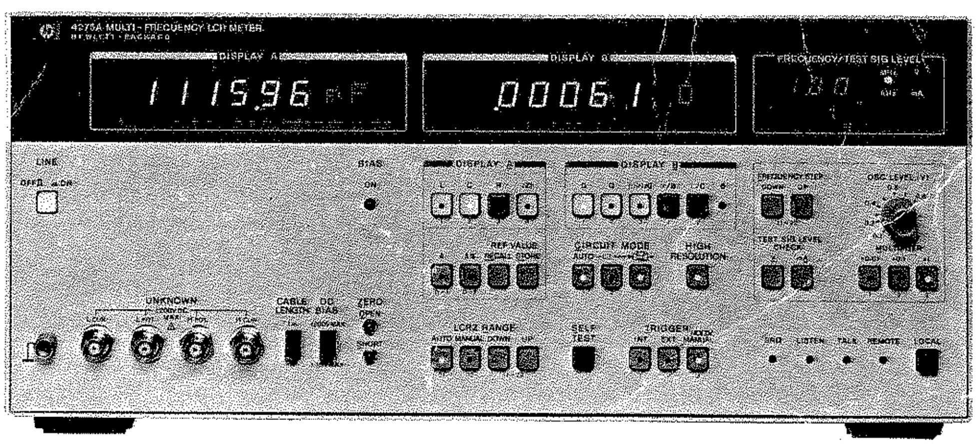
SERVICE MANUAL

4275A
MULTI-FREQUENCY LCR METER



HEWLETT PACKARD

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SERVICE MANUAL

MODEL 4275A
MULTI-FREQUENCY LCR METER

(Including Options 001, 002, 003, 004 and 101)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2045J and above.

Manual Part No. 04275-90012
Microfiche Part No. 04275-90062

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LIST OF ILLUSTRATIONS

Table 4-1. Recommended Performance Test Equipment.

Equipment	Critical Specifications	Recommended Model/Note
Capacitance Standards	1pF ±0.03% 10pF ±0.03% 100pF ±0.03% 1000pF ±0.03% Useable frequencies: up to 10MHz	HP 16381A HP 16382A HP 16383A HP 16384A
Resistance Standards	0.1Ω ±10% 1Ω ±10% 10Ω ±10% 100Ω ±0.03% 1000Ω ±0.03% 10kΩ ±0.03% 100kΩ ±0.03% Useable frequencies: up to 10MHz	HP 16074A Standard Resistor Set
Frequency Counter	Maximum frequency: >10MHz Accuracy: 0.001% (1×10^{-5})	HP 5314A
RF Voltmeter	Voltage range: 1mV to 3V rms f.s. Bandwidth: 10kHz to 10MHz Accuracy: 1%	HP 3400A
DC Voltmeter	Voltage range: 10mV to 100V f.s. Sensitivity: 0.1mV min. Accuracy: 0.05% Input impedance: >10MΩ	HP 3465A/B
Test Cable	BNC to BNC cable	1 ea.
Test Cable	BNC to BNC cable (≤10cm) (Replaceable by Open Termination included in HP 16074A).	2 ea.
Bias Controller	(Needed for Option 001 or 002 Internal DC Bias Supply Test).	HP 16023B
Test Fixture	(Needed for Option 001 Internal DC Bias Supply Test).	HP 16047A
Test Leads	(Needed for Option 002 Internal DC Bias Supply Test).	HP 16048A
HP-IB Controller	(Needed for Option 101 HP-IB Interface Test).	HP 9825A/ w 98210A/ w 98213A/ w 98034A

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION.

4-2. This section provides the check procedures to verify the 4275A specifications listed in Table 1-1. All tests can be performed without access to the interior of the instrument. A simpler operational test is presented in Section III under Self Test (paragraph 3-5). The performance test procedures in this section can also be used to do an incoming inspection of the instrument and to verify whether the instrument meets its specified performance after troubleshooting or making adjustments. If specifications are found to be out of limits, check that controls are properly set, and then proceed to adjustments or troubleshooting.

Note

Allow a 30-minute warm-up and stabilization period before conducting any performance test.

4-3. EQUIPMENT REQUIRED.

4-4. Equipment required for the performance tests is listed in Table 4-1 Recommended Performance Test Equipment. Any equipment whose characteristics equal the critical specifications given in the table may be substituted for the recommended model(s).

Accuracy checks in this section use 16380 series standard capacitors (16381A, 16382A, 16383A and 16384A) and the 16074A Standard Resistor Set. These accessory standards have the specifications which satisfy the performance requirements for the accuracy checks and are especially fit for use as 4275A accuracy test standards.

Note

All components used as standards should be calibrated by an instrument whose specifications are traceable to NBS, PTB, LNE, NRC, JEMIC, or equivalent standards group; or all components should be calibrated directly by an authorized calibration organization such as NBS. The calibration cycle should be determined by the stability specification for each component.

4-5. TEST RECORD.

4-6. Results of the performance tests may be tabulated on the Test Record at the end of these procedures. The Test Record lists all the tested specifications and their acceptable limits. Test results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

4-7. CALIBRATION CYCLE.

4-8. This instrument requires periodic verification of performance. Depending on the use and environmental conditions, the instrument should be checked with the following performance tests at least once every year. To maximize instrument "up time", the recommended preventive maintenance frequency for the 4275A is twice a year.

Performance Test Table

ACCURACY TEST CONSIDERATIONS

This paragraph discusses how the 4275A accuracy is tested and verified. As the 4275A has (because of its wider measurement capabilities), to a great extent, expanded the selectable measurement parameters, frequency and range along with high accuracy (as its features), the accuracy check ranges that need to be verified include some critical measuring regions where accuracies are difficult to be directly compared to the specifications by using standards.

Measurement accuracies are tested by reading the displays when measuring standard capacitors, inductors, resistors and other devices as references whose values are calibrated and certified by transfer of values from national standards. Certain 4275A measurement range capabilities are out of the applicable ranges of the practical standards; so such standards, to satisfy the requirements for checking on all the 4275A ranges, will be unavailable. The method then, is to check accuracies on the specific ranges at which the standards are applicable. Further corroboration for the entire range (to the instrument performance limits), is done by particular tests for evaluating full range accuracy.

Theoretical Background of Accuracy Checks.

The 4275A, in accord with its measurement principles, detects the vector impedance (or its reciprocal value: admittance) of the unknown sample to be tested. The various measurement data provided, with respect to the 13 possible measurement parameters (L, C, R, D, etc.), are arithmetically derived from measured values of the right-angle vector components (resistance and reactance). For example, the capacitance value of a sample is calculated by the following equation relative to the capacitance-to-reactance values:

$$Cx = \frac{1}{2\pi f Xm}$$

Where, Cx is capacitance value of sample,
f is measurement frequency,
Xm is measured reactance value of sample.

As discussed above, each measurement parameter is interrelated with the impedance (or admittance) value so the accuracies on all ranges can be verified if the instrument satisfies specified accuracies for each one of its resistive and reactive measurement parameters, e.g. resistance and capacitance from the lowest through the highest test frequencies.

It is important to note that the accuracy is based on arithmetic relationships as are the parameter relationships. This theoretical background is pertinent to the corroboration of the accuracy evaluations which are done by simplified test procedures instead of time-consuming-tests on the 600 (approximately) possible combinations of the fundamental test parameters (measurement parameter, frequency, range, etc.).

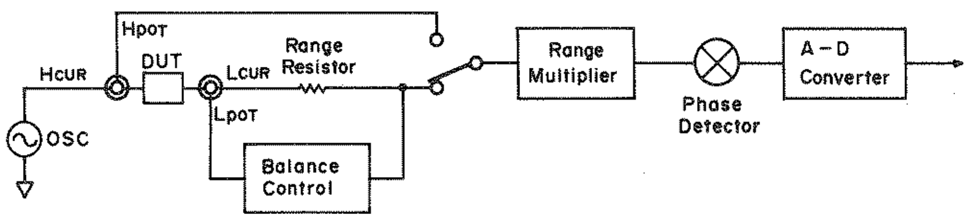
ACCURACY TEST CONSIDERATIONS

Corroboration Check Considerations

The test for measurement accuracy with respect to the vector impedance is made on specific ranges using standards, and on the other ranges by using alternate methods which are (theoretically and experimentally) proven to be practicable for verification of the ranges which otherwise would be uncertifiable because of the limitations of the standards. If the end results of these checks meet all the individual test limits, the instrument should satisfy its specified accuracies across its entire range. Then, how can these methods be explained? Let't look at the performance test articles.

Accuracy test procedures include checks for the following circuit sections:

1) Bridge Circuit Range Resistors.
2) Range Multiplier.
3) Bridge Balance Control.
4) Phase Detector.
5) A-D (Analog to Digital) Converter.



4275A Measurement Section

CAPACITANCE ACCURACY TEST verifies Range Resistor accuracy for the reactive impedance measurement from the lowest through the highest test frequencies. (Balance Control linearity and normal operations of the Phase Detector and A-D Converter are also verified).

RESISTANCE ACCURACY TEST does its verification in a manner similar to that for the Capacitance Accuracy Test, but for resistive impedance measurements. Thus, accuracies for both reactive and resistive components of the vector impedance are verified.

SELF OPERATING TEST verifies the multiples of the Range Multiplier which extends the measurement ranges. The A-D Converter accuracy is also checked by this combined self-test function which enables automatic check of each one of these circuits.

FREQUENCY-PHASE ACCURACY TEST verifies phase-flatness characteristics (minimum phase shift) of the overall measurement section and Phase Detector phase accuracy from the lowest through the highest test frequencies.

Note

A set of detection phases, each different by 90 degrees, is used in the Phase Detector. If their relative phase angles are exactly 90 degrees, the phase relationships of the detection phases on the vector DUT voltage (or current) detected have no influence on the resultant accuracy. The accuracy of the right-angle detection phases is verified by both this test and dissipation factor checks associated with the capacitance Accuracy Test.

ACCURACY TEST STANDARDS

1) Standard Capacitors.

The HP 16380 Series Standard Capacitors, featuring the four terminal pair configuration, are recommended for use as performance test standards. The four standard capacitors 16381A (1pF), 16382A (10pF), 16383A (100pF) and 16384A (1000pF) are calibrated at 0.01% accuracy (within 0.1% of their nominal capacitance values) at 1kHz. For values at frequencies to 10MHz, an extrapolation of the calibrated values at 1kHz is used (this is based on the careful consideration of their inherent residual parameter values and on the actual test measurement to verify the frequency dependency of the values). Capacitance values at frequencies up to 10MHz are read from the graph given on the data sheet of each standard.

Note

A high capacitance standard, useable in the high frequency region, is unavailable. Here's why:

A 10μF capacitor, for example, has an impedance value of 0.16Ω at 100kHz. A capacitance standard would have, in addition, residual impedances which could not be neglected when compared to the pure impedance of 0.16Ω. Thus, an attempt at tests which would use the standard capacitor at the higher operating frequency ranges is not practicable.

2) Standard Resistors.

The standard resistors used for accuracy checks should be practically pure resistances and should maintain an extremely low order of residual reactance at frequencies to 10MHz. The HP 16074A Standard Resistor Set, especially designed as standards useable over a broad frequency region, with four terminal pair configurations, is suitable for the accuracy checks. These thin film resistors, which ensure negligible low stray capacitance and less skin effect, provide the standard resistance values of 0.1Ω, 1Ω and 10Ω at ±10% and 100Ω, 1000Ω, 10kΩ and 100kΩ at ±0.01% calibration accuracies to 10MHz (1MHz at 100kΩ). Open (0S) and short (0Ω) terminations which facilitate optimum zero offset adjustment as well as two quasi-inductors for inductance accuracy checks are included in the 16074A.

Note

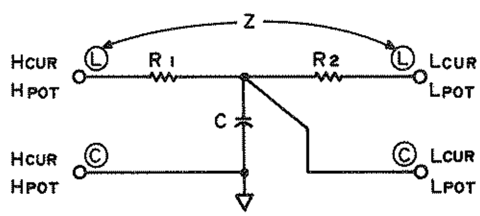
The 0.1Ω, 1Ω and 10Ω resistors are used as the (pure resistance) reference samples in the Frequency-Phase Accuracy Test.

3) Standard Inductors.

The 4275A inductance accuracy is theoretically certified if the capacitance accuracy meets the specifications. Generally, inductors have unwanted parasitic impedances to some extent (that is, coil resistance and distributed capacitance). As these residuals significantly dominate the inductance values at high frequencies, inductance standards useable in RF region (higher than about 100kHz) are substantially unavailable. Inductors with higher inductance values have lower frequency limits.

ACCURACY TEST STANDARDS

If it is desired to check inductance measurement accuracy on least at one range, a quasi-inductor may be useful as a substitution test sample. The quasi-inductor offers an equivalent inductance (when connected to the 4275A) by a simple network circuit consisting of a capacitor and resistors. A quasi-inductor circuit is shown in the figure below:



$$Z = R_1 + R_2 + \underbrace{j\omega C R_1 R_2}_{L}$$

The equivalent inductance value is given by the equation:

$$L = C \cdot R_1 \cdot R_2$$

The values of R and C are respectively measured to calculate the equivalent inductance value (prior to the inductance accuracy check). The HP 16074A Quasi-inductors offer the composite inductance values of 100μH and 100mH. Useable frequency ranges for these inductors are given in the table below:

Sample	Useable frequency range	Recommended test frequency
100μH	100kHz to 10MHz	1MHz
100mH	10kHz to 1MHz	100kHz

Note

Component resistors R_1 and R_2 in the quasi circuit may be measured at dc with a high accuracy DMM. These high stability resistors need only be re-calibrated at the recommended calibration period of 6 months. The capacitors should be checked before each test.

GENERAL

The standards should be of the four terminal pair configuration design to provide compatibility with the instrument. This minimizes reduction in reliability of the values due to the effects of the residuals associated with cabling and connections.

Note

Skin effect should be considered as it affects the value of the standards in the high frequency region. The contribution of skin effect to the resistive factor of the sample increases in proportion to the square root of the frequency and is dominant at high frequencies (generally, in the megahertz region).

4-9. TEST FREQUENCY ACCURACY TEST

4-10. This test verifies that test signal frequencies for 4275A meet the specified frequency accuracy of 0.01%.

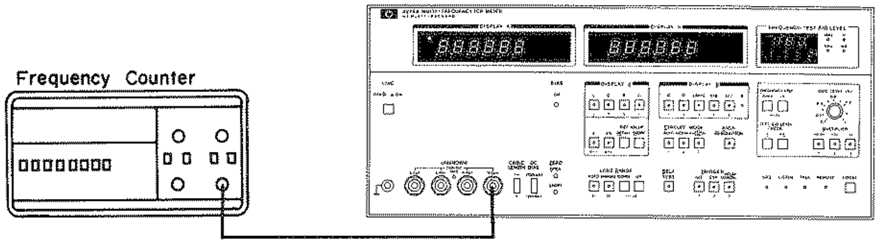


Figure 4-1. Test Frequency Accuracy Test Setup.

EQUIPMENT:

Frequency Counter .... HP 5314A.
Test cable .... BNC to BNC cable.

PROCEDURE:

1. Connect BNC to BNC cable to 4275A UNKNOWN H_{CUR} terminal and to frequency counter input as shown in Figure 4-1.

2. Set 4275A controls as follows:

   MULTIPLIER x1
   OSC LEVEL .... fully cw
   Test frequency 1.00MHz
   DC BIAS switch (rear panel) .... OFF
   Other controls .... any setting

3. Read display output of frequency counter. Frequency readouts must be within 999.9kHz and 1000.1kHz.

4. Change test frequency setting and read frequency counter display output at each of the 10 spot test frequencies (and any optional frequency). Frequency readouts must be within the test limits given in Table 4-2.

Table 4-2. Test Frequency Accuracy Test.

Frequency setting	Test limits
10.0kHz	9.999 - 10.001kHz
20.0kHz	19.998 - 20.002kHz
40.0kHz	39.996 - 40.004kHz
100kHz	99.99 - 100.01kHz
200kHz	199.98 - 200.02kHz
400kHz	399.96 - 400.04kHz
1.00MHz	0.9999 - 1.0001MHz
2.00MHz	1.9998 - 2.0002MHz
4.00MHz	3.9996 - 4.0004MHz
10.0MHz	9.999 - 10.001MHz
Opt. Freq.	±0.01%

10

Note

1) Test limits in above table do not account for reading error contributed by measurement errors in the test equipment.
2) If this test fails, the instrument requires troubleshooting.

4-11. TEST SIGNAL LEVEL (VARIABLE RANGE TEST).

4-12. This test verifies that the variable range of the test signal level for the 4275A meets the specified range span of 1mV and 1V rms at every test frequency setting.

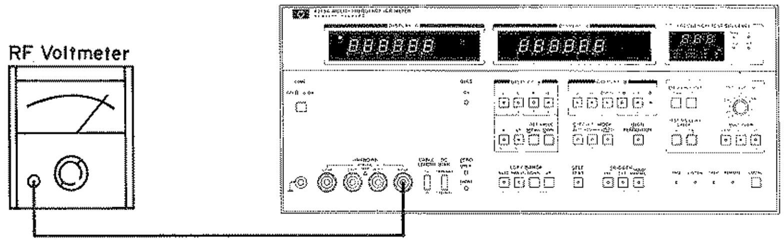


Figure 4-2. Test Signal Level Variable Range Test Setup.

EQUIPMENT:

RF Voltmeter .... HP 3400A and HP 3465A/B
Test cable .... BNC to BNC cable/BNC to dual banana cable

Note

Use RF Voltmeter calibrated for frequency response of 10kHz to 10MHz.

PROCEDURE:

1. Connect BNC to BNC cable to 4275A UNKNOWN H_{CUR} terminal and to RF voltmeter input as shown in Figure 4-2.

2. Set RF voltmeter range as appropriate to measure voltage of 1V rms.

3. Set 4275A controls as follows:

   MULTIPLIER x1
   OSC LEVEL .... fully cw
   Test freqenucy 10.0MHz
   DC BIAS switch (rear panel) .... OFF
   Other controls .... Any setting

4. RF voltmeter readout should be 1.00V rms or more (when the value is corrected for the voltmeter frequency response).

5. Change test frequency setting successively to lower frequencies (from 10.0MHz) and verify that RF voltmeter readout exceeds 1.00V rms at each test frequency setting.

6. Set 4275A controls in accord with table 4-3 and verify that all the test limits given in the table are satisfied.

Table 4-3. Test Signal Level Variable Range Test.

Control settings			Test limits
Test frequency	OSC LEVEL	MULTIPLIER	
Each setting from 10.0kHz to 10.0MHz	fully cw	x1	greater than 1.00V rms
Any setting	fully cw	x0.1	greater than 100mV rms
		x0.01	greater than 10.0mV rms
10kHz	fully ccw	x0.01	less than 1.00mV rms (Use 3465A/B)

4-13. SELF-OPERATING TEST

4-14. The Self-operating test checks operating conditions of the circuits (Range Multiplier for extending measurement capability to higher and lower ranges; Null Detector for bringing bridge into optimum balance; Buffer Amplifiers for accurately detecting potentials across DUT and range resistor; and Integrator for converting analog measurement quantities into digital) which are especially significant for sustaining the specified accuracies. All the tests on these individual circuits can be accomplished easily and simply with the SELF TEST function. To ascertain that these circuits satisfy the performance requirements for ensuring the specified accuracies, display readouts are compared with severe test limits. Because basic circuit operating conditions related to the accuracy are verified in this test, the instrument should be initially checked with this test for acceptability.

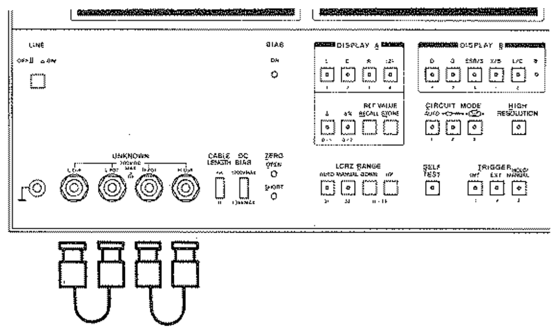


Figure 4-3. Self Operating Test Setup.

EQUIPMENT:

BNC to BNC cable .... 10cm long, 2 required.

Note

If open (OS) termination of the HP 16074A Standard Resistor set is available, use it instead of BNC to BNC cable.

PROCEDURE:

1. Set CABLE LENGTH switch to "0" position.
2. Connect L_{CUR} and L_{POT} terminals with a BNC to BNC cable as shown in Figure 4-3. Similarly Connect H_{CUR} and H_{POT} terminals.

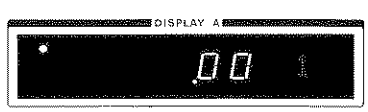
CAUTION

VERIFY THAT DC BIAS INDICATOR LAMP DOES NOT LIGHT. IF ILLUMINATED, SET REAR PANEL DC BIAS SWITCH TO OFF.

3. Set test signal frequency to 100kHz.
4. Press SELF TEST button and then DISPLAY B function D button.

Note

Self test item number (in this case "1" which means the first step) is displayed in DISPLAY A unit indicator as shown below:



5. DISPLAY A and DISPLAY B readouts should be within the following test limits:

   DISPLAY A .... .00±100 counts
   DISPLAY B .... .00±100 counts

6. Press DISPLAY B function Q button. Self test item number "2" is displayed.

7. Set test signal level and frequency as follows:

   MULTIPLIER x1
   OSC LEVEL .... fully cw
   Test frequency 100kHz

8. DISPLAY A readout should be within the follwing test limit:

   DISPLAY A .... -1000.00±100 counts.

9. Change test frequency to 1.00MHz.

10. DISPLAY B readout should be within the following test limit:

    DISPLAY B .... .00±1000 counts.

11. Press DISPLAY B function ESR/G button. Self test item number "3" is displayed.

12. Set test signal in accord with step 7 and repeat test steps 8, 9 and 10 above with respect to the third self-test step.

13. Press DISPLAY B function X/B button. Self test item number "4" is displayed.

14. Set test signal in accord with step 7 ~~other than setting~~ Except set MULTIPLIER to x 0.1. Repeat test steps 8, 9 and 10 above with respect to the fourth self-test step.

15. Press DISPLAY B function L/C button. Self test item number "5" is displayed.

16. Set test signal in accord with step 7 other than setting MULTIPLIER to x 0.01. Repeat test steps 8, 9 and 10 with respect to the fifth self test step.

17. Press DISPLAY A Δ% button. Self test item number "7" is displayed and MULTIPLIER is automatically set to x 0.1.

18. Set test frequency to 100kHz.

19. Display readouts should be within the following test limits:

    DISPLAY A .... .00±1000 counts
    DISPLAY B .... .00±1000 counts

Note

Self test item 6 does not exist.

Table 4-4. Self Operating Test Summary.

Test item	Press button	Control settings			Test Limits	
		MULTIPLIER	OSC LEVEL	Frequency	DISPLAY A	DISPLAY B
1	D	—	—	100kHz	.00±100 counts	.00±100 counts
2	Q	x1	fully cw	100kHz	-1000.00 ±100 counts	—
		x1	fully cw	1.00MHz	—	.00±1000 counts
3	ESR/G	x1	fully cw	100kHz	-1000.00 ±100 counts	—
		x1	fully cw	1.00MHz	—	.00±1000 counts
4	X/B	x0.1	fully cw	100kHz	-1000.00 ±100 counts	—
		x0.1	fully cw	1.00MHz	—	.00±1000 counts
5	L/C	x0.01	fully cw	100kHz	-1000.00 ±100 counts	—
		x0.01	fully cw	1.00MHz	—	.00±1000 counts
7	Δ%	x0.1	fully cw	100kHz	.00±1000 counts	.00±1000 counts

1 14
53
2 126
3

12

4-15. CAPACITANCE ACCURACY TEST.

4-16. This test checks full scale display capacitance measurement accuracies for various combinations of test signal frequency and test signal level. The capacitance accuracy checks are made by connecting a standard capacitor to the instrument and comparing measurement readouts with the calibrated values of the standard to verify that the instrument meets the 4275A accuracy specifications. Accuracies for dissipation factors of nearly zero are also checked in this test. Since fundamental reference elements, (range resistors and detection phases) required for establishing C and D measurement accuracies (and also accuracies of other measurement parameters) are checked by these narrow range tests, almost all ranges, from minimum to maximum, are being verified.

Capacitance accuracy check ranges

Range / Freq.	10kHz	20kHz	40kHz	100kHz	200kHz	400kHz	1MHz	2MHz	4MHz	10MHz
1000pF										
100pF										
10pF										
1000fF	☒	☒			☒			☒		

□ Tested range. ☒ Non-applicable range for recommended capacitance standard.

Note

Test on capacitance ranges for test frequencies listed above should be done at both test signal MULTIPLIER x1 and x0.1 settings (OSC LEVEL control is set to its fully cw position).

Note

Check for dissipation factor accuracies at the same time as that for capacitance accuracies.

Note

Check all ranges in parallel mode. It is sufficient to check any one range in series mode.

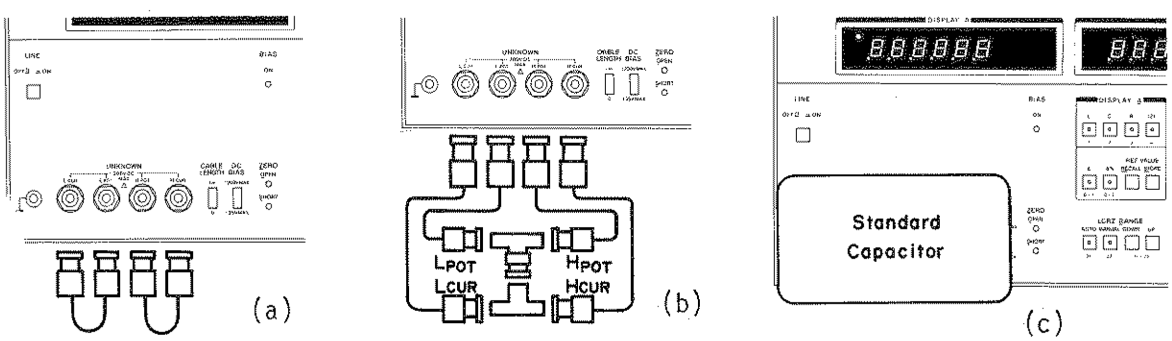


Figure 4-4. Capacitance Accuracy Test Setups.

EQUIPMENT:

Standard capacitors .... 1pF : HP 16381A
10pF : HP 16382A
100pF : HP 16383A
1000pF : HP 16384A
BNC to BNC cable .... 10cm long, 4 ea. required
BNC Tee adapter .... -hp- 1250-0781
-hp- 1251-0781

Note

1) If short (0Ω) and open (OS) terminations of the HP 16074A Standard Resistor Set are available, use them for zero offset adjustment instead of BNC to BNC cables and BNC Tee adapters.
2) Use BNC to BNC cables of 10cm long or less. Using a longer cable may affect test results.

PROCEDURE:

1. Set CABLE LENGTH switch to "0" position.

2. Connect L_{CUR} and L_{POT} terminals with a BNC to BNC cable as shown in Figure 4-4 (a). Similarly connect H_{CUR} and H_{POT} terminals.

3. Set 4275A controls as follows:

Press Self Test OFF

DISPLAY A function	C
Deviation measurement function	off
LCRZ RANGE	AUTO
DISPLAY B function	D
CIRCUIT MODE	AUTO
HIGH RESOLUTION	on
SELF TEST	off
TRIGGER	INT
OSC LEVEL	fully cw
MULTIPLIER	x1

CAUTION

VERIFY THAT DC BIAS INDICATOR LAMP DOES NOT LIGHT. IF ILLUMINATED, SET REAR PANEL DC BIAS SWITCH TO OFF.

4. Press ZERO OPEN button and wait approximately 15 seconds until "open" offset adjustment is completed ("CAL" letters in DISPLAY A disappear).

