W.
A2R11: Change to HP Part No. 0698-6994, R-F 30 2% .125W.
A2R12: Change to HP Part No. 0698-6994, R-F 30 2% .125W.
A2R13: Change to HP Part No. 0698-6994, R-F 30 2% .125W.
A2R14: Change to HP Part No. 0698-6994, R-F 30 2% .125W.
A2R28: Change to HP Part No. 0757-0937, R-F 3600 2% .125W.
A2R29: Change to HP Part No. 0757-0937, R-F 3600 2% .125W.
A2R30: Change to HP Part No. 0698-3136, R-F 17.8K 1% .125W.
A2R31: Change to HP Part No. 0698-3136, R-F 17.8K 1% .125W.
A2R32: Change to HP Part No. 0698-3155, R-F 4640 1% .125W.
A2R33: Change to HP Part No. 0698-3155, R-F 4640 1% .125W.
A2R34: Change to HP Part No. 0757-0913, R-F 360 2% .125W.
A2R35: Change to HP Part No. 0757-0913, R-F 360 2% .125W.
A2R39: Add FACTORY-SELECTED VALUE, NOMINAL VALUE SHOWN.
A2R40: Change to HP Part No. 0757-0909, R-F 240 2% .125W. (FACTORY-SELECTED VALUE, NOMINAL VALUE SHOWN).
A2R41: Change to HP Part No. 0757-0896, R-F 68 2% .125W.
A2R45: Change to HP Part No. 0757-0916, R-F 470 1% .125W.
A2R50: Change to HP Part No. 0757-0898, R-F 82 2% .125W.
A2R51: Change to HP Part No. 0757-0905, R-F 160 2% .125W.
A2R52: Change to HP Part No. 0757-0904, R-F 150 2% .125W.
A2R53: Change to HP Part No. 0757-0389, R-F 33.2 1% .125W.
A2R54: Change to HP Part No. 0757-0389, R-F 33.2 1% .125W.
A2R55: Change to HP Part No. 0757-0927, R-F 1300 2% .125W.
A2R56: Change to HP Part No. 0757-0934, R-F 2700 2% .125W.
A2R58: Change to HP Part No. 0757-0913, R-F 360 2% .125W.

Page 6-14, Parts List Table, (Cont'd)

A2R59: Change to HP Part No. 0757-0935, R-F 3000 2% .125W.
A2R63: Change to HP Part No. 0698-6994, R-F 30 2% .125W.
A2R64: Change to HP Part No. 0698-6994, R-F 30 2% .125W.
A2R65: Change to HP Part No. 0757-0400, R-F 90.9 1% .125W.
A2R66: Change to HP Part No. 0757-0400, R-F 90.9 1% .125W.
A2R69: Change to HP Part No. 0757-0954, R-F 18K 2% .125W.
A2R70: Change to HP Part No. 2100-2742, R-VAR 10K .5W.
A2R71: Change to HP Part No. 0698-5887, R-F 30 5% .25W.
A2R72: Change to HP Part No. 0698-5887, R-F 30 5% .25W.
A2R73: Change to HP Part No. 0757-0417, R-F 562 1% .125W.
A2R74: Change to HP Part No. 0757-0417, R-F 562 1% .125W.
A2R75: Change to HP Part No. 0760-0027, R-F 150 2% 1W.
A2R76: Change to HP Part No. 0760-0027, R-F 150 2% 1W.
A2R81: Change to HP Part No. 0757-0926, R-F 1200 2% .125W.
A2R82: Change to HP Part No. 0757-0926, R-F 1200 2% .125W.
A2R83: Change to HP Part No. 0757-0913, R-F 360 2% .125W.
A2R84: Change to HP Part No. 0757-0913, R-F 360 2% .125W.
A2R85: Change to HP Part No. 0757-0929, R-F 1600 2% .125W.
A2R86: Change to HP Part No. 0757-0929, R-F 1600 2% .125W.
A2R89: Change to HP Part No. 0757-0937, R-F 3600 2% .125W.
A2R90: Change to HP Part No. 0757-0937, R-F 3600 2% .125W.
A2R102: Change to HP Part No. 0757-0420, R-F 750 1% .125W.
A2R103: Change to HP Part No. 0757-0420, R-F 750 1% .125W.
A2R105: Change to HP Part No. 0757-0926, R-F 1200 2% .125W.
A2R106: Change to HP Part No. 0757-0956, R-F 22K 2% .125W.

