CESIUM BEAM FREQUENCY STANDARD

5061A

SERIAL PREFIX: 1428A

This manual applies directly to HP Model 5061A Cesium Beam Frequency Standards having serial prefix 1428A.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 1428A, a "Manual Changes" sheet is included with this manual. For serial prefixes below this number, refer to Appendix I, for manual changes.

OPTIONS

This manual applies directly to Model 5061A instruments with Option 001 (Time Standard), Option 002 (Standby Power Supply), and Option 004 (High Performance Beam Tube).

Printed: JULY 1974

MANUAL PART NO. 05061-9034
MICROFICHE PART NO. 05061-9035

PRINTED IN U.S.A.

HEWLETT hp PACKARD

HEWLETT hp PACKARD

MANUAL CHANGES

MANUAL DESCRIPTION

INSTRUMENT:	5061A
SERIAL PREFIX:	1428A
DATE PRINTED:	JULY 1974
HP PART NO:	05061-9034
MICROFICHE NO:	05061-9035

CHANGE DATE December 17, 1974

(This change supersedes all earlier dated changes)

- Make all changes listed as ERRATA.
- Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL	IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL
1444A	1		

► NEW OR REVISED ITEM

ERRATA

Page 6-18, Table 6-1:

Change A11Q5 and Q6 to 05061-8013 TSTR: SI NPN selected, Mfr Code 28480, Mfr Part No 05061-8013.

Page 8-45, Figure 8-25:

Change A11A1Q5 and Q6 to 05061-8013.
Change A11 and A11A1 to 1428A.

Page A-3, Table 1:

Change A11"Current Series Number" to 1428A. Change the remaining two columns of A11 as shown:

Earlier Series Number	Make Manual Changes
1232A	66
1104A	66, 32
1036A	66, 32, 20
etc.	etc. etc.

Page A-31, Table 1:

Add "Change 66":

Change 66. Page 6-18, Table 6-1:

Change A11A1Q5 and Q6 to 1854-0613 TSTR: SI NPN Mfr Code 80131, Mfr Part No. 2N1701.

Page 8-45, Figure 8-25:

Change Q5 and Q6 to 1854-0613. Change A11 and A11A1 Series to 1232A.

End of Change 66.

End of Errata.

►CHANGE 1

Page 6-14, Table 6-1:
Add A9A1CR3 and CR4 1901-0376, Diode: 35V, 50mA, 2 ea.
Add A9A1R3 0757-0927, R:FNED, 1K, 2%, 1 ea.
Add Terminal Stud 0340-0037, 2 ea.
Terminal Bushing 0340-0039, 2 ea.

Page 8-35, Figure 8-20:
Replace Figure 8-20 and Component Locator with Figures 1 and 2 of this change sheet.

End of Change 1.

MANUAL CHANGES MODEL 5061A

Page 3

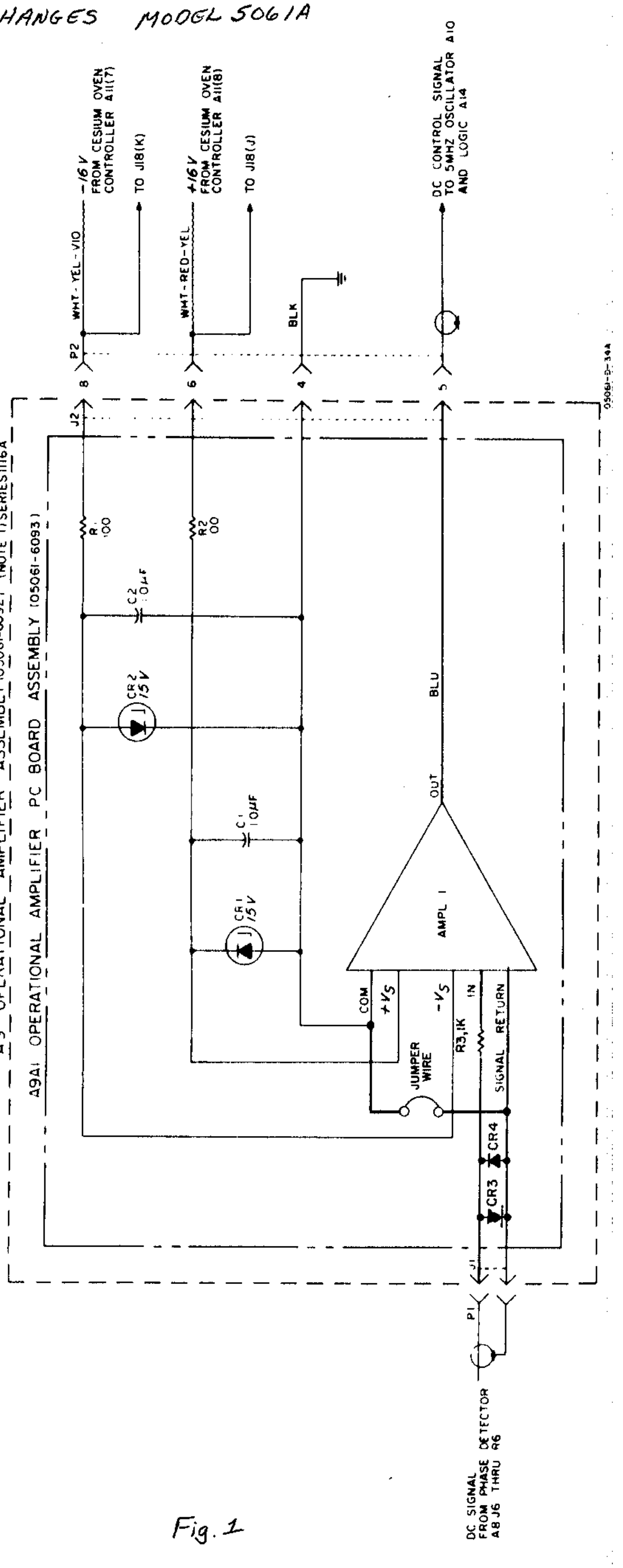

Fig. 1

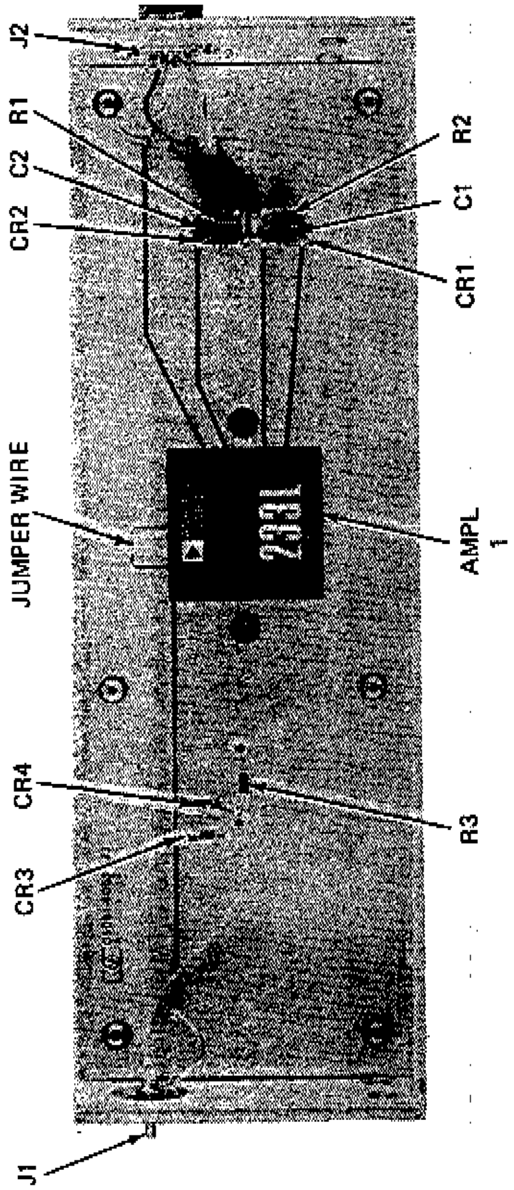

FIGURE 2

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LIST OF FIGURES (Cont'd.)

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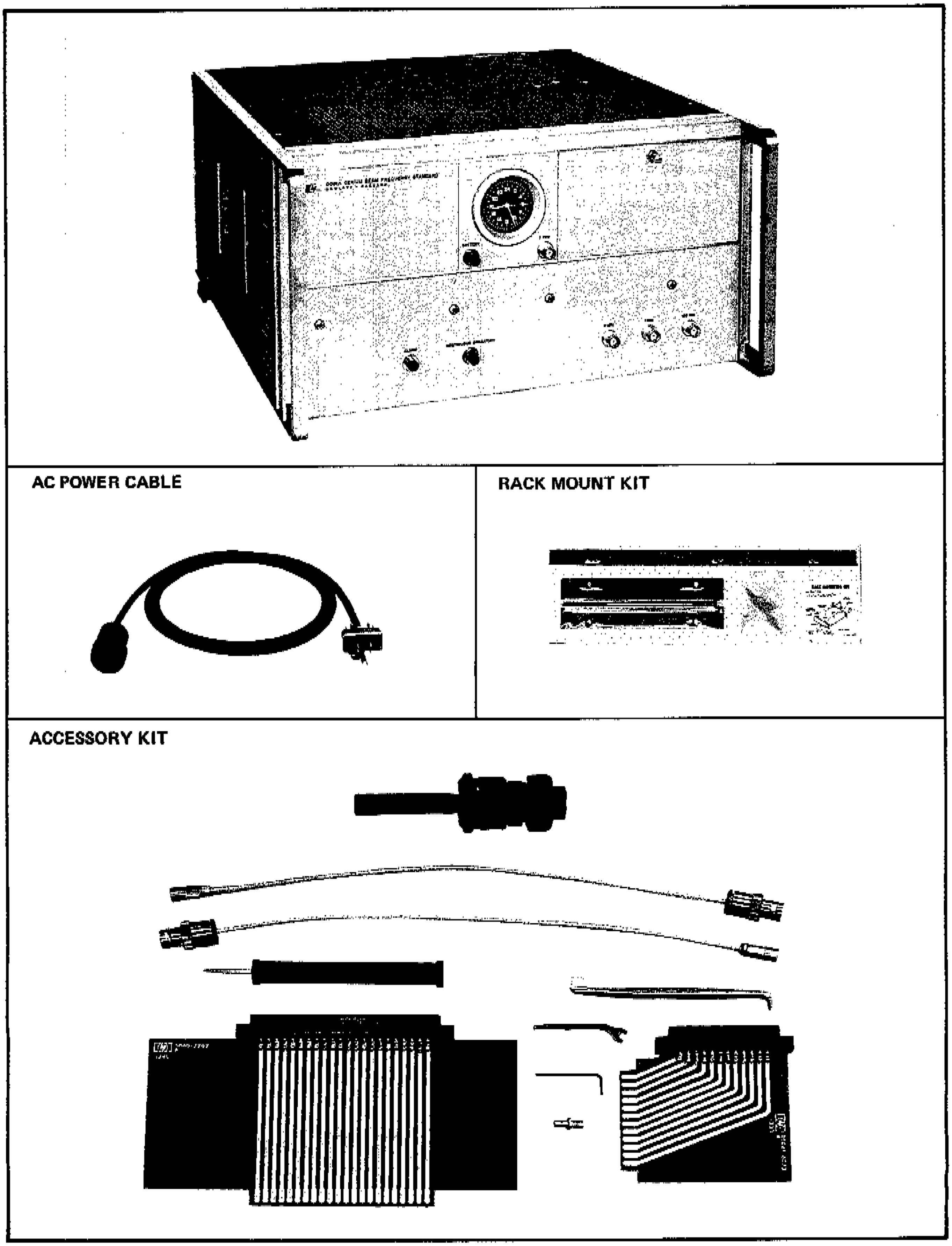
Figure 1. Model 5061A and Accessories



SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION. The Hewlett-Packard Model 5061A Cesium Beam Frequency Standard is a compact, self-contained frequency standard which uses a cesium beam tube resonator to stabilize the output frequency of a quartz crystal oscillator. Solid-state components and the closed-loop, self-checking control circuit provide an accuracy of ±1 part in 10^{11}. When the high-performance tube Option 004 is installed into the 5061A, accuracy increases to ±7 x 10^{-12}. Available output frequencies are 5 MHz, 1 MHz, and 100 kHz.

1-2. In the beam tube, a state-selected beam of Cesium 133 atoms passes through a microwave cavity. When the frequency of the applied microwave magnetic field, derived by multiplying the quartz crystal oscillator frequency, is near the hyperfine transition frequency of Cesium 133 (9,192,631,770.0 Hz), the microwave signal induces transitions from one hyperfine energy level to another. Those atoms which have undergone such a transition are detected by a hot wire ionizer and electron multiplier. The microwave field is phase-modulated at a low frequency of 137 Hz. When the microwave frequency deviates from the center of the atomic resonance, the current from the electron multiplier contains a frequency component which is the same as the modulation frequency. The magnitude of this component is proportional to the frequency deviation and the phase indicates whether the microwave signal is above or below the transition frequency. This component is filtered, amplified, and synchronously detected to provide a dc voltage proportional to the frequency deviation. The integral of this dc voltage automatically corrects the quartz oscillator frequency.

1-3. The standard cesium beam tube exhibits outstanding reliability for its guaranteed life of 3 years. Cesium beam tube life may be extended by operating the cesium beam oven at a lower temperature (see Paragraph 3-10). However, the signal-to-noise ratio decreases, causing decreased short-term stability as shown in Figure 1-2. The high-performance Option 004 tube operation is guaranteed for 14 months from date of shipment. Operating the Option 004 tube at a lower temperature is not recommended since it degrades the tube's high-performance capability.

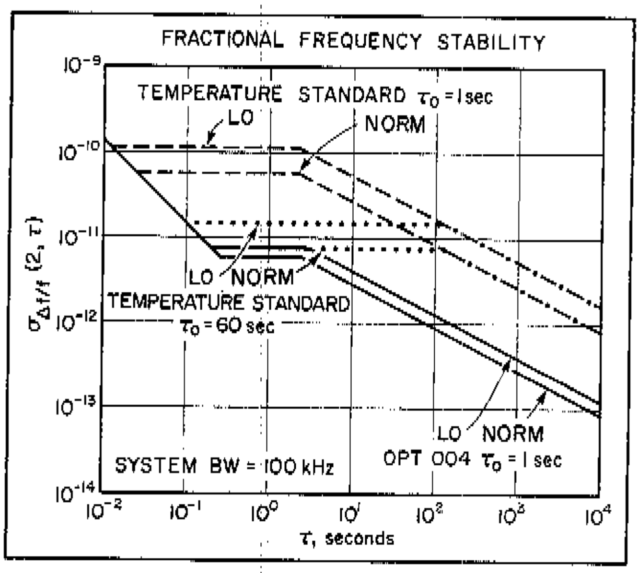
1-4. OPTIONS

1-5. Several options are available. These are:

a. Option 001 Time Standard: This option includes a 24 hr clock movement and switches to allow the clock movement to be set to the nearest second. A one-pulse-per-second output at front and rear panel BNC connectors is provided by this option. An internal "sync" button permits automatic synchronization of the 1PPS output to an external "sync" pulse. By the use of six thumbwheel switches, the output clock pulse is adjustable from 1 μsec to 1 second with respect to a reference pulse.

b. Option 002 Standby Power Supply: Standby power capability for a minimum of 30 minutes (1 hour typically) is provided by an internal battery. Recharging of the battery is automatic, through the use of a digital timing system. A front panel lamp indicates when battery is being used or fast-charged.

Figure 1-2. Cesium Oven Temperature Versus Stability (typical standard instrument)



c. Option 003. Combines Option 001 and Option 002.

d. Option 004 High Performance Cesium Beam Tube: (see Table 1-1 for performance specifications) Option 004 provides improvement in specifications such as accuracy, settability, reproducibility and short-term-stability. Warranty on this tube is 10,000 hrs (about 14 months).

1-6. Circuit Checks and Outputs

1-7. Check circuits provide continuous monitoring of the 5 MHz output signal. Automatic logic circuits present an indication of correct operation. The 5 MHz, 1 MHz, and 100 kHz output levels are at least 1 volt rms when terminated with 50 ohms.

1-8. TERMINOLOGY

1-9. The following definitions apply to terms used throughout this manual.

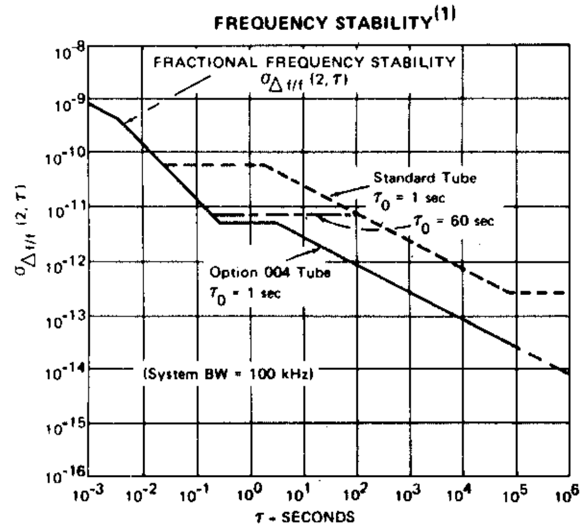
a. UNIVERSAL COORDINATED TIME (UTC). An internationally agreed upon time scale which has the same rate as Atomic Time. UTC is corrected by step adjustments of exactly one second, as needed to remain within 0.7 seconds of Astronomical Time (UT1). The "Bureau International de L'Heure" (BIH) determines when step adjustments are needed.

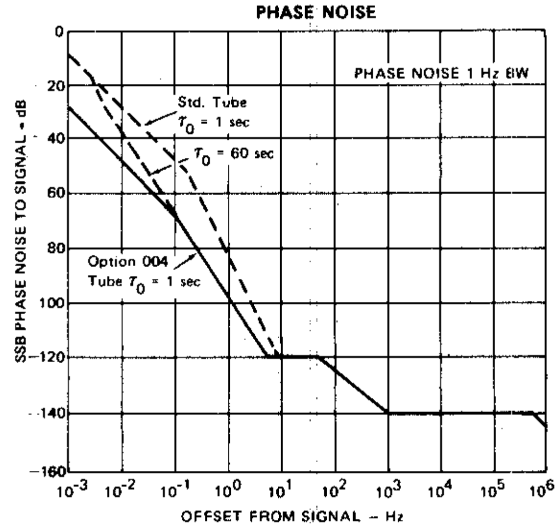
b. ATOMIC TIME. Time scale based on the hyperfine resonance of Cesium 133.

Table 1-1. Specifications

5061A CESIUM BEAM STANDARD

	Standard Beam Tube	Option 004 High Performance Beam Tube
Accuracy:(1) maintained over a temperature range of 0 to 50°C and magnetic fields up to 2 gauss or any combination thereof.	$\pm 1 \times 10^{-11}$	$\pm 7 \times 10^{-12}$
Reproducibility(1)	$\pm 5 \times 10^{-12}$	$\pm 3 \times 10^{-12}$
Settability (Frequency)(1)	$\pm 7 \times 10^{-13}$	$\pm 1 \times 10^{-13}$ (2)
Long-term Stability (for life of cesium beam tube)	$\pm 5 \times 10^{-12}$	$\pm 3 \times 10^{-12}$
DC Magnetic Field Stability, frequency change, any orientation in a 2 gauss field.	$\pm 2 \times 10^{-12}$	$\pm 2 \times 10^{-13}$
Time Constant, quartz oscillator control loop.	1 and 60 sec (3)	1 sec
Warm-up Time at 25°C	45 min.	30 min.
Beam Tube Warranty	3 years	14 months (10,000 hrs)





FREQUENCY STABILITY(1)

τ (sec.)	$\sigma_{\Delta f/f}(2,\tau)$ for τ_0 = 1 sec.	
	Standard Tube	Option 004 Tube
10^{-3}	8.2×10^{-10}	8.2×10^{-10}
10^{-2}	1.5×10^{-10}	1.5×10^{-10}
10^{0}	5.6×10^{-11}	5×10^{-12}
10^{1}	2.5×10^{-11}	2.7×10^{-12}
10^{2}	8×10^{-12}	8.5×10^{-13}
10^{3}	2.5×10^{-12}	2.7×10^{-13}
10^{4}	8×10^{-13}	8.5×10^{-14}

PHASE NOISE

Δf	dB for τ_0 = 1 sec.	
	Standard Tube	Option 004 Tube
10^{-3}	-8	-18
10^{-2}	-28	-48
10^{0}	-82	-96
10^{1}	-120	-120
10^{2}	-125	-125
10^{3}	-140	-140
10^{6}	-146	-146

(1) See definitions.
(2) With 10638A Degausser
(3) Use 60 second time constant for increased short-term stability in controlled environments.

Table 1-1. Specifications (Cont'd.)

GENERAL

HARMONIC DISTORTION: (5 MHz, 1 MHz, and 100 kHz). Down more than 40 dB from rated output.
NONHARMONICALLY RELATED OUTPUT: (5 MHz, 1 MHz, and 100 kHz). Down more than 80 dB from rated output.
SIGNAL-TO-NOISE RATIO: For 1 and 5 MHz, >87 dB at rated output (in a 30 kHz noise bandwidth, 5 MHz output filter bandwidth is approx. 100 Hz).
OUTPUT: 5 MHz, 1 MHz, 100 kHz sinusoidal. >1 Vrms into 50Ω, front and rear BNC connectors.

CESIUM BEAM TUBES

LENGTH: 16 inches.
OPERATING LIFE: 4 years typical.
SHELF LIFE: 2 years in temperature up to 35°C for new tube with full operating life expectance remaining, if storage is according to recommended procedures.

QUARTZ OSCILLATOR

The high quality internal oscillator may be used without turning on the cesium beam tube.
AGING RATE: $<5 \times 10^{-10}$ per 24 hours.
FREQUENCY ADJUSTMENTS:
Fine Adjustment: 5×10^{-8} range, with dial reading parts in 10^{10}.
Coarse Adjustment: 1×10^{-6} range, screwdriver adjustment at front panel.
STABILITY:
As a Function of Ambient Temperature: $<2.5 \times 10^{-9}$ total from 0° to +50°C.
As a Function of Load: $<\pm 2 \times 10^{-11}$ for open circuit to short, and 50Ω R, L, C load change.
As a Function of Supply Voltage: $<\pm 5 \times 10^{-11}$ for 22 to 30 Vdc, or for 115/230 Vac, ±10%.

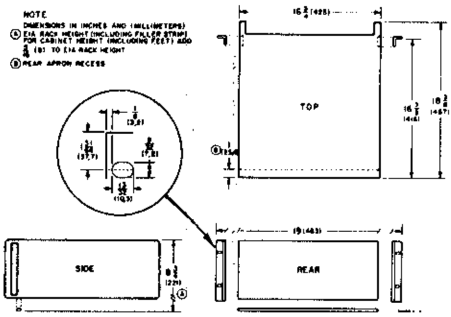
ENVIRONMENTAL:
Temperature: Operating, 0 to 50°C Stability, over full operating temperature range, $<\pm 5 \times 10^{-12}$ change from 25°C reference. Nonoperating, -40 to +75°C (+50°C with Options 001 and 002).
Production units have passed type testing as follows:
Humidity: Operating, to 95% at 40°C.
Altitude: $<2 \times 10^{-12}$ change up to 40,000 ft. operating.
AC Magnetic Field: $<\pm 2 \times 10^{-12}$ for 2 gauss peak for 50, 60 or 400 Hz (±10%) fields.
Vibration: MIL-STD-167 and MIL-T-21200 with isolators.
Shock: MIL-T-21200, Class 1 and MIL-E-5400 (30 G's).
EMC: MIL-I-6181D and MIL-STD-461A.
POWER: 115 or 230 Vac ±10%, 50 to 400 Hz, or 22 to 30 Vdc. Approx. power required:

	DC	AC
5061A and 5061A with Option 004	27W	43W
Option 001 Option 002 Option 003	Add 7.5W Add 4.5W Add 12W	10W 22W 32W

NET WEIGHT: 67 lb. (30.5 kg); Option 001, add 2 lbs. (0.9 kg); Option 002, add 5 lbs. (2.3 kg); Option 004, add 3 lbs. (1.4 kg). Add 12 lbs. (5.5 kg) for shipping weight.

ACCESSORIES FURNISHED: Power Cord, 6 ft (180 cm), detachable. Rack Mounting Kit, HP 5060-0777. Accessory Kit, HP 05061-6070, includes two extender boards, test cables, maintenance tools, and a mating connector 1251-0126 for EXT DC input.

DIMENSIONS:



ACCESSORIES AVAILABLE: EXT DC cable, connects 5061A to 5085A Standby Supply, 103A-16A. 10638A Degausser for use with Option 004 High Performance Tube.

MATING CONNECTORS:
EXT DC INPUT: 1251-0126 (5-contact), Cannon MS 3106E-14S-5S (Series ME) furnished.
AC Line: 1251-2457, Cannon MS3106A-18-22SW.
Degausser: 1251-2797, Bendix PT06A-14-18P1005).
WARRANTY: Instrument, 3 years; optional battery and clock. 1 year (see beam tube warranty).

OPTION 001 TIME STANDARD

CLOCK PULSE:
Rate: 1 pulse per second.
Amplitude: +10V ±10% peak.
Width: 20 μs min.
Rise Time: <50 ns.
Fall Time: <2 μs.
Jitter: <5 ns rms pulse-to-pulse.
Output: Buffered front and rear BNC connectors.
All specs are with 50Ω load.
SYNCHRONIZATION (rear BNC): Automatic, 10 μs (±1 μs) delayed from reference input pulse. Manual adj. to <±50 ns. Reference pulse must be ≥+5V, with a rise time of <50 ns.
CLOCK MOVEMENT: 24 hour with sweep second hand.

OPTION 002 STANDBY POWER SUPPLY

CAPACITY (with Option 001 Clock): 30 minutes minimum at 25°C at full charge from sealed nickel-cadmium batteries.
CHARGE CONTROL: Automatic when ac power is connected.
INDICATOR: A front panel light flashes when ac power is interrupted and battery is being used.

OPTION 003 (COMBINES OPTION 001 AND 002)

OPTION 004 HIGH PERFORMANCE CESIUM BEAM TUBE

Replaces standard beam tube and may be installed with any of the above options. See specifications. For optimum performance the 10638A Degausser should be ordered.

Table 1-1. Specifications (Cont'd.)

DEFINITION OF TERMS

Accuracy

The degree to which an oscillator frequency corresponds to that of an accepted definition. The currently accepted definition is that of the 13th General Conference of Weights and Measures. In practice, this involves comparison with some generally accepted physical embodiment of this definition such as the NBS Frequency Standard. The specified accuracy of the 5061A Cesium Beam Frequency Standard is intrinsic to it and is achieved without calibration.

Reproducibility

The degree to which an oscillator will produce the same frequency from one occasion to another after proper alignment. This does not include calibration.

Settability

The degree to which the frequency of an oscillator may be adjusted to correspond with a reference. This is also termed calibration.

Stability

A. Long-Term frequency stability is defined as the absolute value (magnitude) of the fractional frequency change with time. An observation time sufficiently long to reduce the effects of random noise to an insignificant value is implied. Frequency changes due to environmental effects must be considered separately.

B. Short-term stability is defined as the standard deviation of fractional frequency fluctuations due to random noise in the cesium standard. It may also be expressed as standard deviation of phase. This specification must include the number of samples, the averaging time, the repetition time, and the system bandwidth.

See "Statistics of Atomic Frequency Standards" by David W. Allan, Proceedings of IEEE, Feb. 1966, P. 221, and HP Application Note 116 for measurement details.

c. *CESIUM BEAM TUBE.* Passive atomic resonator using the hyperfine resonance of Cesium 133.

d. "C" FIELD. Magnetic field within the cesium beam tube for fine frequency adjustments.

e. ZEEMAN TRANSITIONS. Transitions excited by application of the Zeeman frequency. These additional energy levels in the hyperfine structure are caused by applying the "C" field (Zeeman splitting). They are used to accurately measure the magnetic field inside the beam tube.

f. LOW FREQUENCY TRANSITIONS. These frequencies appear in the spectrum and are dependent upon the "C" field value. They can be excited independent of the microwave power source.

g. MASS SPECTROMETER. Directs cesium ions to the electron multiplier and prevents impurity ions from reaching the electron multiplier.

h. HOT WIRE IONIZER. Heated tantalum ribbon ionizes cesium atoms which strike it.

i. ELECTRON MULTIPLIER. Amplifies the electron current initiated by a cesium ion striking the first dynode.

j. BEAM CURRENT. Current resulting from the action of the hot wire ionizer and electron multiplier.

Table 1-2. Equipment Supplied

Equipment	Description	HP Part No.
Ac Power Cable	3-conductor with ground pin	05061-6091
Rack Mount Kit	Provides conversion from bench to rack	5060-0777
Accessory Kit:		05061-6070
Adapter	Micon, male-to-male	1250-0813
Connector	Plug female	1251-0126
Screwdriver	Ceramic	8710-0033
Wrench	Key 4 spline	8710-0055
Screwdriver	Offset	8730-0007
Wrench	1/8 inch open-end	8710-1111
Board Extender	22 pin	5060-7202
Cable Assy	Test Micon-to-BNC (2 supplied)	05060-6116
Extend. 90° bend	12 pin	05061-6073

k. ION PUMP. Maintains a vacuum in the cesium beam tube by continuously pumping when the instrument is on.

1-10. SPECIFICATIONS

1-11. Table 1-1 lists the technical specifications for the Model 5061A.

1-12. INSTRUMENT IDENTIFICATION

1-13. Hewlett-Packard instruments have a 10-character serial number (0000A-00000). The 4-digit serial prefix identifies instrument changes. The 5-digit number is the serial number of each instrument. If the serial prefix does not appear on the title page of this manual, there are differences between your instrument and the manual. A manual supplement included with the manual describes the differences. If the supplement is missing, contact the nearest Hewlett-Packard Sales and Service Office listed on the inside rear cover of this manual.

1-14. ACCESSORIES

1-15. Table 1-2 lists equipment supplied and Table 1-3 lists accessories available for the Model 5061A.

Table 1-3. Accessories Available

Accessory	Description	HP Part No.
Standby Power Supply	24Vdc, 2-amp supply with 18 amp-hours standby capacity	Model 5085A
Cable	Connects 5061A to 5085A dc output	103A-16A
Extension Slides and Slide Adapters	Permits sliding instrument out and tilting from rack-mounted position	1490-0718 1490-0721
Degausser	For degaussing option 004 High Performance Cesium Beam Tube	10638A

SECTION II
INSTALLATION

2-1. UNPACKING AND INSPECTION

2-2. Inspect instrument for damage (scratches, dents, broken knobs, etc). If instrument is damaged or fails Performance Check, notify the carrier and the nearest Hewlett-Packard Sales and Service office immediately (Sales and Service offices listed inside back cover). Retain the shipping carton and the padding material for the carrier's inspection. The office will arrange for repair or replacement without waiting for the claim against the carrier to be settled.

2-3. STORAGE AND SHIPMENT

2-4. ENVIRONMENT. The shelf life of the cesium beam tube is two years at storage temperatures up to +35°C (+95°F) if the ion pump is operated 2 to 3 times a year. If the ion pump is not operated to maintain the vacuum within the cesium beam tube, the expected shelf life is reduced. Instructions for pumping the cesium beam tube are found in Paragraph 3-13 of this manual.

2-5. Temperatures during storage and shipment should be limited as follows:

a. Maximum temperature: +75°C (167°F). Long-Term Storage: +35°C (95°F).

b. Minimum temperature: -40°C (-40°F).

NOTE

When storing the 5061A for 6 months or longer, set MODE switch to CS OFF and apply continuous ac line power to the instrument. This enables the ion pump to maintain the vacuum within the cesium beam tube with the cesium beam tube off.

2-6. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here is a recommended method:

a. Wrap the instrument in a large plastic sheet or bag such as HP Part No. 1920-0012.

b. Obtain a "same'size" carton (HP Part No. 9211-1102). Into the bottom of this carton, install a protector pad (HP Part No. 9220-1304).

c. Place the wrapped Instrument into the "same-size" carton.

d. When the carton is sealed, install four polyurethane *foam, post-packs* (HP Part No. 9220-1875) on each corner of the carton.

e. Install the boxed instrument into a final cardboard outer carton (HP Part No. 9211-1730), seal the carton effectively and label it properly.

2-7. ELECTRICAL POWER CONNECTIONS

CAUTION

The Model 5061A has the negative side of its power supply grounded. When operating with auxiliary equipment such as an external battery or clock, check to ensure that the equipment can be connected together.

2-8. AC LINE VOLTAGE. Before reading further, read caution below. The Model 5061A can be operated from either 115- or 230-volt (±10%) power lines. A slide switch on the rear panel permits quick conversion for operation from either voltage. Insert a narrow-blade screwdriver in the switch slot and set the switch to expose the correct numbers to correspond to the line voltage used (Table 2-1). The instrument is supplied with a 115-volt fuse; change this fuse for 230-volt operation (Table 2-1). AC power requirements are:

Standard instrument and
Option 004: 43W
Option 001: add 10W
Option 002: add 22W
Option 003: add 32W

CAUTION

Before connecting ac power to the instrument, be certain slide switch is properly positioned for 115 or 230 volt operation.

Table 2-1. 115/230 Volt Conversion

Conversion	115 Volts	230 Volts
Slide Switch	Right	Left
AC Line Fuse	1.25A	0.8A

2-9. DC LINE VOLTAGE. In addition to ac power capability, the Model 5061A can also operate from an external dc source with a voltage range of +22 to +30 Vdc. The dc power source may be applied simultaneously, with the ac power source. Dc power requirements are:

Without Options:	27W	at 24 Vdc
With Option 001:	add 7.5W	at 24 Vdc
With Option 002:	add 4.5W	at 24 Vdc
With Option 003:	add 12W	at 24 Vdc

Dc power connections are through the rear-panel EXT DC connector.

2-10. POWER CABLES. The Model 5061A is equipped with a detachable ac and dc power cable. Install as follows:

a. AC CABLE.

1. Connect the round, three-conductor female plug to the ac line jack on the instrument rear panel.

2. Connect male plug (two-blade with round grounding pin) to three-conductor (grounded) outlet. Exposed portions of the instrument are grounded for safety through the round pin; when only two-conductor outlets are available, use connector adapter (HP Stock No. 1251-0048) and connect short wire from adapter to a suitable ground.

b. DC CONNECTION.

1. Use the dc power mating connector shipped with the instrument, and connect the external dc source "–" (negative or ground) to connector pin c; connect the external dc source "+" (positive +22 to +30 Vdc) to connector pin A. Remaining three pins are not used.

2-11. Mating Connectors

2-12. Table 2-2 lists the Model 5061A front and rear panel connectors and their respective mating connectors. Not all connectors listed are shipped with the instrument but are included in the table as useful information for installation.

2-13. OPERATION AS BENCH OR RACK INSTRUMENT

2-14. The Model 5061A is shipped from the factory ready for operation as a bench instrument. Parts necessary to convert the instrument for operation as a rack-mounted instrument are supplied as a kit with the instrument. To convert for rack operation, refer to Figure 2-1 and proceed as follows:

Figure 2-1. Conversion for Rack Mounting

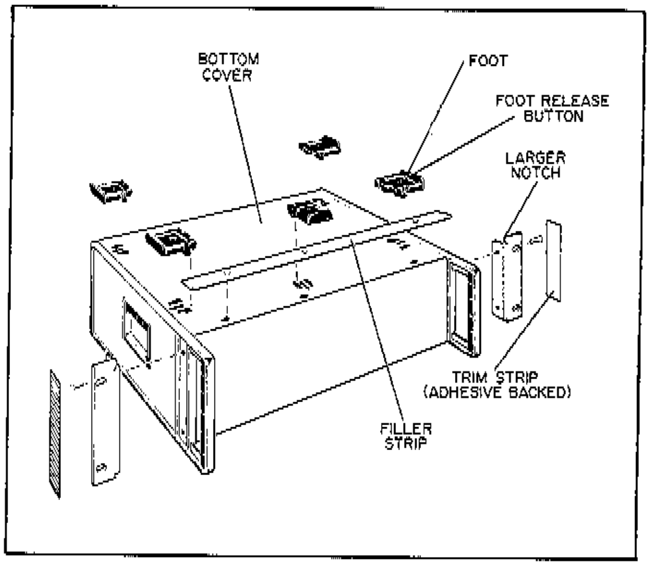


Table 2-2. Mating Connectors

Connector Description	Connector HP Part No.	Mating Connector HP Part No.	Mating Connector Description
BNC female jacks (J2, 6, 8, 10, 11, 12, 14 & 15	1250-0140	1250-0061*	BNC male plug, UG88/U
ZEEMAN MOD INPUT, female jack (J1)	1250-0102	1250-0061*	BNC male plug, UG88/U
EXT DC, 5-pin male jack (J19)	1251-0111	1251-0126	5-pin female plug Cannon MS3106E-14S (Series ME)
AC LINE, 3-pin male jack (J20)	1251-2458	1251-2457	3-pin female plug Cannon MS3106A-18-22SW
OUTPUT Signal, jacks (J5, 7 and 9)	1250-0102	1250-0061*	BNC male plug, UG88/U
1PPS, BNC jack (J13) Option 001 only	1250-0102	1250-0061*	BNC male plug, UG88/U
–2500V, 1-pin female jack (J3)	1251-1977 1251-1979 1251-1981	1251-1977 1251-1978 1251-1980	Hood Connector receptacle Lock Spring
+3500V, 1-pin male jack (J4)	1251-1977 1251-1979 1251-1980	1251-1977 1251-1978 1251-1980	Hood Connector receptacle Lock spring
Degausser		1251-2797*	Bendix PT06A-14-18P1005

*These connectors not shipped with the instrument

a. Remove feet (press the foot-release button, slide foot forward toward center of instrument, and lift off).

b. Remove adhesive-backed trim strips on sides, just behind front handles.

c. Attach filler strip along bottom edge of front panel.

d. Attach mounting brackets to sides (larger corner notch toward bottom of instrument, see Figure 2-1). Instrument is now ready to mount in standard 19-inch rack.

2-15. INSTALLATION LOCATION

2-16. The cesium beam tube installed in the Model 5061A is slightly sensitive to external magnetic fields. Avoid installing the instrument near large motors, generators, transformers, or other equipment which radiates strong fields of 2 Gauss or more. Also avoid placing a strong permanent magnet near the beam tube. These devices can radiate magnetic fields which are strong enough to permanently affect the magnetic shielding within the beam tube. The front-panel C FIELD control compensates for small magnetic field effects such as the earth's magnetic field with respect to the instrument location. For maximum accuracy, check the C FIELD adjustment when the instrument is relocated (See Paragraph 3-8, step k).

SECTION III

OPERATION

3-1. INTRODUCTION

3-2. This section provides operating procedures for the Cesium Beam Frequency Standard. Figure 3-2 provides turn-on procedure. Figures 3-6, 3-7, and 3-8 explain front, top, and rear controls and connectors. The procedures include power connections, warmup after initial turn-on, circuit checks with front panel meter, and initial adjustments. Initial checkout is divided into the following two procedures:

a. Initial Turn-on.

b. Turn-on after Long Storage.

3-3. OPTION 001, 002 AND 004

3-4. Operating procedures for Option 001 (Digital Clock), Option 002 (Internal Standby Battery) and Option 004 (High Performance Beam Tube) are given in Paragraphs 3-15, 3-25, and 3-28.

3-5. TURN-ON PROCEDURES

3-6. General

3-7. These procedures should be followed when the instrument is to be turned on. When the instrument has been off and the quartz crystal and cesium beam tube ovens are cool, 3/4 hour warmup time is required. Table 3-5 lists normal and abnormal front panel light indications. Table 3-1 lists normal meter indications. Table 3-2 lists MODE switch functions. Use these tables as a guide for circuit checks during the turn-on procedure or during operation.

3-8. Initial Turn-On Procedure

a. The front panel TIME CONSTANT switch should be set to SHORT when adjusting the quartz crystal oscillator frequency. When set to LONG, the instrument takes too long to respond and adjustment is difficult.

b. Set instrument controls as follows:

(1) 115/230V switch – match ac line voltage used.
(2) MOD switch – ON.
(3) MODE switch – LOOP OPEN.
(4) CIRCUIT CHECK switch – ION PUMP I.
(5) OSC FREQUENCY $X10^{-10}$ control – adjust to 250.
(6) TIME CONSTANT switch – SHORT.

c. Connect power cord to ac power source. Instrument is on as soon as power is connected.

NOTE

When the 5061A is shipped with Option 002 (Internal Standby Battery), the battery is discharged. Thus, when the instrument is initially turned on, the battery will charge for approximately 20 hours and the BATTERY light is on during the charge cycle.

d. Observe the ION PUMP I current indication. Meter indication may fluctuate and then decrease. After indication decreases below 40-30, the −2500 volt supply and cesium oven heater will be enabled. If ION PUMP I does not decrease within 30 minutes, see Paragraph 3-9.

e. For standard instruments, allow 45 minutes for cesium oven and quartz crystal oven to warm up. For Option 004, allow 30 minutes.

f. Start the divider circuits by:

(1) DIVIDER MODE switch – momentarily set to START, or
(2) DIVIDER MODE switch – set to AUTO START.

NOTE

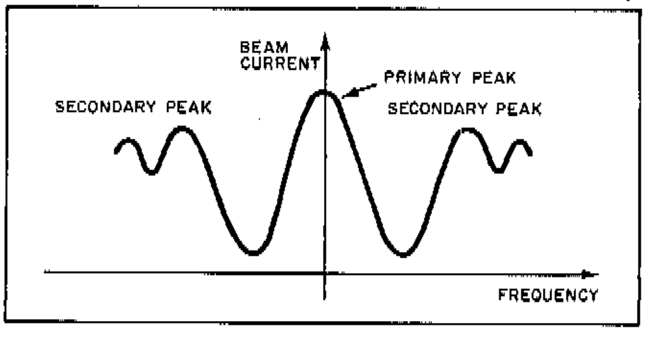
The divider circuits require an initial start signal. The DIVIDER MODE switch (momentary on-off-on type) provides this signal. When the switch is in AUTO START, the dividers start and a start signal is available if the dividers stop. When the switch is set to START, the dividers start and the switch returns to OFF when released. If the dividers stop, they will not start until the switch is again set to START.

g. Set CIRCUIT CHECK switch to BEAM I.

h. Slowly adjust OSC FREQUENCY COARSE for maximum on CIRCUIT CHECK meter. It is possible to peak the BEAM I on a secondary peak. Check the maximum by adjusting OSC FREQUENCY COARSE for a secondary peak on each side of the primary peak (see Figure 3-1). These secondary peaks will be smaller than the primary peak. (Note: Do not use OSC FREQUENCY $X10^{-10}$ control for this adjustment.)

i. Set MODE switch to OPER. Wait 30 seconds, then press LOGIC RESET button. CONTINUOUS OPERATION light should come on and stay on. The quartz crystal oscillator is now locked to the resonant frequency of the cesium beam tube for instruments equipped with Option 004. Do the HI CURRENT degauss, using HP 10638A DEGAUSSER ACCESSORY. Procedures are in the HP 10638A Operating Manual.

Figure 3-1. Beam Current and Applied Frequency



j. The hyperfine transition frequency is slightly sensitive to the earth's magnet field and local magnetic fields. The "C" field within the cesium beam tube compensates for these minor variations and should be adjusted when the instrument is moved or relocated.

k. C FIELD ADJUSTMENT.

(1) With instrument operating normally, set CIRCUIT CHECK switch to CONTROL and carefully adjust OSC FREQUENCY COARSE for zero on CIRCUIT CHECK meter.

(2) Set instrument controls as follows:
(a) MOD switch – OFF
(b) MODE switch – LOOP OPEN
(c) CIRCUIT CHECK switch – BEAM I
(d) OSC FREQUENCY $X10^{-10}$ control – adjust to 250.

(3) Connect the circuit shown in Figure 3-3.

(4) Set 204C oscillator to a Zeeman frequency of 42.82 kHz as displayed on the counter. An error of 1% in the Zeeman frequency causes an error of 3.6 parts in 10^{12} in the 5 MHz output frequency.

(5) Alternately adjust the 200CD oscillator amplitude and C FIELD control for maximum on CIRCUIT CHECK meter.

(6) Check the C FIELD setting by tuning the 200CD oscillator about 500 Hz off peak. Then tune the 200CD oscillator for maximum beam current on CIRCUIT CHECK meter. The oscillator frequency should be within ±100 Hz of the Zeeman frequency initially set on counter. If not, repeat the C Field adjustment. For instruments equipped with OPTION 004: Do the LOW CURRENT degauss, using HP 10638A DEGAUSSER ACCESSORY. Procedures are in the HP 10638A Operating Manual.

(7) Disconnect oscillator and counter. Set MOD switch to ON, MODE switch to OPER. Wait 30 seconds for ALARM light to go off. Push LOGIC RESET button. CONTINUOUS OPERATION light should come on and stay on. The instrument is now frequency-locked to the hyperfine transition frequency of the cesium source and is ready for use.

NOTE

In the Model 5061A, Serial Prefix 1220A and above, the C FIELD dial resolution is 5×10^{-14}/minor division; in Serial Prefixes below 1220A, C FIELD dial resolution is 1×10^{-12}/minor division.

l. Set the CIRCUIT CHECK switch to each position and record each reading in 5061A Operating Record (Table 3-4).

3-9. Turn-On After Long Storage

3-10. If the instrument has not been operated for six months or more, the following procedure should be performed. This procedure checks the cesium beam tube vacuum. Until beam tube vacuum is satisfactory, the hot wire ionizer and electron multiplier are held *off*. During initial warmup of the beam tube, with MODE switch set to LOOP OPEN or OPER, the ion pump may reduce the beam tube pressure to a satisfactory level and thus enable the hot wire ionizer and electron multiplier circuits. This in turn may cause these circuits to be disabled. This is normal operation. The cycle may occur several times before the electron multiplier and hot wire ionizer remain enabled. Power should remain connected to the instrument during this cycling to permit the ion pump to evacuate the beam tube.

a. Before applying power to the instrument, set controls as follows:

(1) 115/230 VAC switch – match ac line voltage used.
(2) MOD switch – OFF
(3) MODE switch – CS OFF
(4) CIRCUIT CHECK switch – ION PUMP I.
(5) TIME CONSTANT switch – SHORT.

b. Connect power to the instrument and observe ION PUMP I indication. If at the end of 1 hour the indication is less than 25, the cesium beam tube vacuum is satisfactory and the turn-on procedure (Paragraph 3-5) can be completed.

c. If at the end of 1 hour the ION PUMP I indication is still full scale, DISCONNECT POWER FROM THE INSTRUMENT.

d. Wait 1 minute and disconnect the red lead from the cesium beam tube at J4 of the +3500 volt supply after turning the metal lock on the connector plug.

e. With power off, connect the positive lead of a +3500 Vdc, 5 milliampere power supply (Harrison Labs Model 6525A or equivalent) to the plug that was removed in step d. Connect the negative lead to the 5061A chassis.

f. If power supply used will not indicate less than 100 microamperes, connect a Clip-on DC Milliammeter (HP Model 428B or equivalent) to the insulated red lead disconnected in step d.

g. Set +3500 Vdc power supply to +3500 volts and turn the power supply ON. Turn on DC Milliammeter and observe current. If after 1 minute the current indication remains 5 milliamperes or more, the cesium beam tube is leaky and must be replaced. Contact your nearest Hewlett-Packard Sales and Service office for assistance.

h. If after 1 minute the current indication is less than 5 milliamperes, leave the +3500 Vdc supply connected and observe the current for 15 minutes. The current should decrease slowly. When the current indication is less than 25 microamperes, turn off the +3500 Vdc supply and disconnect the DC Milliammeter.

i. Connect and lock the plug to J4.

j. Apply operating power to 5061A and observe ION PUMP I indication. CIRCUIT CHECK meter may indicate full scale for a few minutes and should then decrease. When the ION PUMP I reading is less than 25, the beam tube vacuum is satisfactory and the turn-on procedure in Paragraph 3-5 can be used.

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3-7. Front Panel MODE Switch Functions

3-8. The front panel MODE switch functions are described in Table 3-2.

3-9. Front Panel CIRCUIT CHECK Switch and Meter

3-10. Functions and use of the front panel CIRCUIT CHECK switch are listed in Table 3-3.

Table 3-2. MODE Switch Functions

MODE Switch Position	MODE Description
CS OFF (Cesium Off)	Only quartz crystal oscillator circuits energized. Power removed from cesium beam tube except ion pump (+3500V dc). **NOTE** CS OFF used for test purposes and storage.
LOOP OPEN	All circuits operating with atomic control loop open.
OPER	Instrument operating with quartz crystal oscillator locked to the atomic frequency.
LTC	Instrument operating with quartz oscillator locked to cesium resonance. Servo loop time constant is approximately 60 seconds. This mode should be used only in a benign laboratory environment.

Table 3-3. Operating Checks

CIRCUIT CHECK SWITCH		
Switch Position	Correct Meter Indication	Description
BATTERY	0 (35 to 50 with Option 002)	Indicates battery voltage
SUPPLY	35-45	Indicates +18.7 volts regulated supply voltage
ION PUMP I	0-15	Indicates vacuum in cesium beam tube by monitoring ion pump current. Fail-safe circuit removes power to cesium beam tube if current exceeds 40-30 μA.
OSC OVEN	*20–45 (changes with temperature)	Indicates power to oscillator oven heater
CS OVEN	*5-35 (changes with temperature)	Indicates power to oven in cesium beam tube
5 MHz	35-45 (no load)	Indicates level of 5 MHz output
MULT	35-45	Indicates bias to harmonic generator diode
BEAM I	*15-30	Indicates dc beam current from cesium beam tube
CONTROL	0 (may be up to ±50)	Indicates dc control voltage to quartz crystal oscillator
2ND HARMONIC**	*20-45	Indicates 2nd harmonic amplitude (may have small fluctuations)
1 MHz	35-45 (no load)	Indicates 1 MHz divider output level
100 kHz	25-45 (no load)	Indicates 100 kHz divider output level

*During the first several days of operation, this CIRCUIT CHECK meter indication may not fall within the limits shown in this table. This is a normal indication if the CONTINUOUS OPERATION light remains on.

**When meter reading has stabilized it should be set to 40 by adjusting the front panel LOOP GAIN control.

Table 3-1. Operating Checks

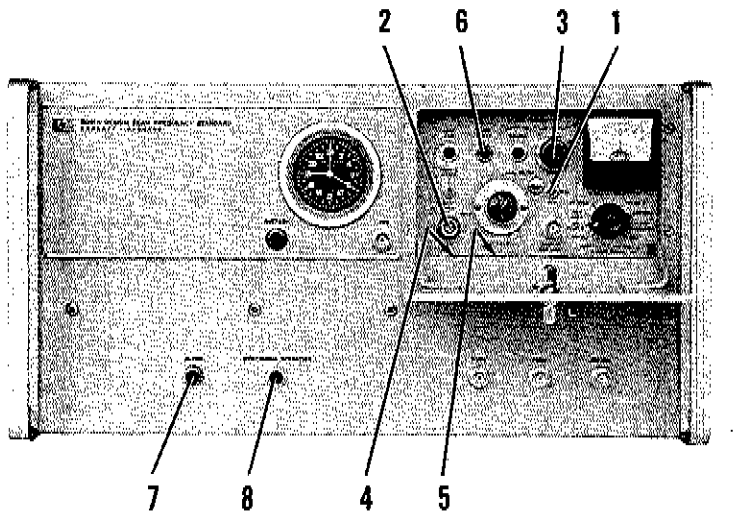
CIRCUIT CHECK		
Switch Position	Meter Indication	Description
BATTERY	0 (40 with Option 002)	Indicates battery voltage
SUPPLY	38-42	Indicates +18.7 volts regulated supply voltage
ION PUMP I	*0-5	Indicates vacuum in cesium beam tube by monitoring ion pump current. Fail-safe circuit removes power to cesium beam tube if current exceeds 40-30 μA.
OSC OVEN	*35-45 (changes with temperature)	Indicates power to oscillator oven heater
CS OVEN	*5-35 (changes with temperature)	Indicates power to oven in cesium beam tube
5 MHz	38-42 (no load)	Indicates level of 5 MHz output
MULT	20-45	Indicates bias to harmonic generator diode
BEAM I	*15-30	Indicates dc beam current from cesium beam tube
CONTROL	0 (may be up to ±50)	Indicates dc control voltage to quartz crystal oscillator
2ND HARMONIC	*25-45	Indicates 2nd harmonic amplitude (may have small fluctuations)
1 MHz	38-42 (no load)	Indicates 1 MHz divider output level
100 kHz	38-42 (no load)	Indicates 100 kHz divider output level

*During the first several days of operation, this CIRCUIT CHECK meter indication may not fall within the limits shown in Table 3-1. This is a normal indication if the CONTINUOUS OPERATION light remains on.

Table 3-2. MODE Switch Functions

MODE Switch Position	Description
OPER	Instrument operating with quartz crystal oscillator locked to the atomic frequency
LOOP OPEN	All circuits operating with atomic control loop open
CS OFF	Only quartz crystal oscillator circuits energized. Power removed from cesium beam tube except ion pump (+3500 Vdc). **Note** **CS OFF used for test purposes and storage.**

Figure 3-2. Turn-On Procedure



Before connecting the 5061A to the ac line, check that the rear panel 115/230V switch is set to match ac line voltage. Open front panel door.

1. Set MOD switch to ON.
2. Set MODE switch to LOOP OPEN.
3. Set OSC FREQUENCY X10^{-10} control to 250.
4. Set TIME CONSTANT switch to SHORT. Connect power cord to ac source. Instrument is on. Wait at least 45 minutes.
5. Set DIVIDER MODE switch to START or AUTO START. If Option 001 (Digital Clock) is installed, START position should be used. Set MODE switch to OPER.
6. Wait 30 seconds, press LOGIC RESET button.
7. ALARM light should be off.
8. CONTINUOUS OPERATION light should be on. The 5061A is now operational. Several days are required after turn-on for some of the internal circuits to stabilize. However, if CONTINUOUS OPERATION light remains on and ALARM light off, the instrument is operating. If any problems are encountered during turn-on, refer to Paragraph 3-5 for more comprehensive turn-on information.
9. Perform "C" Field adjustment, (Paragraph 3-8 step k).

Table 3-3. Synthesized Frequency For Atomic Time Scale (0-UTC)

Synthesized Frequency	Zeeman Frequency
12631771.6 Hz	42.82 kHz

Figure 3-3. Test Setup for "C" Field Adjustment

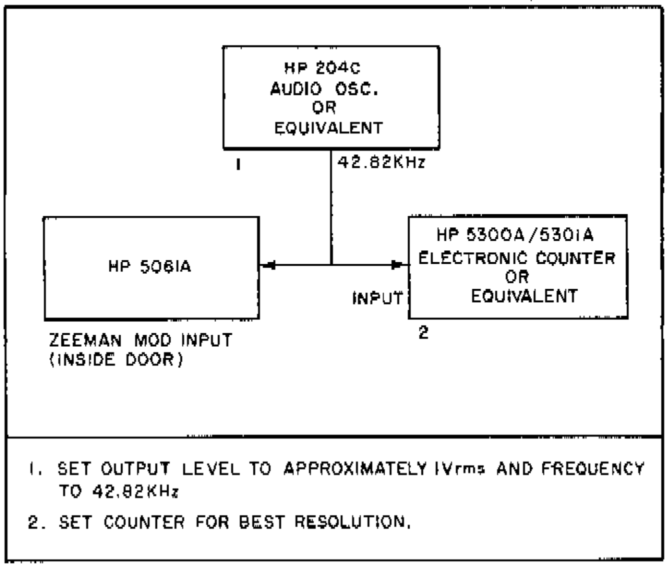


Figure 3-4. Clock Offset Test Setup, Example 1

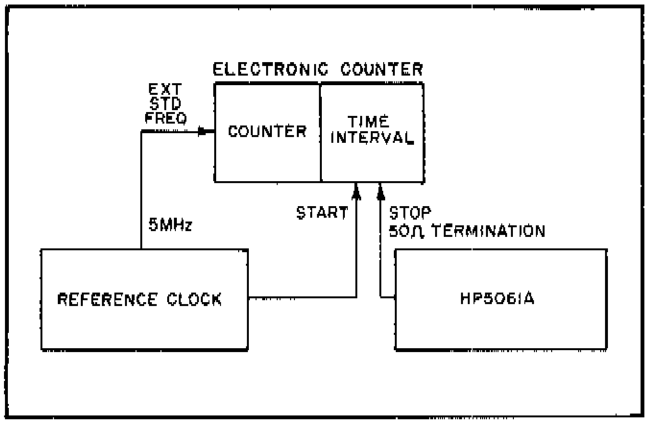


Figure 3-5. Clock Offset Test Setup, Example 2

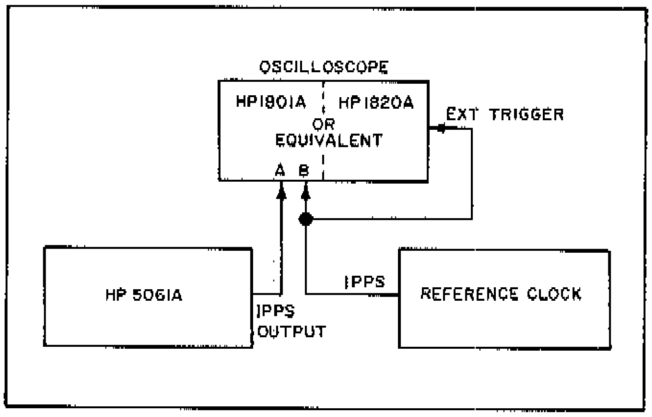


Table 3-4. 5061A Operating Record

Serial Number ________									
Zeeman Frequency 42.82 kHz									
CIRCUIT	METER READINGS				CIRCUIT	METER READINGS			
BATTERY					MULT				
SUPPLY					BEAM I				
ION PUMP I					CONTROL				
OSC. OVEN					2ND HARMONIC				
CS. OVEN					1 MHz				
5 MHz					100 kHz				
DATE					DATE				

Table 3-5. Front Panel Light Indications

Front Panel Lights		Description
ALARM	CONTINUOUS OPERATION	
Off	On	Indicates normal operation.
On	Off	Indicates one or more of the following troubles: 1. Quartz crystal oscillator not locked to cesium resonance peak. 2. Quartz oscillator locked to secondary peak of cesium resonance. To correct the above faults, see Troubleshooting Table 5-4. 3. 2nd Harmonic signal is low, caused by low beam current, but oscillator is still locked to peak of cesium resonance. Adjust front-panel BEAM I METER control for BEAM I meter indication of 20-30, and front-panel LOOP GAIN control for 2ND HARMONIC meter indication of 35-45.
Off	Off	Press RESET switch. If not OK, indicates one or more of the following troubles: 1. Light bulb failure. 2. Synthesizer circuits. 3. Power interruption.
On	On	Indicates the following trouble: Quartz crystal oscillator is locked to resonant frequency of cesium beam tube, but the oscillator has exceeded one-half its control range. To correct this trouble, proceed as follows: 1. Set CIRCUIT CHECK switch to CONTROL. 2. Slowly and carefully adjust OSC FREQUENCY COARSE control for zero on CIRCUIT CIRCUIT CHECK meter. 3. ALARM light should go off and the CONTINUOUS OPERATION light should remain on. NOTE: Making adjustment 2 may cause CONTINUOUS OPERATION light to go off. If this occurs, wait 30 seconds and press LOGIC RESET switch. Light will come on and stay on.

Internal Standby Battery Light (Option 002 only)	
BATTERY	Description
Off	Indicates normal operation.
Flashing	Indicates instrument is powered from internal battery supply.
On	Indicates battery is being charged.

3-11. Cesium Beam LOW Flux Operation Adjustments

3-12. The NORM-LO switch on Cesium Oven Controller Assembly A11 is factory-set to the NORM position. Cesium beam tube life may be extended by operating the tube at a lower flux level. However, by changing the NORM-LO switch to the LO position, the signal-to-noise ratio of the beam tube output is decreased causing decrease in the short-term stability. The long-term stability is not affected. If LO flux operation is desired, proceed as follows:

a. Set the 5061A for normal operation. Refer to Paragraph 3-5.

b. When 5061A is operational, remove top cover, set NORM-LO switch on Cesium Oven Controller Assembly A11 to LO.

NOTE

Wait at least one hour before proceeding. During the cooling period of the cesium oven, decreasing beam current will cause the CONTINUOUS OPERATION light to go off and the ALARM light to come on.

c. Replace top cover.

d. Set CIRCUIT CHECK switch to 2nd HARMONIC.

e. Check that TIME CONSTANT switch is set to SHORT.

f. Adjust LOOP GAIN control, on front panel, for a reading of 40 on the CIRCUIT CHECK meter.

g. If CONTINUOUS OPERATION light is off, press LOGIC RESET button.

h. With instrument operating and CONTINUOUS OPERATION light on, set CIRCUIT CHECK switch to BEAM I. Set BEAM I METER ADJ for 20 on the CIRCUIT CHECK meter.

i. Set CIRCUIT CHECK switch to each position and record meter reading in the 5061A Operating Record (Table 3-4).

3-13. Pumping the Cesium Beam During Storage

3-14. When a cesium beam tube is stored more than 6 months, the ion pump must be operated 2 to 3 times each year to obtain the expected shelf life of the tube. To pump the tube, proceed as follows:

a. Connect the positive (+) lead of a +3500 Vdc., 5 milliamp Power Supply (Harrison Labs Model 6525A or equivalent) to P4 of the beam tube.

NOTE

The cable connected to P4 enters the beam tube at the same place as the cable containing the brown, green, and yellow wires.

b. Connect the negative lead of the +3500 Vdc Power Supply to P17(5) of the beam tube. (P17 is the smaller of the multiple pin connectors).

c. If Power Supply used will not indicate less than 100 microamps, connect a Clip-on DC Milliammeter (HP 428B or equivalent) to the insulated cable of P4.

d. Set the +3500 Vdc Power Supply to +3500 Vdc and turn Power Supply ON.

e. Allow Power Supply to remain connected to the beam tube until the current decreases to 10 microamps.

f. Disconnect the Power Supply and DC Milliammeter (if used).

g. The tube is evacuated and can be stored.

3-15. OPERATION WITH TIME STANDARD (Option 001)

3-16. Option 001 provides the 5061A with a one pulse-per-second (1 PPS) clock output available at both front and rear-panel BNC jacks. The divider drive is an internally connected, 1 MHz signal from the Frequency Divider Assembly A6. The TIME DELAY, six thumbwheel decade switch (A5S1A thru S1F) controls the phase of the clock pulse from 1 μsec to 1 sec with respect to an external reference. The 0-1 μsec TIME DELAY screwdriver adjustment (A5C2) allows fine adjustment over any 1 μsec portion of the thumbwheel settings. The TIME DELAY switch and the 0-1 μsec TIME DELAY control are located under the access door in the top cover.

3-17. The time standard option includes a mechanical clock movement indicating time in hours, minutes, and seconds. FAST and STOP pushbuttons on the divider module (Figure 3-7) permit setting the clock movement to the nearest second. The SYNC pushbutton allows the clock to be synchronized to an external clock or pulse. The hours and minute adjustment is the knob located on the back of the clock movement (pull to engage and adjust, push to release), (see Figure 3-7).

CAUTION

It is necessary to synchronize the clock each time the MODE switch is switched from CS OFF.

3-18. Setting the Clock Phase to an External Clock.

3-19. The phase difference between the 5061A 1PPS output and an external reference clock may be set to any desired point between coincidence and 1 second by using the following procedure. The technique used will depend upon the 5061A application and individual user requirements.

3-20. Automatic Synchronization

3-21. To automatically have the 5061A synchronized and delayed from the reference by 9 to 11 μsec, proceed as follows:

a. Remove the top cover.

b. Using the knob on back of clock movement, set hours and minutes.

c. Replace the top cover and open the access door in the top cover.

d. Using the FAST pushbutton to speed up the clock tick, or STOP pushbutton to stop the clock (release the pushbutton to start clock tick), set the clock to the nearest second.

e. Set the 6 thumbwheel switch to 0 0 0 0 0 0, and 0-1 μsec TIME DELAY control maximum clockwise (do not over-tighten).

f. Connect a reference pulse to the 5061A rear-panel SYNC INPUT jack. The reference input pulse must be greater than +5V, with a rise time of less than 0.5 μsec.

g. Press the SYNC pushbutton on the clock module and hold down for at least 1 second. The next tick of the 5061A will be synchronized to the input reference pulse and delayed in time by 9 to 11 μsec. Any additional offset may be selected by using the 6 thumbwheel switch.

3-22. Manual Synchronization

3-23. EXAMPLE 1. When a delay of less than 10 μsec is desired or the reference pulse is not of sufficient amplitude, polarity or rise time for automatic sychronization, proceed as follows:

a. Perform Paragraphs 3-20, steps a, b, c, and d.

b. Set the 6 thumbwheel switch to 9 9 9 9 9 9, and 0-1 μSEC TIME DELAY control maximum clockwise (do not over-tighten).

c. Connect circuit shown in Figure 3-4.

NOTE

A 50-ohm resistive termination should be used when connecting the 5061A 1 PPS output to the time interval unit to prevent ringing in the pulse.

d. Set counter time base for best resolution to measure desired time offset.

e. Set time interval unit to trigger on the leading edges of the two input pulses.

f. Set the 6 thumbwheel switch and the 0-1 μSEC TIME DELAY adjustment for desired offset as indicated on counter.

3-24. EXAMPLE 2. When precise coincidence of the reference pulse and the 5061A clock tick or an offset between coincidence and 1 μsec is desired, proceed as follows:

a. Perform Paragraph 3-20, steps a, b, c, and d.

b. Set the 6 thumbwheel switch to 9 9 9 9 9 9, and 0-1 μSEC TIME DELAY adjustment maximum clockwise (do not over-tighten).

c. Connect circuit shown in Figure 3-5. No 50-ohm termination is required for this test setup.

d. Adjust the oscilloscope for comparison of the two pulses.

e. Adjust the 6 thumbwheel switch and the 0-1 μSEC TIME DELAY for coincidence or the desired offset between the 5061A clock tick and the reference clock pulse.

3-25. OPERATION WITH INTERNAL STANDBY BATTERY (Option 002)

3-26. Option 002 provides the 5061A with 30 minutes of standby power (typically 1 hour at 25°C) if ac line power should fail. Recharging the battery is automatic by means of an internal digital timing system each time standby power is used. Maximum recharge takes about 20 hours. Minimum recharge is about 120 minutes each time ac power is interrupted. The front-panel BATTERY warning light indicates three battery circuit conditions:

a. Flashes; when instrument is powered from internal battery supply.

b. On; when battery is being charged.

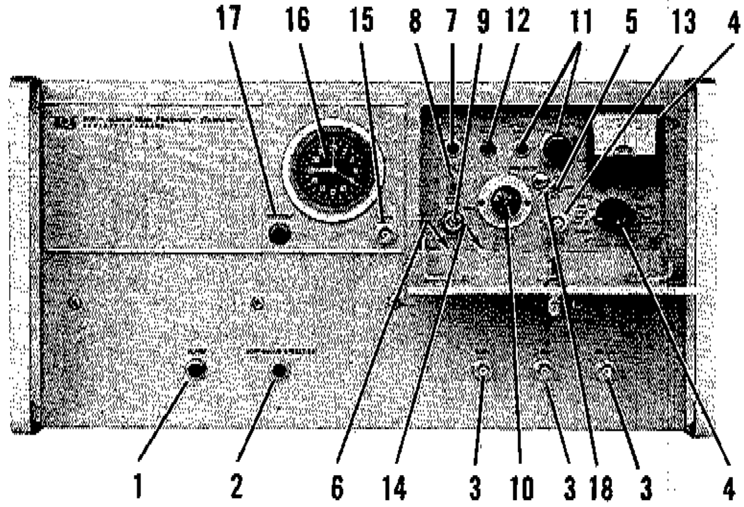
c. Off; when charging cycle is automatically completed.

3-27. If the instrument must be turned off for any reason, disconnect the ac power, remove the bottom cover, and press pushbutton switch S8 located on the bracket supporting A14, A2, and A15 plug-in boards. This disconnects the internal battery supply. The instrument will be on as soon as ac power is reconnected. When operating the instrument from an external dc power supply, leave ac power connected.

NOTE

When Standby Power Supply Option is installed, switching MODE switch from CS OFF to LOOP OPEN may cause internal battery charging circuits to switch to "fast" charge mode. If this occurs remove instrument bottom cover and momentarily connect A2TP5 to ground. This will reset charging circuits to "trickle" charge and turn BATTERY light off.

Figure 3-6. Front-Panel Controls



1. ALARM light: Normally off to indicate:

   a. The multiplied quartz crystal oscillator frequency is frequency-locked to the center maximum of cesium resonance;

   b. the instrument is correctly frequency-locked and beam tube current is satisfactory;

   c. the quartz crystal oscillator dc correction voltage is less than the dynamic limit of ±5.0 Vdc.

2. CONTINUOUS OPERATION light: Normally on to indicate that circuits are functioning properly and instrument is operating as a primary frequency standard.

3. OUTPUTS – 5 MHz, 1 MHz, 100 kHz: BNC jacks paralleled with rear-panel outputs to provide these standard frequencies. Output level is 1 volt rms (minimum) into 50 ohm load.

4. CIRCUIT CHECK switch and meter: Provide monitoring of various circuits for operation checks and trouble indication.

5. MOD ON-OFF switch: Controls 137 Hz modulation of microwave frequency applied to beam tube. Normally ON.

6. TIME CONSTANT switch: Controls instrument loop time constant. Set to SHORT for normal operation. Use Long position for best short-term stability when operating in a controlled environment. For time constant values see Table 1-1.

7. LOOP GAIN control: Adjusts ac amplifier gain.

8. BEAM 1 METER adjust: Adjusts for on-scale meter reading.

9. MODE switch: Controls the mode of operation. Normally set to OPER.

10. C FIELD control: Provides minor adjustment of the magnetic field inside the beam tube frequency. Resolution is 5×10^{-14}/minor division.

11. OSC FREQUENCY controls: COARSE control provides crystal oscillator frequency adjustment of ±500 parts in 10^9. Use only COARSE control to correct oscillator frequency with frequency-locked operation. Fine control $X10^{-10}$ provides adjustment range of 500 parts in 10^{-10}. Set control to 250 for frequency-locked operation with beam tube.

12. LOGIC RESET switch: Push to enable CONTINUOUS OPERATION light after power interruption, repair, or adjustment.

13. ZEEMAN MOD INPUT: Apply Zeeman frequency at this BNC jack during C Field adjustment (see Table 3-3).

14. DIVIDER MODE switch: Allows dividers to be operated in one of two modes; AUTO START or START. To manually start the dividers the switch should be momentarily set to START, then released.

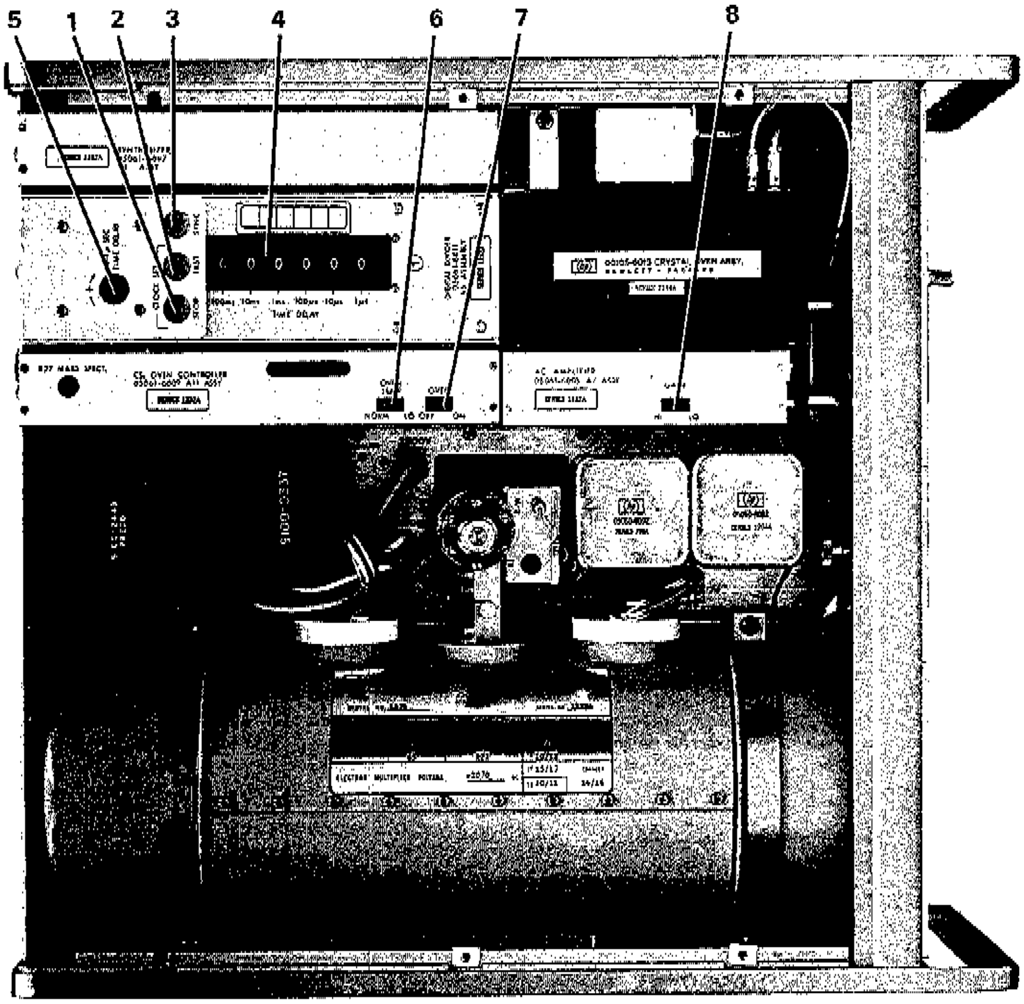
15. 1 PPS jack (Option 001 only): Provides 10 volt, 20 μs, 1 pps into 50 ohms from digital clock.

16. 24-Hour Digital Clock (Option 001 only).

17. BATTERY light (Option 002 only): Normally off. Flashes when 5061A is drawing power from internal battery. On when battery is being fast charged.

18. 5 MHz FILTER: Access hole for adjusting 5 MHz crystal filter.

Figure 3-7. Top Operating Controls



1. CLOCK SET STOP switch (Option 001 only): Digital clock is stopped when switch is depressed, starts when released.

2. CLOCK SET FAST switch (Option 001 only): Digital clock second hand is accelerated when switch is depressed, resumes normal operation when released.

3. Clock SYNC switch (Option 001 only): Synchronizes 5061A Digital Clock with an external clock when depressed; clock remains synchronized when released.

4. Clock TIME DELAY switch (Option 001 only): Selects time delay between an external reference pulse and the internal 1 pulse-per-second clock pulse. Adjustable in decade steps from 1 μs to 1 sec.

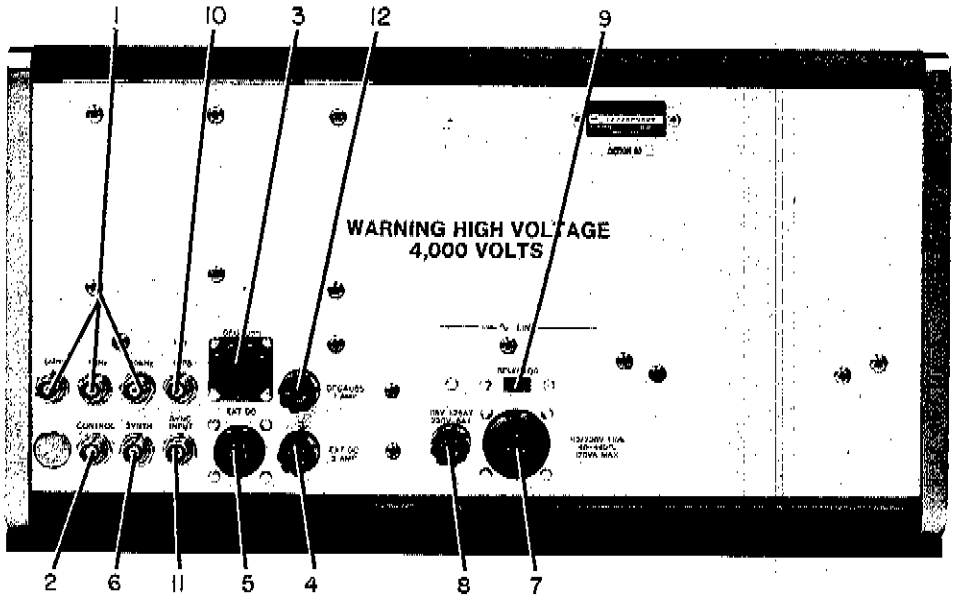
5. 0-1 μSEC TIME DELAY control (Option 001 only): Allows continuous adjustment of clock pulse delay over any 1 μsec range.

6. OVEN TEMP NORM-LO switch: Selects operating temperature for the cesium beam tube oven. Normally set to NORM.

7. OVEN-OFF-ON switch: Switch for cesium beam tube oven. Used in ON position.

8. AC Amplifier GAIN switch: Selects HI or LO gain of amplifier.

Figure 3-8. Rear-Panel Operating Controls



1. OUTPUTS – 5 MHz, 1 MHz, 100 kHz: BNC jacks paralleled with front-panel outputs to provide these standard frequencies.

2. CONTROL jack: Normally not used. Connected to voltage control point between integrator and crystal oscillator.

3. DEGAUSS Connector: Used with Option 004 only. Provides connections for external degaussing equipment which is used only when Option 004 is installed. Option 004 consists of a high performance beam tube.

4. EXT DC fuse: Use 3 ampere fuse (HP No. 2100-0003) when external 24 volt dc is used.

5. EXT DC connector: Five-pin male connector. Used to connect 5061A to external 22-30-volt dc supply. Connect positive terminal to pin A and negative to pin C. Pin C is connected to chassis ground.

6. SYNTH test jack: Synthesizer output frequency of 12,631,771.6 Hz is available at this jack. Amplitude is approximately 150 mv.

7. AC LINE jack: Accepts round female connector on power cable supplied.

8. AC LINE fuse: 1.25-ampere Slo-Blo fuse (HP No. 2100-0305) for 115 Vac operation or 0.8 ampere for 230 Vac operation.

9. 115/230 volt ac line switch: Set to expose correct numbers ("115" or "230") for the ac line voltage used.

10. 1 PPS jack (Options 001 and 003): Provides 10 volts, 20 µsec pulse from digital clock circuits.

11. SYNC INPUT jack (Options 001 and 003): Input to digital divider circuits for external synchronizing pulse. External synchronizing pulse must be +5V or more with rise time of less than 50 nsec.

12. DEGAUSS 1 AMP fuse: Provides protection for a +25V to +33V line from A15 Power Regulator to the J18(A) DEGAUSS connector.

3-28. OPERATION WITH HIGH PERFORMANCE TUBE (Option 004)

3-29. General. Option 004 provides the Model 5061A with improved performance in Accuracy, Reproducibility, Settability, Long and Short-term Stability and Warm-up Time (See Table 1-1). To achieve the specified accuracy and settability the HP 10638A Degausser must be used. Degaussing must be performed after turn-on (see Paragraph 3-8(i)) and after any change in the C field setting (Paragraph 3-8(k) item 6). These changes are included in the appropriate paragraphs.

3-30. OPERATION AS CRYSTAL OSCILLATOR ONLY

3-31. General

3-32. The Model 5061A may be operated as a quartz oscillator frequency standard with only Oscillator Assembly A10 operating and the cesium beam tube switched off. In this operation mode, the instrument has the stability of the crystal oscillator (Table 1-1) and cesium beam tube life is extended.

3-33. Front panel OSC FREQUENCY X10^{-10} control does not require adjustment when the instrument is operated with MODE switch set to OPER. In this mode, oscillator frequency is set with OSC FREQUENCY COARSE control outlined in Paragraph 3-8. However, when the instrument is to be operated as an oscillator only (MODE switch set to CS OFF) the oscillator frequency must be set accurately with OSC FREQUENCY X10^{-10} control.

3-34. Oscillator Only Turn-On Procedure

a. Complete the procedure outlined in Paragraph 3-8.

b. Set instrument controls to:

(1) MOD switch – ON
(2) MODE switch – OPER
(3) CONTINUOUS OPERATION light – On
(4) ALARM light – Off
(5) OSC FREQUENCY X10^{-10} – 250
(6) CIRCUIT CHECK switch – CONTROL

c. Adjust OSC FREQUENCY COARSE control for zero CIRCUIT CHECK meter indication.

d. Connect DC Voltmeter to rear panel CONTROL jack.

e. Slowly adjust OSC FREQUENCY X10^{-10} for less than ±20 mV Voltmeter indication. The quartz oscillator is now adjusted within ±1 part in 10^{10} of the cesium resonance.

f. Set MODE switch to CS OFF. Instrument is now operating as a quartz oscillator frequency standard.

NOTE

When the Model 5061A front panel MODE switch is set to CS OFF position, instrument operating power is reduced by about 2/3. However, if Standby Power Supply Option 002 is installed, battery charger timing circuits will continue to function as if full operating power is being used.

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section includes details of circuit operation. A description of overall instrument operation is given first with logic symbology following. Then each assembly in the instrument is discussed in order of its designation (A1, A2, A3, etc). Designations and names are listed in Table 4-1.

4-3. GENERAL DESCRIPTION

4-4. The Model 5061A Cesium Beam Frequency Standard is capable of defining frequency and therefore needs no calibration. The instrument is capable of realizing the frequency corresponding to the international time interval standard specified by the 12th General Conference of Weights and Measures (9, 192, 631, 770 Hz undisturbed by external fields). The instrument uses a passive atomic resonator of Cesium 133 capable of producing the necessary hyperfine transitions to achieve the frequency 9, 192, 631, 771.6 Hz. The stability of this frequency is 5 parts in 10^{12} for the life of the cesium beam tube. The passive resonator serves as an atomic frequency standard by stabilizing a quartz oscillator in a feedback control circuit. The quartz oscillator, when stabilized, is used for various functions of frequency and time measurement.

4-5. A simplified block diagram is shown in Figure 4-1. The 5 MHz Quartz Oscillator Assembly A10 output is phase modulated by a 137 Hz signal from Phase Detector Assembly A8. The modulation index is kept small to keep modulation distortion low. The modulated 5 MHz signal is multiplied by 18 in Multiplier Assembly A3 and then by 102 in Harmonic Generator Assembly A4.

4-6. Synthesizer Assembly A1 output, also derived from the 5 MHz quartz oscillator, is mixed with the multiplied signal in Harmonic Generator Assembly A4. The result of the multiplying and mixing is a frequency very close to 9, 192, 6 . . . Hz, the Cesium 133 transition frequency. This finalized microwave field is applied to the cesium beam tube.

4-7. Since the 5 MHz quartz oscillator frequency was phase modulated by 137 Hz in Multiplier Assembly A3, the 9, 192, 63 . . . . Hz microwave field contains this modulation. When the phase modulated microwave field is precisely at the peak of cesium resonance, the cesium beam tube output is the 2nd harmonic (274 Hz) of the modulation frequency. When off of the peak, the output is the fundamental (137 Hz) frequency. These two signals are separated in AC Amplifier Assembly A7. The 137 Hz signal is sent to Phase Detector Assembly A8 and Logic Assembly A14. The 274 Hz signal is also sent to Logic Assembly A14.

4-8. Phase Detector Assembly A8 output is a dc voltage proportional to the difference in frequency between the cesium resonance and the applied microwave field. This dc signal is supplied to Operational Amplifier and Integrator A9.

Table 4-1. Assembly Designations

Assembly Number	and Name	HP Part No.
A1	Synthesizer	05061-6097
A2	Battery Charger (Option 002)	05061-6019
A3	Multiplier	05061-6108
A4	Harmonic Generator	05060-6029
A5	Digital Divider (Option 001)	05061-6011
A6	Frequency Divider	05061-6102
A7	AC Amplifier	05061-6005
A8	Phase Detector	05061-6095
A9	Operational Amplifier	05061-6092
A10	Quartz Oscillator	00105-6013
A11	Cesium Oven Controller	05061-6009
A12	Cesium Beam Tube	05061-6077
A13	Buffer Amplifier	05061-6030
A14	Logic	05061-6016
A15	Power Regulator	05061-6099
A17	Terminal Board	05061-6018
A18	+3500 Vdc Power Supply	05060-6093
A19	−2500 Vdc Power Supply	05060-6092

4-9. The output of Operational Amplifier A9 is a voltage which electrically tunes the 5 MHz quartz oscillator to eliminate any frequency difference between the cesium beam tube resonance and the microwave field.

4-10. Buffer Amplifier Assembly A13 isolates the 5 MHz quartz oscillator signal from external loading effects and provides 5 MHz signals to front and rear-panel output jacks.

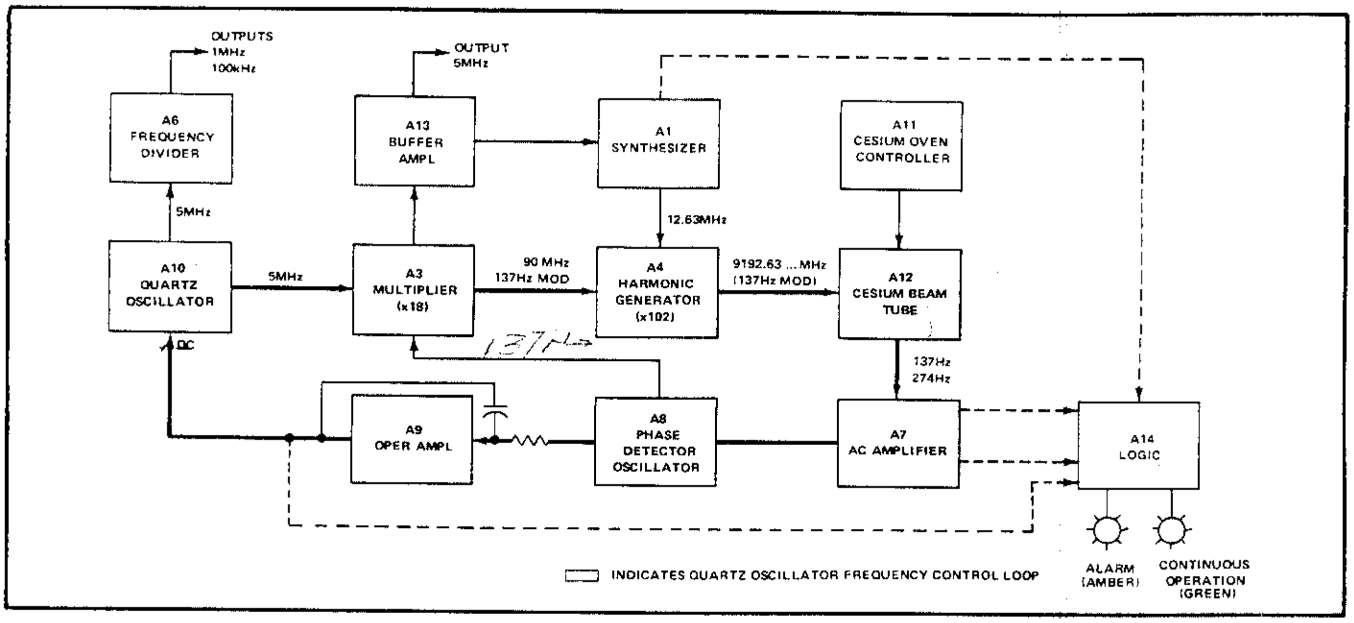
4-11. Frequency Divider Assembly A6 divides the 5 MHz signal to 1 MHz and 100 kHz and provides these signals to front and rear panel output jacks. This assembly also supplies 1 MHz to Digital Divider Assembly A5 (Option 001).

4-12. Logic Assembly A14 receives signals from assemblies A1, A7, A8, and A9 to control front-panel CONTINUOUS OPERATION and ALARM lights.

4-13. Cesium Oven Controller A11 provides power to the cesium beam oven and to Operational Amplifier Assembly A9.

4-14. GATING AND LOGIC

Figure 4-1. Model 5061A Simplified Block Diagram



4-15. The 5061A uses integrated circuits in Synthesizer Assembly A1, Battery Charger Assembly A2 (Option 002), and Digital Divider Assembly A5 (Option 001). As a result, it is necessary to understand basic logic symbols and their application in gating. In the circuit diagrams, AND gate and OR gate symbols are used. The following paragraphs and illustrations introduce logic symbols.

4-16. Logic Symbols

4-17. The symbol shown in Figure 4-2A is for the basic AND function. This AND gate output is high (H) if all inputs are high. The AND gate can have two or more inputs. The symbol in Figure 4-2D is for the basic OR gate. This OR gate output is high when one or more of the inputs is high. The OR gate can also have two or more inputs. A small circle at the input line of a logic symbol indicates a low (L) level activates the function. The symbol of Figure 4-2B shows a low input on all lines causes a high (H) output. A small circle at the output line of a logic symbol indicates a low (L) level when activated, as shown in Figure 4-2C. Thus the small circle indicates inversion. This applies to both types of gates. Figure 4-2 lists examples and truth tables for logic actions. When the output of the OR gate is inverted, it is referred to as a NOR gate. Similarly, an inverted AND gate output gives a NAND gate.

4-18. In a binary system there are only two states, referred to as H or L. The H is the relatively more positive level and L is the relatively less positive level. Positive logic means that the voltage level assigned to the "one" state is more positive than that assigned to the "zero" state. Negative logic has the "one" state less positive than the "zero" state. An H state could be logical "one" or "zero." Thus, positive logic (logical one) or negative logic (logical zero) must be clearly specified. However, H must always represent the more positive level. Figure 4-2 shows four pairs of symbols that have the same truth tables and can be used interchangeably. The same output function can be performed by what appear to be two different logic symbols. The following discussion will show that they are the same. Therefore, more than one symbol can be used to represent a particular function.

4-19. DeMorgan's Theorem and Logic Symbols

4-20. DeMorgan's Theorem states: $\overline{A \cdot B} = \overline{A} + \overline{B}$ and $\overline{A + B}$ = $A \cdot B$, where the dot (·) is read as "and" and the cross (+) is read as "or." The bar across the letters is read as "not." The theorem shows that an AND gate with an inverted output is the same as an OR gate with inverted inputs. The expression $X = \overline{A \cdot B}$ is correct for the AND gate with the inverted output as in Figure 4-2J. From DeMorgan's theorem, $X = \overline{A \cdot B} = \overline{A} + \overline{B}$ and the symbol for $\overline{A} + \overline{B}$ is the OR gate with inverted inputs shown in Figure 4-2J. Thus, the same truth table will work for both symbols. Remember that the symbol used must describe the logic function performed. Positive and negative logic differences are shown in Figure 4-2. When positive logic symbology is used to represent negative logic functions, the dual of the function is produced. For example, a positive logic AND gate becomes a negative logic OR gate. Thus, AND is the dual of OR and NOR is the dual of NAND.

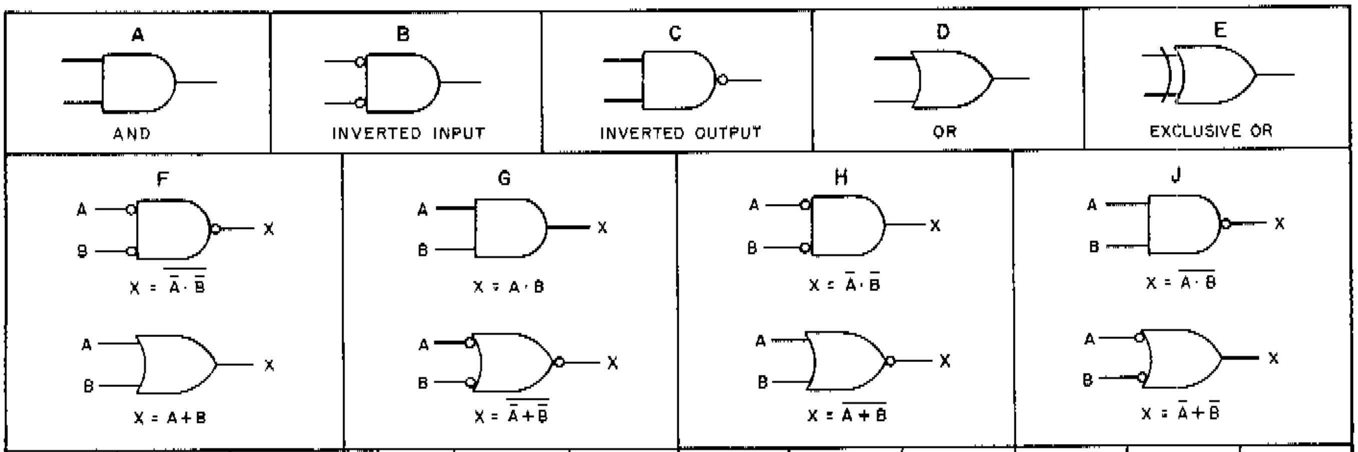
4-21. SYNTHESIZER ASSEMBLY A1

4-22. General

4-23. Synthesizer Assembly A1, Figures 8-8 and 8-9, generates a 12.631, 771, 6 MHz signal that is mixed with 9,180 MHz in Harmonic Generator Assembly A4, producing the 9, 192, 631, 771.6 Hz microwave field which is applied to the cesium beam tube. Synthesizer output frequency of 12.631, 771.6 MHz corresponds to zero-UTC-offset (Atomic Time Scale presently in use).

4-24. Figure 4-3 is a simplified block diagram of Synthesizer Assembly A1. The 5 MHz input signal is first isolated through Buffer Amplifier Assembly A13. This signal is then applied to the synthesizer preset divider circuits. The

Figure 4-2. Gate Symbols and Logic Function Comparison



A	B	X	A	B	X	A	B	X	A	B	X
H	H	H	H	H	H	H	H	L	H	H	L
H	L	H	H	L	L	H	L	L	H	L	H
L	H	H	L	H	L	L	H	L	L	H	H
L	L	L	L	L	L	L	L	H	L	L	H

5 MHz is multiplied by the rational fraction m/n through the action of the synthesizer. The integer "n" is predetermined and controls the preset digital divider output frequency; thus, the preset divider output frequency is 5 MHz/n.

4-25. The preset divider is made up of four decades giving a total dividing capability of 10,000. With each 10,000 count divider input, there will be one output. With the addition of the preset capability this divider can be set to divide by any integer (except 1 through 9, due to preset time, see Figure 4-4). Since the divider can be set to divide by any predetermined integer, the system is considered a divide-by-n preset divider. For example; if the divider were to divide by 2,000, an 8,000 would be preset into the decade before the counting sequence starts, since an 8,000 count is already in the decade from the preset, it will take only 2,000 inputs to get 1 output. Conversely, to divide by 8,000, 2,000 counts are preset into the divider prior to counting.

4-26. During a normal counting sequence, the input gate to the divider is closed for 1.8 microseconds so the divider can be preset. The gate is then opened and the decades divide the input 5 MHz by the preset n integer.

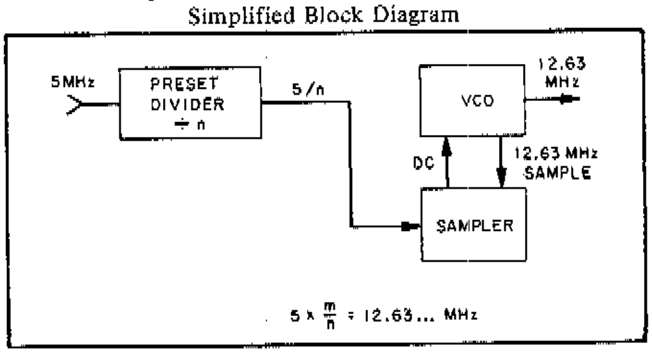
4-27. The integer "m" is determined by the 12.631 ... MHz phase locked voltage controlled oscillator. This oscillator is electrically controlled to oscillate at the "m"th harmonic of 5 MHz/n. To the synthesizer M = 3451 and N = 1366 giving an output frequency of 12.631, 771, 6 MHz.

4-28. The preset divider output frequency, 5 MHz/n, drives a sampling circuit. This circuit samples the 12.631 ... MHz voltage controlled, phase locked oscillator signal. The filtered sampler output is a dc signal proportional to the harmonic relationship between the oscillator frequency and the 5 MHz/n sampler drive frequency. This dc signal controls the 12.631 ... MHz oscillator frequency, thus phase locking the oscillator to the correct m/n ratio. The signal sent to Harmonic Generator Assembly A4 is 12.631 ... MHz. It is also available as a test signal at rear panel SYNTH output jack.

4-29. The preset divider receives 5 MHz from A10 and A13 and provides a 1.8 μsec wide pulse output with a 5 MHz/n repetition rate. The factor n is predetermined by hard-wiring the preset decades to the number which produces the zero UTC OFFSET frequency.

4-30. The preset divider (Figure 8-8) consists of an input gate, Q2-Q3; four preset decades IC1, 2, 5, and 6; one-shot M.V., IC4; NAND gate IC3; and test point driver Q4. The input to A1J1 consists of a 5 MHz sine wave from A13. The input gate, Q2 and Q3, closes for 1.8 μsec as determined by one-shot M.V. IC4. With the decade preset to zero, each decade divides by ten, thus the overall circuit can divide by 10,000. If the decade has a number preset into it, the decade starts its count from the preset number. Counting is performed on the negative going pulse at pin 8 of the decade. The BCD inputs and outputs are positive logic. When the strobe line is low, the counting operation is stopped and the BCD inputs are preset in.

Figure 4-3. Synthesizer Assembly A1 Simplified Block Diagram



4-31. Considering all four decades as a preset divider, the "9" outputs of IC6, 5, and 2 connect to IC3. Note however, that only the "1" output of IC1 connects to IC3. This arrangement allows the decade divider to count to 9991. When a count of 9991 is reached, that is, when all seven inputs of IC3 are HI, IC3(8) goes low to trigger one-shot M.V., IC4. The time (1.8 μsec) from pulse 9991 to 9999 is required to preset the decades. The output of IC4 drives four different points:

a. Blocking Oscillator Q17.

b. Test Point Driver Q4.

c. Strobe line to IC1, 2, 5, and 6.

d. Input Gate Q2 and Q3.

4-32. The output to the blocking oscillator is the divider output. The test point driver is used in selecting C2. The output to Q3 closes the input gate to prevent the 5 MHz pulses from entering the decade divider during the time when the decades are preset. A negative pulse on the strobe line causes the preset numbers to be entered into the decades. Figure 4-4 shows the sequence of events for the divider.

4-33. Capacitor C2 is selected to determine the proper RC time constant for the one-shot M.V. Since the 5 MHz input has a period of 0.2 μsec, C2 is chosen to block out 9 pulses of the input waveform. See paragraph 5-53A for adjustment procedures.

4-34. The jumper wires program the inputs to preset decades IC1, IC2, IC5 and IC6. For example, IC1 input is programmed for a BCD of 4. IC1 (3) is HI and IC1 (4, 10, 11) are LO. IC1 requires positive logic levels at its preset inputs, therefore the HI level at pin 3 represents the BCD 4.

4-35. Q1, CR1 and associated circuitry serve to reduce the 18.7 volts from the regulated supply to a nominal 5 volts for use as V_{CC} power for the IC's.

4-36. Phase Locked Voltage Controlled Oscillator

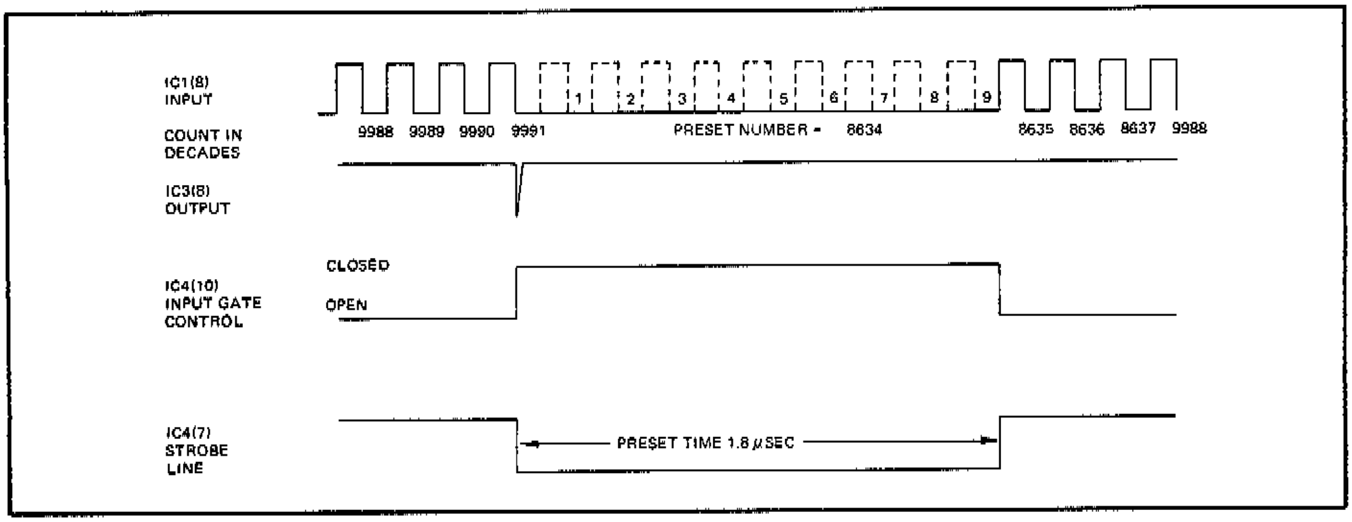
4-37. The phase locked voltage controlled oscillator produces the 12.631, 771, 6 MHz signal applied to Harmonic Generator Assembly A4 for mixing with the 9180 MHz phase modulated signal. Oscillator frequency is determined by the bias voltage applied to varactor CR28.

4-38. Prior to phase locking, the 12.631 . . . MHz voltage controlled oscillator (Q19 and associated components), oscillates at approximately 12.631 . . . MHz, dependent on dc biasing by R71A-B. Transistor Q21 buffers the oscillator and drives Q22. The 12.631 MHz signal is present at T3 primary and in turn through capacitive voltage divider C33, C34 at T2 secondary. This is the input signal for the sampler.

4-39. Transistors Q17, Q18 and associated components are a trigger blocking oscillator circuit driven by output pulses from preset divider output gate IC5. This trigger blocking oscillator in turn drives sampler blocking oscillator Q20 and associated components. Transformer T2 secondary receives 40 nsec pulses from sampler blocking oscillator at the 5 MHz/n frequency. These pulses "turn on" CR36 and CR37 each time they occur. The 12.631 . . . MHz signal, also present in T2 secondary, is very close to the "m"th harmonic of 5 MHz/n. This "m"th harmonic is sampled at 5 MHz/n rate, filtered by C36, and applied to dc amplifier Q23 to control the voltage applied to CR28. This controls the oscillator frequency. Therefore, the voltage level at Q23 gate determines the oscillator frequency.

4-40. When oscillator frequency is the exact "m"th harmonic of 5 MHz/n, the input level at Q23 base will not change since the filtered dc average remains constant. This holds the voltage on CR28 constant and the oscillator frequency does not change. If the oscillator frequency should change, the input level to Q23 will change, changing the voltage on CR28, bringing the oscillator back to correct frequency. When the loop is locked, synthesizer output frequency is 5 MHz(m/n). The dc control voltage to CR28 is also applied to Terminal Board Assembly A17, TP7 (SYNTH).

Figure 4-4. Synthesizer Assembly A1 Timing Diagram



4-41. Transformer T3 couples the synthesized frequency to tuned output amplifier Q26, improving signal purity, and providing two outputs. One output is a 150 mV signal to rear panel SYNTH output jack for test purposes, the other is a 300 mV signal applied to Harmonic Generator Assembly A4 for mixing with the modulated 9180 MHz microwave signal.

4-42. The 12.631 ... MHz voltage controlled oscillator phase-lock range is kept narrow to prevent phase-locking to incorrect harmonics. Diodes CR38, CR39, with C40, C43, R82, and R84 provide AGC dc feedback to Q19 base.

4-43. Transistor Q27 and associated components provide a synthesizer failure signal to Logic Assembly A14. During normal synthesizer operation, Q27 is off and no output signal results. If the synthesizer loses phase-lock, the input to Q23 becomes a random ac signal, coupled through C41 to Q24 base, amplified in Q24, Q25, and rectified by CR40 and CR41. This rectified signal forward biases CR42 and turns Q27 "on" sending a signal to Logic Assembly A14. This turns off the CONTINUOUS OPERATION light. If blocking oscillator Q20 fails, a signal through CR43 will turn on Q27 and apply the same signal to the logic circuits.

4-44. BATTERY CHARGER ASSEMBLY A2 (Option 002)

Figure 8-10

4-45. General

4-46. Standby battery BT1 provides 30 minutes of dc power should the normal power supply or supplies to the instrument fail. If standby battery power is used, and input power returned, battery charger circuits charge the standby battery for the correct period determined by battery use time. The battery charger circuits disconnect the standby battery if battery voltage level reaches +21 Vdc. Front panel BATTERY light DS3 is an indicator of Battery Charger Assembly A2 operation. During normal 5061A operation, the internal standby battery is "trickle" charged. When external power is removed and re-applied, the battery is "fast" charged.

4-47. The battery charger operates in one of three modes:

a. Normal operation: Front panel BATTERY light off. Battery Charger Assembly A2 operating as "trickle" charger for internal standby battery.

b. External ac 5061A power lost: Front panel BATTERY light flashing. Internal battery furnishing power to 5061A.

c. External ac power restored: Front panel BATTERY light on. Battery charger "fast" charging internal battery. Continues to "fast" charge depending on time battery supplied power. When "fast" charge cycle is complete, BATTERY light will go off.

NOTE

The internal standby battery is fully discharged prior to shipment from the factory. When the instrument is initially connected to ac power, the BATTERY light will remain on until internal battery is completely charged (about 20 hours).

4-48. Figure 4-5 is the battery charger block diagram. Diodes CR1, CR2, CR3, CR4, and capacitor C4 are a full wave rectifier and filter for the battery charging circuits. During normal instrument operation, current through series regulator transistor Q1 is regulated to maintain the internal battery, trickle-charged. This current regulation is determined by R28 and Q14 base-emitter voltage. Transistor Q11 is normally biased "off" by Q10 and Q15. Since Q15 is normally "off," the regulated current through R28 trickle charges the battery and operates the battery disconnect circuit. When transistor Q15 is turned "on," Q10 turns "off," Q11 turns "on" to shunt R28 and increase the charging current for "fast" charge mode. "Fast" charge current is set by R19. During normal operation, battery light control Q25 and Q26 are biased "off," holding the front panel BATTERY light off. All other circuits are in a standby state.

4-49. For explanation purposes, assume the 5061A is operated by external dc supply. When the 5061A is operating on external dc power and ac line voltage fails, battery charger circuits see no change and remain in their standby state. When ac line power is restored the charger circuits will continue to trickle charge the standby battery. If ac line power and external dc power fail, the internal standby battery is switched into operation through standby power supply gate circuit in Power Regulator Assembly A15.

NOTE

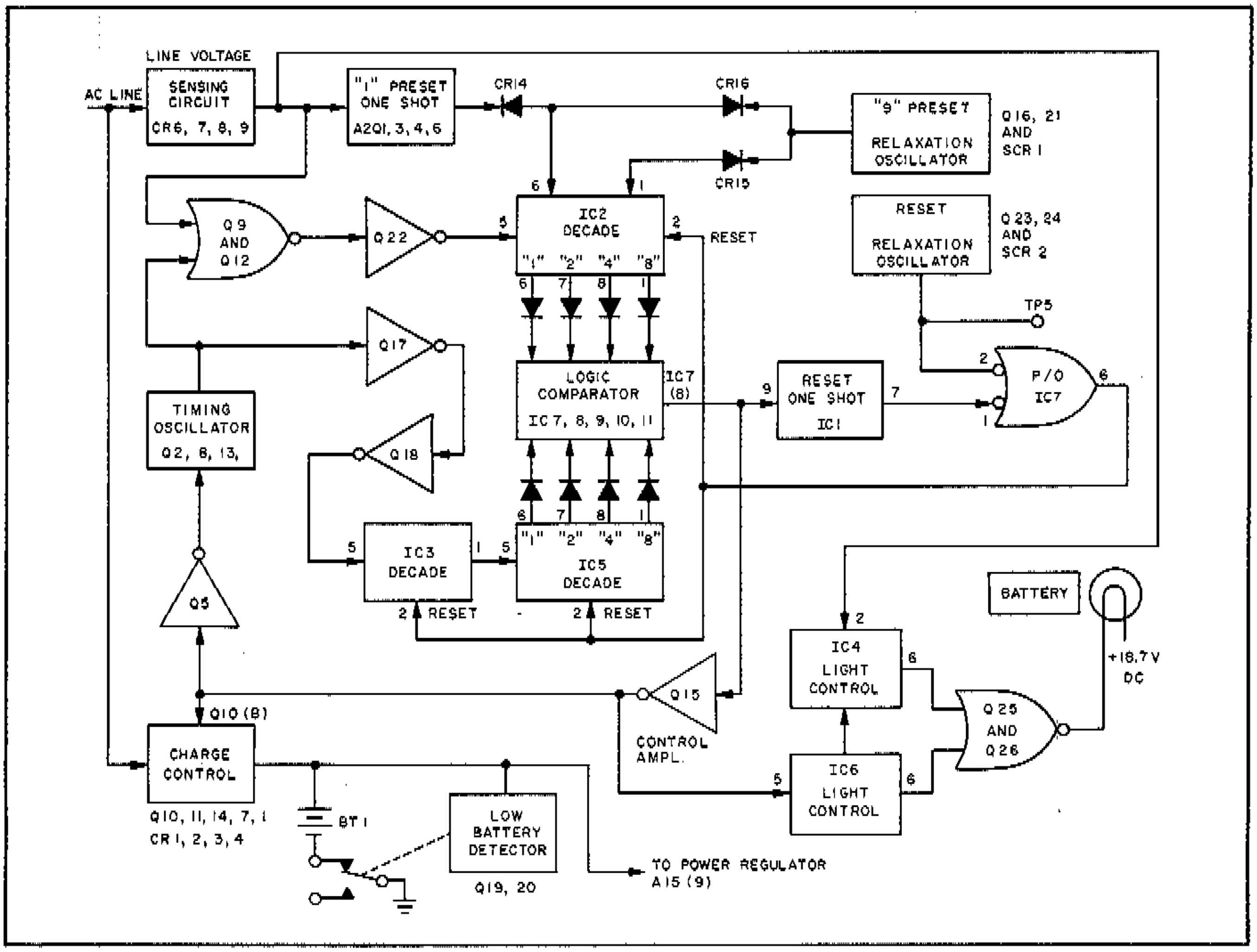
When the 5061A is operated with external standby dc power, instrument ac power must remain connected to charge and re-charge the internal standby battery.

4-50. The positive voltage applied at Q9 and Q4 base circuits holds the battery charger circuits in their standby state. This voltage is present when ac power or external dc power is applied. Diodes CR6, CR7, CR8, CR9, and components C4, R12, R13, and CR13 are an ac sensing circuit. When ac power fails, the positive voltage is still present at Q9 and Q4 through CR10 and CR13 from EXT DC input. When ac and dc power fail, the bias at Q9 and Q4 is no longer present, NOR gate Q9 and Q12 opens, and Q4 collector goes "H". This triggers one-shot circuit Q1, Q3, and Q6 to produce a single negative pulse coupled through CR14 to IC2(6), presetting a "1" into this decade.

4-51. The IC3, IC5 decade combination forms one input to logic comparator IC7, IC8, IC9, IC10, and IC11. Decade IC2 is the other input. The comparator output, IC7(8), controls the operation of Battery Charger Assembly A2. During normal operation, decade IC2 and decades IC3, IC5, are set to "0" allowing the logic comparator to sense coincidence between IC2 and IC5. For each input to IC2, IC3 must have 10 inputs for the count in IC5 to equal IC2. When IC2 and IC5 agree, logic comparator output at IC7(8) is "L".

4-52. As mentioned in Paragraph 4-50, when power is removed from the instrument a "1" is preset into IC2 upsetting the coincidence between IC5 and IC2. When this occurs, IC7(8) goes "H" and remains "H" until coincidence is again established.

Figure 4-5. Battery Charger Block Diagram



4-53. Comparator IC7 output is applied at Q15 base circuit to control Q15 collector voltage. Therefore, IC7 controls battery charger operation through Q15. When Q15 changes state, three circuit functions are affected:

a. Transistor Q10 changes state and sets the charging circuits for "fast" charge when ac line power is returned. The circuit remains in "fast" charge until Q15 returns to normal state.

b. Transistor Q5 changes state and starts the timing oscillator. The oscillator will oscillate until Q15 returns to normal state.

c. Battery light control circuits are activated and front panel BATTERY light flashes on and off until Q15 returns to normal state.

4-54. Timing Oscillator

4-55. When transistor Q15 changes state, Q5 is switched "off" to start the timing oscillator. This circuit produces a positive trigger pulse every 13 minutes until Q15 returns to normal state. Unijunction transistor Q2 acts as a relaxation oscillator causing a switching action on Q8. Each time Q8 is triggered, C7 step-charges until the charge voltage is sufficient to turn "on" Q13. When this occurs, C7 discharges through Q13 to form the positive output trigger pulse. The time required to charge C7 to the correct voltage level is 13 minutes. The output trigger is applied to shaping amplifier Q17-Q18 and NOR gate Q9, Q12.

4-56. Shaping amplifier Q17, Q18, and associated components amplify and shape the input trigger so the signal applied to IC3(5) is a positive input count pulse. The other oscillator output trigger is applied to NOR gate Q12 base circuit. This signal changes amplifier Q22 state, forming a positive input count pulse to IC2(5). Each time the timing oscillator triggers, IC2 receives a count pulse (if NOR gate Q9, Q12 is open). The NOR gate remains open until ac line or external dc power is restored.

4-57. Battery Disconnect

4-58. Transistors Q19, Q20, and associated components form a low-voltage-sensing circuit. If standby battery voltage drops to +21 volts, relay K1 disconnects the battery to prevent battery damage.

4-59. When external power is returned to the 5061A, NOR gate Q9, Q12 is closed by the voltage applied to Q9 base circuit. This same voltage is applied to battery light control

IC2 causing front-panel BATTERY light to remain on. With NOR gate Q9, Q12 closed, decade counter IC2 no longer receives count pulses from the timing oscillator. However, decade counters IC3, IC5 continue to count pulses from the timing oscillator.

4-60. The battery charging circuit, having been preset for "fast" charge described in Paragraph 4-48, fast charges the battery for a period dependent on the number of pulses sent to IC2. The battery continues to "fast" charge, IC3, IC5 continue to count until the total count in IC5 equals the count in IC2. The time required for this coincidence to occur is about 10 times the time required to accumulate the same count in IC2. Mimimum charge time is about 120 minutes.

4-61. Logic Comparator

4-62. Integrated circuits IC8, IC9, IC10, and IC11 operations are similar. Therefore, only IC11 will be discussed. Each output pin of IC2 and IC5 is connected to a NAND gate so that pins 1 are connected to IC11 input, pins 8 connected to IC10 input, pins 7 connected to IC9 input, and pins 6 connected to IC8 input. Each of the IC outputs are connected to NAND gate IC7. All inputs to IC7 (pins 9, 10, 11, 12, and 13) must be "H" for coincidence to occur. If any input remains "L", IC7 output state is "H". During normal instrument operation, the output state of IC7 is "L". Figure 4-6 shows the internal IC functions between IC2 and IC5 applied to IC11 and this output applied to IC7. All other IC inputs to IC7 are similar.

4-63. Assume identical outputs from IC2(1) and IC5(1) are applied to IC11(1 and 10). Pin 1 input is inverted through amplifier A and applied as one input to NAND gate B. The other input to NAND gate B is a complement pulse from IC5(1) to IC11(10). Since NAND gate B has opposite signals at the input, the output applied to IC7(12) is "H". The input to IC11(10) is inverted through amplifier B and applied as one input to NAND gate A. The other input to NAND gate A is a complement signal from IC2(1). NAND gate A has opposite signals at the input so that the output applied to IC7(13) is "H". When this occurs, IC7 senses coincidence between IC2(1) and IC5(1). Only if both inputs to IC11 are the same will IC7 inputs be "H". When all IC7 inputs are "H" the NAND gate output will be "L". This "L" signal at IC7(8) will return the battery charger circuits to normal operation (standby).

4-64. When IC7 changes to the normal "L" operation state, Q15 is cut off. This transition triggers coincidence one-shot IC1, applying a reset signal through an amplifier in IC7 to decades IC2, IC3, and IC5 resetting them to "0". With Q15 cut off, Q10 switches the charging circuit to trickle mode. Transistor Q15 also changes Q5 state, stopping the timing oscillator. Inputs to battery light control return to normal, turning off front panel BATTERY light, indicating Battery Charger Assembly A2 has returned to normal standby condition.

4-65. Battery Light Control

4-66. Figure 4-7 is a simplified schematic of the battery light control circuit. During normal operation an "H" signal is applied to IC4(1), inverted to "L", and applied to NOR gate IC6(3). The other NOR gate input is an "H" signal from Q15 collector. With an "H" and "L" signal present, the output at IC6(6) is "L" and Q26 is held off. The "L" signal at IC4(7) will not start the multivibrator and Q25 is held off. With Q25 and Q26 held off, front panel BATTERY light is off.

4-67. With ac power removed from the instrument, the input at IC4(1) and IC6(5) go "L", IC6(3) goes "H" and IC6(6) output remains "L" holding off Q26. However, the "L" at IC4(2) is inverted to "H" starting the multivibrator.

Figure 4-6. Logic Comparator

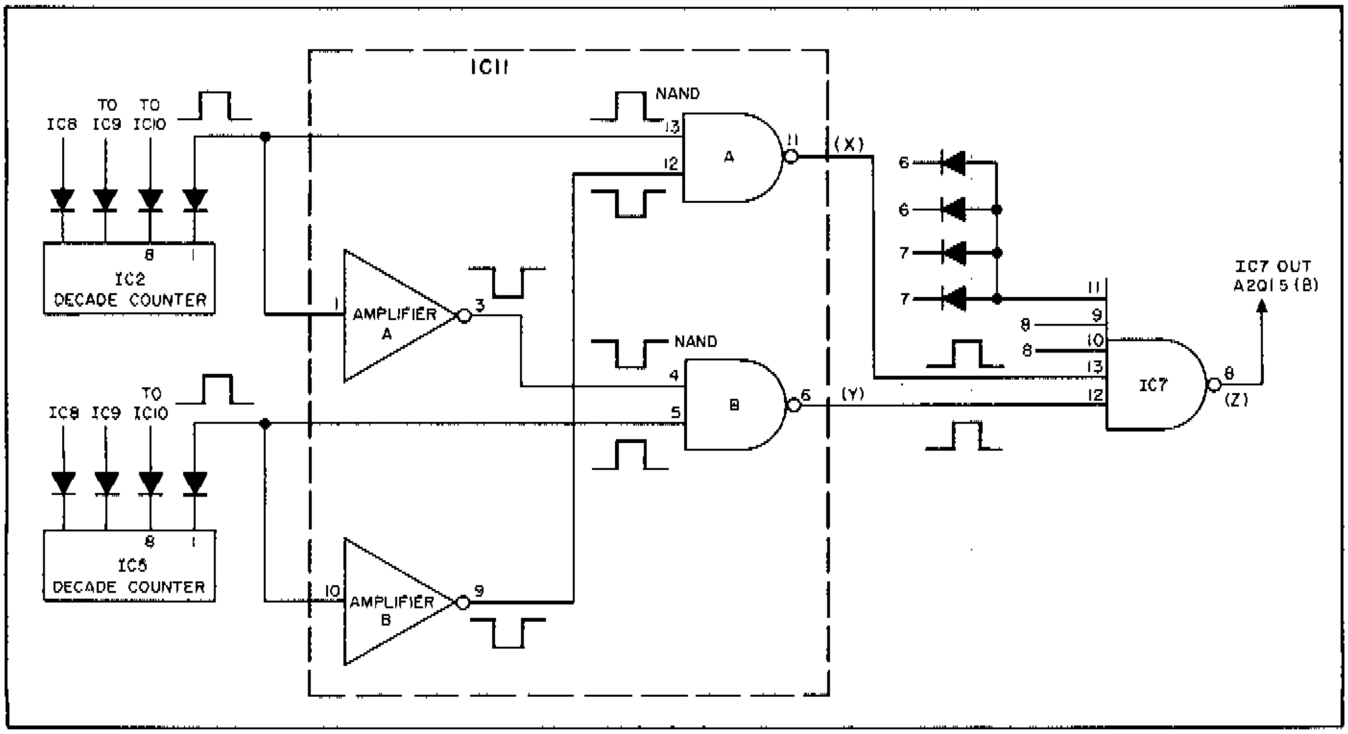
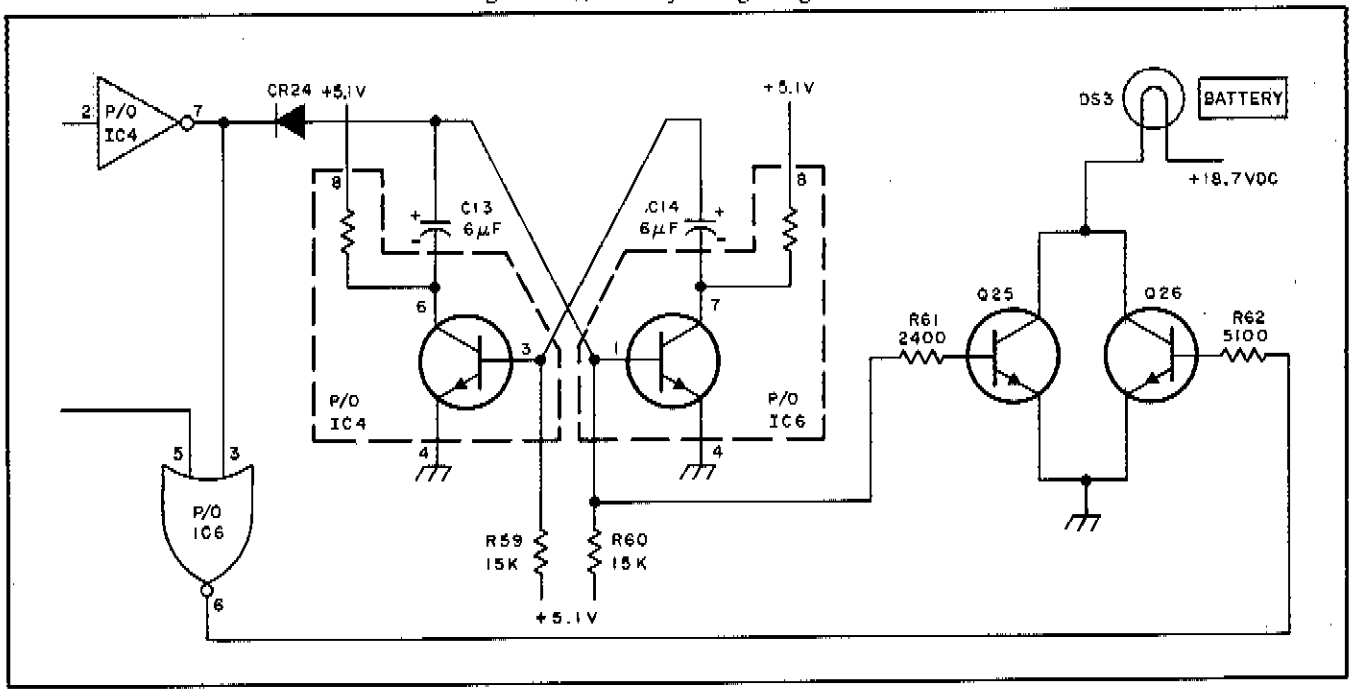


Figure 4-7. Battery Charger Light Control



Transistor Q25 base circuit is alternately biased "H" and "L" at the multivibrator frequency, alternately switching one side of front panel BATTERY light "L", turning the light on and off. This continues until ac power is restored.

4-68. When ac power is returned, IC4(1) goes "H" but the signal at IC6(5) remains "L" until battery "fast" charging is complete. The "H" at IC4(1) is inverted and applied to IC6(3). The output at IC6(6) goes "H" causing Q26 to change state, holding front panel BATTERY light on. The "L" at IC4(7) turns off the multivibrator. When the battery has completely recharged, the signal at NOR gate IC6(5) goes "H", normal operation is restored, and the BATTERY light is off.

4-69. Reset and Preset Relaxation Oscillators

4-70. When the 5061A is shipped with Option 002 or 003, the standby battery is discharged. The reset and preset oscillators reset the decade circuits to "0" and preset a "9" into decade counter IC2. This allows the charging circuits to "fast" charge the internal standby battery for approximately 20 hours (maximum charge time). The full re-charge cycle will also function if relay K1 disconnects the standby battery from the circuit because of low battery voltage, or if the battery is disconnected by switch S8.

4-71. Before initial operating power is applied to the 5061A, SCR2 is off. This silicon switch will turn on 3 seconds after power is applied to the instrument, thus turning off the 3-second reset oscillator. The time required to turn on the silicon switch is determined by C12. With SCR2 off, Q24 applies a reset signal to IC7(2). The signal at IC7(6) resets decade counters IC2, IC3, and IC5 to "0". When C12 charges to the conduction point of Q23, SCR2 turns on, turning off Q24, removing the reset pulse.

4-72. The preset oscillator functions the same except C11 in Q21 gate circuit produces the necessary time constant to hold SCR1 off for 6 seconds. The preset pulse is present during reset time but will not affect the decades until the reset oscillator circuit turns off. With the reset oscillator off, the preset oscillator remains on 3 additional seconds, setting a "9" into IC2(6, 1). When C11 charges to the conduction point of Q21, SCR1 turns on, turning off Q16, removing the preset pulse. Integrated circuit IC2 causes the battery charging circuits to "fast" charge for approximately 20 hours. This same sequence will occur if relay K1 disconnects the battery from the circuit due to low battery voltage.

NOTE

When it is necessary to remove all power from the 5061A, disconnect the ac power cord from the ac source and press battery disconnect switch S8. When ac power is connected, the battery charging circuits will "fast" charge the internal standby battery for 20 hours. If the internal standby battery is fully charged, this additional 20 hour "fast" charge may damage the battery. To inhibit the 20 hour charging cycle, momentarily connect a shorting strap between A2TP5 and chassis, resetting all decades to "0".

4-73. MULTIPLIER ASSEMBLY A3

4-74. General

4-75. Multiplier Assembly A3, Figure 8-11, provides a stable, spectrally clean, 300-milliwatt, 90 MHz signal to Harmonic Generator Assembly A4 and an isolated 5 MHz signal to Buffer Amplifier Assembly A13. The 5 MHz signal from Quartz Oscillator Assembly A10 is applied through J5 to A3 for multiplication and to the 5 MHz isolation amplifier. Prior to multiplication, the 5 MHz is modulated by 137 Hz from Phase Detector Assembly A8. The modulated 5 MHz is doubled to 10 MHz, tripled to 30 MHz, and tripled again to 90 MHz. Isolation amplifier Q2 provides a 50 ohm, 5 MHz source to drive Buffer Amplifier Assembly A13.

4-76. Phase Modulator

4-77. The phase modulator circuit consists of CR2, C10, C12, and L2. A 5 MHz signal is applied through J2, R3, and C3 to Q1 base. A second signal, at 137 Hz, is applied through J1, R13, and R20 to Q1 collector circuit. Varactor CR2, coil L2, and capacitor C12 form a resonant circuit at 5 MHz. When 137 Hz is applied to this tuned circuit, the capacity of varactor CR2 varies at 137 Hz and phase modulates the 5 MHz signal. Diode CR1 and resistor R15 establish dc operating voltage for CR2. In addition to amplifying the input 5 MHz signal, Q1 isolates the 5 MHz modulated signal and prevents feedback to Quartz Oscillator Assembly A10. Breakdown diode CR5 establishes a +7-volt reference for the bases of Q1, Q3, Q4, Q6 and Q9.

4-78. Balanced Doubler

4-79. The 5 to 10 MHz balanced doubler circuit receives modulated 5 MHz through C14 to Q4 base. Amplifier Q4 drives T2 primary at 5 MHz. Transistor Q4 is a class A amplifier and C17 tunes T2 primary to 5 MHz. Gain stability is provided by negative feedback through R23. Ferrite bead E2 suppresses parasitic oscillations. Transformer T2, diode CR3-CR4, form a full-wave rectifier which supplies 10 MHz pulses through C32 to the 10 MHz filter circuit. Inductor L9 provides a current return path for the diodes.

4-80. 10 MHz Filter

4-81. Transistor Q6 is connected as a common-base amplifier and matches the low-impedance balanced doubler circuit to the high-impedance double-tuned 10 MHz filter circuit. Components C34, R30, L12, C36, L14, and C38 form a double tuned 10 MHz filter. Capacitor C40 provides high impedance coupling between the filter and the 10-30 MHz tripler input.

4-82. 10 to 30 MHz Tripler

4-83. Transistor Q9 amplifies the filtered 10 MHz signal for 30 MHz tripler circuit drive. Negative feedback for gain stability is provided by R34. Resonant circuit L18, C48 in Q9 collector circuit is tuned to 10 MHz and provides maximum signal to the tripler circuit. Diodes CR8, CR9, and the two RC networks R36, C49 and R37, C50 generate 10 MHz pulses which are optimum for 3rd harmonic. Capacitor C51 and inductor L20 are tuned to 30 MHz and select this harmonic for amplification and filtering.

4-84. 30 MHz Filter

4-85. Transistor Q3 is connected as a common-base 30 MHz amplifier and provides impedance matching between the low-impedance 30 MHz tripler circuit and the high-impedance double-tuned 30 MHz filter circuit. Components C15, L3, C18, L4, C21, and C23 form the double-tuned 30 MHz filter. Inductor L5 provides a dc return for Q5 base circuit.

4-86. 30 to 90 MHz Class C Tripler and Filter

4-87. Transistor Q5 is a class C tripler with gain controlled by feedback through Q7. Transistor Q5 conducts pulses of current that are rich in 3rd harmonic content. The 90 MHz third harmonic is filtered by double tuned circuit C24, L7, C28, C30, and L10. The filtered 90 MHz signal is applied through C33 to base circuit. Inductor L11 provides a dc return for Q8 base.

4-88. Output amplifier Q8 amplifies the 90 MHz from the 90 MHz filter circuit. Tuned circuit L15, C43 provide additional filtering. Variable capacitor C44 is adjusted to match Q8 output impedance to a 50 ohm load. Capacitor C45 provides a 90 MHz sample to diodes CR6 and CR7 for rectification. The emitter current of Q5 is controlled by Q7. The base current of Q7 is the difference between the current through R31 and diodes CR6 and CR7. Feedback is such that as output level increases or decreases, current through CR6 and CR7 is about equal to current through R31. Resistor R31 is factory selected to set the 90 MHz output at 3.9 volts into 50 ohms.

4-89. 5 MHz Isolation Amplifier

4-90. Isolation amplifier Q2 and associated components provide an unmodulated 5 MHz output signal through J3 to Buffer Amplifier Assembly A13. Transformer T1 isolates the 5 MHz signal from external variations and provides a low impedance output to drive buffer amplifier circuits.

4-91. HARMONIC GENERATOR ASSEMBLY A4

4-92. Harmonic Generator Assembly A4, Figure 8-12, receives a phase modulated 90 MHz signal from Multiplier Assembly A3, a 12.63. . . . . MHz signal from Synthesizer Assembly A1, and generates the 9192.63. . . MHz phase modulated microwave field applied to the cesium beam tube. The heart of this harmonic generator is step recovery diode CR2. The conductivity of this p-n junction device, during reverse recovery, approximates a step function. The transition from reverse conduction to cutoff occurs in approximately 0.1 nanosecond. This results in high-order harmonics with greater efficiency than conventional non-linear harmonic generators.

4-93. The phase modulated 90 MHz signal is applied through J1 to Harmonic Generator A4. Resistors R3, R4, and R5 form a 3 dB matching attenuator to isolate diode input impedance from multiplier output impedance. Capacitors C6, C7, C8, C11, C12 and inductor L3 are a pi-matching network for the 90 MHz signal. Transistor Q1 and associated components provide a low impedance biasing voltage with R2 setting the bias level for CR2.

4-94. The 12.63. . . . . MHz is applied to CR2 bias voltage. The resultant CR2 output is a phase modulated, multiple harmonic signal, including 9180 MHz (102nd harmonic of 90 MHz) and associated 12.63 . . . MHz sidebands. The filter cavity, a high "Q" transmission type, selects the 9180 MHz + 12.63 . . . MHz upper sideband and applies this 9192.63 . . . MHz microwave signal to Cesium Beam Tube Assembly A12. Resistor R1 is adjusted for optimum sideband presence at CR2 output. Inductor L1 and capacitor C5 form a parallel resonant circuit preventing 90 MHz from feeding back to Synthesizer Assembly A1. Test point A4TP1 is used for setting the step recovery diode bias point. Transistor Q1 collector output is a dc voltage applied to CIRCUIT CHECK meter for front panel MULT bias monitoring.

4-95. Front panel input jack, designated ZEEMAN MOD INPUT, allows application of a low frequency to the cesium beam tube causing atomic transitions at field-dependent hyperfine frequencies. This permits accurate magnetic field ("C" Field) adjustment within the beam tube.

4-96. DIGITAL DIVIDER ASSEMBLY A5

(Time Standard Option 001)

4-97. General

4-98. Digital divider circuits provide one pulse-per-second output ticks available at front and rear panel 1 PPS BNC output jacks. The divider drive is an internally connected, 1 MHz signal from Frequency Divider Assembly A6. TIME DELAY, six thumbwheel, decade switch S1A-F (located under top access door) provides 1 μsec to 1 sec delay control of the output tick. A 0-1 μsec TIME DELAY adjustment allows delay control over any 1 μsec portion of the TIME DELAY thumbwheel switch setting.

4-99. The time standard option includes a mechanical clock movement indicating time in hours, minutes, and seconds. FAST and STOP pushbuttons on the divider module (Figure 3-7) permit setting the clock movement to the nearest second. Hours and minutes are mechanically set. SYNC pushbutton (Figure 3-7) allows the digital divider to be automatically synchronized within 9 to 11 μsec of an external reference input pulse. This external reference must be greater than +5 V with a rise time of less than 0.05 μsec.

4-100. Figure 4-8 is a simplified block diagram of Digital Divider Assembly A5. Five sub-assemblies make up the overall assembly:

a. A5A1 Power supply and 1 PPS output.

b. A5A2 Master clock.

c. A5A3 Preset clock.

d. A5A4 Switch circuit.

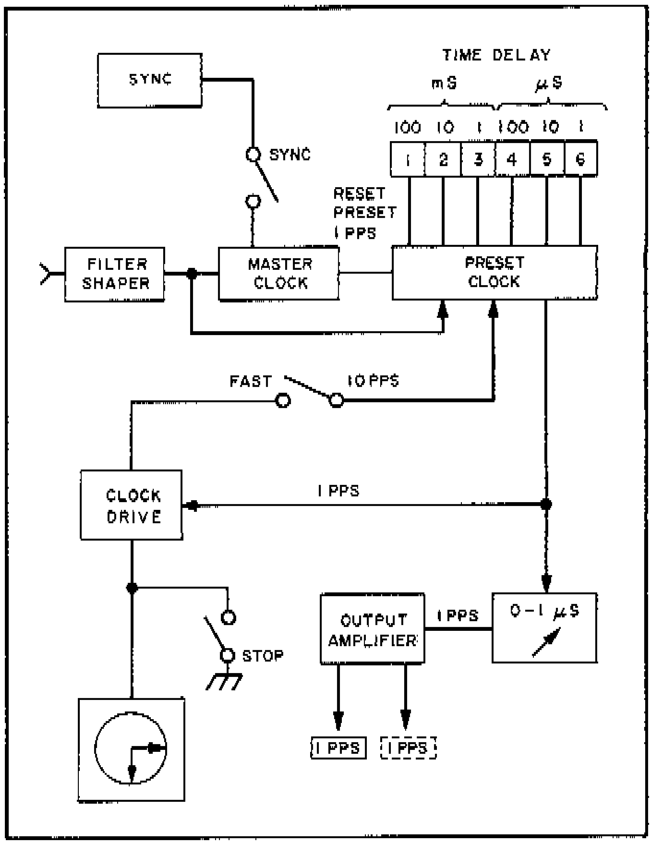
e. A5A5 Interconnecting board.

NOTE

Reference designators in Paragraphs 4-101 through 4-141 are abbreviated; for complete reference designators, add prefix "A5" to reference designators used.

4-101. The input drive signal from Frequency Divider Assembly A6 is applied to an input filter and shaping network; then to the gated 1 MHz multivibrator. Multivibrator output is applied to the following stage (1 MHz clock drive multivibrator) and to preset clock output logic gates A3IC2 and A3IC12B. This signal is the gated output pulse.

Figure 4-8. Digital Divider A5 Block Diagram



4-102. The negative transition of A2IC2 output pulse triggers A2IC3 to produce negative 150 nsec 1 MHz pulses supplied to master clock and preset clock as count pulse inputs.

4-103. The master clock produces a 1 PPS 100 msec output master tick that resets and presets the preset clock. Six decade dividers make up the master clock. The master tick triggers the reset one-shot which triggers the preset one-shot. During reset and preset time, NOR gate A3IC17B holds the preset clock input circuits closed for the preset and reset period.

4-104. The preset clock produces a 1 PPS, 1 μsec pulse, adjustable in phase from 1 μsec to 1 sec depending on the thumbwheel switch settings. This output pulse is sent to the output logic gates together with the gated 1 MHz signal from A2IC2. When coincidence between these two pulses occur, a 150 nsec output pulse at 1 PPS is applied to output blocking oscillator A1Q7-Q8. The variable delay circuit allows delay control over any 1 μsec portion of the .1 μsec to 1 sec time delay produced by the thumbwheel switch setting.

4-105. Blocking oscillator output is amplified and applied to front and rear panel 1 PPS BNC output jacks. The same output pulse from the preset divider logic circuits is applied to clock movement flip-flop circuits through A1Q11-Q12 for mechanical clock movement.

4-106. The mechanical clock movement can be set to the nearest second with FAST and STOP pushbuttons located under the top cover access door. When the FAST button is depressed, the second hand advances at a rate 10 times faster than normal. The STOP button, when pressed, will stop the movement until released.

4-107. The SYNC pushbutton allows Digital Divider Assembly A5 to be synchronized to an external input reference pulse applied at rear panel SYNC input jack. This reference pulse is applied to A2IC2 which synchronizes the master clock within 9 to 11 μsec of the external reference. The pushbutton must be depressed for at least 1 second.

4-108. Input Filter and Shaping Circuits

4-109. The 1 MHz input signal from Frequency Divider Assembly A6 is applied through A2R1 and A2C2 (Figure 8-15) to input amplifiers A2Q1 and A2Q2. Diodes A2CR1-A2CR2 limit the input signal level. Capacitor A2C4 tunes A2T1 primary for 1 MHz. The input signal is amplified by A2Q2, coupled to A2T1 secondary, and applied to a high "Q" 1 MHz filter (A2R9, A2R12, A2C6, A2C7, A2C8, A2C9, A2L1, A2L2, A2L3, and A2Y1) to suppress unwanted signals. The spectrally clean 1 MHz signal is then applied to shaper amplifiers A2Q4 and A2Q6 which square the 1 MHz for application to gated 1 MHz multivibrator A2IC2(9).

4-110. Gated 1 MHz Multivibrator A2IC2

4-111. Integrated circuit A2IC2 produces a 1 MHz, 150 nsec, positive pulse applied to 1 MHz clock drive multivibrator A2IC3(9) and to preset clock output NAND gates A3IC2(1) – A3IC12B(9). When proper gate sequencing occurs, A2IC2 output pulse is gated through A3IC2C or A3IC12B (Figures 4-10 and 4-11) to 1 μsec variable delay multivibrator A4IC1(1) and output tick blocking oscillator A1Q7-Q8, to front and rear panel 1 PPS output jacks.

4-112. Clock Drive Multivibrator A21C3

4-113. The 1 MHz clock drive mv is triggered by the negative transition of A2IC2 output pulse, producing a negative 1 MHz output pulse at A2IC3(7) delayed by 150 nsec. This pulse is the count pulse input for the master clock and preset clock.