5. Connect cables and terminal adapters as shown in Figure 4-4 (b). Connect BNC tee adapters to each other.

6. Press ZERO SHORT button and wait approximately 15 seconds until "short" offset adjustment is completed.

7. Disconnect cables and connect 1pF Standard Capacitor direct to UNKNOWN terminals as shown in Figure 4-4 (c).

8. Set test frequency and test signal level MULTIPLIER in accord with Table 4-5. Capacitance and dissipation factor readouts should be within tolerances given in the table.

9. Change standard capacitor successively to 10pF, 100pF and 1000pF and verify that the instrument satisfies Table 4-5.

Note

1. Table 4-5 applies to the tests at both MULTIPLIER x1 and x 0.1 settings.

2. When 1000pF standard capacitor is measured at 4MHz or 10MHz test frequency, CIRCUIT MODE is automatically set to mode.

Table 4-5. Capacitance Accuracy Tests.

Test frequency	Standard capacitance			
	1pF		10pF	
	C test limits	D test limits	C test limits	D test limits
10.0kHz	——	——	C.V. ±0.0130pF	0±0.00090
20.0kHz	——	——	C.V. ±0.0120pF	0±0.00075
40.0kHz	C.V. ±5.10fF (±15.0fF)	0±0.00360	C.V. ±0.0420pF	0±0.00360
100kHz	C.V. ±4.50fF (±9.0fF)	0±0.00210	C.V. ±0.0360pF	0±0.00210
200kHz	——	——	C.V. ±0.0120pF	0±0.00075
400kHz	C.V. ±4.60fF (±10.0fF)	0±0.00260	C.V. ±0.0160pF	0±0.00135
1.00MHz	C.V. ±4.30fF (±7.0fF)	0±0.00170	C.V. ±0.0130pF	0±0.00090
2.00MHz	——	——	C.V. ±0.0330pF	0±0.00260
4.00MHz	C.V. ±14.00fF (±32.0fF)	0±0.00710	C.V. ±0.1220pF	0±0.00710
10.0MHz	C.V. ±24.00fF (±42.0fF)	0±0.01110	C.V. ±0.2220pF	0±0.01110

C.V. = Calibrated value of standard capacitor.
C test limit values in parenthesis apply to MULTIPLIER X0.1 setting.

Table 4-5. Capacitance Accuracy Tests (continued).

Test frequency	Standard capacitance			
	100pF		1000pF	
	C test limits	D test limits	C test limits	D test limits
10.0kHz	C.V. ±0.130pF	0±0.00090	C.V. ±1.30pF	0±0.00090
20.0kHz	C.V. ±0.120pF	0±0.00075	C.V. ±1.20pF	0±0.00075
40.0kHz	C.V. ±0.160pF	0±0.00135	C.V. ±1.60pF	0±0.00135
100kHz	C.V. ±0.130pF	0±0.00090	C.V. ±1.30pF	0±0.00090
200kHz	C.V. ±0.120pF	0±0.00075	C.V. ±1.20pF	0±0.00075
400kHz	C.V. ±0.160pF	0±0.00135	C.V. ±1.60pF	0±0.00135
1.00MHz	C.V. ±0.130pF	0±0.00090	C.V. ±1.30pF	0±0.00090
2.00MHz	C.V. ±0.330pF	0±0.00260	C.V. ±3.30pF	0+0.00260 -0.00230
4.00MHz	C.V. ±1.202pF	0±0.00710	C.V. ±32.0pF	0+0.01210 -0.01130
10.0MHz	C.V. ±2.200pF	0±0.01110	C.V. ±32.0pF	0+0.01510 -0.01210

C.V. = Calibrated value of standard capacitor.

4-17. RESISTANCE ACCURACY TEST

4-18. This test checks resistance measurement accuracies for full scale displays at each of the 10 spot standard test frequencies. The resistance accuracy checks are made by connecting a standard resistor to the instrument and comparing the measurement readouts with the calibrated values of the standard to verify that the 4275A meets accuracy specifications. As the capacitance accuracy test (in paragraph 4-15) and this resistance accuracy test check the respective elements pertinent to the right-angle impedance vector, measurement accuracies for both resistive and reactive measurement parameters are thus being verified.

Resistance accuracy check ranges

Freq. / Range	10kHz	20kHz	40kHz	100kHz	200kHz	400kHz	1MHz	2MHz	4MHz	10MHz
100kΩ					☒	☒	☒	☒	☒	☒
10kΩ								☒	☒	☒
1000Ω										
100Ω										

□ Tested range. ☒ Non-applicable range for recommecded resistance standard.

Note

The tests on resistance ranges and test frequencies listed above should be done at both test signal MULTIPLIER x1 and x0.1 settings (OSC LEVEL control is set to its fully cw position).

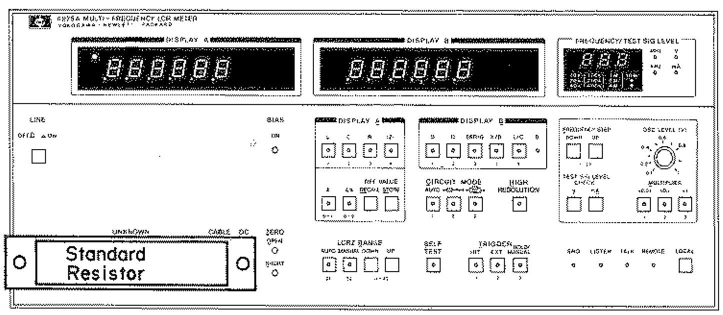


Figure 4-5. Resistance Accuracy Test Setup.

EQUIPMENT:

Standard Resistors .... 100Ω, 1000Ω, 10kΩ, 100kΩ — HP 16074A Standard Resistor Set

PROCEDURE:

1. Set CABLE LENGTH switch to "0" position.

2. Set 4275A controls as follows:

   DISPLAY A function .... R
   Deviation measurement function .... off
   LCRZ RANGE .... AUTO
   CIRCUIT MODE .... AUTO

HIGH RESOLUTION .... on
SELF TEST .... off
TRIGGER .... INT
OSC LEVEL .... fully cw
MULTIPLIER x1

CAUTION

VERIFY THAT DC BIAS INDICATOR LAMP DOES NOT LIGHT. IF ILLUMINATED, SET REAR PANEL DC BIAS SWITCH TO OFF.

Note

If Capacitance Accuracy Test (paragraph 4-15) has not been performed before doing this test, perform zero offset adjustment in accord with Capacitance Accuracy Test steps 2, 4, 5 and 6.

3. Connect 100Ω standard resistor direct to UNKNOWN terminals as shown in Figure 4-5.

4. Set test frequency and test signal level MULTIPLIER in accord with Table 4-6. Resistance readouts should be within tolerances given in the table.

5. Change standard resistor successively to 1000Ω, 10kΩ and 100kΩ and verify that the instrument satisfies Table 4-6.

Note

1. Table 4-6 applies to tests at both MULTIPLIER x1 and X0.1 settings.

2. Measurement CIRCUIT MODE is automatically set to mode on 100Ω range and to mode on other ranges.

Table 4-6. Resistance Accuracy Test.

Test Frequency	Test Limits				
	100Ω	1000Ω	10kΩ	100kΩ	
10.0kHz	C.V. ±0.130Ω	C.V. ±4.0Ω	C.V. ±0.040kΩ	C.V. ±0.40kΩ	16
20.0kHz					
40.0kHz					
100kHz					
200kHz	C.V. ±0.230Ω	C.V. ±5.0Ω	C.V. ±0.050kΩ	———	9
400kHz					
1.00MHz					
2.00MHz	C.V. ±0.550Ω	C.V. ±12.0Ω	———	———	2
4.00MHz	C.V. ±2.070Ω	C.V. ±33.0Ω	———	———	4
10.0MHz					

C.V. = Calibrated value of standard resistor

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HP DAVE APPLE X

4-19. INDUCTANCE ACCURACY TEST (Confirmation Test).

4-20. Inductance accuracy is verified if the instrument meets both capacitance and resistance accuracy test limits. If it is desired to confirm the inductance accuracy on at least at one range, perform the following test:

Note

This confirmation test does not necessarily have to be done.

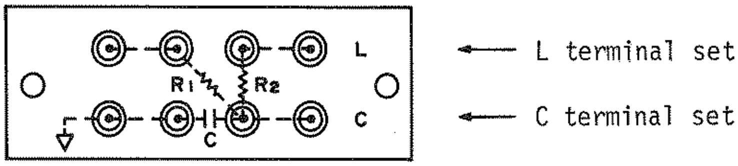


Figure 4-6. HP 16074A Quasi-inductor.

(Internal Connection Configuration is shown in the figure.)

EQUIPMENT:

Quasi-inductor .... from HP 16074A Standard Resistor Set.

PROCEDURE:

1. Set CABLE LENGTH switch to "0" position.

2. Set 4275A controls as follows:

DISPLAY A function C
Deviation measurement function .... off
LCRZ RANGE .... AUTO
CIRCUIT MODE ....
HIGH RESOLUTION .... on
SELF TEST.. off
TRIGGER .... INT
OSC LEVEL .... fully cw
MULTIPLIER x1

CAUTION

VERIFY THAT DC BIAS INDICATOR LAMP DOES NOT LIGHT. IF ILLUMINATED, SET REAR PANEL DC BIAS SWITCH TO OFF.

Note

If Capacitance Accuracy Test (paragraph 4-15) has not been performed before doing this test, perform a zero offset adjustment in accord with Capacitance Accuracy Test steps 2, 4, 5 and 6.

100μH range check

3. Connect 100μH quasi-inductor "C" terminals direct to 4275A UNKNOWN terminals. See Figure 4-6.

4. Set test signal frequency to 1.00MHz.

5. Read displayed capacitance value (Cm). 1021pF

6. Calculate composite inductance value (Lm) from the calbrated values for the component resistors (R_1 and R_2) and the capacitance value obtained in step 5 procedure. Lm is given by equation:

$$Lm = R_1 \cdot R_2 \cdot (Cm - 7.1pF) \quad (H)$$

$R_1 \& 2 = 316.4\Omega$
$R^2 = 100108.96$

7. Disconnect quasi-inductor "C" terminals from UNKNOWN terminals. Connect its "L" terminals to 4275A UNKNOWN terminals.

8. Set DISPLAY A function to "L". → Circuit Mode = ~~500μH~~ 500 nH

9. Inductance display readout should be within ±0.50μH of the calculated Lm value.

10. Disconnect quasi-inductor sample.

102.44
C = 1625.7pF
L = 101.99

100mH range check

11. Check 100mH range using 100mH quasi-inductor and procedures similar to those described in steps 3 through 8. Set test frequency to 100kHz during this test.

Note

Calculate Lm value by the following equation (instead of the equation given in step 6):

$$Lm = R_1 \cdot R_2 \cdot Cm \quad (H)$$

$R_1 \& 2 = 1K\Omega$
$R^2 = 1M\Omega$

12. Inductance display readout should be within ±0.30mH of the calculated Lm value.

109.75

102.06 μH
102.10 μH

Cm = 96.87 nF
Lm = 96.87 mH

C = 96.78 nF
L = 97.00 mH

2

4-21. FREQUENCY-PHASE ACCURACY TEST

4-22. This test checks phase accuracies to ascertain accurate detection of the vector impedance components which are the source of the arithmetic measurement data. The frequency-phase accuracy test is made by connecting a resistor with extremely low reactive elements and by reading reactance display values (almost zero) to verify that the impedance of the DUT is being accurately detected with respect to the right-angle vector components.

Frequency-Phase Accuracy Check Ranges

R range	Test frequency
1000mΩ	10kHz to 1MHz
10Ω	10kHz to 10MHz

Note

The test should be done at both test signal MULTIPLIER x1 and x0.1 set-settings (OSC LEVEL control is set to its fully cw position).

EQUIPMENT:

Resistor 1Ω
10Ω
Terminator 0Ω
Open (OS)
} HP 16074A Standard Resistor Set

Note

The resistors used as references in this test have been designed to maintain extremely low order (residual) reactance at frequencies to 10MHz. Short and open terminators are specially matched to these two resistors in order to ensure an optimum zero offset adjustment.

PROCEDURE:

1. Set CABLE LENGTH switch to "0" position.

2. Connect open (OS) terminator direct to UNKNOWN terminals as shown in Figure 4-5.

3. Set 4275A controls as follows:

DISPLAY A function .... R
Deviation measurement function .... off
LCRZ RANGE .... AUTO
DISPLAY B function X
CIRCUIT MODE .... AUTO
HIGH RESOLUTION .... on
SELF TEST .... off
TRIGGER .... INT
OSC LEVEL .... fully cw
MULTIPLIER x1

CAUTION

VERIFY THAT DC BIAS INDICATOR LAMP DOES NOT LIGHT. IF ILLUMINATED, SET REAR PANEL DC BIAS SWITCH TO OFF.

4. Press ZERO OPEN button and wait approximately 15 seconds until "open" offset adjustment is completed ("CAL" letters in DISPLAY A disappears).

5. Disconnect open terminator and connect 0Ω terminator direct to UNKNOWN terminals.

6. Press ZERO SHORT button and wait approximately 15 seconds until "short" offset adjustment is completed.

7. Disconnect short terminator and connect 1Ω test resistor direct to UNKNOWN terminals.

8. Set test frequency and test signal level MULTIPLIER in accord with Table 4-7. Reactance display readouts should be within tolerances given in the table.

9. Connect 10Ω test resistor in place of 1Ω resistor and verify that Table 4-7 is satisfied.

Note

Table 4-7 applies to tests at both MULTIPLIER x1 and x0.1 settings.

Table 4-7. Frequency-Phase Accuracy Tests.

Test frequency	Reactance test limits	
	1000mΩ	10Ω
10.0kHz 20.0kHz 40.0kHz	0±1.50mΩ	0±0.0130Ω
100kHz	0±1.69mΩ	0±0.0136Ω
200kHz	0±1.87mΩ	0±0.0142Ω
400kHz	0±2.25mΩ	0±0.0155Ω
1.00MHz	0±3.38mΩ	0±0.0193Ω
2.00MHz	———	0±0.0275Ω
4.00MHz	———	0±0.1400Ω
10.0MHz	———	0±0.1780Ω

4-23. INT DC BIAS SUPPLY TEST (OPTION 001)

4-24. This test verifies that the Option 001 Internal DC BIAS Supply applies the specified bias voltages to the device under test.

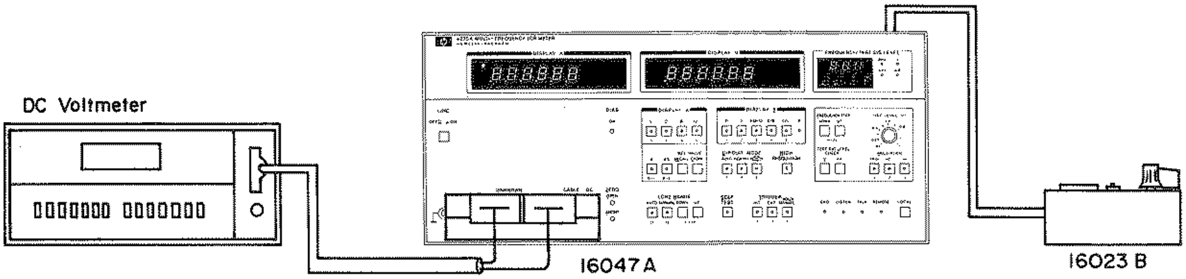


Figure 4-7. Option 001 Int DC Bias Supply Test Setup.

EQUIPMENT:

DC Voltmeter .... HP 3465A/B
Test Fixture .... HP 16047A
Bias Controller .... HP 16023B

PROCEDURE:

1. Set 4275A front panel DC BIAS switch to ±35V MAX and CABLE LENGTH switch to "0" position. Attach 16047A Test Fixture to UNKNOWN terminals.

2. Connect 16023B DC Bias Controller to rear panel INT DC BIAS CONTROL connector.

CAUTION

BEFORE OPERATING DC BIAS SWITCH, VERIFY THAT DC BIAS VOLTAGE HAS BEEN SET TO ZERO VOLTS.

3. Set rear panel DC BIAS switch to INT ±35V/100V (≤.1μF) position.

4. Connect an appropriate pair of wire leads between dc voltmeter input and 16047A Test Fixture (see Figure 4-7).

5. Set dc bias voltage into 16023B DC Bias Controller in accord with Table 4-8. DC voltmeter readouts should be identical with the bias setting voltages within tolerances given in the table.

Note

To change bias voltage:

1. Set a new bias voltage value into the three digit thumbwheel switch of the 16023B.

2. Press 16023B ENTER button (this actuates the 4275A to read the new value).

Table 4-8. DC Bias Voltage Test Limits.

DC Bias Setting	Tolerance	DC Bias Setting	Tolerance
.000V	-.0020 — .0020V	.100V	.0975 — .1025V
.001	-.0010 — .0030	.200	.1970 — .2030
.002	.0000 — .0040	.300	.2965 — .2035
.003	.0010 — .0050	.400	.3960 — .4040
.004	.0020 — .0060		
		.500	.4955 — .5045
.005	.0030 — .0070	.600	.5950 — .6050
.006	.0040 — .0080	.700	.6945 — .7055
.007	.0050 — .0090	.800	.7940 — .8060
.008	.0060 — .0100	.900	.8935 — .9065
.009	.0070 — .0110		
		1.00	.9910 — 1.009
.010	.0080 — .0120	2.00	1.986 — 2.014
.020	.0179 — .0221	3.00	2.982 — 3.018
.030	.0279 — .0321	4.00	3.977 — 4.023
.040	.0378 — .0422		
		5.00	4.972 — 5.028
.050	.0478 — .0522	6.00	5.967 — 6.033
.060	.0577 — .0623	7.00	6.962 — 7.038
.070	.0677 — .0723	8.00	7.958 — 8.042
.080	.0776 — .0824	9.00	8.953 — 9.047
.090	.0876 — .0924		
		10.0	9.930 — 10.07
		20.0	19.88 — 20.12
		30.0	29.82 — 30.16

Note

When dc bias voltage is measured at rear panel INT DC BIAS MONITOR connector, voltmeter readout will be somewhat lower than the actual (applied) voltage because of monitor output impedance (30kΩ). Measured voltage value Em is:

$$Em = E\ bias \times \frac{Zi}{30 + Zi} \quad (V)$$

Where, Zi is voltmeter input impedance (in kΩ).

4-25. INT DC BIAS SUPPLY TEST (OPTION 002)

4-26. This test verifies that the Option 002 Internal DC Bias Supply applies the specified bias voltages to the device under test.

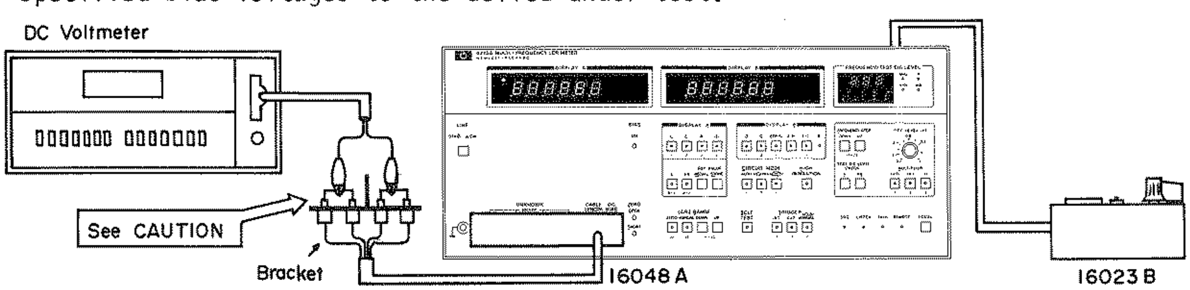


Figure 4-8. Option 002 Int DC Bias Supply Test Setup.

EQUIPMENT:

DC Voltmeter .... HP 3465A/B
Test Leads .... HP 16048A
Bias Controller .... HP 16023B

PROCEDURE:

1. Set 4275A front panel DC BIAS switch to ±200V MAX and CABLE LENGTH switch to "1m" position. Connect 16048A Test Leads to UNKNOWN terminals.

2. Connect 16023B DC BIAS Controller to rear panel INT DC BIAS CONTROL connector.

CAUTION

BEFORE OPERATING DC BIAS SWITCH, VERIFY THAT DC BIAS VOLTAGE HAS BEEN SET TO ZERO VOLTS.

3. Set rear panel DC BIAS switch to INT ±35V/100V (≤.1μF) position.

4. Connect 16048A Test Leads to dc voltmeter input (see Figure 4-8).

CAUTION

DO NOT TOUCH BNC CONNECTOR CENTER PIN WHERE A LIVE VOLTAGE MAY EXIST.

5. Set dc bias voltage into 16023B DC Bias Controller switch in accord with Table 4-9. DC Voltmeter readouts should be identical with the bias setting voltages within tolerances given in the table.

Note

To change bias voltage:

1. Set a new bias voltage value into the three digit thumbwheel switch of the 16023B.

2. Press 16023B ENTER button (this actuates the 4275A to read the new value).

TABLE 4-9. DC Bias Voltage Test Limits.

DC Bias Setting	Tolerance	DC Bias Setting	Tolerance
00.0V	-0.040 — 0.040V	05.0V	4.86 — 5.14V
00.1	0.058 — 0.142	06.0	5.84 — 6.16
00.2	0.156 — 0.244	07.0	6.82 — 7.18
00.3	0.254 — 0.346	08.0	7.80 — 8.20
00.4	0.352 — 0.448	09.0	8.78 — 9.22
00.5	0.450 — 0.550	10.0	9.76 — 10.24
00.6	0.548 — 0.652	20.0	19.56 — 20.44
00.7	0.646 — 0.754	30.0	29.37 — 30.63
00.8	0.744 — 0.856	40.0	39.17 — 40.83
00.9	0.842 — 0.958		
		50.0	48.97 — 51.03
01.0	0.940 — 1.060	60.0	58.77 — 61.23
02.0	1.920 — 2.08	70.0	68.58 — 71.42
03.0	2.90 — 3.10	80.0	78.38 — 81.62
04.0	3.88 — 4.12	90.0	88.18 — 91.82

Note

When dc bias voltage is measured at rear panel INT DC BIAS MONITOR connector, voltmeter readout will be somewhat lower than the actual bias voltage. Refer to note in Paragraph 4-24.

4-27. HP-IB INTERFACE TEST (OPTION 101 ONLY).

4-28. This test verifies that the HP-IB circuitry has the capabilities (listed in Table 3-10) to correctly communicate between external HP-IB devices and the 4275A through the interface bus cable.

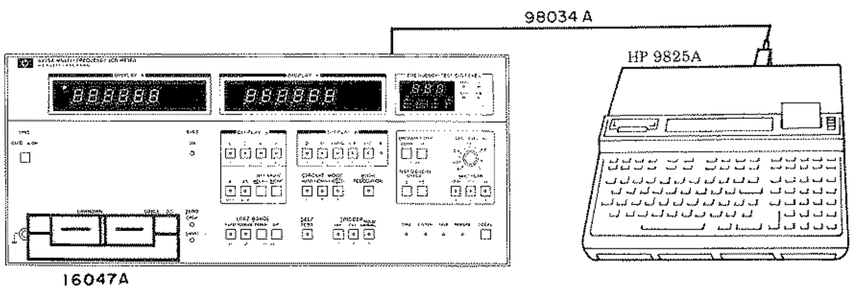


Figure 4-9. HP-IB Interface Test Setup.

EQUIPMENT:

Calculator .... HP 9825A
ROM .... HP 98210A, 98213A
Interface Card with cable .... HP 98034A

Sample capacitor (1000pF∿1000nF)

PROCEDURE:

1. Turn power switches of both the 4275A and 9825A to OFF.
2. Connect 98034A Interface Card with cable between 9825A I/O slot and 4275A rear panel HP-IB connector as shown in Figure 4-9.
3. Install required ROM blocks in 9825A ROM slots.
4. Set 98034A Select Code Switch dial to select code 7 (using a screwdriver).
5. Remove 4275A top cover.
6. Set 4275A A22S1 HP-IB Control Switch to following settings:

   bit 1∿5 : 10001 (17 in binary code)
   bit 6 : 0
   bit 7 : 0
7. Replace top cover.
8. Connect 16047A Test Fixture to 4275A UNKNOWN terminals.
9. Turn 4275A and 9825A ON.
10. Set 4275A controls as follows:

    OSC LEVEL 1
    16047A Test Fixture .... Open
    Other Controls .... Initial control settings.
11. Load test program as shown on Pages 4-24 through 4-27 in calculator.
12. Execute the program.
13. Check that 4275A display, 9825A display, and printed data are in accord with Controller Instructions and Operator Responses for each test program.
14. Perform steps 10 thru 13 with respect to individual test programs and verify that 4275A and 9825A correctly communicates through the HP-IB interface.

TEST PROGRAM 1

[PURPOSE]

This test verifies that 4275A Opt. 101 has the following capabilities:

(1) Remote/Local Capability.

(2) Local Lockout.

(3) Talk Address Disabled by Listen Address.

(4) Listen Address Disabled by Talk Address.

[PROGRAMMING]

```
0: "REMOTE/LOCAL TEST":
1: dim A$[1]
2: 0→A
3: rds(717)→B
4: prt "REMOTE/LOCAL TEST";spc 3
5: rem 7
6: wrt 717,"T1";ent "LISTEN= 1  ,TALK= 0  ,REMOTE= 1",A$
7: if A$="n";1→A
8: cli 7;ent "LISTEN= 0  ,TALK= 0  ,REMOTE= 1",A$
9: if A$="n";1→A
10: lcl 7;ent "LISTEN= 0  ,TALK= 0  ,REMOTE= 0  ",A$
11: if A$="n";1→A
12: rem 717;ent "LISTEN= 1  ,TALK= 0  ,REMOTE= 1  ",A$
13: if A$="n";1→A
14: llo 7
15: lcl 717;ent "LISTEN= 1  ,TALK= 0  ,REMOTE= 0  ",A$
16: if A$="n";1→A
17: wrt 717,"T1";ent "LISTEN= 1  ,TALK= 0  ,REMOTE= 1  ",A$
18: if A$="n";1→A
19: if A=1;prt "REMOTE/LOCAL TEST          FAIL";spc 3;jmp 2
20: prt "REMOTE/LOCAL TEST          PASS";spc 3
21: 0→A
22: prt "LISTEN/TALK TEST";spc 3
23: red 717,A,B;ent "LISTEN= 0  ,TALK= 1  ,REMOTE= 1  ",A$
24: if A$="n";1→A
25: wrt 717,"T1";ent "LISTEN= 1  ,TALK= 0  ,REMOTE= 1  ",A$
26: if A$="n";1→A
27: if A=1;prt "LISTEN/TALK TEST           FAIL";spc 3;jmp 2
28: prt "LISTEN/TALK TEST           PASS";spc 3
29: prt "END";spc 3
30: cli 7
31: lcl 7
32: end
*32472
```

(3) Clears 4275A SRQ Status Byte.

(5) Sets REN (Remote Enable) line of the bus line to "1". Switches selected devices (Interface Select Code 7) to remote operation allowing parameters and device characteristics to be controlled by data message.

(6) Addresses 9825A to talk and 4275A to listen.

(8) Sets IFC (Interface Clear) line of the bus line to "1". Unconditionally causes control to pass back to 9825A (independent of the device currently in control) and stops all communication.

(10) Sets REN to "0". Removes all devices (Interface Select Code 7) from local lockout mode and causes all devices to revert to local.

(12) Sets REN to "1". Switches 4275A to remote operation.

(14) Prevents the device operator from switching the unit to manual control.

(15) Causes 4275A to revert to manual control for future parameter modifications (REN remains at "1").

(17) Returns to the status of Step 14.

(23) Disables listen address by talk address.

(25) Disables talk address by listen address.