ERRATA (Cont'd)

Page 6-14, Parts List Table, (Cont'd)
A2R107: Change to HP Part No. 0757-0956, R-F 22K 2% .125W.
A2R108: Change to HP Part No. 0757-0956, R-F 22K 2% .125W.
A2R109: Change to HP Part No. 0757-0956, R-F 22K 2% .125W.
A2R110: Change to HP Part No. 0757-0950, R-F 12K 2% .125W.
A2R111: Change to HP Part No. 0757-0950, R-F 12K 2% .125W.
A2R112: Change to HP Part No. 0757-0950, R-F 12K 2% .125W.
A2R113: Change to HP Part No. 0757-0950, R-F 12K 2% .125W.
A2R114: Change to HP Part No. 0757-0948, R-F 10K 2% .125W.
A2R115: Change to HP Part No. 0757-0948, R-F 10K 2% .125W.
A2R116: Change to HP Part No. 0757-0948, R-F 10K 2% .125W.
A2R117: Change to HP Part No. 0757-0948, R-F 10K 2% .125W.
A2R121: Change to HP Part No. 0757-0912, R-F 330 2% .125W.
A2R125: Change to HP Part No. 0757-0384, R-F 20 1% .125W.
A2R126: Change to HP Part No. 0757-0384, R-F 20 1% .125W.
A2R127: Change to HP Part No. 0757-0471, R-F 182K 1% .125W. (FACTORY-SELECTED VALUE, NOMINAL VALUE SHOWN).
A2R128: Change to HP Part No. 0757-0471, R-F 182K 1% .125W. (FACTORY-SELECTED VALUE, NOMINAL VALUE SHOWN).
A2R129: Change to HP Part No. 0757-0942, R-F 5600 2% .125W.
A2R130: Change to HP Part No. 2100-2740, R-VAR 22K .5W.
A2R131: Change to HP Part No. 0757-0963, R-F 43K 2% .125W.
A2R132: Change to HP Part No. 0757-0963, R-F 43K 2% .125W.
A2R133: Change to HP Part No. 0757-0943, R-F 6200 2% .125W.
A2R134: Change to HP Part No. 0757-0949, R-F 11K 2% .125W.
A2R136: Add FACTORY-SELECTED VALUE, NOMINAL VALUE SHOWN.
A2R137: Change to HP Part No. 0698-0084, R-F 21. 1% .125W
A2R138: Change to HP Part No. 0698-0084, R-F 2150 1% .125W.

Page 6-14, Parts List Table, (Cont'd)
A2R139: Change to HP Part No. 0757-0384, R-F 20 1% .125W.
A2R140: Change to HP Part No. 0757-0384, R-F 20 1% .125W.
A2R141: Change to HP Part No. 0757-0901, R-F 110 2% .125W.
A2R142: Change to HP Part No. 0757-0923, R-F 910 2% .125W.
A2R143: Change to HP Part No. 0757-0923, R-F 910 2% .125W.
A2R144: Change to HP Part No. 0757-0898, R-F 82 2% .125W.

Page 6-16, Parts List Table,
A3A3: Change to HP Part No. 08012-73401.
A3L2, A3L3, A3L4: Change to 08007-71301, JUMPER ASSY CONSISTS OF A3L3, A3L4, and A3L5.
A3L5: Change reference designator to read A3A3L5.
A3R8: Change to HP Part No. 0757-0940, R-F 4700 2% .125W.
A3R9: Change to HP Part No. 0757-0942, R-F 5600 2% .125W.
A3R10: Change to HP Part No. 0757-0907, R-F 200 2% .125W.
A3R11: Change reference designator to read A3A3R11.
A3R12: Change reference designator to read A3A3R12.
A3R13: Change reference designator to read A3A3R13.
A3R14: Change reference designator to read A3A3R14.
A3R15: Change to A3A3R15, HP Part No. 0757-0069, R-F 121 1% .25W.
A3R16: Change to A3A3R16, HP Part No. 0757-0069, R-F 121 1% .25W.
A3R17: Change to A3A3R17, HP Part No. 0757-0912, R-F 330 2% .125W.
A3R27: Change to A3A3R27, HP Part No. 0757-0294, R-F 17.8 1% .125W.
A3S1: Change HP Part No. to 5080-9685.
A3S2: Change HP Part No. to 5080-9685.
A3S3: Change HP Part No. to 5080-9686.
A3S4: Change HP Part No. to 5080-9687.
A3S5: Change HP Part No. to 5080-9688.