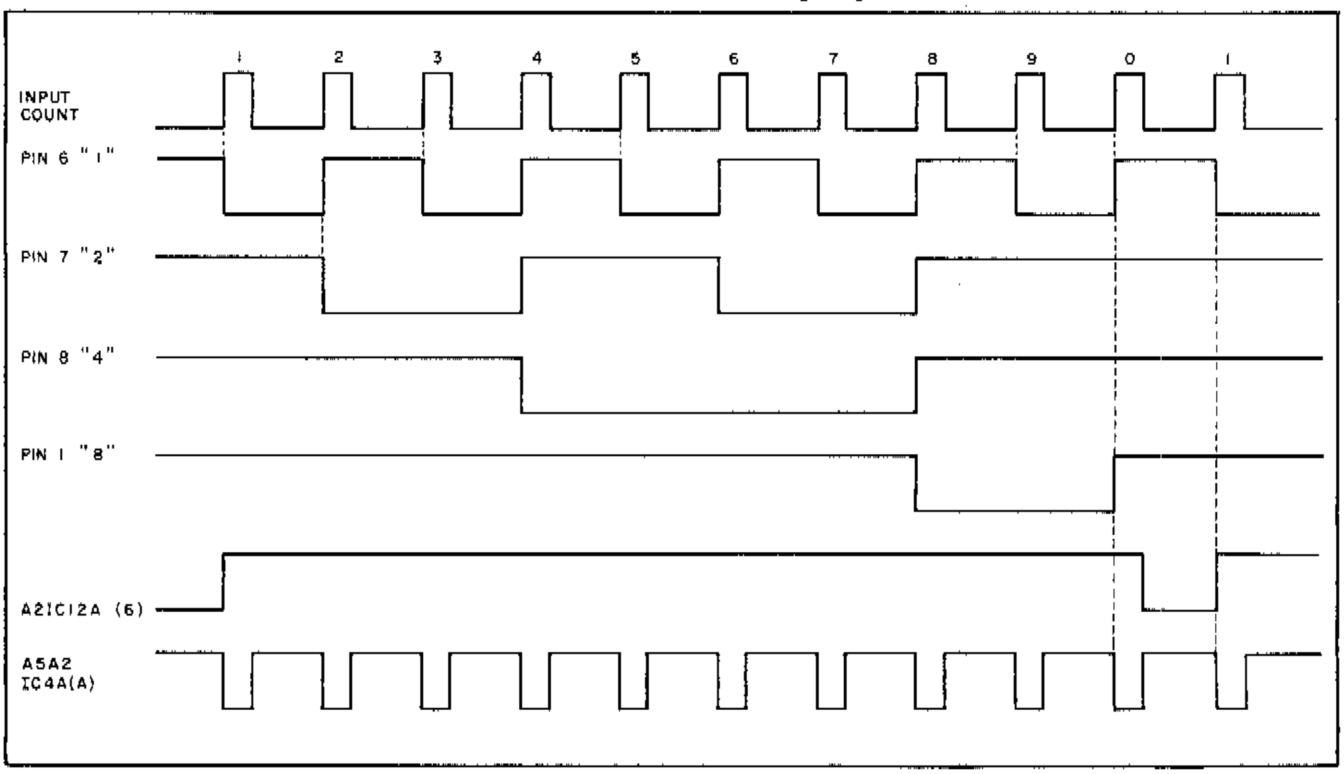
4-114. Master Clock Divider

4-115. The master clock divider is a six decade divider producing a negative, 100 msec, 1 PPS output. This master tick controls the preset clock divider 1 PPS output phase. Since all decades are identical, only A21IC6 (Figure 8-15) will be discussed. Figure 4-9 shows A2IC6 timing diagram.

4-116. Normally, decade dividers are allowed to fill until the count cycles to "0" at which time an output pulse is applied to the next decade. Thus, for each 10 inputs, 1 output pulse is applied to the next stage. However, this technique introduces error due to decade cycling time and decade temperature sensitivity. This error is accumulative through a divider chain and, with 6 decades, could amount to as much as 1 μsec. The technique used in the master clock divider reduces this error to less than 100 nanoseconds.

4-117. An "H" input pulse at A2IC6(5) is necessary for the decade to divide; therefore all count inputs to the inverter A2IC4A(1) must be "L". When the decade is at "0", voltage levels at pins 6, 7, 8, and 1 are "H" and output NAND gate A2IC12A(6) will be "L", applying a "L" count pulse to the following decade inverter. If any input signal to the NAND gate is "L", the following decade inverter will receive an "H" which will not count.

Figure 4-9. Decode-Divider Timing Diagram



4-118. 1 MHz "L" pulses are applied to A2IC4A(1), inverted and applied to the divider. As the count progresses within the IC, pins 6, 7, 8, and 1 will change from "H" to "L" at various counts shown in Figure 4-9. When the tenth count pulse is applied to A2IC6(5), the divider cycles to "0", A2IC6(6, 7, 8, and 1) place an "H" at A2IC12A(1, 2, 4, 5). However A2IC12A(6) is still "H" because the same pulse cycling the decade to "0" places an "L" through A2CR6 to the NAND gate, holding it closed. When this pulse goes "H", the NAND gate applies an "L" to the following decade input inverter as a count pulse. This state will remain until the next "L" count pulse, "1", is applied to A2IC4A(1). A2IC12A(3) goes "L", closes the gate and ends the "L" input to the following decade input inverter. Since the actual output pulse was not processed through the decade, delay due to the decade is eliminated.

4-119. This process is repeated through the five remaining decades with the final output master tick, 1 PPS, 100 msec, negative pulse applied to the following preset clock divider and associated circuits.

4-120. Reset and Preset One-Shot Circuits

4-121. Figures 4-10 and 4-11 show typical timing for Digital Divider Assembly A5. The 1 PPS master clock tick triggers reset one-shot A3IC15 producing complementary 1.3 μsec pulses at pins 7 and 10. The "L" signal at pin 7 drives reset amplifiers A3Q7, Q9, Q11, and decade control NOR gate A3IC17B. This resets A3IC3, IC4, IC5, IC6, IC7, and IC8 to "0". During the decade reset time, A3IC17B(7) output holds all decade input NAND gates closed to any input count. Each time the reset one-shot is triggered a 1.3 μsec "H" signal is also placed at NAND gate A3IC12B(10).

4-122. When the 1.3 μsec pulse at A3IC15(10) goes "L", it triggers preset one-shot A3IC16. The output at pin 10 is inverted by A3Q8, A3Q10, and A3Q12 applying a 0.5 μsec "L" preset pulse into the thumbwheel switch to preset the desired time delay into the preset clock. The same signal at A3IC16(10) causes NOR gate A3IC17B(7) to remain "L" an additional 0.5 μsec which holds the decade input NAND gates closed to any input count. The preset clock decades are now reset and preset.

4-123. Preset Clock Dividers

4-124. Six adjustable decade dividers make up the preset clock divider. The dividing scheme allows division by any integer between 1 and 10^6 by simply setting TIME DELAY thumbwheel switch S1A through S1F. This adjusts the divider output phase from 1 μsec to 1 sec. The phase adjustable output pulse is a 1 PPS, 1 μsec, "L" signal sensed at 9's detector NAND gate A3IC12A(6), applied to inverter A3Q6 and gate-around one-shot A3IC13(9). Figures 4-10 and 4-11 are typical timing diagrams. Figure 4-13 shows preset clock decade A3IC3 and associated components.

4-125. The standard decade divider provides one output pulse for each 10 input pulses. Preset divider A3IC3 provides an output pulse through NAND gate A3IC9A to 9's detector A3IC12A(5) and to the following decade when the preset count and input count total "9" (input to following stage occurs at "8" and continues through "9"). Figure 4-12 shows a standard decade counting diagram such as A3IC3.

4-126. When the decade count is "0", all binary outputs are "H" but as the count progresses, levels at pins 6, 7, 8, and 1 change state depending on the number of pulses into the decade. At the count of "9" pins 1 and 6 are "L" (representing "9") and pins 7 and 8 are "H". The next input pulse "10" will cycle the decade to "0" and the count begins again.

4-127. To change the decade to a divide by 2 divider; when the decade state is "0" (pins 6, 7, 8, 1 "H") and before any input signal is applied to pin 5, pulses are applied to pins 6, 7, and 8 driving them "L". The decade state is "7" before any input signal is applied. The first 2 input pulses cause pins 6 and 1 to go "L" and a "9" is sensed at the output IC9A(3, 5). Thus with only two inputs there is an output or divide by 2 action.

4-128. The preset clock divider chain may be set to divide by any integer from 1 to 10^6 by setting the complement 9 into the decades prior to the counting sequence. This is done automatically by TIME DELAY thumbwheel switch S1A through F. Whatever time delay is set on the switch, the complement "9" is set into the preset clock dividers prior to counting.

4-129. Assume a 1 μsec delay is set on the thumbwheel switch; this presets 999998 into the dividers (switch setting is 000001). Figure 4-10 shows the timing diagram for this switch setting. When the master clock has completed its counting sequence, the master tick output triggers the reset and preset circuits in the preset divider section. During reset and preset time, preset divider decade inputs are held closed. During preset time, 999998 is set into the decades via the thumbwheel switch and "H" signals are preset at A3IC12A(2, 3, 1, 4). However, this gate will not change state since an "L" is present from A3IC9A(6) (this decade has the count of "8"). The first decade receives the first count pulse causing A3IC9A(6) to go "H", which causes A3IC12A(6) to go "L" until the next input pulse to A3IC1A(13), 1 μsec later. The 1 μsec "L" signal is inverted by A3Q6 and applied as an "H" to NAND gate A3IC2C(2). The next gated 1 MHz output pulse from A2IC2 will also place an "H" at A3IC2(1). This causes the gate to change state and apply an "H" signal through NOR gate A3IC2D to 1 μsec variable delay mv A4IC1(9).

4-130. If a delay of 2 μsec is desired, the sequence of events is the same except 999997 would be the preset input information. Instead of the first pulse into A3IC3(5) causing A3IC12A to change state, the second pulse causes the state change; thus the pulse applied to 1 μsec variable delay mv is changed in phase by an additional microsecond. This same sequence of events occurs for all switch settings except 999999.

4-131. When 999999 (Figure 4-11) is set on the thumbwheel switch, no preset information is set into the dividers and they divide by 10^6. When this occurs, the preset divider and master clock are dividing by the same number. The dividers reach a count of 999999 and a small pulse is produced at IC12A(6). This pulse triggers gate-around one-shot A3IC13, producing an "H" 1.1 μsec pulse applied to A3IC12B(12). When the master tick goes "L", A3IC12A(6) goes "H", and the reset one-shot is triggered. This places another "H" at NAND gate A3IC12B(10). With 2 "H" 's present, the next gated 1 MHz pulse will gate through this NAND gate, providing an input pulse to 1 μsec variable delay mv A4IC1(9) through NOR gate A3IC2D.

Figure 4-10. Timing Diagram Thumbwheel Switch Set 000001 & 000002

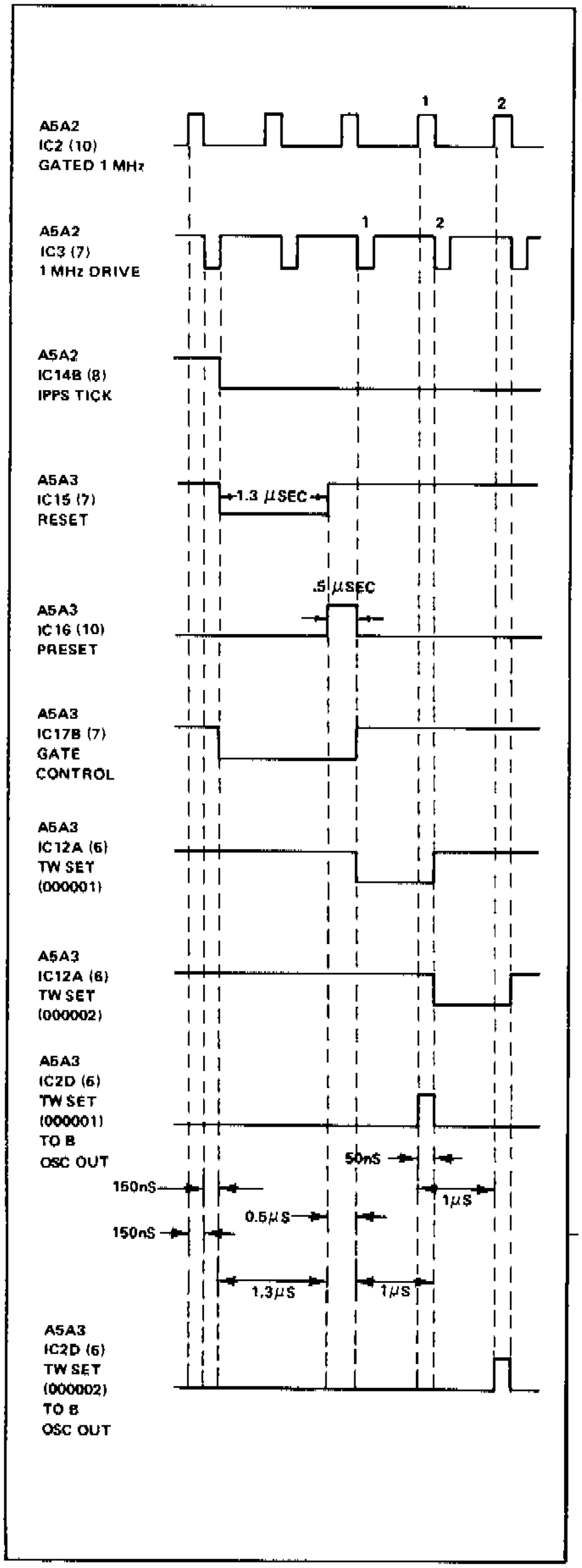


Figure 4-11. Timing Diagram Thumbwheel Switch Set 999999

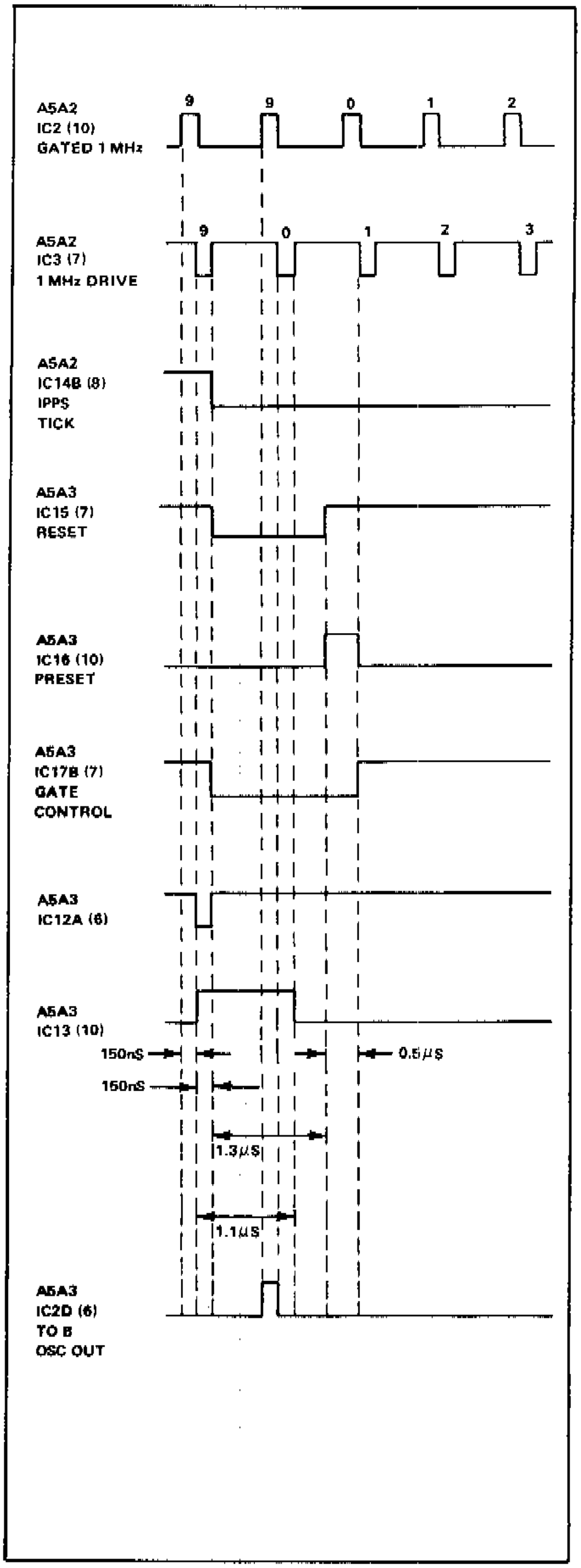
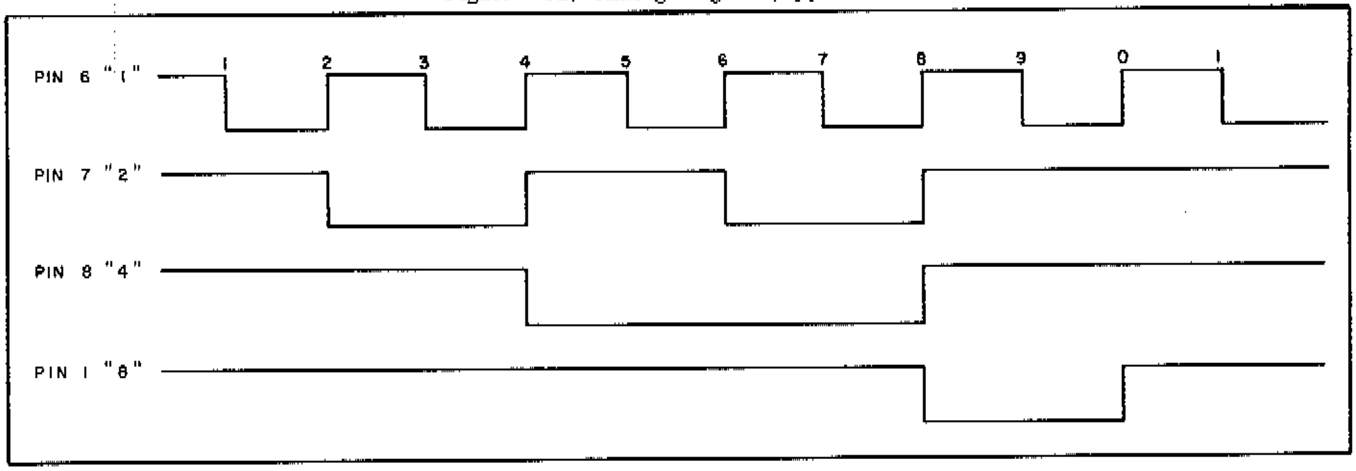


Figure 4-12. Timing Diagram (Typical IC Decade)



4-132. The output pulse is also applied to inverter A3Q13, amplified by A3Q15, and applied to clock movement flip-flop A1IC1. This flip-flop drives amplifiers A1Q11 and Q12 which in turn drive the clock movement. When STOP pushbutton is depressed, A3Q15 collector is grounded. This stops the clock. When FAST pushbutton is depressed, the input pulses to final preset divider A3IC8(5) are applied through S1 to A3Q14. These pulses are 10 times faster than the 1 PPS clock drive and cause the mechanical clock to increase its speed by 10.

4-133. Digital Divider Assembly A5 can be synchronized to an external pulse by pressing SYNC pushbutton S2. This allows the external pulse to trigger sync one-shot A2IC1, resetting the master clock to "0" and holding the input to 1 MHz gated one-shot 1 M.V. for 7.3 microseconds. At the end of the 7.3 μsec period the counting sequence will start. Resistor A2R16 and capacitor A2C10 are adjusted for the 7.3 μsec period.

4-134. Output Circuits

4-135. The phase adjustable 1 PPS output pulse at A3IC2D(6) is applied to variable delay one-shot A4IC1(9). The output, A4IC1(10), is adjustable from 0 to 1 μsec by A4C2 TIME DELAY adjustment. The circuit output is applied through A1C12 and A1CR15 to output tick blocking oscillator A1Q7. The blocking oscillator output is applied through emitter followers A1Q9-Q10 to front and rear panel 1 PPS BNC output jacks. This output is a 1 PPS, 20 μsec, +10V pulse.

4-136. Inverter Power Supply

4-137. The power inverter supplies the low voltage, high current required to operate the integrated circuits in Digital Divider Assembly A5. The power supply has +4.2 Vdc and +13.3 Vdc supplies. Transistors A1Q1 and A1Q2 provide a 2 kHz pulse input through A1T1 to the two supplies.

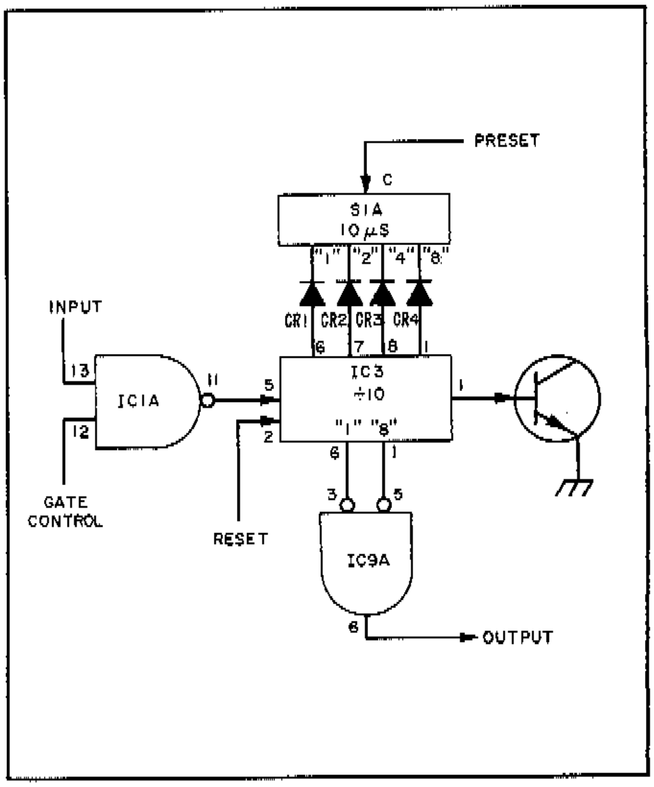
4-138. +4.2 Vdc Supply

4-139. Diodes A1CR2-CR3 and capacitor A1C6 are a full wave rectifier and filter. The unregulated voltage is applied to series regulator A1Q5. Differential amplifier A1Q4 and A1Q6 sense line variations controlling driver A1Q3. Differential amplifier reference is applied from the +13.3 volt supply. Potentiometer A1R3 adjusts the +4.2 Vdc level. Capacitors A1C17-C18 provide additional filtering.

4-140. +13.3 Vdc Supply

4-141. Diodes A1CR4, CR5, CR6, and CR7 are a full wave bridge rectifier. Components A1C7, A1C9, A1C11, A1R4, and A1R9 are the supply filter. Breakdown diode regulates the +13.3 volt supply. Components A1C13, A1C16, A1R11, and A1L2 prevent output tick blocking oscillator pulses from feeding back into the supply.

Figure 4-13. Preset Divider



4-142. FREQUENCY DIVIDER ASSEMBLY A6

4-143. General

4-144. Frequency Divider Assembly A6, Figure 8-17, is a regenerative divider, supplying front and rear-panel output jacks with 1 MHz and 100 kHz signals. Divider start selection is by front-panel DIVIDER MODE switch. Two positions may be selected, AUTO START or START. DIVIDER MODE switch is a momentary on-off-on type. The switch is spring loaded in the START position and returns to off when released. If the dividers stop, they will not re-start unless DIVIDER MODE switch is set to AUTO START or momentarily set to START. When the 5061A is used for time keeping, START position is normally used.

4-145. Two divider circuits make up Frequency Divider Assembly A6. The 1 MHz divider supplies 1 MHz to the 100 kHz divider, 1 MHz to front and rear-panel output jacks, and to Digital Divider Assembly A5 (Option 001). The 100 kHz divider provides 100 kHz to front and rear-panel 100 kHz output jacks. Both divider circuits provide output level indications to front-panel CIRCUIT CHECK meter M1.

4-146. 1 MHz Divider

4-147. The 1 MHz divider is a regenerative divide-by-5 circuit followed by an amplifier stage. This assembly includes signal-sensing logic circuitry to control the divider-start circuits. Assume the 5 MHz signal from A10 Oscillator Assembly is present at the divider circuit input, but the 1 MHz output has not started. Producing the 1 MHz output requires a 1 MHz signal at the base of X4 Multiplier Q4 (this 1 MHz signal is derived from the output signal once the divider starts). Prior to divider start, the required 1 MHz signal is obtained by converting the tuned-amplifier circuit of Q6 into a 1 MHz oscillator by feeding a signal from its output back to its input through field-effect transistor Q5.

4-148. The 5 MHz signal input to A6 is amplified by Q1. Capacitive voltage divider C5, C6 couples a portion of Q1 output to the start-circuit detector stage of CR1, CR2, Q2, and Q3. With the START/AUTO-START switch completing a signal path to Q5 base with this switch in either position, the detector stage biases Q5 "on" to complete the feedback path for Q6 which then oscillates at 1 MHz.

4-149. Multiplier stage Q4 converts 1 MHz at its base to 4 MHz in its tuned collector circuit. The resulting 4 MHz mixes with the input 5 MHz from T1 in mixing diode CR4. The parallel resonance of L2 and C11 tuned to 1 MHz, traps all undesired frequencies in the mixing product. The remaining 1 MHz couples to Q6 to complete the regenerative feedback path. Sustained regenerative oscillation produces 1 MHz which is amplified by Q8 and Q9. This 1 MHz output is also rectified by CR7 and filtered by C28, R35, and C29 for a dc output to the 1 MHz position of the CIRCUIT CHECK meter.

4-150. The 1 MHz output also couples to the start-circuit detector stage of CR5, CR6, and Q7 which sends a dc start signal to start amplifier Q3 for automatic start action with the START/AUTO START switch at AUTO START.

4-151. 100 kHz Divider

4-152. The 100 kHz divider consists of a tuned 1 MHz input amplifier Q10, an integrated circuit decade-divider IC1 and a tuned output amplifier. Low pass filters and traps are used to shape the I.C. divider output and to reduce harmonic distortion. The filtered signal drives a tuned amplifier which provides the 1 Vrms sine-wave output. The 1 MHz input signal from A6(Q6) is amplified by Q10 and saturating transistor amplifier Q13. Decade divider IC1 provides a symmetric 100 kHz square wave at IC1(12).

4-153. The divided output is amplified by Q14, Q15, and Q16 and is available as the 100 kHz output to J2 and J4. A portion of this output is rectified by CR9, filtered by C46, R60, and displayed on front-panel meter at the 100 kHz position. The 1 MHz input signal is also coupled through emitter-follower Q11 and provides the 1 MHz signal to A5 Digital Divider.

4-154. AC AMPLIFIER ASSEMBLY A7

4-155. AC Amplifier Assembly A7, Figure 8-18, is a low noise, narrow-band, high-gain amplifier. This amplifier receives a low-level signal from cesium beam tube electron multiplier and provides an ac voltage, proportional to the amplitude and phase of the input, to Phase Detector Assembly A8. The input signal contains a large 274 Hz second harmonic and small 137 Hz fundamental signal. This signal is separated, amplified and the ac fundamental is applied to Phase Detector Assembly A8. The high level second harmonic is sent to Logic Assembly A14 along with a fundamental sample. These logic circuit inputs are two of the signals controlling front panel CONTINUOUS OPERATION and ALARM lights. The amplifier circuits also contain a differential amplifier that controls current through front panel CIRCUIT CHECK meter when monitoring BEAM I.

4-156. The input signal from Cesium Beam Tube Assembly A12 is applied through J1 and noise filter C1-R1. Transistors Q1, Q2, and Q3 are a low-noise amplifier with negative feedback for gain stability. Both fundamental and second harmonic signals are amplified. Diodes CR1-CR2 are forward biased providing coupling between amplifier stages. The R1-C2 network stabilizes the amplifier at high frequencies. Negative feedback through R12, R3, or R12, R4 stabilizes the amplifier gain. HI-LO GAIN switch A7S1 selects R3 or R4 in the feedback loop extending the range of LOOP GAIN control R17. This improves the amplifier input signal level dynamic range.

4-157. The signal developed across R17 is coupled through C6 to emitter follower Q7. The signal at Q7 emitter is divided. One signal is amplified by Q8 and applied through J3 to Logic Assembly A14. Test output jack J2 is a monitor point for the signal applied to the logic circuits. Capacitors C9 and C11 provide additional noise filtering. The other signal is applied to twin-T-filter C7, C8, C10, R25, R27, and R28. This filter, turned to 274 Hz, greatly reduces second harmonic content applied to emitter follower Q9. Transistor Q9 matches impedance between the twin-T-filter and amplifier Q10. The 137 Hz signal is amplified by Q10 and again filtered through C12, C14, C15, R35, R36; then applied to Q11, Q12, and Q13. These amplifiers provide additional gain and, with the twin-T-filter/feedback loop, operate as a narrow-band tuned amplifier. Twin-T-filter C20, C22, C23, R47, R49, and R50 offer maximum attenuation to 137 Hz. Therefore, the negative feedback signal at Q14 emitter is minimum and amplifier Q11-Q13 gain is maximum at this frequency.

4-158. The two RC networks R37-C16 and R40-C18, stabilize amplifier gain at higher frequencies. Breakdown diodes CR3 and CR4 establish the operating point for Q11-Q13. The 137 Hz at Q13 collector is applied through J4 to Phase Detector Assembly A8, through J5 to Logic Assembly A14, and to Test Output J6.

4-159. Beam current differential amplifier provides current through CIRCUIT CHECK meter M1 when the CIRCUIT CHECK switch is set to BEAM I. Transistors Q4A and Q4B establish a zero "no signal applied" condition to Q5-Q6 bases. With no signal applied the current through R16 and R20 will be equal and CIRCUIT CHECK meter M1 will indicate zero. When an input signal is applied to the differential amplifier the balanced condition is upset causing the CIRCUIT CHECK meter to indicate the current difference through R16 and R20. This current difference is dependent on the signal applied to Q4; hence, proportional to the beam current.

4-160. PHASE DETECTOR ASSEMBLY A8

4-161. Figure 4-14 is a simplified block diagram of Phase Detector Assembly A8. This assembly contains the modulation reference oscillator and 137 Hz phase detector.

4-162. The reference oscillator is a Wien bridge oscillator producing a 274 Hz sine wave output. This signal is shaped in a Schmitt trigger for driving a frequency divider. The frequency divider output is a 137 Hz square wave applied to a phase shifter, phase detector, and sweep amplifier. The phase shifter filters the square wave and provides a 137 Hz, spectrally pure, signal to Multiplier Assembly A3 to modulate the 5 MHz quartz oscillator signal.

4-163. The phase detector produces a dc voltage proportional to the error signal received from AC Amplifier Assembly A7. This dc voltage is applied to Operational Amplifier A9. The sweep amplifier provides a triangular 137 Hz signal for test purposes. Reference oscillator Q1, Q2, Q3 is a Wien bridge oscillator which operates at 274 Hz. The frequency is determined by C1, C3, R4, R7, and R10 with R10 providing a fine frequency adjustment. These components complete the positive feedback loop from Q3 to Q1 to maintain oscillation. A second feedback loop through CR1, CR2, R5, R6, and C2 provides negative feedback for amplitude limiting.

4-164. The 274 Hz signal at Q3 emitter is fed to a Schmitt trigger circuit Q4, Q5, and associated components. This circuit is a shaping circuit with very fast rise and fall times. Capacitor C7 bypasses R14 to couple fast voltage changes from Q4 collector to Q5 base. Either Q4 or Q5 conducts depending on the input signal. When Q5 conducts, the negative-going transition at its collector is supplied to the frequency divider (÷2) circuit. The network composed of C8, CR3, C11, R19, and R21 ensures that only negative pulses are fed to the frequency divider.

4-165. Frequency divider Q6-Q7 is a binary divider producing an output pulse after receiving two similar input pulses from Q5. A negative pulse from Q5 is applied to Q6-Q7 bases simultaneously through gating diodes CR4 and CR5. This negative pulse turns off a conducting transistor. Capacitor C13 provides filtering for Q6-Q7 emitters and R26 establishes a small voltage at the common emitter junction to ensure that one of the two transistors is cut off.

4-166. The phase shift network includes Q8, Q9, and associated components, and allows phase adjustment of the 137 Hz sine wave. This phase shift is necessary to establish the correct relationship between the modulating 137 Hz and the 137 Hz reference sent to the phase detector. Phase Adj control R42 provides the phase adjustment. Because the signals driving transistors Q8 and Q9 are symmetrical square waves, second harmonic content is very low (zero for perfect symmetry). Components R48, C24, R50 and C25 provide low pass filtering. The signal output at J5 is a 137 Hz sine wave with second harmonic distortion at least 80 dB below the signal level.

4-167. Phase detector Q13A-B and associated components receive the 137 Hz reference square wave through Q10 and Q11, the error signal from AC Amplifier Assembly A7, and supplies a dc error signal to Operational Amplifier Assembly A9. Emitter followers Q10-Q11 drive the phase detector and also provide a 137 Hz square wave to Logic Assembly A14. Transistors Q13A-Q13B are alternately turned on and off by the 137 Hz reference square wave. The ac error signal is applied through C27 to T1 secondary. A signal results at T1 center tap which represents the phase and amplitude of the error signal. This resulting signal is filtered by R54 and C29 to provide the output dc error signal to Operational Amplifier Assembly A9. Potentiometer R39 is a dc balance adjustment.

4-168. The square wave signal at Q11 emitter is amplified by Q12. Capacitor C19 provides an integrating action and a triangular 137 Hz wave results at sweep test output J2. This signal is useful for checking phase detector operation and as an oscilloscope sync signal.

4-169. OPERATIONAL AMPLIFIER ASSEMBLY A9

4-170. Figure 8-20 shows the schematic diagram and component locator for Operational Amplifier A9. The amplifier, in conjunction with external feedback capacitors C2 and C3 (see Figure 8-2), forms an integrator circuit. A9 receives dc error voltages from Phase Detector A8 and supplies a dc control voltage to tune the 5 MHz quartz oscillator.

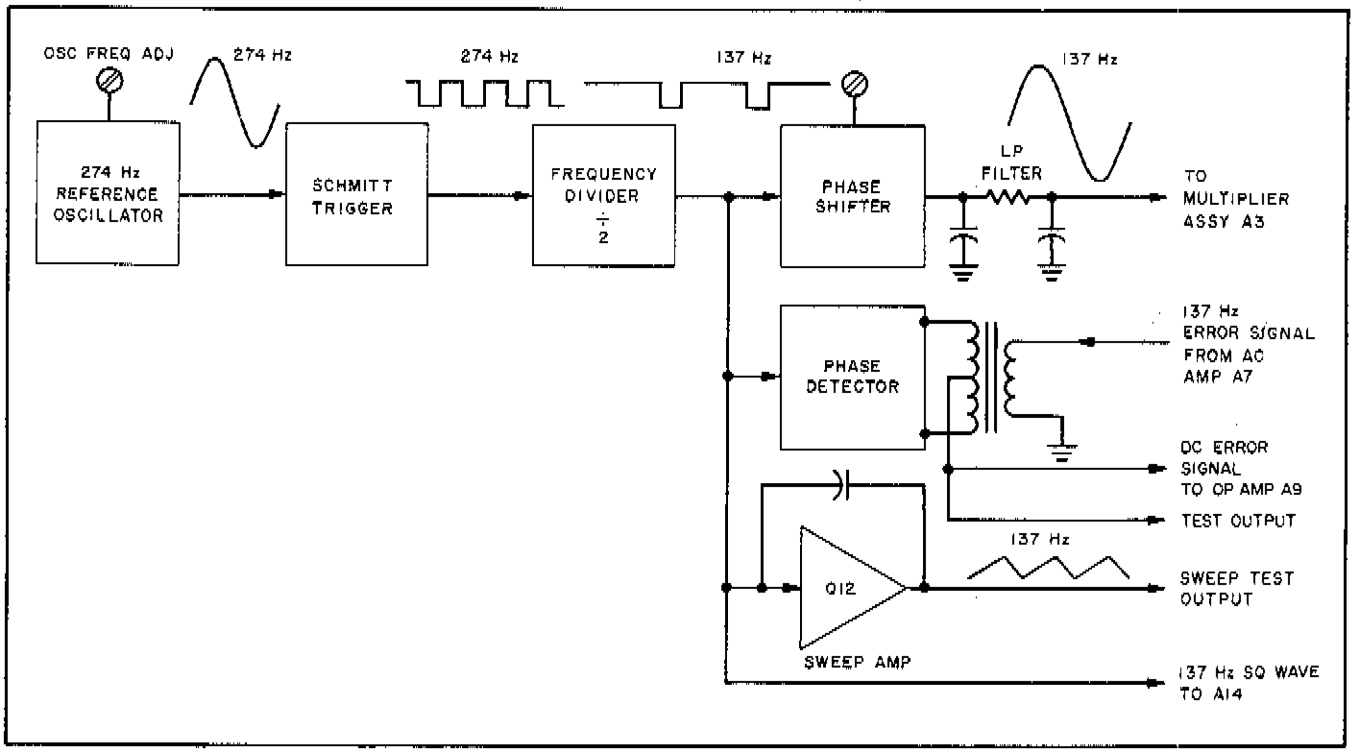
4-171. QUARTZ CRYSTAL OSCILLATOR ASSEMBLY A10

4-172. General

4-173. The voltage controlled 5 MHz signal is generated by the circuits in Quartz Oscillator Assembly A10 (Figure 8-21). This assembly is composed of 4 major sections:

1. Temperature control circuits (Figure 8-22)
2. 5 MHz quartz oscillator circuits (Figure 8-23)
3. Automatic gain control circuits (Figure 8-23)
4. Power amplifier circuits (Figure 8-24)

Figure 4-14. Phase Detector Block Diagram



4-174. The quartz oscillator generates the 5 MHz signal. The AGC amplifier provides feedback to stabilize oscillator crystal current. Power amplifier circuits and a crystal filter isolate the quartz oscillator from external variations and supply the buffered 5 MHz to Frequency Divider Assembly A6 and Multiplier Assembly A3. Oven control circuits maintain the factory set temperature through proportional control of the internal heater.

4-175. The oven temperature is set at the factory to operate the crystal at a temperature where changes in crystal temperature have the smallest effect on oscillator frequency. Placing the quartz oscillator and AGC components inside the oven further improves the oscillator temperature– vs – frequency stability. Shielding and decoupling networks in all leads, except the 5 MHz output, reduce the Radio Frequency Interference radiated or received by the oscillator assembly. The assembly is sealed at the factory; the only adjustments accessible are the front panel OSC FREQUENCY COARSE, OSC FREQUENCY X10^{-10}, and 5 MHz FILTER controls.

4-176. Temperature Control Circuits

4-177. PROPORTIONAL CONTROL. Two heaters maintain oven temperature: HR1, which is proportionally controlled to provide continuous oven temperature control; and HR2, which is thermostatically controlled, and provides fast warm-up. The heater current in a proportional control circuit is a continuous function of oven temperature. The heater current in a thermostat control circuit is either "on" or "off", depending on oven temperature setting. Both control circuits contain a thermal fuse to prevent damage to components within the oven, if the assembly overheats.

NOTE

Reference designators in Paragraphs 4-178 to 4-186 are abbreviated; for complete reference designators, add prefix "A10" to reference designators used.

4-178. PROPORTIONAL TEMPERATURE CONTROL CIRCUIT. AC controller A1 is a Wien bridge oscillator with emitter follower and detector providing a dc signal voltage, proportional to oven temperature, for the dc controller. The Wien bridge oscillator frequency (about 3 kHz) is determined by a phase-shifting network in the bridge A1R1, A1R2, A1C1, and A1C2. The oscillator amplitude is determined by the degenerative feedback through A1R3, A1R4, and RT1 (inside the oven). Since thermistor RT1 is within the oven, Wien bridge oscillator output level is determined by the oven temperature. The thermistor has a negative temperature coefficient so a decrease in oven temperature causes thermistor resistance to increase, increasing oscillator amplitude. Diodes A1CR1, A1CR2, and capacitor A1C10 translate this to a negative dc level applied to dc controller A3.

4-179. DC controller A3Q2, A3Q3, A3Q4, and associated components receives the dc signal (proportional to Wien bridge oscillator amplitude) from ac controller circuits and controls current through HR1. The HR1 heater current is controlled by A3Q4 which is driven through A3Q3 by amplifier A3Q2. Diodes A3CR1 and A3CR2 develop 1.2 volts. The voltage across A3R8 depends on heater current through it, and is added to the voltage across the diodes. This forms a degenerative bias signal for A3Q2. Thus, an increase in current through A3R8 increases A3Q2 current decreases A3Q4 current and decreases current through A3R8 and HR1.

4-180. 5 MHz Oscillator and AGC Circuits

4-181. GENERAL. The 5 MHz signal is generated by an electrically controlled quartz crystal oscillator within the oven. An AGC circuit, also in the oven, provides some amplification for the 5 MHz signal and AGC to prevent crystal mechanical vibrations from causing damage. The oscillator frequency is coarse-tuned by A2A1C7 (front panel OSC FREQUENCY COARSE), and fine-tuned by front panel OSC FREQUENCY X10^{-10} control (R3). The oscillator is electrically tuned by Operational Amplifier Assembly A9 integrated output applied to the -EFC side of varactor A2A1CR1. This electrical tuning is present when front panel MODE switch is set to OPER. The frequency response of the crystal filter in the power amplifier circuit A3 can be tuned by Adjusting A3C10 (front panel 5 MHz CRYSTAL FILTER).

CAUTION

Quartz Oscillator Assembly A10 adjustments OSC FREQUENCY COARSE, OSC FREQUENCY X10^{-10}, and 5 MHz CRYSTAL FILTER are the only adjustments that can be made in the field.

4-182. Oscillator transistor A2A1Q1 drives resonant circuit A2A1L2, A2A1C6, A2A1C7, A2A1C9, and A2A1CR1. Oscillator feedback is through A2A1C10, A2A1C11, A2A1C12, and A2A1L3 to A2A1Q1 base. Capacitor A2A1C8 is an ac ground return at 5 MHz. Base bias for oscillator transistor A2A1Q1 is controlled by the AGC circuit in A2A2; as the oscillator output level increases, the AGC circuit decreases A2A1Q1 base bias, and decreases oscillator output amplitude. Varactor A2A1CR1 capacitance decreases as the reverse-biasing voltage across it increases. This technique controls 5 MHz oscillator with Operational Amplifier Assembly A9 integrated output voltage. Oscillator frequency increases as the reverse-biasing voltage increases.

4-183. The AGC assembly contains two tuned amplifiers, the AGC circuit, and the reference sources for the +6 volt supply for A2A1Q1 and +15 volts for OSC FREQUENCY X10^{-10} control R3. The open-loop gain of tuned amplifier A2A2Q1 is adjusted by A2A2R3; the closed-loop gain is determined by A2A2R9 and A2A2R10. The amplifier output is in phase with its inputs, and drives the tuned amplifier and AGC circuit A2A2Q2. One secondary winding A2A2T2 provides an output signal that is in phase with the input signal from the oscillator; this signal is fed back to A2A2Q1 emitter for gain stabilization of the amplifier pairs, to A2A2Q2 base for neutralization, and through A2A2C13 to the AGC detector circuit. The AGC signal is a dc voltage, proportional to the output level of A2A2T2; it is subtracted from the bias established by A2A2R11 and A2A2R12 to provide the dc bias voltage that controls the gain of oscillator A2A1Q1 to decrease the base bias as the sensed output level increases.

4-184. A10A3 POWER AMPLIFIER

4-185. The A10A3 assembly contains the 5 MHz output amplifiers and the dc controller circuit which supplies dc current for the oscillator oven heater. For a discussion of the dc controller, see "proportional Control Circuit" Paragraph 4-176. 5 MHz from A2A2 couples through A3C1 to buffer amplifier A3Q1. Selected resistor A3R9 sets A3Q1 gain for the correct output at J4 (factor adjustment). This stage feeds adjustable crystal filter network of A3Y1 A3R12, A3C9, 5 MHz crystal filter adjustment A3C10, A3C11, A3C6, and A3C8. Capacitor A3C6 and A3C8 provide ac voltage division for the 5 MHz output to the A4 Frequency Divider Assembly.

4-186. Emitter follower A3Q5 couples the filter network to output amplifier A3Q6. The gain of A3Q6 stage is adjusted by A3R19 and collector resonance is tuned with A3C12. Output transformer A3T1 feeds A10J3. Supply voltage filtering is supplied by A3L1 and A3C5 for A3Q1 and by A3R11 and A3C15 for A3Q5 and A3Q6. Additional RF decoupling for A3Q1 is supplied by A3R5 and A3C3.

4-187. CESIUM OVEN CONTROLLER A11

4-188. General

4-189. Cesium Oven Controller A11 includes a temperature controller for the cesium oven in the cesium beam tube and four voltage supply sections. The controller provides power to heat the Cesium 133 in the beam tube. The voltage sections provide +16 and −16 volts to Operational Amplifier Assembly A9, a square wave to the cesium beam tube hot wire ionizer, and −10 Vdc to AC Amplifier Assembly A7. The 300 Vdc section connects to A9J2, but the voltage is not used.

4-190. Outputs

4-191. GENERAL. Transistors Q2, Q3, transformer T1, and associated components are a 2 kHz multivibrator which magnetically couples square waves through T1 to voltage supply sections and to the cesium oven control circuit. These square waves are isolated from the +17.9 volt supply by C1 and L1. Capacitor C19 suppresses switching transients in T1 primary.

4-192. 16 VOLT SUPPLY. Diodes CR4 through CR7 rectify the square wave from T1 secondary. Resistors R18-R19 and capacitors C14-C15 provide RC filtering for the plus and minus 16 volt supply.

4-193. −10 VOLT SUPPLY. Breakdown diode CR13 and capacitor C20 establish −10 Vdc supply for AC Amplifier Assembly A7.

4-194. HOT WIRE IONIZER SUPPLY. Power to heat the hot wire ionizer is supplied from T1 secondary. These secondary terminals may be connected in various ways, depending upon the hot wire ionizer voltage required for each cesium beam tube. The proper hot wire ionizer taps are indicated on the decal label with each beam tube. Since only heating power is required, the square wave from T1 is applied without rectification to the hot wire ionizer. Potentiometer R27, with R22 and R23, provides an adjustment for changing hot wire ionizer potential. This adjusts a mass spectrometer inside the beam tube. Capacitor C17 prevents variations in the +17.9 V supply from modulating the mass spectrometer voltage.

4-195. 300 VOLT SUPPLY. Full-wave rectifier CR8 through CR11 generates 300 volts which is connected to Operational Amplifier Assembly A9J2, but is not used. The output is filtered by C16 and R20.

4-196. CESIUM OVEN SUPPLY. The oven inside the cesium beam tube must be heated to cause emission of cesium atoms. Power to heat the oven is supplied from the +25 to 33 volt dc input through transistor switches Q5, Q6, and magnetic amplifier T3. Transistors Q2 and Q3 provide a square wave through T1 for alternately switching Q5 and Q6. A dc current, derived from control oscillator Q1 and Q4, controls magnetic amplifier T3. Current to the cesium oven heater is supplied from terminals 6 and 8 of auto-transformer T4.

4-197. Resistor R21A-B and cesium oven thermistor RT (in the oven) are two arms of an ac bridge. Transformer T2 secondary windings form the other bridge arms. The difference voltage across the bridge is applied in series with the emitter of Q1. Transistor Q1 output is amplified in Q4 and appears across T2 primary. This ac voltage is used for the bridge circuit completing the oscillator loop. Feedback to Q1 emitter is such that as the resistance of thermistor in the cesium oven decreases, the amplitude of the control oscillator output decreases. Capacitor C8 and transformer T1 determine the control oscillator frequency.

4-198. DC current through diodes CR2 and CR3 is determined by control oscillator amplitude which is determined by cesium oven thermistor resistance; hence by the oven temperature. Diodes CR3-CR4 rectify the oscillator output and R15, R16, C10, C11, and C12 filter the signal. This rectified and filtered signal is applied to magnetic amplifier transformer primary T3.

4-199. The magnetic amplifier primary is dc biased by the +25 to 33 volt input established across R17. This dc bias controls the constant current of the magnetic amplifier. Control amplifier dc output signal subtracts from this established bias to control the current through the magnetic amplifier. If the cesium oven increases in temperature, the oven thermistor resistance decreases. The control amplifier output decreases, causing an increase in current through the magnetic amplifier. The causes T4 current to decrease, decreasing heater current in the cesium beam tube. Thus, decreasing oven temperature. With the cesium oven at operating temperature, the oven controller circuit functions as a proportional controller, neither fully on nor off.

4-200. Resistor R24 is selected to set cesium oven operating temperature nearly 20°C below normal. This mode allows operation with reduced cesium beam tube flux (about 1/5) and extends beam tube life with slight reduction in short-term stability.

4-201. Diode CR12 with R25, and C18 provide dc voltage to CIRCUIT CHECK meter M1 for monitoring power to the cesium beam tube oven. This CIRCUIT CHECK meter voltage will fluctuate depending on the oven heating current.

4-202. CESIUM BEAM TUBE ASSEMBLY A12

NOTE

Cesium Beam Tube Assembly A12 is an expensive sealed unit and is not designed for repair. The instrument warranty is void if repair is attempted inside the tube. When it is definitely established that the beam tube is defective, notify the nearest Hewlett-Packard Sales and Service Office for repair or replacement. Refer to Paragraph 2-6 (Packaging for Shipment) for packing instructions.

4-203. General

4-204. The cesium beam tube acts as a passive resonator whose outstanding characteristics are an accurately defined resonant frequency and an extremely high Q. The beam tube is excited with a frequency modulated, microwave signal at the atomic transition frequency. This microwave signal is developed from the 5 MHz quartz oscillator frequency. The output signal from the cesium beam tube, when processed by the 5061A circuits, represents the frequency difference between the applied microwave signal and the atomic transition frequency. This processed signal is then used, in a feedback control loop, to stabilize the quartz oscillator frequency. The quartz oscillator frequency is therefore locked to the cesium resonant frequency.

4-205. Beam Tube Physics

4-206. Cesium beam tube resonator operation depends upon the energy transition between two hyperfine levels of the Cesium 133 atom. Energy levels, and transitions between levels, are determined by the fixed quantum mechanical selection rules (Figure 4-15). Atoms can occupy only certain discrete energy levels and transitions between energy levels occur by "jumps" predicted by quantum mechanical rules. Since energy transitions are precisely defined for the cesium atom, the frequency corresponding to these transitions is also precisely defined. The transition frequency of interest lies in the microwave region and is determined by the relationship $E = hf$, where E is the energy difference between states, h is Planck's constant, and f is the frequency. It is upon this frequency f, corresponding to a transition between two atomic states separated by E, that the 5061A frequency standard is based.

4-207. The cesium atom has a single valence electron. The quantum mechanical effects of interest lie in the electronic ground state of the atom and arise from the magnetic interaction of this electron-spin-dipole-moment and the nuclear-spin-dipole-moment. In the absence of external magnetic fields, the electron spin has two possible orientations with respect to the nuclear spin, giving two different energy levels. Upon application of an external magnetic field, the two states are split into additional levels corresponding to the possible orientation of the atom with respect to the external field. In the cesium beam tube resonator, a transition state is used which is least sensitive to environmental magnetic fields (Figure 4-15).

4-208. Cesium Beam Tube

4-209. The cesium beam tube schematic is shown in Figure 4-16. Cesium atoms effuse from the oven source and are formed into a beam by collimating slits. The beam passes through the inhomogeneous magnetic field of the first state selector "A" magnet. This magnet selects the desired state atoms for deflection into the interaction cavity. Within this cavity the selected atoms of cesium are acted upon by the injected microwave magnetic field derived from the 5 MHz quartz oscillator. If this injected microwave field frequency corresponds to the transition frequency of the cesium atom (9,192.631. . . MHz), the atom undergoes a quantum mechanical change which "flops" it into the desired state. Following the interaction within the resonant cavity, the beam passes through the second state selector "B" magnet. This "B" magnet separates the "flopped" atoms and deflects them on to a detector for conversion to a signal current.

4-210. The detector consists of a hot wire to ionize the impinging atoms. An electric field directs the cesium ions into a mass spectrometer which selects cesium ions by directing only cesium ions to the first dynode of an electron multiplier for amplification to a suitable output level. The output current as a function of injected microwave frequency is indicated in Figure 4-17. Beam current goes through a maximum when the frequency of the microwave field sweeps through the resonant frequency of the cesium transition. Width of the central peak and the distance between peaks are functions of the length of the interaction cavity and of the average velocity of the atoms. The line width of the 5061A beam tube output, measured between the peak and valley points is approximately 550 Hz for the standard instrument and 360 Hz for Option 004.

4-211. To ensure that only the desired transition contributes to the signal output, a small, uniform, steady-state magnetic field ("C" field) is maintained around the interaction cavity. This field is set to a value of 61 milligauss to precisely set the cesium resonant point. The complete system is enclosed in additional magnetic shields to reduce the effects of external environmental fields and closed off in a sealed package for evacuation. Continuous vacuum pumping maintains the very low pressure within the system to prevent beam scattering. Spent cesium is collected by getters.

4-212. Beam Tube Discrimination Action

4-213. The beam tube can be thought of as a frequency discriminator. During normal operation, input microwave frequency f_c will lie at the central point. Figure 4-18 shows one cycle of the resulting variation for three values of f_c, the carrier. With f_c centered at f_o the hyperfine transition frequency, the output beam current varies at twice the modulation frequency. If the carrier lies above f_o, as shown by the plot labelled f_{c1}, output current varies at the same rate as the modulation. When the carrier lines below f_o, case f_{c2}, output current varies at the modulation rate but is shifted by 180°. When the applied microwave signal is matched to the cesium resonant frequency, only the second harmonic component of the modulation signal appears in the beam current output. When the applied signal lies above or below this desired value, beam current output contains both fundamental and second harmonic modulation components. These components are used by the instrument to evaluate the correction necessary to tune the quartz oscillator to zero frequency error.

4-214. Beam Tube Test Input (LF Coil)

4-215. LF Coil test point TP2, located on Terminal Board Assembly A17, is connected to the coil within the beam tube. This test point permits introducing a low frequency signal into the beam tube causing low-frequency transitions in the absence of a microwave field. A 1K ohm resistor A17R8 is connected in series with the coil thus requiring a 1 V rms input signal to excite the low-frequency transitions.

4-216. The applied low frequency is dependent upon the "C" field within the beam tube. The "C" field value depends upon the frequency offset and time scale used. Therefore, the low frequency value also depends upon the frequency offset and time scale used.

4-217. When this frequency is applied to the beam tube via TP2, BEAM I indication on CIRCUIT CHECK meter M1 should be maximum if the beam tube is operating normally and MODE switch is set to LOOP OPEN or OPER.

4-218. BUFFER AMPLIFIER ASSEMBLY A13

4-219. Buffer amplifier circuits, Figure 8-26, receive the 5 MHz quartz oscillator signal from Multiplier Assembly A3 and provide 1 volt, 5 MHz signals to front and rear panel output jacks and 5 MHz to Synthesizer Assembly A1.

4-220. Transistors Q2, Q4, and associated components are one of the amplifier circuits. Resistors R2, R4, and R6 provide a 50-ohm input impedance for the 5 MHz. Resistor R4 is selected to set circuit overall gain. Breakdown diode CR1 establishes Q2 and Q4 operating point. Degeneration in Q2 and Q4 emitter circuits is provided by R15 and R21. The amplified Q2 output is coupled through C8 to Q4 base. Transformer T2 isolates the external circuit from buffer amplifier circuits and couples the 5 MHz signal to output jacks J3-J4. Capacitor C10 is factory selected to tune T2 to 5 MHz. A portion of the 5 MHz signal is rectified and filtered by CR2, R24, R25, C13, and C14 supplying the CIRCUIT CHECK meter when CIRCUIT CHECK switch is set to 5 MHz. Network L1-C1 decouple the +18.7 Vdc power supply.

4-221. Transistors Q1, Q3, and associated components are the other amplifier supplying 5 MHz to Synthesizer Assembly A1. This amplifier operation is similar to that previously described in Paragraph 4-220.

Figure 4-15. Energy Level Beam Tube

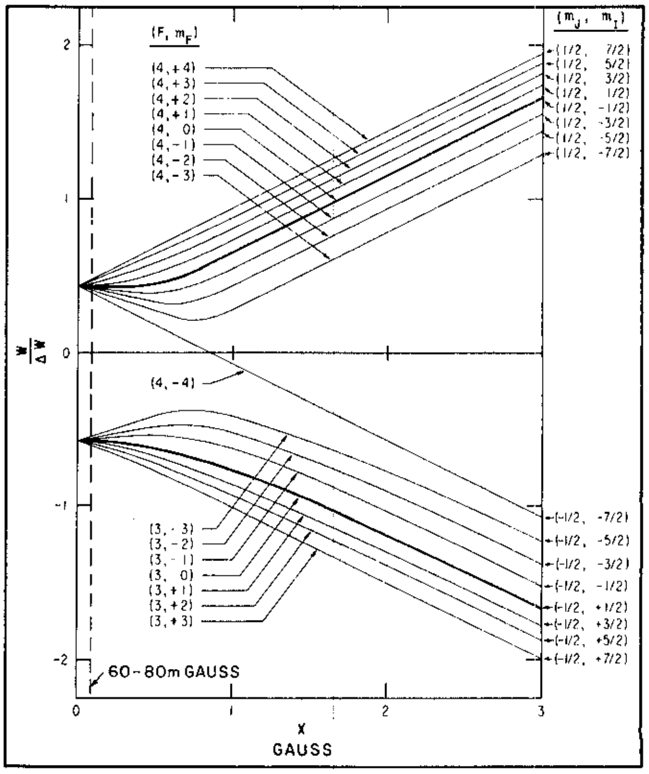


Figure 4-16. Beam Tube Schematic

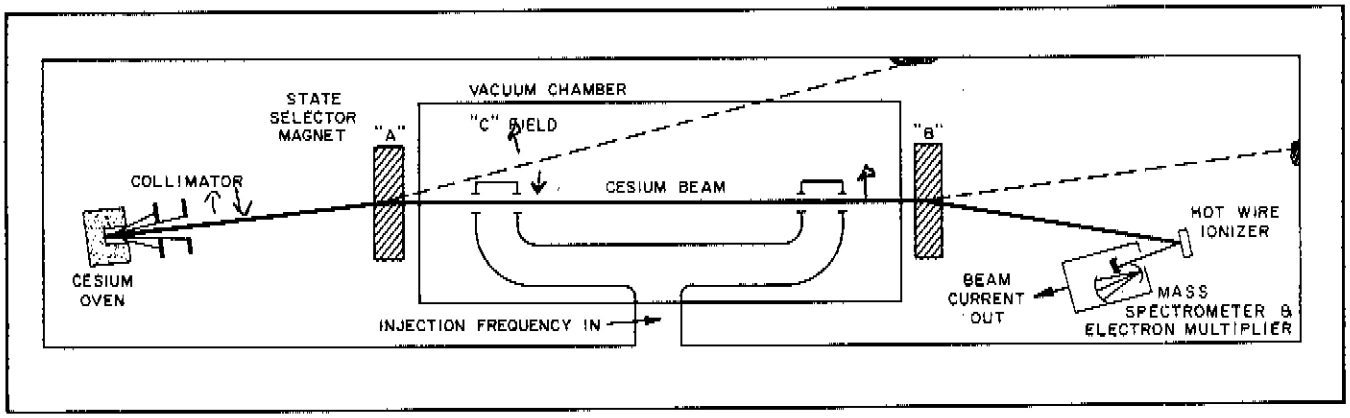


Figure 4-17. Beam Tube Output Current

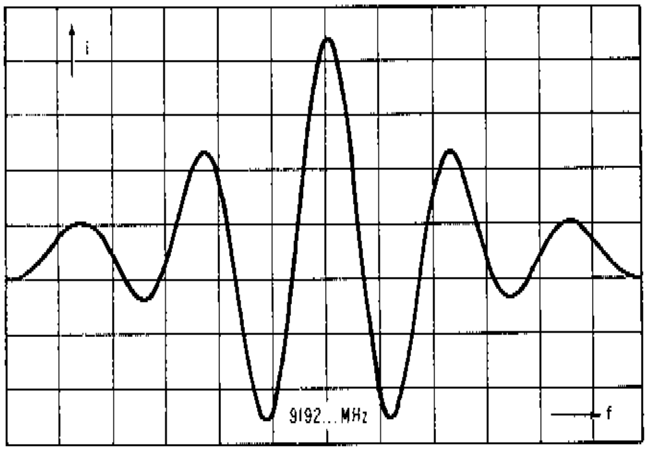
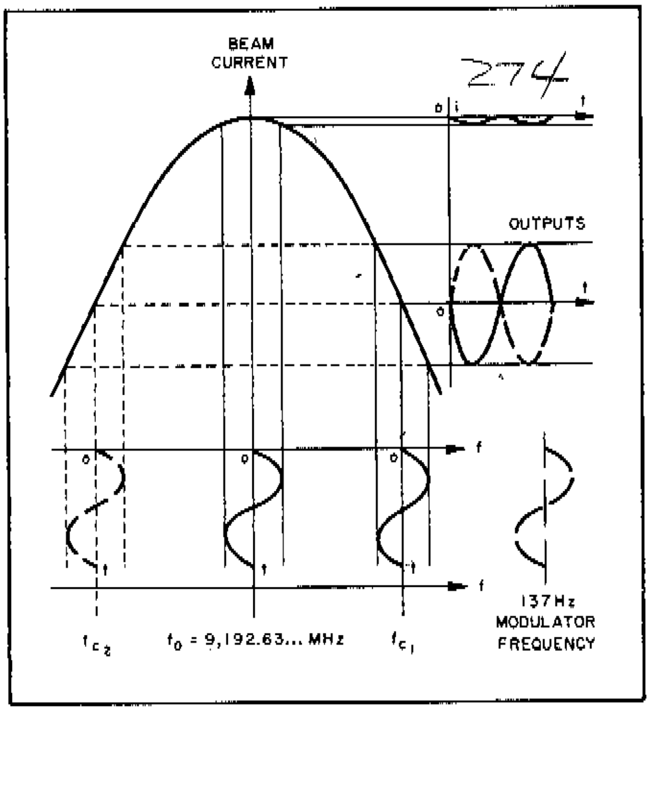


Figure 4-18. Discrimination Action Beam Tube



4-222. LOGIC ASSEMBLY A14

4-223. Logic Assembly A14, Figure 8-27, monitors various circuits and controls front panel CONTINUOUS OPERATION and ALARM lights. These two lights give a constant indication of instrument operation.

4-224. Figure 4-19 is a simplified block diagram of the logic circuits. Four input signals to the logic circuits determine front panel CONTINUOUS OPERATION and ALARM light on/off conditions: 1) 137 Hz from AC Amplifier Assembly A7, 2) 274 Hz from AC Amplifier Assembly A7, 3) dc voltage from Synthesizer Assembly A1, and 4) dc integrator voltage from Operational Amplifier Assembly A9.

4-225. The logic circuits are basically divided into two channels; 1) fundamental channel, and 2) second harmonic channel. Each channel has an OR gate controlling one front panel indicator light. Each OR gate has three inputs. One input to each OR gate is cross-coupled to the other so a signal on the cross-coupled input will operate both OR gates, thus control both front panel lights.

4-226. 2nd Harmonic Channel

4-227. During normal operation, all inputs to the OR gates are "L", causing CONTINUOUS OPERATION light to be on and ALARM light off. Only when the circuits being monitored fail, will "H" inputs be present at the OR gates. CONTINUOUS OPERATION light DS1 is controlled by silicon controlled switch SCR1 through Q23. Transistor Q23 is controlled by the OR gate through Q19. Any "H" input to the OR gate will turn Q19 "on", turning SCR1 "on", turning Q23 "off", turning CONTINUOUS OPERATION light DS1 off. Three inputs are available at the OR gate. The presence of an "H" signal at either input will cause CONTINUOUS OPERATION light DS1 to go off.

4-228. The 274 Hz 2nd Harmonic signal from AC Amplifier Assembly A7 is applied to emitter follower Q1 base. The signal is coupled through C3 and applied to 2nd harmonic tuned amplifier Q2, Q4, Q5, and associated components. Transistor Q6 and components C14, C15, C12, R22, R18, and R19 are an active notch filter at 274 Hz for the negative feed-back loop. The overall gain of second harmonic amplifier circuits is 1500. The 2nd harmonic amplifier output is detected by CR3-CR4, filtered, and applied to emitter follower Q8 base. The output is a dc signal, proportional to the input signal at Q1, applied at integrating amplifier Q11 base. Capacitor C21 integrates the amplified dc input and establishes a steady state condition on Schmitt trigger circuit Q12, Q13, and associated components. With a normal 2nd harmonic signal input, Q12 is "off", Q13 "on", 2nd harmonic switch Q17 "off", and OR gate CR20 senses an "L" input. Therefore, CONTINUOUS OPERATION light DS1 remains on.

4-229. If the 2nd harmonic input signal decreases, the signal at Q12 base increases, causing the Schmitt trigger to change state. Transistor Q12 turns "on", Q13 "off", Q17 "on", and the OR gate senses a "H" signal. This turns "on" SCR1 to turn "off" CONTINUOUS OPERATION light DS1. This "H" signal is also cross-coupled to the fundamental OR gate to turn "on" front panel ALARM light DS2.

4-230. During normal operation, the 2nd harmonic OR gate has an "L" signal present at CR14 from Synthesizer Assembly A1. If the synthesizer unlocks or synthesizer blocking oscillators fail, the signal at CR14 goes "H" to turn "on" SCR1 and turn off the CONTINUOUS OPERATION light.

4-231. The third signal that will turn off CONTINUOUS OPERATION light DS1 is received from the fundamental channel. This signal also turns "on" front panel ALARM light DS2.

4-232. When the 5061A returns to normal operation the CONTINUOUS OPERATION light will remain off due to the action of SCR1. Momentarily depressing LOGIC RESET switch S7 removes anode voltage from SCR1 turning it "off", turning DS1 "on".

4-233. Fundamental Channel

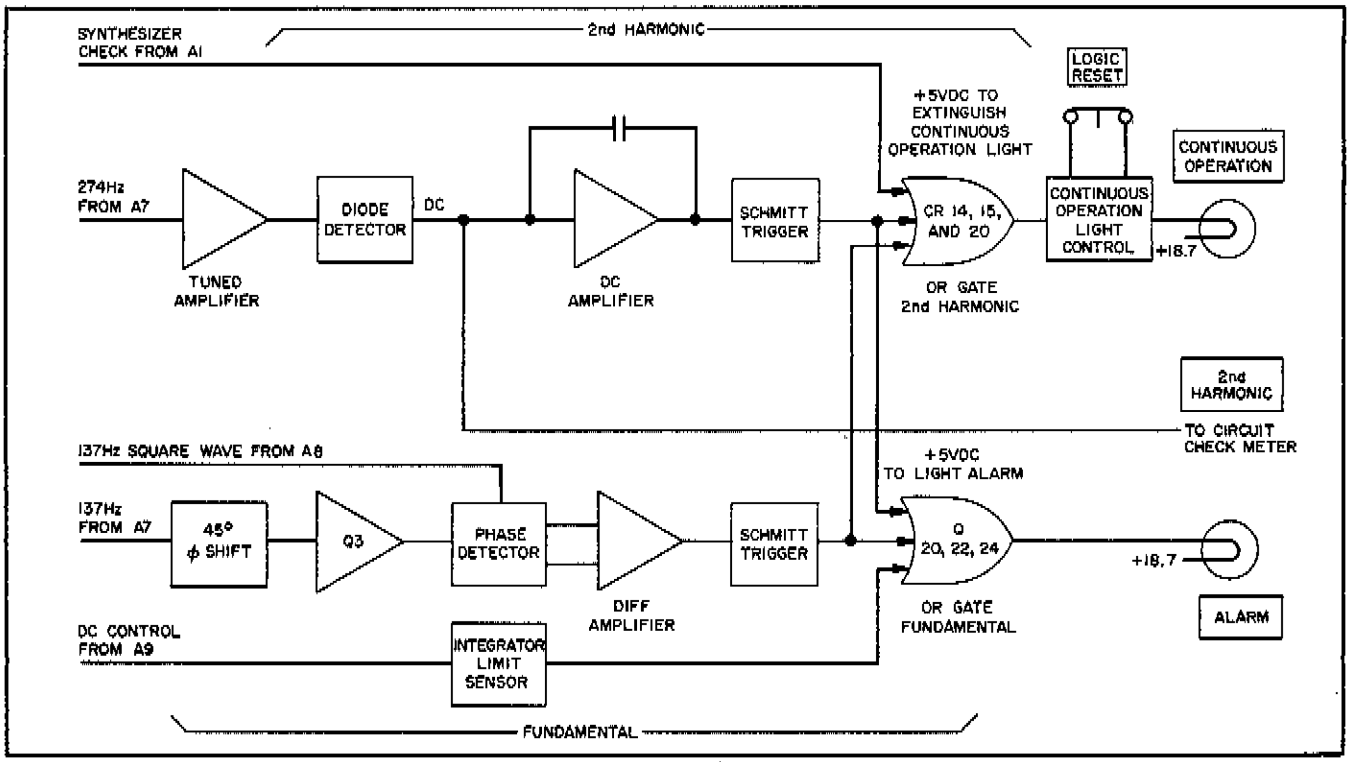
4-234. During normal instrument operation, front-panel ALARM light DS2 is "off". The light on/off function is controlled by fundamental OR gate Q20, Q22, Q24, and associated components. Normally, all OR gate inputs are "L". The ALARM light will go on when one or more OR gate inputs go "H".

4-235. Three inputs to the fundamental OR gate are present. The signal at Q20 is from the second harmonic channel. When this signal is "H", Q20 collector is "L", and the ALARM light is on. Since this signal is also applied to the 2nd harmonic OR gate, CONTINUOUS OPERATION light DS1 goes off.

4-236. Integrator Limit Sensor

4-237. The signal at Q24 base is supplied by integrator limit sensor circuit Q18, Q21, and associated components. The input to this circuit from Operational Amplifier Assembly A9 is the "control voltage" controlling the 5 MHz quartz oscillator frequency. This can be positive or negative dc. During normal instrument operation, the "control voltage" amplitude will be below the breakdown level of CR12 and CR13; Q21 is "on", Q24 is "off", and ALARM light DS2 is off. If the dc "control voltage" exceeds CR12 or CR13 breakdown point, a signal is applied to Q21 base through CR12 (if the signal is negative) or through CR13-Q18 (if the signal is positive). Regardless of signal polarity, Q21 turns "off", Q24 turns "on", and ALARM light DS2 is on. Note that the CONTINUOUS OPERATION light remains on.

Figure 4-19. Logic Block Diagram



4-238. The 137 Hz signal from AC Amplifier Assembly A7 is applied through 45° phase shift network C5, R8 to transistor amplifier Q3 base circuit. The phase shifted signal is synchronously detected by phase detector Q7. This detector is driven by a 137 Hz square wave from Phase Detector Assembly A8.

4-239. Differential amplifier Q9, Q10, and associated components are dc balanced so the output signal is "L" during normal instrument operation. If the instrument should drift from the cesium peak or lock to a secondary peak, the input to Q9 base will unbalance the amplifier, placing a "H" at Q14 base. Normally "off", Q14 changes state turning Q15 "off", and Q16 "on". This turns Q22 "on", and front panel ALARM light turns on. The "H" signal at Q22 base is also coupled to second harmonic OR gate CR15 to turn CONTINUOUS OPERATION light DS1 off. Dc balance for Q10 base is established by R26, R27, R28, R29, and R30. Components C2, R2, and C4 decouple the +18.7 volt supply.

4-240. POWER REGULATOR ASSEMBLY A15

NOTE

In the following discussion, components are identified by complete reference designations. This is to avoid confusion between components located on the chassis and components located on regulator assembly A15. For example, "Q1" refers to a component located on the chassis and "A15Q1" refers to a component located on the regulator assembly.

4-241. Power Regulator Assembly, Figure 8-28, contains the circuits which provide: 1) +18.7 volts to operate the instrument, 2) standby power supply gate to select operating source for instrument, 3) regulated dc current to the C field coil in the cesium beam tube, 4) ion pump current monitor, and 5) electron multiplier regulator. The ion pump current monitor and electron multiplier regulator circuits are located on Power Regulator Assembly A15. However, these circuits relate to the +3500 VDC Power Supply Assembly A18 and the −2500 VDC Power Supply Assembly A19 and are discussed in Paragraph 4-256 and 4-262.

4-242. Input Rectifier and Filter

4-243. AC power is supplied to the instrument through a three conductor ac power cord. The ac power cord ground lead is connected to the instrument chassis. Rear panel 115/230 selector switch S3 is set to match input power source. Fuse F1 is selected depending on the input line voltage used. Capacitor C8A,B is an input line filter. Transformer T1 (7 & 8) provide operating power to Battery Charger Assembly A2 when Standby Power Supply Option 002 is installed. Diodes A15CR1, A15CR2, A15CR3, A15CR4, and components A15C1, C5, L1, and R9 are the power regulator rectifier-filter network. The unregulated dc is applied to series regulator transistor Q2.

4-244. Standby Power Supply Gate

4-245. When Standby Power Supply Option 002 is installed, and the 5061A is connected to ac and external dc power, three unregulated dc voltage sources are available to series regulator Q2. Standby power supply gate selects which unregulated dc voltage is used.

4-246. For discussion purposes assume three unregulated dc voltages are available to series regulator Q2. During normal operation A15Q1 is biased "on" by the rectifier/filter output and the EXT DC input voltage. Breakdown diodes A15CR5 and A15CR7 set the bias levels. With A15Q1 "on", A15Q2 is "off", and A15Q3-Q4 is "off" to prevent the internal standby battery (Option 002) voltage from reaching Q2. When ac power is operating the instrument, A15CR6 is back-biased to prevent the EXT DC input from operating the 5061A. If ac line power fails, A15Q1 is held "on" to prevent the internal battery from operating the instrument. Back bias on A15CR6 is removed, placing the EXT DC input at series regulator Q2. If the EXT DC fails, A15Q1 turns "off", turning A15Q2 "on", turning A15Q3-Q4 "on", placing the internal standby battery voltage at series regulator Q2.

4-247. Power Regulator +18.7 Volts

4-248. The regulator circuit consists of Q2, A15Q5, A15Q6, A15Q8, and associated components. Series regulator Q2 provides the regulation action as controlled by the driver and differential amplifier circuits. Diode A15CR9 establishes the reference bias voltage for A15Q6. Output voltage can be changed by adjusting A15R15. The output from A15Q6, Q8 differential amplifier changes and through A15Q5 controls the Q2 regulator output. Regulator operation may be traced as follows: assume that the output voltage tends to increase. This causes A15Q8 base voltage to increase, increasing the current through this transistor. Since A15R13 carries a constant current, the increase in current in A15Q8 causes a corresponding decrease in current through A15Q6. The current through A15Q6 is the base drive for A15Q5. Therefore, the current through A15Q5 decreases. In a like manner, this decreases the base drive to series regulator Q2, causing the load current to decrease and the output voltage to return to +18.7 volts. Regulator shunt resistor A15R9 provides an initial current to establish bias voltage for the differential amplifier when voltage is initially applied.

4-249. Resistor A15R12 and transistor A15Q7 form a current limiter circuit which provides protection against an abnormal load on the +18.7 line. The current limiter circuit holds regulator current to about 1.5 Amperes. Transistor A15Q7 monitors the +18.7 volt output current. The voltage drop across series resistor A15R12 is applied across the base-emitter junction of A15Q7. When the output current increases, A15Q7 conducts causing A15Q8 to conduct more current. This causes the current through Q2 to be reduced and limits the output current.

4-250. C Field Regulator

4-251. The C field regulator circuit controls the current to the C field coil in the cesium beam tube. Front panel C FIELD potentiometer R8 provides an adjustable reference to one input of differential amplifier U1. The other input is the voltage developed by the C field current through the parallel combination of R19 and R21 (C field coil resistance is negligible). Any disturbance in the "C" field current causes an unbalance in the differential amplifier which then changes the conduction of A15Q9 to counteract the disturbance. Capacitor A15C6 filters noise from U1 input circuit.

4-252. TERMINAL BOARD ASSEMBLY A17

4-253. Printed circuit board assembly A17 (Figure 8-29) contains the series resistors for CIRCUIT CHECK meter M1. This meter can be switched by the CIRCUIT CHECK switch to monitor operation of various circuits in the instrument. Test points TP1 through TP9 are found on the board. Resistors R2 through R7 are factory-selected to normalize the CIRCUIT CHECK meter readings. Standby Power Supply Option 002 fuse F1 is also located on this board.

4-254. +3500 VDC POWER SUPPLY ASSEMBLY A18

4-255. Power Supply

4-256. This assembly includes a blocking oscillator, a voltage transformer, and a voltage doubler circuit which provide +3500 volts to the ion pump in the cesium beam tube. These circuits are inside a hermetically sealed assembly and are not accessible for repair. The ion pump operates any time power is applied to the instrument and maintains pressure within the beam tube to less than 5×10^{-7} mm of Hg. This corresponds to a current of approximately 2 microamperes from the supply for normal beam tube operation after warmup. When the beam tube is first turned on, ion pump current may be more than 40 microamperes. Ion pump current monitor circuits, located on assembly A15, monitor the current and prevents application of +17.9 volts to Cesium Oven Controller Assembly A11, hot wire ionizer, and the electron multiplier until ion pump current is less than 40 microamperes. CIRCUIT CHECK meter monitors ion pump current in the ION PUMP I position.

4-257. Blocking oscillator Q1 generates pulses to trigger switching transistor Q2. Resistor R1 is factory selected to set the output voltage by adjusting the blocking oscillator repetition rate. The voltage doubler and filter includes capacitors C3, C4 and diodes CR2, CR3.

4-258. Ion Pump Current Monitor
(Part of Power Regulator Assembly A15)

4-259. Transistors A15Q10 through A15Q15 and associated components form a current monitor circuit which senses the ion pump current. When this current is less than 40 microamperes, the +17.9 volts at A15(4) is supplied to Cesium Oven Controller Assembly A11. However, when current exceeds 40 microamperes, the +17.9 volts is disabled, removing beam tube operating voltages until tube pressure is correct. During normal operation (proper beam tube pressure), current through divider network A18R4, A18R5, A18R6, and A18R7 is sensed at A15Q10 base, turning "off" this transistor. Transistors A15Q11 and A15Q12 are "on" and A15Q13 is "off", turning "on" A15Q14-A15Q15. The +17.9 volts is then applied to the required circuits. When current through the divider exceeds 40 microamperes, A15Q10 turns "on", turning A15Q11, Q12 "off". This turns A15Q13 "on", turning A15Q14, Q15, disabling the +17.9 volt output. The +3500 Vdc supply is on whenever the instrument is connected to operating power.

4-260. -2500 VDC POWER SUPPLY ASSEMBLY A19

4-261. Power Supply

4-262. This supply includes a blocking oscillator, a voltage transformer, and a voltage doubler circuit providing -2500 Vdc to the electron multiplier in the cesium beam tube. These components are in a hermetically sealed assembly and not accessible for repair. Operation is similar to that of +3500 Volt Power Supply Assembly A18 as discussed in Paragraph 4-254. The -2500 volt supply is regulated by electron multiplier regulator circuits located on Power Regulator Assembly A15.

4-263. Electron Multiplier Regulator
(Part of Assembly A15)

4-264. Transistors A15Q16 through A15Q19 and associated components are a series regulator for the -2500 volt supply. Resistors A15R33 and A15R34 are factory selected to establish the regulator operating voltage. When a new beam tube is installed in the 5061A, these two resistors must be selected for the new tube.

4-265. Differential amplifier A15Q16, A15Q17, and driver A15Q18 control series regulator A15Q19. Breakdown diode A15CR10 establishes a reference at A15Q17 base. For discussing regulator operation, assume the -2500 volts increases to -2600 volts. Differential amplifier A15Q16-Q17 causes A15Q18 to change A15Q19 conduction opposing the voltage change. Resistor A15R38 and capacitor A15C11 stabilizes the feedback loop.

SECTION V

MAINTENANCE

5-1. INTRODUCTION

5-2. This section provides maintenance and service information for the Model 5061A Cesium Beam Frequency Standard. Included is a table of recommended test equipment, an in-cabinet performance check, troubleshooting aids, adjustment procedures, and test setup diagrams.

5-3. TEST EQUIPMENT

5-4. Recommended test equipment for performance checking and troubleshooting is listed in Table 5-1. Other test instruments may be used if their specifications equal the required characteristics. The recommended measuring systems must be composed of a number of standard and special instruments connected together. Therefore, the performance of the measurement system is being checked as well as the performance of the Cesium Beam Frequency Standard. Some measurement systems will require considerable effort to duplicate and also to verify that an "out of specification" reading is traceable to the instrument under test or to the test equipment.

5-5. CIRCUIT CHECK SWITCH

5-6. A check of general operation is made by noting the front panel CIRCUIT CHECK meter indications as the switch is rotated through its twelve positions and comparing these readings with those recorded in Table 3-4. All readings should agree with Table 3-1. Any reading deviation from Table 3-4 or Table 3-1 may readily isolate the instrument problem.

Table 5-1. Recommended Test Equipment

Instrument	Required Characteristics	Use	Model
Primary Frequency Standard	Frequency: 5 MHz and 1 MHz Output Level: 1 Vrms @ 50 ohms Accuracy: $<\pm 1 \times 10^{-11}$	Performance Check Troubleshooting	HP 5061A
Electronic Counter	Frequency Range: 0 to 50 MHz Sensitivity: 100 mV rms Accuracy: ±1 count, ±time base accuracy	Performance Check Troubleshooting Adjustments	HP 5245M
Feedthru Termination	50-ohms male and female BNC	Performance Check Troubleshooting	HP 11048B
RMS Voltmeter	Voltage Range: .3 V to 3 V full scale Frequency Range: 10 Hz to 10 MHz Accuracy: ±5% full scale	Performance Check Troubleshooting	HP 3400A
Oscilloscope	Vertical Frequency Response: dc to 50 MHz Sensitivity: .005 V/cm Calibrated Sweeps: 2 sec to .05 μsec/cm	Performance Check Troubleshooting Adjustments	HP 180A with HP 1820A and HP 1801A HP 10006A Probe
Spectrum Analyzer	Frequency Range: 1 kHz to 110 MHz Response: ±0.5 dB Sensitivity: −130 dBm Scan Width: 2 kHz to 100 MHz Stability: Residual FM less than 20 Hz peak-to-peak	Performance Check Troubleshooting	HP 8552A and HP 8553L
Vector Voltmeter	Frequency: 1 MHz to 1 GHz Voltage Range: 1.5 mV to 1 Vrms	Performance Check Troubleshooting	HP 8405A
Computing Counter with Time Interval Unit and Keyboard Accessory	Frequency: 0 to 320 MHz Sensitivity: 100 mV rms Accuracy: nsec, 11-digit readout	Performance Check Troubleshooting	HP 5360/5379 with HP 5375A

Table 5-1. Recommended Test Equipment (Cont'd.)

Instrument	Required Characteristics	Use	Model
Strip Chart Recorder	Chart Speed: 1, 2, 4, 8 in./hr Spans: .1, .5, 1, and 5V full scale Input Resistance: 200 k Ω/volt Accuracy: .2% full scale	Performance Check Troubleshooting	HP 680
RF Voltmeter	Range: 10 mV to 10 Vrms Frequency Range: 500 kHz to 15 MHz Accuracy: ±3% full scale	Performance Check Troubleshooting	HP 411A
DC Power Supply	Range: 0 to 20 Vdc Output I: 0 to 1 A Line Regulation: 0.001%	Troubleshooting	HP 6101A
Sampling Oscilloscope	Range: 100 MHz	Troubleshooting	HP 140 with HP 1411A and HP 1430A
Audio Oscillator	Frequency Range: 5 Hz to 560 kHz Dial Accuracy: ±3% Output Impedance: 600 ohms Distortion: less than 1%	Performance Check Troubleshooting Adjustments	HP 204B
Step Attenuator	Attenuation: 120 dB Frequency Range: dc to 1 GHz Impedance: 50 ohms nominal	Troubleshooting	HP 355D
DC Electronic Voltmeter	Resistance Range: 1 Ω to 10 M Ω Voltage Range: 0.1 to 1000 V full scale Voltage Accuracy: ±5% full scale	Performance Check Troubleshooting Adjustments	HP 412A
Signal Generator	Frequency: 50 kHz to 65 MHz Level: 0 to 3 Vrms into 50 ohms	Troubleshooting	HP 606A
Amplifier/Filter	Gain: 40 dB Noise Figure: 6 dB Bandwidth: .1 Hz - 9.5 kHz (Noise BW of 15 kHz)	Troubleshooting	Fairchild A739C with appropriate compensation
Clip-On DC Milliammeter	Range: 3mA to 300 mA Accuracy: ±0.1 mA ±3% full scale	Troubleshooting	HP 428B
Electronic Voltmeter	DC Voltage Range: ±15 mV to ±1500 volts full scale Accuracy: ±2% full scale Resistance Range: 10 Ω to 10 M Ω DC Current Range: ±1.5 μA to ±150mA Accuracy: ±3% AC Voltmeter Range: .5 V to 300 V	Troubleshooting	HP 410C
DC Divider Probe	Division: 100:1	Troubleshooting	HP 11045A for HP 410C
Variable Line Source	Variable from 103 Vrms to 127 Vrms and 206 Vrms to 254 Vrms	Troubleshooting	Superior electric powerstat (115V line) 3PF116 or (230V line) 3PF216
Wave Analyzer	Range: 90 dB Frequency: 20 Hz to 50 kHz Sensitivity: 1 μvolt	Troubleshooting	HP302A
AC Voltmeter	Range: 1 mV to 300 V, full scale Frequency: 1 Hz to 1 MHz	Troubleshooting	HP 403A

Table 5-2. In-Cabinet Performance Check

OPERATIONAL CHECK

1. CIRCUIT CHECK METER CHECK

The circuit checks below involve setting the front panel CIRCUIT CHECK switch to its 12 positions and observing the corresponding indication on CIRCUIT CHECK meter. Switch positions and normal indications are listed in Table 3-1 and if instrument has been operational, in Table 3-4. Refer to Section III, Paragraph 3-8 for turn-on procedure. Perform the circuit checks as follows: Set CIRCUIT CHECK switch to its 12 positions. CIRCUIT CHECK meter indications should be as in Table 3-1.

2. OUTPUT FREQUENCIES

Place instrument in operation (CONTINUOUS OPERATION light on, ALARM light off).

Connect 5 MHz from a Primary Frequency Standard as an external time base to an Electronic Counter.

Connect the Counter to each of the following OUTPUTS of the instrument under test:

FRONT PANEL	REAR PANEL
1 MHz	1 MHz
5 MHz	5 MHz
100 kHz	100 kHz

Counter should display the correct frequency, plus or minus the inherent 1-count error of the Counter.

3. OUTPUT VOLTAGES

Place instrument in operation (CONTINUOUS OPERATION light on, ALARM light off).

Connect an RMS Voltmeter through a 50-ohm Feedthru to front panel 5 MHz, 1 MHz, 100 kHz, rear panel 5 MHz, 1 MHz, and 100 kHz output jacks. Voltmeter should indicate between 1.0 and 1.5 Vrms for each frequency checked. Connect the same outputs to the vertical channel of an Oscilloscope. Oscilloscope display should be a clean sine wave.

4. TIME SCALE CHECK

Place instrument in operation (CONTINUOUS OPERATION light on, ALARM light off).

Connect 5 MHz from 5061A under test as an external time base to an Electronic Counter.

Connect the Counter input to rear panel SYNTH output jack of the 5061A under test. Counter should display a frequency of 12,631,771.6 Hz. plus or minus the inherent 1-count Counter error.

Table 5-2. In-Cabinet Performance Check (Cont'd.)

PERFORMANCE CHECK

1. HARMONIC DISTORTION CHECK

Harmonic distortion in the 5 MHz, 1 MHz, and 100 kHz output signals should be at least 40 dB down from the 1 Vrms output. To perform this check, a Spectrum Analyzer is tuned to the fundamental frequency and an amplitude reference is established. The output frequency spectrum is then investigated to determine fundamental-to-sideband amplitude relationship at harmonic points of the fundamental.

Set instrument to normal operation mode (CONTINUOUS OPERATION light on).

Connect equipment shown in Figure 5-1.

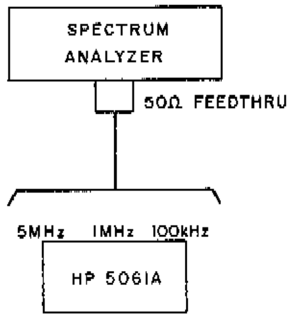
To perform the check proceed as follows:

a. Connect 5 MHz output through 50-ohm Feedthru to Spectrum Analyzer input. Check spectrum at 5 MHz center to 4th harmonic (20 MHz). Harmonics should be below 40 dB.

b. Remove connection from instrument 5 MHz output and connect to 1 MHz output jack. Check spectrum at 1 MHz center to 5th harmonic (5 MHz). Harmonics should be below 40 dB.

c. Remove connection from instrument 1 MHz output and connect to 100 kHz output jack. Check spectrum at 100 kHz center to 50th harmonic (5 MHz). Harmonics should be below 40 dB. Disconnect Spectrum Analyzer from instrument.

Figure 5-1. Harmonic and Non-Harmonic Distortion Test Setup



2. NON-HARMONIC DISTORTION CHECK

Non-harmonic distortion in the 5 MHz, 1 MHz, and 100 kHz output signals should be at least 80 dB down from the 1 Vrms output. To perform this check, a Spectrum Analyzer is tuned to the fundamental frequency and an amplitude reference is established. The output frequency spectrum is then investigated to determine fundamental-to-sideband amplitude relationship at non-harmonic points in the spectrum.

Set instrument to normal operation mode (CONTINUOUS OPERATION light on).

Connect equipment shown in Figure 5-1.

To perform the check proceed as follows:

a. Connect 5 MHz output through 50-ohm Feedthru to Spectrum Analyzer input. Check spectrum at 5 MHz center from 4 MHz to 6 MHz. All sidebands, except 5 MHz, should be 80 dB below the carrier.

b. Remove connection from instrument 5 MHz output and connect to 1 MHz output jack. Check spectrum at 1 MHz center from 900 kHz to 1.1 MHz. All sidebands, except harmonically related, should be 80 dB below the carrier.

c. Remove connection from instrument 1 MHz output and connect to 100 kHz output jack. Check spectrum at 100 kHz center from 30 kHz to 300 kHz. All sidebands, except harmonically related, should be 80 dB below the carrier. Disconnect equipment from instrument.

3. ACCURACY CHECK

Place instrument in normal operation (CONTINUOUS OPERATION light on, ALARM light off). Check that front panel TIME CONSTANT switch is set to SHORT. Check "C" Field setting given in Paragraph 3-8k.

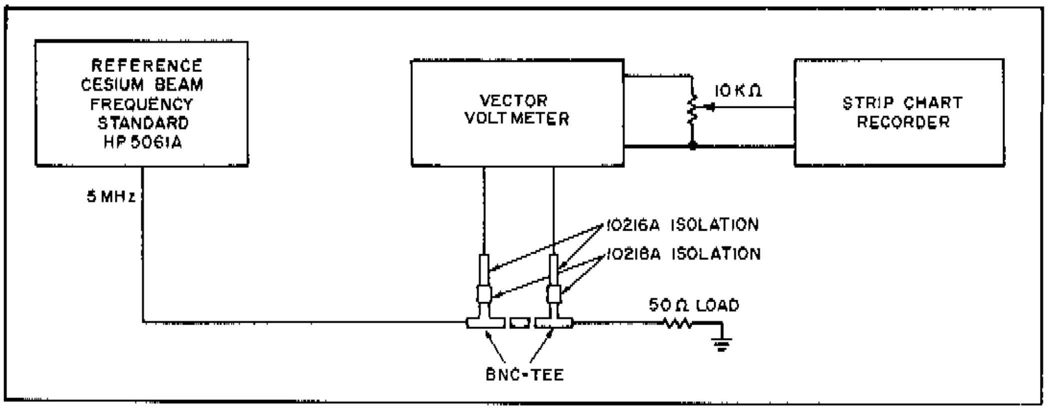
Table 5-2. In-Cabinet Performance Check (Cont'd.)

PERFORMANCE CHECK

3. ACCURACY CHECK Cont'd.

Connect equipment as shown in Figure 5-2. This test setup is for calibrating the measurement system for the accuracy check.

Figure 5-2. Accuracy Measurement Test Setup Calibration



To calibrate the measurement system proceed as follows:

a. Set reference Frequency Standard for normal operation (CONTINUOUS OPERATION light on, ALARM light off).

b. Set Vector Voltmeter FREQ RANGE to agree with input frequency (5 MHz).

c. Zero the Vector Voltmeter, phase-meter on $\pm 6^\circ$ range using PHASE METER ZERO.

d. Set Strip Chart Recorder range to 0.5 V. Set pen to chart scale center with recorder ZERO control.

e. Set Vector Voltmeter phase range to $\pm 180^\circ$ and change METER OFFSET by $+180^\circ$.

f. Adjust 10 k ohm potentiometer for full scale pen deflection on recorder.

g. Change METER OFFSET polarity to (–). Pen should move to opposite chart edge. Make required adjustments to recorder zero and 10 k pot for full scale chart deflection. The recorder is now calibrated for 360° full scale or 0.2 μsec full scale.

Accuracy Measurement. To perform the accuracy measurement proceed as follows:

a. Connect equipment as shown in Figure 5-3.

b. Set both Cesium Beam Frequency Standards for closed loop operation with CONTINUOUS OPERATION light on and ALARM light off.

c. Set Vector Voltmeter PHASE RANGE to 180°.

d. Set Vector Voltmeter PHASE METER ZERO and OFFSET for zero degrees indicated on recorder (center), start strip chart drive at 1 in./hr and record phase change for 8 hours.

e. Determine frequency error using the relationship $\frac{\Delta t}{t} = \frac{\Delta f}{f}$. Since $\frac{\Delta t}{t} = \frac{\Delta f}{f}$ and chart calibration is 0.2 μsec full scale, error in proportional parts is easily found. Accuracy should be ± 1 part in 10^{11} or better for standard tube. For Option 004, accuracy should be $\pm 7 \times 10^{-12}$ or better.

Δt = ϕ change in μsec
t = total measurement time

Table 5-2. In-Cabinet Performance Check (Cont'd.)

PERFORMANCE CHECK

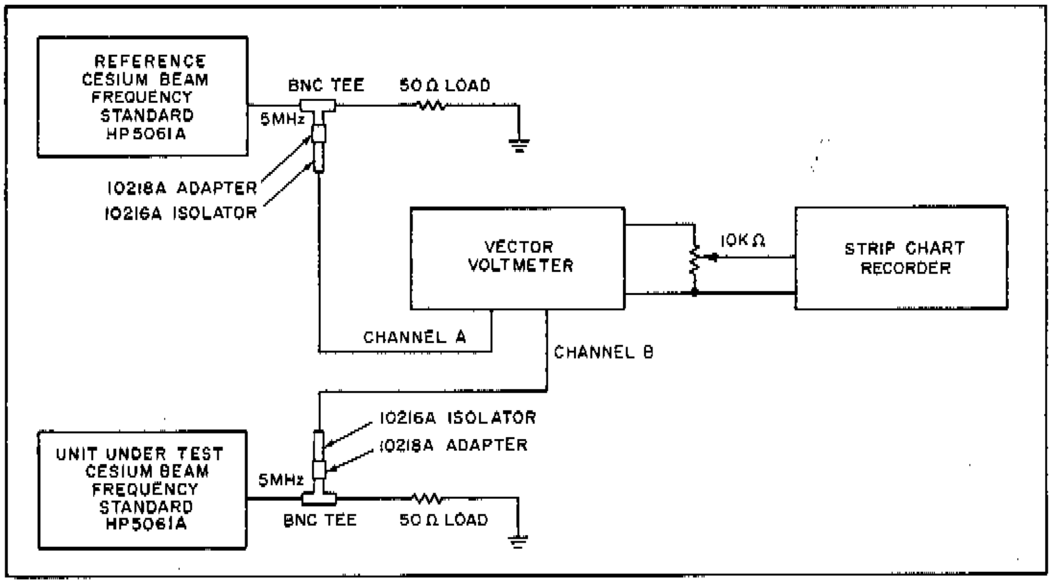
3. ACCURACY CHECK Cont'd.

Example: Assume the instrument under test's phase change over the 8 hour measurement period is 0.1 μsec.

Then $\frac{\Delta t}{t} = \frac{1 \times 10^{-7} \text{ seconds}}{2.88 \times 10^{4} \text{ seconds}} = 3.4 \times 10^{-12}$

To determine instrument frequency difference with respect to the accepted frequency definition, Reference Standard frequency difference must also be known and considered in the calculation.

Figure 5-3. Accuracy Measurement Test Setup



4. CLOCK PULSE CHECK (OPTION 001 and 003)

a. Pulse Parameters. Connect 5061A 1 PPS output to Oscilloscope vertical input. Set instrument for normal operation (CONTINUOUS OPERATION light on, ALARM light off, DIVIDER MODE switch to AUTO START). Parameters should be as indicated:

Rate:	1 pulse-per-second	Rise Time:	<50 nsec
Amplitude:	+10V peak ±10%	Fall Time:	<2 μsec
Width:	20 μsec minimum		

b. Pulse Jitter. To verify the pulse jitter specification (<5ns rms pulse-to-pulse), disconnect the oscilloscope and connect an HP Model 5360A Computing Counter to the 1 PPS jack through the 50-ohm Feedthru, as shown in Figure 5-4. Check for less than 5 nsec jitter, after program below is entered.

PROGRAM FOR R.M.S. JITTER

Standard Deviation Formula is as follows:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(t_i - t_o)^2 - \left(\frac{1}{N}\sum_{i=1}^{N}(t_i - t_o)\right)^2}$$

where:

σ = Standard Deviation		t_i = Time Interval Measured	
N = Number of Measurements		t_o = Any Measurement	

Table 5-2. In-Cabinet Performance Check (Cont'd.)

PERFORMANCE CHECK

4. CLOCK PULSE CHECK (OPTION 001 and 003) Cont'd.

1. LEARN
2. PLUG-IN
3. a x
4. CLEAR x
5. b x
6. CLEAR x
7. X FER PROG
8. c x
9. PLUG-IN
10. $\overline{axy}$
11. – (subtract)
12. b x
13. bxy
14. + (add)
15. b x
16. X (multiply)
17. $\overline{cxy}$
18 + (add)
19. REPEAT
20. $\overleftarrow{Nxy}$
21. ÷ (divide)
22. X FER PROG
23. b x
24. $\overline{Nxy}$
25. ÷ (divide)
26. xy
27. X (multiply)
28. $\overleftarrow{bxy}$
29. x y
30. – (subtract)
*31. (4)
32. $\sqrt{x}$
33. PAUSE
34. RUN
35. START

*When entering this program it is necessary to press any positive number so instrument doesn't take the square root of zero; this step is not learned and has no effect on the program.

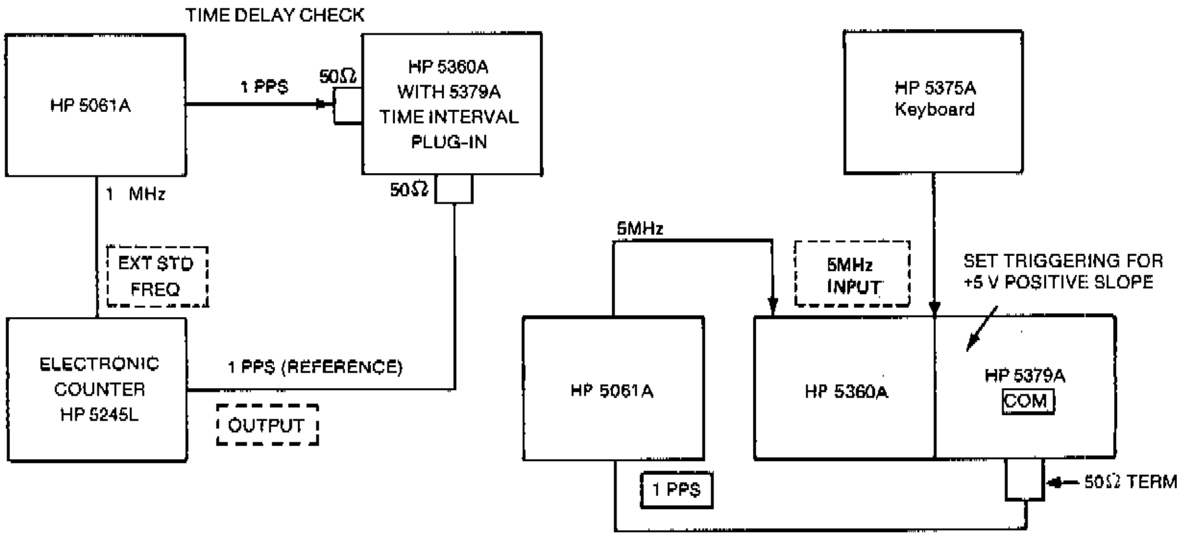
c. Time Delay. To check the time delay thumbwheels, proceed as follows:

1. Connect equipment as shown in Figure 5-4. (Time delay check.)
2. Check TIME DELAY by setting thumbwheel switch to following positions and observing output pulse delay on Time Interval Counter. Time interval change should correspond with switch settings.

7 μsec	800 μsec	80 msec
8 μsec	7 msec	700 msec
70 μsec	8 msec	800 msec
80 μsec	70 msec	999.999 msec
700 μsec		

3. Adjust 0-1 μsec TIME DELAY control for total of 1 sec delay (Thumbwheels set to 999999) indication on Time Interval Counter. This completes clock pulse check.

Figure 5-4. Clock Pulse Test Setups



5. CLOCK PULSE (Option 001) SYNCHRONIZATION CHECK

The Digital Clock Assembly A5 output pulse can be automatically delayed from an input reference pulse by 9 to 11 microseconds. To check synchronization, proceed as follows:

a. Place 5061A in normal operation with dividers on.

b. Connect equipment as shown in Figure 5-5.

Table 5-2. In-Cabinet Performance Check (Cont'd.)

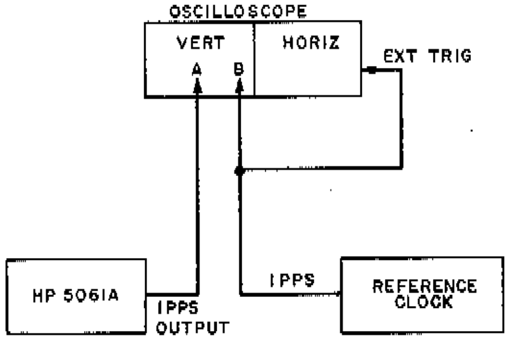
PERFORMANCE CHECK

5. CLOCK PULSE (Option 001) SYNCHRONIZATION CHECK

NOTE: Reference input pulse must be greater than +5 V, with rise time greater than 50 nanoseconds.

c. Press and hold Clock SYNC button located on Digital Clock Assembly A5 (Figure 3-7) for at least one second. The digital clock will synchronize on the first pulse input after the SYNC button is pressed. The oscilloscope display should indicate a 10 ±1 μs time delay.

Figure 5-5. Test Setup For Clock Synchronization Check



6. STANDBY POWER SUPPLY (Option 002) CAPACITY CHECK

Place instrument in normal operation so that CONTINUOUS OPERATION light is on, BATTERY light is off, and ALARM light is off. Disconnect instrument ac power cord from ac line source for 30 minutes. BATTERY light should flash during entire period. Connect instrument ac power cord to ac line. BATTERY light should stay on for approximately 18-21 hours. At completion of recharge cycle BATTERY light should go off. During entire check period, CONTINUOUS OPERATION light should stay on and ALARM light off.

7. RMS DEVIATION OF 5 MHz OUTPUT (SHORT TERM STABILITY)

The rms deviation of the 5 MHz OUTPUT (due to noise and frequency fluctuations) is specified as 5.6×10^{-11} for averaging time of 1-second; 2.5×10^{-11} for 10 seconds averaging time; and for Option 004: 5×10^{-12} for 1 second; 2.7×10^{-12} for 10 seconds.

The system shown in Figure 5-5a checks this rms deviation using a HP 5360A Computing Counter with an automatic program run with the HP 5375A Keyboard. The method used measures, in real time, the standard deviation of N pairs of samples of the frequency measured. The frequency measured is derived from the standard-under-test and a reference standard. The deviations are averaged over N samples and then displayed. Steps to perform this test and the 5360A Keyboard program are given below:

a. Set HP 5061A to OPEN LOOP operation.

b. Connect test set-up as shown in Figure 5-5a. Ensure that reference standard has been in continuous operation for not less than 24 hours.

c. Set HP 5360A Computing Counter control as follows:

Set EXT MEAS TIME to NORMAL (rear panel)
Set CYCLE RATE to maximum ccw out of POWER OFF
Set DIGITS DISPLAYED to AUTO
Press MODULE
Set MEASUREMENT TIME to 1
Set MULTIPLIER to 1S (or 10S)
Set FUNCTION to FREQ
Set INPUT to A
Set LEVEL control to PRESET
Set SENSITIVITY MULTIPLIER to X10
Set AC-DC to DC

Table 5-2. In-Cabinet Performance Check (Cont'd.)

PERFORMANCE CHECK

7. RMS DEVIATION OF 5 MHz OUTPUT (SHORT TERM STABILITY) Cont'd.

d. Adjust reference standard for display of approximately 2 Hz.

e. Depress EXT switch on counter.

f. On Keyboard, set LOOP NUMBER N to 100, SUB-NORMAL-MAN to NORMAL, and load rms deviation program.

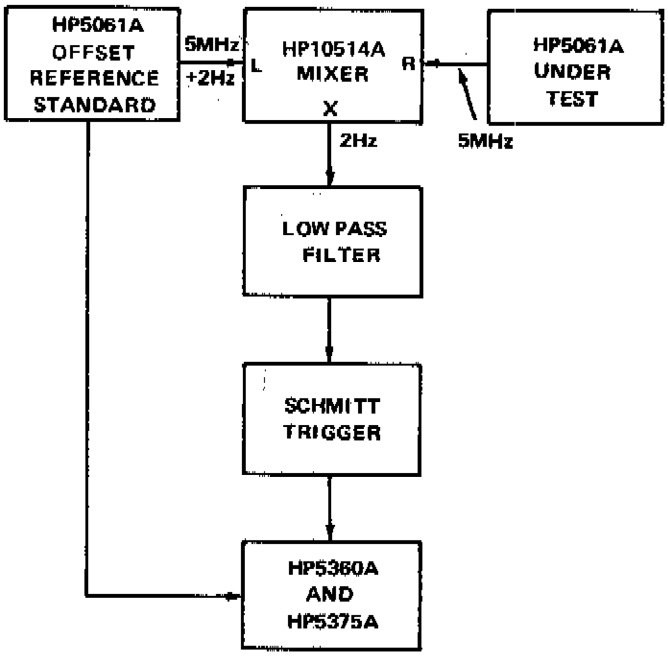
g. Allow sufficient time for 100 samples and note display; display should not exceed the specifications listed in the opening paragraph.

HP 5375A Program for RMS Deviation Check

$f_o = 5\text{ MHz} = 5 \times 10^6$

1. MANUAL
2. 2_f
3. $\sqrt{x}$
4. X
5. 5μ
6. ENTER PREFIX
7. 8M
8. c x
9. LEARN
10. CLEAR x
11. b x
12. XFER PROG
13. MODULE A
14. a x
15. MODULE A
16. $\overrightarrow{a\ x\ y}$
17. –
18. $\overrightarrow{x\ y}$
19. X
20. $\overrightarrow{b\ x\ y}$
21. +
22. b x
23. REPEAT
24. XFER PROG
25. $\overrightarrow{N\ x\ y}$
26. $\overrightarrow{N\ x\ y}$
27. +
28. $\overrightarrow{b\ x\ y}$
29. y x
30. ÷
31. $\sqrt{x}$
32. $\overrightarrow{c\ x\ y}$
33. ÷
34. DISPLAY x
35. RUN
36. START

Figure 5-5a. Test Setup for RMS Deviation of 5 MHz Output



PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 5061A
Cesium Beam Frequency Standard

Tests Performed By ______________________

Serial No. _____ - __________ Option(s) ______________ Date ______________

OPERATIONAL CHECKS

	Description		Check
1.	CIRCUIT CHECK Meter	☐	See Table 3-1 and Table 3-4
2.	Output Frequencies	☐	1 V rms minimum.
	Output Waveforms	☐	Clean sine waves, all outputs.
3.	Frequency on Counter	☐	±1 count, counter error
4.	Time Scale	☐	±1 count, counter error

PERFORMANCE CHECKS

	Description		Check
1.	Harmonic Distortion; greater than 40 dB from rated output	☐	greater than 40 dB
2.	Non-Harmonic Distortion; greater than 80 dB from rated output	☐	greater than 80 dB
3.	Accuracy; Standard Tube $\pm 1 \times 10^{-11}$ Option 004 7×10^{-12}	☐	$\pm 1 \times 10^{-11}$ Option 004 7×10^{-12}
4.	Clock Pulse (Option 001)	☐	Rate: 1 PPS Amplitude: 10 V p-p ±10% Width: 20 μs minimum Rise Time: less than 50 ns Fall Time: less than 2 μs Jitter: less than 5 ns Time Delay: 1 μsec to 1 sec
5.	Clock Pulse Synchronization (Option 001) 10 μsec ±1 μsec	☐	9 to 11 μsec
6.	Standby Power Capacity (Option 002) 1.5 amperes for 30 minutes	☐	30 minutes
7.	Short Term Stability	☐	2.5×10^{-11} (standard tube, for 10 seconds averaging time). 2.7×10^{-12} (Option 004, for 10 seconds averaging time).

5-7. IN-CABINET PERFORMANCE CHECK

5-8. The In-Cabinet Performance Check outlined in Table 5-2 lists checks to verify specifications. The Performance Check Test Record page can be filled out during the checks to provide a permanent performance record of each instrument. In-Cabinet Performance Checks can be used:

a. as part of an incoming inspection check of instrument specifications,

b. as part of a troubleshooting procedure, and

c. after any repairs or adjustments, before returning the instrument to regular service.

5-9. MODULE DESIGNATIONS

5-10. Table 5-3 gives designations, names, and part numbers of all assemblies and modules used.

5-11. INSTRUMENT COVER REMOVAL

5-12. For access to modules in the unit, remove top and bottom covers. Remove the four screws from the cover and slide cover toward rear of instrument. To replace cover, reverse procedure.

5-13. TROUBLESHOOTING

Table 5-3. Assembly Designations

Assembly Number	and Name	HP Part No.
A1	Synthesizer	05061-6097
A2	Battery Charger (Option 002)	05061-6019
A3	Multiplier	05061-6108
A4	Harmonic Generator	05060-6029
A5	Digital Divider (Option 001)	05061-6011
A6	Frequency Divider	05061-6102
A7	AC Amplifier	05061-6005
A8	Phase Detector	05061-6095
A9	Operational Amplifier	05061-6092
A10	Quartz Oscillator	00105-6013
A11	Cesium Oven Controller	05061-6009
A12	Cesium Beam Tube	05061-6077
A13	Buffer Amplifier	05061-6030
A14	Logic	05061-6016
A15	Power Regulator	05061-6099
A17	Terminal Board	05061-6018
A18	+3500 Vdc Power Supply	05060-6093
A19	-2500 Vdc Power Supply	05060-6092

5-14. The best approach to isolating trouble in the instrument is first obtain all possible information from controls, indicators, and connectors; then logically apply this information to locate the defective unit or module. Figures 3-6 (front panel), 3-7 (top controls), 3-8 (rear panel), 8-3 (top internal), 8-4 (bottom internal), 8-2 (block diagram with waveforms) can help understand operation and locate modules and parts. To further aid analysis, each CIRCUIT CHECK switch position is discussed in Paragraph 5-22. Table 5-4 indicates basic instrument trouble indications and checks for their cause. Section VIII in this manual provides circuit diagrams, circuit board component locations, waveforms, and voltage checks. This section, in conjunction with the In-Cabinet Performance Check of Table 5-2, are good troubleshooting aids. When a defective assembly is isolated, refer to that assembly corresponding paragraphs in Section V of this manual.

5-15. When Operational Checks indicate an instrument frequency offset greater than 1 part in 10^{11}, (7×10^{-12} for Option 004) the following checks should be made prior to troubleshooting:

a. Check "C" Field setting given in Paragraph 3-8k.

b. Check Synthesizer frequency given in the In-Cabinet Performance Check Table 5-2.

c. Re-tune control loop (see Paragraph 5-195).

d. Demagnetize cesium beam tube. (See Beam Tube Demagnetization procedure Paragraph 5-172.) For option 004 only: Do the CURRENT degauss procedure using HP 10638A DEGAUSSER ACCESSORY. Procedure is in the HP10638A Operating Manual.

5-16. PERIODIC MAINTENANCE

5-17. The only maintenance necessary to maintain the Model 5061A is periodic checks of the front panel CIRCUIT CHECK meter indications. When the instrument is initially turned on, all CIRCUIT CHECK meter positions should be checked and recorded in Table 3-4. After several days of continuous operation, the meter indications should again be checked and recorded in Table 3-4. If any meter indication changes value, all indications should be again recorded in Table 3-4.

5-18. During the life of the beam tube it is typical for beam current to decay due to aging of the electron multiplier within the beam tube. However, beam tube performance is not deteriorated since tube noise decreases with the current decrease. When meter reading in 2ND HARMONIC position decreases to 20% of the initial value noted in Table 3-4, adjustments are required to front panel BEAM I METER and LOOP GAIN controls.

5-19. When the 2ND HARMONIC indication has decreased to 20% of initial value, proceed as follows:

a. Set instrument controls as follows:

MOD . . . . ON
MODE . . . . OPER
OSC FREQUENCY X10^{-10} 250
CIRCUIT CHECK . . . . . . 2ND HARMONIC
TIME CONSTANT . . . . SHORT

b. Adjust front panel LOOP GAIN control for 40 indication on CIRCUIT CHECK meter. If CONTINUOUS OPERATION light goes off, momentarily press front panel LOGIC RESET button.

c. Set CIRCUIT CHECK switch to BEAM I.

d. Adjust BEAM I METER adjust for 20 on CIRCUIT CHECK meter.

e. Rotate CIRCUIT CHECK switch through all 12 positions and record readings in Table 3-4. After several days, re-check meter indications and record in Table 3-4. This completes the adjustments.

5-20. STANDBY BATTERY PERIODIC MAINTENANCE (Option 002)

5-21. When Option 002 is installed, the internal battery should be "exercised" every 60 days. To "exercise" the battery, disconnect instrument ac power cord from line source for 15 to 20 minutes. This operates the 5061A on internal standby battery power. During internal battery operation, front panel BATTERY light will flash on and off. Connect instrument ac power cord to ac line voltage. BATTERY light will remain on until battery is re-charged. Re-charge cycle is about ten times usage time. CONTINUOUS OPERATION light should remain on during "exercise" period.

5-22. CIRCUIT CHECK SWITCH AND METER

5-23. BATTERY Position

5-24. Meter signal is supplied from the internal standby battery positive side (Option 002 only) through Terminal Board Assembly A17 to S1A(1).

5-25. SUPPLY Position

5-26. Meter signal is supplied from Power Regulator Assembly A15 through Terminal Board Assembly A17 to S1A(2). The meter monitors the regulated +18.7 volt output from this assembly. This voltage is supplied to most circuits in the instrument; therefore a meter indication other than 38-42 indicates trouble in this circuit.

5-27. ION PUMP I Position

5-28. Meter signal is supplied from +3500 Volt Power Supply Assembly A18 through Terminal Board Assembly A17 to S1A(3). The meter indication represents the ion pump current. The beam tube ion pump operates any time power is applied to the instrument. A fail-safe current monitor circuit holds off beam tube power if beam tube pressure is unsatisfactory. The normal meter indication is zero (less than 5.0 microamperes) for the ION PUMP I position.

5-29. OSC OVEN Position

5-30. Meter signal is supplied from Crystal Oscillator Assembly A10 through Terminal Board Assembly A17 to S1A(4). The meter monitors power applied to the proportional oven in the oscillator assembly. At an ambient temperature of +25°C, the meter should indicate between 35 and 45, provided the oven has been operating long enough to reach operating temperature (about 1 hour).

5-31. CS OVEN Position

5-32. Meter signal is supplied from Oven Controller Assembly A11 through Terminal Board Assembly A17 to S1A(5). The meter monitors power applied to the cesium oven in the beam tube with a normal indication between 5 and 35. The normal temperature is dependent on ambient; operation in a cooler environment will cause the indication to increase while a warmer will cause a decrease.

5-33. 5 MHz Position

5-34. Meter signal is supplied from Buffer Amplifier Assembly A13 through Terminal Board Assembly A17 to S1A(6). The meter monitors the 5 MHz standard frequency output. Normal indication is 38 to 42, with no load connected to front or rear panel output connectors. Meter will indicate less when the output is loaded.

5-35. MULT Position

5-36. Meter signal is supplied from Harmonic Generator Assembly A4 through Terminal Board Assembly A17 to S1A(7). The meter monitors the bias current applied to step recovery diode A4CR2. Normal meter indication is 20 to 45. This meter reading indicates the 90 MHz input to Harmonic Generator Assembly A4 is present and the step recovery diode is not open or shorted.

5-37. BEAM I Position

5-38. Meter signal is supplied from AC Amplifier Assembly A7 through Terminal Board Assembly A17 to S1A(8). The meter monitors dc beam current from the beam tube electron multiplier. Normal indication is between 15 and 30 and will be maximum when the beam tube applied frequency is exactly equal to cesium resonance.

5-39. CONTROL Position

5-40. Meter signal is supplied from Operational Amplifier A9 through Terminal Board Assembly A17 to S1A(9) and rear panel CONTROL output jack. The CONTROL indication represents crystal oscillator frequency-correcting dc voltage. When the dc voltage exceeds about ±5.0 volts (50 right or left on CIRCUIT CHECK meter), this approaches the ±7 volt dynamic limit of frequency control and front panel ALARM light will come on. When this occurs, adjust OSC FREQUENCY COARSE control for zero indication on CIRCUIT CHECK meter.

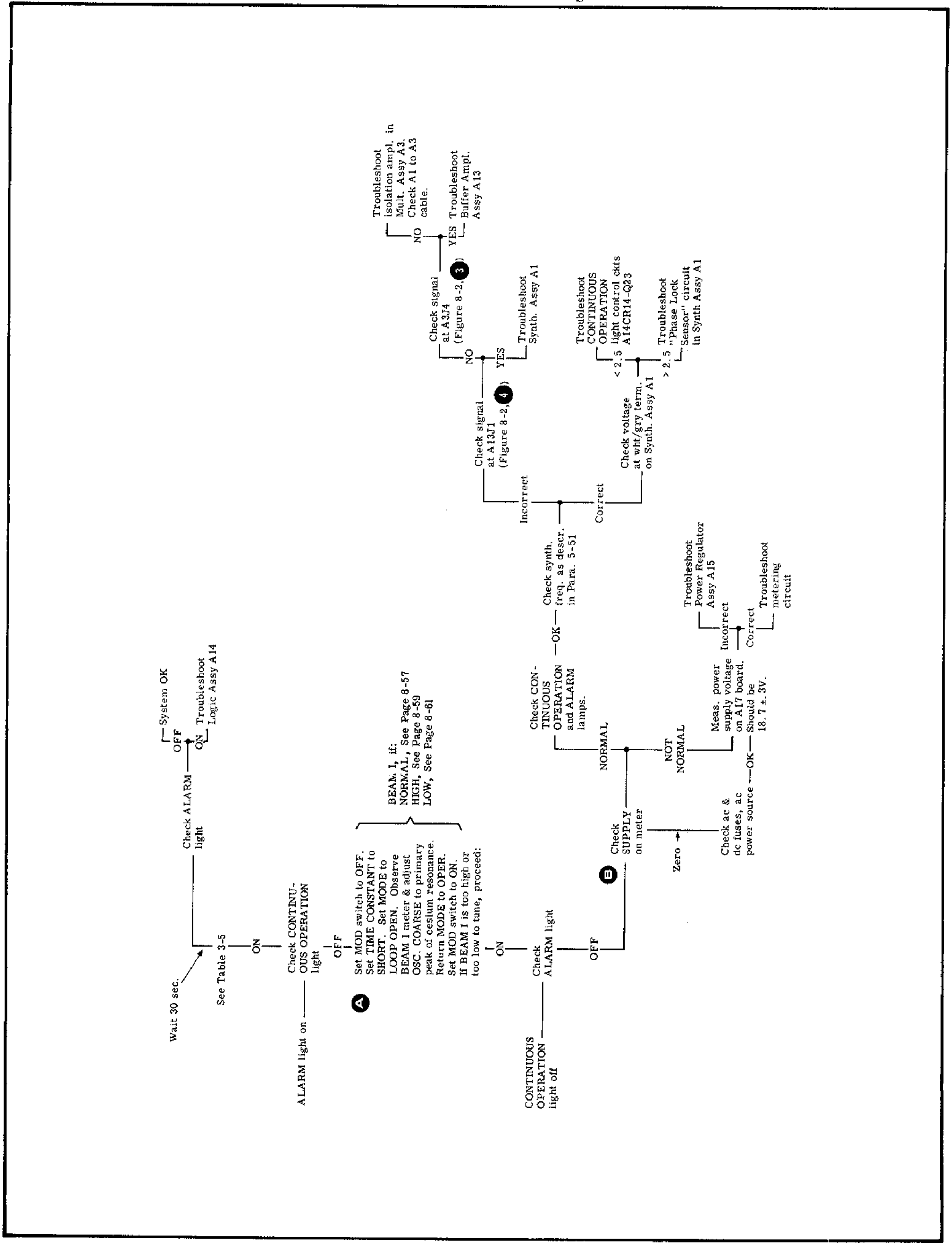
5-41. 2ND HARMONIC Position

5-42. Meter signal is supplied from Logic Assembly A14 through Terminal Board A17 to S1A(10). This signal represents the 274 Hz second harmonic signal voltage level from AC Amplifier Assembly A7, which in turn comes from the beam tube electron multiplier. Normal meter indication is between 35 and 45.

5-43. 1 MHz Position

5-44. Meter signal is supplied from Frequency Divider Assembly A6 through Terminal Board Assembly A17 to S1A(11). The meter monitors the 1 MHz standard frequency output. Normal indication is 38 to 42 with no load connected to front or rear panel output jack. Meter will indicate less when the output is loaded.

Table 5-4. 5061A Troubleshooting Chart



5-45. 100 kHz Position

5-46. Meter signal is supplied from Frequency Divider Assembly A6 through Terminal Board Assembly A17 to S1A(12). The meter monitors the 100 kHz standard frequency output. Normal indication is 38 to 42 with no load connected to front or rear panel output connectors. The meter will indicate less when the output is loaded.

5-47. SYNTHESIZER ASSEMBLY A1

5-48. Normal Operation

5-49. 5061A Synthesizer Module Assembly A1 Series No. 1152A and Above

5-49A. Thumbwheel switches included with earlier synthesizer assemblies have been removed. The function of the switches was to make minor changes to the U.T.C. Time Scale. Since January 1, 1972, the common reference time scale throughout the world has been changed. The previous rate-offset from the Atomic Time Scale has been eliminated and adjustments in U.T.C. time will be in increments of 1 second every 6 to 12 months to maintain the approximate agreement with the time scale based on the earth's rotation.

5-50. Operational Check

5-51. To determine if synthesizer circuits are working properly, connect equipment as shown in Figure 5-6. Counter should indicate a frequency of 12,631,771.6 Hz ±1 count. The RF Voltmeter should indicate 100 mV or more.

5-52. Troubleshooting

5-53. When synthesizer circuits are not functioning properly, remove assembly from instrument, remove module cover, and reconnect the assembly electrically. Connect a ground lead from instrument chassis to synthesizer circuit board ground. Check thoroughly for physical damage, burned or broken components. Check all connectors.

5-53A. One-shot MV IC4, Check and Adjustment. If IC4 is replaced, C2 should be checked and adjusted as follows:

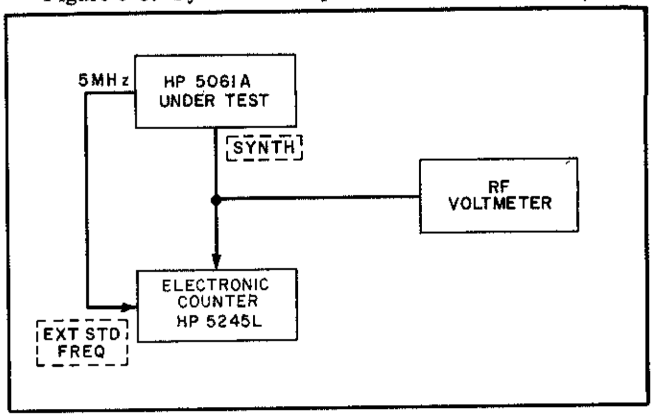
a. Connect a clip lead between either side of R5 and the instrument chassis. This holds the input gate open.

b. Connect an oscilloscope to Q3(C). Set the oscilloscope sweep to 0.2 μseconds/division. Adjust horizontal position and sweep speed controls so that each pulse falls on a graticule line as in waveform 2 , of Figure 8-8.

c. Connect scope external trigger input to TP1. Set scope to trigger on negative slope of pulse. Remove clip lead from R5 to chassis.

d. Check that oscilloscope displays waveform 1 of Figure 8-8. If not, adjust C2 so that 9 pulses are blocked out. These can be easily counted by counting the graticule lines during the period when the input gate is closed. There should be no partially blocked out pulses at the end of the blockout period. A partial pulse may appear at the beginning, but should be counted as blocked out.

Figure 5-6. Synthesizer Operational Check Setup



5-54. Table 5-5 lists the signal period at A1TP1. Table 5-6 is a step-by-step troubleshooting aid, helpful in isolating the trouble area. Once the problem area is located, normal repair techniques should be used.

5-55. A1L2 and A1L4 Replacement and Y1 Frequency Check

5-56. When A1L2 and A1L4 need replacement, the following procedure should be used:

a. Set instrument controls as indicated:
MODE . . . . LOOP OPEN

b. Remove synthesizer assembly from instrument, remove module cover, and reconnect synthesizer 5 MHz input and +18.7 Vdc lead. Connect chassis ground to synthesizer circuit board ground.

c. Lift the end of A1R81 connected to A1R88-R78 junction.

d. Connect this lifted end to the positive lead of a DC Power Supply set to +6.5 V ±0.3 V. Connect DC Power Supply negative lead to synthesizer ground.

e. Measure synthesizer frequency at A1J3 using setup shown in Figure 5-7.

f. If counter indication is greater than 12.631871 MHz or less than 12.631671 MHz, select L2 or L4 as necessary for a counter indication of 12.631771 MHz ±100 Hz. If the values of L2 and L4 exceed a range of 0.15 μh to 2.2 μh replace Y1 and repeat this procedure.

g. When frequency indication is correct, reconnect R81, replace synthesizer cover, and replace synthesizer assembly into the instrument.

h. Reconnect all electrical connections and using test setup in Figure 5-6, check synthesizer output frequencies using Table 3-3.

Table 5-5. Synthesizer A1TP1 Output Period

Digital Divider Hardwired for	Signal Period at A1TP1
2095	273.2 μsec

Table 5-6. Synthesizer Troubleshooting Chart

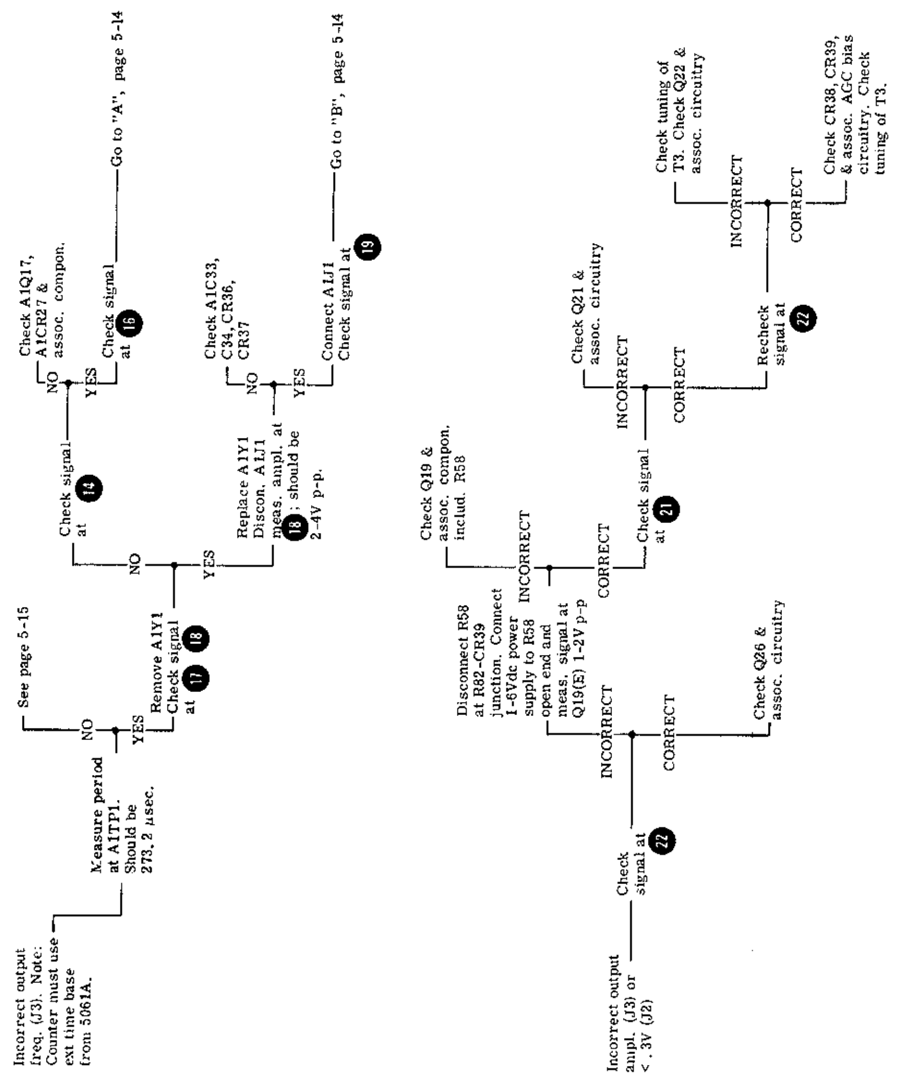


Table 5-6. Synthesizer Troubleshooting Chart (Cont'd.)

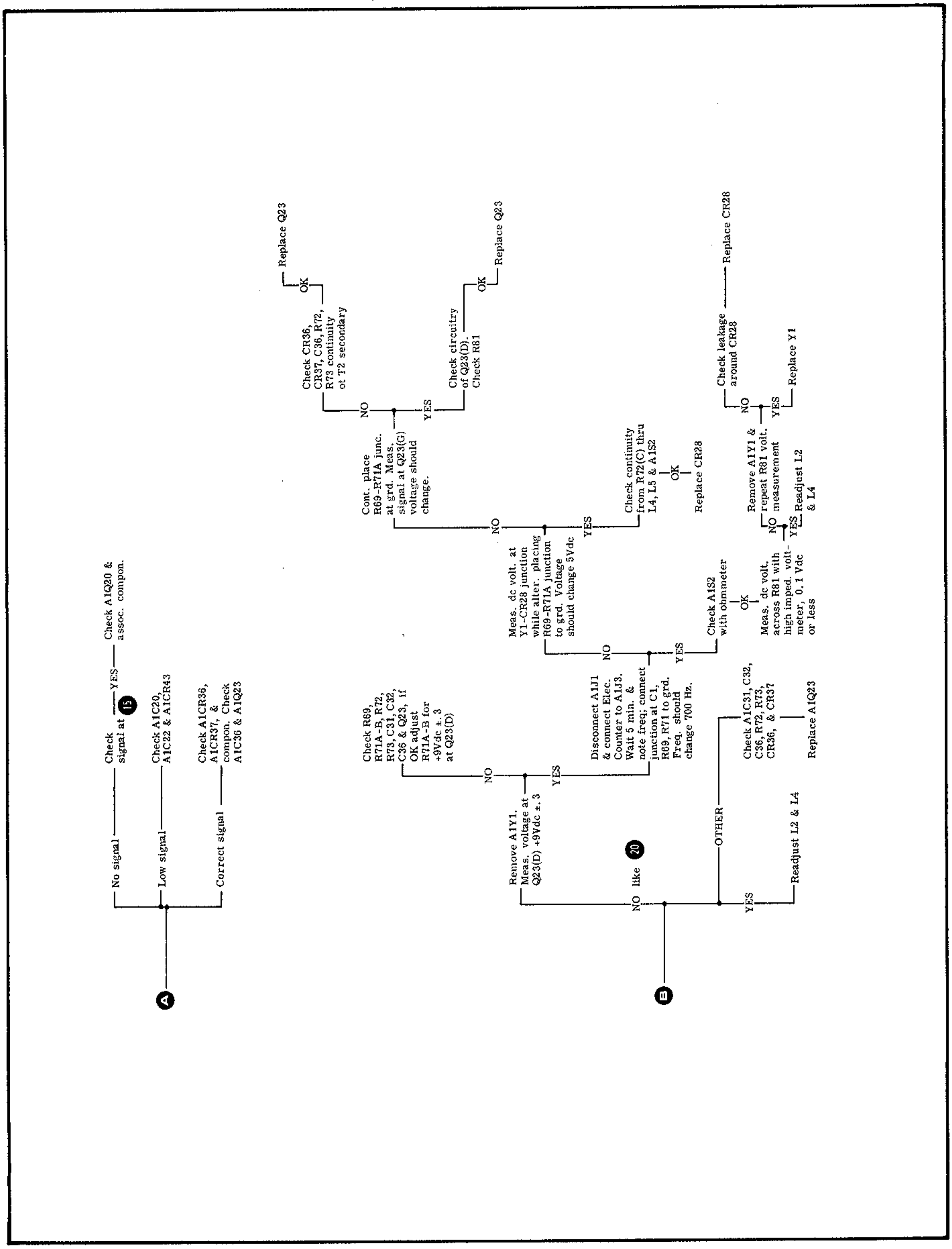
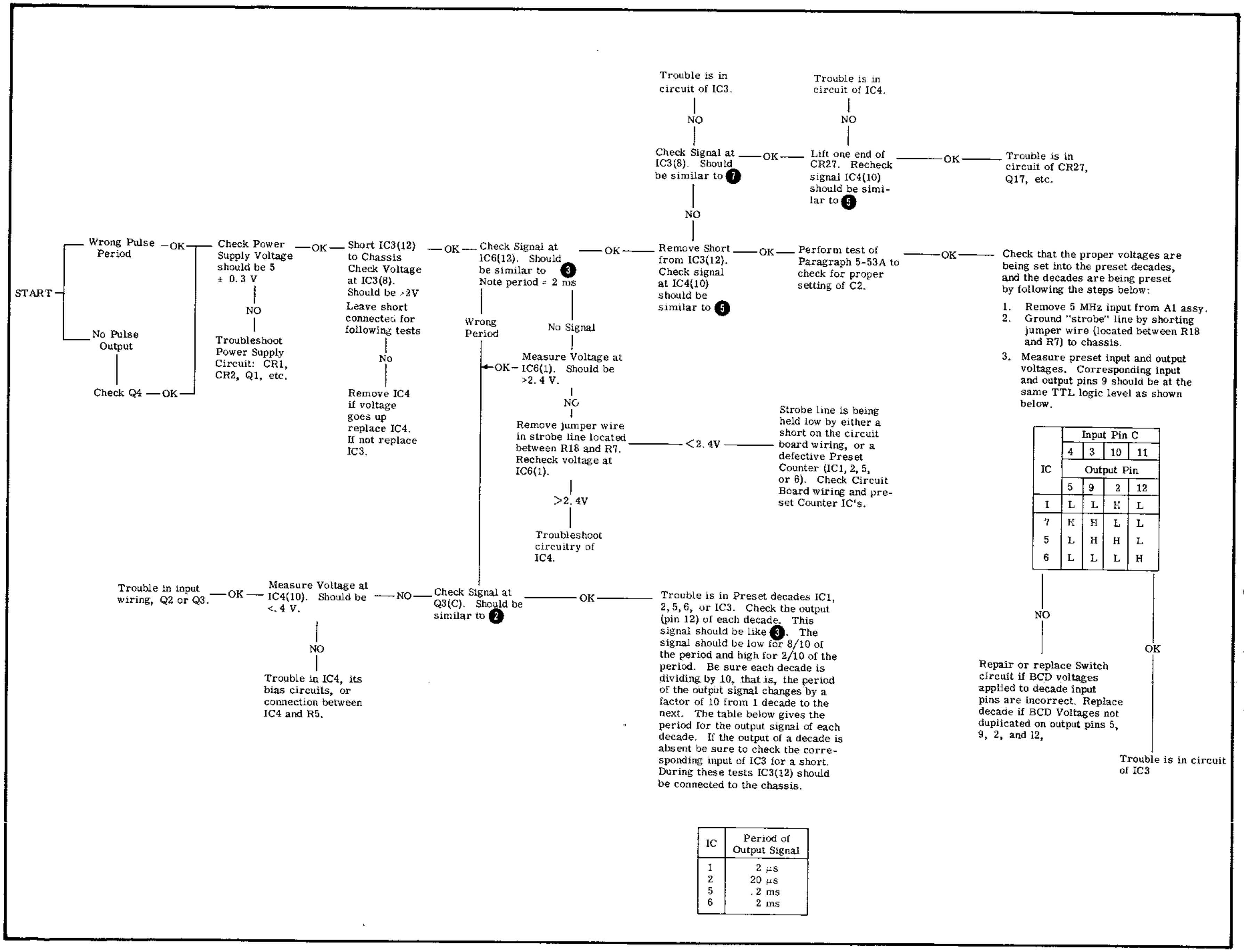


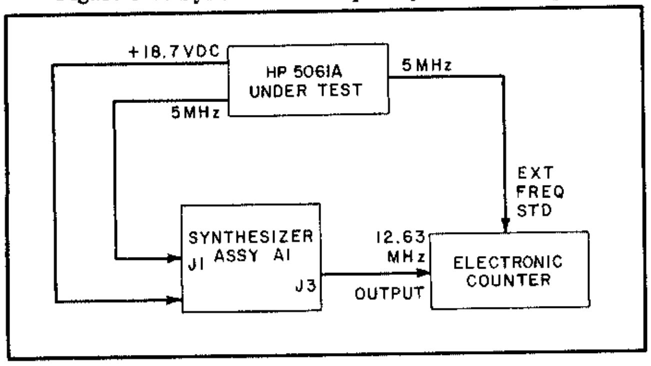
Table 5-6. Synthesizer Troubleshooting Chart (Cont'd.)



IC	Input Pin C			
	4	3	10	11
	Output Pin			
	5	9	2	12
1	L	L	H	L
7	H	H	L	L
5	L	H	H	L
6	L	L	L	H

IC	Period of Output Signal
1	2 μs
2	20 μs
5	.2 ms
6	2 ms

Figure 5-7. Synthesizer Frequency Check Setup



5-57. Module Replacement

5-58. When Synthesizer Assembly A1 is replaced the following adjustment is necessary:

a. Set instrument to normal operation (CONTINUOUS OPERATION light on, ALARM light off).

b. Set CIRCUIT CHECK switch to BEAM I.

c. Remove instrument top cover and locate Harmonic Generator Assembly A4 (Figure 8-3).

d. Adjust A4R1 maximum counterclockwise, then clockwise for maximum CIRCUIT CHECK meter indication. Replace instrument top cover. This completes the adjustment.

5-59. BATTERY CHARGER ASSEMBLY A2 (Option 002)

5-60. See Paragraph 5-250 covering options.

5-61. MULTIPLIER ASSEMBLY A3

5-62. Normal Operation

5-63. Multiplier circuits are part of a stable microwave power source supplying a 300 milliwatt, phase modulated, 90 MHz signal to Harmonic Generator Assembly A4. The multiplier is tuned at the factory to match the specific harmonic generator and cesium beam tube used. Do not adjust multiplier circuits until it is definitely established that fault exists in the multiplier.

5-64. Operational Check

5-65. To determine if the multiplier is operating normally, check inputs and outputs shown in Figure 8-11 with an oscilloscope. To check the 90 MHz output signal, disconnect cable from A3J2 and connect a Sampling Oscilloscope, terminated in 50 ohms. Sync the Sampling Oscilloscope with 5 MHz from the instrument. The 90 MHz displayed on the oscilloscope should be a clean sine wave at 8 to 12 volts peak-to-peak. Remove the Sampling Oscilloscope and replace cable to A3J2.

5-66. Troubleshooting

5-67. When multiplier circuits are not operating properly, the assembly should be removed from the instrument, cover removed, and re-connected allowing access to circuit components.

5-68. When any components in tuned circuits are replaced, the circuit must be retuned. To retune, connect a decoupled oscilloscope to the following stage collector circuit. Re-tune the repaired circuit for maximum amplitude on the oscilloscope. For example: if A3C34 is replaced, connect the oscilloscope to A3Q9 collector and adjust A3L12 and A3L14 for maximum amplitude on the oscilloscope.