Table 4-10. Controller Instructions and Operator Responses for Test Program 1.

Controller Instructions		Operator Response
Displays	Printout	
	REMOTE/LOCAL TEST	
LISTEN = 1, TALK = 0, REMOTE = 1		If 4275A HP-IB Status Indicators and Controller Display are same, press " [Y], [CONTINUE] " in each step. If not, press " [n], [CONTINUE] ".
LISTEN = 0, TALK = 0, REMOTE = 1		
LISTEN = 0, TALK = 0, REMOTE = 0		
LISTEN = 1, TALK = 0, REMOTE = 1		
LISTEN = 1, TALK = 0, REMOTE = 0		
LISTEN = 1, TALK = 0, REMOTE = 1		
	REMOTE/LOCAL TEST PASS	If all steps are correct, this message in outputted.
	REMOTE/LOCAL TEST FAIL	If any step fails, this message is outputted.
	LISTEN/TALK TEST	
LISTEN = 0, TALK = 1, REMOTE = 1		If 4275A HP-IB Status Indicators and Controller Display are same, press " [y], [CONTINUE] " in each step. If not, press " [n], [CONTINUE] ".
LISTEN = 1, TALK = 0, REMOTE = 1		
	LISTEN/TALK TEST PASS	If both steps are correct, this message is outputted.
	LISTEN/TALK TEST FAIL	If any step fails, this message is outputted.
	END	

TEST PROGRAM 2

[PURPOSE]

This test verifies that 4275A Opt. 101 has following capabilities.

(1) Listener.

(2) Device Clear.

[PROGRAMMING]

```
0: "LISTENER TEST":
1: dim A$[50],B$[1]
2: prt "LISTENER TEST";spc 3
3: rem 7
4: cli 7
5: enp "Display A ? (1 thru 4)",A;spc 3
6: enp "Display B ? (1 thru 3)",B;spc 3
7: enp "Circuit Mode ? (1 thru 3)",C;spc 3
8: enp "Deviation Meas ? (0 thru 2)",D;spc 3
9: enp "Frequency Step ? (11 thru 22)",F;spc 3
10: enp "High Resolution ? (0 or 1)",H;spc 3
11: enp "Data Ready ? (0 or 1)",I;spc 3
12: enp "Multiplier ? (1 thru 3)",M;spc 3
13: enp "LCRZ Range ? (11 thru 23,31,32)",R;spc 3
14: enp "Self Test ? (0 or 1)",S;spc 3
15: enp "Trigger ? (1 thru 3)",T;spc 3
16: fmt 1,"A",f1.0,"B",f1.0,"C",f1.0,"D",f1.0,"F",f2.0,"H",f1.0,"I",f1.0
17: fmt 2,"M",f1.0,"R",f2.0,"S",f1.0,"T",f1.0
18: wrt 717,"ST"
19: wrt 717.1,A,B,C,D,F,H,I
20: wrt 717.2,M,R,S,T
21: gsb "K"
22: ent "Is key status true ? (y or n)",B$
23: if B$="n";prt "LISTENER TEST           FAIL";spc 3;jmp 2
24: prt "LISTENER TEST           PASS";spc 3
25: prt "DEVICE CLEAR TEST";spc 3
26: clr 717
27: gsb "K"
28: ent "Is key status true ? (y or n)",B$
29: if B$="n";prt "DEVICE CLEAR TEST           FAIL";spc 3;jmp 2
30: prt "DEVICE CLEAR TEST       PASS";spc 3
31: prt "END";spc 3
32: end
33: "K":
34: wrt 717,"K"
35: red 717,A$
36: prt A$;spc 3
37: ret
*14283
```

(18)∿(20) Transfers Remote program codes from 9825A to 4275A.

(26) Initializes device-dependent functions to predefined state.

(35) Transfers outputted data from 4275A to 9825A.

Table 4-11. Controller Instructions and Operator Responses for Test Program 2.

Controller Instructions		Operator Response
Displays	Printout	
	LISTENER TEST	
Display A ? (1 thru 4)	Display A ? (1 thru 4)	Input HP-IB program code suffix in each step (see Table 3-11). Example: A1 B3 C3 D2 F22 H1 I0 M3 R20 S0 T3
	1	
Display B ? (1 thru 3)	Display B ? (1 thru 3)	
	3	
Circuit Mode ? (1 thru 3)	Circuit Mode ? (1 thru 3)	
	3	
Deviation Meas ? (0 thru 2)	Deviation Meas ? (0 thru 2)	

Table 4-11. Controller Instructions and Operator Responses for Test Program 2.(Cont'd).

Controller Instructions		Operator Response
Displays	Printout	
	2	A1 .... L B3 .... ESR/G C3 .... D2 .... Δ% F18 .... 2(3)MHz H1 .... ON I0 .... OFF M3 .... x1 R15 .... 1000μH S0 .... OFF T3 .... HOLD/MANUAL
Frequency Step ? (11 thru 22)	Frequency Step ? (11 thru 22)	
	18	
High Resolution ? (0 or 1)	High Resolution ? (0 or 1)	
	1	
Data Ready ? (0 or 1)	Data Ready ? (0 or 1)	
	0	
Multiplier ? (1 thru 3)	Multiplier ? (1 thru 3)	
	3	
LCRZ Range ? (11 thru 23,31,32)	LCRZ Range ? (11 thru 23,31,32)	
	15	
Self Test ? (0 or 1)	Self Test ? (0 or 1)	
	0	
Trigger ? (1 thru 3)	Trigger ? (1 thru 3)	
	3	
	A1B3C3D0F18H1I0 M3R15S0T3	This is the key status data of 4275A when it accepts input remote program codes from controller.
Is key status true ? (y or n)	LISTENER TEST PASS LISTENER TEST FAIL	If input remote program codes and outputted key status data are same, press "[y], [CONTINUE]". If not, press "[n], [CONTINUE]".
	DEVICE CLEAR TEST	
	A2B1C1D0F15H0I0 M3R31S0T1	This is the key status data of 4275A when it accepts SDC (Selected Device Clear) command from controller.
Is key status true ? (y or n)	DEVICE CLEAR TEST PASS DEVICE CLEAR TEST FAIL	If outputted key status data and initial control settings (A2 B1 C1 D0 F17 H0 I0 M3 R31 S0 T1) are same, press "[y], [CONTINUE]". If not, press "[n], [CONTINUE]".
	END	

TEST PROGRAM 3

[PURPOSE]

This test verifies that 4275A Opt. 101 has following capabilities:

(1) Talker.

(2) Device Trigger.

[PROGRAMMING]

```
0: "TALKER TEST":
1: prt "TALKER TEST";spc 3
2: dsp "Connect a capacitor to 16047A.";stp
3: prt "DATA OUTPUT TEST"
4: dim A$[50],B$[50],C$[50],D$[50],E$[50],F$[1]
5: rds(717)+C
6: lcl 7
7: flt 5
8: rem 7
9: cli 7
10: clr 717
11: wrt 717,"T3E"
12: red 717,A,B
13: prt A,B;spc 2
14: ent "Is output data true ? (y or n)",F$[1]
15: if F$="n";prt "DATA OUTPUT TEST             FAIL";spc 3;jmp 2
16: prt "DATA OUTPUT TEST           PASS";spc 3
17: prt "COMPLETE DATA OUTPUT TEST"
18: wrt 717,"E"
19: red 717,A$
20: prt A$;spc 2
21: ent "Is output data true ? (y or n)",F$[1]
22: if F$="n";prt "COMPLETE DATA OUTPUT TEST    FAIL";spc 3;jmp 2
23: prt "COMPLETE DATA OUTPUT TEST  PASS";spc 3
24: prt "DEVICE TRIGGER TEST"
25: trg 717
26: red 717,B$
27: prt B$;spc 2
28: ent "Is output data true ? (y or n)",F$[1]
29: if F$="n";prt "DEVICE TRIGGER TEST          FAIL";spc 3;jmp 2
30: prt "DEVICE TRIGGER TEST        PASS";spc 3
31: prt "REFERENCE VALUE TEST"
32: wrt 717,"ST"
33: wrt 717,"RE"
34: red 717,C$
35: prt C$;spc 2
36: ent "Is output data true ? (y or n)",F$[1]
37: if F$="n";prt "REFERENCE VALUE TEST         FAIL";spc 3;jmp 2
38: prt "REFERENCE VALUE TEST       PASS";spc 3
39: prt "TEST SIG LEVEL CHECK TEST"
40: wrt 717,"LV"
41: red 717,D$
42: prt D$;spc 1
43: wrt 717,"LA"
44: red 717,E$
45: prt E$;spc 2
46: ent "Is output data true ? (y or n)",F$[1]
47: if F$="n";prt "TEST SIG LEVEL CHECK TEST    FAIL";spc 3;jmp 2
48: prt "TEST SIG LEVEL CHECK TEST  PASS";spc 3
49: prt "END";spc 3
50: end
*9606
```

(25) Causes 4275A to simultaneously initiate a device-dependent action.

Table 4-12. Controller Instructions and Operator Responses for Test Program 3.

Controller Instructions		Operator Response
Displays	Printout	
	TALKER TEST	
Connect a capacitor to 16047A		Connect a capacitor (1000pF~1000nF) to 16047A Test Fixture. Press " CONTINUE ".
	DATA OUTPUT TEST	
	2.74300e-09 5.00000e-04	

Table 4-12. Controller Instructions and Operator Responses for Test Program 3 (Cont'd).

Controller Instructions		Operator Response
Displays	Printout	
Is output data true? (y or n)	DATA OUTPUT TEST PASS DATA OUTPUT TEST FAIL	If outputted data and values of DISPLAY A and B are same, press "[y], [CONTINUE]". If not, press "[n], [CONTINUE]".
	COMPLETE DATA OU TPUT TEST	
	PLNC+0.27440E-0 8,ND+0.00040E+00	
Is output data true? (y or n)	COMPLETE DATA OU TPUT TEST PASS COMPLETE DATA OU TPUT TEST FAIL	If outputted data is true, press "[y], [CONTINUE]" (see paragraph 3-84). If not, press "[n], [CONTINUE]".
	DEVICE TRIGGER T EST	
	PLNC+0.27430E-0 8,ND+0.00030E+00	
Is output data true? (y or n)	DEVICE TRIGGER T EST PASS DEVICE TRIGGER T EST FAIL	If outputted data is true, press "[y], [CONTINUE]" (see paragraph 3-84). If not, press "[n], [CONTINUE]".
	REFERENCE VALUE TEST	
	C+0.27430E-08	Press RECALL key on 4275A front panel and read stored reference value.
Is output data true? (y or n)	REFERENCE VALUE TEST PASS REFERENCE VALUE TEST FAIL	If outputted data is true, press "[y], [CONTINUE]" (see paragraph 3-86). If not, press "[n], [CONTINUE]".
	TEST SIG LEVEL C HECK TEST	
	NV+1.03E+00 NA+0.17E-04	Press TEST SIG LEVEL CHECK keys on 4275A front panel and read test signal level.
Is output data true? (y or n)	TEST SIG LEVEL C HECK TEST PASS TEST SIG LEVEL C HECK TEST FAIL	If outputted data is true, press "[y], [CONTINUE]" (see paragraph 3-88). If not, press "[n], [CONTINUE]".
	END	

PERFORMANCE TESTS

TEST PROGRAM 4

[PURPOSE]

This test program verifies that 4275A Opt. 101 has following capabilities:

(1) Service Request.

(2) Serial Poll.

[PROGRAMMING]

```
0: "SRQ TEST":
1: prt "SRQ TEST";spc 3
2: fxd 0
3: oni 7,"SRQ"
4: rem 7
5: cli 7
6: clr 717
7: rds(717)→A
8: 0→A;prt "DATA READY";wrt 717,"I1T3E";gsb "LOOP"
9: 0→A;prt "SELF TEST -PASS";wrt 717,"I0S1";gsb "LOOP"
10: 0→A;prt "SELF TEST -FAIL";wrt 717,"A1";gsb "LOOP"
11: 0→A;prt "ZERO OFFSET -PASS";wrt 717,"S0Z0";gsb "LOOP"
12: 0→A;prt "ZERO OFFSET -FAIL(Err1)";wrt 717,"ZS";gsb "LOOP"
13: 0→A;prt "Err5";wrt 717,"T1";wait 9000
14: wrt 717,"ST";gsb "LOOP"
15: 0→A;prt "SYNTAX ERROR";wrt 717,"A5";gsb "LOOP"
16: prt "END";spc 3
17: end
18: "LOOP":eir 7,128
19: if bit(0,A)=1;prt A;spc 3;ret
20: if bit(1,A)=1;prt A;spc 3;ret
21: if bit(2,A)=1;prt A;spc 3;ret
22: if bit(3,A)=1;prt A;spc 3;ret
23: gto "LOOP"
24: "SRQ":rds(717)→A
25: if bit(6,A)=1;jmp 2
26: prt "OTHER DEVICE SRQ";spc 3
27: "IRET":eir 7,128
28: iret
*13153
```

(3) Designates label (SRQ) for service routing to be performed when an interrupt is set by a device on select code 7 bus line.

(18) Labels Loop. Enables Service Request to be sent from device on select code 7 Bus Line. Checks status of SRQ line on the bus line.

(27) Again enables acceptance of SRQ from device because SRQ is disabled when Status Byte signal transfer is completed.

(28) After service subroutine is completed, return to the step that follows step 7, 8 or 9 (as appropriate) to main programming sequence.

Table 4-13. Controller Instructions and Operator Responses for Test Program 4.

Controller Instructions (Printout)	Operator Response
SRQ TEST	
DATA READY	Outputted SRQ Status Byte data should be 65 (= 01000001).
65	
SELF TEST -PASS	Outputted SRQ Status Byte data should be 68 (= 01000100).
68	
SELF TEST -FAIL	Outputted SRQ Status Byte data should be 76 (= 01001100).
76	
ZERO OFFSET -PAS S	Outputted SRQ Status Byte data should be 68 (= 01000100).
68	
ZERO OFFSET -FAI L(Err1)	Outputted SRQ Status Byte data should be 76 (= 01001100).
76	
Err5	Outputted SRQ Status Byte data should be 72 (= 01001000).
72	
SYNTAX ERROR	Outputted SRQ Status Byte data should be 66 (= 01000010).
66	
END	

PERFORMANCE TEST RECORD

Hewlett-Packard
Model 4275A
Multi Frequency LCR Meter
Serial No. ____________

Tested by ____________
Date ____________

Paragraph Number	TEST	Results		
		Minimum	Actual	Maximum
4-9	TEST FREQUENCY ACCURACY TEST			
	Frequency setting			
	10.0kHz	9.999kHz	______	10.001kHz
	20.0kHz	19.998kHz	______	20.002kHz
	40.0kHz	39.996kHz	______	40.004kHz
	100kHz	99.99kHz	______	100.01kHz
	200kHz	199.98kHz	______	200.02kHz
	400kHz	399.96kHz	______	400.04kHz
	1.00MHz	0.9999MHz	______	1.0001MHz
	2.00MHz	1.9998MHz	______	2.0002MHz
	4.00MHz	3.9996MHz	______	4.0004MHz
	10.0MHz	9.999MHz	______	10.001MHz
	Opt. freq. (Hz)	______	______	______
	(Hz)	______	______	______
4-11	TEST SIGNAL LEVEL VARIABLE RANGE TEST			
	MULTIPLIER: x1 OSC LEVEL: fully cw	1.00V rms	______	(at Hz)
	MULTIPLIER: x0.01 OSC LEVEL: fully ccw	(at Hz)	______	1.00mV rms
	MULTIPLIER: x0.1 OSC LEVEL: fully cw	100mV rms	______	(at Hz)
	MULTIPLIER: x0.01 OSC LEVEL: fully cw	10.0mV rms	______	(at Hz)
4-13	SELF OPERATING TEST			
	Test item			
	1 .... DISPLAY A	-1.00	______	1.00
	.... DISPLAY B	-1.00	______	1.00
	2 .... DISPLAY A	-999.00	______	-1001.00
	.... DISPLAY B	-10.00	______	10.00
	3 .... DISPLAY A	-999.00	______	-1001.00
	.... DISPLAY B	-10.00	______	10.00
	4 .... DISPLAY A	-999.00	______	-1001.00
	.... DISPLAY B	-10.00	______	10.00
	5 .... DISPALY A	-999.00	______	-1001.00
	.... DISPLAY B	-10.00	______	10.00
	7 .... DISPALY A	-10.00	______	10.00
	.... DISPLAY B	-10.00	______	10.00

Paragraph Number	TEST	Results Minimum	Results Actual	Results Maximum
4-15	CAPACITANCE ACCURACY TEST			
	1pF MULTIPLIER x1			
	40.0kHz	C.V.-5.10fF		C.V.+5.10fF
	(D)	-0.00360		0.00360
	100kHz	C.V.-4.50fF		C.V.+4.50fF
	(D)	-0.00210		0.00210
	400kHz	C.V.-4.60fF		C.V.+4.60fF
	(D)	-0.00260		0.00260
	1.00MHz	C.V.-4.30fF		C.V.+4.30fF
	(D)	-0.00170		0.00170
	4.00MHz	C.V.-14.00fF		C.V.+14.00fF
	(D)	-0.00710		0.00710
	10.0MHz	C.V.-24.00fF		C.V.+24.00fF
	(D)	-0.01110		0.01110
	1pF MULTIPLIER x0.1			
	40.0kHz	C.V.-15.0fF		C.V.+15.0fF
	(D)	-0.00360		0.00360
	100kHz	C.V.-9.0fF		C.V.+9.0fF
	(D)	-0.00210		0.00210
	400kHz	C.V.-10.0fF		C.V.+10.0fF
	(D)	-0.00260		0.00260
	1.00MHz	C.V.-7.0fF		C.V.+7.0fF
	(D)	-0.00170		0.00170
	4.00MHz	C.V.-32.0fF		C.V.+32.0fF
	(D)	-0.00710		0.00710
	10.0MHz	C.V.-42.0fF		C.V.+42.0fF
	(D)	-0.01110		0.01110
	10pF MULTIPLIER x1			
	10.0kHz	C.V.-0.0130pF		C.V.+0.0130pF
	(D)	-0.00090		0.00090
	20.0kHz	C.V.-0.0120pF		C.V.+0.0120pF
	(D)	-0.00075		0.00075
	40.0kHz	C.V.-0.0420pF		C.V.+0.0420pF
	(D)	-0.00360		0.00360
	100kHz	C.V.-0.0360pF		C.V.+0.0360pF
	(D)	-0.00210		0.00210
	200kHz	C.V.-0.0120pF		C.V.+0.0120pF
	(D)	-0.00075		0.00075
	400kHz	C.V.-0.0160pF		C.V.+0.0160pF
	(D)	-0.00135		0.00135
	1.00MHz	C.V.-0.0130pF		C.V.+0.0130pF
	(D)	-0.00090		0.00090
	2.00MHz	C.V.-0.0330pF		C.V.+0.0330pF
	(D)	-0.00260		0.00260
	4.00MHz	C.V.-0.1220pF		C.V.+0.1220pF
	(D)	-0.00710		0.00710
	10.0MHz	C.V.-0.2220pF		C.V.+0.2220pF
	(D)	-0.01110		0.01110
	Opt. freq. (Hz)			
	(D)			
	Opt. freq. (Hz)			
	(D)			
	1.00MHz	C.V.-0.0130pF		C.V.+0.0130pF
	(D)	-0.00090		0.00090

C.V.= Calibrated Value

Paragraph Number	TEST	Results		
		Minimum	Actual	Maximum
4-15	10pF MULTIPLIER x0.1			
	10.0kHz	C.V.-0.0130pF	______	C.V +0.0130pF
	(D)	-0.00090	______	0.00090
	20.0kHz	C.V.-0.0120pF	______	C.V +0.0120pF
	(D)	-0.00075	______	0.00075
	40.0kHz	C.V.-0.0420pF	______	C.V +0.0420pF
	(D)	-0.00360	______	0.00360
	100kHz	C.V.-0.0360pF	______	C.V +0.0360pF
	(D)	-0.00210	______	0.00210
	200kHz	C.V.-0.0120pF	______	C.V +0.0120pF
	(D)	-0.00075	______	0.00075
	400kHz	C.V.-0.0160pF	______	C.V +0.0160pF
	(D)	-0.00135	______	0.00135
	1.00MHz	C.V.-0.0130pF	______	C.V +0.0130pF
	(D)	-0.00090	______	0.00090
	2.00MHz	C.V.-0.0330pF	______	C.V +0.0330pF
	(D)	-0.00260	______	0.00260
	4.00MHz	C.V.-0.1220pF	______	C.V +0.1220pF
	(D)	-0.00710	______	0.00710
	10.0MHz	C.V.-0.2220pF	______	C.V +0.2220pF
	(D)	-0.01110	______	0.01110
	Opt. freq. (Hz)	______	______	______
	(D)	______	______	______
	Opt. freq. (Hz)	______	______	______
	(D)	______	______	______
	100pF MULTIPLIER x1			
	10.0kHz	C.V.-0.130pF	______	C.V +0.130pF
	(D)	-0.00090	______	0.00090
	20.0kHz	C.V.-0.120pF	______	C.V +0.120pF
	(D)	-0.00075	______	0.00075
	40.0kHz	C.V.-0.160pF	______	C.V +0.160pF
	(D)	-0.00135	______	0.00135
	100kHz	C.V.-0.130pF	______	C.V +0.130pF
	(D)	-0.00090	______	0.00090
	200kHz	C.V.-0.120pF	______	C.V +0.120pF
	(D)	-0.00075	______	0.00075
	400kHz	C.V.-0.160pF	______	C.V +0.160pF
	(D)	-0.00135	______	0.00135
	1.00MHz	C.V.-0.130pF	______	C.V +0.130pF
	(D)	-0.00090	______	0.00090
	2.00MHz	C.V.-0.330pF	______	C.V +0.330pF
	(D)	-0.00260	______	0.00260
	4.00MHz	C.V.-1.202pF	______	C.V +1.202pF
	(D)	-0.00710	______	0.00710
	10.0MHz	C.V.-2.200pF	______	C.V +2.200pF
	(D)	-0.01110	______	0.01110
	Opt. freq. (Hz)	______	______	______
	(D)	______	______	______
	Opt. freq. (Hz)	______	______	______
	(D)	______	______	______

C.V.= Calibrated Value

Paragraph Number	TEST	Results Minimum	Actual	Maximum
4-15	100pF MULTIPLIER x0.1			
	10.0kHz	C.V.-0.130pF		C.V.+0.130pF
	(D)	-0.00090		0.00090
	20.0kHz	C.V.-0.120pF		C.V.+0.120pF
	(D)	-0.00075		0.00075
	40.0kHz	C.V.-0.160pF		C.V.+0.160pF
	(D)	-0.00135		0.00135
	100kHz	C.V.-0.130pF		C.V.+0.130pF
	(D)	-0.00090		0.00090
	200kHz	C.V.-0.120pF		C.V.+0.120pF
	(D)	-0.00075		0.00075
	400kHz	C.V.-0.160pF		C.V.+0.160pF
	(D)	-0.00135		0.00135
	1.00MHz	C.V.-0.130pF		C.V.+0.130pF
	(D)	-0.00090		0.00090
	2.00MHz	C.V.-0.330pF		C.V.+0.330pF
	(D)	-0.00260		0.00260
	4.00MHz	C.V.-1.202pF		C.V.+1.202pF
	(D)	-0.00710		0.00710
	10.0MHz	C.V.-2.200pF		C.V.+2.200pF
	(D)	-0.01110		0.01110
	Opt. freq. (Hz)			
	(D)			
	Opt. freq. (Hz)			
	(D)			
	1000pF MULTIPLIER x1			
	10.0kHz	C.V.-1.30pF		C.V.+1.30pF
	(D)	-0.00090		0.00090
	20.0kHz	C.V.-1.20pF		C.V.+1.20pF
	(D)	-0.00075		0.00075
	40.0kHz	C.V.-1.60pF		C.V.+1.60pF
	(D)	-0.00135		0.00135
	100kHz	C.V.-1.30pF		C.V.+1.30pF
	(D)	-0.00090		0.00090
	200kHz	C.V.-1.20pF		C.V.+1.20pF
	(D)	-0.00075		0.00075
	400kHz	C.V.-1.60pF		C.V.+1.60pF
	(D)	-0.00135		0.00135
	1.00MHz	C.V.-1.30pF		C.V.+1.30pF
	(D)	-0.00090		0.00090
	2.00MHz	C.V.-3.30pF		C.V.+3.30pF
	(D)	-0.00230		0.00260
	4.00MHz	C.V.-32.0pF		C.V.+32.0pF
	(D)	-0.01130		0.01210
	10.0MHz	C.V.-32.0pF		C.V.+32.0pF
	(D)	-0.01210		0.01510
	Opt. freq. (Hz)			
	(D)			
	Opt. freq. (Hz)			
	(D)			

C.V.= Calibrated Value

Paragraph Number	TEST	Results		
		Minimum	Actual	Maximum
4-15	1000pF MULTIPLIER x0.1			
	10.0kHz	C.V.-1.30pF	________	C.V.+1.30pF
	(D)	-0.00090	________	0.00090
	20.0kHz	C.V.-1.20pF	________	C.V.+1.20pF
	(D)	-0.00075	________	0.00075
	40.0kHz	C.V.-1.60pF	________	C.V.+1.60pF
	(D)	-0.00135	________	0.00135
	100kHz	C.V.-1.30pF	________	C.V.+1.30pF
	(D)	-0.00090	________	0.00090
	200kHz	C.V.-1.20pF	________	C.V.+1.20pF
	(D)	-0.00075	________	0.00075
	400kHz	C.V.-1.60pF	________	C.V.+1.60pF
	(D)	-0.00135	________	0.00135
	1.00MHz	C.V.-1.30pF	________	C.V.+1.30pF
	(D)	-0.00090	________	0.00090
	2.00MHz	C.V.-3.30pF	________	C.V.+3.30pF
	(D)	-0.00230	________	0.00260
	4.00MHz	C.V.-32.0pF	________	C.V.+32.0pF
	(D)	-0.01130	________	0.01210
	10.0MHz	C.V.-32.0pF	________	C.V.+32.0pF
	(D)	-0.01210	________	0.01510
	Opt. freq. (Hz)	________	________	________
	(D)	________	________	________
	Opt. freq. (Hz)	________	________	________
4-17	RESISTANCE ACCURACY TEST			
	100Ω MULTIPLIER x1			
	10.0kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	20.0kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	40.0kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	100kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	200kHz	C.V.-0.230Ω	________	C.V.+0.230Ω
	400kHz	C.V.-0.230Ω	________	C.V.+0.230Ω
	1.00MHz	C.V.-0.230Ω	________	C.V.+0.230Ω
	2.00MHz	C.V.-0.550Ω	________	C.V.+0.550Ω
	4.00MHz	C.V.-2.070Ω	________	C.V.+2.070Ω
	10.0MHz	C.V.-2.070Ω	________	C.V.+2.070Ω
	Opt. freq. (Hz)	________	________	________
	Opt. freq. (Hz)	________	________	________
	100Ω MULTIPLIER x0.1			
	10.0kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	20.0kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	40.0kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	100kHz	C.V.-0.130Ω	________	C.V.+0.130Ω
	200kHz	C.V.-0.230Ω	________	C.V.+0.230Ω
	400kHz	C.V.-0.230Ω	________	C.V.+0.230Ω
	1.00MHz	C.V.-0.230Ω	________	C.V.+0.230Ω
	2.00MHz	C.V.-0.550Ω	________	C.V.+0.550Ω
	4.00MHz	C.V.-2.070Ω	________	C.V.+2.070Ω
	10.0MHz	C.V.-2.070Ω	________	C.V.+2.070Ω

