Errata

Title & Document Type: 8003A Pulse Generator Operating and Service Manual

Manual Part Number: 08003-90003

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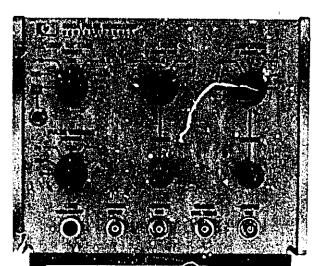
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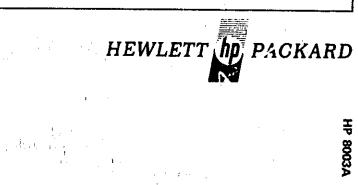
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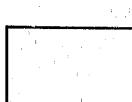


HP 8003A OPERATING AND SERVICE MANUAL

8003A PULSE GENERATOR







OPERATING AND SERVICE MANUAL

HP Part Number: 08003-90003

MODEL 8003A

PULSE GENERATOR

SERIALS PREFIXED: 933-

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HEWLETT-PACNARD COMPANY/COLORADO SPRINGS DIVISION 1900 GARDEN OF YHE GODS ROAD, COLORADO SPRINGS, COLORADO, U.S.A.

Manual Part Number 08003-90003 Microfiche Part Number 08003-90053

PRINTED: OCTOBER 1974

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Model 8003A

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Section I Table 1-1

Table 1-1. Specifications

OUTPUT PULSE

- SOURCE IMPEDANCE: 150Ω ±3% shunted by typically 20 pF at any output voltage.
- PULSE SHAPE: (Measured at 5 V across 50Ω) Rise and Fall time: Less than 5 ns

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- Overshoot and Ringing: Less than 5% of pulse amplitude.
 - Preshoot: Less than 5% of pulse amplitude.
- AMPLITUDE: (Positive and negative output can be independently set)
 - Maximum Output: 5V across 50Ω (10V across an open circuit). Output circuit protected, cannot be damaged by shorting. With internal load disconnected (switch provided), 10V across 50Ω with rise and fall time less than 7ns.
 - Attenuator: Provides 7 steps from 0.05V to 5V in a 1, 2.5, 5 sequence.
 - Vernier: Provides continuous adjustment between ranges, minimum output less than 0.02V across 50Ω.
- POLARITY: Positive and negative simultaneously. Delay between pulses approximately 5 ns.
- PULSE WIDTH: 30ns to 3s in five ranges; vernier provides continuous adjustment between ranges. Maximum Duty Cycle:
 - Greater than 90% from 0. 3Hz to 1MHz
 - Greater than 50% from 1MHz to 10MHz Width Jitter: Less than 0.1% of pulse width at any width setting.
- DELAY: Approximately 150ns fixed delay between Trigger Output and both Pulse Outputs. Internal slide switch permits removal of delay line, reducing delay to about 10ns.

REPETITION RATE AND TRIGGER

FREE-RUNNING:

- Repetition Rate: 0.3Hz to 10MHz in five ranges; vernier provides continuous adjustment betw-en ranges.
- 'reriod Jitter: < 0.1% of period at any'repetition rate setting.

TRIGGERING:

Trigger Input: DC coupled. Sine waves or pulses of either positive or negative polarity up to 10MHz.

- Sensitivity: Sine waves, 2V pk-pk minimum. External Pulses, at least 1V and at least '15ns wide, Maximum input ±10V.
- External Trigger Delay: Approximately 35nc between trigger input and trigger output. Manual: Push button for single pulse.

TRIGGER OUTPUT PULSE (Suitable for triggering another Model 8003A). Width: 15ns ±5ns at 50% amplitude points. Amplitude: Greater than 2V across 50Ω. Polarity: Positive.

SYNCHRONOUS GATING: Gating signal turns generator "on"; pulse repetition rate, amplitude, polarity, and width determined by panel control settings; first pulse is coincident with the leading edge of the gate, last pulse is completed even if gate ends during the pulse.

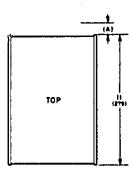
Minimum Gating Signal: -2V. Maximum Input: -20V. Input Impedance: Approximately 1kΩ.

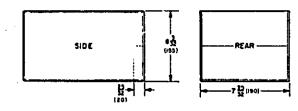
GENERAL

- POWER 115V or 200V +10% -15%, 50Hz - 400Hz, 30W.
- WEIGHT: Net 9 lb (4 kg) Shipping 13 lb (6 kg).

DIMENSIONS:

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OPTION 01: Remote programming.

Section I Paragraphs 1-1 to 1-9

SECTION I GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The HP Model 8003A is a general-purpose pulse source providing positive and negative pulses with fast rise times and a wide range of repetition rate and pulse width. Complete specifications of performance are given in Table 1-1. Both positive and negative pulses are simultaneously available from 50 ohm sources with 5ns rise and fall times. Two seven-step attenuators and two verniers provide continuous and independent control of the amplitude of either output from 0.02 volt to 5 volts across 50 ohms. The internal load of either pulse output may be disconnected by a slide switch provided within the instrument, supplying twice the output voltage across 50 ohms. The frequency range of the instrument from 0.3 Hz to 10 MHz is covered in 5 ranges, with a vernier providing continuous adjustment.

1-3. Trigger output pulses for synchronizing external circuits or instruments have a pulse width of less than 20 nanoseconds and an amplitude of at least 2 volts across 50 ohms. The trigger output is approximately 150 nanoseconds in advance of the main output pulses. Delay may be switched off by a slide switch; the residual delay is then approximately 10 nanoseconds. Gating signals, applied to a rear panel connector, will gate the instrument "on" to produce pulse trains and bursts, determined by the front-panel controls.

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.

1-6. MANUAL IDENTIFICATION

1-7. Hewlett - Packard uses a two - section eightdigit serial number (000-00000). This serial number may be also preceded by a letter. If the first three digits of the serial number, found on the rear panel of the instrument, do not agree with those on the title page of this manual, change sheets supplied with the manual will define differences between your instrument and the Model 8003A described in this manual. To obtain correct manual information for any instrument, contact the nearest Hewlett - Packard Sales/ Service Office; always specify the model number and complete serial number.

1-8. ORDERING ADDITIONAL MANUALS

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

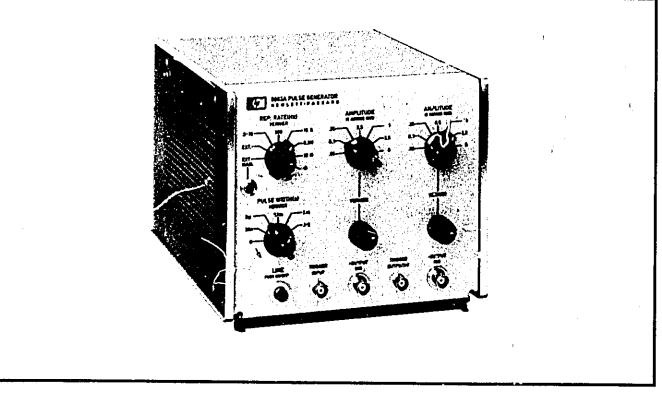


Figure 1-1. HP Model 8003A Pulse Generator

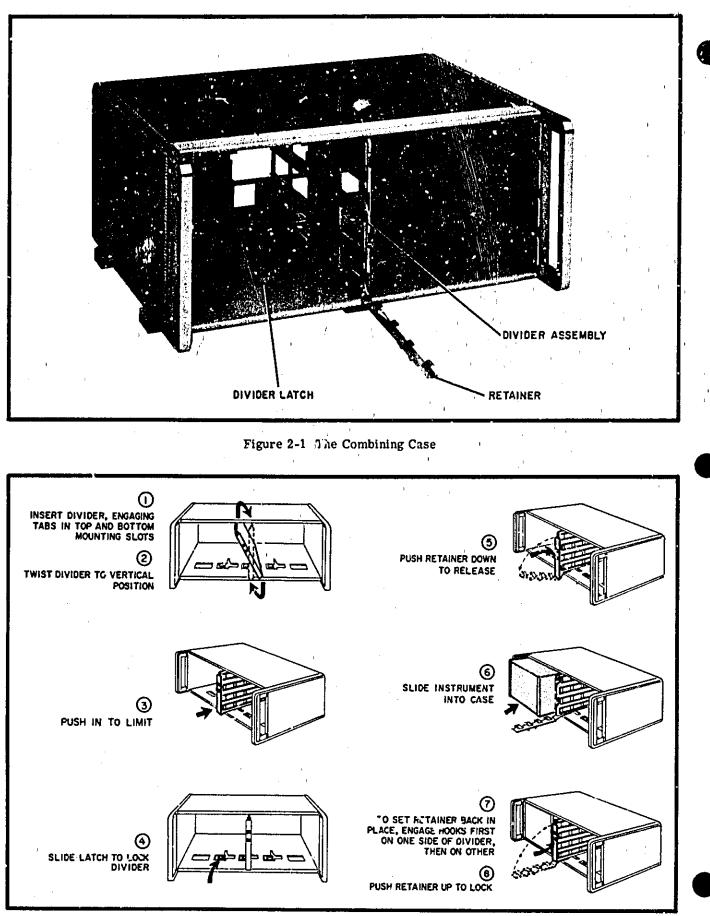


Figure 2-2 Steps to Place Instrument in Combining Case

SECTION II

2-1. INITIAL INSPECTION

2-2. Inspect the instrument for physical damage and check its operation as soon as possible after delivery. Table 5-2 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 if 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. PREPARATION FOR USE

2-4. POWER SOURCE REQUIREMENTS

2-5. The HP Model 8003A may be operated from an ac source of 115 or 230 volts +10%, -15%, at 50 to 400 Hz. Power dissipation is approximately 30 W. When the instrument is shipped from the factory, it is ready for 230 volt operation. For 115 volt operation move the rear panel slide switch, with the instrument power cable disconnected, until the number 115 is visible. A narrow-blade screwdriver maybe used to operate this switch.

CAUTION

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

2-6. FUSE REPLACEMENT

2-7. The fuse is located on the rear panel. Fuse F1 should be 0.5 ampere slow blow for 115 volt operation or 0.25 ampere slow blow for 230 volt operation.

2-8. POWER CABLE

2-9. The HP Model 8003A is equipped with a 3-wire power cable, which, when connected to an appropriate receptacle, grounds the instrument, cabinet and panel. To preserve the 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.

2-10. TEMPERATURE REQUIREMENTS

2-11. The HP Model 8003A uses solid-state components and requires no special cooling. The instrument operates within specifications when the ambient temperature is between $0^{\circ}C$ (32°F) and 55°C (131°F). The pulse generator may be stored between $-40^{\circ}C$ (-40°F) and 75°C (167°F).

2-12. REPACKING

2-13. 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 material to be used if the original packing material is not available or 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.

2-14. RACK MOUNTING

2-15. The HP Model 8003A is a submodular unit that, when used alone, can be bench-mounted only. However, wher used in combination with other submodular units, it can be bench and 'or rack - mounted. The HP combining case and adapter frame are designed specifically for this purpose.

2-16. COMBINING CASE (HP 1051A or 1052A)

2-17. The combining case is a full-module unit which accepts various combinations of submodular units. Being a full-module unit, it can be bench or rack-mounted as any full-module instrument. An illustration of the combining case is shown in Figure 2-1. Instructions for installing the HP Model 8003A in a combining case are given in Figure 2-2.

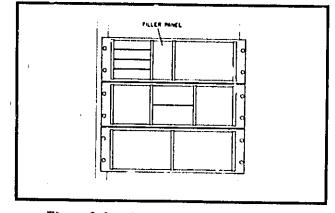
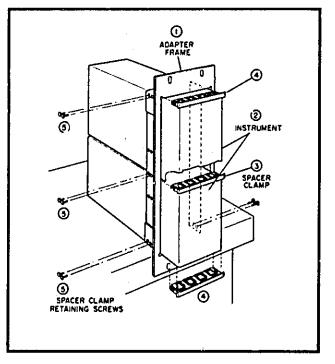


Figure 2-3. Adapter Frame Instrument Combinations

Section II Paragraphs 2-18 to 2-19

2-19. The adapter frame is a rack frame that accepts any combination of submodular units. It can be rack-mounted only. An illustration of the adapter frame is given in Figure 2-3. To assemble, refer to Figure 2-4 and proceed as follows:

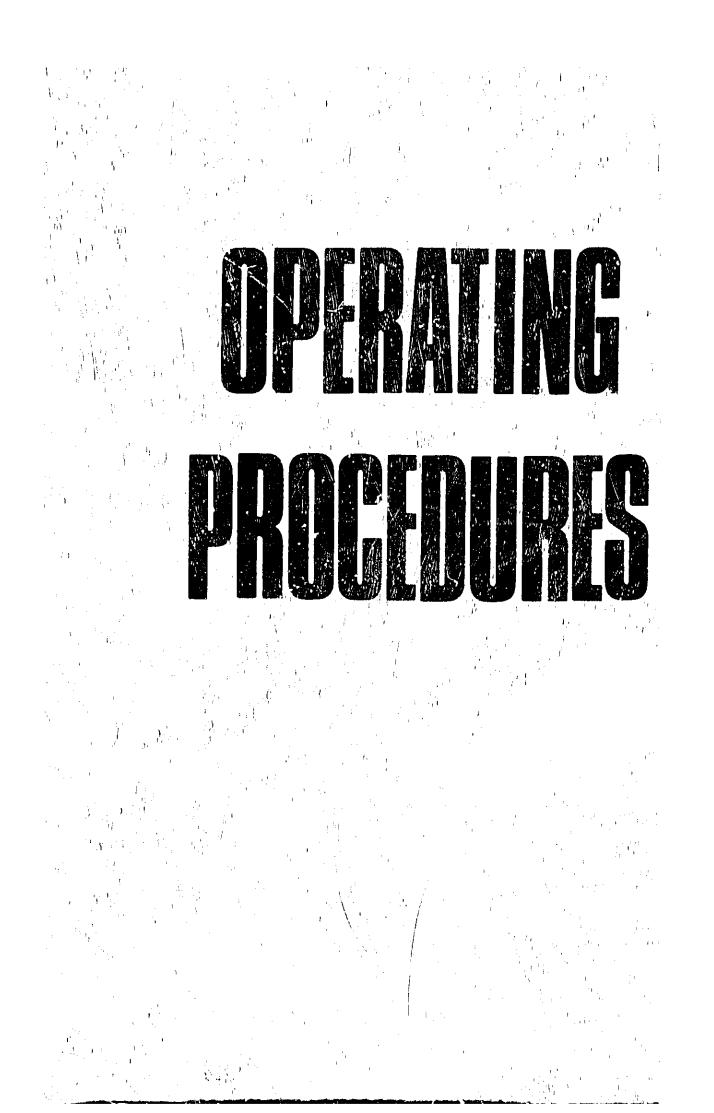
- a. Place the adapter frame (1) on edge of bench as illustrated.
- b. Stack the submodular units (2) in the frame.
- c. Place the spacer clamps (3) between instruments.
- d. Place the spacer clamps (4) on the two ends of the rack-mounted instruments.
- e. Push the combination into the frame.
- f. Insert screws (5) on both sides of frame and ¹ tighten until submodular instruments are secure in frame.
- g. The complete assembly is ready for rackmounting.





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SECTION III

OPERATING INSTRUCTIONS

3-1. INTRODUCTION

3-2. This section contains the operating instructions for the HP Model 8003A Pulse Generator. Figure **3-2** identifies and briefly describes the purpose of each panel control and connector on the instrument. Operating limits of the HP Model 8003A are as specified in Table 1-1.

3-3. TRIGGER MODES

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3-4. INTERNAL TRIGGER MODE

3-5. The HP Model 8003A will generate internally any repetition rate from 0.3 Hz to 10 MHz. The repetition rate is established by setting the REP, RATE selector to any of the five internal ranges and then adjusting the REP. RATE VERNIER to the specific rate desired.

3-6. EXTERNAL TRIGGER MODE

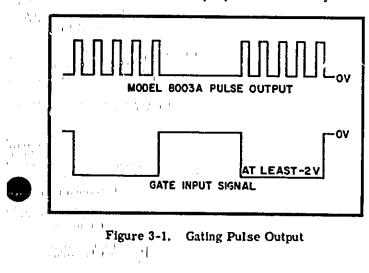
3-7. With the REP. RATE selector set to EXT. + or EXT. -, external signals may be used to initiate pulses in the Model 8003A. Trigger signals, which will cause one pulse out for each trigger in, may be sine waves or pulses of either positive or negative polarity up to 10 MHz. Sine waves must be of at least 2 volts peak to peak amplitude, and pulses must be at least 1 volt peak and at least 15 nanoseconds wide. Maximum allowable input signal is ±10 volts peak.

3-8. MANUAL TRIGGER MODE

3-9. With the REP. RATE selector set to the EXT. +/MAN position, a single output pulse is generated by the Model 8003A each time the MANUAL push button is pressed.

3-10. GATING MODE

3-11. The HP Model 8003A may be gated by an external signal when the OPER. MODE switch is set to GATED. In this mode output pulses occur only when



the gating signal is at least -2 volts (refer to Figure 3-1). The maximum allowable gate signal level is -20 volts. If operation does not require the use of the gating feature, be sure that the OPER. MODE switch, situated on the rear panel, is set to the NORMAL position.

3-12. REMOTE PROGRAMMING

3-13. Remote programming of the Model 8003A is possible with the Option 01 when the REP. RATE, PULSE WIDTH, and AMPLITUDE VERNIER controls are set to the asterisk (*) positions. In the standard Model 8003A these asterisk (*) positions are connected to their adjacent positions. For Option 01 operation refer to Appendix A 1.

3-14. BASIC OPERATION PROCEDURE

3-15. Initial settings are given to obtain a complete pulse for someone unfamiliar with the operation of the Model 8003A. It is important that the PULSE WIDTH and REP. RATE controls be compatible; otherwise, the output signal may be incorrectly interpreted. The following control settings are recommended to obtain a visible rectangular pulse on a high-frequency oscilloscope with sweep time at 50 μ s/cm and with sensitivity at 2 V/cm.

8003A	REP. KATE (Hz)	0. 3M
	VERNIER (R.R.)	ccw
	PULSE WIDTH (s)	·3μ; ⊨
	VERNIER (P. WIDTH)	center
	AMPLITUDE (±)	5V
	VERNIER (AMPL, ±)	cw
	OPER, MODE	Normal

Rotation of the various verniers demonstrates the effect the controls have on the output pulse.

- 3-16. For regular use, proceed as follows:
 - a. Set OPER. MODE slide switch, located on the rear panel, for the desired operation mode (NORMAL or GATED).

NOTE

No output pulse will be generated for normal use if the OPER. MODE slide switch is in GATED position.

- b. Connect either OUTPUT connector to an external test circuit using a 50 ohm coaxial cable and a 50 ohm termination resistor.
- c. Turn instrument on with LINE button.
- d. Set REP. FATE selector switch and its VER-NIER for the desired triggering mode and frequency.

Jection II Paragraphs 3-17 to 3-21

> e. Set PULSE WIDTH selector switch and VER-NIER for the desired output pulse width.

NOTE

The pulse width should be narrower than the output pulse period.

f. Set AMPLITUDE and its VERNIER for desired amplitude,

3-17. INTERNAL CONTROLS

3-18. DELAY SWITCH

3-19. The HP Model 8003A is shipped with an approximate 150 nanoseconds fixed delay between the trigger output pulse and the output pulse. This delay may be reduced to approximately 10 nanoseconds. This is accomplished by removing the instrument bottom cover and by moving the front slide switch on the circuit board into the ND (non-delayed) position. The D (delayed) position is for an $\sigma_{r,r}$ roximate 150 nanoseconds delay.

3-20, TERMINATION SWITCH

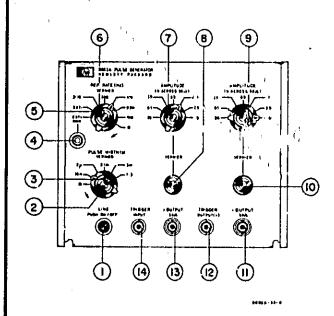
3-21. The pulse generator is shipped so that a maximum output pulse amplitude of 5 volts across 50 ohms may be obtained for both positive and negative pulses. When a greater amplitude is required, either pulse may be doubled by switching out the appropriate internal 50 ohm resistor. This is accomplished by removing the bottom cover and by setting the inner rear slide switch on the circuit board to the ± 10 V position for positive output or by setting the outer rear slide switch on the circuit board to the ± 10 V position for negative output.

NOTE

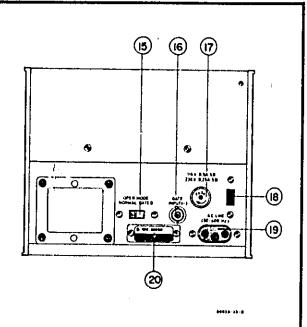
Be sure that the termination slide switches are in the +5 V and -5 V position when no external load is connected to the instrument; otherwise it may be damaged.

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Section III Figure 3-2



- 1. LINE: On/Off switch, glows red when on.
- 2. PULSE WIDTH (s): Selector switch selects output pulse width range. The asterisk (*) position on the standard Model 8003A is connected to the 30n (seconds) range; this extra position may be wired for other needs (refer to Paragraph 5-19). On the Option 01 this position is for remote programming.
- 3. PULSE WIDTH (s) VERNIER: Vernier adjusts output pulse width within the limits set by PUL-SE WIDTH selector switch.
- 4. MAN: Push button provides a single pulse when REP. RATE selector switch is set to EXT. +/MAN. position.
- REP. RATE (Hz): Selector switch selects internal repetition rate, external triggering, or manual triggering. The asterisk (*) position on the standard Model 8003A is connected to the 10 M(Hz) range; this extra position may be wired for other needs (refer to Paragraph 5-17). On the Option 01 this position is for remote programming.
- 6. REP, KATE (Hz) VERNIER: Vernier adjusts internal repetition within limits set by REP. RATE selector switch.
- AMPLITUDE (V ACROSS 50Ω): Switch selects amplitude range of positive output pulse.
- 8. AMPLITUDE VERNIER: Verniter adjusts the amplitude of the positive output pulse within limits set by AMPLITUDE selector switch. Clockwise adjustment selects the maximum amplitude.
- 9. AMPLITUDE (VACROSS 50Ω): Switch selects amplitude range of negative output pulse.



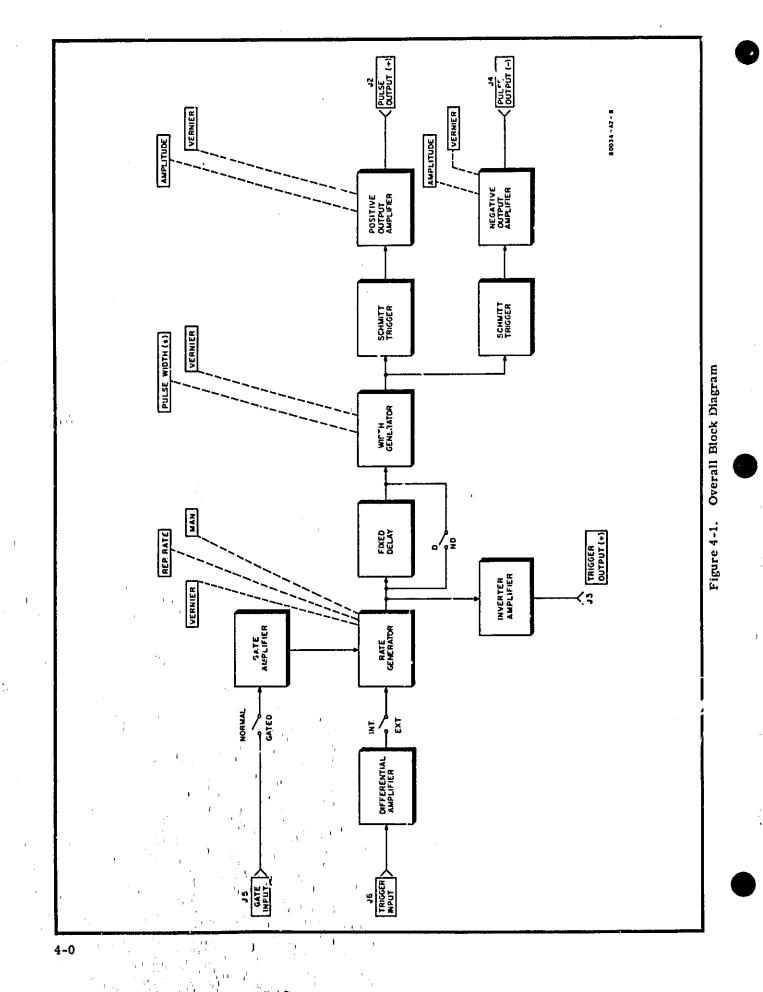
- 10. AMPLITUDE VERNIER: Vernier adjusts the amplitude of the negative output pulse within limits set by AMPLITUDE selector switch. Clockwise adjustment selects the maximum amplitude.
- 11. OUTPUT/50 Ω : Female BNC connector supplies a negative output pulse.
- 12. TRIGGER OUTPUT (+): Female BNC connector supplies a positive trigger pulse.
- +OUTPUT/50Ω: Female BNC connector supplies a positive output pulse.
- 14. TRIGGER INPUT: Female BNC connector accepts external triggering signals.
- 15. OPER. MODE: Switch selects normal or gated mode of operation. In NORMAL, all front-panel controls operate as described. In GATED, output signals, either internally or externally triggered, are generated only during the time that the gating signal is applied.
- GATE INPUT (-): Female BNC connector accepts pulse control signal; -2 volt pulse turns the instrument repetition rate generator on. DC coupled.
- 17. FUSE: Line fuse (1/2 A SB for 115 V ac or 1/4 A SB for 230 V ac). Use only properly-rated fuse.
- 18. 115 V/230 V: Switch selects ac line voltage.
- 19. AC LINE: Receptacle for power cable.
- 20. SERIAL NUMBER: Reference number identifies instrument.

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SECTION IV PRINCIPLES OF OPERATION

4-1. INTRODUCTION

4-2. This section contains the basic principles of operation for the HP Model 8003A Pulse Generator. The basic functions are shown in the block diagram Figure 4-1. The output pulses are formed in the following general sequence. The repetition rate is generated internally or is established by an external triggering source. The signal then passes through the delay circuit which sets up a delay of the output signal with respect to the trigger output signal. The delay may be switched off. Pulse width is then established before the signal goes through both output circuits and their associated attenuators which control the respective pulse amplitudes. The repetition rate circuit also supplies a negative pulse through an inverter amplifier for a positive trigger output. The following paragraphs and diagram provide a more detailed discussion of each basic circuit.

4-3. **REPETITION RATE CIRCUIT**

4-4. Mode of operation for the Model 8003A is established in this circuit (i.e. internal, external or manual triggering), depending on the setting of S4 REP. RATE selector switch. Refer to Figures 4-2 and 7-1.

4-5. INTERNAL TRIGGERING

4-6. For this mode of operation, REP. RATE switch S4 is set to any of the five internal rate settings. Initially, transistors A1Q29 and A1Q30 are not conducting. Then the ramp capacitor, corresponding to the selected range, at the emitter of A1Q30 is charged through the current source A1Q31. The voltage on the capacitor goes negative until it becomes about 0.7V more negative than the base voltage of A1Q30. Then transistor A1Q30 begins to conduct, and the voltage drop across diodes A1CR12, A1CR13, and A1R87 appears on the base of A1Q29. (Diodes A1CR12 and A1CR13 increase loop gain for low current through A1Q30, and capacitor A1C38 increases loop gain for high frequencies). Transistor A1Q29 also starts conducting, and the voltage drop across A1R89 causes A1Q30 to conduct still more. This process continues until both transistors go into saturation. Now the ramp capacitor is charged positively through A1Q30, A1R87, and the diodes A1CR12 and A1CR13. When the current from the ramp capacitor is no longer sufficient to keep A1Q29 saturated. A1Q29 comes out of saturation and hence starts turning A1Q30 off. Again regeneration occurs, and both A1Q29 and A1Q30 turn off. This action produces a negative timing pulse on the emitter of A1Q29. Thus, the repetition rate depends upon the voltage chaige across the ramy capacitor, the ramp capacitance,

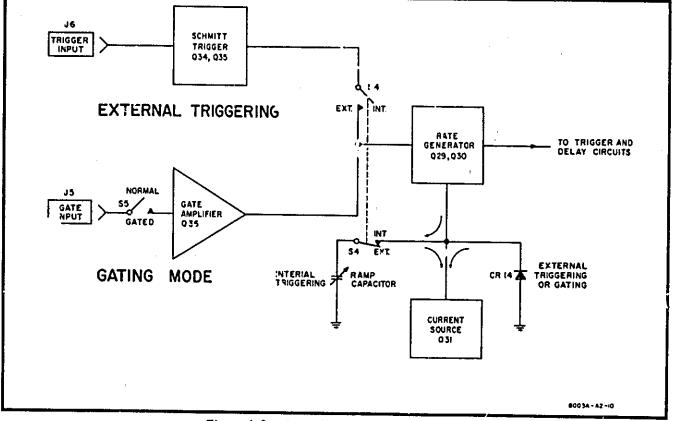


Figure 4-2. Repection Rate Block Diagram

Section IV Paragraphs 4-7 to 4-22

and the charging current. Current through current source A1Q31 can be adjusted by the vernier control R3 to change the repetition rate.

4-7. During internal triggering operation diodes A1CR26 and A1CR27 clamp the collectors of transistor A1Q32 and A1Q33 to a voltage level of approximately 11 volts established by Zener diode A1CR28. This assures that no other collector voltage can be developed and no signal is passed to the Schmitt trigger A1Q34/A1Q35 during internal triggering in the event that an external signal is applied to J6.

4-8. EXTERNAL TRIGGERING

4-9. For this mode of operation REP. RATE switch S4 is set to either EXT. - or EXT. +/MAN. When S4 is set to EXT. -, the Model 8003A is triggered by the negative-going slope of the negative external triggering signal; when S4 is set to EXT. +, the instrument is triggered by the positive-going slope of the positive triggering signal. The external trigger is a bie through J6 to a differential amplifier A1Q32/A2Q33. Diodes A1CR16/A1CR12 protect A1Q32 and A1Q33 against reverse-bias breakdown in the event of excessive negative trigger levels.

4-10. In the EXT. - position A1R98 is connected to +20 volts, and A1CR26 is reverse-biased. When there is a large enough negative triggering signal, A1Q32 conducts less, and the voltage increases positively on the collector of A1Q32 and through A1CR24 onto the base of A1Q34. This signal at A1Q34 causes the Schm.¹⁴ trigger A1Q34/A1Q35 to switch and thereby generates a positive-going spike on inductor A1L2.

4-11 In the EXT + position A1R99 is connected to +20 volts, and A1Ch27 is reverse-biased. When there is no external positive triggering signal, A1Q32 and A1Q33 conduct During this time A1Q34 is cut off. When there is a large enough external positive triggering signal, A1Q33 conducts less, and the voltage increases positively on the collector of A1Q33 and through A1CR25 onto the base of A1Q34. This signal at A1Q34 causes the Schmitt trigger A1Q34/A1Q35 to switch and thereby generates a positive-going spike on inductor A1L2.

4-12. In either of the external positions the REP. RATE selector switch S4 connects A1R111 to -20 volts. Then the A1Q30 base voltage is held slightly negative, about -1 volt. Diode A1CR14 prevents the emitter of A1Q30 from going more negative than its base. (The current frcm current source A1Q31 flows through A1CR14 to ground). Thus the rate generator A1Q29 and A1Q30 remain cut off until a positive spike from the Schmitt trigger passes through A1CR18 and momentarily cuts off A1CR19. During this period A1Q30 base voltage rises; transistor A1Q30 and hence A1Q29 switch on as in the internal triggering operation, therefore giving a negative pulse at the emitter of A1Q29 for each trigger pulse.

4-13. MANUAL TRIGGERING

4-14. For this mcde of operation REP. RATE switch S4 is set to EXT. +/MAN. When the MANUAL push button S3 is pressed, A1C46 begins to charge, giving a positive voltage on the base of the Schmitt trigger. This operation produces a single pulse. Re-leasing the button discharges Λ 1C46 through A1R94.

4-15. GATING MODE

4-16. When the gate switch S5 (refer to Figure 7-1) is in its NORMAL position, the base of / 'Q36 is held negative, and the transistor will not comet. Diodes A1CR20 and A1CR21 prevent the base of A1Q36 from going more negative than -1.4 volts. In the GATED position the base potential of A1Q36 rises to zero volts, and current flows through the transistor. As in external operation, the base voltage of A1Q30 goes negative and keeps A1Q30 turned off; A1CR14 conducts, passing the current from current source A1Q31 to ground. Now a negative signal, applied to the GATE input, cuts off A1Q36, and the current flow is routed through A1CR20 and A1CR21 as before. The base voltage of A1Q30 rises, and the rate generator circuit functions as in the internal operation, producing a train of pulses at the repetition rate setting until the GATE input signal is removed. The leading edge of the first output pulse is synchronized with the leading edge of the gate input signal.

4-17. Gating is also possible in both external positions. An output pulse is produced only when both the trigger input and gate input signals are present.

4-18. TRIGGER OUTPUT AND DELAY CIRCUIT

4-19. The negative pulse from the rate generator is fed to the base of inverter amplifier transistor A1Q38 (refer to Figure 7-2). The signal is inverted, and the positive trigger pulse is taken from the collector and is fed to the TRIGGER OUTPUT (+) connector.

4-20. The negative pulse is also fed to the base of A1Q37, part of the delay circuit. In the non-delayed mode the negative pulse, present on A1Q37 emitter, is fed by A1S1 (delay switch) to the width generator. In the delayed mode the amplified positive pulse from A1Q37 collector is delayed 140 ns by delay line A1DL1, amplified once more by A1Q39, and differentiated by A1L5. Diode A1CR29 removes the positive pulse, and the negative pulse is fed by A1S1 to the width generator.