5-69. The only externally accessible adjustment on the multiplier is MOD LEVEL A3R20. This control normally needs no adjustment. However, if repair or instrument trouble requires that the output be checked or A3R20 setting be checked, perform the following procedure:

a. Set 5061A controls as follows:

MOD . . . . ON
MODE . . . . LOOP OPEN
OSC FREQUENCY X10^{-10} 250
CIRCUIT CHECK . . . . BEAM I
TIME CONSTANT . . . . SHORT

b. Observe CIRCUIT CHECK meter indication and adjust OSC FREQUENCY COARSE control to central peak of cesium resonance.

c. Adjust OSC FREQUENCY X10^{-10} to 200. This offsets the quartz oscillator by −50 parts in 10^{10}.

d. Using the Micon-to-BNC cable supplied, connect test output A7J6, on the bottom instrument deck, to the vertical input of an Oscilloscope.

NOTE

This waveform should be a 137 Hz sine wave. If there is clipping or distortion, reduce ac gain by adjusting front panel LOOP GAIN control for a clean waveform.

e. Adjust MOD LEVEL (A3R20) on Multiplier Assembly A3 for maximum amplitude indication on Oscilloscope.

f. Remove oscilloscope connection from A7J6.

g. Reset Loop Gain and 2nd Harmonic level outlined in Paragraphs 5-108 and 5-197.

5-70. Module Replacement

5-71. When Multiplier A3 is replaced, perform the adjustments in Paragraphs 5-193 through 5-195.

5-72. HARMONIC GENERATOR ASSEMBLY A4

5-73. Normal Operation

5-74. Harmonic generator circuits produce the microwave field applied to the cesium beam tube. This assembly is factory adjusted for optimum performance with a specific multiplier and cesium beam tube assembly. It is not intended for field repair. Make only those adjustments called for in this manual.

5-75. Operational Check

5-76. To determine if harmonic generator circuits are operating normally, check CIRCUIT CHECK meter indication in MULT position. Meter should indicate 35 to 45 for normal operation. Check the 90 MHz input at A4J1 and 12.63.... MHz input at A4J2 with a Sampling Oscilloscope.

5-77. Troubleshooting

5-78. When a trouble in the harmonic generator is found, retune the assembly as outlined in Paragraphs 5-187 and 5-188. If retuning has no effect, remove assembly from instrument. Contact your nearest Hewlett-Packard Sales and Service office listed at the back of this manual.

5-79. When a new beam tube is replaced, the harmonic generator and multiplier assemblies must be adjusted. Use procedure in Paragraphs 5-187 through 5-198.

5-80. Module Replacement

5-81. When Harmonic Generator A4 is replaced, perform the adjustments in Paragraphs 5-187 through 5-197.

5-82. DIGITAL DIVIDER ASSEMBLY A5 (Option 001)

5-83. See Paragraph 5-238 covering options.

5-84. FREQUENCY DIVIDER ASSEMBLY A6

5-85. Normal Operation

5-86. Frequency divider circuits provide 1 MHz and 100 kHz signals to front and rear panel output jacks and 1 MHz to Digital Divider Assembly A5 (Option 001).

5-87. Operational Check

5-88. Divider operation can be easily checked by monitoring CIRCUIT CHECK meter indications and checking output frequencies with an electronic counter. When measuring output frequencies, the counter should be driven with the 5061A, 5 MHz output.

5-89. Troubleshooting

5-90. The divider circuits can be divided into two parts: 1) 1 MHz divider, and 2) 100 kHz divider. Front panel DIVIDER MODE switch may be disconnected during troubleshooting to prevent starting the 1 MHz divider. To start the dividers with DIVIDER MODE switch open, short the pins that connect the blue and gray wires to the divider. Figure 8-17 is furnished as an aid in locating malfunctions. When the divider has been repaired, the following tuning procedure should be performed.

5-91. Tuning Procedure

5-92. ASSEMBLY REMOVAL. The frequency divider assembly must be removed from its mounted position to expose tuning adjustments. If care is exercised during removal, power to instrument can remain on.

a. Remove mounting screws holding divider assembly in instrument.

b. Leave cables and connectors intact and carefully remove assembly from instrument. Place assembly across top of other mounted assemblies with adjustment holes exposed.

5-93. 1 MHz TUNING.

a. Connect a BNC tee to front panel 1 MHz output jack. Connect an Electronic Counter and RMS Voltmeter to the BNC tee. Connect the 5061A 5 MHz output to Counter EXT STD INPUT and set counter for external standard operation.

b. Connect 50-ohm Termination to the rear panel 1 MHz output jack.

c. Connect the blue and gray wires to the divider.

d. Set front panel DIVIDER MODE switch to AUTO START. Tune A6T1, T2, C21 and T3 for maximum indication on RF Voltmeter. Counter should indicate 1 MHz ±1 count.

e. Set DIVIDER MODE switch to center off position. Momentarily disconnect J6 from the instrument. The divider should stop. Set DIVIDER MODE switch to START and release. The divider should start and remain running.

f. Carefully retune A6C21, T1, T2, and T3 for maximum indication on RMS voltmeter. Output level should be between 1.0 and 1.5 Vrms. If less, decrease the value of A6R31 until the output level is between 1.0 and 1.5 volts. This completes the 1 MHz divider tuning.

5-94. 100 kHz TUNING

NOTE

The 100 kHz divider is started by the 1 MHz divider signal. Before tuning the 100 kHz divider make sure the 1 MHz divider is started and running.

a. Observe the CIRCUIT CHECK 100 kHz indication and compare it to Table 3-1.

b. Check for 100 kHz, 1 Vrms into 50-ohms at front and rear panel 100 kHz jacks.

c. Connect oscilloscope probe at Q10 collector. Adjust T4 for maximum amplitude at 1 MHz.

d. Connect oscilloscope probe at Q16 collector. Adjust T5 for maximum amplitude at 100 kHz.

e. Make minor readjustments of T4, T5 for a stable 100 kHz, 1 Vrms into 50-ohms at J2, J4.

f. Disconnect all test equipment from 5061A and re-install divider assembly in instrument. This completes the divider checks and tuning.

5-95. Module Replacement

5-96. No other module adjustments are necessary when Frequency Divider Assembly A6 is replaced.

5-97. AC AMPLIFIER ASSEMBLY A7

5-98. Normal Operation

5-99. The amplifier circuits receive the low-level modulating signal from Cesium Beam Tube Assembly A12 and provide amplified outputs to Phase Detector Assembly A8 and Logic Assembly A14. BEAM I current indication for CIRCUIT CHECK meter is also furnished from the amplifier circuits. The 274 Hz second harmonic and 137 Hz fundamental are contained in the input signal. The 274 Hz is filtered out and supplied to logic circuits while the 137 Hz is further amplified and supplied to phase detector and logic circuits.

5-100. Operational Check

5-101. To determine if AC Amplifier Assembly is operating normally proceed as follows:

a. Set instrument to normal operation (CONTINUOUS OPERATION light on, ALARM light off).

b. With the Micon-to-BNC adapter supplied, connect the vertical input of an Oscilloscope to A7J6 error signal test jack.

c. Set front panel MODE switch to LOOP OPEN.

d. With CIRCUIT CHECK switch to BEAM I, adjust OSC FREQUENCY COARSE for resonant peak.

e. Set OSC FREQUENCY $X10^{-10}$ control to 300. Waveform should be similar to Figure 8-2, (9). Disconnect oscilloscope and cable from instrument.

5-102. Noise Check

a. With instrument operating and MODE switch set to LOOP OPEN, disconnect A7P1 from A7J1. This removes the AC Amplifier input signal.

b. Set AC Amplifier Gain switch A7S1 to HI and set front panel LOOP GAIN control maximum clockwise.

c. Connect an RMS Voltmeter to A7J6 output test jack. Voltmeter indication should be less than 0.5 Vrms. Disconnect RMS Voltmeter.

d. Return switch A7S1 to original position and LOOP GAIN to mid-range.

e. Connect A7P1 to A7J1.

f. Set OSC FREQUENCY $X10^{-10}$ to 250.

g. Set MODE switch to OPER.

h. Set CIRCUIT CHECK switch to 2ND HARMONIC.

i. Adjust LOOP GAIN control for an indication of 40 on CIRCUIT CHECK meter.

5-103. Troubleshooting

5-104. Amplifier components can be easily reached if the assembly is removed from the instrument and connected to an external +18.7 Vdc Power Supply.

5-105. The external dc supply (+) lead should be connected to W-R terminal on the AC Amplifier Assembly and the common (−) lead to circuit board common. If the trouble is in the Beam Current differential amplifier (Q4A/B,5,6) an additional voltage of −10 V must be supplied to the "VIO" terminal. Troubleshooting may now be done in a straightforward manner. DC collector voltages for each amplifier stage are given on the schematic.

5-106. Module Replacement

5-107. When AC amplifier components are repaired or replaced, LOOP GAIN control A7A1R7, 2ND HARMONIC level Paragraph 5-197, modulation phase Paragraph 5-194, and BEAM I meter zero Paragraph 5-196, should be adjusted. To adjust LOOP GAIN, perform procedures listed in next paragraph (Loop Gain Adjustment).

5-108. Loop Gain Adjustment

a. Set 5061A controls as follow:

MOD	ON
MODE	LOOP OPEN
OSC FREQUENCY $X10^{-10}$	250
CIRCUIT CHECK	BEAM I
TIME CONSTANT	SHORT

b. Tune OSC FREQUENCY COARSE control to primary cesium resonance indicated on CIRCUIT CHECK meter.

c. Using the Micon-to-BNC adapter supplied, connect a DC Voltmeter to A8J1 on Phase Detector Assembly A8.

d. Carefully adjust OSC FREQUENCY COARSE control for zero voltmeter indication. Some noise will be present in meter indication. Adjust for minimum meter indication.

e. Set OSC FREQUENCY $X10^{-10}$ control to 200.

f. Adjust front panel LOOP GAIN control for Voltmeter indication of +1.6 ±0.15 volts.

NOTE

AC Amplifier Assembly A7 GAIN switch (A7S1) setting should be changed if LOOP GAIN control range is insufficient to perform step f.

g. Set OSC FREQUENCY $X10^{-10}$ control to 300. Voltmeter should indicate −1.6 ±0.15 Volts. If not, repeat steps b through g.

h. Set MODE switch to OPER. Voltmeter indication should fall to zero. This verifies proper frequency control loop operation.

i. Set OSC FREQUENCY $X10^{-10}$ to 250. Disconnect Voltmeter and adapter cable.

5-109. PHASE DETECTOR ASSEMBLY A8

5-110. Normal Operation

5-111. Phase detector circuits provide the following outputs:

a. 137 Hz, 80 to 300 mV p-p sine wave at A8J5. This is the phase modulation applied to Multiplier Assembly A3.

b. 137 Hz, 12 to 16 V p-p square wave at A8J4. Synchronous detector signal applied to Logic Assy A14.

c. 137 Hz, 1.5 to 2.1 V p-p triangular signal at A8J2. Available for synchronization.

d. Full wave phase detected signal, derived from AC Amplifier Assembly A7, at A8J1 and A8J6. This signal is applied to Operational Amplifier Assembly A9.

NOTE

When the 5061A is operating normally (with the atomic loop closed), the error signal at A8J1 is very small, containing mostly noise. When viewed with an oscilloscope it should appear similar to Figure 8-2, waveform (11).

5-112. Operational Check

5-113. To determine if Phase Detector Assembly is operating normally, perform the following operational checks:

a. Operation mode of 5061A is not important for this check. Remove the cable at A8J5 and with the Micon-to-BNC adapter furnished, connect the vertical input of an Oscilloscope to A8J5. The waveform should be similar to Figure 8-19, (6).

b. Operation mode of 5061A is not important for this check. Remove the cable at A8J4 and with the Micon-to-BNC adapter furnished, connect the vertical input of an Oscilloscope to A8J4. The waveform should be similar to Figure 8-2, (13). Remove the oscilloscope connection and reconnect A8J4.

c. Operation mode of 5061A is not important for this check. Connect vertical channel of an Oscilloscope to A8J2. The waveform should be triangular with 1.5 to 2.1 V p-p amplitude. Disconnect oscilloscope and connect Electronic Counter in its place. The frequency at A8J2 should be 137 Hz ±1 Hz. If not, adjust A8R10 (MOD FREQ) for 137 Hz ±1 Hz as indicated on Counter. Disconnect Counter from instrument.

d. Set 5061A controls to:

OSC FREQUENCY X10^{-10}	250
MODE	LOOP OPEN
CIRCUIT CHECK	BEAM I

Adjust OSC FREQUENCY COARSE control for peak of cesium resonance indicated on CIRCUIT CHECK meter. Set OSC FREQUENCY X10^{-10} control to 300. Remove cable from A8J3 and connect vertical input of Oscilloscope to this cable (A8P3). The waveform should be similar to Figure 8-2, (9). Disconnect Oscilloscope and reconnect A8P3 to A8J3. Connect Oscilloscope to A8J1. The waveform observed should be similar to Figure 8-2, (10). Disconnect Oscilloscope.

NOTE

If this signal is clipped or distorted, readjust OSC FREQUENCY X10^{-10} control for waveform shown in Figure 8-2, (9). This is the amplified error signal from AC Amplifier Assembly A7.

e. Remove cable from A8J3 and connect a DC Voltmeter to A8J1. Signal amplitude should be less than ±1.0 mV. If voltage is incorrect, adjust Phase Zero adjust (A8R39) for zero Vdc ±0.2 mV.

5-114. Troubleshooting

5-115. When any components are repaired or replaced the assembly should be adjusted. When cesium beam tube assembly A12 is replaced, phase detector circuits should be checked and adjusted. For complete check and adjustments, see Paragraphs 5-118 to 5-120.

5-116. Module Replacement

5-117. A new phase detector module may be replaced without removing power from the 5061A. After replacement, new module should be adjusted as follows.

5-118. PHASE MODULATION FREQUENCY ADJUST.

a. Set front panel controls as follows:

TIME CONSTANT	SHORT
MOD	ON
MODE	LOOP OPEN
OSC FREQUENCY X10^{-10}	250
CIRCUIT CHECK	BEAM I

b. Adjust OSC FREQUENCY COARSE control for maximum peak indication shown on CIRCUIT CHECK meter.

c. Connect an Electronic Counter to phase detector SWEEP TEST OUTPUT jack A8J2 located on instrument bottom front deck.

d. Adjust Mod Freq control (A8R10) for 137 Hz ±1 Hz display on Electronic Counter. Disconnect Counter from instrument.

5-119. PHASE DETECTOR ZERO ADJUSTMENT.

a. Set front panel MOD switch to OFF.

b. Disconnect +18.7 Vdc lead (white-red) from AC Amplifier A7.

c. Using adapter cables supplied, connect DC Voltmeter to phase detector test output A8J1.

d. Adjust Phase Detector Zero control A8R39 for less than 1.0 mV indication on voltmeter. Disconnect voltmeter and adapter cable.

e. Connect the +18.7 Vdc lead (white-red) to AC Amplifier Assembly A7.

5-120. PHASE MODULATION PHASE ADJUST.

a. Set 5061A controls as follows:

MOD	ON
MODE	OPER
OSC FREQUENCY X10^{-10}	250
CIRCUIT CHECK	CONTROL
TIME CONSTANT	SHORT

b. Adjust OSC FREQUENCY COARSE for zero CIRCUIT CHECK meter indication.

c. Set MODE switch to LOOP OPEN.

d. Set OSC FREQUENCY X10^{-10} control to 200.

e. Using the adapter cables provided, connect vertical input of Oscilloscope to A8J1.

f. Adjust A8R42 (Phase Adj) for correct waveform shown in Figure 5-8.

NOTE

If A8R42 has insufficient range, reverse the positions of A8R34 and A8R35, located inside the module, so that A8Q8 emitter is connected to A8R35 and A8Q9 emitter is connected to A8R34.

g. Disconnect Oscilloscope and adapter cable from instrument.

h. Set OSC FREQUENCY X10^{-10} to 250. This completes the phase adjustment.

5-121. OPERATIONAL AMPLIFIER ASSEMBLY A9

5-122. Normal Operation

5-123. This integrating amplifier provides the dc control voltage to Oscillator Assembly A10 for controlling quartz oscillator frequency.

5-124. Operational Check

5-125. To determine if amplifier assembly is operating normally proceed as follows:

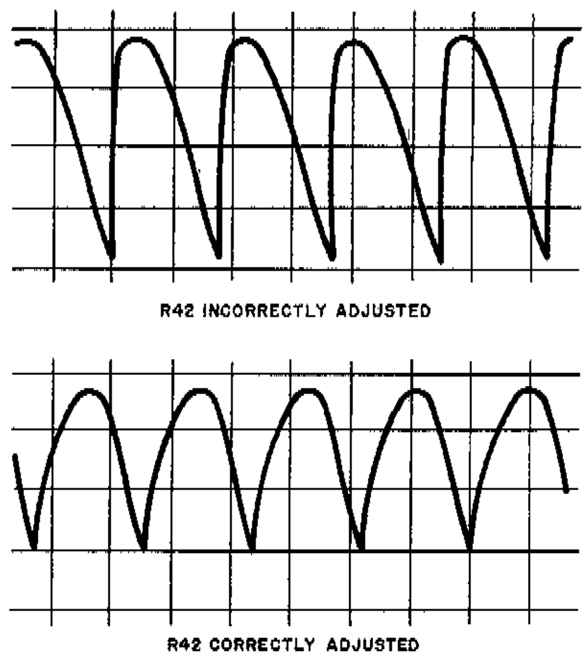
a. Set 5061A MODE switch to OPER and time constant to short.

b. Remove instrument top and bottom covers.

c. Locate TP1 and TP2 on bracket at bottom right side of instrument deck near the front panel (Figure 8-4). Connect a clip lead between TP1 and TP2 shorting the input to Operational Amplifier Assembly A9.

d. Connect a DC Voltmeter to rear panel CONTROL output jack (this same point is available on Terminal Board A17).

Figure 5-8. A8R42 Adjustment



e. Switch front panel MODE switch to LOOP OPEN then to OPER. Observe the voltage on Voltmeter 10 mV range. Voltage will probably drift since Operational Amplifier Assembly A9 integrates its internal zero offset. This drift however, should not exceed 1.5 mV/min. If drift is excessive, check circuit board in vicinity of amplifier input for dirt or dust which could cause leakage paths.

f. Set MODE switch to LOOP OPEN.

g. Remove shorting jumper between TP1 and TP2.

h. Disconnect A8P6 from A8J6 at A8 Phase Detector Assembly output.

i. Using a Micon-to-BNC adapter provided, connect a DC Power Supply set for zero output to A8P6. Connect cable shield to negative (−) terminal of power supply.

j. Adjust DC Power Supply for +1 Vdc output.

k. Set MODE switch to OPER.

l. Observe DC Voltmeter for a decreasing voltage. When CONTROL voltage decreases to −5 Vdc, disconnect DC Power Supply. DC Voltmeter should indicate and retain the voltage indicated when DC Supply was disconnected.

m. Reconnect power supply in opposite polarity; that is, connect power supply + terminal to cable shield and − terminal to cable center conductor.

n. The dc voltmeter should increase through zero and indicate an increasing positive voltage. When DC Voltmeter indicates +5 Vdc, disconnect the DC Power Supply. DC Voltmeter should indicate and retain the voltage indicated when supply was disconnected.

o. Set front panel MODE switch to LOOP OPEN then back to OPER. Voltmeter should indicate zero volts. This concludes the operational check. Disconnect all instruments and test cables and reconnect A8P6 to A8J6.

5-126. Troubleshooting

a. Circuit board in area of input terminals must be clean. Contamination here can cause excessive zero drift.

b. Integrating Capacitors C2 and C3 should also be checked when troubleshooting operational amplifier A9. Resistance across these capacitors should be >5 kM ohms. Check C2, C3 as follows:

1. Remove A8P6, A9J2 and A9P1.

2. Set MODE switch to OPER MODE.

3. Measure resistance, using an HP 412, between A9J2(5) and center of A9P1 (USE CAUTION, 300 V present).

5-127. Module Replacement

a. Remove +18.7 V (white/red) from AC amplifier assembly A7.

b. Proceed as directed in Paragraph 5-192, steps a through e.

5-128. OSCILLATOR ASSEMBLY A10

5-129. General

5-130. The oscillator assembly is not recommended for field repair. Instrument warranty is void if repair or adjustment is attempted inside the assembly. Adjustments other than those available on instrument front panel will also void the warranty. If it is established that a defective component or circuit trouble exists within the oscillator assembly, contact the nearest Hewlett-Packard Sales and Service office for shipping instructions and for packing information.

5-131. Operational Check

5-132. The following procedures may be used to determine proper operation and should be used if the assembly is replaced.

5-133. CIRCUIT CHECKS. The following circuit checks involve checking oscillator inputs and outputs.

a. Set instrument to normal operation with front panel MODE switch set to LOOP OPEN.

b. Disconnect the +20 red wire from the oscillator assembly. Connect a high impedance DC Voltmeter positive lead (+) to the disconnected red wire. Connect common (−) Voltmeter lead to instrument chassis. Voltmeter should indicate between +18.2 and +18.9 Volts. Disconnect Voltmeter and connect red wire back to +20 terminal on oscillator assembly.

c. Disconnect the +24 white-red-blue wire from oscillator assembly. Connect a high impedance DC Voltmeter positive lead (+) to the disconnected white-red-blue wire. Connect common (−) Voltmeter lead to instrument chassis. Voltmeter should indicate between +22 and +33 Volts. Disconnect Voltmeter and connect white-red-blue wire back to +24 terminal on oscillator assembly.

d. Connect high impedance DC Voltmeter to white-orange wire on OSC FREQUENCY X10^{-10} control. Connect common (−) lead to chassis ground. Voltmeter should indicate between +14 and +16 Volts. Disconnect Voltmeter.

e. Connect DC Voltmeter to OSC OVEN pin on Terminal Board Assembly A17(17). Connect common (−) lead to chassis ground. Voltmeter should indicate about +16 Volts. Disconnect Voltmeter.

f. Connect an oscilloscope vertical channel through a 50-ohm Feedthru to A10J3. Oscilloscope display should be similar to Figure 8-2, (1). Remove Oscilloscope and replace A10P3.

g. Connect Oscilloscope vertical channel through 50-ohm Feedthru to A10J4. Oscilloscope display should be similar to Figure 8-2, (2). Remove oscilloscope and re-connect A10J4. If waveform amplitudes observed in steps g and f are low, adjust front panel 5 MHz FILTER control for maximum amplitude of oscilloscope display.

h. Set CIRCUIT CHECK switch to 2ND HARMONIC. Adjust OSC FREQUENCY X10^{-10} control maximum clockwise, maximum counterclockwise, and return to 250. CIRCUIT CHECK meter should track with control movement.

i. Disconnect cable from −EFC on oscillator assembly. Connect DC Power Supply common lead (−) to −EFC on oscillator assembly. Connect positive lead (+) to chassis ground. Slowly adjust DC Power Supply to −5 Volts. CIRCUIT CHECK meter should track with Power Supply. Disconnect Power Supply and re-connect −EFC cable.

j. Set CIRCUIT CHECK switch to OSC OVEN, 5 MHz, SUPPLY, and observe CIRCUIT CHECK meter indication at each position. Meter indications should agree with Table 3-1. This completes the oscillator circuit checks.

5-134. OUTPUT VOLTAGE AND WAVEFORMS. In addition to the circuit checks, the following checks can be performed, using equipment listed in Table 5-1. To observe 5 MHz output voltage and waveforms:

a. Terminate rear panel 5 MHz output jack with 50-ohm Termination and connect an RMS Voltmeter to front panel 5 MHz output jack. Output level should be at least 1 Volt rms.

b. Repeat step a, using an Oscilloscope. Signal should be a sine wave with no apparent distortion.

5-135. SIGNAL TO NOISE RATIO. Figure 5-9 shows the test setup diagram for the signal-to-noise ratio test. The required test equipment and characteristics are listed in Table 5-1. To perform the signal-to-noise ratio test, proceed as follows:

a. Using BNC "tee", connect RF millivoltmeter to L input of mixer.

b. Adjust attenuator so that mixer is operating with linear characteristics. That is, a 1 dB change in attenuator setting causes a 1 dB change in the RF millivoltmeter. This is the minimum amount of attenuation that must remain in the system at all times.

c. Record voltage indication of RF millivoltmeter.

d. Disconnect Cesium Standard under test from attenuator.

e. Set signal generator dial to 5 MHz, output level to minimum.

f. Connect signal generator RF output to attenuator input.

g. Adjust signal generator output level to give same indication on RF millivoltmeter as in step c.

h. Connect reference frequency standard 5 MHz output to mixer R input.

i. Set attenuator to 70 dB.

j. Set AC voltmeter FUNCTION switch to 1 CPS range. Adjust RANGE switch for an on-scale reading.

k. Adjust signal generator frequency for maximum on AC voltmeter.

l. Record the following:

1. Attenuator setting	70 dB
2. AC voltmeter range	______ dB
3. Voltmeter scale reading (±)	______ dB
4. Reference signal level (algebraic sum of 1, 2, and 3)	______ dB

m. Disconnect signal generator from attenuator input and reconnect the 5 MHz output from the instrument under test to the attenuator input.

n. Set attenuators to value noted in step b. Connect DC voltmeter to 50 ohm termination at output of mixer and adjust for on-scale reading.

o. Slowly adjust reference oscillator (COARSE AND FINE) frequency adjustments so that reading on DC voltmeter stops moving, and, is less than ±1 mV. It will not be possible to keep this voltage stable for more than a few seconds but this initial setting will suffice.

p. Reconnect amplifier to mixer output. Increase AC voltmeter sensitivity until an on-scale reading is obtained. Record the following:

1. Attenuator setting	______ dB
2. AC voltmeter range	______ dB
3. Voltmeter scale reading (±)	______ dB
4. Noise signal level (algebraic sum of 1, 2, and 3)	______ dB

q. Calculate the signal-to-noise ratio using the following format as a guide:

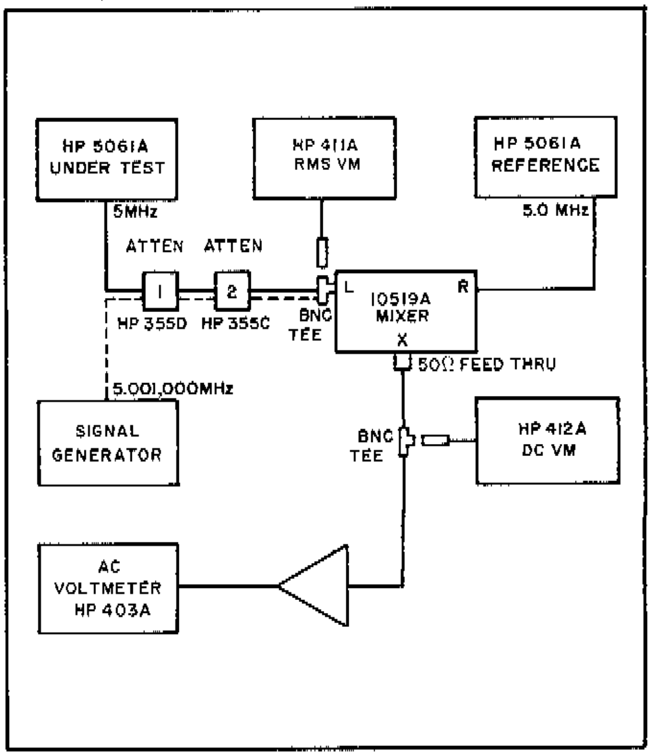
1. Noise level, step p-4	______ dB
2. Reference signal level, step l-4	______ dB
3. Subtract 2 from 1 (sign should be negative)	______ dB

The result obtained on line 3 should be corrected by −3 dB to account for noise contribution from the reference oscillator, and by a 1 dB meter correction to arrive at the RMS noise figure (the meter is an average reading device and its indication is 1 dB low for noise measurements).

4. Add −2 dB to 3.

The result obtained on line 4 shall be less than −87 dB.

Figure 5-9. Signal-to-Noise Ratio Test Setup



5-136. NON HARMONIC DISTORTION. Non harmonically related distortion for oscillator operation is at least 80 dB below the 1 Vrms output level. To measure non-harmonic distortion, a Spectrum Analyzer is tuned to the 5 MHz fundamental and an amplitude reference is established. Output frequency spectrum is then investigated to determine fundamental to sideband amplitude relationship at non-harmonic points of the spectrum. To check non-harmonic distortion, proceed as follows:

a. Set instrument to normal operation (CONTINUOUS OPERATION light on, ALARM light off).

b. Set CIRCUIT CHECK switch to CONTROL.

c. Adjust OSC FREQUENCY COARSE control for zero CIRCUIT CHECK meter indication.

d. Set MODE switch to LOOP OPEN. Frequency loop is open and Oscillator Assembly A10 is operating without control.

e. Connect instrument 5 MHz output through 50 ohm Termination to Spectrum Analyzer input. Check Spectrum at 5 MHz center from 4 MHz to 6 MHz. All sidebands, except 5 MHz point, should be 80 dB below the carrier. This completes non harmonic distortion check.

5-137. HARMONIC DISTORTION. Harmonic distortion, for oscillator operation, should be at least 40 dB down from the 1 Vrms output. To perform this check, a Spectrum Analyzer is tuned to the 5 MHz output and an amplitude reference is established. Output frequency spectrum is then investigated to determine fundamental to sideband amplitude relationship at harmonic points of the fundamental.

a. Set instrument to normal operation (CONTINUOUS OPERATION light on, ALARM light off).

b. Set CIRCUIT CHECK switch to CONTROL.

c. Adjust OSC FREQUENCY COARSE control for zero CIRCUIT CHECK meter indication.

d. Set MODE switch to LOOP OPEN. Frequency loop is open and Oscillator Assembly A10 is operating without control.

e. Connect instrument 5 MHz output through 50 ohm Termination to Spectrum Analyzer input. Check Spectrum at 5 MHz center to 4th harmonic (20 MHz). Harmonics should be 40 dB below the carrier. This completes harmonic distortion check.

5-138. STABILITY. Stability specifications for the 5 MHz output are as follows:

a. As a function of ambient temperature: less than 2.5×10^{-9} from 0°C to +50°C.

b. As a function of load: less than $\pm 2 \times 10^{-11}$ for open circuit to short circuit, and 50-ohms, R, L. and C load changes.

c. As a function of supply voltage: less than $\pm 5 \times 10^{-11}$ for 10% change from nominal (115 or 230 Vac) line voltage or a dc voltage change between 22 and 30 V.

5-139. Figure 5-10 is the block diagram of a system used to test the stability as a function of temperature, load, and supply voltage. The equipment used is listed in Table 5-1; equipment with equivalent characteristics may be used. Perform the stability test as follows:

a. Connect equipment as shown in Figure 5-10.

b. Connect channel A of voltmeter to reference source and channel B to oscillator under test.

c. Set 5061A under test to normal operation (CONTINUOUS OPERATION light on, ALARM light off). Set CIRCUIT CHECK switch to CONTROL. Adjust OSC FREQUENCY COARSE control for zero CIRCUIT CHECK meter indication. Set MODE switch to LOOP OPEN. Frequency loop is open and Oscillator Assembly A10 is operating without control.

d. Set reference 5061A to normal operation (CONTINUOUS OPERATION light on, ALARM light off).

e. Set oscillator under test to same frequency as reference source by adjusting Test 5061A OSC FREQUENCY COARSE and OSC FREQUENCY $X10^{-10}$ frequency for minimum movement on most sensitive range of voltmeter RANGE and METER OFFSET.

f. Set PHASE METER ZERO and OFFSET for zero.

g. Record PHASE METER reading after 100 sec.

h. Determine frequency difference between A and B inputs using following equation:

Since

$$360°/\text{sec} = 1\ \text{Hz, then } \frac{360°/\text{sec}}{1\ \text{Hz}} = \frac{\Delta\phi/t}{\Delta f}$$

solving for Δf;

$$\Delta f = \frac{\Delta\phi}{360°(t)}$$

t = time in seconds, required for the phase change measured

Δf = frequency difference between input signals

$\Delta\phi$ = phase change in degrees (8405A reading)

Dividing Δf by the frequency of the reference oscillator then gives the frequency difference in proportional parts. Example:

Standard frequency f = 5 MHz

$\Delta\phi$ measured on 8405A = 1.3°

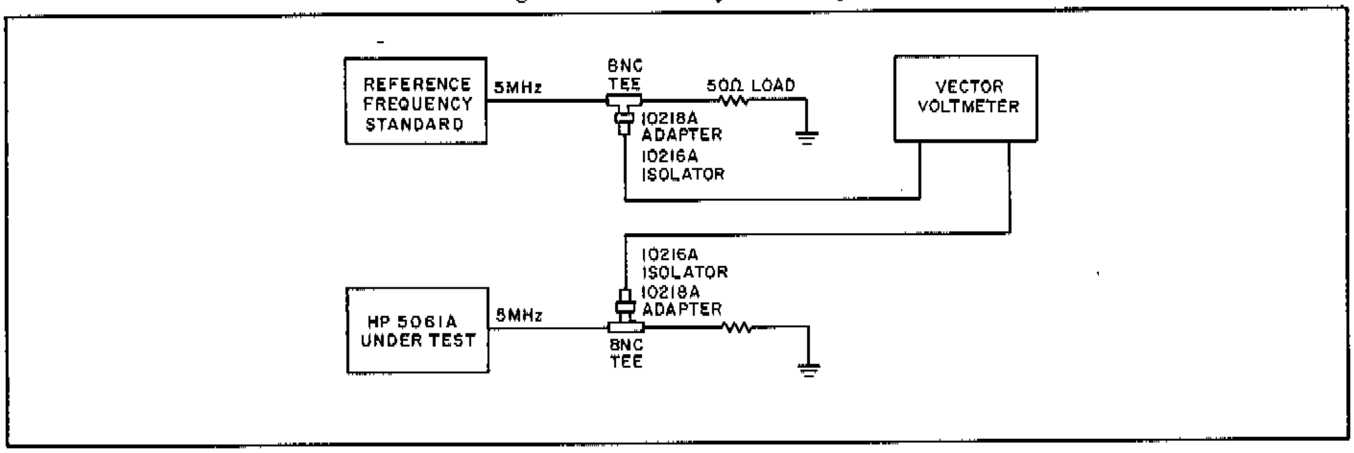
Δt = 100 seconds

$$\frac{\Delta f}{f} = \frac{\Delta\phi}{t(360°)(f)} = \frac{1.3°}{360°(100)(5 \times 10^6)} = \frac{1.3}{1.8 \times 10^{11}} =$$

7.2×10^{-12} or 7.2 parts in 10^{12}.

i. Repeat step h after 24 hours; stability should be ≤ 5 parts in 10^{10}.

Figure 5-10. Stability Test Setup



5-140. To check oscillator stability as a function of temperature, place oscillator under test in a controlled temperature chamber. Set temperature to 0°C and after 4 hours perform stability test. Stability should be as stated in Table 1-1. Set temperature to 50°C and after 4 hours repeat the above test. Stability should be as stated in Table 1-1.

5-141. To check oscillator stability with load change, leave system connected as for temperature check with the temperature now set to 25°C. Remove all loads from oscillator under test. Perform stability test with the following loads on 5 MHz OUTPUT: open circuit, 50-ohm resistive, inductive and capacitive. To perform stability test with 5 MHz OUTPUT shorted, leave system connected as in temperature check and connect vector voltmeter channel A to reference source 1 MHz OUTPUT and channel B to 1 MHz OUTPUT of unit under test. Connect short to 5 MHz Output connector.

5-142. To check oscillator stability with supply voltage changes, leave system connected as for temperature test. Without interrupting power, connect 5061A under test to +22 to +30 volt dc source and perform stability test. Stability should be as stated in Table 1-1. Repeat test with oscillator connected to variable line voltage source set to 103 Vac and then to 127 Vac. Stability should be as stated in Table 1-1.

5-143. Module Replacement

5-144. To remove Oscillator Assembly A10, proceed as follows:

a. Remove all operating power.

NOTE

If Standby Battery Option 002 is installed, remove instrument bottom cover. Remove ac power and press S8 located on bottom instrument deck (Figure 8-4).

b. Remove instrument top cover.

c. Remove 4 screws holding the oven in place. One screw is on bottom, three on top. One is attached in front of AC Amplifier Assembly A7. Use offset screwdriver provided.

d. Partially remove oscillator and frame assembly.

e. Disconnect all electrical connections.

f. Remove oscillator and frame assembly from instrument.

g. Remove oscillator from frame assembly.

h. Replace oscillator by reversing the above procedure.

NOTE

When replacing the oscillator and frame assembly, care should be taken in handling the gray and white-yellow-gray wires. These wires carry ac line voltage to the oscillator assembly. If Time Standard Option 001 is installed, Digital Divider Assembly A5 (Figure 8-7) should be removed when reconnecting the gray and white-yellow-gray wires.

i. After replacing the new oscillator assembly, operational check should be performed (Paragraphs 5-131 through 5-141).

5-145. CESIUM OVEN CONTROLLER ASSEMBLY A11

5-146. Normal Operation

5-147. Oven controller circuits provide power to the cesium beam tube as required. In addition, they supply power to the hot wire ionizer, mass spectrometer (in beam tube), 16 volts and 300 volts to Operational Amplifier A9, minus 10 volts to AC Amplifier Assembly A7, and voltage for front panel CIRCUIT CHECK meter indication when set to CS OVEN. During cesium oven warmup, front panel meter indication should be full scale and will decrease to between 5 and 35 depending on oven temperature. Mass Spectrometer adjust A11R27 and voltage checks are outlined in the following paragraphs. Make these checks only when oven controller failure is suspected or after repair.

5-148. Operational Checks

5-149. MASS SPECTROMETER ADJUSTMENT.

a. Place 5061A in normal operation (MODE switch to OPER, CONTINUOUS OPERATION light on, ALARM light off).

b. Set CIRCUIT CHECK switch to BEAM I.

c. Remove instrument bottom cover, locate Cesium Oven Controller Assembly A11 (Figure 8-3), and adjust A11R27 Mass Spectrometer adjust for maximum CIRCUIT CHECK meter indication.

5-150. 300 VOLT CHECK

NOTE

300 V is not used by A9 Assembly with Stock Number 05061-6089.

a. Disconnect ALL operating voltages from 5061A.

b. Remove instrument top and bottom covers.

c. Remove Cesium Oven Controller Assembly A11 (Figure 8-3), remove assembly cover, and reconnect oven controller to instrument so components are accessible.

d. Connect instrument to operating power and place in normal operation (Paragraph 3-8).

e. Connect DC Voltmeter positive lead (+) to A11J1 (11). Connect common lead (−) to A11J1(10). Voltmeter should indicate between +270 and +360 volts. Disconnect Voltmeter.

5-151. 16 VOLT CHECK

a. Connect DC Voltmeter (set to measure negative voltage) positive lead (+) to A11J1(7). Connect common lead (−) to instrument chassis. Voltmeter should indicate between −16 and −18 Volts.

b. Disconnect positive Voltmeter lead, set Voltmeter to measure negative voltage (−), and connect Voltmeter to A11J1(8). Voltmeter should indicate between +16 and +18 Volts. Disconnect Voltmeter.

5-152. 10 VOLT CHECK. Connect DC Voltmeter (set to measure negative voltage) positive lead (+) to A11J1(6). Connect common lead to chassis ground. Voltmeter should indicate between −8 and −10 volts This completes the voltage checks. Disconnect Voltmeter and disconnect ALL instrument operating power. Replace module cover and re-install in instrument. Instrument is ready for turn-on.

5-153. Module Replacement

a. Disconnect AC and DC power whenever removing or replacing A11 assembly.

b. On new A11 assembly, wire A11T1, A11T2, and A11T4 the same as these transformers in the old A11 assembly.

NOTE

Wiring of the transformer taps should agree with information given on cesium beam tube decal.

c. Remove R21A and B from old assembly and install them in the same positions in the new assembly. Do the same with R24.

d. Perform mass spectrometer adjustment Paragraph 5-149.

5-154. Figure 8-25 is provided and is a good trouble-shooting aid. When repair or replacement is made, perform Mass Spectrometer adjustment (Paragraph 5-149) and all voltage checks (Paragraph 5-183 h to q.).

5-155. CESIUM BEAM TUBE ASSEMBLY A12

5-156. Warranty

5-157. The Cesium Beam Tube Assembly (05061-6077) used in the Standard 5061A is guaranteed for three years from date of shipment. The High Performance Cesium Beam Tube (05061-6101) used in Option 004 is guaranteed for 14 months from the date of shipment. When the checks and adjustments in the following paragraphs determine that the cesium beam tube is defective, contact the nearest Hewlett-Packard Sales and Service office for shipping instructions.

5-158. General

5-159 (A). No adjustments are provided for Cesium Beam Tube Assembly A12. It is a sealed unit and repair inside should not be attempted. However, the following paragraphs outline checks for the beam tube, a replacement procedure (with necessary adjustments after replacement), and an adjustment procedure for optimizing instrument operation if beam tube output current decreases. Regarding beam tube operation in the Model 5061A, the following points should be remembered:

1. The BEAM I indication on front panel CIRCUIT CHECK meter may decrease slowly with time. This is normal. Along with the BEAM I, the 2ND HARMONIC indication will decrease. When the 2ND HARMONIC INDICATION falls to about 20, the LOOP GAIN and BEAM I METER adjustments should be made as described in Paragraph 5-19.

2. Adjusting loop gain and meter indications does not increase the beam tube output current, but rather compensates for the current decrease.

3. The adjustments in (2) can be made with confidence that instrument operation will remain well within specifications.

5-159 (B) **Normal Operation.** During normal operation the output of the Cesium Beam Tube is a negative current with a peak magnitude of roughly 0.2 μa. The magnitude of this current varies with applied frequency as shown in Figure 3-1. This current is displayed on the front-panel meter in the BEAM I position. The 2ND HARMONIC meter reading is also an indication of the magnitude of the beam current. There are 5 supplies which provide power and high voltages to the Cesium Beam Tube. These are the Cesium Oven, Hot-Wire Ionizer, and Mass Spectrometer power supplies, located in the A11 cesium oven controller; A18 +3500 V and A19 −2500 V power supplies. Each of these supplies must be working properly for the Cesium Beam Tube to produce an output current. Magnitude of the beam current is also controlled by the amount of microwave power sent to the tube, from the A4 Harmonic Generator. Up to the saturation point, more micro-wave power causes more beam current. Thus, the beam current can be used as a power indicator when tuning the A4 Harmonic Generator Assembly. Beyond this point the beam current reduces with increasing power. The microwave tuning procedure insures that the tube is not in saturation. A schematic of the Cesium Beam Tube is shown in Figure 8-5 and may be used to check circuit continuity through the tube.

5-159 (C) **Troubleshooting.** There are two types of Cesium Beam Tube failures; Systemic, and End-Of-Life. Systemic failures are caused by a malfunction inside the tube and are usually characterized by a **sudden** loss or change in beam current. These symptoms may also be caused by failures in the beam tube power supplies or in the circuits which generate the applied microwave signal. Before replacing the tube, these circuits should be eliminated as a cause-of-the-change in beam current. Table 5-4 should be used for a step-by-step procedure in isolating faults of this type. Table 5-6a summarizes the beam tube input, and power supply signals, and their measurement.

5-159 (D) **End-Of-Life Failure.** This failure is characterized by a gradual increase in noise from the tube accompanied by either an increasing or decreasing signal from the tube. End-Of-Life failures result from the tube running out of cesium or from excess free cesium inside the tube causing noise in the detector system. A cesium beam tube is considered to be at the end of its life when the cesium standard will no longer meet its short-term-stability specification.

Table 5-6a. Beam Tube Signals Summary

INPUT	Voltage or Waveform	Where Measured	Applicable Procedure
Cesium Oven Power	Fig. 8-2(7)	J16 (1,2) Front Panel Meter	
Hot Wire Ionizer	Fig. 8-2(6)	J17 (1,2)	
-2500V			Para 5-233
+3500V			Para 5-228
LF Coil			Para 5-162
Microwave Power			Para 5-163
Beam Tube Signal			Para 5-165

However, it is not absolutely necessary to replace the cesium tube at this point. Even though the cesium tube may be somewhat noisy it can continue to operate the instrument and define frequency with sufficient accuracy and stability for many applications. To obtain as much useful life as possible, the user should replace the cesium beam tube only when the instrument performance has degraded to where it is unsuitable in its specific application. Minimum specifications for the standard cesium tube (05061-6077) are as follows: The paragraph notations show where to find the procedure for the measurement.

Signal to Noise Ratio (Para. 5-167) = 300
Peak-valley/background (Para. 5-189) = 1
Peak beam current = 0.8×10^{-8}A

If the cesium tube output signal falls below any of these specifications it is considered to be at the end of its life. The end of life criteria for the "High Performance" beam tube (05061-6101) Option 004, is called the figure-of-merit (F_m):

$$F_m = \frac{s/n}{(LW)} \sqrt{\frac{PVB + 1}{PVB + 2}} \geq 10$$

Where:

s/n = Signal to noise ratio (Para. 5-167)

(LW) = Line width (on cesium beam tube label)

PVB = Peak-Valley/background (Para. 5-189)

As the formula indicates, the tube is functioning normally if the figure of merit (F_m) is 10 or greater. However, the instrument will function very well even if the figure-of-merit drops below 10. The standard cesium tube has a figure-of-merit of 1 to 2.

5-160. Operational Checks

5-161. GENERAL. Beam tube failure should be definitely established prior to replacement. Failure indications can be due to associated circuitry and this aspect should be thoroughly investigated. Table 5-4 is a good aid in checking associated circuits and assemblies. For example: low beam current indication may be caused by low microwave field output from Harmonic Generator Assembly A4 or no beam current indication may be caused by absence of one or more operating voltages. The following checks should determine if cesium beam tube replacement is required. Before performing the procedures, determine if operating voltages are present at Cesium Beam Tube Assembly A12.

CAUTION

High voltages are present at Cesium Beam Tube Assembly A12.

5-162. LF COIL CHECK. The L.F. (low frequency) coil input to the cesium tube enables a beam current to be generated independent of the microwave input. This check is very useful for troubleshooting. A failure in the microwave generating circuits (A1, A3, A4), the beam tube power supplies (A11, A18, A19), or the tube itself can cause a loss of beam current. If performing this test restores the beam current, it indicates the failure is in the microwave generating circuits. If beam current is not restored, it indicates that the fault is in the cesium beam tube power supplies or the tube itself.

a. Set MODE switch to LOOP OPEN.

b. Remove instrument bottom cover and disconnect A4J2 from Harmonic Generator Assembly A4. This removes the beam tube microwave field.

c. On Terminal Board Assembly A17, locate LF Coil test point.

d. Connect a low frequency oscillator to A17 L.F. coil test point.

e. Set the Oscillator to 21.41 kHz about 1 Vrms.

f. If beam current increases, it indicates the beam tube and power supplies are operating properly.

g. Set instrument CIRCUIT CHECK switch to BEAM I and adjust the Oscillator frequency and amplitude for maximum indication on CIRCUIT CHECK meter. Note this reading.

h. Disconnect the oscillator and connect A4J2.

5-163. MICROWAVE-FIELD CHECK. This check determines if the microwave field is of sufficient power to saturate the beam tube microwave cavity. Do the check as follows:

a. MODE switch to LOOP OPEN; MOD switch to OFF.

b. Set CIRCUIT CHECK to BEAM I.

c. Carefully adjust OSC FREQUENCY COARSE to the primary peak of the cesium resonance as indicated on the CIRCUIT CHECK meter (see Figure 3-1).

NOTE

Three peaks will be encountered: two peaks of lower amplitude and one peak of higher amplitude. The higher amplitude peak represents the primary peak of the cesium resonance.

d. Disconnect A7P1 from A7J1 and connect a high impedance dc voltmeter to A7P1.

e. The saturation check is performed by turning A4R1 maximum ccw, then slowly cw until the dc voltmeter just indicates a peak (see Figure 5-10a).

f. Continue turning A4R1 cw. The dc voltmeter indication will remain the same, or decreases then increases again to the peak level of step e. This indicates saturation.

g. If A4R1 is turned further cw, the dc voltmeter indication will decrease, then increase to a peak of lower amplitude than in step e.

h. The correct peak is the one listed in step e. Always reset A4R1 by turning it full ccw and then cw to the first peak.

i. If the double peak (step e and f) is not evident (not saturated), pull A4 Attenuator out slightly and repeat steps e and f (see Figure 5-11). If saturation cannot be attained with the attenuator pulled out all the way, realign A4 Harmonic Generator as described in Paragraph 5-187.

5-164. BEAM TUBE SIGNAL CHECK. The useful output beam current ("flop" signal) from the beam tube is a measure of its efficiency. The "flop"-signal-to-background-noise-current-ratio is easily measured and thus is a quick check of beam tube operation. A high-input impedance Electronic Voltmeter is used to measure the "flop" signal and background noise current; then these values are used to compute the ratio. The relationship used is:

$$\frac{V_p - V_v}{V_B} > 1$$

Where:

V_p = Cesium resonance central peak voltage
V_v = Adjacent Cesium resonance valley voltage
V_B = Background noise with no RF signal applied to tube

5-165. With instrument tuned to the central maximum outlined in Paragraphs 3-8a through 3-8h, remove instrument top and bottom covers, and set controls to:

MOD	OFF
CIRCUIT CHECK	BEAM I
MODE	OPER

a. Remove the input cable from A7J1 and connect DC Voltmeter to this cable. This is the beam tube output signal. Record the voltmeter indication as peak voltage value (V_p).

b. Set MODE switch to LOOP OPEN.

c. Slowly adjust OSC FREQUENCY COARSE control for valley signal (adjacent to the peak) indicated on DC Voltmeter. Record the voltmeter indication as valley voltage (V_v).

d. Retune OSC FREQUENCY COARSE control to central maximum indication on voltmeter.

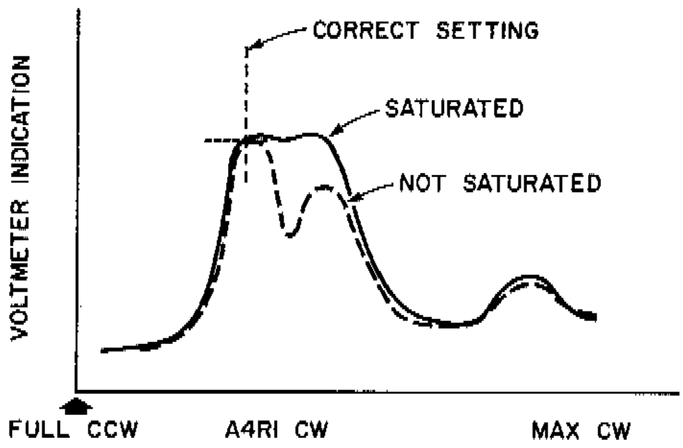
e. Locate Harmonic Generator Assembly A4 (Figure 8-3). Disconnect 12.63.... MHz signal by removing cable connected to A4J2. Voltmeter indication is background noise. Record this value as V_B.

f. Compute the "flop"-signal-to-background ratio using

$$\frac{V_p - V_v}{V_B} > 1.$$

5-166. A value greater than 1 is a good indication that transitions within the beam tube are occurring and beam tube operation is satisfactory. This completes the check.

Figure 5-10a. Saturation Check



A4 SATURATION CHECK

5-167. SIGNAL-TO-NOISE CHECK. The signal-to-noise ratio of the cesium beam tube output helps determine the short-term-stability performance of the instrument. On instruments equipped with the Standard Cesium Beam Tube (HP P/N 05061-6077), the tube must have a signal-to-noise ratio of 300 or greater in order for the instrument to meet specifications. On instruments equipped with the Option 004 High Performance Cesium Beam Tube (HP P/N 05061-6101), this test is used to determine the figure of merit. Figure of merit must be ≥10. See Paragraph 5-159 (C) for further details. Failure of this test may not necessarily mean that the cesium beam tube is defective. Be sure to read Paragraph 5-159 (A), (B), (C), and (D).

5-168. The signal-to-noise ratio for the cesium beam tube is defined as the ratio of beam resonance current (I_p) minus the resonance current valley (I_v), divided by the noise current (I_n). This relationship is expressed by:

$$\frac{S}{N} = \frac{I_p - I_v}{I_n} = \frac{I_s}{I_n}$$

Where:

I_s = Useful beam current

I_n = Beam tube noise current in a 1/4 cycle bandwidth

The values of I_s and I_n are computed from the measurements made in the procedure outlined in Paragraphs 5-170 and 5-171.

5-169. To find the useful beam current signal value I_s, the instrument is tuned to the beam current resonance peak and valley. A high input impedance (100 megohms or more) DC Voltmeter is used to determine this value. This meter input impedance value (R_{meter}) is the denominator when the measured peak and valley voltages are converted to current. With this method the beam current peak becomes

$$I_p = \frac{V_p}{R_{meter}}$$

and the beam current valley becomes

$$I_v = \frac{V_v}{R_{meter}}$$

where V_p is the peak voltage measured and V_v is the valley or minimum voltage measured adjacent to the peak.

5-170. To find the cesium beam tube noise current a sensitive wave analyzer (HP Model 302A) is connected to the output of the beam tube signal preamplifier (located in the A7 assembly). Because the analyzer will be reading noise, an RC filter circuit is added to the analyzer's recorder output to average the meter reading. The bandwidth of the HP302A wave analyzer is nominally 6 Hz, but should be checked before making this test as this value is used in computing the noise current. The preamplifier in the instrument's A7 assembly produces a voltage output, which is proportional to its noise-current input from the cesium beam tube. The constant of proportionality is called the "transfer impedance". When the average value of the noise voltage is determined, it is divided by the transfer impedance to obtain the noise current.

5-171. The following procedure outlines the method for computing the cesium beam tube signal-to-noise ratio.

a. Set MOD switch OFF and MODE switch to LOOP OPEN.

b. Remove cable from A7J1, and using the adapters provided, connect the cable to the input of a high-impedance voltmeter. The meter reading is the dc beam current.

c. Tune the oscillator COARSE control to the primary peak of the cesium resonance as displayed on the meter (see Figure 3-1). Record this voltage as V_p.

d. Adjust the COARSE control to the "valley", or minimum beam current, indication adjacent to the primary peak. Record this voltage as V_v.

e. Compute the signal current (I_s) by using

$$I_s = \frac{V_p - V_v}{R_{meter}} = \underline{\qquad\qquad}.$$

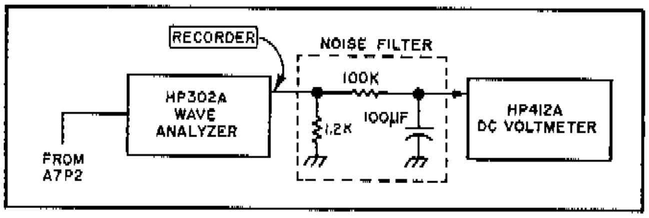
f. Readjust the COARSE control to the primary peak of the cesium resonance. Remove the voltmeter and reconnect the cable to A7J1.

g. Connect HP Model 302A Wave Analyzer input to A7J2.

h. Set GAIN switch on A7 assembly to LOW, and adjust LOOP GAIN control on front panel full clockwise. Ensure MOD switch is OFF; if it is not, repeat steps a through h.

i. Construct an RC filter as shown in Figure 5-10b and connect it to wave analyzer RECORDER output.

Figure 5-10b. RC Filter



j. Set HP Model 302A Wave Analyzer controls to:
SCALE VALUE . . . . ABSOLUTE
MAX INPUT VOLTAGE 0.03
FREQUENCY . . . . 137 Hz
RANGE . . . . average meter indication less than half scale

k. Wait 1 minute before taking a reading. The voltage indication on the high-impedance dc voltmeter is related to the wave analyzer as listed in Table 5-6b.

Table 5-6b. Voltmeter-Wave Analyzer Indications

Analyzer Range	DC Voltmeter Range	Actual Indication on DC Voltmeter
100 μV	1 Volt	0 to 100 μV
100 μV	.3 Volt	0 to 30 μV
300 μV	1 Volt	0 to 300 μV
300 μV	.3 Volt	0 to 100 μV

l. Record reading on the analyzer as V_n. The actual noise current (I_n) coming from the cesium tube is calculated using this formula:

$$I_n = \frac{V_n}{5.34 \times 10^6} \sqrt{\frac{1/4}{\text{B.W. Analyzer}}}$$

The formula converts the noise voltage reading on the analyzer to noise current from the tube. The expression under the square root sign converts the noise reading to equivalent noise in a 1/4 Hz bandwidth.

m. Compute the beam tube signal-to-noise ratio:

$$S/N = \frac{I_s}{I_n}$$

NOTE

Be sure to reset LOOP GAIN as described in step n.

n. Remove wave analyzer connection and reset LOOP GAIN control by following the procedure of paragraphs 5-19(a) through (e). If the LOOP GAIN control has insufficient range to perform the adjustment, set the GAIN switch on the A7 assembly to HI. This will enable the adjustment to be performed.

5-172. BEAM TUBE DEMAGNETIZATION

5-173. General

5-174. When the cesium beam tube has been exposed to a strong magnetic field the tube may require demagnetization. Frequency offsets greater than 1 part in 10^{11} may be due to beam tube magnetization. The following procedure can be used to demagnetize the beam tube. A 6.3 Vac filament transformer is used for degaussing the inner shield. This procedure is for the standard tube only. For Option 004 High Performance Beam Tube, use the HP 10638A Degausser. User instructions are included with the HP 10638A.

5-175. Procedure for Standard Tube

5-176. To degauss the beam tube inner shield, a transformer is required (HP Part No. 9100-0058, or equivalent) with a 6.3 Vac secondary winding capable of carrying 2 Amperes. A 1-ohm, 5-watt resistor (HP Part No. 0811-0040) and variable line voltage source are also required. Proceed as follows:

a. Remove ALL instrument operating power and remove bottom cover.

b. Connect the primary of the transformer to Variable Line Voltage Source output. Connect 1-ohm, 5-watt resistor between A17TP3 and 6.3 Vac terminal and the other transformer 6.3 Vac output terminal to ground.

c. Set Variable Line Voltage Source for "0" volts output and connect to proper voltage, 60 Hz power.

d. Within a 15-second interval, rotate the Variable Line Source to supply 125 Volts to the transformer input and then rotate back to zero input. (A shorter interval for this operation does not degauss satisfactorily and a longer interval may damage "C" Field coil in the beam tube. This completes inner shield degaussing. Disconnect leads, replace instrument cover. Instrument is ready for turn on.

5-177. CESIUM BEAM TUBE REPLACEMENT PROCEDURE

5-178. General

5-179. When it is definitely established that the cesium beam tube is defective, the following replacement procedure should be used. The procedure consists of three parts:

a. Removing the old cesium beam tube.

b. Installing the new tube.

c. Adjustments required for optimum performance with the new tube.

5-180. Removing the Cesium Beam Tube

5-181. To remove the tube, proceed as follows:

a. Disconnect power from the Model 5061A and remove instrument top and bottom covers.

b. If Option 002 (Internal Standby Battery) is installed, depress battery disconnect pushbutton switch S8 located on a bracket on the bottom of the instrument near the center of the deck. Remove A2 assembly.

c. Remove three miniature plugs P1, P2, and P3 from the bottom of Harmonic Generator Assembly A4.

d. Locate the two large wires connected between the beam tube and power supply. These wires are the +3500 V and −2500 V supply leads. Unplug +3500 V plug J4 and −2500 V plug J3 by turning the metal lock on each connector plug.

e. Loosen four screws in the beam tube hold-down straps. Do not remove straps at this time.

f. Release snap-locks on both cable plugs P16 and P17 by moving the bar at the bottom of the plug toward the front panel. Disconnect P16 and P17. Remove White/Red and blue wires from Harmonic Generator assembly A4.

g. Rotate beam tube 45° to allow removal of Harmonic Generator Assembly A4. If beam tube is stuck in place, carefully loosen each end.

h. Remove Cesium Oven Controller Module A11 by unplugging A11P1 from the bottom of the instrument, removing two screws at the rear of the module, and one screw accessible from the bottom at the front of the module (There are two screws located at this point; the screw closer to the rear of the module is the correct one.)

i. Disconnect Harmonic Generator Assembly A4 by removing four screws from flange attached to beam tube. The harmonic generator will be mounted on the new cesium beam tube.

j. Carefully lift out beam tube after removing screws and hold-down straps.

5-182. Cesium Beam Tube Installation

5-183. To install new beam tube, proced as follows:

a. Place new beam tube in the instrument with the label facing up so the waveguide flange for the harmonic generator faces toward the center of the instrument (see Figure 3-7). Place the two metal hold-down straps over the beam tube. Insert the four screws in the hold-down straps and loosely fasten the beam tube in place. Rotate the tube so that harmonic generator may be installed.

b. Connect +3500 V plug J4 and −2500 V plug J3 and lock connectors in place.

c. Connect the two beam tube cable plugs to their jacks, J16 and J17, and lock connectors in place.

d. Attach Harmonic Generator Assembly A4 to the new beam tube. The knurled cavity tuning control on the harmonic generator is positioned up. Tighten the four mounting screws securely to insure a good electrical connection.

e. Rotate the beam tube to provide top cover clearance and permit electrical connections to the Harmonic Generator Assembly. Tighten the four screws in the beam tube hold-down straps.

f. Observe identification markings on Harmonic Generator Assembly A4 and connect the white-red and blue wires.

g. Connect three miniature plugs P1, P2, and P3 to the bottom of the Harmonic Generator. Note the connector markings for proper connections.

h. Remove A11 cover.

NOTE

Refer to Cesium Oven Controller A11 schematic diagram in this manual to identify components referred to in the following steps.

i. Locate A11T1 (9100-0335) near the plug. On some instruments there may be a resistor connected to either terminal 14, 15, 16, or 17 of T1. Any resistors connected between these terminals, or between these terminals and the circuit board, should be removed at this time. If there are no resistors connected to the terminals of T1, proceed to the next step.

1. Some cesium tubes may require installation of a current limiting resistor (or resistors) on the output of T1 to optimize the ionizer current. These resistors are designated R33 and R34. Check the parts envelopes provided

with your new cesium beam tube to see whether R33, R34 (or both) have been supplied:

(a) If they have been supplied go to step 2.

(b) If they have not been supplied:

(1) Check to see if there is a wire connected between T1(17) and the circuit board hole directly beneath it. If not, install a wire in this position.

(2) Perform step 2 (d) below.

2. Installation of R33 and/or R34. Before proceeding, read through steps a, b, and c, below to become familiar with the procedure. Also read the example in step c which is a typical installation.

(a) If only R33 is provided, go to step b. When R34 is provided, solder one end of R34 in the circuit board hole directly below terminal 14 of T1 (9100-0335). If there is a wire connected between T1 and this point, remove the wire and replace it with R34. Check circuit board wiring against schematic to verify proper placement of R34. Do not connect other end of R34 at this time.

(b) Solder one end of R33 in the circuit board hole below terminal 17 of T1 (9100-0335). If there is a wire connected between T1 and this point, remove it to allow installation of R33. Solder other end of R33 to terminal 17 of T1. Check circuit board wiring against schematic to verify proper placement of R33. **If only R33 was provided, go to step d below; otherwise go to step c.**

(c) Note the Hot Wire Ionizer taps called out on the new cesium beam tube decal. Connect R34 to T1 as shown in Table 5-6c. When this has been completed go on to step 5-183(j).

(d) Note the Hot Wire Ionizer taps called out on the new cesium beam tube decal. Connect orange wire from circuit board to T1 as shown in Table 5-6c. When this has been completed go to step 5-183(j).

Table 5-6c. Hot Wire Ionizer Taps

Taps Called for on Beam Tube Decal	Connect R34 or Orange Wire to Terminals	Strap Terminals
15, 17	15	14 and 16
16, 17	16	none
14, 17	14	15 and 16

(e) **Example:** R33 is provided, and the new cesium beam tube decal specifies use of terminals 14 and 17 on T1. The Hot Wire Ionizer circuit should be wired as follows (refer to schematic).

(1) R33 will be connected between terminal 17 of T1 and the output line on the circuit board.

(2) A wire will be connected to terminal 14 of T1 and the output line on the circuit board.

(3) Terminals 15 and 16 of T1 will be connected together.

j. Locate A11T2 (9100-0333) near the NORMAL - LOW switch. Note the transformer taps called out on the new beam tube decal. Connect A11T2 white wires as indicated on the new beam tube decal for LOW flux, and yellow wires as indicated for NORMAL flux.

k. Locate A11T4 (9100-2234). Note taps called for T4 brown wires on the new beam tube decal. Connect brown wires for NORMAL flux.

m. Locate A11R21A, B and A11R24A, B stand-off terminals near the slide switches. Remove the resistors on these terminals.

n. Install the resistors supplied with the new cesium beam tube on A11R21A, B and A11R24A, B terminals.

o. Replace A11 cover.

p. Replace A11 assembly in the instrument and tighten the three mounting screws.

q. Connect plug A11P1 to assembly and fasten snap-lock. This completes installation of the new cesium beam tube. Leave the top and bottom covers off since several adjustments are now required.

NOTE

Do not apply power to instrument at this time.

5-184. Adjustment Procedures

5-185. To adjust the 5061A for optimum performance, proceed as follows:

NOTE

Do not apply instrument power at this time.

5-186. ELECTRON MULTIPLIER VOLTAGE ADJUST (A15R33, A15R34).

a. Connect high voltage probe lead of a high impedance DC Voltmeter, set to measure approximately −0.25 Vdc, to −2500 Vdc power supply assembly A19, pin 3. Connect the common lead of the voltmeter to 5061A chassis. The test point is located at the bottom, center front of the instrument deck.

NOTE

An internal resistive 10,000:1 divider allows measurement of this voltage with a standard Voltmeter.

b. Set MODE switch to LOOP OPEN.

c. Replace A2 assembly. Connect power to the 5061A.

d. Set CIRCUIT CHECK switch to ION PUMP I and observe current indication on CIRCUIT CHECK meter of 5061A. Meter may indicate full scale and then decrease. After indication decreases below 40, -2500 Vdc supply and cesium oven heater will be enabled. If ION PUMP I does not decrease, see Paragraph 3-9.

e. Set TIME CONSTANT switch to SHORT.

f. Locate R33 and R34 on Power Regulator Assembly A15. These resistors are used to adjust the electron multiplier -2500 Vdc supply.

g. Note the electron multiplier voltage called out on the new beam tube decal. The voltmeter should indicate 1/10,000 of this value. For example: if the electron multiplier voltage on the beam tube decal is -2200 Vdc, the voltmeter should indicate -0.22 Vdc. If the voltage is too low, disconnect all power (and battery with Option 002) from the 5061A and reduce the value of A15R33. If the voltage is too high, increase the value of A15R33. Connect power to the 5061A, wait for the -2500 Vdc power supply to enable (see step d) and observe the voltage on the dc voltmeter. Adjust A15R33 resistance until the electron multiplier voltage is within ±50V of the value specified for the new beam tube. It may be necessary to increase A15R34 for proper electron multiplier voltage.

5-187. HARMONIC GENERATOR ASSEMBLY A4 ADJUSTMENTS. The Harmonic Generator Assembly removed from the old beam tube should require only slight adjustment to operate with the new beam tube. RF level in the beam tube cavity is adjusted by first optimizing the harmonic generator for maximum 9192.63 MHz signal; then adjusting this level into the beam tube to obtain maximum beam current. Beam current is measured by connecting a picoammeter or to the voltage probe of a high impedance DC Voltmeter directly to the beam tube output.

NOTE

The high impedance voltmeter is used to measure beam current by measuring the voltage drop across its input impedance.

5-188. The following adjustments should be made only after the 5061A is at operating temperature and the instrument is tuned to primary peak of cesium resonance (refer to Paragraph 3-8, Turn-On Procedure).

CAUTION

Adjust only those controls on Harmonic Generator Assembly A4 which are specifically referred to in the following procedure. The others are factory set and should NOT be adjusted.

a. Set 5061A controls as follows:

TIME CONSTANT . . . . SHORT
MOD . . . . OFF
MODE . . . . LOOP OPEN

b. To monitor beam current, disconnect A7P1 from A7J1. Use the Micon, male-to-male adapter and the Micon-to-BNC cable (provided with the 5061A) to connect A7P1 to the dc voltmeter.

c. Locate A11R27 MASS SPECT adjustment on Cesium Oven Controller A11 and adjust for maximum beam current as indicated on the voltmeter.

d. Carefully adjust front-panel OSC FREQUENCY COARSE control to the primary peak of the cesium resonance as indicated on the dc voltmeter. If this cannot be done, adjust OSC FREQUENCY COARSE for an output frequency of 5 MHz ±0.1 Hz at the front-panel 5 MHz OUTPUT.

NOTE

Three peaks will be encountered: two peaks of lower amplitude and one peak of higher amplitude. The higher amplitude peak represents the primary peak of the cesium resonance (see Figure 3-1).

e. Loosen Attenuator locking screw (Figure 5-11) and pull attenuator maximum out (minimum attenuation). Adjust A4R1 maximum ccw and note the voltmeter indication: this is the background level. Adjust A4R1 cw for a peak indication on the dc voltmeter. If no increase in beam current is indicated on the voltmeter, go to step g.

f. Push A4 Attenuator in for an indication about halfway between the background level and the peak level attained. Then, go to step i.

g. If no increase is attained, set A4R1 maximum ccw, then 1/8 to 1/4 turn cw. Loosen the knurled lock-nut on A4 tuning cavity (see Figure 5-11) and adjust the cavity tuning control maximum ccw, then 3/4 turn cw. This sets the alignment starting point to ≅9192 MHz. Adjust A4S5 for a beam current peak indication on the dc voltmeter. Keep A4S5 locking nut snug when making this adjustment.

CAUTION

Less than 1/2 turn of A4S5 should be needed.

h. Carefully push A4 attenuator in, until dc voltmeter indication is halfway between the background level noted in step e and the peak level attained.

i. Adjust A4R1 maximum ccw, then carefully cw for a peak indication on the dc voltmeter. When a peak indication is attained, carefully readjust A4R1 ccw for a dc voltmeter indication which is halfway between the peak and background levels to ensure that the beam tube is not saturated.

j. Adjust A4 cavity tuning control (see Figure 5-11) for a peak indication on the dc voltmeter. Tighten the cavity Tuning Control Lock.

k. Keeping lock-nut snug, adjust A4S5 for a peak indication on the dc voltmeter.

l. Push attenuator in until dc voltmeter indication is about halfway between the background level noted in step e and the peak indication attained.

NOTE

On some Harmonic Generator/Cesium Beam Tube combinations, it may occur that the attenuator will be pushed all the way in before a beam current level halfway between the peak and background levels can be reached. If this occurs, leave the attenuator pushed all the way in.

m. Adjust A4R1 maximum ccw, then cw until a peak indication on the dc voltmeter is attained. Then, readjust A4R1 ccw, slightly, until the dc voltmeter indication is halfway between the background level noted in step e and the peak indication attained in this step. Repeat steps k, l, m until no further beam I increase is attained by adjusting A4S5.

n. Adjust A4S5 for a peak indication on the dc voltmeter. When making the final adjustment, tighten the lock nut, while adjusting A4S5, so that the peak indication is obtained when the locknut is tight (do not overtighten).

o. Adjust A4R1 full ccw, and then cw to the first peak indication on the dc voltmeter.

CAUTION

In Step p, if the attenuator has previously been pushed all the way in, the beam current may decrease as the attenuator is pulled out. Should this occur, lock the attenuator all the way in and adjust A4R1 as in step p.

p. Pull A4 attenuator out until dc voltmeter peaks then decreases slightly, about 1 minor division of the voltmeter, (this is the optimum beam current). Carefully lock the set-screw, then adjust A4R1 ccw for a dc voltmeter peak indication. This peak should be equal to the maximum beam current previously measured in this step.

q. To check for saturation, turn A4R1 maximum ccw, then cw until the dc voltmeter indicates a peak (see Figure 5-10a).

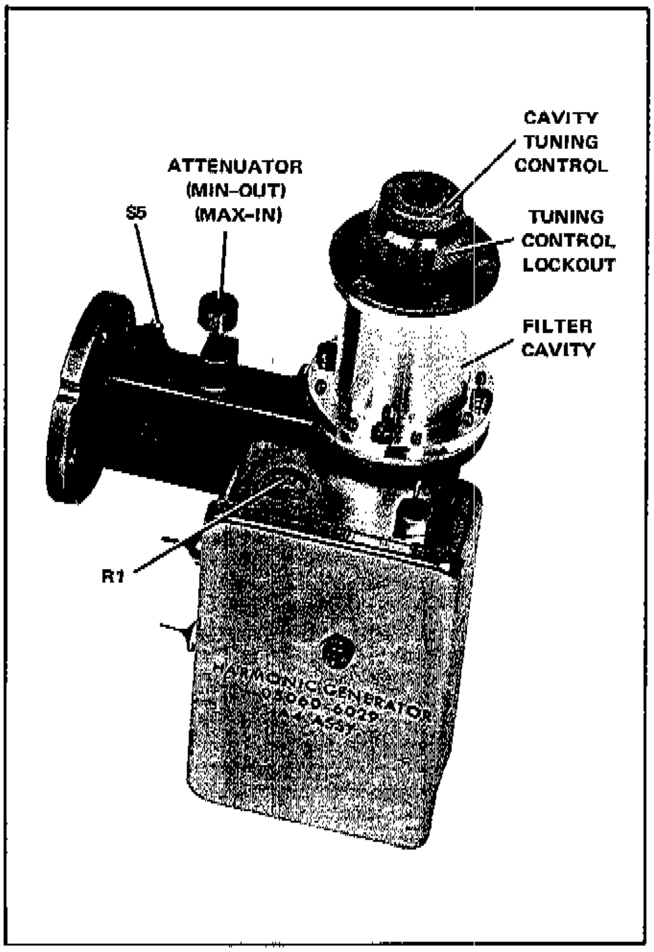
r. Continue turning A4R1 cw. The dc voltmeter indication will remain the same, or decrease then increase again to the peak level of step p. This double peaking indicates saturation.

s. If A4R1 is turned further cw, the dc voltmeter indication will decrease, then increase to a peak of lower amplitude than in step p.

t. The correct peak is the one listed in step p. Always reset A4R1 by turning it full ccw and then cw to the first peak.

u. If the double peak (step p and r) is not evident (not saturated), pull A4 attenuator out slightly and repeat steps q and r (see Figure 5-11). If saturation cannot be attained with the attenuator pulled out all the way, realign A4 Harmonic Generator as described in Paragraph 5-187.

Figure 5-11. Harmonic Generator Assembly A4



5-189. BEAM CURRENT RECORD. The Voltmeter connection used in the previous adjustment procedure (Harmonic Generator A4) will remain connected for the Beam Current Record check. The "peak", "Valley", and "background" figures should be recorded and referred to, along with the beam tube serial number, should it be necessary to contact Hewlett-Packard. The quotient,

$$\frac{\text{Peak Signal - Valley Signal}}{\text{Background Signal}}$$

is a good indicator of the beam tube's performance. A value greater than 1 indicates that the beam tube is performing satisfactorily.

a. Check the 5061A front panel controls. They should be as follows:

TIME CONSTANT	SHORT
MOD	OFF
MODE	LOOP OPEN

b. Adjust the front panel OSC FREQUENCY COARSE adjustment for the primary peak of cesium resonance. Record this reading as the "peak signal".

c. Adjust the OSC FREQUENCY COARSE to the first minimum adjacent to the primary beam current peak. Record this reading as the "valley signal".

d. Adjust the OSC FREQUENCY COARSE for the primary peak of cesium resonance.

e. Remove A4P2 on the bottom center of the instrument deck from the Harmonic Generator Assembly. Record the meter reading as the "background signal".

f. Reconnect A4P2 to the Harmonic Generator Assembly.

g. Disconnect the voltmeter and adapter cable from 5061A.

h. Reconnect cable to A7J1 of AC Amplifier Assembly.

5-190. PHASE MODULATION FREQUENCY ADJUSTMENT.

a. Connect an Electronic Counter to the sweep test output of Phase Detector Module A8J2 located on the bottom front of the deck.

b. Adjust A8R10 MOD FREQ for 137 Hz ±1 Hz on the counter.

c. Remove counter from A8J2.

5-191. PHASE DETECTOR ZERO ADJUSTMENTS.

a. Check that MOD switch on front panel is OFF.

b. Disconnect +18.7 Vdc lead (white-red) from AC Amplifier A7.

c. Using adapter cables supplied, connect a dc voltmeter to phase detector test output A8J1.

d. Adjust A8R39, Phase Detector Zero, for a voltage reading of less than 1 mV.

e. Disconnect dc voltmeter and adapter cable.

f. Leave the +18.7 Vdc lead (white-red) disconnected.

5-192. OPERATIONAL AMPLIFIER ZERO ADJUSTMENTS.

a. Locate TP1 and TP2 on bracket at bottom right side of instrument deck near the front panel. Connect a clip lead between TP1 and TP2 to short the input of the Operational Amplifier.

b. Connect a dc voltmeter to CONTROL BNC jack on rear panel, or control test point on Terminal Board Assembly A17.

c. Set MODE switch to LOOP OPEN, and then to OPER. Observe the voltage on the 3 mV range of the Voltmeter. This voltage will probably be drifting slightly, however, the drift rate should not exceed 1.5 mV/minute. If the drift rate is greater than 1.5 mV/minute, check circuit board for dirt or leakage paths around amplifier input. If board is clean, then amplifier block A9AMP1 should be replaced.

d. Remove the shorting clip lead from TP1 and TP2 installed in step 5-192(a). Adjust A8R39, Phase Detector Zero so that the reading on the DC voltmeter stops drifting. Set MODE switch to LOOP OPEN and then back to OPER. This will discharge the integrating capacitor and reset the amplifier output to zero. Again adjust A8R39 for minimum drift or change as indicated on DC Voltmeter. Once the drift is stopped, it may or may not remain stopped. However, it should easily remain within the 1.5 mV/minute specification.

e. Remove DC Voltmeter and reconnect the +18.7 Vdc lead (white-red) to AC amplifier assembly A7.

5-193. PHASE MODULATION AMPLITUDE ADJUSTMENT.

a. Set 5061A controls as follows:

MOD	ON
MODE	LOOP OPEN
OSC FREQUENCY $X10^{-10}$	250
CIRCUIT CHECK	BEAM I
TIME CONSTANT	SHORT

b. Observe CIRCUIT CHECK meter indication and adjust OSC FREQUENCY COARSE to the central peak of atomic resonance.

c. Adjust OSC FREQUENCY $X10^{-10}$ to 200. The quartz oscillator is now offset by 50 parts in 10^{10}.

d. Using the Micon-to-BNC cable supplied, connect test output A7J6 on the bottom instrument deck to the vertical input of an oscilloscope

NOTE

This waveform should be a sine wave. If there is clipping or distortion of this waveform, reduce ac gain by adjusting LOOP GAIN control on front panel. It will be reset later.

e. Adjust MOD LEVEL A3R20 on Multiplier Assembly A3 for maximum voltage on oscilloscope.

f. Remove the oscilloscope connection from A7J6.

5-194. PHASE MODULATION PHASE ADJUST.

a. Check that the 5061A is set as follows:

MOD	ON
MODE	LOOP OPEN
OSC FREQUENCY $X10^{-10}$	200
CIRCUIT CHECK	BEAM I
TIME CONSTANT	SHORT

b. Using Micon-to-BNC cable provided, connect an oscilloscope to A8J1 on Phase Detector Assembly A8.

c. Adjust A8R42 Mod Phase for the correct waveform as shown in Figure 5-8.

NOTE

If A8R42 has insufficient range, reverse the positions of A8R34 and A8R35, located inside the module, so that A8Q8 emitter is connected to A8R35 and A8Q9 emitter is connected to A8R34. Repeat step c.

d. Reset OSC FREQUENCY X10^{-10} to 250.

5-195. AC GAIN ADJUSTMENT.

a. Set 5061A controls as follows:

MOD	ON
MODE	LOOP OPEN
OSC FREQUENCY X10^{-10}	250
CIRCUIT CHECK	BEAM I
TIME CONSTANT	SHORT

b. Tune OSC FREQUENCY COARSE control to primary cesium resonance indicated on CIRCUIT CHECK meter.

c. Using the Micon-to-BNC adapter supplied, connect DC Voltmeter to A8J1 located on Phase Detector Assembly A8.

d. Carefully adjust OSC FREQUENCY COARSE control for zero voltmeter indication. Some noise will be present in meter indication. Make adjustment for minimum meter indication.

e. Set OSC FREQUENCY X10^{-10} control to 200.

f. Adjust front panel LOOP GAIN control for +1.6 ±0.15 Volts Voltmeter indication.

NOTE

AC Amplifier Assembly A7 GAIN switch (A7S1) position should be changed if LOOP GAIN control range is insufficient to perform step f.

g. Set OSC FREQUENCY X10^{-10} control to 300. Voltmeter should indicate -1.6 ±0.15 Volts. If not, repeat steps a through g.

h. Set MODE switch to OPER. Voltmeter indication should fall to zero. This verifies proper frequency control loop operation.

i. Set OSC FREQUENCY X10^{-10} to 250. Disconnect Voltmeter and adapter cable.

5-196. BEAM I METER ADJUSTMENT.

a. Locate AC Amplifier Assembly A7 (Figure 8-3) and disconnect A7J1. Front panel CIRCUIT CHECK meter (switch set to BEAM I) should indicate zero. If not, adjust AMPLIFIER BALANCE (A7R18 inside module) for zero CIRCUIT CHECK meter indication. Reconnect A7J1.

b. With instrument operating and CONTINUOUS OPERATION light on, set CIRCUIT CHECK switch to BEAM I. Adjust BEAM I METER adjust for 20 on CIRCUIT CHECK meter.

5-197. LOGIC CIRCUIT ADJUSTMENTS.

a. Check and set 5061A front panel controls as indicated:

MOD	ON
MODE	LOOP OPEN
OSC FREQUENCY X10^{-10}	250
CIRCUIT CHECK	BEAM I
TIME CONSTANT	SHORT

b. Tune OSC FREQUENCY COARSE control to primary cesium resonance indicated on CIRCUIT CHECK meter.

c. Set MODE switch to OPER. Momentarily press LOGIC RESET. CONTINUOUS OPERATION light should come on and stay on.

NOTE

Power may remain connected in the following step if care is taken in removal and installation of Logic Assembly A14.

d. Remove Logic Assembly A14 and re-install using 22-pin extender board (HP Part No. 5060-7202) provided. Be certain that Logic Assembly A14 orientation is correct before insertion.

e. Set CIRCUIT CHECK switch to 2ND HARMONIC.

f. Adjust A14R1 (2ND HARM GAIN ADJ) for a CIRCUIT CHECK meter indication of 40.

g. Locate Oven Controller Assembly A11 and adjust MASS SPECT control (A11R27) maximum counterclockwise.

h. Set front panel MOD switch to OFF.

i. Connect the common lead (-) of a DC Voltmeter to chassis ground. With the positive (+) lead, measure A14Q9 and A14Q10 collector voltages.

j. Adjust BAL control (A14R27) for equal voltages at A14Q9 and A14Q10 collectors ±0.3 Volt. The voltage indications should be between +9 and +11 Vdc.

k. Set front panel controls as indicated:

MOD	ON
MODE	LOOP OPEN
CIRCUIT CHECK	BEAM I

l. Adjust MASS SPECT control (A11R27) for maximum CIRCUIT CHECK meter indication.

m. Adjust OSC FREQUENCY COARSE control for peak of cesium resonance observed on CIRCUIT CHECK meter. Note meter reading.

n. Adjust MASS SPECT control (A11R27) for half indication noted in step m.

o. Adjust OSC FREQUENCY COARSE control to the adjacent secondary peak of cesium resonance observed on CIRCUIT CHECK meter.

p. Adjust FUND GAIN ADJ (A14R12) maximum counterclockwise.

q. Connect a clip-lead from A14Q11 collector to ground. Set MODE switch to OPER.

r. In Small increments, adjust FUND GAIN ADJ (A14R12) clockwise until front panel ALARM turns on. Due to circuit time constant, wait a few seconds between incremental adjustments. Remove clip-lead.

s. Set MODE switch to LOOP OPEN. Adjust OSC FREQUENCY COARSE control for peak of cesium resonance observed on CIRCUIT CHECK meter.

t. Adjust MASS SPECT control (A11R27) for maximum indication on CIRCUIT CHECK meter.

u. Set MODE switch to OPER. Wait 30 seconds. Momentarily press LOGIC RESET button. CONTINUOUS OPERATION light should come on and stay on. Remove all test equipment and cables. Reinstall A14.

5-198. C FIELD ADJUSTMENT.

a. Perform steps in Paragraph 3-8k, C Field Adjustment.

b. Replace top and bottom covers. This completes the cesium beam tube replacement procedure.

5-199. BUFFER AMPLIFIER ASSEMBLY A13

5-200. Normal Operation

5-201. Buffer Amplifier, A13, amplifies and distributes the 5 MHz signal from Multiplier Assembly A3J3. One output goes to A1 Synthesizer Assembly. A dc signal is sent, via A17 Terminal Board, to the CIRCUIT CHECK Meter, 5 MHz position. The front and rear panel 5 MHz outputs, also originate from A13 Buffer Amplifiers. The normal input level to A13J2 is about 1 Vrms (3 Volts peak-to-peak) into 50-ohms. Output level at A13J3, J4 should be > 1 Vrms into 50-ohms. The CIRCUIT CHECK meter indication should be greater than 38 with the front and rear panel 5 MHz BNC connectors unterminated.

5-202. Module Replacement

5-203. Replacement module needs no adjustment.

5-204. LOGIC ASSEMBLY A14

5-205. Normal Operation

5-206. This assembly controls front panel CONTINUOUS OPERATION and ALARM lights and also supplies a dc signal through Terminal Board Assembly A17 to front panel CIRCUIT CHECK meter when CIRCUIT CHECK switch is set to 2ND HARMONIC.

5-207. Operational Checks

5-208. Logic circuits may be easily checked for operation by simulating various instrument failures. To check the assembly proceed as follows:

5-209. FUNDAMENTAL CHANNEL.

a. Carefully remove Logic Assembly A14 (Figure 8-4) from the instrument, re-insert using 22-pin adapter board (HP Part No. 5060-7202) supplied.

NOTE

Power need not be removed from the instrument during logic assembly removal.

b. With power applied to the instrument set front panel controls as indicated:

MOD	ON
MODE	LOOP OPEN
OSC FREQUENCY X10^{-10}	250
TIME CONSTANT	SHORT
CIRCUIT CHECK	BEAM I

c. Adjust OSC FREQUENCY COARSE control for peak cesium resonance indication on CIRCUIT CHECK meter.

d. Set MODE switch to OPER. Momentarily press LOGIC RESET button. CONTINUOUS OPERATION light should come on and stay on.

e. Set CIRCUIT CHECK switch to CONTROL. Carefully adjust OSC FREQUENCY COARSE control for zero CIRCUIT CHECK meter indication.

f. Connect shorting jumper between A14Q11 collector and ground.

g. Connect high impedance DC Voltmeter to A14CR15 anode.

h. Rapidly turn OSC FREQUENCY X10^{-10} control 1/2 turn clockwise.

i. ALARM light should turn on then off. DC Voltmeter indication should rise to +5 Volts then decrease to normal.

j. Set MODE switch to LOOP OPEN and CIRCUIT CHECK switch to BEAM I.

k. Adjust OSC FREQUENCY COARSE control to an adjacent secondary peak indication on CIRCUIT CHECK meter. Set MODE switch to OPER.

l. ALARM light should come on and stay on. DC Voltmeter indication should rise to +5 Volts.

m. Remove shorting jumper from A14Q11 and disconnect DC Voltmeter.

n. Set MODE switch to LOOP OPEN and OSC FREQUENCY X10^{-10} control to 250.

o. Tune OSC FREQUENCY COARSE control for peak cesium resonance indication on CIRCUIT CHECK meter. Set MODE switch to OPER.

5-210. 2ND HARMONIC CHANNEL.

a. Connect high impedance DC Voltmeter to A14CR20 anode. Voltage indication should be zero or very low +dc.

b. Set front panel MOD switch to OFF. DC Voltmeter should indicate +5.5 Volts. ALARM light should turn on.

c. Set front panel MOD switch to ON. ALARM light should go off and DC Voltmeter indication should return to normal. Disconnect Voltmeter.

5-211. INTEGRATOR LIMIT CHECK.

a. Connect DC Voltmeter to CONTROL test point on Terminal Board Assembly A17.

b. Slowly adjust OSC FREQUENCY COARSE control clockwise until ALARM light comes on and stays on. Voltmeter indication should be between -3.5 and -6.5 Volts.

c. Slowly adjust OSC FREQUENCY COARSE control counterclockwise until ALARM light comes on and stays on. Voltmeter indication should be between +3.5 and +6.5 Volts.

d. Disconnect voltmeter and connect it to A14CR14 anode.

5-212. SYNTHESIZER CHECK.

a. Set MODE switch to LOOP OPEN.

b. Adjust OSC FREQUENCY COARSE control for peak cesium resonance indication on CIRCUIT CHECK meter. Set MODE switch to OPER.

c. Momentarily press LOGIC RESET button. CONTINUOUS OPERATION light should come on and stay on.

d. Locate Buffer Amplifier Assembly A13 (Figure 8-3). Disconnect A13(J1); CONTINUOUS OPERATION lamp should go off and voltmeter indication should be greater than +5.5 Volts (ALARM lamp may come on). Reconnect A13J1. Disconnect Voltmeter.

5-213. Troubleshooting

5-214. Logic Assembly A14 operational checks, waveforms and voltage levels given in Figure 8-27 are good troubleshooting aids.

5-215. Module Replacement

5-216. When components are replaced or a new module is installed, adjustment procedure in Paragraphs 5-195 through 5-197 should be performed.

5-217. POWER REGULATOR ASSEMBLY A15

5-218. Normal Operation

5-219. This assembly contains 5 functional circuits:

a. Standby Power Supply Gate

b. +18.7 V Power Regulator

c. C Field Regulator

d. Ion Pump Current Monitor

e. Electron Multiplier Regulator.

5-220. Operational Checks

5-221. POWER REGULATOR AND C FIELD REGULATOR. The C Field control on instrument front panel adjusts the C Field regulator. This regulates the current to the beam tube C Field coil. Adjustment procedure for the C FIELD control is outlined in Section III, Operation. To perform the checks proceed as follows:

a. Remove ALL instrument power.

b. Remove instrument bottom cover. Remove Regulator Assembly (Figure 8-4), re-install using 22-pin adapter board extender furnished (HP Part No. 5060-7202).

c. Connect instrument to operating power.

d. Connect DC Voltmeter to pin 15 on the Regulator board. Adjust A15R15 for a meter indication of +18.7 V. Disconnect Voltmeter.

e. Connect Clip-on DC Milliammeter probe to yellow wire connected to A17(29) (Figure 8-4). The "C" Field current should be between 10 mA and 25 mA. Disconnect clip-on meter.

5-222. ION PUMP CURRENT MONITOR AND ELECTRON MULTIPLIER REGULATOR. There are no adjustments to these circuits. The current monitor disables the +17.9 volts to the Cesium Oven Controller when ion pump current exceeds 40 microamperes. This same +17.9 is supplied to the electron multiplier regulator thus disabling the -2500 Vdc supply. Figure 8-31 shows the relationship between Power Regulator Assembly A15 and the +3500 and -2500 Vdc power supplies. The checks outlined below will verify proper operation and should be performed after repair, replacement, or when regulator circuit failure is suspected.

NOTE

When a defective A15 Assembly is replaced with a new assembly, resistors R33 and R34 from the defective A15 Assembly must be transfered to the new A15 Assembly.

5-223. VOLTAGE CHECKS. Leave instrument "on" with circuit board connected to instrument through 22-pin extender board.

a. Connect a DC Voltmeter to A15(2). Voltage should be between +25 and +33 Vdc.

b. Connect DC Voltmeter to A15(3). Voltage should be between +18.4 and +19.0 Volts.

c. Connect DC Voltmeter to A15(1). Voltage should be greater than +1 V.

d. Connect DC Voltmeter to A15(4). Voltage should be at least +17.5 volts. This completes the circuit checks. Disconnect all instrument power, remove extender board, re-install A15. Connect power.

NOTE

When installing or removing Power Regulator Assembly A15, ALL instrument power MUST be removed. If Standby Power Supply Option 002 is installed, press battery disconnect switch S8 (Figure 8-4) after removing external power.

5-224. TERMINAL BOARD ASSEMBLY A17

5-225. This assembly contains no active components. All front panel CIRCUIT CHECK meter resistors are on this assembly. Nine test points and Standby Power Supply Option 002 fuse F1 are also on the terminal board. Figure 8-29 (A17 schematic and component locator) indicate component location and wire colors of leads connected to A17 terminals. Test points are labeled as follows:

TP1	"Control"
TP2	"LF Coil"
TP3	"C Field"
TP4	"25 to 33 Volts"
TP5	"+18.7 V"
TP6	"+18.7 V(A)"
TP7	"Synth"
TP8	"+18.7 V(D)"
TP9	"F1"

5-226. +3500 VDC POWER SUPPLY ASSEMBLY A18

5-227. Power supply components are contained in a hermetically sealed unit and are not accessible for repair or replacement. When trouble occurs in +3500 Vdc circuits, power is automatically removed from Cesium Oven Controller Assembly A11 and the electron multiplier. The following procedure will check A18 circuit operation. If this procedure indicates a failure, remove module assembly and ship to nearest Hewlett-Packard Sales and Service office (see list at back of this manual).

5-228. Operational Check

a. With instrument power on, remove top cover.

b. Set front panel MODE switch to LOOP OPEN.

c. Set CIRCUIT CHECK switch to ION PUMP I. CIRCUIT CHECK meter should indicate less than two minor divisions (after normal warmup) for normal operation.

d. Connect high voltage probe to Electronic Voltmeter. Set Voltmeter to measure +100 V and connect Voltmeter common (-) to instrument chassis. Turn on Voltmeter and let warm up for normal operation.

e. Disconnect ALL instrument power.

f. Locate large red wire coming from beam tube and connecting to +3500 V receptacle on instrument chassis. Disconnect this wire from +3500 V receptacle P4.

g. Connect instrument power.

, h. Carefully contact the center conductor of chassis receptacle P4 with the High Voltage Probe. Voltmeter should indicate greater than 30(3000) Volts for normal operation.

i. Disconnect ALL instrument power. Disconnect Voltmeter. Re-connect wire removed in step f. This completes operational check.

5-229. Module Replacement

5-230. No adjustments are necessary when module is replaced.

5-231. -2500 VDC POWER SUPPLY ASSEMBLY A19

5-232. The power supply components are contained in a hermetically sealed unit and are not accessible for repair or replacement. This supply is for the electron multiplier inside the cesium beam tube. Resistors A15R30 and A15R31 are selected to establish the correct -2500 V power supply output voltage for a specific beam tube. Power Regulator Assembly A15 circuits control the -2500 volt supply, therefore, they can prevent a -2500 volt output. The following operational check procedure should determine if the -2500 volt supply is operating normally. If this procedure indicates module failure, remove the unit from the instrument and return to your nearest Hewlett-Packard Sales and Service office for repair or replacement (see list at the back of this manual).

5-233. Operational Check

a. With instrument power on, remove bottom cover.

b. Set Front panel MODE switch to LOOP OPEN.

c. Set CIRCUIT CHECK switch to ION PUMP I. CIRCUIT CHECK meter should indicate less than two minor divisions (after normal warmup) for normal operation.

d. Set DC Voltmeter to measure -0.3 Vdc. Connect common (-) Voltmeter lead to instrument chassis. Connect the positive (+) lead to -2500 Vdc Power Supply Assembly A19(3). This test point is located at the bottom, center front of the instrument deck.

NOTE

An internal resistive 10,000:1 divider allows measurement of this voltage with a standard Voltmeter.

5-234. Voltmeter should indicate electron multiplier voltage (±50 V) called out on beam tube decal. If voltage is incorrect, A15R30 and A15R31 should be adjusted as outlined in Paragraph 5-186.

NOTE

When adjusting A15R30 and A15R31, care should be taken to make the adjustment very carefully since a 1% change in electron multiplier voltage will cause a 9% change in beam current.

5-235. Since A19 is controlled by a feedback loop starting at A19(4), through a 55 Megohm resistor string in the beam tube, ending at A15(6), an open circuit or poor connection in this loop will cause incorrect module output.

5-236. Module Replacement

5-237. If assembly A19 is replaced, A15R30 and A15R31 must be adjusted (see Paragraph 5-186).

5-238. DIGITAL DIVIDER ASSEMBLY A5 (Option 001)

5-239. Normal Operation

5-240. Digital divider circuits provide one pulse-per-second output ticks available at front and rear panel 1 PPS BNC output jacks. The divider drive is an internally connected 1 MHz signal from Frequency Divider Assembly A6. Option 001 circuits also provide drive for front panel digital clock.

5-241. Operational Check

5-242. Complete operational check is given in Table 5-2, items 4 and 5.

5-243. Troubleshooting

5-244. The entire digital divider assembly may be removed and re-connected for troubleshooting. Extender board (HP Part No. 05061-6073) furnished, makes circuit board components available for testing.

5-245. Digital divider power supply common is isolated from instrument common. To observe waveforms and measure divider voltages, divider common may be connected to instrument common for troubleshooting with no adverse effect. However, this connection must be removed when divider is re-assembled.

5-246. Each circuit board inputs and outputs are available on interconnection board assembly A5A5. Thus trouble may be isolated to one specific board assembly before disassembling the entire unit. Tables 5-7 and 5-8, and Figures 8-13, 8-14, 8-15, and 8-16 provide troubleshooting information.

5-247. Periodic adjustments to divider circuits are not necessary. When adjustable components or components related to adjustable components are replaced, the following adjustments should be made.

a. A5A2T1 Adjustment. With instrument in normal operation (frequency divider on) connect RMS Voltmeter to A5A2T1 secondary (Figure 8-15). Adjust A5A2T1 for maximum voltage indication on Voltmeter.

b. A5A2C9 Adjustment. With instrument in normal operation (frequency divider on) connect Oscilloscope to A5A2Q6 collector (Figure 8-15). Adjust A5A2C9 for most symmetrical square wave observed on oscilloscope.

c. A5A2C10 Adjustment. With instrument in normal operation (frequency dividers on) set TIME DELAY thumbwheel switch to "000000" and 0-1 μsec TIME DELAY adjust to max. cw. Externally synchronize digital divider circuits (Paragraph 3-18). Using an Oscilloscope, compare external synchronization pulse with 1 PPS output pulse. Adjust A5A2C10 for 10 μsec 1 PPS delay ±1 μsec.

Table 5-7. Troubleshooting Table

Trouble	Check
Will not synchronize to external pulse.	Check external pulse characteristics (Table 1-1). Check sync circuitry A5A2 (Q3, IC1, Q5, and Q7).
Incorrect output pulse shape.	Check output circuits A5A4 (IC1, Q1), A5A1 (Q7 and Q10), and 13.3V supply (A5A1).
TIME DELAY switch does not affect output pulse time delay.	Check each switch position (Table 5-2, Item 4). If symptom is in only 1 or 2 switch positions, check preset circuitry associated with those positions including preset coupling diodes and the associated decade. If symptoms are present regardless of thumbwheel settings, refer to Table 5-8. If output stops only when thumbwheel switch setting is "999999" trouble is probably in A5A3 (IC13, IC12B, or IC2D).

d. A5A1R13 Adjustment. With instrument power connected, connect DC Voltmeter across A5A1C17. Adjust A5A1R13 for +4.2 V ±0.1 V Voltmeter indication.

5-248. Module Replacement

5-249. No adjustments required when Digital Divider Assembly or circuit board assemblies are replaced.

5-250. STANDBY POWER SUPPLY (Option 002)

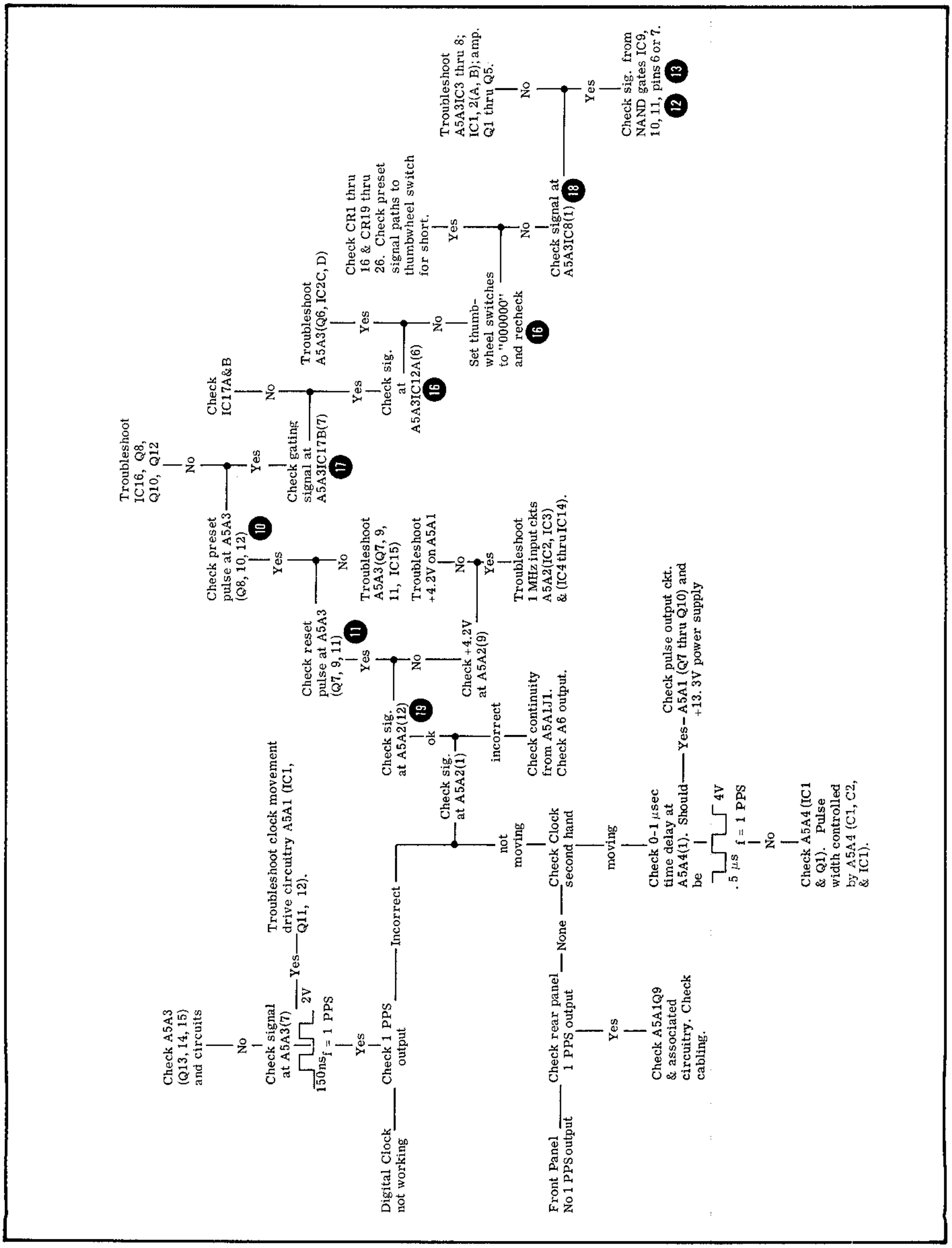
5-251. Normal Operation

5-252. Standby battery BT1 provides 30 minutes of dc power should instrument external operating supplies fail. If standby power is used, and ac line power returned, Battery Charger Assembly A2 charges the standby battery for the correct period determined by battery use time.

5-253. Operational Check and Troubleshooting

5-254. All instrument operating power must be removed before removing Battery Charger Assembly A2 from the instrument. The following checks should be performed only if trouble is suspected in the circuits.

Table 5-8. Assembly A5 Troubleshooting Chart



5-255. Assembly Removal and Replacement

5-256. REMOVAL. To remove Battery Charger Assembly A2 proceed as follows:

a. Remove instrument bottom cover.

b. Remove instrument external ac power then press battery disconnect switch S8 (Figure 8-4).

c. Remove battery charger board A2 (Figure 8-3).

NOTE

Instrument may be operated with Battery Charger Assembly A2 removed.

5-257. REPLACEMENT. To replace the assembly proceed as follows:

a. Measure resistance between A2(1) and A2(2). If open, proced to step c.

b. If short (relay A2K1 closed), connect the positive (+) lead of a DC Power Supply to A2(1). Connect the common (-) lead to A2Q20 collector. Adjust Power Supply for +18.7 Volts. This will open the relay.

c. The assembly may now be re-installed in the instrument. If checks and measurements are to be made, re-connect the circuit board through extender board (HP Part No. 05060-7202) provided.

5-258. Internal Battery and Battery Circuit Check

a. Disconnect ALL external instrument power. Front panel BATTERY light should flash on/off and instrument should remain operational on internal standby battery. If internal battery does not take over instrument operation, check battery condition and standby power supply gate circuit on Power Regulator Assembly A15. If front panel BATTERY light does not flash, check DS3 lamp then voltage at A2IC4(1). This voltage should be about 0 Vdc. If voltage is correct, most probable trouble is battery light control circuit (A2IC4, IC6, Q25, and Q26).

b. Allow instrument to operate on internal standby battery until protective relay A2K1 opens battery circuit. This should occur when battery voltage reaches between +23 and +21 Volts. Battery should supply power for at least 1/2 hour. If battery does not supply power for 30 minutes, step c should be performed to recondition battery.

NOTE

When instrument has been operated with internal standby battery on "trickle" charge for long periods of time (BATTERY light off), steps b and c may have to be performed several times to completely recondition the battery. If battery will not provide power for 1/2 hour after 4 reconditioning cycles (steps b and c), and charging current and charging time are correct (steps c and d), replace battery.

c. Reconnect instrument ac power. BATTERY light should come on and stay on for 18 to 21 hours "fast" charge time. Battery charging circuits should return to "trickle" charge and BATTERY light should go off at the conclusion of this period.

d. During "fast" charge cycle, connect Clip-on Milliammeter to either internal battery lead. "Fast" charge current should be 250 ±30 mA.

e. During "trickle" charge mode, connect Clip-on Milliammeter to either internal lead. "Trickle" charge current should be between 25 and 55 mA.

5-259. "Fast" charge rate is controlled by A2R19. Adjustment range, for this resistor, is 1K to 3K ohms. "Fast" charge mode is turned on by an "L" signal at A2Q15 collector (+0.5 V or less). Transistor A2Q15 is turned on by an "H" (about +2.5 V) resulting from out of coincidence between A2IC2 and A2IC5. If the correct signal is not present at A2IC7(8), perform the following checks in the order given: 1) Reset/Preset (Paragraph 5-265), 2) Logic Comparator (Paragraph 5-267), and 3) Decades (Paragraph 5-269).

5-260. Incorrect "fast" charge time can be caused by troubles in timing oscillator, decades, or logic comparator. To isolate the trouble circuit, perform following checks in order given: 1) Timing Oscillator (Paragraph 5-266), 2) Decades (Paragraph 5-269), 3) Reset/Preset (Paragraph 5-265), and 4) Logic Comparator (Paragraph 5-267).

5-261. With internal battery charged and instrument operating on external ac line power, disconnect ac power to instrument for 15 minutes, then reconnect. Battery should "fast" charge for 4 to 8 hours as indicated by BATTERY light. If charge time is incorrect, perform following checks in order given: 1) Reset (Paragraph 5-264), 2) Timing Oscillator (Paragraph 5-266), 3) Logic Comparator (Paragraph 5-267), and 4) Decades (Paragraph 5-269).

5-262. Circuit Tests

5-263. These tests will check individual circuits on Battery Charger Assembly A2. If failure is indicated in a circuit, repair circuit and perform battery charger operational check.

5-264. RESET TEST. With external ac power connected perform the following test:

a. Set Oscilloscope to trigger on a negative pulse and connect vertical channel to A2IC7(1).

b. Momentarily ground A2TP4.

c. Momentarily ground A2TP5 and observe Oscilloscope display. Should be negative 4 μsec wide, 4 Volt pulse.

5-265. RESET/PRESET TEST. With external ac power connected perform the following tests:

a. Connect DC Voltmeter, set to measure +3 Volts, to A2TP6.

b. Disconnect AC power and press battery disconnect switch S8.

c. Reconnect AC power. Voltage should rise to about +1.5 Volts for 1-1/2 sec to 3 sec then fall below 0.5 Volts.

d. If no response, repeat steps b and c with Voltmeter connected to A2TP5. When AC power is restored, voltage should remain low for about 1.5 to 3 seconds then rise to +5 V. If correct indication is noted in this step but not in step c, NAND gate IC7 is probable trouble. If incorrect indication is noted in this step, troubleshoot reset relaxation oscillator.

e. Connect DC Voltmeter to A2TP4.

f. Disconnect AC power and press battery disconnect switch S8.

g. Reconnect AC power. Voltmeter should indicate "L" for about 4 to 6 seconds then rise to about +4.5 V. Failure of this test indicates possible trouble in preset relaxation oscillator circuit. Check diodes A2CR14, CR15, and CR16.

5-266. TIMING OSCILLATOR TEST. With external ac power connected perform the following test:

a. Connect shorting jumper between A2Q15 collector and ground. This turns on the timing oscillator.

b. Connect 15K ohm resistor between A2TP1 and A2TP2. This speeds up the timing oscillator frequency for oscilloscope viewing.

c. Connect Oscilloscope to A2Q8 collector. Waveform should be similar to Figure 8-10, (1).

d. Remove ac line power and observe waveform at A2Q12 collector. Should be negative, 1 V p-p, 1 pulse-per-13 sec, 40 msec pulse width.

e. Restore ac line power and measure dc voltage at A2Q12 collector. Should be less than 0.5 V.

f. Remove 15K ohm resistor between A2TP1 and A2TP2 and replace with 150K ohm resistor.

g. Connect Electronic Counter, set to measure period, to A2Q18 collector. Period should be between 170 and 230 seconds. If period is incorrect, adjust A2R16 for correct period.

h. Remove short from A2Q15 and the 150K ohm resistor from A2TP1-TP2, and disconnect Counter.

5-267. LOGIC COMPARATOR TEST. With external ac line power connected, internal battery fully charged, perform the following test:

NOTE

This test is made by forcing A2IC2 and A2IC5 into specific states (Table 5-9) and monitoring resulting logic comparator output, A2IC7(8), at A2Q15 collector.

a. Connect shorting jumper between A2Q5 collector and ground. This turns off the timing oscillator.

b. Connect DC Voltmeter, set to indicate 3 V, to A2Q15 collector.

c. Connect shorting jumper between A2TP6 and ground.

d. Force all decade outputs to their "H" (greater than +1.5 V) state by:

1) Removing short from A2TP6

2) Momentarily shorting A2TP5 to ground.

3) Re-connecting short between A2TP6 and ground.

NOTE

Step d resets ALL decades to zero. Therefore, perform this step before forcing in "L" states described in step e.

e. Using Table 5-9, force specific terminals of A2IC2 and A2IC5 "L" while observing Voltmeter connected in step b. Voltmeter indication should agree with Table 5-9.

NOTE

To force desired decade output to "L" (less than +0.5 V) state, momentarily short that output to ground. Decade outputs are most easily reached at coupling diode (A2CR20 through A2CR23 and A2CR25 through A2CR28) cathode terminal.

f. If logic comparator fails one or more logic checks (Table 5-9), leave the failed state set in and measure voltages at all comparator gates and inverters. Thus it can be determined which gate or inverter is malfunctioning.

Table 5-9. Logic Comparator Logic Check

A2IC2 Terminal				A2IC5 Terminal				A2Q15(c) $H \approx +1V$ $L \approx +.5V$
6	7	8	1	6	7	8	1	
H	H	H	H	H	H	H	H	H
L	H	H	H	H	H	H	H	L
L	H	H	H	L	H	H	H	H
H	H	H	H	L	H	H	H	L
H	L	H	H	H	H	H	H	L
H	L	H	H	H	L	H	H	H
H	H	H	H	H	L	H	H	L
H	H	L	H	H	H	H	H	L
H	H	L	H	H	H	L	H	H
H	H	H	H	H	H	L	H	L
H	H	H	L	H	H	H	H	L
H	H	H	L	H	H	H	L	H
H	H	H	H	H	H	H	L	L

5-268. POWER-LOSS ONE-SHOT TEST. With external ac line power connected, perform the following test:

a. Connect Oscilloscope to A2Q6 collector.

b. Disconnect instrument AC line power. Oscilloscope waveform should be negative 3 Volt p-p, 15 msec pulse.

5-269. DECADE TESTS.

Counting. With external ac line power connected, perform the following test:

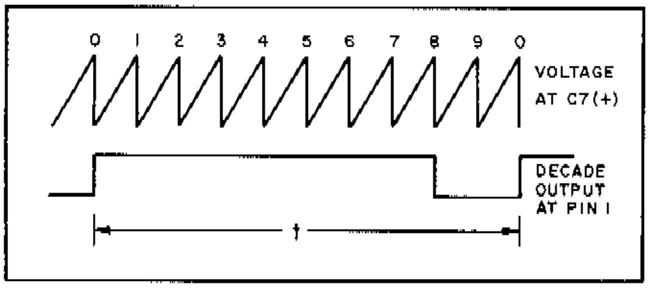
a. Connect shorting jumper between A2Q5 collector and ground.

b. Connect shorting jumper between A2TP6 and ground.

c. Connect 10K ohm resistor between +18.7 Volt supply and positive (+) side of A2C7. This increases A2Q13 output frequency.

d. Connect one Dual Channel Oscilloscope input to positive (+) side of A2C7. Connect other Oscilloscope input to A2CR23 cathode. Set Oscilloscope A2C7 input to 2 V/cm and A2CR23 input to 0.5 V/cm.

Figure 5-12. Battery Charger Counting Waveform



e. Remove AC line power. Oscilloscope waveforms should be similar to Figure 5-12.

f. Re-connect ac line power.

g. Remove Oscilloscope connection at A2CR23 and connect to A2IC3(1). Note t in Figure 5-12.

h. Remove Oscilloscope connection at A2IC3(1) and connect to A2IC5(1). This period should be 10 times that noted in step g.

i. Remove short from A2TP6, 10K ohm resistor installed in step c, and Oscilloscope connections.

Reset. With external ac line power connected and shorting jumper between A2Q5 collector and ground, perform the following test:

a. Connect DC Voltmeter to IC2(8). If voltage is "L" (< +0.5 V) go to step b. If "H" (about +1.5 V), momentarily short IC2(8) to ground. This will cause "H" state to go "L".

b. Momentarily short A2TP5 to ground. Voltmeter indication should go from "L" to "H". If decade does not respond, connect DC Voltmeter to decade reset terminal (pin 2). Voltage at this point should be "L".

c. Momentarily short A2TP5 to ground. Voltmeter indication should go from "L" to "H". If this does not occur, check NAND gate A2IC7. If A2IC7 is operating correctly, A2IC2 is not resetting.

d. Repeat steps a, b, and c for A2IC3(8) and A2IC5(8).

5-270. Module Replacement

5-271. No adjustments required when Battery Charger Assembly A2 is replaced.

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Tables 6-1, 6-2 (Option 002), and 6-3 (Option 001) list parts in reference designator alphanumerical order and indicates the description, quantity and HP part number of each part, together with any applicable notes. Included are:

a. Description of part (see abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-4.

c. Manufacturer's part number.

d. Total quantity used in the instrument (Qty column).

6-3. Miscellaneous parts are listed with Tables 6-1, 6-2, and 6-3.

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Sales and Service office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers.

6-6. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	MP	= mechanical part	U	= integrated circuit
B	= motor	FL	= filter	P	= plug	V	= vacuum, tube, neon bulb, photocell, etc.
BT	= battery	IC	= integrated circuit	Q	= transistor		
C	= capacitor	J	= jack	R	= resistor	VR	= voltage regulator
CP	= coupler	K	= relay	RT	= thermistor	W	= cable
CR	= diode	L	= inductor	S	= switch	X	= socket
DL	= delay line	LS	= loud speaker	T	= transformer	Y	= crystal
DS	= device signaling (lamp)	M	= meter	TB	= terminal board	Z	= tuned cavity, network
E	= misc electronic part	MK	= microphone	TP	= test point		

ABBREVIATIONS

A	= amperes
AFC	= automatic frequency control
AMPL	= amplifier
BFO	= beat frequency oscillator
BE CU	= beryllium copper
BH	= binder head
BP	= bandpass
BRS	= brass
BWO	= backward wave oscillator
CCW	= counter-clockwise
CER	= ceramic
CMO	= cabinet mount only
COEF	= coefficient
COM	= common
COMP	= composition
COMPL	= complete
CONN	= connector
CP	= cadmium plate
CRT	= cathode-ray tube
CW	= clockwise
DEPC	= deposited carbon
DR	= drive
ELECT	= electrolytic
ENCAP	= encapsulated
EXT	= external
F	= farads
FH	= flat head
FIL H	= fillister head
FXD	= fixed
G	= giga (10^9)
GE	= germanium
GL	= glass
GRD	= ground(ed)

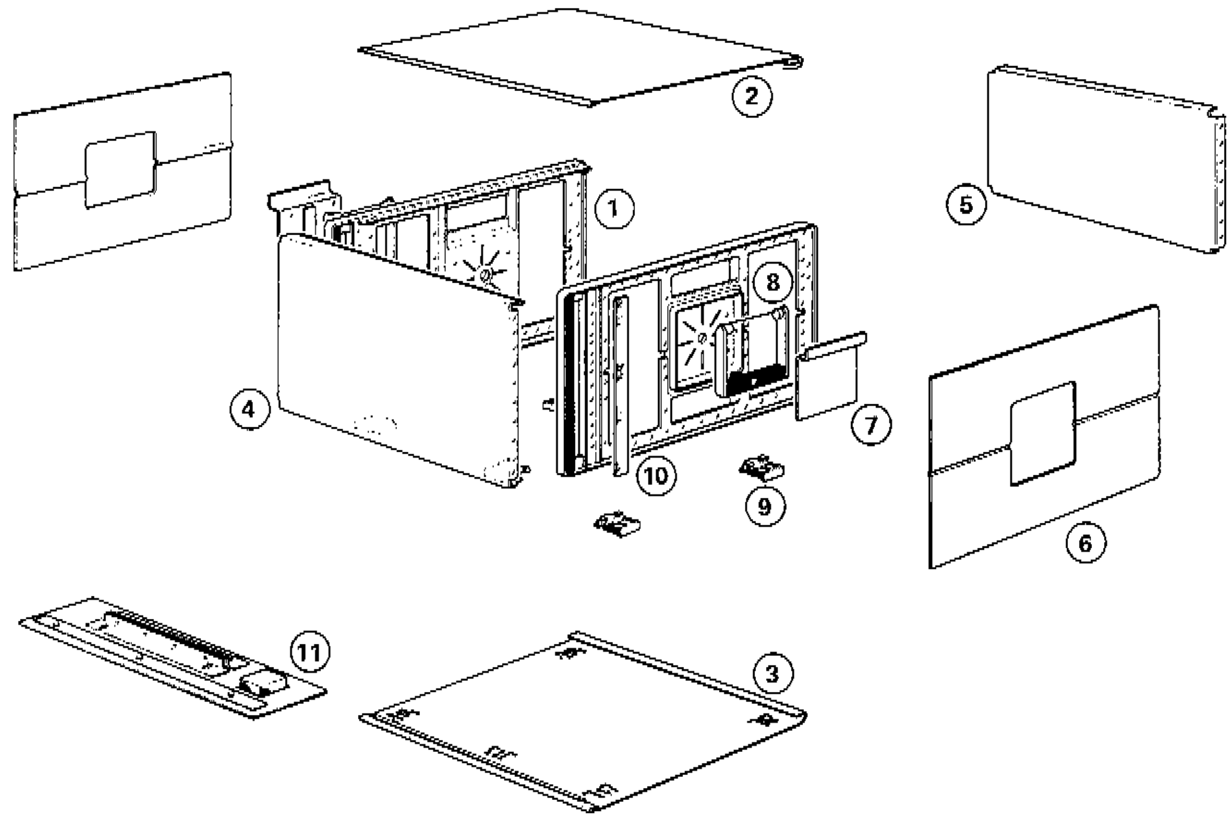
H	= henries
HDW	= hardware
HEX	= hexagonal
HG	= mercury
HR	= hour(s)
HZ	= hertz
IF	= intermediate freq
IMPG	= impregnated
INCD	= incandescent
INCL	= include(s)
INS	= insulation(ed)
INT	= internal
K	= kilo = 1000
LH	= left hand
LIN	= linear taper
LK WASH	= lock washer
LOG	= logarithmic taper
LPF	= low pass filter
M	= milli = 10^{-3}
MEG	= meg = 10^6
MET FLM	= metal film
MET OX	= metallic oxide
MFR	= manufacturer
MHZ	= mega hertz
MINAT	= miniature
MOM	= momentary
MOS	= metal ozide substrate
MTG	= mounting
MY	= "mylar"
N	= nano (10^{-9})
N/C	= normally closed
NE	= neon
NI PL	= nickel plate

N/O	= normally open
NOM	= nominal
NPO	= negative positive zero (zero temperature coefficient)
NPN	= negative-positive-negative
NRFR	= not recommended for field replacement
NSR	= not separately replaceable
OBD	= order by description
OH	= oval head
OX	= oxide
P	= peak
PC	= printed circuit
PF	= picofarads = 10^{-12} farads
PH BRZ	= phosphor bronze
PHL	= Phillips
PIV	= peak inverse voltage
PNP	= positive-negative-positive
P/O	= part of
POLY	= polystyrene
PORC	= porcelain
POS	= position(s)
POT	= potentiometer
PP	= peak-to-peak
PT	= point
PWV	= peak working voltage
RECT	= rectifier
RF	= radio frequency
RH	= round head or right hand

RMO	= rack mount only
RMS	= root-mean square
RWV	= reverse working voltage
S-B	= slow-blow
SCR	= screw
SE	= selenium
SECT	= section(s)
SEMICON	= semiconductor
SI	= silicon
SIL	= silver
SL	= slide
SPG	= spring
SPL	= special
SST	= stainless steel
SR	= split ring
STL	= steel
TA	= tantalum
TD	= time delay
TGL	= toggle
THD	= thread
TI	= titanium
TOL	= tolerance
TRIM	= trimmer
TWT	= traveling wave tube
U	= micro = 10^{-6}
VAR	= variable
VDCW	= dc working volts
W/	= with
W	= watts
WIV	= working inverse voltage
WW	= wirewound
W/O	= without

01194-14

Figure 6-1. Cabinet Parts



Item	Description	HP Part No.
1	Frame Assembly	5060-0736
2	Cover: Top	05061-2041
3	Bottom Cover Assembly	5060-0755
4	Panel: Front	05061-0015
5	Panel: Rear	05061-0016
6	Cover: Side	5000-0747
7	Retainer-Handle Assembly	5060-0765
8	Handle Assembly: Side	5060-0763
9	Foot Assembly: FM	5060-0767
10	Plate: Fluted Aluminum	5000-0053
11	Kit: Rack Mount	5060-0777

NOTE

This change provides for the new standard and optional instrument colors. Option A85 designates use of light gray panel with olive gray cabinet. Option X95 designates use of light gray panel and blue textured cabinet. Standard colors are mint gray panel and olive gray cabinet. Table 6-A shows part numbers and part color for the standard instrument and the various options.

Figure 6-1. Cabinet Parts (Cont'd.)