C.V.= Calibrated Value

Paragraph Number	TEST	Results		
		Minimum	Actual	Maximum
4-17	1000Ω MULTIPLIER x1			
	10.0kHz	C.V.-4.0Ω		C.V.+4.0Ω
	20.0kHz	C.V.-4.0Ω		C.V.+4.0Ω
	40.0kHz	C.V.-4.0Ω		C.V.+4.0Ω
	100kHz	C.V.-4.0Ω		C.V.+4.0Ω
	200kHz	C.V.-5.0Ω		C.V.+5.0Ω
	400kHz	C.V.-5.0Ω		C.V.+5.0Ω
	1.00MHz	C.V.-5.0Ω		C.V.+5.0Ω
	2.00MHz	C.V.-12.0Ω		C.V.+12.0Ω
	4.00MHz	C.V.-33.0Ω		C.V.+33.0Ω
	10.0MHz	C.V.-33.0Ω		C.V.+33.0Ω
	Opt. freq. (Hz)			
	Opt. freq. (Hz)			
	1000Ω MULTIPLIER x0.1			
	10.0kHz	C.V.-4.0Ω		C.V.+4.0Ω
	20.0kHz	C.V.-4.0Ω		C.V.+4.0Ω
	40.0kHz	C.V.-4.0Ω		C.V.+4.0Ω
	100kHz	C.V.-4.0Ω		C.V.+4.0Ω
	200kHz	C.V.-5.0Ω		C.V.+5.0Ω
	400kHz	C.V.-5.0Ω		C.V.+5.0Ω
	1.00MHz	C.V.-5.0Ω		C.V.+5.0Ω
	2.00MHz	C.V.-12.0Ω		C.V.+12.0Ω
	4.00MHz	C.V.-33.0Ω		C.V.+33.0Ω
	10.0MHz	C.V.-33.0Ω		C.V.+33.0Ω
	Opt. freq. (Hz)			
	Opt. freq. (Hz)			
	10kΩ MULTIPLIER x1			
	10.0kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	20.0kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	40.0kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	100kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	200kHz	C.V.-0.050kΩ		C.V.+0.050kΩ
	400kHz	C.V.-0.050kΩ		C.V.+0.050kΩ
	1.00MHz	C.V.-0.050kΩ		C.V.+0.050kΩ
	Opt. freq. (Hz)			
	Opt. freq. (Hz)			
	10kΩ MULTIPLIER x0.1			
	10.0kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	20.0kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	40.0kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	100kHz	C.V.-0.040kΩ		C.V.+0.040kΩ
	200kHz	C.V.-0.050kΩ		C.V.+0.050kΩ
	400kHz	C.V.-0.050kΩ		C.V.+0.050kΩ
	1.00MHz	C.V.-0.050kΩ		C.V.+0.050kΩ
	Opt. freq. (Hz)			
	Opt. freq. (Hz)			

C.V.= Calibrated Value

Paragraph Number	TEST		Results	
		Minimum	Actual	Maximum
4-17	100kΩ MULTIPLIER x1			
	10.0kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	20.0kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	40.0kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	100kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	Opt. freq. (Hz)	______	______	______
	Opt. freq. (Hz)	______	______	______
	100kΩ MULTIPLIER x0.1			
	10.0kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	20.0kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	40.0kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	100kHz	C.V.-0.40kΩ	______	C.V.+0.40kΩ
	Opt. freq. (Hz)	______	______	______
	Opt. freq. (Hz)	______	______	______
4-21	FREQUENCY-PHASE ACCURACY TEST			
	1000mΩ 10.0kHz	-1.50mΩ	______	1.50mΩ
	20.0kHz	-1.50mΩ	______	1.50mΩ
	40.0kHz	-1.50mΩ	______	1.50mΩ
	100kHz	-1.69mΩ	______	1.69mΩ
	200kHz	-1.87mΩ	______	1.87mΩ
	400kHz	-2.25mΩ	______	2.25mΩ
	1.00MHz	-3.38mΩ	______	3.38mΩ
	10Ω 10.0kHz	-0.0130Ω	______	0.0130Ω
	20.0kHz	-0.0130Ω	______	0.0130Ω
	40.0kHz	-0.0130Ω	______	0.0130Ω
	100kHz	-0.0136Ω	______	0.0136Ω
	200kHz	-0.0142Ω	______	0.0142Ω
	400kHz	-0.0155Ω	______	0.0155Ω
	1.00MHz	-0.0193Ω	______	0.0193Ω
	2.00MHz	-0.0275Ω	______	0.0275Ω
	4.00MHz	-0.1400Ω	______	0.1400Ω
	10.0MHz	-0.1780Ω	______	0.1780Ω

C.V. = Calibrated Value

Paragraph Number	TEST	Results		
		Minimum	Actual	Maximum
4-23	INT DC BIAS SUPPLY TEST (OPTION 001 ONLY)			
	.000V	-.0020V	________	.0020V
	.002V	.0000V	________	.0040V
	.005V	.0030V	________	.0070V
	.010V	.0080V	________	.0120V
	.020V	.0179V	________	.0221V
	.050V	.0478V	________	.0522V
	.100V	.0975V	________	.1025V
	.200V	.1970V	________	.2030V
	.500V	.4955V	________	.5045V
	1.00V	.9910V	________	1.009V
	2.00V	1.986V	________	2.014V
	5.00V	4.972V	________	5.028V
	10.0V	9.930V	________	10.07V
	20.0V	19.88V	________	20.12V
	30.0V	29.82V	________	30.16V
4-25	INT DC BIAS SUPPLY TEST (OPTION 002 ONLY)			
	00.0V	-0.040V	________	0.040V
	00.2V	0.156V	________	0.244V
	00.5V	0.450V	________	0.550V
	01.0V	0.940V	________	1.060V
	02.0V	1.920V	________	2.08V
	05.0V	4.86V	________	5.14V
	10.0V	9.76V	________	10.24V
	20.0V	19.56V	________	20.44V
	50.0V	48.97V	________	51.03V
	90.0V	88.18V	________	91.82V

Table 5-0. Recommended Test Equipment.

Equipment	Critical Specifications	Recommended Model/Note	Use
Digital Voltmeter	Voltage range: 10mV to 100V f.s. Accuracy: 0.05% Input impedance: >10MΩ	HP 3465A/B	A T
Oscilloscope	Bandwidth: 100MHz Sensitivity: 5mV/div Dual channel input.	HP 1740A	A T
RF Voltmeter	Voltage range: 1mV to 3Vrms f.s. Bandwidth: 10KHz to 10MHz Accuracy	HP 3403C	A
Pulse Generator	Output: 5V p-p to 50Ω load. Pulsewidth: 100mS Duty: 50%	HP 8011A	A
Signature Analyzer		HP 5004A	T
Capacitance Standards	1pF ±0.03% 10pF ±0.03% 100pF ±0.03% 1000pF ±0.03%	HP 16381A HP 16382A HP 16383A HP 16384A	A
Resistance Standards	100Ω ±0.03% 1KΩ ±0.03% 10KΩ ±0.03% 100KΩ ±0.03% Open termination Short termination	HP 16074A Standard Resistor Set	A T
Bias Controller	(Option 001 or 002 only)	HP 16023B	A
Test Leads	Accessory test leads, 1m	HP 16048A	A
Bracket	(Accessory for HP 16048A)	1 ea.	A
DVM input cable	Dual banana-to-alligator clip cable	1 ea.	AT
Oscilloscope probe	10MΩ, 10:1	HP 10004D	AT
BNC cable	20cm or less	1 ea.	A
	10cm	4 ea.	A
50Ω Feed-through Termination		-hp- 11048C	A
BNC Tee Adapter	Female-to-female-to-male	-hp- 1250-0781	A
Reed relay	Drive voltage: 5V	-hp- 0490-0916	A
Resistor	500Ω 10% 5KΩ 10%	-hp- 0757-0416 -hp- 0757-0438	A
Extender board	-	-hp- 5060-4025	AT

A: Adjustment T: Troubleshooting

SECTION V
ADJUSTMENT

5-1. INTRODUCTION.

5-2. This section provides the information needed to adjust the 4275A to its specifications (listed in Table 1-1). The prime purpose of adjustment is to return the instrument to its peak operating capabilities after repairs have been made. Adjustment procedures can also be periodically performed to maintain top notch performance. Recommended adjustment cycle for the 4275A is once every six months. All adjustable components referred to in individual adjustments are summarized in Table 5-1. If proper performance cannot be achieved after adjustment procedure has been performed, refer to Section VIII Troubleshooting Procedures.

Note

Before proceeding to any adjustment, allow a warm up time of more than 30 minutes to stabilize operating conditions.

5-3. SAFETY REQUIREMENTS.

5-4. Although the instrument has been designed in accordance with international safety standards, this manual contains information, cautions and warnings which must be followed to ensure safe operation and to keep the instrument in safe condition. Adjustments described in this section should be performed only by qualified service personnel.

WARNING

ANY INTERRUPTION OF THE PROTECTIVE (GROUNDED) CONDUCTOR (INSIDE OR OUTSIDE OF THE INSTRUMENT) OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO MAKE THE INSTRUMENT DANGEROUS. INTENTIONAL INTERRUPTION IS PROHIBITED.

5-5. The opening of covers for removal of parts, except those to which access can be gained by hand, is likely to expose live parts.

5-6. Capacitors inside instrument may still be charged even if instrument has been disconnected from its source of supply.

WARNING

ADJUSTMENTS DESCRIBED HEREIN ARE PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT AFTER PROTECTIVE COVERS HAVE BEEN REMOVED. ENERGY EXISTING AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

5-7. EQUIPMENT REQUIRED.

5-8. The equipment needed to adjust the Model 4275A is listed in Table 5-0 (page 5-0). This equipment should always be calibrated to satisfy its own specifications and those of the required characteristics. If the recommended model is not available, any instrument that has specifications equal to or better than required specifications may be substituted.

5-9. FACTORY SELECTED COMPONENTS.

5-10. Factory selected components can be recognized by an asterisk adjacent to the reference designator on the schematic diagrams in Section VIII (nominal value is shown). Table 5-2 lists all factory selected components with their nominal value ranges and their influence on instrument performance.

Adjustable components, with reference designators are listed in Table 5-1. The table gives the name of the control to be adjusted and the purpose of its adjustment.

5-11. ADJUSTMENT RELATIONSHIPS.

5-12. The adjustment procedures, beginning with paragraph 5-18, should be performed in step sequence as they are interactive. Neglecting or changing procedures may make it impossible to obtain best 4275A performance. Table 5-3 shows necessary adjustment procedures to be used after repair to the instrument.

5-13. ADJUSTMENT LOCATIONS.

5-14. To help you to identify the appropriate adjustment points, the locations of the components to be adjusted are illustrated throughout the adjustment procedures. The locations of the factory selected components, connectors and other components related to the adjustments are shown in the individual board assembly component illustrations (fold-out service sheet).

Table 5-1. Adjustable Components.

Reference Designator	Name of Control	Purpose
A1C5 C19 (Para 5-40)		To properly compensate for range resistor signal phase shift due to residual reactive factors in the range resistor input/output circuits (at 4MHz and 10MHz test frequencies).
A1C20 C21 C22 C23 (Para 5-36)		To compensate for stray capacitances in the range resistor circuit and to eliminate measurement errors due to range resistor current phase shift.
A1R1 R2 (Para 5-40)		To properly compensate for range resistor signal amplitude error due to residual resistive factors in the range resistor input/output circuits (at 4MHz and 10MHz test frequencies).
A1R3 (Para 5-34) (Para 5-38)		To properly compensate for residual impedances in range resistor input/output circuits.
A1R28 R29 R30 R31 (Para 5-36)		To set range resistor values for maximizing measurement accuracy on each measurement range.
A2C8 C9 C13 C14 (Para 5-26)	Q1 ADJ Q2 ADJ Q3 ADJ Q4 ADJ	To optimize bridge balance settling time.
A2R13 R14 (Para 5-26)	OS1 ADJ OS2 ADJ	To eliminate phase errors from modulator circuit and to optimize bridge circuit balance condition.
A2R92 (Para 5-32)	LEVEL ADJ	To set sensitivity of test signal level monitor circuitry and to maximize monitor display accuracy.
A3C13 (Para 5-24)		To equalize test signal level for all test signal frequencies.
A3R1 (Para 5-22) (Para 5-32)		To set maximum test signal level (1V) applicable to samples.

Table 5-1. Adjustable Components (Cont'd).

Reference Designator	Name of Control	Purpose
A3R9 (Para 5-22)		To set test signal level variable range as well as to calibrate level control dial.
A4A1C3 (Para 5-28)	PHASE	To equalize phase characteristics for the two channel amplifiers in process amplifier input stages and to maximize accuracy at higher test frequencies.
A4A1R1 (Para 5-20)	TRACKING	To eliminate a dc offset voltage from process amplifier.
A4A1R8 (Para 5-28)	AMP	To set process amplifier gain for maximizing measurement accuracy.
A4A2R1 (Para 5-20)	TRACKING	To eliminate dc offset voltage from process amplifier.
A4A3C3 R10 (Para 5-30)	PHASE AMP	To eliminate both attenuation errors and phase shift from process amplifier gain attenuator circuits and to maximize accuracy of measurement for each test signal level MULTIPLIER setting (x1, x0.1 and x0.01).
A4A4C3 R2 (Para 5-30)	PHASE AMP	
A5C15 (Para 5-30)	1/4 ϕ ADJ	To eliminate both attenuation errors and phase shift from A-D converter input attenuator circuits and to maximize measurement accuracy for each test signal level MULTIPLIER setting (x1, x0.1 and x0.01).
A5R4 R11 (Para 5-30)	1/2 ϕ ADJ 1/2 AMP ADJ	
A5R16 (Para 5-30)	1/4 AMP ADJ	
A5R120 (Para 5-18)	REF ADJ	To maximize conversion accuracy of A-D converter circuit.
A11R3 (Para 5-16)	STD ADJ	To set dc power supply output voltages.

Table 5-2. Factory Selected Components.

<table>
<tr><th>Component</th><th>Nominal Value Range</th><th>Effect on Performance</th></tr>
<tr><td>A1C24
C25</td><td>HP P/N 0160-2236 C:FXD 1.0pF
HP P/N 0160-2241 C:FXD 2.2pF
HP P/N 0150-0059 C:FXD 3.3pF
* HP/P/N 0160-2248 C:FXD 4.3pF
HP P/N 0160-2251 C:FXD 5.6pF
HP P/N 0160-2253 C:FXD 6.8pF
HP P/N 0160-2255 C:FXD 8.2pF
HP P/N 0160-2257 C:FXD 10.0pF</td><td>Changes phase compensation adjustment range for 100Ω range resistor.</td></tr>
<tr><td>A1C26</td><td>HP P/N 0160-2239 C:FXD 1.8pF
HP P/N 0160-2243 C:FXD 2.7pF
HP P/N 0160-2247 C:FXD 3.9pF
* HP P/N 0160-2250 C:FXD 5.1pF
HP P/N 0160-2252 C:FXD 6.2pF
HP P/N 0160-2254 C:FXD 7.5pF
HP P/N 0160-2255 C:FXD 8.2pF
HP P/N 0160-2257 C:FXD 10.0pF</td><td>Changes phase compensation adjustment range for 1000Ω range resistor.</td></tr>
<tr><td>A1C27</td><td>HP P/N 0160-2239 C:FXD 1.8pF
HP P/N 0160-2243 C:FXD 2.7pF
HP P/N 0160-2247 C:FXD 3.9pF
HP P/N 0160-2250 C:FXD 5.1pF
HP P/N 0160-2252 C:FXD 6.2pF
* HP P/N 0160-2254 C:FXD 7.5pF
HP P/N 0160-2255 C:FXD 8.2pF
HP P/N 0160-2256 C:FXD 9.1pF
HP P/N 0160-2257 C:FXD 10.0pF</td><td>Changes phase compensation adjustment range for 10kΩ range resistor.</td></tr>
<tr><td>A1C28</td><td>HP P/N 0140-0190 C:FXD 39.0pF
HP P/N 0160-2200 C:FXD 43.0pF
HP P/N 0160-2201 C:FXD 51.0pF
* HP P/N 0140-0205 C:FXD 62.0pF
HP P/N 0160-2202 C:FXD 75.0pF
HP P/N 0140-0193 C:FXD 82.0pF</td><td>Changes range resistor phase compensation adjustment range for 10MHz test signal frequency.</td></tr>
<tr><td>A1R4</td><td>HP P/N 0698-3132 R:FXD 261.0Ω
HP P/N 0698-3443 R:FXD 287.0Ω
* HP P/N 0698-3444 R:FXD 316.0Ω</td><td>Changes compensation adjustment range for display offset error count due to residual impedances in range resistor signal circuit.</td></tr>
<tr><td>A3C6
C21</td><td>HP P/N 0160-2256 C:FXD 9.1pF
HP P/N 0160-2257 C:FXD 10.0pF
* HP P/N 0160-2258 C:FXD 11.0pF
HP P/N 0160-2259 C:FXD 12.0pF
HP P/N 0160-2260 C:FXD 13.0pF</td><td rowspan="2">Changes magnitude of frequency compensation value in test signal level attenuation circuitry (which responds to MULTIPLIER function setting).</td></tr>
<tr><td>A3C20
C22</td><td>HP P/N 0160-2206 C:FXD 160.0pF
HP P/N 0140-0197 C:FXD 180.0pF
HP P/N 0140-0198 C:FXD 200.0pF
* HP P/N 0160-0134 C:FXD 220.0pF
HP P/N 0140-0199 C:FXD 240.0pF
HP P/N 0140-0210 C:FXD 270.0pF
HP P/N 0160-2207 C:FXD 300.0pF</td></tr>
</table>

Figure 5-2. Factory Selected Components (Cont'd).

Component	Nominal Value Range	Effect on Performance
A3C76	HP P/N 0160-2205 C:FXD 120.0pF * HP P/N 0160-2206 C:FXD 160.0pF HP P/N 0140-0197 C:FXD 180.0pF HP P/N 0140-0198 C:FXD 220.0pF	Changes sensitivity of test signal level monitor display at high frequencies.
A4A2C3	HP P/N 0160-2236 C:FXD 1.0pF HP P/N 0160-2239 C:FXD 1.8pF HP P/N 0160-2243 C:FXD 2.7pF * HP P/N 0160-2246 C:FXD 3.6pF HP P/N 0160-2248 C:FXD 4.3pF HP P/N 0160-2249 C:FXD 4.7pF	Changes process amplifier frequency response adjustment range.
A5C70	None HP P/N 0160-2201 C:FXD 51.0pF HP P/N 0160-2204 C:FXD 100.0pF HP P/N 0140-0196 C:FXD 150.0pF HP P/N 0140-0198 C:FXD 200.0pF HP P/N 0140-0199 C:FXD 240.0pF HP P/N 0160-2207 C:FXD 300.0pF HP P/N 0160-2209 C:FXD 360.0pF HP P/N 0160-0939 C:FXD 430.0pF HP P/N 0160-2210 C:FXD 470.0pF	Eliminates display count errors due to A-D converter output zero offset.

Note: Component marked (*) in table is usually used.

INITIAL OPERATING PROCEDURE.

Preparatory to adjusting the 4275A, do the following to locate and to gain access to the adjustment controls (this procedure facilitates a thoroughgoing adjustment):

[FUNDAMENTAL OPERATING CHECKS]

Confirm that instrument power line selector switches are set for local power line voltage. Program Memory Test described on page 3-1 and the SELF TEST procedure in Figure 3-0 on page 3-0 should be completely performed and successfully passed before progressing to adjustment procedure.

[TOP COVER REMOVAL]

Remove top cover as follows:

a. Loosen the retaining screw at rear of top cover.

b. Pull top cover towards the rear and lift off.

WARNING

TO INSURE PERSONAL SAFETY FROM POSSIBLE ELECTRICAL SHOCK HAZARDS AND RESULTANT INJURY, USE INSULATED ADJUSTMENT TOOL.

Table 5-3. Adjustment Requirements.

Assembly repaired or replaced	Required adjustment(s)
A1 04275-66501 (Range Resistor & Null Detector)	Para. 5-33, 5-35, 5-37, 5-39.
A2 04275-66502 (Modulator)	Para. 5-25, 5-31.
A3 04275-66503 (Power Amplifier)	Para. 5-21, 5-23, 5-31.
A4 04275-66504 (Process Amplifier)	Para. 5-19, 5-27, 5-29.
A5 04275-66505 (A-D Converter)	Para. 5-17, 5-29.
A6 04275-66506 (Oscillator)	None.
A7 04275-66507 A8 04274-66508 A9 04275-66513 A10 04275-66520	None.
A11 04274-66511 (Power Supply)	Para. 5-15.
A21 04274-66521 (Opt. 001 DC Bias)	Para. 5-41.
A22 04274-66522	None.
A23 04274-66523 (Opt. 002 DC Bias)	Para. 5-42.

5-15. DC POWER SUPPLY VOLTAGE ADJUSTMENT (A11).

5-16. This adjustment sets internal dc power supply output voltages to their nominal values to ensure that the instrument functions under proper operating voltages.

EQUIPMENT:

Digital Voltmeter .... HP 3465 A/B
Voltmeter input cable .... Dual banana to dual alligator clip cable

PROCEDURE:

1. Connect Digital Voltmeter input to TP1 (+12V) on 4275A A11 Power Supply board.

2. Set DVM range as appropriate to measure 12V and read the display output.

3. Adjust potentiometer A11R3 (STD ADJ) so that the display readout is within 11.76V to 12.12V.

4. Check voltages at A11TP5, TP10 and TP17. DVM display readouts should satisfy the test limits given in Table 5-4. If any check fails, re-adjust A11R3.

Table 5-4. DC Power Supply Voltage Test Limits.

Test Point	Test limits
TP 1	11.76 to 12.12V
TP 5	-11.79 to -12.15V
TP10	- 4.89 to - 5.04V
TP17	4.81 to 4.96V

5-17. A-D CONVERTER ACCURACY ADJUSTMENT (A5).

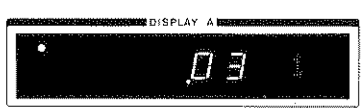
5-18. This adjustment equalizes the (absolute) values of both positive and negative reference voltages used in the A-D converter and optimizes A-D conversion accuracy.

EQUIPMENT:

No test equipment is required for this adjustment.

PROCEDURE:

1. Press SELF TEST key. Verify that the key indicator lamp lights. Next, press DISPLAY B "D" function key. Test step item number "1" is displayed in DISPLAY A unit indicator as shown below.



2. Set test frequency to 100kHz by pressing FREQUENCY STEP DOWN or UP key.

3. Check that DISPLAY A readout is .00 within ±3 counts.

Note

If the display readout exceeds the above test limits, change capacitance value of A5*C70. Increasing the capacitance value by 30pF decreases the display by 1 count. Selectable capacitance value range is 500pF maximum.

4. Adjust potentiometer A5R120 (DC ref ADJ) so that DISPLAY B display output is .00 within ±10 counts. See page 5-19 for the location of R120.

Troubleshooting hints

If the A5R120 adjustment can not be achieved, an excessive dc offset voltage of A5U16 or a failure in A5U11 circuitry is a probable cause of the trouble. Relative difference in resistance values of A5R116 and R117 is also one of the possibilities.

5-19. PROCESS AMPLIFIER DC OFFSET ADJUSTMENT (A4).

5-20. This adjustment eliminates any residual dc offset voltage from A4 Process Amplifier and maximizes accuracy of measurement.

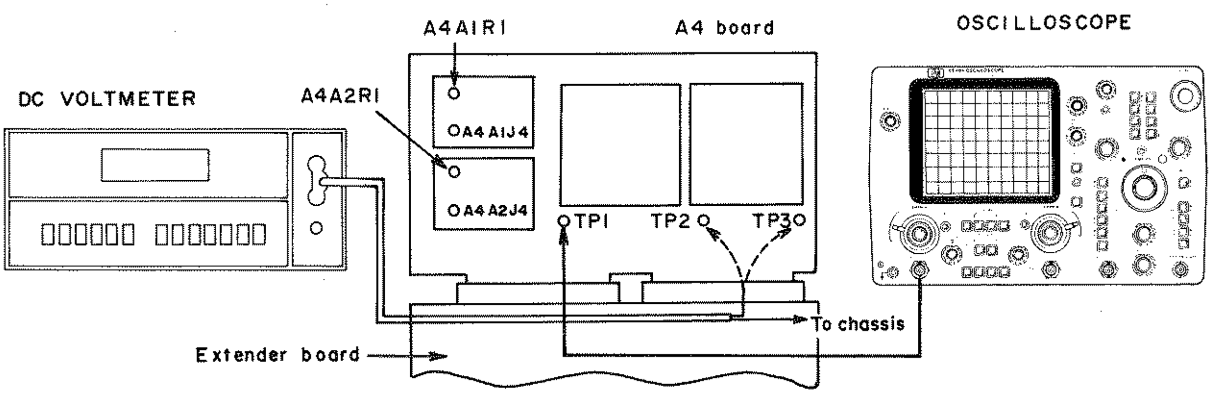


Figure 5-1. Process Amplifier DC Offset Adjustment Setup.

EQUIPMENT:

Digital Voltmeter .... HP 3465 A/B
Voltmeter input cable .... Dual banana to dual alligator clip cable
Oscilloscope .... HP 1740A
Probe (10MΩ, 10:1) .... HP 10004D

Note

Use extender board (HP Part No: 5060-4025) to gain access to test points and adjustment components on A4 board.

PROCEDURE:

1. Disconnect the two coaxial cable SMB connectors from A4A1J4 (ERR BLK) and A4A2J4 (EDUT WHT).

2. Connect Digital Voltmeter input to 4275A A4 Process Amplifier board TP2 (-10). Voltmeter display readout should be -10.3V dc within ±0.5V.

3. Connect voltmeter input to A4TP3 (+10). Verify that voltmeter readout is 10.3V within ±0.5V.

4. Remove voltmeter input cable.

5. Set oscilloscope controls as follows:

   Vertical sensitivity 5mV/div
   Sweep time 10ms/div

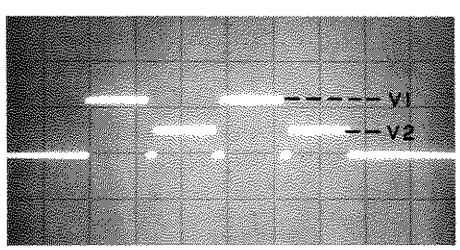
   Center baseline with vertical position adjustment control. Externally trigger the oscilloscope from A5TP2.

6. Set 4275A controls as follows:

   SELF TEST .... on
   MULTIPLIER X1
   OSC LEVEL .... fully cw
   Test signal frequency 100kHz

   Press REF VALUE STORE key (to select self test step 20, 21, 22, 31, 41 or 51). Now select test step 31 by repeatedly pressing LCRZ RANGE DOWN or UP key (as necessary). The selected test step number is displayed in DISPLAY B unit indicator as shown below:

7. Connect oscilloscope input probe (10:1) to A4TP1. The waveform observed on the oscilloscope will probably be quite similar to that shown in Figure 5-2 below.



The waveform varies depending on amount of the adjustment error and type of misadjustment.

Figure 5-2. Waveform at A4TP1.

8. Individually adjust potentiometers *A4A1R1 and *A4A2R1 so that peak voltages of both V1 and V2 are 0V within ±20mV peak (2 minor scale divisions).

*Note

These potentiometers are accessible through an adjustment hole in the shield cover of each sub-board.

Troubleshooting hints

If either A4A1R1 or A4A2R1 adjustment can not be achieved, excessive pinch-off current in A4A1Q1 or A4A2Q1 is a probable cause of the trouble. These transistors should be selected in terms of their current characteristics.

9. Reconnect coaxial cable SMB connectors to A4A1J4 and A4A2J4.

5-21. TEST SIGNAL LEVEL ADJUSTMENT (A3).

5-22. This adjustment properly sets test signal level variable range and calibrates front panel level control dial (dial accuracy is unspecified).