4-21. WIDTH GENERATOR

4-22. This circuit establishes the width of the output pulse. The pulse width is controlled by the setting of PULSE WIDTH selector switch S6 and PULSE WIDTH VERNIER R6 (refer to Figure 7-2). The width circuit receives the signal developed in the delay circuit to switch Schmitt trigger A1Q23/A1Q24. Initially A1Q23 is cut off, and A1Q24 is conducting, which results in a voltage drop across A1X72; consequently, A1Q25 conducts. Thus, the current from current source A1Q26 flows through A1Q25. At the same

time A1Q27 of the Schmitt trigger is held off while A1Q28 conducts. The incoming negative pulse from the delay circuit changes the state of Schmitt trigger A1Q23/A1Q24, causing A1Q23 to conduct and A1Q24 to cut off. Now A1Q25 cuts off, and the selected width capacitor is linearly charged by the current source A1Q26 to a level of about +4 volts. At this level Schmitt trigger A1Q27/A1Q28 changes state. A1Q28 collector goes rostive, turns off A1Q23, and returns the circuit to its original condition. The output waveform is taken from Schmitt trigger transistor A1Q23 collector, is differentiated, and is fed as positive and negative spikes to the output circuit.

4-23. POSITIVE AND NEGATIVE OUTPUT CIRCUITS

4-24. The output circuits form the output pulses and drive an output load. With reference to the negative output (refer to Figure 7-3), driver and output amplifier transistors A1Q17 through A1Q20 (a cascode amplifier) are initially held cut off by switching transistor A1Q16, which is conducting heavily. The positive portion of the width generator output changes the state of Schmitt trigger A1Q14/A1Q15. Transistor A1Q14 cuts off, and A1Q15 conducts. Hence, the collector voltage of A1Q14 becomes more negative, switching off A1Q16. The switching action is very fast, and immediately the base potentials of A1Q17 and A1Q18 become less negative and the transistors feed a current of about 105 mA to 'he emitters of A1Q19 and A1Q20 respectively. A1Q19 and A1Q20 collector voltage goes more negative, and this fall is passed to the output attenuator. The circuit remains in this state until the negative signal from the width generator switches the circuit to its original condition. Voltage source, A1Q21 and A1Q22, regulates the base potentials of the driver and output amplifier transistors, this provides the AMPLITUDE VERNIER control. The positive output circuit functions in a similar in oner. Schmitt trigger transistor A1Q5 is switched on by the positive input pulse, and the voltage rise on A1Q6 collector controls the switching transistor A1Q7; the resultant output of the circuit is a positive pulse. The output attenuators consist of 3 resistive networks with attenuation of 1, 2.5 and 5, which are used individually or in series to provide stepped attenuation of the outputs.

4-25. POWER SUPPLY

4-26. The power supply operates from either 115 or 230 volts ac, which is rectified and regulated to provide dc outputs of -20 and +20 volts. Two separate primary windings of transformer T1 are switched by S2 in parallel for 115 volt operation or in series for 230 volt operation (refer to Figure 7-4). Both negative and positive supplies operate in a similar manner. With reference to the positive supply, error amplifier transistor A1Q4 senses and amplifies any change in the output voltage. The change is applied through driver transistor A1Q3 to the series regulator Q2, which acts as a variable series resistor in the current path.

A INTENANCE

Section V Table 5-1

Table 5-1.	Required Test Equip	nent
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Recommen	nded Instrument	Required	
Туре	Model	Characteristics	Required For
High Frequency Osvilloscope	HP 180A with HP 1801A and 1821A	Band Width: 50 MHz Vertical Sensitivity: 0.05-2 V/cm Dual Trace Operating Mode Sweep Delay Capability	Performance Check and Troubleshooting
Sampling Oscilloscope	HP 140A with HP 1410A and HP 1424A	Band Width: 1 GHz Sweep Time: 10ns/cm - 5 µs/cm	Performance Check and Adjustments
Square Wave Generator	HP 217A	Rise Time: < 10 ns Repetition Rate: 10 kHz Amplitude: -2 V	Performance Check and Troubleshooting
Test Oscillator	HP 651B	Frequency Range: 10kHz to 10MHz Output Amplitude: 2V pk-pk	Performance Check
DC Volt-Ohmmeter	нр 412А	Voltage Range: 1 to 30 V Accuracy: ±1 % on 30 V scale Input Resistance: ≥1 MΩ Resistance Range: 100 kΩ	Adjustment and Troubleshooting
AC Voltmeter	HP 400Đ	Range: 1 to 250 V Accuracy: ±3% Input Impedance: 10 MΩ with 15 pF	Troubleshooting
Digital Voltmeter	HP 3430A	Voltage Range: ±20 V Ground: Floating Accuracy: 0.1% Input Resistance: ≥10 MΩ	Adjustments
50Ω Attenuator (2 required)	HP 8491A	Band Width: i GHz Attenuation: 20dB	Performance Check and Adjustments
Tee (2 required)	HP 10221A	50Ω System	Perf. Check and Adjustments
Feed-Through Termination (2 required)	HP 11048B	50Ω (±1 ohm) Load	Performance Check
BNC Tee	UG - 274B/U 74868		Performance Check
Termination (2 required)	GR 874-W50B	Resistance: 50Ω Power Rating: 1 W Minimum	Performance Check and Adjustments
Adapter (2 required)	GR 874	Type N to GR	Performance Check
Cable Assembly (4 required)	NP 10120A	3 Ft 50 Ω coax. terminated at both ends. with BNC male connectors	Performance Check and Adjustments
Cable Assembly (2 required)	HI 10122A	3 Ft 50Ω coax cable BNC - N typy	Performance Check and Adjustments

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SECTION V MAINTENANCE

5-1. INTRODUCTION

5-2. This section provides maintenance and service information for the Model 8003A Pulse Generator. Performance check, adjustment procedures, troubleshooting, and repair and replacement information are covered in this section. A minimum instrument warm-up time of 15 minutes should be allowed before attempting the performance check or the adjustments. Pulse characteristics terminology used in this section is illustrated in Figure 5-1. Schematic diagrams are included at the rear of the manual.

5-3. TEST EQUIPMENT

5-4. Test equipment required for maintaining and checking the performance of the Model 8003A is listed in Table 5-1. Test equipment having characteristics similar to those listed in the table may be substituted for the equipment listed.

5.5 PERFORMANCE CHECK

5-6. The performance check presented in Table 5-2 is a procedure designed to compare the operation of the Model 8003A with its specifications. These checks can be incorporated in a periodic maintenance, postrepair, and incoming quality control inspection. A performance check test card is provided in Table 5-3 for a record of the performance check results. Also an instrument calibration and component replacement record is given in Table 5-4.

5-7. INSTRUMENT COVER REMOVAL

5-8. The top, bottom, and all side covers are separately removable. Each cover is held in place by screws. The top and bottom covers slide toward the rear panel to free the curved portion before lifting off. Always disconnect the power cord before removing the instrument covers. Removal of bottom cover provides access to all components on circuit board A1 except A1Q10, A1Q11, A1Q19, and A1Q20, which are accessible by removal of the top cover.

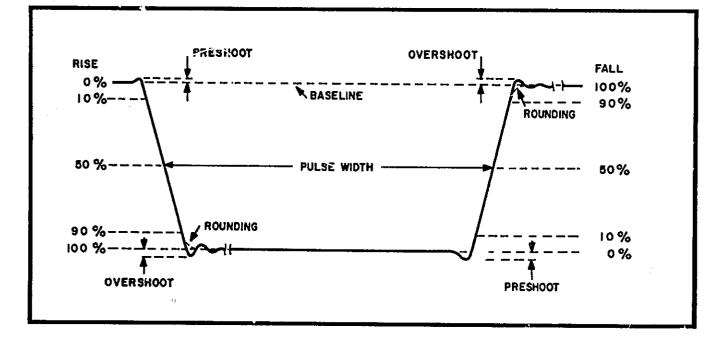
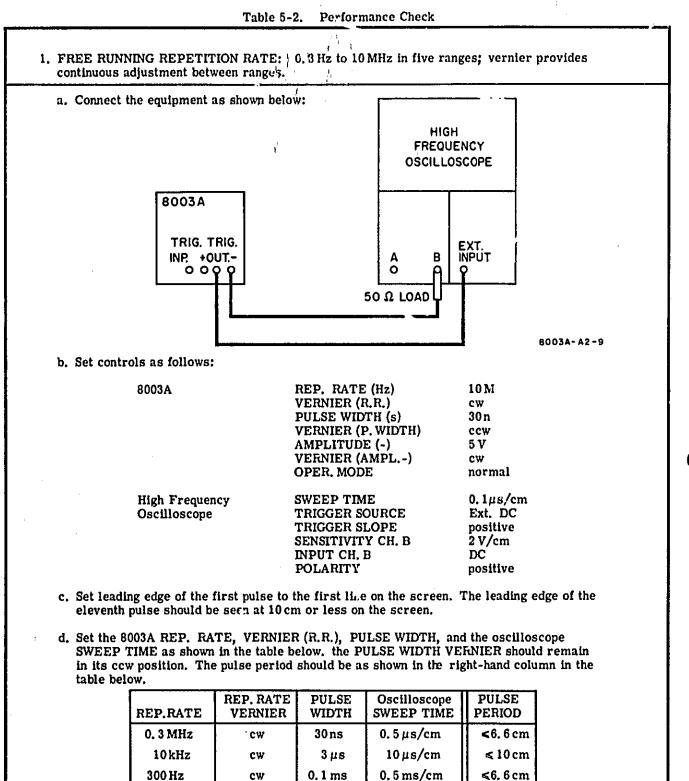


Figure 5-1. Definition of Output Pulse Characteristics

5-1

Section V Table 5-2 Model 8003A



REP.RATE	REP. RATE VERNIER	PULSE WIDTH	Oscilloscope SWEEP TIME	PULSE PERIOD
0. 3 MHz	· cw	30ns	0.5µs/cm	<6.6 cm
10kHz	cw	3 µ s	10µs/cm	≤10 cm
300 Hz	cw	0.1 ms	0.5ms/cm	≤6.6 cm
.3 - 10 Hz	cw	3 ms	10 ms/cm	≤10cm
.3 - 10 Hz	ccw	3 ms	0.5 s/cm	≥6,6cm
300 Hz	ccw	3 ms	20 ms/cm	≥5 cm
10kHz	ccw	0, 1 ms	0.5ms/cm	≥6.6 cm
0. 3 MHz	ccw	3 µ s	20 µ s/cm	≥5 cm
10 MHz	ccw	30 ns	0.5µs/cm	≥6,6cm

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Model 8003A

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Section V Table 5-2

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Table 5-2. Performance Check (cont'd)

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- 2. PULSE WIDTH: 30ns to 3s in five ranges; vernier provides continuous adjustment between ranges.
 - a. Use same equipment setup as shown in Performance-Check Paragraph 1 a.
 - b. Set the 8003A REP. RATE VERNIER in its cw position. Set the 8003A PULSE WIDTH, VERNIER (P. WIDTH), and REP. RATE and the oscilloscope SWEEP TIME as shown in the table below. The width of the output pulse, measured at 50% of amplitude height, should be as shown in the right-hand column of the table below.

PULSE WIDTH	P, WIDTH VERNIER	REP. RATE	Oscilloscope SWEEP TIME	OUTPUT PULSE WIDTH
30 n s	ccw	10 MHz	0.1 µs/cm	≼ 3 mm
3 µ s	ccw	0. 3 MHz	0.5µs/cm	< 6 cm
0, 1 ms	ccw	10 kHz	20 µ s/cm	≪5 cm
3 ms	ccw	300 Hz	0,5ms/cm	≤6 cm
0.1 - 35	ccw	0.3 - 10 Hz	10ms/cm	≤10 cm
3 ms	cw	0.3 - 10 Hz	20 ms/cm	≥5 cm
9.1 ms	cw	0, 3 - 10 Hz	0.5 ms/cm	≥6 cm
3 μs	cw	300 Hz	20µs/cm	≥5 cm
30 ns	cw	10 kHz	0.5µs/cm	≥6 cm

c. Set oscilloscope sweep time to 0.5 s/cm, 8003A REP. FATE (Hz) to EXT. +/MAN.,
PULSE WIDTH to 0.1 - 3 s, and PULSE WIDTH (s) VERNIER cw. Press MAN. button.
Pulse width should be 6 cm or more.

3. AMPLITUDE:

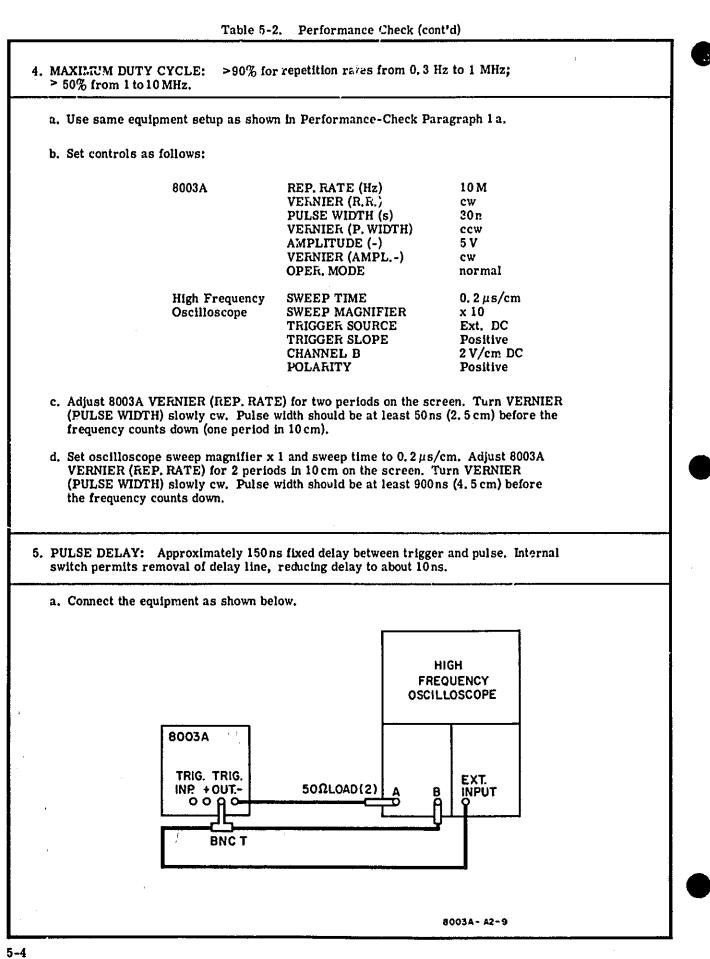
Seven-step attenuator reduces output to 0.05 V in a 5, 2.5, 1 sequence. Vernier provides continuous adjustment between steps and reduces minimum output to < 0.02 V. Maximum Output is 5 V (10 V across an open circuit). Internal switch permits removal of internal load, increasing output to at least 10 V across 50 ohm.

¹ a. Use same equipment setup as shown in Performance-Check Paragraph 1 a.

b. Set 8003A REP. KATE (Hz) to 10k, VERNIER (R. R.) ccw, PULSE WIDTH (s) to 0.1 m, and VERNIER (P. WIDTH) to ccw. Check to see that the output pulse amplitude on the Oscilloscope for each setting should be as shown in the right-hand column of the following table.

Oscilloscope Sensitivity	8003A Amplitude	Amplitude Vernier	Pulse Amplitude
1 V/cm	5 volts	cw	≥5 cm
0.5	2.5	cw	>5 cm
0.2	1	cw	≥5cm
0.1	0.5	cw	≥5 cm
0.05	0.25	cw	≥5 cm
0.05	0, 1	cw	≥2 cm
0.05	0.05	cw	>1 cm
0. 05	0.05	ccw	< 0.4 cm
0.05	0.1	ccw	< 1 cm
0.05	0.25	ccw	≤2 cm
0,1	0,5	cew	≤2 cm
0.2	1.0	ccw	<2 cm
0, 5	2.5	ccw	≤2 cm
1	5	ccw	≤2 cm

Section V Table 5-2



Section V Table 5-2

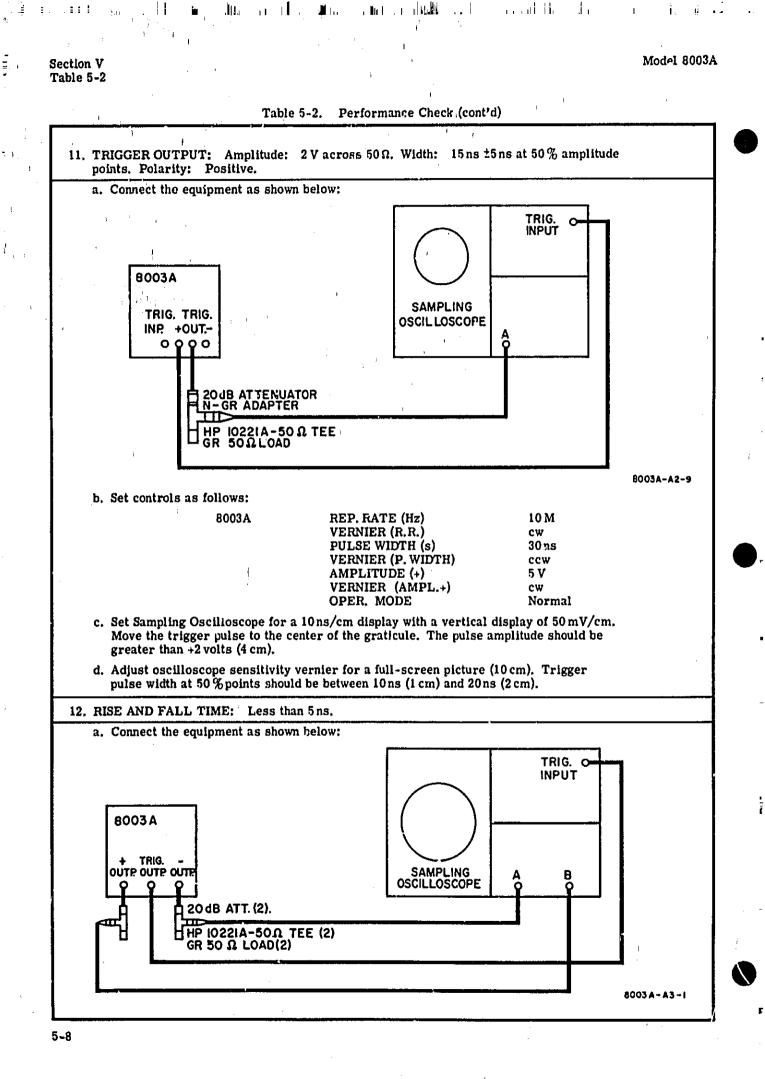
b. Set front panel controls as follows:		
8003A	REP. RATE (Hz) VERNIER (R.R.) PULSE WIDTH (s) VERNIER (P. WIDTH) AMPLITUDE (-) VERNIER (AMPL)	10 M center 30 n ccw 5 V cw
High Frequency Oscilloscope	SWEEP TIME SENSITIVITY CH. A and B CHANNEL SELECTOR TRIGGER SOURCE TRIGGER SLOPE	, 1 μs/cm 2 V/cm Alternate EXT, AC Positive
 c. Remove the 8003A bottom cover. Se delayed) position. Delay between 10 ns (1.0 mm). 	t the front slide switch on t a trigger and output pulse sl	he circuit board in the ND (non- hould be approximately
d. Set the front "lide switch on the circ trigger and output pulse should be an on 8003A.	uit board in the D (delayed) pproximately 150ns (1.5cm	position. Delay between). Replace bottom cover
polarity, and width determined by panelleading edge of the gate, last pulse is or gating signal: -2 V. Maximum input: a. Connect equipmont as shown below: SQUARE BNC BNC TRIG. TRIG. TRIG.	ompleted even if gate ends -20 V.	HIGH FREQUENCY SCILLOSCOPE
b. Set controls as follows:		8003 A-A3-2
8003A	REP. KATE (Hz) VERNIER (R.R.) PULSE WIDTH (s) VERNIER (P. WIDTH) AMPLITUDE (-)	0, 3 M ссw 3 µs ссw 5 V

-

Table 5-2,	Performance	Check	(cont'd)	

	High Frequency Oscilloscope	SWEEP TIME TRIGGER SOURCF TRIGGEK SLOPF, CHANNEL SEL, SENSITIVITY CH. A SENSITIVITY CH. B	20µs/cm Ext. DC Positive Alternate 1 V/cm DC 2 V/cn. DC	
c. Set Squar	e-Wave Generator for a l	10kHz output pulse with 2.0	V (2 cm) amplitude.	
d. Turn 8003 Pulses sh pulse,	3A VERNIEK (REP. KATH all occur only during "on	E) slowly cw; observe pulse a time" from the Square Way	burst on the screen. ve Generator output	
Trigger ínpu ≥2 V pk-pk. Approximate	Pulses, IV peak, at lea	on Rate: 0 to 10 MrIz. of either polarity. Sensitiv st 15 ns wide. Maximum inp input and trigger output. Inp	out. ±10 V. Delay:	
a. Connect e	quipment as shown below	•		
	TEST OSCILLA 8003A TRIG. INP:+TRIG- 0000		HIGH FREQUENCY OSCILLOSCOPE B EXT. INPUT O OAD	
			8003 A - A3 - 2	
b. Set control	ls as follows:			
	8003A	REP. RATE (Hz) VERNIER (R.R.) PULSE WIDTH (s) VERNIER (P. WIDTH) AMPLITUDE (-) VEKNIER (AMPL) OPER. MODE	Ext, + ccw 30ns ccw 5 V cw Normal	
ž	High Frequency Oscilloscope	SWEEP TIME TRIGGER SOURCE TRIGGER SLOPE CHANNEL SELECTOR SENSITIVITY CH. A SENSITIVITY CH. B	0.1µs/cm Ext. DC Positive Alternate 1 V/cm DC 2 V/cm DC	

·	able 5	-2. Performance Check (cont'd	l)
	c. Set the Test Oscillator for a 10 M as shown on the Oscilloscope.	Hz frequency and for a 2 V peak-	to-peak amplitude
	d. Center both channels vertically n the positive slope of the sine wave	nd observe the wave forms. Puls e.	e should begin during
	e. Set 800 ^{::} A REP. KATE to EXT waye.	Pulse should begin during negati	ve slope of the sine
8,	MANUAL TRIGGERING: Push butto	n for single pulse,	
	a. Use same equipment setup as sho disconnect the test escillator lead EXT. +/MAN, PULSE WIDTH to 3 oscilloscope sweep time to 20μ s/	from the 8003A. Set 8003A REF μ s, and OPER. MODE to NORM	P. RATE to
	 b. Press MAN, push-button switch a should occur when the button is pu released. 	nd observe pulse on oscilloscope ished. No pulse should occur who	e. Only one pulse en the button is
9.	PERIOD JITTER: < 0.1% of period	• · · · · · · · · · · · · · · · · · · ·	79°4
	a. Connect the (-) OUTPUT terminal Frequency Oscilloscope with a 50	on the Model 8003A to the input is feed-through termination,	B on the H'gh
	b. Set controls as follows:	1	
	8003A	REP. KATE (Hz) VERNIER (R.R.) PUI.SE WIDTH (s) VERNIER (P. WIDTH) AMPLITUDE (-) VERNIER (AMPL) OPER, MODE	10 Κ cw 3 μs ccw 5 V cw Normal
	High Frequency Oscilloscope	SWEEP TIME SENSITIVITY CH. B SWEEP SELECTOR DELAYING SWEEP TIME MAIN SWEEP MODE DELAYED SWEEP MODE TRIGGEK SLOPE DELAY LENGTH	0. 1 ms/cm 2 V/cm DC Main Sweep 0. 1 μs/cm Internal Auto Negative 0. 5
	c. Adjust VEKNIEK (REP. KATE) for selector delayed. Turn delay leng visible pulse is at the center of the of the pulse. Jitter should be less	a 0.1 ms (1 cm) period. Switch of th control cw until the leading ed e graticule. Measure the jitter o	oscilloscope sweep ge of the first
10.	PULSE WIDTH JITTER:⊲ 0.1% of pu	lse width on any width setting.	
	a. Use same equipment setup as desc	ribed in Performance-Check Pa	ragraph 9a.
	b. Set the oscilloscope sweep selecto to 0.1 ms/cm. Adjust 8003A VERN VERNIEK (P. WIDTH) for a 0.1 ms	NER (KEP, KATE) for a 0.2 ms p	the sweep time period and
	c. Delay the pulse on the Oscilloscop Move the trailing edge of the first center of the graticule. Measure t width jitter should be less than 0.1	visible pulse with the delay leng he jitter on the trailing edge of t	th control to the
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	Table 5-:	2. Performance Check (cont'd)	
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b. Set controls as i	follows:	I	
	8003A	REP. RATE (Hz)	10 M
		VERNIER (R.R.)	cw
		PULSE WIDTH (s)	30 n
		VERNIER (P. WIDTH)	ccw
		AMPLITUDE (+)	5 V
		VERNIER (AMPL.+)	cw
н. Т		AMPLITUDE (-)	5 V
		VERNIER (AMPL) OPEK. MODE	cw Normal
	Samalian	SWEEP TIME	00 / m
	Sampling Oscilloscope	MAIN SWEEP MAGNIFIER	20 ns/cm
	Oschioscope	TRIGGERING	x 29 EXT.
		TRIGGER SLOPE	5AI, +
		CHANNEL SELECTOR	B
		CHANNEL A POLARITY	- up
		CHANNEL B POLARITY	+ up
		SENSITIVITY CH. A	50 mV/cm
		SENSITIVITY CH. B	50 mV/cm
		DELAY LENGTH	0
c. Adjust oscillosc	ope vertical positio	ning control and 8003A AMPLIT	IDE VERNIER
for a positive out	tput pulse with a ful	ll-screen picture (10 cm).	
d. Move the leading delay control. T	g edge of the pulse he rise time should	to the center of the graticule with I be less than 5ns (5cm).	h the oscilloscope
e. Move the trailing	g edge of the pulse	to the center of the graticule wit be less than 5 ns (5 cm).	h the oscilloscope
ueray control. T	he fair time should	be ress than one (o cm).	I.
f. Change the oscil	loscope channel sel	lector to A. Adjust 8003A negativ full-screen picture (10 cm).	ve AMPLITUDE
f. Change the oscil	loscope channel sel output pulse for a	lector to A. Adjust 8003A negativ	ve AMPLITUDE
f. Change the oscil VERNIEK for an g. Repeat Paragrap	loscope channel sel output pulse for a ohs 12 d and 12 e.	lector to A. Adjust 8003A negativ full-screen picture (10 cm).	ve AMPLITUDE
f. Change the oscil VERNIEK for an g. Repeat Paragrap J. PRESHOOT, OVER	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING	lector to A. Adjust 8003A negativ full-screen picture (10 cm). HNG: < 5% of pulse amplitude.	
f. Change the oscil VERNIEK for an g. Repeat Paragrap J. PRESHOOT, OVER	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING	lector to A. Adjust 8003A negativ full-screen picture (10 cm).	
 f. Change the oscil VERNIEK for an g. Repeat Paragrap b. PRESHOOT, OVER a. Use same equipm 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING nent setup as shown	lector to A. Adjust 8003A negativ full-screen picture (10 cm). HNG: < 5% of pulse amplitude.	
 f. Change the oscil VERNIEK for an g. Repeat Paragrap b. PRESHOOT, OVER a. Use same equipm Paragraph 12 a. 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING nent setup as shown	lector to A. Adjust 8003A negativ full-screen picture (10 cm). HNG: < 5% of pulse amplitude. n in Rise-And-Fall-Time-Perfor	mance-Check
 Change the oscil VERNIEK for an Repeat Paragrap PRESHOOT, OVER a. Use same equipm Paragraph 12 a. 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING nent setup as shown ontrols as follows:	lector to A. Adjust 8003A negativ full-screen picture (10 cm). HNG: < 5% of pulse amplitude. n in Rise-And-Fall-Time-Perfor REP. RATE (Hz)	
 f. Change the oscil VERNIEK for an g. Repeat Paragrap b. PRESHOOT, OVER a. Use same equipm Paragraph 12 a. 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING nent setup as shown ontrols as follows:	lector to A. Adjust 8003A negative full-screen picture (10 cm). HING: < 5% of pulse amplitude. In in Rise-And-Fall-Time-Perfor REP. RATE (Hz) VERNIER (R.R.) PULSE WIDTH (s)	mance-Check 10 M
 Change the oscil VERNIEK for an Repeat Paragrap PRESHOOT, OVER a. Use same equipm Paragraph 12 a. 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING nent setup as shown ontrols as follows:	lector to A. Adjust 8003A negative full-screen picture (10 cm). SING: < 5% of pulse amplitude. In in Rise-And-Fall-Time-Perfor REP. RATE (Hz) VERNIER (R.R.) PULSE WIDTH (S) VERNIER (P. WIDTH)	mance-Check 10 M ccw 30 n center
 Change the oscil VERNIEK for an Repeat Paragrap PRESHOOT, OVER a. Use same equipm Paragraph 12 a. 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND RING nent setup as shown ontrols as follows:	lector to A. Adjust 8003A negative full-screen picture (10 cm). SING: < 5% of pulse amplitude. In in Rise-And-Fall-Time-Perfor REP. RATE (Hz) VERNIER (R.R.) PULSE WIDTH (s) VERNIER (P. WIDTH) AMPLITUDE (+)	mance-Check 10 M ccw 30 n center 5 V
 f. Change the oscil VERNIEK for an g. Repeat Paragraph d. PRESHOOT, OVER a. Use same equipm Paragraph 12 a. b. Set iront panel control 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND KING nent setup as shown ontrols as follows: 8003A	lector to A. Adjust 8003A negative full-screen picture (10 cm). SING: < 5% of pulse amplitude. In in Rise-And-Fall-Time-Perfor REP. RATE (Hz) VERNIER (R.R.) PULSE WIDTH (s) VERNIER (P. WIDTH) AMPLITUDE (+) VERNIER (AMPL.+)	mance-Check 10 M ccw 30 n center 5 V cw
 f. Change the oscil VERNIEK for an g. Repeat Paragrap 3. PRESHOOT, OVER a. Use same equipm Paragraph 12 a. b. Set iront panel control c. Set Sampling Oscil 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND KING ment setup as shown ontrols as follows: 8003A	lector to A. Adjust 8003A negative full-screen picture (10 cm). SING: < 5% of pulse amplitude. In in Rise-And-Fall-Time-Perfor REP. RATE (Hz) VERNIER (R.R.) PULSE WIDTH (s) VERNIER (P. WIDTH) AMPLITUDE (+)	mance-Check 10 M ccw 30 n center 5 V cw
 f. Change the oscil VERNIEK for an g. Repeat Paragrap 3. PRESHOOT, OVER a. Use same equipm Paragraph 12 a. b. Set iront panel control c. Set Sampling Oscifor both channels d. Adjust oscilloscor leading edge is control 	loscope channel sel output pulse for a ohs 12 d and 12 e. SHOOT, AND KING ment setup as shown ontrols as follows: 8003A cilloscope for a 20 r s. Set oscilloscope	lector to A. Adjust 8003A negative full-screen picture (10 cm). SING: < 5% of pulse amplitude. In in Rise-And-Fall-Time-Perfor REP. HATE (Hz) VERNIEK (R.R.) PULSE WIDTH (s) VERNIEK (R.R.) PULSE WIDTH (s) VERNIEK (P. WIDTH) AMPLITUDE (+) VERNIEK (AMPL.+) DS/cm display with a 50 mV/cm ve channel selector to B.	mance-Check 10 M ccw 30 n center 5 V cw vertical sensitivity rting point of the

Section V Table 5-2

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Table 5-2. Performance Check (cont'd)

Model 8003A

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- f. Adjust oscilloscope delay control until the top of the pulse trailing edge is centered on the crt. The preshoot on the trailing edge should be less than 5% (5 mm) of pulse amplitude.
- g. Adjust oscilloscope vertical position control until the bottom of the trailing edge is centered on the crt. The overshoot and ringing on the pulse trailing edge should be less than 5% (5 mm) of pulse amplitude.
- h. Change oscilloscope channel selector to A and repeat Performance-Check Paragraphs 13 d through 13 g.