5061A BG = BLUE GRAY LG = LIGHT GRAY MG = MINT GRAY OG = OLIVE GRAY			New Std.	A85	X95 (Old Std)	001	002	003	A85 & 001	A85 & 002	A85 & 003	X95 & 001	X95 & 002	X95 & 003
PANEL FRONT	L.G.	05061-0015		X	X				X	X	X	X	X	X
	M.G.	05061-0061	X			X	X	X						
PANEL DOOR	L.G.	05061-0019		X	X				X	X	X	X	X	X
	M.G.	05061-0062	X			X	X	X						
PANEL LEFT	L.G.	05061-0020		X	X									
	M.G.	05061-0055	X											
PANEL LEFT	L.G.	05061-0021								X			X	
	M.G.	05061-0059					X							
PANEL CENTER	L.G.	05061-0022							X			X		
	M.G.	05061-0057				X								
PANEL CENTER	L.G.	05061-0023									X			X
	M.G.	05061-0060						X						
PANEL LEFT	L.G.	05061-0024							X		X	X		X
	M.G.	05061-0058				X		X						
PANEL INSIDE	L.G.	05061-0029		X	X				X	X	X	X	X	X
	M.G.	05061-0056	X			X	X	X						
PANEL SPACER	L.G.	05060-2014		X	X				X	X	X	X	X	X
	M.G.	05061-2058	X			X	X	X						
DOOR FRONT	L.G.	05061-2020		X	X				X	X	X	X	X	X
	M.G.	05061-2060	X			X	X	X						
COVER TOP	B.G.	05061-2041			X								X	
	O.G.	05061-2059	X	X			X			X				
COVER TOP	B.G.	05061-6034										X		X
	O.G.	05061-6100				X		X	X		X			
COVER BOTTOM	B.G.	5060-0755			X							X	X	X
	O.G.	5060-8719	X	X		X	X	X	X	X	X			
COVER SIDE	B.G.	5000-0747			X							X	X	X
	O.G.	5000-8727	X	X		X	X	X	X	X	X			
RETAINER HANDLE	B.G.	5060-0765			X							X	X	X
	O.G.	5060-8735	X	X		X	X	X	X	X	X			
LOCK: DIVIDER START	L.G.	05061-2044		X	X				X	X	X	X	X	X
	M.G.	05061-2067	X			X	X	X						

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05061-6097	1	MODULE ASSY:SYNTHESIZER	28480	05061-6097
A1 MISC PARTS	05061-0053	1	CHASSIS:SYNTHESIZER	28480	05061-0053
	05061-2003	2	PLATE:END	28480	05061-2003
	05061-0054	1	COVER:SYNTHESIZER	28480	05061-0054
	05061-2005	1	PLATE:END	28480	05061-2005
A1J1	1250-0258	33	JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A1J1	0340-0119	13	INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
A1J2	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A1J2	0340-0119		INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
A1J3	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A1J3	0340-0119		INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
A1A1	05061-6098	1	BOARD ASSY:SYNTHESIZER	28480	05061-6098
A1A1 MISC PARTS	0340-0039	22	INSULATOR:BUSHING	28480	0340-0039
A1A1 MISC PARTS	0340-0162	1	INSULATOR:TSTR FOR TO-66	13103	A0340-0162-1
A1A1C1	0160-0127	22	C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C2	0160-3010	1	C:FXD MICA 285 PF 1% SELECTABLE	00853	RDM15F(285)F3C
A1A1C2	0140-0221	2	C:FXD MICA 220 PF 1% FACT.SELECT.(TYP VALUE)	28480	0140-0221
A1A1C3 THRU A1A1C14			NOT ASSIGNED		
A1A1C15	0150-0121	17	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A1A1C16	0160-0174	7	C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A1A1C17	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A1A1C18	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C19	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C20	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A1A1C21	0140-0180	2	C:FXD MICA 2000 PF 2%	28480	0140-0180
A1A1C22	0170-0082	2	C:FXD MY 0.01UF 20% 50VDCW	84411	601PE STYLE 1
A1A1C23	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C24	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C25	0140-0220	2	C:FXD MICA 200 PF 1% 300VDCW	28480	0140-0220
A1A1C26	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C27	0150-0093	45	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C28	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C29	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C30	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C31	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C32	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C33	0140-0208	2	C:FXD MICA 680 PF 5%	72136	RDM15F681J3C
A1A1C34	0140-0222	1	C:FXD MICA 240 PF 1% 300VDCW	28480	0140-0222
A1A1C35	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C36	0160-0340	2	C:FXD MICA 600 PF 1%	28480	0160-0340
A1A1C37	0180-0291	5	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1A1C38	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C39			NOT ASSIGNED		
A1A1C40	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C41	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C42	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C43	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C44	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A1A1C45	0180-0106	8	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A1A1C46	0140-0220		C:FXD MICA 200 PF 1% 300VDCW	28480	0140-0220
A1A1C47	0180-0197	2	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1A1C48	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1A1C49	0180-0010	1	C:FXD ELECT 8 UF -15+20% 30VDCW	56289	132D805C2030U0 DYM
A1A1CR1	1902-3086	1	DIODE BREAKDOWN:4.75 V 2%	28480	1902-3086
A1A1C50	0160-0342	1	C: FXD 800 PF 300VDCW		
A1A1CR2	1901-0025	5	DIODE:SILICON 100MA/1V	07263	FD 2387
A1A1CR3 THRU A1A1CR26			NOT ASSIGNED		
			NOT ASSIGNED		
A1A1CR27	1902-3024	1	DIODE:BREAKDOWN 2.87V 5%	04713	SZ10939-26
A1A1CR28	0122-0013	1	C:VOLTAGE VAR 39 PF 30VDCW	28480	0122-0013
A1A1CR29	1901-0050	10	DIODE:SI 200 MA AT 1V	07263	FDA 6308
A1A1CR30	1901-0040	38	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1A1CR31	1902-3193	1	DIODE BREAKDOWN:13.3V 5%	28480	1902-3193
A1A1CR32	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A1A1CR33	1902-0064	1	DIODE BREAKDOWN:7.5V	28480	1902-0064
A1A1CR34	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A1A1CR35	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A1A1CR36	1901-0146	2	DIODE:SILICON 35 WUV	28480	1901-0146
A1A1CR37	1901-0146		DIODE:SILICON 35 WUV	28480	1901-0146
A1A1CR38	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1A1CR39	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1A1CR40	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1A1CR41	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1A1CR42	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1A1CR43	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A1IC1	1820-0322	4	IC:TTL DECADE DIVIDER	56289	N8280A
A1A1IC2	1820-0322		IC:TTL DECADE DIVIDER	56289	N8280A
A1A1IC3	1820-0070	1	IC:TTL 8-INPT POS NAND GATE	01295	SN7430N
A1A1IC4	1820-0580	1	IC:DIGITAL	28480	1820-0580
A1A1IC5	1820-0322		IC:TTL DECADE DIVIDER	56289	N8280A
A1A1IC6	1820-0322		IC:TTL DECADE DIVIDER	56289	N8280A
A1A1L1	9140-0237	1	COIL:FXD 200 UH 5%	28480	9140-0237
A1A1L2	9140-0046	2	COIL:FXD RF 1.2 MH	28480	9140-0046
A1A1L3	9140-0187	1	COIL:FXD RF 0.15 UH 10%	36196	31503M
A1A1L4	9140-0046		COIL:FXD RF 1.2 MH	28480	9140-0046
A1A1L5	9140-0190	1	COIL:FXD RF 0.22 UH 20% } SELECTABLE	82142	4411-2M
A1A1L5	9100-1617	1	COIL/CHOKE:3.90 UH 10% } RANGE	28480	9100-1617
A1A1L6	9140-0137	2	COIL:FXD RF 1000 UH 5%	28480	9140-0137
A1A1Q1	1854-0072	1	TSTR:SI NPN	80131	2N3054
A1A1Q2	1854-0009	3	TSTR:SI NPN	80131	2N709
A1A1Q3	1854-0009		TSTR:SI NPN	80131	2N709
A1A1Q4	1854-0009		TSTR:SI NPN	80131	2N709
A1A1Q5			-		
A1A1Q16			NOT ASSIGNED		
A1A1Q17	1854-0032	1	TSTR:SI NPN	80131	2N2221
A1A1Q18	1854-0035	3	TSTR:SI NPN	28480	1854-0035
A1A1Q19	1854-0092	4	TSTR:SI NPN	80131	2N3563
A1A1Q20	1854-0273	1	TSTR:SI NPN	28480	1854-0273
A1A1Q21	1854-0092		TSTR:SI NPN	80131	2N3563
A1A1Q22	1854-0092		TSTR:SI NPN	80131	2N3563
A1A1Q23	1855-0096	1	TSTR:SI FET	28480	1855-0096
A1A1Q24	1854-0003	48	TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A1A1Q25	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A1A1Q26	1854-0092		TSTR:SI NPN	80131	2N3563
A1A1Q27	1854-0023	13	TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A1A1R1	0757-0818	1	R:FXD MET FLM 825 OHM 1% 1/2W	28480	0757-0818
A1A1R2	0757-0900	23	R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A1A1R3	0698-3617	1	R:FXD MET FLM 75 OHM 5% 2W	28480	0698-3617
A1A1R4	0757-0924	35	R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1R5	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1R6	0757-0948	75	R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R7	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R8	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R9	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R10	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R11	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R12	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R13	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R14	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R15	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R16	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R17	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R18	0757-0917	8	R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A1A1R19	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R20	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1R21	0757-0940	11	R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A1A1R22	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1R23	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R24	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R25	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R26	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R27 THRU			-		
A1A1R51			NOT ASSIGNED		
A1A1R52	0757-0967	2	R:FXD FLM 62K OHM 2% 1/8W	28480	0757-0967
A1A1R53	0757-0916	14	R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A1A1R54	0757-0962	3	R:FXD FLM 39K OHM 2% 1/8W	28480	0757-0962
A1A1R55	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R56	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A1A1R57	0721-0011	1	R:FXD DEPC 500K OHM 1% 1/8W	28480	0721-0011
A1A1R58	0757-0957	10	R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A1A1R59	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A1A1R60	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A1A1R61	0757-0907	10	R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A1A1R62	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A1A1R63	0757-0931	17	R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A1A1R64	0757-0944	4	R:FXD FLM 6.8K OHM 2% 1/8W	28480	0757-0944
A1A1R65	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A1A1R66	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R67	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A1A1R68	0757-0935	8	R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A1R69	0757-0972	17	R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A1A1R70	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1R71	0757-0942	7	R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A1A1R72	0698-3130	2	R:FXD MET FLM 2.70 MEGOHM 1% 1/8W	28480	0698-3130
A1A1R73	0698-3130		R:FXD MET FLM 2.70 MEGOHM 1% 1/8W	28480	0698-3130
A1A1R74	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A1A1R75	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A1A1R76	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-C931
A1A1R77	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A1A1R78	0757-0964	6	R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A1A1R79	0757-0950	3	R:FXD FLM 12K OHM 2% 1/8W	28480	0757-0950
A1A1R80	0757-0960	8	R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A1A1R81	0698-3129	5	R:FXD DEPC 1.00 MEGOHM 1% 1/8W	28480	0698-3129
A1A1R82	0757-0943	3	R:FXD FLM 6.2K OHM 2% 1/8W	28480	0757-0943
A1A1R83	0698-3126	1	R:FXD DEPC 2.21 MEGOHM 1% 1/8W	28480	0698-3126
A1A1R84	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R85	0698-3127	1	R:FXD DEPC 4.75 MEGOHM 2% 1/8W	28480	0698-3127
A1A1R86	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A1A1R87	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1R88	0698-3129		R:FXD DEPC 1.00 MEGOHM 1% 1/8W	28480	0698-3129
A1A1R89	0757-0950		R:FXD FLM 12K OHM 2% 1/8W	28480	0757-0950
A1A1R90	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1R91	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A1A1R92	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A1A1R93	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A1A1R94	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A1A1R96	0757-0896	2	R:FXD MET FLM 68 OHM 2% 1/8W	28480	0757-0896
A1A1R97	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A1A1R98	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A1A1R99	0757-0962		R:FXD FLM 39K OHM 2% 1/8W	28480	0757-0962
A1A1R100	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A1A1T1	05061-8001	1	TRANSFORMER:BLOCK OSCILLATOR #1	28480	05061-8001
A1A1T2	05061-8011	1	TRANSFORMER:BLACK OSCILLATOR 2	28480	05061-8011
A1A1T3	05061-8003	1	TRANSFORMER SAMPLER:OR	28480	05061-8003
A1A1T4	05061-8004	1	TRANSFORMER:MHZ OUTPUT	28480	05061-8004
A1A1XY1	1200-0758	1	SOCKET:CRYSTAL	91506	8004-1G17
A1A1Y1	0410-0143	1	CRYSTAL:QUARTZ 12.632 MHZ	28480	0410-0143
A2			FOR A2 PARTS LIST REFER TO TABLE 6-2.		
A3	05061-6108	1	MULTIPLIER ASSY:5-90 MHZ	28480	05061-6108
	0360-1680	1	TERMINAL:SOLDER STUD 4-40 UNC-2A THREAD	01255	755
A3 MISC PARTS	1205-0011	1	HEAT DISSIPATOR:FOR TO-5 AND TO-9 CASES	98978	TXBF-032-025B
	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
	2230-0024	32	SCREW:STL PAN HD 4-40 THD	00000	OBD
FL1,FL2	00106-6059	2	FILTER:FEED-THRU (C1-L1 AND C53-L21)	28480	00106-6059
	05061-0050	1	COVER:BOTTOM	28480	05061-0050
A3 MISC PARTS	05061-2047	1	PLATE:END	28480	05061-2047
	05061-0051	1	COVER:TOP	28480	05061-0051
	05061-2048	1	PLATE:END	28480	05061-2048
A3A1	05060-6106	1	ASSY:MULTIPLIER P.C. BOARD	28480	05060-6106
A3A1C1			PART OF FL1		
A3A1C2	0180-0113	15	C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A3A1C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C4	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C5	0140-0198	5	C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A3A1C6	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C7	0140-0223	3	C:FXD MICA 260 PF 1% 300VDCW	28480	0140-0223
A3A1C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C9	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C10	0180-0100	17	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A3A1C11	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C12	0140-0179	3	C:FXD MICA 1000 PF 2%	28480	0140-0179
A3A1C13	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C14	0160-0179	3	C:FXD MICA 33 PF 5% 300VDCW	14655	RDM15E330J3S
A3A1C15	0140-0176	4	C:FXD MICA 100 PF 2%	28480	0140-0176
A3A1C16	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C17	0160-2307	2	C:FXD MICA 47 PF 5%	28480	0160-2307
A3A1C18	0150-0059	3	C:FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-COJO-339C
A3A1C19	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C20	0180-0137	1	C:FXD ELECT 100 UF 20% 10VDCW	56289	150D107X0010R2-DYS
A3A1C21	0140-0198		C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A3A1C22	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C23	0140-0198		C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A3A1C24	0160-0178	2	C:FXD MICA 27PF 5% 300VDCW	04062	RDM15E270J3S
A3A1C25	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1C26	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C27	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C28	0160-2240	1	C:FXD CER 2.0 PF 500VDCW	72982	301-000-COKO-209C
A3A1C29	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C30	0160-0196	1	C:FXD MICA 24PF 5% 300VDCW	04062	RDM15C240J3S
A3A1C31	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C32	0140-0176		C:FXD MICA 100 PF 2%	28480	0140-0176
A3A1C33	0150-0062	2	C:FXD CER 8.2-0.25 PF 500VDCW	72982	301-000-COHO-829C
A3A1C34	0140-0198		C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A3A1C35	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C36	0150-0062		C:FXD CER 8.2-0.25 PF 500VDCW	72982	301-000-COHO-829C
A3A1C37	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A3A1C38	0140-0198		C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A3A1C39	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C40	0140-0201	1	C:FXD MICA 12 PF 5%	28480	0140-0201
A3A1C41	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C42	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A3A1C43	0140-0202	1	C:FXD MICA 15 PF 5% 500VDCW	28480	0140-0202
A3A1C44	0130-0016	2	C:VAR CER 5-25 PF NPO	28480	0130-0016
A3A1C45	0150-0059		C:FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-COJO-339C
A3A1C46	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C47	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C48	0140-0210	1	C:FXD MICA 270 PF 5%	28480	0140-0210
A3A1C49	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C50	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3A1C51	0140-0225	2	C:FXD MICA 300 PF 1%	28480	0140-0225
A3A1C52	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A3A1CR1	1902-0018	1	DIODE BREAKDOWN:11.7V 5%	04713	1N941
A3A1CR2	0122-0016	1	C:VOLTAGE VAR 150-180 PF 20% 15VDCW	28480	0122-0016
A3A1CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A3A1CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A3A1CR5	1902-0013	1	DIODE:BREAKDOWN 6.8V 10% 1.5W	28480	1902-0013
A3A1CR6	1901-0347	2	DIODE:SILICON 8V	28480	1901-0347
A3A1CR7	1901-0347		DIODE:SILICON 8V	28480	1901-0347
A3A1CR8	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A3A1CR9	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A3A1E1	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A3A1E2	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A3A1E3	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A3A1E4	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A3A1E5	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A3A1E6	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A3A1E7			NOT ASSIGNED		
A3A1E8	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A3A1L1			NSR PART OF FL1, FL2.		
A3A1L2	05060-6033	1	COIL ASSY:5MC	28480	05060-6033
A3A1L3	05060-6031	2	COIL ASSY:30MC	28480	05060-6031
A3A1L4	05060-6031		COIL ASSY:30MC	28480	05060-6031
A3A1L5	9140-0146	2	COIL:FXD RF 10.0 UH	99800	1025-44
A3A1L6	9140-0138	5	COIL/CHOKE 180 UH 5%	28480	9140-0138
A3A1L7	05060-6030	4	COIL ASSY:90MC	28480	05060-6030
A3A1L8	9140-0138		COIL/CHOKE 180 UH 5%	28480	9140-0138
A3A1L9	9140-0180	2	COIL/CHOKE 2.70 UH 10%	28480	9140-0180
A3A1L10	05060-6030		COIL ASSY:90MC	28480	05060-6030
A3A1L11	9140-0158	3	COIL:FXD RF 1 UH 10%	99800	1025-20
A3A1L12	05060-6032	2	COIL ASSY:10MC	28480	05060-6032
A3A1L13	9140-0138		COIL/CHOKE 180 UH 5%	28480	9140-0138
A3A1L14	05060-6032		COIL ASSY:10MC	28480	05060-6032
A3A1L15	05060-6030		COIL ASSY:90MC	28480	05060-6030
A3A1L16	9140-0138		COIL/CHOKE 180 UH 5%	28480	9140-0138
A3A1L17	9140-0138		COIL/CHOKE 180 UH 5%	28480	9140-0138
A3A1L18	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A3A1L19	9140-0180		COIL/CHOKE 2.70 UH 10%	28480	9140-0180
A3A1L20	05060-6030		COIL ASSY:90MC	28480	05060-6030
A3A1L21			NSR PART OF FL1, FL2.		
A3A1L23	9140-0146		COIL:FXD RF 10.0 UH	99800	1025-44
A3A1L24	9140-0096	1	COIL/CHOKE 1.00 UH 10%	99800	1537-12
A3A1Q1	1854-0005	29	TSTR:SI NPN	80131	2N708
A3A1Q2	1854-0005		TSTR:SI NPN	80131	2N708
A3A1Q3	1854-0005		TSTR:SI NPN	80131	2N708
A3A1Q4	1854-0005		TSTR:SI NPN	80131	2N708
A3A1Q5	1854-0233	2	TSTR:SI NPN	80131	2N3866
A3A1Q6	1854-0005		TSTR:SI NPN	80131	2N708
A3A1Q7	1854-0045	1	TSTR:SI NPN	04713	2N956
A3A1Q8	1854-0233		TSTR:SI NPN	80131	2N3866
A3A1Q9	1854-0005		TSTR:SI NPN	80131	2N708

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1R1	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A3A1R2	0757-0895	1	R:FXD FLM 62 OHM 2% 1/8W	28480	0757-0895
A3A1R3	0757-0894	7	R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A3A1R4	0757-0912	2	R:FXD MET FLM 330 OHM 2% 1/8W	28480	0757-0912
A3A1R5	0757-0894		R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A3A1R6	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A3A1R7	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A3A1R8	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A3A1R9	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A3A1R10	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A3A1R11	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A3A1R12	0757-0911	4	R:FXD FLM 300 OHM 2% 1/8W	28480	0757-0911
A3A1R13	0757-0965	8	R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A3A1R14	0757-0920	2	R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A3A1R15	0758-0017	1	R:FXD MET OX 1500 OHM 5% 1/2W	28480	0758-0017
A3A1R16	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A3A1R17	0757-0385	3	R:FXD MET FLM 22.1 OHM 1% 1/8W	28480	0757-0385
A3A1R18	0698-3431	1	R:FXD MET FLM 23.7 OHM 1% 1/8W	28480	0698-3431
A3A1R19	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A3A1R20	2100-1761	2	R:VAR WW 10K OHM 5% TYPE V 1W	28480	2100-1761
A3A1R21	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A3A1R22	0757-0932	9	R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A3A1R23	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A3A1R24	0757-0919	1	R:FXD FLM 620 OHM 2% 1/8W	28480	0757-0919
A3A1R25	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A3A1R26	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A3A1R27	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A3A1R28	0757-0899	2	R:FXD FLM 91 OHM 2% 1/8W	28480	0757-0899
A3A1R29	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A3A1R30	0757-0928	4	R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A3A1R31	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A3A1R32	0698-3106	5	R:FXD DEPC 5 OHM 1% 1/8W	28480	0698-3106
A3A1R33	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A3A1R34	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A3A1R35	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A3A1R36	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A3A1R37	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A3A1T1	107A-65J-3A	3	TRANSFORMER ASSY:5MC	28480	107A-65J-3A
A3A1T1	107A-69A-278	6	PAD:MOUNTING, FOR T1 AND T2	28480	107A-69A-278
A3A1T2	05060-6035	1	TRANSFORMER ASSY:5MC	28480	05060-6035
A3A1T2	107A-69A-278		PAD:MOUNTING, FOR T1 AND T2	28480	107A-69A-278
A4	05060-6029	1	ASSY:GENERATOR HARMONIC NOT RECOMMENDED FOR FIELD REPAIR.	28480	05060-6029
	05060-0050	1	RING:CONTACT	28480	05060-0050
	3030-0150	1	SCREW:SET 2-56 THD 4-SPLINE SOCKET DR	00000	OBD
	05060-2039	1	COVER	28480	05060-2039
	05060-2051	1	PLUNGER:FILTER CAVITY	28480	05060-2051
	05060-2052	1	COVER:FILTER CAVITY	28480	05060-2052
	05060-2053	1	LOCKNUT:FILTER	28480	05060-2053
	05060-2054	1	KNOB:FILTER CAVITY	28480	05060-2054
	05060-2069	1	HOLDER:BIMETAL	28480	05060-2069
	05061-2061	1	STRIP	28480	05061-2061
	05060-2071	4	SCREW ADJUSTMENT	28480	05060-2071
	05060-2085	1	ATTENUATOR:PLATE	28480	05060-2085
	05060-2086	1	ROD:ATTENUATOR	28480	05060-2086
	05060-2087	1	KNOB:ATTENUATOR	28480	05060-2087
A4 MISC PARTS	05060-2089	1	CAP:ATTENUATOR	28480	05060-2089
	05060-2092	1	CORE C	28480	05060-2092
	05060-2093	1	HOLDER:DIODE	28480	05060-2093
	05060-2094	1	SLEEVE:FLANGE	28480	05060-2094
	05060-2095	1	PIN:FLANGE SLEEVE	28480	05060-2095
	05060-2097	1	HOLDER:DIODE	28480	05060-2097
	05060-2098	1	SPRING:COMPRESSION	28480	05060-2098
	05060-2099	1	PLUG:THREADED	28480	05060-2099
	05060-2100	1	CAVITY WAVEGUIDE	28480	05060-2100
	05060-2101	1	CAVITY:FILTER	28480	05060-2101
	05060-2102	1	PLATE:FILTER CAVITY	28480	05060-2102
	0570-1167	1	SCREW:TUNING 55	28480	05061-2062
	05060-6091	1	CAN ASSY:HARMONIC GENERATOR	28480	05060-6091
	05060-2038	1	CAN	28480	05060-2038
	107A-69A-15C	1	SPACER:POWER AMPLIFIER	28480	107A-69A-15C
A4CR2	1901-0167	2	DIODE:SILICON	28480	1901-0167
A4A1	05060-6037	1	ASSY:HARMONIC GENERATOR P.C. BOARD	28480	05060-6037
A4A1C2	0140-0196	1	C:FXD MICA 150 PF 5%	72136	RDM15F151J3C
A4A1C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A1C4	0180-0160	1	C:FXD ELECT 22 UF 20% 35VDCW	28480	0180-0160
A4A1C5	0150-0059		C:FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-C0J0-339C
A4A1C6	0160-0181	2	C:FXD MICA 30PF 5% 300VDCW	14655	RDM15E300J3S
A4A1C7	0140-0215	1	C:FXD MICA 80 PF 2% 300VDCW	28480	0140-0215
A4A1C8	0130-0016		C:VAR CER 5-25 PF NPO	28480	0130-0016
A4A1C12	0160-2257	1	C:FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A4A1CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A4A1L1	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A4A1L2	9140-0179	1	COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A4A1L3	05060-6087	1	COIL ASSY:90MC	28480	05060-6087
A4A1L4	9140-0106	1	COIL:FXD 0.47 UH	28480	9140-0106
A4A1Q1	1853-0001	5	TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A4A1R1	2100-1756	1	R:VAR WW 200 OHM 5% TYPE V 1W	28480	2100-1756
A4A1R2	2100-0896	1	R:VAR WW 15K OHM 5% LIN 1W	28480	2100-0896
A4A1R3	0757-0346	7	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A4A1R4	0757-0911		R:FXD FLM 300 OHM 2% 1/8W	28480	0757-0911
A4A1R5	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A4A1R6	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A4A1R7	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A4A1R8	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A4 C1	0160-2049	5	C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A4 C9	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A4 C10	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A4 CR1	1901-0167		DIODE:SILICON	28480	1901-0167
A4 J1	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A4 J1	5020-0176		INSULATOR FOR SNAP-ON PINS	28480	5020-0176
A4 J2	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A4 J2	5020-0176		INSULATOR FOR SNAP-ON PINS	28480	5020-0176
A4 J3	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A4 J3	5020-0176		INSULATOR FOR SNAP-ON PINS	28480	5020-0176
A5			FOR A5 PARTS LIST, REFER TO TABLE 6-3.		
A6	05061-6102	1	MODULE ASSY:FREQUENCY DIVIDER	28480	05061-6102
	0340-0119		INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
	2230-0024		SCREW:STL PAN HD 4-40 THD	00000	OBD
A6	05060-0012	1	SHIELD:DIVIDER	28480	05060-0012
MISC	05061-0003	1	COVER:BOTTOM	28480	05061-0003
PARTS	05061-0004	1	COVER:TOP	28480	05061-0004
	05061-2028	1	PLATE:END	28480	05061-2028
	05061-2029	1	PLATE:END	28480	05061-2029
A6FL1	05060-6061	1	FILTER ASSY:FEED-THRU	28480	05060-6061
A6FL2	00106-6059		FILTER:FEED-THRU	28480	00106-6059
A6FL3	00106-6059		FILTER:FEED-THRU	28480	00106-6059
A6J1	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J2	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J3	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J4	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J5	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J6	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J7	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6A1	05061-6103	1	BOARD ASSY:FREQUENCY DIVIDER	28480	05061-6103
A6A1C1	0160-0161	5	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C2	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A6A1C3	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6A1C4	0140-0178	1	C:FXD MICA 560 PF 2%	72136	RDM15F561G3C
A6A1C5	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C6	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6A1C7	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C8	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C9	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C10	0140-0176		C:FXD MICA 100 PF 2%	28480	0140-0176
A6A1C11	0140-0208		C:FXD MICA 680 PF 5%	72136	RDM15F681J3C
A6A1C12	0140-0179		C:FXD MICA 1000 PF 2%	28480	0140-0179
A6A1C13	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C14	0140-0221		C:FXD MICA 220 PF 1%	28480	0140-0221
A6A1C15	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C16	0140-0231	1	C:FXD MICA 440PF 1% 300VDCW	04062	RDM15F441F3C
A6A1C17	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C18	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C19	0140-0154	1	C:FXD MICA 1300 PF 5%	28480	0140-0154
A6A1C20	0140-0204	1	C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A6A1C21	0121-0046	5	C:VARI CER 9-35 PF	28480	0121-0046
A6A1C22	0140-0179		C:FXD MICA 1000 PF 2%	28480	0140-0179
A6A1C23	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C24	0140-0159	1	C:FXD MICA 3000 PF 2%	28480	0140-0159
A6A1C25	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A1C26	0140-0180		C:FXD MICA 2000 PF 2%	28480	0140-0180
A6A1C27	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C28	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C29	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C30	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A6A1C31	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C32	0160-2566	1	C:FXD MICA 2000 PF 2% 300VDCW	00853	RDM19F202G3S
A6A1C33	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C34	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A6A1C35	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A6A1C36	0160-0194	1	C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A6A1C37	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A6A1C38	0160-0340		C:FXD MICA 600 PF 1%	28480	0160-0340
A6A1C39	0160-3064	1	C:FXD MICA 1000 PF 5% 300VDCW	00853	RDM19F102J3S
A6A1C40	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A6A1C41	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1C42	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1C43	0160-2331	2	C:FXD MICA 8200 PF 1%	00853	RDM20F822F1S
A6A1C44	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1C45	0160-2331		C:FXD MICA 8200 PF 1%	00853	RDM20F822F1S
A6A1C46	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1CR1	1902-0006	1	DIODE BREAKDOWN:7.0V 1%	28480	1902-0006
A6A1CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6A1CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6A1CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6A1CR5	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6A1CR6	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6A1CR7	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6A1CR8	1902-3105	1	DIODE BREAKDOWN:5.62V 2%	04713	SZ10939 111
A6A1CR9	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6A1IC1	1820-0055	1	IC:TTL DECADE COUNTER 10 MHZ MIN.	01295	SN7490N
A6A1L1	9140-0129	6	COIL:FXD RF 220 UH	28480	9140-0129
A6A1L2	9140-0107	1	COIL:FXD RF 27 UH 10%	99800	1840-38
A6A1L3	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L4	9140-0118	2	COIL:FXD 500 UH 5%	28480	9140-0118
A6A1L5	9140-0118		COIL:FXD 500 UH 5%	28480	9140-0118
A6A1L6	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L7	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L8	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L9	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L10	9100-1647	1	COIL/CHOKE 470 UH 5%	82142	19-1331-27J
A6A1Q1	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q2	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q3	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q4	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q5	1855-0056	1	TSTR:SI FET	80131	2N4342
A6A1Q6	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q7	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A6A1Q8	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q9	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q10	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q11	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q12	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q13	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q14	1853-0010	1	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A6A1Q15	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q16	1854-0005		TSTR:SI NPN	80131	2N708
A6A1R1	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A6A1R2	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A6A1R3	0757-0936	6	R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A6A1R4	0757-0893	15	R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R5	0757-0921	3	R:FXD MET FLM 750 OHM 2% 1/8W	28480	0757-0921
A6A1R5	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R6	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R7	0757-0897	1	R:FXD FLM 75 OHM 2% 1/8W	28480	0757-0897
A6A1R8	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R9	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R10	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A6A1R11	0757-0929	4	R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A6A1R12	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R13	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A6A1R14	0757-0963	3	R:FXD FLM 43K OHM 2% 1/8W	28480	0757-0963
A6A1R15	0757-0955	8	R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A6A1R16	0757-0944		R:FXD FLM 6.8K OHM 2% 1/8W	28480	0757-0944
A6A1R17	0757-0930	2	R:FXD FLM 1.8K OHM 2% 1/8W	28480	0757-0930

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A1R18	0757-0958	3	R:FXD MET FLM 27K OHM 2% 1/8W	28480	0757-0958
A6A1R19	0757-0976	7	R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A6A1R20	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R21	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A6A1R22	0757-0474	2	R:FXD MET FLM 243K OHM 1% 1/8W	28480	0757-0474
A6A1R22	0757-0474		R:FXD MET FLM 243K OHM 1% 1/8W	28480	0757-0474
A6A1R23	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R24	0757-0929		R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A6A1R25	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A6A1R26	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R27	0757-0952	11	R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A6A1R28	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A6A1R29	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A6A1R30	0757-0920		R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A6A1R31	0757-0898	4	R:FXD FLM 82 OHM 2% 1/8W	28480	0757-0898
A6A1R32	0757-0922	2	R:FXD FLM 820 OHM 2% 1/8W	28480	0757-0922
A6A1R33	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A6A1R34	0757-0951	3	R:FXD FLM 13K OHM 2% 1/8W	28480	0757-0951
A6A1R35	0757-0944		R:FXD FLM 6.8K OHM 2% 1/8W	28480	0757-0944
A6A1R36	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R37	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R38	0757-0927	4	R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A6A1R39	0757-0927		R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A6A1R40	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A6A1R41	0757-0915	3	R:FXD FLM 430 OHM 2% 1/8W	28480	0757-0915
A6A1R42	0757-0927		R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A6A1R43	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A6A1R44	0757-1060	1	R:FXD MET FLM 196 OHM 1% 1/2W	28480	0757-1060
A6A1R45	0757-0938	5	R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A6A1R46	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A6A1R47	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R48	0757-0941	14	R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A6A1R49	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A6A1R50	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A6A1R51	0757-0929		R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A6A1R52	0757-0936		R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A6A1R53	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A6A1R54	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A6A1R55	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A6A1R56	0757-0911		R:FXD FLM 300 OHM 2% 1/8W	28480	0757-0911
A6A1R57	0757-0915		R:FXD FLM 430 OHM 2% 1/8W	28480	0757-0915
A6A1R58	0757-0899		R:FXD FLM 91 OHM 2% 1/8W	28480	0757-0899
A6A1R59	0757-0922		R:FXD FLM 820 OHM 2% 1/8W	28480	0757-0922
A6A1R60	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A6A1T1	05061-8006	1	TRANSFORMER:5MHZ INPUT	28480	05061-8006
A6A1T2	05061-8005	2	TRANSFORMER:1MHZ-4MHZ	28480	05061-8005
A6A1T3	05061-8007	1	TRANSFORMER:1MHZ OUTPUT	28480	05061-8007
A6A1T4	05061-8007		TRANSFORMER:1MHZ OUTPUT	28480	05061-8007
A6A1T5	107A-9C	1	TRANSFORMER ASSY:100KHZ	28480	107A-9C
A7	05061-6005	1	MODULE ASSY:AC AMPLIFIER	28480	05061-6005
	0340-0119		INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
	00105-2010	1	TIP:INPUT	28480	00105-2010
	05061-0005	1	CHASSIS:AC AMPLIFER	28480	05061-0005
A7 MISC PARTS	05061-0006	1	COVER:AC AMPLIFIER	28480	05061-0006
	05061-2001	2	PLATE:END	28480	05061-2001
	05061-2007	1	PLATE:END	28480	05061-2007
	05061-2039	1	SHAFT	28480	05061-2039
A7J1	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A7J2	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A7J3	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A7J4	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A7J5	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A7J6	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A7R17	2100-3182	1	R:VAR CERMET 10K OHM 20% LOG 1/4W	28480	2100-3182
A7A1	05061-6006	1	BOARD ASSY:AC AMPLIFIER	28480	05061-6006
A7A1C1	0160-2415	1	C:FXD MY 0.0082 UF 5% 200VDCW	28480	0160-2415
A7A1C2	0140-0225		C:FXD MICA 300 PF 1%	28480	0140-0225
A7A1C3	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A7A1C4	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A7A1C5	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A7A1C6	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A7A1C7	0160-0180	4	C:FXD MY 0.033 UF 5%	28480	0160-0180
A7A1C8	0170-0084	2	C:FXD MY 0.068UF 20% 50VDCW	84411	601PE STYLE 3
A7A1C9	0170-0094	3	C:FXD MY 0.047UF 20% 50VDCW	84411	TYPE 602
A7A1C10	0160-0180		C:FXD MY 0.033 UF 5%	28480	0160-0180

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7A1C11	0170-0094		C:FXD MY 0.047UF 20% 50VDCW	84411	TYPE 602
A7A1C12	0160-0128	4	C:FXD CER 2.2 UF 20% 25VDCW	56289	5C152C2S-CML
A7A1C13	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A7A1C14	0170-0085	7	C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3
A7A1C15	0170-0085		C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3
A7A1C16	0150-0086	1	C:FXD CER 0.0047 UF 20% 500VDCW	56289	29C333A3-CDH
A7A1C17	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A7A1C18	0170-0082		C:FXD MY 0.01UF 20% 50VDCW	84411	601PE STYLE 1
A7A1C19	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A7A1C20	0170-0091	3	C:FXD POLY 0.01213 UF 2% 50VDCW	56289	P146504 PYP
A7A1C21	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A7A1C22	0170-0090	2	C:FXD POLY 0.0252 UF 1% 50VDCW	56289	P246505 PYP
A7A1C23	0170-0091		C:FXD POLY 0.01213 UF 2% 50VDCW	56289	P146504 PYP
A7A1CR1	1901-0033	12	DIODE:SILICON 100MA 180WV	07263	FD3369
A7A1CR2	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A7A1CR3	1902-0245	1	DIODE:BREAKDOWN 6.8V 5% 1N4099	04713	1N4099
A7A1CR4	1902-1172	1	DIODE BREAKDOWN:9.1V 5%	04713	1N4103
A7A1CR5	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A7A1Q1	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A7A1Q2	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A7A1Q3	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q4	1855-0049	1	TSTR:SI FET N-CHANNEL DUAL	28480	1855-0049
A7A1Q5	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A7A1Q6	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A7A1Q7	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q8	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q9	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q10	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q11	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q12	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q13	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1Q14	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A7A1R1	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A7A1R2	0757-0966	3	R:FXD FLM 56K OHM 2% 1/8W	28480	0757-0966
A7A1R3	0730-0168	1	R:FXD DEPC 10 MEGOHM 1% 1W	28480	0730-0168
A7A1R4	0698-3131	1	R:FXD DEPC 3.30 MEGOHM 1% 1/8W	28480	0698-3131
A7A1R5	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R6	0757-0966		R:FXD FLM 56K OHM 2% 1/8W	28480	0757-0966
A7A1R7	0757-0966		R:FXD FLM 56K OHM 2% 1/8W	28480	0757-0966
A7A1R8	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R9	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A7A1R10	0698-3129		R:FXD DEPC 1.00 MEGOHM 1% 1/8W	28480	0698-3129
A7A1R11	0757-0946	1	R:FXD FLM 8.2K OHM 2% 1/8W	28480	0757-0946
A7A1R12	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A7A1R13	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A7A1R14	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A7A1R15	0757-0959	4	R:FXD FLM 30K OHM 2% 1/8W	28480	0757-0959
A7A1R16	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A7A1R17	NOT ASSIGNED				
A7A1R18	2100-1772	1	R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A7A1R19	0757-0929		R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A7A1R20	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A7A1R21	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A7A1R22	0757-0970	1	R:FXD FLM 82K OHM 2% 1/8W	28480	0757-0970
A7A1R23	0757-0976		R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A7A1R24	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A7A1R25	0698-4308	2	R:FXD MET FLM 16.9K OHM 1% 1/8W	28480	0698-4308
A7A1R26	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R27	0698-5469	1	R:FXD MET FLM 8665 OHM 1% 1/8W	28480	0698-5469
A7A1R28	0698-4308		R:FXD MET FLM 16.9K OHM 1% 1/8W	28480	0698-4308
A7A1R29	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A7A1R30	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R31	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A7A1R32	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R33	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R34	0757-0896		R:FXD MET FLM 68 OHM 2% 1/8W	28480	0757-0896
A7A1R35	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A7A1R36	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A7A1R37	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A7A1R38	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A7A1R39	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A7A1R40	0757-0894		R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A7A1R41	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A7A1R42	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R43	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7A1R44	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A7A1R45	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A7A1R46	0698-3129		R:FXD DEPC 1.00 MEGOHM 1% 1/8W	28480	0698-3129
A7A1R47	0698-0077	2	R:FXD MET FLM 93.1K OHM 1% 1/8W	28480	0698-0077
A7A1R48	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A7A1R49	0757-0457	2	R:FXD MET FLM 47.5K OHM 1% 1/8W	28480	0757-0457
A7A1R50	0698-0077		R:FXD MET FLM 93.1K OHM 1% 1/8W	28480	0698-0077
A7A1R51	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A7A1R52	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A7A1R53	0757-0900	1	R:FXD 100Ω 2% 1/8W	28480	0757-0900
A7A1	0340-0037	4	POST:TERMINAL		0340-0037
MISC PARTS	0340-0039		INSULATOR:BUSHING	28480	0340-0039
A8	05061-6095	1	MODULE ASSY:PHASE DETECTOR	28480	05061-6095
	0340-0119		INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
	2230-0024		SCREW:STL PAN HD 4-40 THD	00000	OBD
A8	5020-0176		INSULATOR FOR SNAP-ON PINS	28480	5020-0176
MISC PARTS	05060-0008	1	COVER:BOTTOM	28480	05060-0008
	05061-0007	1	COVER:TOP	28480	05061-0007
	05061-2033	1	PLATE:END	28480	05061-2033
	05061-2034	1	PLATE:END	28480	05061-2034
A8J1	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A8J2	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A8J3	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A8J4	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A8J5	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A8J6	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A8E1, E2	9170-0029	2	BEAD:FERRITE		9170-0029
A8A1	05060-6096	1	BOARD ASSY:PHASE DETECTOR	28480	05060-6096
A8A1C1	0170-0091		C:FXD POLY 0.01213 UF 2% 50VDCW	56289	P146504 PYP
A8A1C2	0180-0117	6	C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A8A1C3	0170-0090		C:FXD POLY 0.0252 UF 1% 50VDCW	56289	P246505 PYP
A8A1C4	0180-0116	3	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A8A1C5	0140-0209	1	C:FXD MICA 5.0 PF 10%	28480	0140-0209
A8A1C6	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A8A1C7	0140-0176		C:FXD MICA 100 PF 2%	28480	0140-0176
A8A1C8	0160-0370	3	C:FXD MICA 20 PF 5%	28480	0160-0370
A8A1C9	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A8A1C10	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A8A1C11	0160-2307		C:FXD MICA 47 PF 5%	28480	0160-2307
A8A1C12	0160-0370		C:FXD MICA 20 PF 5%	28480	0160-0370
A8A1C13	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A8A1C14	0160-0370		C:FXD MICA 20 PF 5%	28480	0160-0370
A8A1C15	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A8A1C16	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A8A1C17	0160-0869	2	C:FXD MY 0.47 UF 10% 50VDCW	82047	65F17AA474
A8A1C18	0160-0869		C:FXD MY 0.47 UF 10% 50VDCW	82047	65F17AA474
A8A1C19	0170-0085		C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3
A8A1C20	0170-0086	2	C:FXD MY 0.22UF 20% 50VDCW	84411	601PE STYLE 3
A8A1C21	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A8A1C22	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A8A1C23	0170-0085		C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3
A8A1C24	0170-0094		C:FXD MY 0.047UF 20% 50VDCW	84411	TYPE 602
A8A1C25	0170-0085		C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3
A8A1C26	0170-0085		C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3
A8A1C27	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A8A1C28	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A8A1C29	0170-0085		C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3
A8A1CR1	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A8A1CR2	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A8A1CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A8A1CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A8A1CR5	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A8A1CR6	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A8A1CR7	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A8A1Q1	1854-0541		TSTR:SI NPN	28480	1854-0541
A8A1Q2	1854-0541		TSTR:SI NPN	28480	1854-0541
A8A1Q3	1854-0541		TSTR:SI NPN	28480	1854-0541
A8A1Q4	1854-0005		TSTR:SI NPN	80131	2N708
A8A1Q5	1854-0005		TSTR:SI NPN	80131	2N708
A8A1Q6	1854-0005		TSTR:SI NPN	80131	2N708
A8A1Q7	1854-0005		TSTR:SI NPN	80131	2N708
A8A1Q8	1854-0541		TSTR:SI NPN	28480	1854-0541
A8A1Q9	1854-0641		TSTR:SI NPN	28480	1854-0541
A8A1Q10	1854-0541		TSTR:SI NPN	28480	1854-0541
A8A1Q11	1854-0541		TSTR:SI NPN	28480	1854-0541
A8A1Q12	1854-0541		TSTR:SI NPN	28480	1854-0541
A8A1Q13	1853-0005	1	TSTR:SI PNP	80131	2N941

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8A1R1	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A8A1R2	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A8A1R3	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A8A1R4	0757-0457		R:FXD MET FLM 47.5K OHM 1% 1/8W	28480	0757-0457
A8A1R5	0757-0444	1	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A8A1R6	0757-0959		R:FXD FLM 30K OHM 2% 1/8W	28480	0757-0959
A8A1R7	0757-0450	1	R:FXD MET FLM 22.1K OHM 1% 1/8W	28480	0757-0450
A8A1R8	0757-0894		R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A8A1R9	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A8A1R10	2100-1760	1	R:VAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A8A1R11	0757-0945	1	R:FXD FLM 7.5K OHM 2% 1/8W	28480	0757-0945
A8A1R12	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A8A1R13	0757-0442	2	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A8A1R14	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A8A1R15	0757-0914	3	R:FXD FLM 390 OHM 2% 1/8W	28480	0757-0914
A8A1R16	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A8A1R17	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A8A1R18	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A8A1R19	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A8A1R20	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A8A1R21	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A8A1R22	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A8A1R23	0757-0273	3	R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A8A1R24	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A8A1R25	0757-0958		R:FXD MET FLM 27K OHM 2% 1/8W	28480	0757-0958
A8A1R26	0757-0914		R:FXD FLM 390 OHM 2% 1/8W	28480	0757-0914
A8A1R27	0757-0958		R:FXD MET FLM 27K OHM 2% 1/8W	28480	0757-0958
A8A1R28	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A8A1R29	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A8A1R30	0757-0427	4	R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A8A1R31	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A8A1R32	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A8A1R33	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A8A1R34	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A8A1R35	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A8A1R36	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A8A1R37	0757-0976		R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A8A1R38	0727-0013	2	R:FXD DEPC 24.3 OHM 1% 1/2W	28480	0727-0013
A8A1R39	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A8A1R39	2100-1762	1	R:VAR WW 20K 5% 1W	75042	CT-106-4
A8A1R40	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A8A1R41	0757-0964		R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A8A1R42	2100-1923	1	R:VAR WW 50K OHM 5% LIN 1W	28480	2100-1923
A8A1R43	0757-0964		R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A8A1R44	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A8A1R45	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A8A1R46	0757-0964		R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A8A1R47	0727-0013		R:FXD DEPC 24.3 OHM 1% 1/2W	28480	0727-0013
A8A1R48	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A8A1R49	0727-0002	1	R:FXD DEPC 3.0 OHM 1% 1/2W	28480	0727-0002
A8A1R50	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A8A1R51	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A8A1R52	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A8A1R53	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A8A1R54	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A8A1T1	9100-0340	1	TRANSFORMER	28480	9100-0340
A9	05061-6092	1	MODULE ASSY:OPERATIONAL AMPLIFIER	28480	05061-6092
	1200-0080	2	INSULATOR:TRANSISTOR MTG.	71785	294834
	1251-0215	2	RETAINER:CONNECTOR SUBMINAT TYPE D	71468	DE51224-1
	2230-0024		SCREW:STL PAN HD 4-40 THD	00000	OBD
A9	1251-0631	1	CONN. SPRING SOCKET		1251-0631
MISC	05061-0047	1	COVER:BOTTOM	28480	05061-0047
PARTS	05061-0048	1	COVER:TOP	28480	05061-0048
	05061-2035	1	PLATE:END	28480	05061-2035
	05061-2036	1	PLATE:END	28480	05061-2036
A9J1	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A9J2	1251-0216	2	CONNECTOR:MALE 9-CONTACT TYPE D	71468	DEM-9P
A9A1	05061-6093	1	BOARD ASSY:OPERATIONAL AMPLIFIER	28480	05061-6093
A9A1AMP1	0960-0089	1	OPERATING AMPLIFIER	28480	0960-0089
A9A1C1	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A9A1C2	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A9A1CR1	1902-0063	3	DIODE BREAKDOWN:15V	28480	1902-0063
A9A1CR2	1902-0063		DIODE BREAKDOWN:15V	28480	1902-0063
A9A1R1	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A9A1R2	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A10	00105-6013	1	OSCILLATOR ASSY:5 MHZ REBUILT OSCILLATOR IS AVAILABLE; ORDER HP PART NO. 00105-6034. COMPONENTS INSIDE A10 ARE NOT RECOMMENDED FOR CUSTOMER FACILITY REPAIR	28480	00105-6013

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10			REBUILT OSC. ASSY. IS AVAILABLE; ORDER HP PART NO. 00105-6034. COMPONENTS INSIDE A10 NOT RECOMMENDED FOR CUSTOMER FACILITY REPAIR.		
A10A1	00105-6006	1	ASSY:CONTROLLER AC	28480	00105-6006
A10A1C1	0160-2671	2	C:FXD MY 0.1 UF 5% 80VDCW	56289	192P1045R8-PTS
A10A1C2	0160-2672	1	C:FXD MY 0.047 UF 5% 80VDCW	28480	0160-2672
A10A1C3	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10A1C4	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10A1C5			NOT ASSIGNED		
A10A1C6	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10A1C7	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10A1C8	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10A1C9	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10A1C10	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10A1C11	0150-0122	1	C:FXD CER 2000 PF 20% 500VDCW	72982	801-000-Y5S-202M
A10A1C12	0160-0182	1	C:FXD MICA 47PF 5% 300VDCW	14655	RDM15E470J3S
A10A1CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A10A1CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A10A1F1	2110-0254	2	FUSE:THERMAL 15A	15558	1194
A10A1F2	2110-0254		FUSE:THERMAL 15A	15558	1194
A10A1Q1	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A10A1Q2	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A10A1R1	0757-0422	2	R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A10A1R2	0757-0415	1	R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A10A1R3	2100-2224	1	R:VAR WW 200 OHM 5% LIN 1W	28480	2100-2224
A10A1R4	0757-0419	1	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A10A1R4			FACTORY SELECTED VALUE.		
A10A1R4	0757-0420	1	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A10A1R4			FACTORY SELECTED VALUE.		
A10A1R4	0757-0421	1	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A10A1R4			FACTORY SELECTED VALUE.		
A10A1R4	0757-0422		R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A10A1R4			FACTORY SELECTED VALUE.		
A10A1R5	0757-0939	2	R:FXD FLM 4.3K OHM 2% 1/8W	28480	0757-0939
A10A1R6	0757-0939		R:FXD FLM 4.3K OHM 2% 1/8W	28480	0757-0939
A10A1R7	0757-0976		R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A10A1R8	0757-0904	2	R:FXD FLM 150 OHM 2% 1/8W	28480	0757-0904
A10A1R9	0757-0913	2	R:FXD MET FLM 360 OHM 2% 1/8W	28480	0757-0913
A10A1R10	0757-0913		R:FXD MET FLM 360 OHM 2% 1/8W	28480	0757-0913
A10A1R11	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A10A1R12	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A10A2	00105-6010	1	ASSY:OSCILLATOR AND AGC 5MHZ	28480	00105-6010
A10A2	0340-0039		INSULATOR:BUSHING	28480	0340-0039
A10A2	3050-0253	2	WASHER:SPRING	28480	3050-0253
A10A2	00105-0002	2	COVER:OVEN	28480	00105-0002
A10A2	00105-2008	2	SCREW:GUIDE	28480	00105-2008
A10A2	00105-2015	1	COVER:CRYSTAL	28480	00105-2015
A10A2	00105-4003	2	SPACER:PLASTIC	28480	00105-4003
A10A2	00105-4007	1	SHAFT:COARSE	28480	00105-4007
A10A2	00105-4015	4	SPACER:PLASTIC	28480	00105-4015
A10A2C5	0160-2437	4	C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A10A2C6	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A10A2C7	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A10A2C8	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A10A2L2	00105-8004		COIL:FREQ PADDING(TYPICAL VALUE 30UH)	28480	00105-8004
A10A2L2	00105-8006		COIL FREQUENCY-PAD	28480	00105-8006
A10A2L2	00105-8008	1	COIL FREQUENCY-PAD	28480	00105-8008
A10A2R3	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A10A2R4	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A10A2W1	00105-6008	1	CABLE:AGC OUTPUT	28480	00105-6008
A10A2Y1	5080-0049	1	CRYSTAL:5MHZ	28480	5080-0049
A10A3	00105-6007	1	ASSY:POWER AMPLIFIER BOARD	28480	00105-6007
A10A3C1	0160-2055	19	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A3C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A3C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A3C4	0180-2182	1	C:FXD ELECT 18 UF 10% 50VDCW	28480	0180-2182
A10A3C5	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A3C6	0160-2326	1	C:FXD MICA 150 PF 5%	28480	0160-2326
A10A3C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A3C8	0160-2188	1	C:FXD MY 0.0039 UF 5% 200VDCW	56289	292P39252-PTS
A10A3C9	0160-0178		C:FXD MICA 27PF 5% 300VDCW	04062	RDM15E270J3S
A10A3C9	0160-0179		C:FXD MICA 33 PF 5% 300VDCW	14655	RDM15E330J3S
A10A3C9	0160-0181		C:FXD MICA 30PF 5% 300VDCW	14655	RDM15E300J3S
A10A3C10	0121-0046		C:VARI CER 9-35 PF	28480	0121-0046

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10A3C11	0160-2328	1	C:FXD MICA 200 PF 1% 300VDCW	04062	RDM15F201F3S
A10A3C12	0121-0046		C:VARI CER 9-35 PF	28480	0121-0046
A10A3C13	0140-0197	1	C:FXD MICA 180 PF 5% 300VDCW	14655	RDM15F181J3C
A10A3C13	0160-2005	1	C:FXD MICA 230PF 1% 500VDCW	04062	RDM15F231F5C
A10A3C13	0160-2025	1	C:FXD MICA 220 PF 5% 500VDCW	28480	0160-2025
A10A3C13	0160-2531	1	C:FXD MICA 240 PF 1% 300VDCW	00853	RDM15F241F3S
A10A3C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A3C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A3CR1	1901-0049	2	DIODE:SILICON 50PIV	28480	1901-0049
A10A3CR2	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
A10A3CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A10A3L1	9100-2430	3	INDUCTOR:220 UH	82142	15S-221K
A10A3L2	9100-2430		INDUCTOR:220 UH	82142	15S-221K
A10A3L3	9100-2430		INDUCTOR:220 UH	82142	15S-221K
A10A3Q1	1854-0005		TSTR:SI NPN	80131	2N708
A10A3Q2	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A10A3Q3	1854-0039	2	TSTR:SI NPN	80131	2N3053
A10A3Q4	1854-0020	2	TSTR:SI NPN	28480	1854-0020
A10A3Q5	1854-0005		TSTR:SI NPN	80131	2N708
A10A3Q6	1854-0251	1	TSTR:SI NPN	28480	1854-0251
A10A3R1	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A10A3R2	0757-0954	4	R:FXD FLM 18K OHM 2% 1/8W	28480	0757-0954
A10A3R3	0757-0962		R:FXD FLM 39K OHM 2% 1/8W	28480	0757-0962
A10A3R4	0757-0956	4	R:FXD FLM 22K OHM 2% 1/8W	28480	0757-0956
A10A3R5	0757-0910	1	R:FXD MET FLM 270 OHM 2% 1/8W	28480	0757-0910
A10A3R6	0757-0956		R:FXD FLM 22K OHM 2% 1/8W	28480	0757-0956
A10A3R7	0757-0937	1	R:FXD FLM 3.6K OHM 2% 1/8W	28480	0757-0937
A10A3R8	0698-0001	1	R:FXD COMP 4.7 OHM 5% 1/2W	01121	EB 47G5
A10A3R9	0757-0895		R:FXD FLM 62 OHM 2% 1/8W	28480	0757-0895
A10A3R9	0757-0896		R:FXD MET FLM 68 OHM 2% 1/8W	28480	0757-0896
A10A3R9	0757-0897		R:FXD FLM 75 OHM 2% 1/8W	28480	0757-0897
A10A3R9	0757-0898		R:FXD FLM 82 OHM 2% 1/8W	28480	0757-0898
A10A3R10	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A10A3R11	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A10A3R12	0698-3427	1	R:FXD MET FLM 13.3 OHM 1% 1/8W	28480	0698-3427
A10A3R12	0698-3428	1	R:FXD MET FLM 14.7 OHM 1% 1/8W	28480	0698-3428
A10A3R12	0698-3432	1	R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A10A3R12	0698-3435	1	R:FXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A10A3R12	0698-4037	1	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A10A3R12	0698-4088	1	R:FXD MET FLM 27 OHM 1% 1/8W	28480	0698-4088
A10A3R12	0698-4364	1	R:FXD FLM 17.4 OHM 1% 1/8W	28480	0698-4364
A10A3R12	0698-4366	1	R:FXD FLM 19.1 OHM 1% 1/8W	28480	0698-4366
A10A3R12	0698-4368	1	R:FXD FLM 21 OHM 1% 1/8W	28480	0698-4368
A10A3R12	0698-4369	1	R:FXD FLM 23.2 OHM 1% 1/8W	28480	0698-4369
A10A3R12	0757-0180	1	R:FXD MET FLM 31.6 OHM 1% 1/8W	28480	0757-0180
A10A3R12	0757-0295	1	R:FXD MET FLM 11.5 OHM 1% 1/8W	28480	0757-0295
A10A3R12	0757-0316	1	R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A10A3R12	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A10A3R12	0757-0368	1	R:FXD MET FLM 34 OHM 1% 1/8W	28480	0757-0368
A10A3R12	0757-0378	1	R:FXD MET FLM 11.0 OHM 1% 1/8W	28480	0757-0378
A10A3R12	0757-0379	1	R:FXD MET FLM 12.1 OHM 1% 1/8W	28480	0757-0379
A10A3R12	0757-0382	1	R:FXD MET FLM 16.2 OHM 1% 1/8W	28480	0757-0382
A10A3R12	0757-0383	5	R:FXD MET FLM 18.2 OHM 1% 1/8W	28480	0757-0383
A10A3R12	0757-0384		R:FXD FLM 20 OHM 1% 1/8W	28480	0757-0384
A10A3R12	0757-0385		R:FXD MET FLM 22.1 OHM 1% 1/8W	28480	0757-0385
A10A3R12	0757-0386		R:FXD FLM 24.3 OHM 1% 1/8W	28480	0757-0386
A10A3R12	0757-0390		R:FXD MET FLM 36.5 OHM 1% 1/8W	28480	0757-0390
A10A3R13	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A10A3R14	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A10A3R15	0757-0959		R:FXD FLM 30K OHM 2% 1/8W	28480	0757-0959
A10A3R16	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A10A3R17	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A10A3R18	0757-0918	3	R:FXD FLM 560 OHM 2% 1/8W	28480	0757-0918
A10A3R19	2100-1788	1	R:VAR FLM 500 OHM 10% LIN 1/2W	28480	2100-1788
A10A3R20	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A10A3R21	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A10A3T1	00105-8007	1	TRANSFORMER:POWER AMPLIFIER	28480	00105-8007
A10A 2A1	00105-6005	1	ASSY:OSCILLATOR 5MHZ	28480	00105-6005
A10A 2C1	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C5	0160-3222	1	C:FXD PORC 100 PF 5% 100VDCW	95275	VY10CA101JA
A10A 2C6	0160-3223	1	C:FXD PORC 11 PF 5% 500VDCW	95275	VY10CA110JA
A10A 2C7	0121-0179	1	C:VARI GLASS 1-28 PF	28480	0121-0179

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10A 2C8	0180-0218	4	C:FXD ELECT 0.15 UF 10% 35VDCW	28480	0180-0218
A10A 2C9	0160-3224	1	C:FXD PORC 75 PF 5% 300VDCW	95275	VY10CA750JA
A10A 2C9	0160-3464	1	C:FXD PORC 82 PF 5% 300VDCW	95275	VY10CA820JA
A10A 2C10	0160-3221	1	C:FXD PORC 300 PF 5% 50VDCW	95275	VY10CA301JA
A10A 2C11	0160-3225	1	C:FXD PORC 3000 PF 5% 100VDCW	95275	VY20CA302JA
A10A 2C12	0160-2671		C:FXD MY 0.1 UF 5% 80VDCW	56289	192P1045R8-PTS
A10A 2CR1	0122-0011	1	DIODE:CAPACITOR VARI 100 PF	01281	V739
A10A 2L1	9100-2820	1	CHOKE:180 UH 5%	76493	72F184AP
A10A 2L3	00105-8005	1	COIL:MODE SUPRESSOR .47UH	28480	00105-8005
A10A 2Q1	1854-0073	3	TSTR:SI NPN(SELECTED FROM 2N2857)	28480	1854-0073
A10A 2R1	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A10A 2R2	0757-0909	1	R:FXD FLM 240 OHM 2% 1/8W	28480	0757-0909
A10A 2R3	0721-0025	4	R:FXD DEPC 4.99 MEGOHM 2% 1/8W	28480	0721-0025
A10A 2R4	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A10A 2R5	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A10A 2R6	0721-0025		R:FXD DEPC 4.99 MEGOHM 2% 1/8W	28480	0721-0025
A10A 2	00105-6009	1	ASSY:AGC N.S.R. ORDER ASSY00105-6010	28480	00105-600.
A10A 2	00105-6003	1	ASSY:AGC INPUT BOARD	28480	00105-6003
A10A 2C1	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C4	0180-0218		C:FXD ELECT 0.15 UF 10% 35VDCW	28480	0180-0218
A10A 2C5	0121-0046		C:VARI CER 9-35 PF	28480	0121-0046
A10A 2C6	0160-0179		C:FXD MICA 33 PF 5% 300VDCW	14655	RDM15E330J3S
A10A 2C7	0180-0218		C:FXD ELECT 0.15 UF 10% 35VDCW	28480	0180-0218
A10A 2CR1	1902-0049	1	DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A10A 2CR2	1902-0063		DIODE BREAKDOWN:15V	28480	1902-0063
A10A 2Q1	1854-0073		TSTR:SI NPN(SELECTED FROM 2N2857)	28480	1854-0073
A10A 2R1	0757-0936		R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A10A 2R2	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A10A 2R3	2100-1738	1	R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A10A 2R4	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A10A 2R5	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A10A 2R6	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A10A 2R7	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A10A 2R8	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A10A 2R9	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A10A 2T1	00105-8001	1	TRANSFORMER:AGC INPUT	28480	00105-8001
A10A 2	00105-6004	1	ASSY:AGC OUTPUT BOARD	28480	00105-6004
A10A 2C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C9	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C10	0160-2010	1	C:FXD MET MYLAR 0.47UF 20% 200VDCW	14752	21031C474
A10A 2C11	0121-0046		C:VARI CER 9-35 PF	28480	0121-0046
A10A 2C12	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C13	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A10A 2C15	0160-2013	1	C:FXD MICA 39 PF 5% 300VDCW	04062	RDM15E390J3S
A10A 2C16	0180-0218		C:FXD ELECT 0.15 UF 10% 35VDCW	28480	0180-0218
A10A 2CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A10A 2CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A10A 2Q2	1854-0073		TSTR:SI NPN(SELECTED FROM 2N2857)	28480	1854-0073
A10A 2R10	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A10A 2R11	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A10A 2R12	2100-2216	1	R:VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2216
A10A 2R13	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A10A 2R14	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A10A 2R15	0757-0954		R:FXD FLM 18K OHM 2% 1/8W	28480	0757-0954
A10A 2R16	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A10A 2T2	00105-8002	1	TRANSFORMER:AGC OUTPUT	28480	00105-8002
A11	05061-6009	1	CESIUM OVEN CONTROLLER	28480	05061-6009
A11 MISC PARTS	1251-1042	1	RETAINER:CONNECTOR	71468	DB 51221-1
	05061-0009	1	CHASSIS:CESIUM OVEN	28480	05061-0009
	05061-0010	1	COVER:CESIUM OVEN	28480	05061-0010
	05061-2001		PLATE:END	28480	05061-2001
	05061-2003		PLATE:END	28480	05061-2003
A11J1	1251-0063	1	CONNECTOR MALE SUBMIN TYPE D 25CONTACT	71468	M-25P
A11A1	05061-6010	1	BOARD ASSY:CESIUM OVEN CONTROLLER	28480	05061-6010
A11A1C1	0180-0097	11	C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A11A1C2	0160-0128		C:FXD CER 2.2 UF 20% 25VDCW	56289	5C152C2S-CML
A11A1C3	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A11A1C4	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A11A1C5	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A11A1C6	0150-0096	4	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A11A1C7	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A11A1C8	0160-0845	1	C:FXD MY 0.22 UF 10% 400VDCW	84411	HEW 29

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11A1C9	0180-0022	1	C:FXD ELECT 3.9 UF 10% 35VDCW	28480	0180-0022
A11A1C10	0180-0159	2	C:FXD ELECT 220 UF 20% 10VDCW	28480	0180-0159
A11A1C11	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A11A1C12	0180-0159		C:FXD ELECT 220 UF 20% 10VDCW	28480	0180-0159
A11A1C13	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A11A1C14	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A11A1C15	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A11A1C16	0170-0086		C:FXD MY 0.22UF 20% 50VDCW	84411	601PE STYLE 3
A11A1C17	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11A1C18	0160-0128		C:FXD CER 2.2 UF 20% 25VDCW	56289	5C152C2S-CML
A11A1C19	0160-0162	2	C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A11A1C20	0180-1746	1	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A11A1C21	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A11A1C22	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A11A1CR1	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A11A1CR2	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A11A1CR3	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A11A1CR4	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A11A1CR5	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A11A1CR6	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A11A1CR7	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A11A1CR8	1901-0030	4	DIODE:SILICON 800 PIV	28480	1901-0030
A11A1CR9	1901-0030		DIODE:SILICON 800 PIV	28480	1901-0030
A11A1CR10	1901-0030		DIODE:SILICON 800 PIV	28480	1901-0030
A11A1CR11	1901-0030		DIODE:SILICON 800 PIV	28480	1901-0030
A11A1CR12	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A11A1CR13	1902-0025	1	DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A11A1CR14	1902-3048	2	DIODE BREAKDOWN:SILICON 3.48V 5%	28480	1902-3048
A11A1CR15	1902-3048		DIODE BREAKDOWN:SILICON 3.48V 5%	28480	1902-3048
A11A1CR16	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A11A1L1	05060-6034	1	COIL ASSY:27 UH FILTER	28480	05060-6034
A11A1L2	05060-6073	1	COIL ASSY:350 UH FILTER	28480	05060-6073
A11A1Q1	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A11A1Q2	1854-0062	8	TSTR:SI NPN	80131	2N1701
A11A1Q3	1854-0062		TSTR:SI NPN	80131	2N1701
A11A1Q4	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A11A1Q5	1854-0813		TSTR:SI NPN	80131	2N1701
A11A1Q6	1854-0813		TSTR:SI NPN	80131	2N1701
A11A1R1	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A11A1R2	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A11A1R3	0757-0964		R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A11A1R4	0757-0944		R:FXD FLM 6.8K OHM 2% 1/8W	28480	0757-0944
A11A1R5	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A11A1R6	0757-0943		R:FXD FLM 6.2K OHM 2% 1/8W	28480	0757-0943
A11A1R7	0757-0930		R:FXD FLM 1.8K OHM 2% 1/8W	28480	0757-0930
A11A1R8	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A11A1R9	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A11A1R10	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A11A1R11	0757-0905	1	R:FXD FLM 160 OHM 2% 1/8W	28480	0757-0905
A11A1R12	0757-0912		R:FXD MET FLM 330 OHM 2% 1/8W	28480	0757-0912
A11A1R13	0757-0383		R:FXD MET FLM 18.2 OHM 1% 1/8W	28480	0757-0383
A11A1R14	0757-0383		R:FXD MET FLM 18.2 OHM 1% 1/8W	28480	0757-0383
A11A1R15	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A11A1R16	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A11A1R17	0757-0943		R:FXD FLM 6.2K OHM 2% 1/8W	28480	0757-0943
			SELECTABLE VALUE.		
A11A1R17	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
			SELECTABLE VALUE.		
A11A1R18	0757-0383		R:FXD MET FLM 18.2 OHM 1% 1/8W	28480	0757-0383
A11A1R19	0757-0383		R:FXD MET FLM 18.2 OHM 1% 1/8W	28480	0757-0383
A11A1R20	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A11A1R21	0757-0400	1	R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
			FACTORY SELECTED VALUE.		
A11A1R22	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A11A1R23	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A11A1R24	0757-0904		R:FXD FLM 150 OHM 2% 1/8W	28480	0757-0904
			FACTORY SELECTED VALUE.		
A11A1R25	0757-0467	1	R:FXD MET FLM 121K OHM 1% 1/8W	28480	0757-0467
A11A1R26	0757-0477	1	R:FXD MET FLM 332K OHM 1% 1/8W	28480	0757-0477
A11A1R27	2100-1761		R:VAR WW 10K OHM 5% TYPE V 1W	28480	2100-1761
A11A1R28			NOT ASSIGNED		
A11A1R29			NOT ASSIGNED		
A11A1R30			NOT ASSIGNED		
A11A1R31	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A11A1R32	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11A1R33	0812-0017	3	R:FXD WW 0.25 OHM 5% 3W	28480	0812-0017
A11A1R34	0812-0017		R:FXD WW 0.25 OHM 5% 3W	28480	0812-0017
A11A1R35	0757-0921		R:FXD MET FLM 750 OHM 2% 1/8W	28480	0757-0921
A11A1R36	0757-0934	1	R:FXD FLM 2.7K OHM 2% 1/8W FACTORY SELECTED VALUE.	28480	0757-0934
A11A1T1	9100-0335	1	TRANSFORMER	28480	9100-0335
A11A1T2	9100-0333	1	TRANSFORMER	28480	9100-0333
A11A1T3	9100-0336	1	TRANSFORMER	28480	9100-0336
A11A1T4	9100-2234	1	TRANSFORMER:AUDIO	28480	9100-2234
A12	05061-6077	1	CESIUM BEAM TUBE ASSY (NOT FIELD REPAIRABLE)	28480	05061-6077
			(NOT FIELD REPAIRABLE(OPT 004))		
A12	05061-6101	1	CESIUM BEAM TUBE ASSY(OPT. 004)	28480	05061-6101
A12J16	1251-0215		RETAINER:CONNECTOR SUBMINAT TYPE D	71468	DE51224-1
A12J17	1251-0220	1	RETAINER:CONNECTOR SUBMINAT TYPE D	71468	DA51220-1
A12P16	1251-0216		CONNECTOR:MALE 9-CONTACT TYPE D	71468	DEM-9P
A12P16 MISC	1251-0217	1	CONNECTOR:HOOD SUBMINAT TYPE D	71468	DE-24657
A12P16 MISC	1251-0218	1	CONNECTOR:LOCK POST SUBMINAT TYPE D	71468	D53018
A12P17	1251-0179	1	CONNECTOR:COAXIAL	71468	DM-53740-5001
A12P17 MISC	1251-0222	1	HOOD:CONNECTOR FOR SUB-MINAT CONN TYPE	91468	DA-24658
A13	05061-6030	1	AC AMPLIFIER ASSY	28480	05061-6030
A13 MISC PARTS	05061-0030	1	CHASSIS:BUFFER	28480	05061-0030
	05061-2008	1	PLATE:END	28480	05061-2008
	05061-2009	1	PLATE:END	28480	05061-2009
	05061-0031	1	COVER:BUFFER AMPLIFIER	28480	05061-0031
A13C1	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A13C2	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A13J1	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A13J2	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A13J3	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A13J4	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A13A1	05061-6107	1	BOARD ASSY:AC AMPLIFIER	28480	05061-6107
A13A1 MISC PARTS	7100-0101	2	SHIELD:MU-METAL	02875	HU8920-11/16-MU-HTD
	107A-69A-27B		PAD:MOUNTING, FOR T1 AND T2	28480	107A-69A-27B
A13A1C1	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C2	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C4	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C5	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C6	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C7	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C9	0140-0223		C:FXD MICA 260 PF 1% 300VDCW FACTORY SELECTED VALUE.	28480	0140-0223
A13A1C10	0140-0223		C:FXD MICA 260 PF 1% 300VDCW	28480	0140-0223
A13A1C11	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C12	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1C13	0160-0128		C:FXD CER 2.2 UF 20% 25VDCW	56289	5C152C25-CML
A13A1C14	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A13A1CR1	1902-3149	1	DIODE BREAKDOWN:9.09V 5%	28480	1902-3149
A13A1CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A13A1L1	9140-0137		COIL:FXD RF 1000 UH 5%	28480	9140-0137
A13A1Q1	1854-0005		TSTR:SI NPN	80131	2N708
A13A1Q2	1854-0005		TSTR:SI NPN	80131	2N708
A13A1Q3	1854-0005		TSTR:SI NPN	80131	2N708
A13A1Q4	1854-0019	1	TSTR:SI NPN	28480	1854-0019
A13A1R1	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A13A1R2			NOT ASSIGNED		
A13A1R3	0757-0918		R:FXD FLM 560 OHM 2% 1/8W	28480	0757-0918
A13A1R4	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A13A1R5	0757-0894		R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A13A1R6	0757-0894		R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A13A1R7	0757-0936		R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A13A1R8	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A13A1R9	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A13A1R10	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A13A1R11	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A13A1R12	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A13A1R13	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A13A1R14	0757-0385		R:FXD MET FLM 22.1 OHM 1% 1/8W	28480	0757-0385
A13A1R15	0757-0385		R:FXD MET FLM 22.1 OHM 1% 1/8W	28480	0757-0385
A13A1R16	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A13A1R17	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A13A1R18	0757-0923	1	R:FXD FLM 910 OHM 2% 1/8W	28480	0757-0923
A13A1R19	0757-0921		R:FXD MET FLM 750 OHM 2% 1/8W	28480	0757-0921
A13A1R20	0757-0898		R:FXD FLM 82 OHM 2% 1/8W	28480	0757-0898

See introduction to this section for ordering information

Table 6–1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13A1R21	0757-0898		R:FXD FLM 82 OHM 2% 1/8W	28480	0757-0898
A13A1R22	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A13A1R23	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A13A1R24	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A13A1R25	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A13A1T1	00105-8007		TRANSFORMER ASSY:5MC	28480	
A13A1T2	00105-8007		TRANSFORMER ASSY:5MC	28480	
A14	05061-6016	1	BOARD ASSY:LOGIC	28480	05061-6016
A14C1	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A14C2	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A14C3	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A14C4	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A14C5	0170-0084		C:FXD MY 0.068UF 20% 50VDCW	84411	601PE STYLE 3
A14C6	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A14C7	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A14C8	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A14C9	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A14C10	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A14C11	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A14C12	0160-3302	1	C:FXD MY 0.068 UF 5% 50VDCW	84411	601CPE
A14C13	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A14C14	0160-0180		C:FXD MY 0.033 UF 5%	28480	0160-0180
A14C15	0160-0180		C:FXD MY 0.033 UF 5%	28480	0160-0180
A14C16	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A14C17	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A14C18	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A14C19	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A14C20	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A14C21	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A14C22	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A14C23	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A14CR1	1902-0074	3	DIODE:BREAKDOWN 7.15V 5%	04713	SZ10939-140
A14CR2	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A14CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR5	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR6	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR7	1902-0034	2	DIODE:5.76V 10%	28480	1902-0034
A14CR8	1902-0074		DIODE:BREAKDOWN 7.15V 5%	04713	SZ10939-140
A14CR9	1902-0074		DIODE:BREAKDOWN 7.15V 5%	04713	SZ10939-140
A14CR10	1902-0067	2	DIODE:BREAKDOWN 11.5V 5%	28480	1902-0067
A14CR11	1902-0067		DIODE:BREAKDOWN 11.5V 5%	28480	1902-0067
A14CR12	1902-0034		DIODE:5.76V 10%	28480	1902-0034
A14CR13	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A14CR14	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR15	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR16	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR17	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR18	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR19	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14CR20	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A14Q1	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q2	1854-0005		TSTR:SI NPN	80131	2N708
A14Q3	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q4	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q5	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q6	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q7	1853-0022	1	TSTR:SI PNP	80131	2N941
A14Q8	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A14Q9	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A14Q10	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A14Q11	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A14Q12	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q13	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q14	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q15	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q16	1854-0005		TSTR:SI NPN	80131	2N708
A14Q17	1854-0005		TSTR:SI NPN	80131	2N708
A14Q18	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q19	1854-0005		TSTR:SI NPN	80131	2N708
A14Q20	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q21	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q22	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14Q23	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14Q24	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A14R1	2100-1775	1	R:VAR WW 5K OHM 5% TYPE H 1W	28480	2100-1775
A14R2	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A14R3	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A14R4	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A14R5	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A14R6	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A14R7	0757-0976		R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A14R8	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R9	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A14R10	0757-0383		R:FXD MET FLM 18.2 OHM 1% 1/8W	28480	0757-0383
A14R11	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R12	2100-1774	1	R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A14R13	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R14	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A14R15	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A14R16	0757-0950		R:FXD FLM 12K OHM 2% 1/8W	28480	0757-0950
A14R17	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R18	0757-0954		R:FXD FLM 18K OHM 2% 1/8W	28480	0757-0954
A14R19	0757-0954		R:FXD FLM 18K OHM 2% 1/8W	28480	0757-0954
A14R20	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A14R21	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A14R22	0757-0947	1	R:FXD FLM 9.1K OHM 2% 1/8W	28480	0757-0947
A14R23	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R24	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A14R25	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A14R26	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A14R27	2100-1773	1	R:VAR WW 1K OHM 5% TYPE H 1W	28480	2100-1773
A14R28	0757-0949	1	R:FXD FLM 11K OHM 2% 1/8W	28480	0757-0949
A14R29	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A14R30	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A14R31	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A14R32	0698-3129		R:FXD DEPC 1.00 MEGOHM 1% 1/8W	28480	0698-3129
A14R33	0757-0951		R:FXD FLM 13K OHM 2% 1/8W	28480	0757-0951
A14R34	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R35	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A14R36	0757-0936		R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A14R37	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A14R38	0757-0951		R:FXD FLM 13K OHM 2% 1/8W	28480	0757-0951
A14R39	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A14R40	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R41	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R42	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A14R43	0757-0963		R:FXD FLM 43K OHM 2% 1/8W	28480	0757-0963
A14R44	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A14R45	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R46	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A14R47	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A14R48	0757-0976		R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A14R49	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A14R50	0757-0976		R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A14R51	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A14R52	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R53	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A14R54	0757-0933	2	R:FXD FLM 2.4K OHM 2% 1/8W	28480	0757-0933
A14R55	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A14R56	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A14R57	0757-0963		R:FXD FLM 43K OHM 2% 1/8W	28480	0757-0963
A14R58	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A14R59	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R60	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A14R61	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A14R62	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A14R63	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A14R64	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A14R65	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R66	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A14R67	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A14R68	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R69	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14R70	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A14SCR1	1884-0070	1	SWITCH:SC SI PNPN	03508	3N81

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15	05061-6099	1	BOARD ASSY:POWER REGULATOR	28480	05061-6099
A15C1	0170-0072	1	C:FXD MY 1 UF 10% 200VDCW	84411	HEW 54
A15C2	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A15C3	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A15C4	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A15C5	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C6	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A15C7	0160-2199	1	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A15C8	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A15C9	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C10	0170-0019	1	C:FXD MY 0.1 UF 5% 200VDCW	28480	0170-0019
A15C11	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C12	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15CR1	1901-0200	6	DIODE:SI 3 A 100 PRRV	28480	1901-0200
A15CR2	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A15CR3	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A15CR4	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A15CR5	1902-3234	2	DIODE BREAKDOWN:19.6V 5%	28480	1902-3234
A15CR6	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A15CR7	1902-3234		DIODE BREAKDOWN:19.6V 5%	28480	1902-3234
A15CR8	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A15CR9	1902-0672	1	DIODE BREAKDOWN:9.0V 5% 500MW	28480	1N939
A15CR10	1902-0071	1	DIODE:BREAKDOWN 9.0V 5%	28480	1902-0071
A15L1	9100-0339	2	COIL:FXD RF AIR 5 MICROHENRIES	28480	9100-0339
A15Q1	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q2	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q3	1853-0024	3	TSTR:SI PNP	80131	2N3778
A15Q4	1854-0062		TSTR:SI NPN	80131	2N1701
A15Q5	1853-0024		TSTR:SI PNP	80131	2N3778
A15Q6	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q7	1853-0024		TSTR:SI PNP	80131	2N3778
A15Q8	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q9	1854-0039		TSTR:SI NPN	80131	2N3053
A15Q10	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15Q11	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q12	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q13	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q14	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q15	1854-0062		TSTR:SI NPN	80131	2N1701
A15Q16	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15Q17	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15Q18	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q19	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15R1	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R2	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R3	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A15R4	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A15R5	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A15R6	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A15R7	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A15R8	0757-0914		R:FXD FLM 390 OHM 2% 1/8W	28480	0757-0914
A15R9	0767-0001	1	R:FXD MET FLM 400 OHM 5% 3W	28480	0767-0001
A15R10	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A15R11	0757-0927		R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A15R12	0812-0017		R:FXD WW 0.25 OHM 5% 3W	28480	0812-0017
A15R13	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A15R14	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A15R15	2100-1770	1	R:VAR WW 100 OHM 5% TYPE H 1W	28480	2100-1770
A15R16	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A15R17	0757-0918		R:FXD FLM 560 OHM 2% 1/8W	28480	0757-0918
A15R18	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A15R19	0757-0933		R:FXD FLM 2.4K OHM 2% 1/8W	28480	0757-0933
A15R20	0757-0915		R:FXD FLM 430 OHM 2% 1/8W	28480	0757-0915
A15R21	0811-3260	1	R: FXD 235 OHM FAC. SEL.		
A15R22	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A15R23	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A15R24	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A15R25	0757-0481	1	R:FXD MET FLM 475K OHM 1% 1/8W	28480	0757-0481
A15R26	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A15R27	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R28	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R29	0757-0911		R:FXD FLM 300 OHM 2% 1/8W	28480	0757-0911
A15R30	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A15R31	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15R32	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A15R33	0698-4345	1	R:FXD MET FLM 2 MEGOHM 1% 1/4W	28480	0698-4345
A15R34	0727-0229	1	R:FXD CARBON 265K OHM 1% 1/2W	28480	0727-0229
A15R35	0757-0473	3	R:FXD MET FLM 221K OHM 1% 1/8W	28480	0757-0473
A15R36	0757-0473		R:FXD MET FLM 221K OHM 1% 1/8W	28480	0757-0473
A15R37	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A15R38	0757-0936		R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A15R39	0727-0012	1	R:FXD DEPC 20 OHM 1% 1/2W	28480	0727-0012
A15R40	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A15U1	1826-0045	1	IC:LINEAR, OP. AMPL.	12040	LM201AH
A16			NOT ASSIGNED		
A17	05061-6018	1	TERMINAL BOARD ASSY	28480	05061-6018
A17F1	2110-0274	1	FUSE:3A	75915	276003
A17R1	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A17R2	0757-0959		R:FXD FLM 30K OHM 2% 1/8W	28480	0757-0959
A17R3	0757-0956		R:FXD FLM 22K OHM 2% 1/8W	28480	0757-0956
A17R4	0757-0967		R:FXD FLM 62K OHM 2% 1/8W	28480	0757-0967
A17R5	0757-0956		R:FXD FLM 22K OHM 2% 1/8W	28480	0757-0956
A17R6	0757-0964		R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A17R7	0698-3456	1	R:FXD MET FLM 287K OHM 1% 1/8W	28480	0698-3456
A17R8	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A17R9	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A17R10	0698-3260	1	R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A17R11	0757-0485	1	R:FXD MET FLM 681K OHM 1% 1/8W	28480	0757-0485
A17R12	0811-1792	2	R:FXD WW 66.2K OHM 0.1% 1/40W	28480	0811-1792
A17R13	0811-1792		R:FXD WW 66.2K OHM 0.1% 1/40W	28480	0811-1792
A18	05060-6093	1	ASSY+3500VDC POWER SUPPLY(NSR)	28480	05060-6093
			FIELD REPAIR NOT RECOMMENDED.		
A18 MISC PARTS	0900-0011	6	O RING	28480	0900-0011
	0950-0140	1	BASE ASSY:POWER SUPPLY	28480	0950-0140
	05060-2077	4	BLOCK MOUNTING	28480	05060-2077
	05060-2081	6	SPACER	28480	05060-2081
A18C1	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A18C2	0160-0157	2	C:FXD MY 0.0047 UF 10% 200VDCW	56289	192P47292-PTS
A18C3	0160-0994	2	C:FXD MY 0.001 UF 10% 4000VDCW	71436	PMS 102-4M
A18C4	0160-0995	3	C:FXD MY 0.01 UF 10% 4000VDCW	71436	PMS 103-4M
A18C5	0170-0078	1	C:FXD MY 0.47 UF 5% 150VDCW	11711	107V474J
A18C6	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A18CR1	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A18CR2	1901-0405	4	DIODE:SILICON 5000 PIV 10MA	28480	1901-0405
A18CR3	1901-0405		DIODE:SILICON 5000 PIV 10MA	28480	1901-0405
A18Q1	1854-0035		TSTR:SI NPN	28480	1854-0035
A18Q2	1854-0062		TSTR:SI NPN	80131	2N1701
A18R1	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A18R2	0698-3106		R:FXD DEPC 5 OHM 1% 1/8W	28480	0698-3106
A18R3	0698-3106		R:FXD DEPC 5 OHM 1% 1/8W	28480	0698-3106
A18R4	0698-3305	1	R:FXD DEPC 200 MEGOHM 10% 1W	28480	0698-3305
A18R5	0757-0473		R:FXD MET FLM 221K OHM 1% 1/8W	28480	0757-0473
A18R6	0757-0969	2	R:FXD FLM 75K OHM 2% 1/8W	28480	0757-0969
A18R7	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A18R8	0757-0894		R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A18T1	05060-6113	2	TRANSFORMER ASSY	28480	05060-6113
A18T2	05060-6109	1	TRANSFORMER ASSY	28480	05060-6109
A19	05060-6092	1	ASSY:-2500VDC POWER SUPPLY(NSR)	28480	05060-6092
			FIELD REPAIR NOT RECOMMENDED		
A19 MISC PARTS	0900-0011		O RING	28480	0900-0011
	0950-0139	1	BASE ASSY:POWER SUPPLY	28480	0950-0139
	7100-0435	1	CAN:SQUARE	28480	7100-0435
	05060-2077		BLOCK MOUNTING	28480	05060-2077
	05060-2081		SPACER	28480	05060-2081
A19C1	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A19C2	0160-0157		C:FXD MY 0.0047 UF 10% 200VDCW	56289	192P47292-PTS
A19C3	0160-0994		C:FXD MY 0.001 UF 10% 4000VDCW	71436	PMS 102-4M
A19C4	0160-0995		C:FXD MY 0.01 UF 10% 4000VDCW	71436	PMS 103-4M
A19C5	0160-0995		C:FXD MY 0.01 UF 10% 4000VDCW	71436	PMS 103-4M
A19CR1	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A19CR2	1901-0405		DIODE:SILICON 5000 PIV 10MA	28480	1901-0405
A19CR3	1901-0405		DIODE:SILICON 5000 PIV 10MA	28480	1901-0405
A19Q1	1854-0035		TSTR:SI NPN	28480	1854-0035
A19Q2	1854-0062		TSTR:SI NPN	80131	2N1701
A19R1	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A19R2	0698-3106		R:FXD DEPC 5 OHM 1% 1/8W	28480	0698-3106
A19R3	0698-3106		R:FXD DEPC 5 OHM 1% 1/8W	28480	0698-3106
A19R4	0727-0287	1	R:FXD CARBON 2 MEGOHM 1% 1/2W	28480	0727-0287
A19R5	0698-8419	1	R:FXD DEPC 200 MEGOHM 10% 1W	28480	0698-8419

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A19R6	0721-0025		R:FXD DEPC 4.99 MEGOHM 2% 1/8W	28480	0721-0025
A19R7	0721-0025		R:FXD DEPC 4.99 MEGOHM 2% 1/8W	28480	0721-0025
A19R8	0757-0969		R:FXD FLM 75K OHM 2% 1/8W	28480	0757-0969
A19R9	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A19T1	05060-6113		TRANSFORMER ASSY	28480	05060-6113
A19T2	05060-6112	1	TRANSFORMER ASSY	28480	05060-6112

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS & MISC PARTS		
C1	0160-0975	1	C:FXD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
C2	0160-4201	1	C:FXD 8 UF	28480	0160-4201
C4			SEE OPTION 002		
C5	0180-0090	1	C:FXD ELECT 1000 UF 50VDCW	56289	D31972
C6	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
C7	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
C8	0160-3611	1	C:FXD CER DISC 7200 PF 10% 250VDCW	56289	41C407-COH
CR1	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
DS1	1450-0705	1	LAMPHOLDER:FRONT MOUNTING DISPLAY LITE	07137	RDL-83-F12-000
DS1	2140-0245	2	LAMP:INCANDESCENT 28.0V	08806	387
DS2	1450-0114	1	LAMPHOLDER:AMBER LENS	07137	RDL-83-F3-000
DS2	2140-0245		LAMP:INCANDESCENT 28.0V	08806	387
F1	2110-0020	1	FUSE:0.8A 250V SLOW-BLOW FOR 230V OPERATION	75915	313.800S
F1	2110-0305	1	FUSE:1.25 AMP SLOW BLOW	71400	MDX-1-1/4A
F1	1400-0084	4	FUSEHOLDER:EXTRACTOR POST TYPE FOR 115V OPERATION	75915	342014
F2	2110-0007	1	FUSE:CARTRIDGE 1 AMP 250V SLOW BLOW	75915	313001
F2	1400-0084		FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
F3	2110-0003	1	FUSE:CARTRIDGE 3 AMP 3 AG	75915	312003
F3	1400-0084		FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
J1	1250-0102	4	CONNECTOR:BNC	28480	1250-0102
J2	1250-0140	8	BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J3	1251-1978	2	CONNECTOR:RACK AND PANEL	81312	PM1P
J4	1251-1979	2	CONNECTOR:RACK AND PANEL	81312	PM1S
J5	1250-0102		CONNECTOR:BNC	28480	1250-0102
J6	1250-0140		BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J7	1250-0102		CONNECTOR:BNC	28480	1250-0102
J8	1250-0140		BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J9	1250-0102		CONNECTOR:BNC	28480	1250-0102
J10	1250-0140		BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J11	1250-0140		BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J12	1250-0140		BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J14	1250-0140		BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J15	1250-0140		BODY:RF CONNECTOR, MALE BNC SERIES	02660	31-357-1022
J18	1251-2796	1	CONNECTOR:18 FEMALE CONTACTS	83298	PT02A-14-18S(005)
J19	1251-0111	1	CONNECTOR:RECEPTACLE MALE 5-CONTACT	71468	MS3102R14S-5P
J20	1251-2458	1	CONNECTOR:CIR. 3 MALE #16 CONTACT	02660	MS3102A-18-22PW
L1	9100-0337	1	REACTOR:50 MILLIHENRIES	28480	9100-0337
L2	9100-0339		COIL:FXD RF AIR 5 MICROHENRIES	28480	9100-0339
M1	1120-1472	1	METER:50-0-50 UA	28480	1120-1472
P3	1251-1980	2	LOCKSPRING:RACK AND PANEL CONNECTOR	81312	M4LS
P3	1251-1981	2	LOCKRING:R & P CONNECTOR	81312	M4LR
P3	1251-1977	2	HOOD:RACK AND PANEL CONNECTOR	81312	H10
P3	1251-1979		CONNECTOR:RACK AND PANEL	81312	PM1S
P4	1251-1980		LOCKSPRING:RACK AND PANEL CONNECTOR	81312	M4LS
P4	1251-1981		LOCKRING:R & P CONNECTOR	81312	M4LR
P4	1251-1977		HOOD:RACK AND PANEL CONNECTOR	81312	H10
P4	1251-1978		CONNECTOR:RACK AND PANEL	81312	PM1P
Q2	1854-0020		TSTR:SI NPN	28480	1854-0020
Q2	0340-0487	1	INSULATOR:TSTR FOR TO-8 CASE	76530	298233
Q2	1200-0087	1	CLAMP:TRANSISTOR	02735	DF-13-4
Q2	1200-0092	1	BUSHING:TRANSISTOR	02735	495334 1
R1	0757-0440	1	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
R2	0698-3136	1	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
R3	2100-2425	1	R:VAR WW 20K OHM 3% LIN 1.5W	28480	2100-2425
R3	2100-2427	1	MOUNTING BRACKET FOR VAR. RESISTOR	73138	568W
R4	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
R5	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
R6	0730-0145	1	R:FXD DEPC 12 MEGOHM 1% 1W	28480	0730-0145
R7	2100-2429	1	R:VAR WW 250K OHM 20% LIN 3/4W	28480	2100-2429
R8	2100-1414	1	R:VAR WW 5K OHM 5% LIN 10-TURN 3/4W	28480	2100-1414
R9	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
S1	3100-0893	1	SWITCH:ROTARY	28480	3100-0893
S2	3100-0894	1	SWITCH:ROTARY	28480	3100-0894
S3	3101-1234	1	SWITCH:SLIDE DPDT	82389	11A-1242
S4	3101-1155	1	SWITCH:TOGGLE SPDT	28480	3101-1155
S5	3101-0163	1	SWITCH:TOGGLE SPDT	04009	MST-105D
S6	3101-0045	1	SWITCH:SLIDE DPDT 0.5 AMP 125 VDC	42190	11238
S7	3101-0124	1	SWITCH:PUSHBUTTON SPST N/O MOMENTARY	28480	3101-0124
T1	9100-2449	1	TRANSFORMER	28480	9100-2449
W1	05061-6035	1	CABLE ASSY:FRONT	28480	05061-6035

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
W1	1250-0050	10	NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W1	1250-0051	10	CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W1	1250-0259	24	CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W1	1250-0260	24	CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W1	1250-0261	24	INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W1	1250-0262	24	FERRULE FOR RF CONNECTOR	28480	1250-0262
W1	1250-0263	24	WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W1	1250-0264	24	WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W1	1250-0265	24	NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W1	8120-0229	26	CABLE:RF COAX RG	04217	421-105
W2	05061-6036	1	CABLE ASSY:BUFFER REAR	28480	05061-6036
W2	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W2	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W2	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W2	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W2	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W2	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W2	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W2	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W2	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W2	8120-0229		CABLE:RF COAX RG	04217	421-105
W3	05061-6037	1	CABLE ASSY:SYNTH	28480	05061-6037
W3	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W3	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W3	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W3	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W3	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W3	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W3	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W3	8120-0229		CABLE:RF COAX RG	04217	421-105
W4	05061-6038	1	CABLE ASSY:MULTIPLIER	28480	05061-6038
W4	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W4	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W4	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W4	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W4	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W4	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W4	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W4	8120-0229		CABLE:RF COAX RG	04217	421-105
W5	05061-6039	1	CABLE ASSY:OSCILLATOR	28480	05061-6039
W5	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W5	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W5	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W5	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W5	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W5	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W5	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W5	8120-0229		CABLE:RF COAX RG	04217	421-105
W6	05061-6040	1	CABLE ASSY:OSCILLATOR	28480	05061-6040
W6	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W6	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W6	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W6	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W6	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W6	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W6	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W6	8120-0229		CABLE:RF COAX RG	04217	421-105
W7	05061-6041	1	CABLE ASSY:2ND HARMONIC	28480	05061-6041
W7	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W7	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W7	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W7	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W7	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W7	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W7	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W7	8120-0229		CABLE:RF COAX RG	04217	421-105
W8	05061-6042	1	CABLE ASSY:COAX FROM AC TO LOG	28480	05061-6042
W8	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W8	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W8	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W8	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W8	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W8	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W8	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W8	8120-0229		CABLE:RF COAX RG	04217	421-105

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
W9	05061-6043	1	CABLE ASSY:PHASE DETECTOR	28480	05061-6043
W9	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W9	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W9	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W9	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W9	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W9	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W9	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W9	8120-0229		CABLE:RF COAX RG	04217	421-105
W10	05061-6044	1	CABLE ASSY:MODULE MULTIPLIER	28480	05061-6044
W10	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W10	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W10	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W10	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W10	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W10	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W10	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W10	8120-0229		CABLE:RF COAX RG	04217	421-105
W11	05061-6045	1	CABLE ASSY:SYNTH	28480	05061-6045
W11	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W11	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W11	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W11	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W11	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W11	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W11	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W11	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W11	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W11	8120-0229		CABLE:RF COAX RG	04217	421-105
W12	05061-6046	1	CABLE ASSY:FREQUENCY DIVIDER	28480	05061-6046
W12	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W12	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W12	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W12	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W12	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W12	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W12	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W12	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W12	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W12	8120-0229		CABLE:RF COAX RG	04217	421-105
W13	05061-6047	1	CABLE ASSY:FREQUENCY DIVIDER	28480	05061-6047
W13	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W13	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W13	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W13	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W13	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W13	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W13	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W13	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W13	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W13	8120-0229		CABLE:RF COAX RG	04217	421-105
W14	05061-6048	1	CABLE ASSY:TUBE	28480	05061-6048
W14	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W14	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W14	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W14	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W14	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W14	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W14	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W14	1251-0180	2	INSERT:R & P CONNECTOR	08718	DM-53742-5001
W14	8120-0229		CABLE:RF COAX RG	04217	421-105
W15			NOT ASSIGNED		
W16	05061-6050	1	CABLE ASSY:PHASE	28480	05061-6050
W16	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W16	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W16	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W16	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W16	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W16	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W16	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W16	8120-0229		CABLE:RF COAX RG	04217	421-105
W17	05061-6051	1	CABLE ASSY:RETURN	28480	05061-6051
W17	1251-0180		INSERT:R & P CONNECTOR	08718	DM-53742-5001
W17	8120-0229		CABLE:RF COAX RG	04217	421-105
W18	05061-6052	1	CABLE ASSY:FREQUENCY	28480	05061-6052

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
W18	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W18	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W18	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W18	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W18	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W18	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W18	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W18	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W18	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W18	8120-0229		CABLE:RF COAX RG	04217	421-105
W19	05061-6053	1	CABLE ASSY:DIVIDER	28480	05061-6053
W19	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W19	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W19	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W19	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W19	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W19	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W19	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W19	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W19	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W19	8120-0229		CABLE:RF COAX RG	04217	421-105
W20			NOT ASSIGNED		
W21	05061-6055	1	CABLE ASSY:PHASE	28480	05061-6055
W21	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W21	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W21	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W21	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W21	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W21	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W21	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W21	8120-0229		CABLE:RF COAX RG	04217	421-105
W22	05061-6056	1	CABLE ASSY:PHASE	28480	05061-6056
W22	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W22	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W22	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W22	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W22	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W22	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W22	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W22	8120-0229		CABLE:RF COAX RG	04217	421-105
W23	05061-6057	1	CABLE ASSY:MODULATOR	28480	05061-6057
W23	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W23	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W23	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W23	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W23	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W23	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W23	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W23	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W23	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W23	8120-0229		CABLE:RF COAX RG	04217	421-105
W24	05061-6058	1	CABLE ASSY:TERMINAL	28480	05061-6058
W24	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W24	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W24	8120-0229		CABLE:RF COAX RG	04217	421-105
W25	05061-6059	1	CABLE ASSY:OPER. AMPLIFIER	28480	05061-6089
W25	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W25	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W25	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W25	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W25	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W25	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W25	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W25	8120-0229		CABLE:RF COAX RG	04217	421-105
W26			-		
W28			NOT ASSIGNED		
W29	05061-6064	1	CABLE ASSY:OSCILLATOR	28480	05061-6064
W29	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W29	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W29	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W29	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W29	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W29	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W29	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W29	8120-0229		CABLE:RF COAX RG	04217	421-105

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
W30	05061-6065	1	CABLE ASSY:BUFFER SYNTH	28480	05061-6065
W30	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W30	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W30	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W30	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W30	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W30	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W30	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W30	8120-0229		CABLE:RF COAX RG	04217	421-105
W31			NOT ASSIGNED		
W32	05061-6069	1	CABLE ASSY:DIGITAL DIVIDER	28480	05061-6069
W32	1250-0050		NUT:RF CONNECTOR BNC SERIES	02660	31-2125-2
W32	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
W32	1250-0259		CONNECTOR:RF SUB-MINIATURE 50 OHM	28480	1250-0259
W32	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
W32	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
W32	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
W32	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
W32	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
W32	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
W32	8120-0229		CABLE:RF COAX RG	04217	421-105
W33	05061-6091	1	CABLE ASSY:POWER	28480	05061-6091
W33	0360-0057	1	TERMINATION:CRIMP LUG FOR #8 SCREW	00000	OBD
W33	1251-0037	1	CONNECTOR:AC POWER 3 MALE PLUG CONTACT	97534	UP-131-M
W33	1251-0193	1	INSULATOR:CONNECTOR	97534	UP-121
W33	1251-0352	1	BUSHING:CIRCULAR CONNECTOR(SIZE 14S)	91737	18220-6
W33	1251-2457	1	CONNECTOR:CIR. 3 FEMALE #16 CONTACT	02660	MS3106A-18-22SW
W33	1251-2479	1	CLAMP:CIR. CONNECTOR	02660	97-3057-10-6
W33	8120-0022	1	CABLE:18/3 300V RMS	70903	SJC-18/3
	0340-0039		INSULATOR:BUSHING	28480	0340-0039
	0340-0119		INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
	0362-0187	3	CAP:WIRE TERMINATION	06090	TC4008
	0370-0104	1	KNOB:BLK BAR W/ARROW 1/4" SHAFT	28480	0370-0104
	0403-0131	12	GUIDE:P.C. BOARD, GREY	28480	0403-0131
	0510-0182	1	FASTENER:LATCH	94222	27-10-301-30
	0590-0035	1	NUT:CLAMP	08145	1510 NUT
	1140-0014	1	DIAL:TURNS COUNTING 15 TURN	73138	MODEL 2606
	1410-0052	2	BUSHING:POTENTIOMETER	28480	1410-0052
	1480-0017	2	PIN:DOWEL 0.1252" DIA	00000	OBD
	1480-0059	1	PIN:SPRING 0.062" NOM. DIA	00000	OBD
	2950-0040	2	NUT:HEX 3/8"-32 X 1/2"	28480	2950-0040
	5000-0053	2	PLATE:FLUTED ALUMINUM	28480	5000-0053
	5000-0232	3	INSULATOR:PC BOARD CONNECTOR 22 PIN	28480	5000-0232
	5000-0747	2	COVER:SIDE	28480	5000-0747
	5020-0176		INSULATOR FOR SNAP-ON PINS	28480	5020-0176
	5060-0222	2	HANDLE ASSY:5H SIDE	28480	5060-0222
	5060-0736	2	FRAME ASSY	28480	5060-0736
	5060-0755	1	BOTTOM COVER ASSY	28480	5060-0755
	5060-0765	2	RETAINER HANDLE ASSY(OPTIONS)	28480	5060-0765
	5060-0767	5	FOOT ASSY:FM	28480	5060-0767
	5060-0777	1	KIT:RACK MOUNT	28480	5060-0777
	05060-0001	2	CLAMP TUBE SUPPORT, TOP	28480	05060-0001
	05060-0021	2	INSULATOR:BEAM TUBE STRAP	28480	05060-0021
	05060-0024	2	INSULATOR:BEAM TUBE BRACKET	28480	05060-0024
	05060-2002	2	ROD:TUBE SUPPORT	28480	05060-2002
XF2	1400-0084		FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
	05060-2014	2	SPACER:PANEL	28480	05060-2014
	05060-2064	2	BRACKET:CHASSIS	28480	05060-2064
	05060-2082	1	BRACKET:MT C FIELD	28480	05060-2082
	05060-2083	1	COVER:FIELD DIAL	28480	05060-2083
	05061-0008	1	BRACKET CAP	28480	05061-0008
	05061-0015	1	PANEL:FRONT	28480	05061-0015
	05061-0016	1	PANEL:REAR	28480	05061-0016
	05061-0017	1	CHASSIS:SMALL	28480	05061-0017
	05061-0018	1	CHASSIS:LARGE	28480	05061-0018
	05061-0019	1	PANEL:DOOR INSIDE	28480	05061-0019
	05061-0020	1	PANEL:LEFT	28480	05061-0020
	05061-0025	1	BRACKET:BUFFER AMPLIFIER	28480	05061-0025
	05061-0028	1	BRACKET:P.C. BOARD	28480	05061-0028
	05061-0029	1	PANEL:INSIDE	28480	05061-0029
	05061-0032	1	BRACKET:OSCILLATOR	28480	05061-0032
	05061-0035	1	BRACKET:P.C. BOARD	28480	05061-0035
	05061-0042	1	CAN ROUND-HALF, BEAM TUBE	28480	05061-0042
	05061-0043	1	CAN ROUND-HALF, BEAM TUBE	28480	05061-0043
	05061-0045	1	BRACKET	28480	05061-0045

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	05061-0046	1	BRACKET	28480	05061-0046
	05061-2020	1	DOOR:FRONT	28480	05061-2020
	05061-2032	1	BRACKET:MOUNT	28480	05061-2032
	05061-2037	2	BRACKET:TUBE	28480	05061-2037
	05061-2038	1	SPACER:OPERATIONAL AMPLIFIER	28480	05061-2038
	05061-2041	1	COVER:TOP	28480	05061-2041
	05061-2042	1	BAR:DOOR TO CLOCK	28480	05061-2042
	05061-2043	2	GUIDE:DOOR TO CLOCK	28480	05061-2043
	05061-2044	1	LOCK:DOOR TO CLOCK	28480	05061-2044
	05061-2045	1	PLATE:LEFT	28480	05061-2045
	05061-6060	1	CABLE ASSY:MAIN	28480	05061-6060
	05061-6066	1	CABLE ASSY:PANEL	28480	05061-6066
	05061-6067	1	CABLE ASSY:PANEL	28480	05061-6067

See introduction to this section for ordering information

Table 6-2. Option 002 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			TABLE 6-2, OPTION 002		
OPTION 002	05061-6075	1	STANDBY POWER SUPPLY(OPTION 002)	28480	05061-6075
OPT.002 MISC PARTS	05061-0014	1	BRACKET:CAPACITOR	28480	05061-0014
	05061-0021	1	PANEL:LEFT	28480	05061-0021
	05061-0026	1	BRACKET:BATTERY	28480	05061-0026
	05061-0027	1	GASKET:BATTERY	28480	05061-0027
BT1	1420-0053	1	BATTERY:24 V 2.3A	88220	TYPE HP 607W
C4	0180-0047	1	C:FXD ELECT 500 UF 75VDCW	56289	032443 DFP
DS3	2140-0025	1	LAMP:INCANDESCENT 28.0V 0.04 AMPS	08806	327
DS3	1450-0114	1	LAMPHOLDER:AMBER LENS	07137	ROL-83-F3-000
Q1	1854-0067	1	TSTR:SI NPN	80131	2N1701
Q1	0340-0487	1	INSULATOR:TSTR FOR TO-8 CASE	76530	293233
Q1	1200-0087	1	CLAMP:TRANSISTOR	02735	DF-13-A
Q1	1200-0092	1	BUSHING:TRANSISTOR	02735	495334 I
S8	3101-0124	1	SWITCH:PUSHBUTTON SPST	28480	3101-0124
A2	05061-6019	1	BOARD ASSY:BATTERY CHARGER	28480	05061-6019
A2C1	0150-0093	2	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C2	0160-0127	4	C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A2C3	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A2C4	0180-0106	3	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A2C5	0180-0113	2	C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A2C6	0150-0121	1	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A2C7	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A2C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C9	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A2C10	0140-0234	5	C:FXD MICA 500 PF 1%	28480	0140-0234
A2C11	0180-0116	1	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X903582-DYS
A2C12	0180-0117	1	C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A2C13	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A2C14	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A2C15	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A2C16	0160-3875	1	C:FXD 22 PF 200VDC		
A2CR1	1901-0029	8	DIODE:SILICON 600 PIV	28480	1901-0029
A2CR2	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A2CR3	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A2CR4	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A2CR5	1902-0041	4	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A2CR6	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A2CR7	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A2CR8	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A2CR9	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A2CR10	1902-3214	1	DIODE BREAKDOWN:16.2V 2%	28480	1902-3214
A2CR11	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A2CR12	1902-3290	1	DIODE BREAKDOWN:SILICON 31.6V 5%	28480	1902-3290
A2CR13	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A2CR14	1910-0016	12	DIODE:GE 60 WIV	28480	1910-0016
A2CR15	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR16	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR17	1902-0523	1	DIODE:ZENER 16.9V 2MA	28480	1902-0523
A2CR18	1901-0040	5	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR19	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A2CR20	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR21	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR22	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR23	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR24	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR25	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR26	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR27	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR28	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR29	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR30	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR31	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR32	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2IC1	1820-0315	1	INTEGRATED CIRCUIT	28480	1820-0315
A2IC2	1820-0329	3	IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A2IC3	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A2IC4	1820-0080	2	IC:RTL GATE QUAD 2-INPT	28480	1820-0080
A2IC5	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A2IC6	1820-0080		IC:RTL GATE QUAD 2-INPT	28480	1820-0080
A2IC7	1820-0086	1	IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A2IC8	1820-0094	4	IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A2IC9	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A2IC10	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A2IC11	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A2K1	0490-0475	1	RELAY:DPDT 28V 2A	99928	LSA-2C-248
A2Q1	1854-0005	13	TSTR:SI NPN	80131	2N708

See introduction to this section for ordering information

Table 6-2. Option 002 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2Q2	1855-0010	3	TSTR:SI	80131	2N2646
A2Q3	1854-0005		TSTR:SI NPN	80131	2N708
A2Q4	1854-0005		TSTR:SI NPN	80131	2N708
A2Q5	1854-0005		TSTR:SI NPN	80131	2N708
A2Q6	1854-0005		TSTR:SI NPN	80131	2N708
A2Q7	1854-0039	4	TSTR:SI NPN	80131	2N3053
A2Q8	1853-0001	1	TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A2Q9	1854-0005		TSTR:SI NPN	80131	2N708
A2Q10	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q11	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q12	1854-0005		TSTR:SI NPN	80131	2N708
A2Q13	1855-0027	1	TSTR:SI	80131	2N2647
A2Q14	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q15	1854-0005		TSTR:SI NPN	80131	2N708
A2Q16	1854-0005		TSTR:SI NPN	80131	2N708
A2Q17	1854-0005		TSTR:SI NPN	80131	2N708
A2Q18	1854-0005		TSTR:SI NPN	80131	2N708
A2Q19	1854-0003	4	TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A2Q20	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A2Q21	1855-0010		TSTR:SI	80131	2N2646
A2Q22	1854-0005		TSTR:SI NPN	80131	2N708
A2Q23	1855-0010		TSTR:SI	80131	2N2646
A2Q24	1854-0005		TSTR:SI NPN	80131	2N708
A2Q25	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A2Q26	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A2R1	0757-0924	12	R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R2	0764-0013	2	R:FXD MET OX 56 OHM 5% 2W	28480	0764-0013
A2R3	0757-0938	8	R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R4	0757-0928	1	R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A2R5	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R6	0757-0907	3	R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A2R7	0757-0952	5	R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A2R8	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R9	0757-0486	3	R:FXD MET FLM 750K OHM 1% 1/8W	28480	0757-0486
A2R10	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R11	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R12	0757-0962	1	R:FXD FLM 39K OHM 2% 1/8W	28480	0757-0962
A2R13	0757-0955	1	R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A2R14	0757-0931	10	R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R15	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R16	2100-1769	1	R:VAR WW 50 OHM 5% TYPE H 1W	28480	2100-1769
A2R17	0758-0063	1	R:FXD MET OX 1600 OHM 5% 1/2W	28480	0758-0063
A2R18	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R19	0757-0933		R: FXD FLM 2.4K OHM 2% 1/8W	28480	0757-0933
A2R20	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R21	0757-0900	2	R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A2R22	0757-0896	1	R:FXD MET FLM 68 OHM 2% 1/8W	28480	0757-0896
A2R23	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R24	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R25	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A2R26	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R27	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R28	0757-0346	1	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A2R29	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R30	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R31	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R32	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R33	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R34	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R35	0757-0948	5	R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A2R36	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R37	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A2R38	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R39	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R40	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A2R41	0757-0933		R: FXD FLM 2.4K OHM 2% 1/8W	28480	0757-0933
A2R42	0757-0909	1	R:FXD FLM 240 OHM 2% 1/8W	28480	0757-0909
A2R43	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A2R44	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R45	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A2R46	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R47	0757-0486		R:FXD MET FLM 750K OHM 1% 1/8W	28480	0757-0486
A2R48	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A2R49	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A2R50	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931

See introduction to this section for ordering information

Table 6-2. Option 002 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R51	0757-0486		R:FXD MET FLM 750K OHM 1% 1/8W	28480	0757-0486
A2R52	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A2R53	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A2R54	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A2R55	0757-0933		R: FXD FLM 2.4K OHM 2% 1/8W	28480	0757-0933
A2R56	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A2R57	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A2R58	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A2R59	0757-0917	1	R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A2R60	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A2R61	0757-0933	1	R:FXD FLM 2.4K OHM 2% 1/8W	28480	0757-0933
A2R62	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A2R63	0757-0942	1	R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A2R64	0764-0013		R:FXD MET OX 56 OHM 5% 2W	28480	0764-0013
A2SCR1	1884-0070	2	SWITCH:SC SI PNPN	03508	3N81
A2SCR2	1884-0070		SWITCH:SC SI PNPN	03508	3N81
A17F1	2110-0274	1	FUSE:3A	75915	276003

See introduction to this section for ordering information

Table 6-3. Option 001 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			TABLE 6-3, OPTION 001		
A1 OPTION 001	05061-6074	1	DIGITAL DIVIDER ASSY	28480	05061-6074
	1250-0102	1	CONNECTOR:BNC	28480	1250-0102
	1390-0036	1	FASTENER:STUD RECEIVER	78553	C-1663-017-24
	1390-0144	1	FASTENER:PANEL,BALL STUD	78553	P101-525
	05061-0022	1	PANEL:CENTER	28480	05061-0022
	05061-0024	1	PANEL:LEFT	28480	05061-0024
	05061-2023	1	PLATE:LEFT	28480	05061-2023
A1 OPT.001 MISC PARTS	05061-6011	2	MODULATOR ASSY:DIGITAL DIVIDER	28480	05061-6011
	05061-6034	1	COVER:ASSY TOP	28480	05061-6034
	05061-6061	1	CABLE ASSY:FREQUENCY DIVIDER	28480	05061-6061
	05061-6062	1	CABLE ASSY:DIGITAL DIVIDER	28480	05061-6062
	05061-6068	1	CABLE ASSY:DIGITAL DIVIDER	28480	05061-6068
	05061-6069	1	CABLE ASSY:DIGITAL DIVIDER	28480	05061-6069
	05061-6071	1	CABLE ASSY:CLOCK	28480	05061-6071
	05061-6085	1	CLOCK ASSY:OPT 01-03	28480	05061-6085
	05061-6011		MODULE ASSY:DIGITAL DIVIDER	28480	05061-6011
	0400-0084	1	BUSHING:SNAP 0.250" ID	28520	SB-437-4
	05061-0011	1	CHASSIS:DIGITAL D	28480	05061-0011
	05061-0012	1	COVER:DIGITAL DIVIDER	28480	05061-0012
A5 MISC PARTS	05061-0013	1	BRACKET:DIGITAL DIVIDER	28480	05061-0013
	05061-0037	1	BRACKET:GUARD	28480	05061-0037
	05061-2026	1	PLATE:END	28480	05061-2026
	05061-2027	1	PLATE:END	28480	05061-2027
A5S1	3101-0052	2	SWITCH:PUSHBUTTON SPST	82389	961 LESS HWD
A5S2	3101-1159	1	SWITCH:PUSHBUTTON SPDT	82389	105-1051
A5S3	3101-0052		SWITCH:PUSHBUTTON SPST	82389	961 LESS HWD
A5A1	05061-6015	1	BOARD ASSY:POWER SUPPLY	28480	05061-6015
A5A1C1	0180-0097	2	C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A5A1C2	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A5A1C3	0160-0162	1	C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5A1C4	0150-0096	2	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A5A1C5	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A5A1C6	0180-0098	3	C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A5A1C7	0180-0098		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A5A1C8	0180-0117	4	C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A5A1C9	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A5A1C10	0150-0093	4	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A1C11	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A5A1C12	0140-0203	1	C:FXD MICA 30 PF 5%	28480	0140-0203
A5A1C13	0160-0127	2	C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A5A1C14	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A5A1C15	0160-0174	1	C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C1187S-CML
A5A1C16	0180-0116	1	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A5A1C17	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A1C18	0180-0098		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A5A1C19	0180-0532	1	C:FXD CER 6.8 UF 20% 25VDCW		DGR8GS2B35M
A5A1CR1	1901-0040	16	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A1CR2	1901-0410	2	DIODE:SILICON 100 PIV 3 AMP 1N4720	02735	1N4720
A5A1CR3	1901-0410		DIODE:SILICON 100 PIV 3 AMP 1N4720	02735	1N4720
A5A1CR4	1901-0028	4	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A5A1CR5	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A5A1CR6	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A5A1CR7	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A5A1CR8	1902-3193	1	DIODE BREAKDOWN:13.3V 5%	28480	1902-3193
A5A1CR9	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A1CR10	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A1CR11	1902-0554	4	DIODE BREAKDOWN:10V 1W	28480	1902-0554
A5A1CR12	1902-0554		DIODE BREAKDOWN:10V 1W	28480	1902-0554
A5A1CR13	1902-0554		DIODE BREAKDOWN:10V 1W	28480	1902-0554
A5A1CR14	1902-0554		DIODE BREAKDOWN:10V 1W	28480	1902-0554
A5A1CR15	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A1IC1	1820-0313	1	IC:DTL RS/JK CLOCKED F/F	28480	1820-0313
A5A1J1	1250-0257	4	CONNECTOR:RF 50 OHM PC MOUNT	28480	1250-0257
A5A1J2	1250-0257		CONNECTOR:RF 50 OHM PC MOUNT	28480	1250-0257
A5A1J3	1250-0257		CONNECTOR:RF 50 OHM PC MOUNT	28480	1250-0257
A5A1J4	1250-0257	—	CONNECTOR:RF 50 OHM PC MOUNT	28480	1250-0257
A6A1L1, L2	9100-1630	2	COIL:FXD RF 51 UH	28480	9100-1630
A5A1Q1	1854-0613	3	TSTR:SI NPN	28480	1854-0613
A5A1Q2	1854-0613		TSTR:SI NPN	28480	1854-0613
A5A1Q3	1853-0001	1	TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A5A1Q4	1854-0003	3	TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A5A1Q5	1854-0020		TSTR:SI NPN	28480	1854-0020
A5A1Q6	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A5A1Q7	1854-0005	6	TSTR:SI NPN	80131	2N708

See introduction to this section for ordering information

Table 6-3. Option 001 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A1Q8	1854-0035	1	TSTR:SI NPN	28480	1854-0035
A5A1Q9	1854-0039	2	TSTR:SI NPN	80131	2N3053
A5A1Q10	1854-0039		TSTR:SI NPN	80131	2N3053
A5A1Q11	1854-0005		TSTR:SI NPN	80131	2N708
A5A1Q12	1854-0005		TSTR:SI NPN	80131	2N708
A5A1R1	0757-0942	1	R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A5A1R2	0757-0900	11	R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A1R3	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A1R4	0757-0894	1	R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A5A1R5	0757-0929	1	R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A5A1R6	0757-0914	2	R:FXD FLM 390 OHM 2% 1/8W	28480	0757-0914
A5A1R7	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A1R8	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A1R9	0757-0346	2	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A5A1R10	0757-0948	11	R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A1R11	0757-0914		R:FXD FLM 390 OHM 2% 1/8W	28480	0757-0914
A5A1R12	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A1R13	2100-1773	1	R:VAR WW 1K OHM 5% TYPE H 1W	28480	2100-1773
A5A1R14	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A5A1R15	0757-0907	3	R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A5A1R16	0757-0920	5	R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A5A1R17	0757-0920		R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A5A1R18	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A1R19	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A5A1R20	0757-0907		R:FXD FLM 200 OHM 2% 1/8W	28480	0757-0907
A5A1R21	0757-0931	48	R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A1R22	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A1R23	0757-0924	26	R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A1R24	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A1R25	0757-0920		R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A5A1R26	0757-0920		R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A5A1T1	9100-2448	1	TRANSFORMER	28480	9100-2448
A5A1T2	05061-8010	1	TRANSFORMER	28480	05061-8010
A5A2	05061-6014	1	BOARD ASSY:MASTER CLOCK	28480	05061-6014
A5A2C1	0150-0121	2	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A5A2C2	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A2C3	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A5A2C4	0140-0180	1	C:FXD MICA 2000 PF 2%	28480	0140-0180
A5A2C5	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A5A2C6	0140-0234	2	C:FXD MICA 500 PF 1%	28480	0140-0234
A5A2C7	0160-0196	1	C:FXD MICA 24PF 5% 300VDCW	04062	RDM15C240J3S
A5A2C8	0140-0234		C:FXD MICA 500 PF 1%	28480	0140-0234
A5A2C9	0121-0105	10	C:VAR CER 9-35 PF NPO	28480	0121-0105
A5A2C10	0160-0342	1	C:FXD MICA 800 PF 5%		
A5A2C11	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A2C12	0140-0202	2	C:FXD MICA 15 PF 5% 500VDCW	28480	0140-0202
A5A2C13	0140-0202		C:FXD MICA 15 PF 5% 500VDCW	28480	0140-0202
A5A2CR1	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR3	1902-0064	1	DIODE BREAKDOWN:7.5V	28480	1902-0064
A5A2CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR5	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR6	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR7	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR8	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR9	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR10	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2CR11	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A2IC1	1820-0580	6	IC:DIGITAL	28480	1820-0580
A5A2IC2	1820-0580		IC:DIGITAL	28480	1820-0580
A5A2IC3	1820-0580		IC:DIGITAL	28480	1820-0580
A5A2IC4	1820-0094	4	IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A5A2IC5	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A5A2IC6	1820-0329	12	IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A2IC7	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A2IC8	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A2IC9	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A2IC10	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A2IC11	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A2IC12	1820-0086	4	IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A5A2IC13	1820-0086		IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A5A2IC14	1820-0086		IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A5A2L1	9100-1630		COIL:FXD RF 51 UH	28480	9100-1630
A5A2L2	9140-0137	1	COIL:FXD RF 1000 UH 5%	28480	9140-0137
A5A2L3	9100-1630		COIL:FXD RF 51 UH	28480	9100-1630

See introduction to this section for ordering information

Table 6-3. Option 001 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A2Q1	1854-0005		TSTR:SI NPN	80131	2N708
A5A2Q2	1854-0005		TSTR:SI NPN	80131	2N708
A5A2Q3	1854-0009	19	TSTR:SI NPN	80131	2N709
A5A2Q4	1854-0009		TSTR:SI NPN	80131	2N709
A5A2Q5	1854-0009		TSTR:SI NPN	80131	2N709
A5A2Q6	1854-0009		TSTR:SI NPN	80131	2N709
A5A2Q7	1854-0009		TSTR:SI NPN	80131	2N709
A5A2R1	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R2	0757-0946	1	R:FXD FLM 8.2K OHM 2% 1/8W	28480	0757-0946
A5A2R3	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A2R4	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R5	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A2R6	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A2R7	0757-0920		R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A5A2R8	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A2R9	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R10	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A2R11	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R12	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R13	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R14	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A2R15	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A2R16	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A2R17	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R18	0757-0917	4	R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A5A2R19	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R20	0757-0972	1	R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A5A2R21	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R22	0757-0938	2	R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A5A2R23	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R24	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A5A2R25	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A2R26	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R27	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A2R28	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A2R29	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R30	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R31	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R32	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R33	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R34	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R35	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R36	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R37	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R38	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R39	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R40	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R41	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R42	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R43	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R44	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R45	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2R46	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A2T1	05061-8005	1	TRANSFORMER:1MHZ-4MHZ	28480	05061-8005
A5A2T2	05061-8009	1	TRANSFORMER:SYNC	28480	05061-8009
A5A2XY1	1200-0159	1	CRYSTAL HOLDER	28480	1200-0159
A5A2Y1	0410-0012	1	CRYSTAL: 1MC +/-0.001%	00136	OBD
A5A3	05061-6013	1	BOARD ASSY:PRESET CLOCK	28480	05061-6013
A5A3	05061-2024	6	CONNECTOR:6 PIN	28480	05061-2024
A5A3C1	0140-0198	2	C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A5A3C2	0140-0191	1	C:FXD MICA 56 PF 5% 300VDCW	19701	RDM15E560J 300V
A5A3C3	0140-0198		C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A5A3CR1	1910-0016	24	DIODE:GE 60 WIV	28480	1910-0016
A5A3CR2	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR3	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR4	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR5	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR6	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR7	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR8	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR9	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR10	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR11	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR12	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR13	1910-0016		DIODE:GE 60 WIV	28480	1910-0016

See introduction to this section for ordering information

Table 6-3. Option 001 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A3CR14	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR15	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR16	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR17	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A3CR18	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5A3CR19	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR20	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR21	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR22	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR23	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR24	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR25	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3CR26	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A5A3IC1	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A5A3IC2	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A5A3IC3	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A3IC4	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A3IC5	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A3IC6	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A3IC7	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A3IC8	1820-0329		IC:TTL DECADE COUNTER 5 MHZ MIN.	28480	1820-0329
A5A3IC9	1820-0080	4	IC:RTL GATE QUAD 2-INPT	28480	1820-0080
A5A3IC10	1820-0080		IC:RTL GATE QUAD 2-INPT	28480	1820-0080
A5A3IC11	1820-0080		IC:RTL GATE QUAD 2-INPT	28480	1820-0080
A5A3IC12	1820-0086		IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A5A3IC13	1820-0580		IC:DIGITAL	28480	1820-0580
A5A3IC15	1820-0580		IC:DIGITAL	28480	1820-0580
A5A3IC16	1820-0580		IC:DIGITAL	28480	1820-0580
A5A3IC17	1820-0080		IC:RTL GATE QUAD 2-INPT	28480	1820-0080
A5A3Q1	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q2	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q3	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q4	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q5	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q6	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q7	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q8	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q9	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q10	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q11	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q12	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q13	1854-0009		TSTR:SI NPN	80131	2N709
A5A3Q14	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A5A3Q15	1854-0009		TSTR:SI NPN	80131	2N709
A5A3R1	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R2	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R3	0757-0928	12	R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R4	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R5	0757-0935	5	R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A5A3R6	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R7	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R8	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R9	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R10	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R11	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A5A3R12	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R13	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R14	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R15	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R16	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R17	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A5A3R18	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R19	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R20	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R21	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R22	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R23	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A5A3R24	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R25	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R26	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R27	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R28	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R29	0757-0935		R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935
A5A3R30	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R31	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931

See introduction to this section for ordering information

Table 6-3. Option 001 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A3R32	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R33	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R34	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A5A3R35	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R36	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R37	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R38	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R39	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R40	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R41	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R42	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A5A3R43	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A3R44	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R45	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R46	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A3R47	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R48	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R49	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R50	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A5A3R51	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R52	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R53	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R54	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A5A3R55	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R56	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R57	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A3R58	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R59	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A5A3R60	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A3R61	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3R62	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A3S1	3100-2061	1	SWITCH:THUMBWHEEL	28480	3100-2061
A5A4	05061-6033	1	BOARD ASSY:SWITCH	28480	05061-6033
A5A4C1	0140-0176	1	C:FXD MICA 100 PF 2%	28480	0140-0176
A5A4C2	0121-0425	1	C:VAR MICA 70 TO 350 PF 175VDCW	14655	T51810-7
A5A4IC1	1820-0315	1	INTEGRATED CIRCUIT	28480	1820-0315
A5A4Q1	1854-0005		TSTR:SI NPN	80131	2N708
A5A4R1	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A5A4R2	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A5A4R3	0757-0931		R:FXD FLM 2K OHM 2% 1/8W	28480	0757-0931
A5A5	05061-6012	1	BOARD ASSY:INTERCONNECTION	28480	05061-6012
A5A5XA1	05061-2025	4	CONNECTOR:12 PIN	28480	05061-2025
A5A5XA2	05061-2025		CONNECTOR:12 PIN	28480	05061-2025
A5A5XA3	05061-2025		CONNECTOR:12 PIN	28480	05061-2025
A5A5XA4	05061-2025		CONNECTOR:12 PIN	28480	05061-2025

See introduction to this section for ordering information

Table 6-4. Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
00000	U.S.A. COMMON	ANY SUPPLIER OF U.S.A.	
00136	MC COY ELECTRONICS CO.	MT. HOLLY SPRINGS, PA.	17065
00853	SANGAMO ELECTRIC CO.PICKENS DIV.	PICKENS, S.C.	29671
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
01255	LITTON INDUSTRIES INC. (USECO)	BEVERLY HILLS, CALIF.	90210
01281	TRW SEMICONDUCTOR INC.	LAWNDALE, CALIF.	90260
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
02114	FERROXCUBE CORP.	SAUGERTIES, N.Y.	12477
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
02735	RCA SOLID STATE & RECEIVING TUBE DIV.	SOMERVILLE, N.J.	08876
02875	HUDSON TOOL & DIE CO.	NEWARK, N.J.	07105
03508	G.E. CO. SEMICONDUCTOR PROD. DEPT.	SYRACUSE, N.Y.	13201
04009	ARROW, HART & HEGEMAN ELECT. CO.	HARTFORD, CONN.	06106
04062	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
04217	ESSEX WIRE CORP. & CABLE DIV.	ANAHEIM, CALIF.	92801
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
06090	RAYCHEM CORP.	MENLO PARK, CALIF.	94025
07137	TRANSISTOR ELECTRONICS CORP.	MINNEAPOLIS, MINN.	55424
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
08145	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
08718	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
08806	G.E. CO. MINIATURE LAMP DEPT.	CLEVELAND, OHIO	44112
11711	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
12040	NATIONAL SEMICONDUCTOR CORP.	DANBURY, CONN.	06810
12574	GULTON IND. INC. DATA SYSTEM DIV.	ALBUQUERQUE, N.M.	87108
13103	THERMALLOY CO.	DALLAS, TEX.	75247
14655	CORNELL DUBLIER ELECT. DIV.FEDERAL PACIFIC ELECT. CO.	NEWARK, N.J.	07105
14752	ELECTRO-CUBE INC.	SAN GABRIEL, CALIF.	91776
15558	MICON ELECTRONICS INC.	GARDEN CITY LONG IS., N.Y.	11530
19701	ELECTRA/MIDLAND CORP.	MINERAL WELLS, TEX.	76067
28480	HEWLETT-PACKARD CO. CORPORATE HQ	YOUR NEAREST HP OFFICE	
28520	HEYMAN MFG. CO.	KENILWORTH N.J.	07033
36196	STANWYCK COIL PROD. LTD.	HAWKSBURY ONTARIO, CANADA	
42190	MUTER CO. THE	CHICAGO, ILL.	60638
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
70903	BELDEN CORP.	CHICAGO, ILL.	60644
71400	BUSSMANN MFG. DIV. MC GRAW-EDISON CO.	ST. LOUIS, MO.	63017
71436	CHICAGO CONDENSER CORP.	CHICAGO, ILL.	60647
71468	ITT CANNON ELECT. INC.	LOS ANGELES, CALIF.	90031
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
73138	BECKMAN INST. INC. HELIPOT DIV.	FULLERTON, CALIF.	92634
75042	INTERNATIONAL RESISTANCE CO. INC.	PHILADELPHIA, PA.	19108
75915	LITTELFUSE INC.	DES PLAINES, ILL.	60016
76493	MILLER J.W. CO.	COMPTON, CALIF.	90024
76530	CINCH MONADNOCK MILLS DIV. TRW INC.	CITY OF INDUSTRY, CALIF.	91746
78553	TINNERMAN PROD. INC.	CLEVELAND, OHIO	44129
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
81312	WINCHESTER ELECTRONICS DIV. LITTON IND. INC.	OAKVILLE, CONN.	06779
82047	SPERTI FARADAY INC. COOPER HEWITT ELECT. CO. DIV.	HOBOKEN, N.J.	07030
82142	AIRCO SPEER ELECT. COMP.	DU BOIS, PA.	15801
82389	SWITCHCRAFT INC.	CHICAGO, ILL.	60630
83298	BENDIX CORP. ELECTRIC POWER DIV.	EATONTOWN, N.J.	07724
84411	TRW CAPACITOR DIV.	OGALLALA, NEBR.	69153
88220	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
91418	RADIO MATERIALS CO.	CHICAGO, ILL.	60646
91468	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
91506	AUGAT INC.	ATTLEBORO, MASS.	02703
91737	ITT GREMAR INC.	WOBURN, MASS.	01801
94222	SOUTHCO INC.	LESTER, PA.	19113
95275	VITRAMON INC.	BRIDGEPORT, CONN.	06601
97534	A.P.M. HEXSEAL CORP.	ENGLEWOOD N.J.	07631
98291	SEALECTRO CORP.	MAMARONECK, N.Y.	10544
98978	INTERNATIONAL ELECT. RESEARCH CORP.	BURBANK, CALIF.	91502
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052
99928	BRANSON CORP.	DENNVILLE, N.J.	07834

SECTION VII

NOT USED

For backdating information go to Appendix I at the back of this manual.

SECTION VIII

CIRCUIT DIAGRAMS

8-1. GENERAL

8-2. This section contains the block, wiring, schematic, waveforms, and component location diagrams for the Model 5061A including Time Standard Option 001 and Standby Power Supply Option 002.

8-3. REFERENCE DESIGNATORS

8-4. The reference designation system used for identifying assemblies and components is illustrated in Figure 8-1. The Reference Designation Index on each figure (except block and wiring diagrams) lists the components shown in the schematic diagram portion of that figure. Complete parts descriptions are given in Section VI of this manual.

Figure 8-1. Schematic Diagram Notes

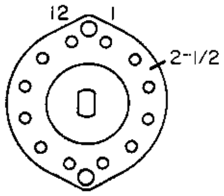
SYMBOLS

- FRONT PANEL
- REAR PANEL
- KNOB CONTROL
- SCREWDRIVER ADJUST
- MAIN SIGNAL PATH
- FEEDBACK PATH
- CONDUCTING ELEMENT
- CW — WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE
- POWER LINE GROUND
- CIRCUIT COMMON GROUND
- 8 — TEST POINT
- "AND" GATE
- "OR" GATE

WAVEFORMS SHOWN ARE TYPICAL

SWITCH DESIGNATIONS

A3S1BR(2-1/2)



A3S1	SWITCH S1 WITHIN ASSEMBLY A3
B	2ND WAFER FROM FRONT (A=1ST, ETC)
R	REAR OF WAFER (F=FRONT)
(2-1/2)	TERMINAL LOCATION ($2\frac{1}{2}$) (VIEWED FROM FRONT)

REFERENCE DESIGNATIONS

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

ASSEMBLY	ABBREVIATION	COMPLETE DESCRIPTION
A25	C1	A25C1
A25A1	CR1	A25A1CR1
NO PREFIX	J3	J3

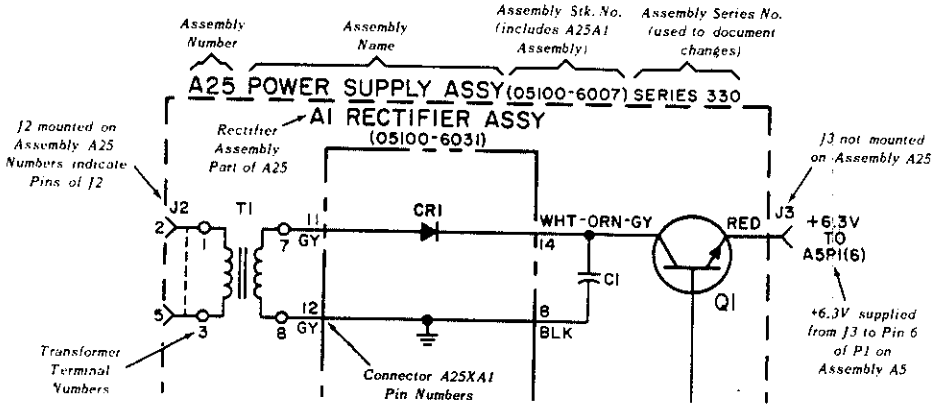
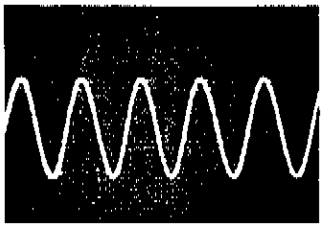
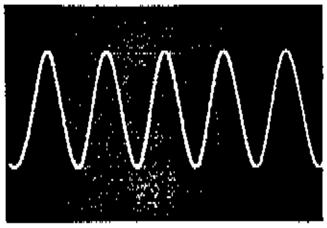


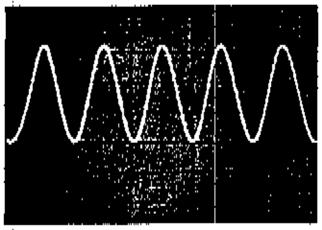
Fig. 8-2 Sht 1 of 5



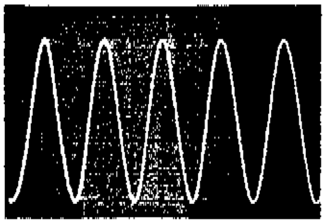
❶ 1V/cm, .1 μs/cm
50Ω Term. at scope



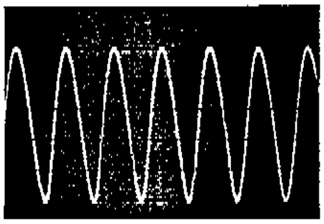
❷ .05V/cm, .1 μs/cm



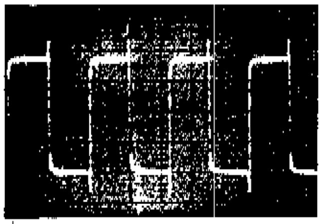
❸ 1V/cm, .1 μs/cm
50Ω Term. at scope



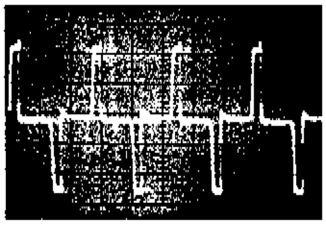
❹ .5V/cm, .1 μs/cm



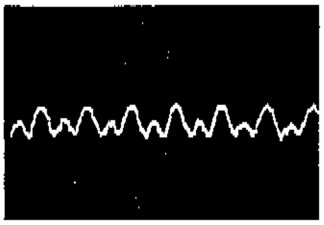
❺ .2V/cm, .05 μs/cm
Synth. time scale 0366



❻ .5V/cm, .2 ms/cm
at J17 (3-4)

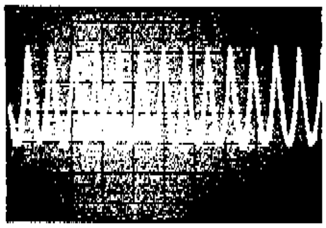


❼ 2V/cm, .2 ms/cm
at J16 (6-7)

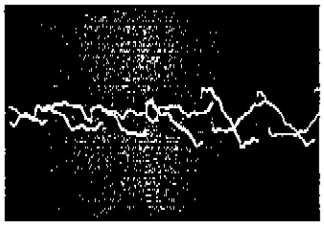


❽ 20 mV/cm, 5 ms/cm OSC FREQ X10^{-10} set to 300.
MODE to LOOP OPEN

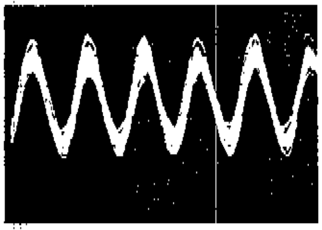
❾ 5V/cm, 5 ms/cm
MODE to LOOP OPEN
OSC FREQ X10^{-10} at 300



❿ 1V/cm, 5 ms/cm
MODE to LOOP OPEN
OSC FREQ X10^{-10} at 300

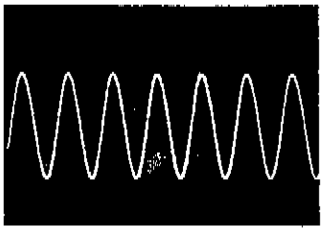


⓫ .2V/cm, 5 ms/cm

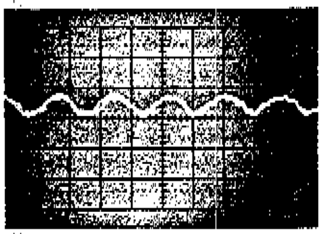


⓬ .02V/cm, 2 ms/cm

⓭ 5V/cm, 2 ms/cm



⓮ .05V/cm, 5 ms/cm

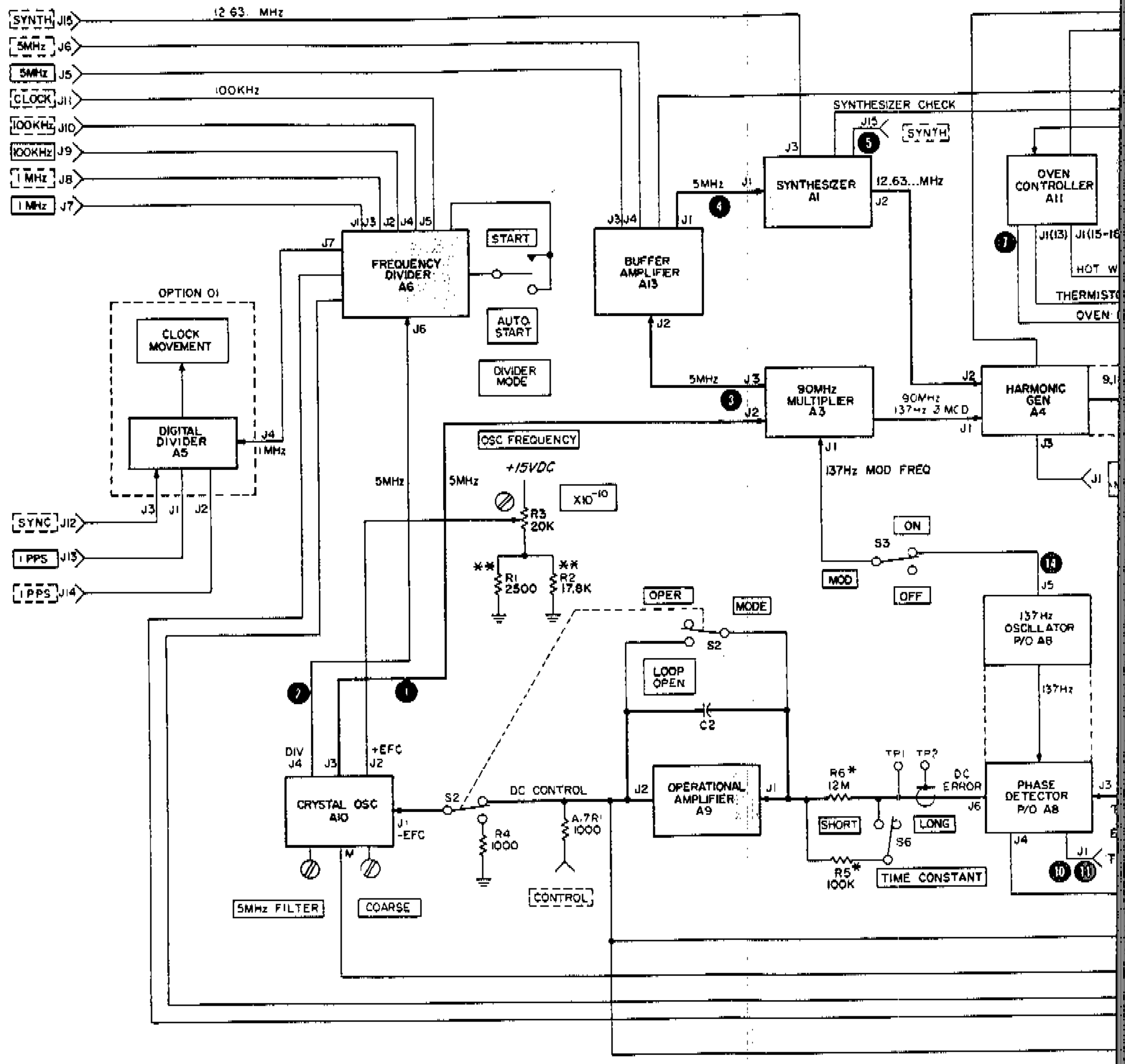


⓯ .05V/cm, 2 ms/cm
MODE to LOOP OPEN
OSC on cesium peak

5061A: Normal operation unless noted.

Oscilloscope: DC coupled.