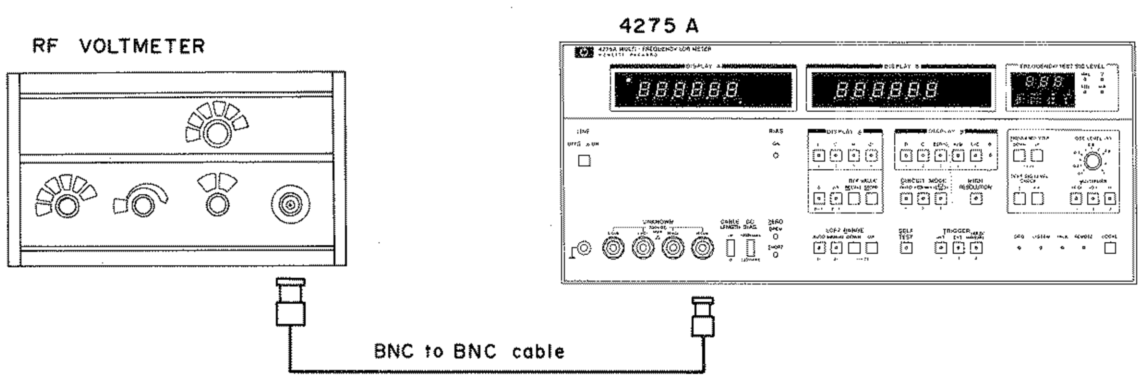


Figure 5-3. Test Signal Level Adjustment Setup.

EQUIPMENT:

RF Voltmeter .... HP 3403C or HP 400E
Voltmeter input cable .... BNC to BNC cable

PROCEDURE:

1. Connect a BNC to BNC cable between RF voltmeter input and 4275A UNKNOWN H_{CUR} terminal.

2. Set RF voltmeter range to 1V f.s.

3. Set 4275A test signal as follows:

    Test signal frequency 100kHz
    MULTIPLIER X1
    OSC LEVEL .... fully cw

4. Read voltmeter indication and note its value.

    Voltmeter reading __________ mV rms

5. Set 4275A OSC LEVEL control to 0.1 and RF voltmeter range to 0.1V f.s.

6. Adjust potentiometer A3R9 so that voltmeter readout is 1/10 of the voltage value noted in step 4 (within ±1mV rms).

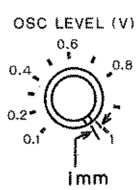
7. Set 4275A MULTIPLIER to x1 and RF voltmeter range to 1V f.s.

8. Set 4275A OSC LEVEL control knob to its 1V dial scale point on the front panel.

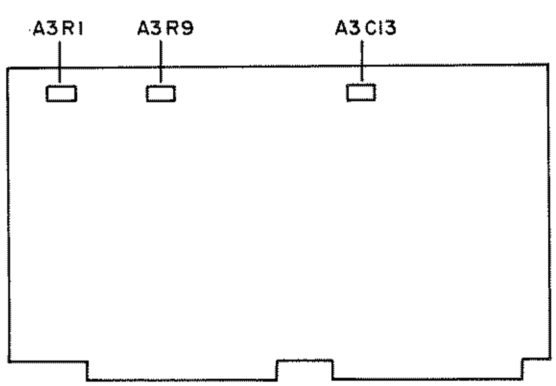
9. Adjust A3R1 so that voltmeter readout is 1.00V rms ±0.01V.

Note

If OSC LEVEL control knob has been mechanically shifted from its normal position, restore as follows:



1. Rotate the knob fully cw.
2. Loosen knob retaining screws (two) and set the knob as illustrated at left.
3. Fasten the knob at this position.



A3 Board Adjustment Locations.

5-23. TEST SIGNAL LEVEL FLATNESS ADJUSTMENT (A3).

5-24. This adjustment equalizes test signal level for all selectable test frequency points.

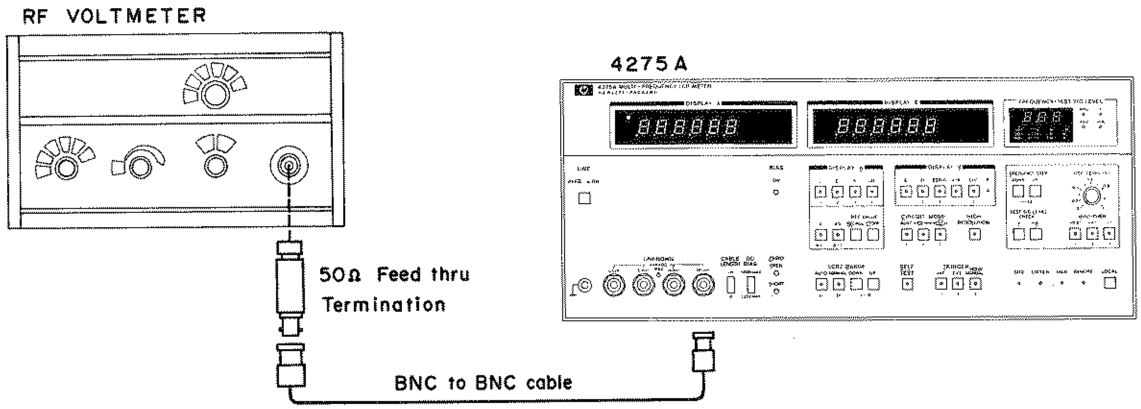


Figure 5-4. Test Signal Level Flatness Adjustment Setup.

EQUIPMENT:

RF Voltmeter	HP 3403C or HP 400E
50Ω feed-through termination	-hp- 11048C
Voltmeter input cable	BNC to BNC cable (20cm or less)

PROCEDURE:

1. Connect a 50Ω feed through termination between 4275A UNKNOWN H_{CUR} terminal and RF voltmeter input using a BNC to BNC cable. See Figure 5-4.

2. Set 4275A controls as follows:

   Test frequency 100kHz
   MULTIPLIER x1
   OSC LEVEL .... fully cw

3. Set RF voltmeter range to 1V f.s.

4. Read voltmeter indication and note its value.

   Voltmeter reading ___________ mV rms.

5. Set 4275A test signal frequency to 10MHz.

6. Adjust trimmer capacitor A3C13 so that voltmeter readout is identical to the value noted in step 4 (within ±10mV rms).

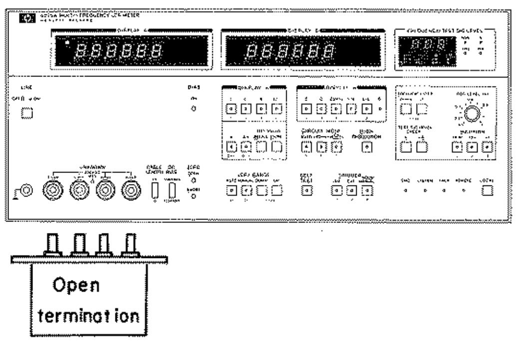
5-25. BRIDGE BALANCE ADJUSTMENT (A2).

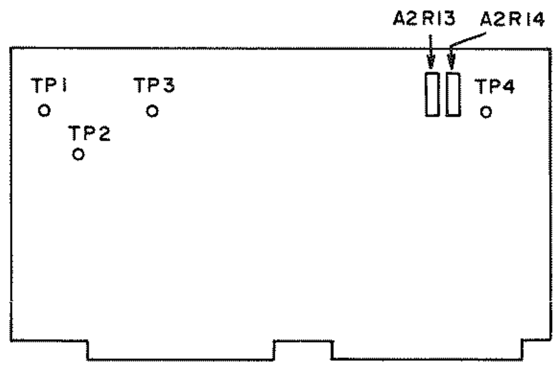
5-26. The bridge balance adjustment is comprised of two independent adjustments for bringing measurement bridge circuit into the optimum balance condition and for maximizing accuracy of measurement. The adjustments included are:

1) Bridge zero offset adjustment.
2) Balance control phase tracking adjustment.

1. Bridge zero offset adjustment (preliminary).

This adjustment is a preliminary operation to facilitate optimizing the bridge zero offset adjustment. By appropriately performing the zero offset adjustment, any balance control phase error which could cause a slight bridge unbalance with a resultant offset count error in the measurement display output to occur is minimized. Final adjustment should be done after the phase tracking adjustment is completed.





A2 Board Adjustment Locations.

Figure 5-5. Bridge Zero Offset Adjustment Setup.

EQUIPMENT:

Open termination .... HP 16074A Standard Resistor Set

Note

If the 16074A Standard Resistor Set is unavailable, use two BNC cables (10cm long).

PROCEDURE:

1. Set 4275A CABLE LENGTH switch to "0" position.

2. Connect "Open" termination (of the HP 16074A Standard Resistor Set) direct to 4275A UNKNOWN terminals.

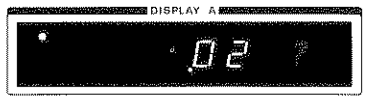
Note

Otherwise, connect H_{CUR} and H_{POT} terminals together with a short BNC cable. Similarly connect L_{CUR} and L_{POT} terminals together.

3. Set 4275A controls as follows:

DISPLAY A function	R
Test signal frequency	100kHz
MULTIPLIER	x1
OSC LEVEL	fully cw
SELF TEST	on

4. Press Δ% key to select self test step "7". Test step number "7" is displayed in DISPLAY A unit indicator as illustrated below:



5. Adjust A2R13 (OS1 ADJ) so that DISPLAY A readout is .00±30 counts.

6. Adjust A2R14 for (OS2 ADJ) for .00±30 counts on DISPLAY B.

7. Since the A2R13 and R14 adjustments interact, alternately perform steps 5 and 6 until both DISPLAY A and DISPLAY B readouts meet the allowable range limits.

8. Set test signal frequency to 4MHz and verify that both DISPLAY A and DISPLAY B display outputs are .00 within ±30 counts. If either of the display outputs exceeds the test limits, repeat steps 5 and 6.

Troubleshooting hints

If either A2R13 or A2R14 adjustment can not be achieved, an excessive output offset voltage in A2U3 or A2U4 is a probable cause of the trouble.

2. Balance control phase tracking adjustment.

This adjustment optimizes the bridge circuit balance settling time (when a sample device is connected to the UNKNOWN terminals).

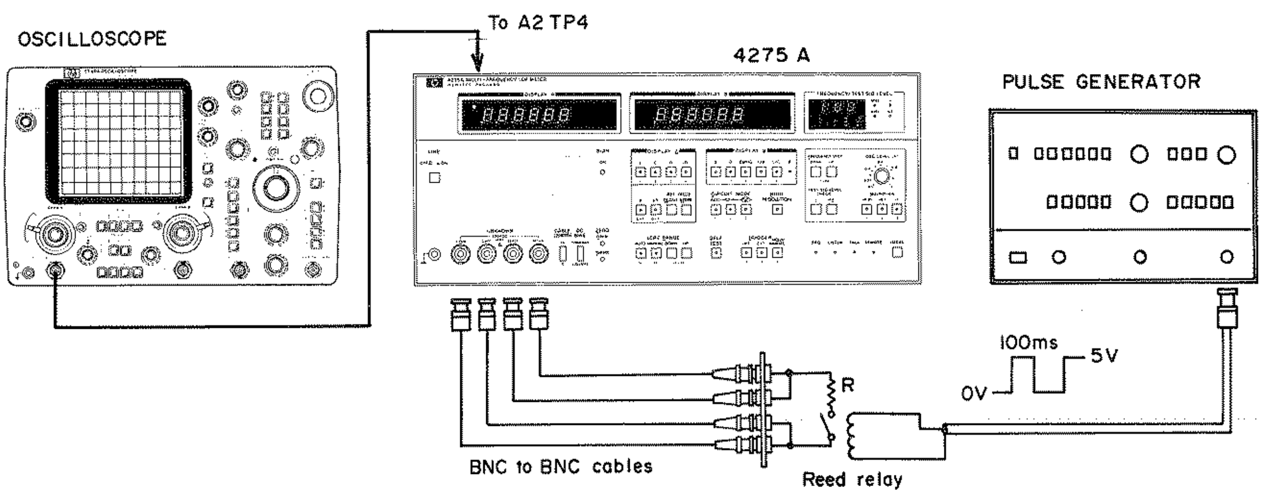


Figure 5-6. Balance Control Phase Tracking Adjustment Setup.

ADJUSTMENTS

EQUIPMENT:

OSCILLOSCOPE	HP 1740A
Probe (10MΩ, 10:1)	HP 10004D
Pulse Generator	HP 8011A
Cable	BNC to BNC Cable (10cm long, 4ea. required)
	BNC cable
Reed relay (5V)	-hp- 0490-0916 or equivalent
Resistor: 500Ω	-hp- 0757-0416 (511Ω)
5kΩ	-hp- 0757-0438 (5.11kΩ)
Bracket	HP 16048A accessory

PROCEDURE:

1. Connect test equipment as illustrated in Figure 5-6.

Note

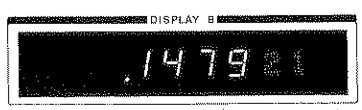
Connect a short lead (0Ω) instead of resistor R shown in the figure.

2. Set 4275A controls as follows:

DISPLAY A function	R
Test frequency	10MHz
MULTIPLIER	x1
OSC LEVEL	fully cw
SELF TEST	on
CABLE LENGTH	0

3. Press REF VALUE STORE key.

4. Press 4275A LCRZ RANGE UP and DOWN key until self test step "21" is selected. The selected test step number is displayed in DISPLAY B unit indicator as shown below:



(Ω unit is displayed in DISPLAY A.)

5. Set pulse generator output for a 5V peak (0V⎍5V) squarewave with a periodic rate of 200ms.

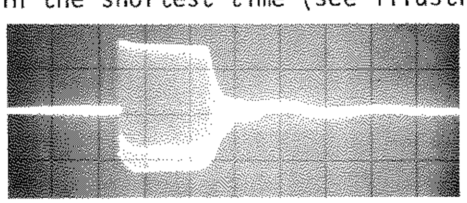
6. Set oscilloscope controls as follows:

Vertical sensitivity	0.2V/div
Sweep time	1ms/div

Trigger the oscilloscope externally from pulse generator.

7. Connect oscilloscope to A2TP4 to observe waveform.

8. Adjust trimmer capacitors A2C8 and C13 so that damped vibration waveform at A2TP4 decays in the shortest time (see illustration below).



Since the A2C8 and C13 adjustments interact, alternately repeat the adjustments several times.

9. Change 4275A test signal frequency, in turn, to 4MHz, 2MHz and to 1MHz. Verify that transient time T of the damped vibration waveform at each test frequency is shorter than that at 10MHz test frequency.

10. Connect a 500Ω resistor in series with the reed relay contacts (see Figure 5-5).

11. Press 4275A LCRZ RANGE UP and DOWN key until self test step "20" is selected.

12. Check that the transient time T of the waveform at A2TP4 is within 20ms at 10MHz, 4MHz, 2MHz and 1MHz test frequencies.

13. Connect a 5kΩ resistor in place of the 500Ω resistor.

14. Press 4275A LCRZ RANGE UP and DOWN key until self test step "31" is selected. Set test signal frequency to 10MHz.

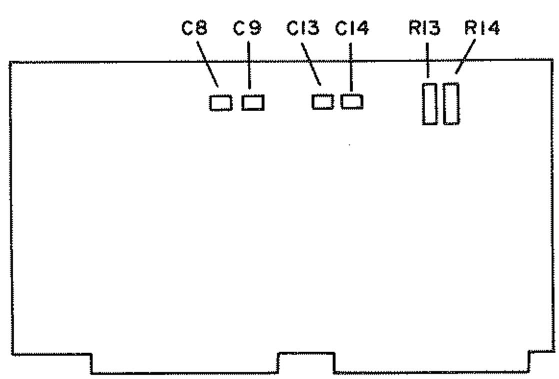
15. Adjust trimmer capacitors A2C9 and C14 so that the transient time T of the waveform at A2TP4 is as short as possible.

16. Check that the transient time T is within 20ms at 4MHz, 2MHz and 1MHz test frequencies.

3. Bridge zero offset adjustment (final adjustment).

1. Perform preliminary adjustment procedure steps 1, 2 and 3.

2. Alternately adjust A2R13 and R14 so that both DISPLAY A and DISPLAY B readouts are .00 within ±30 counts.



A2 Board Adjustment Locations.

5-27. PROCESS AMPLIFIER GAIN ADJUSTMENT (A4).

5-28. This adjustment eliminates any amplification factor errors from A4 Process Amplifier so that bridge circuit vector signal voltages are exactly detected thus maximizing accuracy of measurement.

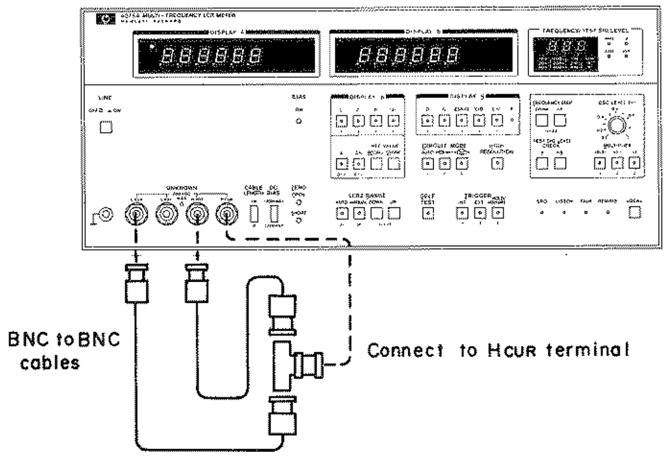


Figure 5-7. Process Amplifier Gain Adjustment Setup.

EQUIPMENT:

Connection cable (10cm long) .... BNC to BNC cable 2ea. required

BNC Tee adapter .... -hp- 1250-0781

Note

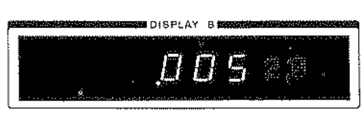
The relative difference in cable length of the two BNC cables used must be within ±0.3cm.

PROCEDURE:

1. Connect BNC cables and a BNC Tee adapter as illustrated in Figure 5-7.
2. Disconnect coaxial cable connector from A1J2 (Lc) and connect it to A4A1J4 in place of the normal cable connector.
3. Set 4275A controls as follows:

   DISPLAY A function .... R
   Test signal frequency............. 100kHz
   MULTIPLIER x1
   OSC LEVEL .... fully cw
   SELF TEST .... on

4. Press REF VALUE STORE key.
5. Press LCRZ RANGE UP and DOWN key until self test step "20" is selected and is displayed in DISPLAY B unit indicator as shown below:



6. Adjust potentiometer A4A1R8 so that DISPLAY A display output is -100000 within ±20 counts.

7. Set test signal frequency to 10MHz.

8. Adjust trimmer capacitor A4A1C3 so that DISPLAY B display output is .000 within ±20 counts.

Note

Check that DISPLAY A readout is within 100000±300 counts (after doing the A4A1C3 adjustment).

9. Reconnect the cables shifted in step 2 to their normal connection points.

Troubleshooting hints

If the A4A1C3 adjustment can not be achieved, change value of A4A2C3 (normally 3.6pF) to a value calculated from the DISPLAY B offset count by using the equation below:

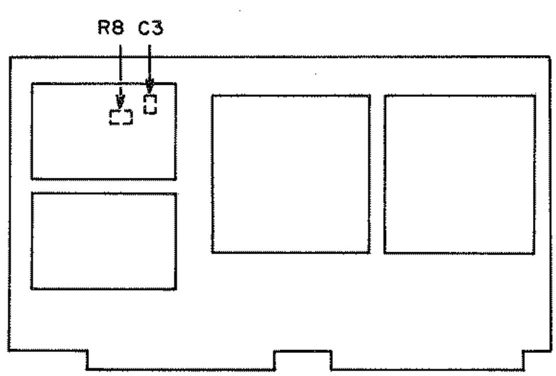
A4A1C3 is in its fully ccw position --

$$\text{Value of A4A2C3} = \left(5.6 + \frac{\text{Offset count}}{135}\right) \text{pF}$$

A4A1C3 is in its fully cw position --

$$\text{Value of A4A2C3} = \left(1.6 - \frac{\text{Offset count}}{135}\right) \text{pF}$$

C3 selectable value range is 0pF to 8pF.

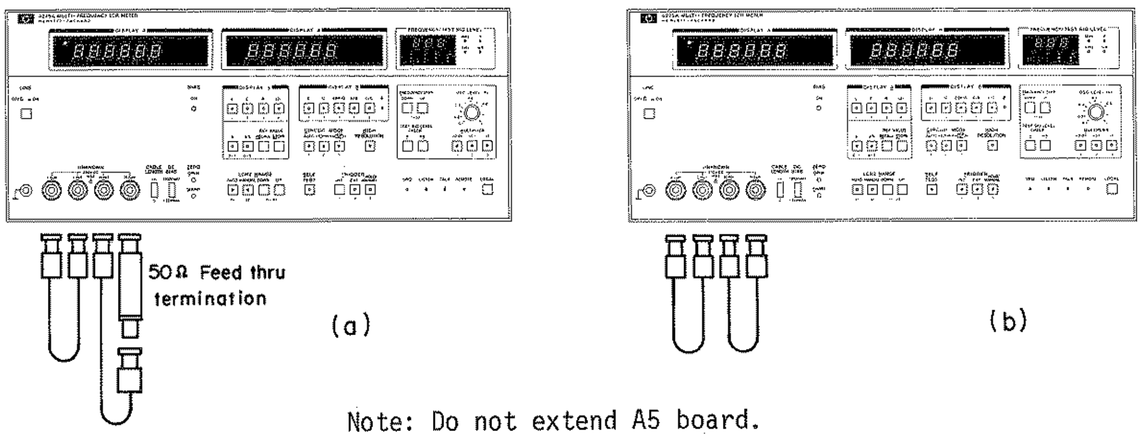


A4 Board Adjustment Locations.

5-29. ATTENUATOR ADJUSTMENT (A5, A4).

5-30. This adjustment eliminates errors in the attenuation circuit attenuation ratios from A5 A-D Converter input circuit for maximizing accuracy of measurement for each test signal level setting. This adjustment consists of four adjustment steps, which are:

1) 1/2 attenuator adjustment (A5)
2) 1/4 attenuator adjustment (A5)
3) 1/10 attenuator adjustment (A4)
4) 1/100 attenuator adjustment (A4)



Note: Do not extend A5 board.

Figure 5-8. Attenuator Adjustment Setup.

EQUIPMENT:

50Ω feed-through termination .... -hp- 11048C
Connection cable (10cm long) .... BNC to BNC cables
2ea. required

PROCEDURE:

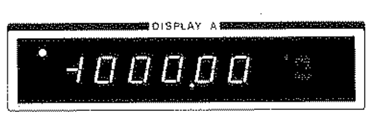
1) 1/2 attenuator adjustment.

1. Connect a 50Ω feed-through termination and two BNC cables to 4275A UNKNOWN terminals as shown in Figure 5-8 (a).

2. Set 4275A controls as follows:

Test signal frequency 100kHz
MULTIPLIER x1
OSC LEVEL .... fully cw
CABLE LENGTH 0
SELF TEST .... on

3. Press DISPLAY B function Q button to select self test step "2". The test step number "2" is displayed in DISPLAY A unit indicator as shown below:



4. Adjust potentiometer A5R11 so that DISPLAY A display output is -100000 within ±10 counts.

5. Set test signal frequency to 10MHz.

6. Adjust potentiometer A5R4 (1/2ϕ ADJ) so that DISPLAY B display output is .00 within ±20 counts.

Note

Check that DISPLAY A display output is -100000 within ±600 counts after doing the A5R4 adjustment.

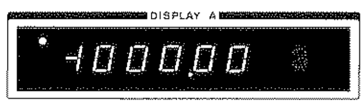
2) 1/4 attenuator adjustment.

1. Remove 50Ω feed-through termination and connect BNC cable between UNKNOWN H_{CUR} and H_{POT} terminals. See Figure 5-8 (b).

2. Set 4275A controls as follows:

Test signal frequency 100kHz
MULTIPLIER x1
OSC LEVEL .... fully cw
SELF TEST .... on

3. Press DISPLAY B function ESR/G key to select self test step "3". DISPLAY A unit indicator displays the number "3" as shown below.



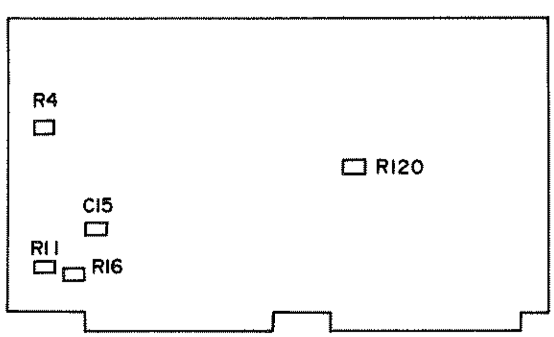
4. Adjust potentiometer A5R16 so that DISPLAY A display readout is -100000 within ±10 counts.

5. Set test signal frequency to 10MHz.

6. Adjust trimmer capacitor A5C15 (1/4 ϕ ADJ) so that DISPLAY B display output is .00 within ±20 counts.

Note

Check that DISPLAY A display output is -100000 within ±600 counts (after doing the A5C15 adjustment.



A5 Board Adjustment Locations.

3) 1/10 attenuator adjustment.

1. Connect BNC cables to UNKNOWN terminals as shown in Figure 5-8 (b).

2. Set 4275A controls as follows:

Test signal frequency	100kHz
MULTIPLIER	x0.1
OSC LEVEL	fully cw
SELF TEST	on

3. Press DISPLAY B function X/B key to select self test step "4". DISPLAY A unit indicator displays the number "4" as shown below.

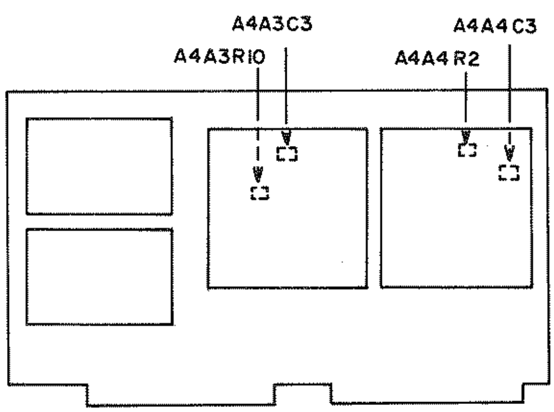
4. Adjust potentiometer A4A3R10 so that DISPLAY A display output is -100000 within ±10 counts.

5. Set test signal frequency to 10MHz.

6. Adjust trimmer capacitor A4A3C3 so that DISPLAY B display output is .00 within ±40 counts.

Note

Check that DISPLAY A display output is -100000 within ±800 counts (after doing the A4A3C3 adjustment).



A4 Board Adjustment Locations.

4) 1/100 attenuator adjustment.

1. Connect BNC cables to UNKNOWN terminals as shown in Figure 5-8 (b).

2. Set 4275A controls as follows:

   Test signal frequency 100kHz
   MULTIPLIER x0.01
   OSC LEVEL .... fully cw
   SELF TEST .... on

3. Press DISPLAY B function L/C key to select self test step "5". DISPLAY A unit indicator displays the number "5" as shown below:

4. Adjust potentiometer A4A4R2 so that DISPLAY A display output is -100000 within ±10 counts.

5. Set test signal frequency to 10MHz.

6. Adjust trimmer capacitor A4A4C3 so that DISPLAY B display output is .00 within ±40 counts.

Note

Check that DISPLAY A display output is -100000 within ±800 counts (after doing the A4A4C3 adjustment).

5-31. TEST SIG LEVEL CHECK ACCURACY ADJUSTMENT (A3, A2).

5-32. This adjustment appropriately adjusts the test signal level monitor circuit for appropriate sensitivity and frequency flatness to maximize the accuracy of test signal level display (FREQUENCY/TEST SIG LEVEL display) for all test signal level and frequency settings.