Section V Table 5-3

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Paragraph Reference		Check	<u>}</u>	Required	Results Ac
1.	Free Running Repetit	ion Rate	······		
step c	10 MHz	Upper Limit	î.	≥10 MHz	≤ 10 cm
step d	0. 3 MHz	Upper Limit		≥0, 3 MHz	≤6.6cm
	10 kHz	Upper Limit		≥10kHz	< 10 cm
	300 Hz	Upper Limit	1	≥300 Hz	< 6. 6 cm
	10 Hz	Upper Limit	1	≥10 Hz	
	10 Hz		· · · · ·		≤10 cm
	300 Hz	Lower Limit		≤.3 Hz	>6.6 cm
	10 kHz	Lower Limit		< 10 Hz	≥5 cm
		Lower Limit		<300 Hz	≥6.6 cm
	0. 3 MHz	Lower Limit		< 10 kHz	≥5 cm
:	10 MHz	Lower Limit		≤0. 3 MHz	≥6.6 cm
2.	Pulse Width				, .
step b	30 ns	Lower Limit		≤ 30ns	< 3 mm
	3 µ s	Lower Limit	l	< 3 μs	≼ 6 cm
	0.1r.s	Lower Limit	1	≼0, 1 ms	≤5 cm
	3 ms	Lower Limit		< 3 ms	< 6 cm
	0.1-35	Lower Limit	· ·	< 0.1s	≤ 10 cm
7	3 ms	Upper Limit		≥0.1s	≥5 cm
	0.1 ms	Upper Limit		≥0.15 ≥3ms	≥6 cm
	3 µ в	Upper Limit		≥0, 1 ms	≥5 cn.
	3 ns	Upper Limit		μο, 1 ms /≥3μs	≥6 cm
					,
step c	0.1-3s	Upper Limit		≥3 s	≥6 cm
3.	Amplitude		1		
step b	5 V	Upper Limit		≥5 V	>5 cm
-	2.5V	Upper Limit		≥2.5V	>5 cm.
	1V	Upper Limit		≥1 V	≥5 cm
	0.5V	Upper Limit		≥6.5V	≥5 cm
	0. 25 V	Upper Limit		>0. 25 V	≥5 cm
	0.1 V	Upper Limit		≥0, 1 V	
	0.05 V	Upper Limit		≥0.05 V	≥2 cm
	0.05 V	Lower Limit	I		>1 cm
	0.1 V	Lower Limit		≤ 0. 02 V	<4 mm
·	0. 25 V			≤0.05 V	<1 cm
	0.5 V	Lower Limit		≤ 0.1 V	≤2 cm
	1.0V	Lower Limit		≤ 0. 25 V	≼2 cm
	2.5V	Lower Limit		< 0. 5 V	<2 cm
	5V	Lower Limit		< 1.0V	≤2 cm
		Lower Limit		< 2. 5 V	<2 cm
4.	Maximum Duty Cycle				
step c	50% at 10 MHz			≥50ns	≥2.5cm
step d	90% at 1 MHz			≥900ns	>4.5 cm
5.	Pulse Delay				
step c	Not Delayed			≈ 10ns	≈1.0mm
step d	Delayed			≈150ns	≈1.5 cm
6.	Synchronized Gating				L
step d	Minimum Gating S	ignal: -2 V		Dulas antes +	uning
			l l	Pulse only du	
				square waves	s. L

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Table 5-3. Performance Check Test Card

5-11

Section V Table 5-3

Paragraph Reference	Check	Required Results Actual
7.	External Triggering	
step d	Ext. +	Pulses only during sine wave positive slope.
step e	Ext	Pulses only during sine wave negative slope.
8.	Manual Triggering	
step b	Push button for single pulses	One pulse for pushed button.
9.	Period Jitter	
step c	< 0.1%	< 0.1 µs < 1 cm
10.	Pulse Width Jitter	
step c	< 0.1% on any width setting	< 0.1 µs < 1 2m
11.	Trigger Output	
step c	Amplitude:	>+2 V > 4 cm
step d	Width:	15ns 15ns 1.5cm 20.5cm
12.	Rise And Fall Time	
step d	Negative Rise Time	<5ns <5cm
step e	Negative Fall Time	<5ns <5cm
step g	Positive Rise Time	<5ns <5cm
	Positive Fall Time	<5ns <5cm
13.	Preshoot, Overshoot, and Ringing	
step d	Positive Leading Edge Preshoot	<5% <5 mm
step e	Positive Leading Edge Overshoot and Ringing	<5% <5 mm
step f	Positive Trailing Edge Preshoot	<5% <5mm
step g	Positive Trailing Edge Overshoot and Ringing	<5% <5 mm
step h	Negative Leading Edge Preshoot	<5% <5 mm
	Negative Leading Edge Overshoot and Ringing	<5%, <5 mm
	Negative Trailing Edge Preshoot	<5 ^(y) <5 mm
	Negative Trailing Edge Overshoot and Ringing	<5(%) <5 mn:

Table 5-3. Performance Check Test Card (cont'd)

5-9. ADJUSTMENTS

5-10. This section gives a complete adjustment procedure for the Model 8003A. This procedure should be conducted only after it has been established that the Model 8003A does not meet its published specifications and does not require troubleshooting. Indiscriminate adjustment of internal controls to refine pulses or to correct major malfunctions may actually cause more difficulty. Since some adjustments interact with others, follow the procedures in the suggosted sequence. Refer to Figure 5-2.

5-11. POWER SUPPLY

- a. Measure the voltage between test point +20 V on bottom circuit board A1 and the chassis round with a DC Digital Voltmeter. Adjust A1R19 fo: +20 volts.
- b. Measure the voltage between test point -20 V on bottom circuit board A1 and chassis ground. Adjust A1R9 for -20 volts.

5-12. REPETITION RATE

a. Connect the -OUTPUT of the Model 8003A to the input of the High Frequency Oscilloscope, terminated at its input with a 50 ohm resistor. Connect the 3003A TRIGGER OUTPUT (+) to the oscilloscope trigger input.

b. Set controls as follows:

8003A	REP. RATE (Hz)	10 M
	VERNIER (R.R.)	CW
	PULSE WIDTH	30 ns
	VERNIER (P. WIDTH)	CCW
	AMPLITUDE (±)	5 V
	VERNIER (AMPL. [±])	cw
	OPER. MODE	normal
High Froq.	SWEEP TIME	0.1 µs/cm
Oscilloacope	TRIGGER SOURCE	Ext. DC
•	TRIGGER SLOPE	positive
	SWEEP SELECTOR	main sweep

SENSITIVITY CH. B

POLARITY

b. Set leading edge of the second pulse to the first line on the screen. Adjust A1C40 so that the leading edge of the twelfth pulse (10 reriods) is seen at 9.6 cm on the screen.

2 V/cm DC

positive

5-13. PULSE WIDTH

- a. Connect equipment as described in Paragraph 5-12a.
- b. Set oscilloscope sweep time to 0.1μ s/cm and sweep magnifier to x10. Center picture on the screen. Adjust A1C35 until pulse width at 50% of the pulse amplitude is less than 2.8 cm.

Section V Paragraphs 5-9 to 5-18

5-14. SPECIALLY SELECTED COMPONENTS

5-15. Components A1C25, A1R56, A1C50, and A1R124 are specially selected at the factory during the testing of the instrument. Selection of the components is needed ONLY if their respective driver amplifier transistors are replaced. The selected resistors influence the output pulse rounding, and the selected capacitors influence the output pulse overshoot and ringing. The resistance range is likely to be between 56 and 100 ohms, and the capacitance range is likely to be between 15 and 39 picofarads. Selected component values, shown in the circuit diagram and listed in the replaceable parts lists, are only typical values. Actual values must be selected experimentally.

5-16. SPECIAL SWITCH CONNECTIONS FOR THE ASTERISK (*) POSITIONS

5-17. REP. RATE RANGE SWITCH

5-18. An additional repetition rate range below 10 M can be connected into the instrument for the asterisk (*) switch position. By installing a capacitor, a desired intermediate repetition rate cange or a slower repetition rate other than 0.3 Hz may be selected in the asterisk (*) position. Connect the capacitor posi-

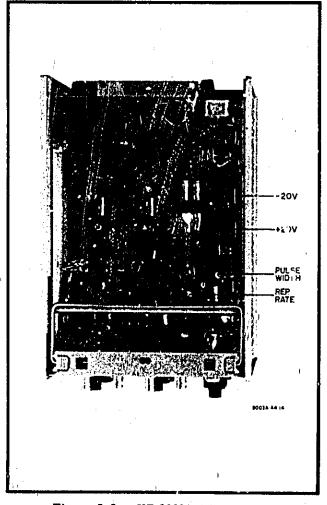


Figure 5-2. HP 8003A Adjustments

5-13

Table 5-4. Calibration and Component Replacement Record For Hewlett-Packard Model 8003A Pulse Generator

Instrument Serial No. _____

CALIBRATION

Date	Description of Calibration Made	Paragraphs Used
	· · · · · · · · · · · · · · · · · · ·	<u> </u>
	,	
		:
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	· · · · · · · · · · · · · · · · · · ·	

COMPONENT REPLACEMENT

Date	Component Designator	Nature of Failure
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tive lead to terminal 12 of the REP. RATE switch S4A(F), front of the first wafer (refer to Figure 7-1). Ground the capacitor negative lead. The capacitor specifications should include a minimum dc working voltage of 10 volts and a maximum leakage current of 50 microamperes. Excessive leakage current lowers the lower limit of the REP. RATE range and can make its VERNIER inoperative over part of its range. The approximate capacitance (in microfarads) may be calculated by dividing the desired repetition rate lower limit (in Hz) into 33, i.e. c = 33/f.

5-19. PULSE WIDTH RANGE SWITCH

5-20. An additional pulse width range above 30 nanoseconds can be connected into the instrument for the asterisk (*) switch position. By installing a capacitor, a desired intermediate pulse width range or a wider pulse width other than 3 seconds can be selected in the asterisk (*) position. Connect the capacitor positive lead to terminal 2 of the PULSE WIDTH switch S6A(R), rear of the first wafer (refer to Figure 7-2). Ground the capacitor negative lead. The capacitor specifications should include a minimum dc working voltage of 10 volts, and a maximum leakage current of 50 microamperes. Excessive leakage current raises the upper limit of the PULSE WIDTH range and can make its vernier inoperative over part of its range. The approximate capacitance (in microfarads) may be calculated by multiplying the pulse width lower limit (in seconds) by 1000, i.e. $c = W \ge 1000$.

5-21. PULSE WIDTH VERNIER RATIO

5-22. The pulse generator is shipped by the manufacturer so that the asterisk (*) PULSE WIDTH position range is connected in parallel with the 30 ns range. In this position the pulse width vernice ratio is 1 to 100. Opening the shorting connection between terminal 1 and 6 on the front of switch wafer S6A (F) changes the ratio to 1 to 30. An intermediate ratio between 1 to 30 and 1 to 100 may be obtained by connecting an additional resistor between switch terminal 1 and 6; this additional resistor is in parallel with R7.

5-23. TROUBLESHOOTING

5-24. GENERAL PROCEDURES

5-25. This troubleshooting information is intended as a guide in isolating a trouble first to a section of the circuitry and then to a specific circuit. The location of the circuit components on their circuit board are identified in figures near the schematic diagrams. Waveform checks and typical dc voltage measurements aid in locating a faulty circuit or component. Control settings for waveforms and typical dc voltages are given in Table 7-2. Troubleshooting test points for waveforms are indicated by numbers inside a star on the schematics. Typical dc voltage values and waveforms appear on the schematics. Refer to Table 7-1 for notes which apply to the schematic diagrams. If satisfactory operation or repairs cannot be accomplished, contact the nearest HP Sales/Service Office (list at rear of this manual).

5-26. OVERALL TROUBLESHOOTING

5-27. To locate trouble in the Model 8003A, start with a thorough visual inspection and then proceed to electrical checkout as necessary. During the visual inspection, look for burned or loose components, loose wire connections, or any other similar condition which suggests a source of trouble. Be sure to check for a blown fuse during the visual inspection. For fuse replacement with 115 volts use a 0.5 amp slowblow fuse; with 230 volts use 0.25 amp slow-blow fuse. Repair any faulty component or connection that is isolated during the visual inspection and check instrument performance before continuing to troubleshoot the instrument.

5-28. If no obvious fault is located during the visual inspection, proceed with the electrical check out as shown in troubleshooting flow chart, Figure 5-3. This figure shows a systematic approach in locating a faulty circuit. A High Frequency Oscilloscope with a high impedance probe should be used to check the test point waveforms, shown in Figure 5-3 and also on the circuit diagrams. Control settings may be found on Figure 5-3 and in Table 7-2.

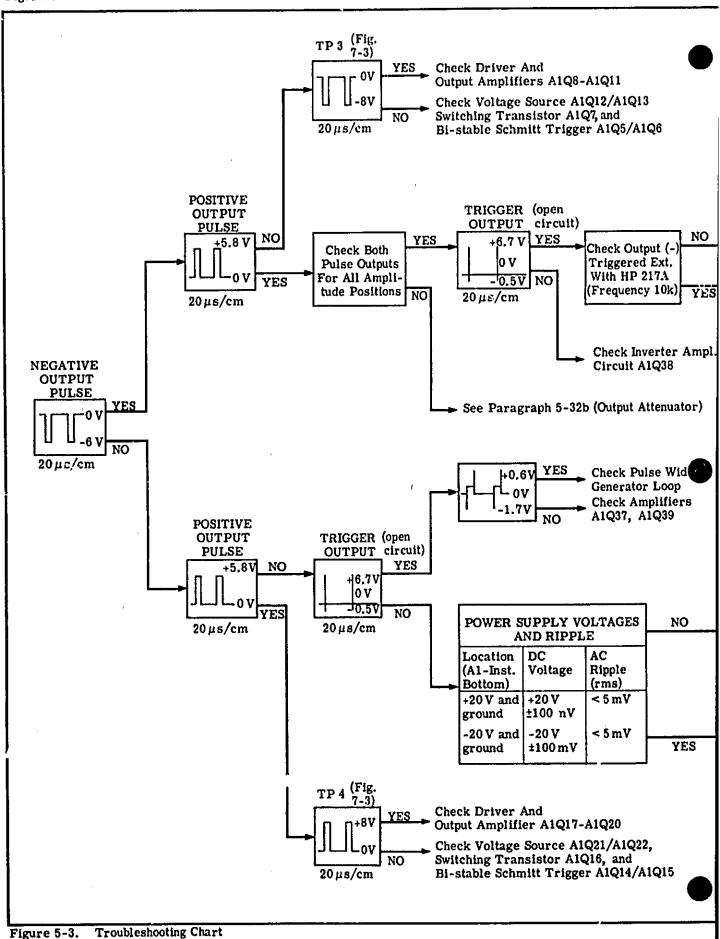
5-29. This troubleshooting procedure starts by limiting the location of the source of trouble by observing the trigger output and pulse output waveforms from the front panel. The results of these waveforms should determine which major part of the instrument is faulty. Then by checking the test point waveforms in this part of the HP Model 8003A, the source of trouble can be narrowed down to circuitry between two test points. If there is more than one cause of trouble, this procedure may be repeated until all faults are located.

5-30. The source of trouble may be narrowed down to several components by checking the circuit diagrams typical voltages with a dc voltmeter. These voltages are with respect to ground and may vary somewhat from instrument to instrument. Individual components may be checked for shorts or for open circuits with an ohmmeter.

5-31. On troubleshooting and in replacement 'n general, always be sure that the transistor, diode, and capacitor pins are connected in correct position as recommended by their manufacturer. Refer to Figures 5-6 and 5-7. To help with proper replacement of semiconductors, the emitter connection is identified by a small dot etched on the circuit board beside the connection point. This dot can also be found for the positive terminal of electrolytic capacitors and for the cathode of diodes. Components not on the circuit boards are located in Figure 5-5.

5-32. LOCATING MALFUNCTIONS

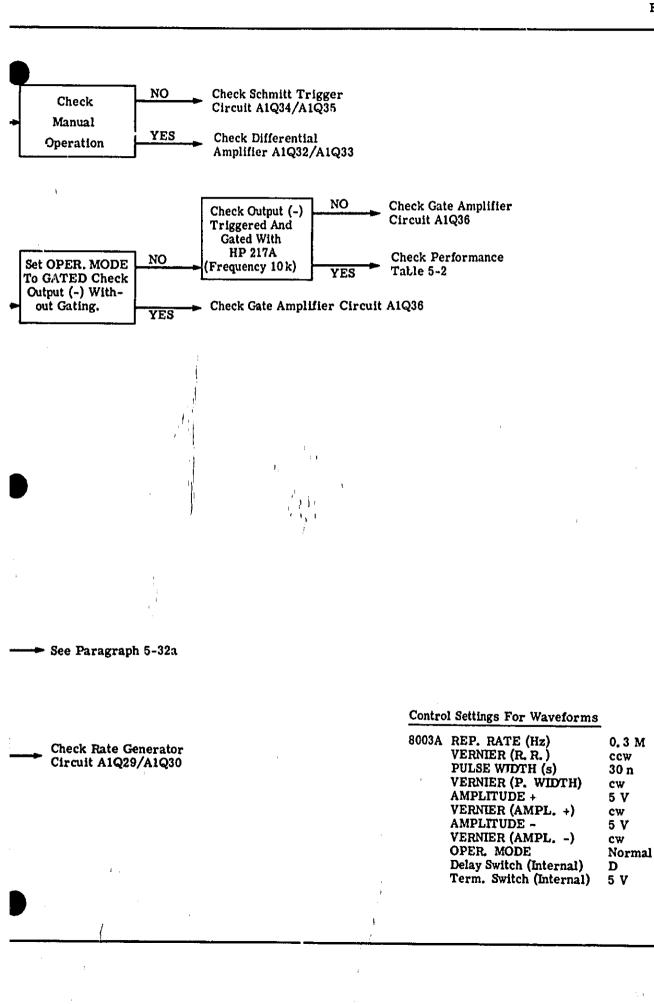
a. POWER SUPPLY. If the power supply voltages are slightly out of tolerance, refer to section 5-12 for power supply adjustments. If any power supply voltages are far out of adjustment, check the applicable circuitry for unusual voltSection V Figure 5-3

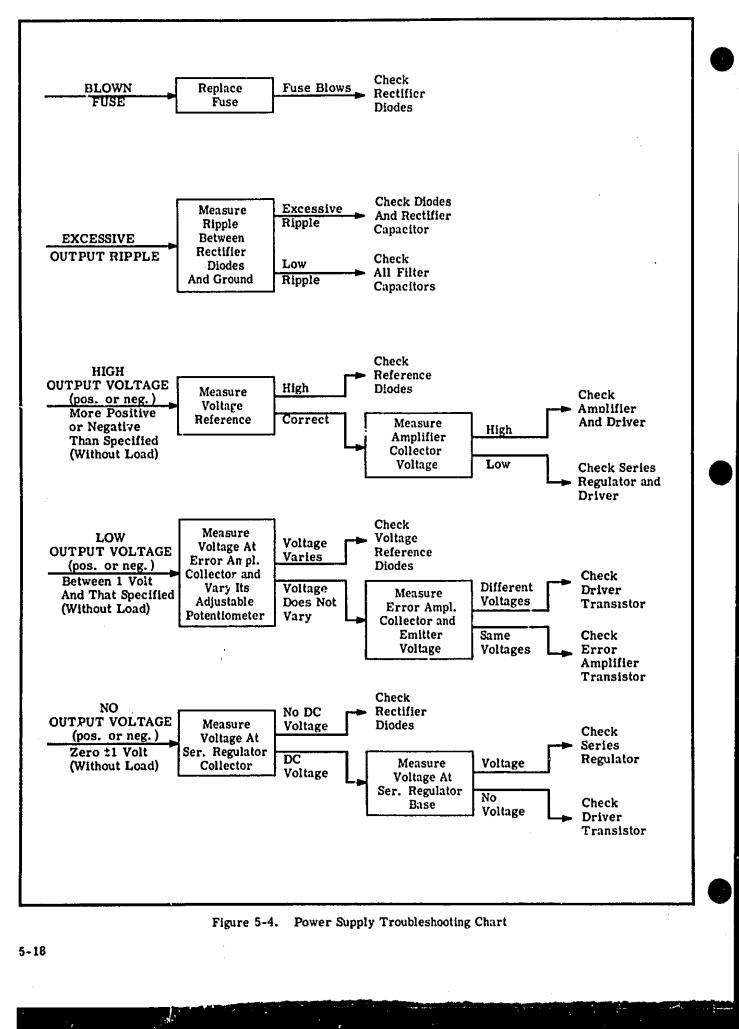


5-16

Model 8003A

Section V Figure 5-3





Section VI

Section V Paragraphs 5-33 to 5-36

ages which do not make sense. Figure 5-4 should aid in finding defect in the power supply. With this in mind, check for faulty components with an ohmmeter. If there is a short circuit, this may be traced with an ohmmeter. The normal resistance of the power supply loads with respect to chassis ground, which may be checked at power supply inputs on top of bottom circuit board A1, is listed below:

TP +20 V	260 N
TP -20 V	400 ቤ

NOTE

Disconnect power before checking resistances.

b. OUTPUT ATTENUATOR. Check pulse amplitude on the 2.5, 1, and 0.5 volt setting for both attenuator assemblies A2 and A3. If the pulse amplitude is incorrect on the 2.5 volt setting, the faulty resistor should be R1, R2, or R3. If the pulse amplitude is incorrect on the 1 volt setting, the faulty resistor should be R4, R5, or R6. If the pulse amplitude is incorrect on the 0.5 volt setting, the faulty resistor should be R7, R8, or R9. This assembly may be re-

paired by removal of its housing. Instructions for pulse attenuator disassembly are found in paragraph 5-36. Attenuator component identification is found in Figure 7-3.

5-33. REPAIR AND REPLACEMENT

5-34. GENERAL

5-35. The following paragraphs provide recommended procedures and techniques for repair or replacement of components. Refer to figures given in List of Illustrations for location and identification of components or assemblies. Section VI contains information for ordering parts.

5-36. PULSE ATTENUATOR DISASSEMBLY

- a. Loosen the two Allen screws on the pulse amplitude knob and remove the knob.
- b. Remove the two bracket nuts and the one bracket screw supporting the attenuator housing.
- c. Remove the four clamping nuts and screws on the attenuator housing.
- d. Rotate the assembly to check and to replace the components.

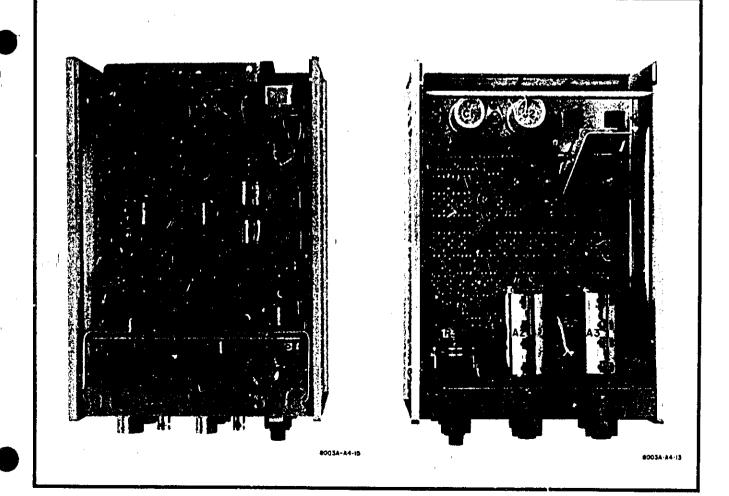


Figure 5-5. HP 8003A Assembly and Off-board Component Identification

Section V Paragraphs 5-37 to 5-47

5-37. DIODES

5-38. Solid-state diodes are manufactured in several different physical packages. Figure 5-6 shows a couple of typical diode configurations, identifying the cathode. If the cathode marking is removed or doubt exists as to polarity, an ohmmeter may be used to determine the proper connection.

5-39. TRANSISTORS

5-40. The following procedures and data are given to aid in determining whether a transistor is operational. Tests are given for both in-circuit and outof-circuit transistors. Lead identification of common transistors with various shapes used in this instrument are shown in Figure 5-7.

5-41. IN-CIRCUIT TESTING

5-42. The common causes of transistor failures are internal short and open circuits. In transistor circuit testing the most important consideration is the transistor base-emitter junction. Like the control grid of a vacuum tube, this is the operational control point in the transistor. This junction is essentially a solid-state diode. For the transistor to conduct, the diode must conduct; that is, the diode must be forward biased. As with simple diodes, the forwardbias polarity is determined by the materials forming the junction. Use the transistor symbol on the schematic diagram to determine the bias polarity required to forward-bias the base emitter junction. Figure 5-8 shows transistor symbols with terminals labeled. Notice that the emitter arrow conventionally points toward the type N material. The other two columns of the illustration compare the Llasing required to cause conduction and cut-off in transistors and vacuum tubes. If the transistor base-emitter diode (junction) is forward-biased, the transistor conducts. If the diode is heavily forward-blased, the transistor saturates. However, if the base-emitter diode is reverse - biased, the transistor is cut off. The voltage drop across a forward-blased emitterbase diode varies with transistor collector current. For example, a germanium transistor has a typical forward-bias, base-emitter voltage of 0.2 - 0.3 volts when collector current is low and of 0.4 - 0.5 volts when collector current is high. In contrast, forwardbias voltage for silicon transistors is about twice that for germanium types: about 0.5 - 0.7 volts when collector current is low, and about 0.8 - 0.9 volts when collector current is high.

5-43. When examining a transistor stage, first determine if the emitter-base is biased for conduction (forward-biased) by measuring the voltage difference between emitter and base. When using an electronic voltmeter, do not measure directly between emitter and base; there may be sufficient loop current between the voltmeter leads to damage the transistor. Inctead, measure each voltage separately with respect to a voltage common point (e.g. chassis).

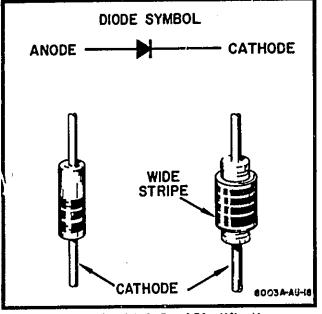


Figure 5-6. Diode Lead Identification

5-44. TESTING TRANSISTORS WITH AN OHMMET 3R

5-45. The two common causes of transistor failure are internal short and open circuits. Remove the transistor from the circuit and use an ohmmeter to measure internal resistance. See Table 5-5 for measurement data.

CAUTION

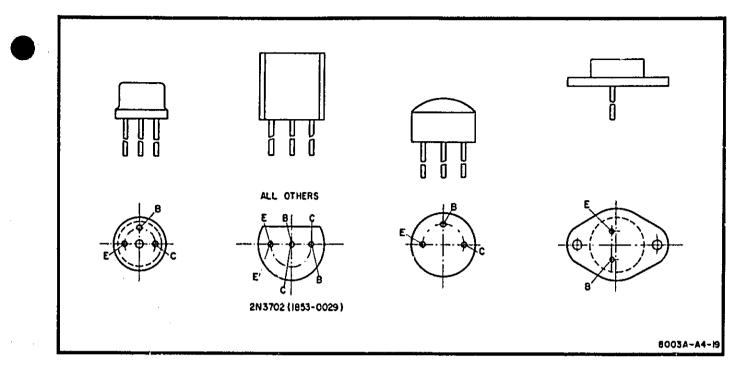
Most ohmmeters can supply enough current or voltage to damage a transistor. Before using an ohmmeter to measure transistor forward or reverse resistance, check open-circuit voltage and shortcircuit current output ON THE RANGE TO BE USED. Open-circuit voltage must not exceed 1.5 V and short-circuit current must be less than 3 mA. See Table 5-6 for safe resistance ranges for some common ohmmeters.

5-46. ETCHED CIRCUITS

5-47. The etched circuit boards in the HP Model 8003A are a plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results. Table 5-7 lists recommended tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work:

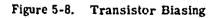
a. Do not use a high-power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

Model 8003A





DEVICE	SYMBOL	CUTOFF	CONDUCTING
VACUUM TUBE		+200V(TYPICAL)	+200V(TYPICAL)
N PN TRANSISTOR		+20V(TYPICAL)	+ 20V (TYPICAL) +.2V TO +.9V CONTROL CURRENT
PNP TRANSISTOR	COLLECTOR BASE EMITTER	-20V(TYPICAL)	-20V (TYPICAL) -2V TO 9V CONTROL CURRENT 8003A-44-16



Section V Tables 5-5 to 5-7

Trans	Transistor		Dhmmeter	Measure		
Typ 	e	Pos. lead to	Neg. lead to	Resistance (ohm)		
	Small	emitter	base	200 - 500		
PNP	Signal	emitter	collector	10k - 100k		
Ger- manium	_	emitter	base	30 · 50		
	Power	emitter	collector	se /eral hundred		
	Small	emitter	base	1k - 3k		
PNP	Sigral	emitter	collector	very high (might read open)		
Silicon	Power	emitter emitter	base collector	200 - 1000 high, often greater than 1M		
	Small	base	emitter	1k - 3k		
NPN	Signal	collector	emitter	very high (might read open)		
Silicon	Power	base collector		200 - 1000 greater than 1M		
	To test for transistor action, add collector-base short. Measured resistance should decrease.					

Table 5-5.Output- or Circuit-Transistor
Measurement

	Safe	Open Ckt	Short Ckt		ad
Ohmmeter	Range(s)	Voltage	Current	Color	Polarity
412A	R x 1k R x 10k R x 100k R x 100k R x 1M R x 10M	1.0V 1.0V 1.0V 1.0V 1.0V	1mA 100μA 10μA 1μA 0.1μA	Red Blk	+
410C	R x 1k R x 10k R x 100k R x 100k R x 1M R x 10M	1.3V 1.3V 1.3V 1.3V 1.3V 1.3V	0. 57mA 57μA 5. 7μA 0. 5μA 0. 05μA	Red Blk	+ -
410B	R x 100 R x 1k R x 10k R x 100k R x 100k R x 1M	1.1V 1.1V 1.1V 1.1V 1.1V 1.1V	1.1mA 110μA 11μA 1.1μA 0.11μA	Blk Red	+ -
Simpson 260	R x 100	1.5 V	1mA	Red Blk	+
Simpson 269	R x 1k	1.5V	0. 82mA	Blk Red	+ -
-	R x 100 R x 1k	1.5V 1.5V	3, 25mA 325µA		es with erial

1.5 V

1.5V

750µA

75µA

Number

Table 5-6.Safe Ohmmeter Range for TransistorResistance Measurement

Model 8003A

Table 5-7. Etched Circuit Soldering Equipment

Triplett 310

R x 10 R x 100

Item	Use	Specification	Item Recommended
Sordering Tool	Soldering Unsoldering	Wattage rating: 37.5 Tip Temp: 759-800°F Tip Size: 1/8" OD	Ungar #776 Handle with Ungar #1237 Heating Unit
Soldering Tip, general purpose	Soldering Unsoldering	Shape: chisel Size: 1/8"	Ungar #PL113
De-soldering aid	Unsoldering multi- connection components (e.g., Tube sockets)	Suction device to remove molten solder from connection	Soldapullt by the Edsyn Company, Arleta, California
Resin (flux) solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board mat- erial or conductor bond- ing agent	Freon Isopropyl Alcohol (100 % dry) Chloroform
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/ lead), 18 gauge (SWG) preferred	
Protective Coating	Contamination, corro- sion protection after soldering	Good electrical insulation, corrosion-prevention properties	Krylon * #1302 Humiseal Protective Coating, Type 1B12 by Columbia Technical Corp. Woodside 77, New York

* Krylon Inc., Norristown, Pennsylvania

- b. Use a suction device (Table 5-7) or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP ME-TAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OB-JECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.
- c. After soldering, remove excess flux from the soldered area and apply a protective coating to prevent contamination and corrosion. See Table 5-7.
- 5-48. COMPONENT REPLACEMENT
 - a. Remove defective component from circuit board.
 - b. Remove solder from mounting holes using a suction desoldering device (Table 5-7) or wooden toothpick.
 - c. Shape leads of replacement component to match mounting hole sp

- d. Insert component leads into mounting holes, and position component as the original was positioned. Do not force leads or replacement component into mounting holes. Sharp lead ends may damage plated-through conductor.
- e. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of board. A heat sink (longnose pliers, commerical heat-sink tweezers, etc) should be used when replacing transistors and diodes in order to prevent conduction of excessive heat from the soldering iron to the component.

5-49. ETCHED CONDUCTOR REPAIR

5-50. A broken or burned section of conductor can be repaired in the field by bridging the damaged section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

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SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-2 lists the parts in alphanumeric order by reference designation. Reference designations for groups of identical items may be shown as TP1-TP9 followed by a single part number and description, indicating that TP1 through TP9 are separate but identical parts.

6-3. Parts consisting of several smaller, yet separately replaceable parts such as jacks or relays have all sub-parts listed so that partial replacement of these items can be accomplished.

64. An asterisk following the description of a part indicates optimum value selected at the factory, average value shown.

6.5. ORDERING INFORMATION.

6-6. Many parts used in Hewlett-Packard equipment are manufactured by HP or to HP specification.

6-7. To obtain replacement parts from HP, address order or inquiry to the nearest Hewlett-Packard Sales/Service Office (names and addresses in Appendix B of this manual), and supply the following information:

- a. HP Part Number of item(s).
- b. model number and serial number of instrument.
- c. quantity of part(s) desired.

6-8. To order a part not listed in the table, provide the following information:

a. model number and serial number of the instrument.

b. discription of the part, including function and location in the instrument.