Page 6-18, Parts List Table,
A4R1: Change to HP Part No. 0757-0935, R-F 3000 2% .125W.
A4R2: Change to HP Part No. 0757-0935, R-F 3000 2% .125W.
A4R3: Change to HP Part No. 0757-0941, R-F 5100 2% .125W.
A4R4: Change to HP Part No. 0757-0941, R-F 5100 2% .125W.
A4R5: Change to HP Part No. 0757-0946, R-F 8200 2% .125W.

ERRATA (Cont'd)

Page 6-18, Parts List Table, (Cont'd)
A4R6: Change to HP Part No. 0757-0946, R-F 8200 2% .125W.
A4R7: Change to HP Part No. 0757-0931, R-F 2000 2% .125W.
A4R8: Change to HP Part No. 0757-0931, R-F 2000 2% .125W.
A4R11: Change to HP Part No. 0757-0931, R-F 2000 2% .125W.
A4R12: Change to HP Part No. 0757-0931, R-F 2000 2% .125W.
A4R13: Change to HP Part No. 0757-0932, R-F 2200 2% .125W.
A4R14: Change to HP Part No. 0757-0932, R-F 2200 2% .125W.
A4R17: Change to HP Part No. 0757-0927, R-F 1300 2% .125W.
A4R18: Change to HP Part No. 0757-0927, R-F 1300 2% .125W.

Diagram 1,
Add: A1C68 (10 uF) from −17V lead of A1R3 to ground. Show electrolitic symbol with positive end of A1C68 to ground.
A1C6: Change value to 30 pF.
A1C25: Show symbol connected from −17V to ground.
A1R33: Change value to 3600.
A1C11: Change value to 150.
A1R59: Change value to 1600.
Delete: A1L19. Connect A1R33 directly to ground.
A1R35: Change value to 90.9.

Diagram 2,
A1R123: Change value to 681.
A1R150: Change value to 10.
A1R174: Change value to 300.
A1R175: Change value to 6.2K.
Add: A1R44 (100 ohms) in signal path from A1Q12-collector to A1Q16-emitter.
A1R154 (in A1Q16-base): Change reference designator to A1R144.
Add: A1R140 (100 ohms) in signal path from A1Q16-collector to junction A1Q22/A1Q52.
A1R138: Change value to 120.

Diagram 3,
A1R78: Change value to 36.5
A1CR19: Add value of 6.19V.
A1CR21: Add value of 2.61V.
A1C83: Change reference designator to A1C38.
A1R80: Change value to 36.5
Add: A1R96 (100 ohms) in signal path from collector of A1Q33.

Diagram 4,
A1R89: Change value to 33.2.
A1R54: Change reference designator to A1R94.
A1R105: Change value to 36.5.
A1CR27: Change value to 2.61V.
A1R108: Change value to 36.5.
Delete: A1L10. Connect A1R109 directly to ground.

Diagram 5,
A2CR33: Add value of 8.25V.
A2CR1, A2CR2, A2CR3, A2CR4: Show value of 5.62V for each diode.
A2R127: Change value to 182K and add asterisk to show factory-selected value.
A2R128: Change value to 182K and add asterisk to show factory-selected value.
A2R28: Change value to 3.6K.
A2R130: Change value to 22K.
A2R129: Change value to 5.6K.
A2R34: Change value to 360.
A2C45: Change value to 47.
A2C17: Change value to 100.
A2C16: Add value of 10.

Diagram 6,
Replace with Diagram 6 from this change sheet.

Diagram 7,
A4R9: Change value to 0.51.
A4CR9: Add value of 6.19V.
A4CR10: Add value of 6.19V.