Fig. 8-2
Sht. 2 of 5

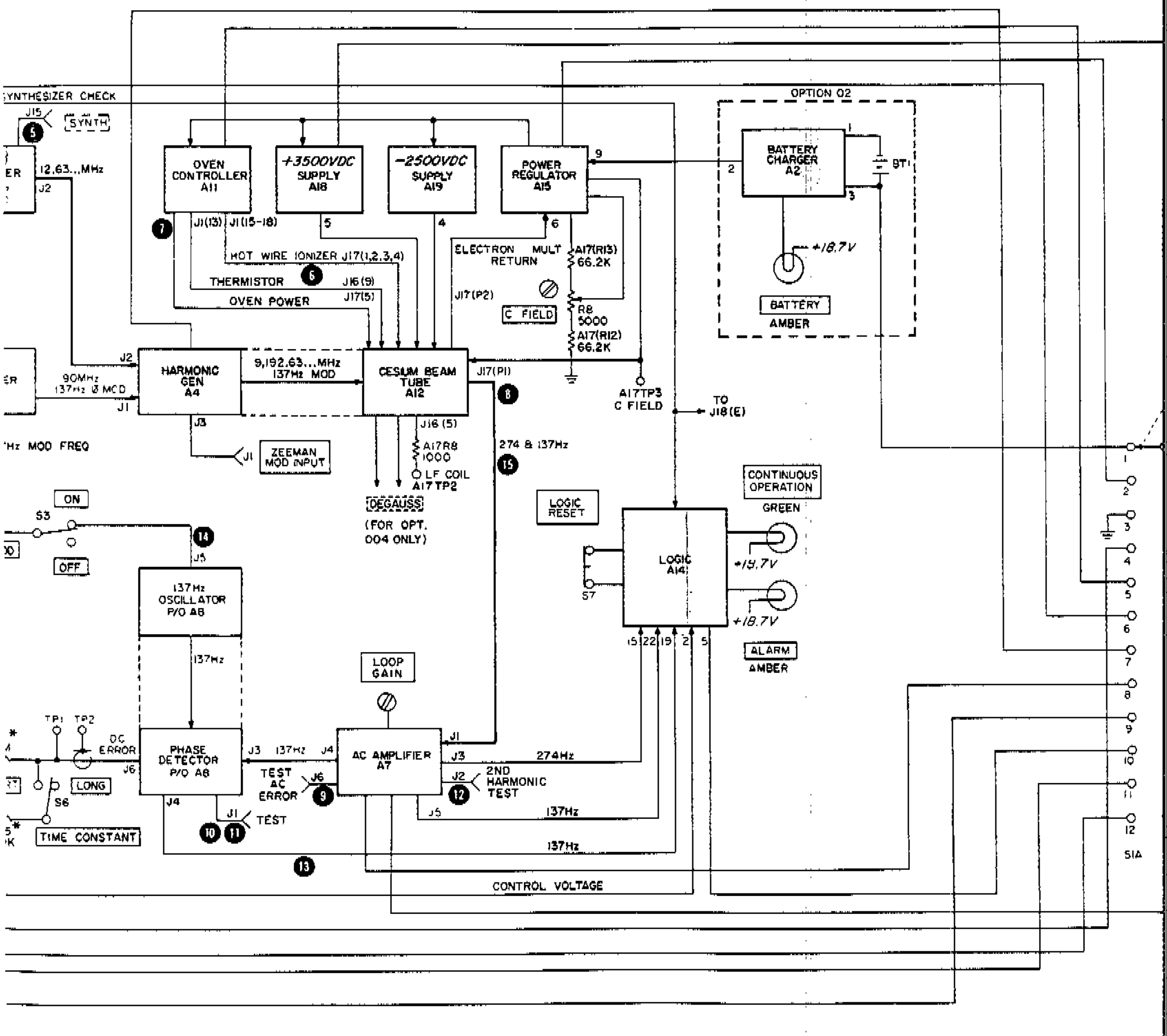


NOTE

* R6 OPTION 004
2.4M <2 X 10^-12
2.0M 2 TO 3 X 10^-12
1.0M 3 TO 4 X 10^-12
400K 4 TO 5 X 10^-12
** FACTORY SELECT

C3: DELETED

Fig. 8-2
Sht 3 of 5



C3: DELETED

Fig. 8-2
Sht. 4 of 5

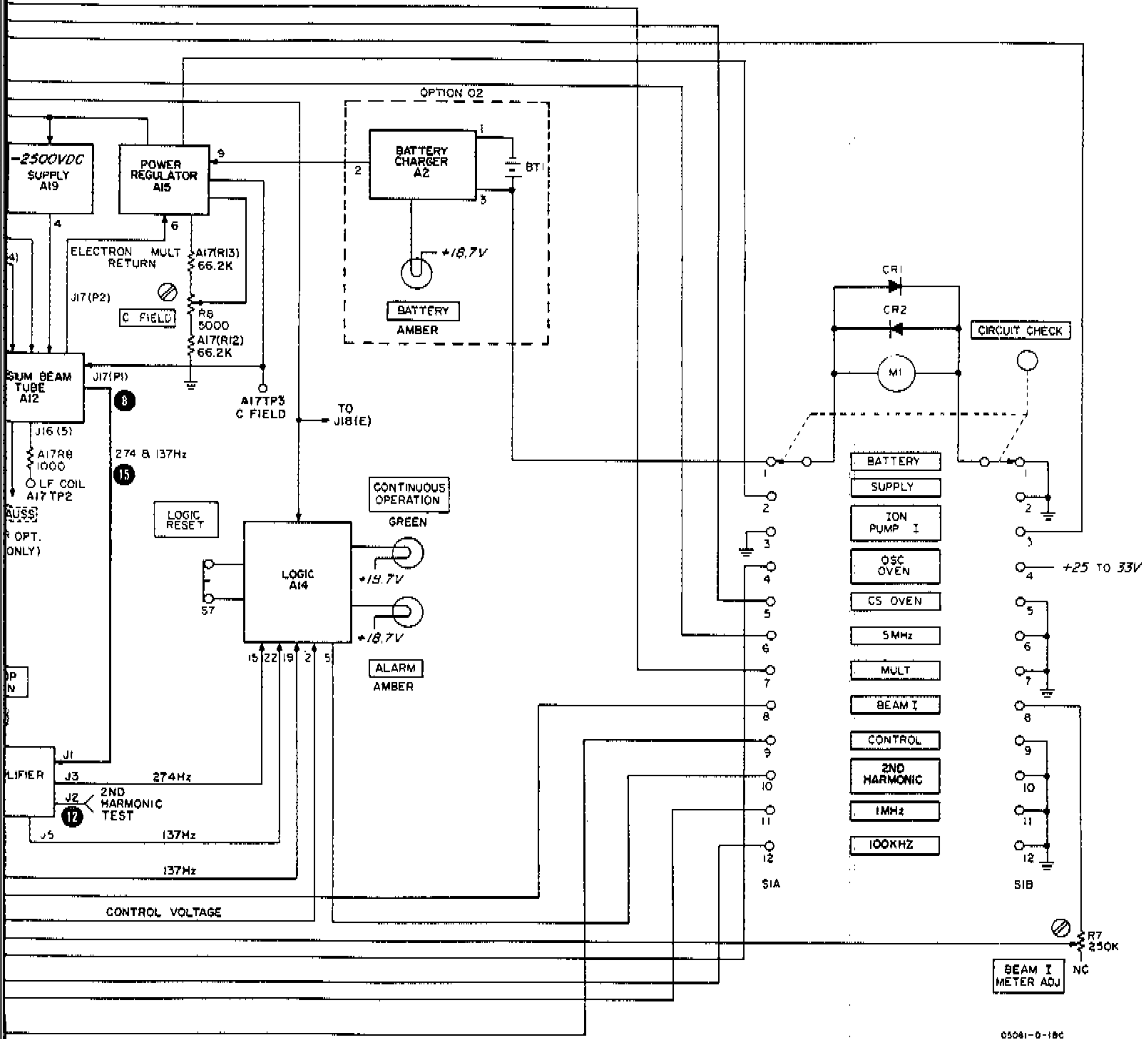


Figure 8-2. Block Diagram

Figure 8-3. Top Internal and Front Panel

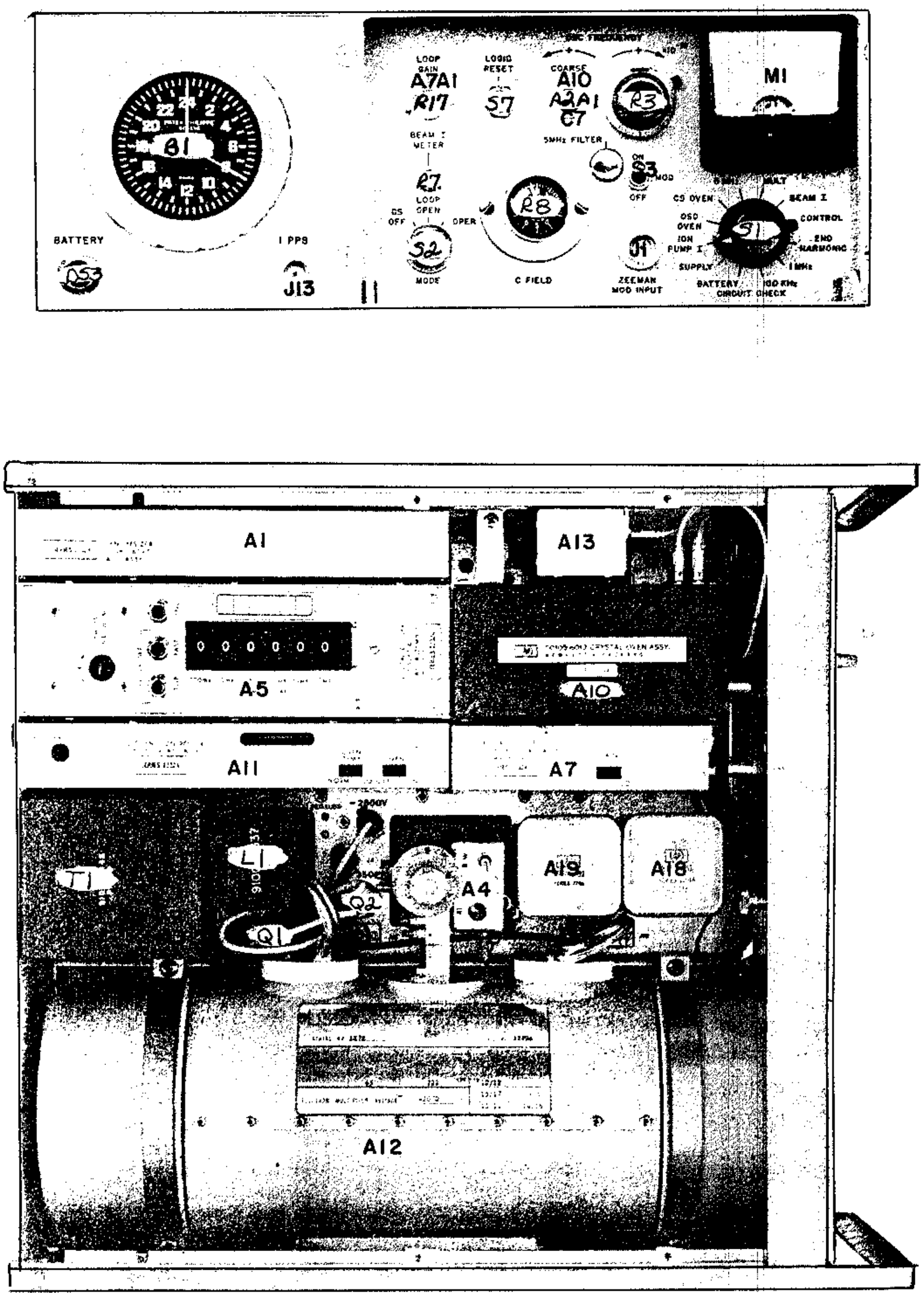


Fig. 8-5
Sht 1 OF 4

Figure 8-4. Bottom Internal

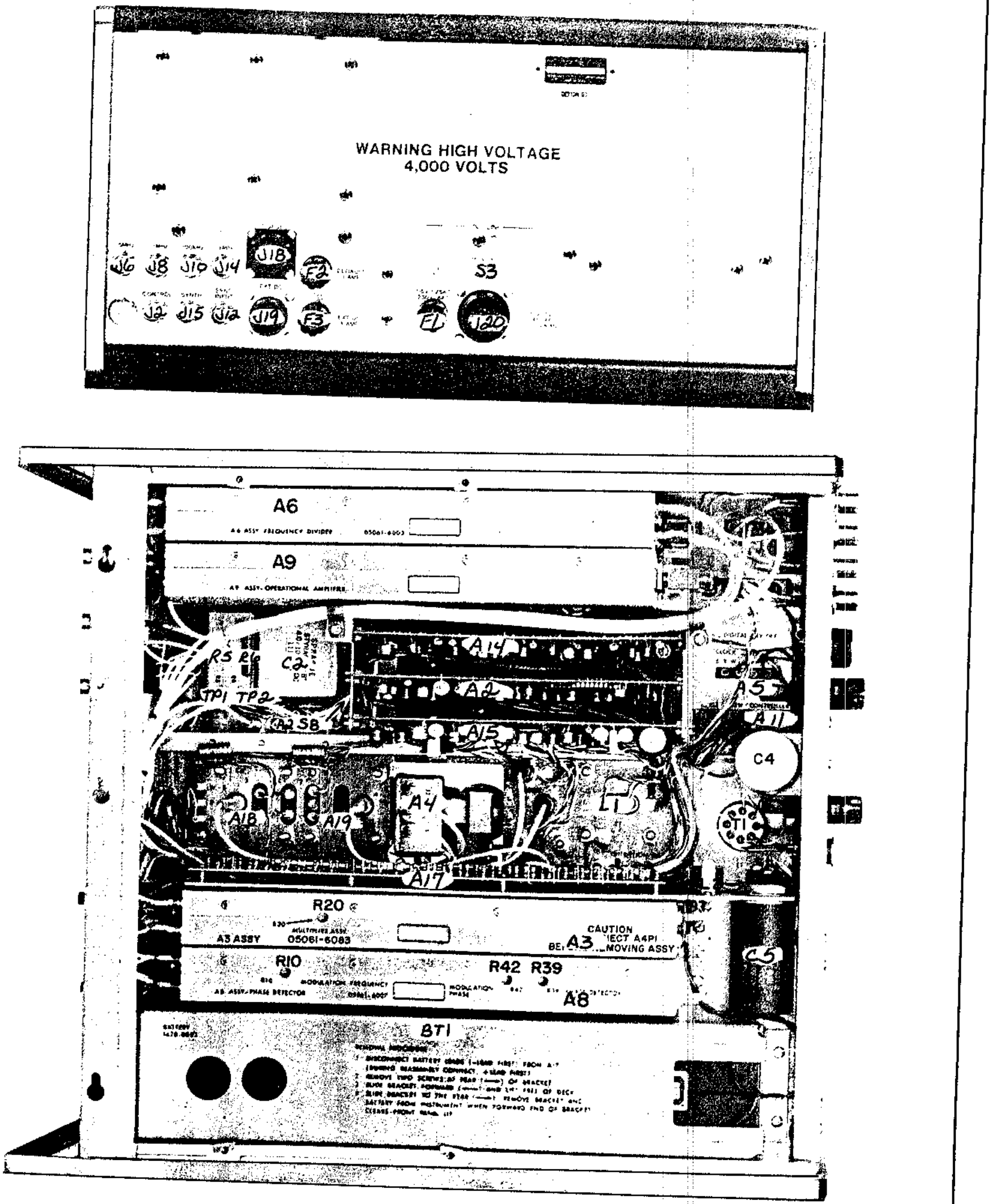
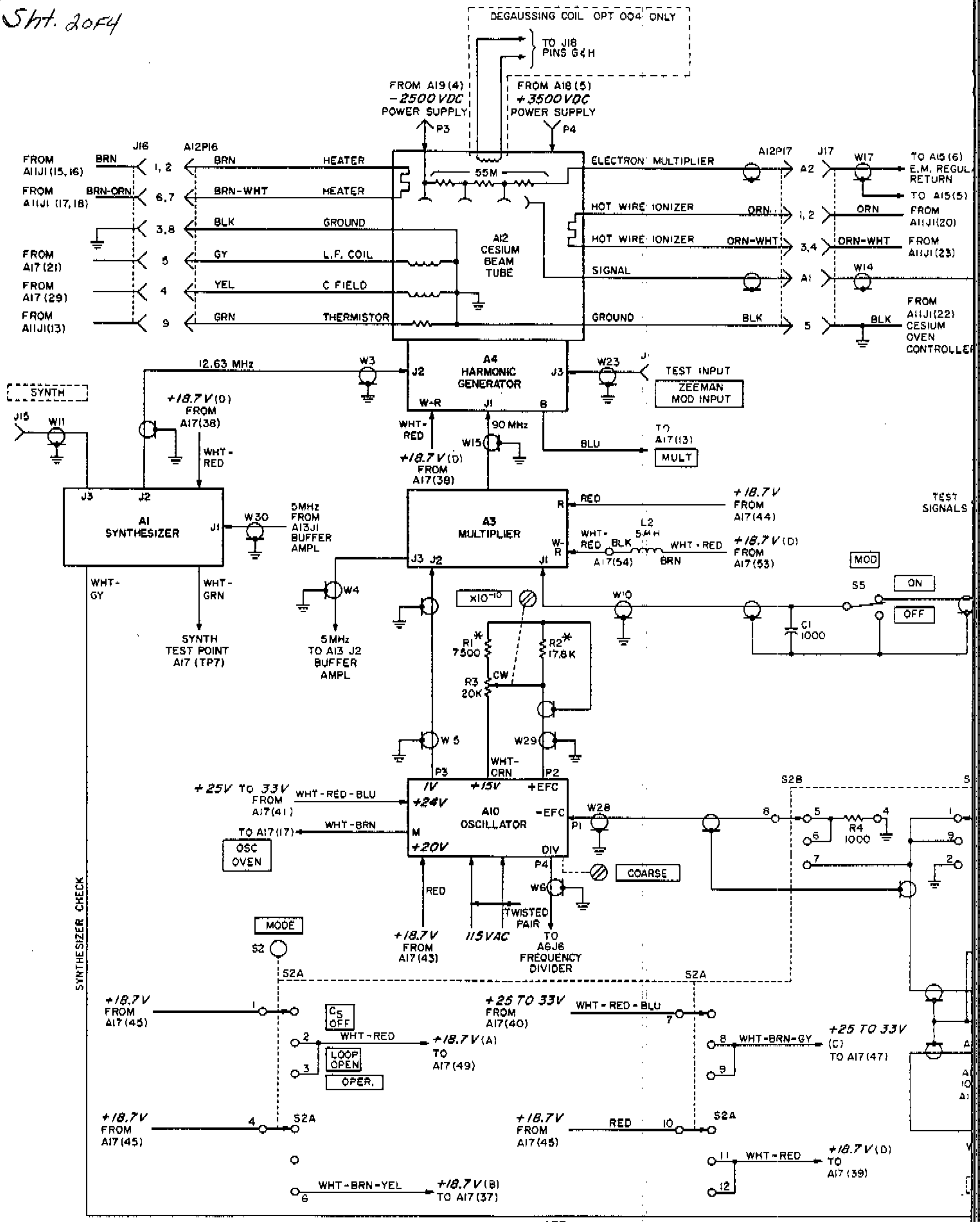


Fig. 8-5
Sht. 2 of 4

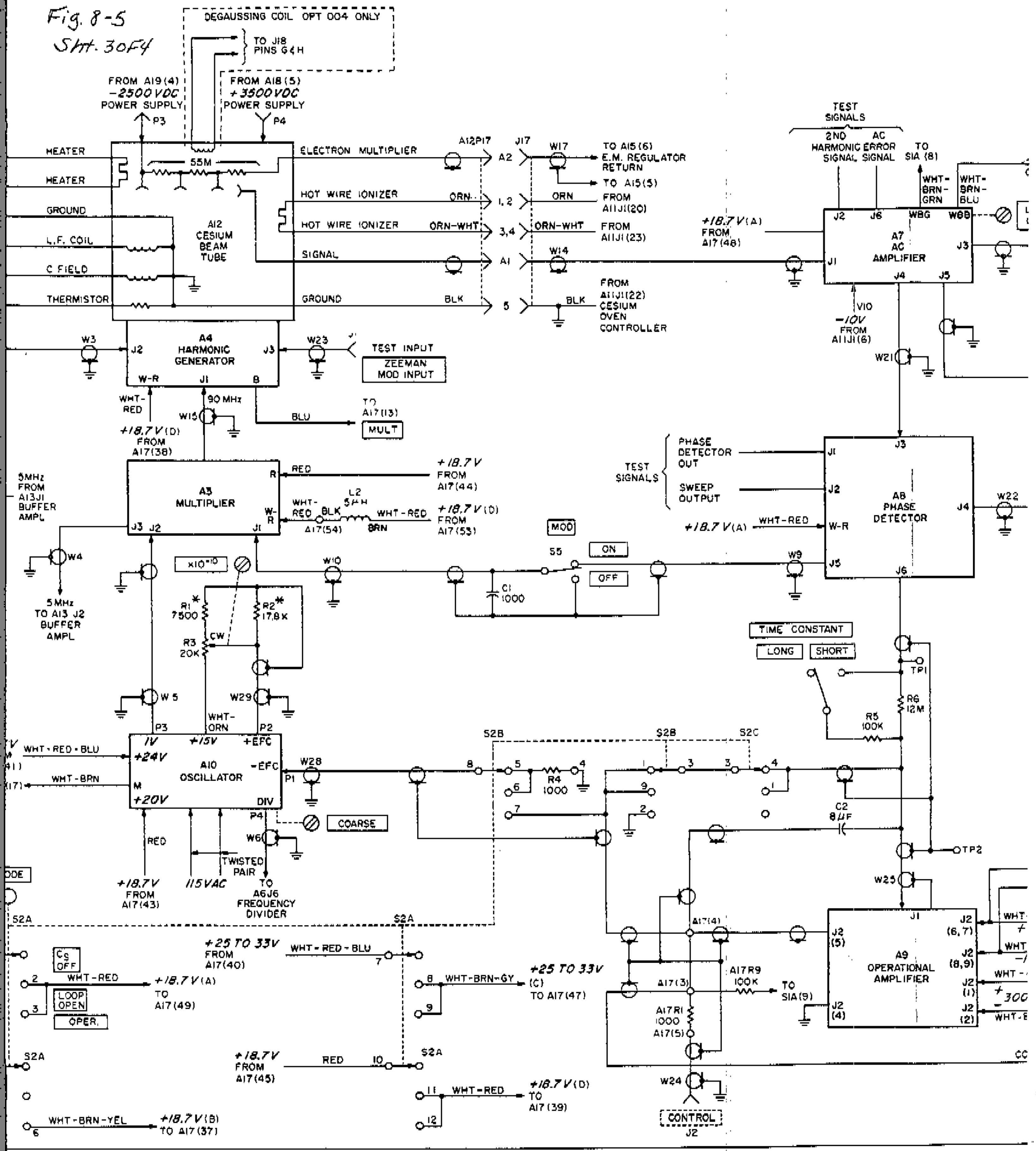


NOTE

* R6 OPTION 004
2.4M <2 X 10-12
2.0M 2 TO 3 X 10-12
1.0M 3 TO 4 X 10-12
400K 4 TO 5 X 10-12

C3 DELETED

Fig. 8-5
Sht. 3 of 4



NOTE

* R6 OPTION 004 — C3: DELETED

2.4M	<2 X 10-12
2.0M	2 TO 3 X 10-12
1.0M	3 TO 4 X 10-12
400K	4 TO 5 X 10-12

Fig. 8-5
Sht. 4 of 4

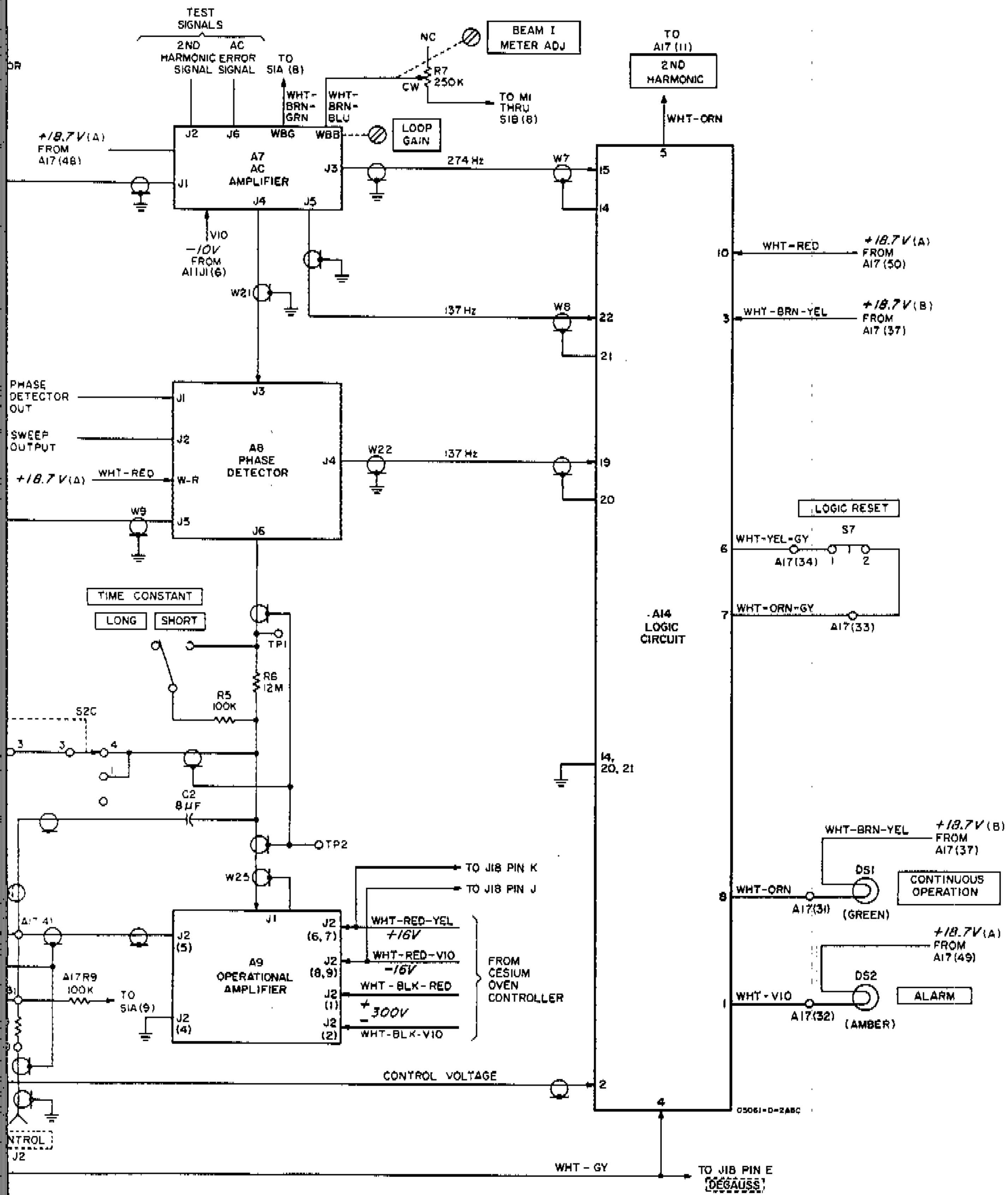


Figure 8-5. Wiring Diagram

Fig. 8-6
Sht. 1 of 4

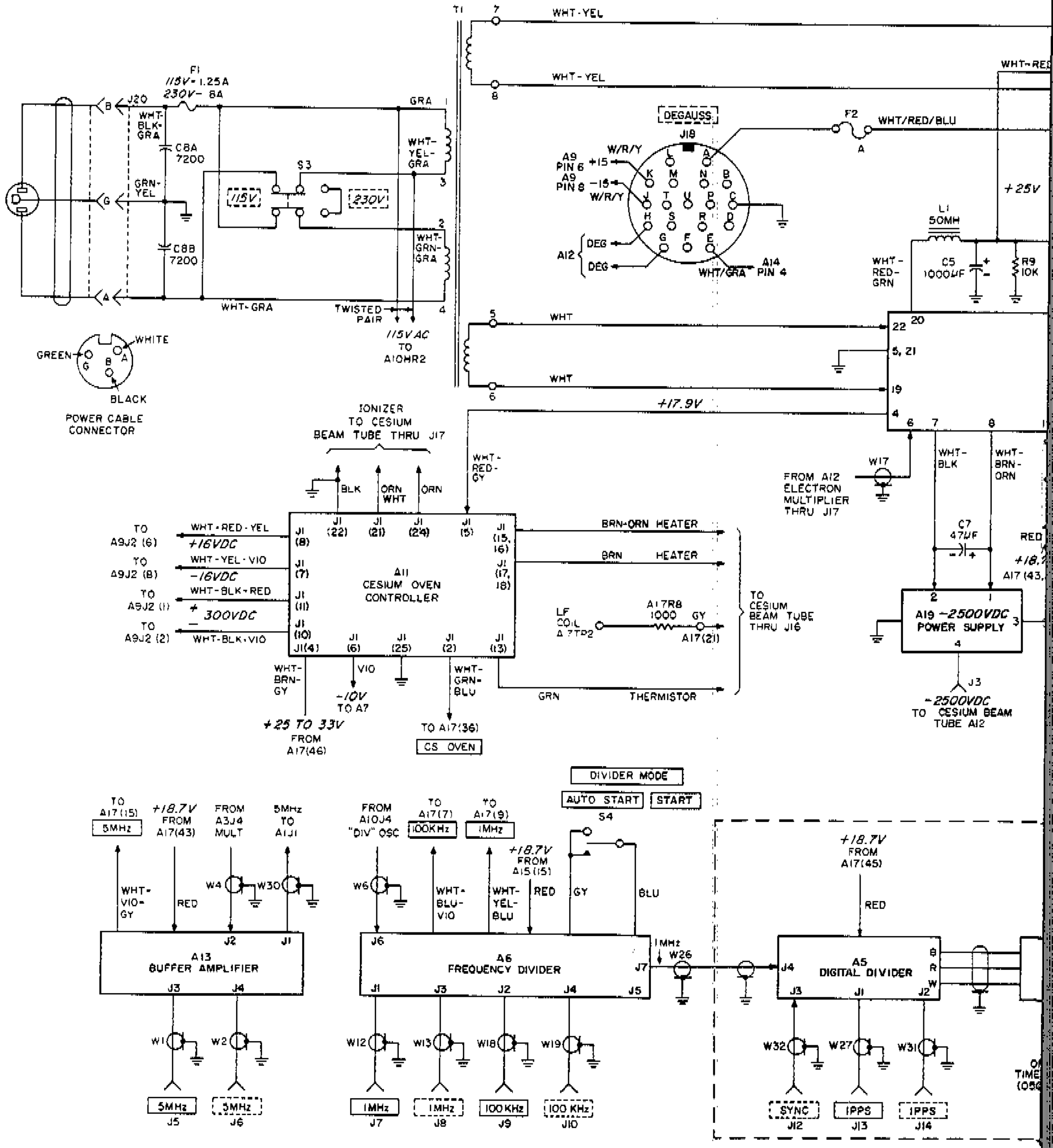


Fig. 8-6
Sht. 2 of 4

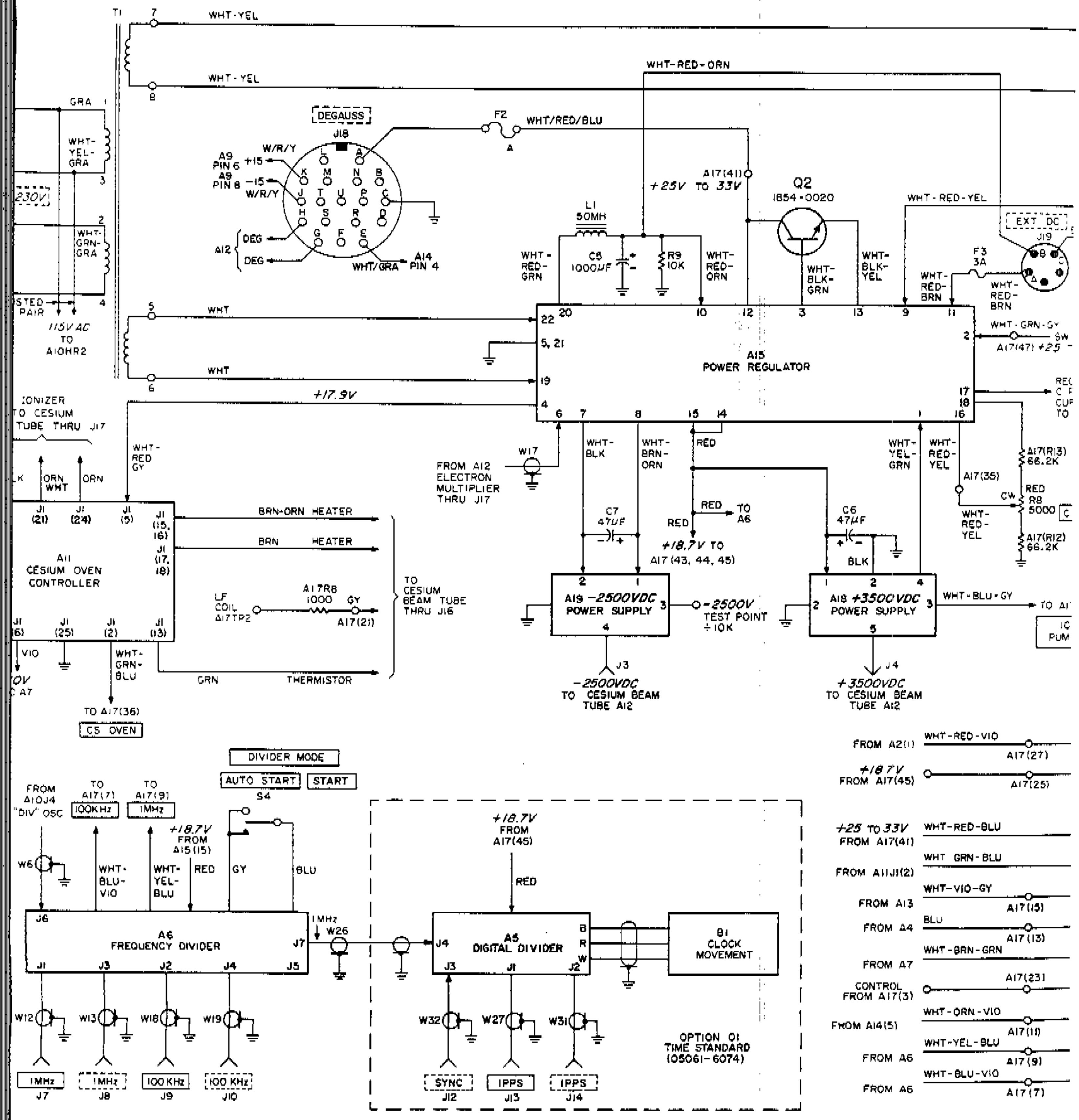


Fig. 8-6
Sht. 3 of 4

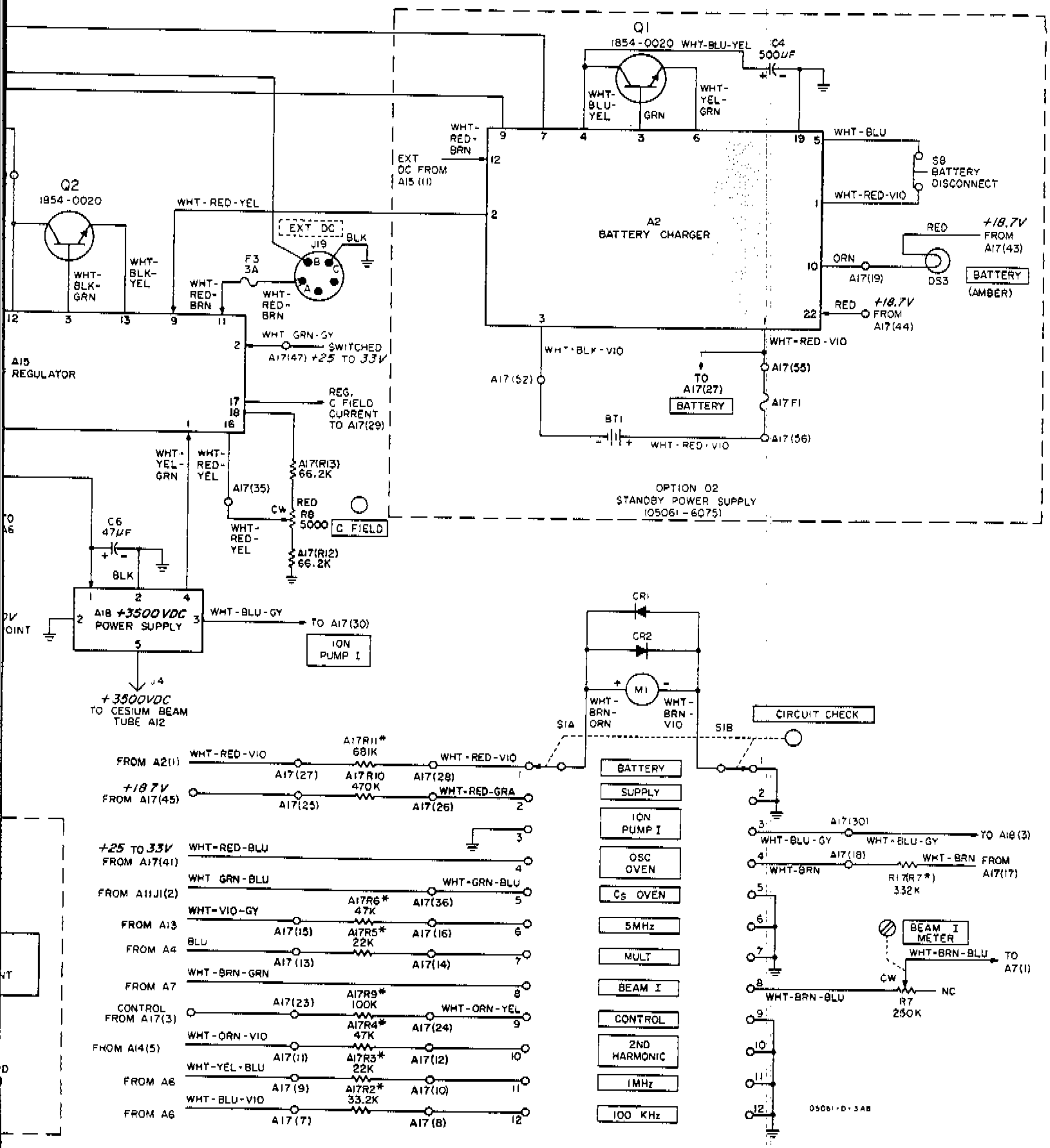
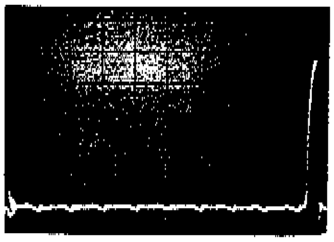
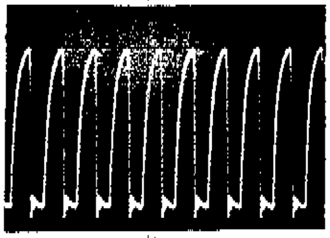


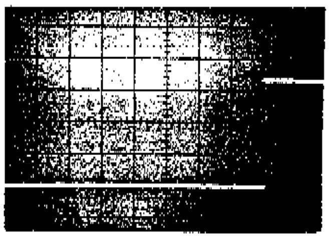
Figure 8-6. Wiring Diagram



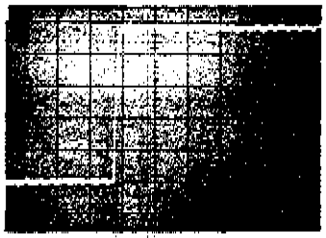
1 Q3(c). Scope sync from negative slope at TP1. H = .2 μsec/div, V = 1V/div pulse on right is first pulse into divider after preset (A + 1).



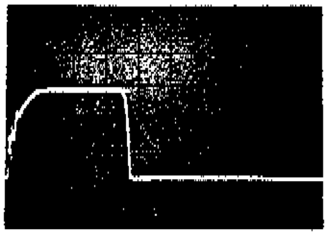
2 Q3(c). H = .2 μsec/div, V = 1V/div input pulses to divider with input gate disabled (RS or IC3(12) shorted to chassis).



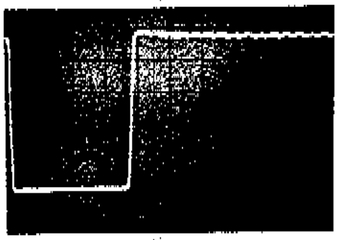
3 IC6(12). Scope internal sync on negative slope. Output of preset divider chain with IC3(12) shorted to chassis. H = .2 ms/div, V = 1V/div.



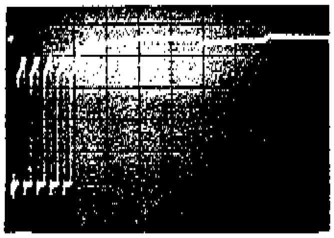
4 Strobe line @IC4(7). Normal operation. H = .5 μsec/div, V = 1V/div.



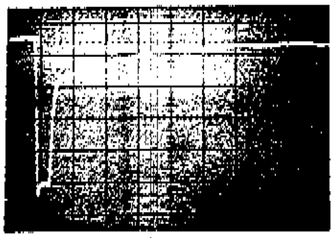
5 IC4(10). Normal operation. H = .5 μsec/div, V = 1V/div.



6 TP1. Normal operation. H = .5 μsec/div, V = 1V/div.



7 IC3(8). IV/IC4 not operating. H = 1 μsec/div, V = 1V/div.



8 IC3(8). Normal operation. H = 0.1 μsec/div, V = 1V/div.

Fig. 8-8
Sht 1 of 5

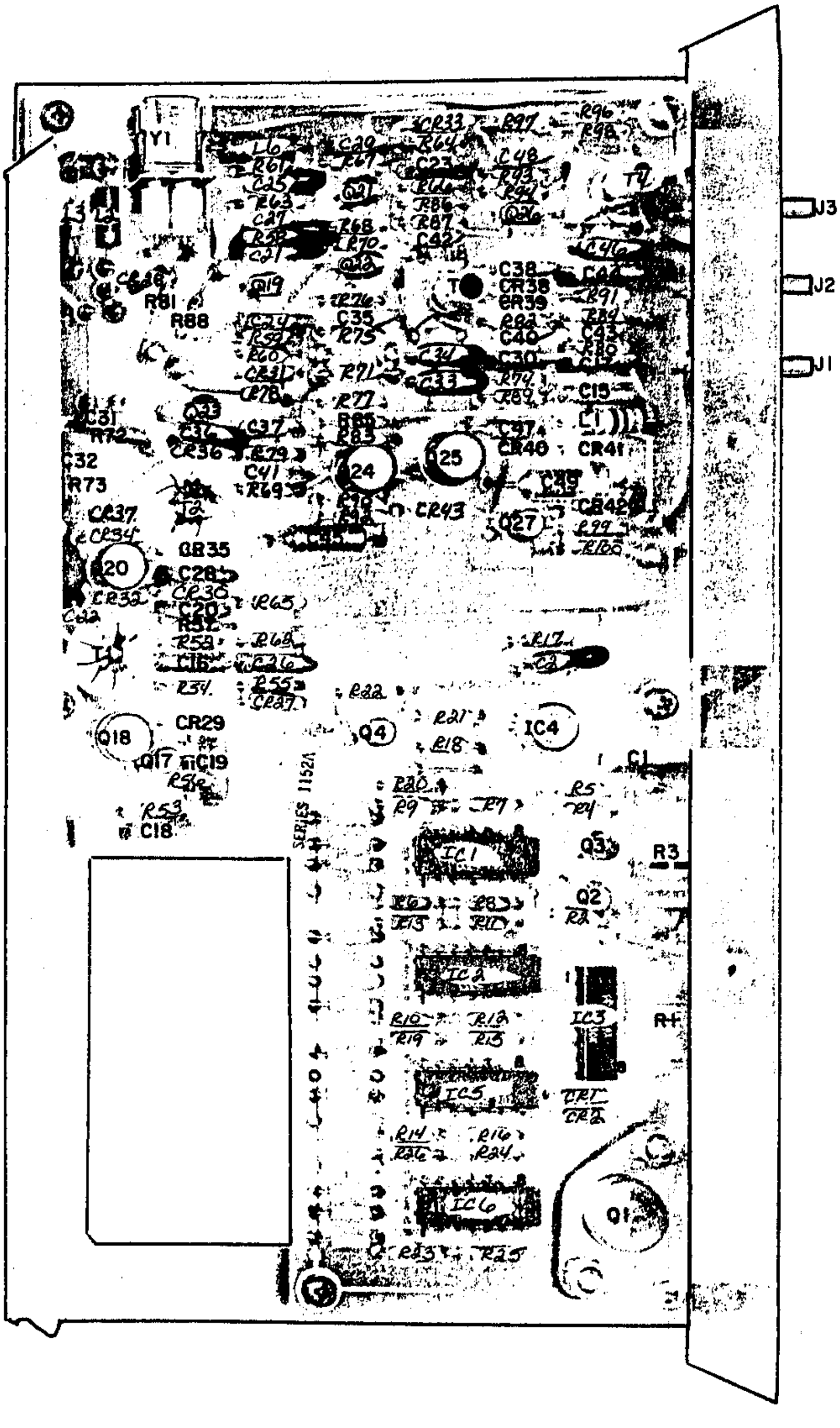


Figure 8-7. Synthesizer Assembly A1, Component Locator

Fig. 8-8
Sht. 2 of 5

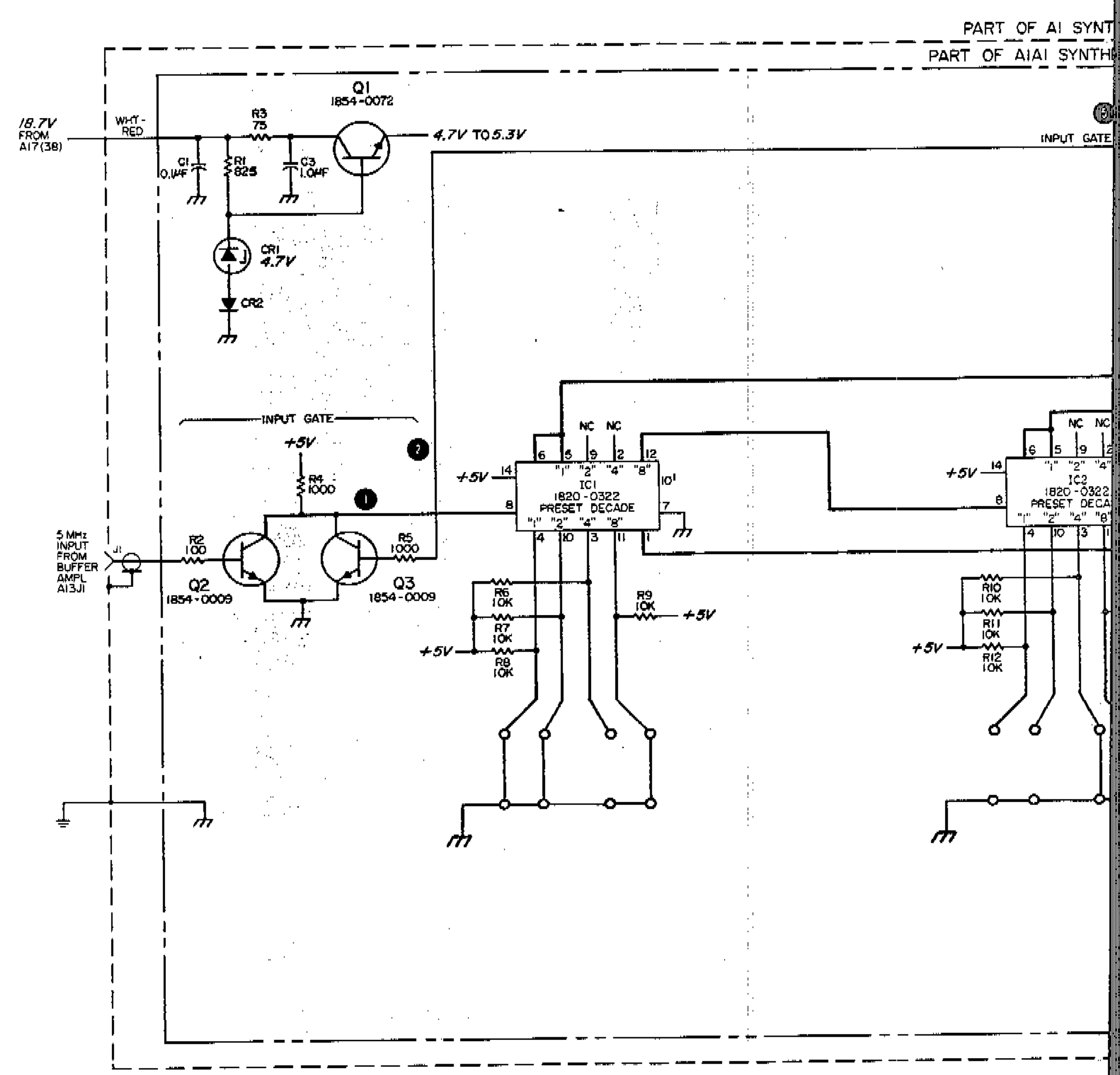
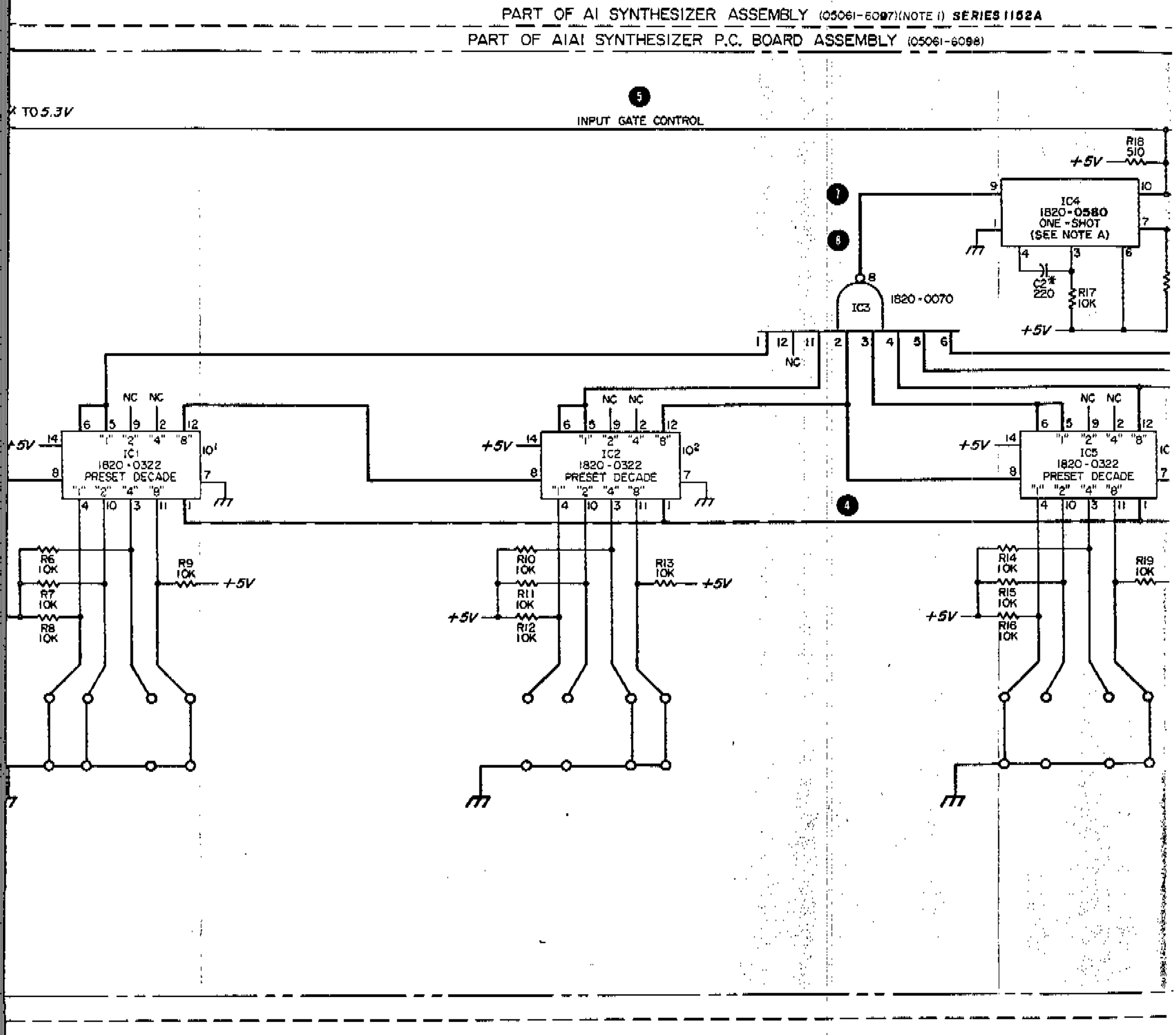
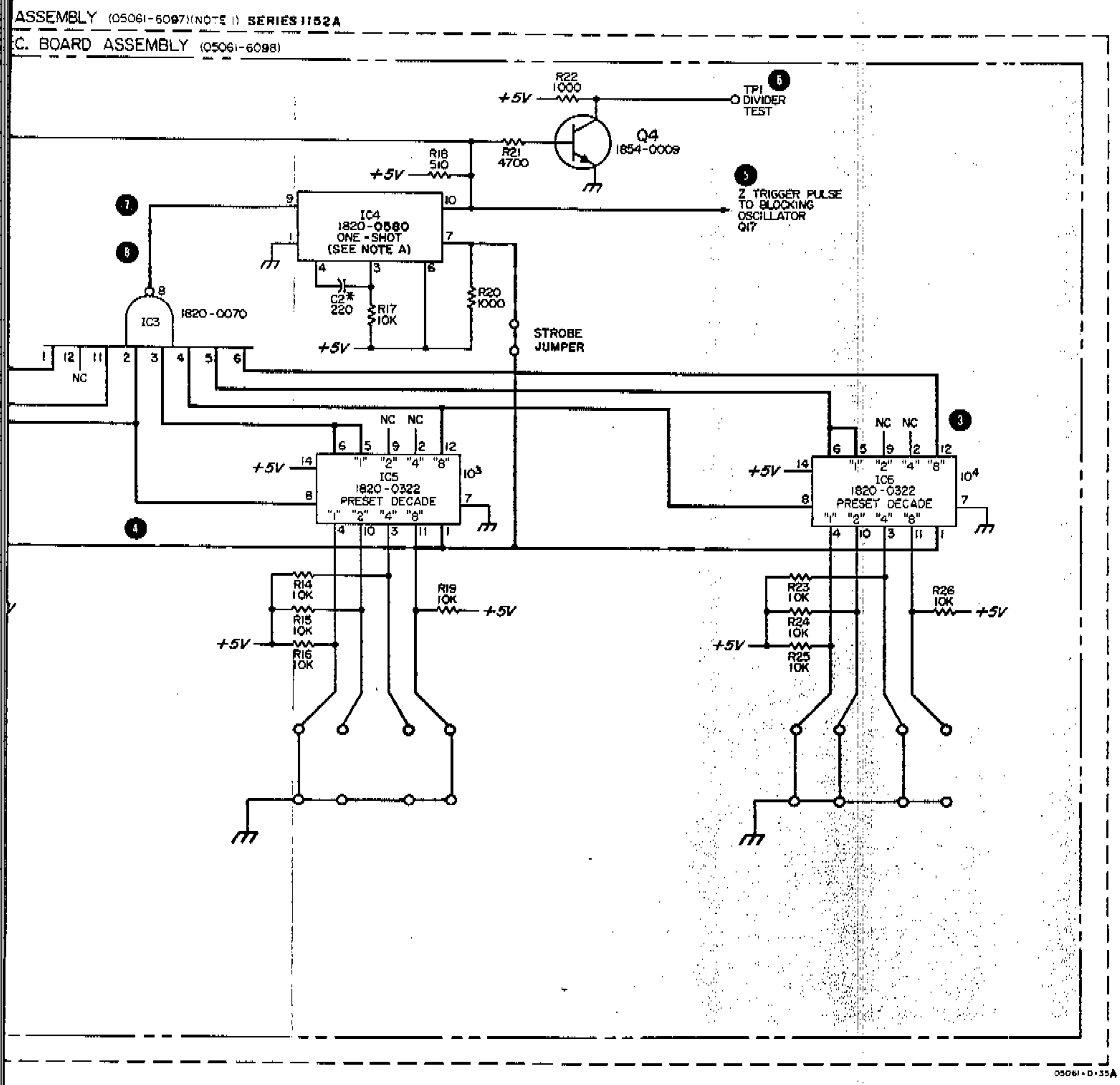


Fig 8-8
Sht. 3 of 5



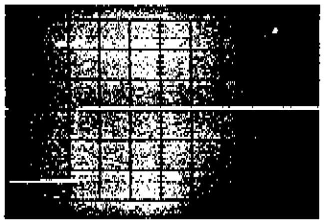
NOTE A: IF IC4 IS REPLACI
C2 MUST BE CHECK
FOR PROPER SELE(
SEE PARAGRAPH 5

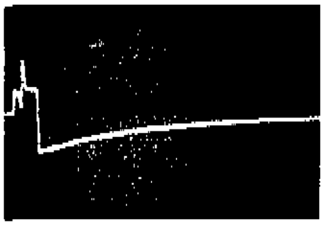
Fig. 8-8
Sht. 4 of 5

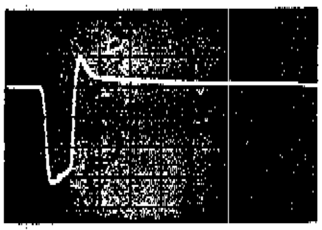


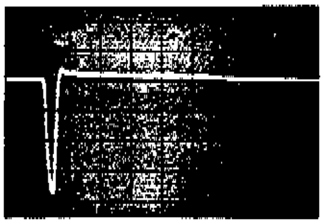
NOTE A: IF IC4 IS REPLACED,
C2 MUST BE CHECKED
FOR PROPER SELECTION.
SEE PARAGRAPH 5-53A

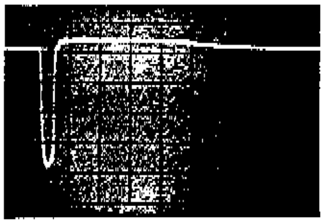
Figure 8-8. Synthesizer Assembly A1
Digital Section

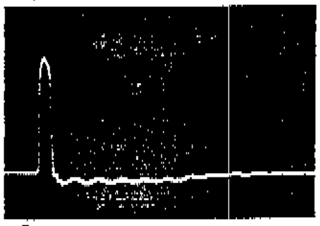

13 1V/cm, 1 μs/cm

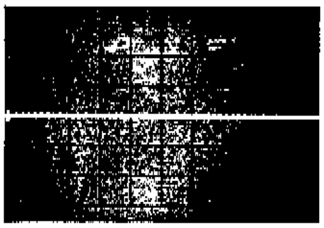

14 1V/cm, .5 μs/cm

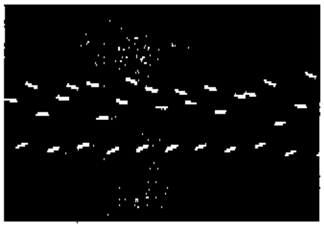

15 5V/cm, .1 μs/cm

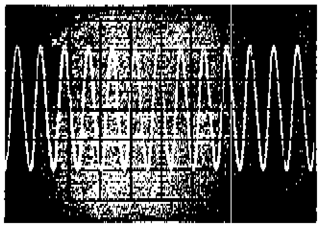

16 5V/cm, .1 μs/cm

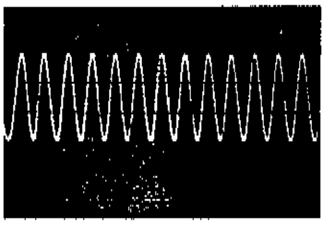

17 2V/cm, .1 μs/cm
A1Y1 disconnected


18 2V/cm, .1 μs/cm
A1Y1 disconnected


19 1V/cm, 2 μs/cm
Phase loop locked


20 .5V/cm, 2 ms/cm
Phase loop not locked


21 0.5V/cm, .1 μs/cm


22 1V/cm, .1 μs/cm

5061A: Normal operation unless noted.

Oscilloscope: DC coupled

Fig 8-9
Sht. 1 of 4

Model 5061A

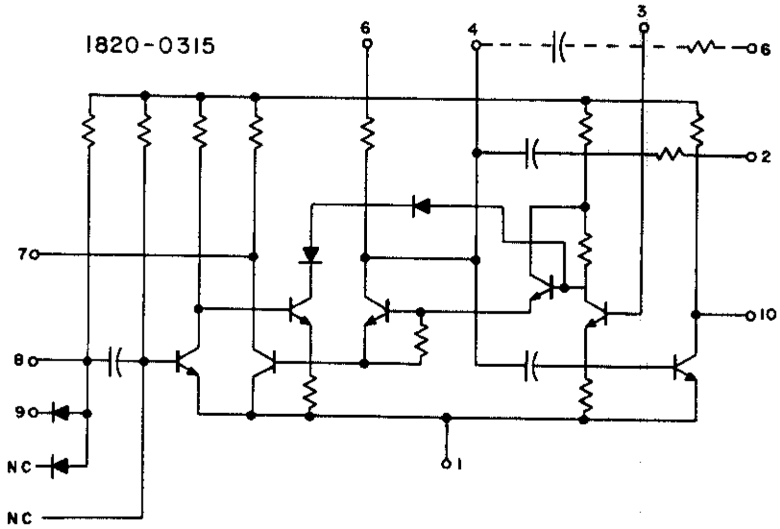


Fig. 8-9
Sht. 2 of 4

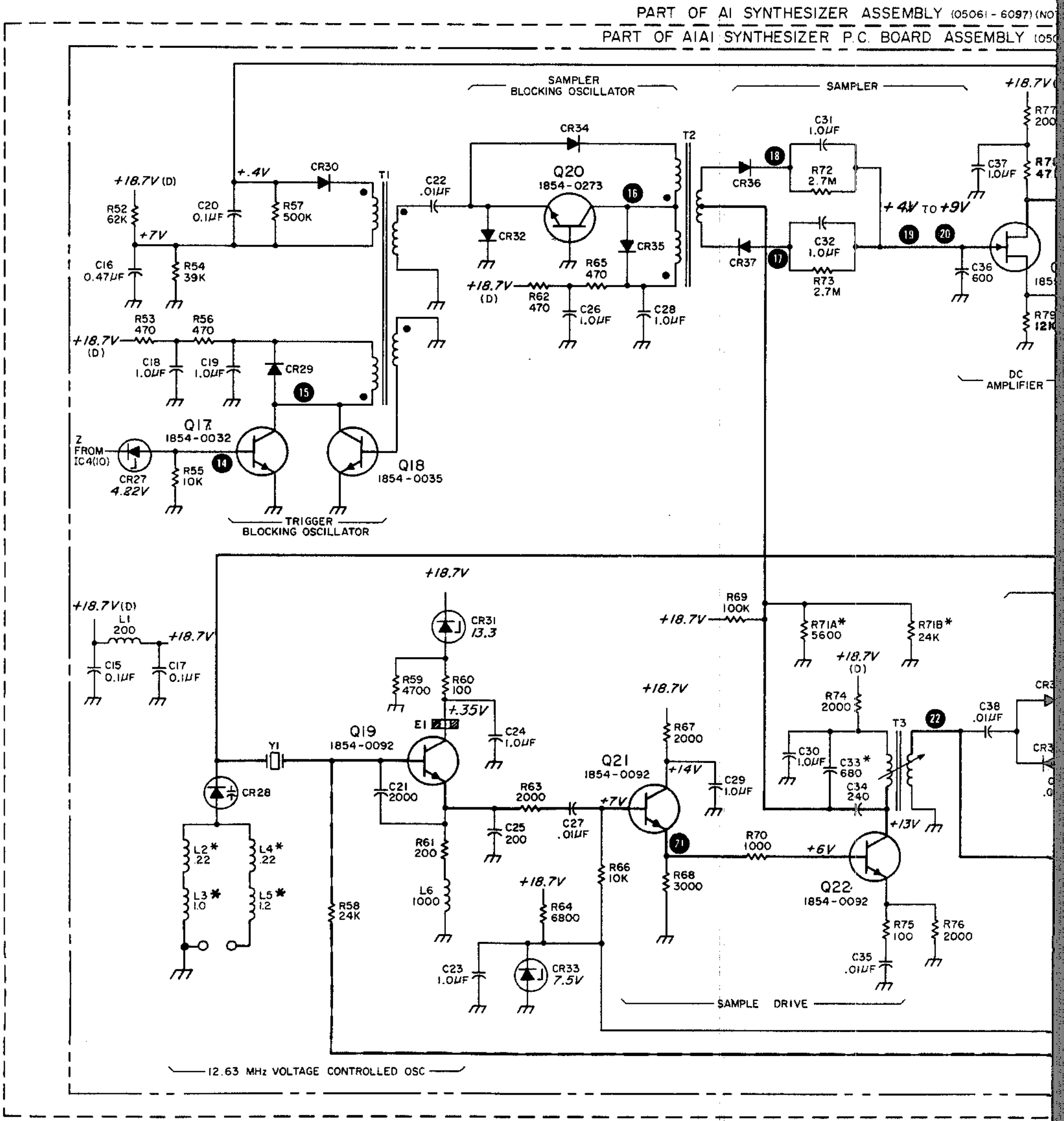
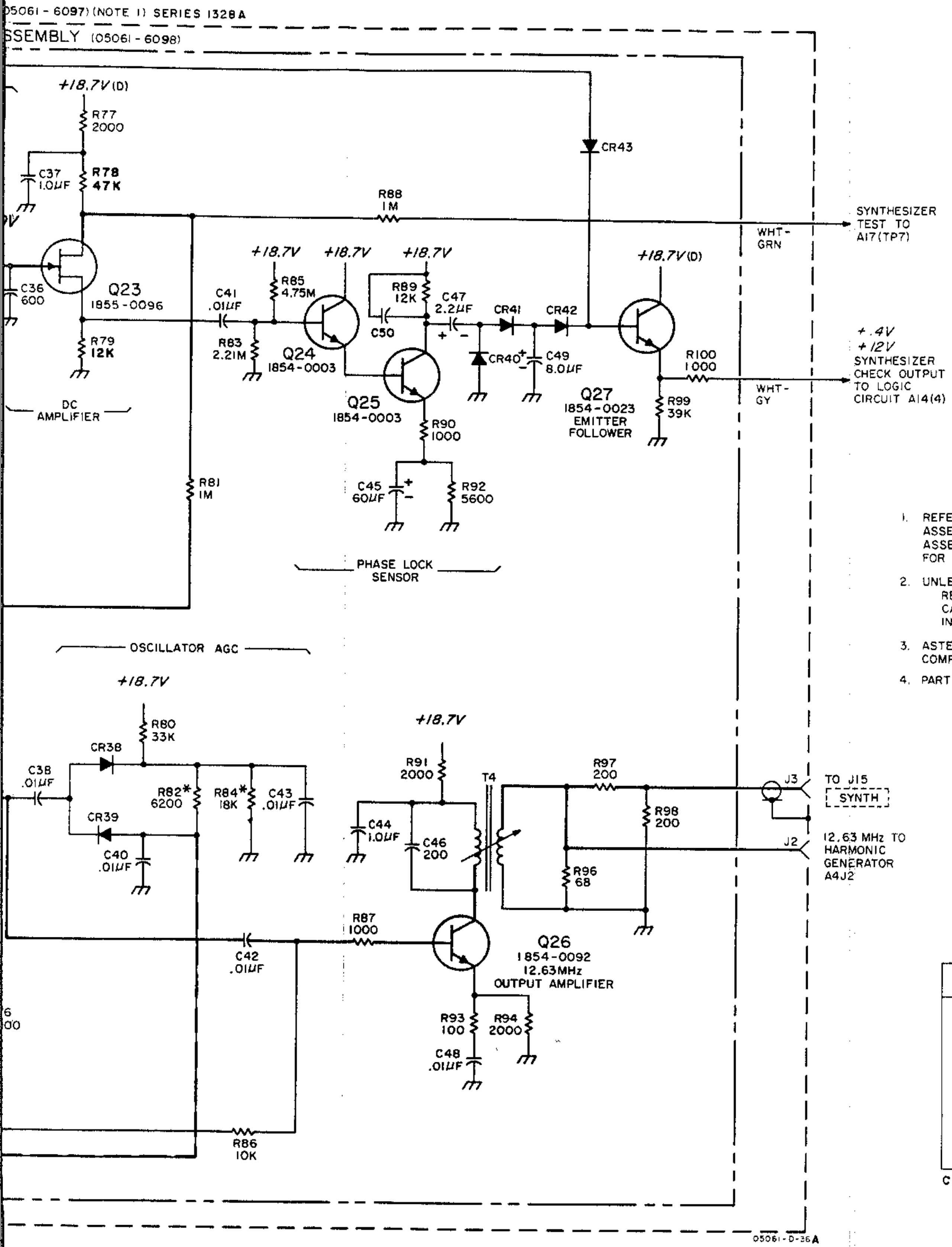


Fig. 8-9
Sht. 3 of 4



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. PART OF "TIME SCALE SELECTOR"

REFERENCE DESIGNATIONS

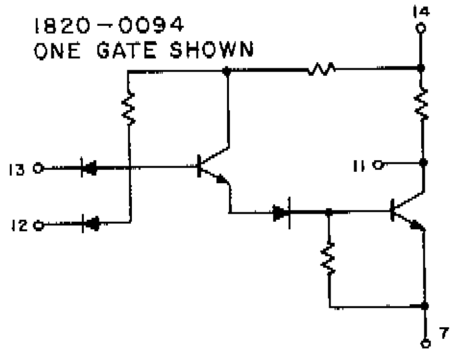
A1	A1A1
J1-3	C1-3 C15-49 CR1,2,27-43 IC1-6 L1-6 Q1-4,17-27 R1-26,52-94 R96-100 T1-4 TP1 Y1

C39, DELETED

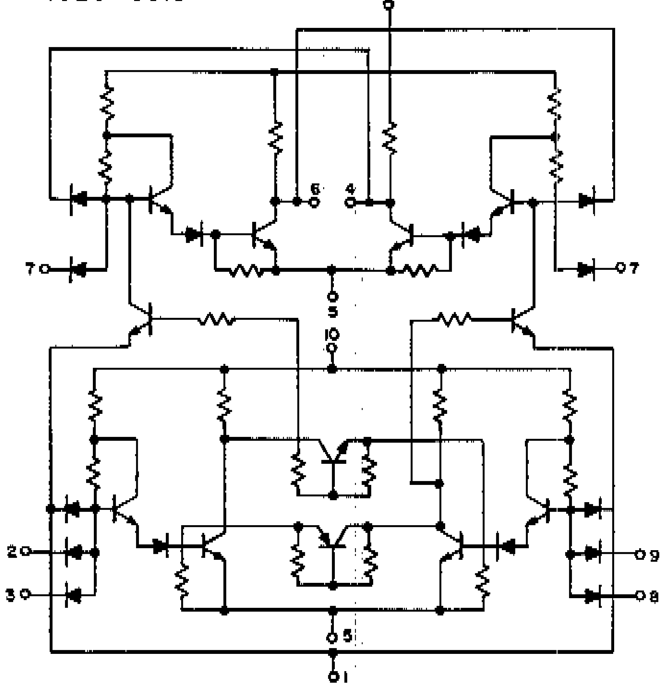
Figure 8-9. Synthesizer Assembly A1 Phase Locked Oscillator Section

Fig. 8-9 Sht. 4 of 4

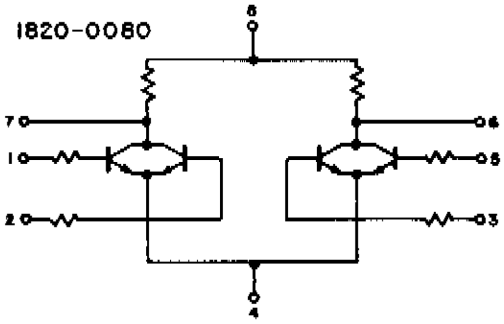
1820-0094
ONE GATE SHOWN



1820-0313



1820-0080



1820-0086

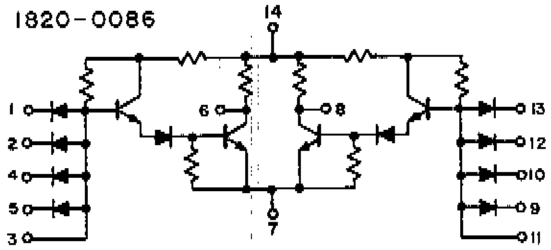
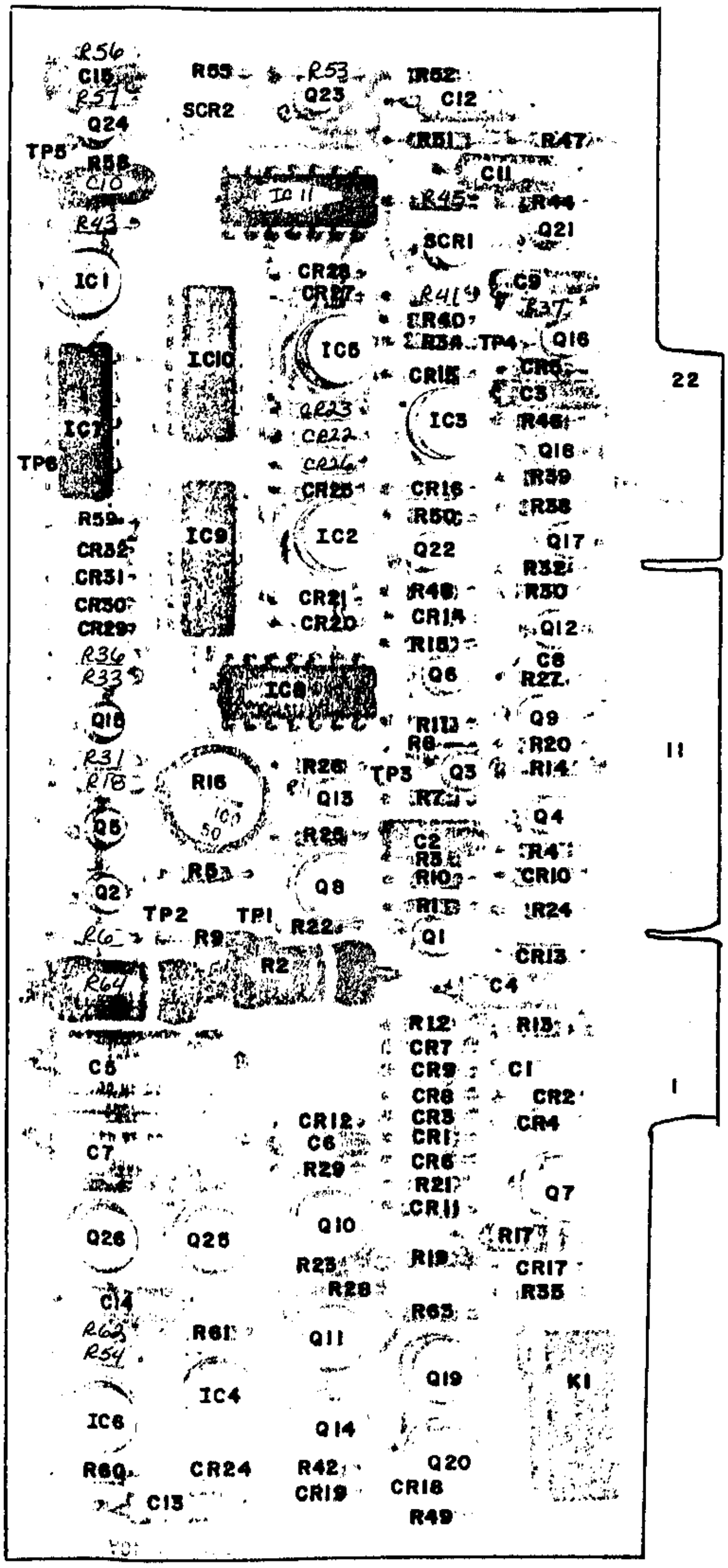


Fig. 8-10
Sht. 1 of 4



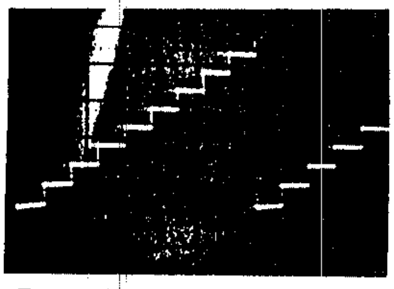
NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. PROTECTIVE RELAY K1 OPENS IF BATTERY VOLTAGE DECREASES BELOW 21 VDC

REFERENCE DESIGNATIONS

NO PREFIX	A2	A17
BT1 C4 DS3 Q1 S8	C1-15 CR1-32 IC1-11 K1 Q1-26 R1-64 SCR1,2 TP1-6	F1

05061-0-6



❶ 2V/cm, 2 sec/cm

5061A: 15KΩ resistor connected between A2TP1 and A2TP2. External power disconnected BATTERY light on or flashing.

Oscilloscope: DC coupled

Fig. 8-10
Sht. 2 of 4

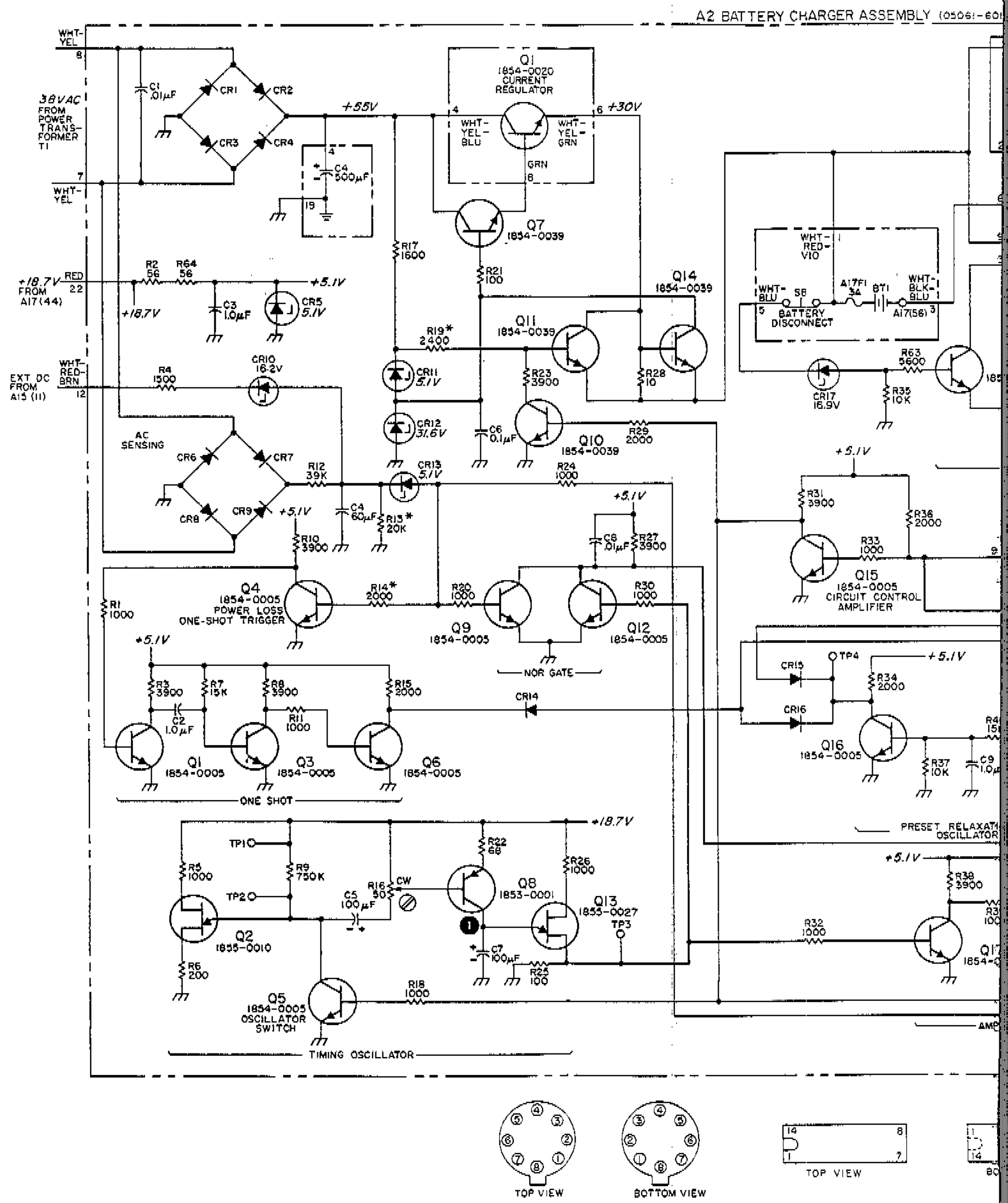


Fig. 8-10
Sht 3 OF 4

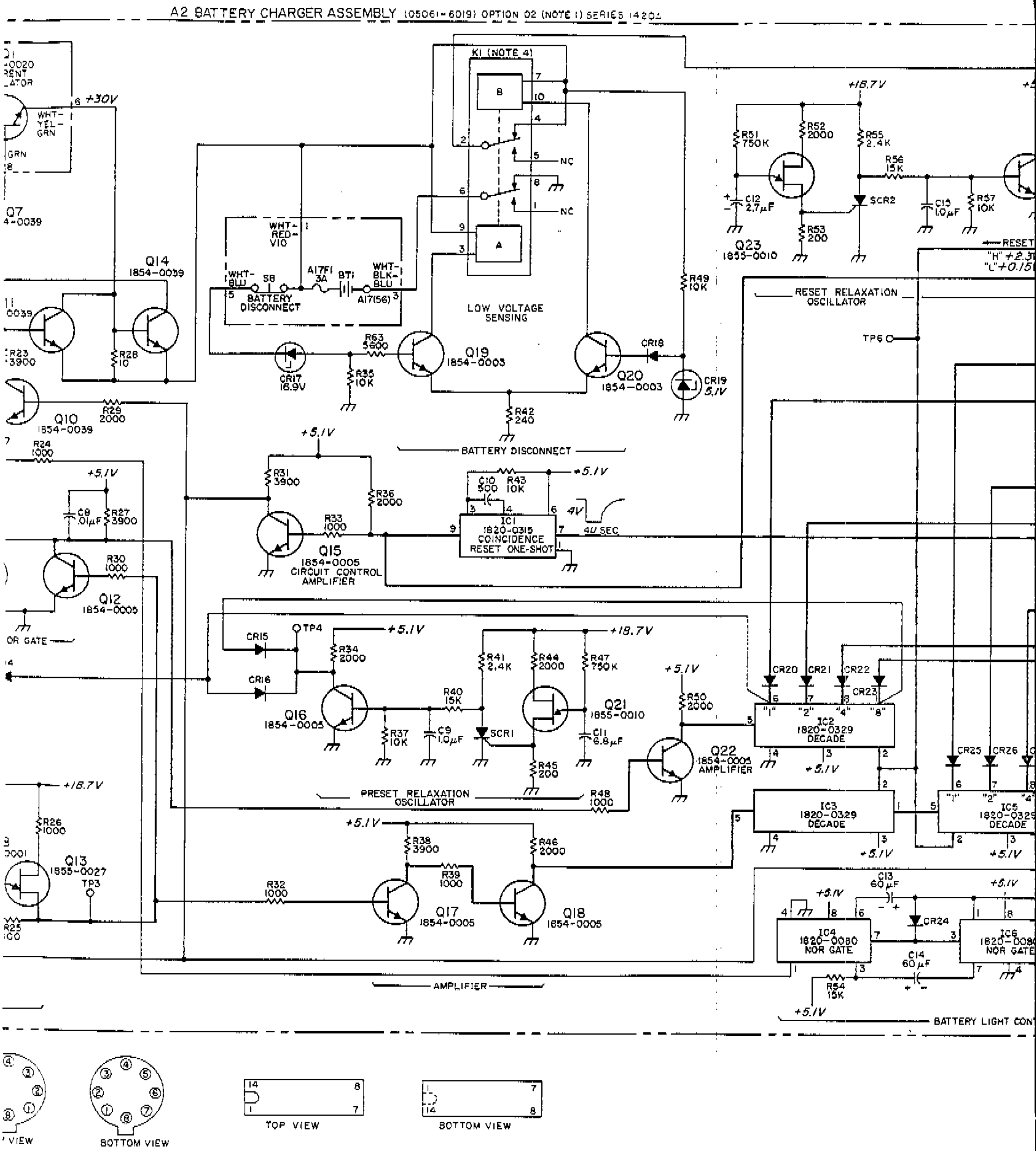


Fig. 8-10
Sht 4 of 4

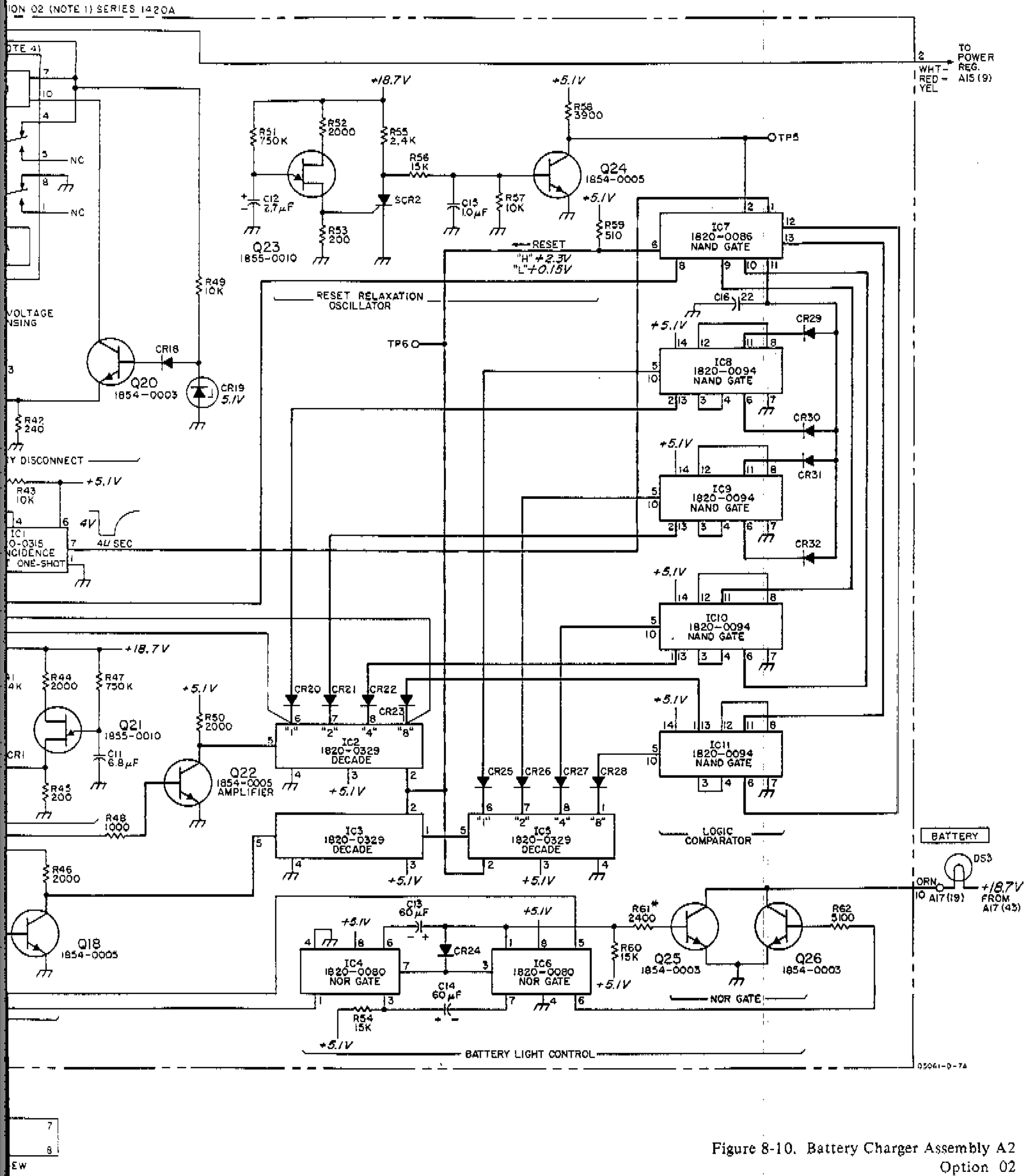
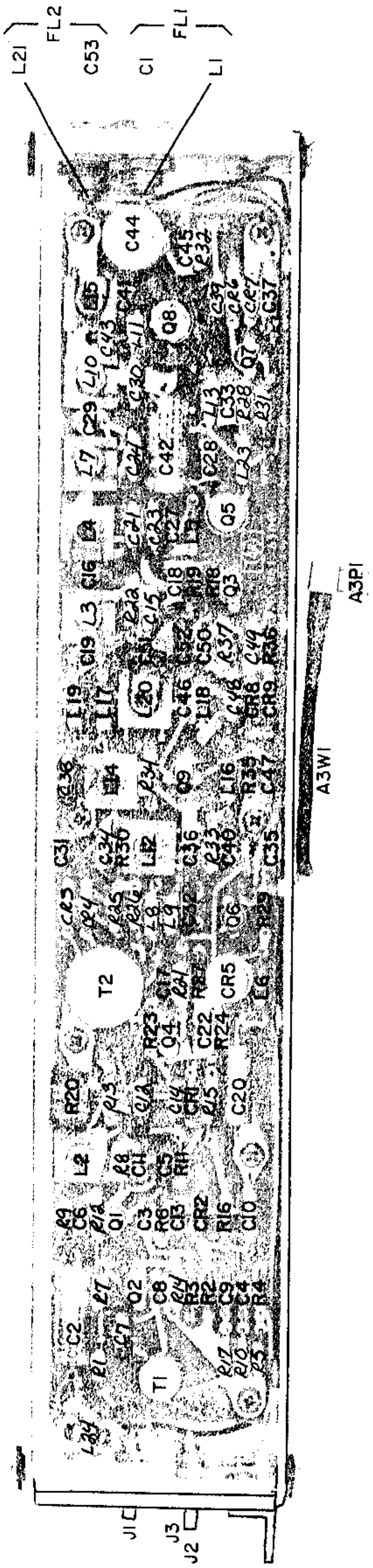
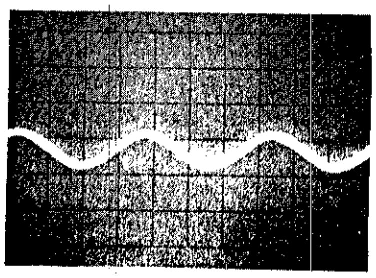


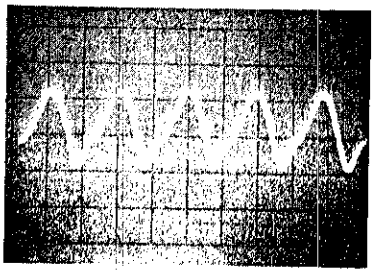
Figure 8-10. Battery Charger Assembly A2
Option 02

Fig. 8-11 Sht. 1 of 4

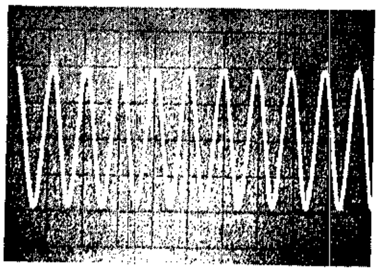




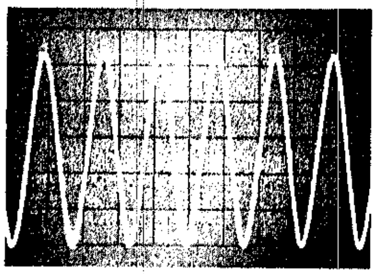
❶ .01V/cm, 2 ms/cm
Disconnect A3P5



❷ .05V/cm, .1 μs/cm



❸ 2V/cm, .1 μs/cm

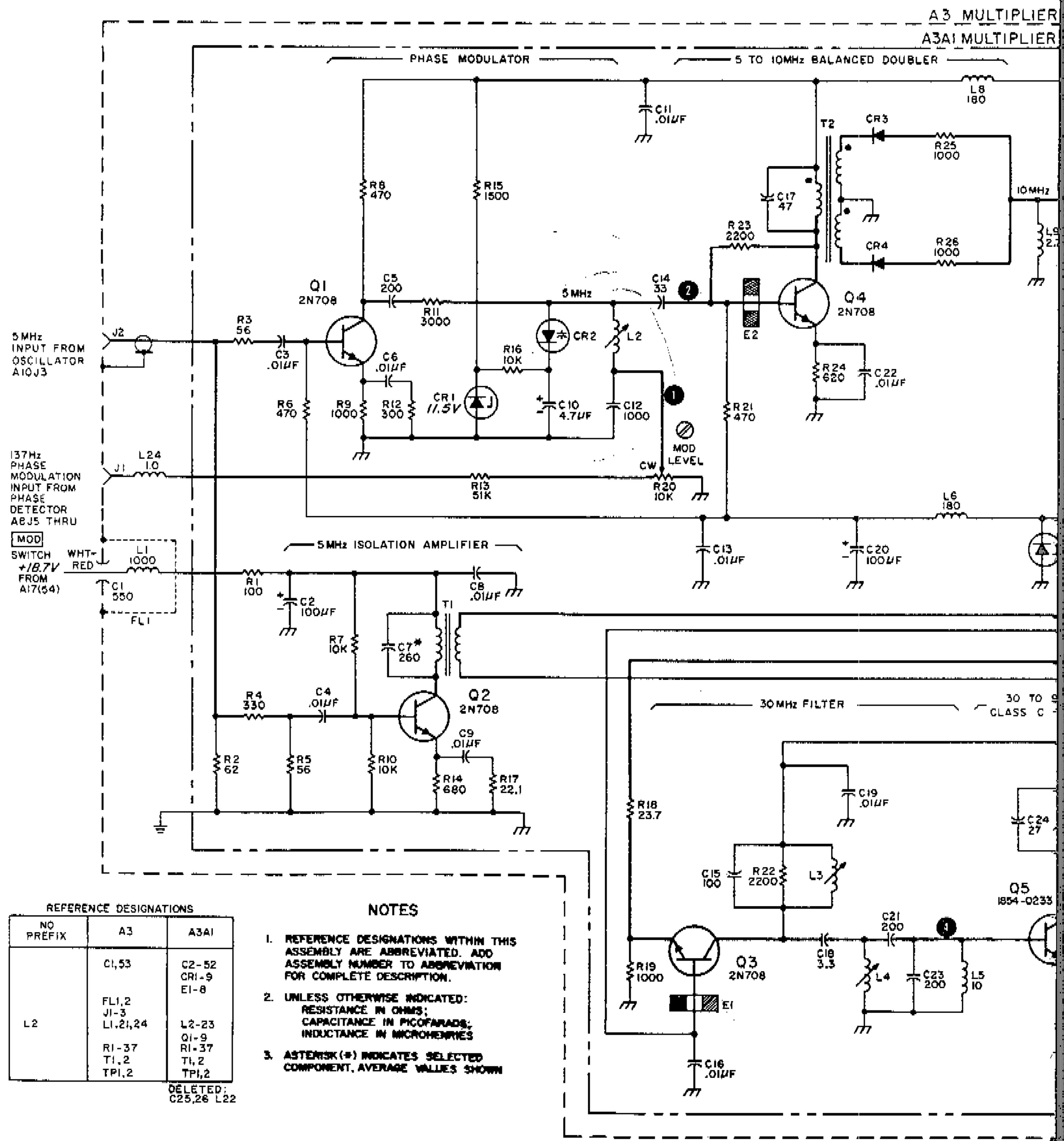


❹ 1V/cm, .01 μs/cm

5061A: Normal operation unless noted.

Oscilloscope: DC coupled

Fig. 8-11
Sht. 2 of 4



REFERENCE DESIGNATIONS

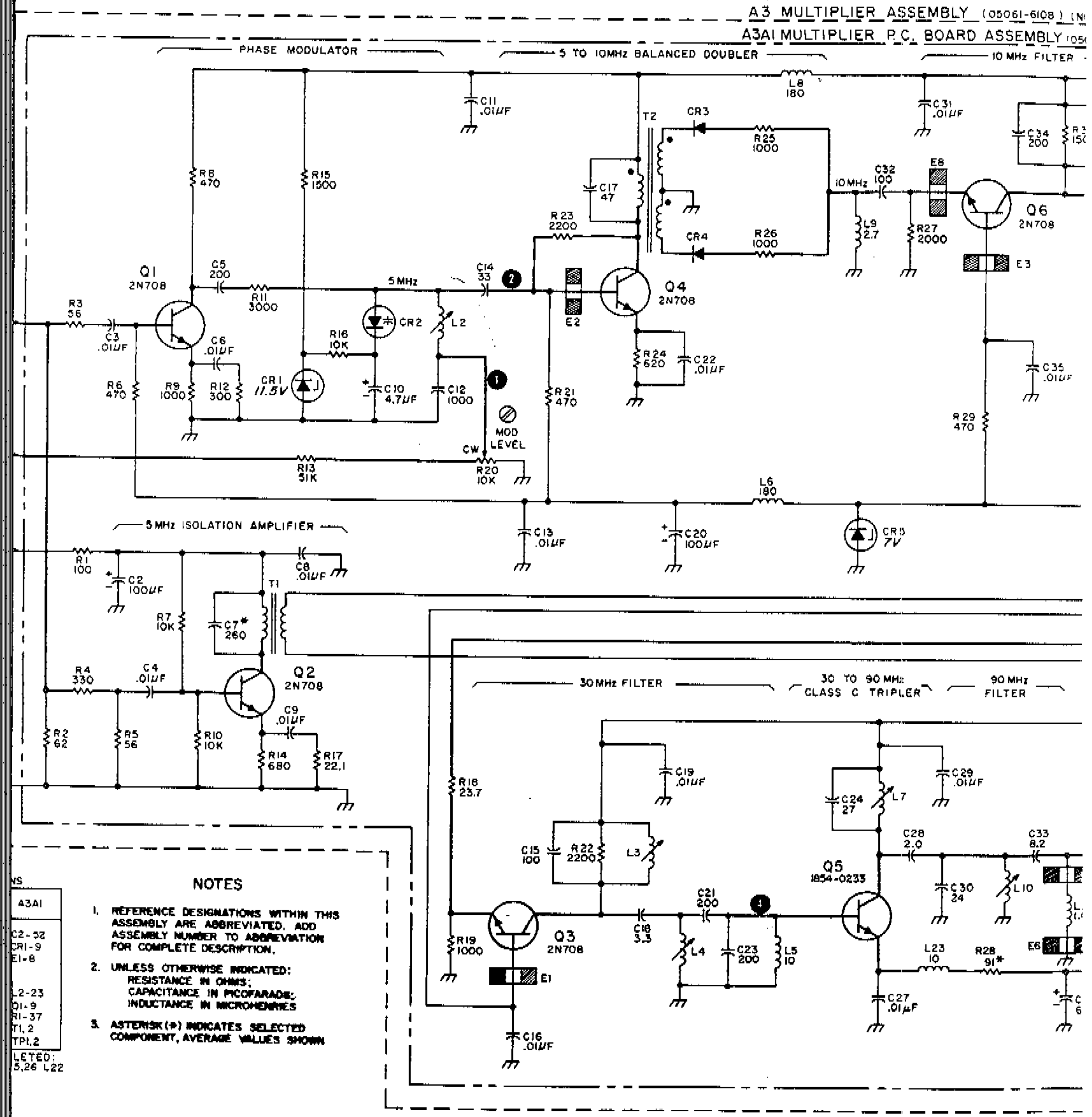
NO PREFIX	A3	A3A1
L2	C1,53 FL1,2 J1-3 L1,21,24 R1-37 T1,2 TP1,2	C2-52 CR1-9 E1-8 L2-23 Q1-9 R1-37 T1,2 TP1,2

DELETED: C25,26 L22

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

Fig. 8-11
Sht. 3 of 4



NOTES

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2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

Fig. 8-11 Sht. 4 of 4

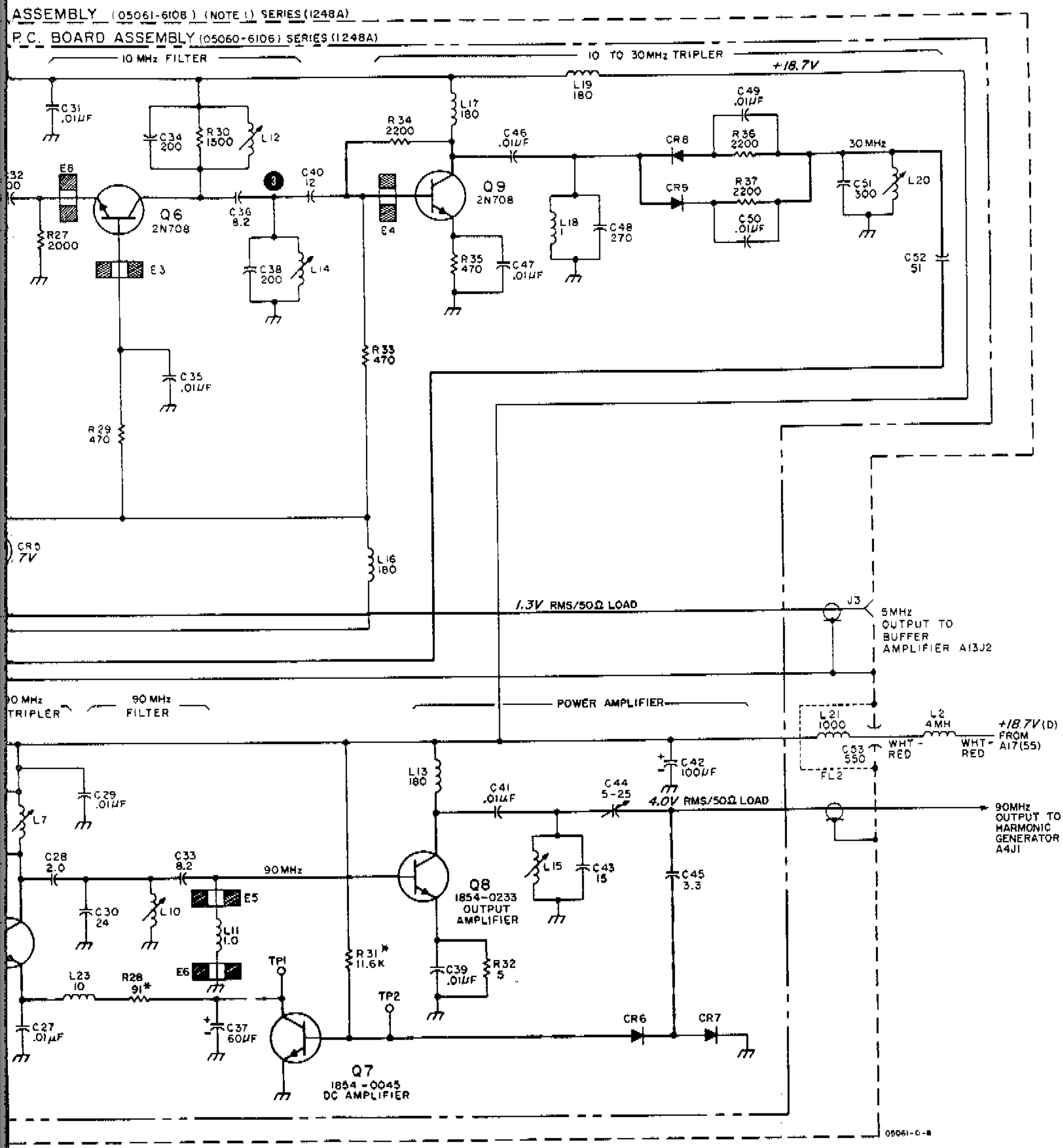


Figure 8-11. Multiplier Assembly A3

Fig. 8-12
Sht. 1 of 3

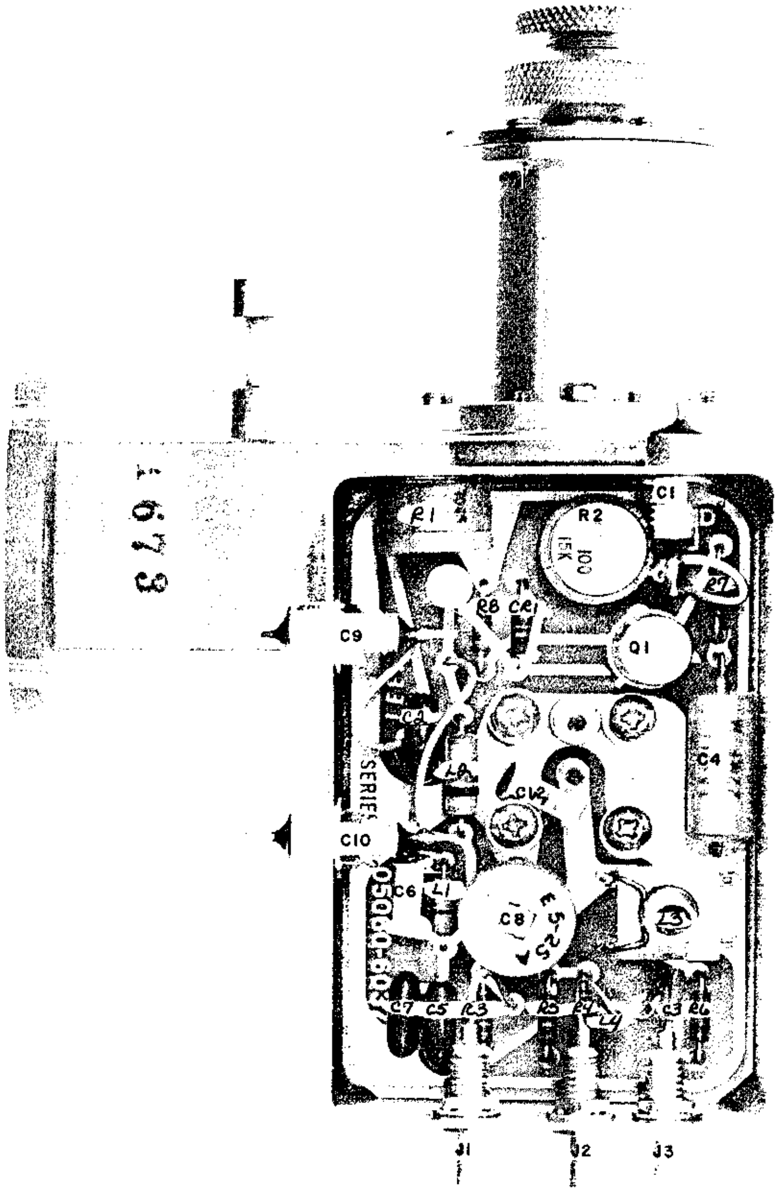
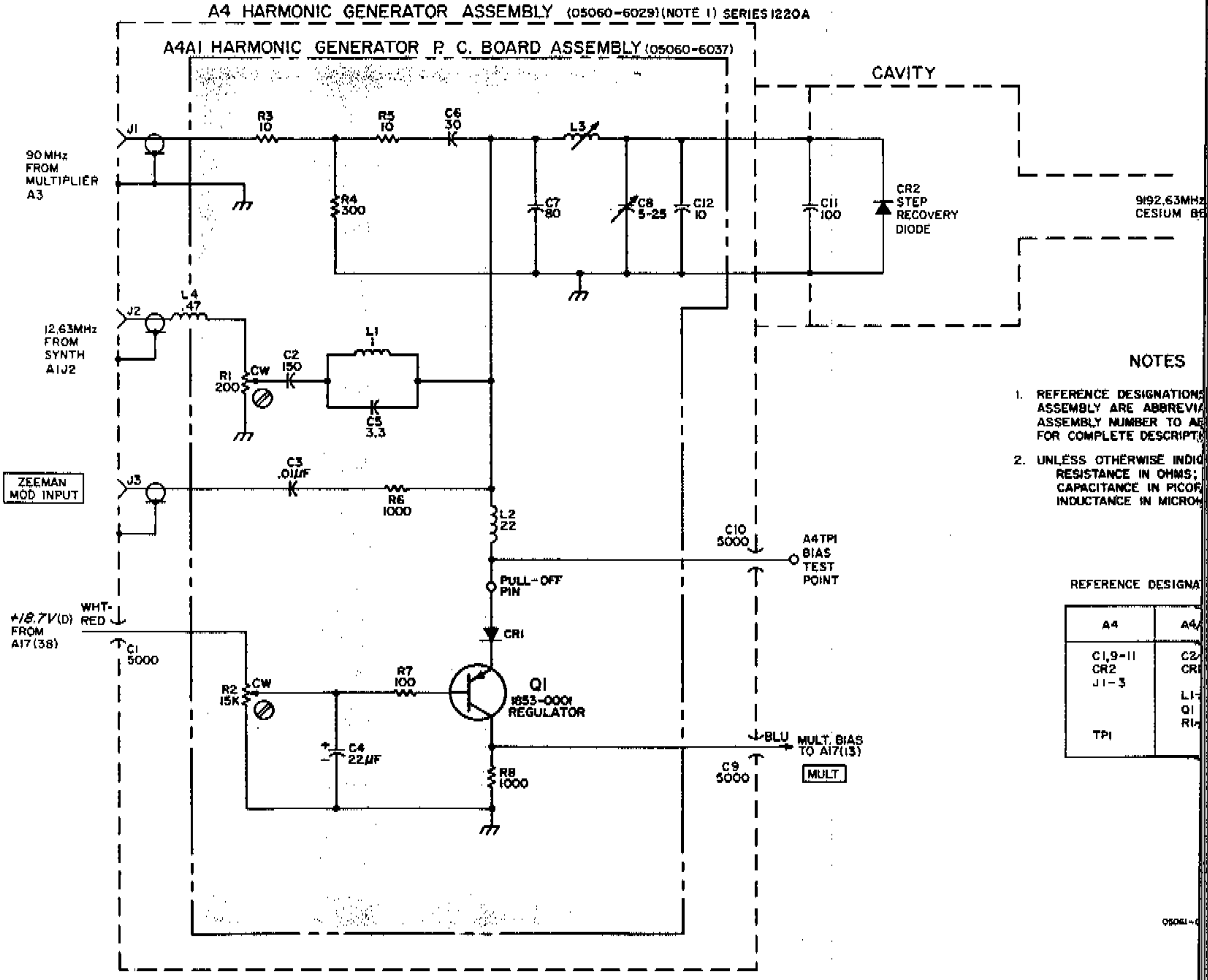


Fig. 8-12
Sht. 2 of 3



NOTES

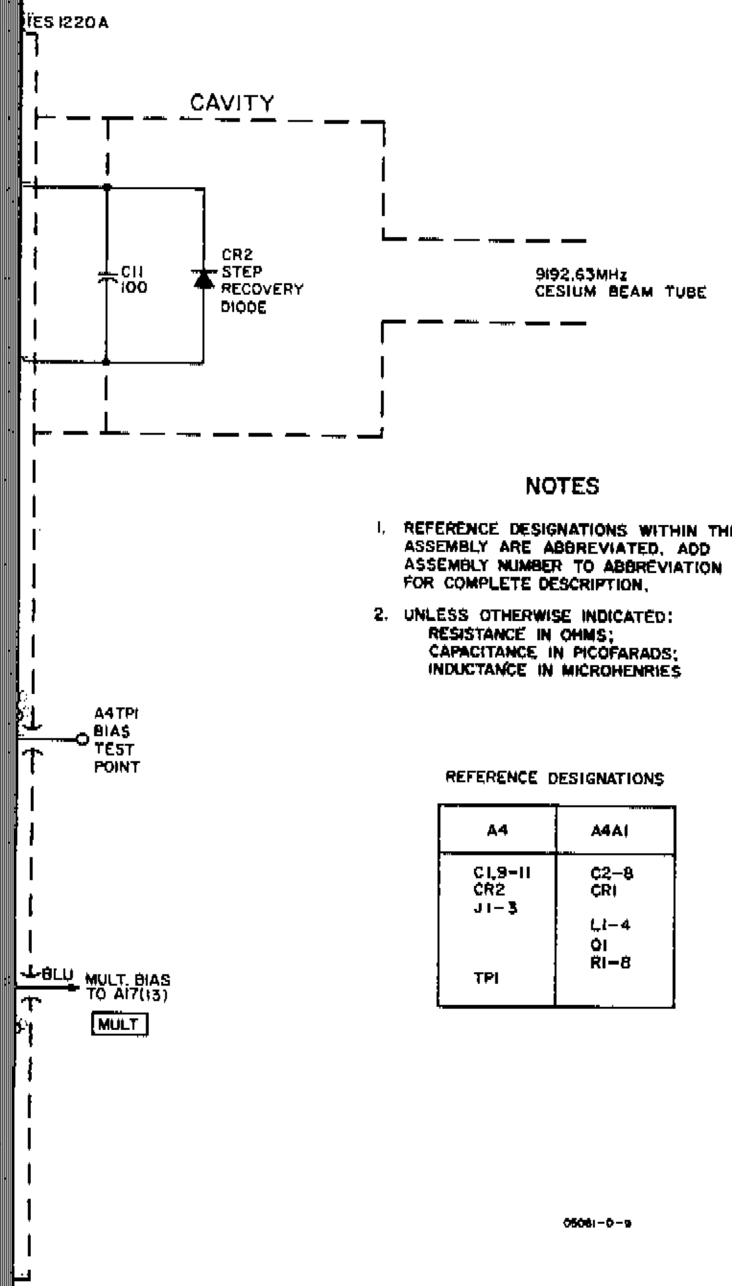
1. REFERENCE DESIGNATIONS ASSEMBLY ARE ABBREVIA ASSEMBLY NUMBER TO AB FOR COMPLETE DESCRIPT
2. UNLESS OTHERWISE INDIC RESISTANCE IN OHMS; CAPACITANCE IN PICOF INDUCTANCE IN MICROH

REFERENCE DESIGNAT

A4	A4/
C1,9-11 CR2 J1-3 TP1	C2/ CR L1- Q1 R1-

05061-

Fig. 8-12
Sht. 3 of 3



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES

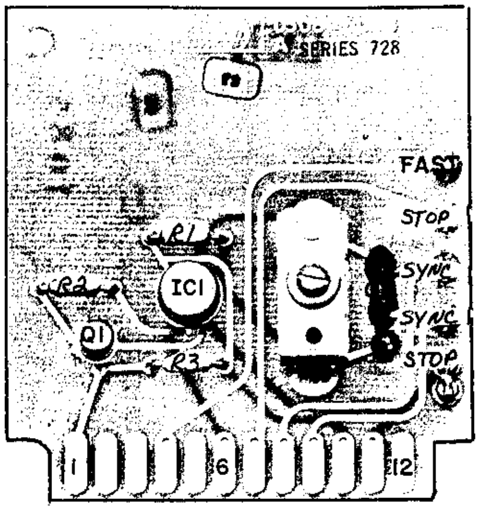
REFERENCE DESIGNATIONS

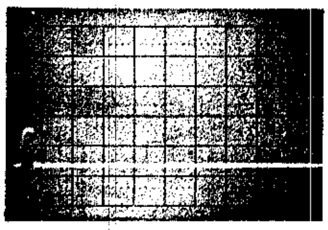
A4	A4A1
C1,9-11 CR2 J1-3 TP1	C2-8 CR1 L1-4 Q1 R1-8

05081-0-9

Figure 8-12. Harmonic Generator Assembly A4

Fig. 8-13
Sht. 1 of 5





15 2V/cm, .5 μs/cm

Oscilloscope: DC coupled

5061A: Divider running, TIME DELAY set to 000000.

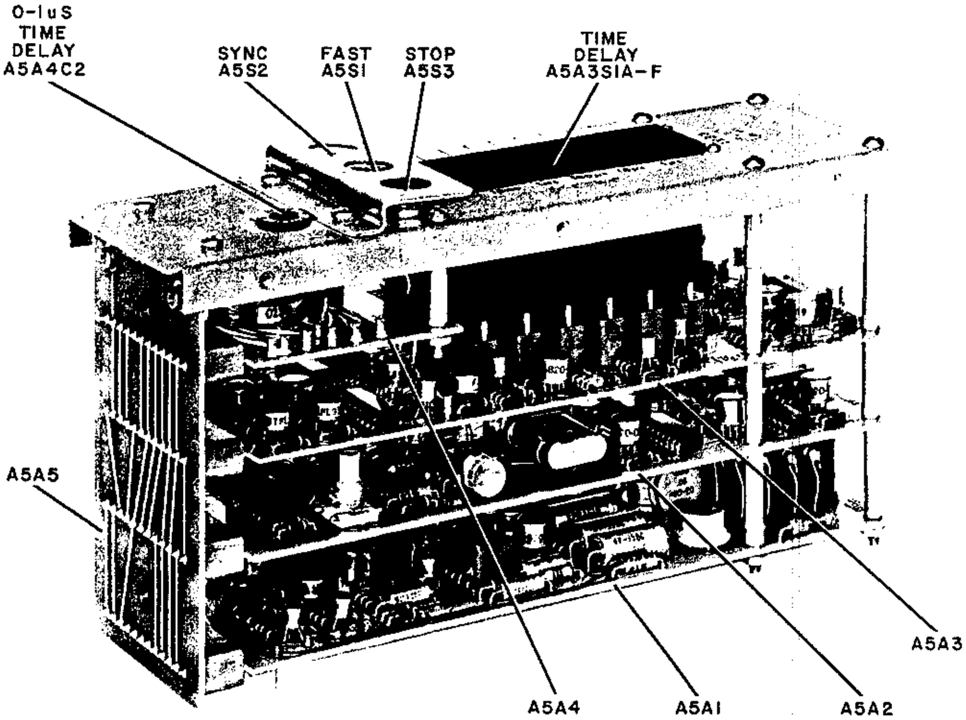
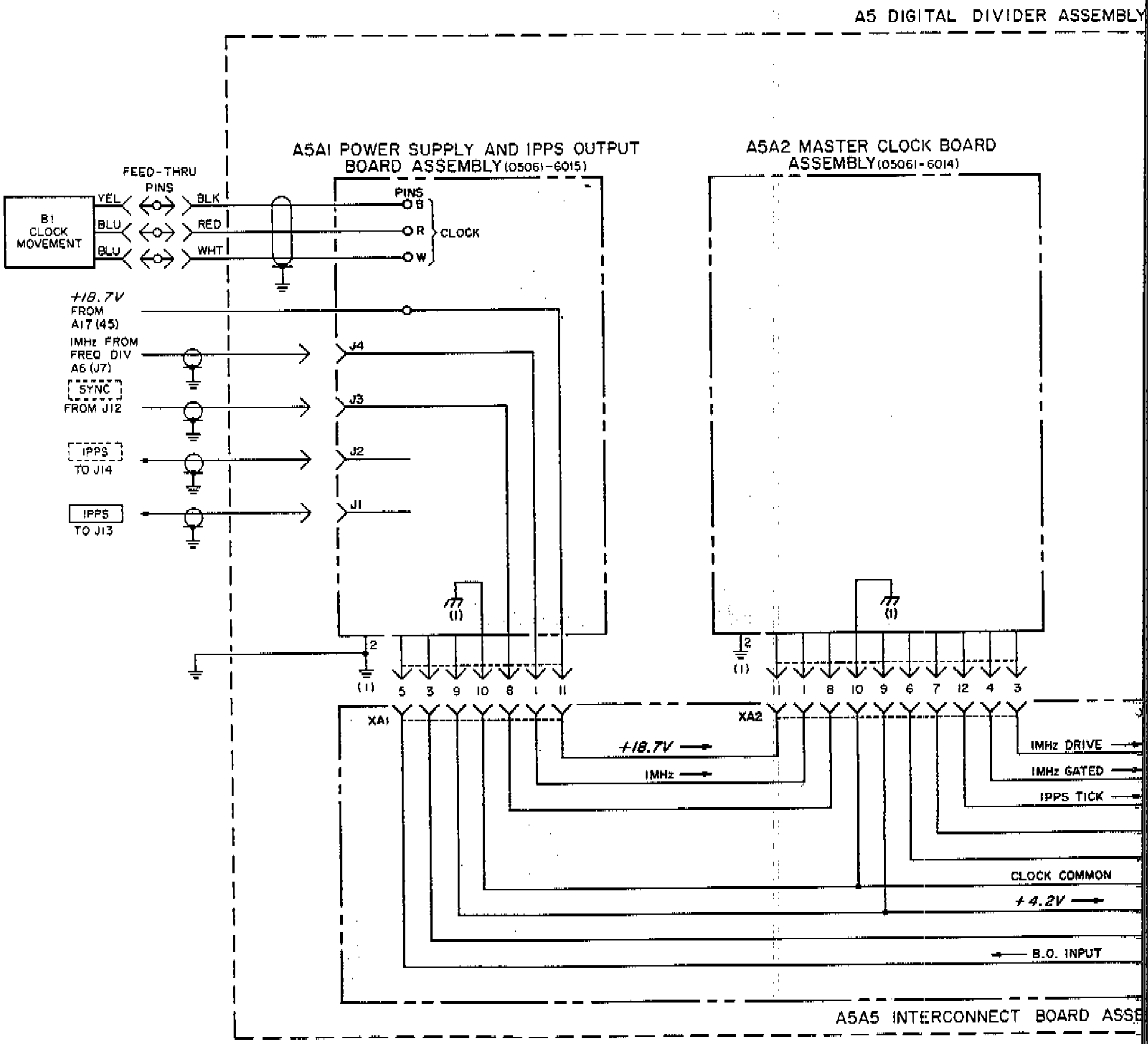


Fig. 8-13
Sht 2 of 5



NOTES

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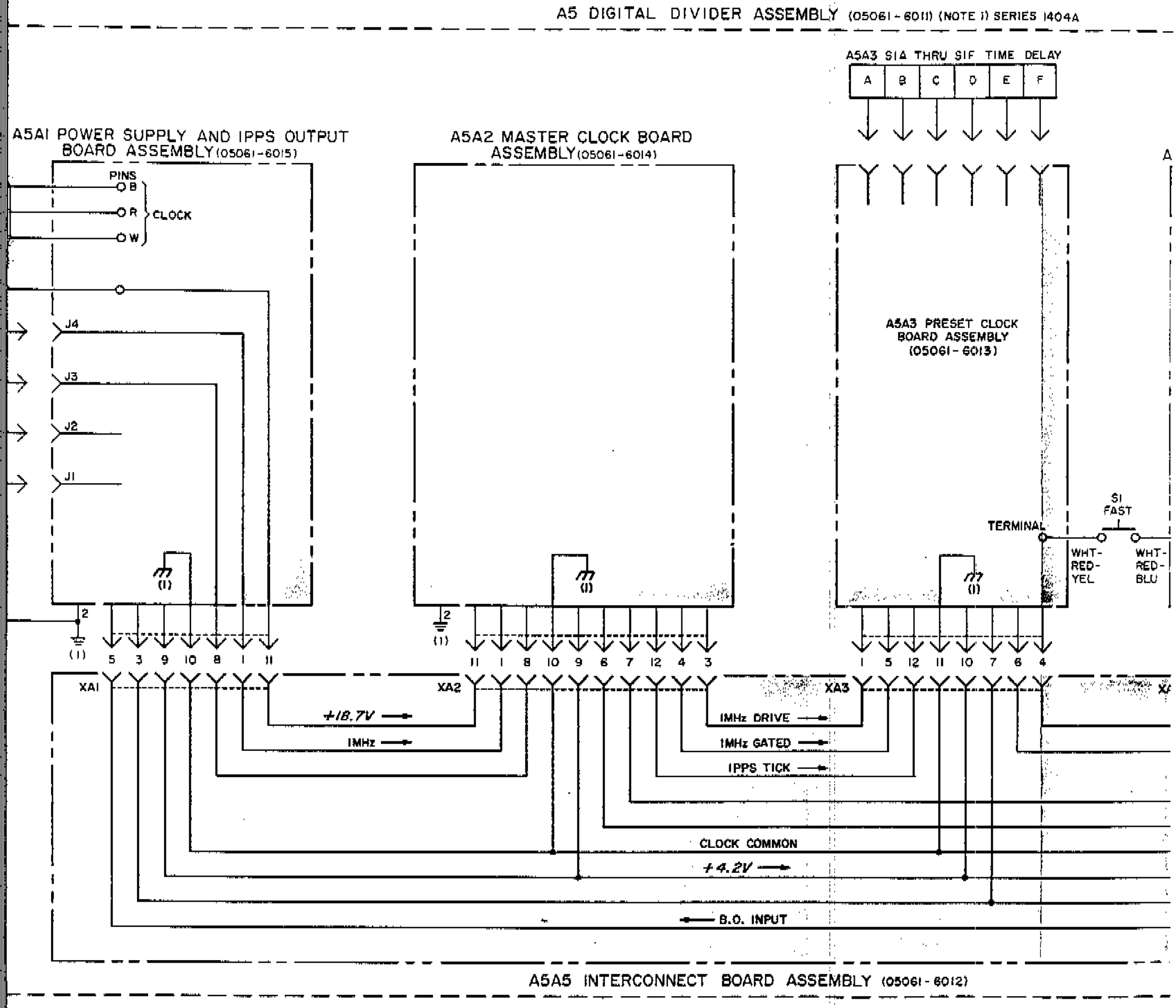
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

Fig. 8-13
Sht 3 of 5



NOTES

REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

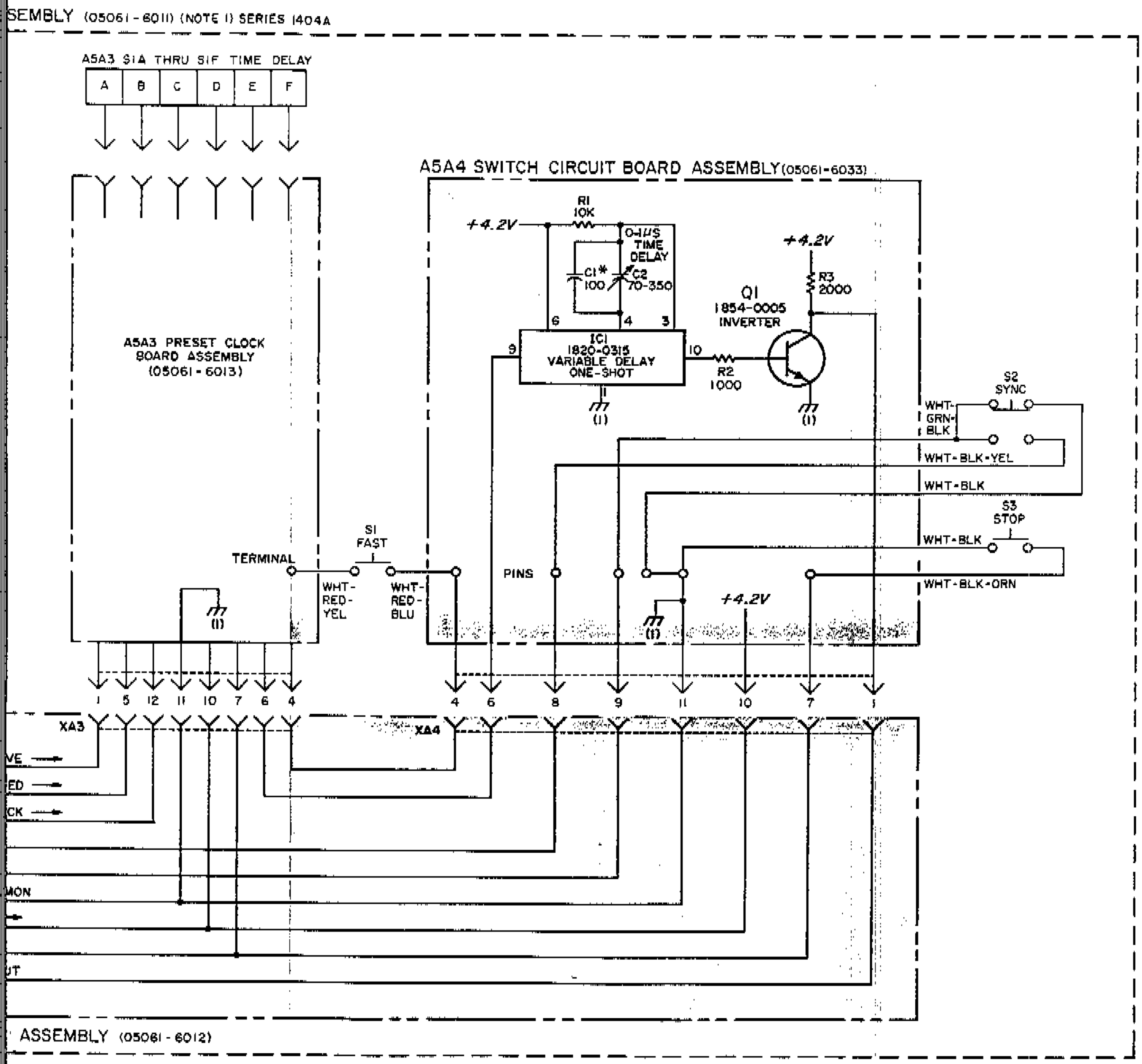
UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS;
CAPACITANCE IN PICOFARADS;

ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

NO PREFIX	A5A4
B1 S1-3	C1, 2 IC1 Q1 R1-3

Fig. 8-13
Sht. 4 of 5

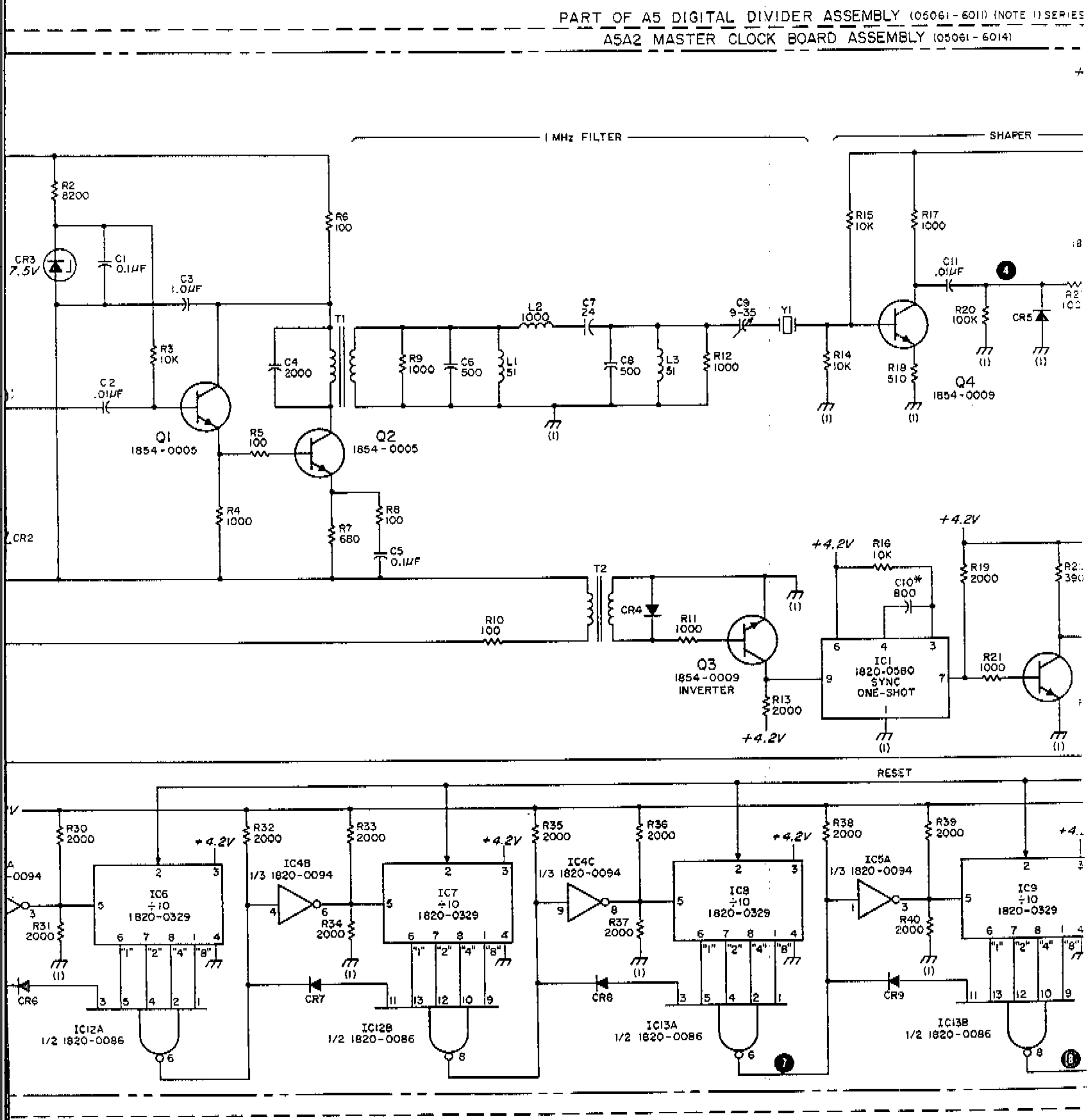


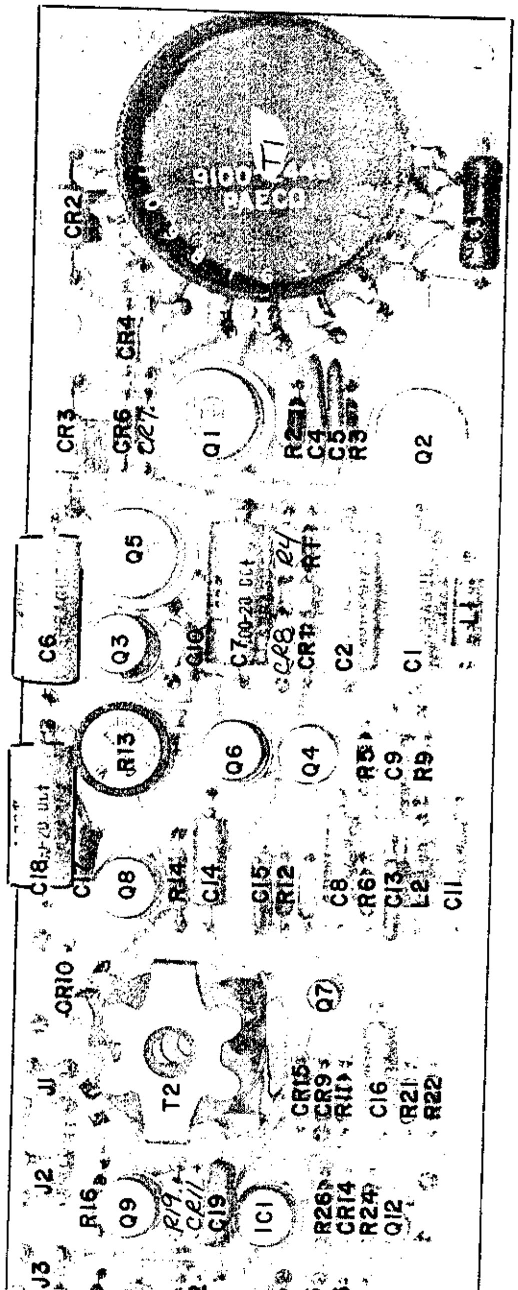
REFERENCE DESIGNATIONS

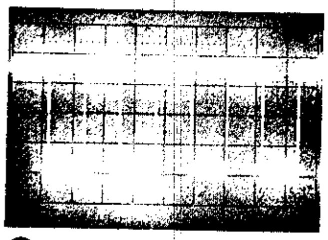
NO PREFIX	A5A4
B1 S1-3	C1, 2 IC1 Q1 R1-3

Figure 8-13. Digital Divider Assembly A5 (Option 01)
Switch Circuit Board Assembly A5A4
Interconnection Board A5A5

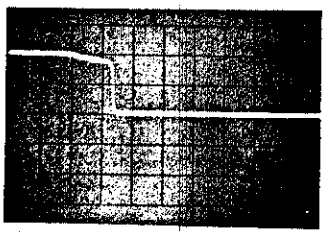
Fig. 8-15
Sht. 3 of 5



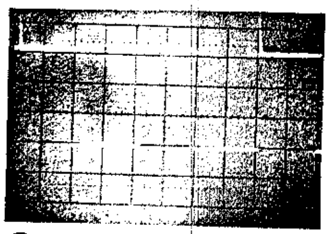




❶ 10V/cm, .2 ms/cm



❷ 5V/cm, 10 μs/cm
use 50Ω Feedthru

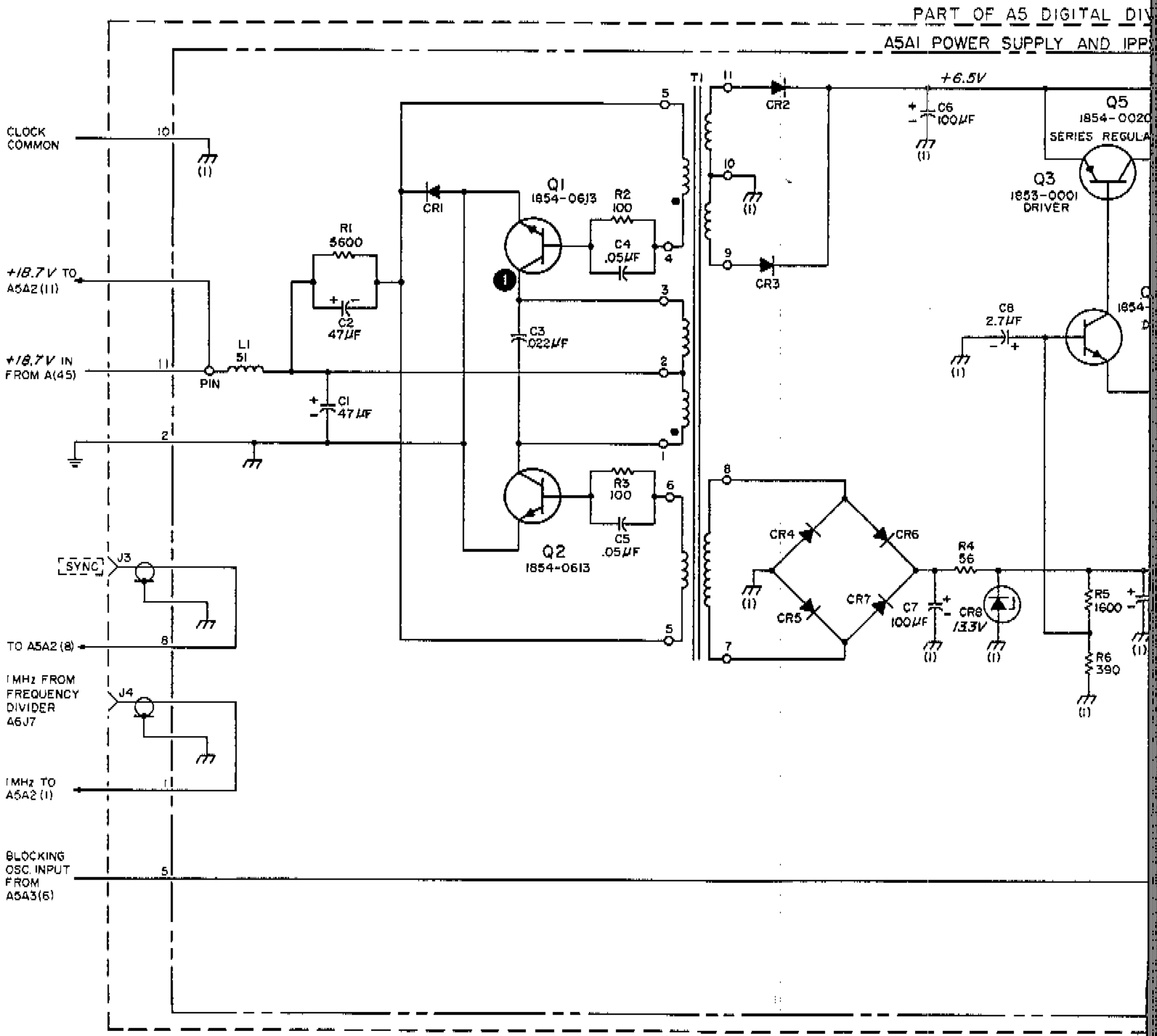


❸ 2V/cm, .5 sec/cm

Oscilloscope: DC coupled

5061A: Divider running, TIME DELAY set to 000000.

Fig. 8-14
Sht. 2 of 5



NOTES

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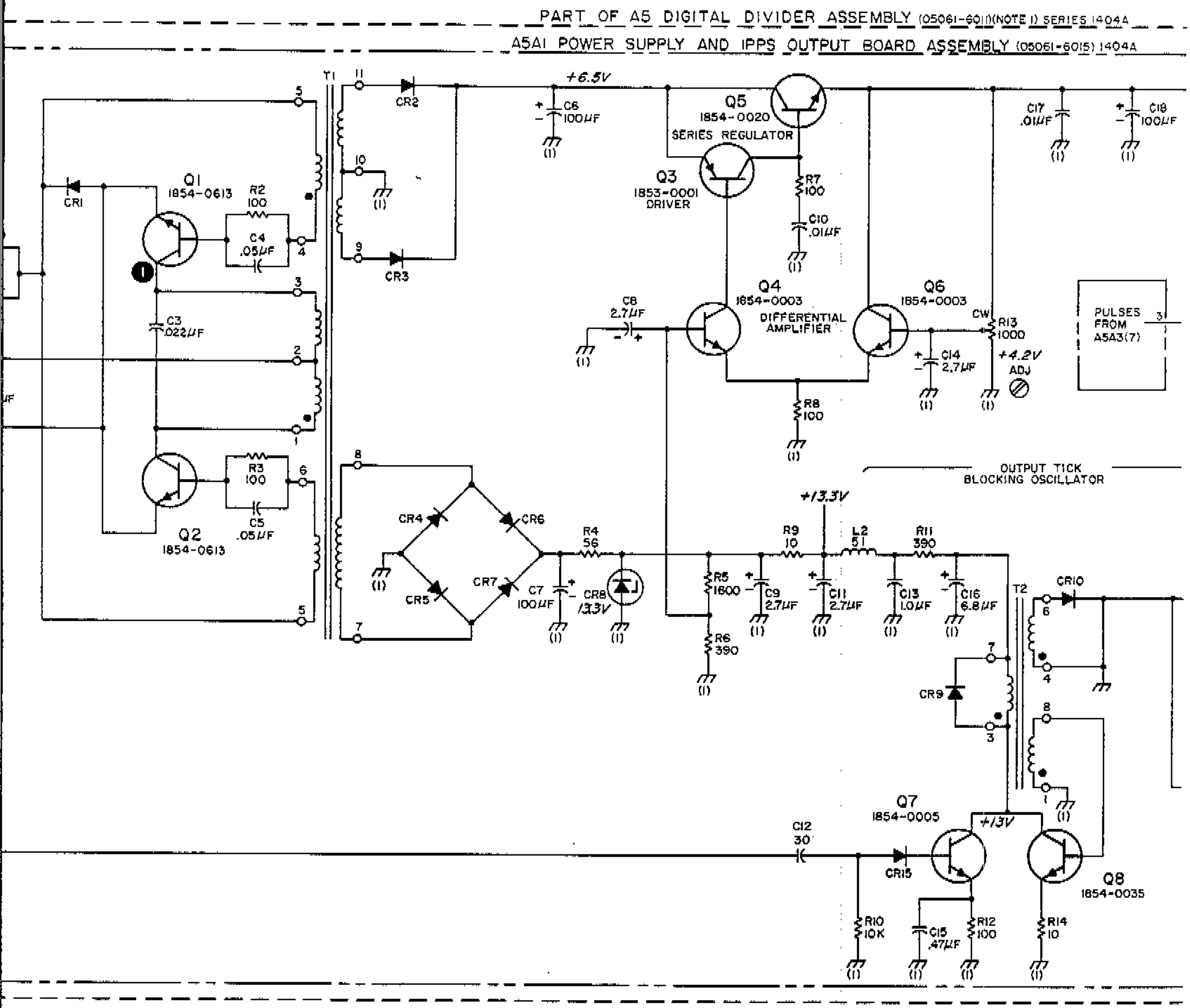
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

Fig. 8-14
Sht. 3 of 5



WITHIN THIS
TED. ADD
BREVIATION
ON.

ATED:

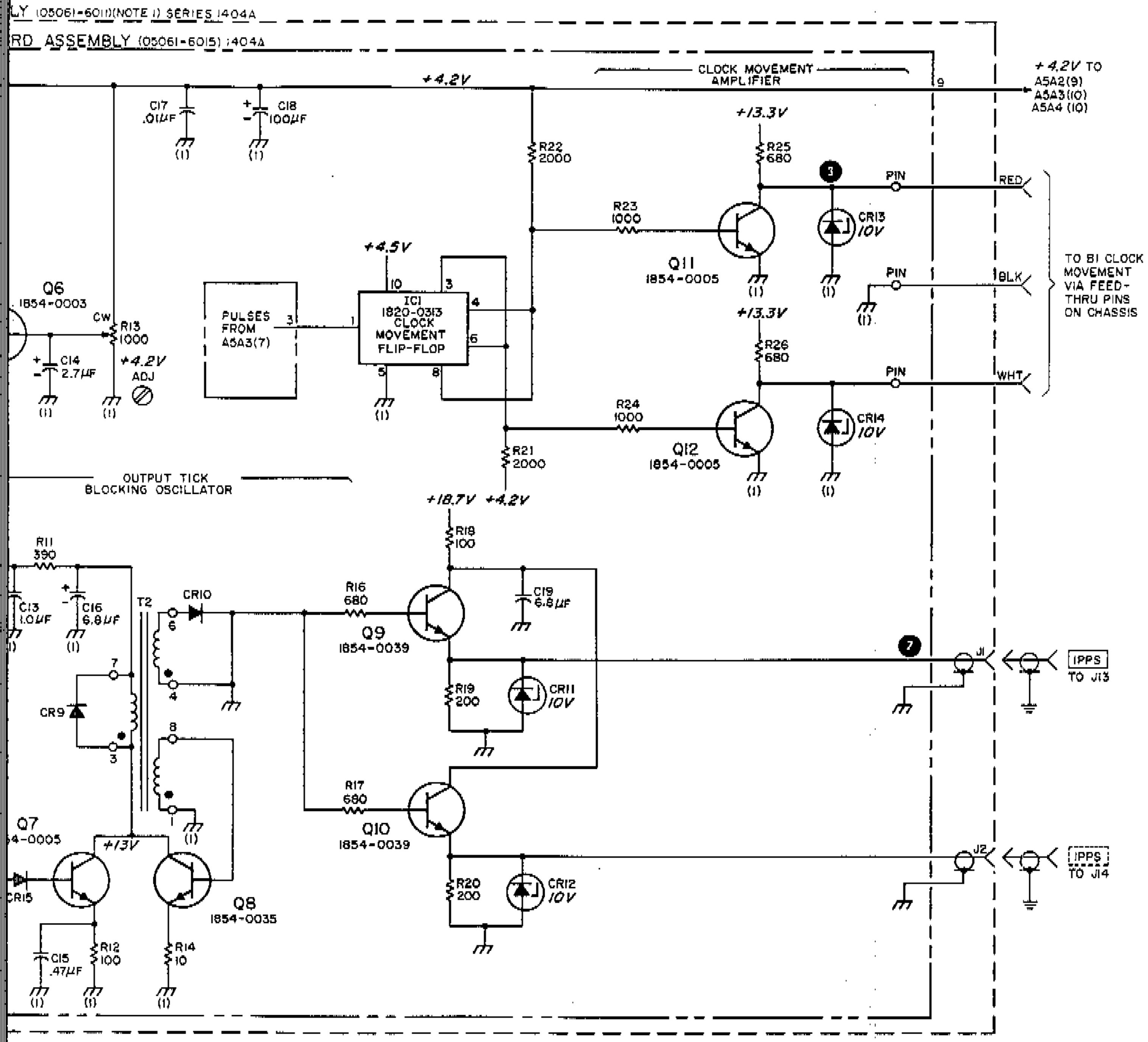
ARADS;
ENRIES

ELECTED
UES SHOWN

REFERENCE DESIGNATIONS

A5	A5A1
J1-4	C1-19 CR1-15 IC1 L1,2 Q1-12 R1-26 T1,2

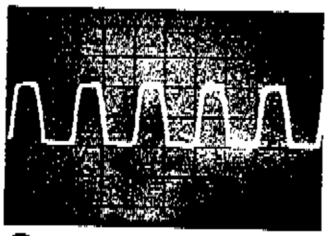
Fig 8-14
Sht 4 of 5



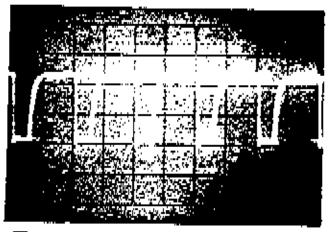
REFERENCE DESIGNATIONS

A5	A5A1
J1 - 4	C1 - 19 CR1 - 15 IC1 L1, 2 Q1 - 12 R1 - 26 T1, 2

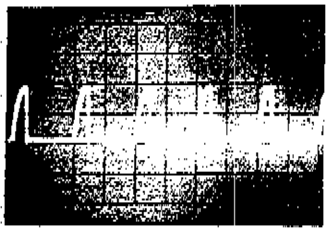
Figure 8-14. Digital Divider Assembly A5 (Option 01) Power Supply and 1 PPS Output Board Assembly A5A1



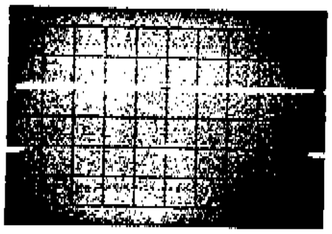
4 1V/cm, .5 μs/cm



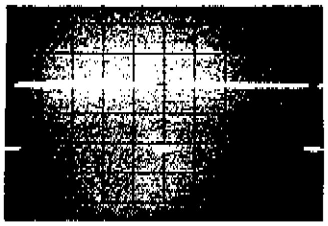
5 2V/cm, .5 μs/cm



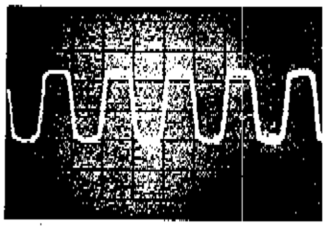
6 2V/cm, .5 μs/cm



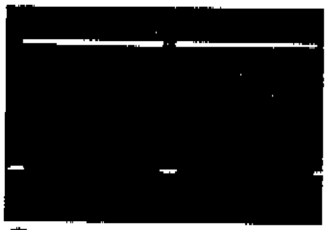
7 2V/cm, .2 ms/cm



8 2V/cm, 2 ms/cm



9 .5V/cm, .5 μs/cm

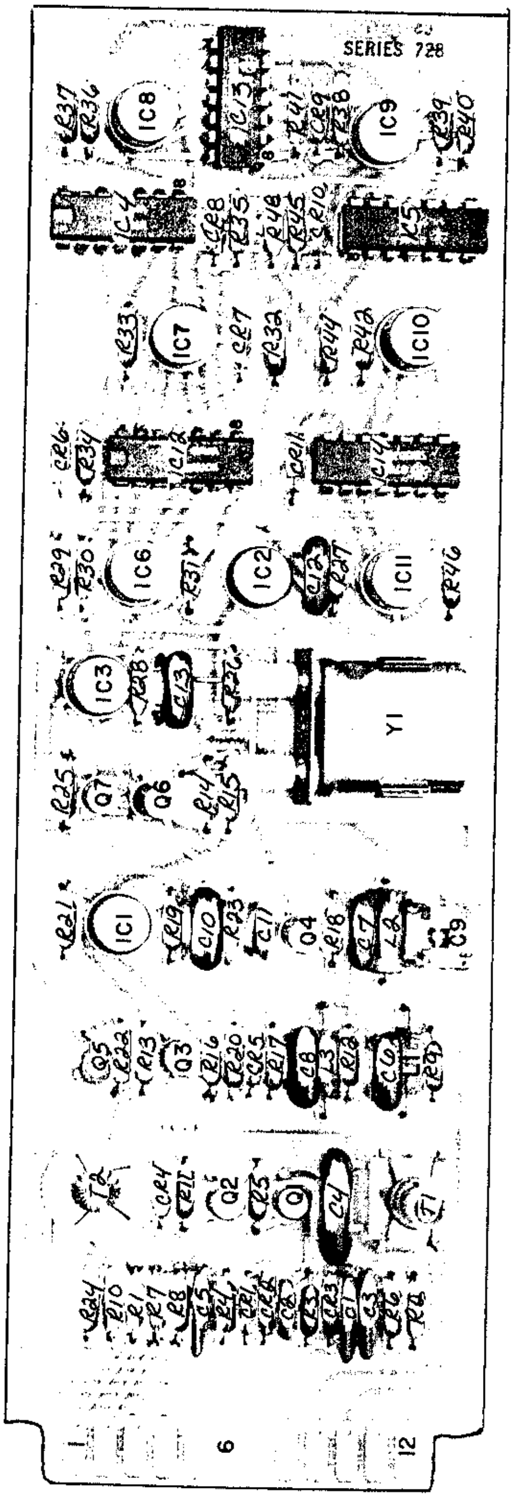


19 1V/cm, .2 sec/cm

Oscilloscope: DC coupled

5061A: Divider running
TIME DELAY thumbwheel switch set to 000000.