	I		REFEREN	CE DES	IGNATORS		
٨	- as: unbly	E	 mise, electronic part 	м	= nieter	тв	• terminal board
ÄT	= attenuator	F	= fuse	MP	mechanical part	TP	* test point
	resistive termination	FL	> filter	2	= plug	Ű	= microcircuit(non-repairable)
D	a motor, fan	Ĥ.	* hardware	PS	= power supply	Ŷ	« vacuum tube, neon bulb,
č	= capacitur	ïc	* integrated circuit	Q	* transistor	•	photocell, stc.
ČР	* coupling	J	= jack	Ř	= resistor	VR	* voltage regulator (divide)
CR	= diodo	ĸ	= relay	RT	= thermistor	Ŵ	 caple country connet
DL	* delay line	L	= inductor	S		x	= socket
DS		LS		ъ Т	= switch	Ŷ	
D2	 device signaling (lamp) 	ها	= speaker	L	= transformer	r	= crystal
			ABb	REVIA	TIONS		
A	= ampere(s)	Ge	• germanium	minat	= miniatore	s-b	slow-blow
ampl	= amplifier(s)	Ğ	 giga (10²) 	mom.	= momentary	Se	= slow-blow = selenium
ampt	 amprinertay assembly 	к) к)	• glass				
цазу	 assementy 	grd		mtg	= mounting	sect	= section(s)
1.4	have and end	Kru	= ground(ed)	my.	= mylar	semicon	semiconductor(s)
bd	= board(s)				···-9.	51	= silteon
Եթ	+ bandpans	n	= henry(ies)	n.	= nano (10 ⁻⁹)	sil	= silver
c	= centi (10 ⁻²)	Hμ	* mercury	n/c	normally closed	51	= slide
car.	= carbon	hr	= hour(s)	Ne	* neon	sp	# single pole
CCW	# counterclockwise	HP	# Hewlett-Packard	n/o	= normally open	spl	* special
cer	= coramic	Hz	+ hertz	npo	* negative positive zero	st	single throw
					(zero temperature	std	= standard
coax.	* coaxiai	if.	 intermediate freq 		coefficient)		
coef	+ COCHIECTER	unupg	impregnated	nsr	= not separately	Ta	= tantalum
com comp	* CONTINUE	Ined	# invandescent		replacemble	td	= time delay
	composition	incl	= include(s)		····	TD	= tunnel_diode(s)
20nn CRT	= connector(s)	105	= insulation(ed)	obd	order by description	1g1	= toggle
	∗ cothode-ray tube	int	= internat	UX.	= oxide	Ti	= titanium
C.M.	* clockwise				····	tol	= tolerance
ď	= deci (10 ⁻¹)	k	= kilo (10 ³)	þ	= pico (10 ⁻¹²)	trin.	= trimmer
depe	 deposited carbon 	~	- #110 (10)	pe -	<pre>= pico (ro) = printed (etched) circuit(s)</pre>	** **** *	- Whither
dp	= double pole	1b	= pound(s)	PGM	= primed (elened) circuit(s) = program	u	= micro (10 ⁺⁶)
dt	• double throw	let	= lever			u	= micro (10)
	- addite throw	H.	= linear taper	piv	= peak inverse voltage(s)		
elect.	= clectrolytic			p/u	= part of	V	= volt(s)
encap	- an an surfact at	le ti	» logarithmic taper	poly	= polystyrene	var	= variable
ext	= external	lp`	= low-pass filter(s)	pore	= porcelain		
VAL	= vaternal			poa	= position(s)	w,	= wait(s)
F		nı	= milli (10 ⁻³) = mega (10 ⁶)	pot.	• potentiometer(s)	w/.	= with
	= fo) (s)	М	• mega (10 ⁻)	pit - pit	* peak-to-peak	w/o	= without
fet	= neld-effect transistor(s)		= metal film	rect	= rectifier(s)	wVdc	= dn working volt(s)
fxd	= fixed	metox	metal oxide	rl	= radio frequency	ww	* wirewound

Table 6-1. Reference Designators And Abbreviations

Section VI Table 6-2

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			Table 6-2. Replaceable Parts	
Ref Desig =	HP Part No.	TQ	Description (Refer to Table 6-1.)	
!				
Al	08003-66501		A: Upard assembly	
	0000-00501			
A1C1	0180-0049		C: fxd alum 20 uF 50 wVdc	
A162	0160-0320	1	C: fxd cer .05 uF -20% +80% 25 wVdc	
A1C3 A1C4	0180-0049		C: fxd alum 20 uF 50 wVdc C: fxd alum 20 uF 50 wVdc	
A1C5	0160-0820		C: fxd cer .05 uF -20% +80% 25 wVdc	
A1C6	0180-0049		C: fxd alum 20 uF 50 wVdc	
A107	0150-0050		C: fxd cer 0.001 uF t'00 wVdc	
A1C8	0140-0145		C: fxd mica 22 pF 5% 500 wVdc	
A1C9	0140-0192		C: fxd mica 68 pF 5% 300 wVdc	
A1C10	0180-0291		C: fxd Ta 1 uF 10% 35 wVdc	
A1C11	0160-2306		C: fxd mica 27 pF 5% 300 wVdc	
A1C12	0180-0291		C: fxd Ta 1 uF 10% 35 wVdc	
A1C13	0150-0093		C: fxd cer 0.01 uF -20% +80% 100 wVdc	
A1C14 A1C15	0150-0093 0180-0291		C: fxd cir 0.01 uF20% +80% 100 wVdc C: fxd Ta 1 uF 10% 35 wVdc	
	0160-0291		C: 1x0 Ta T 0r 10% 35 WVdc	
A1C16	0180-1706		C: fxd Ta 100 uF 20% 25 wVdc	
A1C17	0150-0050		C: fxd cer 0.001 uF 600 wVdc	
A1C18 A1C19	0140-0145		C: fxd mics 22 pF 5% 500 wVdc	
A1C19 A1C20	0140-0192 0180-0291		C: fxd mica 68 pF 300 wVdc C: fxd Ta 1 uF 10% 35 wVdc	
A1C21	0180-0291		C: fxd Ta 1 uF 10% 35 wVdc	
A1C22	0160-2198		C: fxd mica 20 pF 5% 500 wVdc	Í
A1C23	0150-0093		C: fxd cer 0.01 uF -20% +80% 100 wVdc	
A1C24	0150-0093	[C: fxd cer 0.01 uF -20% +80% 100 wVdc	
A1C25	0140-0145		C: fxd mica 22 pF 5% 500 wVdc (*)	
A1C26	0180-0291		C: fxd Ta 1 uF 10% 35 wVdc	
A1C27	0180-1706		C: fxd Ta 100 uF 20% 25 wVdc	
A1C28	0140-0145		C: fxd mica 22 pF 5% 500 wVdc	
A1C29 A1C30	0150-0093 0180-2207		C: fxd cer 0.01 uF -20% +80% 100 wVdc C: fxd Elect 100 uF 10% 10 wVdc.	
A1C31	0180-2109	ĺ	C: fxd Ta 3.3 uF 5% 35 wVdc	
A1C32	0170-0019	ļ	C: fxd mylar 0.1 uF 5% 200 wVdc	
A1C33	0140-0174		C: fxd mica 3050 pF 1% 100 wVdc	
A1C34	0140-0204		C: fxd mica 47 pF 5% 500 wVdc	
A1C35	0121-0046		C: var cer 9-35 pF	
A1C37	0140-0194		C: fxd mica 110 pF 5% 300 wVdc	
A1C38	0140-0190		C: fxd mica 39 pF 5% 300 wVdc	
A1C39 A1C40	0140-0145		C: fxd mica 22 pF 5% 500 wVdc	
A1C40 A1C41	0121-0046 0140-0204		C: var cer 9–35 pF C: fxd mica 47 pF 5% 500 wVdc	
A1C42	0140-017 .		C: fxd mica 3050 pF 1% 100 wVdc	
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Section VI Table 6-2

Table 6-2.	Replaceable Parts (Cont'd)
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Ref	HP Part No.	τα	Description	
Desig		10	(Refer to Table 6-1.)	
A1C43	0170-0019		C: fxd mylar 0.1 uF 5% 200 wVdc	
A1C44	0180-2109		C: fxd Ta 3.3 uF 5% 35 wVdc	
A1C45 A1C46	0180-2207		C: fxd Elect 100 uF 10% 10 wVdc	
A1C48	0180-0374 0150-0050		C: fxd Ta 10 uF 10% 20 wVdc C: fxd cer 0.001 uF 600 wVdc	
	0100-0000			
A1C48	0150-0071		C: fxd cer 400 pF 5% 500 wVdc	
A1C49	0140-0191		C: fxd mica 56 pF 5% 300 wVdc	
A1C50	0140-0202		C: fxd mica 15 pF 5% 500 wVdc (*)	
A1C51	0140-0201	{	C: fxd mica 12 pF 5% 500 wVdc	
A1C52	1080-0291		C: fxd Ta 1 uF 10% 35 wVdc	
A1C53	0180-0291		C: fxd Ta 1 uF 10% 35 wVdc	
A1C54	0180-0291	1	C: fxd Ta 1 uF 10% 35 wVdc	
A1C55	0180-0197		C: fxd Ta 2.2 uF 10% 20 wVdc	
A1C56	0180-0291		C: fxd Ta 1 uF 10% 35 wVdc	
A1C57	0150-0121		C: fxd cer 0.1 uF -20% +80% 50 wVdc	
A1C58	0150-0121		C: fxd cer 0.1 uF -20% +80% 50 wVdc	
A1CR1	1901-0045		CR: Si	
A1CR2	1901-0045		CR: Si	
A1CR3	1901-0045		CR: Si	
A1CR4	1901-0045	1	CR: Si	
A1CR5	1902-0048		VR: breakdown 6.81V 5% 400 mW	
A1CR6	1901-0045			
A1CR7	1901-0045		CR: Si CR: Si	
A1CR8	1901-0045		CR: Si	
A1CR9	1901-0045	1 1	CR: Si	
A1CR10	1902-0048		VR: breakdown 6.81V 5% 400 mW	
A1CR11	1001 0040			
AICR12	1901-0040 1901-0040		CR: Si	
A1CR13	1901-0040		CR: Si CR: Si	
A1CR14	1901-0040		CR: Si	
A1CR15	1901-0040		CR: Si	
A1CR16	1010 0010			
AICR17	1910-0016 1910-0016		CR: Ge CR: Ge	
A1CR18	1901-0040		CR: Si	
A1CR19	1901-0040		CR: Si	
A1CR20	1901-0040		CR: Si	
A1CR21	1001.0040			
AICR22	1901-0040 1910-0016		CR: Si	
A1CR23	1910-0016		CR: Ge CR: Ge	
A1CR24	1901-0040		CR: Si	
A1CR25	1901-0040		CR: Si	

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Section VI Table 6-2

Model 8003A

Table 6-2. Replaceable Parts (Cont'd)

		rr		
Ref Desig	HP Part No.	тο	Description (Refer to Table 6-1.)	
Desiĝ		┠───╂		- (
A1CR26	1901-0040] [CR: Si	
A1CR27	1901-0040		CR: Si	
A1CR28	1902-3150		VR: breakdown 9.09V 2% 400 mW	
A1CR29	1901-0040		CR: Si	1
A1CR30	1901-0040		CR: Si	
A1DL1	9190-0007	1 1	DL: 140 ns	
	2400 4040			
A1L1	9100-1616		L: fxd 1.5 uH 10%	
A1L2	9140-0111		L: fxd 3.3 uH 10%	
A1L3	9140-0096		L: fxd 1 uH 10%	1
A1L5	9100-1616		L: fxd 1.5 uH 10%	
A1MP1	08003-01101		MP: heat sink, U shaped	
A1MP2-	Consists of:		MP: heat dissapator (used on Q10, Q11, Q19 and Q20)	
A1MP5	1205-0007		MP: heat dissapator (used on GTO, GTT, GTS and G2O) MP: heat dissapator nut	
	1205-0008] [MP: heat dissapator hut MP: heat dissapator body	
	12030000			
A1MP6-	1205-0011		MP: heat dissepator (used on Q12 and Q21)	
A1MP8			· · · · · · · · · · · · · · · · · · ·	I
A1MP9-	1205-0037		MP: heat dissapator (used on Q1, Q2, Q3, and Q4)	
A1MP12				
A1Q1	1854-0307		Q: Sinpn	
A102	1854-0307		Q: Sinpn	
A103	1854-0307		Q: Sinpn	
A1Q4	1854-0307		Q: Si min	
4405	1051 0015			
A105	1854-0215		Q: Sinpn	
A106	1854-0215		Q: Sinph	
A107	1853-0218		Q: Sipnp	
A108	1853-0218	1	Q: Sipnp	
A1Q9	1853-0218	1	Q: Sipnp	
A1Q10	1853-0012		Q: Si pnp 2M2904A	1
A1010	1853-0012	1	Q: Si pnp 2M2904A Q: Si pnp 2M2904A	
A1012	1854-0003	1 1	Q: Sinpn 2N1711	1
A1012 A1013	1853-0020		Q: Sipnp	1
A1013 A1014	1853-0020		Q: Sipnp 2N3906	1
			a, a pip zitabu	
A1Q15	1853-0036		Q: Si pnp 2N3906	
A1Q16	1854-0019		Q: Sinpn	
A1Q17	1854-0267		Q: Sinpn	
A1Q18	1854-0267		Q: Sinpn	
A1Q19	5080-1040		Q: Si npn (Selected)	1
				1
				1
				1
i				11
	ļ			
8	1	1		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	HP Part No.	тα	Description (Refer to Table 6-1.)
e e a g			
A1Q20	5080-1040		Q: Sinpn (Selected)
A1Q21	1853-0012		Q: Sipnp 2M2904A
A1Q22	1854-0307		Q: Sinpn
A1023	1853-0036		Q: Si pnp 2N3906
A1Q24	1853-0036		Q: Si pnp 2N3906
A1025	1854-0019		Q: Sinpn
A1Q26	1853-0034		Q: Si pnp
A1027	1854-0215		Q: Sinpn
A1Q28	1854-0215		Q: Sinpn
A1029	1853-0036		Q: Si pnp 2N3906
,			
A1030	1854-0260		Q: Si npn 2N3227
A1031	1854-0215		Q: Sinpn
A1032	1854-0215		Q: Sinpn
A1033	1854-0215		Q: Sinpn
A1034	1854-0215		Q: Sinpn
	1001 0210		
A1Q35	1854-0215		Q: Sinpn
A1035	1854-0215		Q: Sinpn
A1030 A1037	1853-0034		Q: Sipp
A1Q38	1853-0034	i	Q: Sipnp
A1Q39	1854-0215		Q: Sipp
A1033	10040210		a. Sinph
A1R1	07E 0035		R: fxd metfim 3000 ohms 5% 1/4W
A1R2	0758-0005		
A1R3	0758-0003		R: fxd metfim 4700 ohms 5% 1/4W
A1R4	0758-0062		R: fxd metfim 2000 ohms 5% 1/4W
A1R5	0758-0048		R: fxd metfim 200 ohms 5% 1/4W
, Ains	07500040		R: fxd metflm 8200 ohms 5% 1/4W
A1R6	0758-0042		R: fxd metflm 1300 ohms 5% 1/4W
A1R7	0758-0033		R: fxd metfim 2000 ohms 5% 1/4W
A1R8	0758-0034		
A1R9	2106-2795		R: fxd metflm 2400 ohms 5% 1/4W
A1R10	0758-0042		R: var comp 470 ohms ±20% 5W R: fxd mattim 1200 ohms 5% 1/4W
	V1 V7 VV7Z		R: fxd metfim 1300 ohms 5% 1/4W
A1R11	0758-0035		R: fxd metflm 3000 ohms 5% 1/4W
A1R12	0758-0005		R: fxd metrim 3000 onms 5% 1/4w R: fxd metrim 4700 ohms 5% 1/4W
A1R13	0758-0033		R: fxd metfim 2000 ohms 5% 1/4W
A1R14	0758-0062		R: fxd metrim 2000 ohms 5% 1/4W
A1R15	0758-0048		
	V/ JO/ UMD		R: fxd metfim 8200 ohms 5% 1/4W
A1R16	0758-0042		B: fud motifue 1200 above EN/ 4 (4))
A1R17	0758-0042		R: fxd metfim 1300 ohms 5% 1/4W
A1R18	0758-0034		R: fxd metfim 2000 ohms 5% 1/4W
A1R19	2100-2795		R: fxd metfim 2400 ohms 5% 1/4W
AIR20	0758-0042		R: var comp 470 ohms ±20% 5W
711120	07000042		R: fxd metflm 1300 ohms 5% 1/4W
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Table 6-2. Replaceable Parts (Cont'd)

Ref	HP Part No.	та	Description	
Desig	HE Part NO.	iu i	(Refer to Table 6-1.)	
i				
A1R21	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	
A1R22	0757-0429		R: fxd metflm 1820 ohms 1% 1/8W	
A1R23	0757-0403		Fi: fxd metfim 121 ohms 1% 1/8W	
A1R24	0758-0062		R: fxd metfim 200 ohms 5% 1/4W	
A1R25	0758-0127		R: fxd metfim 430 ohms 5% 1/4W	
A1R26	0758-0031		R: fxd metflm 680 ohms 5% 1/4W	
A1R27	0757-0419		R: fxd metfim 681 ohms 1% 1/8W	
A1R28	0757-0283		R: fxd metfim 2000 ohms 1% 1/8W	
A1R29	0758-0028		R: fxd metfim 270 ohms 5% 1/4W	
A1R30	0761-0025		R: fxd metox 129 ohms 5% 1W	
	0,0,0020			
A1R31	0698-5137		R: fxd metfim 47 ohms 5% 1/4W	
A1R32	0761-0003		R: fxd metfim 62 ohms 5% 1W	
A1R33	0761-0003		R: fxd metfim 62 ohms 5% 1W	
·A1R34	0760-0027		R: fxd metfim 150 ohms 2% 1W	
A1R35	0760-0027		R: fxd metfim 150 ohms 2% 1W	
	0/00/002/	1	n. TKU methin 150 orinis 276 TW	
A1R36	0758-0017		R: fxd metfim 1500 ohms 5% 1/4W	
A1R37	0758-0096		R: fxd metfim 110 ohms 5% 1/4W	
A1R38	0758-0003		R: fxd metfim 1000 ohms 5% 1/4W	
A1R39	0758-0043		R: fxd metfim 1800 ohms 5% 1/4W (*)	
A1R40	0700000			
			Not assigned	1
A1R41	0758-0031		Dy fud mostline COD at the EQL + (1) (1)	
A1R42	0757-0429		R: fxd metfim 680 ohms 5% 1/4W (*)	
A1R43	0757-0280		R: fxd metfim 1820 ohms 1% 1/8W	
A1R44	0758-0127		R: fxd metfim 1000 ohms 1% 1/8W	
A1R45	0757-0284		R: fxd metflm 430 ohms 5% 1/4W	
A1040	0757-0204		R: fxd metflm 150 ohms 1% 1/8W	
A1R46	0758-0007		D. And monthly and the rate of a land	
A1R47	0757-0283		R: fxd metfim 150 phms 5% 1/4W	
A1R48	0757-0419		R: fxd metflm 2000 ohms 1% 1/8W	
A1R49			R: fxd metfim 681 ohms 1% 1/8W	
	0758-0031		R: fxd metfim 680 ohms 5% 1/4W	
A1R50	0758-0028		R: fxd metflm 270 ohms 5% 1/4W	
A1051	0764 0005			
A1R51 A1R52	0761-0025	[R: fxd metox 120 ohms 5% 1W	
	0758-0094		R: fxd metfim 62 ohms 5% 1/4W	
A1R53	0758-0044		R: fxd metfim 2200 ohms 5% 1/4W	
A1R54	0761-0003		R: fxd metfim 62 ohms 5% 1W	i.
A1R55	0761-0003		R: fxd metfim 62 ohms 5% 1W	
A1R56	0750 0100		De faid an effer de la morie terre ter	
	0758-0126		R: fxd metfim 51 ohms 5% 1/4W (*)	
A1R57	0760-0027		R: fxd metfim 150 ohms 2% 1W	
A1R58 A1R59	0760-0027		R: fxd metfim 150 chms 2% 1W	
	0758-0017		R: fxd metflm 1500 ohms 5% 1/4W	
A1R60	0758-0096		R: fxd metfim 110 ohms 5% 1/4W	
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Model 8003A

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Table 6-2. Replaceable Parts (Cont'd)