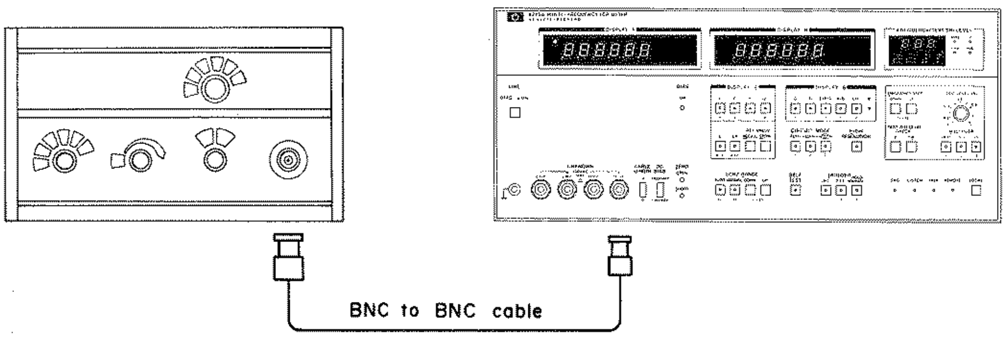


Figure 5-9. Test Signal Level Check Accuracy Adjustment Setup.

EQUIPMENT:

RF Voltmeter .... HP 3403C or HP 400E
Voltmeter input cable .... BNC to BNC cable
Open termination .... HP 16074 Standard Resistor Set

Note

If the 16074A Standard Resistor Set is unavailable, use two BNC cables (10cm long).

PROCEDURE:

1. Connect "Open" termination (of the HP 16074A Standard Resistor Set) to 4275A UNKNOWN terminals.

Note

Otherwise, connect H_{CUR} and H_{POT} terminals together with a short BNC cable. Similarly connect L_{CUR} and L_{POT} terminals.

2. Set 4275A controls as follows:

DISPLAY A function C
DISPLAY B function .... ESR/G
Test signal frequency 100kHz
MULTIPLIER x1
OSC LEVEL 1
LCRZ RANGE .... AUTO

Note

Set OSC LEVEL control knob to its "1" dial position (not to its full cw position).

Note

Check that both DISPLAY A and DISPLAY B display outputs are .0±20 counts.

3. Press and hold TEST SIG LEVEL CHECK V key.

4. Adjust potentiometer A3R1 so that FREQUENCY/TEST SIG LEVEL display output is 1.00 (V) within ±1 count.

*Note

If the A3R1 has been well-adjusted (and need not be adjusted), omit steps 5 and 6 that follow.

*5. Connect RF voltmeter input to 4275A UNKNOWN H_{CUR} terminal with a BNC to BNC connector as shown in Figure 5-9.

*6. Adjust potentiometer A2R92 for 1.00V±0.01V rms on the RF voltmeter indication.

7. Set test signal frequency to 10MHz. Connect "Open" termination to 4275A UNKNOWN terminals.

8. Check that FREQUENCY/TEST SIG LEVEL display output is 0.90 (V) within ±5 counts.

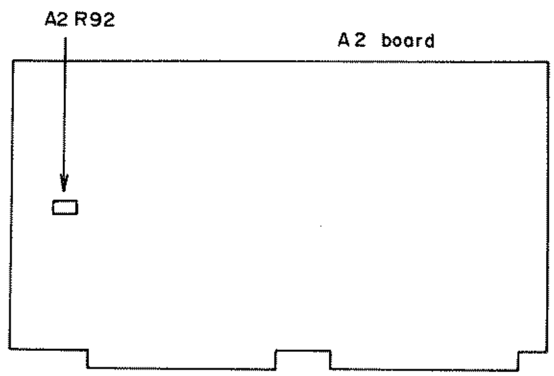
Note

Do not use an extender board with A3 board for this check.

Note

Test signal level actually falls to about 0.9V rms at 10MHz.

9. If the display output is too high or too low, change value of capacitor A3C76 (normally 51pF). Increasing the capacitance value increases the displayed voltage value. Adjustable capacitance value range is 30pF to 200pF.



A2 Board Adjustment Location.

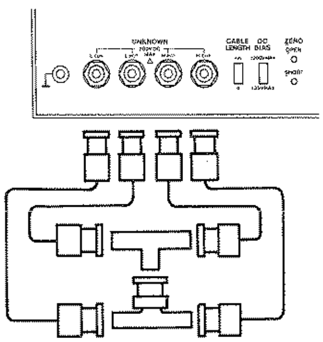
Confirmation check 1

Set MULTIPLIER to x0.1 and to x0.01. Check that the test limits given in the table below are satisfied (at 10MHz).

MULTIPLIER Setting	TEST SIG LEVEL display
x0.1	.088 to .112
x0.01	.007 to .013

Confirmation check 2

a. Connect "Short" termination (of the HP 16074A Standard Resistor Set) to 4275A UNKNOWN terminals.



Note

Otherwise, connect short BNC cables and BNC Tee adapters as illustrated at left.

b. Set 4275A controls as follows:

DISPLAY A function .... R
DISPLAY B function .... X/B
Test signal frequency 100kHz
MULTIPLIER x1
OSC LEVEL 1
LCRZ RANGE .... AUTO

c. Press and hold TEST SIG LEVEL CHECK mA key.

d. Check that FREQUENCY/TEST SIG LEVEL display output is 10.0mA within ±0.5mA.

5-33. CMR AMPLIFIER GAIN ADJUSTMENT (A1).

5-34. This adjustment properly sets the amplification factor of A1 CMR amplifier which compensates for test signal propagation losses in the range resistor circuit (internal wiring losses) to maximize accuracy of measurement.

EQUIPMENT:

Cable (10cm long) .... BNC to BNC cable

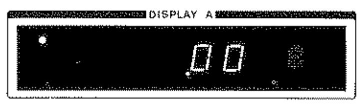
PROCEDURE:

1. Connect 4275A UNKNOWN H_{CUR} and H_{POT} terminals together with a short BNC cable.

2. Set 4275A controls as follows:

   Test signal frequency 100kHz
   OSC LEVEL .... fully cw
   SELF TEST .... on

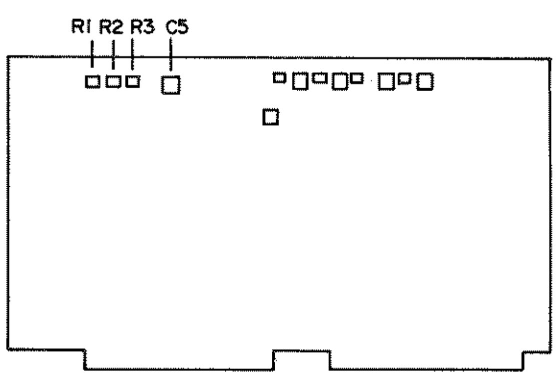
3. Press REF VALUE RECALL key to select self test step "8". DISPLAY A unit indicator displays the number "8" as shown below.



4. Adjust potentiometer A1R3 for minimum display readout (less than 10 counts) on DISPLAY A.

Note

If the A1R3 adjustment can not be achieved, change value of A1R4 (normally 316Ω). Adjustable range is 256Ω to 316Ω.



A1 Board Adjustment Locations.

5-35. RANGE RESISTOR ADJUSTMENTS (A1).

5-36. The range resistor adjustments fix the values of the bridge circuit reference resistor elements (range resistors) to maximize accuracy on each measurement range. The adjustments are made by connecting a standard resistor or a standard capacitor as a DUT, and by setting the range resistor adjustment potentiometers and phase compensators for the calibrated values of the standard on measurement display outputs.

EQUIPMENT:

Standard resistors .... HP 16074A Standard
(100Ω, 1kΩ, 10kΩ, 100kΩ±0.03%) Resistor Set

10pF Standard capacitor (±0.03%) .... HP 16382A

Note

The HP 16382A is a component of the HP 16380A Standard Capacitor Set.

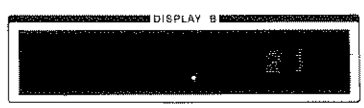
PROCEDURE:

1) Range resistor adjustments.

1. Set 4275A controls as follows:

DISPLAY A function .... R
DISPLAY B function X
Test signal frequency 100kHz
MULTIPLIER x0.1
OSC LEVEL .... fully cw
SELF TEST .... on
CABLE LENGTH switch 0

2. Press REF VALUE STORE key. Self test step number "21" is displayed in DISPLAY B unit indicator as shown below:



3. Press LCRZ RANGE UP or DOWN key to select self test step "50" (monitor DISPLAY B unit indicator display).

4. Connect a 100kΩ standard resistor (direct) to 4275A UNKNOWN terminals.

5. Adjust potentiometer A1R31 so that DISPLAY A display output is the calibrated value of the standard resistor within ±20 counts.

Note

Unit indicator displays "μS" instead of kΩ.

6. Press LCRZ RANGE DOWN key once to select self test step "40".

7. Connect a 10kΩ standard resistor in place of the 100kΩ resistor.

8. Adjust potentiometer A1R30 so that DISPLAY A display output is the calibrated value of the standard resistor within ±20 counts.

9. Press LCRZ RANGE DOWN key once to select self test step "30".

10. Connect a 1kΩ standard resistor in place of the 10kΩ resistor.

11. Adjust potentiometer A1R29 so that DISPLAY A display output is the calibrated value of the standard resistor within ±20 counts.

12. Press LCRZ RANGE DOWN key once to select self test step "20".

Note

DISPLAY A unit indicator displays "ms".

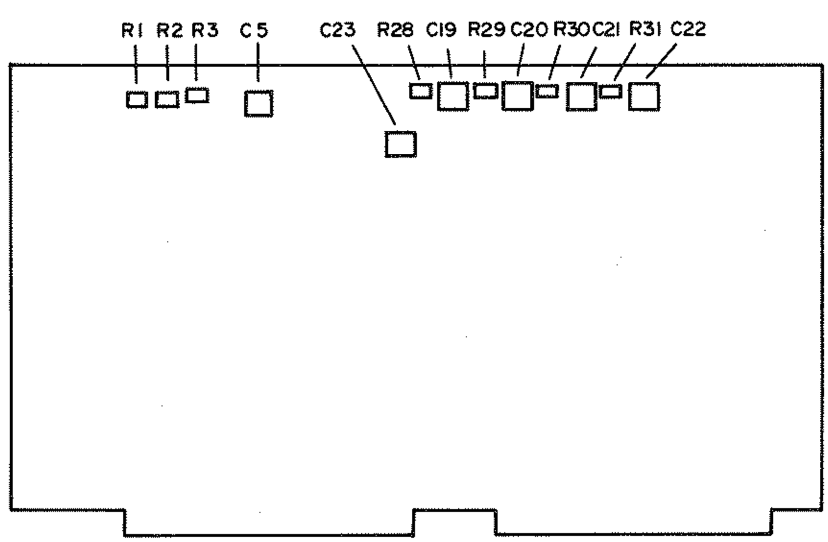
13. Connect a 100Ω standard resistor in place of the 1kΩ resistor.

14. Adjust potentiometer A1R28 so that DISPLAY A display output is the calibrated value of the standard resistor within ±20 counts.

2) Range resistor phase adjustments.

1. Set 4275A controls as follows:

DISPLAY A function	C
DISPLAY B function	D
Test signal frequency	100kHz
MULTIPLIER	X0.1
OSC LEVEL	fully cw
SELF TEST	off
HIGH RESOLUTION	off
CABLE LENGTH switch	0
LCRZ RANGE	AUTO



A1 Board Adjustment Locations.

2. Connect a 10pF standard capacitor direct to 4275A UNKNOWN terminals.

Note

Test leads should not be used for any phase adjustment.

3. Adjust trimmer capacitor A1C22 so that dissipation factor readout on DISPLAY B is within the range of .0000 and .0004.
4. Set test signal frequency to 1MHz.
5. Adjust trimmer capacitor A1C21 so that dissipation factor readout is within the range of -.0001 and .0003.
6. Set test signal frequency to 10MHz.
7. Adjust trimmer capacitor A1C23 so that capacitance readout on DISPLAY A is the calibrated value of the standard capacitor within ±20 counts (±0.02pF).
8. Adjust trimmer capacitor A1C20 so that dissipation factor readout on DISPLAY B is .0010 within ±20 counts.

Troubleshooting hints

1) If any trimmer capacitor adjustment can not be achieved, firstly try to the particular range resistor slightly upward on the printed circuit board (to reduce stray capacitances).

2) If A1C21 adjustment can not be achieved, change value of capacitor A1C27 (normally 7.5pF). Increasing the capacitance of C27 decreases DISPLAY A display counts. Adjustable value range is 0 to 10pF.

3) If A1C23 adjustment can not be achieved, change value of capacitor A1C28 (normally 62pF). Increasing the capacitance of C28 decreases DISPLAY A display counts. Adjustable value range is 37 to 87pF.

4) If A1C20 adjustment can not be achieved, change value of capacitor A1C26 (normally 5.1pF). Increasing the capacitance of C26 decreases DISPLAY B display counts. Adjustable value range is 0 to 10pF.

5-37. CMR AMPLIFIER 2MHz GAIN ADJUSTMENT (A1).

5-38. This adjustment optimizes CMR amplifier gain (preliminarly adjusted in paragraph 5-34) to maximize accuracy of measurement at 2MHz test signal frequency.

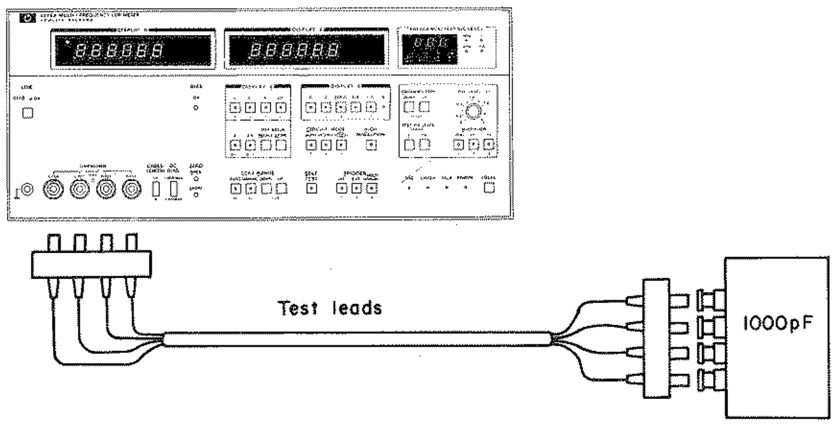


Figure 5-10. CMR Amplifier 2MHz Gain Adjustment Setup.

EQUIPMENT:

1000pF standard capacitor .... HP 16384A
Test leads (1m long) .... HP 16048A

Note

The HP 16384A is a component of the Hp 16380A Standard Capacitor Set.

PROCEDURE:

1. Set 4275A controls as follows:

DISPLAY A function C
DISPLAY B function .... D
CIRCUIT MODE .... AUTO
Test signal frequency 2MHz
MULTIPLIER x0.1
OSC LEVEL .... fully cw
CABLE LENGTH 0

2. Connect a 1000pF standard capacitor direct to 4275A UNKNOWN terminals.

3. Read dissipation factor display output on DISPLAY B and note its value as "X".

4. Set 4275A CABLE LENGTH switch to "1m" position.

5. Connect the 1000pF standard capacitor using 1m test leads as shown in Figure 5-10.

6. Read dissipation factor display output (as "Y" value).

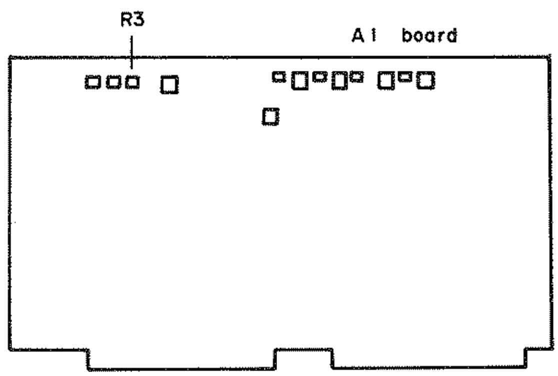
7. Calculate the value given by the following equation:

$$Xadj = \frac{X+Y}{2}$$

8. Adjust potentiometer A1R3 so that the dissipation factor readout (on DISPLAY B) is identical to the calculated Xadj value.

9. Repeat steps 1 through 5 until the following condition is satisfied.

$$Xadj = \frac{X+Y}{2} \pm 5 \text{ counts}$$



A1 Board Adjustment Locations.

5-39. 4MHz/10MHz CMR AMPLIFIER AND RANGE RESISTOR PHASE ADJUSTMENTS (A1).

5-40. This adjustment optimizes CMR amplifier gain and properly sets range resistor signal phase compensator to maximize accuracy of measurement at 4MHz and 10MHz test signal frequencies.

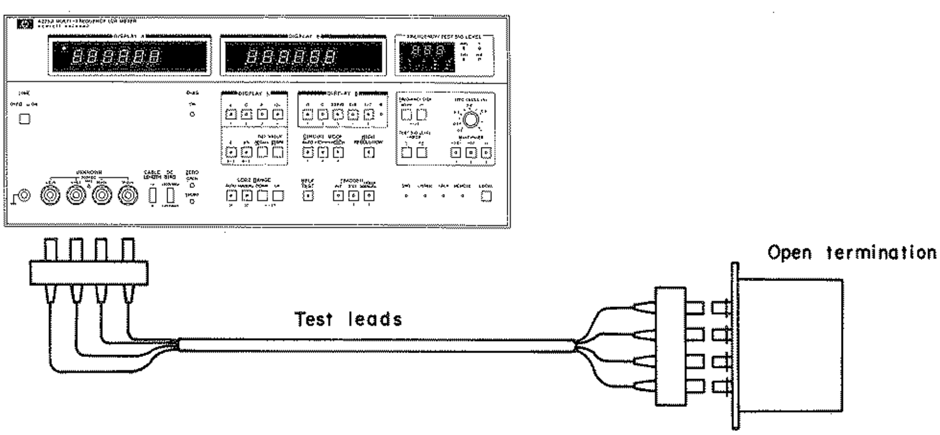


Figure 5-11. 10MHz CMR Amplifier and Range Resistor phase Adjustment Setup.

EQUIPMENT:

Standard capacitor 10pF	HP 16382A
100pF	HP 16383A
Test leads (1m long)	HP 16048A
Open termination	HP 16074A
Short termination	Standard Resistor Set

Note

The 16074A accessory test leads can be used as 1m test leads (instead of HP 16048A).

PROCEDURE:

1. Set 4275A controls as follows:

DISPLAY A function	C
DISPLAY B function	D
Test signal frequency	10MHz
MULTIPLIER	x0.1
OSC LEVEL	fully cw
CABLE LENGTH	1m

2. Connect 1m test leads to 4275A UNKNOWN terminals and to "Open" termination (of the 16074A Standard Resistor Set) as illustrated in Figure 5-11.

3. Press 4275A ZERO OPEN button to perform (open) zero offset adjustment.

4. Connect "Short" termination (of the 16074A Standard Resistor Set) in place of the "Open" termination.

5. Press ZERO SHORT button to perform (short) zero offset adjustment.

6. Connect a 10pF standard capacitor at end of test leads in place of the "Short" termination.

7. Read capacitance and dissipation factor display outputs (in DISPLAY A and DISPLAY B). Note the readouts in counts as follows:

Capacitance value	X counts
Dissipation factor value	Y counts

8. Connect a 100pF standard capacitor in place of the 10pF capacitor.

9. Adjust trimmer capacitor A1C5 so that capacitance display output in DISPLAY A is X counts within ±50 counts.

10. Adjust potentiometer A1R2 so that dissipation factor display output in DISPLAY B is Y counts within ±50 counts.

11. Since A1C5 and A1R2 adjustments interact, repeat steps 7 and 10 several times.

12. Set test signal frequency to 4MHz.

13. Adjust potentiometer A1R1 so that dissipation factor display output in DISPLAY B is 00 counts within ±20 counts.

14. Disconnect test leads. Set 4275A CABLE LENGTH switch to "0" position.

15. Connect "Open" termination direct to 4275A UNKNOWN terminals.

16. Press ZERO OPEN button to perform (open) zero offset adjustment.

17. Connect "Short" termination direct to 4275A UNKNOWN terminals in place of the "Open" termination.

18. Press ZERO SHORT button to perform (short) zero offset adjustment.

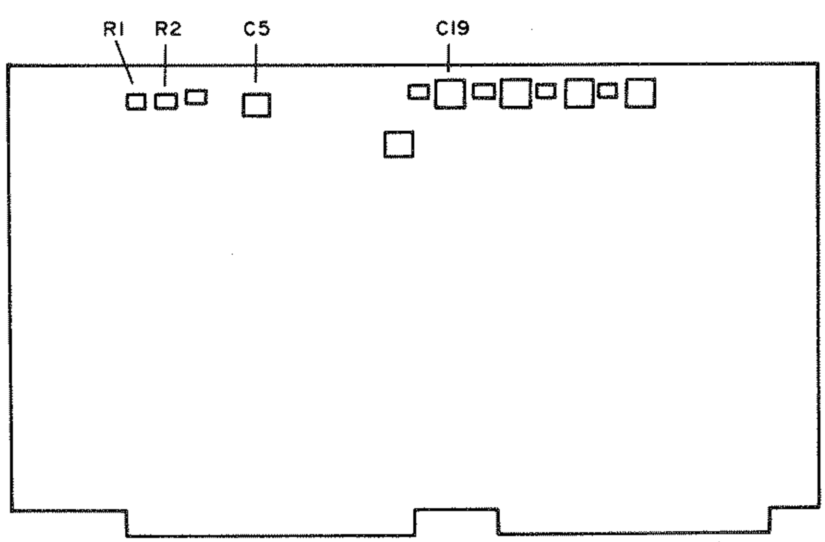
19. Connect a 100pF standard capacitor direct to 4275A UNKNOWN terminals in place of the "Short" termination.

20. Adjust trimmer capacitor A1C19 so that dissipation factor display output in DISPLAY B is .0010 within ±20 counts.

21. Since A1C5, A1R2, A1R1 and A1C19 adjustments interact, again perform steps 1 through 20 (to improve adjustment accuracy).

Troubleshooting hints

> If A1C19 adjustment can not be achieved, change values of both A1C24 and C25 (normally 4.3pF). Increasing the value increases display counts. Adjustable value range is 0pF to 10pF.



A1 Board Adjustment Locations.

5-41. ±35V INTERNAL DC BIAS SUPPLY ADJUSTMENT (A21) (Opt. 001 only).

PURPOSE:

To set internal dc voltage and the gain of DAC and Amplifier so that accurate dc bias voltages can be applied to the sample in response to bias control input.

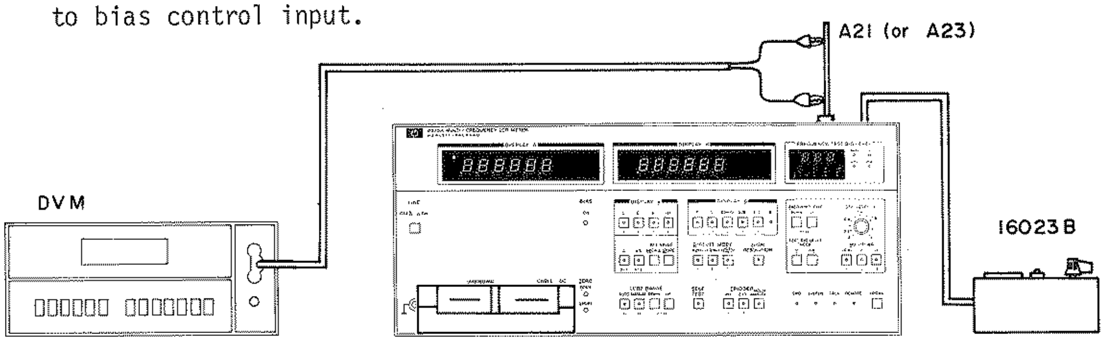


Figure 5-12. Internal DC Bias Supply Adjustment Setup.

EQUIPMENT:

Bias Controller .... HP 16023B
Digital Voltmeter .... HP 3465B

PROCEDURE:

1. Set 4275A controls as follows:

   DC BIAS Switch...................... ±35v MAX
   DISPLAY A function C
   TRIGGER .... MANUAL
   MULTIPLIER .... X .01
   OSC LEVEL .... Fully CCW
   Other Controls .... Any Settings
   DC BIAS Selector SW ..... INT 35V/100V (C≤.1μF)
   (rear panel)

2. Set 16023B DC Bias Controller thumbwheel switch to 0.00 and connect its 24 pin male connector to INT DC BIAS CONTROL Connector on the 4275A rear panel. See Figure 5-12.

3. Take out A21 board. Install extender board in A21 slot and install A21 board in extender.

   CAUTION:

   Before taking A21 board out, DC Bias connector board must be pulled out toward the rear panel by loosening its two screws.

4. Set DVM controls as follows:

   FUNCTION V
   RANGE 200V

5. Connect DVM plus input to the negative lead of A21C19 (-42V) and minus input to the positive lead of A21C19 (GND ⏚) with dual banana to alligator clip cable.

6. Adjust A21R83 so the DVM reads -42V±0.1V and check that the voltage across A21C18 is within +42.0V±1.0V.

Note

Change DVM range control to the appropliate setting for the adjustments that follow.

7. Change 16023B thumbwheel switch setting to -.00Vx1. Press ENTER button.

8. Connect DVM plus input to A21TP3 and munus input to XA21 16R connector pin (GND▽).

9. Adjust A21R12 until the DVM reads 0V±0.1mV.

10. Change 16023B thumbwheel switch setting to +.00Vx1. Press ENTER button.

11. Adjust A21R11 until the DVM reads 0V±0.1mV.

12. Remove DVM plus input from A21TP3 and connect it to TP2.

13. Adjust A21R8 until the DVM reads 0V±0.1mV.

14. Change 16023B thumbwheel switch setting to -9.00V x1. Press ENTER button.

15. Adjust A21R13 until the DVM reads -9V±.002V.

16. Remove DVM input cable and 16023B from 4275A.

Note

Although the variable resister A21R48 is mounted on the A21 board, it is a "factory only" adjustable component and is not field adjustable.

5-42. ±100V INTERNAL DC BIAS SUPPLY ADJUSTMENT (A23) (Opt. 002 only).

PURPOSE and EQUIPMENT:

Same as in Para. 5-41.

PROCEDURE:

1. Set 4275A controls as follows:

DC BIAS Switch .... ±200V MAX
TRIGGER .... MANUAL
DISPLAY A function C
OSC LEVEL .... Fully CCW
Other Controls .... Any settings
DC BIAS Selector SW ..... INT 35V/100V (C≤.1μF)
(rear panel)

2. Set 16023B DC Bias Controller thumbwheel switch to .000 and connect its 24 pin male connector to INT DC BIAS CONTROLLER connector on the 4275A rear panel. Refer to Figure 5-12 except for the difference in test pins and board number.

ADJUSTMENTS

3. Take out A23 board. Install extender board in A23 slot and install A23 board in extender.

Note

Before taking A23 board out, DC Bias connector board must be pulled out toward rear pannel by loosening its two screws.

4. Set DVM controls as follows:

FUNCTION V
RANGE 200V

5. Connect DVM plus input to the negative lead of A23C26 and minus input to the positive lead of A23C26 with dual banana to alligator clip cable.