Fig. 8-15
Sht. 1 of 5



NOTES

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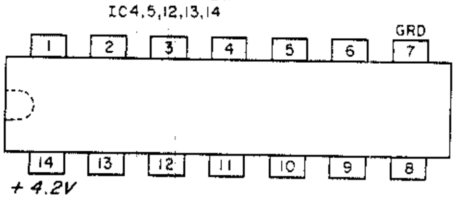
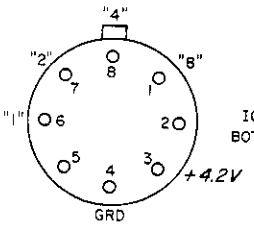
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A5	A5A2
S2	C1-13 CR1-11 IC1-14 L1-3 Q1-7 R1-46 T1,2 Y1

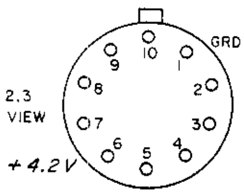
BOTTOM VIEW
IC4,5,12,13,14





IC6, 7, 8, 9, 10, 11
BOTTOM VIEW

IC1, 2, 3
BOTTOM VIEW



05061-D-12

Fig. 8-15
Sht. 2 of 5

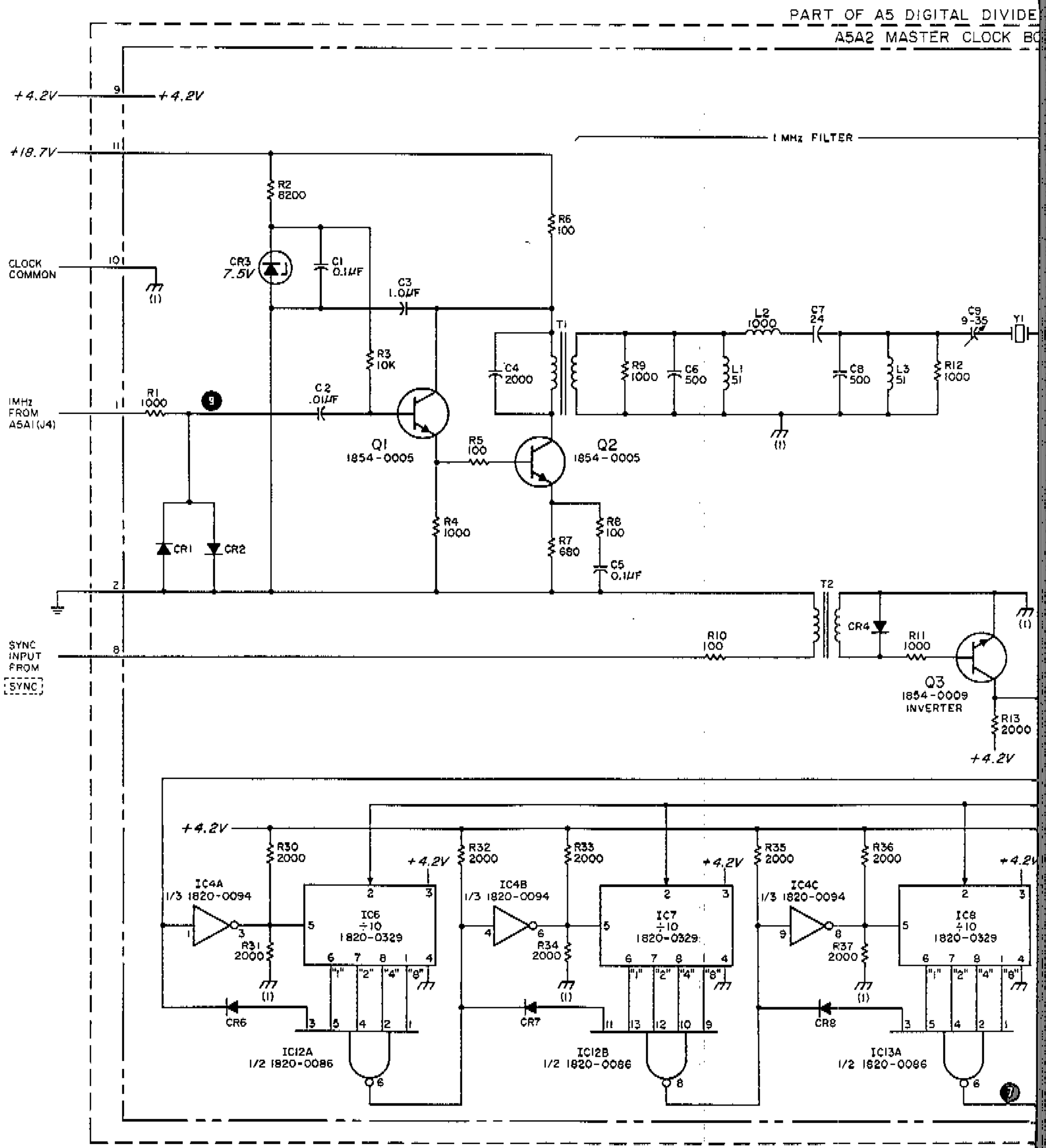


Fig. 8-15
Sht. 3 of 5

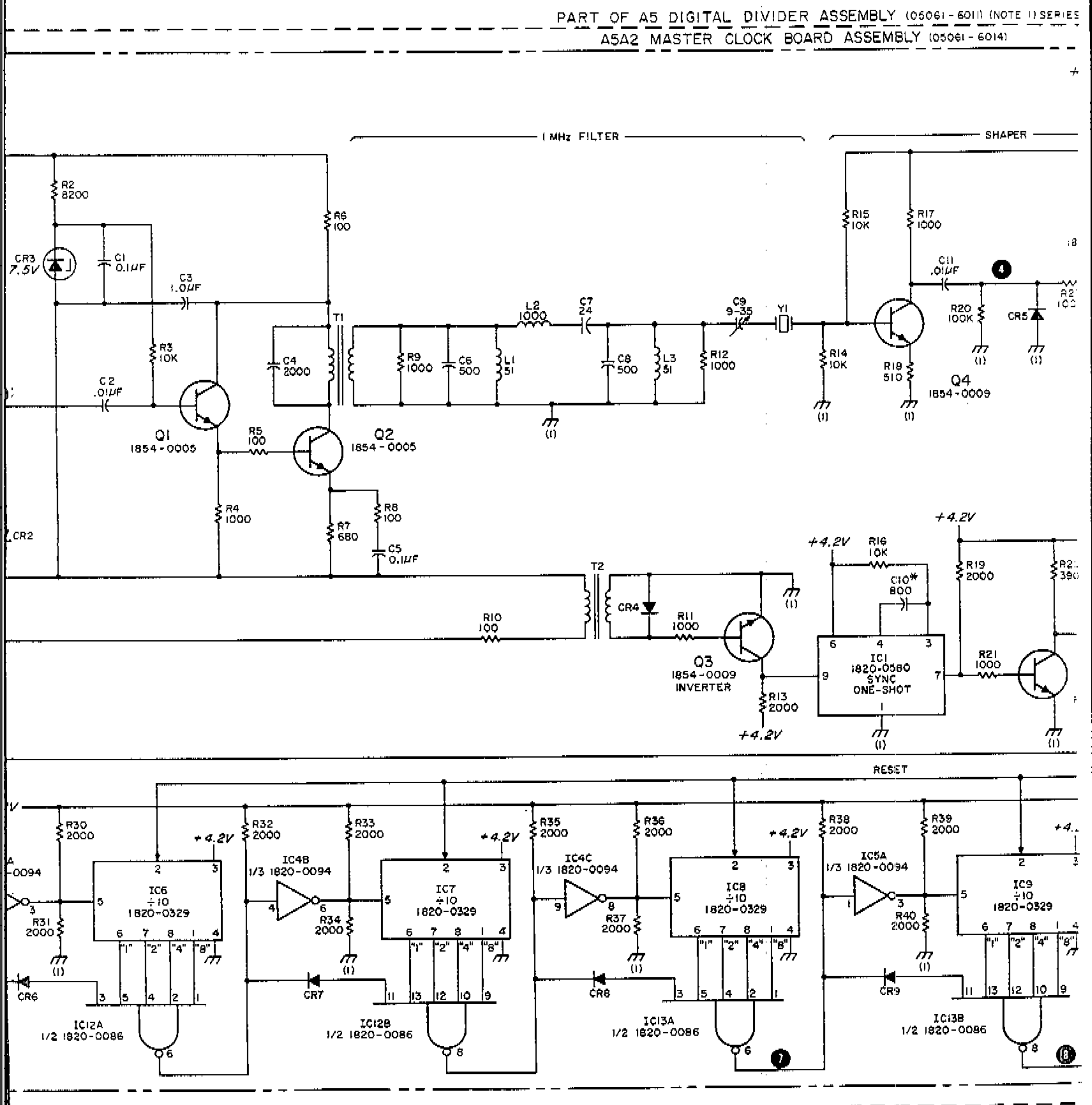


Fig. 8-15
Sht 4 of 5

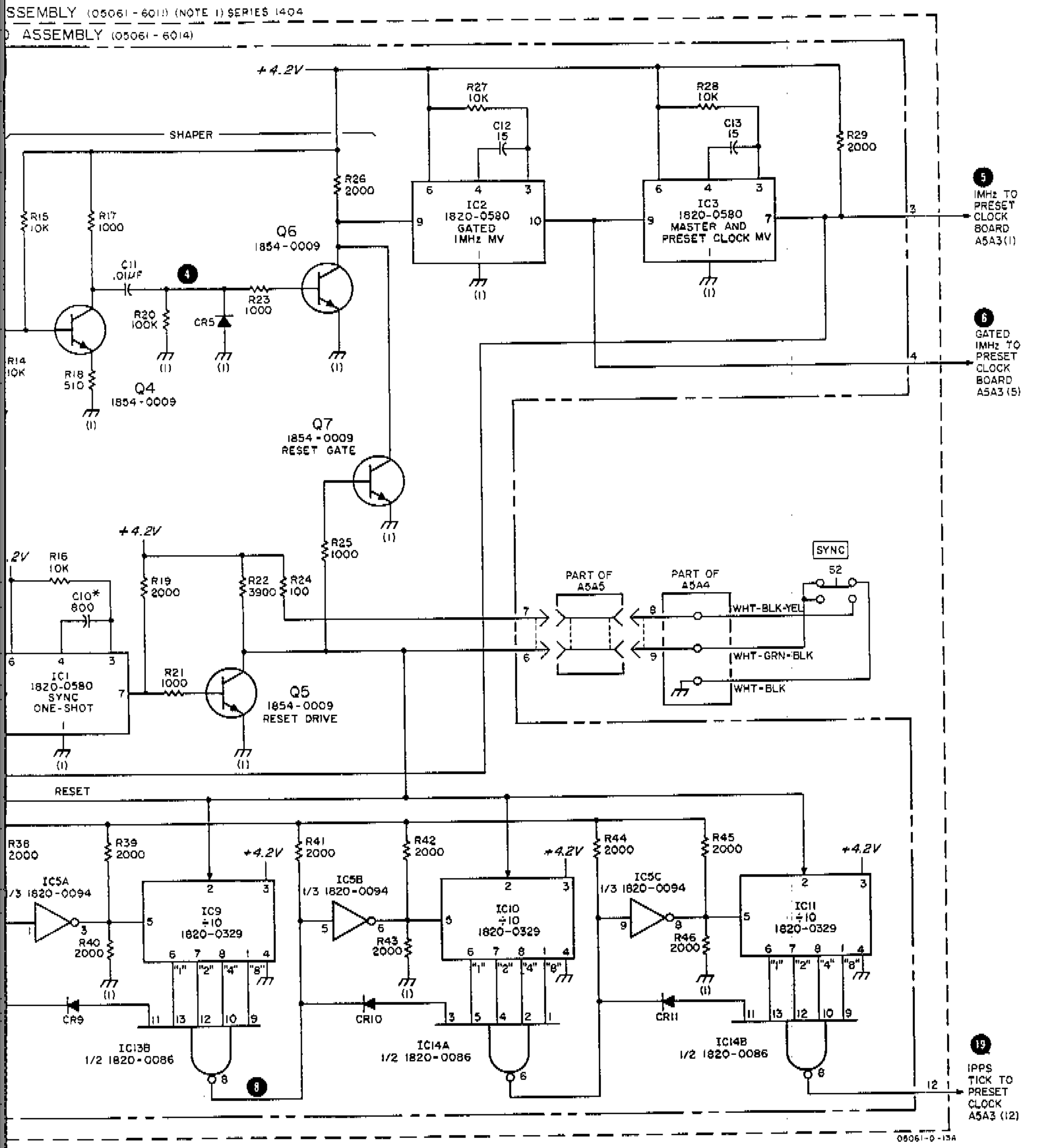
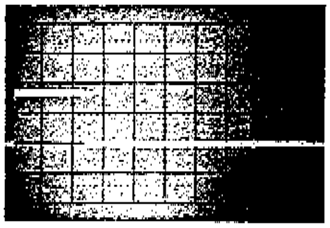
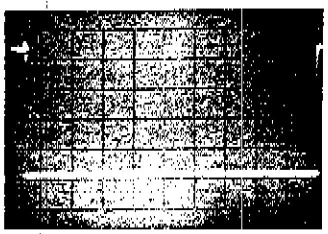


Figure 8-15. Digital Divider Assembly A5 (Option 01)
Master Clock Board Assembly A5A2

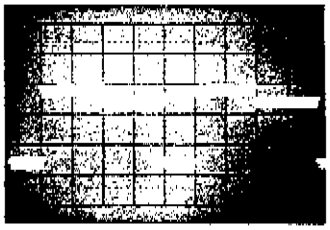
10 1V/cm, .2 μs/cm



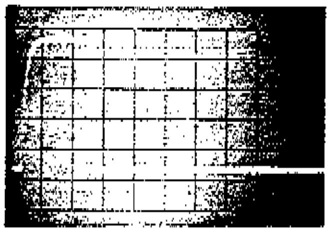
11 1V/cm, .5 μs/cm



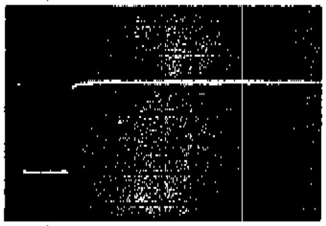
12 1V/cm, 20 μs/cm



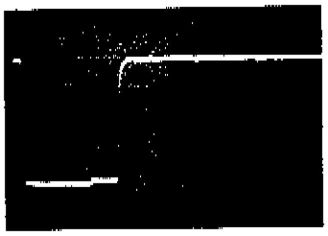
13 .5V/cm, .2 ms/cm



14 1V/cm, .5 μs/cm



16 1V/cm, .5 μs/cm



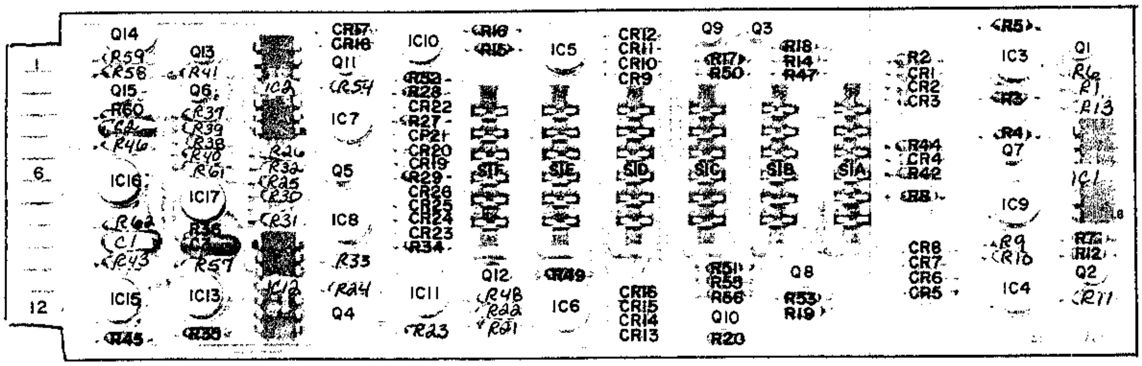
17 1V/cm, .5 μs/cm

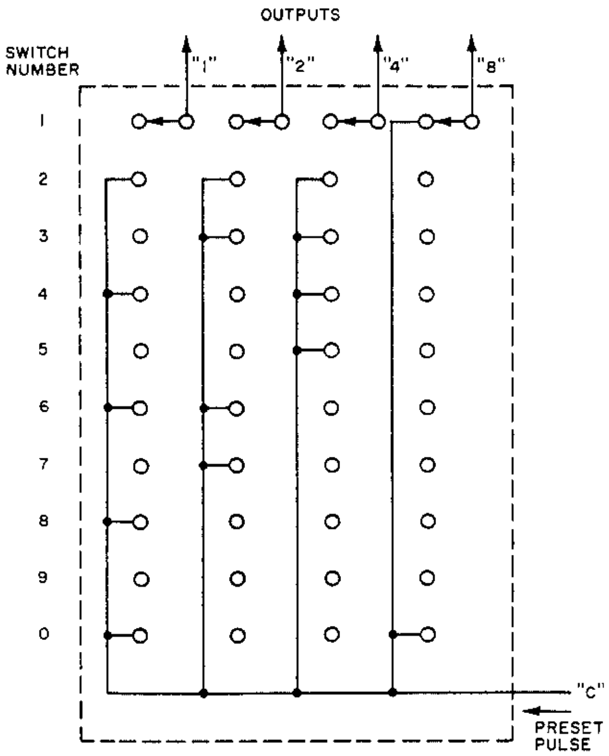
18 1V/cm, .2 sec/cm

Oscilloscope: DC coupled

5061A: Divider running, TIME DELAY set to 000000.

Fig. 8-16
Sht. 1 of 4





A5A3S1
TYPICAL SECTION

NOTES

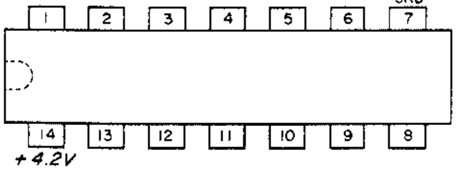
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS

REFERENCE DESIGNATIONS

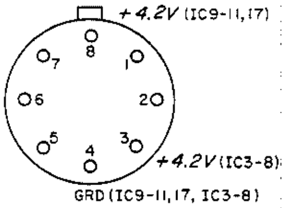
A5A3
C1-3 CR1-26 IC1-17 Q1-15 R1-62 S1

NOT ASSIGNED:
IC14

BOTTOM VIEW
IC 1, 2, 12



BOTTOM VIEW



BOTTOM VIEW
IC13-16

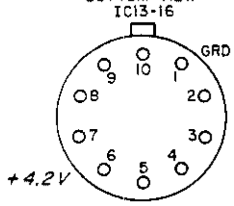


Fig. 8-16
Sht. 2 of 4

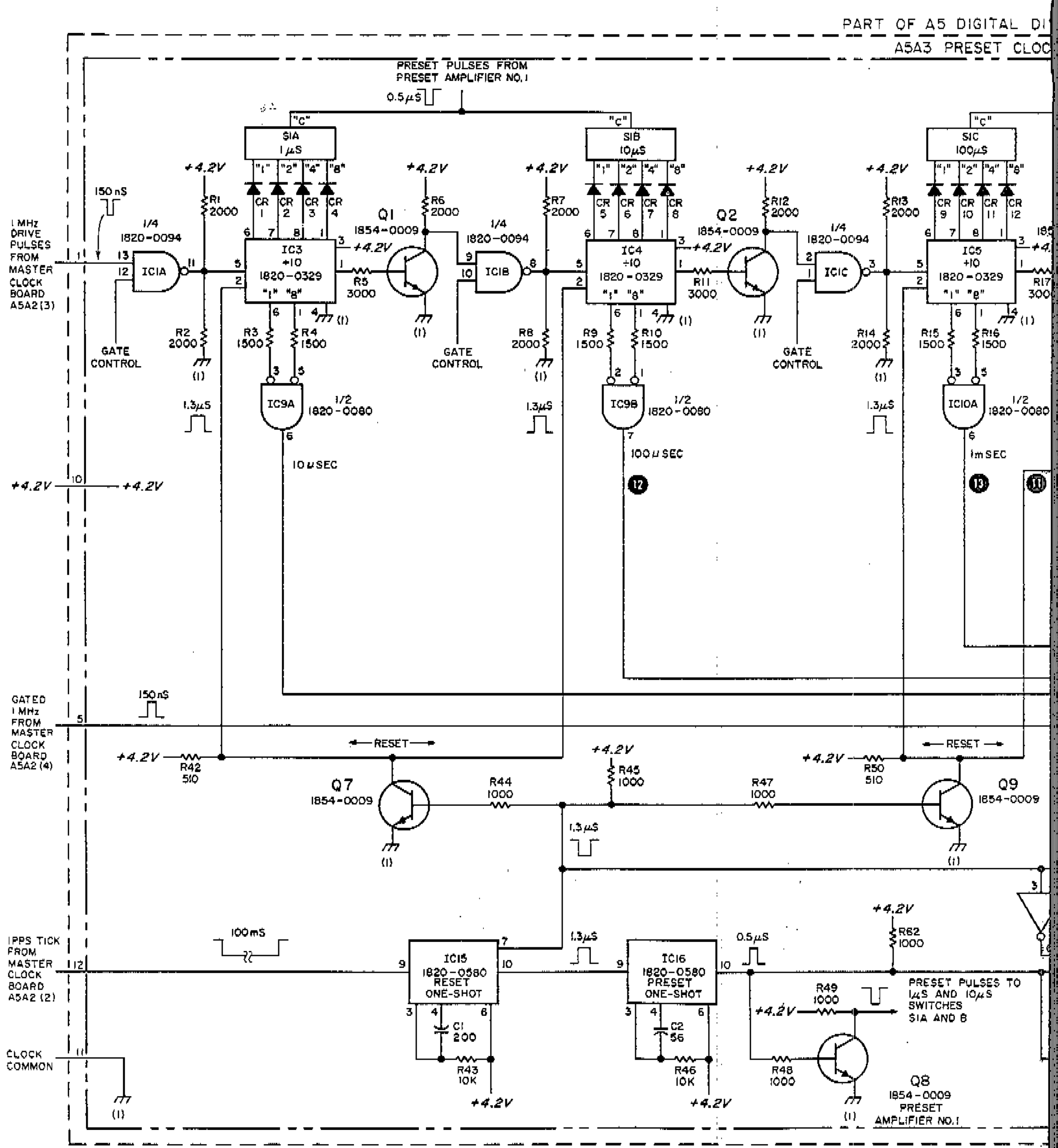


Fig. 8-16
Sht. 3 OF 4

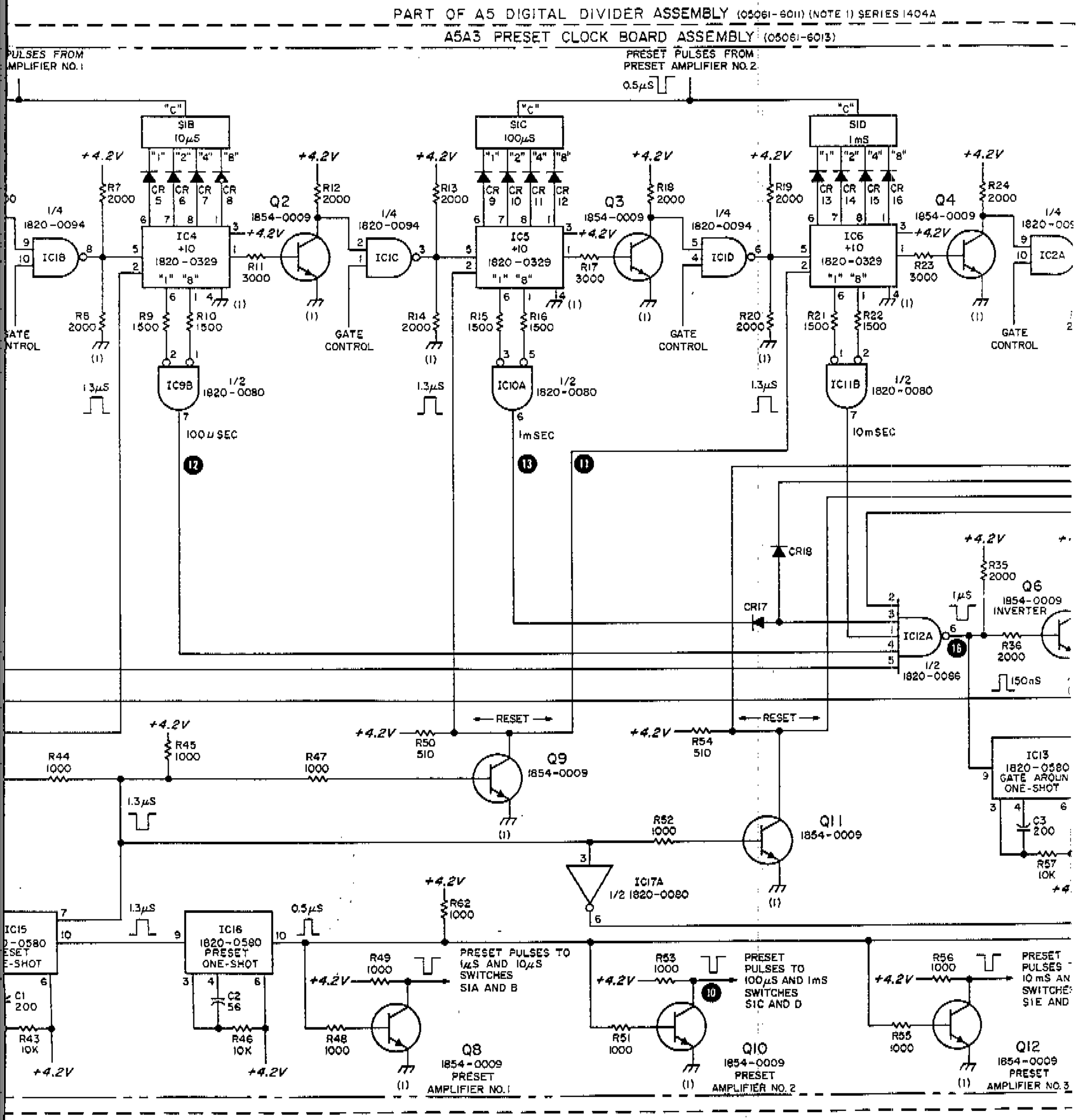


Fig. 8-16
Sht. 4 of 4

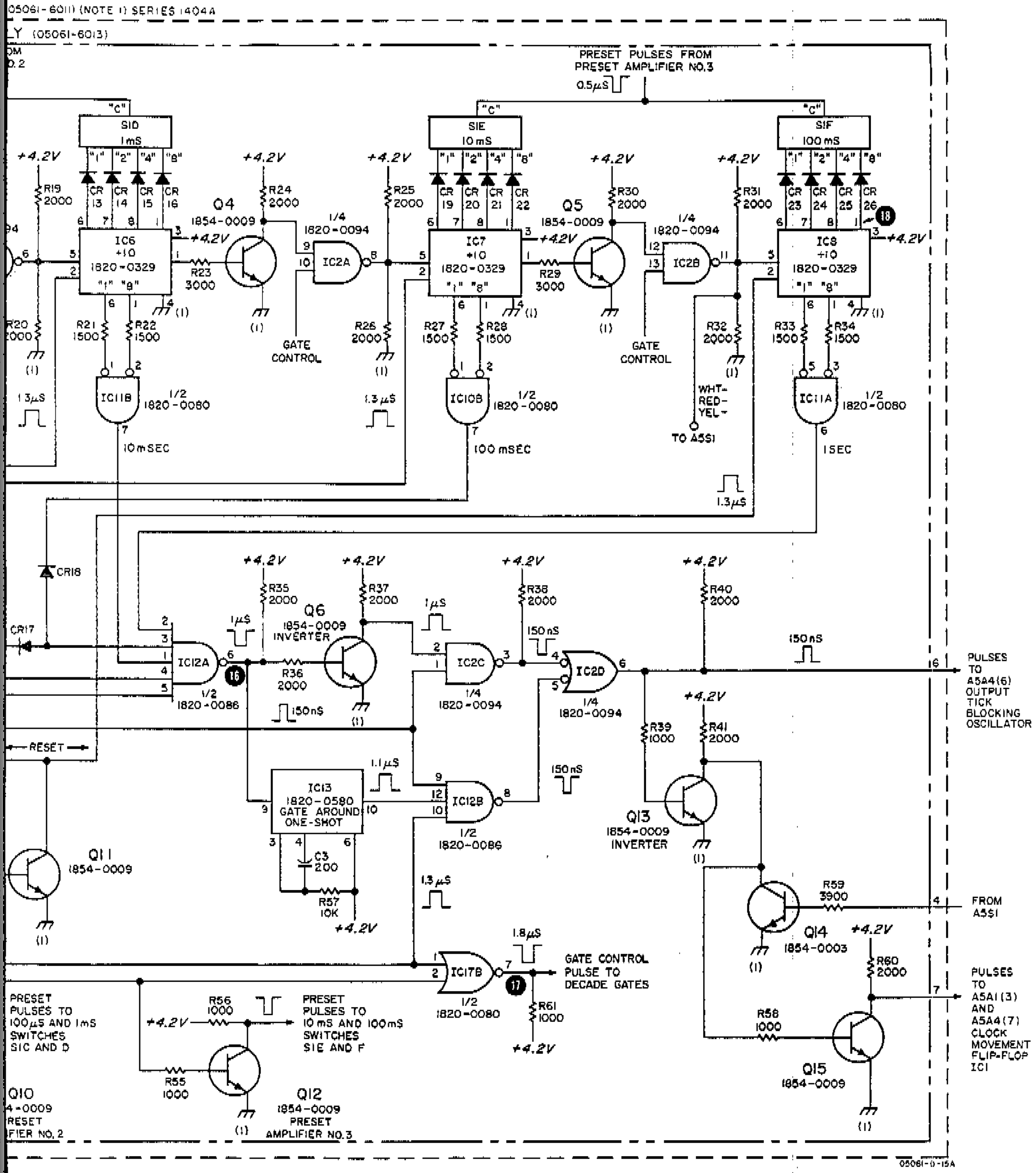
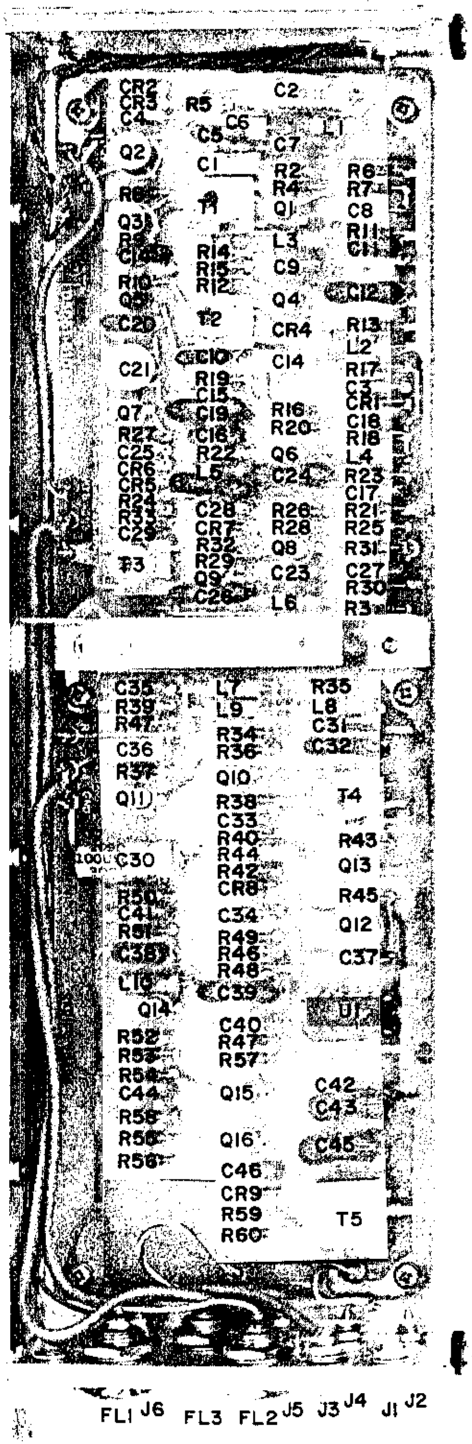
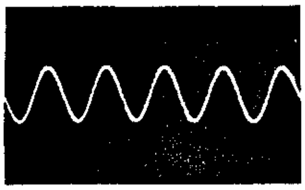


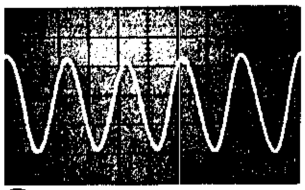
Figure 8-16. Digital Divider Assembly A5 (Option 01)
Preset Clock Board Assembly A5A3

Fig. 8-17
Sht. 1 of 3

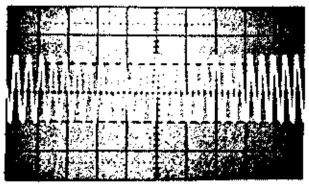




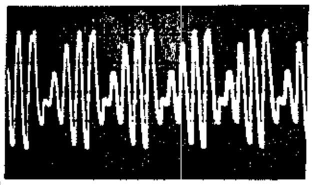
1 .1V/cm, .1 μs/cm



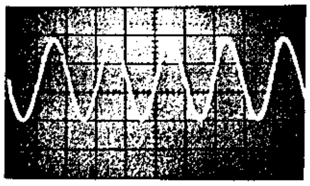
2 .1 V/cm, .1 μs/cm



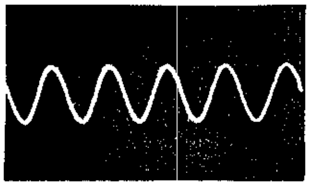
3 .5V/cm, .5 μs/cm
(DIVIDER INOPERATIVE)



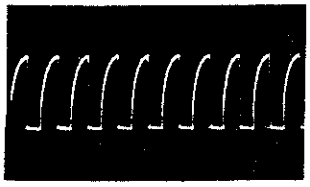
4 .5V/cm, .5 μs/cm
(DIVIDER OPERATIVE)



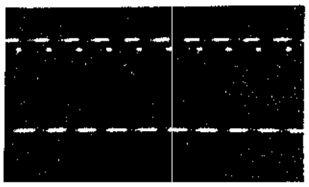
5 2V/cm, .5 μs/cm



6 2V/cm, .5 μs/cm



7 2V/cm
1 μsec/cm
dc coupled



8 1V/cm
10 μsec/cm
dc coupled

Fig. 8-17
Sht. 2 of 3

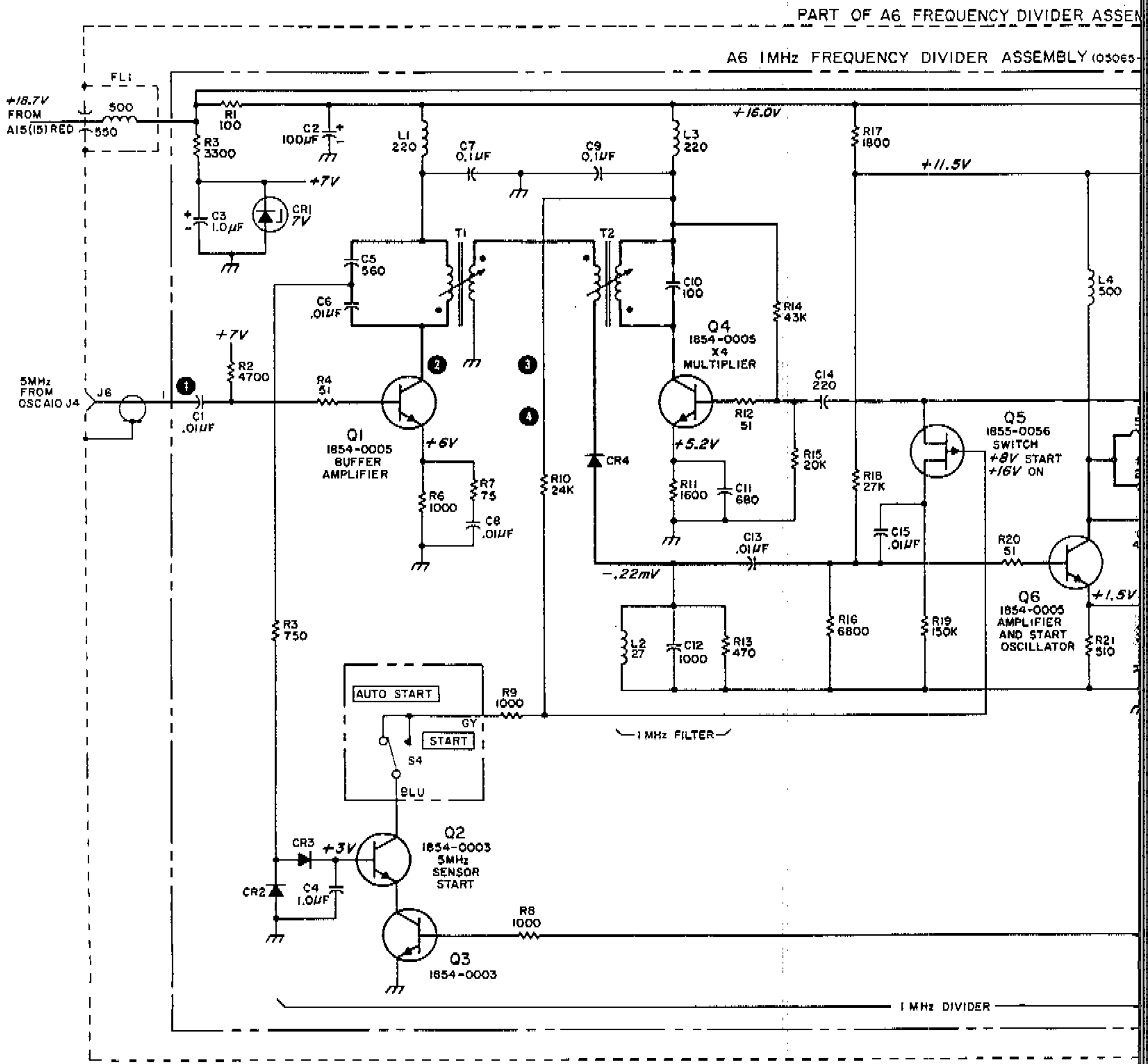


Fig. 8-17
Sht 3 of 3

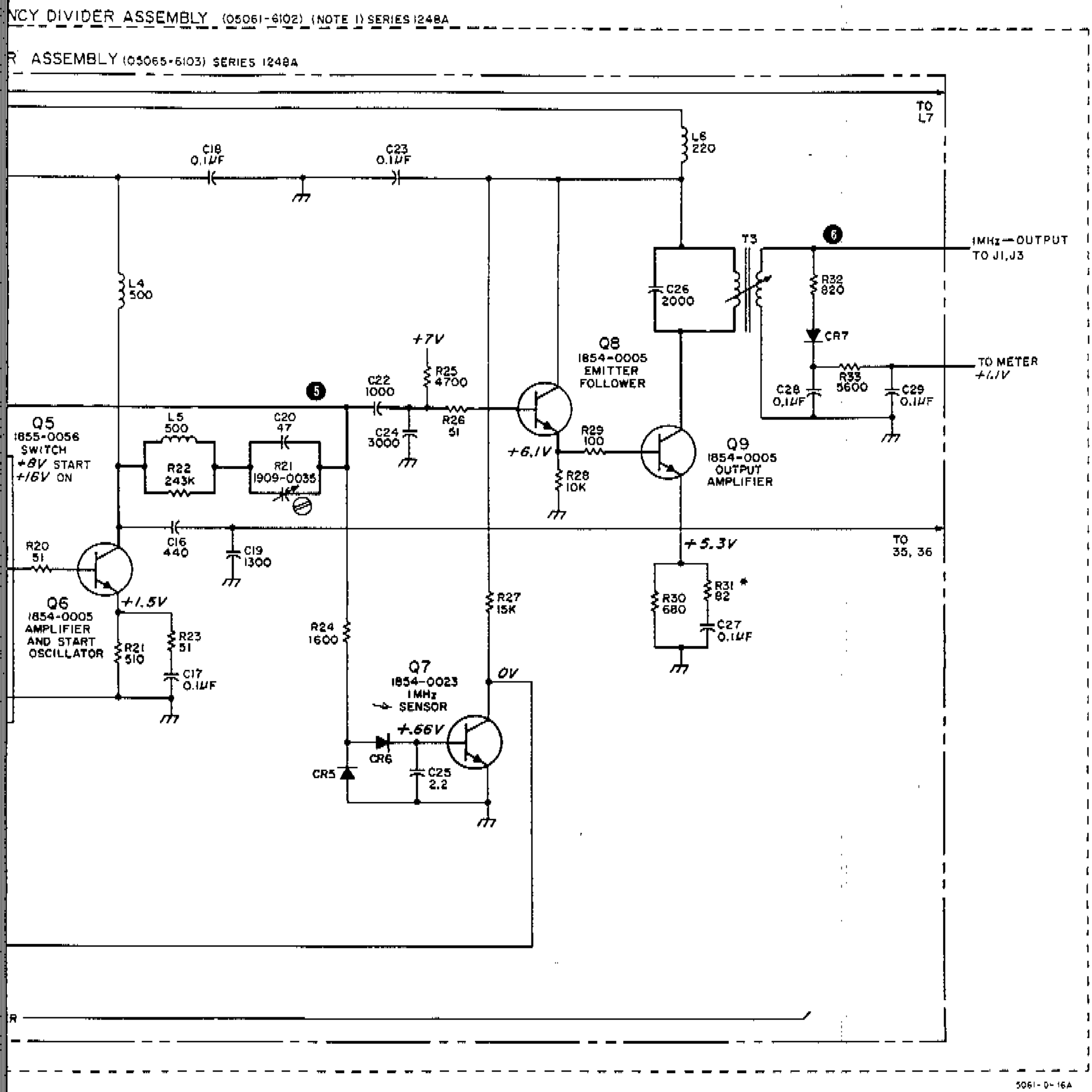


Figure 8-17. Frequency Divider Assembly A6
Frequency Divider Board Assembly A6A1
(Sheet 1 of 2)

Fig. 8-17 (a)
Sht. 1 of 2

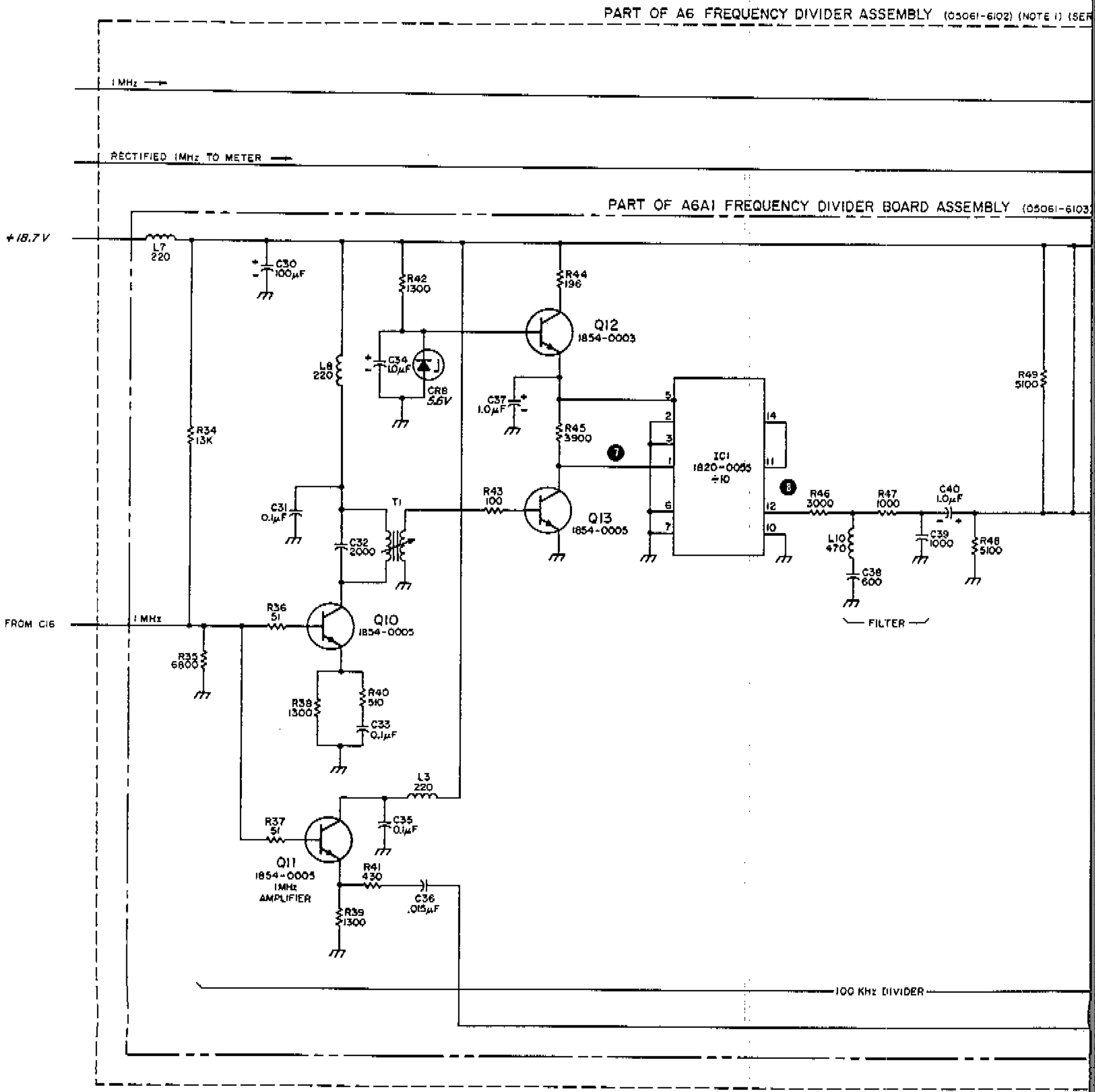


Fig. 8-17(a)
Sht. 2 of 2

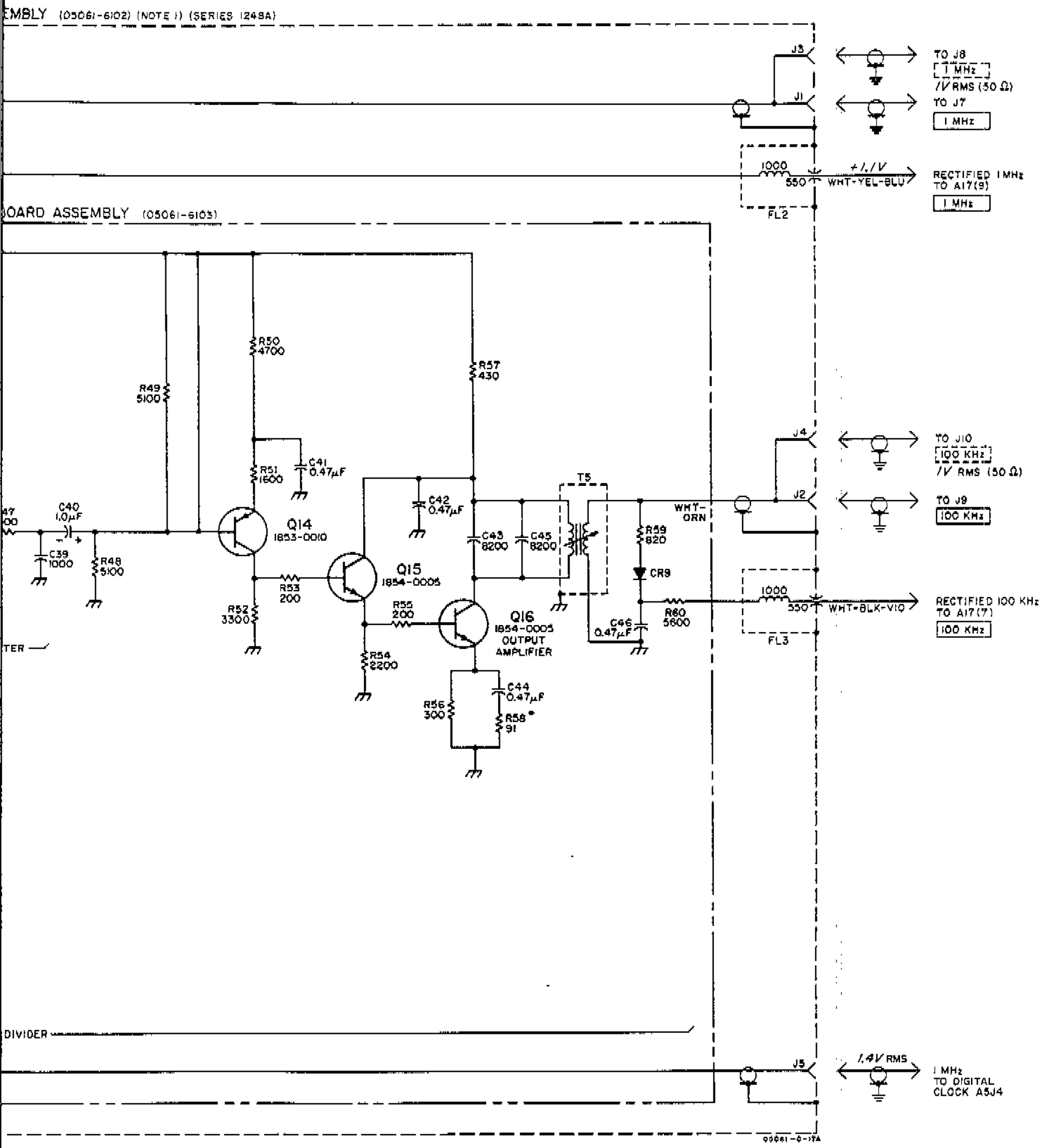


Figure 8-17. Frequency Divider Assembly A6
Frequency Divider Board Assembly A6A1
(Sheet 2 of 2)

Fig. 8-18
Sht. 1 of 4

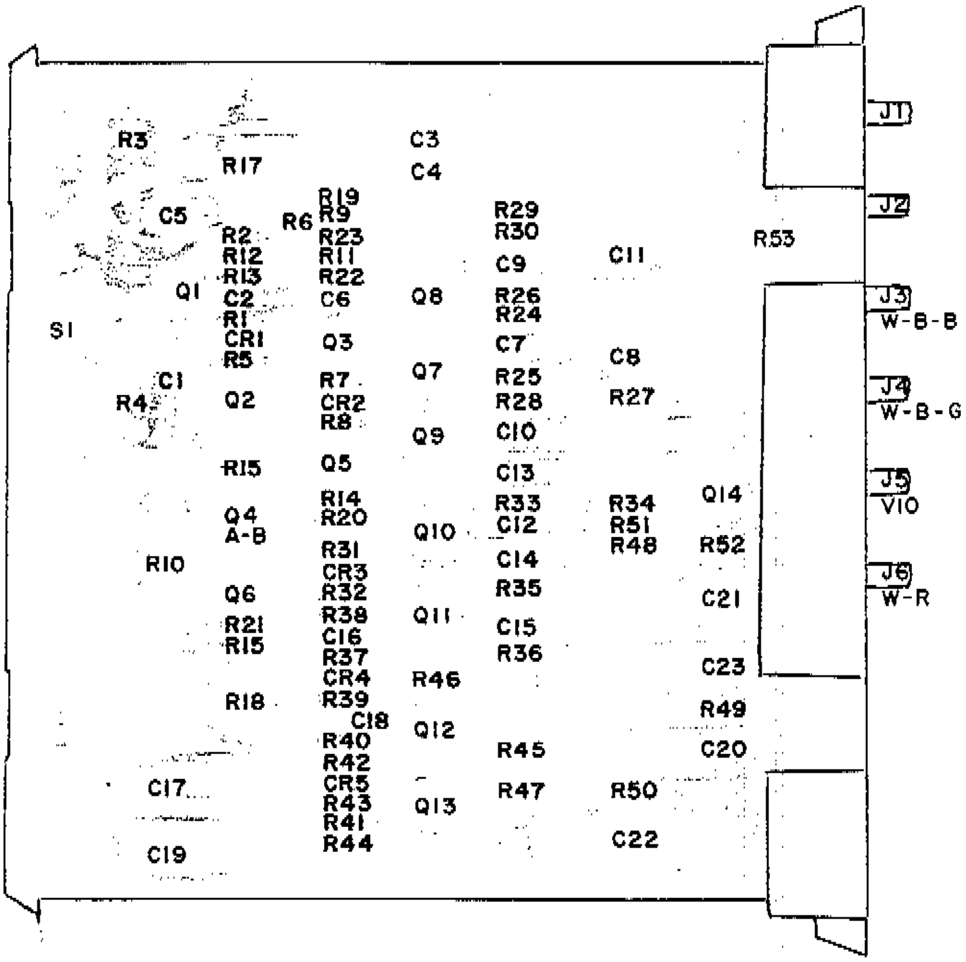


Fig. 8-18
Sht. 2 of 4

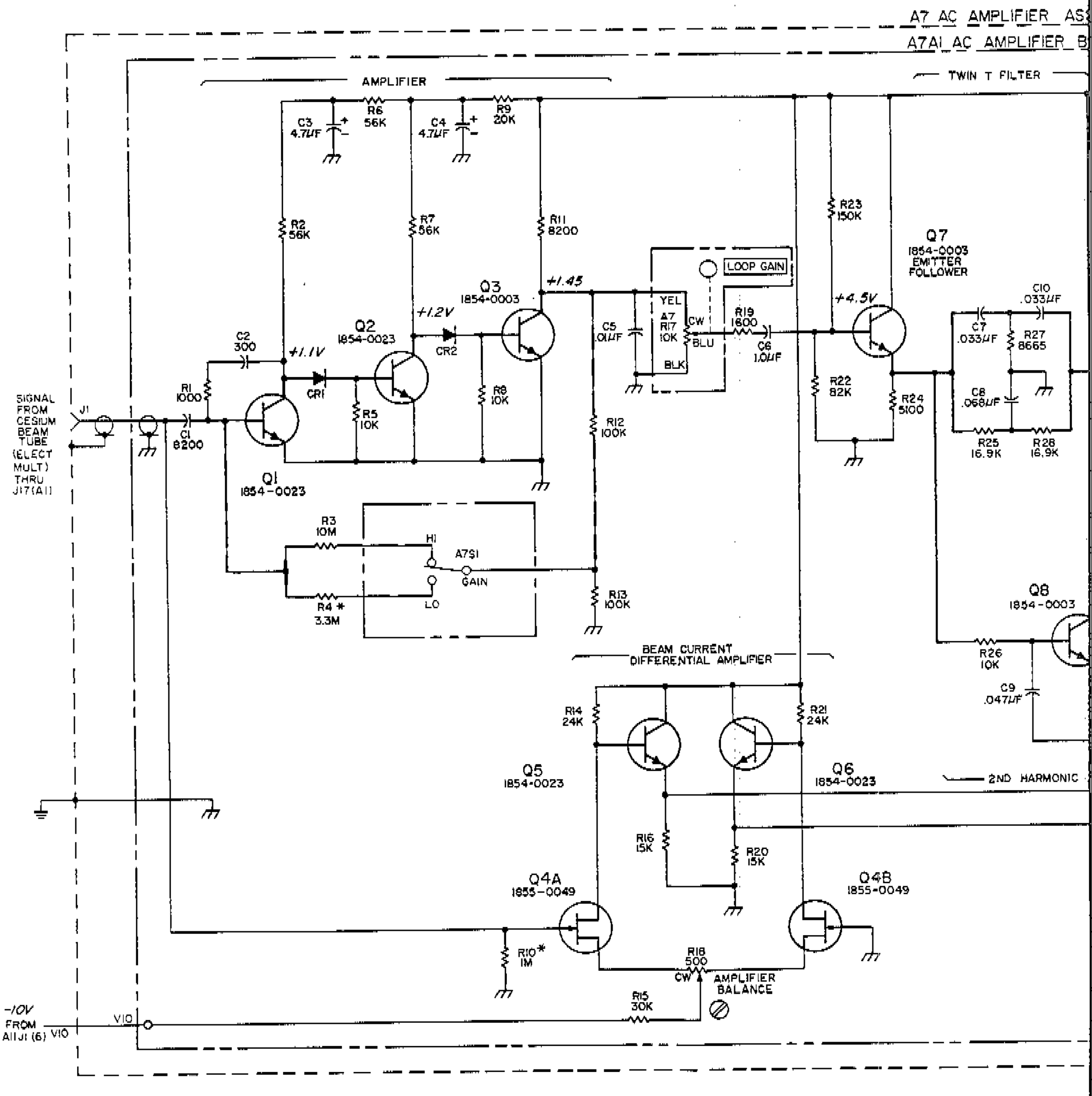


Fig. 8-18
Sht. 3 of 4

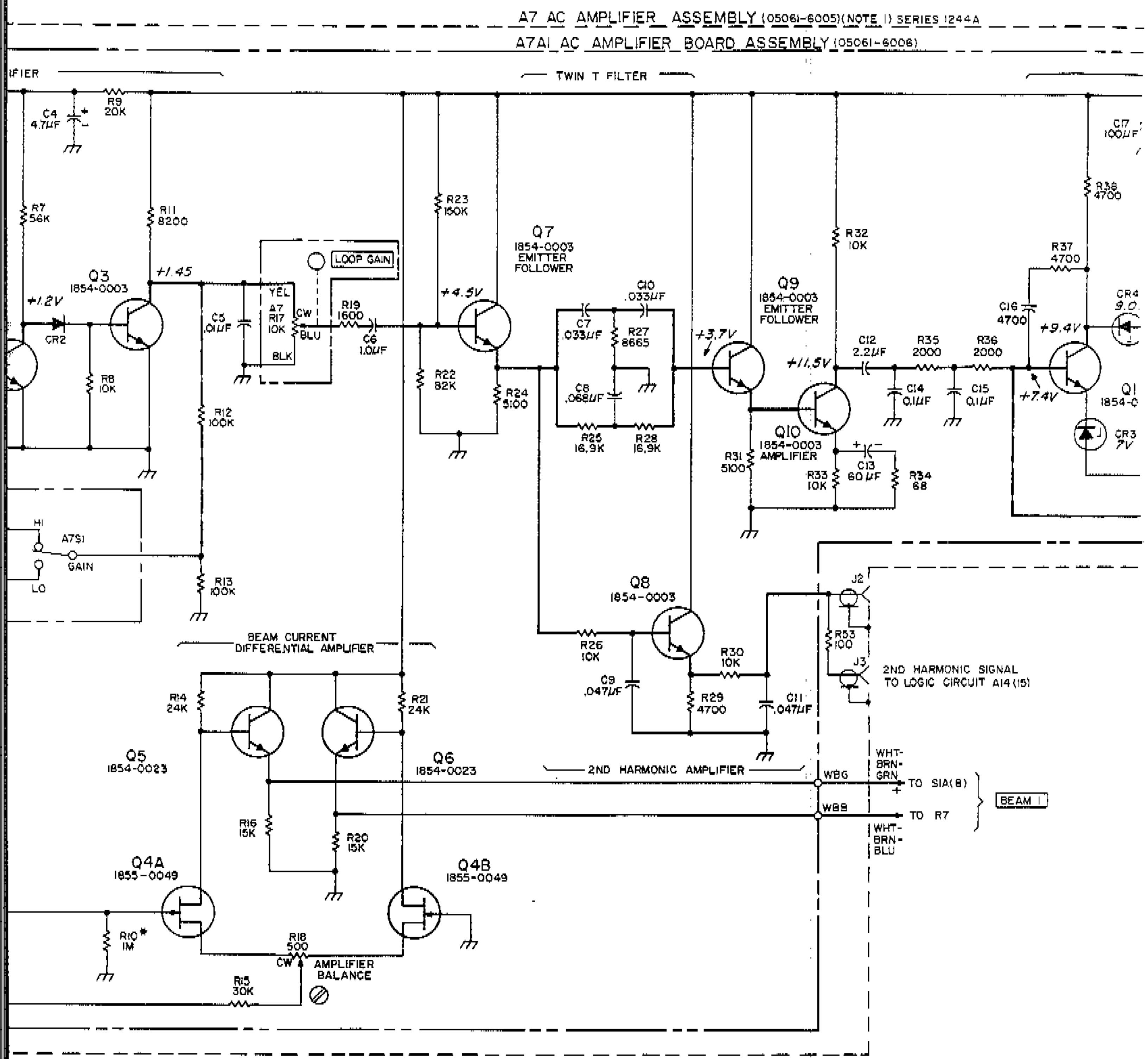
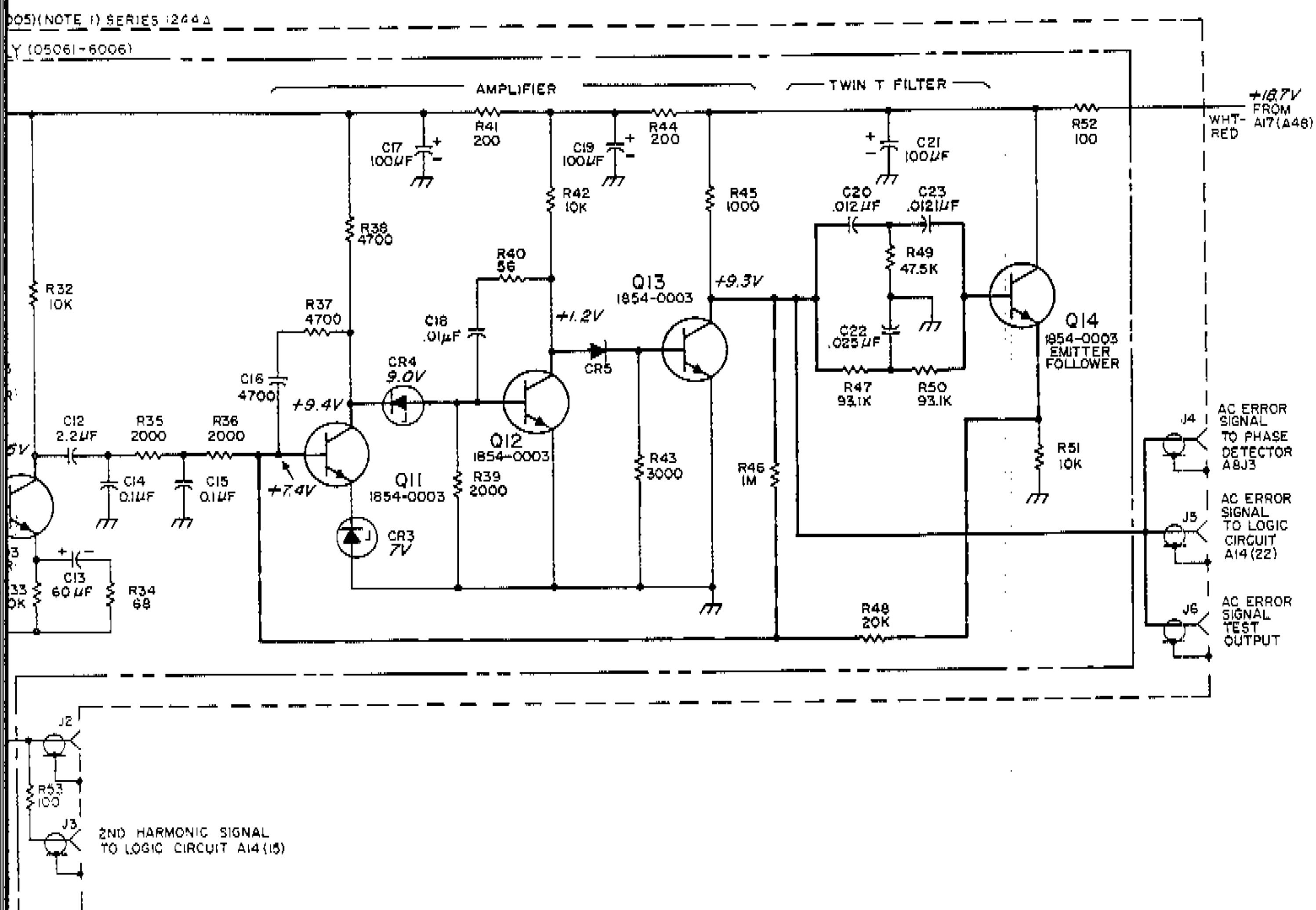
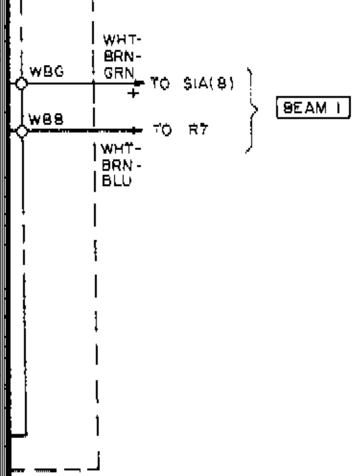


Fig. 8-18
Sht. 4 of 4





NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. VOLTAGES MEASURED WITH A7S1 SET TO LO AND A7R17 SET TO MIDRANGE

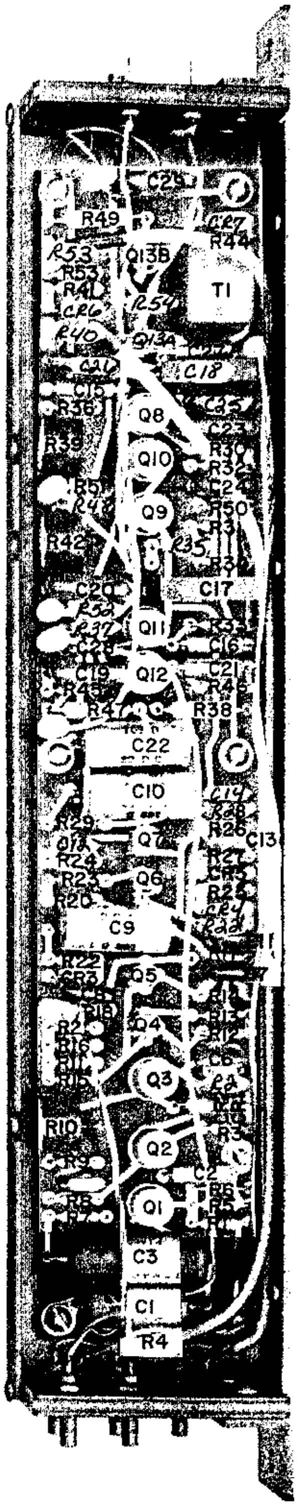
REFERENCE DESIGNATIONS

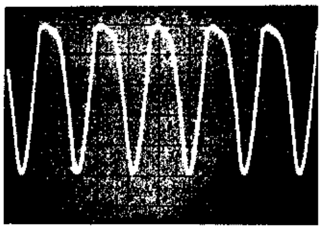
A7	A7A1
J1-6 R17, 53 S1	C1 - 23 CR1 - 5 Q1 - 14 R1 - 16, 18 - 52

05061-D-184A

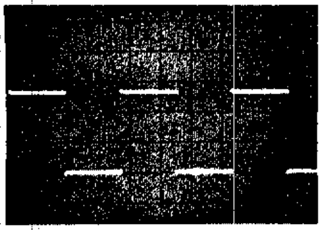
Figure 8-18. AC Amplifier Assembly A7

Fig. 8-19
Sht. 1of 4

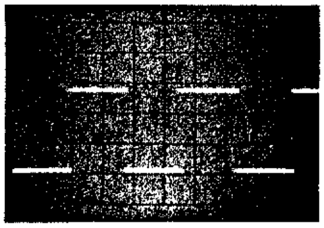




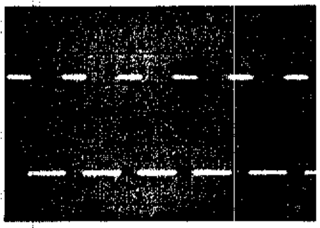
❶ .5V/cm, 2 ms/cm



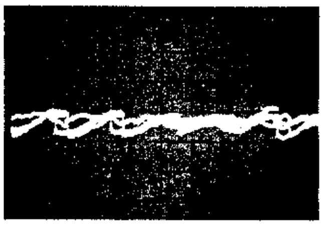
❷ 5V/cm, 2 ms/cm



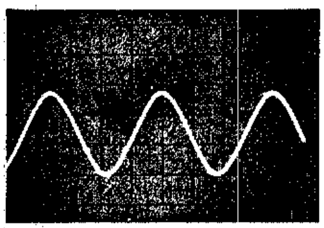
❸ 5V/cm, 2 ms/cm



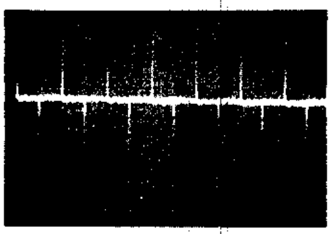
❹ 5V/cm, 2 ms/cm



❺ .005V/cm, 2 ms/cm



❻ .05V/cm, 2 ms/cm

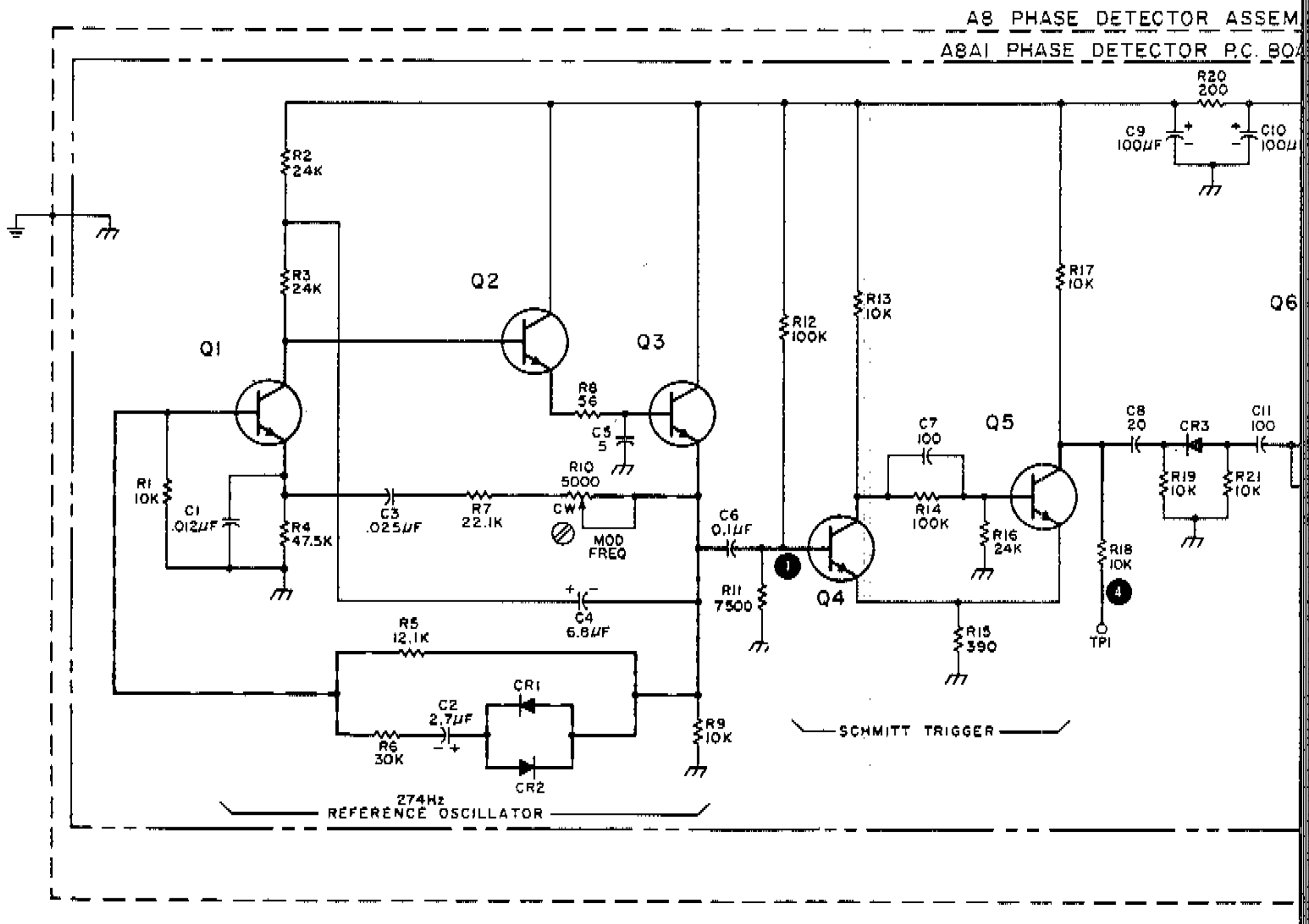


❼ .005V/cm, 5 ms/cm
No ac error input at
A8J3

Oscilloscope: DC coupled

5061A: Normal operation unless noted

Fig. 8-19
Sht. 2 of 4



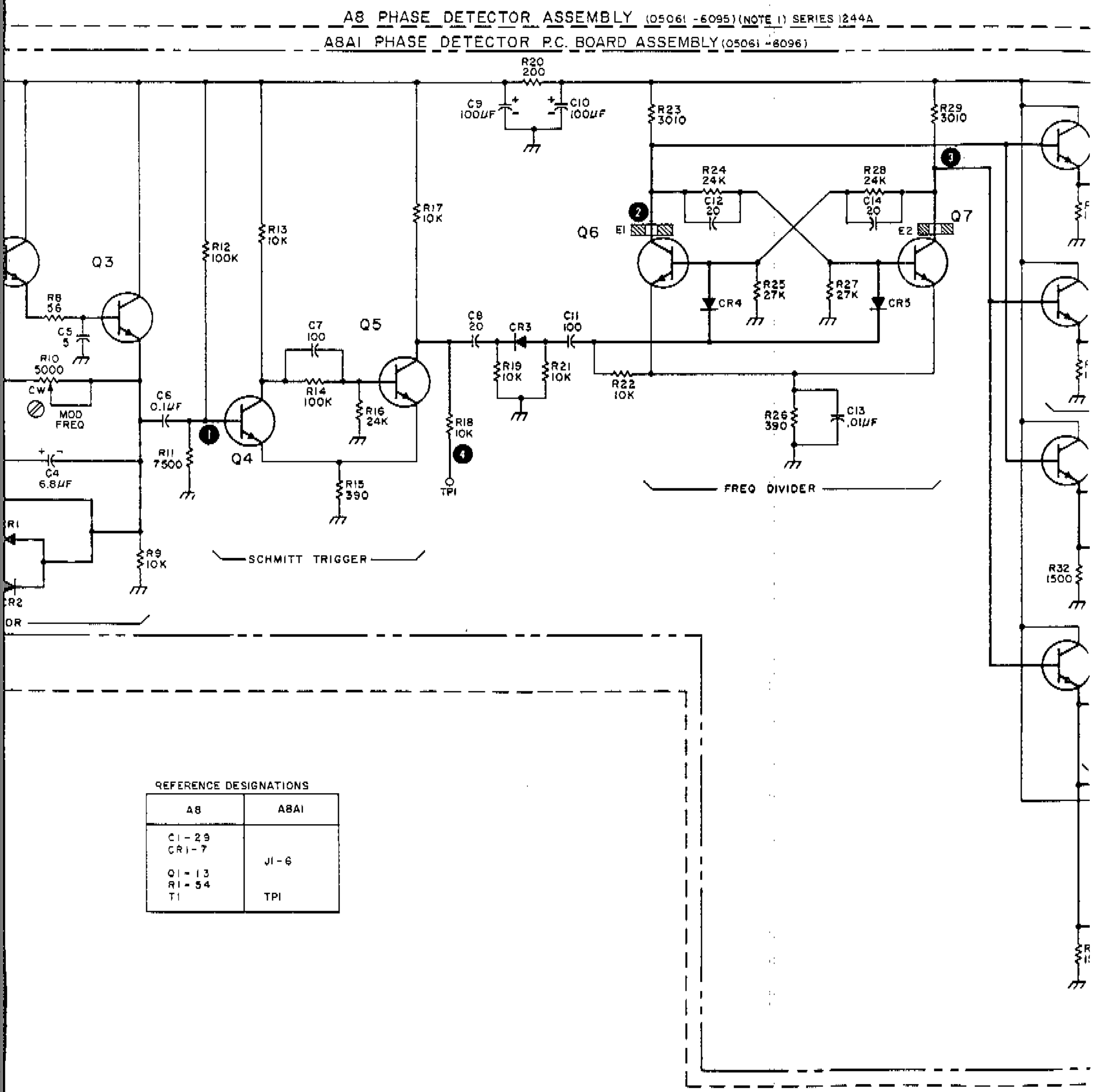
NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS;
3. Q13A AND Q13B ARE A MATCHED PAIR

REFERENCE DESIGNATIONS

A8	A8A1
C1-29 CR1-7	J1-6
Q1-13 R1-34 T1	TP1

Fig. 8-19
Sht 3 of 4



REFERENCE DESIGNATIONS

A8	A8A1
C1-29 CR1-7 Q1-13 R1-54 T1	J1-6 TP1

Fig. 8-19
Sht: 4 of 4

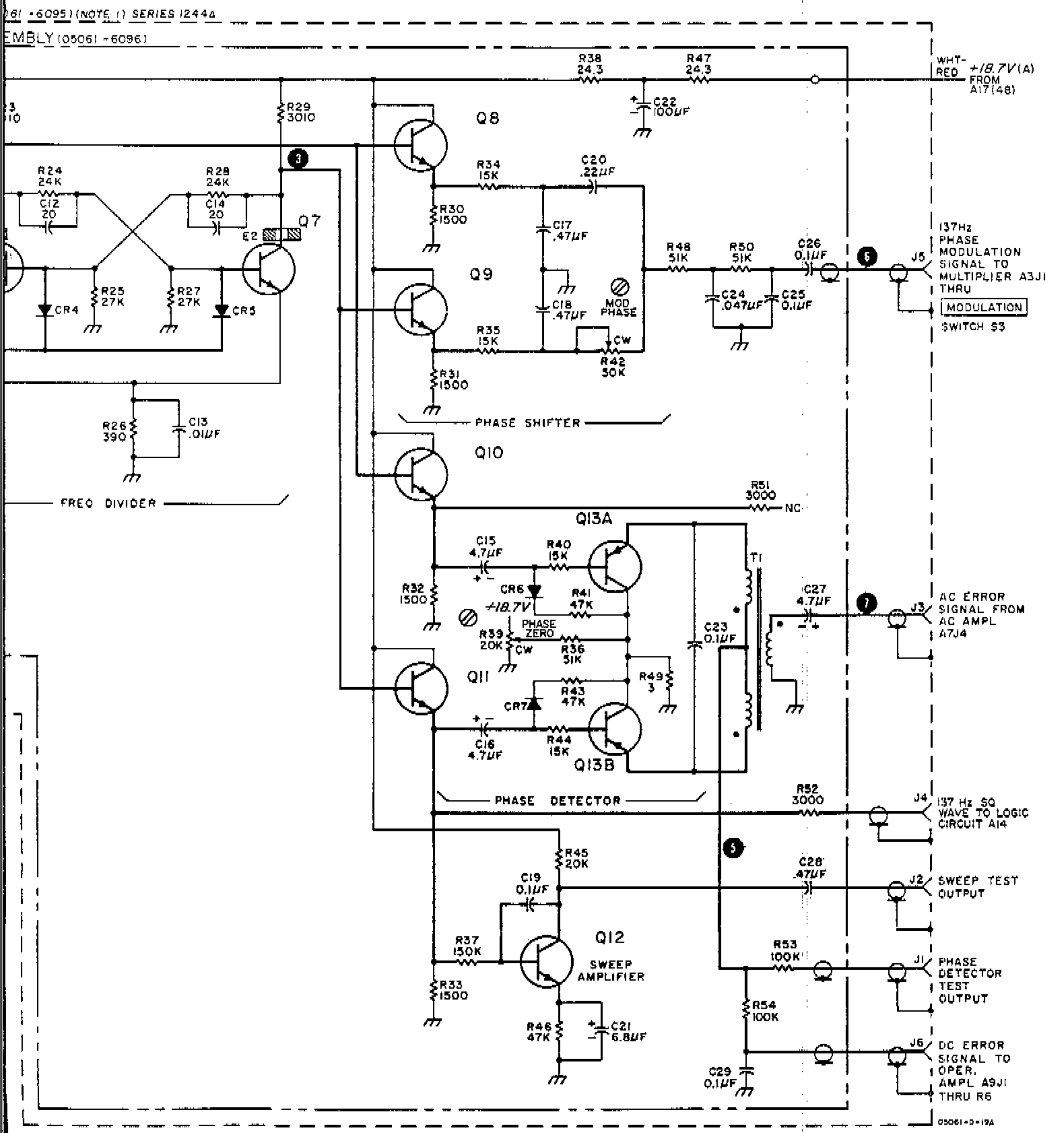


Figure 8-19. Phase Detector Assembly A8

Fig. 8-20
Sht. 1 of 3

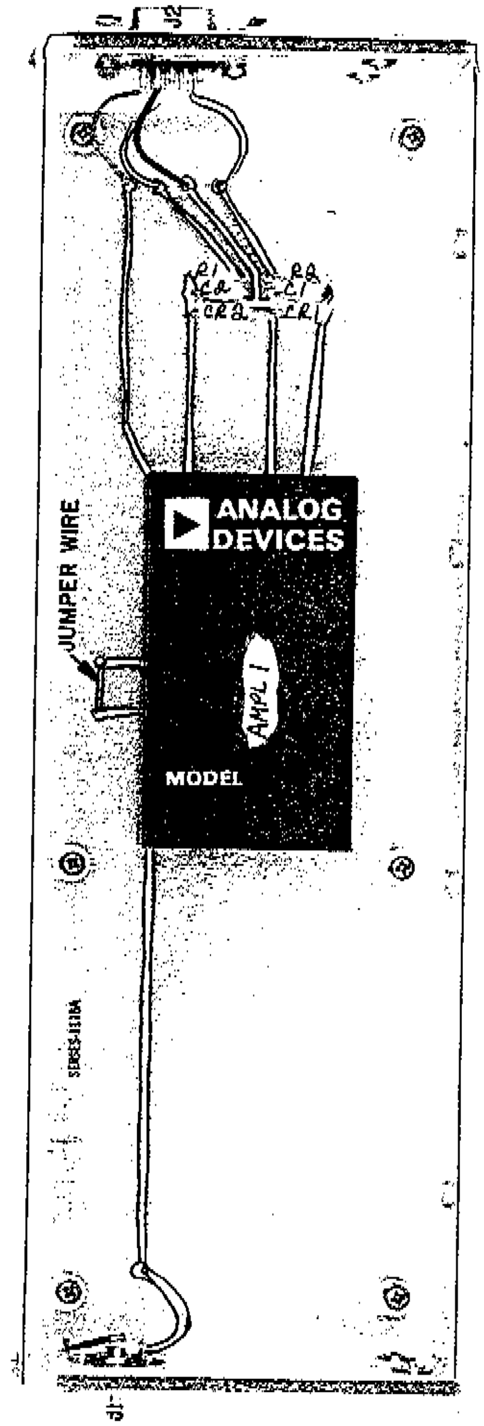


Fig. 8-20
Sht. 2 of 3

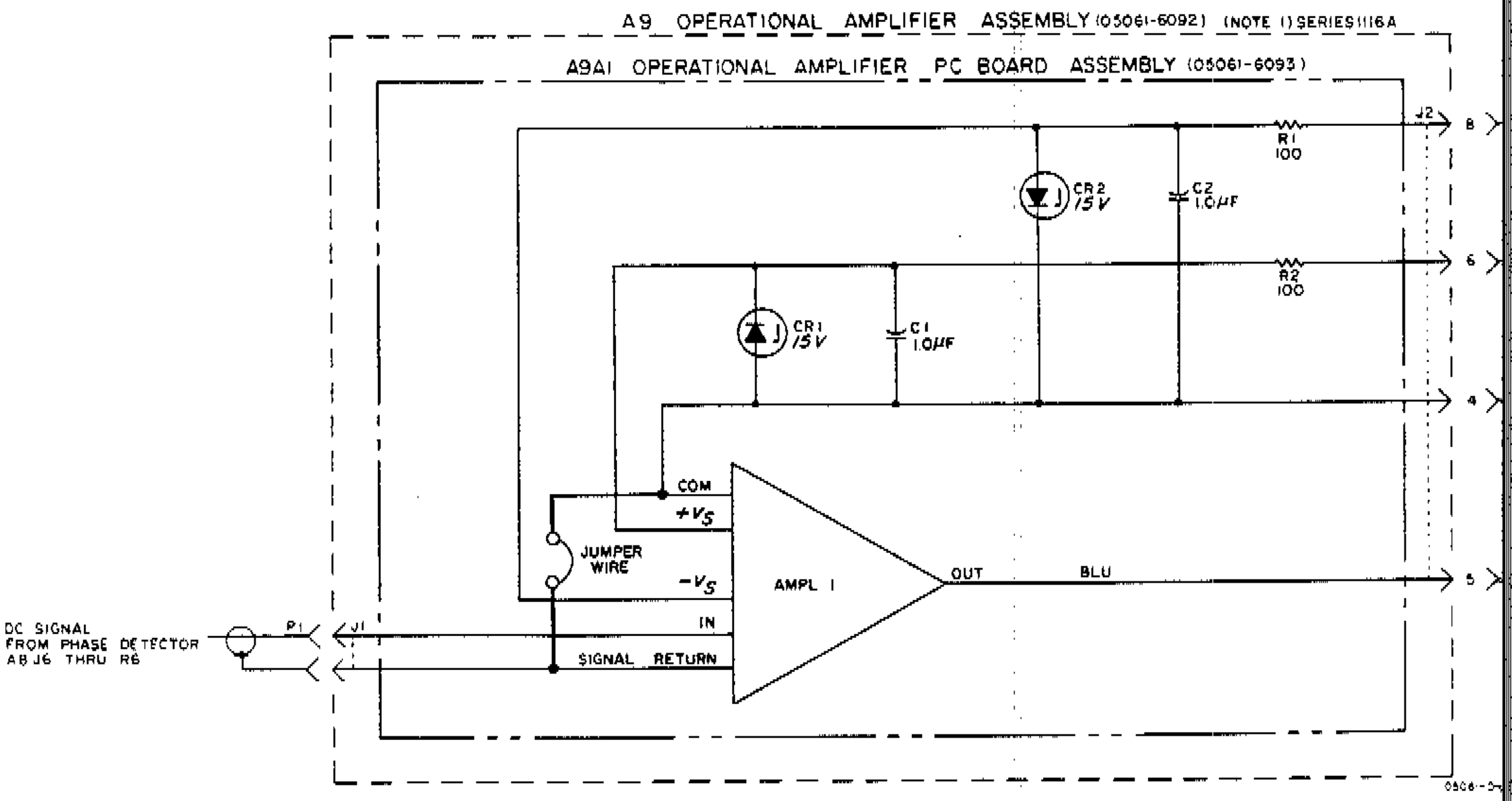
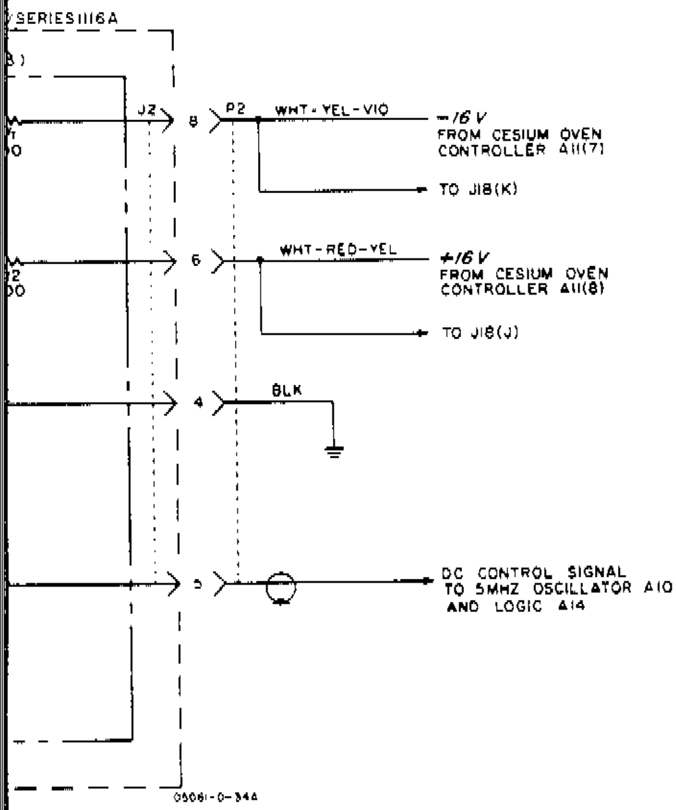


Fig. 8-20
Sht. 3 of 3



NOTES

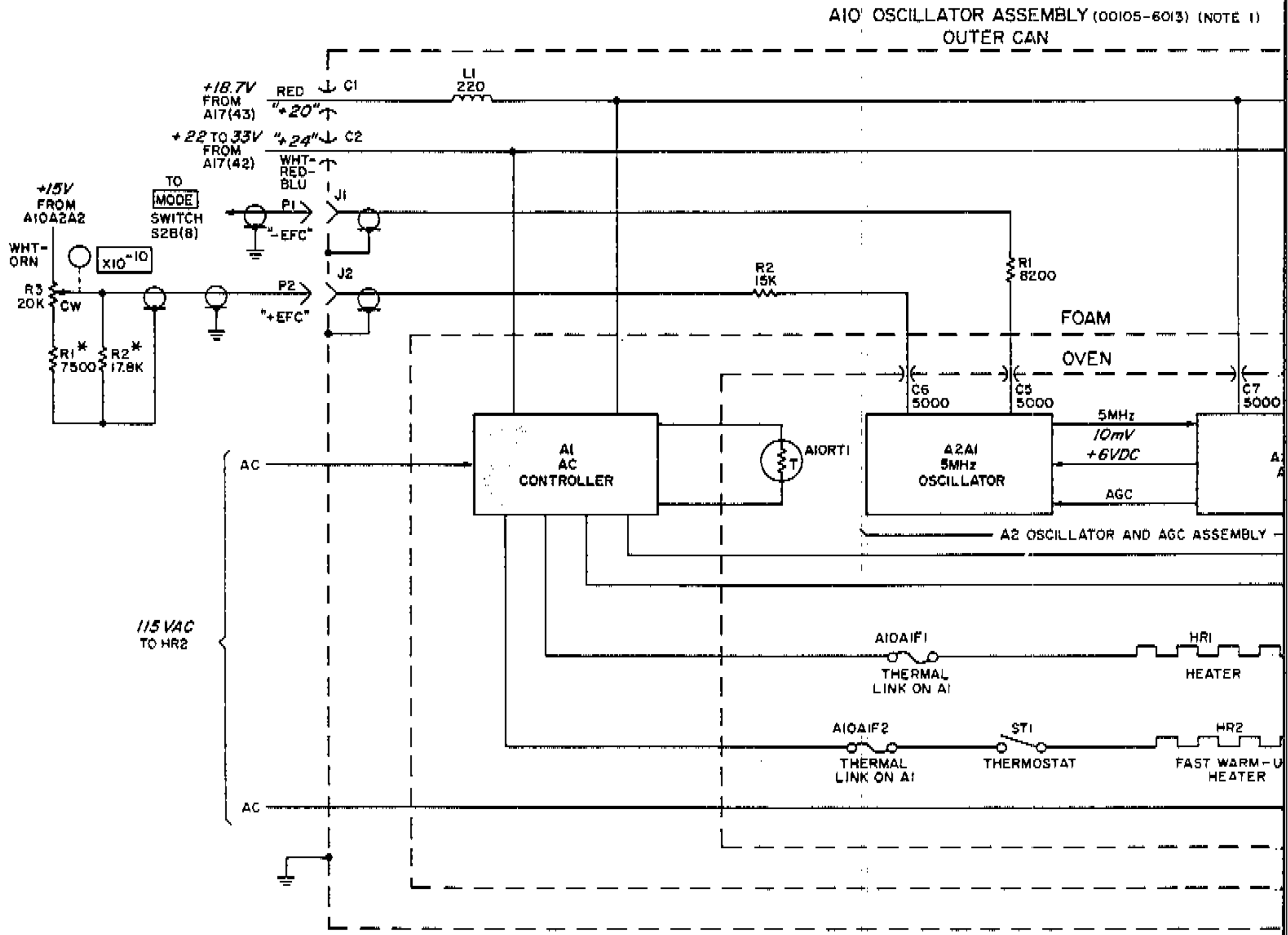
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED
   RESISTANCE IN OHMS,
   CAPACITANCE IN PICOFARADS.

REFERENCE DESIGNATIONS

NO PREFIX	A9	A9A1
P1, 2	J1, 2	C1, 2 CR1, 2 R1, 2

Figure 8-20. Operational Amplifier Assembly A9

Fig. 8-21
Sht. 1 of 2



NOTES

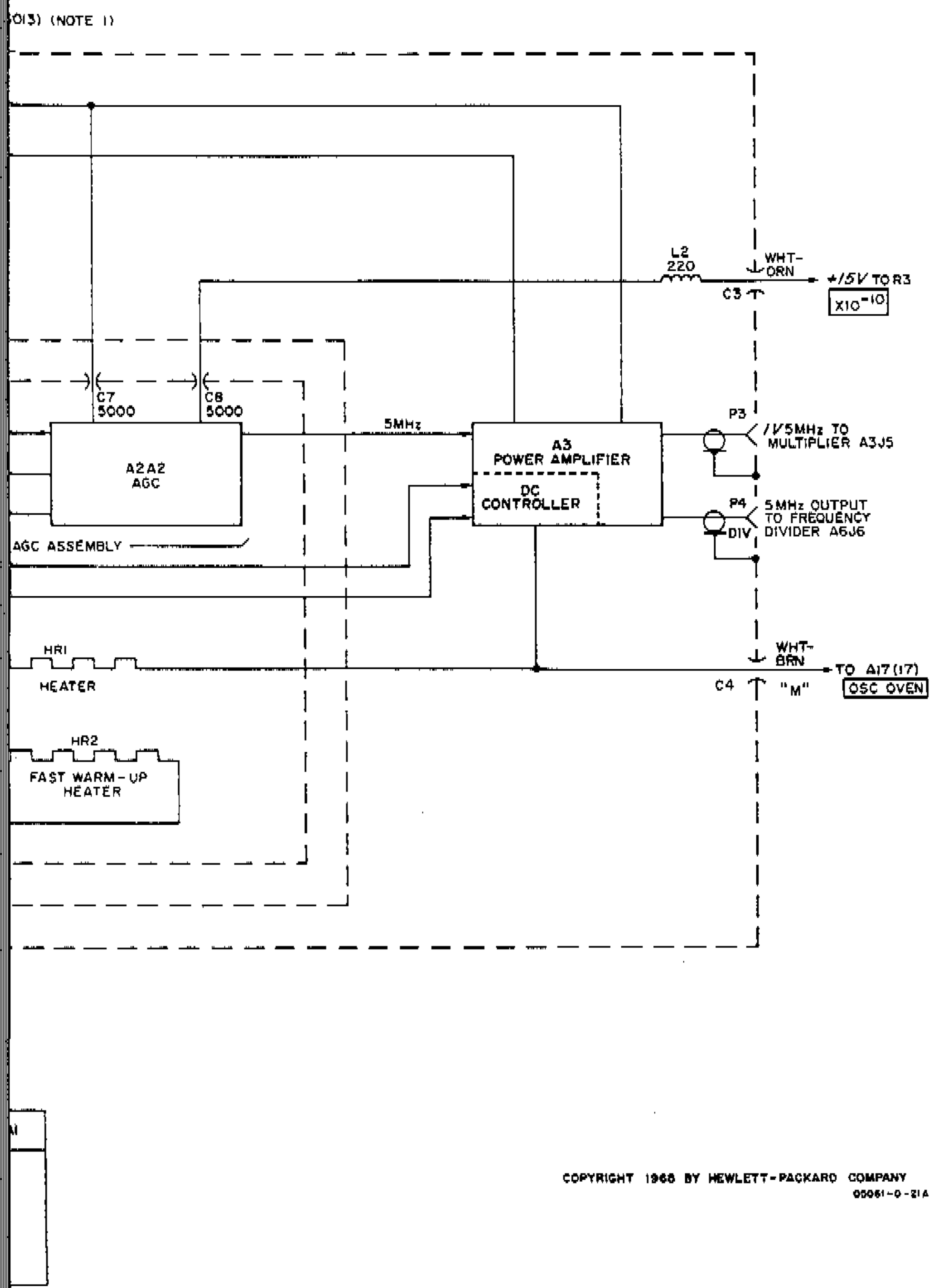
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES

* FACTORY SELECT VALUE.

REFERENCE DESIGNATIONS

NO PREFIX	A10	A10A1
P1,2 R1-3	C1-8 HR1,2 J1,2 L1,2 P3,4 R1,2 RT1 ST1	F1,2

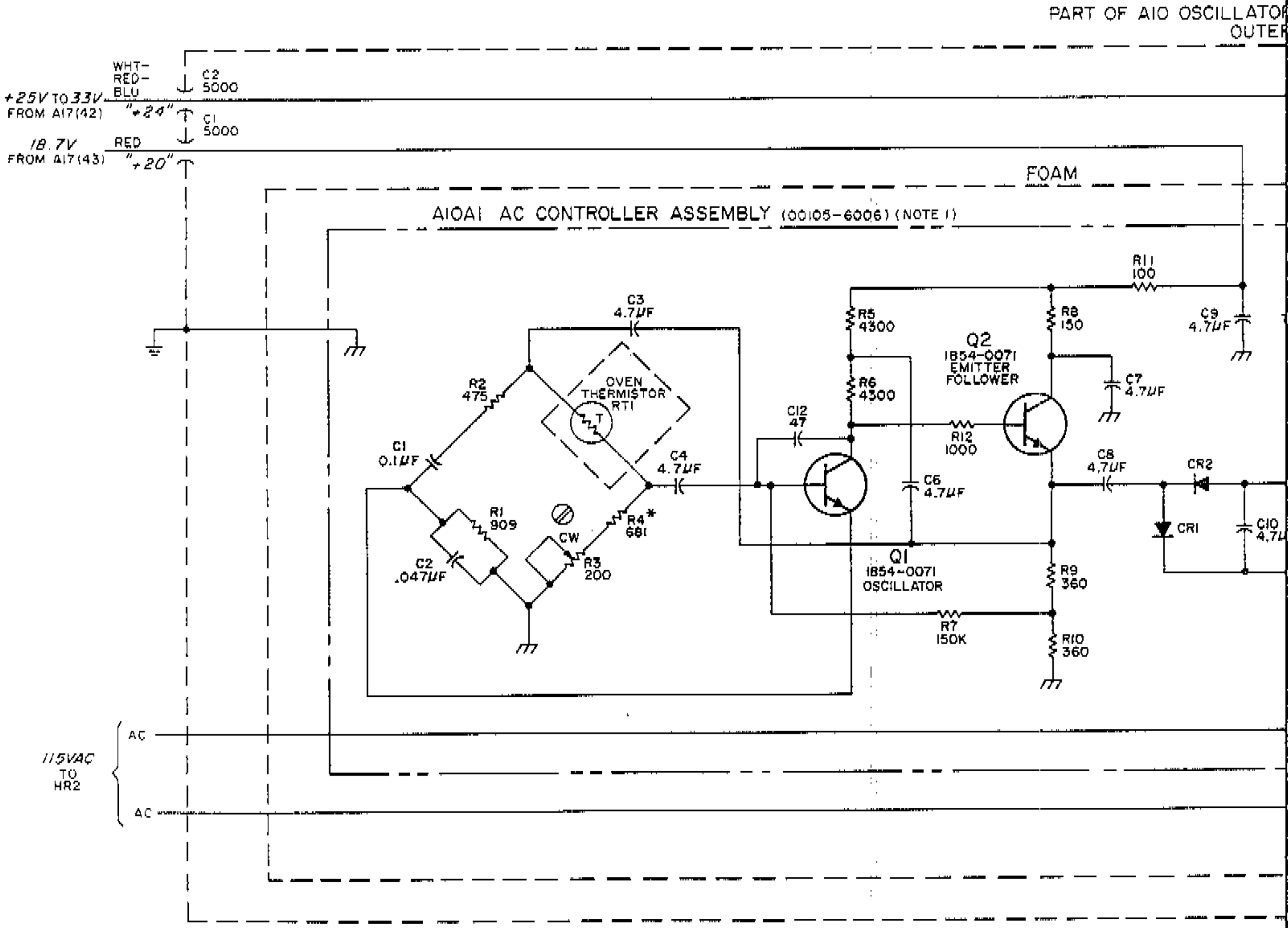
Fig. 8-21
Sht. 2 of 2



05061-D-21A

Figure 8-21. Oscillator Assembly A10

Fig. 8-22
Sht. 1 of 3



NOTES

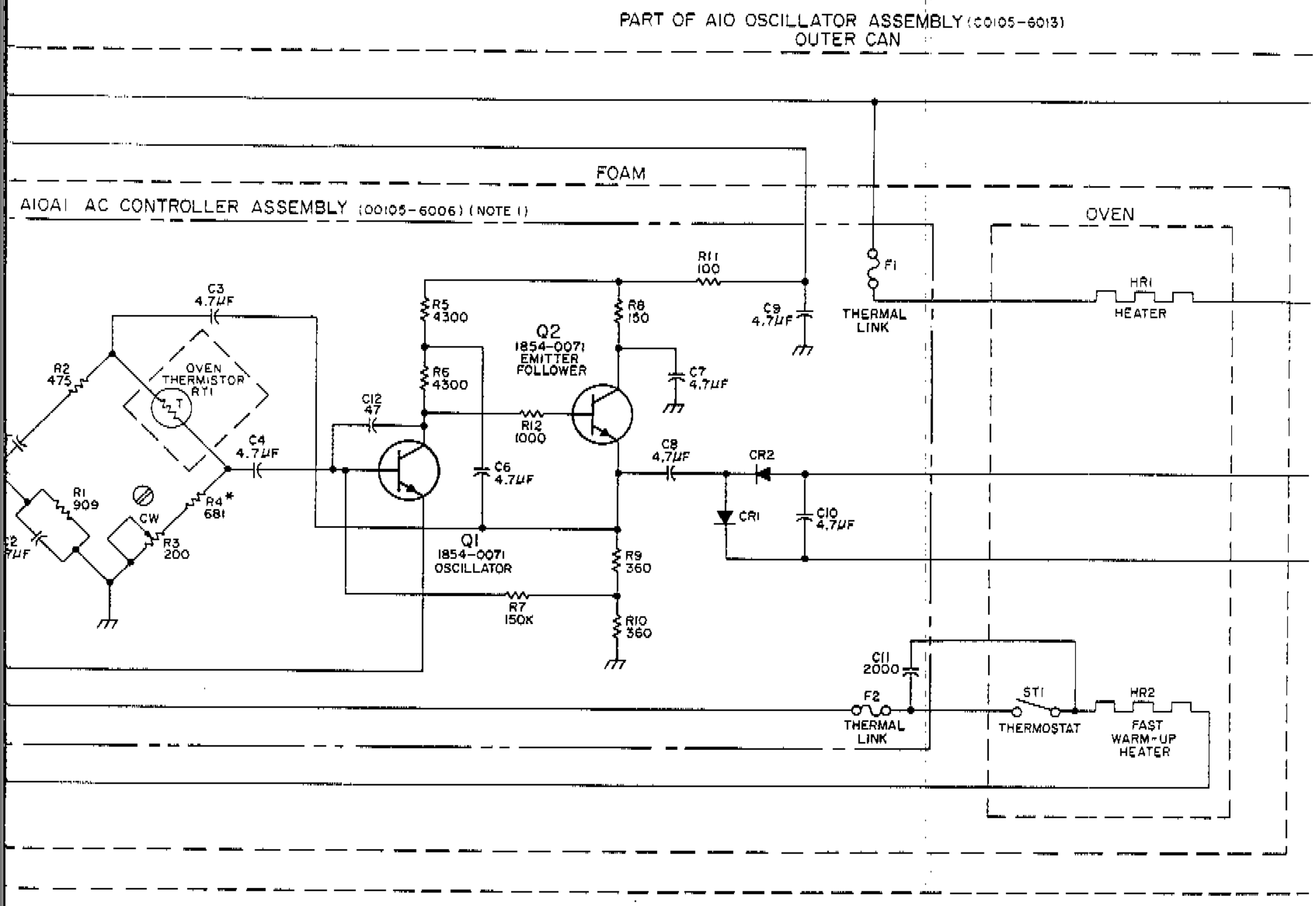
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGN

A10	A10 A1
C1,2,4	C1-12 CR1,2 F1,2
HR1,2	
	Q1,2 R1-12
RT1 ST1	

DELETED

Fig. 8-22
Sht. 2 of 3



WITHIN THIS
ED. ADD
REVIATION
N.

TED:

RADS;
NRIES

LECTED
ES SHOWN

REFERENCE DESIGNATIONS

A10	A10 A1	A10 A3
C1,2,4 HR1,2 RT1 ST1	C1-12 CR1,2 F1,2 Q1,2 R1-12	C2,4 CR1-3 L3 Q2-4 R2,3,8,10,20

DELETED C5

Fig 8-22
Sht. 3 of 3

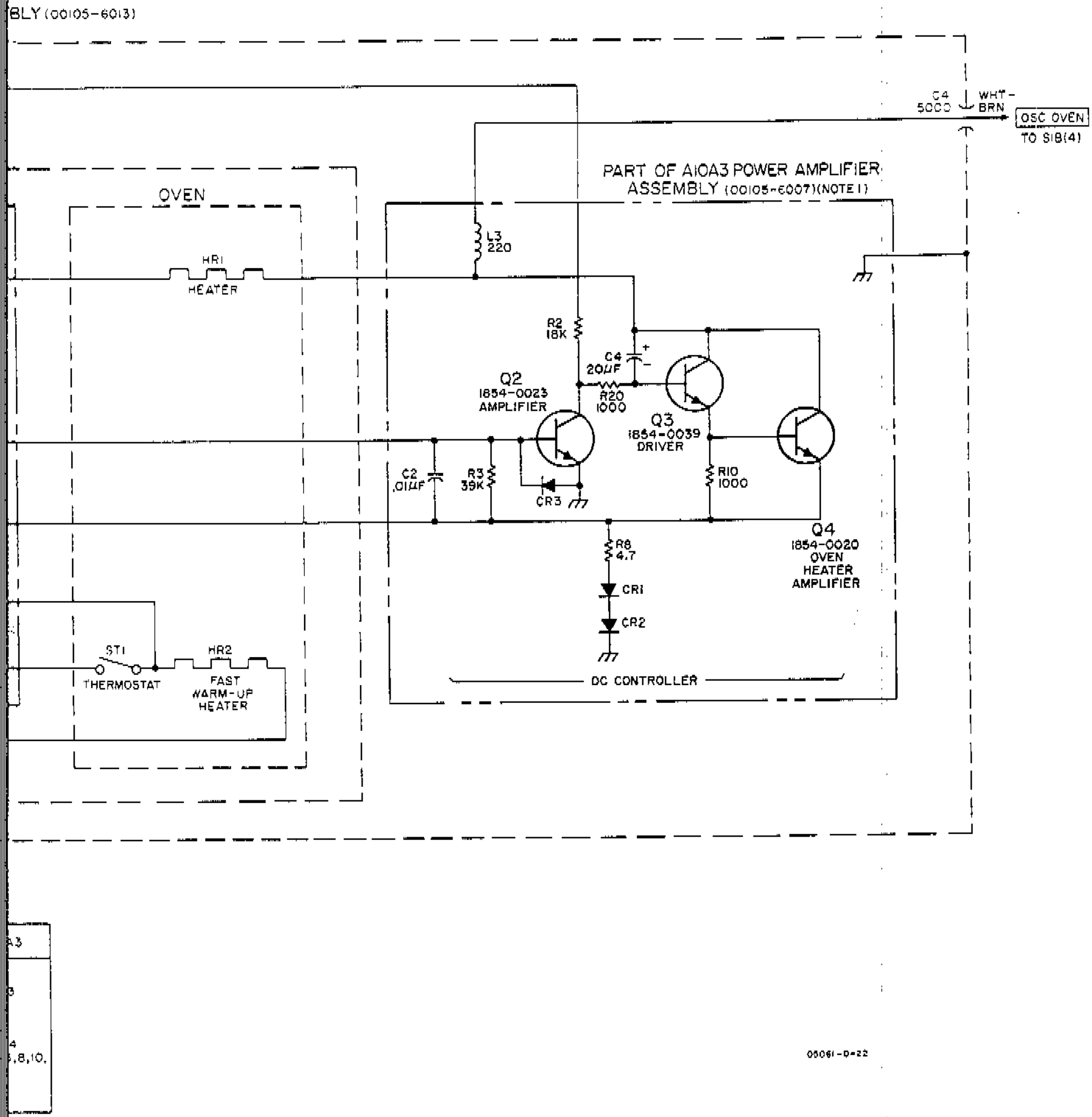
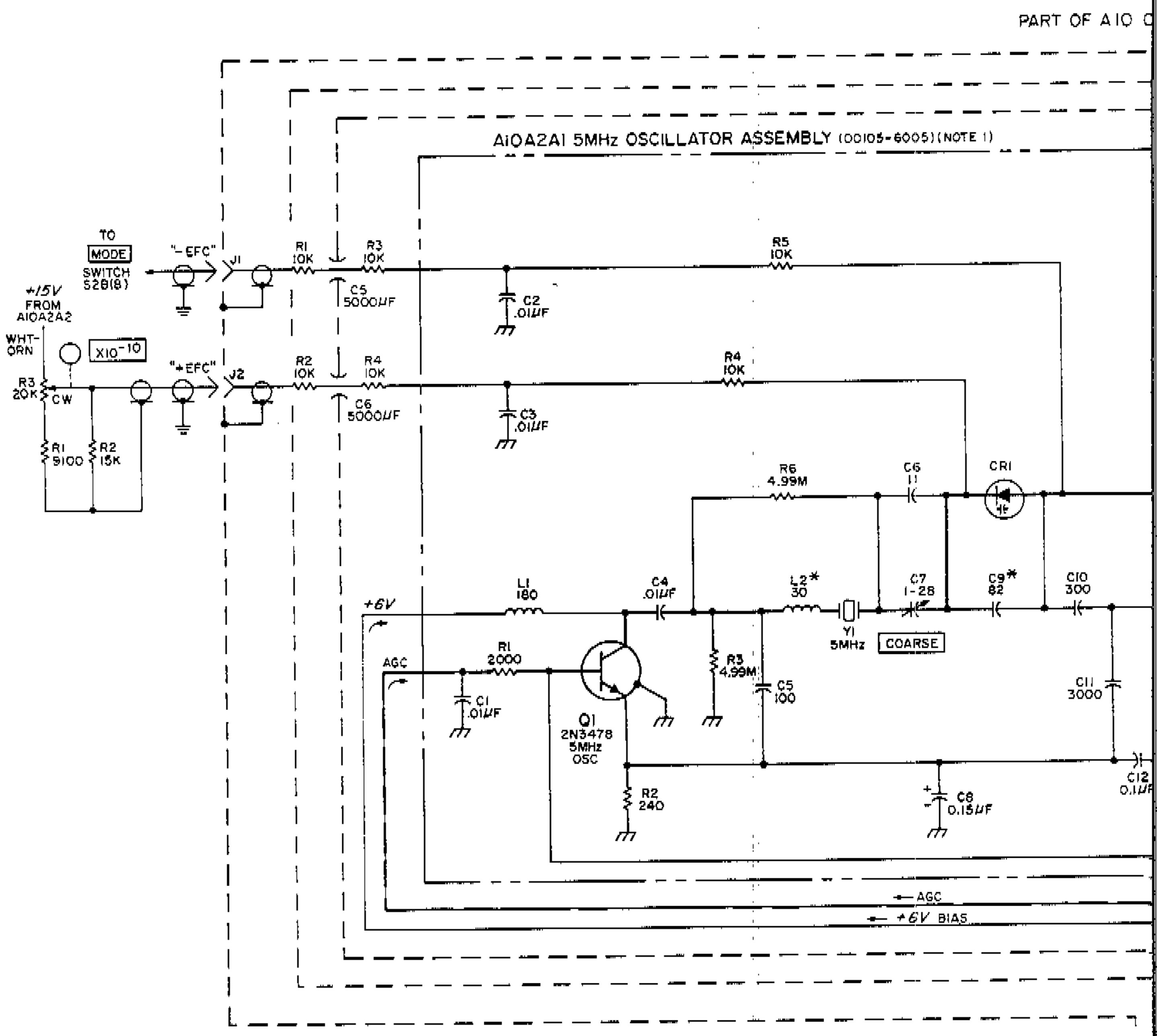


Figure 8-22. Oscillator Assembly A10
AC Controller Assembly A10A1
Power Amplifier Assembly A20A3

Fig. 8-23
Sht. 1 of 3



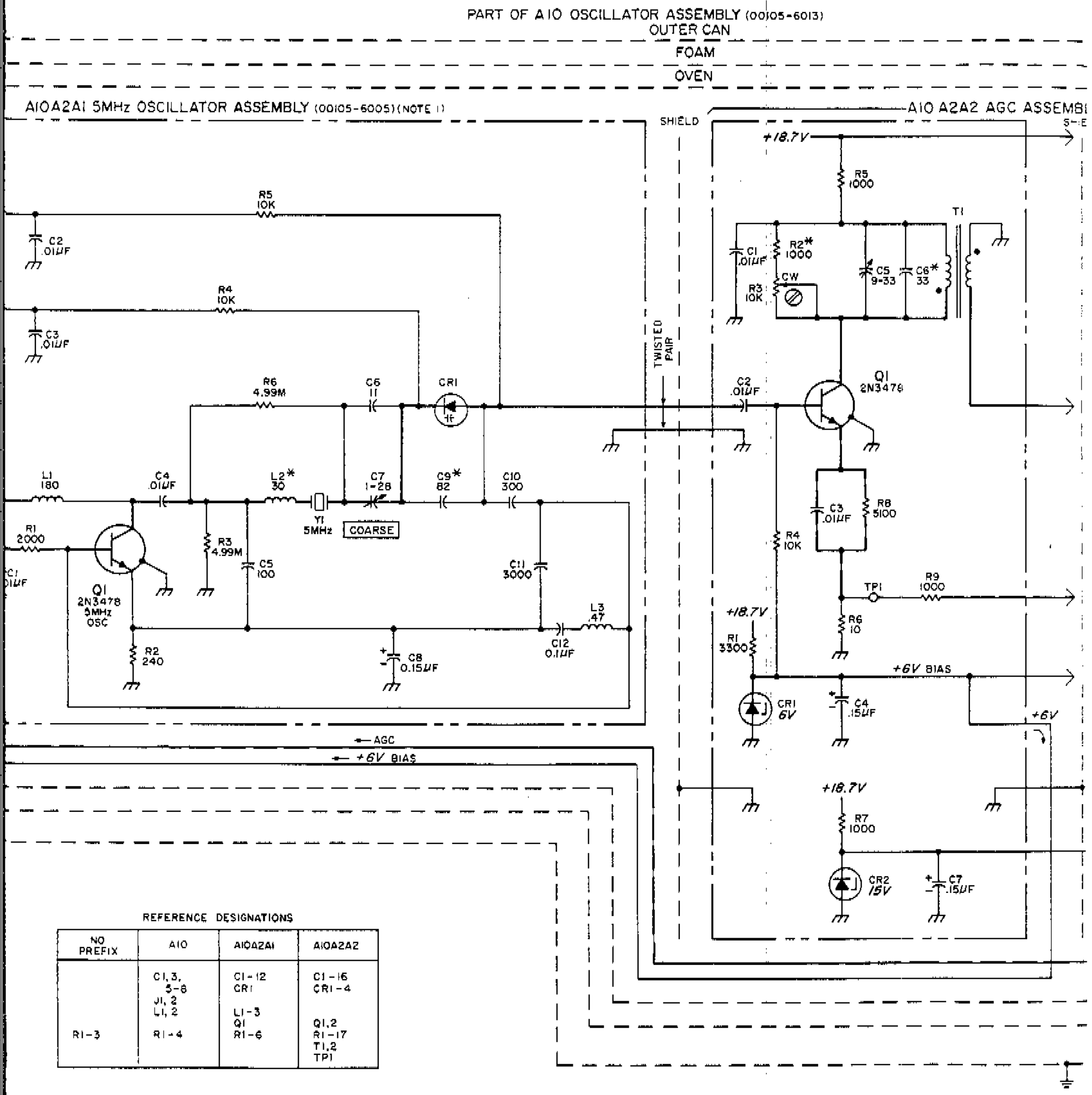
NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT. AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

NO PREFIX	A10	A10A2A1	A10A2A2
R1-3	C1,3, 5-8 J1, 2 L1, 2 R1-4	C1-12 CR1 L1-3 Q1 R1-6	C1-16 CR1-4 Q1,2 R1-17 T1,2 TP1

Fig. 8-23
Sht. 2 of 3



REFERENCE DESIGNATIONS

NO PREFIX	A10	A10A2A1	A10A2A2
R1-3	C1,3, 5-8, J1,2, L1,2, R1-4	C1-12, CR1, L1-3, Q1, R1-6	C1-16, CR1-4, Q1,2, R1-17, T1,2, TP1

Fig. 8-23
Sht. 3 of 3

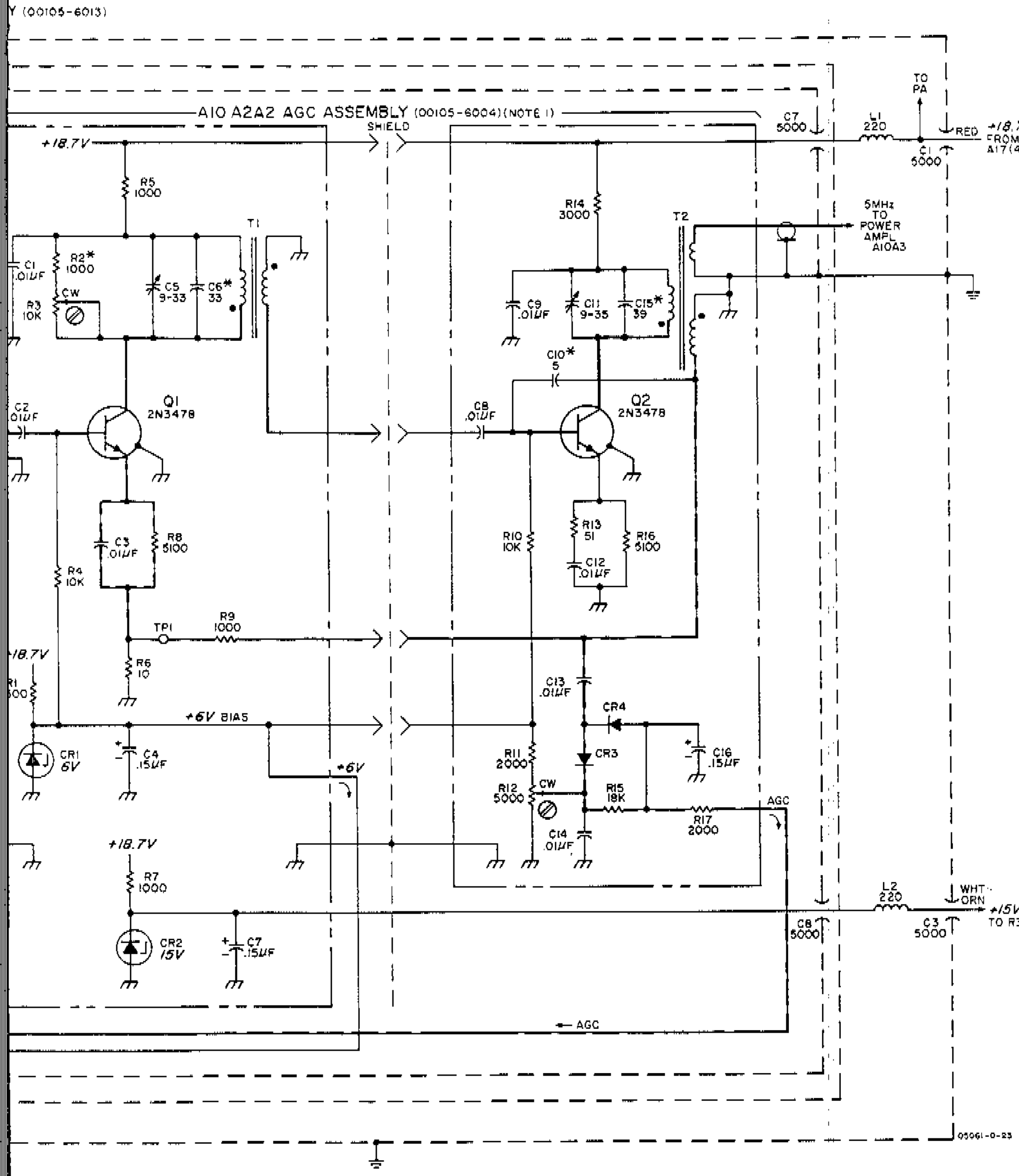


Figure 8-23. Oscillator Assembly A10
5 MHz Oscillator Assembly A10A2A1
AGC Assembly A10A2A2

Fig. 8-24
Sht. 1 of 3

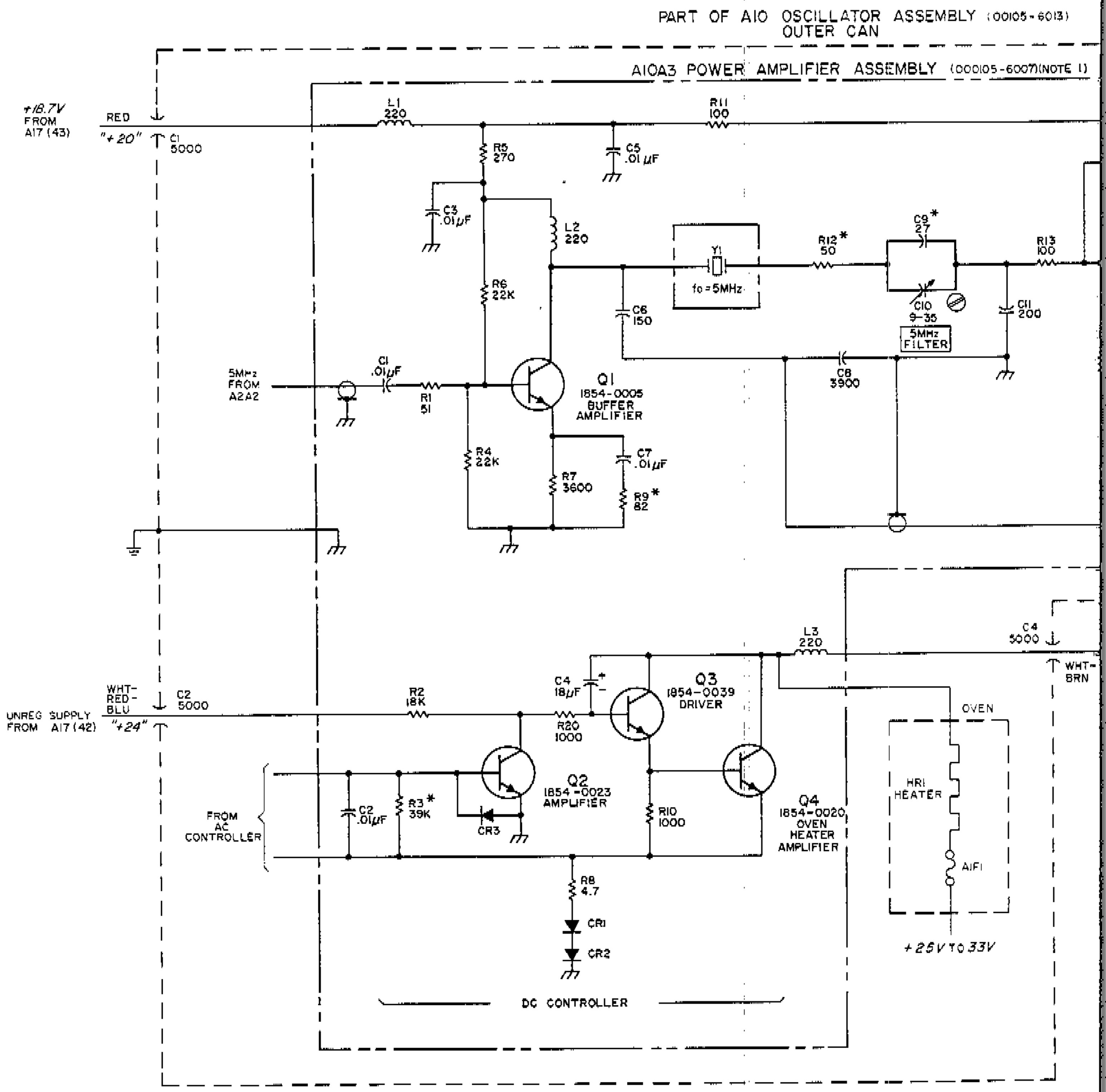
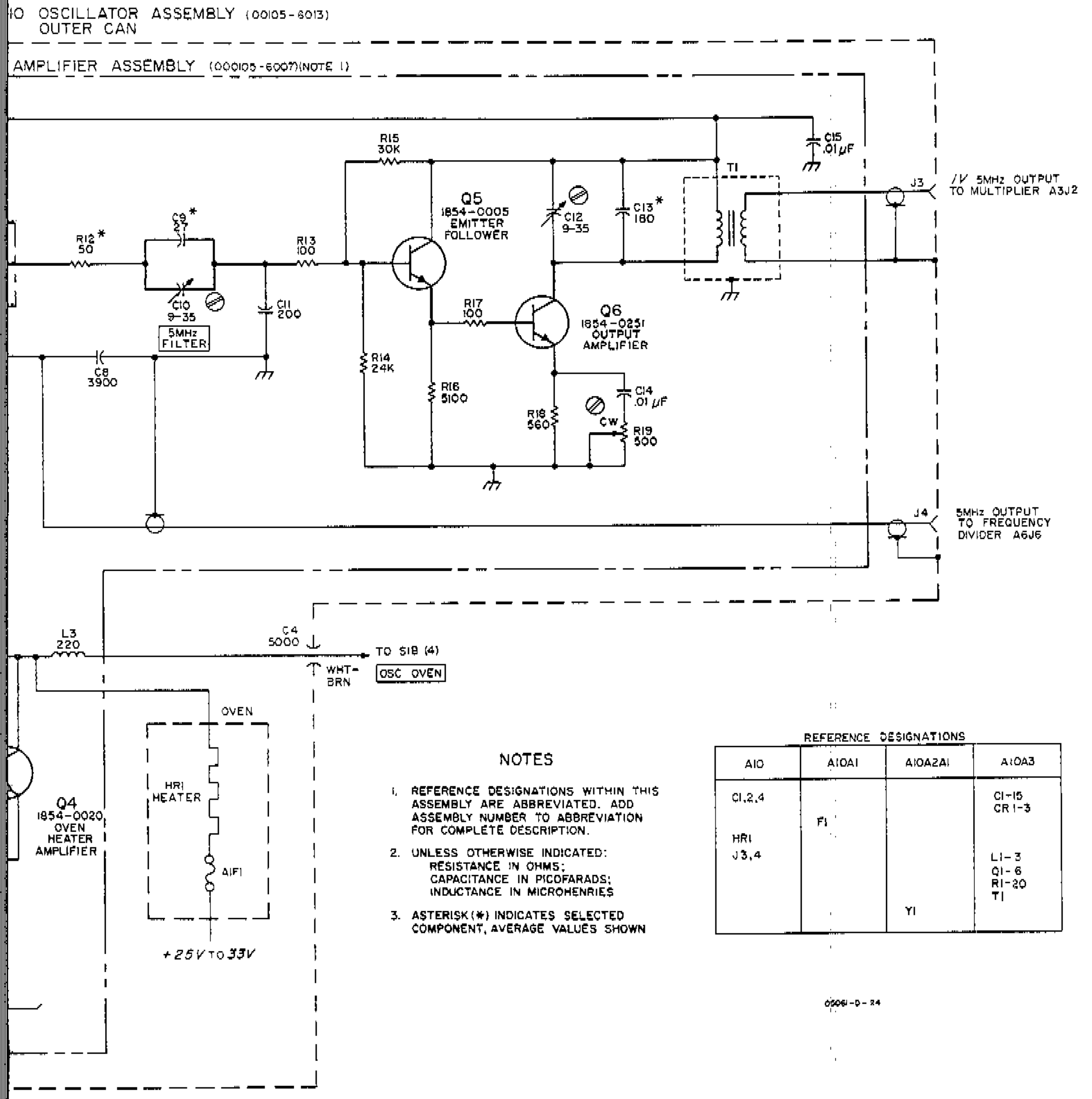


Fig. 8-24
Sht 2 of 3



NOTES

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2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

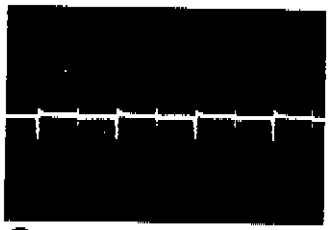
A10	A10A1	A10A2A1	A10A3
C1,2,4 HR1 J3,4	F1	Y1	C1-15 CR1-3 L1-3 Q1-6 R1-20 T1

05061-D-24

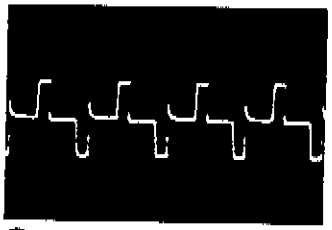
Figure 8-24. Oscillator Assembly A10
Power Amplifier Assembly A10A3

Fig. 8-24
Sht. 3 of 3

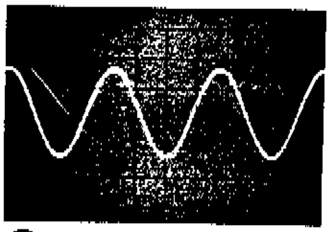
1 A 5V/cm, .2 ms/cm
CS OVEN on full



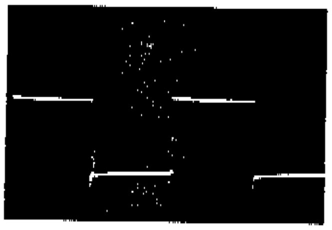
1 B 5V/cm, .2 ms/cm
CS OVEN off



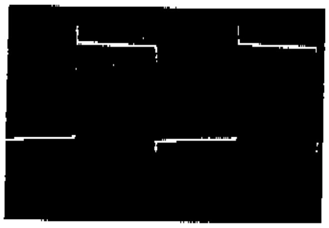
1 C 5V/cm, .2 ms/cm
CS OVEN normal



2 5V/cm, .1 ms/cm



3 10V/cm, .1 ms/cm



4 10V/cm, .1 ms/cm

Oscilloscope: DC coupled
5061A: CS OVEN set to NORM

Fig. 8-25
Sht. 1 of 4

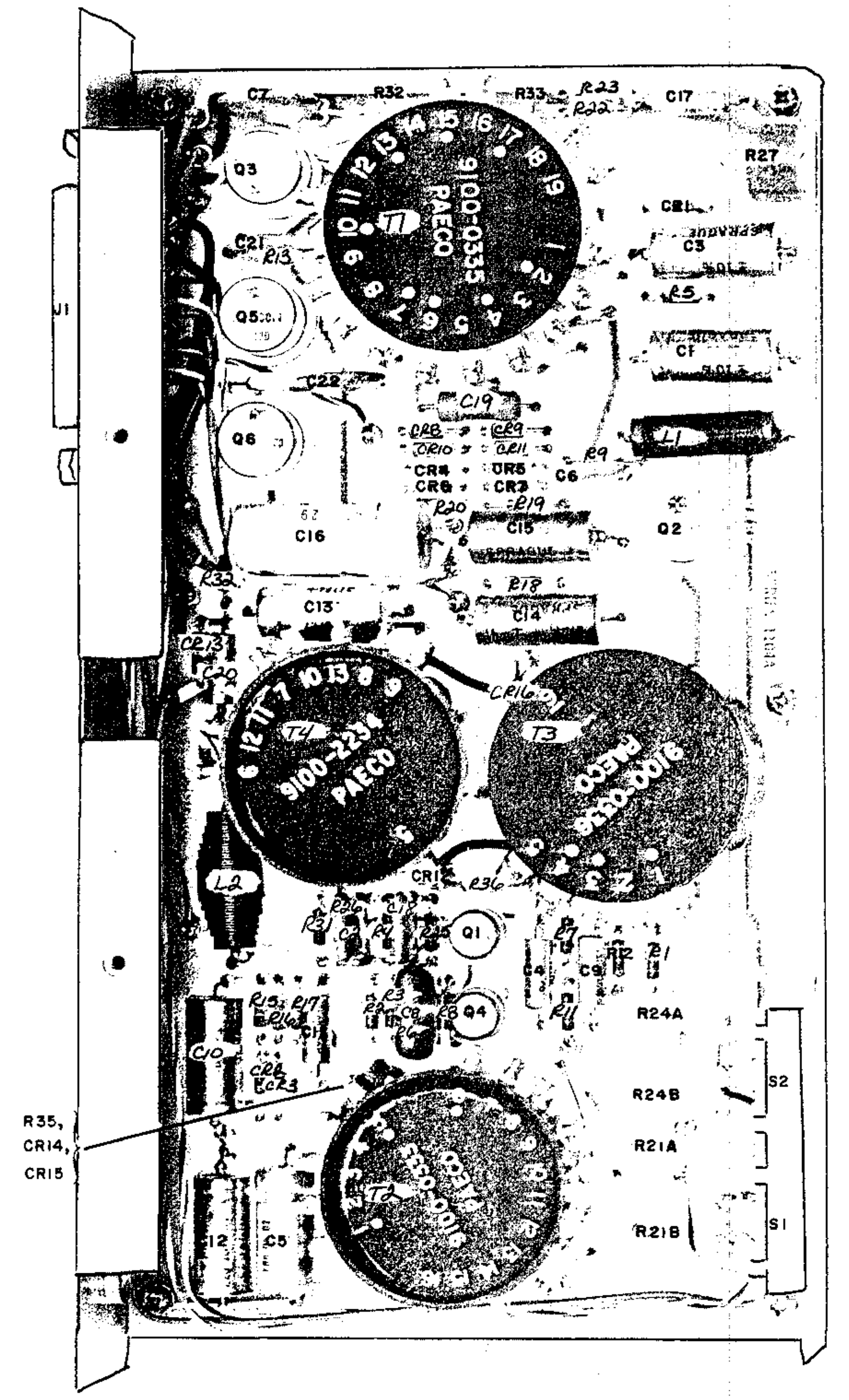


Fig. 8-25
Sht. 2 of 4

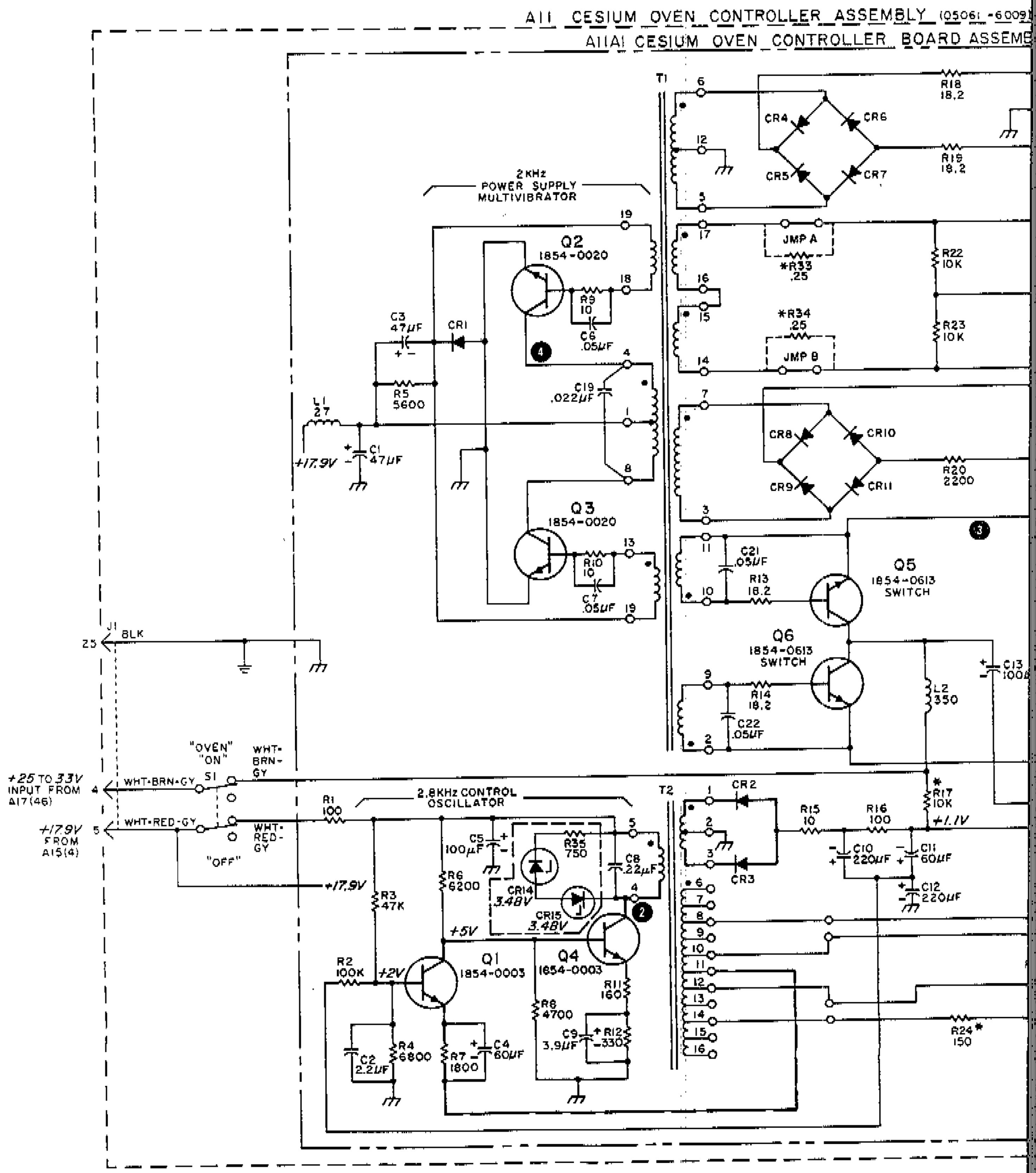


Fig. 8-25
Sht. 3 of 4

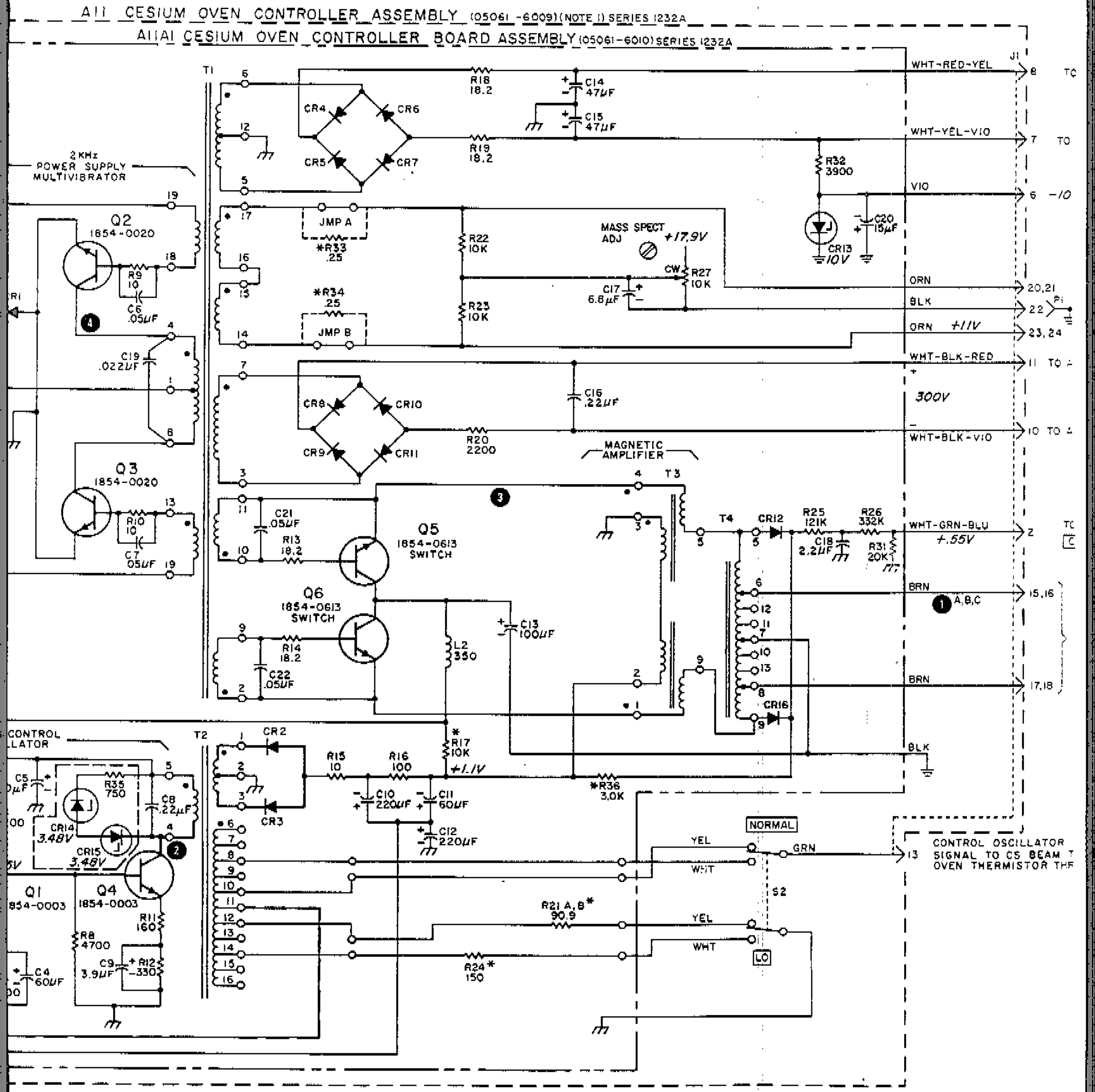
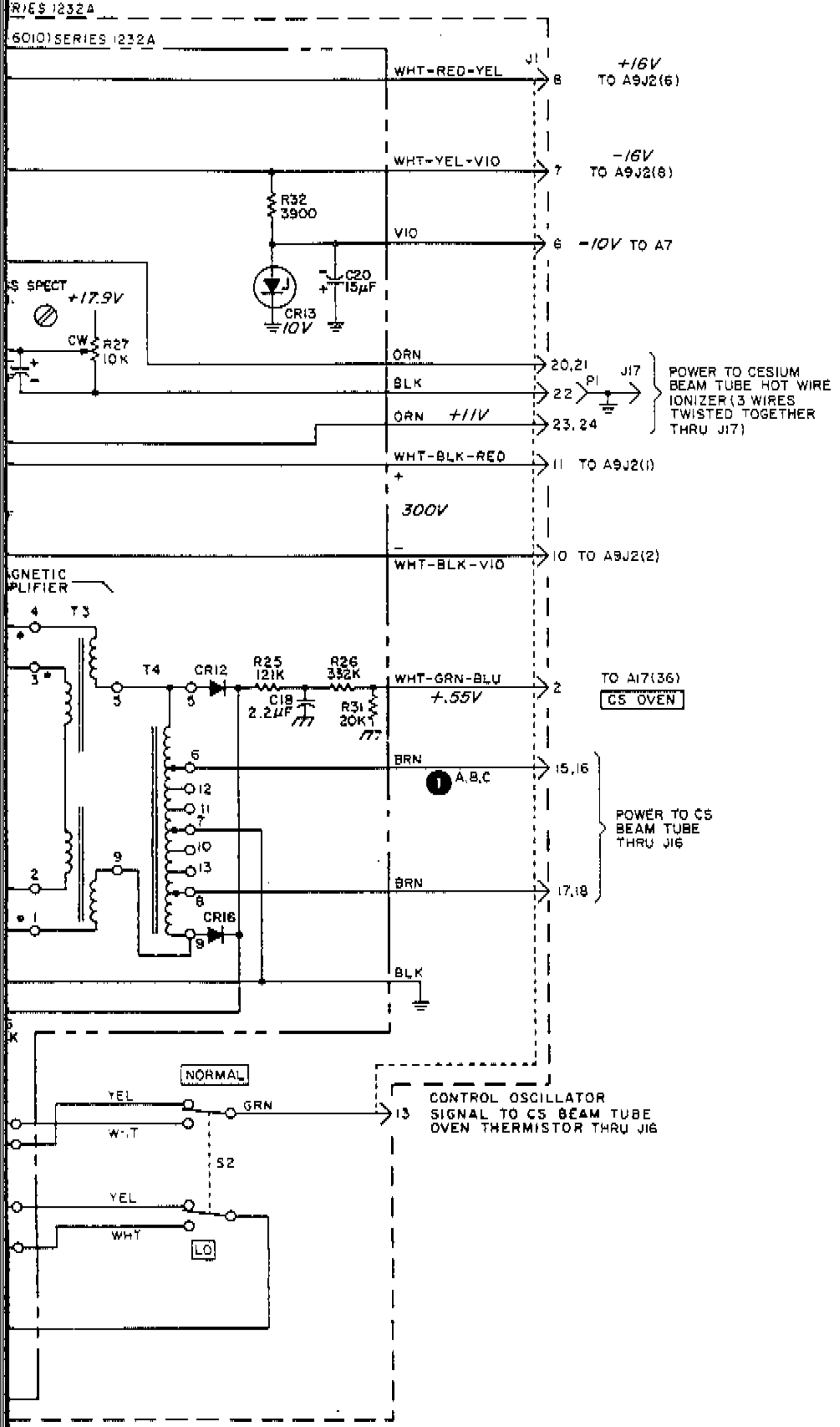


Fig 8-25
Sht. 4 of 4



NOTES

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2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. JUMPER A OR B OR BOTH MAY BE REPLACED BY R33 AND/OR R34.