Desig HP Part No. TQ (Refer to Table 6-1.) A1R61 0757-0003 R: fxd metfim 1000 ohms 5% 1/4W (*) A1R62 0758-0003 R: fxd metfim 2000 ohms 5% 1/4W (*) A1R65 0757-006 R: fxd metfim 1000 ohms 5% 1/4W (*) A1R64 0757-1066 R: fxd metfim 1000 ohms 5% 1/4W (*) A1R65 0757-0260 R: fxd metfim 1000 ohms 5% 1/4W A1R66 0757-1066 R: fxd metfim 1000 ohms 1% 1/8W A1R67 0758-0280 R: fxd metfim 1000 ohms 5% 1/4W A1R70 0758-027 R: fxd metfim 300 ohms 5% 1/4W A1R72 0758-0280 R: fxd metfim 310 ohms 5% 1/4W A1R72 0758-0283 R: fxd metfim 30 ohms 5% 1/4W A1R73 0757-0283 R: fxd metfim 2000 ohms 5% 1/4W A1R76 0757-0283 R: fxd metfim 100 ohms 5% 1/4W A1R76 0757-0728 R: fxd metfim 100 ohms 5% 1/4W A1R76 0757-0728 R: fxd metfim 100 ohms 5% 1/4W A1R77 0758-0016 R: fxd metfim 100 ohms 5% 1/4W A1R76 0757-0728 R: fxd metfim 100 ohms 5% 1/4W	Ref			Description
A1R61 0757-0003 R: fxd metfim 1000 chms 5% 1/4W A1R62 0758-0003 R: fxd metfim 2000 chms 5% 1/4W (*) A1R63 0758-0031 R: fxd metfim 680 chms 5% 1/4W (*) A1R65 0757-0431 R: fxd metfim 680 chms 5% 1/4W (*) A1R66 0757-0431 R: fxd metfim 1300 chms 1% 1/8W A1R67 0757-0280 R: fxd metfim 1000 chms 1% 1/8W A1R70 0758-0276 R: fxd metfim 1000 chms 1% 1/8W A1R70 0758-0083 R: fxd metfim 61.9 chms 1% 1/8W A1R71 0758-0083 R: fxd metfim 61.0 chms 5% 1/4W A1R71 0758-0030 R: fxd metfim 61.0 chms 5% 1/4W A1R72 0757-0283 R: fxd metfim 1000 chms 5% 1/4W A1R72 0757-0283 R: fxd metfim 1000 chms 5% 1/4W A1R76 0757-0283 R: fxd metfim 1000 chms 5% 1/4W A1R76 0756-0016 R: fxd metfim 100 chms 5% 1/4W A1R76 0757-0283 R: fxd metfim 100 chms 5% 1/4W A1R77 0758-0016 R: fxd metfim 100 chms 5% 1/4W A1R81 0757-0730 R: fxd metfim 120 chms 1% 1/8W A1R81 0757-0730 R: fxd metfim 120 chms 1% 1/4W		HP Part No.	TQ	
A1R62 0768-0033 R: fxd metfin 2000 ohms 5% 1/4W (*) A1R63 0757-0201 R: fxd metfin 680 ohms 5% 1/4W (*) A1R65 0757-0431 R: fxd metfin 680 ohms 5% 1/4W A1R66 0757-0200 R: fxd metfin 1360 ohms 1% 1/8W A1R67 0757-0200 R: fxd metfin 1000 ohms 1% 1/8W A1R72 0765-0220 R: fxd metfin 1000 ohms 1% 1/8W A1R72 0758-0033 R: fxd metfin 1000 ohms 1% 1/8W A1R70 0758-0030 R: fxd metfin 680 ohms 5% 1/4W A1R71 0758-0033 R: fxd metfin 510 ohms 5% 1/4W A1R71 0765-0212 R: fxd metfin 510 ohms 5% 1/4W A1R73 0757-0223 R: fxd metfin 2000 ohms 1% 1/8W A1R75 0757-0283 R: fxd metfin 300 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfin 300 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfin 160 ohms 1% 1/8W A1R77 0786 0016 R: fxd metfin 160 ohms 1% 1/8W A1R77 0786 0025 R: fxd metfin 160 ohms 1% 1/8W A1R81 0757-0703 R: fxd metfin 160 ohms 1% 1/8W A1R82 0757-0738 R: fxd metfin 160 ohms 1% 1/4W A1R				
A1R62 0758-0033 R: fxd metfin 2000 ohms 5% 1/4W (*) A1R63 0757-0431 R: fxd metfin 680 ohms 5% 1/4W (*) A1R64 0757-0431 R: fxd metfin 680 ohms 5% 1/4W (*) A1R65 0757-0431 R: fxd metfin 1360 ohms 1% 1/6W A1R66 0757-0280 R: fxd metfin 1360 ohms 1% 1/6W A1R70 0756-0280 R: fxd metfin 1360 ohms 1% 1/6W A1R70 0757-0280 R: fxd metfin 680 ohms 5% 1/4W A1R70 0758-0083 R: fxd metfin 610 ohms 1% 1/6W A1R71 0758-0083 R: fxd metfin 610 ohms 5% 1/4W A1R71 0758-0083 R: fxd metfin 510 ohms 5% 1/4W A1R71 0758-0083 R: fxd metfin 510 ohms 5% 1/4W A1R73 0757-0412 R: fxd metfin 510 ohms 5% 1/4W A1R75 0757-0428 R: fxd metfin 2000 ohms 1% 1/6W A1R76 0757-0283 R: fxd metfin 2000 ohms 1% 1/6W A1R76 0757-0283 R: fxd metfin 160 ohms 5% 1/4W A1R76 0757-0283 R: fxd metfin 160 ohms 5% 1/4W A1R77 0758-0016 R: fxd metfin 160 ohms 5% 1/4W A1R81 0757-0703 R: fxd metfin 160 ohms 1% 1/6W <td< td=""><td></td><td></td><td></td><td></td></td<>				
A1R62 0758-0033 R: fxd metfin 2000 ohms 5% 1/4W (*) A1R63 0757-0431 R: fxd metfin 680 ohms 5% 1/4W (*) A1R64 0757-0431 R: fxd metfin 680 ohms 5% 1/4W (*) A1R65 0757-0431 R: fxd metfin 1360 ohms 1% 1/6W A1R66 0757-0280 R: fxd metfin 1360 ohms 1% 1/6W A1R70 0756-0280 R: fxd metfin 1360 ohms 1% 1/6W A1R70 0757-0280 R: fxd metfin 680 ohms 5% 1/4W A1R70 0758-0083 R: fxd metfin 610 ohms 1% 1/6W A1R71 0758-0083 R: fxd metfin 610 ohms 5% 1/4W A1R71 0758-0083 R: fxd metfin 510 ohms 5% 1/4W A1R71 0758-0083 R: fxd metfin 510 ohms 5% 1/4W A1R73 0757-0412 R: fxd metfin 510 ohms 5% 1/4W A1R75 0757-0428 R: fxd metfin 2000 ohms 1% 1/6W A1R76 0757-0283 R: fxd metfin 2000 ohms 1% 1/6W A1R76 0757-0283 R: fxd metfin 160 ohms 5% 1/4W A1R76 0757-0283 R: fxd metfin 160 ohms 5% 1/4W A1R77 0758-0016 R: fxd metfin 160 ohms 5% 1/4W A1R81 0757-0703 R: fxd metfin 160 ohms 1% 1/6W <td< td=""><td></td><td></td><td></td><td></td></td<>				
A1R62 0768-0033 R: fxd metfin 2000 ohms 5% 1/4W (*) A1R63 0757-02031 R: fxd metfin 680 ohms 5% 1/4W (*) A1R64 0757-0431 R: fxd metfin 680 ohms 5% 1/4W (*) A1R65 0757-0431 R: fxd metfin 1360 ohms 1% 1/6W A1R66 0757-0280 R: fxd metfin 1360 ohms 1% 1/6W A1R72 0756-0280 R: fxd metfin 1000 ohms 1% 1/8W A1R72 0755-0276 R: fxd metfin 680 ohms 1% 1/8W A1R70 0758-0033 R: fxd metfin 610 ohms 1% 1/8W A1R71 0758-0033 R: fxd metfin 510 ohms 5% 1/4W A1R71 0758-0033 R: fxd metfin 510 ohms 5% 1/4W A1R72 0757-0419 R: fxd metfin 510 ohms 5% 1/4W A1R73 0757-0428 R: fxd metfin 300 ohms 1% 1/8W A1R75 0757-0283 R: fxd metfin 300 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfin 300 ohms 5% 1/4W A1R76 0757-0283 R: fxd metfin 160 ohms 5% 1/4W A1R76 0757-0283 R: fxd metfin 160 ohms 5% 1/4W A1R87 0757-0703 R: fxd metfin 160 ohms 5% 1/4W A1R83 0757-0704 R: fxd metfin 160 ohms 1% 1/8W	A1861	0757.0003		B: frd metilm 1000 obme 5% 1/4W
A1 R63 Not assigned A1 R64 0758 0031 R: fxd metfim 680 chms 5% 1/4W (*) A1 R65 0757-0431 R: fxd metfim 230 chms 1% 1/8W A1 R66 0757-0280 R: fxd metfim 1360 chms 1% 1/8W A1 R67 0757-0280 R: fxd metfim 1360 chms 1% 1/8W A1 R67 0757-0280 R: fxd metfim 1360 chms 1% 1/8W A1 R70 0758-0212 R: fxd metfim 1360 chms 5% 1/4W A1 R70 0758-0208 R: fxd metfim 68 chms 5% 1/4W A1 R70 0758-0083 R: fxd metfim 510 chms 5% 1/4W A1 R70 0758-0083 R: fxd metfim 510 chms 5% 1/4W A1 R71 0758-0083 R: fxd metfim 620 chms 1% 1/8W A1 R72 0757-0283 R: fxd metfim 610 chms 5% 1/4W A1 R75 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1 R76 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1 R76 0757-0283 R: fxd metfim 160 ohms 5% 1/4W A1 R76 0757-0703 R: fxd metfim 160 ohms 5% 1/4W A1 R81 0757-0733 R: fxd metfim 160 ohms 1% 1/8W A1 R82 0757-0738 R:				
A1R64 0758/0031 R: fxd metfim 660 chms 5% 1/4W (*) A1R65 0757/0431 R: fxd metfim 1360 chms 1% 1/8W A1R66 0757/0280 R: fxd metfim 1360 chms 1% 1/8W A1R67 0758/027 R: fxd metfim 1360 chms 1% 1/8W A1R70 0758/0280 R: fxd metfim 610 chms 1% 1/8W A1R70 0758/0030 R: fxd metfim 610 chms 5% 1/4W A1R71 0758/0030 R: fxd metfim 510 chms 5% 1/4W A1R72 0688/5991 R: fxd metfim 631 chms 5% 1/4W A1R73 0757/0428 R: fxd metfim 630 chms 5% 1/4W A1R73 0757/0428 R: fxd metfim 620 chms 5% 1/4W A1R74 0757/0428 R: fxd metfim 200 ohms 1% 1/8W A1R75 0757/0283 R: fxd metfim 200 ohms 1% 1/8W A1R76 0757/0283 R: fxd metfim 100 ohms 5% 1/4W A1R76 0757/0283 R: fxd metfim 160 ohms 5% 1/4W A1R81 0757/0405 R: fxd metfim 160 ohms 1% 1/6W A1R82 0757/0730 R: fxd metfim 180 ohms 1% 1/4W A1R85 0757/0738 R: fxd metfim 180 ohms 1% 1/4W A1R86 0757/0726 R: fxd metfim 100 ohms 1% 1/4W A1R86		0/00/0000		
A1R65 0757-0431 R: fxd metfim 2430 ohms 1% 1/8W A1R66 0767-1096 R: fxd metfim 1360 ohms 1% 1/8W A1R67 0757-0280 R: fxd metfim 1300 ohms 5% 1/4W A1R67 0758-0276 R: fxd metfim 61.9 ohms 1% 1/8W A1R70 0758-0083 R: fxd metfim 61.9 ohms 5% 1/4W A1R71 0758-0083 R: fxd metfim 61.0 ohms 5% 1/4W A1R71 0758-0030 R: fxd metfim 61.0 ohms 5% 1/4W A1R73 0757-0428 R: fxd metfim 130 ohms 5% 1/4W A1R75 0757-0428 R: fxd metfim 1620 ohms 1% 1/8W A1R75 0757-0428 R: fxd metfim 1620 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfim 2000 ohms 5% 1/4W A1R78 0757-0406 R: fxd metfim 100 ohms 5% 1/4W A1R81 0757-0730 R: fxd metfim 162 ohms 1% 1/8W A1R83 0757-0730 R: fxd metfim 1820 ohms 1% 1/4W A1R84 0757-0730 R: fxd metfim 1820 ohms 1% 1/4W A1R84 0757-0726 R: fxd metfim 100 ohms 5% 1/4W A1R85 0757-0726 R: fxd metfim 1200 ohms 1% 1/8W A1R		0750 0021		
A1866 0757.1096 R: fxd metlim 1360 ohms 1% 1/8W A1867 0757.0280 R: fxd metlim 1000 ohms 1% 1/8W A1872 0756.027 R: fxd metlim 1300 ohms 5% 1/4W A1873 0755.0276 R: fxd metlim 61.0 ohms 5% 1/4W A1873 0756.0030 R: fxd metlim 61.0 ohms 5% 1/4W A1873 0757.0283 R: fxd metlim 61.0 ohms 5% 1/4W A1873 0757.0428 R: fxd metlim 1620 ohms 5% 1/4W A1873 0757.0428 R: fxd metlim 610 ohms 5% 1/4W A1874 0757.0428 R: fxd metlim 1620 ohms 1% 1/8W A1875 0757.0283 R: fxd metlim 2000 ohms 5% 1/4W A1876 0757.0283 R: fxd metlim 100 ohms 5% 1/4W A1876 0757.0283 R: fxd metlim 100 ohms 5% 1/4W A1876 0757.0283 R: fxd metlim 100 ohms 5% 1/4W A1876 0757.0283 R: fxd metlim 100 ohms 5% 1/4W A1877 0758.0025 R: fxd metlim 162 ohms 1% 1/8W A1881 0757.0730 R: fxd metlim 162 ohms 1% 1/4W A1882 0757.0730 R: fxd metlim 162 ohms 1% 1/4W A1884 0757.0726 R: fxd metlim 174 ohms 1% 1/4W A1889 <td></td> <td></td> <td></td> <td></td>				
A1R67 0757-0280 R: fxd metfilm 1000 ohms 1% 1/8W A1R62 0758-0127 R: fxd metfilm 430 ohms 5% 1/4W A1R70 0758-0083 R: fxd metfilm 61.9 ohms 1% 1/8W A1R70 0758-0083 R: fxd metfilm 61.9 ohms 5% 1/4W A1R71 0758-0083 R: fxd metfilm 61.9 ohms 5% 1/4W A1R73 0757-0228 R: fxd metfilm 620 ohms 5% 1/4W A1R73 0757-0428 R: fxd metfilm 620 ohms 5% 1/4W A1R75 0757-0283 R: fxd metfilm 620 ohms 5% 1/4W A1R75 0757-0283 R: fxd metfilm 620 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfilm 2000 ohms 1% 1/8W A1R77 0756 0016 R: fxd metfilm 100 ohms 5% 1/4W A1R78 0757-0283 R: fxd metfilm 100 ohms 5% 1/4W A1R78 0757-0706 R: fxd metfilm 100 ohms 5% 1/4W A1R81 0757-0730 R: fxd metfilm 160 ohms 5% 1/4W A1R82 0757-0730 R: fxd metfilm 180 ohms 1% 1/4W A1R83 0757-0730 R: fxd metfilm 180 ohms 1% 1/4W A1R84 0757-0730 R: fxd metfilm 180 ohms 1% 1/4W A1R85 0757-0721 R: fxd metfilm 100 ohms 1% 1/4W	ATROD	0/5/-0431		n: 1xa metrim 2430 onms 1% 1/8W
A1R67 0757-0280 R: fxd metfilm 1000 ohms 1% 1/8W A1R62 0756-0127 R: fxd metfilm 1000 ohms 5% 1/4W A1R70 0758-0083 R: fxd metfilm 61.9 ohms 5% 1/4W A1R70 0758-0083 R: fxd metfilm 61.9 ohms 5% 1/4W A1R71 0758-0030 R: fxd metfilm 61.9 ohms 5% 1/4W A1R73 0757-0128 R: fxd metfilm 620 ohms 5% 1/4W A1R73 0757-0419 R: fxd metfilm 620 ohms 5% 1/4W A1R75 0757-0283 R: fxd metfilm 620 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfilm 620 ohms 1% 1/8W A1R77 0756 0016 R: fxd metfilm 000 ohms 5% 1/4W A1R77 0756 0016 R: fxd metfilm 100 ohms 5% 1/4W A1R78 0757-0283 R: fxd metfilm 100 ohms 5% 1/4W A1R78 0757-0700 R: fxd metfilm 160 ohms 5% 1/4W A1R81 0757-0730 R: fxd metfilm 1620 ohms 1% 1/4W A1R82 0757-0730 R: fxd metfilm 180 ohms 1% 1/4W A1R83 0757-0730 R: fxd metfilm 180 ohms 1% 1/4W A1R84 0757-0730 R: fxd metfilm 100 ohms 1% 1/4W A1R84 0757-0721 R: fxd metfilm 1200 ohms 1% 1/4W	AIDER	0757 1006		By full mostly 1260 above 10/ 1/000
A1F*2 075B-5127 R: fxd metfim 430 ohms 5% 1/4W A1F 63 075-0276 R: fxd metfim 61.0 ohms 1% 1/8W A1R70 0758 0083 R: fxd metfim 61 ohms 5% 1/4W A1R71 0758 0030 R: fxd metfim 43 ohms 5% 1/4W A1R73 0757-0428 R: fxd metfim 43 ohms 5% 1/4W A1R73 0757-0428 R: fxd metfim 43 ohms 5% 1/4W A1R74 0757-0428 R: fxd metfim 1620 ohms 1% 1/8W A1R75 0757-0428 R: fxd metfim 2000 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1R77 0758-0016 R: fxd metfim 2000 ohms 1% 1/8W A1R77 0758-0025 R: fxd metfim 160 ohms 5% 1/4W A1R81 0757-0780 R: fxd metfim 160 ohms 5% 1/4W A1R81 0757-0730 R: fxd metfim 162 ohms 1% 1/8W A1R82 0757-0738 R: fxd metfim 1820 ohms 1% 1/4W A1R84 0757-0738 R: fxd metfim 1820 ohms 1% 1/4W A1R86 0757-0738 R: fxd metfim 1820 ohms 1% 1/4W A1R86 0757-0738 R: fxd metfim 100 ohms 1% 1/4W A1R87 0757-0726 R: fxd metfim 100 ohms 1% 1/4W A1R89				
A1F 85 075*0276 R: fxd metfim 61.9 ohms 1% 1/8W A1R70 0788 0083 R: fxd metfim 68 ohms 5% 1/4W A1R71 0758 0030 R: fxd metfim 630 ohms 5% 1/4W A1R72 0688 5891 R: fxd metfim 510 ohms 5% 1/4W A1R73 0757-0428 R: fxd metfim 1620 ohms 1% 1/8W A1R75 0757-0283 R: fxd metfim 681 ohms 1% 1/8W A1R76 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1R77 0758 0016 R: fxd metfim 300 ohms 5% 1/4W A1R78 0757-0283 R: fxd metfim 160 ohms 5% 1/4W A1R78 0757-0283 R: fxd metfim 160 ohms 5% 1/4W A1R78 0757-07405 R: fxd metfim 162 ohms 1% 1/8W A1R81 0757-0730 R: fxd metfim 210 ohms 1% 1/4W A1R82 0757-0730 R: fxd metfim 182 ohms 1% 1/4W A1R84 0757-0730 R: fxd metfim 1820 ohms 1% 1/4W A1R85 0757-0726 R: fxd metfim 180 ohms 1% 1/4W A1R86 0757-0726 R: fxd metfim 1200 ohms 1% 1/4W A1R86 0757-0726 R: fxd metfim 1200 ohms 1% 1/4W A1R90 0757-0737 R: fxd metfim 100 ohms 5% 1/4W A1R91		(
A1R70 0758-0083 R: fxd mettlim 68 ohms 5% 1/4W A1R71 0758-0030 R: fxd mettlim 510 ohms 5% 1/4W A1R73 0757-0428 R: fxd mettlim 1620 ohms 1% 1/8W A1R73 0757-0428 R: fxd mettlim 1620 ohms 1% 1/8W A1R75 0757-0283 R: fxd mettlim 1620 ohms 1% 1/8W A1R76 0757-0283 R: fxd mettlim 2000 ohms 1% 1/8W A1R76 0757-0283 R: fxd mettlim 2000 ohms 1% 1/8W A1R77 0758-0016 R: fxd mettlim 100 ohms 5% 1/4W A1R78 0757-0283 R: fxd mettlim 160 ohms 5% 1/4W A1R78 0757-0750 R: fxd mettlim 160 ohms 5% 1/4W A1R81 0757-0730 R: fxd mettlim 160 ohms 5% 1/4W A1R82 0757-0730 R: fxd mettlim 160 ohms 1% 1/4W A1R84 0757-0738 R: fxd mettlim 120 ohms 1% 1/4W A1R85 0757-0726 R: fxd mettlim 511 ohms 1% 1/4W A1R86 0757-0727 R: fxd mettlim 120 ohms 1% 1/4W A1R87 0757-0726 R: fxd mettlim 120 ohms 1% 1/4W A1R89 0698-3438 R: fxd mettlim 120 ohms 1% 1/4W A1R91 0757-0727 R: fxd mettlim 100 ohms 1% 1/4W				
A18.71 0758.0030 R: fxd metfim 510 ohms 5% 1/4W A18.73 0757.0428 R: fxd metfim 43 ohms 5% 1/4W A18.73 0757.0428 R: fxd metfim 620 ohms 1% 1/8W A18.74 0757.0419 R: fxd metfim 630 ohms 1% 1/8W A18.75 0757.0283 R: fxd metfim 2000 ohms 1% 1/8W A18.76 0757.0283 R: fxd metfim 2000 ohms 1% 1/8W A18.77 0758.0016 R: fxd metfim 300 ohms 5% 1/4W A18.78 0757.0283 R: fxd metfim 160 ohms 5% 1/4W A18.78 0758.0016 R: fxd metfim 160 ohms 5% 1/4W A18.80 0758.0025 R: fxd metfim 160 ohms 5% 1/4W A18.81 0757.0405 R: fxd metfim 160 ohms 1% 1/8W A18.81 0757.0405 R: fxd metfim 2210 ohms 1% 1/4W A18.83 0757.0730 R: fxd metfim 1700 ohms 1% 1/4W A18.82 0757.0738 R: fxd metfim 1820 ohms 1% 1/4W A18.84 0757.0726 R: fxd metfim 170 ohms 1% 1/4W A18.85 0757.0726 R: fxd metfim 120 ohms 1% 1/4W A18.89 0757.0737 R: fxd metfim 120 ohms 1% 1/4W A18.89 0757.0737 R: fxd metfim 100 ohms 1% 1/4W				
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A187? 0698-5891 R: fxd metfim 1620 ohms 1% 1/4W A1873 0757-0428 R: fxd metfim 1620 ohms 1% 1/8W A1875 0757-0283 R: fxd metfim 1620 ohms 1% 1/8W A1875 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1876 0757-0283 R: fxd metfim 2000 ohms 5% 1/4W A1876 0757-0283 R: fxd metfim 300 ohms 5% 1/4W A1877 0758-0016 R: fxd metfim 160 ohms 5% 1/4W A1876 0757-07283 R: fxd metfim 160 ohms 5% 1/4W A1870 0758-0025 R: fxd metfim 160 ohms 5% 1/4W A1880 0757-0730 R: fxd metfim 750 ohms 1% 1/4W A1882 0757-0730 R: fxd metfim 200 ohms 1% 1/4W A1882 0757-0738 R: fxd metfim 1820 ohms 1% 1/4W A1884 0757-0728 R: fxd metfim 511 ohms 1% 1/4W A1885 0757-0721 R: fxd metfim 511 ohms 1% 1/4W A1886 0757-0721 R: fxd metfim 100 ohms 5% 1/4W A1890 0957-0721 R: fxd metfim 1200 ohms 1% 1/4W A1890 0757-0737 R: fxd metfim 1200 ohms 1% 1/4W A1891 0757-0737 R: fxd metfim 100 ohms 5% 1/4W A1890 <td>Δ1R 21</td> <td>0759 0020</td> <td></td> <td>By fud months EtC almos ED/ 1/411</td>	Δ1R 21	0759 0020		By fud months EtC almos ED/ 1/411
A1873 0757-0428 R: fxd metfim 1620 ohms 1% 1/8W A1874 0757-0419 R: fxd metfim 681 ohms 1% 1/8W A1875 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1876 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1876 0757-0283 R: fxd metfim 2000 ohms 1% 1/8W A1877 0758-0016 R: fxd metfim 300 ohms 5% 1/4W A1877 0758-0016 R: fxd metfim 300 ohms 5% 1/4W A1878 0757-0405 R: fxd metfim 160 ohms 5% 1/4W A1881 0757-0730 R: fxd metfim 750 ohms 1% 1/8W A1882 0757-0730 R: fxd metfim 2210 ohms 1% 1/4W A1883 0757-0738 R: fxd metfim 3010 ohms 1% 1/4W A1884 0757-0726 R: fxd metfim 3010 ohms 1% 1/4W A1886 0757-0721 R: fxd metfim 110 ohms 1% 1/4W A1886 0757-0727 R: fxd metfim 1200 ohms 1% 1/4W A1889 0698-3438 R: fxd metfim 1200 ohms 1% 1/4W A1890 0757-0727 R: fxd metfim 1200 ohms 1% 1/4W A1891 0757-0737 R: fxd metfim 100 ohms 5% 1/4W A1892 0757-0737 R: fxd metfim 100 ohms 5% 1/4W A1893 </td <td></td> <td></td> <td> 1</td> <td></td>			1	
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A1R78 Not assigned A1R30 0758-0025 A1R81 0757-0405 R: fxd metfim 160 ohms 5%-1/4W A1R82 0757-0740 A1R83 0757-0740 A1R84 0757-0740 A1R85 0757-0740 A1R85 0757-0738 A1R85 0757-0738 A1R85 0757-0738 A1R85 0757-0738 R: fxd metfim 750 ohms 1% 1/4W A1R85 0757-0726 R: fxd metfim 3010 ohms 1% 1/4W A1R86 0757-0721 R: fxd metfim 274 ohms 1% 1/4W A1R88 0757-0721 R: fxd metfim 147 ohms 1% 1/4W A1R89 0698-3438 R: fxd metfim 1200 ohms 1% 1/8W A1R91 0757-0273 R: fxd metfim 1200 ohms 1% 1/8W A1R91 0757-0737 R: fxd metfim 100 ohms 5% 1/4W A1R94 0758-0024 A1R95 0758-0024 A1R96 0698-5884 R: fxd metfim 100 ohms 5% 1/4W				
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A1R83 0757-0740 R: fxd metfim 2210 ohms 1% 1/4W A1R84 0757-0738 R: fxd metfim 1820 ohms 1% 1/4W A1R85 0757-0739 R: fxd metfim 3010 ohms 1% 1/4W A1R86 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R87 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R88 0757-0721 R: fxd metfim 147 ohms 1% 1/4W A1R89 0698-3438 R: fxd metfim 147 ohms 1% 1/8W A1R90 0757-1097 R: fxd metfim 1200 ohms 1% 1/8W A1R91 0757-0273 R: fxd metfim 3010 ohms 1% 1/8W A1R92 0757-0737 R: fxd metfim 1620 ohms 1% 1/4W A1R93 0758-0024 R: fxd metfim 100 ohms 5% 1/4W A1R95 0758-0024 R: fxd metfim 100 ohms 5% 1/4W A1R96 0698-5884 R: fxd metfim 100 ohms 5% 1/4W A1R97 0758-0034 R: fxd metfim 100 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R98 0757-0726 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99	A1092	0757 0720		De Andreaster TCO at a 400 A Mar
A1R84 0757-0738 R: fxd metfim 1820 ohms 1% 1/4W A1R85 0757-0739 R: fxd metfim 3010 ohms 1% 1/4W A1R86 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R87 0757-0721 R: fxd metfim 511 ohms 1% 1/4W A1R88 0757-0721 R: fxd metfim 1274 ohms 1% 1/4W A1R89 0698-3438 R: fxd metfim 147 ohms 1% 1/4W A1R90 0757-1097 R: fxd metfim 1200 ohms 1% 1/8W A1R91 0757-0273 R: fxd metfim 1200 ohms 1% 1/8W A1R92 0757-0737 R: fxd metfim 1620 ohms 1% 1/4W A1R93 0758 0024 R: fxd metfim 100 ohms 5% 1/4W A1R95 0758 0024 R: fxd metfim 100 ohms 5% 1/4W A1R96 0698-5884 R: fxd metfim 100 ohms 5% 1/4W A1R96 0698-5884 R: fxd metfim 1000 ohms 5% 1/4W A1R97 0758-0003 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 5% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 5% 1/4W A1R99 <td></td> <td></td> <td></td> <td></td>				
A1R85 0757-0339 R: fxd metflm 3010 ohms 1% 1/4W A1R86 0757-0726 R: fxd metflm 511 ohms 1% 1/4W A1R87 0757-0726 R: fxd metflm 511 ohms 1% 1/4W A1R88 0757-0721 R: fxd metflm 511 ohms 1% 1/4W A1R89 0698-3438 R: fxd metflm 147 ohms 1% 1/4W A1R89 0698-3438 R: fxd metflm 147 ohms 1% 1/8W A1R90 0757-0727 R: fxd metflm 1200 ohms 1% 1/8W A1R91 0757-0737 R: fxd metflm 1620 ohms 1% 1/8W A1R92 0757-0737 R: fxd metflm 1620 ohms 1% 1/4W A1R93 0758-0024 R: fxd metflm 100 ohms 5% 1/4W A1R95 0758-0024 R: fxd metflm 100 ohms 5% 1/4W A1R96 0698-5884 R: fxd metflm 100 ohms 5% 1/4W A1R97 0758-0003 R: fxd metflm 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metflm 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metflm 1000 ohms 5% 1/4W A1R99 0757-0726 R: fxd metflm 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metflm 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metflm 511 ohms 1% 1/4W A1R99				
A1R86 Not assigned A1R87 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R88 0757-0721 R: fxd metfim 274 ohms 1% 1/4W A1R89 0698-3438 R: fxd metfim 147 ohms 1% 1/4W A1R90 0757-0727 R: fxd metfim 147 ohms 1% 1/8W A1R90 0757-0737 R: fxd metfim 1200 ohms 1% 1/8W A1R91 0757-0737 R: fxd metfim 1620 ohms 1% 1/4W A1R92 0757-0737 R: fxd metfim 1620 ohms 1% 1/4W A1R93 0758 0024 R: fxd metfim 100 ohms 5% 1/4W A1R95 0758 0024 R: fxd metfim 100 ohms 5% 1/4W A1R96 0698 5884 R: fxd metfim 100 ohms 5% 1/4W A1R97 0758 0003 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd me				
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A1R89 0698.3438 R: fxd metfim 147 ohms 1% 1/8W A1R90 0757.1097 R: fxd metfim 1200 ohms 1% 1/8W A1R91 0757-0273 R: fxd metfim 1200 ohms 1% 1/8W A1R92 0757-0737 R: fxd metfim 1620 ohms 1% 1/8W A1R93 0757-0737 R: fxd metfim 1620 ohms 1% 1/4W A1R93 0758-0024 R: fxd metfim 100 ohms 5% 1/4W A1R95 0758-0024 R: fxd metfim 100 ohms 5% 1/4W A1R95 0758-0024 R: fxd metfim 100 ohms 5% 1/4W A1R96 0698-5884 R: fxd metfim 100 ohms 5% 1/4W A1R97 0758-0003 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R100 0758-0033 R: fxd metfim 511 ohms 1% 1/4W				
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A1R93 Not assigned A1R94 0758 0024 A1R95 0758 0024 A1R96 0698 5884 A1R97 0758 0003 A1R98 0757 0726 A1R99 0757 0726 A1R100 0758 0033 B: fxd metfilm 511 ohms 1% 1/4W A1R100 0758 0033 B: fxd metfilm 2000 ohms 5% 1/4W		0101-0213		or two metrim 2010 onms 1% 1/8W
A1R93 Not assigned A1R94 0758-0024 A1R95 0758-0024 A1R96 0698-5884 A1R97 0758-0003 A1R98 0757-0726 A1R99 0757-0726 A1R100 0758-0033 A1R100 0758-0033 A1R100 0758-0033	A1892	0767-0737		Pr fud motiling 1600 along 164 4 (4)4
A1R94 0758 0024 R: fxd metfim 100 ohms 5% 1/4W A1R95 0758 0024 R: fxd metfim 100 ohms 5% 1/4W A1R96 0698 5884 R: fxd metfim 100 ohms 5% 1/4W A1R97 0758 0003 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R90 0758 0033 R: fxd metfim 511 ohms 1% 1/4W		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
A1R95 0758.0024 R: fxd metfim 100 ohms 5% 1/4W A1R96 0698.5884 R: fxd metfim 22 ohms 5% 1/4W A1R97 0758.0003 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757.0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757.0726 R: fxd metfim 511 ohms 1% 1/4W A1R100 0758.0033 R: fxd metfilm 511 ohms 1% 1/4W		0758.0024		
A1R96 06985884 R: fxd metfim 22 ohms 5% 1/4W A1R97 0758-0003 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R100 0758-0033 R: fxd metfilm 511 ohms 1% 1/4W				
A1R97 0758-0003 R: fxd metfim 1000 ohms 5% 1/4W A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfilm 511 ohms 1% 1/4W A1R100 0758-0033 R: fxd metfilm 2000 ohms 5% 1/4W				
A1R98 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfim 511 ohms 1% 1/4W A1R100 0758-0033 R: fxd metfilm 2000 ohms 5% 1/4W				··· ··· ···· ·························
A1R98 0757-0726 R: fxd metfilm 511 ohms 1% 1/4W A1R99 0757-0726 R: fxd metfilm 511 ohms 1% 1/4W A1R100 0758-0033 R: fxd metfilm 2000 ohms 5% 1/4W	A1897	0758.0003		B: frd metfin 1000 ohme 5% 1/4M
A1R99 0757-0726 R: fxd metfilm 511 ohms 1% 1/4W A1R100 0758 0033 R: fxd metfilm 2000 ohms 5% 1/4W				
A1R100 0758 0033 R: fxd metilm 2000 ohms 5% 1/4W				
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Table 6-2. Replaceable Parts (Cont'd)

Desig HP Part No. TQ (Refer to Table 6-1.) A1R102 0757-0354 R: fxd metfim 3650 ohms 1% 1/4W A1R103 0757-0354 R: fxd metfim 3650 ohms 1% 1/4W A1R105 0757-0354 R: fxd metfim 3650 ohms 1% 1/4W A1R106 0758-0080 R: txd metfim 750 ohms 5% 1/4W A1R106 0758-0080 R: txd metfim 1200 ohms 1% 1/8W A1R106 0758-0070 R: txd metfim 1200 ohms 5% 1/4W A1R106 0758-0070 R: txd metfim 1200 ohms 5% 1/4W A1R106 0758-0070 R: txd metfim 3000 ohms 5% 1/4W A1R110 0758-0003 R: txd metfim 3000 ohms 5% 1/4W A1R111 0758-0003 R: txd metfim 3000 ohms 5% 1/4W A1R112 0758-0003 R: txd metfim 1000 ohms 5% 1/4W A1R115 0758-0003 R: txd metfim 20 ohms 5% 1/4W A1R116 0598-5887 R: txd metfim 1000 ohms 5% 1/4W A1R117 0756-0004 R: txd metfim 1000 ohms 5% 1/4W A1R118 0758-0003 R: txd metfim 100 ohms 5% 1/4W A1R112 0758-0003 R: txd metfim 100 ohms 5% 1/4W	Ref			Description
A1R102 0757-0354 R: fxd metfin 3650 ohms 1% 1/4W A1R103 0757-0354 R: fxd metfin 3650 ohms 1% 1/4W A1R104 0757-0353 R: fxd metfin 3050 ohms 1% 1/4W A1R105 0755-0303 R: fxd metfin 3050 ohms 1% 1/4W A1R106 0755-0303 R: fxd metfin 1200 ohms 1% 1/8W A1R105 0757-0307 R: fxd metfin 1200 ohms 5% 1/4W A1R106 0755-0433 R: fxd metfin 1200 ohms 5% 1/4W A1R110 0755-0433 R: fxd metfin 300 ohms 5% 1/4W A1R111 0755-0003 R: fxd metfin 300 ohms 5% 1/4W A1R111 0755-0045 R: fxd metfin 300 ohms 5% 1/4W A1R112 0755-0036 R: fxd metfin 300 ohms 5% 1/4W A1R112 0755-0045 R: fxd metfin 300 ohms 5% 1/4W A1R113 0756-0030 R: fxd metfin 300 ohms 5% 1/4W A1R114 0756-0034 R: fxd metfin 30 ohms 5% 1/4W A1R115 0756-0046 R: fxd metfin 100 ohms 5% 1/4W A1R116 0756-0047 R: fxd metfin 100 ohms 5% 1/4W A1R116 0756-0052 R: fxd metfin 100 ohms 5% 1/4W A1R116		HP Part No.	TQ	
A1R103 0757-0354 R: fxd metfin 3650 ohms 1% 1/4W A1R104 0757-0283 R: fxd metfin 2000 ohms 1% 1/6W A1R105 0758-0030 R: fxd metfin 1200 ohms 1% 1/6W A1R106 0758-0030 R: fxd metfin 1200 ohms 1% 1/6W A1R106 0758-0030 R: fxd metfin 1200 ohms 1% 1/6W A1R106 0758-0030 R: fxd metfin 1200 ohms 5% 1/4W A1R109 0757-0433 R: fxd metfin 3200 ohms 5% 1/4W A1R110 0758-0030 R: fxd metfin 300 ohms 5% 1/4W A1R111 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R112 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R113 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R115 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R115 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R115 0758-0035 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0036 R: fxd metfin 300 ohms 5% 1/4W				
A1R103 0757-0354 R: fxd metfin 3650 ohms 1% 1/4W A1R104 0757-0283 R: fxd metfin 2000 ohms 1% 1/6W A1R105 0758-0030 R: fxd metfin 1200 ohms 1% 1/6W A1R106 0758-0030 R: fxd metfin 1200 ohms 1% 1/6W A1R106 0758-0030 R: fxd metfin 1200 ohms 1% 1/6W A1R106 0758-0030 R: fxd metfin 1200 ohms 5% 1/4W A1R109 0757-0433 R: fxd metfin 3200 ohms 5% 1/4W A1R110 0758-0030 R: fxd metfin 300 ohms 5% 1/4W A1R111 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R112 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R113 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0033 R: fxd metfin 300 ohms 5% 1/4W A1R115 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R115 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0034 R: fxd metfin 300 ohms 5% 1/4W A1R115 0758-0035 R: fxd metfin 300 ohms 5% 1/4W A1R114 0758-0036 R: fxd metfin 300 ohms 5% 1/4W				
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A1S1 3101-0070 S: Slide dpdt A1S2 3101-0070 S: Slide dpdt A1S3 3101-0070 S: Slide dpdt A2 08003-63401 A: attenuator asser.bly A2R1 0757-0172 R: fxd metfim 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R4 0757-069 R: fxd metfim 121 ohms 1% 1/4W	A1R167	0761-0046		R: fxd metox 110 ohms 5% 1W
A1S1 3101-0070 S: Slide dpdt A1S2 3101-0070 S: Slide dpdt A1S3 3101-0070 S: Slide dpdt A2 08003-63401 A: attenuator asser.bly A2R1 0757-0172 R: fxd metfim 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R4 0757-069 R: fxd metfim 121 ohms 1% 1/4W				
A1S2 3101-0070 S: Slide dpdt A1S3 3101-0070 S: Slide dpdt A2 08003-63401 A: attenuator asser.bly A2R1 0757-0172 R: fxd metfilm 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfilm 121 ohms 1% 1/4W	A1R168	0761-0046		R: fxd metox 110 ohms 5% 1W
A1S2 3101-0070 S: Slide dpdt A1S3 3101-0070 S: Slide dpdt A2 08003-63401 A: attenuator asser.bly A2R1 0757-0172 R: fxd metfilm 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfilm 121 ohms 1% 1/4W				
A1S2 3101-0070 S: Slide dpdt A1S3 3101-0070 S: Slide dpdt A2 08003-63401 A: attenuator asser.bly A2R1 0757-0172 R: fxd metfilm 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfilm 121 ohms 1% 1/4W	A1S1	3101-0070		S: Slide dpdt
A1S3 3101-0070 S: Slide dpdt A2 08003-63401 A: attenuator asser.bly A2R1 0757-0172 R: fxd metfilm 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R4 0757-069 R: fxd metfilm 150 ohms 1% 1/2W				
A2 08003-63401 A: attenuator assembly A2R1 0757-0172 R: fxd metfilm 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfilm 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfilm 150 ohms 1% 1/2W				
A2R1 0757-0172 R: fxd metfim 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfim 121 ohms 1% 1/4W				
A2R1 0757-0172 R: fxd metfim 37.4 ohms 1% 1/2W A2R2 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfim 121 ohms 1% 1/4W	A2	08003-63401		A: attenuator essen.hiv
A2R2 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfim 121 ohms 1% 1/4W				
A2R2 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R3 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfim 121 ohms 1% 1/4W	A2R1	0757-0172	1	B: frd mattim 27.4 above 19/ 1/381
A2R3 0757-0801 R: fxd metfim 150 ohms 1% 1/2W A2R4 0757-0069 R: fxd metfim 121 ohms 1% 1/4W			ļ	
A2R4 0757-0069 R: fxd metfim 121 ohms 1% 1/4W				
		1		
A2RD U/5/-U/95 H: fxd metfim 75 ohms 1% 1/2W				
	A2H5	0757-0795		R: txd metfim 75 ohms 1% 1/2W
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Model 8003A

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Section VI Table 6-2

Table 6-2. Replaceable Parts (Cont'd)

Ref			Densitation
Desig	HP Part No.	τα	Description
กระเสี	ļ	ļl	(Refer to Table 6-1,)
A2R6	0757-0795		R: fxd metflm 75 ohms 1% 1/2W
A2R7	0757-0071		R: fxd metfim 247.5 ohms 1% 1/4W
A2R8	0757-1005		R: fxd metflm 61.11 ohms 1% 1/2W
A1R9	0757-1005		R: fxd metflm 61.11 ohms 1% 1/2W
A2S1	5060-1749		S: rotary
A3	08003-63401		A: Attenuator assembly
A3R1	0757-0172		R: fxd metfim 37.4 ohms 1% 1/2W
A3R2	0757-0801		R: metflm 150 ohms 1% 1/2W
A3R3	0757-0801		R: metfim 150 ohms 1% 1/2W
A3R4	0757-0069		R: metfim 121 ohms 1% 1/4W
A3R5	0757-0795		R: metilm 75 ohms 1% 1/2W
A3R6	0767-0795		R: metflm 75 ohms 1% 1/2W
A3R7	0757-0071		R: metfim 247.5 ohms 1% 1/4W
A3R8	0757-1005		R: metfim 61.11 ohms 1% 1/2W
A3R9	0757-1005		R: metlfm 61.11 ohms 1% 1/2W
A3S1	5060-1749		S: rotary
A4	08003-61902		A: switch assy: PULSE WIDTH (includes R2, R6 R7)
A5	00000 01001		and S6
MD MD	08003-61901		A: switch assy: REP RATE (includes R3 and S4)
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	0100.000		
C1	0180-0353		C: fxd elect alum 450 uF 50 wVdc
C2 C3 C4	0180-353		C: fxd elect alum 450 uF 50 wVdc C: fxd cer 5000 pF 20% 3K wVdc
ČĂ	0160-3801		C: txa cer 5000 pF 20% 3K wVdc
DS1	1450-0106		C: fxd cer 5000 pF 20% 3K wVdc DS: neon lamp (part of S1)
	1400 0100		DS. neon amp (part of ST)
E1	0340-0162		EQ: insulator, transistor Q1
E2	0340-0162		EQ: insulator, transistor Q2
F1	2110-0008		
			F: cartridge 1/2A s-b (115V line)
	2110-0018		F: cartridge 1/4A s-b (230V line)
J1	1251-2357		J: connector AC power (1101A only)
J1	1251-0148		J: connector AC power
J2	1250-0140		J: BNC (+ OUTPUT 50 ohms)
J3	1250-0083		J: BNC (TRIGGER OUTPUT)
J4	1250-0140		J: BNC (- OUTPUT 50 ohms)
J5	1250-0083		J: BNC (GATE INPUT)
J6	1250-0083		J: BNC (TRIGGER INPUT)
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Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	HP Part No.	מז	Description (Refer to Table 6-1.)	
1101	0070 0000			
MP1 MP2	0370-0099		MP: knob (REP RATE)	
MP2 MP3	0370-0134		MP: knob (REP RATE VERNIER)	
MP3 MP4	0370-0077		MP: knob (AMPLITUDE)	
MP4 MP5	0370-0077 0370-0084		MP: knob (AMPLITUDE)	
MFD	0370-0084		MP: knob (AMPLITUDE VERNIER)	
MP6	0370-0084		MP: knob (AMPLITUDE VERNIER)	
MP7	0370-0099		MP: knob (PULSE WIDTH)	
MP8	0370-0134		MP: knob (PULSE WIDTH VERNIER)	
MP9	08003-00210		MP: panel, front	
MP10	1490-0032		MP: stand, tilt	
MP11	5060-0728		MP: foot assembly, half module	
MP12	08003-00208		MP: panel, rear (1101A only)	
MP12	08003-00202		MP: panel, rear	
MP13	7100-0389		MP: cover transformer	
MP14	08003-00601		MP: heat sink, shield	
MP15	5060-0720		MP: cover, top (1101A only)	1
MP15	5060-0718		MP: cover, top	
MP16	5000-0717		MP: cover, bottom	
MP17	5000-0567		MP: cover, side (perforated)	
Q1	1854-0072		Q: Si npn 2N3054	
Q2	1854-0072		Q: Si npn 2N3054	
R1	0758-0049		R: fxd metfim 33k ohms 5% 1/4W	
R2	0698-6802		R: fxd metflm 10 ohms 5% 1/8W	
R3	2100-2684		R: var 100k ohms 10%	I
R4	2100-0036		R: var comp 1000 ohms 20% 1/2W	
R5	2100-0036		R: var comp 1000 ohms 20% 1/2W	
R6	2100-2683		Dr. use 1001. share 100	
R7	0757-0428		R: var 100k ohms 10% R: fxd metfim 1620 ohms 1% 1/8W	
C1	2101 0100			
S1 S2	3101-0100 3101-1234		S: pushbutton spdt, (line) (includes DS1)	
52 S2	3101-1234		S: slide dpdt (line voltage select) (1101A only)	
S3	3101-0124		S: slide dpdt (line voltage select)	
54 S4	3100-0511		S: pushbutton spst (MANUAL) S: rotary	
S5	3101-0903		S: slide dpdt (GATE/NORMAL) (1101A only)	
S5	3101-0011		S: slide dpdt (GATED/NORMAL)	
S6	3101-0512		S: rotary	
T1	9100-0525		T: power	
W1)	8120-0100		W: cable, AC power 7.5 feet long (SCHUKO PLUG)	
W2	8120-0078		W: cable, AC power 7.5 feet long (SCHUKO PLUG)	
W2	8120-1545		W: cable, AC power (1101A only)	
XF1	1400-0084		XF: fuse holder	1
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TABLE 6-3. CODE LIST OF MANUFACTURERS

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbit arily assigned to suppliers not appearing in the H4 Handbooks.