6. Adjust A23R55 until the DVM reads -42.0V±0.1V.

Note

Change DVM range control to the appropriate setting for the adjustments that follow:

7. Connect DVM plus input to the A23TP2 and minus input to the XA23 16R connector pin (GND▽2).

8. Set 16023B thumbwheel switch control to -.00Vx1. Press ENTER button.

9. Adjust A23R11 until the DVM reads 0V±0.1mV.

10. Change 16023B thumbwheel switch setting to +0.00x1. Press ENTER button.

11. Adjust A23R10 until the DVM reads 0V±0.1mV.

12. Disconnect DVM plus input from A23TP2 and connect it to TP1.

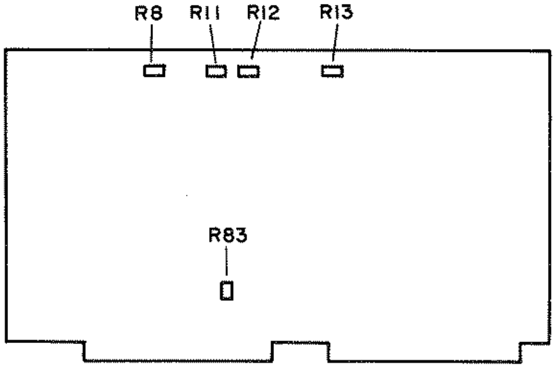
13. Change 16023B thumbwheel switch setting to -0.00Vx1. Press ENTER button.

14. Adjust A23R8 until the DVM reads 0V±2mV.

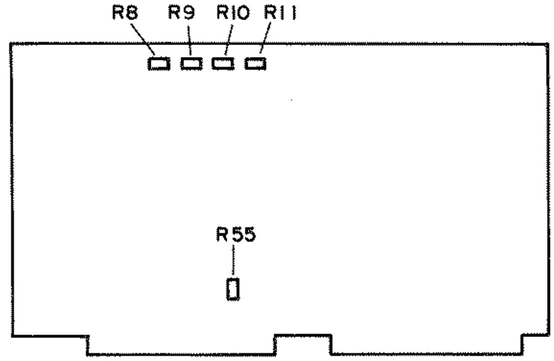
15. Change 16023B thumbwheel switch setting to -9.00Vx1. Press ENTER button.

16. Adjust A23R9 until the DVM reads -90V±40mV.

17. Remove DVM input cable and 16023B from 4275A.



A21 Board Adjustment Locations.



A23 Board Adjustment Locations.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-3 lists all replaceable parts in reference designator order. Table 6-2 contains the names and addresses that correspond to the manufacturer's code numbers.

6-3. ABBREVIATIONS.

6-4. Table 6-1 lists abbreviations used in parts list, schematics and throughout the manual. In some cases, two forms of abbreviations are used, one in all capital letters, and one in partial capitals or no capitals. This occurs because the abbreviations in parts list are always all capitals. However, in the schematics and in other parts of the manual, other abbreviation forms with both lower case and upper case letters are used.

6-5. REPLACEABLE PARTS LIST.

6-6. Table 6-3 is a list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alphanumerical order by reference designation.

b. Chassis-mounted parts in alphanumerical order by reference designation.

c. Miscellaneous parts.

d. Illustrated parts breakdowns, if appropriate.

The information for each part includes:

a. The Hewlett-Packard part number.

b. The total quantity (Qty) in the instrument.

Table 6-1. List of Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	= assembly	E	= misc electronic part	P	= plug	U	= integrated circuit
B	= motor	F	= fuse	Q	= transistor	V	= vacuum, tube, neon bulb, photocell, etc.
BT	= battery	FL	= filter	R	= resistor		
C	= capacitor	J	= jack	RT	= thermistor	VR	= voltage regulator
CP	= coupler	K	= relay	S	= switch	W	= cable
CR	= diode	L	= inductor	T	= transformer	X	= socket
DL	= delay line	M	= meter	TB	= terminal board	Y	= crystal
DS	= device signaling (lamp)	MP	= mechanical part	TP	= test point		

ABBREVIATIONS

A	= amperes	H	= henries	NPN	= negative-positive-negative	RWV	= reverse working voltage
A.F.C.	= automatic frequency control	HEX	= hexagonal	NRFR	= not recommended for field replacement	S-B	= slow-blow
AMPL	= amplifier	HG	= mercury	NSR	= not separately replaceable	SCR	= screw
B.F.O.	= beat frequency oscillator	HR	= hour(s)	OBD	= order by description	SE	= selenium
BE CU	= beryllium copper	Hz	= hertz	OH	= oval head	SECT	= section(s)
BH	= binder head	IF	= intermediate freq.	OX	= oxide	SEMICON	= semiconductor
BP	= bandpass	IMPG	= impregnated	P	= peak	SI	= silicon
BRS	= brass	INCD	= incandescent	PC	= printed circuit	SIL	= silver
BWO	= backward wave oscillator	INCL	= include(s)	p	= pico = 10^{-12}	SL	= slide
CCW	= counter-clockwise	INS	= insulation(ed)	PH BRZ	= phosphor bronze	SPG	= spring
CER	= ceramic	INT	= internal	PHL	= Phillips	SPL	= special
CMO	= cabinet mount only	k	= kilo = 1000	PIV	= peak inverse voltage	SST	= stainless steel
COEF	= coefficient	LH	= left hand	PNP	= positive-negative-positive	SR	= split ring
COM	= common	LIN	= linear taper	P/O	= part of	STL	= steel
COMP	= composition	LK WASH	= lock washer	POLY	= polystyrene	TA	= tantalum
COMPL	= complete	LOG	= logarithmic taper	PORC	= porcelain	TD	= time delay
CONN	= connector	LPF	= low pass filter	POS	= position(s)	TGL	= toggle
CP	= cadmium plate	m	= milli = 10^{-3}	POT	= potentiometer	THD	= thread
CRT	= cathode-ray tube	M	= meg = 10^{6}	PP	= peak-to-peak	TI	= titanium
CW	= clockwise	MET FLM	= metal film	PT	= point	TOL	= tolerance
DEPC	= deposited carbon	MET OX	= metallic oxide	PWV	= peak working voltage	TRIM	= trimmer
DR	= drive	MFR	= manufacturer	RECT	= rectifier	TWT	= traveling wave tube
ELECT	= electrolytic	MINAT	= miniature	RF	= radio frequency	μ	= micro = 10^{-6}
ENCAP	= encapsulated	MOM	= momentary	RH	= round head or right hand	VAR	= variable
EXT	= external	MTG	= mounting	RMO	= rack mount only	VDCW	= dc working volts
F	= farads	MY	= "mylar"	RMS	= root-mean square	W/	= with
f	= femto = 10^{-15}	n	= nano = 10^{-9}			W	= watts
FH	= flat head	N/C	= normally closed			WIV	= working inverse voltage
FIL H	= fillister head	NE	= neon			WW	= wirewound
FXD	= fixed	NI PL	= nickel plate			W/O	= without
G	= giga = 10^{9}	N/O	= normally open				
GE	= germanium	NPO	= negative positive zero (zero temperature coefficient)				
GL	= glass						
GRD	= ground(ed)						

0001-9700

c. A description of the part.

d. A typical manufacturer of the part in a five-digit code.

e. The manufacturer's number for the part.

The total quantity for each part is given only once at the first appearance of the part number in the list.

6-7. ORDERING INFORMATION.

6-8. To order a part listed in the replaceable parts table, give the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, state the full instrument model and serial number, the description and function of the part, and the number of parts required. Address your order to the nearest Hewlett-Packard office.

6-10. SPARE PARTS KIT.

6-11. Stocking spare parts for an instrument is often done to insure quick return to service after a malfunction occurs. Hewlett-Packard has a Spare Parts Kit available for this purpose. The kit consists of selected replaceable assemblies and components for this instrument. The contents of the kit and the Recommended Spares List are based on failure reports and repair data, and parts support for one year. A complimentary Recommended Spares List for this instrument may be obtained on request and the Spare Parts Kit may be ordered through your nearest Hewlett-Packard office.

6-12. DIRECT MAIL ORDER SYSTEM.

6-13. Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are:

a. Direct ordering and shipment from the HP Parts Center in Mountain View, California.

b. No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local HP Office when the orders require billing and invoicing).

c. Prepaid transportation (there is a small handling change for each order).

d. No invoices --- to provide these advantages, a check or money order must accompany each order.

6-14. Mail order forms and specific ordering information is available through your local HP Office. Addresses and phone numbers are located at the back of this manual.

Table 6-2. Manufacturers Code Lists.

NFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
C0633	AKTIEBOLAGET RIFA	BROMMA	SE	
00000	ANY SATISFACTORY SUPPLIER			
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
01928	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	08876
02111	SPECTROL ELECTRONICS CORP	CITY OF IND	CA	91745
02114	FERROXCUBE CORP	SAUGERTIES	NY	12477
03888	KDI PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
12954	SIEMENS CORP COMPONENTS GROUP	SCOTTSDALE	AZ	85252
18324	SIGNETICS CORP	SUNNYVALE	CA	94086
19701	NEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
24046	TRANSITRON ELECTRONIC CORP	WAKEFIELD	MA	01880
24355	ANALOG DEVICES INC	NORWOOD	MA	02062
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON	NC	28401
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
30983	NEPCO/ELECTRA CORP	SAN DIEGO	CA	92121
32293	INTERSIL INC	CUPERTINO	CA	95014
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE	CA	92507
34649	INTEL CORP	MOUNTAIN VIEW	CA	95051
52763	STETTNER-TRUSH INC	CAZENOVIA	NY	13035
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC	CT	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON	CA	92634
75915	LITTELFUSE INC	DES PLAINES	IL	60016

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	04275-66501	9	1	RANGE RESISTOR & NULL DETECTOR BD. ASSY	28480	04275-66501
	05275-26501	7		PC BOARD, BLANK	28480	05275-26501
A1C1	0160-2055	9	120	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C2	0180-1083	3	51	CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C3	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C4	0160-2260	8	2	CAPACITOR-FXD 13PF +-5% 500VDC CER 0+-30	28480	0160-2260
A1C5	0121-0105	4	4	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A1C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C7	0180-1077	5	12	CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A1C8	0180-1085	5	46	CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C9	0160-3443	1	33	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C11	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C14	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C15	0160-2307	4	6	CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A1C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C17	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C18	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C19	0121-0036	0	2	CAPACITOR-V TRMR-CER 5.5-18PF 350V	52763	304324 5.5/18PF NPO
A1C20	0121-0453	5	3	CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0303-105
A1C21	0121-0453	5		CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0303-105
A1C22	0121-0453	5		CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0303-105
A1C23	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A1C24	0160-2248	2	2	CAPACITOR-FXD 4.3PF +-.25PF 500VDC CER	28480	0160-2248
A1C25	0160-2248	2		CAPACITOR-FXD 4.3PF +-.25PF 500VDC CER	28480	0160-2248
A1C26	0160-2250	6	2	CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A1C27	0160-2254	0	1	CAPACITOR-FXD 7.5PF +-.25PF 500VDC CER	28480	0160-2254
A1C28	0140-0205	5	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A1C29	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A1C30	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A1C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C32	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C33	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C36	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C37	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C38	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C39	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C40	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C41	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C42	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C43	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C44	0160-2208	4	2	CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A1C45	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A1C46	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C47	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C48	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C49	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C50	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C51	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C52	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C53	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C54	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C55	0160-2264	2	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A1C56	0160-2204	0	5	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A1C57	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C58	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C59	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C60	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C61	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C62	0160-2249	3	7	CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A1C63	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A1C64	0180-1051	5	2	CAPACITOR, FXD 100 UF 16V M	28480	0180-1051
A1C65	0180-1051	5		CAPACITOR, FXD 100 UF 16V M	28480	0180-1051
A1C66	0160-2249	3		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A1C67	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A1C68	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A1C69	0160-2150	5	2	CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A1C70	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1C71	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C72	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C73	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C74	0150-0059	8	1	CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0150-0059
A1C75	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C76	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C77	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C78	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C79	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C80	0160-2260	8		CAPACITOR-FXD 13PF +-5% 500VDC CER 0+-30	28480	0160-2260
A1C81	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C82	0160-2249	3		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A1C83	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C84	0160-2249	3		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A1C85	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C86	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C87	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C88	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C89	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C90	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C91	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C92	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C93	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C94	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C95	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C96	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C97	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C98	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C99	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C100	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C101	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1C102	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C103	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A1C104	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A1C105	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C106	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C107	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C108	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C109	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A1C110	0160-2255	1		CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A1C111	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A1C112	0180-1086	6	3	CAPACITOR-FXD 33uF +50-30% 16VDC	28480	0180-1086
A1C130	0160-2203	9	2	CAPACITOR-FXD 91PF +-5% 300VDC MICA 0+70	28480	0160-2203
A1CR1	1901-0040	1	76	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR3	1902-3149	9	3	DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	28480	1902-3149
A1CR4	1902-3149	9		DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	28480	1902-3149
A1CR5	1901-0033	2	10	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR9	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR11	1901-0025	2	8	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR12	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR13	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR14	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR15	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR16	1901-0029	6	4	DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A1CR17	1901-0029	6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A1CR18	1901-0029	6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A1CR19	1901-0029	6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A1CR20	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR21	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1CR22	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR23	1902-0049	2	7	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A1CR24	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR25	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A1CR26	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A1CR27	1902-3149	9		DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	28480	1902-3149
A1CR28	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR29	1902-3082	9	9	DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A1CR30	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A1CR31	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1K1	0490-0234	9	7	RELAY-REED	28480	
A1K2	0490-0234	9		RELAY-REED	28480	
A1K3	0490-0240	1	11	RELAY, REED	28480	
A1K4	0490-0240	1		RELAY, REED	28480	
A1K5	0490-0234	1		RELAY, REED	28480	0490-0234
A1K6	0490-0234	1		RELAY, REED	28480	0490-0234
A1K7	0490-0234	1		RELAY, REED	28480	0490-0234
A1K8	0490-0234	1		RELAY, REED	28480	0490-0234
A1K9	0490-0234	1		RELAY, REED	28480	0490-0234
A1K10	0490-0234	1		RELAY, REED	28480	0490-0234
A1K11	0490-0234	1		RELAY, REED	28480	0490-0234
A1K12	0490-0240	9		RELAY-REED	28480	0490-0240
A1K13	0490-0240	9		RELAY-REED	28480	0490-0240
A1K14	0490-0240	9		RELAY-REED	28480	0490-0240
A1L1	9170-0029	3	36	CORE-SHIELDING BEAD	28480	9170-0029
A1L2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A1L3	9140-0210	1	4	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1L4	9140-0210	1		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1L5	9140-0210	1		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1L6	9140-0137	1	1	COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A1L7	9140-0179	1	5	COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A1L8	9140-0179	1		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A1Q1	1853-0018	0	1	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A1Q2	1854-0130	9	1	TRANSISTOR NPN Si PD=350mW FT=4.5GHz	28480	1854-0130
A1Q3	1854-0092	2	31	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q4	1855-0081	1	13	TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A1Q5	1853-0020	4	13	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q6	1854-0345	8	10	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1Q8	1854-0071	7	28	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q10	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q11	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q12	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q13	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q14	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q15	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q16	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1Q17	1855-0123	2	1	TRANSISTOR DUAL-FET N-CHANNEL VDmax=30V	28480	1855-0123
A1Q18	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q19	1854-0019	3	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1Q20	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1Q21	1854-0477	7	3	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1Q22	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1Q23	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q24	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q25	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q26	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q27	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q28	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q29	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q30	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q31	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q32	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q33	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q34	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q35	1855-0261	9	4	TRANSISTOR MOS-FET PD=100mW ID=15mA	28480	1855-0261
A1Q36	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q37	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q38	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q39	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q40	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q41	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q42	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q43	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q44	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1R1	2100-2489	9	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A1R2	2100-2521	0	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A1R3	2100-2632	4	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	30983	ET50X101
A1R4	0698-3444	1	26	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R5	0698-0082	7	8	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R6	0757-0416	7	10	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R7	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R8	0757-0280	3	40	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R9	0698-3430	5	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A1R10	0757-0410	1	4	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R11	0683-1035	1	17	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R11	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R12	0683-1025	9	30	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R13	0683-2225	3	34	RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R16	0683-4705	8	43	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R17	0757-1094	9	3	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A1R18	0698-3262	1	1	RESISTOR 40.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-4022-F
A1R19	0683-1015	7	12	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A1R20	0683-1005	5	14	RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A1R21	0757-0401	0	12	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R22	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R23	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R24	0757-0417	8	3	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A1R25	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R26	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A1R27	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A1R28	2100-2522	1	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A1R29	2100-3199	0	2	RESISTOR-TRMR 20 20% C SIDE-ADJ 1-TRN	30983	ET50X200
A1R30	2100-2413	9	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	30983	ET50X201
A1R31	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A1R32	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R33	0698-2316	4	2	RESISTOR, FXD MET FLM 101.3 OHM 0.1% 1/8		
A1R34	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1R35	0698-2338	0	1	RESISTOR 950 .1% .125W	28480	0698-2338
A1R36	0698-3441	8	3	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A1R37	0698-2339	1	1	RESISTOR 10.5k .1% .125W	28480	0698-2339
A1R38	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R39	0698-2340	4	1	RESISTOR 95k .1% .125W	28480	0698-2340
A1R40	0683-5605	9	1	RESISTOR 56 5% .25W FC TC=-400/+500	01121	CB5605
A1R41	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R42	0683-4725	2	35	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R43	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R44	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R45	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R46	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R47	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R48	0757-0442	9	19	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R49	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R50	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R51	0757-0465	6	11	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A1R52	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R53	0683-3325	6	10	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A1R54	0698-3155	1	15	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A1R55	0698-0084	9	18	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1R56	0757-0428	1	3	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1R57	0698-0083	8	4	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R58	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R59	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A1R60	2100-1788	9	2	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	82PR500
A1R61	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R62	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R63	0757-0418	9	3	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1R64	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R65	0757-0346	2	7	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R66	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R67	0683-2205	9	22	RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R68	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R69	0757-0279	0	10	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R70	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R71	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R72	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R73	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R74	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R75	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R76	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R77	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R78	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R79	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R80	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R81	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R82	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R83	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R84	0757-0403	2	4	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A1R85	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1R86	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R87	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R88	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R89	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R90	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R91	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R92	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R93	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R94	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R95	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R96	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R97	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R98	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R100	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1R101	0757-0418	5	5	RESISTOR 619 1% .125W F TC=0+-100	24546	
A1R102	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A1R103	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R104	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R105	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R106	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R107	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R108	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R109	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R110	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R111	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R112	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R113	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R114	0683-3335	8	6	RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A1R115	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R116	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R117	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R118	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R119	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R120	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R121	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R122	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R123	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R124	0683-0475	1	2	RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A1R124	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R125	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R126	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R127	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R128	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R129	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R130	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R131	0683-0475	1		RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A1R131	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R132	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R134	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R135	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A1R136	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A1R137	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R138	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R139	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R140	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R141	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R142	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A1R143	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R144	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R145	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A1R146	0698-3268	7	1	RESISTOR 11.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1152-F
A1R147	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R148	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R149	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R150	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R151	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R160	0698-3153	9	4	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1T1	9100-0877	2	1	TRANSFORMER-SIGNAL 300uH 1:1:1	28480	9100-0877
A1T2	9100-0879	4	3	TRANSFORMER-SIGNAL 10mH 20%	28480	9100-0879
A1T3	9100-0879	4		TRANSFORMER-SIGNAL 10mH 20%	28480	9100-0879
A1T4	9100-0823	8	5	TRANSFORMER(TDK113B1) 1:1:1	28480	9100-0823
A1U1	1826-0319	7	2	IC OP AMP TO-99	27014	LF356H
A1U2	1820-0203	6	1	IC OP AMP GP TO-99	01928	CA741CT
				A1 MISCELLANEOUS PARTS		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	1250-0257	1	12	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
	04275-00602	3	1	PLATE SHIELD, A1	28480	04275-00602
	04275-00621	6	1	PLATE, SHIELD	28480	04275-00621
A2	04275-66502	0	1	MODULATOR BOARD ASSEMBLY	28480	04275-66502
	04275-26502	6		PC BOARD, BLANK	28480	04275-26502
A2C1	0150-0121	5	27	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C2*	0160-2940	1	6	CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2940
A2C3*	0160-2940	1		CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2940
A2C4	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C5*	0160-2255	1	6	CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A2C6	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C8	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A2C9	0121-0105	7	5	CAPACITOR-V TRMR-CER 9-35PF 350V PC-MTG	52763	
A2C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C12	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C13	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A2C14	0121-0105	7		CAPACITOR-V TRMR-CER 9-35PF 350V PC-MTG	52763	
A2C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C17	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C18	0160-0174	9	1	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A2C19	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C20	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C21	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C22	0180-0197	8	10	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C23	0160-2265	3	9	CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C24	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C25	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C26	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C27	0160-0127	2	26	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C28	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C29	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C30	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C31	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C32	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A2C33	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C34	0160-2255	1		CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A2C35	0160-2255	1		CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A2C36	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C38	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C39	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C40	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C41	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C42	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C43	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C44	0140-0190	7	1	CAPACITOR-FXD 39PF +-5% 300VDC MICA	72136	DM15E390J0300WV1CR
A2C46	0160-0158	9	1	CAPACITOR-FXD 5600PF +-10% 200VDC POLYE	28480	0160-0158
A2C47	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C48	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C49	0140-0178	1	1	CAPACITOR-FXD 560PF +-2% 300VDC MICA	72136	DM15F561G0300WV1CR
A2C49	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C50	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C51	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C52	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C53*	0160-2259	5	6	CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A2C54	0140-0193	0	2	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A2C55	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C56	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C57	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C58*	0160-2259	5		CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A2C59	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A2C60	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C61	0160-2940	1		CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2940
A2C62	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C63	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C64	0160-2940	1		CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2940
A2C65	0160-2940	1		CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2940
A2C66	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A2C67	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C68	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C69	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C70	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C71	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2C72	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C73	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C74	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C75	0160-2255	1		CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A2C76	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C77	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C78	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C79	0160-2255	1		CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A2C80	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C81	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C82	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C83	0160-1603	1	2	C:FXD MY 1 UF 10% 100VDCW	28480	0160-1603
A2C84	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C85	0160-2940	1		CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2940
A2C86	0160-1603	1		C:FXD MY 1 UF 10% 100VDCW	28480	0160-1603
A2C87	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C88	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C89	0180-1083	3			28480	0180-1083
A2C90	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C91	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
				CAPACITOR-FXD 33uF +75-10% 25VDC		
A2C92	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C93	0160-2259	5		CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A2C94	0160-2241	5	2	CAPACITOR-FXD 2.2PF +-.25PF 500VDC CER	28480	0160-2241
A2C95	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C96	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C97	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C99	0160-2203	4	6	CAPACITOR-FXD 91PF +-5% 300VDC MICA	72136	
A2C100	0160-2217	4	3	CAPACITOR-FXD 910PF +-5% 300VDC MICA	28480	
A2C101	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C102	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C103	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C104	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C105	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C106*	0160-2259	5		CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A2C107	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2C108	0160-2241	5		CAPACITOR-FXD 2.2PF +-.25PF 500VDC CER	28480	0160-2241
A2C109	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C110	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C111	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C112	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C113	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2C114	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A2CP1	1990-0104	5	2	PHOTOCELL: LAMP	28480	1990-0104
A2CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR2	1901-0518	8	10	DIODE-SCHOTTKY	28480	1901-0518
A2CR3	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A2CR4	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A2CR5	1902-0041	4	2	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A2CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR14	1902-3036	3	4	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A2CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR15	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A2CR16	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A2CR17	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A2CR25~28	1901-0040			DIODE-SWITCHING		
A2K1	0490-0240	9		RELAY-REED	28480	0490-0240
A2K2	0490-0240	9		RELAY-REED	28480	0490-0240
A2L1	9100-0880	7	4	COIL-FXD 22uH 5%	28480	9100-0880
A2L2	9100-0880	7		COIL-FXD 22uH 5%	28480	9100-0880
A2L3	9100-0880	7		COIL-FXD 22uH 5%	28480	9100-0880
A2L4	9100-0880	7		COIL-FXD 22uH 5%	28480	9100-0880
A2L5	9100-0881	8	4	COIL-FXD 5.6uH 5%	28480	9100-0881
A2L6	9100-0881	8		COIL-FXD 5.6uH 5%	28480	9100-0881
A2L7	9100-0881	8		COIL-FXD 5.6uH 5%	28480	9100-0881
A2L8	9100-0881	8		COIL-FXD 5.6uH 5%	28480	9100-0881
A2L9	9140-0114	4	6	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A2L10	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114

See introduction to this section for ordering information
*Indicates factory selected value