REFERENCE DESIGNATIONS

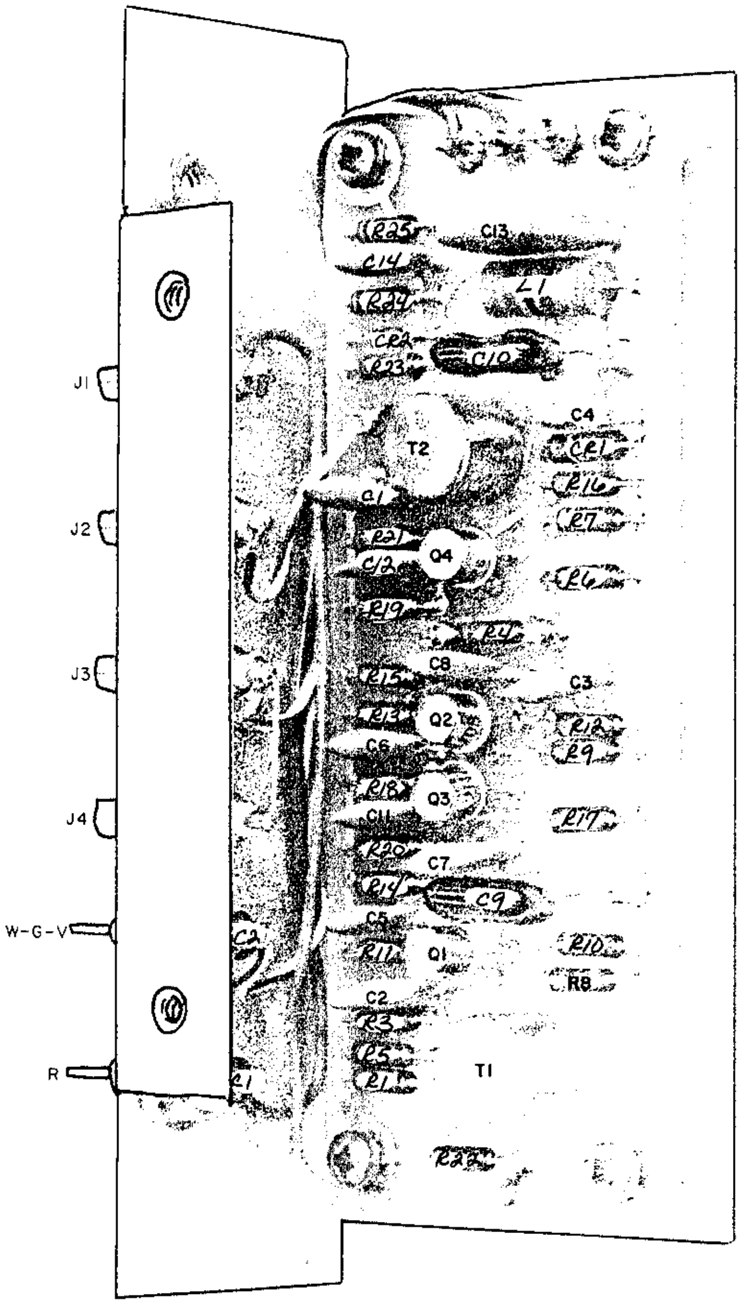
NO PREFIX	A11	A11A1
J17 P1	J1 S1,2	C1-22 CR1-16 L1,2 R1-27 R31-36 T1-4

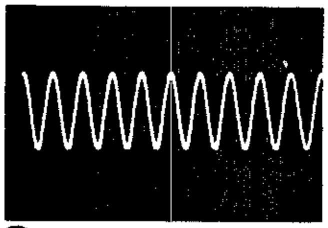
TAPS USED ON HOT WIRE IONIZER SECONDARY OF T1		
HOT WIRE IONIZER VOLTAGE	OUTPUT TAPS	STRAP TAPS
<1.2V	15, 17	14, 16
1.2V-1.6V	16, 17	
>1.6V	14, 17	15, 16

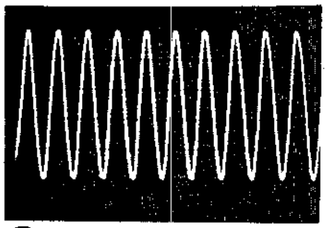
05061-D-25

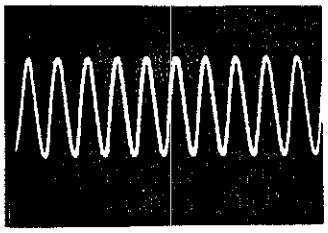
Figure 8-25. Cesium Oven Controller Assembly A11

Fig. 8-26
Sht. 1 of 3




1 2V/cm, .2 μs/cm


2 .5V/cm, .2 μs/cm


3 5V/cm, .2 μs/cm

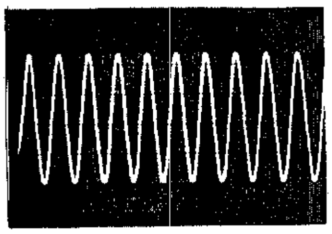

4 .5V/cm, .2 μs/cm

Fig 8-26
Sht. 2 of 3

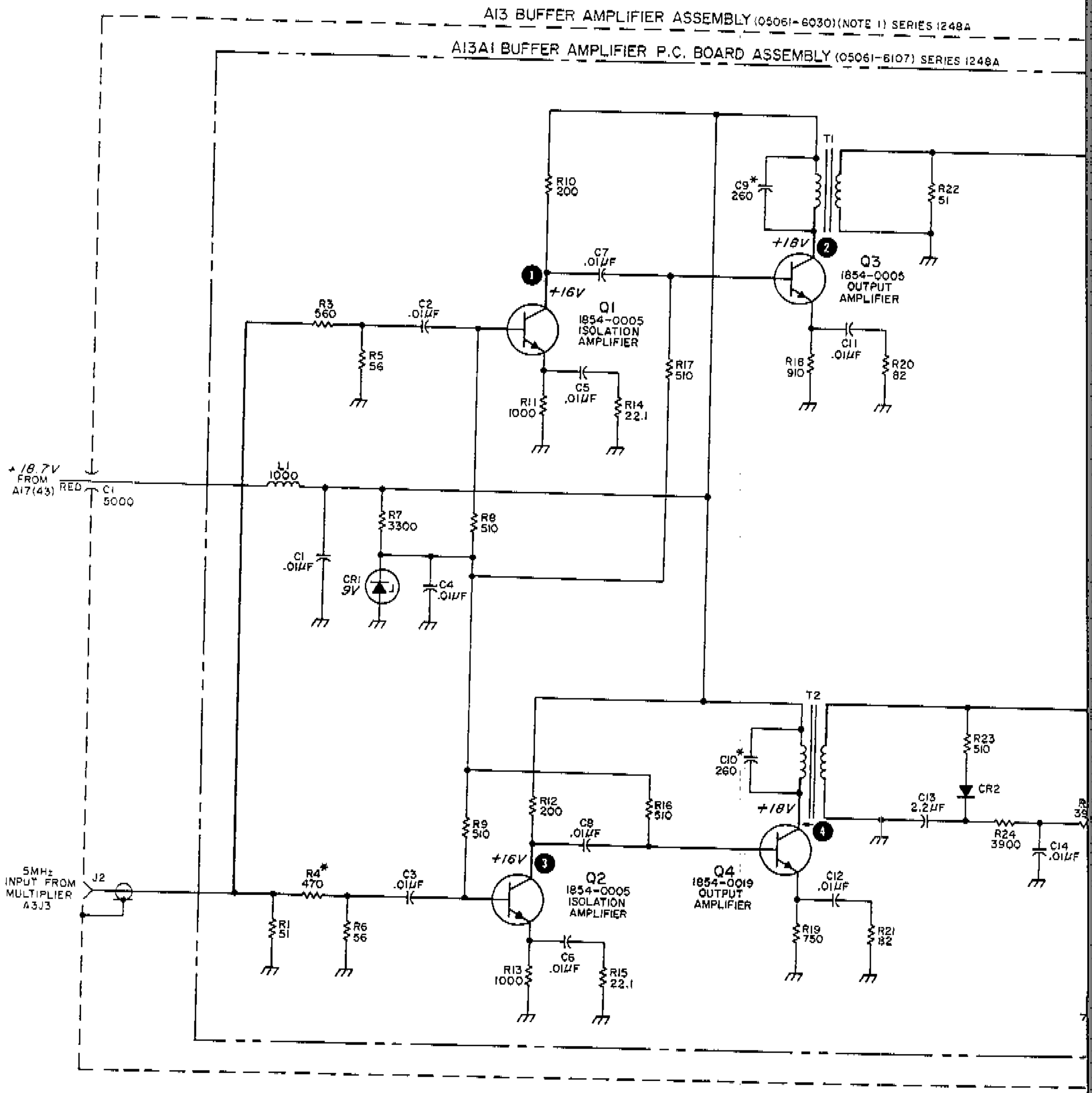
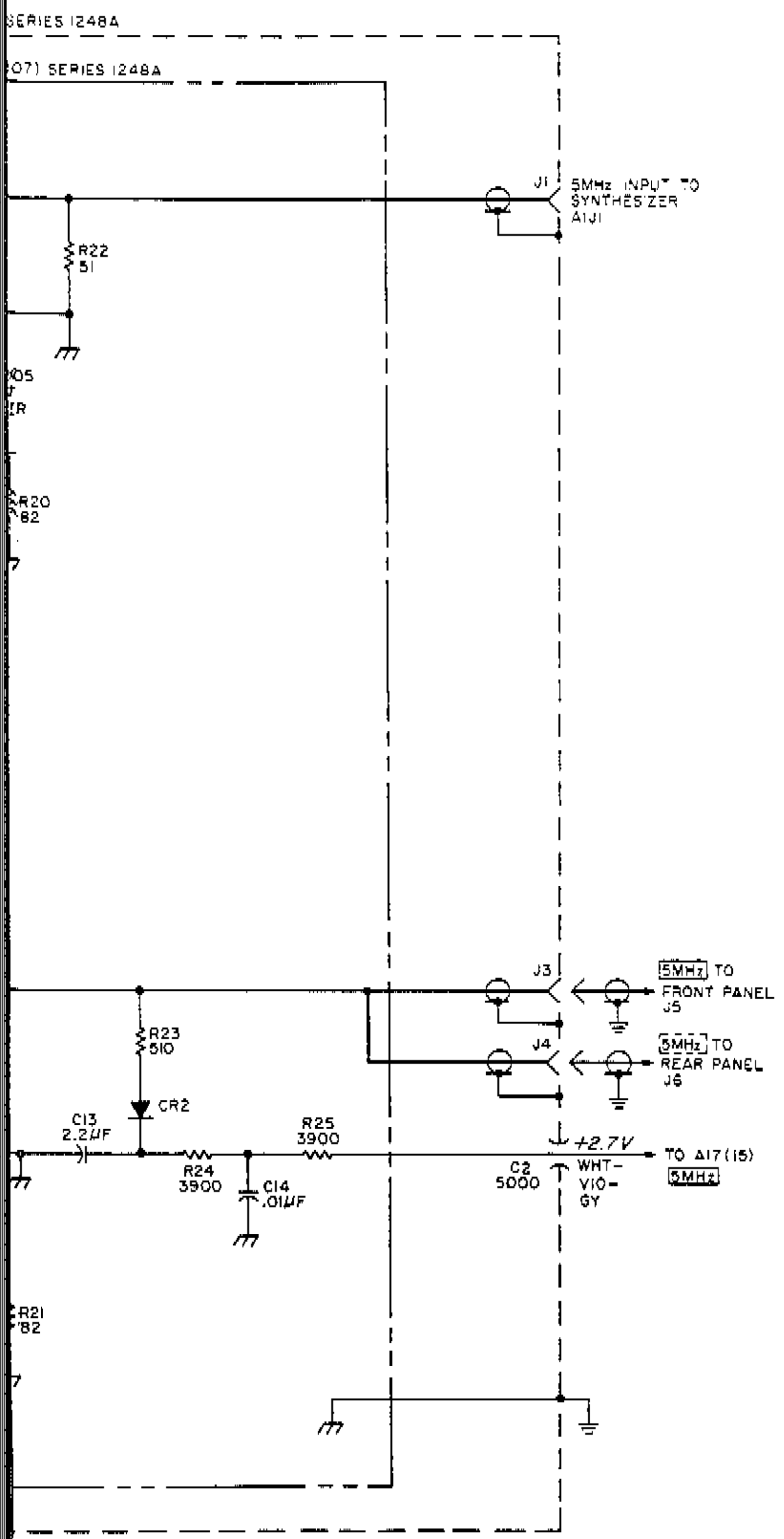


Fig. 8-26
Sht. 3 of 3



NOTES

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2. UNLESS OTHERWISE INDICATED:
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   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

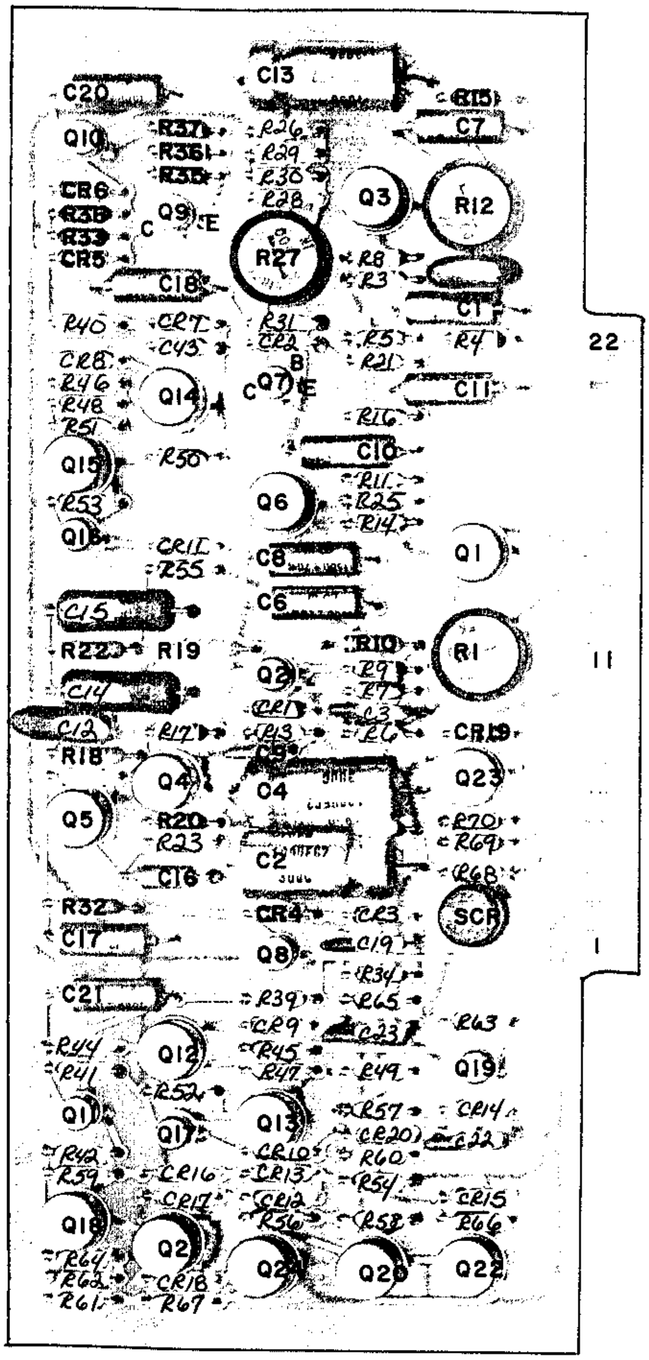
A13	A13A1
C1,2	C1-14 CR1,2
J1-4	L1 Q1-4 R1,3 T1,2

R2 NOT USED

05061-0-26A

Figure 8-26. Buffer Amplifier Assembly A13

Fig. 8-27
Sht. 1 of 4



NOTES

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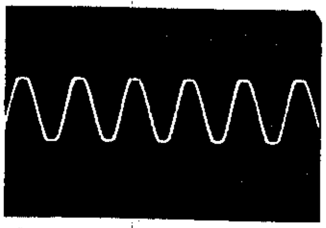
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

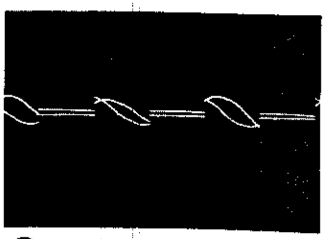
REFERENCE DESIGNATIONS

NO PREFIX	A14
DS1,2 S7	C1-23 CR1-20 Q1-24 R1-70 SCR1

05061-D-27



❶ 2V/cm, 2 ms/cm



❷ .5V/cm, 2 ms/cm

Oscilloscope: DC coupled

5061A: Normal operation

Fig. 8-27
Sht. 2 of 4

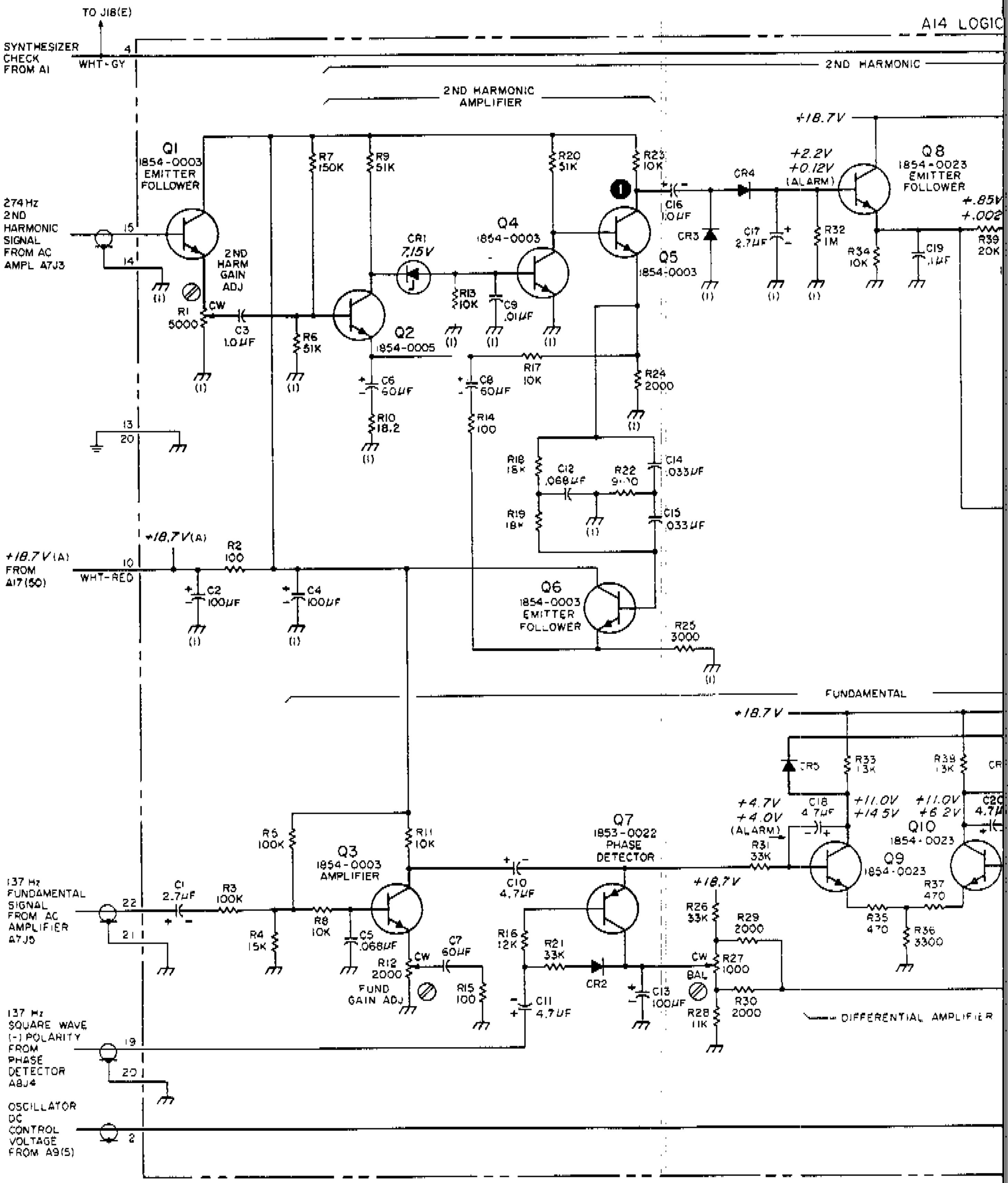


Fig. 8-27
Sht. 3 of 4

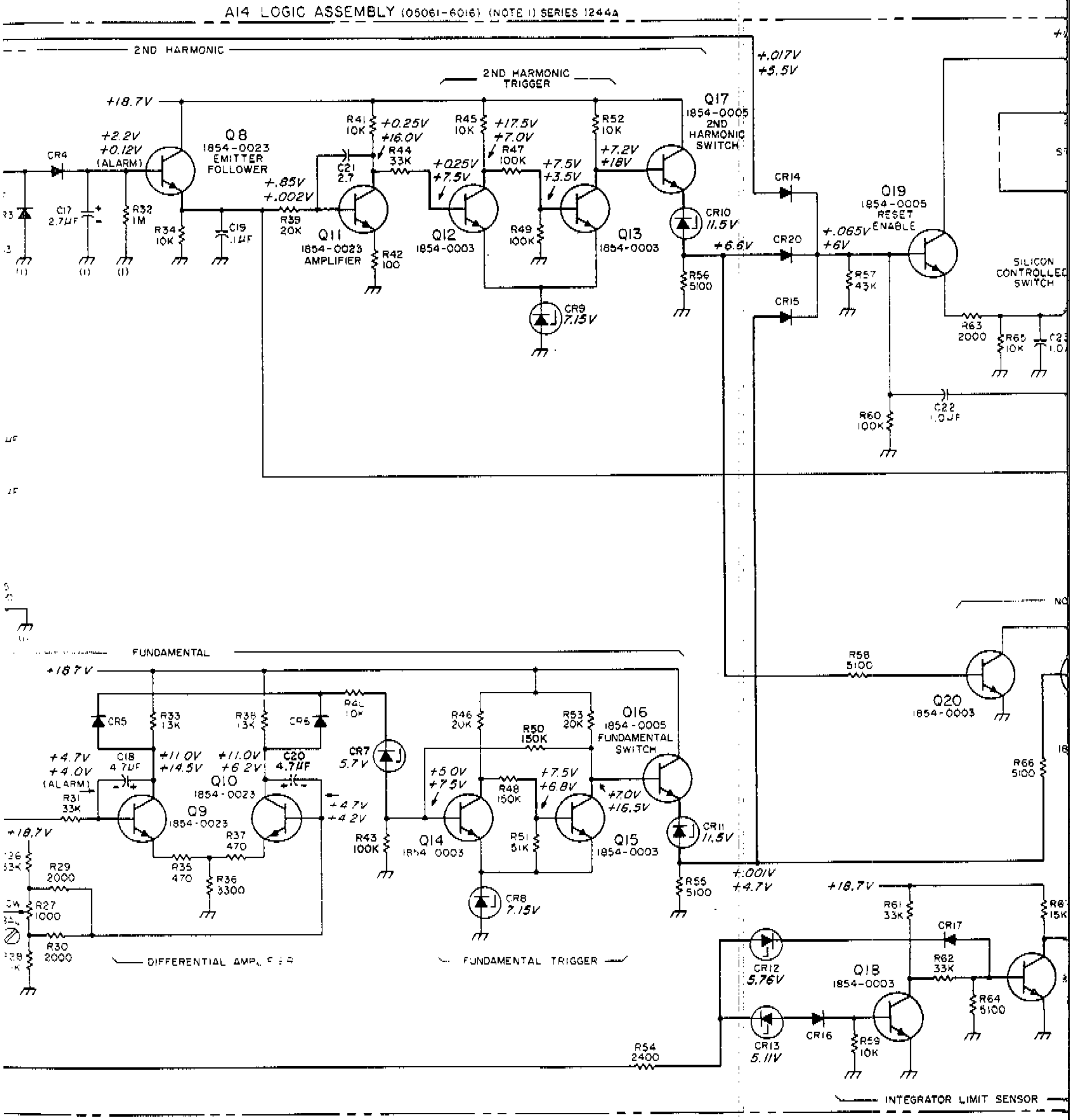


Fig. 8-27
Sht. 4 of 4

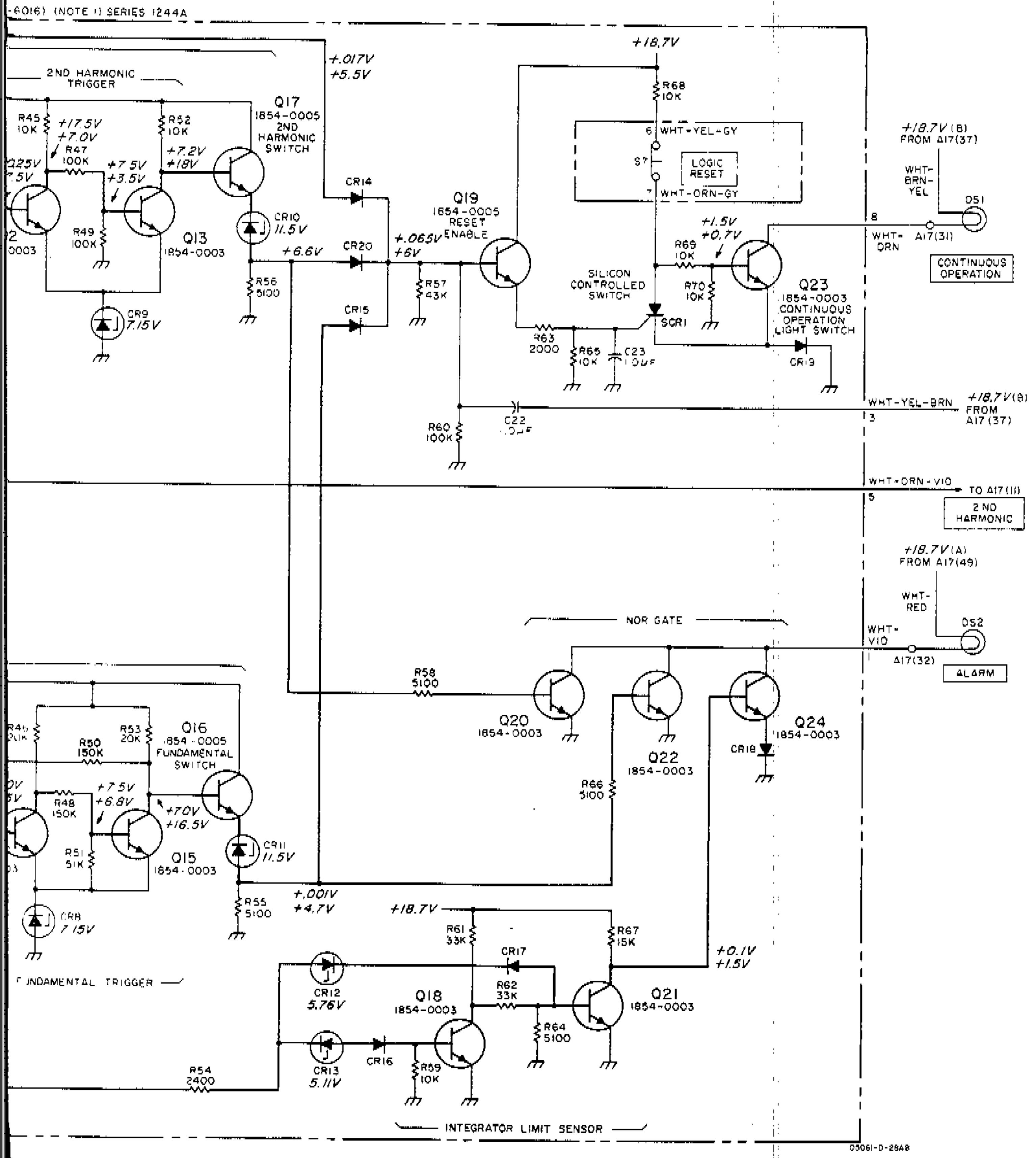


Figure 8-27. Logic Assembly A14

Fig. 8-28
Sht. 1 of 4

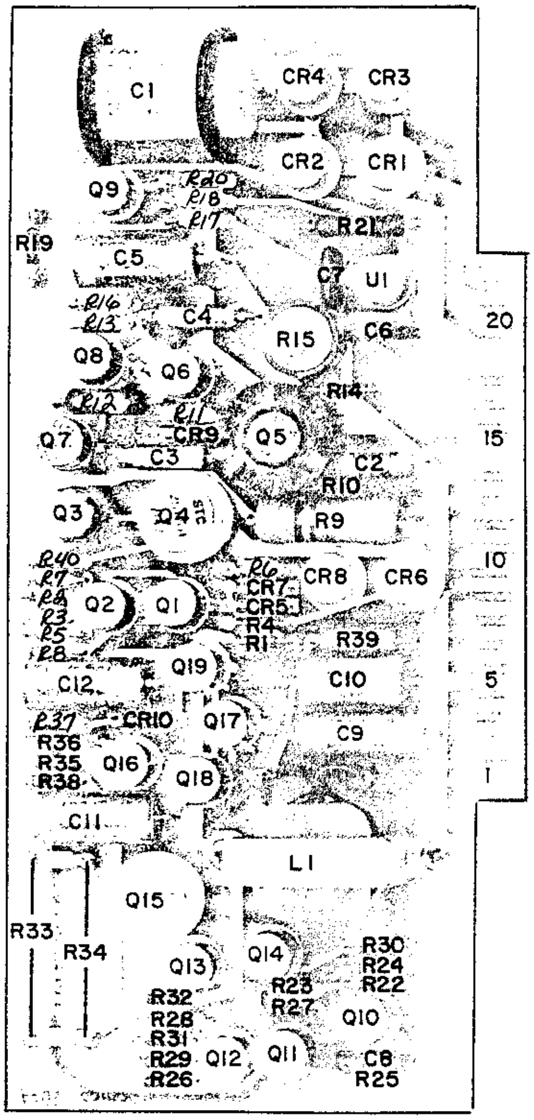
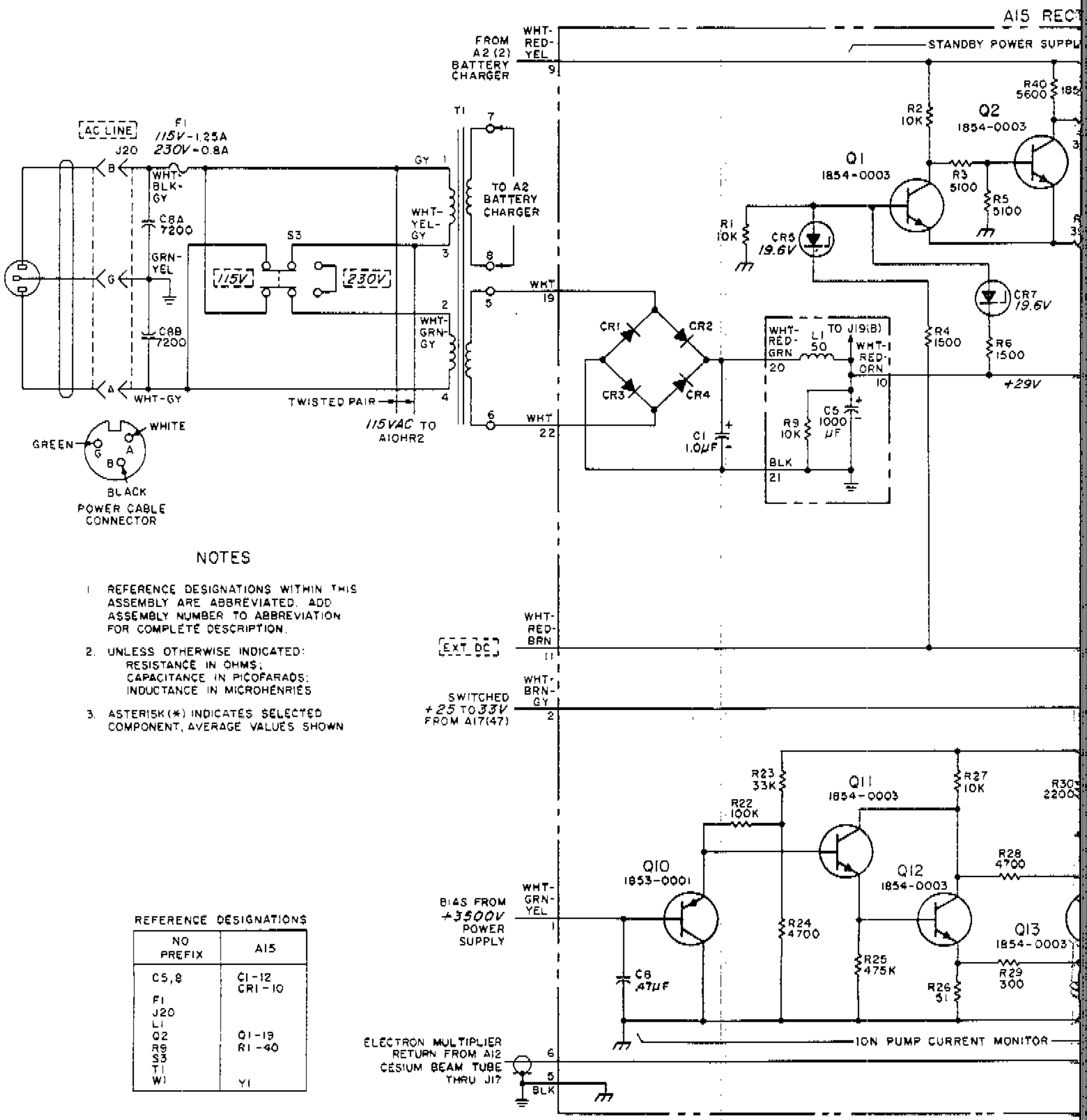


Fig. 8-28
Sht. 2 of 4



NOTES

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2. UNLESS OTHERWISE INDICATED:
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   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

NO PREFIX	A15
C5,8	C1-12
	CR1-10
F1	
J20	
L1	
Q2	Q1-19
R9	R1-40
S3	
T1	
W1	Y1

Fig. 8-28
Sht. 3 of 4

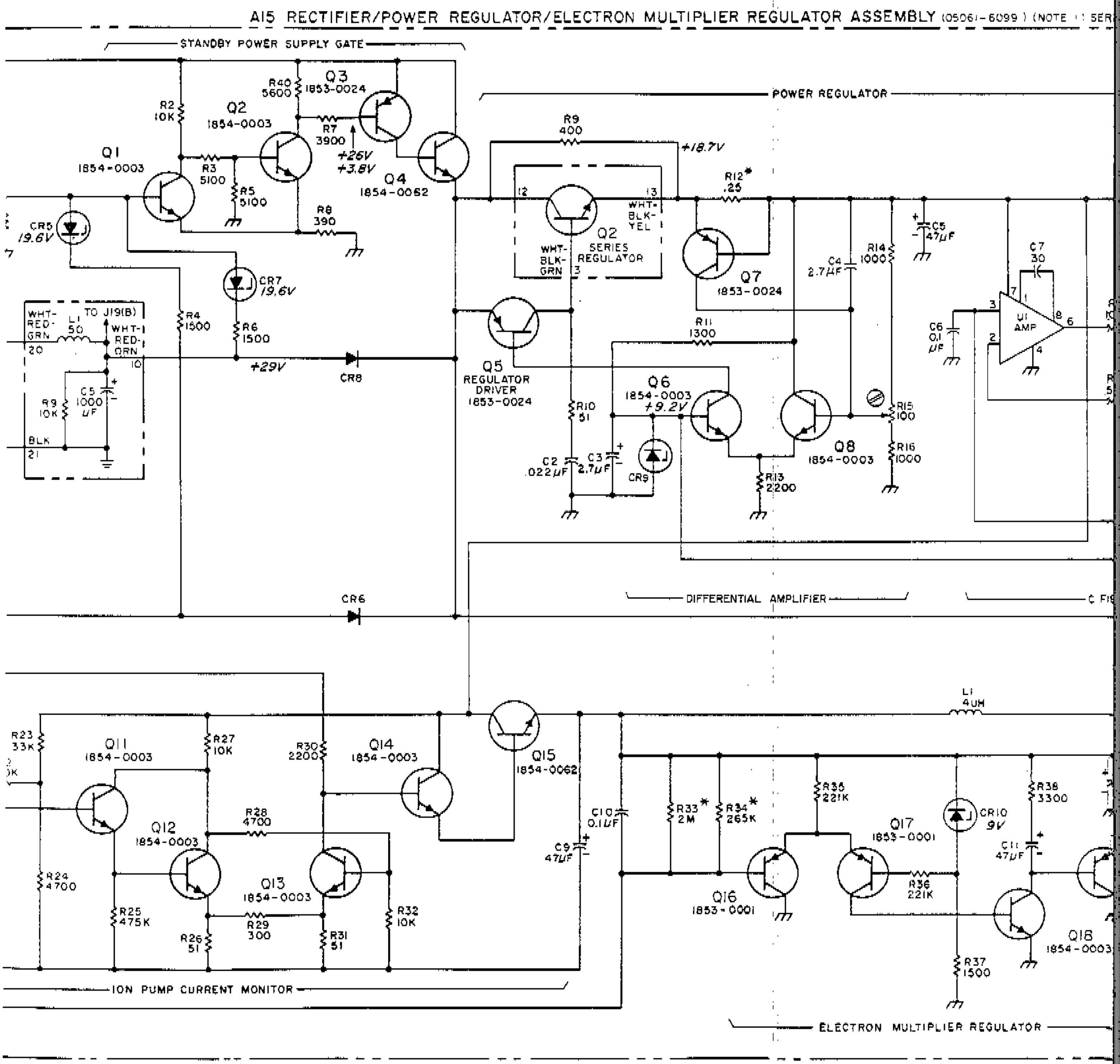


Fig. 8-28
Sht. 4 of 4

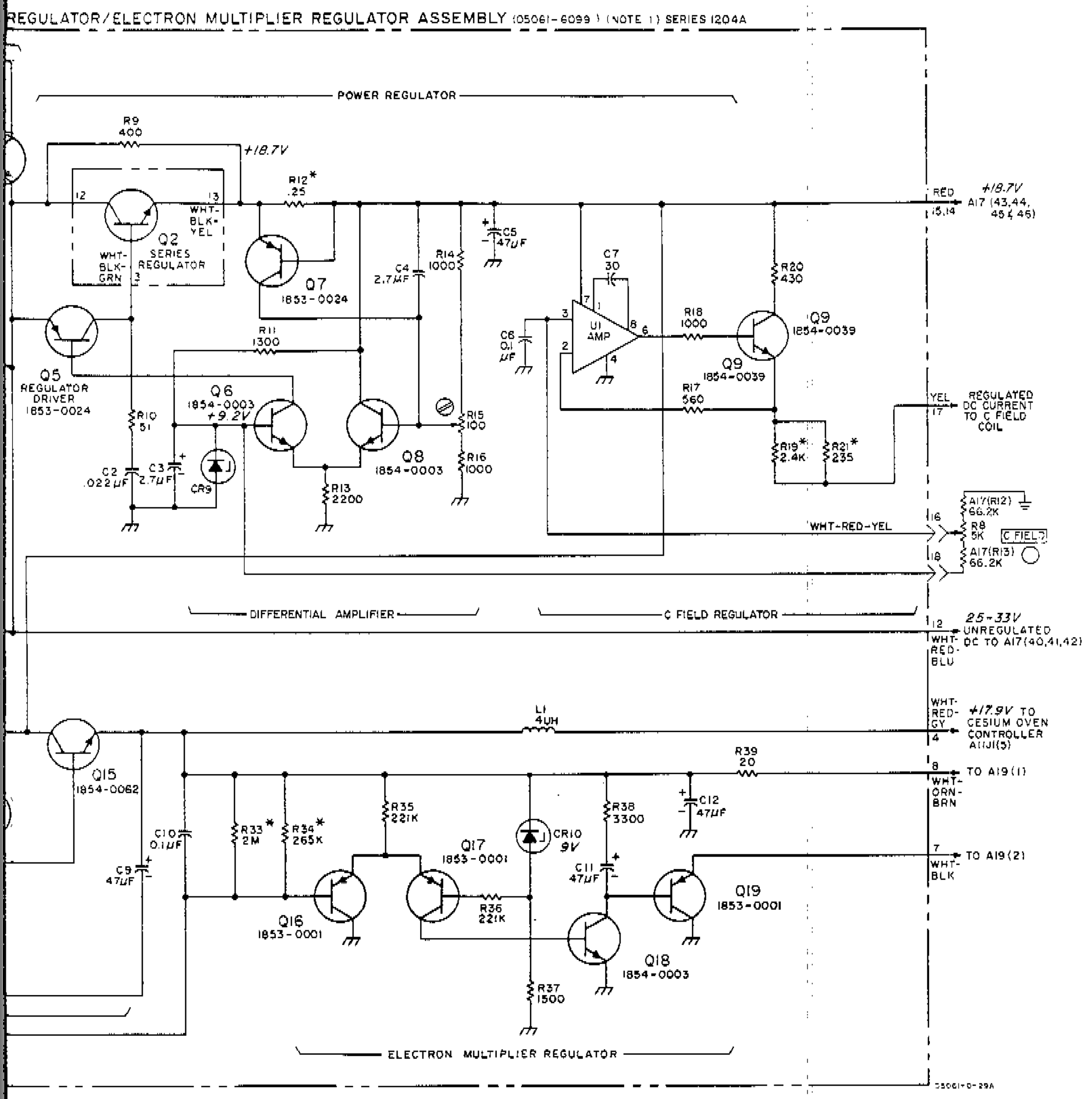


Figure 8-28. Power Regulator Assembly A15

Fig. 8-29
Sht. 1 of 4

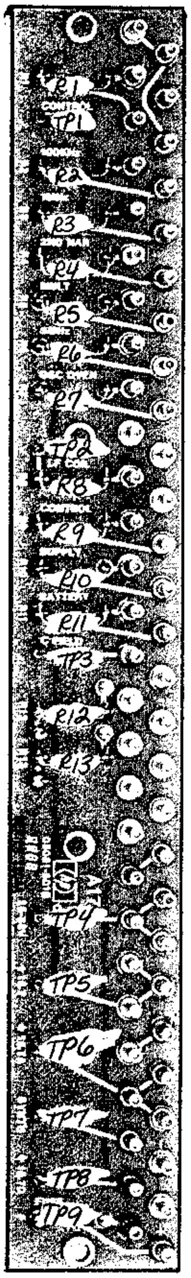
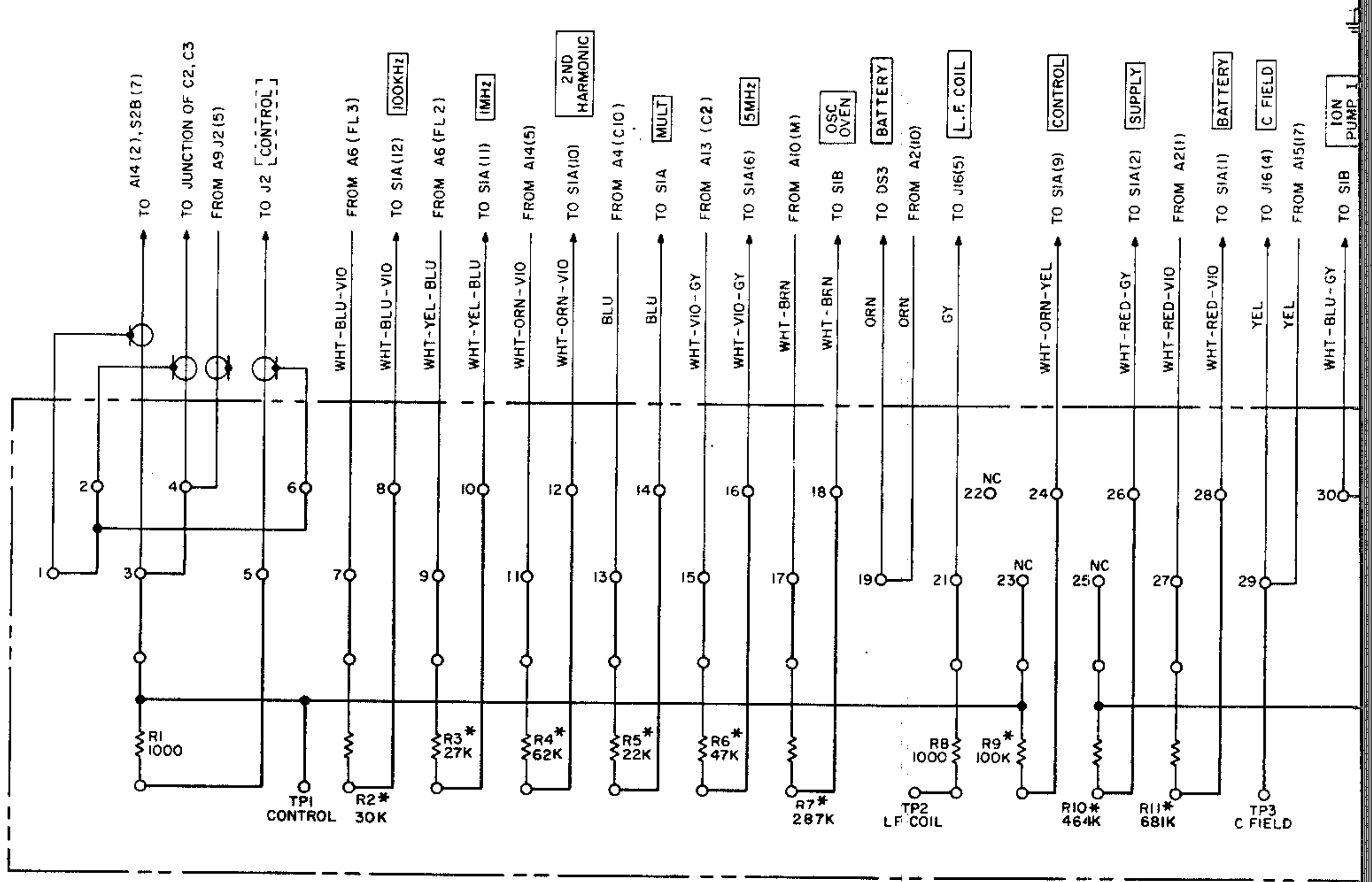


Fig. 8-29
Sht. 2 of 4

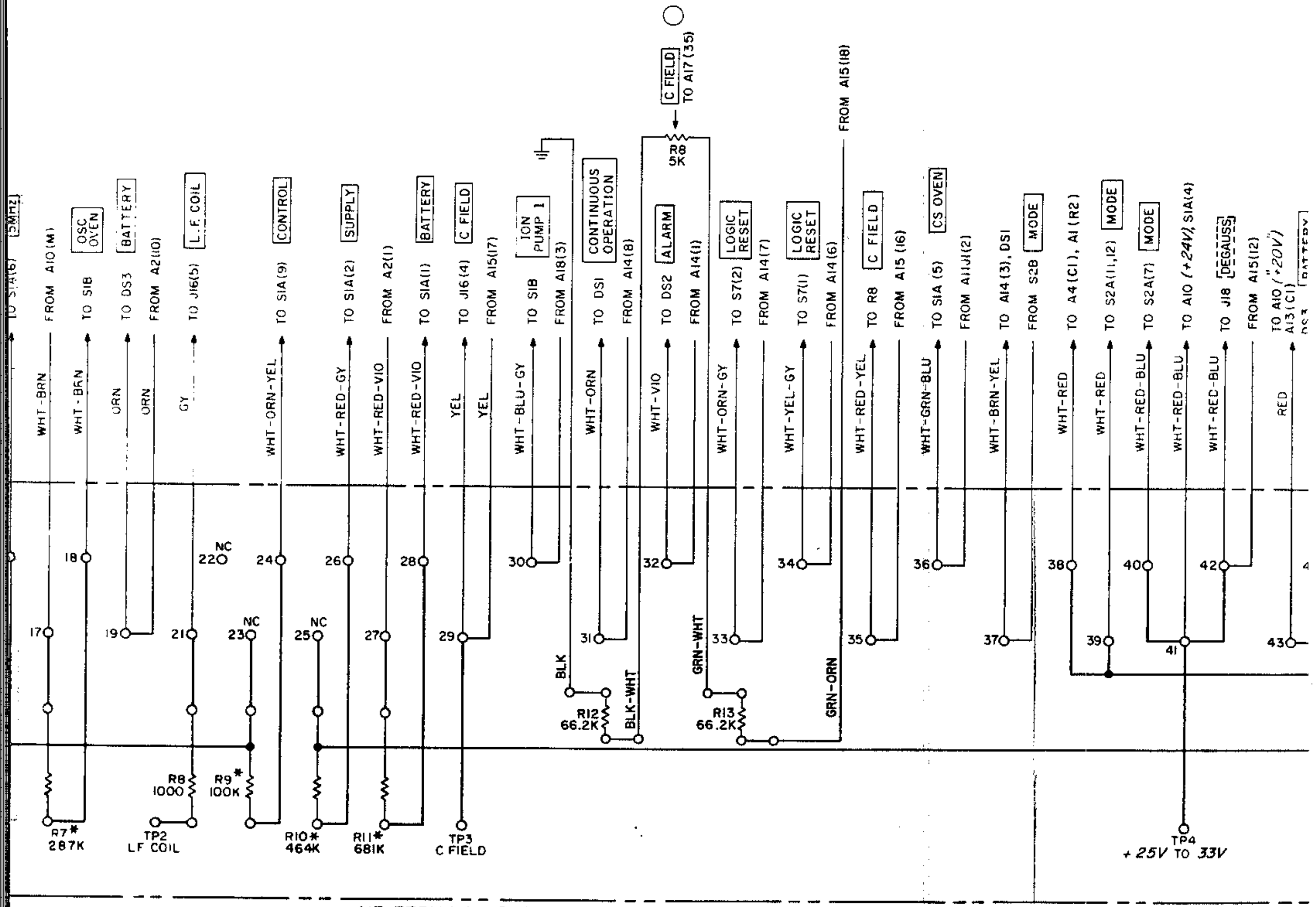


A17 TERMINAL BOAR

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS;
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

Fig. 8-29
Sht. 3 of 4



A17 TERMINAL BOARD ASSEMBLY (05061-6018) (NOTE 1) SERIES 1204A

NOTES

CE DESIGNATIONS WITHIN THIS
Y ARE ABBREVIATED. ADD
Y NUMBER TO ABBREVIATION
PLETE DESCRIPTION.

OTHERWISE INDICATED:
TANCE IN OHMS;

(*) INDICATES SELECTED
ENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS
A17
F1 R1-13 TP1-9

Fig. 8-29
Sht. 4 of 4

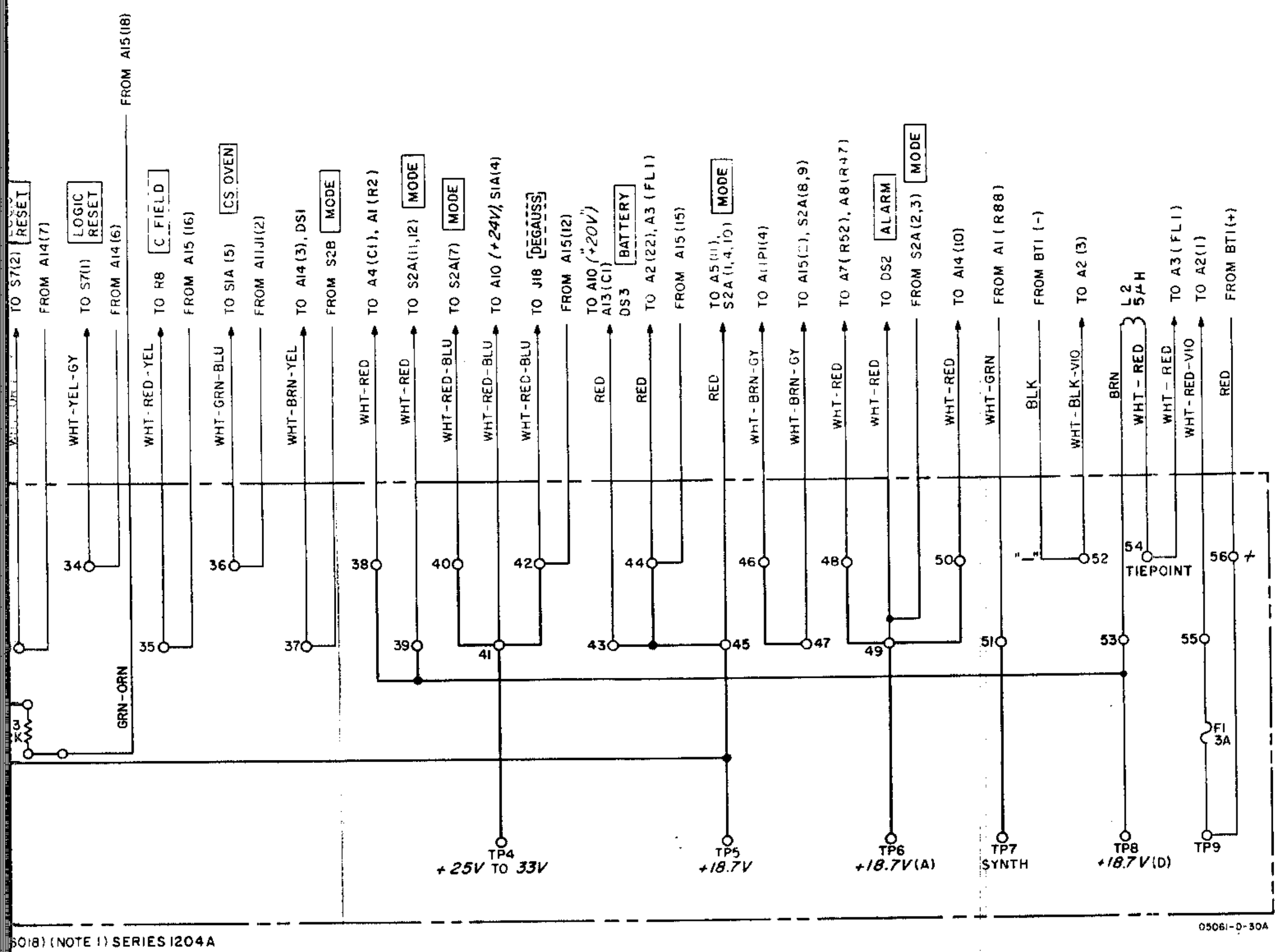
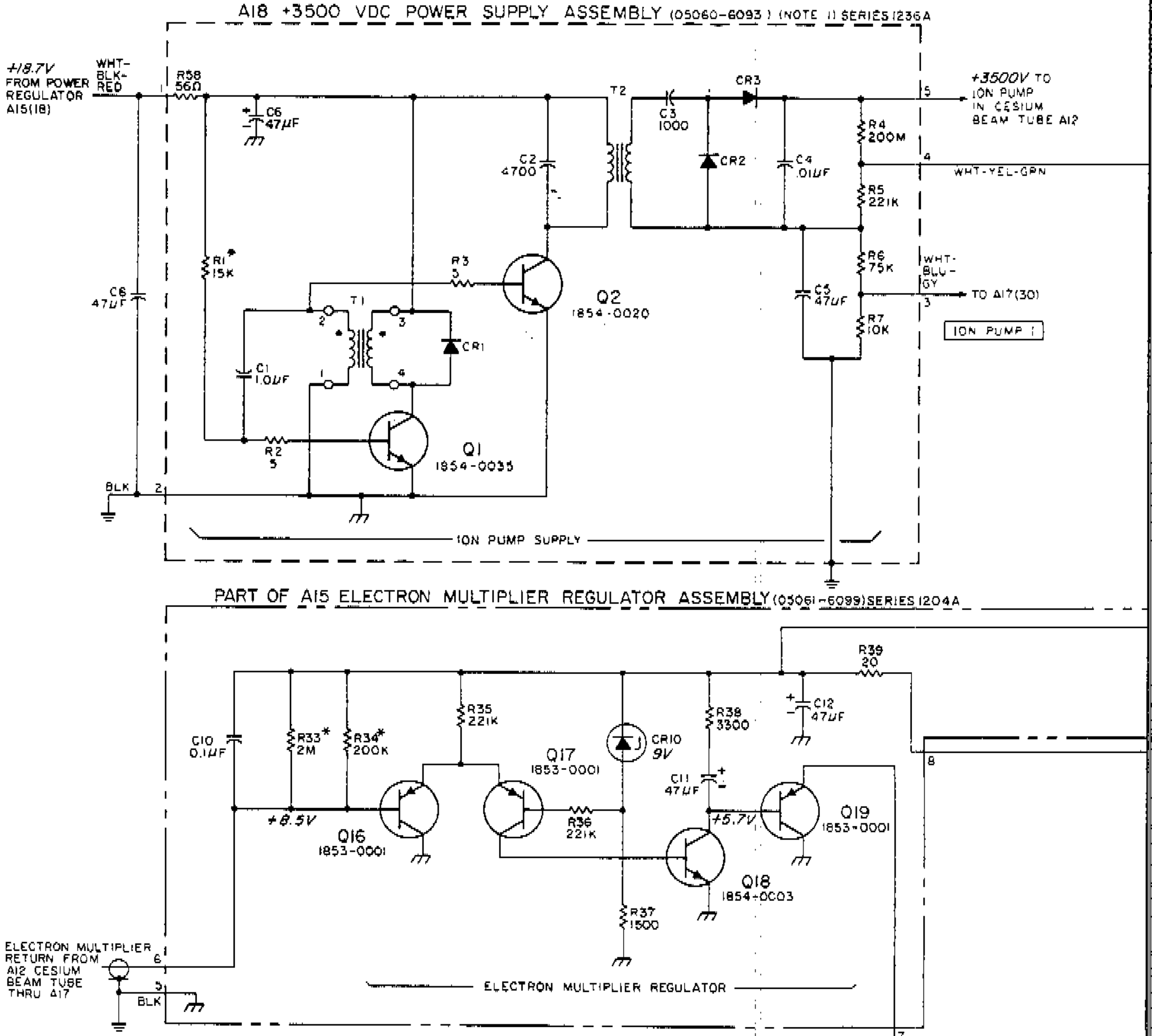


Figure 8-29. Terminal Board Assembly A17

Fig. 8-30
Sht. 1 of 3



NOTES

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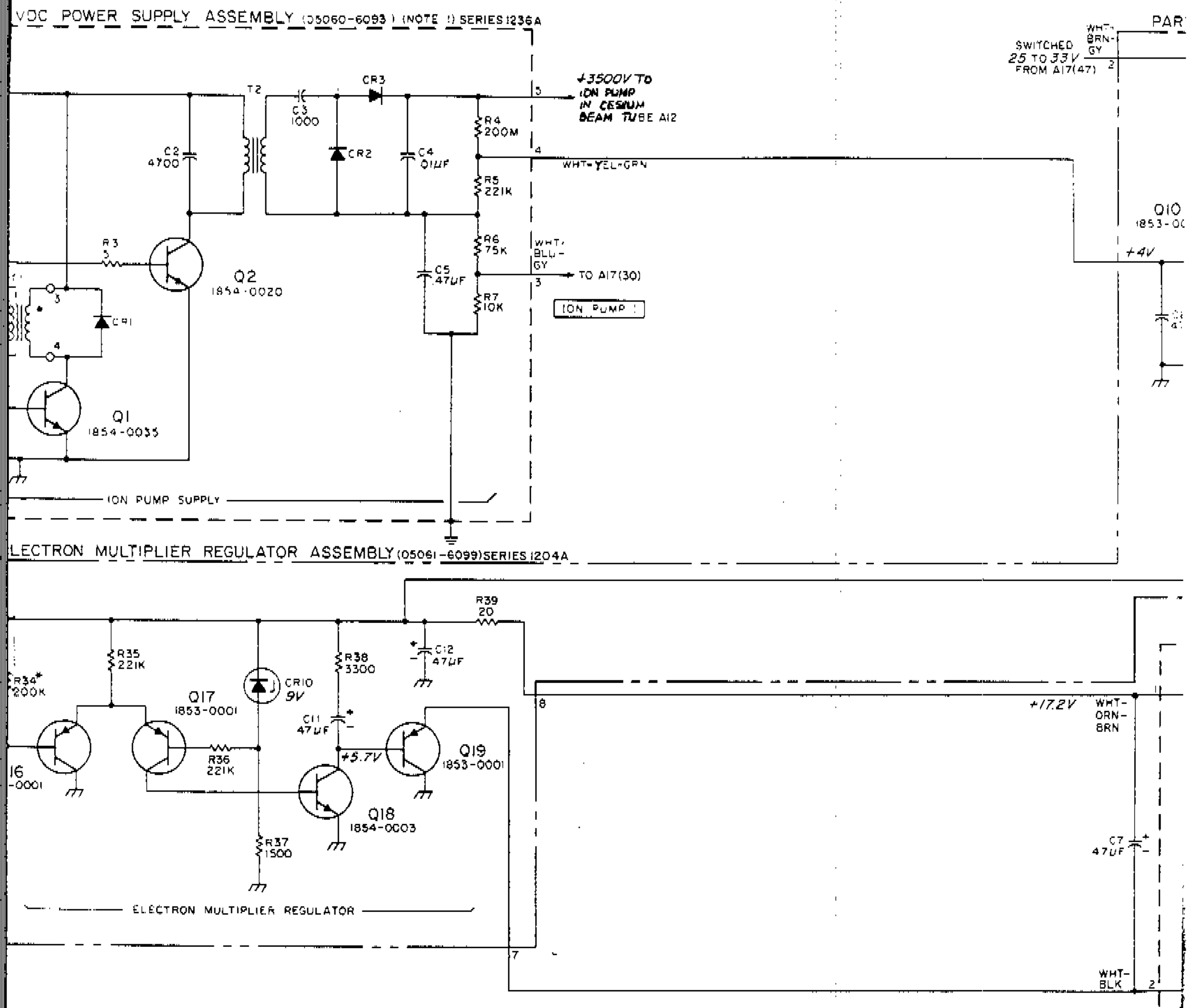
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

NO PREFIX
C6,7

Fig. 8-30
Sht. 2 of 3



NS WITHIN THIS
IATED, ADD
ABBREVIATION
TION.

ICATED:
S;
FARADS;
HENRIES

SELECTED
ALUES SHOWN

REFERENCE DESIGNATIONS

NO PREFIX	A15	A18	A19
C6,7	C8-12 CR10 L1 Q10-19 R22-39	C1-6 CR1-3 Q1,2 R1-8 T1,2	C1-5 CR1-3 Q1,2 R1-9 T1,2

Fig. 8-30
Sht. 3 of 3

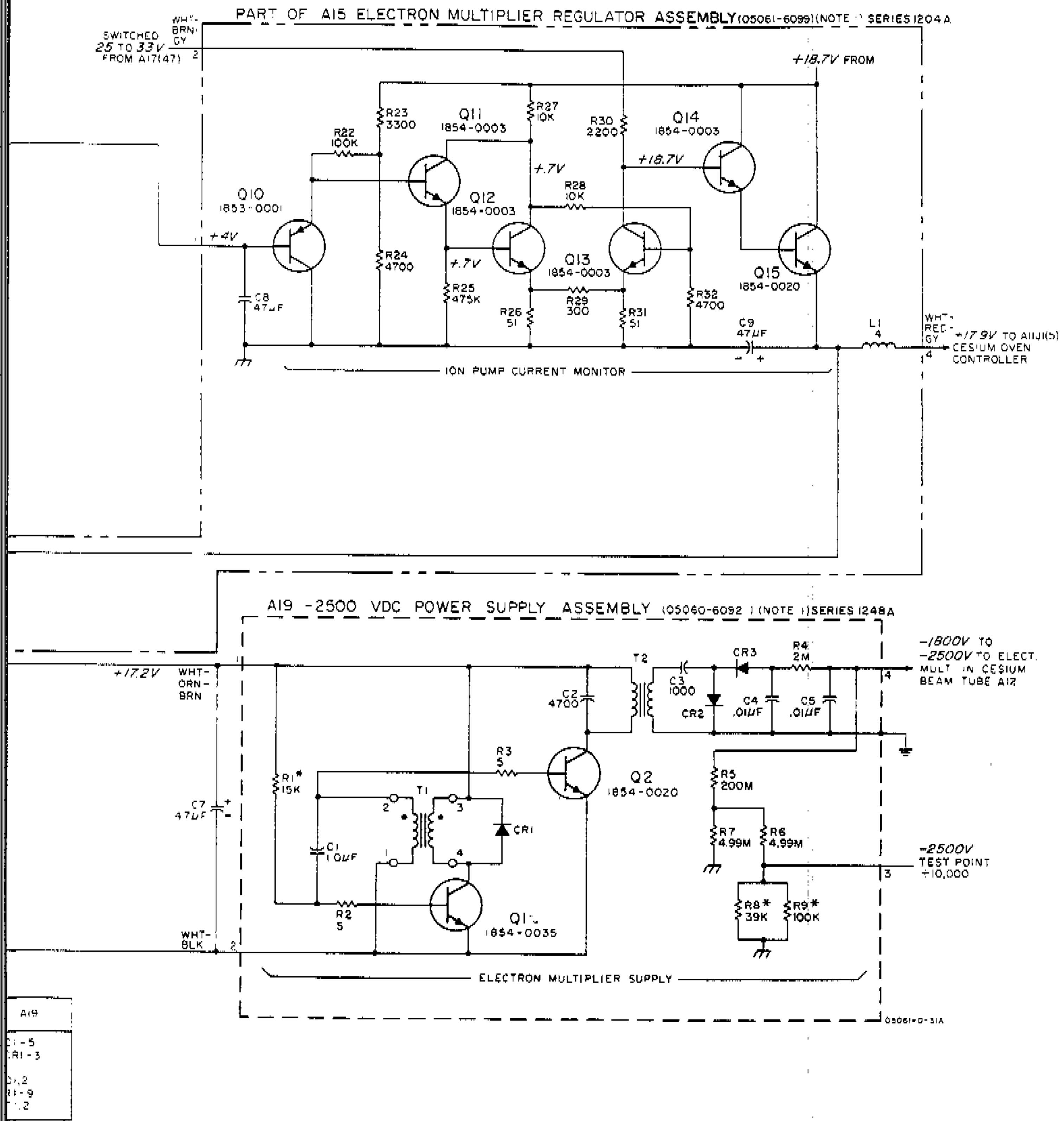
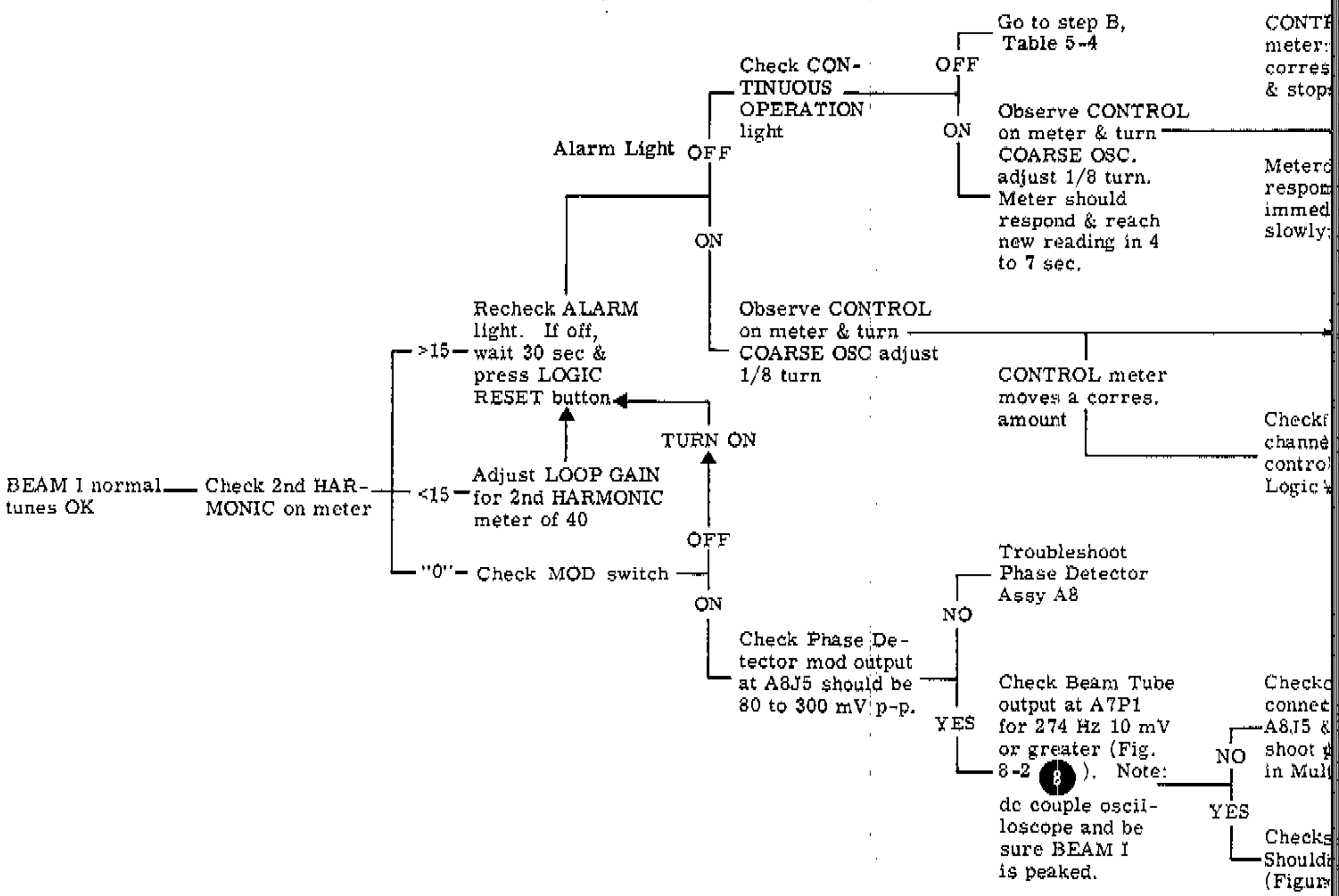
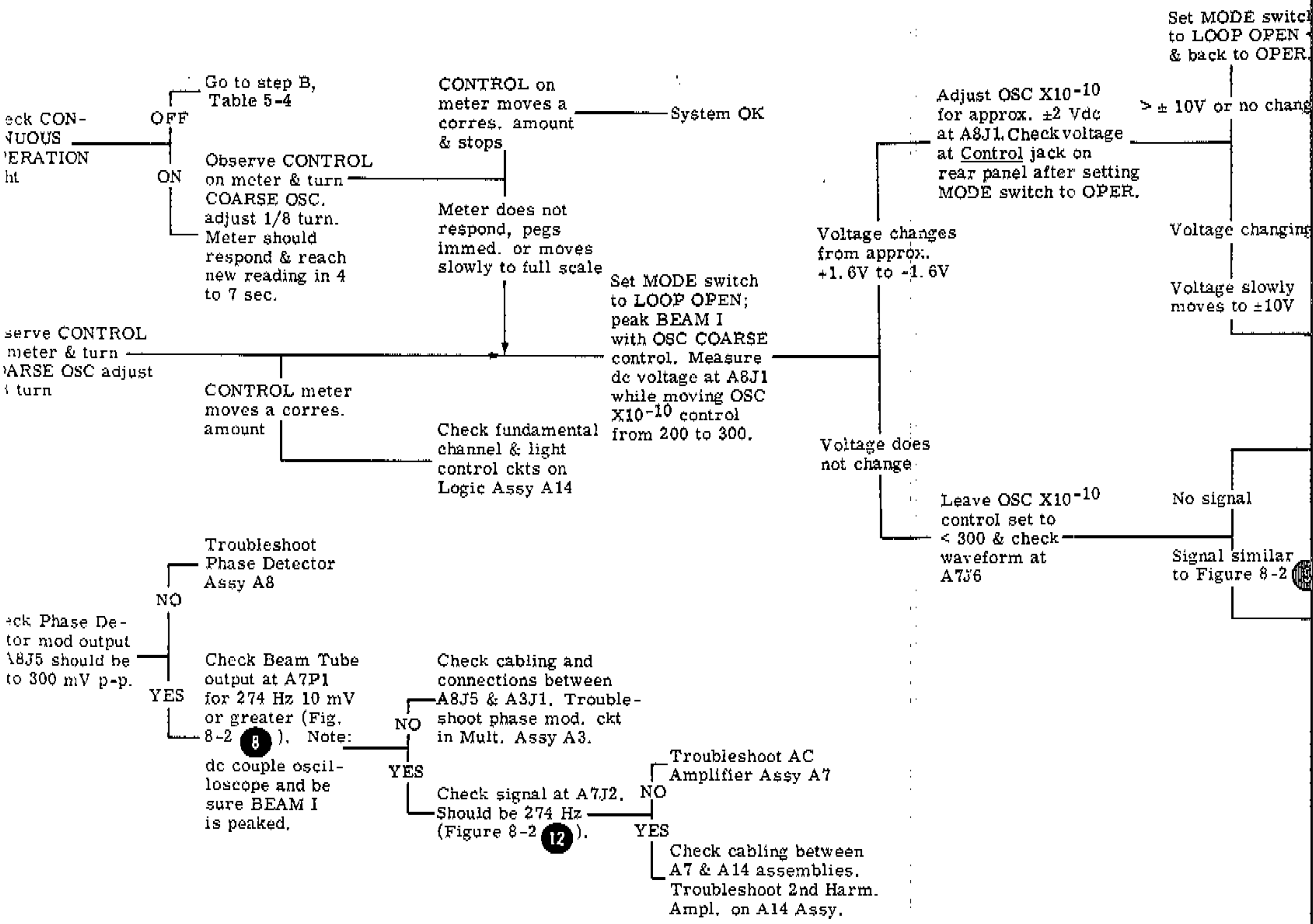


Figure 8-30. +3500 Vdc Power Supply Assembly A18
-2500 Vdc Power Supply Assembly A19

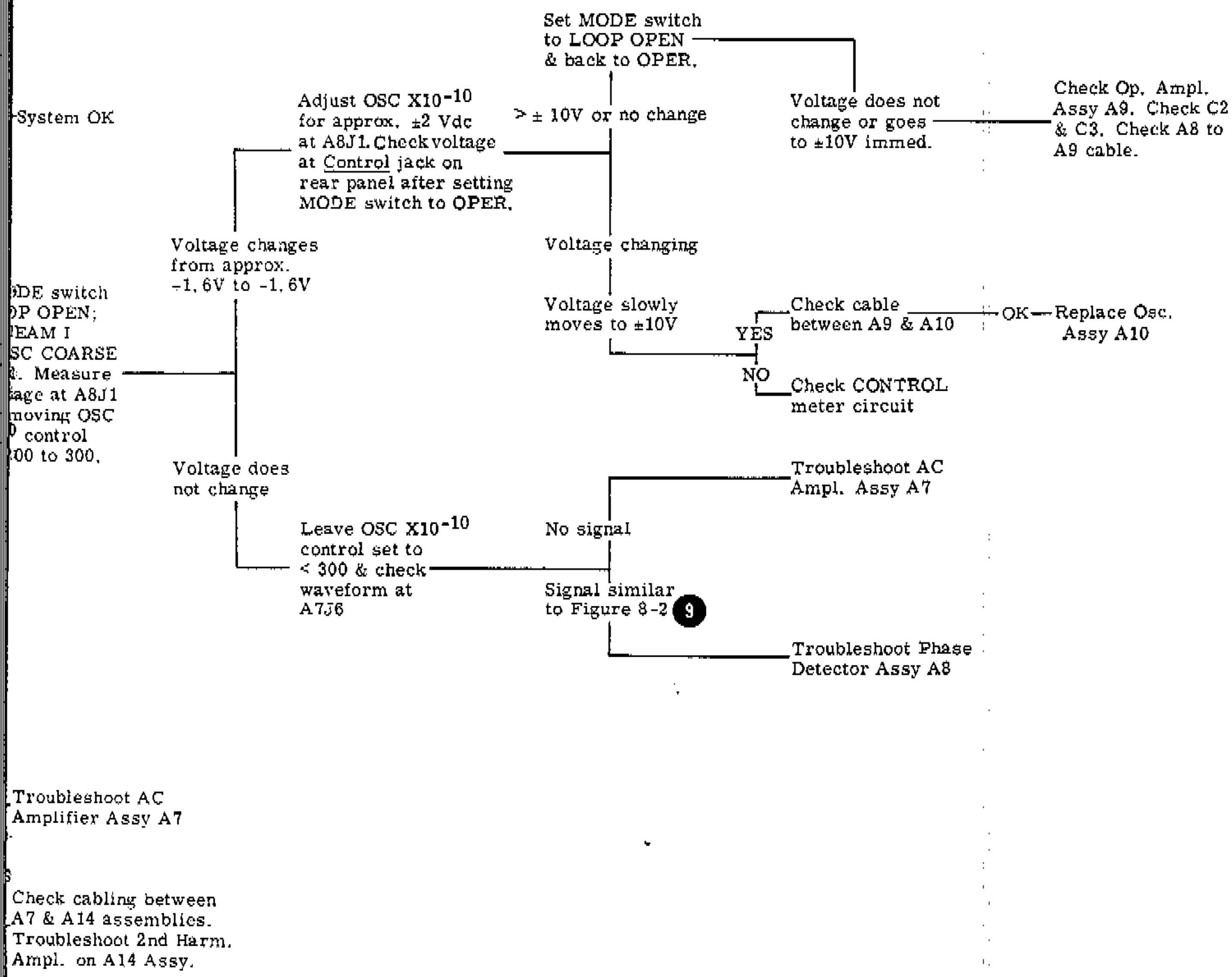
BEAM I: NORMAL
Sht. 1 of 3



BEAM I: NORMAL
Sht. 2 of 3



BEAM I: NORMAL
Sht. 3 of 3



BEAM I: HIGH
Sht. 1 of 2

BEAM I too high meter pegs

Check electron mult. voltage at A19(3) should be voltage indicated on beam tube decal ÷ 10,000 (≈.25V)

correct

Remove AC-DC power from instrument. Remove beam tube plug P16. Meas. thermister resistance between Pin 9 & ground. Should be approx. value indicated on beam tube decal. Replace P16 & reconnect ac power. **C**

Resistance correct

Meas. $\frac{V_p - V_v}{V_b}$

Para. 5-164

> 1

< 1

Resistance incorrect

Troubleshoot cesium oven control ckt. & interconnecting cables

Resistance = 0 or ∞

Check J16 or P16 for short or open

OK

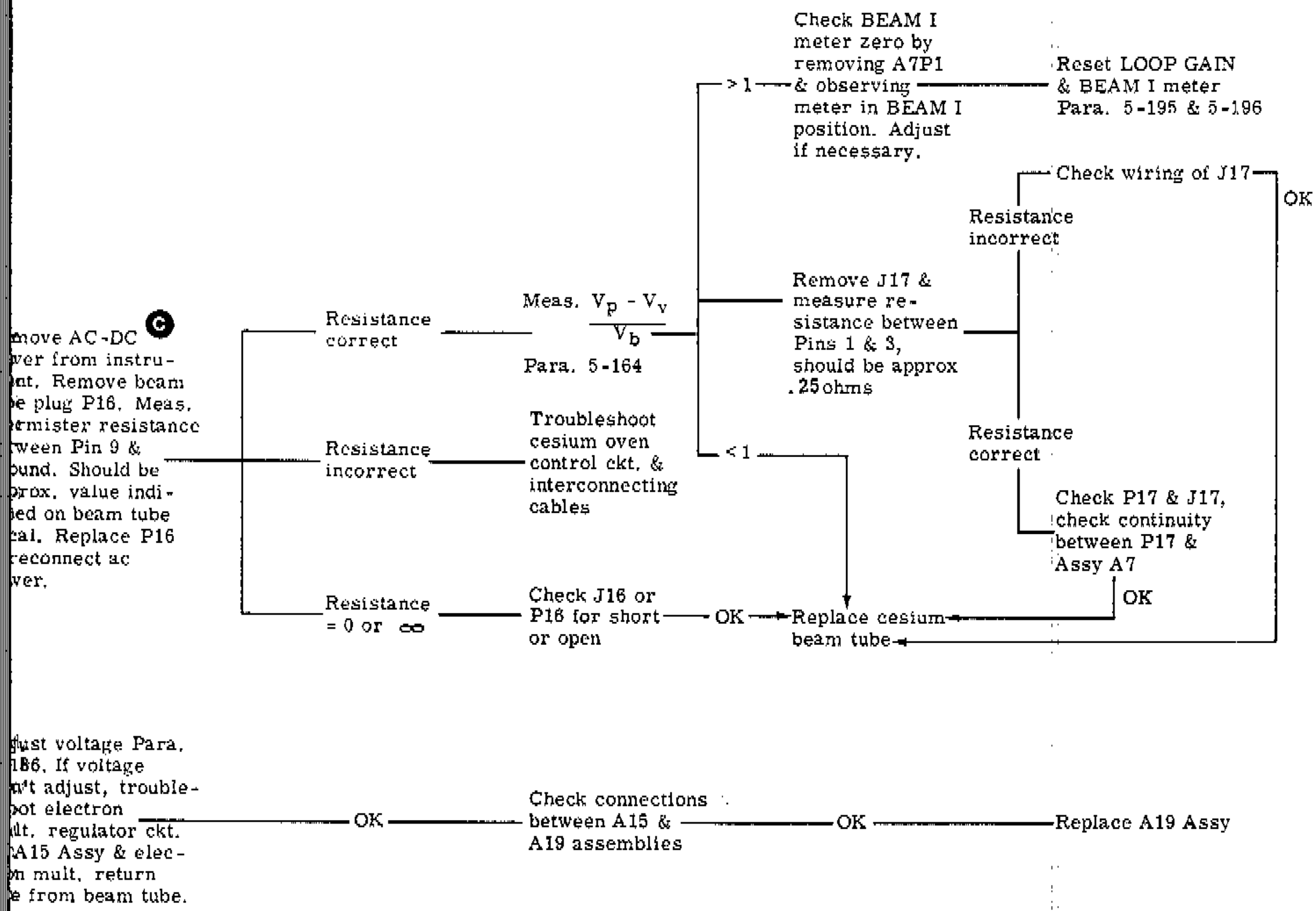
5% off

Adjust voltage Para. 5-186. If voltage won't adjust, troubleshoot electron mult. regulator ckt. on A15 Assy & electron mult. return line from beam tube.

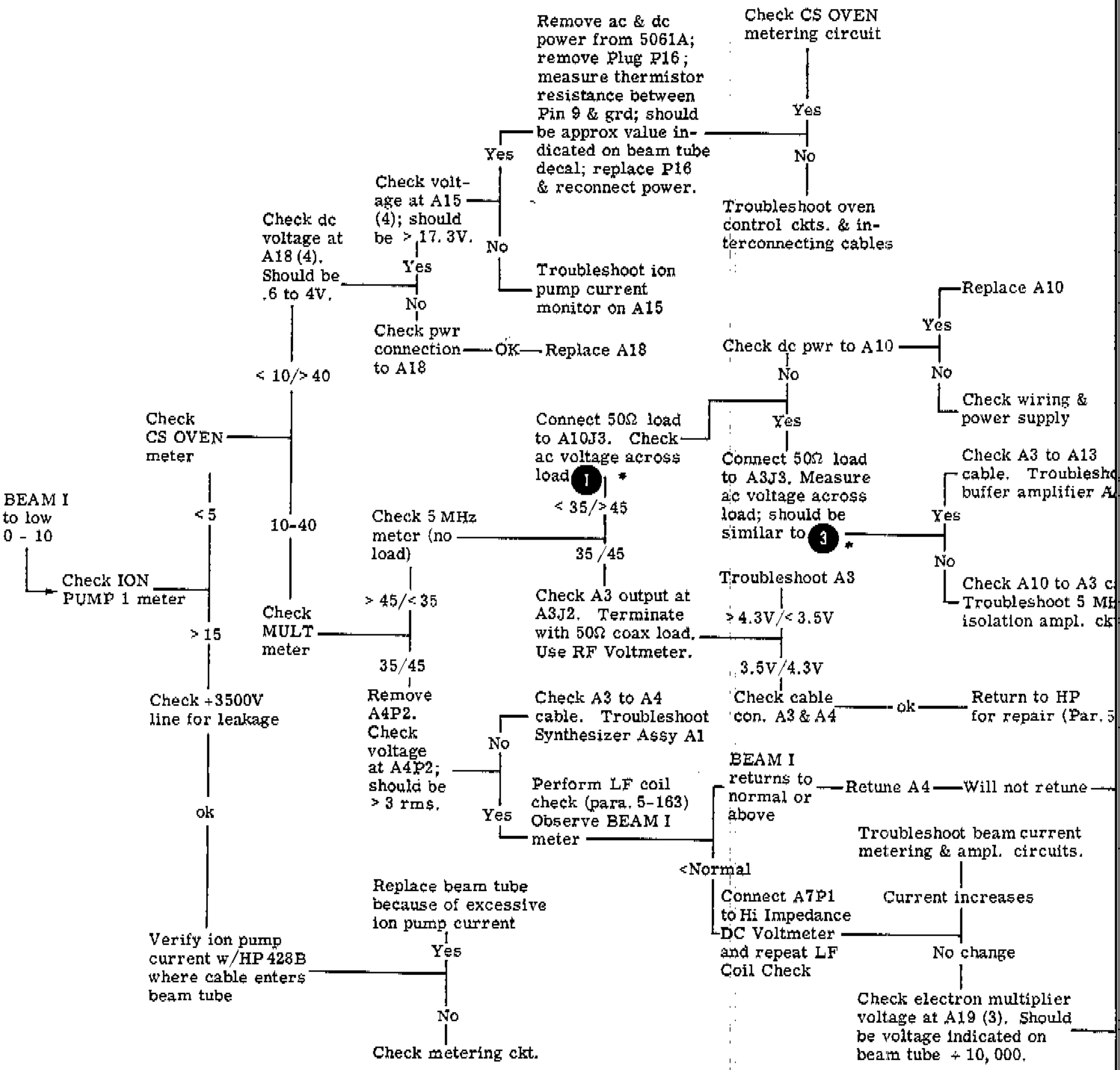
OK

Check connections between A15 & A19 assemblies

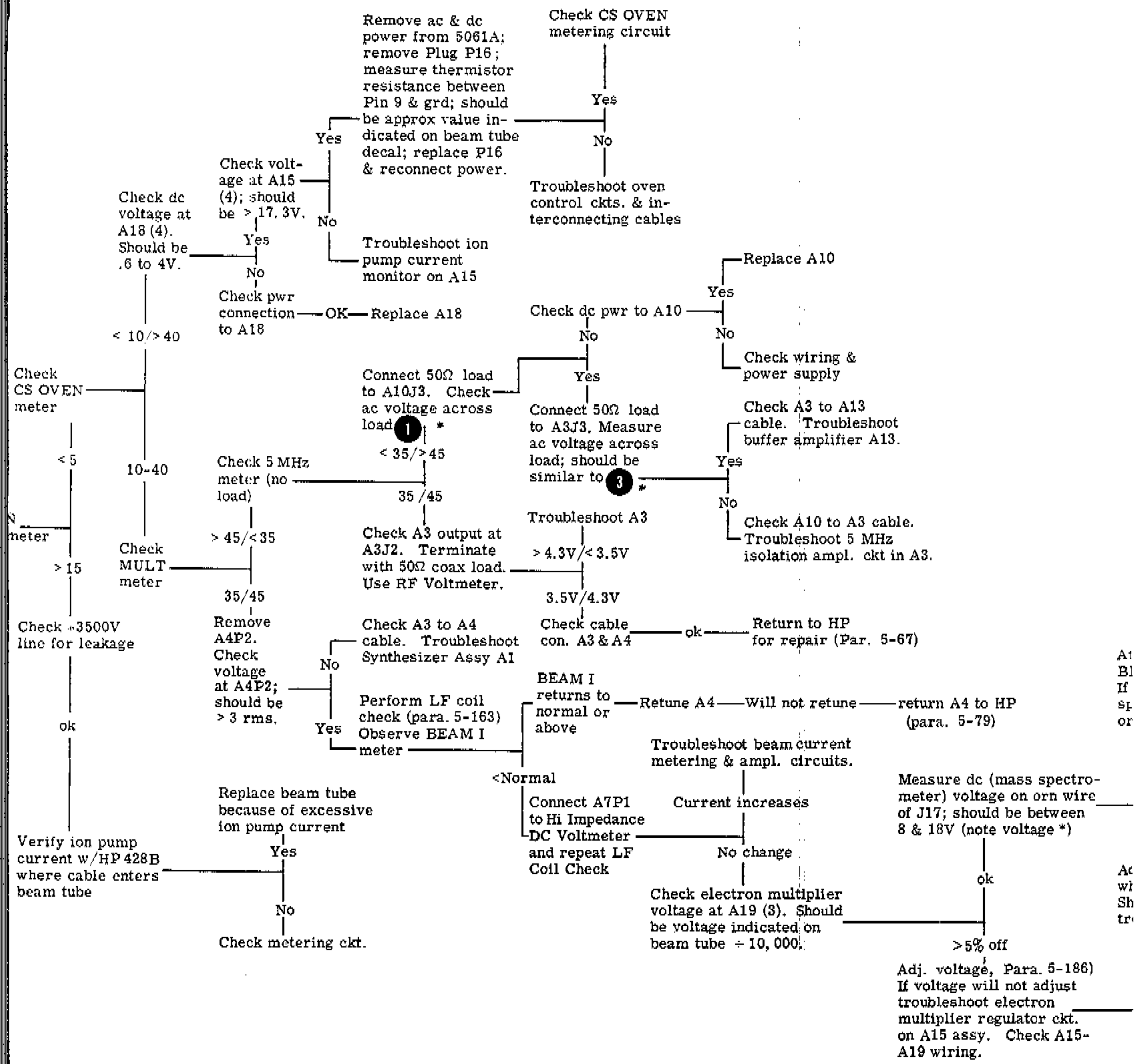
BEAM I: HIGH
Sht. 2 of 2



BEAM I: LOW
Sht. 1 of 3



BEAM I: LOW
Sht: 2 of 3



BEAM I: LOW
Sht. 3 of 3

ce A10

k wiring &
r supply

k A3 to A13
. Troubleshoot
amplifier A13.

A10 to A3 cable.
leshoot 5 MHz
ton ampl. ckt in A3.

rn to HP
epair (Par. 5-67)

not retune — return A4 to HP (para. 5-79)

m current
circuits.

ses

ge

ultiplier
. Should
ed on
00.

Go to C P- Beam I: High

ok

Observe ac voltage hot wire ionizer on orn. wire at J17 6 *

waveform incorrect

Troubleshoot A11 ckt. & interconnecting cables. Check resistance of hot wire ionizer at pins 1 & 3. of P17. Should be approx .75Ω.

resistance incorrect

Check wiring of P17. If ok replace tube.

no change

Attempt to maximize BEAM I by adj. A11R27. If BEAM I does not respond, reset A11R27 to original voltage noted*

BEAM I increases with adj.

Go to Step A (Table 5-4)

ok

voltage responds to control

Measure dc (mass spectrometer) voltage on orn wire of J17; should be between 8 & 18V (note voltage *)

>18V/<8V

Ad. A11R27 mass spec. while observing voltage. Should change with controll setting

voltage does not respond to control

Troubleshoot mass spectrometer. Adjust circuit in A11 assy.

ok

>5% off

Adj. voltage, Para. 5-186) If voltage will not adjust troubleshoot electron multiplier regulator ckt. on A15 assy. Check A15-A19 wiring. — OK — Replace A19

APPENDIX I

MANUAL CHANGES AND OPTIONS

1. MANUAL CHANGES

2. This manual applies directly to Model 5061A Cesium Beam Frequency Standards with serial prefix 1428A.

3. NEWER INSTRUMENTS

4. As instruments are improved, serial prefixes above 1428A may be assigned. The manuals for these instruments will be supplied with a manual change sheet containing the required updating information. If the change sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office.

5. OLDER INSTRUMENTS

6. Table 1 in this appendix lists each assembly, its current series number, earlier series numbers and the changes required to backdate the manual to the applicable assembly series number. Table 1A also lists changes which apply to the instrument mainframe only.

7. The instrument series prefix number indicates the highest series number of the instrument mainframe and/or of one or more sub-assemblies or modules used in the 5061A (excluding A10, 5 MHz Oscillator and A2 BATTERY CHARGER ASSEMBLY).

8. For instrument series numbers less than 1428A, down to and including 1204A, check the series numbers of the sub-assemblies and modules and make the changes listed in Appendix I, Table 1. For instruments series number 1132A and below, make change number 53, THEN make the changes listed in Appendix I, Table 1.

9. OPTION 001 (Time Standard)

10. Option 001 Time Standard: This option includes a 24-hr clock movement and switches to allow the clock movement to be set to the nearest second. A one-pulse-per-second output at front and rear panel BNC connectors is provided by this option. An internal "sync" button permits automatic synchronization of the 1PPS output to an external "sync" pulse. By the use of six thumbwheel switches, the output clock pulse is adjustable from 1 μsec to 1 second with respect to a reference pulse.

11. OPTION 002 (Standby Power Supply).

12. Option 002 Standby Power Supply: Standby power capability for a minimum of 30 minutes (1 hour typically) is provided by an internal battery. Recharging of the battery is automatic, through the use of a digital timing system. A front panel lamp indicates when battery is being used or fast-charged.

13. OPTION 003. Combines Option 001 and Option 002.

14. OPTION 004 (High Performance Tube)

15. Option 004 High Performance Cesium Beam Tube. (See Table 1-1 for performance specifications.) Option 004 provides improvement in specifications such as accuracy, settability, reproducibility and short-term-stability. Warranty on this tube is 10,000 hrs (about 14 months).

Table 1. Manual Changes

Assembly Number	Current Series Number	Earlier Series Number	Make Manual Changes
A1	1328A	1316A	64
		1152A	64, 65
		1040A	64, 65, 36
		932	64, 65, 36, 36A
		838	64, 65, 36, 36A, 1
		832	64, 65, 36, 36A, 1, 2
		828	64, 65, 36, 36A, 1, 2, 3
		748	64, 65, 36, 36A, 1, 2, 3, 4
		728	64, 65, 36, 36A, 1, 2, 3, 4, 5
A2	1352A	1112A	62
		1040A	62, 48
		936	62, 48, 6
		838	62, 48, 6, 7
		812	62, 48, 6, 7, 8
		728	62, 48, 6, 7, 8, 9
A3	1248A	1224A	54
		1124A	54, 33
		1040A	54, 33, 34
		824	54, 33, 34, 35
		808	54, 33, 34, 35, 10
		732	54, 33, 34, 35, 10, 11
		612	54, 33, 34, 35, 10, 11, 12
A4	1220A	952	37
		824	37, 13
		732	37, 13, 14
		528	37, 13, 14, 15
A5	1404A	1332A	62
		1248A	62, 63, 59
		1232A	62, 63, 60
		1040A	62, 63, 59, 32
		728	62, 59, 32, 32A
A6	1248A	728	55

Table 1A. Manual Changes for Instrument Mainframe

Current Instrument Prefix	Earlier Instrument Prefixes	Make Manual Changes
1428A	1328A	61

Table 1. Manual Changes (Cont'd.)

Assembly Number	Current Series Number	Earlier Series Number	Make Manual Changes
A7	1244A	1132A	44A
		1120A	44A, 45
		808	44A, 45, 46
		728	44A, 45, 46, 16
A8	1244A	1116A	46A
		808	46A, 47
		712	46A, 47, 17
A9	1116A	944	44
		728	44, 18
		620	44, 18, 19
A10			
A11	1232A	1104A	32
		1036A	32, 20
		940	32, 20, 21
		928	32, 20, 21, 22
		728	32, 20, 21, 22, 23
A12	1240A	1220A	49
		1116A	49
		1104A	49, 50
		740	49, 50
		728	49, 50, 24
A13	1248A	916	56,
		728	56, 51
A14	1244A	1236A	56A
		1208A	56A, 57
		1040A	56A, 57, 38
		916	56A, 57, 38, 39
		820	56A, 57, 38, 39, 25
		748	56A, 57, 38, 39, 25, 26
		728	56A, 57, 38, 39, 25, 26, 27
A15	1204A	1040A	40
		828	40, 41
		748	40, 41, 42
		728	40, 41, 42, 28
		724	40, 41, 42, 28, 29
A17	1204A	728	43
A18	1236A	1204A	52
		512	52, 53
A19	1248A	728	58
		512	58, 30

CHANGE 1.

Figure 8-8:

Replace schematic diagram with Figure 1.

Figure 8-7:

Replace component locator with Figure 2.

Table 1. Manual Changes (Cont'd.)

CHANGE 1 (Cont'd.)	Figure 8-9: Replace schematic diagram with Figure 3. Table 6-1: Replace A1 parts list with Table 2.
CHANGE 2.	Figures 1 and 2: DELETE: R103, R104, and R105 Figure 3: Change Q17 part number to "1854-0005" Table 2: DELETE: Listings for A1A1R103, R104, and R105 Change A1A1Q17 part number to "1854-0005"
CHANGE 3.	Figure 1: Change A1A1R19 to "2000" ohms Table 2: Change A1A1R19 to "0757-0931" "2K" Figure 3: Change A1A1R58 to "10K" Change A1A1R82 to "20K" Table 2: Change A1A1R58 to "0757-0948" "10K" Change A1A1R82 to "0757-0955" "20K"
CHANGE 4.	Table 2: Change A1A1CR27 to 1902-3024; Diode, Breakdown, 2.87V Change A1A1R101 to 0757-0924; 2K, 2%, 1/4W
CHANGE 5.	Figures 1 and 3 and Table 2: Change the following: C33 to 0140-0234; C:Fxd, 500 pF C34 to 0140-0225; C:Fxd, 300 pF C39 to 0140-0220; C:Fxd, 200 pF CR2 to 1902-3104; Diode, Breakdown, 5.6V *L2, 4 to 9140-0046; Coil: Fxd, 1.2 μH L7 to 9140-0096; Coil: RF 1.0 μH (Connect L7 between junction of R73-C32 and C36-Q23 base) Q23 to 1854-0023; Transistor, NPN R7, 14 to 0757-0935; R: Fxd, 3K R30 to 0757-0931; R: Fxd, 2K R78 to 0757-0479; R: Fxd, 392K R79 to 0757-0972; R: Fxd, 100K R96, 98 to 0757-0894; R: Fxd, 56 ohm
CHANGE 6.	Figure 8-10 and Table 6-1: Change A2R2 to 120 ohms, 0698-3622, 5%, 2W Change A2R23 to 2400 ohms, 0757-0933, 2%, 1/4W Delete A2R64 and replace with a straight-thru connection

Table 1. Manual Changes (Cont'd.)

CHANGE 7.	Figure 8-10 and Table 6-1: Change A2CR17 to 1902-0184, 16.2V
CHANGE 8.	Figure 8-10 and Table 6-1: Change A2Q13 to 1855-0010 Change A2CR17 to 1902-3203, 14.7V Change A2CR19 to 1902-0052, 6.81V
CHANGE 9.	Figure 8-10 and Table 6-1: Change A2CR19 to 1902-3104, 5.6V
CHANGE 10.	Figure 8-11: Replace Figure 8-11 with Figure 4. **NOTE** **Multiplier Assemblies with HP Part No. 05061-6083 (Series 824 and above) cannot be interchanged with Assemblies with HP Part No. 5060-6001 (Series 808 and below).**
CHANGE 11.	Figure 4 and Table 6-1: Change the following: A3C21 to 0140-0196, 150 pF A3C17 to 0140-0198, 200 pF A3C23 to 0140-0225, 300 pF A3C28 to 0150-0059, 3.3 pF A3R13 to 0757-0972, 100K A3Q5 to 1854-0013, 2N2218A A3C25, 26 to 0150-0093, 0.01 μF (add across R25, R26) Delete E7 and E8
CHANGE 12.	Figure 4 and Table 6-1: Change the following: A3C43 to 0140-0145, 22 pF A3C27 to 0140-0195, 130 pF A3C23 to 0140-0196, 150 pF A3C21 to 0140-0225, 300 pF A3C25, 26 to 0150-0093, 0.1 μF
CHANGE 13.	Figure 8-12 and Table 6-1: Delete A4C12
CHANGE 14.	Figure 8-12 and Table 6-1: Delete A4L4
CHANGE 15.	No manual changes are necessary
CHANGE 16.	Figure 8-18: Change A7A1CR4 to 1902-0246, Diode, Breakdown, 11V
CHANGE 17.	Figure 8-19 and Table 6-1: Change A8R42 to 2100-1437, 20K, R: Var.

Table 1. Manual Changes (Cont'd.)

CHANGE 18.

Figure 8-20 and Table 6-1:

Replace Figure 8-20 (schematic diagram) with Figure 5.

Replace Figure 8-20 component locator with Figure 6.

Replace A9 portion of Table 6-1 with Table 3.

Paragraph 5-125:

Older units had a zero adjustment, A9R28. To change the adjustment procedure, delete the fourth and fifth sentences in step e. "This drift however . . . . " and "If drift is excessive . . . . ". Add the following step between step e and f:

> Adjust A9R28 (INTEGRATOR ZERO) to stop this drift. Switch MODE switch to LOOP OPEN then back to OPER. This will discharge the integrating capacitor and permit using the Voltmeter on a lower range for more precise zero setting. Again adjust A9R28 to stop any drift in the control voltage. Observe voltmeter. Drift should be less than 1.5 mV/minimum.

CHANGE 19.

No manual changes are necessary.

CHANGE 20.

Table 6-1:

Change the following:

A11A1R15 to 0757-0906, 180 ohms, 2%, 1/4W
A11A1R16 to 0757-0907, 200 ohms, 2%, 1/4W
A11A1R17 to 0757-0943, 6.2K ohms, 2%, 1/4W
A11A1R25 to 0757-0970, 82K, 2%, 1/4W

Delete:

A11A1CR14, CR15, and CR16
A11A1R35, R36

Figure 8-25:

Replace Figure 8-25 with Figure 7. On Figure 7, indicate that A11A1R28, R29, R30 and M1 are deleted for series 1036A, 940 and 928.

CHANGE 21.

Figure 7 and Table 6-1:

Delete A11A1R33 and R34.

CHANGE 22.

Figure 7 and Table 6-1:

Change A11A1R17 to 8.2K, 0757-0946

CHANGE 23.

Figure 7 and Table 6-1:

Indicate that M1, R29, R30, and R28 are installed on Series 728 boards.

CHANGE 24.

Cesium Beam tubes with serial prefix numbers 740 and above have a magnetic shield installed.

NOTE

Cesium Beam tubes with series number 740 cannot be installed in 5061A instruments with serial numbers 736-0110 and lower. Replacement tube for lower prefixes is 05061-6072.

CHANGE 25.

Table 6-1:

Change A14SCR1 to 1884-0003

Table 1. Manual Changes (Cont'd.)

CHANGE 26.

Figure 8-27 and Table 6-1:

Change A14R18 and R19 to 0698-4308, 16.9K, 1%, 1/8W
Change A14R22 to 0698-5469, 8.66K, 1%, 1/8W

CHANGE 27.

Figure 8-27 and Table 6-1:

Change the following:

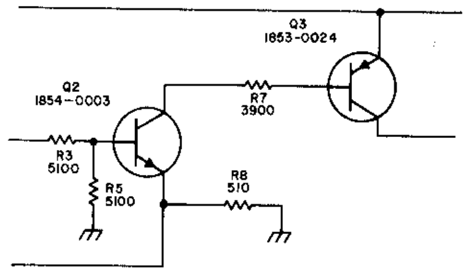
A14R35 and R37 to 0757-0909, 240 ohms
A14R43 to 0757-0963, 43K
A14R50 to 0757-0968, 68K
A14Q12 and Q13 to 1854-0005

CHANGE 28.

Figure 8-28 and Table 6-1:

Change A15R8 to 0757-0917, 510 ohms, 2%, 1/8W
Change A15CR7 to 1902-3245, Diode, Breakdown, 21.5V

The following partial schematic indicates the circuit change.



A14 Series 728 Circuit Change

CHANGE 29.

Figure 8-28 and Table 6-1:

Delete A15C13

CHANGE 30.

Figure 8-20 and Table 6-1:

Delete A19R5, R6, R7, R8, and R9.

CHANGE 31.

Figure 8-2 and Table 6-1:

Change BATTERY lamp to RED
Change ALARM lamp to RED

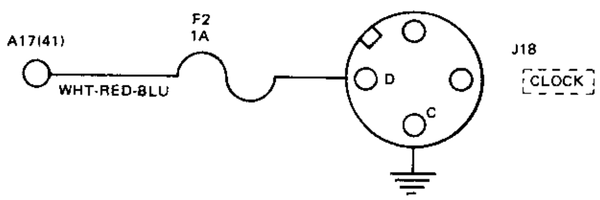
Figure 8-5:

Change CONTINUOUS OPERATION lamp to AMBER
Change ALARM lamp to RED

Figure 8-6 and Table 6-1:

Change F1 to 1 Amp, HP Part No. 2110-0007
Change C8A and B to 0160-3611, 5000 pF, 20%, 250 VAC

On schematic, at A17(41), add the following circuit:



Change J20 to HP Part No. 1251-0146
Change S3 to 3101-0033
Change W1 to 05061-6091

Figure 1. Synthesizer Assembly A1, Digital Section, Series 838

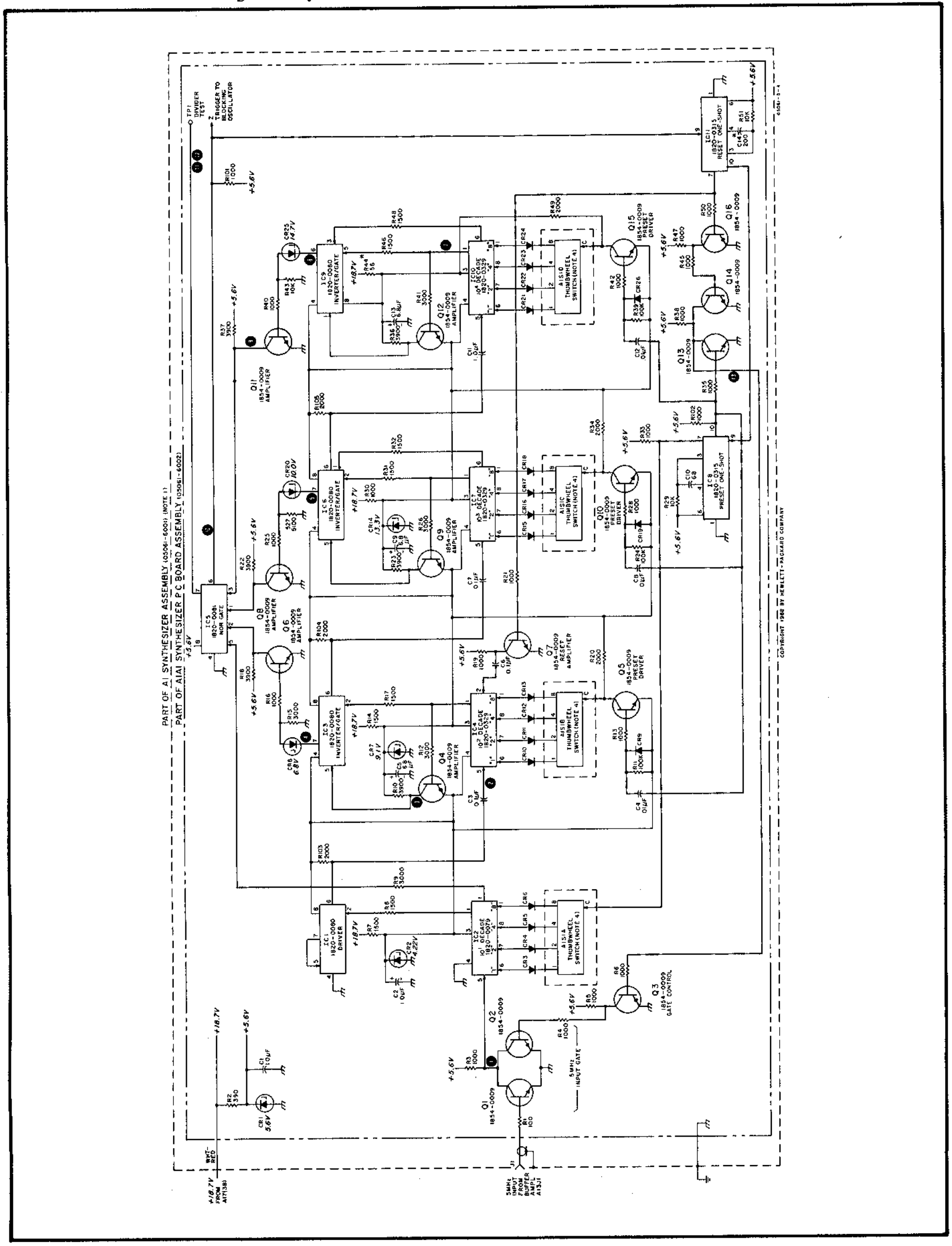


Figure 2. Synthesizer Assembly A1, Series 838

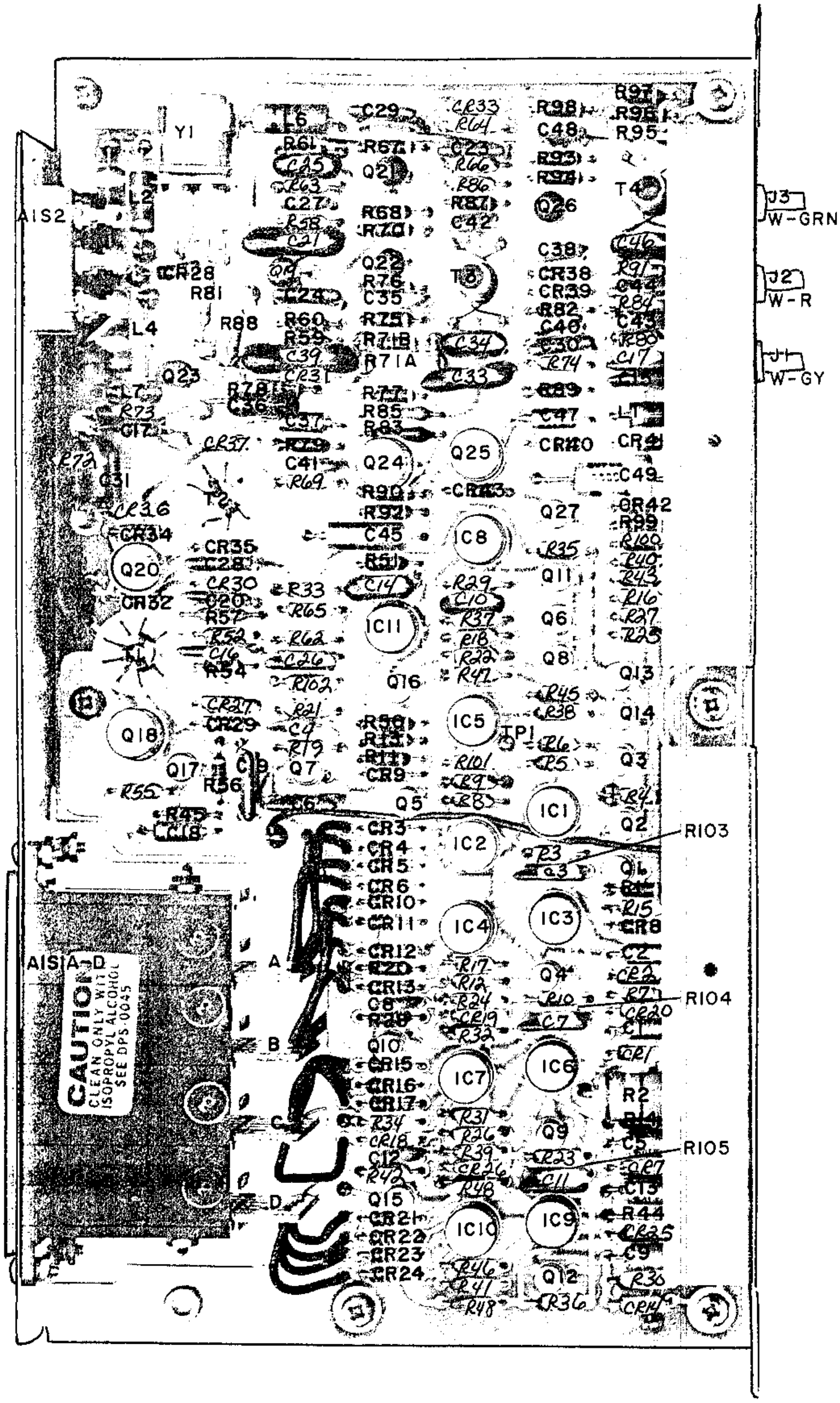


Figure 3. Synthesizer Assembly A1, Phase Locked Oscillator Section, Series 838

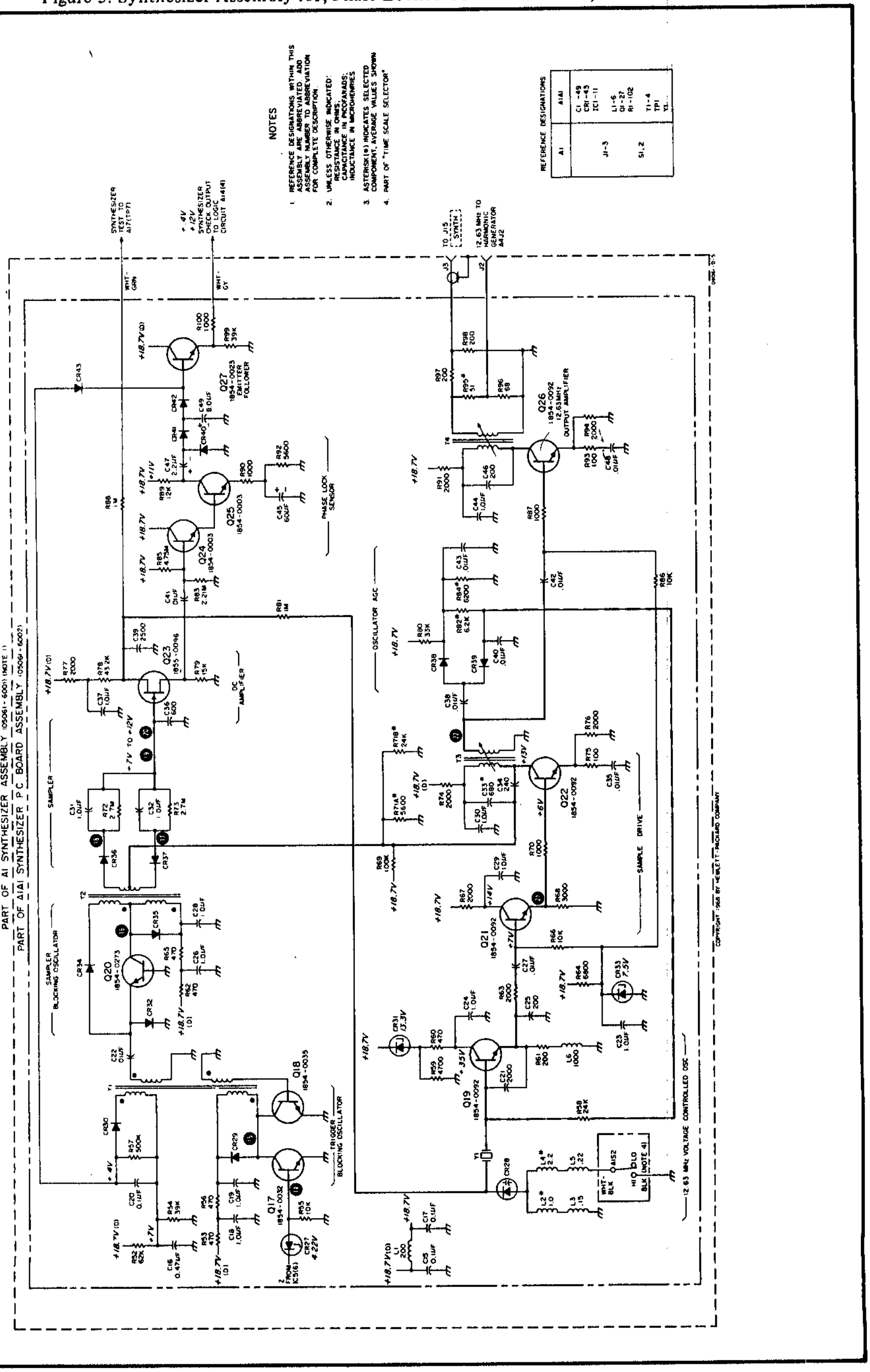


Table 2. Reference Designation Index for A1A1, Series 838

Reference Designation	hp Part No.	Description #	Note
A1	05061-6001	MODULE ASSY: SYNTHESIZER BOARD	
A1J1	1250-0258	JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	
A1J2	1250-0258	JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	
A1J3	1250-0258	JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	
A1S1	3100-2063	SWITCH: THUMBWHEEL	
		MISCELLANEOUS	
	0340-0119	INSULATED FEED THRU:TEFLON	
	05061-0001	CHASSIS:SYNTHESIZER INCL S2	
	05061-6078	COVER:SYNTHESIZER	
		PLATE:END	
		PLATE:END	
A1A1	05061-6002	BOARD ASSY:SYNTHESIZER	
	05061-2002	BOARD:BLANK PC	
A1A1C1	0180-0291	C:FXD ELECT 1UF 10% 35VDCW	
A1A1C2	0180-0291	C:FXD ELECT 1UF 10% 35VDCW	
A1A1C3	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1A1C4	0150-0093	C:FXD CER 0.01 UF +80%-20% 100VDCW	
A1A1C5	0180-0116	C:FXD ELECT 6.8 UF 10% 35VDCW	
A1A1C6	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1A1C7	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1A1C8	0150-0093	C:FXD CER 0.01 UF +80%-20% 100VDCW	
A1A1C9	0180-0116	C:FXD ELECT 6.8 UF 10% 35VDCW	
A1A1C10	0140-0192	C:FXD MICA 68 PF 5%	
A1A1C11	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C12	0150-0093	C:FXD CER 0.01 UF +80%-20% 100VDCW	
A1A1C13	0180-0116	C:FXD ELECT 6.8 UF 10% 35VDCW	
A1A1C14	0140-0220	C:FXD MICA 200 PF 1% 300VDCW	
A1A1C15	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1A1C16	0160-0174	C:FXD CER 0.47 UF +80%-20% 25 VDCW	
A1A1C17	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1A1C18	0180-0291	C:FXD ELECT 1UF 10% 35VDCW	
A1A1C19	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C20	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1A1C21	0140-0180	C:FXD MIC 2000 PF 2%	
A1A1C22	0150-0093	C:FXD CER 0.01 UF +80%-20% 100VDCW	
A1A1C23	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C24	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C25	0140-0220	C:FXD MICA 200 PF 1% 300VDCW	
A1A1C26	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C27	0150-0093	C:FXD CER 0.01 UF +80%-20% 100VDCW	
A1A1C28	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C29	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C30	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C31	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C32	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1A1C33	0160-2214	C:FXD MICA 680 PF 5%	
A1A1C34	0140-0199	C:FXD MICA 240 PF 5%	
A1A1C35	0150-0093	C:FXD CER 0.01 UF +80%-20% 100 VDCW	
A1A1C36	0160-0340	C:FXD MICA 600 PF 1%	
A1A1C37	0180-0291	C:FXD ELECT 1UF 10% 35VDCW	

See introduction to this section for ordering information

Table 2. Reference Designation Index for A1A1, Series 838 (Cont'd.)

Reference Designation	hp Part No.	Description #	Note
A1A1C38	0150-0093	C:FXD CER 0.01 UF +80%-20% 100VDCW	
A1A1C39	0160-0147	C:FXD MICA 2500PF 2% 300VDCW	
A1A1C40	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1A1C41	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1A1C42	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1A1C43	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1A1C44	0160-0127	C:FXD CER 1 UF 20% 25VDCW	
A1A1C45	0180-0106	C:FXD ELECT TA 60UF 20% 6VDCW	
A1A1C46	0140-0220	C:FXD MICA 200 PF 1% 300VDCW	
A1A1C47	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A1A1C48	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1A1C49	0180-0010	C:FXD ELECT TA 8.0UF -15% +10% 30VDCW	
A1A1CR1	1902-3104	DIODE BREAKDOWN:5.62V 5%	
A1A1CR2	1902-3070	DIODE BREAKDOWN:4.22V 5%	
A1A1CR3	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR4	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR5	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR6	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR7	1902-3149	DIODE BREAKDOWN:9.09V 5%	
A1A1CR8	1902-0052	DIODE BREAKDOWN:6.81V	
A1A1CR9	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR10	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR11	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR12	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR13	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR14	1902-3193	DIODE BREAKDOWN:13.3V 5%	
A1A1CR15	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR16	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR17	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR18	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR19	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR20	1902-0025	DIODE BREAKDOWN:10.0V 5% 400 MW	
A1A1CR21	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR22	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR23	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR24	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A1A1CR25	1902-3203	DIODE BREAKDOWN:SILICON 14.7V 5%	
A1A1CR26	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR27	1902-3070	DIODE BREAKDOWN:4.22V 5%	
A1A1CR28	0122-0013	C:VOLTAGE VAR 39 PF 30VDCW	
A1A1CR29	1901-0050	DIODE:SILICON 75V	
A1A1CR30	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR31	1902-3193	DIODE BREAKDOWN:13.3V 5%	
A1A1CR32	1901-0050	DIODE:SILICON 75V	
A1A1CR33	1902-0064	DIODE BREAKDOWN:7.5V	
A1A1CR34	1901-0050	DIODE:SILICON 75V	
A1A1CR35	1901-0050	DIODE:SILICON 75V	
A1A1CR36	1901-0146	DIODE:SILICON 35 WUV	
A1A1CR37	1901-0146	DIODE:SILICON 35 WUV	
A1A1CR38	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR39	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR40	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR41	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR42	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR43	1901-0040	DIODE:SILICON 30MA 30WV	

See introduction to this section for ordering information

Table 2. Reference Designation Index for A1A1, Series 838 (Cont'd.)

Reference Designation	hp Part No.	Description #	Note
A1A1IC1	1820-0080	INTEGRATED CIRCUIT	
A1A1IC2	1820-0079	CIRCUIT:HP 5084-0001	
A1A1IC3	1820-0080	INTEGRATED CIRCUIT	
A1A1IC4	1820-0329	INTEGRATED CIRCUIT	
A1A1IC5	1820-0081	INTEGRATED CIRCUIT	
A1A1IC6	1820-0080	INTEGRATED CIRCUIT	
A1A1IC7	1820-0329	INTEGRATED CIRCUIT	
A1A1IC8	1820-0315	INTEGRATED CIRCUIT	
A1A1IC9	1820-0080	INTEGRATED CIRCUIT	
A1A1IC10	1820-0329	INTEGRATED CIRCUIT	
A1A1IC11	1820-0315	INTEGRATED CIRCUIT	
A1A1L1	9140-0237	COIL:FXD 200 UH 5%	
A1A1L2	9140-0096	COIL:FXD RF 1 UH	
A1A1L3	9140-0187	COIL:FXD RF 0.15 UH 10% FACTORY SELECTED PART	
A1A1L4	9140-0077	COIL:FXD RF 2.2 UH 5%	
A1A1L5	9140-0190	COIL:FXD RF 0.22 UH 20% FACTORY SELECTED PART	
A1A1L6	9140-0137	COIL:FXD RF 1 MH 5%	
A1A1Q1	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q2	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q3	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q4	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q5	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q6	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q7	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q8	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q9	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q10	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q11	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q12	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q13	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q14	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q15	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q16	1854-0009	TRANSISTOR:SILICON NPN 2N709	
A1A1Q17	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A1A1Q18	1854-0035	TRANSISTOR:NPN SILICON	
A1A1Q19	1854-0092	TRANSISTOR:SILICON NPN 2N3563	
A1A1Q20	1854-0273	TRANSISTOR:SILICON NPN	
A1A1Q21	1854-0092	TRANSISTOR:SILICON NPN 2N3563	
A1A1Q22	1854-0092	TRANSISTOR:SILICON NPN 2N3563	
A1A1Q23	1855-0096	TRANSISTOR:FET	
A1A1Q24	1854-0003	TRANSISTOR:NPN SILICON	
A1A1Q25	1854-0003	TRANSISTOR:NPN SILICON	
A1A1Q26	1854-0092	TRANSISTOR:SILICON NPN 2N3563	
A1A1Q27	1854-0023	TRANSISTOR:SILICON NPN	
A1A1R1	0757-0900	R:FXD MET FLM 100 OHM 2% 1/4W	
A1A1R2	0698-3633	R:FXD MET OX 390 OHM 5% 2W	
A1A1R3	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R4	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R5	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R6	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R7	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	
A1A1R8	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	

See introduction to this section for ordering information

Table 2. Reference Designation Index for A1A1, Series 838 (Cont'd.)

Reference Designation	hp Part No.	Description #	Note
A1A1R9	0757-0935	R:FXD MET FLM 3.0K OHM 2% 1/4W	
A1A1R10	0757-0938	R:FXD MET FLM 3.9K OHM 2% 1/4W	
A1A1R11	0757-0972	R:FXD MET FLM 100K OHM 2% 1/4W	
A1A1R12	0757-0935	R:FXD MET FLM 3.0K OHM 2% 1/4W	
A1A1R13	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R14	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	
A1A1R15	0757-0935	R:FXD MET FLM 3.0K OHM 2% 1/4W	
A1A1R16	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R17	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	
A1A1R18	0757-0938	R:FXD MET FLM 3.9K OHM 2% 1/4W	
A1A1R19	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R20	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R21	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R22	0757-0938	R:FXD MET FLM 3.9K OHM 2% 1/4W	
A1A1R23	0757-0938	R:FXD MET FLM 3.9K OHM 2% 1/4W	
A1A1R24	0757-0972	R:FXD MET FLM 100K OHM 2% 1/4W	
A1A1R25	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R26	0757-0935	R:FXD MET FLM 3.0K OHM 2% 1/4W	
A1A1R27	0757-0941	R:FXD MET FLM 5.1K OHM 2% 1/4W	
A1A1R28	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R29	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A1A1R30	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R31	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	
A1A1R32	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	
A1A1R33	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R34	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R35	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R36	0757-0938	R:FXD MET FLM 3.9K OHM 2% 1/4W	
A1A1R37	0757-0938	R:FXD MET FLM 3.9K OHM 2% 1/4W	
A1A1R38	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R39	0757-0972	R:FXD MET FLM 100K OHM 2% 1/4W	
A1A1R40	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R41	0757-0935	R:FXD MET FLM 3.0K OHM 2% 1/4W	
A1A1R42	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R43	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A1A1R44	0757-0894	R:FXD MET FLM 56 OHM 2% 1/4W FACTORY SELECTED PART	
A1A1R45	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R46	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	
A1A1R47	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R48	0757-0928	R:FXD MET FLM 1.5K OHM 2% 1/4W	
A1A1R49	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R50	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R51	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A1A1R52	0757-0967	R:FXD MET FLM 62K OHM 2% 1/4W	
A1A1R53	0757-0916	R:FXD MET FLM 470 OHM 2% 1/4W	
A1A1R54	0757-0962	R:FXD MET FLM 39K OHM 2% 1/4W	
A1A1R55	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A1A1R56	0757-0916	R:FXD MET FLM 470 OHM 2% 1/4W	
A1A1R57	0721-0011	R:FXD DEPC 500K OHM 1% 1/8W	
A1A1R58	0757-0957	R:FXD MET FLM 24K OHM 2% 1/4W	
A1A1R59	0757-0940	R:FXD MET FLM 4.7K OHM 2% 1/4W	
A1A1R60	0757-0916	R:FXD MET FLM 470 OHM 2% 1/4W	
A1A1R61	0757-0907	R:FXD MET FLM 200 OHM 2% 1/4W	
A1A1R62	0757-0916	R:FXD MET FLM 470 OHM 2% 1/4W	
A1A1R63	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R64	0757-0944	R:FXD MET FLM 6.8K OHM 2% 1/4W	

See introduction to this section for ordering information

Table 2. Reference Designation Index for A1A1, Series 838 (Cont'd.)

Reference Designation	hp Part No.	Description #	Note
A1A1R65	0757-0916	R:FXD MET FLM 470 OHM 2% 1/4W	
A1A1R66	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A1A1R67	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R68	0757-0935	R:FXD MET FLM 3.0K OHM 2% 1/4W	
A1A1R69	0757-0972	R:FXD MET FLM 100K OHM 2% 1/4W	
A1A1R70	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R71	0757-0962	R:FXD MET FLM 39K OHM 2% 1/4W FACTORY SELECTED PART	
A1A1R72	0698-3130	R:FXD MET FLM 2.70 MEGOHM 1% 1/8W	
A1A1R73	0698-3130	R:FXD MET FLM 2.70 MEGOHM 1% 1/8W	
A1A1R74	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R75	0757-0900	R:FXD MET FLM 100 OHM 2% 1/4W	
A1A1R76	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R77	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R78	0757-0456	R:FXD MET FLM 43.2K OHM 1% 1/8W	
A1A1R79	0757-0952	R:FXD MET FLM 15K OHM 2% 1/4W	
A1A1R80	0757-0960	R:FXD MET FLM 33K OHM 2% 1/4W	
A1A1R81	0698-3129	R:FXD DEPC 1.00 MEGOHM 1% 1/8W	
A1A1R82	0757-0943	R:FXD MET FLM 6.2K OHM 2% 1/4W	
A1A1R83	0698-3126	R:FXD DEPC 2.21 MEGOHM 1% 1/8W	
A1A1R84	0757-0943	R:FXD MET FLM 6.2K OHM 2% 1/4W	
A1A1R85	0698-3127	R:FXD DEPC 4.75 MEGOHM 2% 1/8W	
A1A1R86	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A1A1R87	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R88	0698-3129	R:FXD DEPC 1.00 MEGOHM 1% 1/8W	
A1A1R89	0757-0950	R:FXD MET FLM 12K OHM 2% 1/4W	
A1A1R90	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R91	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R92	0757-0942	R:FXD MET FLM 5.6K OHM 2% 1/4W	
A1A1R93	0757-0900	R:FXD MET FLM 100 OHM 2% 1/4W	
A1A1R94	0757-0931	R:FXD MET FLM 2.0K OHM 2% 1/4W	
A1A1R95	0757-0909	R:FXD MET FLM 240 OHM 2% 1/4W	
A1A1R96	0757-0896	R:FXD MET FLM 68 OHM 2% 1/4W	
A1A1R97	0757-0907	R:FXD MET FLM 200 OHM 2% 1/4W	
A1A1R98	0757-0907	R:FXD MET FLM 200 OHM 2% 1/4W	
A1A1R99	0757-0962	R:FXD MET FLM 39K OHM 2% 1/4W	
A1A1R100	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R101	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R102	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A1A1R103	0757-0931	R:FXD MET FLM 2K OHM 2% 1/4W	
A1A1R104	0757-0931	R:FXD MET FLM 2K OHM 2% 1/4W	
A1A1R105	0757-0931	R:FXD MET FLM 2K OHM 2% 1/4W	
A1A1T1	05061-8001	TRANSFORMER:BLOCK OSCILLATOR #1	
A1A1T2	05061-8002	TRANSFORMER:BLOCK OSCILLATOR #2	
A1A1T3	05061-8003	TRANSFORMER SAMPLER:DR	
A1A1T4	05061-8004	TRANSFORMER:MHZ OUTPUT	
A1A1XY1	1200-0758	SOCKET:CRYSTAL	
A1A1Y1	0410-0143	CRYSTAL:QUARTZ 12.632 MHZ	
		MISCELLANEOUS	
	0340-0037	POST:TERMINAL	
	0340-0039	INSULATOR:BUSHING	

See introduction to this section for ordering information

Figure 4. Multiplier Assembly A3 Series No. 808 Schematic Diagram

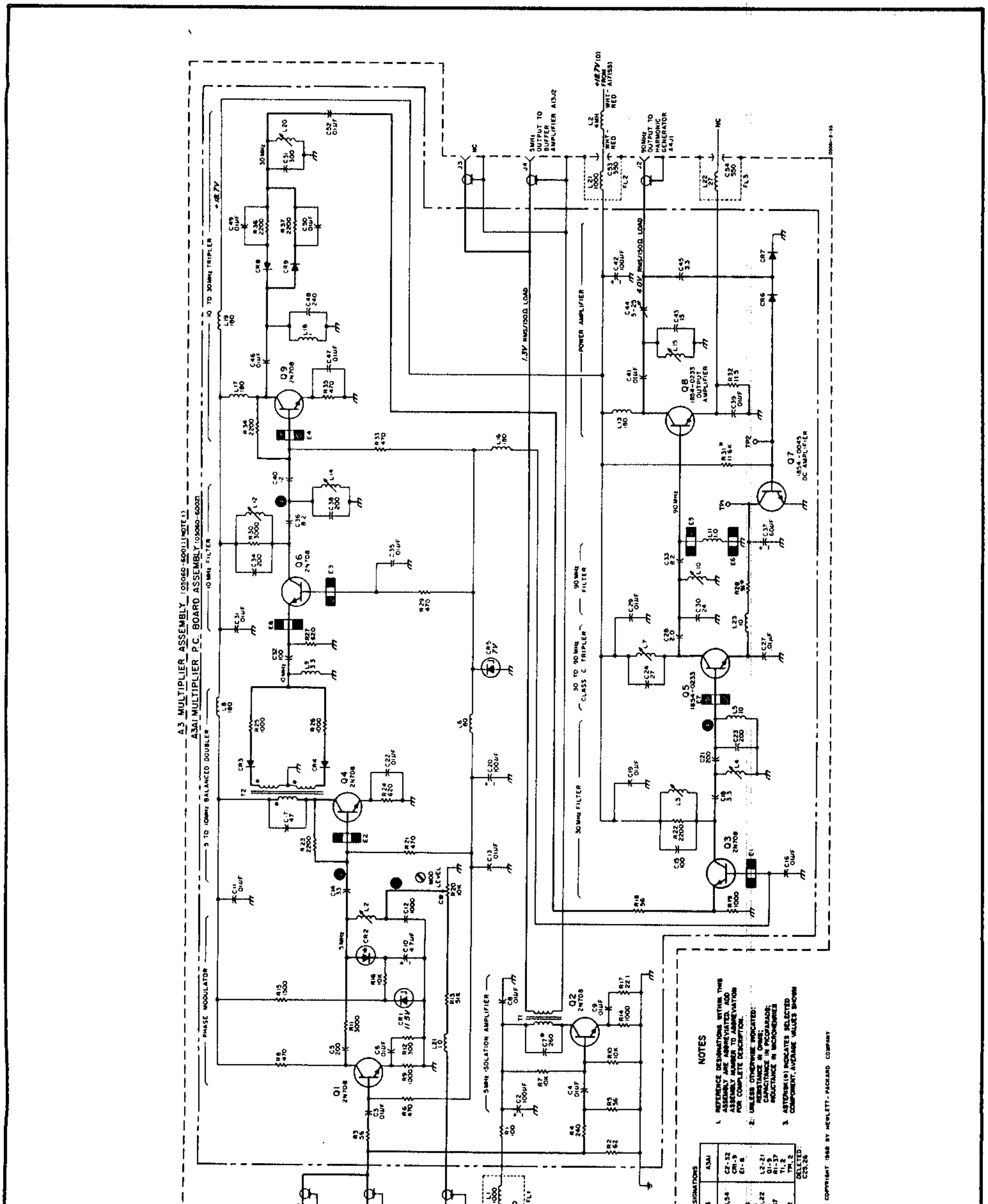


Figure 5. Operational Amplifier A9, Series 728, Schematic Diagram

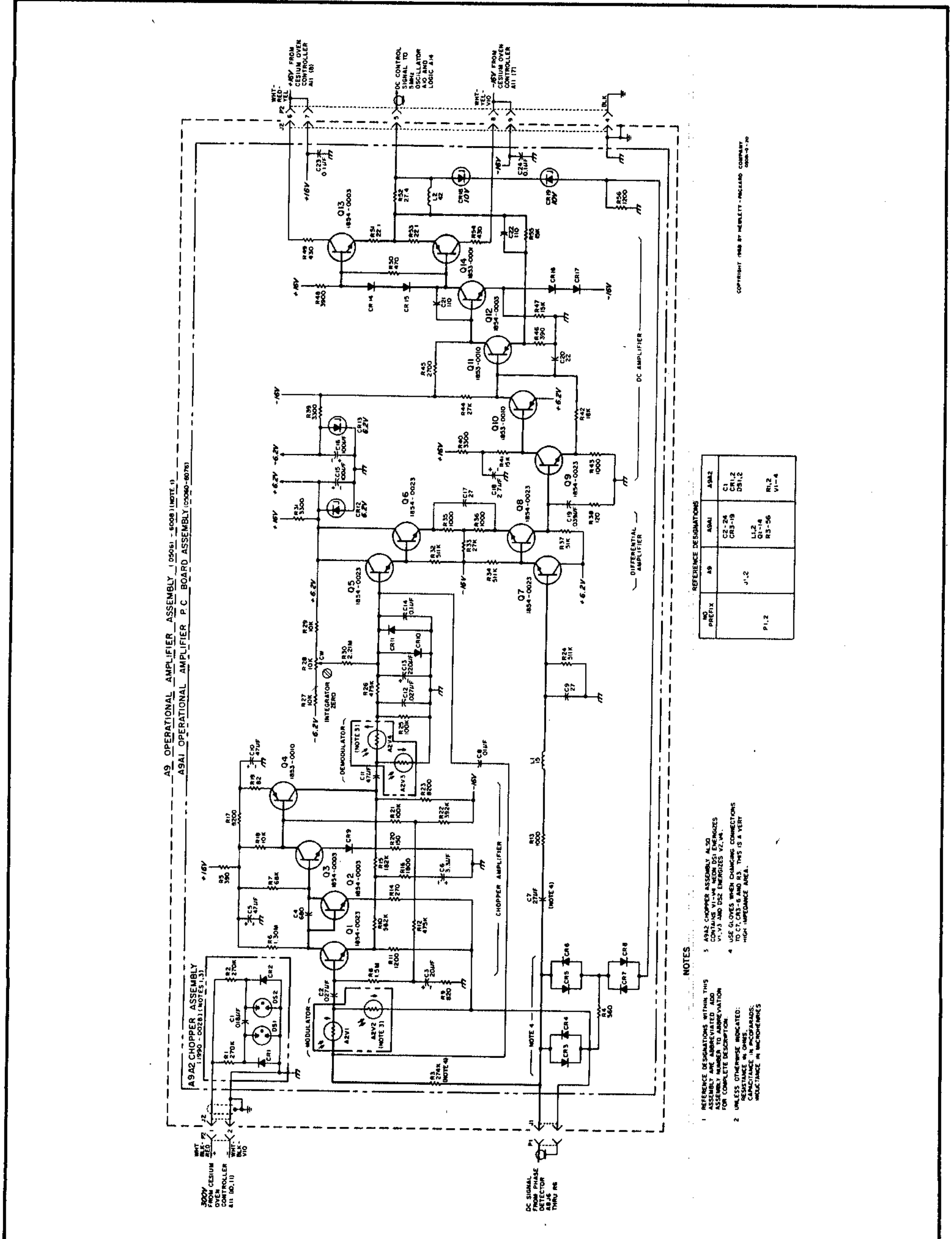


Figure 6. Operational Amplifier A9, Series 728, Component Locator

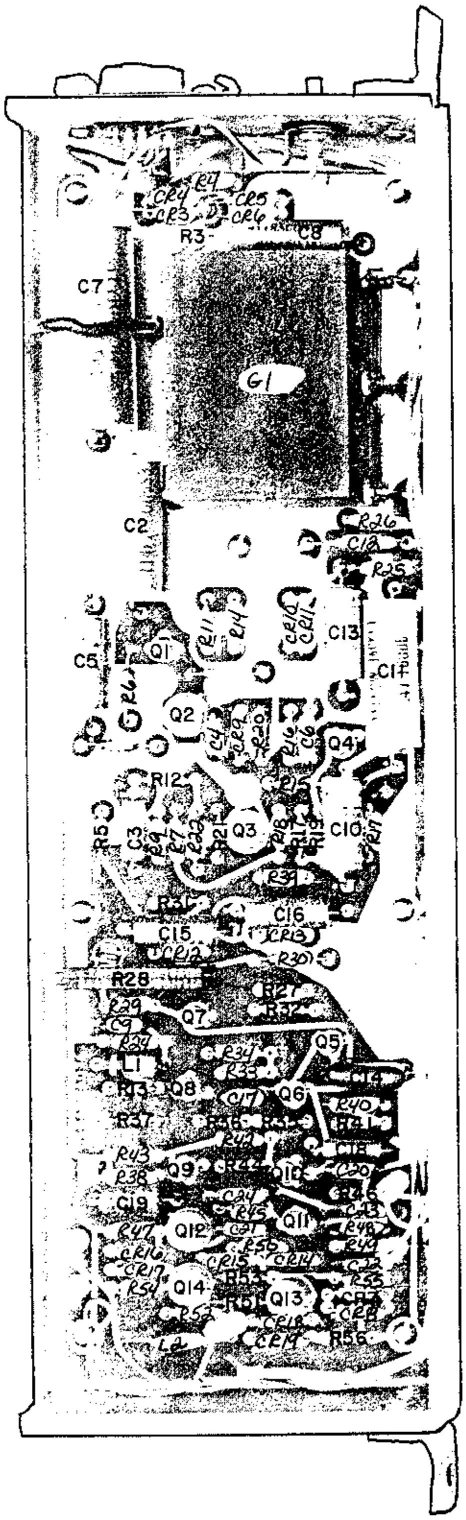


Table 3. Reference Designation Index for A9, Series 728

Reference Designation	hp Part No.	Description #	Note
A9	05061-6008	MODULE ASSY:OPER. AMPLIFIER	
A9J1	1250-0258	JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	
A9J2	1251-0216	CONNECTOR:MAIL 9-CONTACT TYPE D	
	8160-0035	BRAID:WIRE SHIELDING MONEL 3/32 OD	
	5020-0176	INSULATOR FOR SNAP-ON PINS	
	05060-0028	COVER:BOTTOM	
	05060-6076	ASSY:OPERATIONAL AMPLIFIER P.C. BD	
	05061-0034	COVER:OPER. AMPLIFIER	
	05061-2035	PLATE:END	
	05061-2036	PLATE:END	
	05060-6076	ASSY:OPERATIONAL AMPLIFIER P.C. BD	
	05060-2056	BOARD:BLANK PC	
A9A1C1		N.S.R. PART OF CHOPPER ASSY G1	
A9A1C2	0160-0288	C:FXD POLY 0.027 UF 10% 50VDCW	
A9A1C3	0180-0193	C:FXD ELECT 20 UF 10VDCW	
A9A1C4	0140-0208	C:FXD MICA 680 PF 5%	
A9A1C5	0180-0097	C:FXD ELECT 47UF 10% 35VDCW	
A9A1C6	0180-0210	C:FXD ELECT 3.3 UF 20% 15VDCW	
A9A1C7	0160-0291	C:FXD POLY 0.27 UF 20% 50VDCW	
A9A1C8	0170-0029	C:FXD POLY 0.01 UF 10% 50VDCW	
A9A1C9	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A9A1C10	0180-0097	C:FXD ELECT 47UF 10% 35VDCW	
A9A1C11	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9A1C12	0170-0066	C:FXD MY 0.027UF 10% 200VDCW	
A9A1C13	0180-0159	C:FXD ELECT 220 UF 10% 10VDCW	
A9A1C14	0170-0085	C:FXD MY 0.1UF 20% 50VDCW	
A9A1C15	0180-0137	C:FXD ELECT 100UF 20% 10VDCW	
A9A1C16	0180-0137	C:FXD ELECT 100UF 20% 10VDCW	
A9A1C17	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A9A1C18	0180-0117	C:FXD ELECT TA 2.7UF 10% 35VDCW	
A9A1C19	0160-0164	C:FXD MY 0.039 UF 10% 200VDCW	
A9A1C20	0140-0145	C:FXD MICA 22 PF 5%	
A9A1C21	0140-0194	C:FXD MICA 110 PF 5%	
A9A1C22	0140-0194	C:FXD MICA 110 PF 5%	
A9A1C23	0170-0085	C:FXD MY 0.1UF 20% 50VDCW	
A9A1C24	0170-0085	C:FXD MY 0.1UF 20% 50VDCW	
A9A1CR1		N.S.R. PART OF CHOPPER ASSY G1	
A9A1CR2		N.S.R. PART OF CHOPPER ASSY G1	
A9A1CR3	1901-0156	DIODE:SILICON	
A9A1CR4	1901-0156	DIODE:SILICON	
A9A1CR5	1901-0156	DIODE:SILICON	
A9A1CR6	1901-0156	DIODE:SILICON	
A9A1CR7	1901-0156	DIODE:SILICON	
A9A1CR8	1901-0156	DIODE:SILICON	
A9A1CR9	1901-0025	DIODE:SILICON 100WV 100MA	
A9A1CR10	1901-0025	DIODE:SILICON 100WV 100MA	
A9A1CR11	1901-0025	DIODE:SILICON 100WV 100MA	
A9A1CR12	1902-0096	DIODE:AVALANCHE 6.2V	

See introduction to this section for ordering information

Table 3. Reference Designation Index for A9, Series 728 (Cont'd.)