Cede No.	Manufacturer	Address	Çede No.	Manufacturer	Address	Code No.	Manufacturer	Address
84000				Ultronis, Inc.			Ti-Tal, Inc.	Berketey, Calif.
	McCay Electronics	Any scyption of U.S. Nount Holly Springs, Pa.		Union Carbide Corp., Linde	San Mateo, Calif. Div., Kowet Dent		Corbarundum Co.	Ningara Falls, N.Y.
	Sage Electronics Corp.	Rochoster, N.Y.			Cleveland, Ohio		CTS of Betne, Inc.	Berne, Ind.
	Cenco tac,	Danielson, Cunn,	05574	Viking lad, Inc.	Canaga Park, Calif,		Chicage Telephone of C	
00334	Kumidial	Colton, Calif.	05593	Iltumitianie Engineering Co.				to. Passdens, Calif.
	Nicrolron Co., Inc.	Valley Straam, N.Y.	05616	Cosno Plashe			Bay State Electronics C	
	Gailack Iac.	Cherry Bill, N. J.		ic/o E'ectrical Spac. Ca.				ve Div. Pale Alto, Calif.
	Adiavas Caip, Anp. (nc.	New Bedfard, Mass.		Barber Colman Co.	Rockford, III.		Notional Seat	Downey, Colif.
	Alierals Radio Corp.	Harrisburg, Pa.	43720	Tiffen Optical Co. Robben Robal			Duncan Electionics Inc.	Costo Noso, Calif.
	Nothern Engineering La	Bookton, H.J. Datatatien. Inc.	03779	Welte-Tet Corp.	its, Loag Jaland, N.Y. Westbury, N.Y.		General Instrument Corp Div., Products Group	, aemiconvocioe Nawaik, N.J.
		Burllagton, Wis,		Stewart Engineeting Co.	Santa Cruz, Calif,	11717	Inperial Electronic, Inc	
80653	Sangame Electric Co., J			Rabelield Engineering Inc.	Wakafield, Mass,		Notabs, Inc.	Pale Alte, Calif.
		Pickens, S.C.	06004	Bassick Co., Div, of Stawa		12136	Philadelphis Handle Co.	
	Got Leginsering Co.	City of Industry, Cal,			Bridgeport, Conn.	12361	Grave Mig. Co., Inc.	Shady Grave, Pa.
	Call E. Helmas Cerp.	Las Angeles, Colif.		Raycham Colp,	Rednood City, Calif.	12574	Guilon Ind. Inc. Dala Sy	
	Ritteleb int, Conuni Floritio Co. C	Livingston, N.J.		Bausch and Lomb Oplical Co				Albuquerque, N.M.
6160X	General Electric Co., C			E.T.A. Preducts Co. ef Am			Clarasist Mig. Co.	Oover, N.K.
01005	Alden Products Co.	Hudson Fails, N.Y. Burching, Mass	46348	Anatom Electronic Hardword			Elmar Filter Corp. Minnen Blastein Co., 13	W. Käyön, Conn.
	Allen Bradley Co.	Brockton, Mass, Milwaukan, Wis,	06555	Boodo Electrical Instrument	New Rockelle, N.Y. Co., loc.		Nippon Electric Co., Lt Notus Electronics Curp.	d. Tokyo, Japan Clark, N. J.
	Litten ladustries, fac.	Beveriy Hills, Calif.			Penacaok, N.H.		Delle Somiceaductor Inc.	
	TRE Semiconductors, in		06666	General Davices Co., Inc.	Indianapatta, fed,		Dickson Electronics Cor	
01235	Tazas jastruments, jac.,		06751	Sencor Div. Components Inc			Thernolley	Qelles, Texas
	Transister Products D	liv. Dailan, Taxan	06812	Terrington Mig. Co., West (liv.	13396	Telefunkan (Gubh)	Konover, Carmany
	The Alliance Mfg. Co.	Allianco, Ghio			Van Nuys, Calif,	11015	- Ridland-Wright Div. of P	acific Industries, Inc.
	Pacific Relays, Inc.	Yan Nuya, Calif,		Vallan Assoc, Einne Div.	fan Calles, Calil,			Kanaas Cily, Kanaas
	Amereck Carp. Palse Engineering Co.	Rechlord, III,		Kelvin Electric Co.	Van Ruys, Calif.		Som-Tuch	Renhery Park, Callf.
	Feirescube Corp. of Ane	Santa Claro, Calif. Irica Saugerties, N.Y.		- Digilisa Co. Transislat Electronics Corp.	Pasadena, Calif.		Calif, Resistat Corp.	Santa Manica, Calif.
	Theslock Signals, Inc.	Long Brauch, M. J.		Westinghouse Electric Corp.	Mianeopolis, Minn.		American Components,) ITT Somiconductor, A.D.	
	Cole Rubber and Plastics	t Inc. Sunnyvnie, Calif.		Electronic Tube Div.	Elaita, N.Y.	11111	ITT Semiconductor, A D & Telegraph Corp.	West Palm Beach, Fla,
	Anphonal-Berg Electioni		07145	Felmakm Carp.	New York, N.Y.	16693	Rawlett-Pachaid Compan	
82735	Radio Corp. of America,		07233	Cinch-Graphik Co.	City of Industry, Calif,		Carnell Dublier Electric	
	and Mataziala Oiv,	Somstville, N. J.		Silicon Transistar Carp.	Calle Place, N.Y.		Corning Glass Works	Coming, N.Y.
um	Vecaline Co. of America			Avnet Carp.	Culver City, Calif.		Electro Cube Inc.	San Gabilet, Calif.
87777	Hophins Englacering Co.	Qid Saybiaak, Cana. Tao Kayataak, Cana.	07263	Faitchild Conora & Inst. Co			Williams Mfg. Co.	San Jose, Calif.
		. San Fernendo, Culif. 4. Dapt. Syracuso, N.Y.	A7177	Somiconductor Div. Nonnools Rubber Co.	Hountain View, Calif.		Webster Electronics Co.	New York, N.Y.
	Apes Nachine & Tool Co			Bisteker Cerp. , The	Minnaapalis, Minn, Manlarny Park, Calif.		Scienics Corp.	Kothildge, Colif.
	Eldens Carp.	Cemplon, Calif.		Sylvania Elect, Pige, Inc.,			Adjustable Bushing Co. Nicron Electronics	N. Hollywood, Calif.
63818	Parker Saal Co.	Los Angeles, Callf.			Nounisin View, Calif.			n City, Long Island, H.Y.
	Transition Electric Corp.		07700	Technice, Mire Products Inc.		15566	Amprahe Inst. Carp.	Lynbrook, N.Y.
	Pytelils Resister Ce., 1	inc. Cadar Knalls, K.J.		Badine E sci. Co.	Thicage, III.		Cabletronics	Casta Meso, Calif.
61334	Singer Co., Diehl Div,	Proceeditor III a		Continenta' Device Corp	Hawthairs, Calif,	15172	Tweatieth Century Colt !	
81066	Fladerur Plant Arrow, Hast and Hugeman	Sumerville, N.J.	01373	Raytheon Mfg. 30.,	Neveral Area Artic			Santa Clara, Calif.
	NIGAN' DOLT DAS DETEND	Hailfaid, Coan.	01630	Semiconductur Div. Hewlett-Packard Co., Boont	Novatsia View, Calif		Fonwal Eloci, Inc.	Framiagham, Mass.
04013	Tautus Corp.	Lanbertville, N. J.			Rechaway, N.J.		Anelco Inc.	Mt. View, Calif.
84062	Atta Electronic Inc.	Great Nech, N.Y.	08145	U.S. Enginentes Co.	Las Angeles, Calif.		Spruce Plac Nica Co. Omni-Spoctra Inc.	Spruce Pine, N.C. Oetroit, til.
	Hi-Q Division of Anravau	u Nyrlie Beach, S. C.		Blinn, Delbert Co.	Panons, Calif.		Compuler Diede Corp.	Ladi, N.J.
	Precision Paper Tube Co		Q8358	Buigess Battery Co.			Ideal Prac. Neter Co., 1	
04404	Oynec Division of Hewle			Alagara é	'alls, Onterio, Canada		De Jur Hoter Div.	Breaklyn, N.Y.
8/263	Tuluania Stantein Bindual	Pala Ailo, Calif. In Minimum		Beulsch Fastener Corp.	Los Augoles, Calil,		Delco Radio Div. el G.N	. Carp. Kakama, Jed.
89834	Sylvania Electric Product Device Div.	in, microwave Housiain View, Calif.		Bristol Co., The State Constant	Waletbuty, Conn.		Thermonolics Inc.	Conoga Park, Calif.
04713	Moloralo, Inc., Semicani			Slean Company ITT Cannon Electric Inc., P	Sun Valley, Callf,		Titkes Company	Kounlain View, Calif.
• • • • •		Phoenix, Atizana	48738	ti i çanışı gişetire inc., P	Photala, Arizona		Hantin Hotal Products Co	
04732	Filtran Co., Inc. Western	n Div.	68727	Kalional Radio Lab. Inc.	Paranus, N.J.		Angeliahm Prec, Jac.	Ne. Hollywood, Calif.
	•	Culver City, Calif.		CBS Einclrentes Semicandus	let		NeGtau-Edisan Co. Romas Dastan Parifin tar	Manchester, N.H.
	Automotic Electric Co.	Rorthisko, (11,		Operalians, Div of C. B. S.			Power Dosign Pacific in Clavite Carp., Somicond	
	Sequela Wice Co.	Redwood City, Calif.		•	Lowell, Mass,	19895	manine werkt tamirous	Pale Alto, Calif.
	Precision Coll Spring Co.			Kol-Raia	ladianapalis, Ind.	18324	Signatics Corp.	Sunnyvate, Calif.
	P.H. Helor Company Company Mrs. Families	Westchester, III.		Babcuck Relays Div,	Custa Nusa, Cullf,		Ty-Car Mfg. Co., Inc.	Holiston, Mass.
64273	Component Mfg. Service (Texas Capacitar Co.	Houston, Toxas		TRE Elect, Camp. Div.	Des Plainer, jit.
05006	Twentieth Century Plasti	W. Bridgswaler, Hass.	00345	Tech, led. lec. Alaba Elect		18583	Curlis tastiement, fac.	Mt. Hisco, N.Y.
	· ····································	Las Angeles, Calif,		Electro Assemblius, Inc. Wolfory Battery Co. of	Chicago, III.		Yishay Intertachaology,	nc. Malvern, Pa,
05277	Wastinghause Electric Co				anto, Ontario, Canada		E.I. DuPent and Co., In	
	Semt-Conductor Dopt.	Youngwood, Pa.	10214	General Transiator Western C	ante, unierra, ganrad. Ala.		Durant Nig. Co. The Bendin Corp., Navig	Milwaukee, Wis.

00015-45 Revised: April, 1968

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Fism: FSC. H4-1 H4-2 Handbook Supplements Dated AUGUST 1966 Dated NOV. 1962

TABLE 6-3. CODE LIST OF MANUFACTURERS (Cont'd)

Code

Address Manufacturer 19500 Thomas A. Edison incustions, Div. of West Orange, N. J. Baldwin Park, Calil, Rasaabeads, N.Y. McGlaw Editon Co. 19549 Cancas 19644 LRC Electronics 1970) Electro Mig. Co. 20183 General Attonics Corp. Independence, Konsas Philodelahip, Pa. 21276 Executione, Inc. L 21335 Fafnir Benring Co., The 21520 Fansteel Mulailurgical Corp. Long Island Cily, H.Y. Now Britain, Cons. N. Chicago, 11t. 71783 Brilish Radio Electronics Ltd. Washington, D.C. 24455 G.E. Lamp Division Rein Park Claveland, Ohio 24655 General Radio Co. Want Cancard, Mann. Huntington, Ind. New Rockelle, N.Y. 24621 Moncor Inc., Coup, Div. 76365 Gries Reproducer Corp. 26462 Grabet Fife Co. al Adarica, inc. Cartaladt. N. J. Hallister, Calif. 26851 Connec/Hallistar Co. 26592 Hamilton Wolch Co. Lancaster, Pa. Palo Alto, Calif. 23430 Hewielt-Packard Co. 28520 Hayman Mig. Co. Keniluatib, N.J. 10817 Instrument Specialties Co., Inc. Little Falls, B.J. Owenaboto, Ky. Chicago, III. 33173 G.E. Receiving Tube Dept. 35434 Loclichm Inc. 16125 Stanwych Coil Products Lid. Hankesbury, Ontailo, Canada 36287 Cunningham, W. H. & Hill, Lld. Torento Galario, Canada 37942 P.R. Mailory & Co. inc. Indianapolis, Ind. 39583 Mechanical Industries Prad. Co. 40920 Ministure Precision Bearings, Inc. Akran, Ohio Kanne, N.H. 42190 Huter Co. Chicago, Pi, 13950 C.A. Hateren Co. Englanged, Cula. Statie, 10. 44655 Oballe Mig. Co. 46384 Penn Eng. & Mig. Corp. 47904 Polaruid Curp. Depiestown, Pa. Cambridge, Nass. 48620 Precision Theimometer & Inst. Co Sculkanpton, Pa. 45555 Microwave & Power Tube Div. Waltham, Mass. Wentminnter, Md. 52030 Rewan Controller Co. 52583 Sanbarn Company Wollham, Moss. \$4294 Shalleross Mfg. Co. 55026 Simpson Electric Co. Salaá, N.C. Chicago, Ill. 35933 Sensione Carp. Eins 35938 Raytheon Co. Commercial Apperatus & Einsterd, N.Y. le. Rorwalb, Conn, Systems Div. 56137 Sas, Ling Fibie Co., Inc. Tanswands, M.Y. 56289 Spragae Electric Co. North Adams, Mass. 59416 Teles Carp. 59730 Thomas & Bails Co. Tulse, Ohla. Elizabeth, N.J. 6074] Tripfett Electrical Inst. Co. 61775 Union Switch and Signal, Divy of Blufften, Ohio Vestinghauss Air Brake Co. Pittaburgh, Po. 67119 Universal Finchile Co. Quesso, Nick, Mt. Veinon, N. Y. \$3743 Ward-Leonard Electric Co. 64959 Western Electric Co., Inc. 65092 Westen Inst. Inc. Westen-Hewark Res Yoth, N.Y. Rowath, N.J. \$5255 Willeh Mfg. Co. Chicage, Ill \$5346 Minseath Mining & Jfg. Co. Revere Mincan Div. Chicage, III. St. Paul, Minn. Barlfard, Conn. 20226 Alien Mie. Co. 20305 Allied Control 20316 Alliestal Sciew Product Co., Inc. New Yoth, H.Y. Garden City, h. V. Deireit, Nic ... Chicago, III. 70417 Angles, Div. of Chrysler Carp. 20485 Allantie Indin Rubber Worbs, Inc. Union City, H.J. Minnespolis, Minn. 30563 Angelite Co., Inc. 10674 ADC Pinducts Inc. 70303 Beiden Mig. Co. Chickey, 111.

Code No. Manufacturer Address 70558 Bud Electronic Corp. Claveland, Ohio 71002 Binbach Radio Co. 71034 Billey Electric Co., Inc. New Yeth, N.Y. Erie, Pa. 71041 Boston Gear Works Div. of Murray Co. y Co. Quincy, Mass. Willoughby, Ohio Combridge, Wass. Paramus, N.J. at Taxax 71218 Bud Radio, Inc. 71275 Cambridge Thermionics Corp. 71286 Camles Fastenet Corp. 71313 Caidwall Candenser Corp. Lindenhurst L.J., N.Y. 73400 Bussmann Hig. Div, el McGraw-Edison Co. St. Louis, Mo. Chicago, Ill 71436 Chicago Condenses Caip. 71447 Calli, Spring Co., Inc. 71450 CFS Corp. Pica-Rivers, Calif. Elbhart, Ind. 71468 ITT Cannon Electric Inc. Las Angeles, Calif. Burbank, Calif. 71471 Cinema, Div. Aeravoz Corp. 71412 C.P. Clare & Co. Chicago, III. 28530 Centralab Div. of Glabe Union Inc. Milwaukee, Wik. 7[616 Conneicial Plastics Co. Chicago, III. New York, N.Y. Providance, R.J. 71700 Coinish Mite Co., The 71707 Colo Coil Co., Inc. 73744 Chicege Ministute Lanp Works United B. Jones Div. 71785 Cinch Mig. Co., Howard B. Jones Div. Chicege, III. Curcegu, 107, 21984 Dow Corning Corp. Middand, Mich. 22136 Electro Holive Mig. Co., Jac. Willimsatic, Conn. 71984 Dow Carping Colo. 32619 Diallaht Corp. Brocklyn, N.Y. 72656 Indiano General Corp., Electronics Div. Kensby, N.J. 72635 General Instrument Corp., Cap. Div. Nawarh, N. J. 72765 Dinke Hig. Co. 72825 Hugh H. Eby Inc. Harwood Heights, 113. Philadelphia, Po. 72928 Gudeman Co. 72928 Einstic Stop Nut Corp. 72964 Robert M. Hadley Co. Chicage, II). Union, H.J. Los Angeles, Calif. 72864 Robert W. Hadley Co. 72862 Erie Vochnological Products, Inc. Erie, Pa 72882 Erie Vochnological Products, Inc. Princelon, Inf. Etie, Ps. 73076 H.W. Haiper Co. Chicage, ilf. 73138 Helipal Div, of Beckman inst., Inc. Fullerten, Calif. 73293 Hughes Products Division of Hughes Nunpeit Beach, Calif. Aircraft Cu. 73445 Amperes Elect Co. Hicksville, L.I., N.Y. 73506 Bradley Semiconductor Corp. New Haven, Conn. 73555 Catling Electric, Inc. 73586 Circle F Mfr. Co. Haitford, Cana. Trenton, N.J. 73682 George K. Gorrett Co., Div. MSL Industries inc. Føderst Screw Products Inc. Philadelahin, Pa. 73734 Chicago, Ilt. Cincinnali, Onio Elyria, Ohio 73743 Fischer Special Mfg. Co. 73753 General Industries Co., The 73846 Goshen Stamping & Teol Co. Gasben, Ind. 22895 JEB Flechtanics Carp. Brooklyn, N.Y. San Jose, Calif. 73905 Jannings Radio Mig. Corp. 73957 Grasy-Pin Carp. Ridgetiald, N.J. 74275 Signalite Int. Nepfune, N.J. 74455 J.H. Winns, and Sons 74861 Industrial Condensor Corp. Winchebler, Hass. Chicago, Ill. 74868 R.F. Products Division al Amphenol-Barg Danbury, Cann. Electronics Corp. 71910 E.F. Johnson Co. Taseca, Minn. 75042 International Resistance Co. 75263 Kayslone Carbon Co., Inc. Philadalphia, Pa. 31. Marys, Pa. 75378 C75 Knights (+1. 75382 Kulke Electric Co paration Sandwich, 111. Ht. Vernon, N.Y. Chicago, III. 75818 Long Electric Mig. Co. Des Plaines, III. Etie, Pa. 75915 Littlefuse, Inc. 76005 Lord Miz. Co.

Monufacture Address 16210 C.W. Harwedet San Flancisco, Calif. 36433 General Instrument Corp., Mitamald Division Reward, N.J 76487 James Willen Mig. Co., Inc. 76493 J.W. Willer Co. Halden, Hass. Los Angeles, Calif. Jacya J.W. Miller Co. Los Ange 36330 Cinch-Monadaoth, Div. of United Chir ites Carr San Leandro, Calif, Fastenar Carn. 76545 Nueller Electric Ca. Cleveland, Ohio 76703 National Union 76854 Oak Banufacturing Co. Nombile N. A. Crystal Lake, III. 76634 Oth Manufacturing vo. 077000 201700 73068 The Pandix Colp., Electrodysamics Div. N. Hollywood, Calif. 73075 Pacific Metals Co. San Fibercisco, Calif. 77721 Phanastran instrument and Electronic Co. 37252 Philadelphia Steat and Wire Corp. Philadelphia, Pa. South Pasadena, Calif. 77342 Austican Machine & Foundry Co. Polter Princeton, Ind. & Brumfield Dev. 77630 TAW Electionic Components Div. Cauden, N. J. 73638 General Instrument Corp., Rectifier Div. Biochlyn, N.Y. 77768 Resistance Products Co Hattisburg, Pa. 77569 Rubbeicialt Carp. of Calif. Torrenen, Calif. 74149 Shakeprool Division of Illinois Tool Works Elen. iit. So. Brointree, Moss. 74277 Signa 78283 Signal Indicator Corp. New Yolk, N.Y. Pilwan, N.J. 78250 Struthers-Dunn Inc. 28452 Thompson-Bremer & Co. Chicago, III. 78471 Tilley Mig. Co. 78488 Slackpole Carbon Co. San Francisco, Calif. St. Marys, Pa. Waltham, Mass. Cleveland, Ohio JE431 Standard Thomson Corp 18553 Tienerman Products, Inc. 1790 Transformer Engineers San Gabriet, Calif. Newtonville, Mass. J8347 Ucinite Co. 75136 Waldes Kahinuar inc. Long Island City, N.Y. 19142 Veeder Root, Inc. Haitford, Coan. 39142 VEERER HUN, HELL 19251 WERTO MIZ. Co. Chicago, HI. 39277 Confinental-With Electronics Corp. Philadelphia, Pa. 75563 Zierirt Mig. Corp. New Rochelle, H.Y. \$0031 Nor ,o Division of Sessions Clock Co. Nomislawn, N.J. 80120 Schnitzer Alloy Products Co. Elizabath, N.J. 10133 Electronic Industries Association. Any brand Tube meeting EtA Standards-Washington, DC. 20207 Uniman Switch, Div, Maxon Electronics Corp. Wallingford, Conn. New Yosh, N.Y. Chicago, III, \$0273 United Transformer Corn. 20248 Oxford Electric Caro. 40746 Unive Line, Riverburg, Controls Co. 20216 Boures Inc. 20211 Acro Div, of Robertship Controls Co. Columbus, Ohio 10486 All Star Seaducts Inc. Deliance, Ohio Montovin, Calif, 80509 Avery Label Co. 80583 ham antiund Co., Inc. New York, N.Y. 20540 Lievens, Arnald, Co., Inc. Basian, Mass. 60613 Die co Gray Co. Dautos, Ohio \$1030 lat instignal Instruments Inc. Orange, Conn. 81030 - A ayhilt Co. 81035 - Thind Transformet Corp. LaGrange, III. Venice, Calif. \$1312 Sinchester Elec. Div. Lillan Ind., Inc. Oakville, Conn. 81349 Military Specification Et Segundo, Calif. 81483 International Rectifiar Carp. \$154] Aupan Electronics, Inc. Cambridge, Maryland 81860 Barry Cantrols, Div. Barry Wright Carp. Watertown, Mass. 87042 Carles Precision Electric Co. Shahis, 201.

Fram: FSC. Handbaok Supplements H4-1 Dated AUGUST 1966 H4-2 Dated NOV, 1962

00015-45 Nevised: April, 1968

TABLE 6-3. CODE LIST OF MANUFACTURERS (Cont'd)

Code		
No.	Manufacturer	Address
82047	Spert) Faraday Inc., Copp Electric Div,	It Hemilt Hubakes, N.J.
82142		n of Speer Du Bois, Pa.
82130	Falichild Camera & Inst. C System Div.	orp. Space & Defense
82209	Nagure Industries, Inc.	Paramus, N.J. Glacawich, Conn.
82219	Sylvania Electric Prod. Inc Electronic Tube Division	
82376	Astron Colp. East	i Enpotium, Pa. Newark, Harrisca, N, J.
82389 82647	Switcheralt, Inc. Retain & Controls Inc. Spe	Chicogo, ill.
		Allieboro, Mass.
82768 82866	Phillips-Advance Control C Research Products Corp.	
12177	Ration Mig. Co., Jac.	Wadston, Wis. Woodstock, N.Y.
82693	Veclor Electronic Co.	Glendain, Calif.
#305# #30#6	Care Fastener Co.	Cambridge, Mass.
83468	Nuw Kampahise Ball Beasin	Poterborough, N.H.
83125	General lastrument Corp.,	Copocitor Div.
83348	ITT With had Cable Dru	Deilington, S.C.
13116	ITT Wite and Cable Div, Victory Eng. Corp.	Los Angeles, Calif. Springfield, N.J.
43294	Bendin Corp., Red Bank Di	iv. Red Bank, N. J.
43315	Hubbell Corp.	Mundetein,)If,
83324 83330	Rossa lác. Suilh, Herman H., Inc.	Nuwpert Beach, Colif. Brochlyn, N.Y.
13332	Tech Labs	Palisado's Park, N. J.
83385 83501	Central Screw Co.	Chicago, Ill.
81301	Gavilt Wire and Cable Co. Div. of Amerace Corp.	Breckfield, Mass.
83594	Buttoughs Corp. Electrenic	Tubs Div,
43240	Balan Paukida Com. Conc.	Plaiatistd, N.J.
# 37 4Q	Union Carbide Corp. Consu	Ner Prod. (IIV, New York, N.Y,
\mathbf{n}	Madul Eng. and Mig., Inc.	Hualington, Jad.
83821 83942	Loyd Scruggs Co.	Festus, Mo.
14171	Aeronautical Inst. & Radio Arco Efectronics Inc.	Co. Ledi, N.J. Graat Neck, N.Y.
11116	A.J. Glaseaer Co., Inc.	San Francisco, Calif,
84432 84970	TRW Capacilot Div,	Ogallala, Neb.
15454	Saikes Tarzian, Inc. Beanlon Molding Company	Bloomington, Ind. Boontan, N.J.
15471	A.B. Boyd Co.	San Francisco, Colif,
85474 85660	R.N. Bracamonie & Co.	San Fraccisco, Colif.
85911	Kalled Kaids, Inc. Seenarse Rubber Co.	Handen, Conn. Chicago, III.
66197	Clifton Precision Products	Co., lac.
*****	Bandistan Bubbas Bandusta	Cliften Heights, Pa.
66579 86684	Precision Rubber Products - Radio Corp. of America, El	Corp. Dayton, Ohio ectronic
	Comp. & Devices Div,	Hanista, N.J.
\$7034	Natto Industrias	Annheim, Calif.
87216	Philes Corporation (Lanada	le Olvision) Lansdele, Pa,
\$7473	Western Fibraus Glass Pred	ucla Co.
87664	Nau Watasa 8 Maansa Iro	San Francisco, Calif.
87910	You Walets & Rogers Inc	San Francisco, Calif. Providence, R.L.
18140	Culler-Hammer, Inc.	Liacota, șii.

Code	Harry Carto say	
No.	Manufacturer	Address
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
44698	Geneist Rais, Inc.	Bullalo, N.Y.
- 69231	Graybar Electric Co.	Oakland, Calil,
19473	G. E. Distributing Curp. United Transformer Co.	Scheneclady, N.Y.
10010	United Shoe Machinery Corp.	Chicago, 111. Beverly, Mass.
90179	US Rubbes Co., Consumer Ind	
	Pred. Div.	Passaic, N. J.
90970		an Francisco, Calif. 👘
91146	ITT Connon Elect, Inc., Soler	o Div. Salem, Nasa.
\$1260 \$1245	Connor Spring Mig. Co. S Miller Diel & Nemeplate Co.	an Francisco, Calif.
JUI	Radio Materials Co.	Chicago, III.
91506	Augul Inc.	Attleboro, Mass.
91637	Dale Electionics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grave, Po.
91737	Gremar Mig. Co., Jac.	Wakefield, Mass.
91827 91866	KFDevelopmentCo. F Naito Mig. Co., Inc.	ledwood City, Chill."
91525		Chicago, III. Div.
		Fteepolt, III.
91963	Nahm-Dias. Spiing Co.	Qakland, Calif.
92180	Tru-Cannector Carp.	Peabody, Mass.
92167 92607	El, tet Optical Co. Inc.	Rechester, N.Y.
11141	Tensolite Insulated Wire Co.,	Tellylown, N.Y.
92702	INC Megnelics Corp. Weshur	y Long Island, N.Y.
12166	Hudson Lamp Co.	Keziney, N.J.
93332	Sylvania Electric Prod. Inc.	
	Semiconductor Div.	Wobute, Moss,
93369 93430	Robbins & Myers Inc. P Stavens Mig. Co., Jac.	alisades Park, N. J.
93632	Wofers Mig. Co.	Banafield, Ohie Culver Sily, Calif.
93929	G.V. Contiols	Livingstan, N.J.
94137	General Cable Carp.	Bayonne, N.J.
94144	Raytheen Co.', Canp. Div., :	
94144	Comp. Operations Seinstellie Etechnolog Bunducte	Quincy, Mass.
	Scientific Electronics Products	Loveland, Colo.
94154	Wagner Elact, Corp., Tung-Sal	Div. Newark, N.J.
94197	Cuttias-Wright Corp. Electronic	se Div.
	· · · · · · · · · · · · · · · · · · ·	Enst Paterson, N.J.
94222 94330	South Chester Calp. Wile Cloth Products, Inc.	Chester, Pa,
14375	Automatic Matal Products Co.	Bellwcod, jil, Brockfyn, N.Y,
14412	Worcanter Pressed Aluminum C	áld.
		Worcester, Mass.
14636	Wagnacialt Elecitic Co.	Chicago, III.
95023	George A. Philbrick Researche	
95236	Allies Products Corp.,	Boston, Mass,
35238	Continental Connector Corp.	Dania, Fia. Woodside, N.Y.
95263	Leeciali Mig. Co., Inc.	Long Island, N.Y.
95265	National Coll Co.	Sherlden, Wyo.
\$5275	Vilramon, inc	Bridgeport, Conn.
95348 95354	Galdan Colp. Malkor (1915) Co. A	Blaamfield, N.J.
90304 95566	Ainol. (Aneering Co.	olling Moodowa, 311.
35712	Dage Electric Co., Jac.	Marango, til, Franklin, Ind.
15114	Sieman Nig, Co.	Wayne, III.
15987	Weckasser Co.	Chicago, III.

\$60%5 Hi-Q Div. of Astovsk Corp. Olean, M. Y \$8255 Thordsron-Meissner Inc. Mt. Carmel, III \$8255 Thordsron-Meissner Inc. Mt. Carmel, III \$8255 Galam Maunfecturing Co. Les Asgeles, Calilli \$8330 Catilon Screw Co. Oskland, Calil \$8531 Microwave Asteciates, Inc. Burlingten, Maan \$8531 Microwave Asteciates, Inc. Burlingten, Maan \$8531 Each Transformer Co. Oskland, Calil \$9746 Industrial Relaning Ring Co. Irvington, N. Y \$9735 Automatic & Precision Mig. Englewood, N. J \$9739 Reon Reaistor Corp. Yaskers, N. Y \$9738 Litton System Inc., Adler-Weslraz Commun, Div. \$8159 Rubber Teck, Inc. Gardeena, Calil \$8159 Rubber Teck, Inc. Sandrea, Calili \$8220 Hordett-Pachaid 10., Moseley Div. Pasadeas, Calili \$8278 Microdot, Inc. Sondreas, Calili \$8279 Microdot, Inc. Sondreas, Calili \$8271 General Mills Inc., Electronics Div. Miameapolia, Miam \$82734 Pacco	Code No.	Manufacturer	Address
36256 Thordarson-Meissner Jac. Mt. Canmel, fti. 36256 Salar Maufachning Co. Les Asgeles, Calif 36300 Catiton Screw Co. Ghicego, Hi 36310 Eacel Transformer Co. Okhland, Cabif 37454 Industrial Relaming Ring Co. Les Asgeles, Calif 37454 Industrial Relaming Ring Co. Unington, N.J 37315 Automotic A. Precision Mfg. Englewood, N.J. 37317 Automotic A. Precision Mfg. Yankers, N. Y 37317 Automotic A. Precision Mfg. Yankers, N. Y 37318 Litton System Inc., Adler-Weelcax Commun. Div. New Rochelle, N. Y 38131 K. Troncis, (ac, Jamalce, N. Y Saster, S. Calif 38228 Ricodol, Inc. So. Pasadena, Calif Pastdena, Calif 38278 Microdol, Inc. So. Pasadena, Calif So. Pasadena, Calif 38278 Microdol, Inc. So. Pasadena, Calif So. Pasadena, Calif 38278 Microdol, Inc., Electronics Div. Mianeapolis, Miansanech, N. Y 38731 General Wills Inc., Electronics Div. Mianeapolis, Miansanech, N. Y 38732 Paeco Div. of Hawletl-Pach	\$6067	Huggins Laboratories	Sunayvale, Colif.
98296 Solar Manufacturing Co. Les Angeles, Califer 9530 Cattlen Stera Co. Chicago, Hi 95341 Bicconwave Astociates, (nc. Butingten, Maan 9530 Eacol Transformer Co. Oshtand, Calif 97444 Industrial Relaning Ring Co. Irvington, N.J. 97373 Reon Realistor Corp. Yahkers, N.Y. 97373 Been Realistor Corp. Yahkers, N.Y. 97373 Litten System Inc., Adlar-Westena Commun. Oiv. 97373 Rech Realistor Corp. Yahkers, N.Y. 97373 Rech Realistor Corp. Yahkers, N.Y. 97373 Rech Realistor Corp. Yahkers, N.Y. 97373 Rech Reis, Inc. Gardens, Calif 98236 Rubber Tack, Inc. Damaters, Calif 98237 Nordelt-Packatd 1 o., Moseley Div. Pasadena, Calif 98238 Sealectro Corp. Manusaech, N.Y 98339 Sealectro Corp. Burbank, Calif 98331 General Mills Inc., Electronics Div. Manusaech, N.Y 98349 Pacco Div., of Humitell-Packard Co. Palo Allo, Calif 98340 Calumbla Technical Corp.	\$60*5		Olean, N.Y.
95330 Catiton Screw Co. Chicago, till 95344 Microwave Asteciates, (nc. Burlington, Maan 95503 Excel Transformer Co. Okhkad, Catili 97464 Industrial Relating Ring Co. Okhkad, Catili 97454 Industrial Relating Ring Co. Urvington, N. J. 97375 Automatic & Precision Mig. Englewood, N. J. 97378 Reon Revisior Corp. Yankers, N. Y. 97383 Litton System Inc., Adiar-Westraz Dommyn, Oiv, 98131 F. Troncis, (nc. Jamales, N. Y. 98132 Fortancis, (nc. Jamales, N. Y. 98133 Sabber Tack, inc. Gardens, Calili 98220 Iscalett-Packatd I o., Mosefey Div. Pasadens, Calili 98231 Sealectro Corp. Mamanasch, N. Y. 98732 Sealectro Corp. Mamanasch, N. Y. 98733 General Mills Inc., Electronics Div. Miameapolia, Miam 98734 Paeco Div., of Huwlett-Packard Co. Palo Allo, Calif 98734 Paeco Div., of Huwlett-Packard Co. Burbank, Calif 98735 Laterasional Electronic Sceaters Corp. Burbank, Calif <td< td=""><td>36256</td><td></td><td>üt. Carnel, ill,</td></td<>	36256		üt. Carnel, ill,
95341 Microwave Associates, (nc. Buthagten, Mass 95508 Excel Transformer Co. Oshtaed, Celli 97464 Industrial Relaining Ring Co. Izvington, N. J 97373 Automatic & Precision Mig. Englewood, N. J. 97373 Reas Resistar Corp. Yankers, N. Y 97373 Litton System inc., Adlar-Westraz Commun, Oiv, Rew Rechelle, N. Y 98141 F. Troncis, (nc. Jamalco, N. Y Sardens, Celli 98278 Ruber Teck, Inc. Gardens, Celli 98270 Hocodati, Inc. So. Pasadens, Celli 982731 General Writs Inc., Electronics Div. Mumersech, N. Y 98732 General Writs Inc., Electronics Div. Mumersech, N. Y 98733 General Writs Inc., Electronics Div. Mumersech, N. Y 98734 Pace Div. of Hawleth-Pachard Co. Plo Allo, Calli 98735 General Writs Inc., Electronics Div. Muneapolis, Mine 98734 Pace Div. of Hawleth-Pachard Co. Plo Allo, Calli 98735 North Hills Electronic Lesearch Corp. Butbaak, Calli 98109 Calumbia Technical Corp. Butbaak, Callif 99109<	36236		Los Angeles, Calif.
95503 Excel Transformer Co. Oshiand, Calil 97454 Industral Ratinning Ring Co. Irvington, N. J 97535 Automatic & Precision Mig. Englewood, N. J 97535 Rutomatic & Precision Mig. Englewood, N. J 97535 Litton System Inc., Adlar-Weslica Commun. Ouv. New Rachelle, N. Y 98141 F-Ionetis, Inc. Jamalce, N. J 98135 Rubber Tack, Inc. Gardens, Calil 98220 Ivalett-Packard To., Mozeley Div. Pasadens, Calil 98235 Sealectro Corp. Mamsaneck, N. Y 98376 General Writs Inc., Electronics Div. Bardens, Calil 98731 General Writs Inc., Electronics Div. Mamsaneck, N. Y 98732 Zero Mig. Co. Burbank, Calil 98733 General Writs Inc., Electronics Div. Mansaneck, Calil 98734 Paeco Div. of Hawlett-Packard Co. Palo Allo, Calil 98735 Varian Associates Palo Allo, Calil 98736 Columbia Technical Corp. New York, R. Y 93737 Parien Corp. Burbank, Calil 93108 Aarian Asociates Palo Allo, Calil	96330	Catiton Screw Co.	Chicago, III.
97464 Industrial Relating Ring Co. Irvington, N. J 97333 Automatic & Precision Mig. Englewood, N. J 97393 Reas Resistor Corp. Yankers, N. Y 97383 Litton System Inc., Adlar-Westraz Dommon, Oiv, Rew Rechelle, N. Y 98141 F. Trancis, (nc. Jamalce, N. J 98134 F. Trancis, (nc. Jamalce, N. Y 98135 Rabber Tack, inc. Gardens, Calif 98220 Iscalett-Pachatd I.e., Mosefey Div. Pasadens, Calif 98231 Sealectro Corp. Mamanesch, N. Y 98732 Sealectro Corp. Burbanh, Calif 98733 General Mills Inc., Electronics Div. Mianeapolis, Mian 98734 Paeco Div, of Humlett-Packard Co. Palo Allo, Calif 98231 North Hills Electronic Sceserch Corp. Burbanh, Calif 98312 North Hills Electronic Sceserch Corp. Burbanh, Calif 93109 Columbis Technical Corp. Mianeapolis, Indi 93109 Columbis Technical Corp. Mianeapolis, Calif 93123 Yarian Associates Palo Allo, Calif 93124 Matectoris Corp. Satharora, N. Y	96341	Microwave Associates, Inc.	Builington, Mass.
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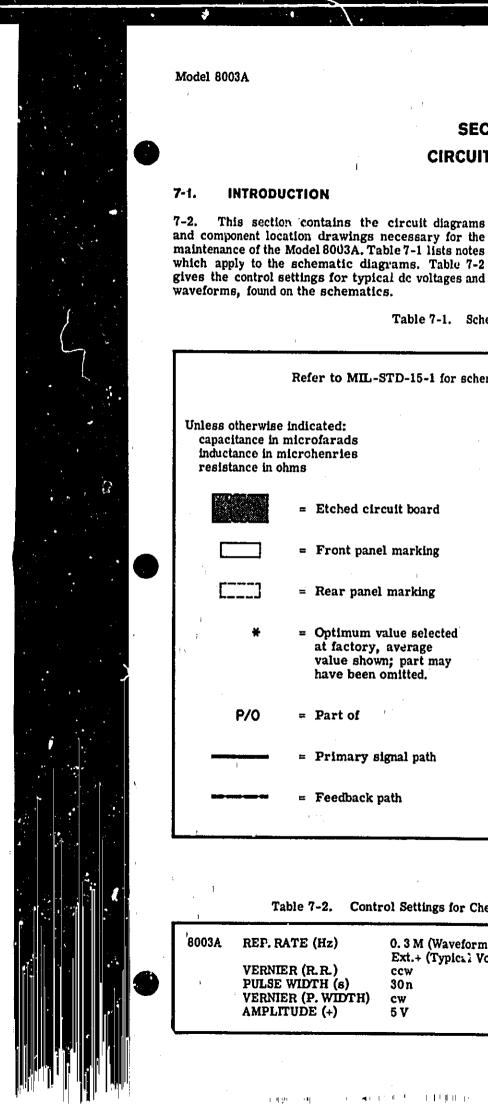
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00015-45 Revisud: April, 1968

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SCHEMATIC UIAGKAMS



Secdon VII Paragraphs 7-1 to 7-3

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SECTION VII **CIRCUIT DIAGRAMS**

7-3. Some switch and circuit board assemblies are shown in part on different pages. To find a specific instrument component, refer to the REFER-ENCE DESIGNATIONS box which appears on each schematic diagram. Components are designated using a UNIT NUMBERING SYSTEM. The full designation of a component includes the assembly on which the part is mounted and the individual part designation.

 Table 7-1.
 Schematic Diagram Notes

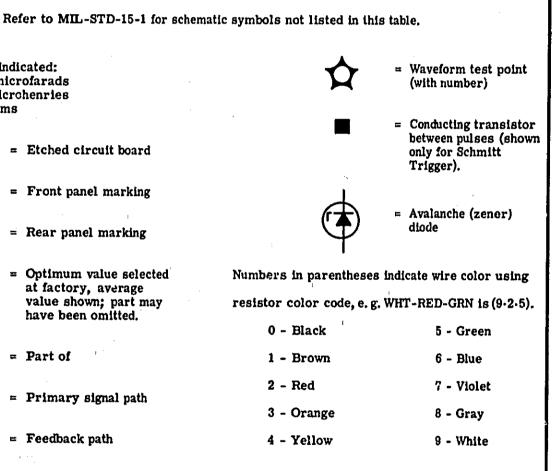
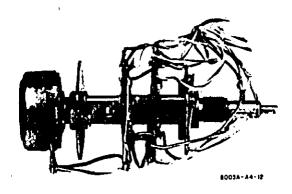


Table 7-2. Control Settings for Checking Waveforms and Tvical DC Voltages

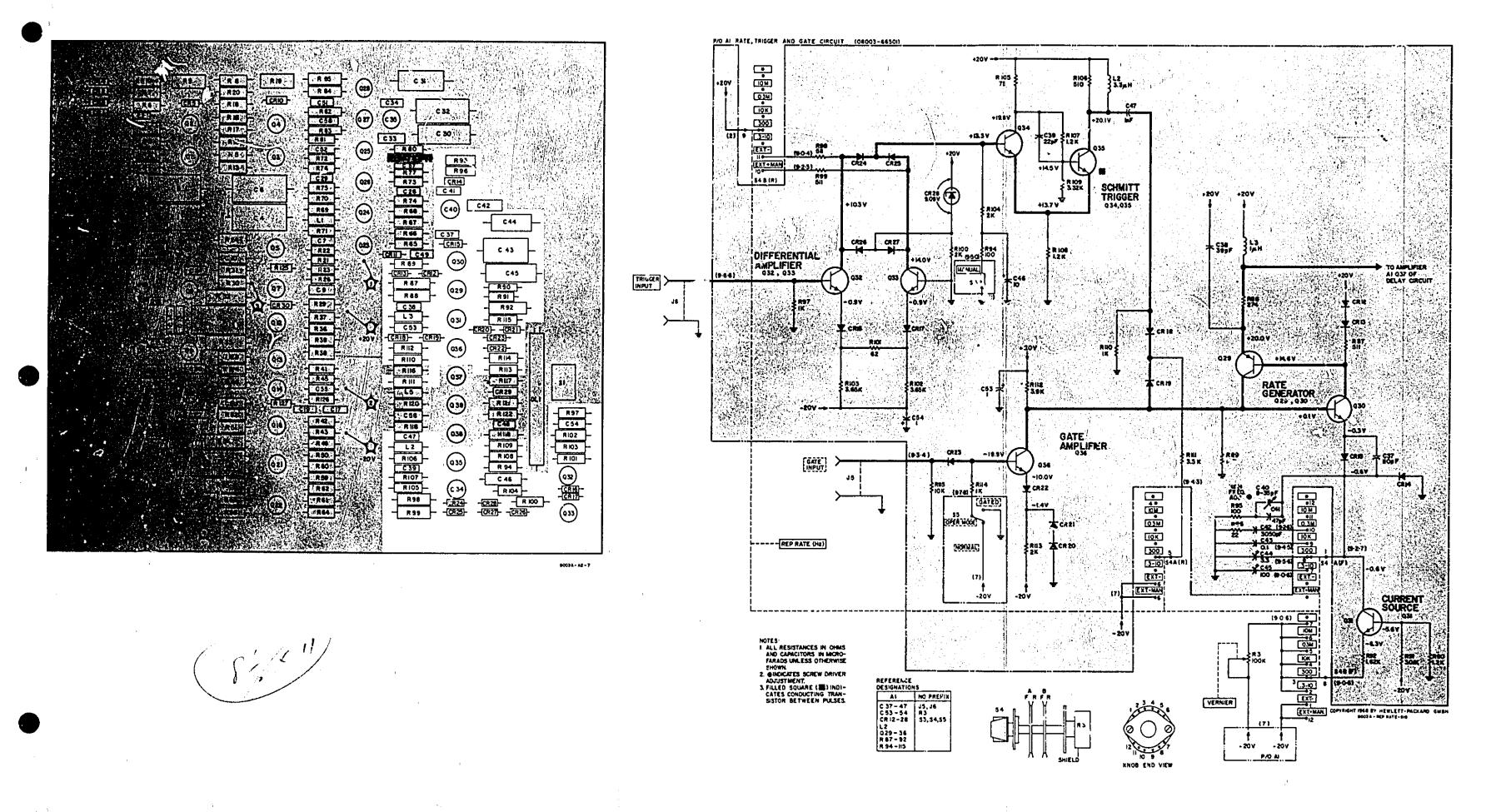
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v	Termination Switch (Internal)	5 V

Section VII Figure 7-1

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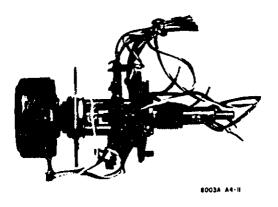
Repetition Rate Switch



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Figure 7-1. Repetition Rate and Gate Circuit

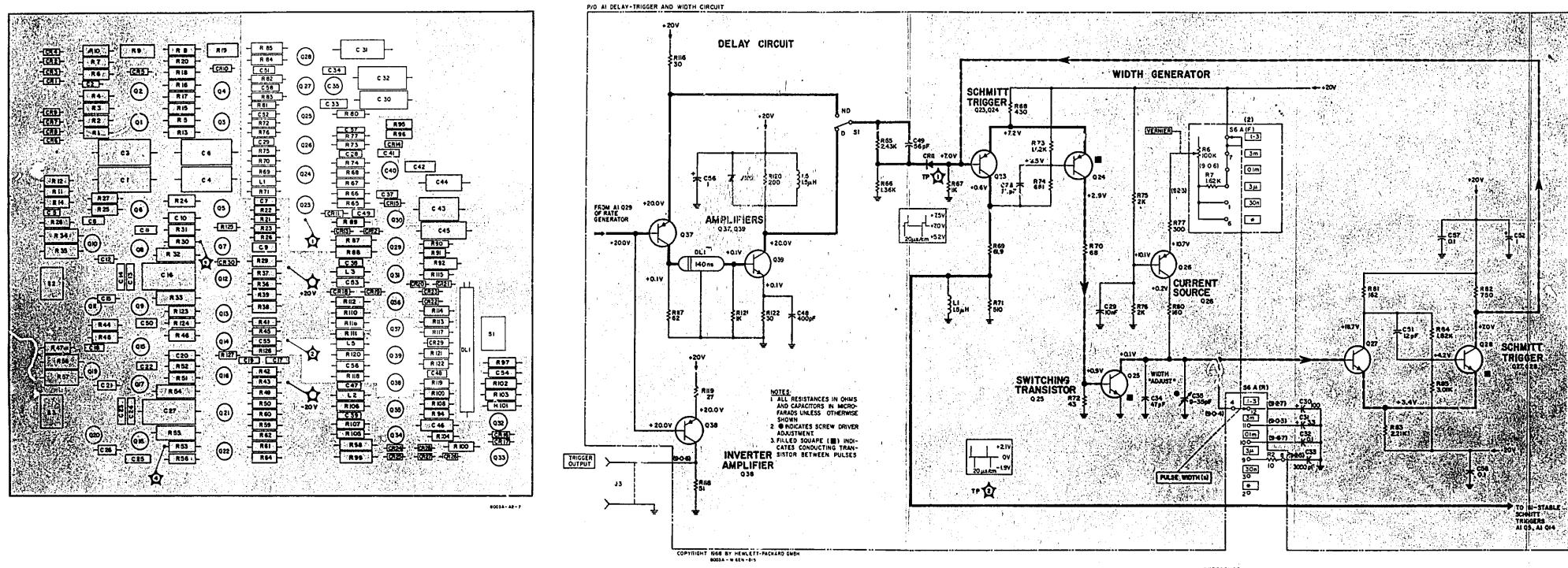
Section VII Figure 7-2 Model 8003A



Pulse Width Switch

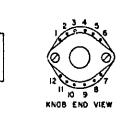


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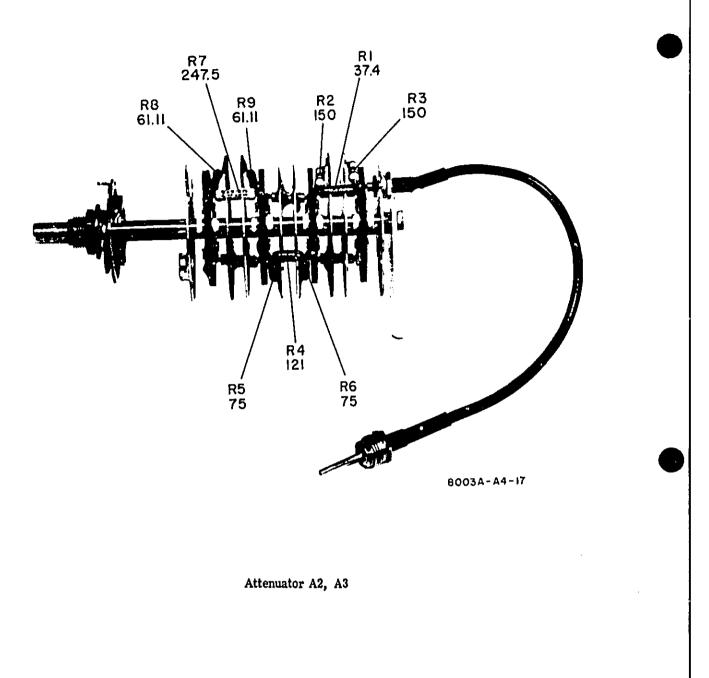


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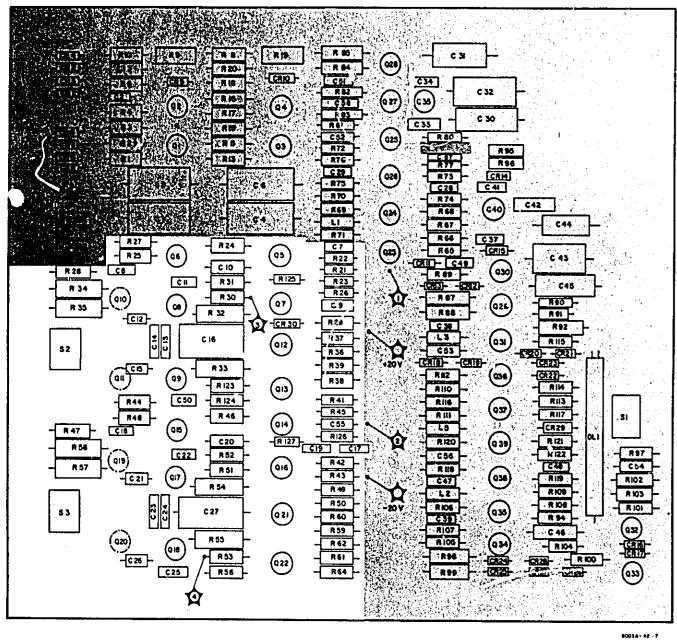
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Figure 7-2. Delay, Trigger, and Width Circuit 7-5





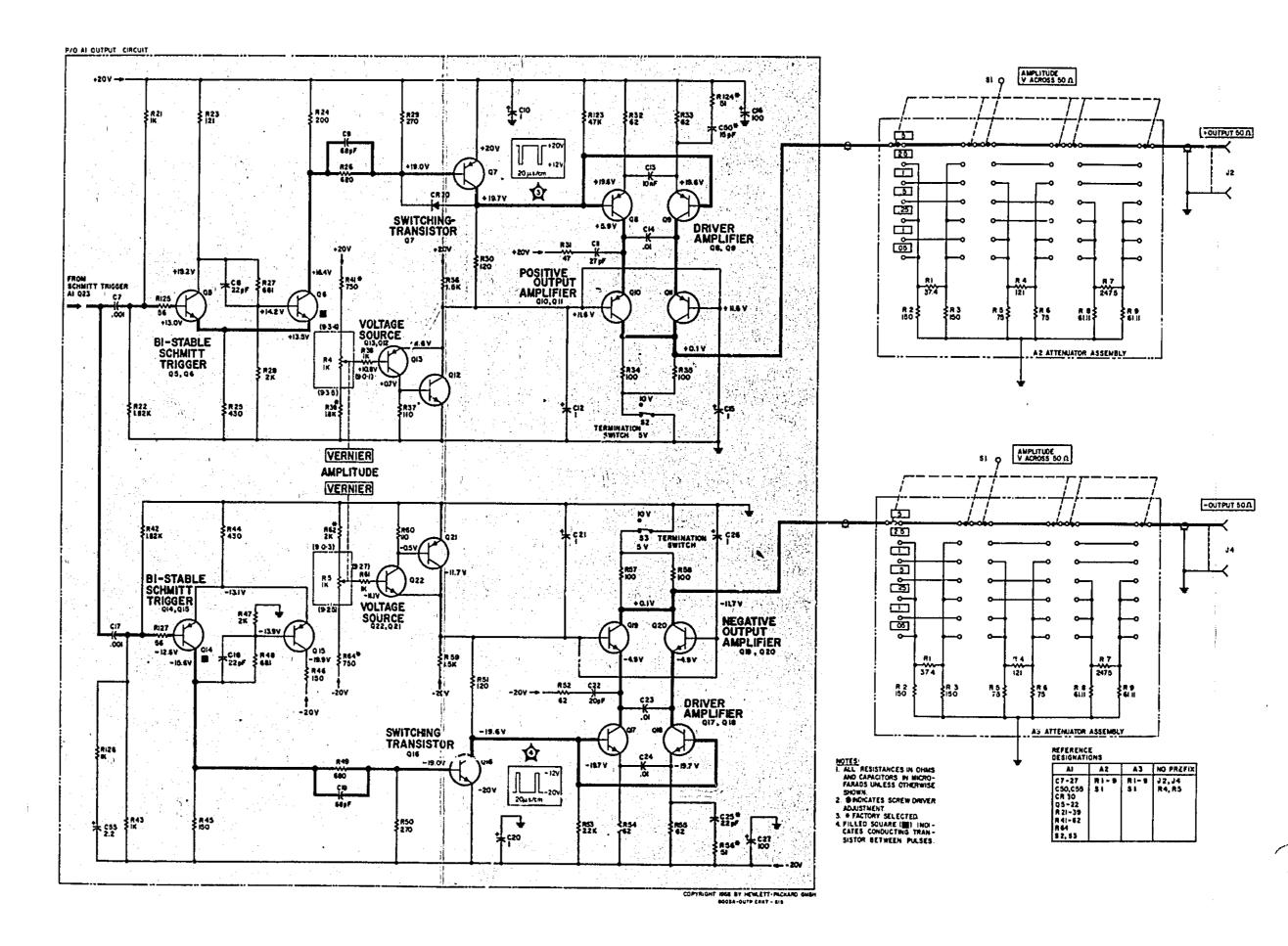
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Section VII Figure 7-3

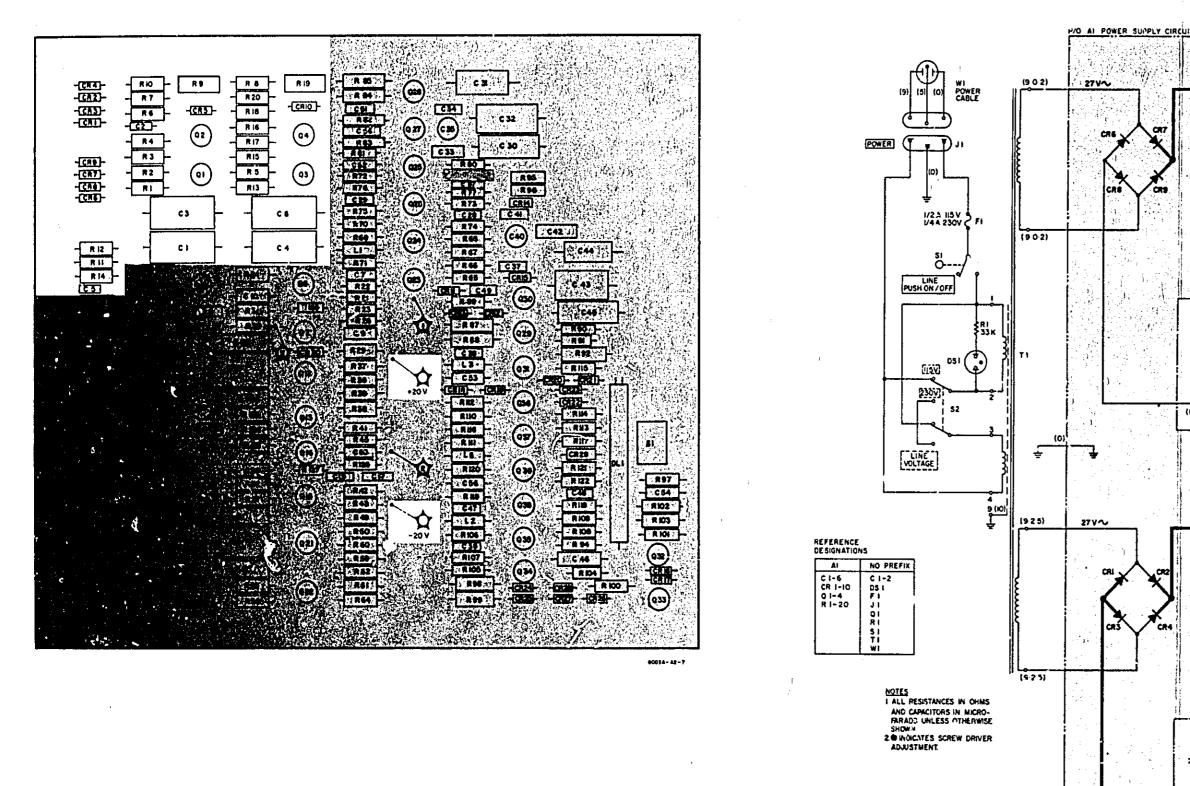
Figure 7-3. Output Circuit 7-7/7-8

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։ ՀՀ Model 8003A

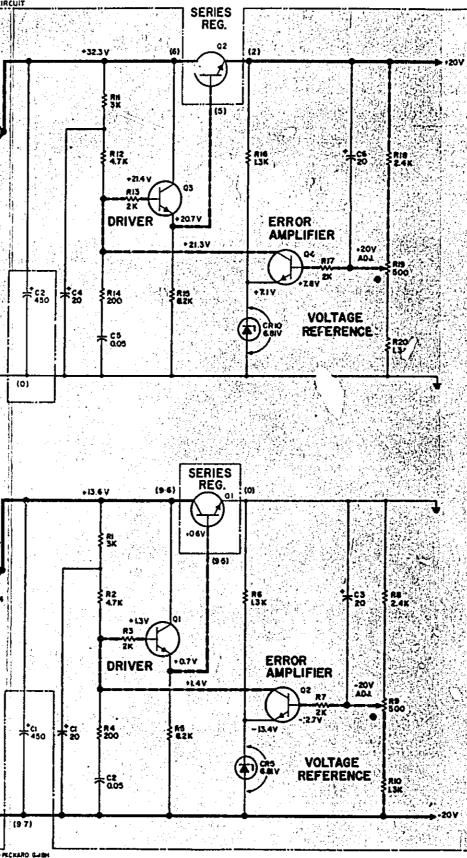
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Figure 7-4. Power Supply Circuit



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Appendix A I Figure A1-1 Model 8003A

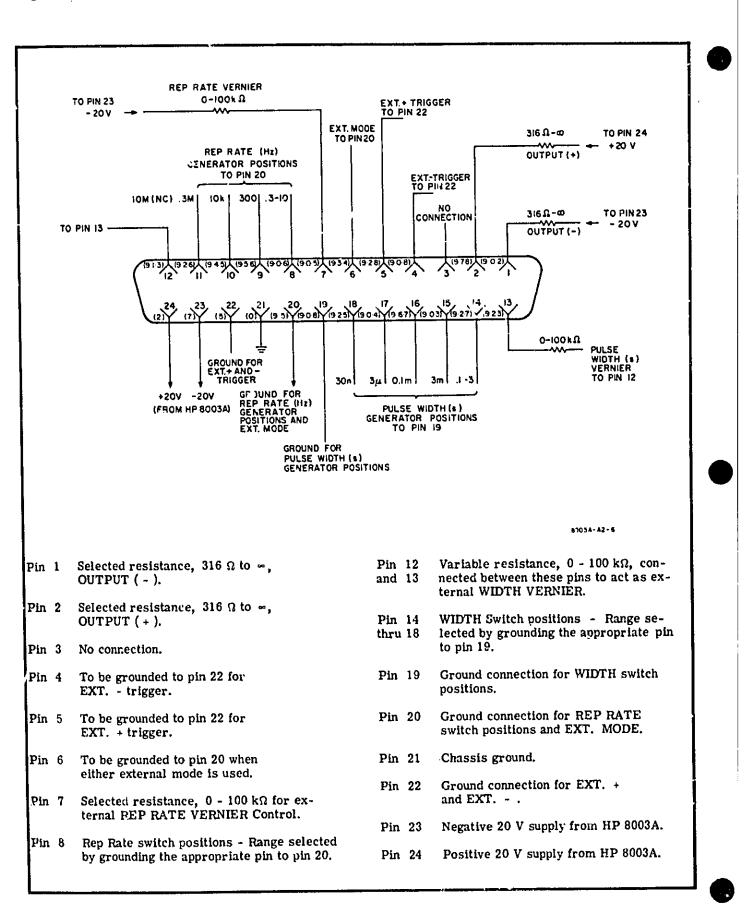


Figure A1-1. Pin Identification for Connector J7 (Rear Panel) and it3 Mating Connector (Wiring Side)

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APPENDIX A1 OPTION 01: REMOTE FROGRAMMING

A1-1 INTRODUCTION

A1-2 The HP 8003A Option 01 Pulse Generator provides all the characteristics of the standard HP 8003A besides permitting remote electrical control of the repetition rate, pulse width, and amplitude. The instrument may be wired for a pulse output vith fixed characteristics, to a switch and resistance control box for a variable pulse output, or into a system whereby another instrument can program its operation. Remote control of repetition rate and pulse width ranges is accomplished by contact closure, while within the selected range they can be controlled by external resistances. The amplitude is controlled within the range of the attenuator by external resistences.

A1-3 OPERATION

For remote programming of the pulse gene-A1-4 rator, connect the HP 8003A Option 01 as in Table A1-1 for the desired pulse characteristics. For identification of each of the connector pins, refer to Fig. A1-1. Table A1-2 lists the approximate resistances needed for connection to get a desired pulse amplitude with the AMPLITUDE switch set to 5 V. Pin wiring can be connected to a mating connector which plugs into the rear panel connector J7. This mating connector may be ordered from Amphenol Corp. or Cinch Mfg. Co. by order no. 57-30240 or from Hewlett-Packard by order no. 1251-0293. After the appropriate connections have been made, the pulse generator can be controlled electrically by setting the REP. RATE, PULSE WIDTH, and AMPLITUDE VERNIER controls to the asterisk (*) position.

Table A1-1. 8003A Option 01 Connections

For remote programming, make the desired connections through J7 and set 8003A REP RATE (Hz), PULSE WIDTH (s), and AMPLITUDE VERNIER controls to the asterisk (*) position.

Function	Range	Connection
REP RATE (H.	Ext. + (positive)	Pin 5 to Pin 22 and Pin 6 to Pin 20
	Ext (negative)	Pin 4 to Pin 22 and Pin 6 to Pin 20
	. 3 Hz to 10 Hz	Pin 8 to Pin 20
	10 Hz to 300 Hz	Pin 9 to Pin 20
	300 Hz to 10 kHz	Pia 10 to Pin 20
	10 kHz to 0.3 MHz	Pin 11 to Pin 20
	0.3 MHz to 10 MHz	No Connection
VERNIER, R.R.	Variable within each KEP. RATE range.	Pin 7 through resistance \neq (0 - 100 k Ω) to Pin 23
PULSE WIDTH (s)	30 ns to 3 µs	Pin 18 to Pin 19
	3 μs to 0.1 ms	Pin 17 to Pin 19
	0.1 ms to 3 ms	Pin 16 to Pin 19
	3 ms to .1 s	Pin 15 to Pin 19
	.1 s to 3 s	Pin 14 to Pin 19
VERNIER, P.W.	Variable within each PULSE WIDTH range	Pin 13 through resistance \neq (0 - 100 k Ω) to Pin 12
VERNIER AMPLITUDE OUTPUT (+)	+ 0. 5 V to + 5 V	Pin 2 through resistance ⁴ (316 $\Omega = \infty$) to Pin 24 (AMPL, VERNIER R4 fully
VERNIER AMPLITUDE OUTPUT (-)	- 0. 5 V to - 5 V	Pin 1 through resistance ⁴ (316 Ω - ∞) t Pin 23 (AMPL. VERNIER R5 fully cw)

***** A fixed or a variable resistor may be used for the verniers. For AMPLITUDE VERNIERS the approximate resistance is given for a desired pulse amplitude in Table A1-2.

PULSE AMPLITUDE	Selectable Resistance ± 20%	
5.0 V	∞ (open)	
4.5 V	9.1 kΩ	
4.0 V	4.7 kΩ	
3.5 V	2.7 kΩ	
3.0 V	1.6 kΩ	
2.5 V	1,3 kΩ	
2.0 V	910 . 2	
1.5 V	680 Ω	
1.0 V	470 Ω	
0.5 V	316 Ω	

Table A1-2.Resistance For Output Amplitude withAmplitude Switch Set To 5 V

A1-5 PRINCIPLES OF OPERATION

A1-6 The internally triggered repetition rate range, external triggering, and pulse width range are electrically controlled by grounding the resistor at the base of a switching transistor which turns on the transistor and connects its related circuitry. The resistor at the transistor base is grounded by connecting the appropriate bins of connector J7 as shown in Table A1-1.

A1-7 The repetition rate vernier, pulse width vernier, and amplitude vernier are electrically controlled by connecting a variable or fixed resistance into its respective circuit through one connector J7 pin and supplying it with its necessary supply voltage through another connector J7 pin. For continuous control use a potentiometer; for a fixed or stepped control use fixed resistors.

A1-8 In all other respects the circuits function exactly as described in Section IV of this manual. The internal connections and circuits associated with remote programming may be seen in the circuit diagrams. Refer to Figures A1-2, A1-3, and A1-4. The circuit diagram for the Option 01 power supply may be seen in Figure 7-4.