Reference Designation	hp Part No.	Description #	Note
A9A1CR13	1902-0096	DIODE:AVALANCHE 6.2V	
A9A1CR14	1901-0025	DIODE:SILICON 100WV 100MA	
A9A1CR15	1901-0025	DIODE:SILICON 100WV 100MA	
A9A1CR16	1901-0025	DIODE:SILICON 100WV 100MA	
A9A1CR17	1901-0025	DIODE:SILICON 100WV 100MA	
A9A1CR18	1902-0025	DIODE, BREAKDOWN:10.0V 5% 400 MW	
A9A1CR19	1902-0025	DIODE, BREAKDOWN:10.0V 5% 400 MW	
A9A1DS1		N.S.R. PART OF CHOPPER ASSY G1	
A9A1DS2		N.S.R. PART OF CHOPPER ASSY G1	
A9A1G1	1990-0028	CHOPPER:PHOTOELECTRIC	
A9A1J1	1250-0258	JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	
A9A1J2	1251-0216	CONNECTOR:MALE 9-CONTACT TYPE D	
A9A1L1	9140-0082	COIL:FXD RF 15UH	
A9A1L2	9140-0040	COIL:FXD RF 42UH	
A9A1Q1	1854-0023	TRANSISTOR:SILICON NPN	
A9A1Q2	1854-0003	TRANSISTOR:NPN SILICON	
A9A1Q3	1854-0003	TRANSISTOR:NPN SILICON	
A9A1Q4	1853-0010	TRANSISTOR:SILICON PNP	
A9A1Q5	1854-0023	TRANSISTOR:SILICON NPN	
A9A1Q6	1854-0023	TRANSISTOR:SILICON NPN	
A9A1Q7	1854-0023	TRANSISTOR:SILICON NPN	
A9A1Q8	1854-0023	TRANSISTOR:SILICON NPN	
A9A1Q9	1854-0023	TRANSISTOR:SILICON NPN	
A9A1Q10	1853-0020	TRANSISTOR:SILICON PNP	
A9A1Q11	1853-0020	TRANSISTOR:SILICON PNP	
A9A1Q12	1854-0003	TRANSISTOR:NPN SILICON	
A9A1Q13	1854-0003	TRANSISTOR:NPN SILICON	
A9A1Q14	1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	
A9A1R1		N.S.R. PART OF CHOPPER ASSY G1	
A9A1R2		N.S.R. PART OF CHOPPER ASSY G1	
A9A1R3	0757-0475	R:FXD MET FLM 274K OHM 1% 1/8W	
A9A1R4	0757-0918	R:FXD MET FLM 560 OHM 2% 1/4W	
A9A1R5	0757-0914	R:FXD MET FLM 390 OHM 2% 1/4W	
A9A1R6	0698-3124	R:FXD DEPC 1.30 MEGOHM 1% 1/8W	
A9A1R7	0757-0968	R:FXD MET FLM 68K OHM 2% 1/4W	
A9A1R8	0698-3125	R:FXD DEPC 1.50 MEGOHM 1% 1/8W	
A9A1R9	0757-0922	R:FXD MET FLM 820 OHM 2% 1/4W	
A9A1R10	0698-3116	R:FXD DEPC 562K OHM 1% 1/8W	
A9A1R11	0757-0926	R:FXD MET FLM 1.2K OHM 2% 1/4W	
A9A1R12	0757-0481	R:FXD MET FLM 475K OHM 1% 1/8W	
A9A1R13	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A9A1R14	0757-0910	R:FXD MET FLM 270 OHM 2% 1/4W	
A9A1R15	0757-0471	R:FXD MET FLM 182K OHM 1% 1/8W	
A9A1R16	0757-0930	R:FXD MET FLM 1800 OHM 2% 1/4W	
A9A1R17	0757-0946	R:FXD MET FLM 8.2K OHM 2% 1/4W	
A9A1R18	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A9A1R19	0757-0898	R:FXD MET FLM 82 OHM 2% 1/4W	
A9A1R20	0757-0904	R:FXD MET FLM 150 OHM 2% 1/4W	
A9A1R21	0757-0972	R:FXD MET FLM 100K OHM 2% 1/4W	
A9A1R22	0757-0479	R:FXD MET FLM 392K OHM 1% 1/8W	

See introduction to this section for ordering information

Table 3. Reference Designation Index for A9, Series 728 (Cont'd.)

Reference Designation	hp Part No.	Description #	Note
A9A1R23	0757-0946	R:FXD MET FLM 8.2K OHM 2% 1/4W	
A9A1R24	0757-0482	R:FXD MET FLM 511K OHM 1% 1/8W	
A9A1R25	0757-0972	R:FXD MET FLM 100K OHM 2% 1/4W	
A9A1R26	0757-0481	R:FXD MET FLM 475K OHM 1% 1/8W	
A9A1R27	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A9A1R28	2100-0451	R:VAR WW 10K OHM 10% 1W	
A9A1R29	0757-0948	R:FXD MET FLM 10K OHM 2% 1/4W	
A9A1R30	0698-3126	R:FXD DEPC 2.21 MEGOHM 1% 1/8W	
A9A1R31	0757-0936	R:FXD MET FLM 3.3K OHM 2% 1/4W	
A9A1R32	0757-0482	R:FXD MET FLM 511K OHM 1% 1/8W	
A9A1R33	0757-0958	R:FXD MET FLM 27K OHM 2% 1/4W	
A9A1R34	0757-0482	R:FXD MET FLM 511K OHM 1% 1/8W	
A9A1R35	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A9A1R36	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A9A1R37	0757-0965	R:FXD MET FLM 51K OHM 2% 1/4W	
A9A1R38	0757-0902	R:FXD MET FLM 120 OHM 2% 1/4W	
A9A1R39	0757-0936	R:FXD MET FLM 3.3K OHM 2% 1/4W	
A9A1R40	0757-0936	R:FXD MET FLM 3.3K OHM 2% 1/4W	
A9A1R41	0757-0952	R:FXD MET FLM 15K OHM 2% 1/4W	
A9A1R42	0757-0954	R:FXD MET FLM 18K OHM 2% 1/4W	
A9A1R43	0757-0924	R:FXD MET FLM 1.0K OHM 2% 1/4W	
A9A1R44	0757-0958	R:FXD MET FLM 27K OHM 2% 1/4W	
A9A1R45	0757-0934	R:FXD MET FLM 2.7K OHM 2% 1/4W	
A9A1R46	0757-0914	R:FXD MET FLM 390 OHM 2% 1/4W	
A9A1R47	0757-0952	R:FXD MET FLM 15K OHM 2% 1/4W	
A9A1R48	0757-0938	R:FXD MET FLM 3.9K OHM 2% 1/4W	
A9A1R49	0757-0900	R:FXD MET FLM 100 OHM 2% 1/4W	
A9A1R50	0757-0916	R:FXD MET FLM 470 OHM 2% 1/4W	
A9A1R51	0757-0385	R:FXD MET FLM 22.1 OHM 1% 1/8W	
A9A1R52	0757-0387	R:FXD MET FLM 27.4 OHM 2% 1/8W	
A9A1R53	0757-0385	R:FXD MET FLM 22.1 OHM 1% 1/8W	
A9A1R54	0757-0900	R:FXD MET FLM 100 OHM 2% 1/4W	
A9A1R55	0757-0952	R:FXD MET FLM 15K OHM 2% 1/4W	
A9A1R56	0757-0926	R:FXD MET FLM 1.2K OHM 2% 1/4W	
	8160-0035	BRAID:WIRE SHIELDING MONEL 3/32 OD	
	0340-0037	POST:TERMINAL	
	05060-0028	COVER:BOTTOM	
	05060-0027		
	5020-0176	INSULATOR FOR SNAP-ON PINS	
	1251-0215	RETAINER:CONNECTOR SUB-MINAT TYPE D	
	0340-0039	INSULATOR:BUSHING	
	1200-0080	INSULATOR:TRANSISTOR MTG.	

See introduction to this section for ordering information

Figure 7. Cesium Oven Controller Assembly A11, Series 1036A and below

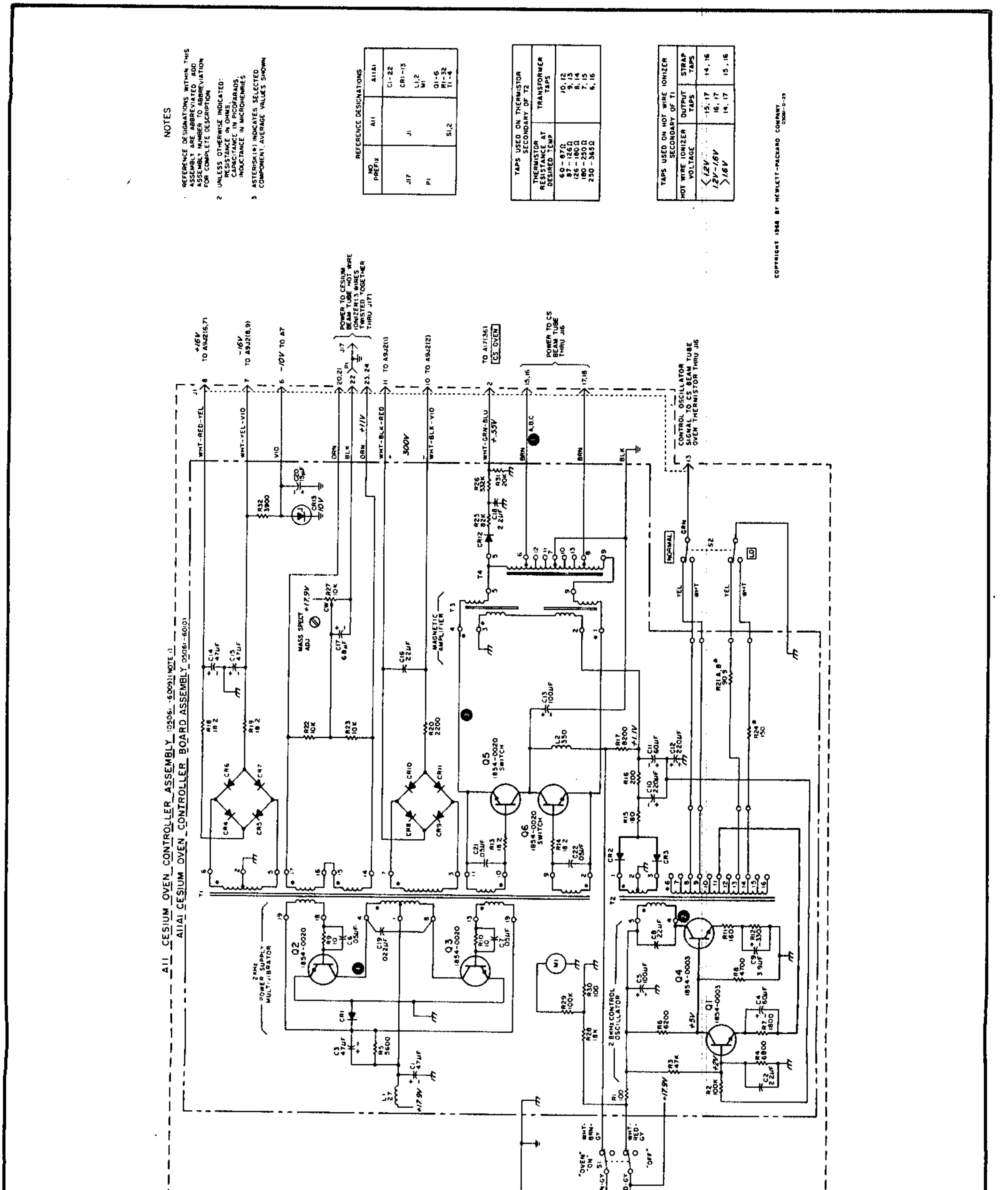


Table 1. Manual Changes (Cont'd.)

Change 32

Page 6-18, Table 6-1:
Change A11A1CR4 to CR7 from 1901-0050 to 1901-0039; make description read "DIODE: SILICON, 200 ma 50 wV.

Page 6-34, Table 6-3:
Change A5A1CR4 to CR7 from 1901-0028 to 1901-0049; change description to 50 PIV from 400 PIV.
Change A11 series number to 1104A.
Change A5 series number to 1040A.

Change 32A

Page 6-35, Table 6-3:
Change A5A1Q9 and Q10 to 1854-0003, Mfr. No. 2N1711.

Page 8-21, Figure 8-14:
Change A5A1Q9 and Q10 to 1854-0003.

Page 6-35, Table 6-3:
Change A5A2IC1, IC2, IC3 from 1820-0580 to 1820-0315.

Page 8-23, Figure 8-15:
Change A5A2IC1, IC2, IC3 from 1820-0580 to 1820-0315.

Page 6-37, Table 6-3:
Change A5A3IC13, IC15, IC16 from 1820-0580 to 1820-0315.

Page 8-25, Figure 8-16:
Change A5A3IC13, IC15, IC16 from 1820-0580 to 1820-0315.
Change A5 Series Number to 728.

Change 33

Table 6-1, page 6-8:
Change A3A1R4 from 0757-0912 to 0757-0909; R:FXD FLM 240 OHM, 2%, 1/8 W.
Change A3A1R14 from 0757-0920 to 0757-0924; R:FXD MET FLM 1K OHM.
Make these value changes to A3 Multiplier schematic, Figure 8-11. Change A3 series number to 1124A.

Change 34

Table 6-1, pages 6-6, 6-7, 6-8:
Change A3 Assembly from 05061-6094 to 05061-6083.
Change A3A1C48 from 0140-0210 to 0140-0199; C: FXD MICA 240 pf.
Change A3A1C52 from 0160-2201 to 0150-0093; C: FXD CER .01 μf.
Add A3A1E7 9170-0029; CORE FERRITE BEAD, MFR PART NO. 56-590-65A2/4A. ADD A3 A1E7 to base circuit of A3A1Q5.
Change A3A1L9 from 9140-0180 to 9140-0138, COIL/CHOKE 180 μh.
Change A3A1R18 from 0698-3431 to 0757-0894, R: FXD FLM 56 OHM.
Change A3A1R27 from 0757-0931 to 0757-0919, R:FXD FLM, 620 OHM.
Change A3A1R30 from 0757-0928 to 0757-0935, R:FXD FLM 3K OHM.
Change A3A1R32 from 0698-3106 to 0757-0295, R:FXD FLM 11.5 OHM.
Make these value changes to A3 Multiplier schematic, Figure 8-11.
Change A3 Series number to 1040A.

Change 35

Table 6-1, page 6-7:
Change A3A1E1 to E8 from 9160-0029 to 9170-0016.
Change A3A1R20 from 2100-1761 to 2100-0989.
Change A3 series number to 824.

Change 36

Table 6-1, page 6-4:
Change A1 part number from 05061-6097 to 05061-6087.
Change A1A1 part number from 05061-6098 to 05061-6088.
Change A1 misc. from 05061-0053 to 05061-0001, Chassis: Synthesizer (includes S2).
Change A1 misc. from 05061-0054 to 05061-0002, Cover: Synthesizer.
Add A1A1S1; 3011-2652, Switch: Thumbwheel.
Add, A1A1C39, 0160-0147, C:FXD MICA, 2500 pF 2% 300 VDCW:
Table 6-1, page 6-6:
Change A1A1R78 from 0757-0964 to 0757-0456, R:FXD MET FLM 43.2K OHM.
Change A1A1R79 from 0757-0950 to 0757-0952 R:FXD FLM 15K OHM. Use Figures 8, 9 and 10 of Appendix I in place of Figures 8-8 and 8-9. Change Series to 1040A.

Change 36A

Table 6-1, page 6-5:
Change A1A1IC4 from 1820-0580 to 1820-0315. Figure 9 of Appendix I, change A1A1IC4 to 1820-0315. Change A1 Series to 932.

Change 37

Page 6-8, Table 6-1:
Change A4 misc part 05060-2061 to 05060-2070.
Change A4 misc part 0570-1167 to 05061-2105.
Change A4 series to 952.

Table 1. Manual Changes (Cont'd.)

Change 38

Page 6-20, Table 6-1:
Delete A14E1. On Figure 8-27, delete A14E1 from the base circuit of Q1.
Change A14 series to 1040A.

Change 39

Plating used on A14 circuit foil is different. Keying slots are not used on Series 916. No electrical changes. Change A14 series number to 916.

Change 40

Page 6-22. Table 6-1:
Replace A15 Power Regulator parts list with Table 4 of Appendix I.
Replace Figure 8-28 with Figures 11 and 12 of Appendix I.
Replace Figure 8-30 with Figure 13 of Appendix I.
Change A15 Series to 1040A.

Change 41

Plating used on A15 circuit foil is different. Keying slots are not used on series 828. No electrical changes. Change A14 series number to 828.

Change 42

Page 6-22, Table 6-1:
Delete A15Q5 heat sink from parts list. In Appendix I, change A15 series prefix to 748.

Change 43

Page 6-23, Table 6-1:
Delete A17R12 and R13.
Replace Figure 8-29 with Appendix I Figures 14 and 15.
Change A17 series number to 728.

Change 44

Page 6-14, Table 6-1:
Change A9 module part number from 05061-6092 to 05061-6089.
Change A9A1 Board Assembly Part Number from 05061-6093 to 05061-6090.
Replace Figure 8-20 with Appendix I Figures 16 and 17.
Change A9 series number to 944.

Change 44A

Page 6-13, Table 6-1:
Delete A7A1R53.

Page 8-31, Figure 8-18:
Delete A7A1R53 from diagram and from component locator. Draw a line, on diagram connecting J2 input to J3 input.
Change A7 Series Number to 1132A.

Change 45

Page 6-12, Table 6-1:
Change A7A1R17 from 2100-3182 to 2100-2428.
Change A7 series number to 1120A.

Change 46

Page 6-12, Table 6-1:
Change A7A1R7 from 0757-0966 to 0757-0962, R:FXD 39K OHM.
Change A7A1Q2 from 1854-0023 to 1854-0003.
Change Figure 8-18, A7A1R7 to 39K OHM, and A7A1Q2 to 1854-0003.
Change A7 series number to 808.

Change 46A

Page 6-13, Table 6-1:
Delete A8E1, A8E2.

Page 8-33, Figure 8-19:
Delete E1 and E2 from collectors of Q6 and Q7.
Change A8 Series number to 1116A.

Change 47

Page 6-13, Table 6-1:
Change A8 Phase Detector part number from 05061-6095 to 05061-6007.
Change A8A1 part number from 05061-6096 to 05061-6011.
Change A8 series number to 808.

Change 48

Page 6-31, Table 6-2:
Change A2CR10 from 1902-3214 to 1902-3224, DIODE: BREAKDOWN, 17.8V.
Make voltage changes to Figure 8-10 (A10CR2).
Change A2 series number to 1040A.

Change 49

Cesium Beam Tubes with HP part no. 05081-60020, series number 1116A and above must use A4 Harmonic Generator series number 1220A.

Change 50

Cesium Beam Tubes with HP part no. 05061-6077 (series 740), 05060-6120 (series 740 to 1104A), or 05081-60020 (series 1104A) must use A4 Harmonic Generator series number 952.

Change 51

Page 6-19, Table 6-1:
Change A13R19 from 0757-0921 R:FXD 750 OHM, 2%,

Table 1. Manual Changes (Cont'd)

Change 51 (Continued)

.2W to 0757-0923 R:FXD 910 OHM, 2%, .2W. Figure 8-26, change A13R19 to 910 OHM.
Change A13Q4 from 1854-0019, TRANSISTOR: NPN to, 1854-0005 TRANSISTOR NPN (2N708). Figure 8-26, change A13Q4 to 1854-0005.
Change A13 series number to 728.

Change 52

Page 6-23, Table 6-1:
Change A18T2 from 05061-6109 to 05061-6112. Change A18 series to 1204A.

Change 53

Page 6-23, Table 6-1:
Delete A18C6 and A18R8.
Figure 8-30, Delete A18C6 and A18R8. Change A18 series number to 512.
Do changes 36, 38, 40 and 43.
Replace Figures 8-2, 8-3, 8-4, 8-5 and 8-6 of the manual with Appendix I, Figures 18, 19, 20, 21 and 22 respectively.
Page 6-25, Table 6-1:
Delete F2, XF2 and J18.
Figure 1-1: Replace this figure with Appendix I, Figure 23.
Table 1-2, Equipment Supplied: Delete Wrench, 1/8" open-end, 8710-1111.
Figures 3-7 and 3-8: Replace these figures with Appendix I, Figures 24 and 25 respectively.
Delete Option 004 information from Section I of the 5061A manual.
Table 2-2, delete Degausser from table.

Section III; delete Option 004 information from Section III.
Replace Table 3-3 with Appendix I, Table 6a.
Paragraph 3-8a: Replace with Appendix I, Paragraph 3-8a.
Paragraph 3-8k(7): Delete the NOTE following this paragraph.

Section IV, Table 4-1:
Change A1 to 05061-6087
A8 to 05061-6007
A15 to 05061-6017
Paragraph 4-4 line 11; change "5 parts in 10^{12}" to "1 part in 10^{11}".
Paragraphs 4-23, 4-24, 4-26, 4-29, 4-34 and 4-42: replace with Appendix 1 replacement paragraphs 4-23, 4-24, 4-26, 4-29, 4-34, 4-42, 5-49 and 5-51.
Figure 4-3: Replace with Appendix I, Figure 17a.

Replacement paragraphs:

3-8. Initial Turn-On Procedure

a. Remove instrument top cover. Locate Synthesizer Assembly A1 (Figure 3-7). Set TIME SCALE switch to either "Atomic Time Scale" (thumbwheel switch set to 2095) or the current UT2 offset (Table 3-3). Replace top cover.

4-23. Synthesizer Assembly A1, Figures 8-8 and 8-9, produces a 12.63 ...... MHz signal that is mixed with 9,180 MHz in Harmonic Generator Assembly A4, producing the 9, 192, 63 .... Hz microwave field which is applied to the cesium beam tube. Synthesizer output frequency is adjustable by a slide and thumbwheel switch located under the instrument top panel. The switch setting is dependent on instrument time scale selected. If operated on Atomic Time (AT), synthesizer output is 12, 631, 771.6 Hz. If Universal Time (UTC) is selected, the current (1968) offset is −300 parts in 10^{10} and synthesizer output frequency will be 12, 632, 047.5 Hz (Table 3-3). The 9180 MHz and 12.63 ...... MHz will produce a frequency within ±7 parts in 10^{11} of the hyperfine transition frequency of Cesium 133 (in the presence of a 72 milligauss magnetic field). Remaining error is corrected through beam tube "C" field adjustment. The synthesizer dynamic range allows frequency offsets from zero (Atomic Time) to −700 parts in 10^{10}.

4-26. During a normal counting sequence, the input gate to the divider is closed for 1.8 microseconds so the divider can be preset. The gate is then opened and the decades divide the input 5 MHz by the preset n integer dependent on frequency offset desired (Table 3-3). This counting technique permits the large dynamic range necessary for the instrument frequency offset capability.

4-29. The preset divider receives 5 MHz from A10 and A13 and provides a 1.8 μsec wide pulse output with a 5 MHz/n repetition rate. The factor n is determined by the setting on thumbwheel switch S1.

4-24. Figure 4-3 is a simplified block diagram of Synthesizer Assembly A1. The 5 MHz input signal is first isolated through Buffer Amplifier Assembly A13. This signal is then applied to the synthesizer preset divider circuits. The 5 MHz is mutliplied by the rational fraction m/n through the action of the synthesizer. The integer "n" is determined by thumbwheel switch A1S1A, B, C, D which controls the preset digital divider output frequency; thus, the preset divider output frequency is 5 MHz/n.

4-34. Thumbwheel switch S1 functions as a decimal to BCD converter. For example, if decimal 6 is entered on S1A the BCD inputs of IC1 (pins 4 and 11) will be low, and pins 10 and 3 will be high. Since IC1 requires positive logic levels at the preset inputs, the high levels at IC1(10) and (3) represent BCD 4 and 2.

Figure 17a. Synthesizer Assembly A1
Simplified Block Diagram

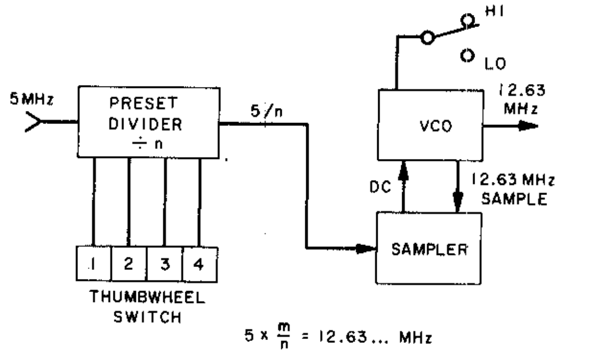


Table 4. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	5020-0176		INSULATOR FOR SNAP-ON PINS	28480	5020-0176
A15C1	0170-0072	1	C:FXD MY 1 UF 10% 200VDCW	84411	HEW 54
A15C2	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A15C3	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A15C4	0180-0117		C:FXD ELECT 2.7 UF 10% 35VDCW	28480	0180-0117
A15C5	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C6	0180-0160		C:FXD ELECT 22 UF 20% 35VDCW	28480	0180-0160
A15C7	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C8	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A15C9	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C10	0170-0019	1	C:FXD MY 0.1 UF 5% 200VDCW	28480	0170-0019
A15C11	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C12	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A15C13	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A15CR1	1901-0200	6	DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR2	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR3	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR4	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR5	1902-3234	2	DIODE BREAKDOWN:19.6V 5%	28480	1902-3234
A15CR6	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR7	1902-3234		DIODE BREAKDOWN:19.6V 5%	28480	1902-3234
A15CR8	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR9	1902-0676	1	DIODE BREAKDOWN:18.7V(MATCHED PR.)	28480	1902-0676
A15CR10	1902-0071	1	DIODE:BREAKDOWN 9.0V 5%	28480	1902-0071
A15L1	9100-0339	2	COIL:FXD RF AIR 5 MICROHENRIES	28480	9100-0339
A15Q1	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q2	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q3	1853-0024	3	TSTR:SI PNP	80131	2N3778
A15Q4	1854-0062		TSTR:SI NPN	80131	2N1701
A15Q5	1853-0024		TSTR:SI PNP	80131	2N3778
A15Q6	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q7	1853-0024		TSTR:SI PNP	80131	2N3778
A15Q8	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q9	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15Q10	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q11	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q12	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15Q13	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q14	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q15	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q16	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q17	1854-0062		TSTR:SI NPN	80131	2N1701
A15Q18	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15Q19	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15Q20	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A15Q21	1853-0001		TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A15R1	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R2	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R3	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A15R4	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A15R5	0757-0941		R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941
A15R6	0757-0928		R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A15R7	0757-0938		R:FXD FLM 3.9K OHM 2% 1/8W	28480	0757-0938
A15R8	0757-0914		R:FXD FLM 390 OHM 2% 1/8W	28480	0757-0914
A15R9	0767-0001	1	R:FXD MET FLM 400 OHM 5% 3W	28480	0767-0001
A15R10	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A15R11	0757-0927		R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A15R12	0812-0017		R:FXD WW 0.25 OHM 5% 3W	28480	0812-0017
A15R13	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A15R14	0757-0927		R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A15R15	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A15R16	0727-0012	2	R:FXD DEPC 20 OHM 1% 1/2W	28480	0727-0012
A15R17	0811-0931	1	R:FXD WW 660 OHM 1% 1W	28480	0811-0931
A15R18	0757-0894		R:FXD FLM 56 OHM 2% 1/8W	28480	0757-0894
A15R19	0757-0972		R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972
A15R20	0757-0960		R:FXD FLM 33K OHM 2% 1/8W	28480	0757-0960
A15R21	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A15R22	0757-0481	1	R:FXD MET FLM 475K OHM 1% 1/8W	28480	0757-0481
A15R23	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R24	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A15R25	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A15R26	0757-0911		R:FXD FLM 300 OHM 2% 1/8W	28480	0757-0911
A15R27	0757-0932		R:FXD MET FLM 2.2K OHM 2% 1/8W	28480	0757-0932
A15R28	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A15R29	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A15R30	0698-4345		R:FXD MET FLM 2 MEGOHM 1% 1/4W	28480	0698-4345
A15R31	0727-0229		R:FXD CARBON 265K OHM 1% 1/2W	28480	0727-0229
A15R32	0757-0473	1	R:FXD MET FLM 221K OHM 1% 1/8W	28480	0757-0473
A15R33	0757-0473	1	R:FXD MET FLM 221K OHM 1% 1/8W	28480	0757-0473
A15R34	0757-0928	3	R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A15R35	0757-0936		R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A15R36	0727-0012		R:FXD DEPC 20 OHM 1% 1/2W	28480	0727-0012
A15R37	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A15XQ1	1205-0011		HEAT DISSIPATOR:FOR TO-5 AND TO-9 CASES	98978	TXBF-032-0259

Table 1. Manual Changes (Cont'd.)

Table 5-2, Item 4: Replace item 4, with Appendix 1, Table 5.

Table 5. Time Scale Check

4. TIME SCALE CHECK

Place instrument in operation (CONTINUOUS OPERATION light on, ALARM light off).

Remove instrument top cover.

Connect 5 MHz from a Primary Frequency Standard as an external time base to an Electronic Counter.

Connect the Counter to rear panel SYNTH output jack of the 5061A under test. Set TIME SCALE SELECTOR thumbwheel switch and HI-LO slide switch (Figure 3-7) located on Synthesizer Assembly A1, to the settings listed. Counter should display the corresponding frequency, plus or minus the inherent 1-count Counter error.

Synthesized Frequency	Number on Thumbwheel	Slide Switch	Synthesized Frequency	Number on Thumbwheel	Slide Switch
12631771.6 Hz	2095	LO	12632139.8 Hz	4567	HI
12631818.2 Hz	0076	LO	12632186.6 Hz	9665	HI
12631863.7 Hz	3036	LO	12632231.4 Hz	0736	HI
12631909.6 Hz	6186	LO	12632278.1 Hz	3845	HI
12631955.8 Hz	2115	LO	12632323.2 Hz	5257	HI
12632001.6 Hz	9105	LO	12632369.5 Hz	7337	HI
12632047.5 Hz	0366	LO	12632415.3 Hz	8617	HI
12632093.9 Hz	4396	HI			

Reset TIME SCALE switches to instrument operating offset and replace top cover.

Change 53 (Continued)

4-42. The 12.632 MHz voltage controlled oscillator phase lock range is kept narrow to prevent phase locking to incorrect harmonics. To accommodate the dynamic range required for complete coverage of all UT2 (UTC) offset frequencies, the voltage controlled oscillator has two overlapping frequency ranges, selected by the setting of HI-LO switch A1S2. Table 3-3 indicates the proper setting for appropriate synthesizer frequencies. Diodes CR38, CR39, with C40, C43, R82, and R84 provide AGC dc feedback to Q19 base.

5-49. Synthesizer circuits provide 12.63 . . . MHz to Harmonic Generator Assembly A4. The exact frequency is determined by setting TIME SCALE thumbwheel and HI-LO switches. Table 3-3 lists the output frequencies corresponding to specific thumbwheel and slide switch settings.

5-51. To determine if synthesizer circuits are working properly, connect equipment as shown in Figure 5-6. Set instrument for normal operation (CONTINUOUS OPERATION light on, ALARM light off). Check several switch settings throughout Table 3-3. Counter should indicate the corresponding frequency ±1 count. The RF Voltmeter should indicate 100 mV or more at each check point.

End of Replacement Paragraphs.

Paragraph 5-15: Add the following between step a and step b. "Check Synthesizer Assembly TIMESCALE Switch settings given in Paragraph 3-8a.
Paragraphs 5-49 and 5-51: Replace this paragraph with Appendix I Replacement Paragraphs 5-49 and 5-51.

Table 5-5: Replace this table with Appendix I, Table 6.

Paragraph 5-56 steps e to h: Replace with the following steps e to m. Change manual series number to 1132A.

e. Set TIME SCALE slide switch on synthesizer to LO.

f. Measure synthesizer frequency at A1J3 using setup shown in Figure 5-7.

Table 1. Manual Changes (Cont'd.)

Change 53 (Continued)

Table 6. Synthesizer A1TP1 Output Period vs Thumbwheel Switch Setting

Thumbwheel Setting	Signal Period at A1TP1
2095	819.6 μsec
0076	660.0 μsec
3036	739.4 μsec
6186	636.8 μsec
2115	977.6 μsec
9105	996.2 μsec
0366	674.0 μsec
4396	613.2 μsec
4567	469.2 μsec
9665	866.2 μsec
0736	726.0 μsec
3845	904.4 μsec
5257	495.0 μsec
7337	532.6 μsec
8617	566.4 μsec

g. If counter indication is greater than 12.632110 MHz or less than 12.631710 MHz, replace A1Y1 before proceeding.

h. Adjust L2 as necessary for a counter indication of 12.631910 MHz, ±60 Hz.

i. Set TIME SCALE slide switch on synthesizer to HI.

j. Adjust L4 as necessary for a counter indication of 12.632250 MHz, ±60 Hz.

k. Set TIME SCALE slide switch on synthesizer to LO. Check that counter indication is 12.631910 MHz, ±60 Hz. If frequency is incorrect, repeat steps h through k.

l. When frequency at HI and LO settings are correct, reconnect R81, replace synthesizer cover, and replace synthesizer assembly into the instrument.

m. Reconnect all electrical connections and using test setup in Figure 5-6, check synthesizer output frequencies using Table 3-3. All thumbwheel switch settings should correspond with associated frequencies ±1 count.

Change 54

Page 6-6, Table 6-1:
Change A3 from 05061-6108 to 05061-6094.
Change A3A1 from 05060-6106 to 05060-6002.
Figure 8-11: Change A3 Multiplier Assembly from 05061-6108 to 05061-6094; change A3A1 Multiplier P.C. Board Assembly from 05060-6106 to 05060-6002.
Table 4-1 and Table 5-3 Assembly Designations:
Change A3 Multiplier from 05061-6108 to 05061-6094.
Change A3 and A3A1 series numbers to 1224A.

Change 55

Table 4-1 and Table 5-3, Assembly Designations:
Change A6 Frequency Divider from 05061-6102 to 05061-6003.
Paragraphs 4-147 to 4-150 and 4-152, 4-153: Replace with Appendix 1, Replacement Paragraphs 4-147 to 4-150 and 4-152, 5-153.

Replacement paragraphs.

4-147. For explanation purposes, assume DIVIDER MODE switch S4 is set to AUTO START. The divider start requirements are a 1 MHz signal at X4 multiplier Q4 and a 5 MHz signal at buffer amplifier Q1 base. Quartz Oscillator Assembly A10 5 MHz output is coupled through capacitor C1 to buffer amplifier Q1, amplified, and coupled to transformer T1 and T2 primary circuit. Capacitive voltage divider C5-C6 couples the signal through detector diodes CR2-CR3 to 5 MHz rectifier Q2 causing switch Q5 to change state. Feedback is through Q5-C16 to amplifier and start oscillator transistor Q6 base. Components L5, C17, C20, C21, C22, and R22 are resonant at 1 MHz forming the remainder of the feedback loop necessary for Q6 to oscillate at 1 MHz.

4-148. Transistor Q6 output is coupled through C15 to X4 multiplier Q4, multiplied to 4 MHz, and coupled through T2 primary to T1 secondary windings. The 5 MHz from buffer amplifier Q1 is also present in T2 secondary. Both signals are applied to mixer diode CR4. Components L2, C13, and R12 form a 1 MHz tuned circuit permitting 1 MHz to couple through C14 to amplifier Q6 base circuit. Q6 provides three 1 MHz output signals: 1) through C17 to the 100 kHz divider circuit, 2) through C23 to emitter follower Q8, amplified by Q9, and transformer coupled through T3 to front and rear-panel 1 MHz output jacks, and 3) coupled to X4 multiplier Q4 sustaining the regenerative process.

4-149. A portion of Q6 output is applied to detector diodes CR5-CR6, causing Q7 to change state, changing Q2 and Q3 state, and eliminates the oscillator feedback path through Q5 and C16. Transistor Q6 is no longer an oscillator but a class A amplifier. If DIVIDER MODE switch S4 was initially set to momentary START, the divider starts as described. However, when S4 returns to off, emitter is opened, removing feedback to Q6, and Q6 operates as an amplifier.

4-150. Breakdown diode CR1 and capacitor C7 form a +7 volt bias supply. Components L1, L3, L4, L6, C2, C3, C8, C10, C19, and C24 decouple the divider circuits from the +18.7 volt supply.

4-152. This divider functions the same as the 1 MHz circuit. Assume the 1 MHz divider has started but the 100 kHz has not. The divider start requirements are a 100 kHz signal at X9 multiplier Q12 and a 1 MHz signal at 1 MHz

Table 1. Manual Changes (Cont'd.)

Table 6a. Synthesized Frequencies

UTC Offset Part in 10^{10}	Synthesized Frequency	Number on Thumbwheel	Slide Switch	Zeeman Frequency
0 (Atomic)	12631771.6 Hz	2095	LO	42.82 kHz
-50	12631818.2 Hz	0076	LO	50.49 kHz
-100	12631863.7 Hz	3036	LO	44.80 kHz
-150	12631909.6 Hz	6186	LO	43.65 kHz
-200	12631955.8 Hz	2115	LO	47.42 kHz
-250	12632001.6 Hz	9105	LO	45.35 kHz
-300	12632047.5 Hz	0366	LO	44.18 kHz
-350	12632093.9 Hz	4396	HI	50.18 kHz
-400	12632139.8 Hz	4567	HI	49.20 kHz
-450	12632186.6 Hz	9665	HI	57.66 kHz
-500	12632231.4 Hz	0736	HI	45.14 kHz
-550	12632278.1 Hz	3845	HI	53.23 kHz
-600	12632323.2 Hz	5257	HI	43.86 kHz
-650	12632369.5 Hz	7337	HI	47.78 kHz
-700	12632415.3 Hz	8617	HI	45.10 kHz

The Universal Time Scale, UT2, is related to the earth's rotation and has been proceeding at a rate slightly slower than that of the atomic scale. The UT2 time-interval second is slightly longer. A UTC time scale which approximates UT2 can be produced by oscillations offset from the atomic frequency by an amount proportional to the difference in their intervals.

By international agreement, this frequency offset is fixed each year by the Bureau International de l'Heure in Paris. For 1965 the offset was -150×10^{-10}, and for 1966, 1967, and 1968 it is -300×10^{-10}.

The above table lists the thumbwheel switch settings for frequency offsets between 0 (Atomic time scale) and -700 parts in 10^{10}.

Change 55 (Continued)

amplifier Q10. The 1 MHz divider circuit provides 1 MHz through T1 to Q10. The signal is amplified and coupled to T4-T5 primary circuits. Gate Q13 state is changed by 1 MHz rectifier Q7, and changing state of switch Q15. Feedback is through Q15-C41 to amplifier and start oscillator Q16 base. Components L13, C45, C46, C47, and R61 are resonant at 100 kHz and from the necessary feedback loop for Q16 to oscillate at 100 kHz. Transistor Q16 output is coupled through C40 to X9 multiplier Q12, multiplied to 900 kHz, and coupled through T5 primary to T2 secondary windings. 1 MHz amplifier Q1 output is also coupled to T5 secondary and both signals are applied to mixer diode CR8. Components L10, C37, and R44 form a 100 kHz tuned circuit permitting 100 kHz to couple through C39 to Q16 base. A portion of the 100 kHz signal is applied to CR9-CR10 changing 100 kHz rectifier transistor Q18 state. This changes Q14-Q15 state, and breaks the oscillator feedback loop through Q15. Transistor Q16 now functions as a class A amplifier. Feedback through C40 to Q12 maintains regenerative oscillator action.

Table 1. Manual Changes (Cont'd.)

Change 55 (Continued)

4-153. The 100 kHz signal is coupled through C46 to emitter follower Q19, amplified in Q20, and applied through T6 to front and rear-panel 100 kHz output jacks. A 100 kHz signal is coupled from Q16 through C42 to 100 kHz clock amplifier Q17 base. The amplified signal is coupled through C50 to rear-panel CLOCK output jack. Components L7, L9, C32, C24, C33, L11, C57, C58, and C49 decouple the 100 kHz divider from the +18.7 volt supply. Diode CR7 with R32, C29, C30, CR11, R70, R71, and C54 provide output level indications to front-panel CIRCUIT CHECK meter.

Paragraph 5-94, 100 kHz Tuning: Replace with Appendix I, Replacement Paragraph 5-94.

Replacement paragraph.

5-94. 100 kHz TUNING.

Note

> 100 kHz divider is started by 1 MHz from the 1 MHz divider. Therefore, before tuning the 100 kHz divider the 1 MHz divider must be started and running.

a. Connect a BNC tee connector to front panel 100 kHz output jack. Connect Electronic Counter and RMS Voltmeter to the BNC tee. Connect the 5061A 5 MHz output to Counter EXT STD INPUT and set counter for external standard operation.

b. Connect 50-ohm Termination to 100 kHz output jack on 5061A rear panel.

c. Start the dividers by setting DIVIDER MODE switch to AUTO START.

d. Carefully tune A6L13, T4, T6, and T5 for maximum indication on RF voltmeter. Output level should be between 1.0 and 1.5 Vrms. If less, decrease the value of A6R69 until the output level is between 1.0 and 1.5 Vrms. Electronic Counter should indicate 100 kHz ±1 count.

e. Disconnect all test equipment from 5061A and re-install divider assembly in instrument. This completes the divider checks and tuning.

Table 6-1, Replaceable Parts:
Replace A6 information in Table 6-1 with Appendix I, Table 7.
Replace Figure 8-17 sheets 1 and 2 with Appendix I Figures 26, 27, 28 and 29. Change A6 series number to 728.

Change 56

Table 6-1 A13 Buffer Amplifier Assembly:
Change A13A1 from 05061-6107 to 05061-6031.
Change A13R1 to 0757-0900 R: MET FLM 100 OHMS.
Add A13R2, 0757-0900, R: MET FLM 100 OHMS.
Figure 8-26: Replace A13 Component Locator with Appendix I, Figure 7a.

Change A13R1 to read A13R2, value 100 OHMS.
Add A13R1, 100 OHMS to J2 side of A13R3 and circuit ground.
Change A13 series number to 916.

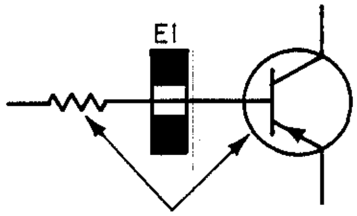
Change 56A

Page 6-20, Table 6-1:

Add A14E1: HP Part No. 9170-0029, Core: Ferrite Bead.

Page 8-49, Figure 8-27:

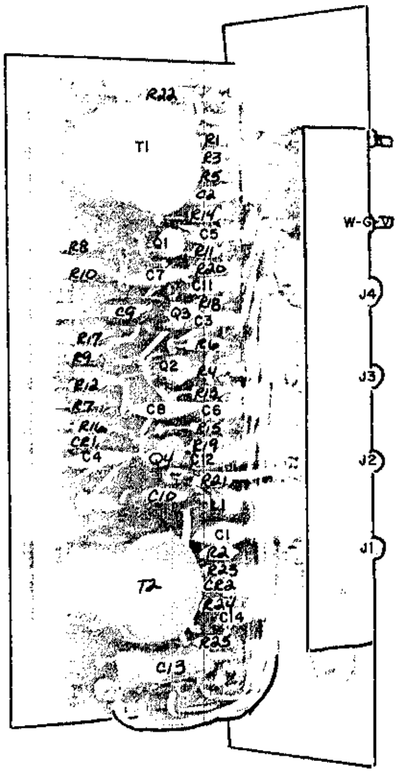
Add A14E1 to Q1 base (Symbol for E1) is:



Components are for example only

Change A14 Series Number to 1236A.

Figure 7a. A13 Buffer Amplifier



Change 57

Page 6-21, Table 6-1:
Change A14R10 from 0757-0383 to 0698-3435, R:FXD MET FLM 38.3 OHMS.
Figure 8-27, change A14R10 from 18.2 OHMS to 38.3 OHMS.
Change A14 series number to 1208A.

Change 58

Page 6-23, Table 6-1:
Change A19R5 from 0698-8419 to 0698-3305. No other effects result from this change.
Change A19 series number to 728.

Change 59

Page 6-34, Table 6-3:
Change A5A1Q1, Q2 to 1854-0020

Page 8-21, Figure 8-14:
Change Q1 and Q2 to 1854-0020.
Change A5 Series Number to 1248A.

Change 60

Page 6-36, Table 6-3:
Change A5A3C1 and A5A3C3 to 0140-0196, C:FXD MICA 150 pF, 5%, Mfr. Part No. RDM 15F 151 J3C.

Page 8-25, Figure 8-16:
Change A5A3C1 and A5A3C3 to 150.

Pages 8-21, 8-23 and 8-25, Figures 8-14, 8-15 and 8-16:
Change A5 Series Number to 1232A.

Pages 8-21, 8-23 and 8-25, Figures 8-14, 8-15 and 8-16; respectively:
Change A5 Series Number to 1232A.

Change 61

Page 6-25, Table 6-1:
Change C2 from 0160-4201 to 0160-3488, C:FXD 3.0 μf, Mfr. Part No. 0160-3488.
Add C3; HP Part No. 0160-3489, C:FXD 5.0 μf, Mfr. Part No. 0160-3489.
Change DS1, DS2 from 2140-0245 to 2140-0025, Mfr. Part No. 327.

Page 8-3, Figure 8-2:
Add C3 notation next to C2. Delete references to "C3 deleted" at bottom of page.

Page 8-5, Figure 8-5:
Change C2 to 3 μf.
Add C3, 5 μf, in parallel with C2.
Delete references to "C3 deleted" at bottom of page.
Change manual prefix to 1328A.

Change 66

Pages 6-32, 6-33, Table 6-2:
Change A2R41 and A2R55 to 0757-0941.
R: FXD Met FLM 5.1K Mfr No. 0757-0941.
R19 remains 2.4K.

Page 8-13, Figure 8-10:
Change A2R41, R55 to 5.1K.
Change A2 Series No. to 1352A.

Change 62

(For A5) Page 6-34, Table 6-3:
Change A5A1C19 from 0180-0532 to 0160-0128 C:FXD, CER, 2.2 μf, Mfr. Part No. 5C152C2S-CML.

Page 8-21, Figure 8-14:
Change A5A1C19 from 6.8 μf to 2.2 μf.
Change A5A1 Series Number to 1332A.
Change A5 Series Number on Pages 8-19, 8-21, 8-23, and 8-25 to 1332A.

(For A2) Page 6-31, Table 6-2:
Delete A2C16.
Change manual prefix to 1328A.

Page 8-13, Figure 8-10:
Delete A2C16 from component locator and from schematic diagram.
Change A2 Series Number to 1112A.

Change 63

Page 6-36, Table 6-3:
Change A5A3C1 and A5A3C3 to 0140-0196 C:FXD, MICA 150 pf, Mfr. Part No. RDM15F151J3C.

Page 8-25, Figure 8-16:
Change A5A3C1 and C3 to 150 pf.

Pages 8-21, 8-23, and 8-25, Figures 8-14, 8-15, and 8-16:
Change A5 Series Numbers to 1248A.
Manual prefix remains at 1328A.

Change 64

Page 6-6, Table 6-1:
Delete A1A1E1.
Page 8-11, Figure 8-9:
Delete A1A1E1 from Q19 collector.
Change A1 Series Number to 1316A.
Change manual prefix to 1316A.

Change 65

Page 6-4, Table 6-1:
Delete A1A1C50.

Page 8-11, Figure 8-9:
Delete A1A1C50 from across A1A1R89.
Change A1 Series Number to 1152A.
Change manual prefix to 1248A.

Figure 8. Synthesizer Assembly A1, Component Locator, Series 1040A

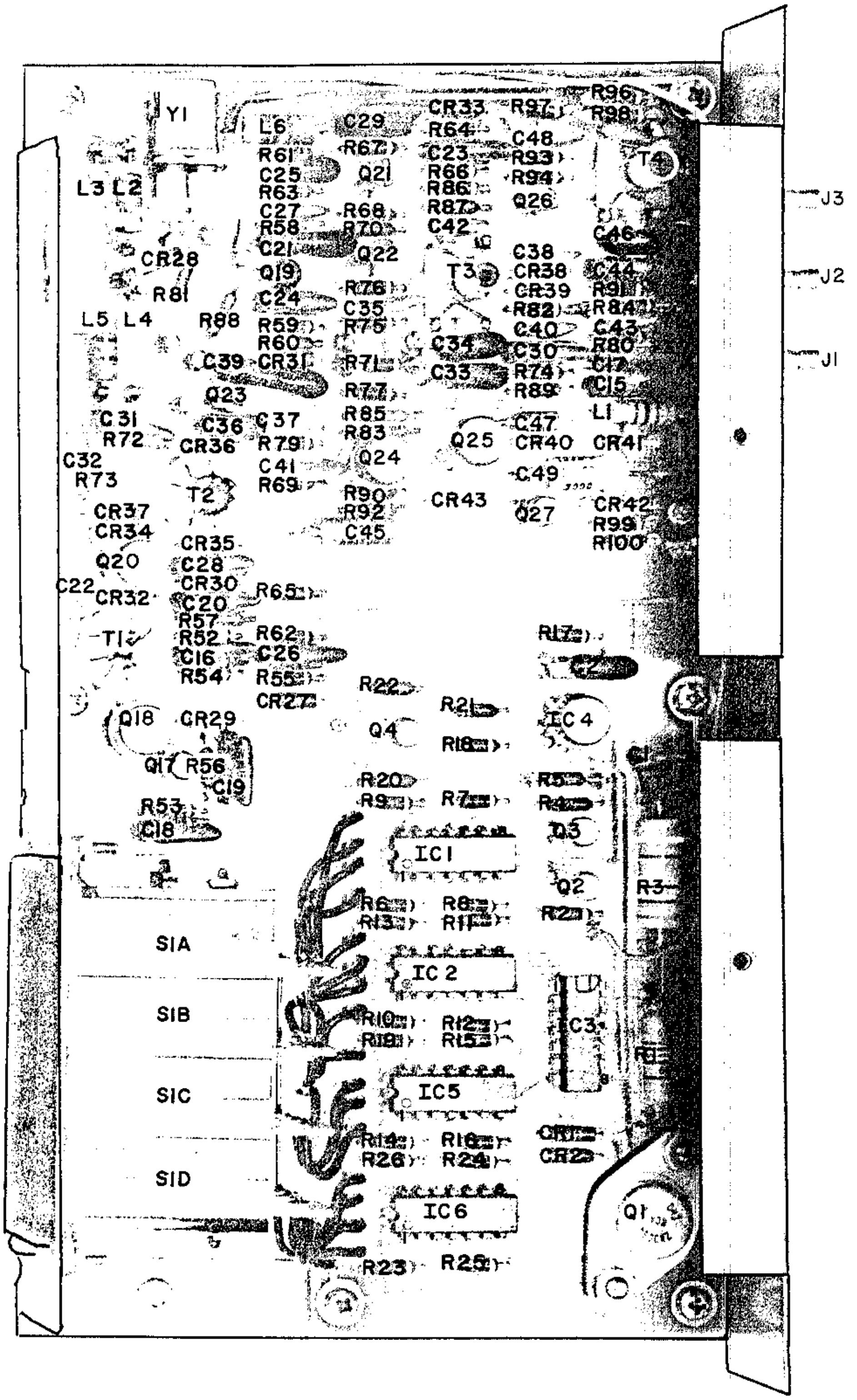


Figure 9. Synthesizer Assembly A1 Digital Section, Series 1040A

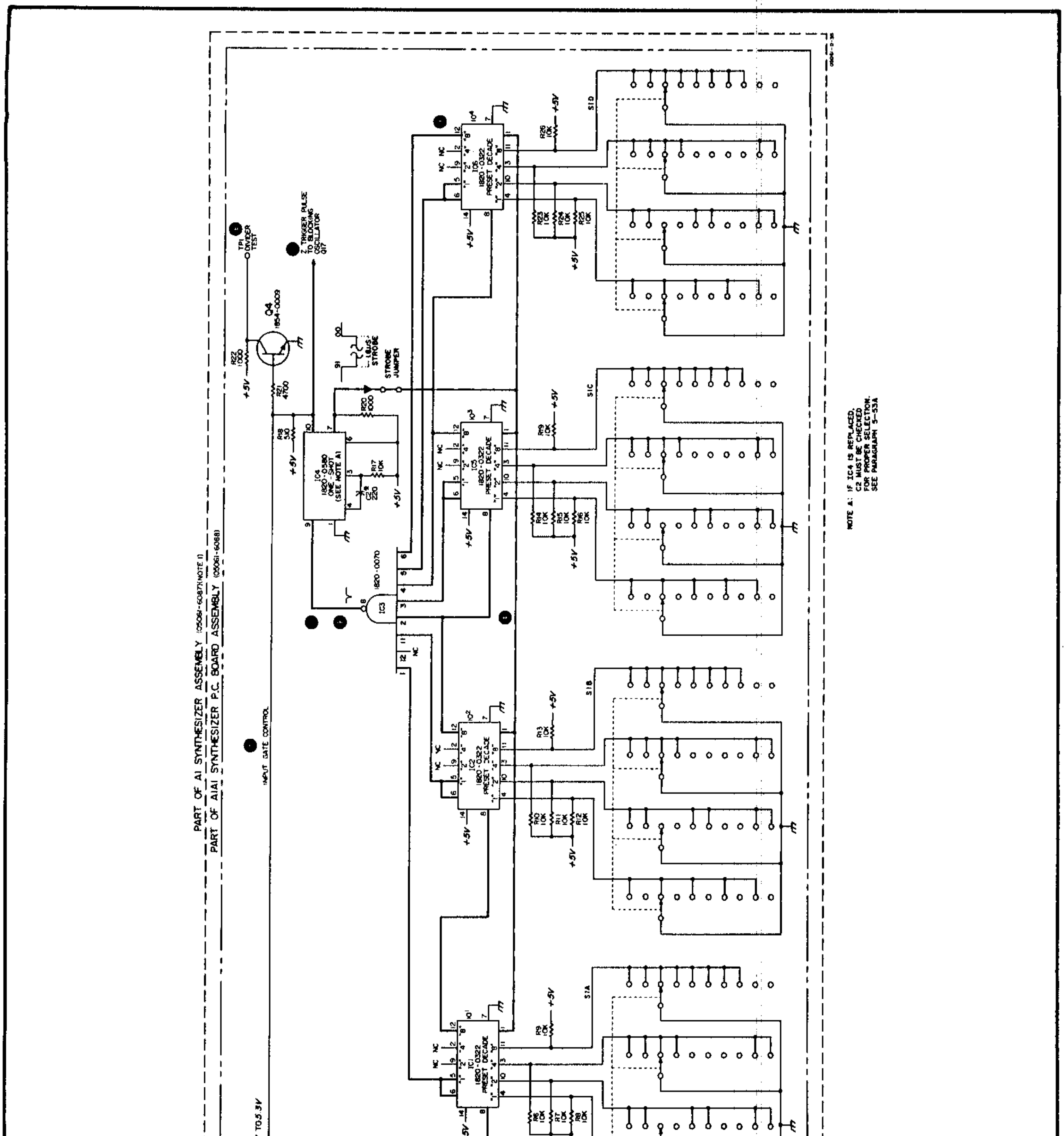


Figure 10. Synthesizer Assembly A1 Phase Locked Oscillator Section, Series 1040A

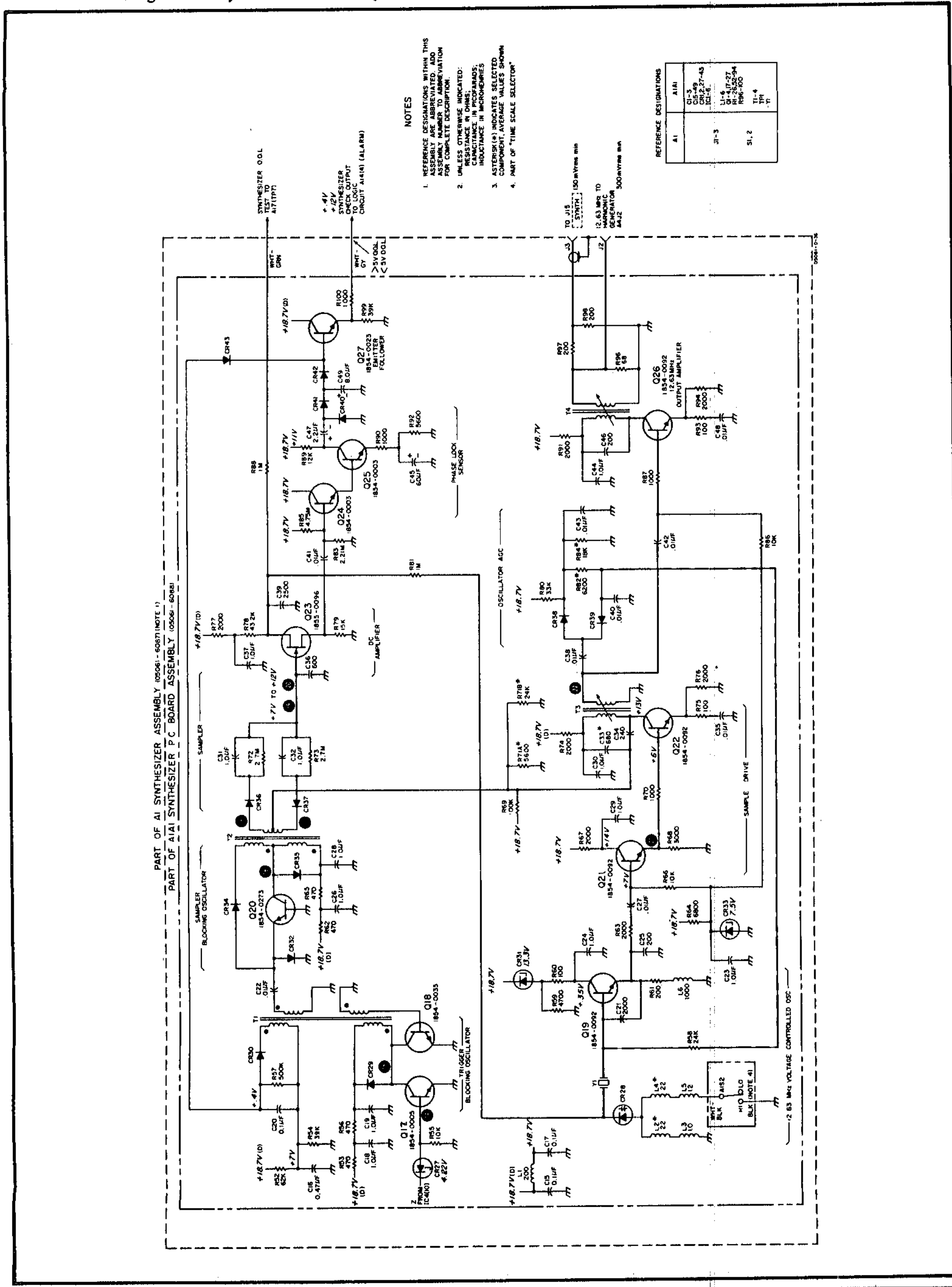


Figure 11. A15 Power Regulator Component Locator

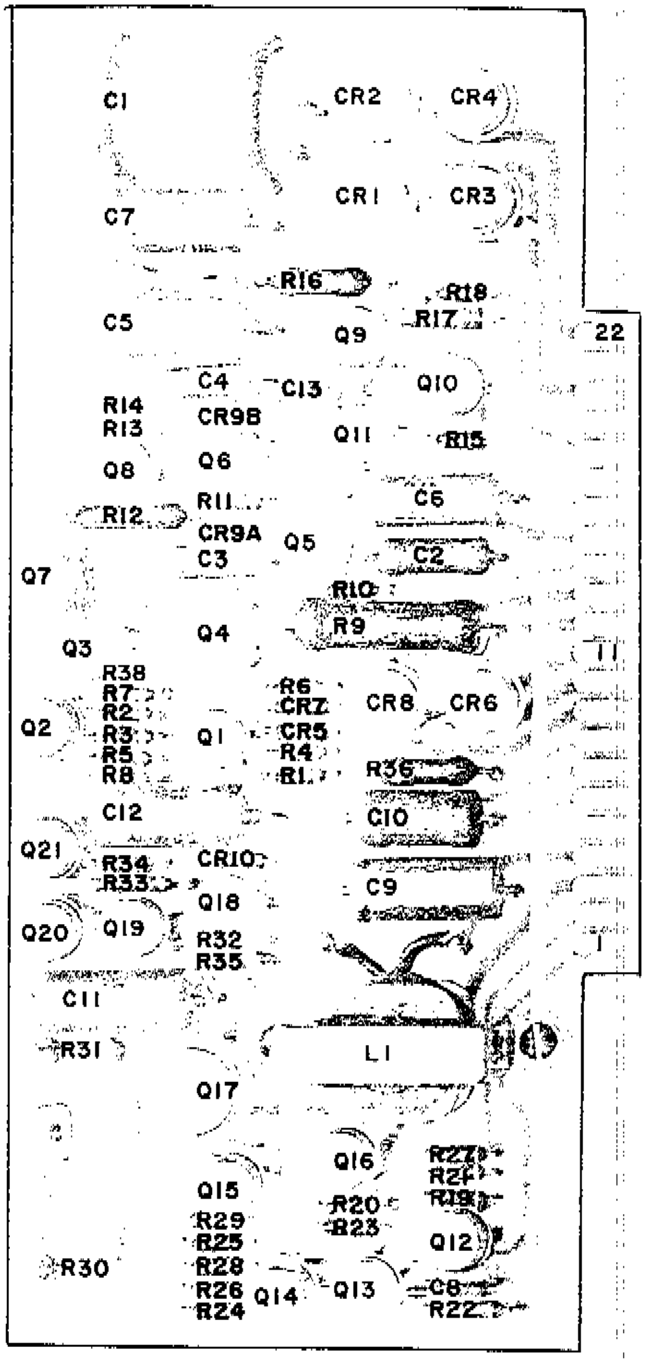


Figure 12. Power Regulator Assembly A15

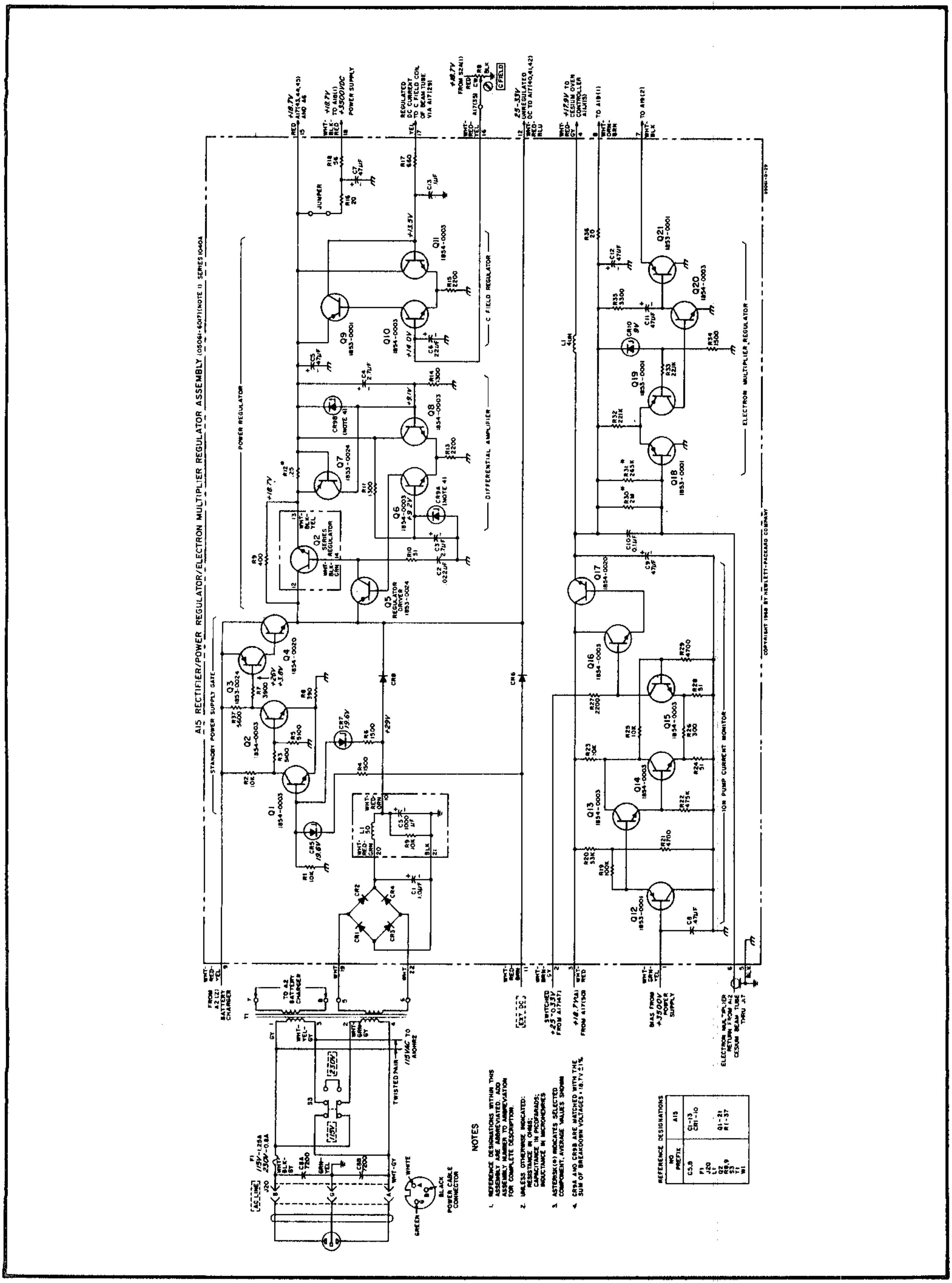


Figure 13. +3500 Vdc Power Supply Assembly A18   -2500 Vdc Power Supply Assembly A19

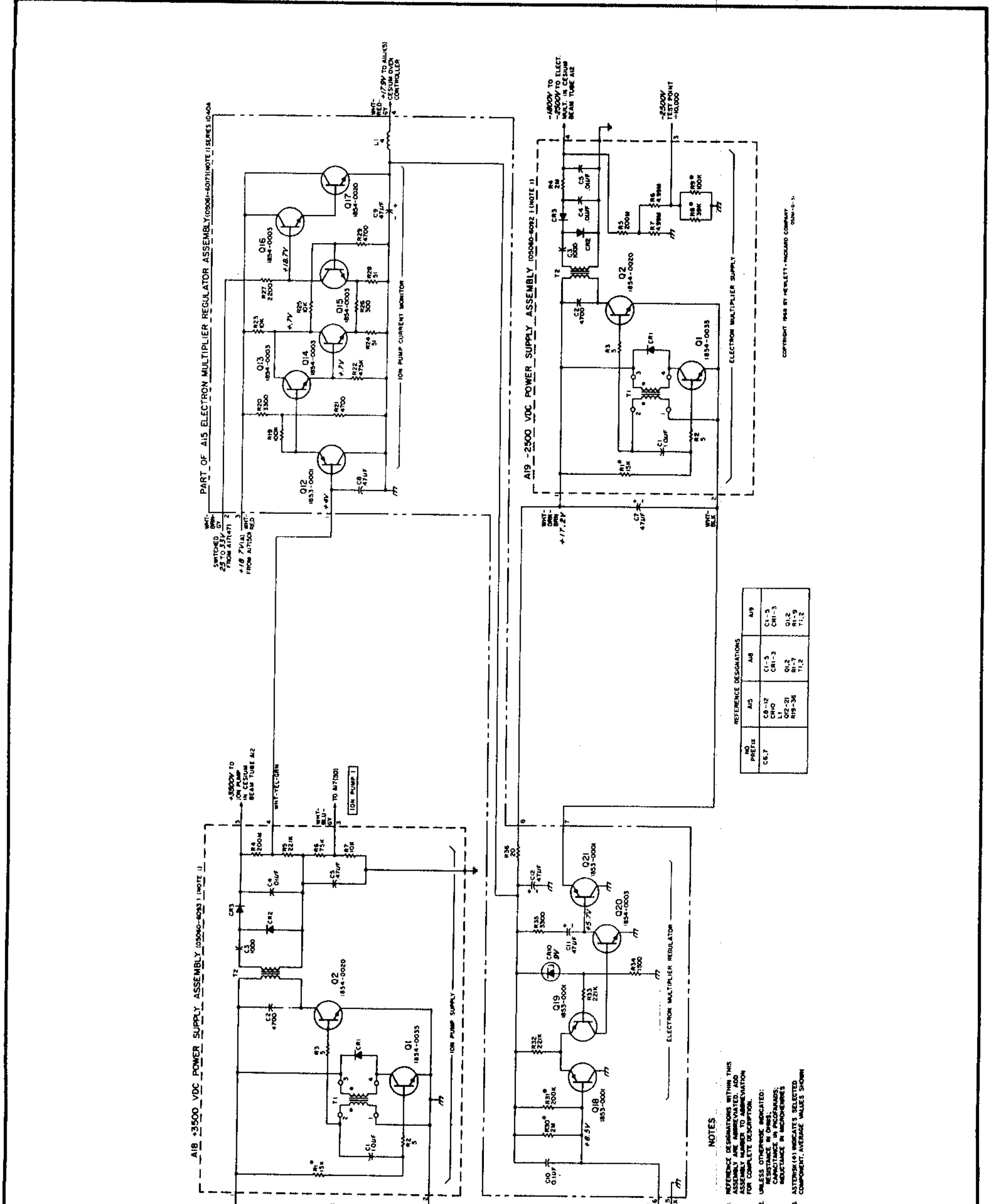


Figure 14. A17 Terminal Board Component Locator

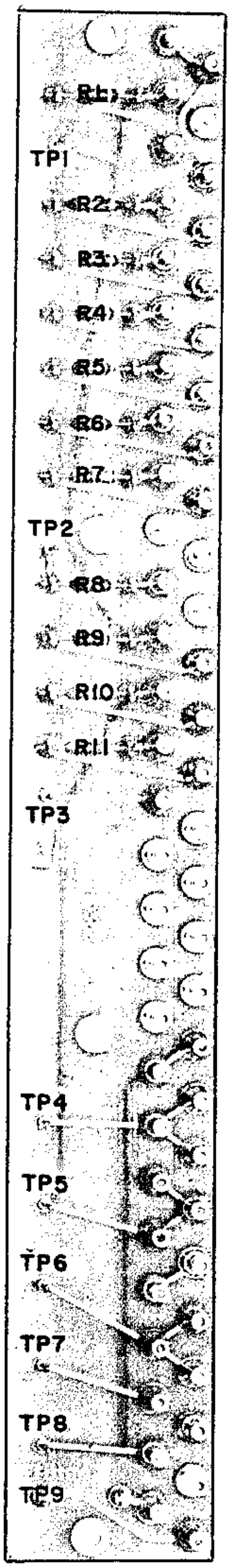


Figure 15. Terminal Board Assembly A17

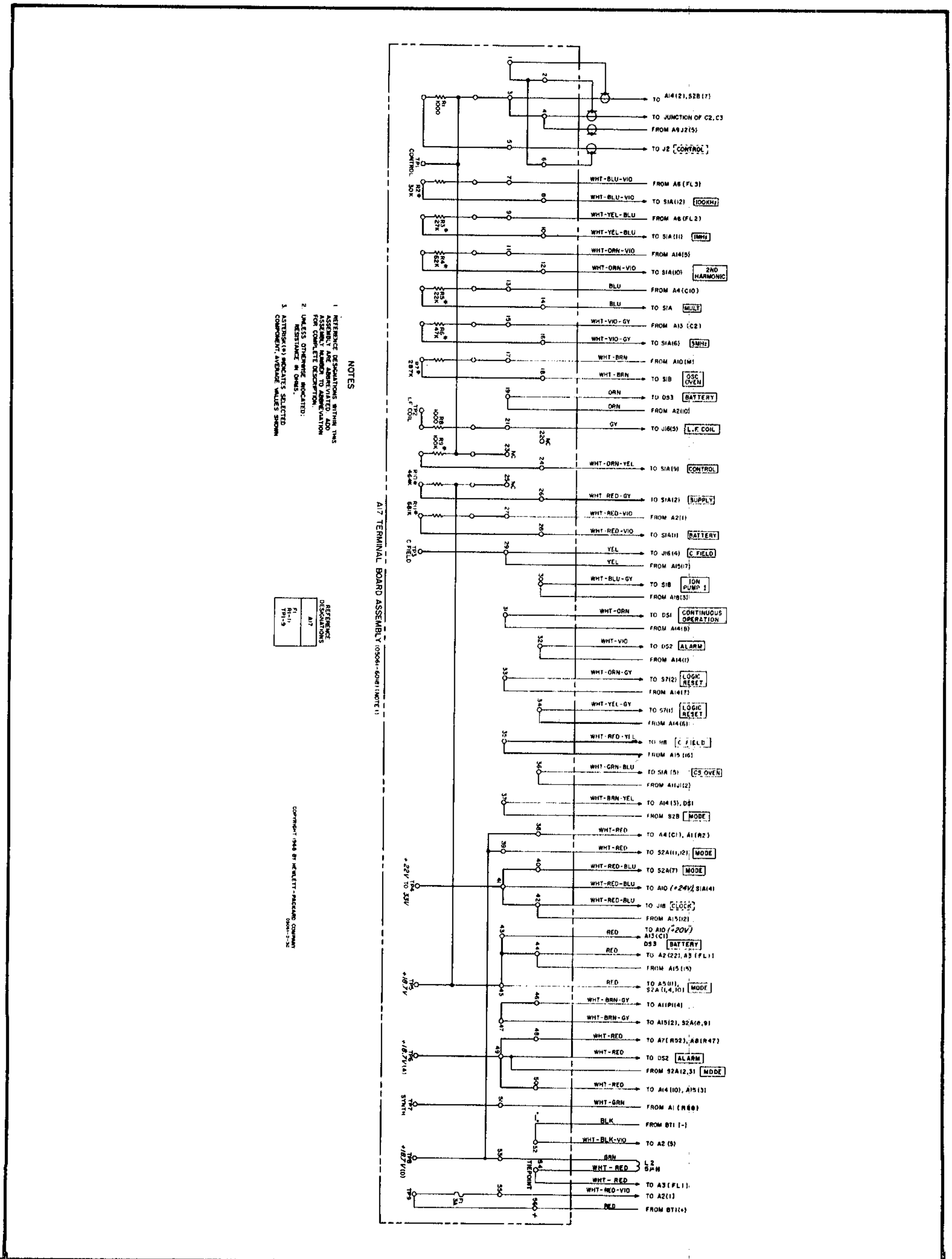


Figure 16. A9 Operational Amplifier Component Locator

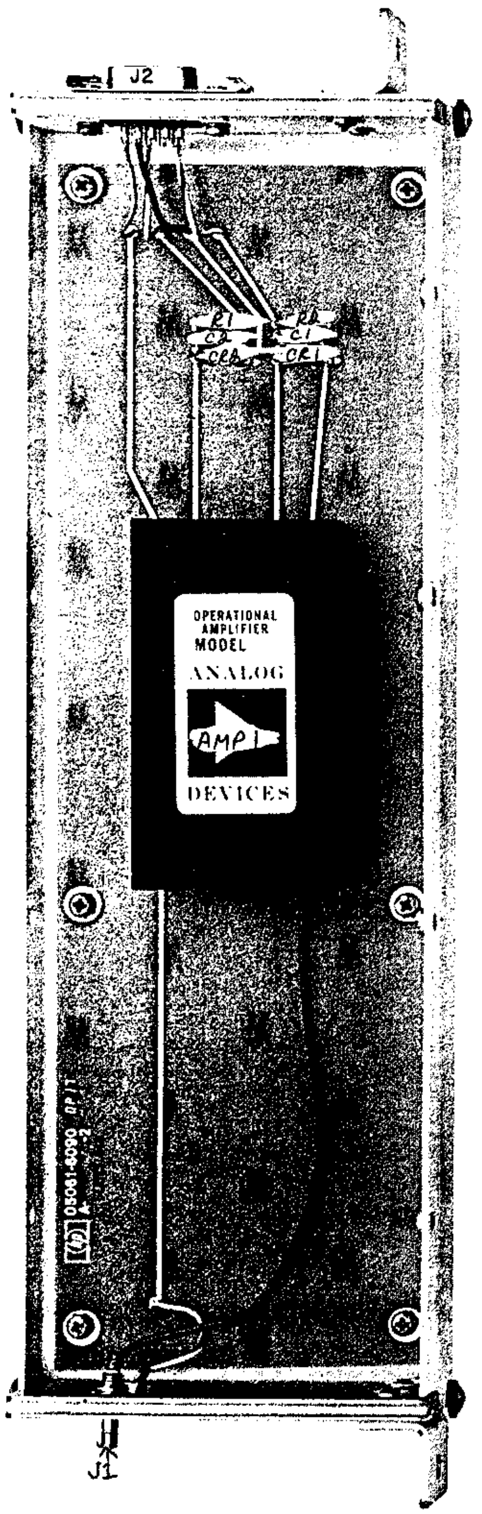


Figure 17. Operational Amplifier Assembly A9

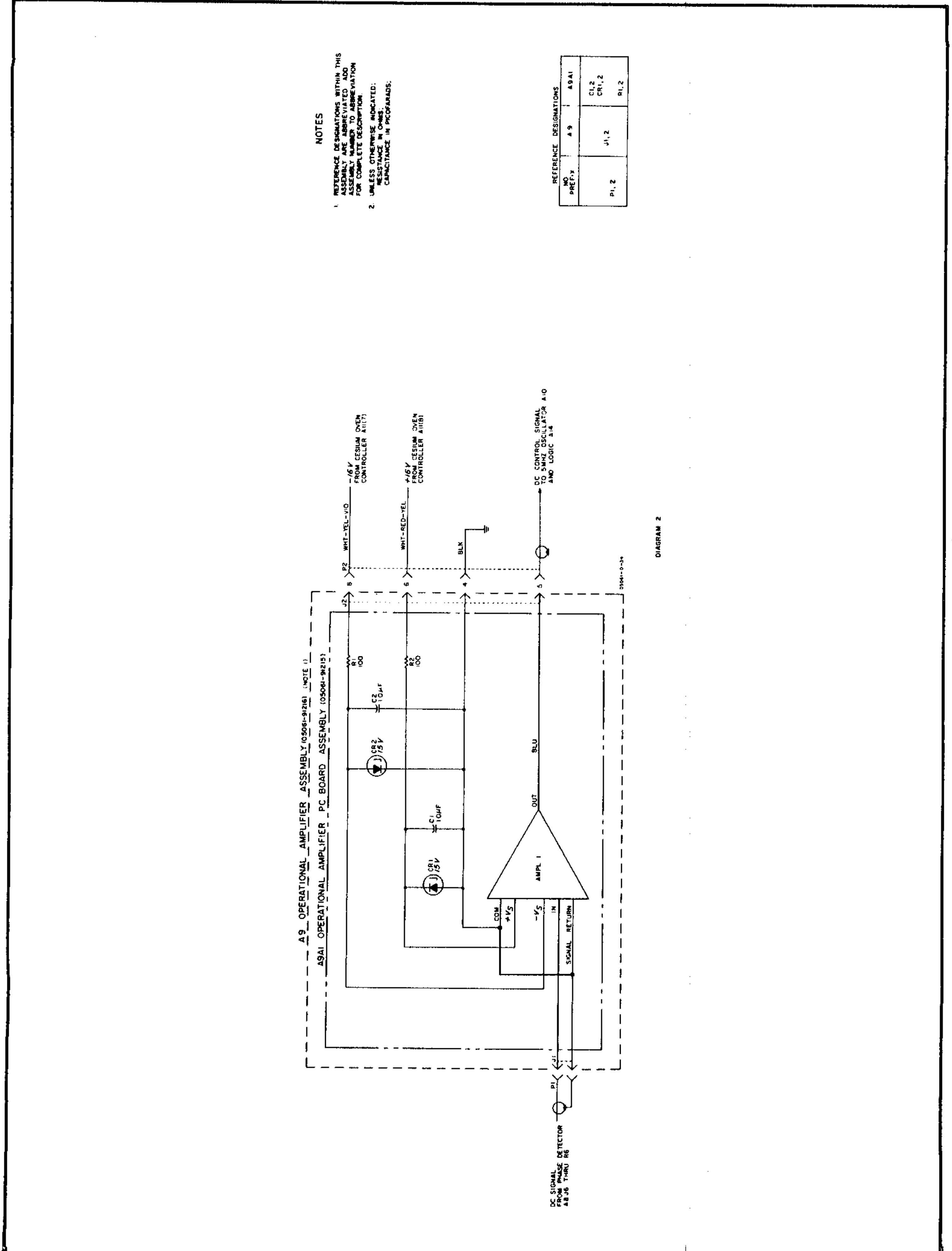


Figure 18. Block Diagram

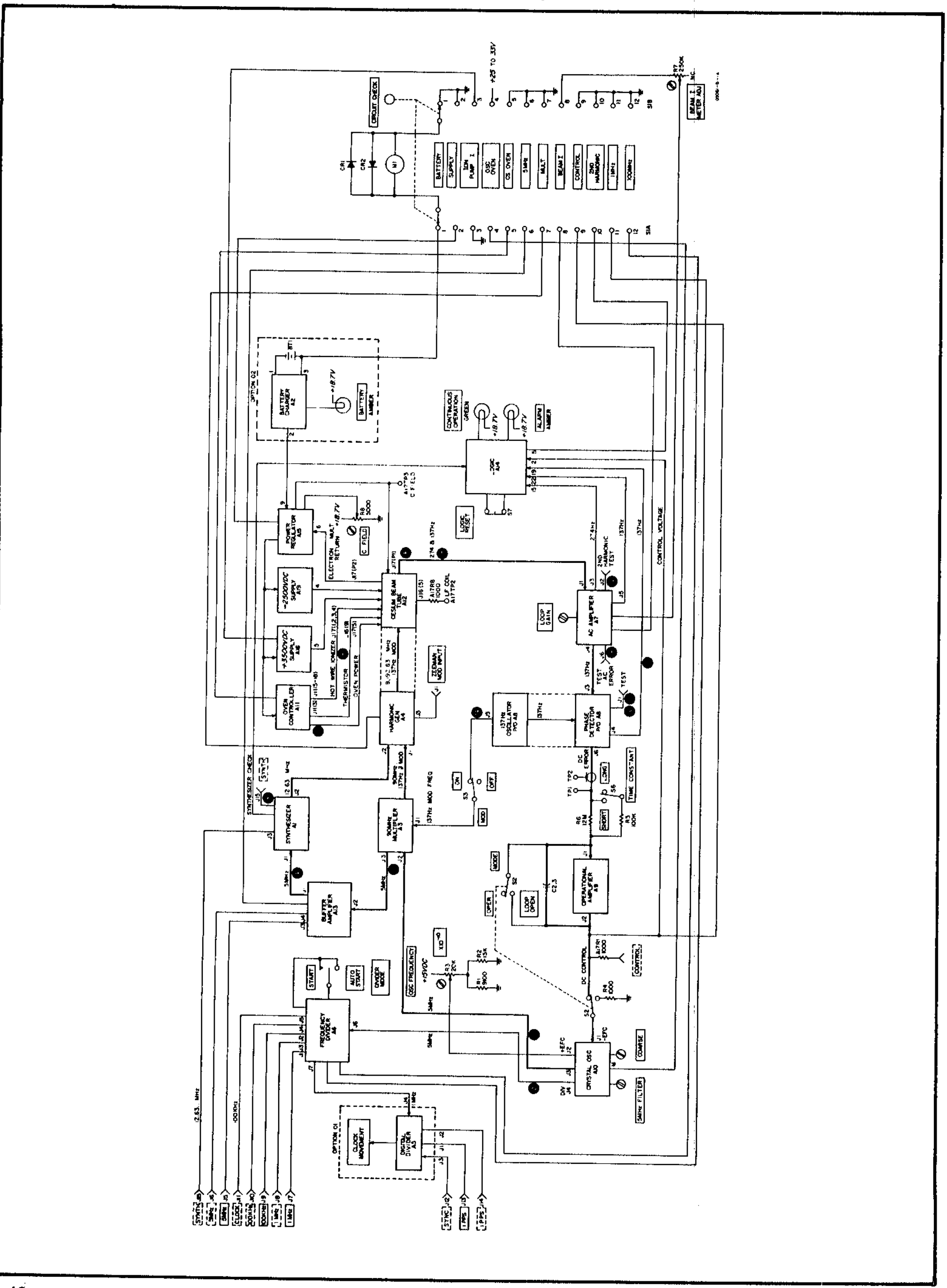
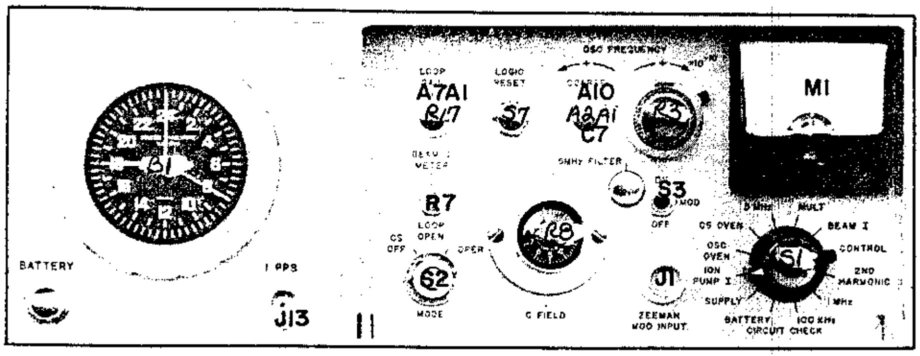


Figure 19. Top Internal and Front Panel



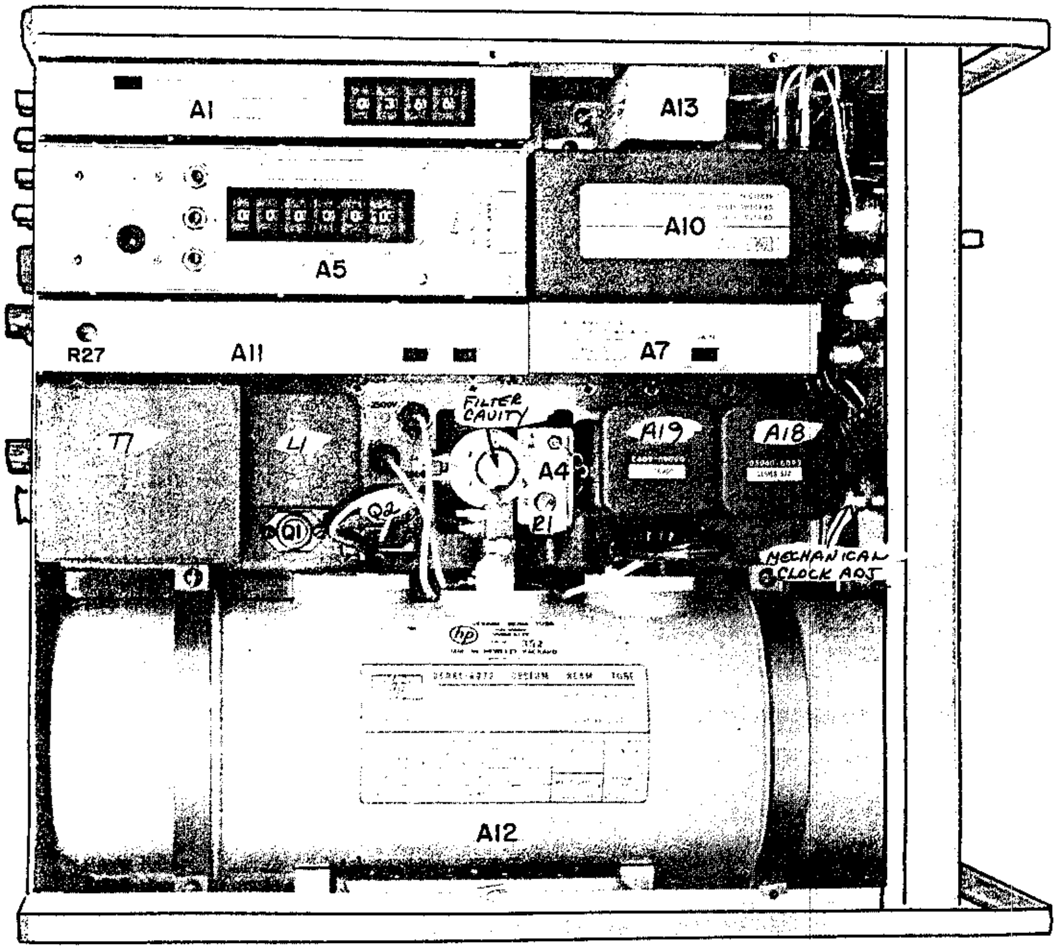


Figure 20. Bottom Internal

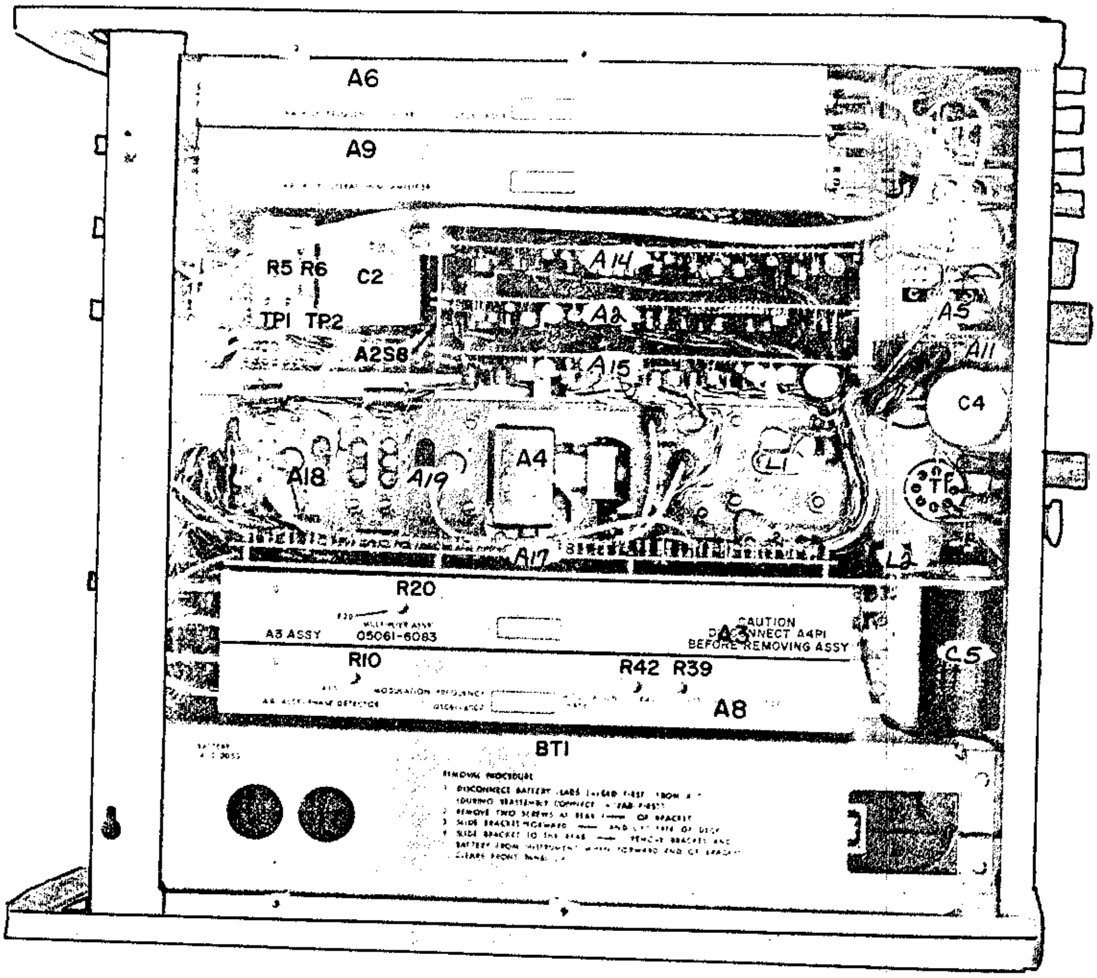


Figure 21. Wiring Diagram

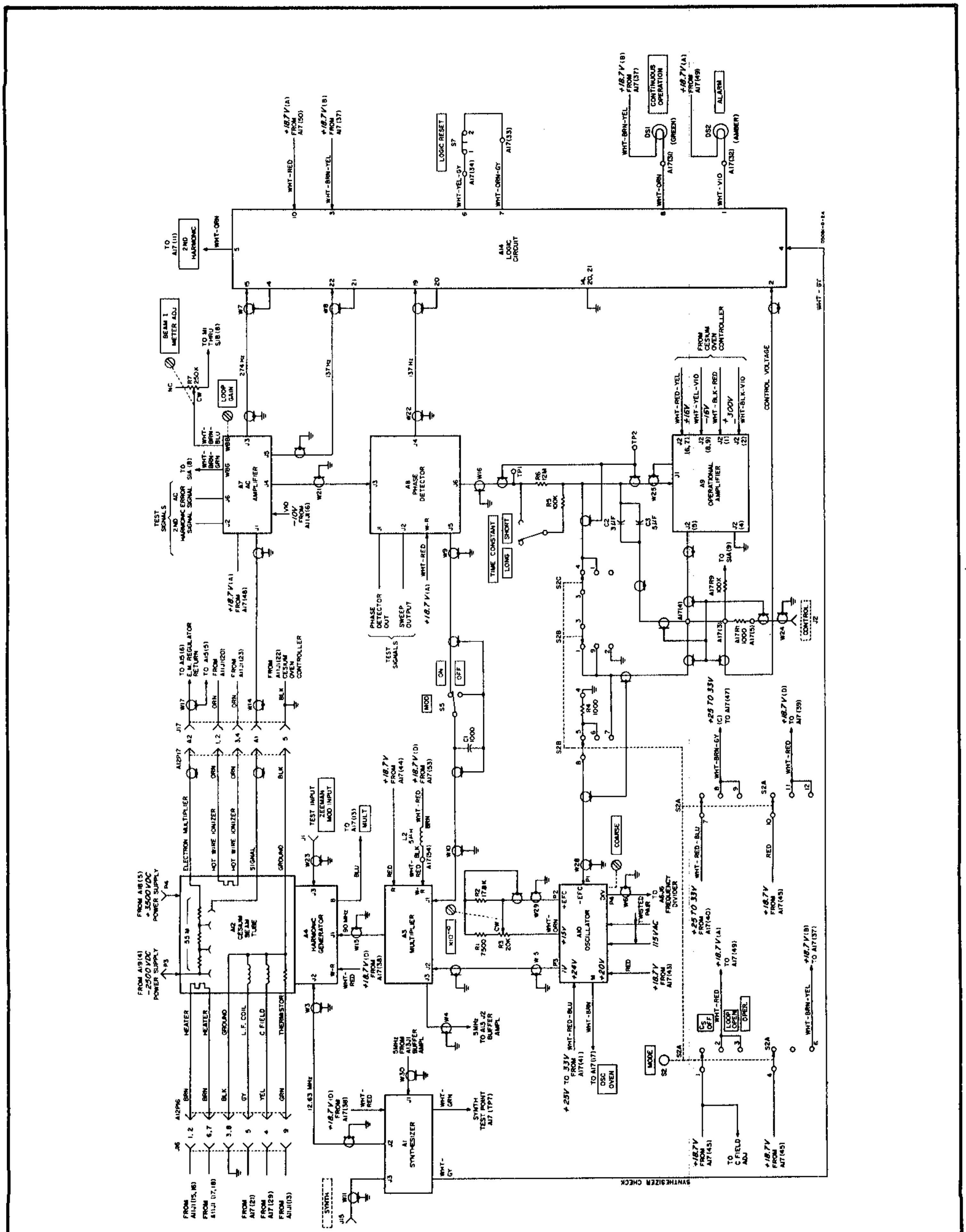


Figure 22. Wiring Diagram

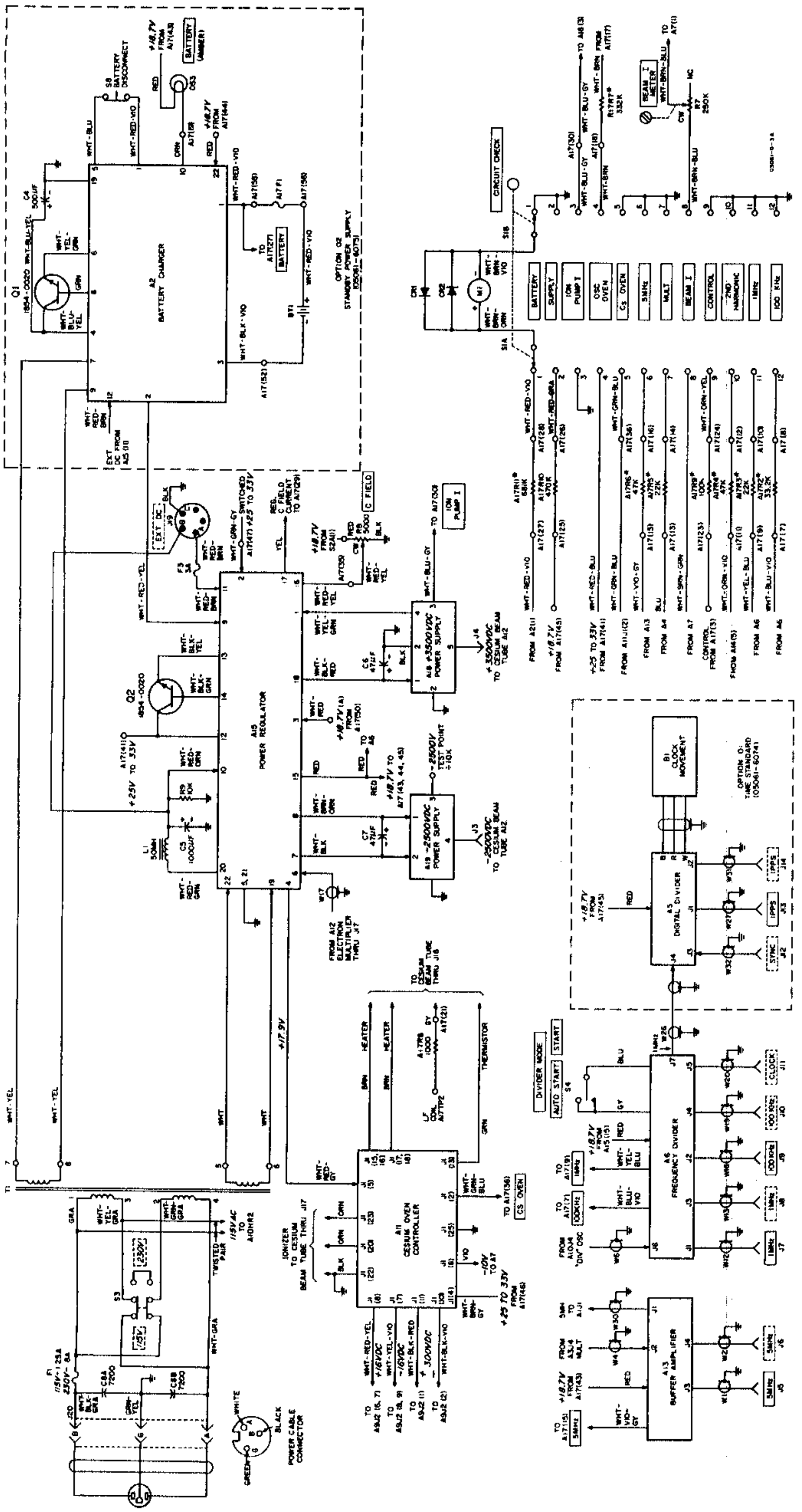


Figure 23. Model 5061A and Accessories

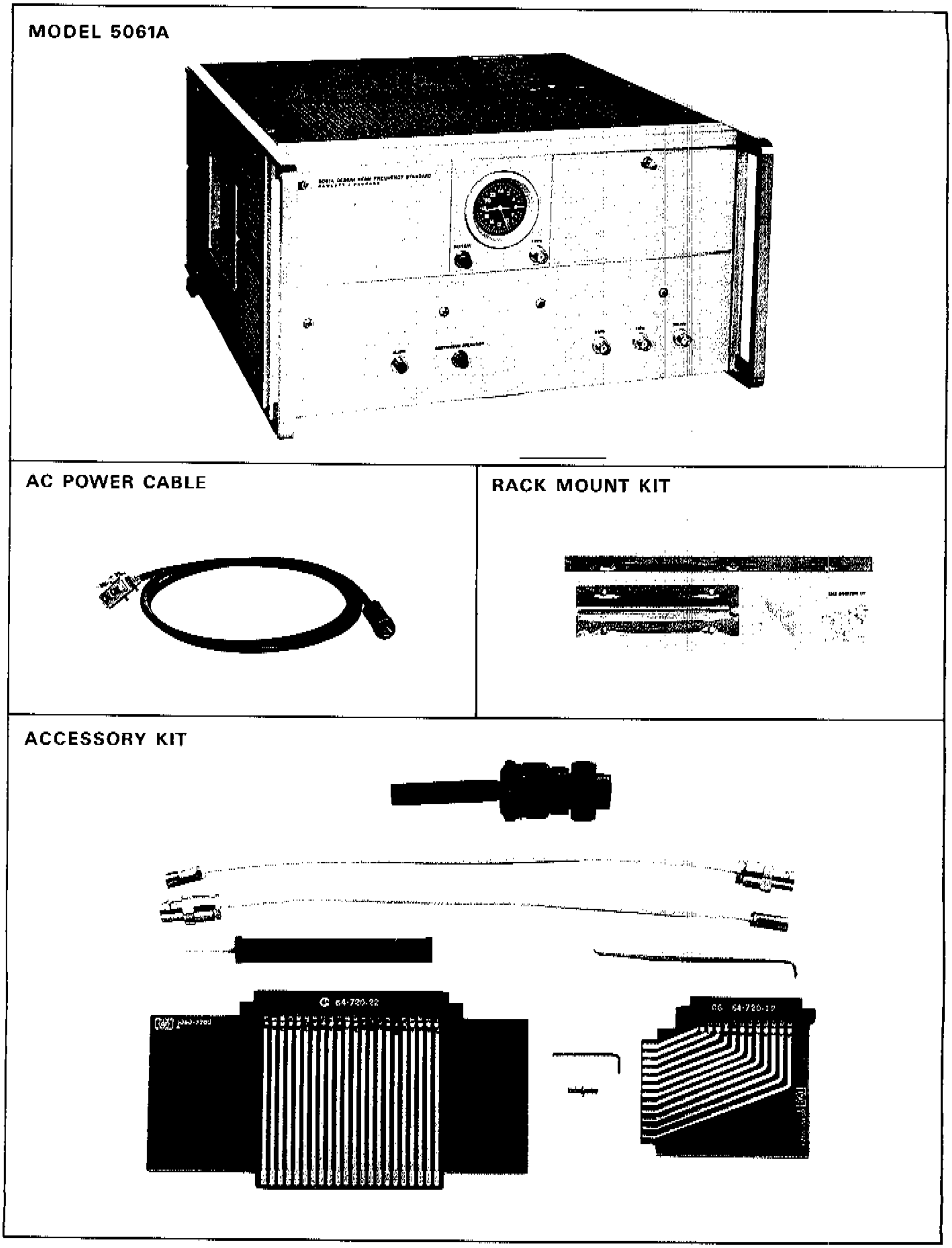
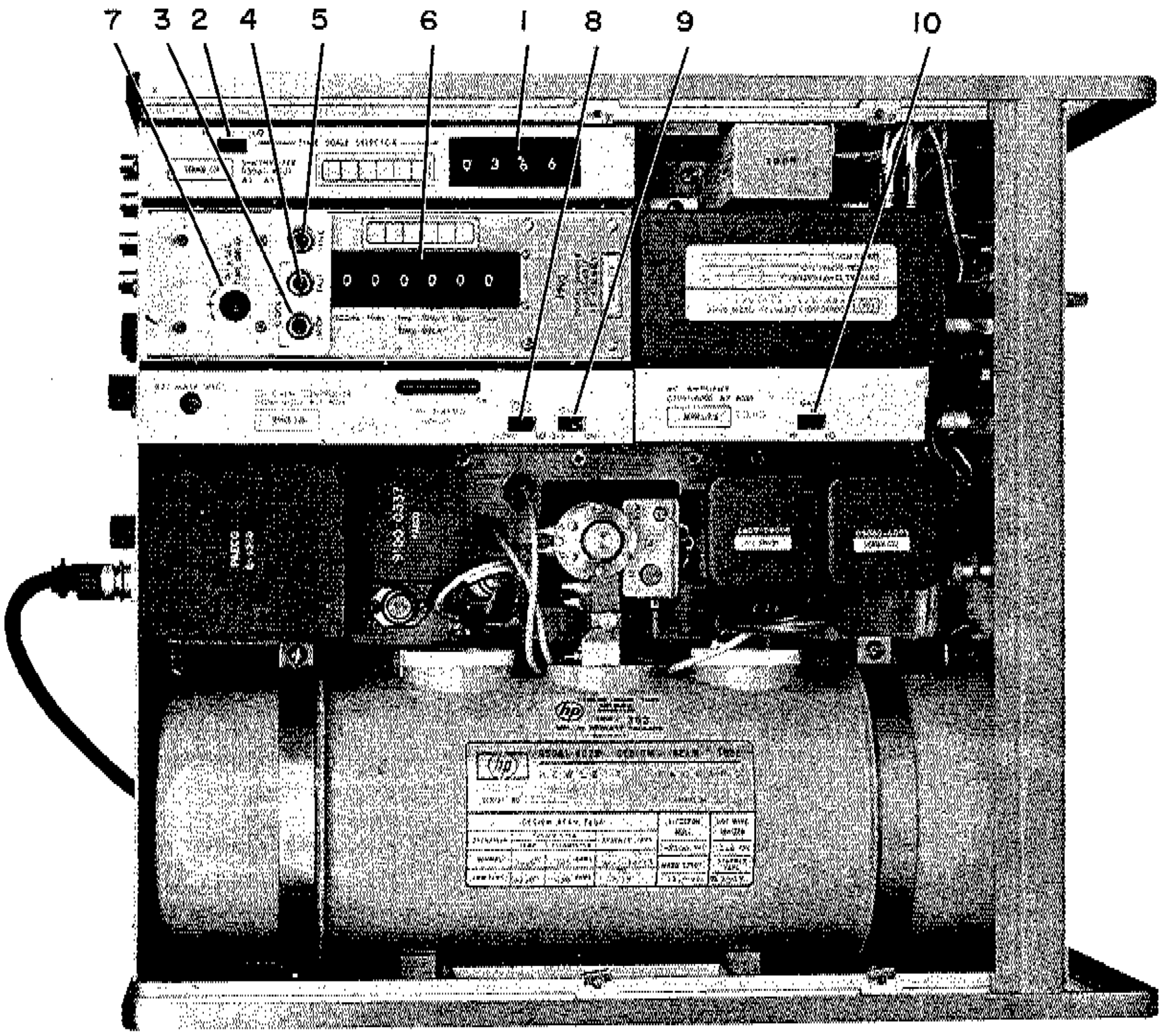


Figure 24. Top Operating Controls



1. Synthesizer TIME SCALE SELECTOR thumbwheel switch: Selects synthesized frequency input to Harmonic Generator.

2. Synthesizer TIME SCALE SELECTOR HI-LO switch: Used in conjunction with thumbwheel switch to select synthesized frequency.

3. CLOCK SET STOP switch (Option 01 only): Digital clock is stopped when switch is depressed, starts when released.

4. CLOCK SET FAST switch (Option 01 only): Digital clock second hand is accelerated when switch is depressed, resumes normal operation when released.

5. Clock SYNC switch (Option 01 only): Synchronizes 5061A Digital Clock with an external clock when depressed; clock remains synchronized when released.

6. Clock TIME DELAY switch (Option 01 only): Selects time delay between an external reference pulse and the internal 1 pulse-per-second clock pulse. Adjustable in decade steps from 1 μs to 1 sec.

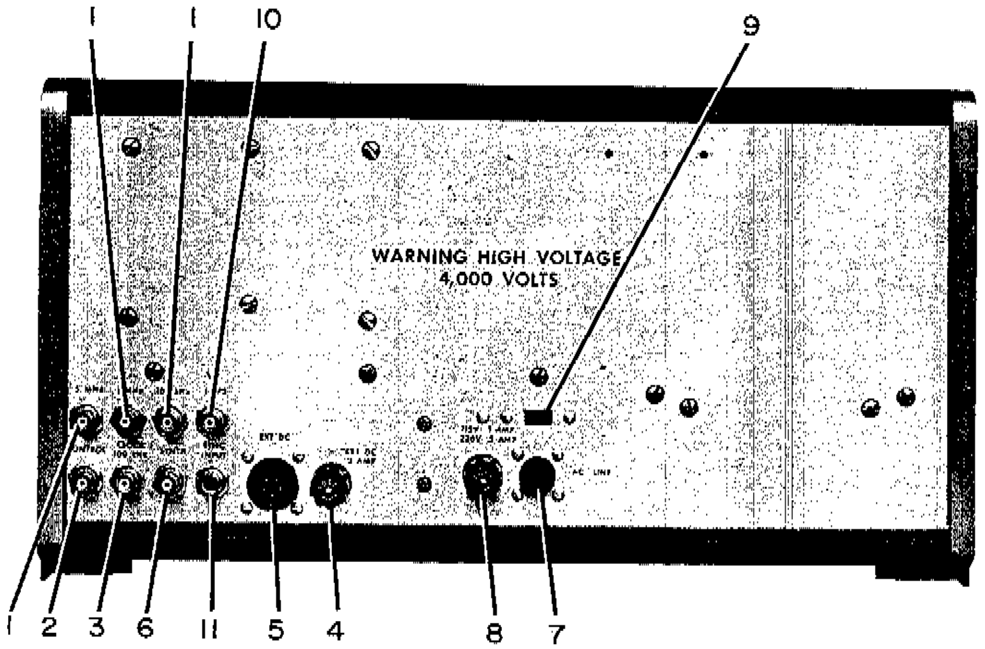
7. 0-1 μSEC TIME DELAY control (Option 01 only): Allows continuous adjustment of clock pulse delay over any 1 μsec range.

8. OVEN TEMP NORM-LO switch: Selects operating temperature for the cesium beam tube oven. Normally set to NORM.

9. OVEN OFF-ON switch: Switch for cesium beam tube oven. Used in ON position.

10. AC Amplifier GAIN switch: Selects HI or LO gain of amplifier.

Figure 25. Rear-Panel Operating Controls



1. OUTPUTS - 5 MHz, 1 MHz, 100 kHz: BNC jacks paralleled with front-panel outputs to provide these standard frequencies.

2. CONTROL jack: Normally not used. Connected to voltage control point between integrator and crystal oscillator.

3. CLOCK 100 kHz jack: 0.5 volt rms (min), 100 kHz sine wave into 1000 ohm load for driving HP 115BR Frequency Divider and Digital Clock or equivalent.

4. EXT DC fuse: Use 3 ampere fuse (HP #2110-0003) when external 24 volt dc is used.

5. EXT DC connector: Five-pin male connector. Used to connect 5061A to external 24-volt dc supply.

6. SYNTH test jack: Synthesizer output frequency is available at this jack, frequency depends on time scale used (see Table 3-3).

7. AC LINE jack: Accepts round female connector on power cable supplied.

8. AC LINE fuse: 1.25-ampere Slo-Blo fuse (HP No. 2110-0305) for 115 Vac operation or 0.8 ampere for 230 Vac operation.

9. 115/230 volt ac line switch: Set to expose correct numbers ("115" or "230") for the ac line voltage used.

10. 1 PPS jack (Option 01 only): Provides 10 volts, 20 μsec pulse from digital clock circuits.

11. SYNC INPUT jack (Option 01 only): Input to digital divider circuits for external synchronizing pulse. External synchronizing pulse must be +5V or more with rise time of less than 50 nsec.

Table 7. Replaceable Parts, 5061A W/O Option

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	0340-0119		INSULATED FEED THRU:TEFLON	98291	FT-SM-023-P20
	2230-0024		SCREW:STL PAN HD 4-40 THD	00000	OBD
	05060-0012	1	SHIELD:DIVIDER	28480	05060-0012
A6 MISC PARTS	05061-0003	1	COVER:BOTTOM	28480	05061-0003
	05061-0004	1	COVER:TOP	28480	05061-0004
	05061-2028	1	PLATE:END	28480	05061-2028
	05061-2029	1	PLATE:END	28480	05061-2029
A6FL1	05060-6061	1	FILTER ASSY:FEED-THRU	28480	05060-6061
A6FL2	00106-6059		FILTER:FEED-THRU	28480	00106-6059
A6FL3	00106-6059		FILTER:FEED-THRU	28480	00106-6059
A6J1	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J2	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J3	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J4	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J5	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J6	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6J7	1250-0258		JACK:COAXIAL 50-OHM SUB-MINAT CHASSIS	15558	9287
A6A1	05061-6004	1	BOARD ASSY:FREQUENCY DIVIDER	28480	05061-6004
A6A1C1	0160-0161	5	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C2	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A6A1C3	0180-0113		C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2
A6A1C4	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6A1C5	0140-0178	1	C:FXD MICA 560 PF 2%	72136	RDM15F561G3C
A6A1C6	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C7	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6A1C8	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C9	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C10	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C11	0140-0176		C:FXD MICA 100 PF 2%	28480	0140-0176
A6A1C12	0140-0208		C:FXD MICA 680 PF 5%	72136	RDM15F681J3C
A6A1C13	0140-0179		C:FXD MICA 1000 PF 2%	28480	0140-0179
A6A1C14	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C15	0140-0221		C:FXD MICA 220 PF 1%	28480	0140-0221
A6A1C16	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A1C17	0140-0231	1	C:FXD MICA 440PF 1% 300VDCW	04062	RDM15F441F3C
A6A1C18	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C19	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C20	0140-0154	1	C:FXD MICA 1300 PF 5%	28480	0140-0154
A6A1C21	0140-0204	1	C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A6A1C22	0121-0046	5	C:VARI CER 9-35 PF	28480	0121-0046
A6A1C23	0140-0179		C:FXD MICA 1000 PF 2%	28480	0140-0179
A6A1C24	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C25	0140-0159	1	C:FXD MICA 3000 PF 2%	28480	0140-0159
A6A1C26	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6A1C27	0140-0180		C:FXD MICA 2000 PF 2%	28480	0140-0180
A6A1C28	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C29	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C30	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C31	0140-0180		C:FXD MICA 2000 PF 2%	28480	0140-0180
A6A1C32	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C34	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C35	0140-0228	1	C:FXD MICA 360 PF 1% 300VDCW	28480	0140-0228
A6A1C36	0140-0170	2	C:FXD MICA 5600 PF 5% 300VDCW	28480	0140-0170
A6A1C37	0160-0301	1	C:FXD MY 0.012 UF 10% 200VDCW	56289	192P12392-PTS
A6A1C38	0160-0194	4	C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A6A1C39	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A6A1C40	0140-0220		C:FXD MICA 200 PF 1% 300VDCW	28480	0140-0220
A6A1C41	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A6A1C42	0140-0235	1	C:FXD MICA 2250PF 1% 300VDCW	14655	RDM20F(22500F3C
A6A1C43	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6A1C44	0160-0162	3	C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A6A1C45	0160-0954	1	C:FXD MICA 1269 PF 1%	28480	0160-0954
A6A1C46	0140-0170		C:FXD MICA 5600 PF 5% 300VDCW	28480	0140-0170
A6A1C47	0160-0163	1	C:FXD MY 0.033 UF 10% 200VDCW	56289	192P33392-PTS
A6A1C48	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6A1C49	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1C50	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A6A1C51	0140-0184	2	C:FXD MICA 8200 PF 1% 100VDCW	28480	0140-0184
A6A1C52	0140-0184		C:FXD MICA 8200 PF 1% 100VDCW	28480	0140-0184
A6A1C53	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1C54	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1C55	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A6A1C57	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1C58	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML
A6A1CR1	1902-0006	1	DIODE BREAKDOWN:7.0V 1%	28480	1902-0006
A6A1CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088

Table 7. Replaceable Parts, 5061A W/O Option (Cont'd.)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A1CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A1L1	9140-0129	7	COIL:FXD RF 220 UH	28480	9140-0129
A6A1L2	9140-0107	1	COIL:FXD RF 27 UH 10%	99800	1840-38
A6A1L3	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L4	9140-0118	2	COIL:FXD 500 UH 5%	28480	9140-0118
A6A1L5	9140-0118		COIL:FXD 500 UH 5%	28480	9140-0118
A6A1L6	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L7	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L8	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L9	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L10	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A6A1L11	9140-0072	1	COIL:RF 5000 UH 10%	95265	SA5000-I
A6A1L12	107A-9F	1	COIL ASSY	28480	107A-9F
A6A1Q1	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q2	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q3	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q4	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q5	1855-0056	2	TSTR:SI FET	80131	2N4342
A6A1Q6	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q7	1854-0023		TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A6A1Q8	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q9	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q10	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q11	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q12	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q13	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q14	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q15	1855-0056		TSTR:SI FET	80131	2N4342
A6A1Q16	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q17	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q18	1854-0003		TSTR:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003
A6A1Q19	1854-0005		TSTR:SI NPN	80131	2N708
A6A1Q20	1854-0005		TSTR:SI NPN	80131	2N708
A6A1R1	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A6A1R2	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A6A1R3	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A6A1R4	0757-0936	5	R:FXD FLM 3.3K OHM 2% 1/8W	28480	0757-0936
A6A1R5	0757-0893	19	R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R6	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R7	0757-0897	1	R:FXD FLM 75 OHM 2% 1/8W	28480	0757-0897
A6A1R8	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R9	0757-0957		R:FXD FLM 24K OHM 2% 1/8W	28480	0757-0957
A6A1R10	0757-0929		R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A6A1R11	0757-0893	4	R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R12	0757-0916		R:FXD MET FLM 470 OHM 2% 1/8W	28480	0757-0916
A6A1R13	0757-0963		R:FXD FLM 43K OHM 2% 1/8W	28480	0757-0963
		3			
A6A1R14	0757-0955		R:FXD FLM 20K OHM 2% 1/8W	28480	0757-0955
A6A1R15	0757-0944-	8	R:FXD FLM 6.8K OHM 2% 1/8W	28480	0757-0944
A6A1R16	0757-0930		R:FXD FLM 1.8K OHM 2% 1/8W	28480	0757-0930
A6A1R17	0757-0958	4	R:FXD MET FLM 27K OHM 2% 1/8W	28480	0757-0958
A6A1R18	0757-0976	3	R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
		7			
A6A1R19	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R20	0757-0917		R:FXD FLM 510 OHM 2% 1/8W	28480	0757-0917
A6A1R21	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R22	0757-0474		R:FXD MET FLM 243K OHM 1% 1/8W	28480	0757-0474
A6A1R22	0757-0929	1	R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A6A1R24	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A6A1R25	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R26	0757-0952		R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952
A6A1R27	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A6A1R28	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A6A1R29	0757-0920		R:FXD FLM 680 OHM 2% 1/8W	28480	0757-0920
A6A1R30	0757-0893	1	R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R31	0757-0922		R:FXD FLM 820 OHM 2% 1/8W	28480	0757-0922
A6A1R32	0757-0942	2	R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A6A1R33	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A6A1R34	0757-0947		R:FXD FLM 9.1K OHM 2% 1/8W	28480	0757-0947
A6A1R35	0757-0893	2	R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R36	0757-0927		R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A6A1R37	0757-0893	4	R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R38	0757-0977		R:FXD FLM 1.3K OHM 2% 1/8W	28480	0757-0927
A6A1R39	0757-0915		R:FXD FLM 430 OHM 2% 1/8W	28480	0757-0915
A6A1R40	0757-0924	1	R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R41	0757-0944		R:FXD FLM 6.8K OHM 2% 1/8W	28480	0757-0944
A6A1R42	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A6A1R43	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893

Table 7. Replaceable Parts, 5061A W/O Option (Cont'd.)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A1R44	0757-0918	3	R:FXD FLM 560 OHM 2% 1/8W	28480	0757-0918
A6A1R45	0757-0940		R:FXD FLM 4700 OHM 2% 1/8W	28480	0757-0940
A6A1R46	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A6A1R47	0757-0950		R:FXD FLM 12K OHM 2% 1/8W	28480	0757-0950
A6A1R48	0757-0966	3	R:FXD FLM 56K OHM 2% 1/8W	28480	0757-0966
A6A1R49	0757-0965		R:FXD FLM 51K OHM 2% 1/8W	28480	0757-0965
A6A1R50	0757-0976		R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976
A6A1R51	0757-0948		R:FXD FLM 10K OHM 2% 1/8W	28480	0757-0948
A6A1R52	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R53	0757-0930		R:FXD FLM 1.8K OHM 2% 1/8W	28480	0757-0930
A6A1R54	0757-0926	1	R:FXD FLM 1.2K OHM 2% 1/8W	28480	0757-0926
A6A1R54	0757-0933	2	R:FXD FLM 2.4K OHM 2% 1/8W	28480	0757-0933
A6A1R55	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R56	0757-0928	4	R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928
A6A1R57	0757-0934	2	R:FXD FLM 2.7K OHM 2% 1/8W	28480	0757-0934
A6A1R58	0757-0929		R:FXD FLM 1.6K OHM 2% 1/8W	28480	0757-0929
A6A1R60	0757-0968	1	R:FXD MET FLM 68K OHM 2% 1/8W	28480	0757-0968
A6A1R61	0757-0937	3	R:FXD FLM 3.6K OHM 2% 1/8W	28480	0757-0937
A6A1R62	0757-0946	2	R:FXD FLM 8.2K OHM 2% 1/8W	28480	0757-0946
A6A1R63	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R64	0757-0900		R:FXD MET FLM 100 OHM 2% 1/8W	28480	0757-0900
A6A1R65	0757-0930		R:FXD FLM 1.8K OHM 2% 1/8W	28480	0757-0930
A6A1R66	0757-0908	1	R:FXD FLM 220 OHM 2% 1/8W	28480	0757-0908
A6A1R67	0757-0906	2	R:FXD MET FLM 180 OHM 2% 1/8W	28480	0757-0906
A6A1R68	0757-0906		R:FXD MET FLM 180 OHM 2% 1/8W	28480	0757-0906
A6A1R69	0757-0893		R:FXD FLM 51 OHM 2% 1/8W	28480	0757-0893
A6A1R70	0757-0922		R:FXD FLM 820 OHM 2% 1/8W	28480	0757-0922
A6A1R71	0757-0942		R:FXD FLM 5.6K OHM 2% 1/8W	28480	0757-0942
A6A1R72	0757-0924		R:FXD MET FLM 1K OHM 2% 1/8W	28480	0757-0924
A6A1R73	0757-0937		R:FXD FLM 3.6K OHM 2% 1/8W	28480	0757-0937
A6A1R74	0757-0921	3	R:FXD MET FLM 750 OHM 2% 1/8W	28480	0757-0921
A6A1T1	05061-8006	1	TRANSFORMER:5MHZ INPUT	28480	05061-8006
A6A1T2	05061-8005	2	TRANSFORMER:1MHZ-4MHZ	28480	05061-8005
A6A1T3	05061-8007	1	TRANSFORMER:1MHZ OUTPUT	28480	05061-8007
A6A1T4	05061-8005		TRANSFORMER:1MHZ-4MHZ	28480	05061-8005
A6A1T5	05061-8008	1	TRANSFORMER:.9MHZ MULTIPLIER	28480	05061-8008
A6A1T6	107A-9C	1	TRANSFORMER ASSY:100KHZ	28480	107A-9C

Figure 26. A6 Component Locator

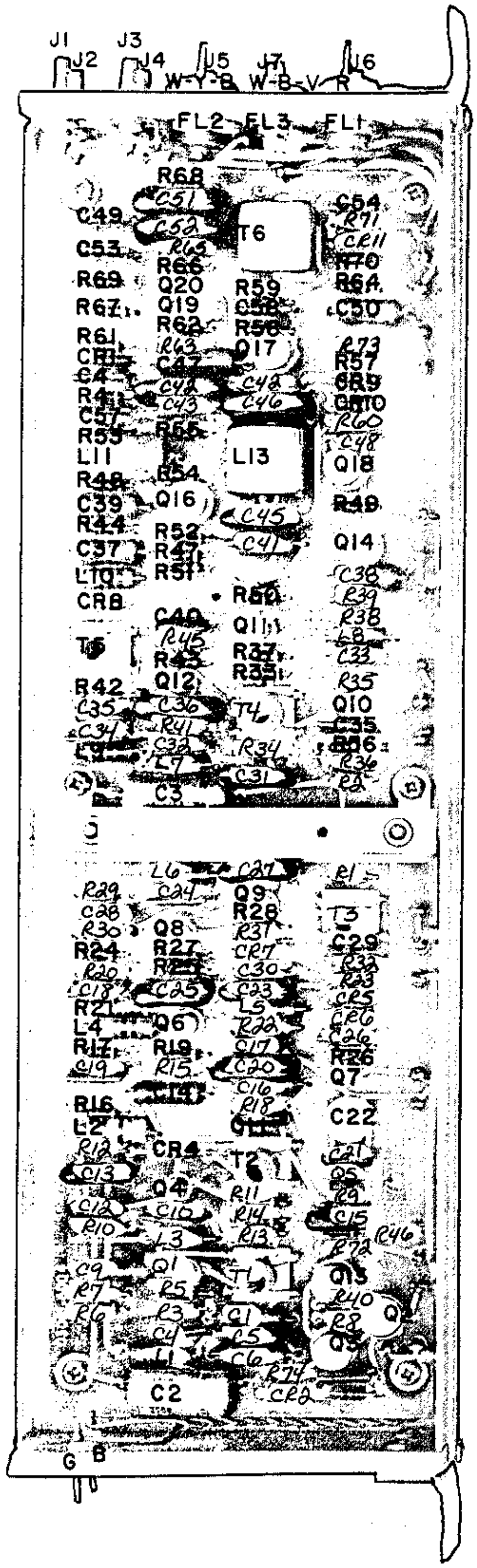


Figure 27. Frequency Divider Assembly A6

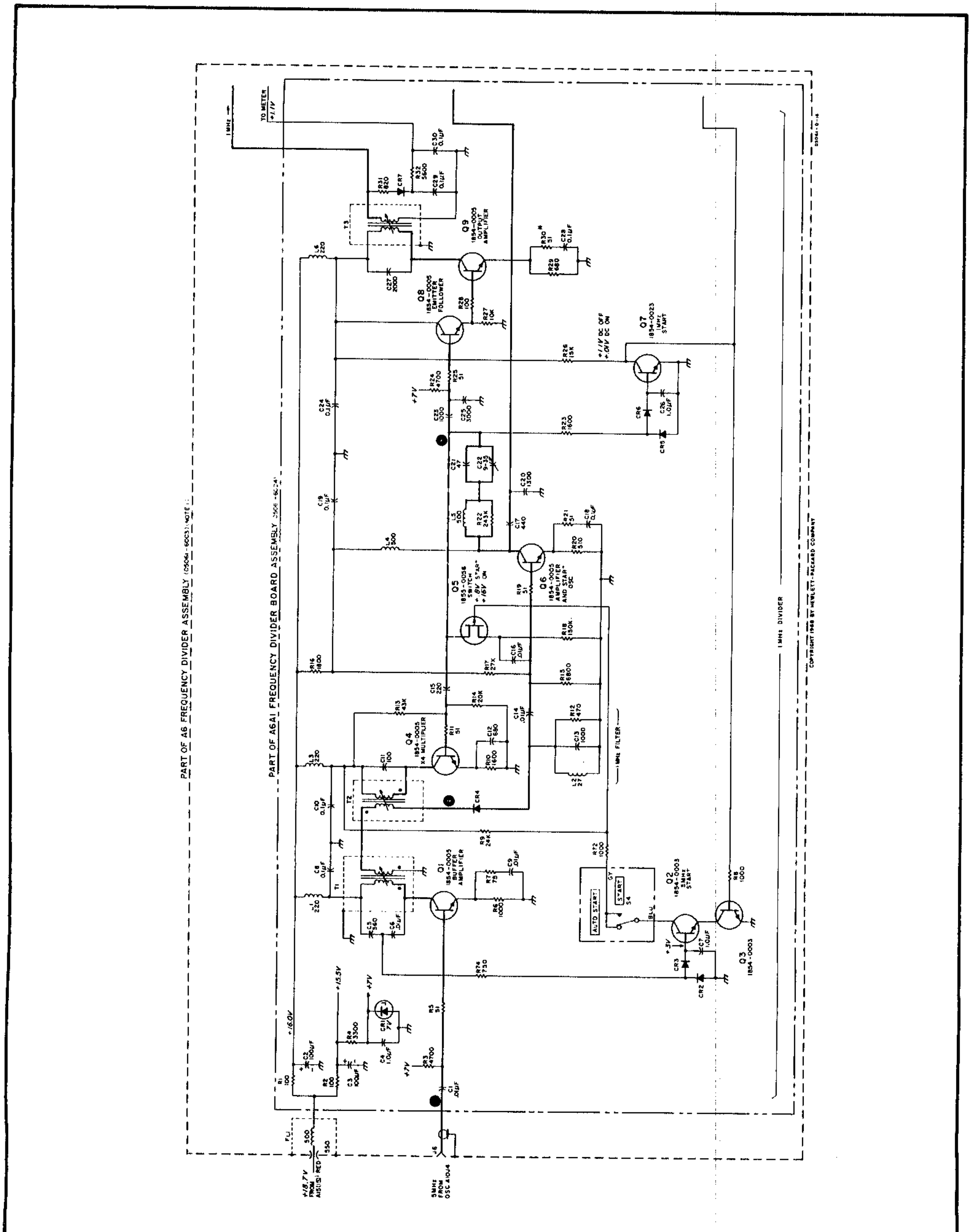
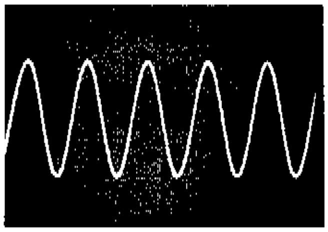
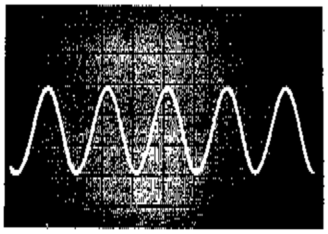


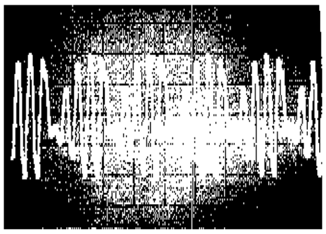
Figure 28. A6 Waveforms



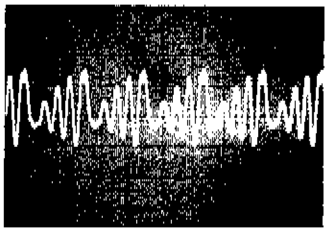
1 .05V/cm, .1 μs/cm



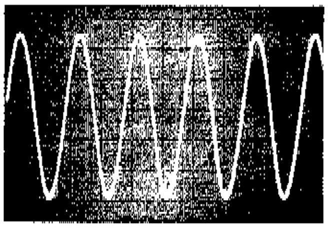
2 1V/cm, .1 μs/cm



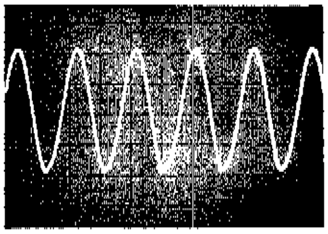
3 .5V/cm, .5 μs/cm



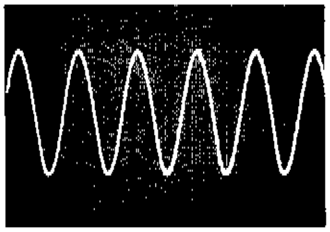
4 .5V/cm, .5 μs/cm
1 MHz Divider will not start



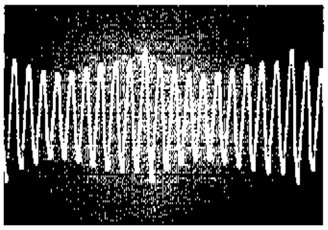
5 1V/cm, .5 μs/cm



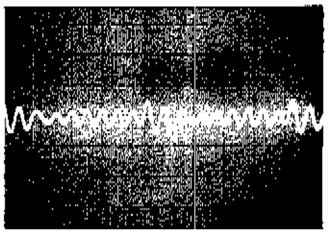
6 1V/cm, .5 μs/cm



7 1V/cm, .5 μs/cm

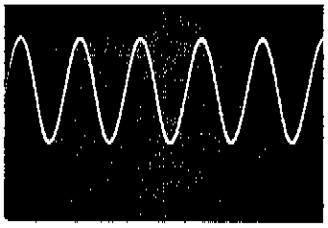


8 .5V/cm, 2 μs/cm



9 .5V/cm, 5 μs/cm
100 kHz Divider will not start

5061A: Normal operation with DIVIDER MODE set to AUTO START.



10 2V/cm, 5 μs/cm

Oscilloscope: DC coupled

Figure 29. Frequency Divider Assembly A6