Table A1-3. HP 8003A Option 01 Replaceable Parts

Description		TQ	r.s
C: FXD C. μF + 80 - 20% 100 VDCW C: FXD MICA 33 pF 5% 300 VDCW C: FXD TA 100 μF 20% 25 VDCW		812	
R: FXD COMP 1 MΩ 5% 1/4W R: FXD COMP 1.2 MΩ 5% 1/4W R: FXD 10 KΩ 5% 1/8 MET F1M		1 1 13	
R: FXD MET FLM 1. 62 KΩ 1% 1/8 W R: FXD MET FLM 1.3KΩ 5% 1/4W		1 13	
CONNECTOR: FEMALE (24 CONTACTS) TRANSISTOR SILICON PNP 2N 3906 TRANSISTOR SILICON NRN 2N 3904		1 7 6	
R: VAR COMP 1 K Ω 1 W PANEL: REAR		1	
PANEL FRONT CABLE: REMOTE PROGRAMMING SWITCH: ASSY REP BATE		1 1 1	
SWITCH: ASSY WIDTH SWITCH PRINTED CIRCUIT BOARD ASSEMBLY		ĩ	
	C: FXD C. μ F + 80 - 20% 100 VDCW C: FXD MICA 33 pF 5% 300 VDCW C: FXD TA 100 μ F 20% 25 VDCW R: FXD COMP 1 MΩ 5% 1/4W R: FXD COMP 1.2 MΩ 5% 1/4W R: FXD COMP 1.2 MΩ 5% 1/4W R: FXD MET FLM 1.62 KΩ 1% 1/8 W R: FXD MET FLM 1.3KΩ 5% 1/4W CONNECTOR: FEMALE (24 CONTACTS) TRANSISTOR SILICON PNP 2N 3906 TRANSISTOR SILICON NPN 2N 3904 R: VAR COMP 1 KΩ 1 W PANEL: REAR PANEL: REAR PANEL: FRONT CABLE: REMOTE PROGRAMMING SWITCH: ASSY REP RATE SWITCH: ASSY WIDTH SWITCH	C: FXD C. μ F + 80 - 20% 100 VDCW C: FXD MICA 33 pF 5% 300 VDCW C: FXD TA 100 μ F 20% 25 VDCW R: FXD COMP 1 MΩ 5% 1/4W R: FXD COMP 1.2 MΩ 5% 1/4W R: FXD COMP 1.2 MΩ 5% 1/4W R: FXD MET FLM 1.62 KΩ 1% 1/8 W R: FXD MET FLM 1.3KΩ 5% 1/4W CONNECTOR: FEMALE (24 CONTACTS) TRANSISTOR SILICON PNP 2N 3906 TRANSISTOR SILICON NPN 2N 3904 R: VAR COMP 1 KΩ 1 W PANEL: REAR PANEL: FRONT CABLE: REMCTE PROGRAMMING SWITCH: ASSY REP RATE SWITCH: ASSY WIDTH SWITCH	C: FXD C. μ F + 80 - 20% 100 VDCW 8 C: FXD MICA 33 pF 5% 300 VDCW 1 C: FXD TA 100 μ F 20% 25 VDCW 2 R: FXD COMP 1 MΩ 5% 1/4W 1 R: FXD COMP 1.2 MΩ 5% 1/4W 1 R: FXD COMP 1.2 MΩ 5% 1/4W 1 R: FXD MET FLM 1.62 KΩ 1% 1/8 W 1 R: FXD MET FLM 1.62 KΩ 1% 1/8 W 1 R: FXD MET FLM 1.3KΩ 5% 1/4W 13 CONNECTOR: FEMALE (24 CONTACTS) 1 TRANSISTOR SILICON PNP 2N 3906 7 TRANSISTOR SILICON NPN 2N 3904 6 R: VAR COMP 1 KΩ 1 W 1 PANEL: REAR 1 PANEL: FRONT 1 CABLE: REMCTE PROGRAMMING 1 SWITCH: ASSY REP RATE 1 SWITCH: ASSY WIDTH SWITCH 1

Model 8003A

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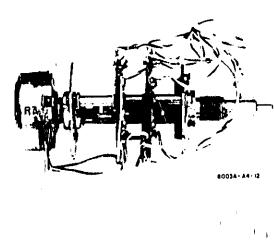
Table A1-4.	HP 8003A	Option 01	Parts Reference	Designation Index
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Reference Designation	HP Part No.	Description
Add: A1C59 thru A1C66	0150-0093	C: FXD CER 0. 01 μF + 80 - 20%100 VDCW
A1Q40 thru A1Q46	1853-0036	TRANSISTOR SILICON PNP 2N 3906
A1Q47 thru A1Q52	1854-0215	TRANSISTOR SILICON NPN 2N 3904
A1679	0757-0428	R: FXD MET FLM 1.62 KΩ 1% 1/8 W
A1R129	0757-0948	R: FXD FLM 10 KΩ 2% 1/8 W
A1R130 thru A1R134	0758-0042	' R: FXD MET FLM 1.3 KΩ 5% 1/4 W
A1R135 thru A1R140	0757-0948	R: FXD FLM 10 KΩ 2% 1/8 W
A1R141 thru A1R147	0758-0042	R: FXD MET FLM 1.3 KΩ 5% 1/4 W
A1R148 thru A1R153	0398-4278	R: FXD MET FLM 10 KΩ 5% 1/8 W
A1R154	0758-0042	I: FXD MET FLM 1.3 KΩ 5% 1/4 W
A1R155 thru A1R158	0683-1055	L. FXD COMP 1 MΩ 5% 1/4 W
A1R159	0683-1255	R: FXD COMP 1.2 MΩ 5% 1/4 W
A1R160 thru A1R163	0683-1055	R: FXD COMP 1 M() 5% 1/4 W
A1R164 A6	0683-1255 08003-61905	R: FXD COMP 1.2 MΩ 5% 1/4 W SWITCH: ASSY RATE-WIDTH
J7	1251-0292	CONNECTOR: FEMALE (24 CONTACTS)
W2	08003-61602	CABLE: REMOTE PROGRAMMING
Delete: R7	0757-0428	R: FXD MET FLM 1.62 KΩ 1%
Change: A1 to A1C30 to A1C41 to A1C45 to R4 and	08003-66502 0120-1706 0160-2150 0180-1706 2100-0539	PRINTED CIRCUIT BOARD ASSEMBLY C: FXD TA 100 μF 20% 25 VDCW C: FXD MICA 33 pF 5% 300 VDCW C: FXD TA 100 μF 20% 25 VDCW R: VAR COMP 1 KΩ 1 W
R5 S4 to S6 to	08003-61903 08003-61904	SWITCH: ASSY REP RATE SWITCH: ASSY WIDTH SWITCH

See intr duction to Section VI.

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Model 8003A



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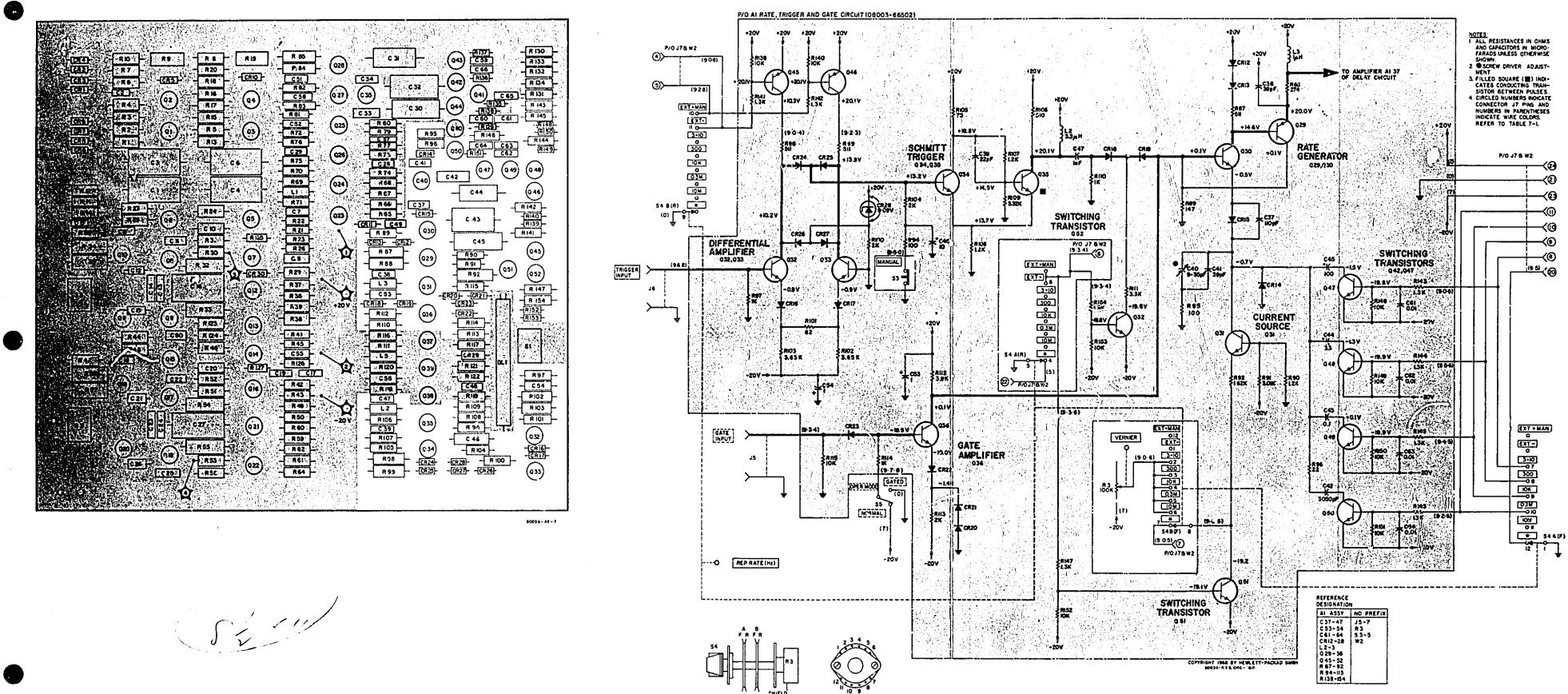
Repetition Rate Switch

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A1-4

Model 8003A

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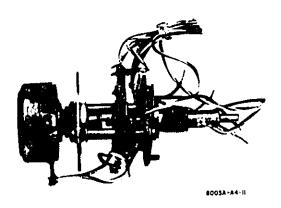


KNOB END VIEW

Appendix A1 Figure A1-2

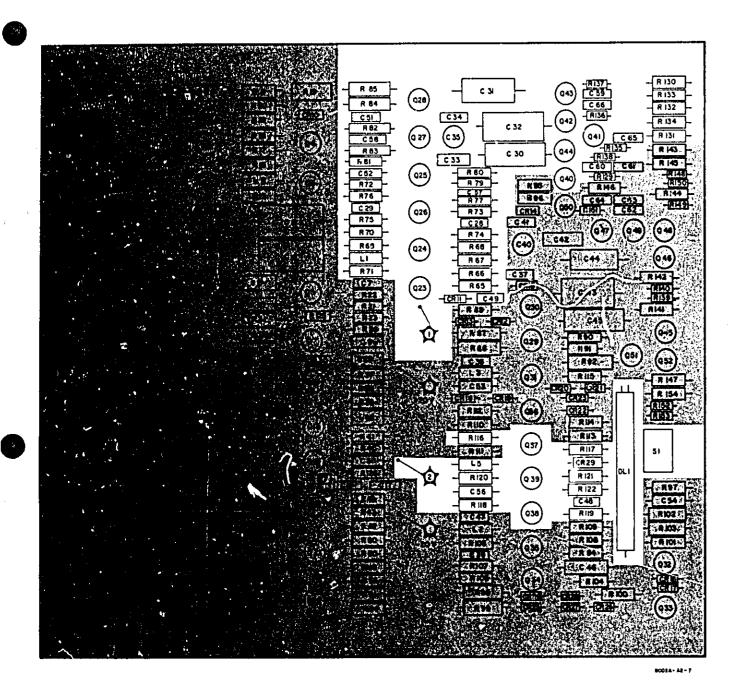
PEAUCE

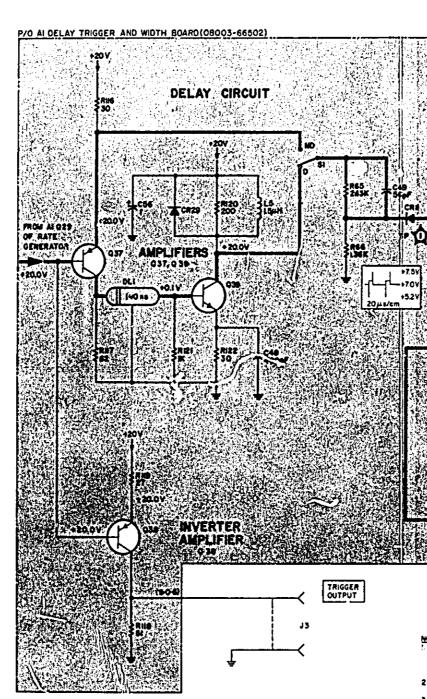
Figure A1-2. Option 01 Repetition Rate and Gate Circuit A1-5 Ļ

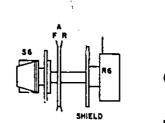


Pulse Width Switch

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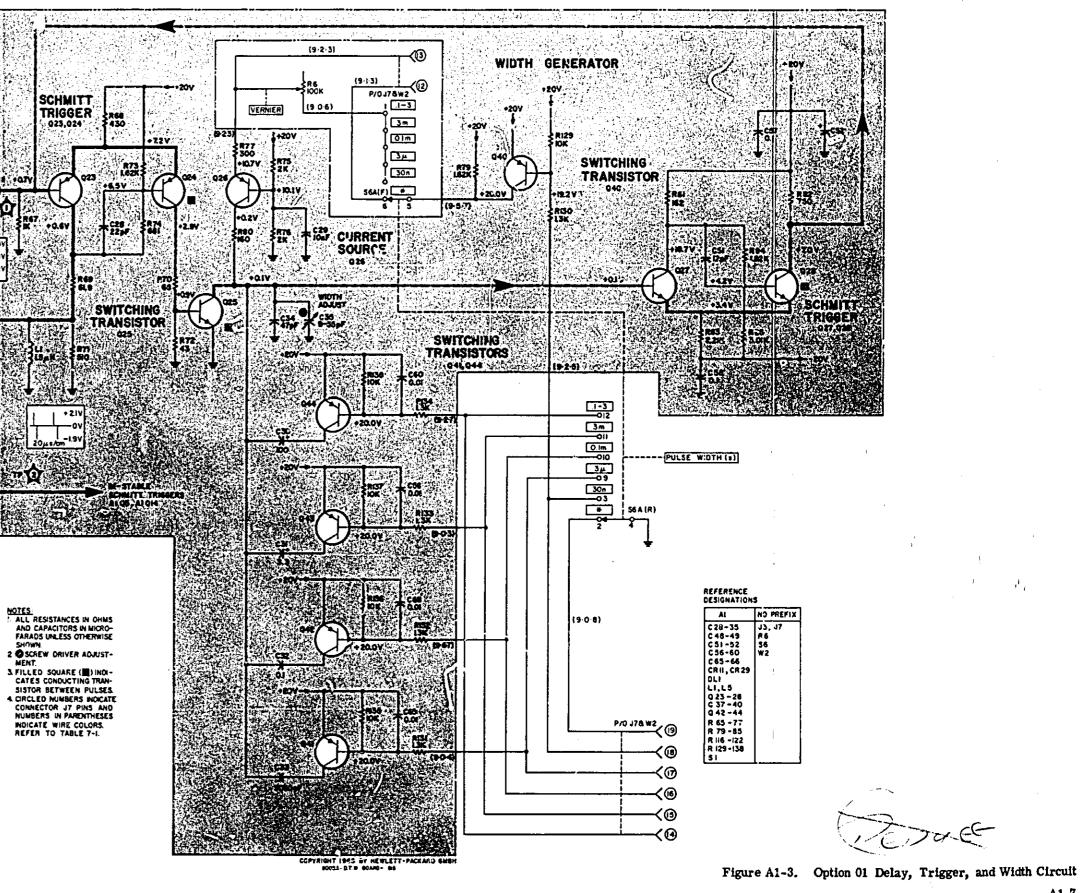




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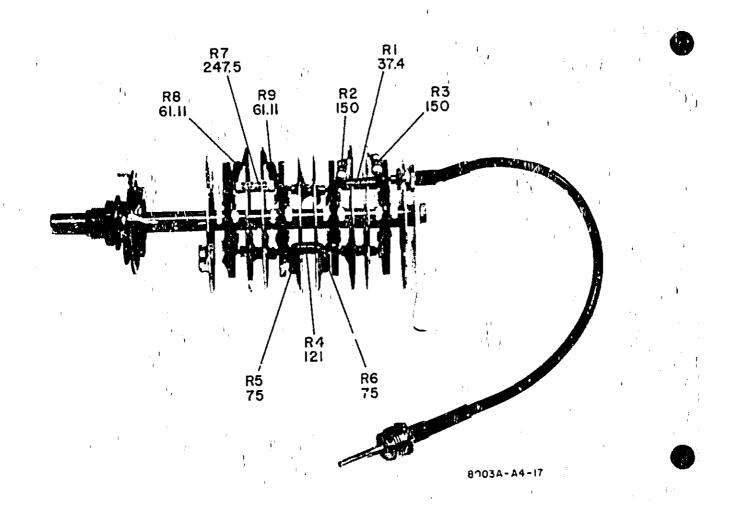
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A1-7

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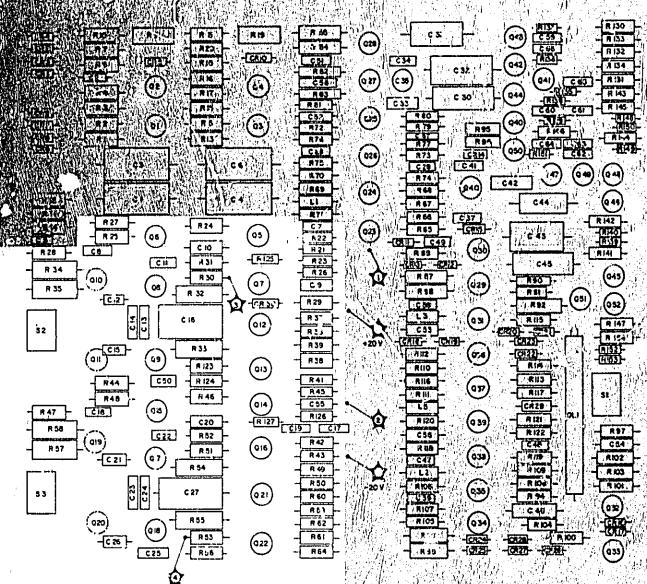


Attenuator A2, A3

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Site X ()

Model 8003A



R 33 - R 123 - H 124 - H 465 - C20 - R 52 - R 51 R 54

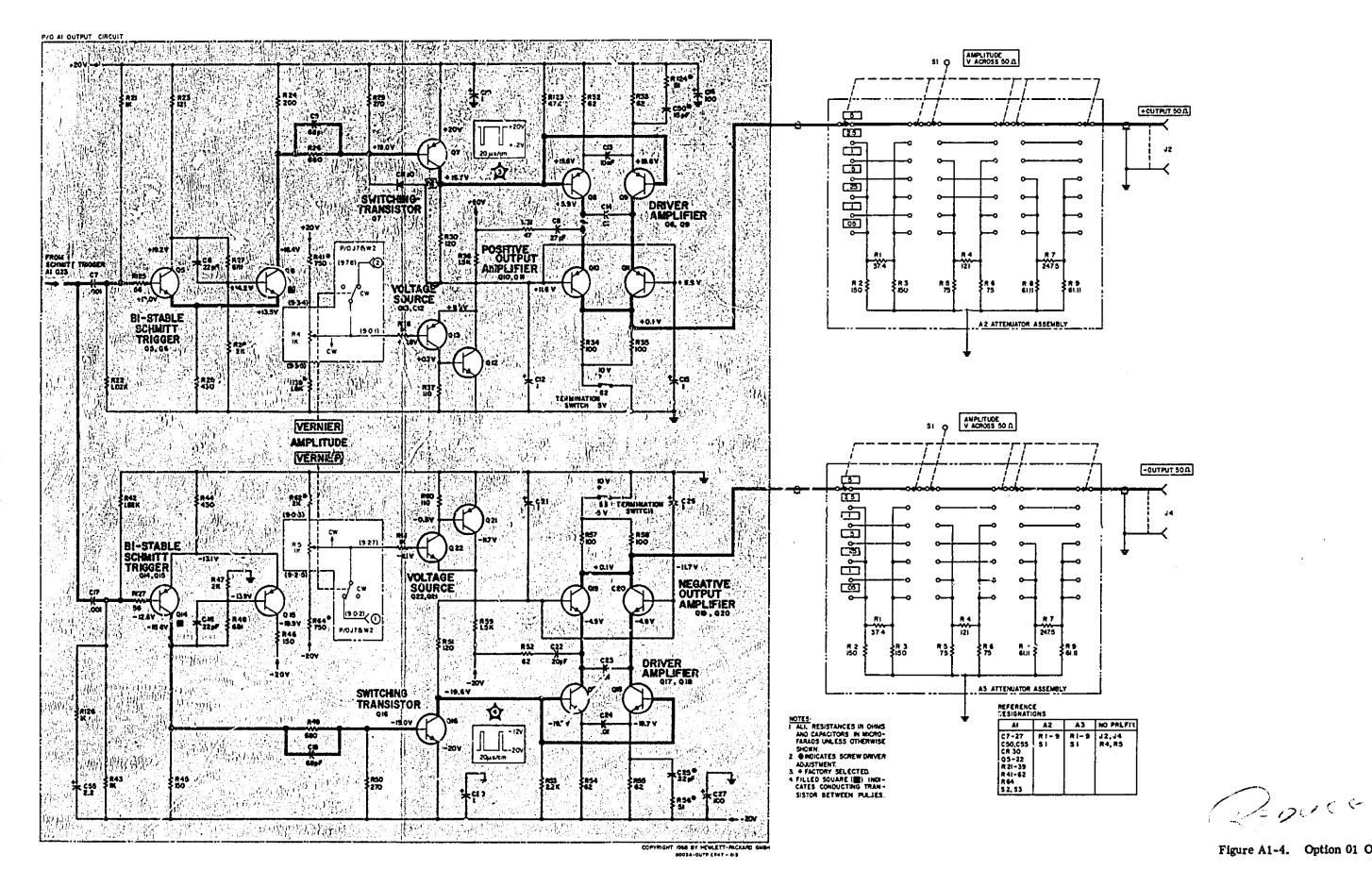
R 130 R 132 R 132 A 134 R 131 R 143 R 143

St

40034-38-7

C 24 C 27 53 (00) -[83]-R 55 企

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A State to be the

- R 47 - R 58

R 57

Appendix A1 Figure A1-4

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Figure A1-4. Option 01 Output Circuit

A1-9





Model 8003A

Appendix A2

APPENDIX A2 BACKDATING AND MODIFICATION INFORMATION FOR OPTICN U1 HP 8003A PULSE GENERATOR

This manual backdating appendix makes this manual applicable to earlier instruments. Instrument-component values that differ from those in the manual, yet are not listed in the backdating sheet, should be replaced using the part number given in the manual.

Instrument Serial Prefix

Make Manual Changes

Instrument Serial Prefix

Make Manual Changes

732, 805	1, 3	
815, 826	2, 3	
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CHANGE 1

Figure A1-4 and Tables 6-1 and 6-2:

Delete A1CR30 (HP 1901-0040).

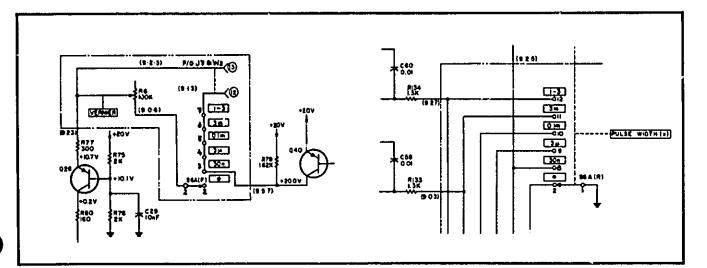
Change A1Q7 to HP Stock No. 1850-0099, TRANSISTOR GERMANIUM PNP

Figure A1-3:

Change terminal connections for Pulse Width Switch S6 as shown in Figure A2-1.

NOTE

If this switch is replaced, the current switch should be rewired according to current models as shown in Figure A1-3.



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1002000

Figure A2-1 S8 Terminal Connections

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Figure A1-2:

Change terminal connections for Repetition Rate Switch S4 as shown in Figure A2-2.

NOTE

If this switch is replaced, the current switch should be rewired according to current models as shown in Figure A1-2.

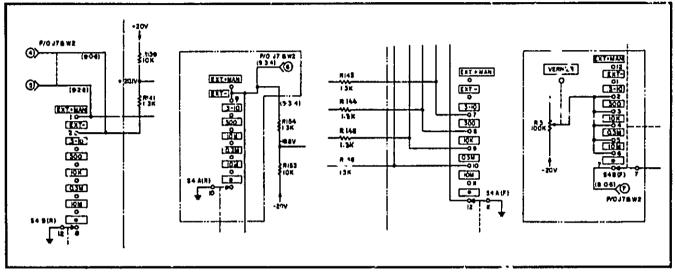


Figure A2-2. S4 Terminal Connections

Figure A1-4:

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Change Amplitude Verniers as shown in Figure A2-3.

NOTE

If these verniers are replaced, the curve overniers should be rewired according to Figure A2-4.

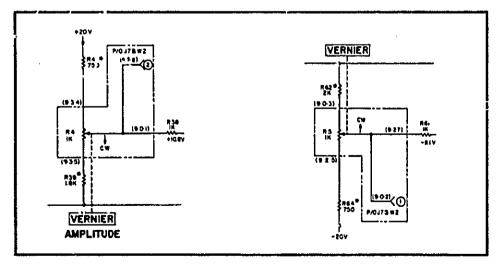


Figure A2-3. 8003A Option 01 Amplitude Verniers

Model 8003A

Appendix A2

CHANGE 2

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Figure A1-4 and Tables 6-1 and 6-2:

Change A1Q7 to HP Stock No. 1853-0082, TRANSISTOR SI PNP and A1R26 to HP Stock No. 0758-0062, R: FIXED MET OX 200Ω 5% 1/2 W.

Figure A1-2

Change terminal connections for wafer S4 B(F) of Repetition Rate Switch as shown in Figure A2-4.

NOTE

If this switch is replaced, the current switch should be rewired according to current models as shown in Figure A1-2.

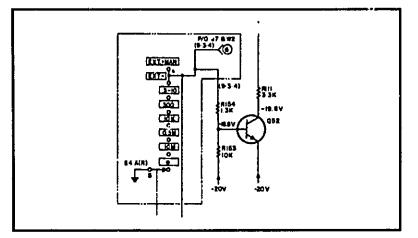


Figure A2-4. S4 A(R) Terminal Connections

Figure A1-3:

Change terminal connections for wafer S6 A (R) of the Pulse Width Switch as shown in Figure A2-5.

NOTE

If this switch is replaced, the current switch should be rewired according to current models as shown in Figure A1-3.

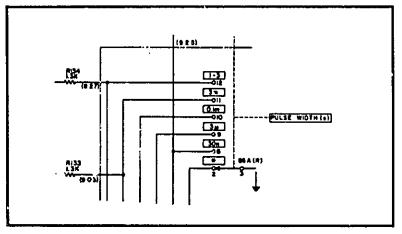


Figure A2-5. S6 A (R) Terminal Connections

CHANGE 3

Figures A1-1 and Table A1-1:

Change Pin 22 to Pin 21 for grounding EXT. + and EXT. - ti igger.

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APPENDIX B

OPTION X95: LIGHT GRAY COLOR OPTION

B-1 INTRODUCTION

B-2 N/w color standards and color combinations have been adopted for Hewlett-Packard instruments. Option X95 is offered to those users having need for new

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instruments with older HP color combinations or for replacement parts for older instruments.

B-3 Parts peculiar to Model 8003A Option X95 are listed in table B-1.

Ref Desig	HP Part No.	Description MP: Panel front light gray	
MP9	08003-00210		
M212	08003-00208	MP: Panel rear light gray (Serial prefix 1101A only)	
MP12	08003-00202	MP: Panel rear light gray	
MP15	5060-0720	MP: Cover top light gray (Serial prefix 1101A only)	
MP15	5060-0717	MP: Cover top light gray	
MP16	5000-0717	MP: Cover bottom light gray	
MP17	5000-0567	MP: Cover side (perforated) light gray	

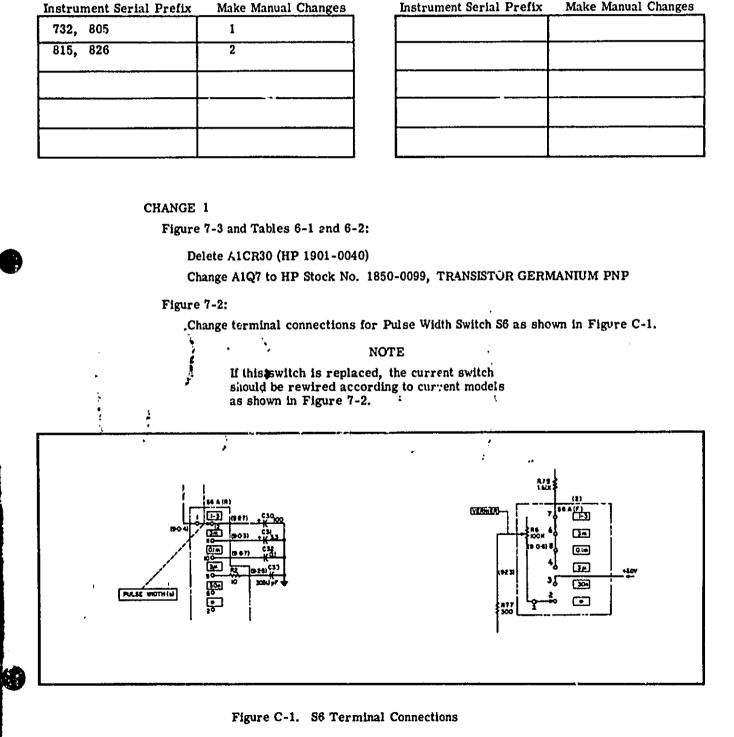
Table B-1. Option X95 Replaceable Parts





Make Manual Changes

APPENDIX C



BACKDATING AND MODIFICATION INFORMATION FOR STANDARD HP 8003A PULSE GENERATOR

This manual backdating appendix makes this manual applicable to earlier instruments. Instrument-component values that differ from those in the manual, yet are not listed in the backdating sheet, should be replaced using the part number giv'n in the manual.

Make Manual Changes

Instrument Serial Prefix

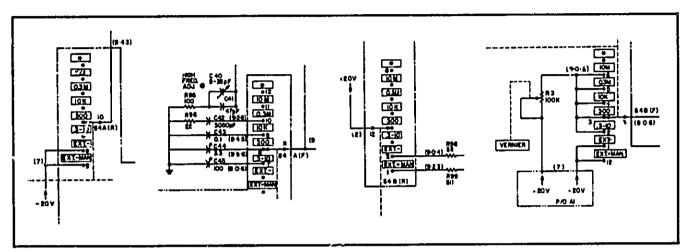
C-1

Figure 7-1:

Change terminal connections for Repetition Rate Switch S4 as shown in Figure C-2.

NOTE

If this switch is replaced, the current switch should be rewired according to current models as shown in Figure 7-1.





CHANGE 2

Figure 7-3 and Tables 6-1 and 6-2:

Change A1Q7 to HP Stock No. 1853-0082, TRANSISTOR SI PNP and A1R26 to HP Stock No. 0758-0062, R: FIXED MET OX 200 Ω 5% 1/2 W.

Figure 7-1:

Change terminal connections for wafer S4 B (F) of Repetition Rate Switch as shown in Figure C-3.

NOTE

If this switch is replaced, the current switch should be rewired according to current models as shown in Figure 7-1.

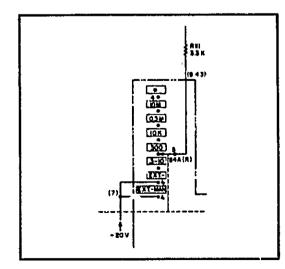


Figure C-3. S4 A (R) Terminal Connections

C-2

Figure 7-2:

Change terminal connections for wafer S6 A (R) of the Pulse Width Switch as shown in Figure C-4.

NOTE

If this switch is replaced, the current switch should be rewired according to current models as shown in Figure A7-2.

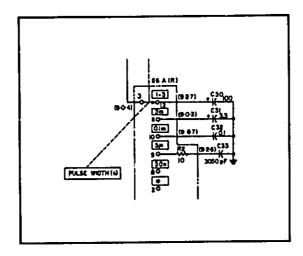


Figure C-4. S6 A (R) Terminal Connections



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MODEL 8003A

PULSE GENERATOR

Manual Serials prefixed: 933-Manual Printed: Oct 1974

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
1101A	1		
1206A	1, 2		
1233A	1, 2, 3		

△ ERR \TA

Page 7-7/7-8, figure 7-3, A1R34, A1R35, A1R67, and A1R58: Change values to 150 ohms. Add: A1R165 (150 ohm) in parallel with A1R34. Add: A1R166 (150 ohm) in parallel with A1R57. Add: A1R167 (110 ohm) between collector of A1Q12 and junction of A1Q13/A1R36. Add: A1R168 (110 ohm) between collector of A1Q21 and junction of A1Q22/A1R59. Page 7-9, figure 7-4, Add: C3 (0,005 UF) on J1 from ground terminal to pin connected to 71, pin 4. Add: C4 (0.005 UF) on J1 from ground terminal to pin connected to F1. Figure 7-1, 7-2, 7-3, 7-4, A1-2, A1-3, and A1-4, Add the following components to the component location diagrams: R165: between R35 and S2. R166: between R57 and S3. between C16 and R33. R167: R168: between C27 and R55. Appendix A1, figures A1-2, A1-3, and A1-4,

Component location diagram:

A1R155 through A1R164 are located on underside of board assembly A1. Appendix A1, figure A1-2, Add: A1R160 (1 megohm) in parallel with A1C45. Add: A1R161 (1 megohm) in parallel with A1C44. Add: A1R162 (1 megohm) in parallel with A1C43. Add: A1R163 (1 megohm) in parallel with A1C42. Add: A1R164 (1.2 megohm) between +20V and collector A1031. A1Q45: Change designator to A1Q46. A1Q46: Change designator to A1Q45. A1R139: Change designator to A1R140. A1R140: Change designator to A1R139. A1R141: Change designator to A1R142. A1R142: Change designator to A1R141. Appendix A1, figure A1-3. Add: A1R155 (1 megohm) in parallel with A1C30. Add: A1R156 (1 megohm) in parallel with A1C31. Add: A1R157 (1 megohm) in parallel with A1C32. Add: A1R158 (1 megohm) in parallel with A1C33. Add: A1R159 (1.2 megohm) between -20V and collector of A1025. Appendix A1, figure A1-4, A1CR30: Delete connection at junction of A1R30/

A1Q7 and redraw to junction of A1R30/A1R36.

21 October 1974 $\Delta = \text{Latest}$ additions to this change sheet. This change sheet supersedes all prior change sheets for this manual. Supplement A for 08003-90003 Model 8003A Page 2/2

△ CHANGE 1

Appendix A1, Table A1-3, Add: HP Part No. 08003-00207; Panel, rear.

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 Δ CHANGE 2

Table 6-2,

MF9. Change to HP Part No. 08003-10201, MP: Panel Front mint-gray. MP12: Change to HP Part No. 08003-70201, MP: Panel rear mint-gray.

Table 6-2 (Cont'd)

MP15: Change to HP Part No. 5060-8577, MP: Cover top mint-gray.
MP16: Change to HP Part No. 5000-8583, MP: Cover bottom mint-gray.
MP17: Change to HP Part No. 5000-8479, MP: Cover side mint gray.

Δ CHANGE 3

Table 6-2, S1: Change to HP Part No. 3101-1248.

MP9: Change to HP Part No. 08003-10203. Table A1-3, Change HP Part No. of rear panel to 08003-10206. Table D-1, MP9: Change to HP Part No. 08003-10207.

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