Model 4275A
Section VI

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2L11-A2L20	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A2Q1	1854-0215	1	28	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q4	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q5	1853-0089	5	6	TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A2Q6	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A2Q7	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A2Q8	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q9	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A2Q10	1855-0261	9		TEANSISTOR MOS-FET PD=100mW ID=15mA	28480	1855-0261
A2Q11	1855-0091	3	21	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A2Q12	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A2Q13	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q14	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A2Q15	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q16	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q17	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A2Q18	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q19	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q20	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q21	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q22	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A2Q23	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A2Q24	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q25	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q26	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q27	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q28	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q29	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A2Q30	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A2Q31	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q32	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q33	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2R1	0698-3160	8	4	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A2R2	0757-0199	3	4	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A2R3	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A2R4	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A2R5	0757-0278	9	10	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A2R6	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R7	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A2R8	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R9	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R10	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R11	0698-3447	3		RESISTOR 422 1% .125W F TC=0+-100	24546	
A2R12	0698-3447	3		RESISTOR 422 1% .125W F TC=0+-100	24546	
A2R13	2100-3161	6	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A2R14	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A2R15	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R16	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R17	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R18	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R19	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R21	0683-1045	3	13	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A2R22	0683-2245	7	1	RESISTOR 220K 5% .25W FC TC=-800/+900	01121	CB2245
A2R23	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A2R24	0683-4735	4	9	RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A2R25	0683-1825	7	7	RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R26	0683-2725	8	8	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R27	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R29	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R30	0683-1525	4	2	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A2R31	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R32	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R34	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R35	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A2R36	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R37	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A2R38	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R39	0683-2235	5	17	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A2R40	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R41	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A2R42	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R43	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R44	0698-3700	2	4	RESISTOR 715 1% .125W F TC=0+-100	24546	C4-1/8-T0-715R-F
A2R45	0698-3700	2		RESISTOR 715 1% .125W F TC=0+-100	24546	C4-1/8-T0-715R-F
A2R46	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R47	0698-3700	2		RESISTOR 715 1% .125W F TC=0+-100	24546	C4-1/8-T0-715R-F
A2R48	0698-3700	2		RESISTOR 715 1% .125W F TC=0+-100	24546	C4-1/8-T0-715R-F
A2R49	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A2R50	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R51	0683-1055	5	6	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A2R52	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A2R53	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R54	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R55	0698-3447	3		RESISTOR 422 1% .125W F TC=0+-100	24546	
A2R56	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A2R57	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R58	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R59	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R60	0698-3447	3		RESISTOR 422 1% .125W F TC=0+-100	24546	
A2R61	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A2R62	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R63	0683-8215	3	1	RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A2R64	0698-6624	5	4	RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A2R65	0683-4715	0	8	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R66	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A2R67	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R68	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R69	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R70	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R71	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A2R72	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R73	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A2R74	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R75	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R76	0698-3457	6	3	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A2R77	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R78	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A2R79	0698-3260	9	5	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A2R80	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2R81	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2R82	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R83	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R84	0698-7842	1	4	RESISTOR 26.1K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-2612-B
A2R85	0698-6943	1	4	RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A2R86	0698-6943	1		RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A2R87	0698-7842	1		RESISTOR 26.1K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-2612-B
A2R88	0698-7842	1		RESISTOR 26.1K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-2612-B
A2R89	0698-6943	1		RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A2R90	0698-6943	1		RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A2R91	0698-7842	1		RESISTOR 26.1K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-2612-B
A2R92	2100-2574	9		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	
A2R93	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A2R94	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A2R95	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A2R97	0683-3315	4	1	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A2R99	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R100	0683-1225	1	2	RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A2R101	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R102	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R103	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R104	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R105	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R106	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R107	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R108	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R109	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R110	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R111	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R112	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A2R113	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R114	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R115	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R116	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R117	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R118	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R119	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R120	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R121	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R122	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R123	0698-3453	2	2	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A2R124	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R125	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R126	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A2R127	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R128	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R129	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A2R130	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A2R131	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R132	0683-6805	3	2	RESISTOR 68 5% .25W FC TC=-400/+500	01121	CB6805
A2R133	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A2R134	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A2R135	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R136	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A2R137	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R138	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R139	0757-0277	8	5	RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A2R140	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R141	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A2R142	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A2R143	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R144	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A2R145	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A2R146	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R147	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A2R148	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A2R149	0683-6805	3		RESISTOR 68 5% .25W FC TC=-400/+500	01121	CB6805
A2R150	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R151	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A2R152	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R153	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A2R154	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R155	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A2R156	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A2R156	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A2R157	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R159	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R160	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R161	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R162	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R163	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A2R164	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A2R165	0683-1835	9	3	RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A2R166	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A2R167	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R168	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R169	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R170	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R171	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A2R172	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A2R173	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A2R174	0683-1015			RESISTOR 100 5% .25W 250WVDC		
A2T1	9100-0855	6	5	TRANSFORMER-PULSE 1:1:1	28480	9100-0855
A2T2	9100-0855	6		TRANSFORMER-PULSE 1:1:1	28480	9100-0855
A2T3	9100-0855	6		TRANSFORMER-PULSE 1:1:1	28480	9100-0855
A2T4	9100-0855	6		TRANSFORMER-PULSE 1:1:1	28480	9100-0855
A2T5	9100-0855	6		TRANSFORMER-PULSE 1:1:1	28480	9100-0855
A2T6	9100-0879	4		TRANSFORMER-SIGNAL 10mH 20%	28480	9100-0879
A2T7	9100-0823	8		TRANSFORMER(TDK11381) 1:1:1	28480	9100-0823
A2U1	1826-0139	9	4	IC OP AMP GP DUAL 8-DIP-P	01928	CA1458G
A2U2	1820-0427	6	5	IC MODULATOR TO-100	04713	MC1496G
A2U3	5080-3056	6		IC MODULATOR TO-100	04713	
A2U4	5080-3056	6		IC MODULATOR TO-100	04713	
A2U5	1826-0139	9		IC OP AMP GP DUAL 8-DIP-P	01928	CA1458G
A2U6	1820-0427	6		IC MODULATOR TO-100	04713	MC1496G
A2U7	1820-0427	6		IC MODULATOR TO-100	04713	MC1496G
A2U8	1826-0111	6	2	IC OP AMP LOW-BIAS-H-IMPD TO-99	27014	
A2U9	1826-0111	6		IC OP AMP LOW-BIAS-H-IMPD TO-99	27014	
A2U10	1826-0138	8	9	IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				A2 MISCELLANEOUS PARTS		
	04275-00606	7	1	PLATE SHIELD, A2	28480	04275-00606
	04275-00607	8	1	PLATE SHIELD, A2	28480	04275-00607
	04275-00622	7	2	PLATE SHIELD	28480	04275-00622
	04275-00623	8	1	PLATE SHIELD	28480	04275-00623
A3	04275-66503	1	1	POWER AMPLIFIER BOARD ASSEMBLY	28480	04275-66503
	04275-26503	7		PC BOARD, BLANK	28480	04275-26503
A3C1	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C2	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C5	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C6	0160-2258	4	4	CAPACITOR-FXD 11PF +-5% 500VDC CER 0+-30	28480	0160-2258
A3C7	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C8	0160-2249	3		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A3C9	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C10	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C12	0160-2207	3	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A3C13	0121-0059	7		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A3C14	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C15	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A3C16	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C17	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C18	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C19	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C20	0160-0134	1	3	CAPACITOR-FXD 220PF +-5% 300VDC MICA	28480	0160-0134
A3C21	0160-2258	4		CAPACITOR-FXD 11PF +-5% 500VDC CER 0+-30	28480	0160-2258
A3C22	0160-0134	1		CAPACITOR-FXD 220PF +-5% 300VDC MICA	28480	0160-0134
A3C23	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A3C24	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A3C25	0180-1086	6		CAPACITOR-FXD 33uF +50-30% 16VDC	28480	0180-1086
A3C26	0150-0052	1	4	CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
A3C27	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C28	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A3C29	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C30	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A3C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C32	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C33	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C34	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C36	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C37	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A3C39	0140-0197	4		CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A3C40	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C41	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C42	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C43	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C44	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C45	0160-2258	4		CAPACITOR-FXD 11PF +-5% 500VDC CER 0+-30	28480	0160-2258
A3C46	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C47	0160-2249	3		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A3C48	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C49	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C50	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C51	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A3C52	0160-2250	6		CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A3C53	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C54	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A3C55	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C56	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C57	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C58	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C59	0140-0195	9		CAPACITOR-FXD 130PF +-5% 300VDC MICA 0+70	28480	
A3C60	0160-2258	4		CAPACITOR-FXD 11PF +-5% 500VDC CER 0+-30	28480	0160-2258
A3C61	0140-0199	1		CAPACITOR-FXD 240PF +-5% 300VDC MICA	28480	
A3C62	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A3C63	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A3C64	0180-1086	6		CAPACITOR-FXD 33uF +50-30% 16VDC	28480	0180-1086
A3C65	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3C66	0140-0197	4		CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A3C67	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A3C68	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C69	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A3C70	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C71	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C72	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C73	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C74	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C75	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C76	0140-0191	2	2	CAPACITOR-FXD 56PF +-5% 300VDC MICA	28480	
A3C77	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C78	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A3C79	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C80	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C81	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C82	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C83	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A3C84	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A3C85	0180-1077	5		CAPACITOR-FXD 220uF +50-10% 16VDC	28480	0180-1077
A3C86	0180-1078	6	1	CAPACITOR-FXD 330uF +50-10% 6.3VDC	28480	0180-1078
A3C87	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C88	0160-3443	1		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3CR1	1902-3160	4	4	DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	1902-3160
A3CR2	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A3CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR11	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A3CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR18	1902-3160	4		DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	1902-3160
A3CR19	1902-3160	4		DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	1902-3160
A3CR20	1902-3160	4		DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	1902-3160
A3CR21	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR22	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR23	1902-0064	1	1	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	28480	1902-0064
A3J1	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A3J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A3J3	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A3J4	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A3K1	0490-0234	1		RELAY, REED	28480	0490-0234
A3K2	0490-0234	1		RELAY, REED	28480	0490-0234
A3L1	9140-0179	1		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A3L2	9140-0179	1		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A3L3	9140-0210	1		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A3Q1	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q2	1855-0261	9		TRANSISTOR MOS-FET PD=100mW ID=15mA	28480	1855-0261
A3Q3	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q4	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q6	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q7	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q8	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q10	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q11	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q12	1853-0203	5	4	TRANSISTOR PNP SI PD=360MW FT=700MHZ	28480	1853-0203
A3Q13	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q14	1854-0247	9	2	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A3Q15	1853-0203	5		TRANSISTOR PNP SI PD=360MW FT=700MHZ	28480	1853-0203
A3Q16	1853-0012	4	5	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A3Q17	1854-0345	6		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q18	1855-0261	9			28480	1855-0261
A3Q19	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q20	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
				TRANSISTOr MOS-FET PD=100mW ID=15mA		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3Q21	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q22	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q23	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q24	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q25	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q26	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q27	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q28	1853-0203	5		TRANSISTOR PNP SI PD=360MW FT=700MHZ	28480	1853-0203
A3Q29	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q30	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A3Q31	1853-0203	5		TRANSISTOR PNP SI PD=360MW FT=700MHZ	28480	1853-0203
A3Q32	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A3Q33	1853-0084	0	2	TRANSISTOR PNP 2N4918 SI PD=30W FT=3MHZ	04713	2N4918
A3Q34	1854-0389	0	2	TRANSISTOR NPN 2N4922 SI PD=30W FT=3MHZ	04713	2N4922
A3Q35	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3R1	2100-0552	3	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 1-TRN	28480	2100-0552
A3R2	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A3R3	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R4	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A3R5	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A3R6	0698-2234	5	1	RESISTOR 330 5% .125W	28480	0698-2234
A3R7	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R8	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A3R9	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A3R10	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R12	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3R13	0698-4433	0	2	RESISTOR 2.26K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2261-F
A3R14	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R15	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R16	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R17	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3R18	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3R19	0757-0420	3	10	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A3R20	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A3R21	0757-0402	1	5	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R22	0757-0410	1		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A3R23	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R24	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A3R25	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R26	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R27	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A3R28	0757-0405	4	3	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A3R29	0757-0402	1		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R30	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R31	0757-0402	1		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R32	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R33	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R34	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R35	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R36	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R37	0698-3404	3	4	RESISTOR 383 1% .5W F TC=0+-100	28480	0698-3404
A3R38	0698-3404	3		RESISTOR 383 1% .5W F TC=0+-100	28480	0698-3404
A3R39	0698-3404	3		RESISTOR 383 1% .5W F TC=0+-100	28480	0698-3404
A3R40	0698-3404	3		RESISTOR 383 1% .5W F TC=0+-100	28480	0698-3404
A3R41	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A3R42	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A3R43	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A3R44	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A3R45	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A3R46	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A3R47	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A3R48	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A3R49	0683-1515	2	5	RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A3R50	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R51	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R52	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R53	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R54	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R55	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R56	0683-3305	2	4	RESISTOR 33 5% .25W FC TC=-400/+500	01121	CB3305
A3R57	0698-4488	9	2	RESISTOR 590 1% .125W F TC=0+-100	24546	C4-1/8-T0-590R-F
A3R58	0683-3305	2		RESISTOR 33 5% .25W FC TC=-400/+500	01121	CB3305
A3R59	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R60	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R61	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R62	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R63	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A3R65	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R66	0683-1535	6	2	RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A3R67	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A3R67	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R68	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A3R69	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A3R70	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R71	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A3R72	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A3R73	0757-0411	2	1	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A3R74	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R75	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A3R76	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R77	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R78	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A3R79	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R79	0698-4433	0		RESISTOR 2.26K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2261-F
A3R80	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R81	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R82	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R83	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3R84	0698-4460	3	1	RESISTOR 649 1% .125W F TC=0+-100	24546	C4-1/8-T0-649R-F
A3R85	0757-0433	2	1	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	
A3R86	0757-0402	1		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R87	0757-0410	1		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A3R88	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R89	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A3R90	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R91	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R92	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A3R93	0757-0280	9		RESISTOR 1K 1% .125W F TC=0+-100	24546	
A3R94	0757-0402	1		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R95	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R96	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R98	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R99	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R100	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A3R101	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A3R102	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A3R103	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A3R104	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A3R105	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A3R106	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A3R107	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R108	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R109	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R110	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R111	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R112	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R113	0683-3305	2		RESISTOR 33 5% .25W FC TC=-400/+500	01121	CB3305
A3R114	0698-4458	9		RESISTOR 590 1% .125W F TC=0+-100	24546	C4-1/8-T0-590R-F
A3R115	0683-3305	2		RESISTOR 33 5% .25W FC TC=-400/+500	01121	CB3305
A3R116	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R117	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R118	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R119	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R120	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A3R121	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R122	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A3R123	0698-2344	8	1	RESISTOR 2.45k .25% .125W	28480	0698-2344
A3R124	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A3R125	0683-1205	7	8	RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A3R126	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A3R127	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A3R128	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A3R129	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A3R130	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A3R131	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R132	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R133	1810-0205	7	2	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A3R134	1810-0205	7		NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A3R135	1810-0212	6	1	NETWORK-RES 16-DIP22.0K OHM X 8	01121	316B223

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R136	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R137	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A3R138	0698-2343	7	5	RESISTOR 50 .1% .125W	28480	0698-2343
A3R139	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R140	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A3R141	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A3R142	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A3T1	9100-0823	8		TRANSFORMER(TDK;1381) 1:1:1	28480	9100-0823
A3T2	9100-0876	1	2	TRANSFORMER-SIGNAL 2mH 30% 1:1	28480	9100-0876
A3T3	9100-0823	8		TRANSFORMER(TDK;1381) 1:1:1	28480	9100-0823
A3T4	9100-0822	7	4	TRANSFORMER;PULSE(11307)	28480	9100-0822
A3T5	9100-0823	8		TRANSFORMER(TDK;1381) 1:1:1	28480	9100-0823
A3T6	9100-0876	1		TRANSFORMER-SIGNAL 2mH 30% 1:1	28480	9100-0876
A3T7	9100-0822	7		TRANSFORMER;PULSE(11307)	28480	9100-0822
A3U1	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
A3U2	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
A3U3	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
A3U4	1820-1730	6	6	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A3U5	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
				A3 MISCELLANEOUS PARTS		
	1205-0050	7	4	HEAT SINK TO-5/TO-39-CS	28480	1205-0050
	04274-00612	4	1	SHIELD PLATE A3	28480	04274-00612
	04275-00608	9	1	SHIELD PLATE A3	28480	04275-00608
	04275-00609	0	1	SHIELD PLATE A3	28480	04275-00609
	04275-00610	3	1	SHIELD PLATE A3	28480	04275-00610
A4	04275-66504	2	1	PROCESS AMPLIFIER BOARD ASSEMBLY	28480	04275-66504
	04275-26504	8		PC BOARD, BLANK	28480	04275-26504
A4C1	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C2	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C3	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C4	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C5	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C6	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C7	0160-3456	6	6	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4C8	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4C9	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C10	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C11	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C12	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C13	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4C14	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C17	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4CR1	1901-0376	6	25	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4CR2	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4CR5	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4L1	9140-0129	1	12	COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A4L2	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A4L3	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A4L4	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A4L5	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A4L6	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A4L7	9100-1788	6	7	CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/4B
A4L8	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/4B
A4Q1	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4Q2	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4Q3	1853-0300	3	4	TRANSISTOR PNP SI TO-18 PD=300MW	28480	1853-0300
A4Q4	1853-0012	8		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A4Q5	1853-0300	3		TRANSISTOR PNP SI TO-18 PD=300MW	28480	1853-0300
A4Q6	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q7	1854-0039	7	3	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	01928	2N3053S
A4Q8	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q9	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4Q10	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q11	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4R1	0757-0487	2	25	RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R2	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R3	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R4	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R5	1810-0207	9	4	NETWORK-RES 8-SIP22.0K OHM X 7	01121	208A223

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R6	1810-0207	9		NETWORK-RES 8-SIP22.0K OHM X 7	01121	208A223
A4R7	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R8	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A4R9	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4R10	0683-2745	2	2	RESISTOR 270K 5% .25W FC TC=-800/+900	01121	CB2745
A4R11	0683-2745	2		RESISTOR 270K 5% .25W FC TC=-800/+900	01121	CB2745
A4R12	0683-1545	8	2	RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A4R13	0683-1545	8		RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A4R14	0683-0275	9	4	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A4R15	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4R16	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4R17	0683-0275	9		RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A4R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R19	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4R20	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R22	0698-3150	6	3	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A4R23	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A4R24	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4R25	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R26	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R27	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4R28	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R29	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4R30	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4T1	9100-0871	6	3	TRANSFORMER-SIGNAL 500uH 20% 1:1:1	28480	9100-0871
A4U1	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
A4U2	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
A4U3	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
				A4 MISCELLANEOUS PARTS		
	04275-00612	5	2	SHIELD COVER A4	28480	04275-00612
	04275-00613	6	2	SHIELD COVER A4	28480	04275-00613
A4A1	04275-66541	7	1	ERR BUFFER AMPLIFIER BOARD ASSEMBLY	28480	04275-66541
	04275-26541	3		PC BOARD, BLANK	28480	04275-26541
A4A1C1	0160-3060	8	36	CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A1C2	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A1C3	0121-0517	8	1	CAPACITOR-V TRMR-PSTN .8-4.5PF 750V	18736	
A4A1C4	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A1C5	0150-0052	1		CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
A4A1C6	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A1C7	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A1C8	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4A1CR1	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4A1CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A1CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A1CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4A1CR5	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A1CR6	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A1CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A1J4	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A4A1L1	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A1L2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A1L3	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A1L4	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A1L5	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A1L6	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A1Q1	1855-0268	6	2	TRANSISTOR J-FET N-CHAN D-MODE TO-92 SI	17856	J309
A4A1Q2	1854-0628	0	9	TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A1Q3	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4A1Q4	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4A1Q5	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A1Q6	1853-0354	7	12	TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A1R1	2100-3252	6	2	RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	28480	2100-3252
A4A1R2	0698-3136	8	5	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A1R3	0698-3429	2	8	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A4A1R4	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A4A1R5	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A1R6	0698-3439	4	2	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A4A1R7	0698-4037	0	4	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A4A1R8	2100-3199	0		RESISTOR-TRMR 20 20% C SIDE-ADJ 1-TRN	30983	ET50X200
A4A1R9	0757-0439	4	3	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A1R10	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4A1R11	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A1R12	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A1R13	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A1R14	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A1R15	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4A1R16	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A1R17	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A1T1	9100-0871	6		TRANSFORMER-SIGNAL 500uH 20% 1:1:1	28480	9100-0871
				A4A1 MISCELLANEOUS PARTS		
	1251-0600	0	5	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A2	04275-66542	8	1	EDUT BUFFER AMPLIFIER BOARD ASSEMBLY	28480	04275-66542
	04275-26542	4		PC BOARD, BLANK	28480	04275-26542
A4A2C1	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A2C2	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A2C3	0160-2246	0	1	CAPACITOR-FXD 3.6PF +-.25PF 500VDC CER	28480	0160-2246
A4A2C4	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A2C5	0150-0052	1		CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
A4A2C6	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A2C7	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A2C8	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4A2CR1	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4A2CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A2CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A2CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A2CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4A2CR6	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A2CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A2J4	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A4A2L1	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A2L2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A2L3	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A2L4	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A2L5	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A2L6	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A2Q1	1855-0268	6		TRANSISTOR J-FET N-CHAN D-MODE TO-92 SI	17856	J309
A4A2Q2	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A2Q3	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4A2Q4	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4A2Q5	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A2Q6	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A2R1	2100-3252	6		RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	28480	2100-3252
A4A2R2	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A2R3	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A4A2R4	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A4A2R5	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A2R6	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A4A2R7	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A4A2R8	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A2R9	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A2R10	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A4A2R11	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A2R12	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A2R13	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A2R14	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A2R15	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4A2R16	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A2R17	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A2T1	9100-0871	6		TRANSFORMER-SIGNAL 500uH 20% 1:1:1	28480	9100-0871
				A4A2 MISCELLANEOUS PARTS		
	1251-4683	7	23	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-4683
A4A3	04275-66543	9	1	AM AMPLIFIER BOARD ASSEMBLY	28480	04275-66543
	04275-26543	5		PC BOARD, BLANK	28480	04275-26543
A4A3C1	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4A3C2	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C3	0121-0059	7		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A4A3C4	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C5	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4A3C6	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C7	0160-2265	3		CAPACITOR-FXD 22PF +-5% 500VDC CER 0+-30	28480	0160-2265
A4A3C8	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C9	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C10	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4A3C11	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4A3C12	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4A3C13	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C14	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C16	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A3C17	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A4A3C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A3CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A3CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A3CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A3CR5	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A3CR6	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A3CR7	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A3L1	9100-1629	4	5	COIL-MLD 47UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1629
A4A3L2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A3L3	9100-1629	4		COIL-MLD 47UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1629
A4A3Q1	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4A3Q2	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A4A3Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4A3Q4	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A4A3Q5	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A3Q6	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4A3Q7	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A3Q8	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4A3Q9	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4A3Q10	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A3Q11	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A3Q12	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A4A3Q13	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4A3Q14	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A4A3Q15	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4A3Q16	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4A3Q17	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A3Q18	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A3R1	0698-3155	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4A3R2	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A4A3R3	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A4A3R4	0757-0180	2	11	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A3R5	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A4A3R6	0757-0399	5	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A4A3R7	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A3R8	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A4A3R9	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A4A3R10	2100-0589	6	4	RESISTOR-TRMR 10 10% C SIDE-ADJ 1-TRN	28480	2100-0589
A4A3R11	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A3R12	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A3R13	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A3R14	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A3R15	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A4A3R16	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A3R17	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4A3R18	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A4A3R19	0698-2239	0	4	RESISTOR 1.5	28480	0698-2239
A4A3R20	0698-2343	7		RESISTOR 50 .1% .125W	28480	0698-2343
A4A3R21	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A3R22	0757-0294	9	5	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A4A3R23	0757-0294	9		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A4A3R24	0698-3151	7	2	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A4A3R25	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A3R26	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A4A3R27	0698-2342	6	2	RESISTOR 450 .1% .125W	28480	0698-2342
A4A3R28	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A3R30	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A3R31	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A4A3R32	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A3R33	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A4A3R34	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4A3R35	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A4A3R36	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4A3R37	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
				A4A3 MISCELLANEOUS PARTS		
	1251-4683	7		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-4683
A4A4	04275-66544	0	1	AM AMPLIFIER BOARD ASSEMBLY	28480	04275-66544
	04275-26544	6		PC BOARD, BLANK	28480	04275-26544
A4A4C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C3	0121-0059	7		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A4A4C4	0160-2259	5		CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A4A4C5	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C6	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C7	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A4A4C8	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4A4C9	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C10	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C11	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C12	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C13	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C14	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4A4C15	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4C16	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A4A4CR1	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A4CR2	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A4CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A4CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A4CR5	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A4A4CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A4CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A4CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A4CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A4CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A4CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A4L1	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4A4Q1	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A4Q2	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4A4Q3	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A4A4Q4	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A4A4Q5	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A4A4Q6	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A4Q7	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A4Q8	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A4Q9	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A4Q10	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A4Q11	1854-0628	0		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A4A4Q12	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4A4Q13	1854-0039	7		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	01928	2N3053S
A4A4Q14	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A4A4R1	0698-2342	6		RESISTOR 450 .1% .125W	28480	0698-2342
A4A4R2	2100-0589	6		RESISTOR-TRMR 10 10% C SIDE-ADJ 1-TRN	28480	2100-0589
A4A4R3	0698-2343	7		RESISTOR 50 .1% .125W	28480	0698-2343
A4A4R4	0698-2239	0		RESISTOR 1.5	28480	0698-2239
A4A4R5	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A4R6	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A4R7	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A4R8	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A4R9	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A4A4R10	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A4R11	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A4R12	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A4R13	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A4R14	0757-0294	9		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A4A4R15	0698-3434	9	1	RESISTOR 34.8 1% .125W F TC=0+-100	24546	C4-1/8-T0-34R8-F
A4A4R16	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A4R17	0757-0294	9		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A4A4R18	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A4A4R19	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A4A4R20	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A4R21	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A4R22	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A4A4R23	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A4A4R24	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A4A4R25	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4A4R26	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A4A4R27	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A4A4R28	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A4R29	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A4A4R30	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A4A4R31	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
				A4A4 MISCELLANEOUS PARTS		
	1251-4683	7		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-4683
A5	04275-66505	3	1	A-D CONVERTER BOARD ASSEMBLY	28480	04275-66505
	04275-26505	9		PC BOARD, BLANK	28480	04275-26505
A5C1	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C2	0160-2261	9		CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A5C3	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C4	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C5	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C6	0160-2261	9		CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A5C7	0160-2239	1	2	CAPACITOR-FXD 1.8PF +-.25PF 500VDC CER	28480	0160-2239
A5C8	0160-2239	1		CAPACITOR-FXD 1.8PF +-.25PF 500VDC CER	28480	0160-2239
A5C9	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C10	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C11	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C12	0160-2200	6	1	CAPACITOR-FXD 43PF +-5% 300VDC MICA	28480	0160-2200
A5C13	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C14	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C15	0121-0036	0		CAPACITOR-V TRMR-CER 5.5-18PF 350V	52763	304324 5.5/18PF NPO
A5C16	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C17	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C18	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C19	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C20	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C21	0160-2257	3	1	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A5C22	0160-3060	8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A5C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C29	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A5C30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C32	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C33	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C36	0160-0939	4	1	CAPACITOR-FXD 430PF +-5% 300VDC MICA	28480	0160-0939
A5C37	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C38	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C39	0160-1674	6	1	CAPACITOR-FXD .33uF 5% 200VDC	28480	0160-1674
A5C40	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A5C41	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A5C42	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C43	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C44	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C45	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C46	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C47	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C48	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C49	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C50	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C51	0180-1083	3		CAPACITOR-FXD 33uF +75-10% 25VDC	28480	0180-1083
A5C52	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C53	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C54	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C55	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR8	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A5CR9	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A5CR10	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5CR11	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A5CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR18	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR19	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR20	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR21	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR22	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR23	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR24	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A5CR25	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A5CR26	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR27	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR28	1901-1011	6	1	DIODE-ARRAY VF DIFF=5MV	28480	1901-1011
A5CR29	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A5CR30	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR31	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR32	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A5CR33	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A5L1	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A5L2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A5L3	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A5L4	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A5L5	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A5L6	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/4B
A5L7	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/4B
A5L8	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/4B
A5L9	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/4B
A5Q1	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A5Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A5Q3	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A5Q4	1855-0127	9	1	TRANSISTOR FET N-CHANNEL SI	28480	
A5Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A5Q6	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A5Q7	1853-0015	7	2	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A5Q8	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q9	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q10	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A5Q11	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q12	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q13	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q14	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q15	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A5Q16	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A5Q17	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A5Q18	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A5Q19	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A5Q20	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A5Q21	1855-0111	8	8	TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q22	1855-0111	8		TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q23	1855-0111	8		TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q24	1855-0111	8		TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q25	1855-0111	8		TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q26	1855-0111	8		TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q27	1855-0111	8		TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q28	1855-0111	8		TRANSISTOR FET N-CHANNEL	28480	1855-0111
A5Q29	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q30	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q31	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q32	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q33	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q34	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q35	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q36	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q37	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q38	1853-0300	3		TRANSISTOR PNP SI TO-18 PD=300MW	28480	1853-0300
A5Q39	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A5Q40	1853-0300	3		TRANSISTOR PNP SI TO-18 PD=300MW	28480	1853-0300
A5Q41	1854-0039	7		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	01928	2N3053S
A5Q42	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5R1	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A5R2	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R3	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R4	2100-3273	1	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	28480	2100-3273
A5R5	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A5R6	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R8	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A5R9	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A5R10	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A5R11	2100-0589	6		RESISTOR-TRMR 10 10% C SIDE-ADJ 1-TRN	28480	2100-0589
A5R12	0698-2316	4		RESISTOR, FXD MET FLM 101.3 OHM 0.1% 1/8		
A5R13	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A5R14	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A5R15	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A5R16	2100-0589	6		RESISTOR-TRMR 10 10% C SIDE-ADJ 1-TRN	28480	2100-0589
A5R17	0698-2343	7		RESISTOR 50 .1% .125W	28480	0698-2343
A5R18	0698-2239	0		RESISTOR 1.5	28480	0698-2239
A5R19	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A5R20	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A5R21	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A5R22	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R23	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R24	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R25	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A5R26	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A5R27	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R28	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A5R29	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A5R30	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A5R31	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A5R32	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A5R33	0757-0487	2		RESISTOR 825K 1% .125W F TC=0+-100	28480	0757-0487
A5R34	0698-2239	0		RESISTOR 1.5	28480	0698-2239
A5R35	0757-0294	9		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A5R36	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A5R37	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A5R38	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A5R39	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A5R40	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A5R41	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A5R42	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A5R43	0757-0419	0	3	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A5R44	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A5R45	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A5R46	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R47	0698-2343	7		RESISTOR 50 .1% .125W	28480	0698-2343
A5R48	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R49	0698-4479	4	2	RESISTOR 14K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1402-F
A5R50	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A5R51	0698-3438	3	9	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R52	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R53	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R54	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A5R55	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R56	0698-4479	4		RESISTOR 14K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1402-F
A5R57	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A5R58	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R59	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R60	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R61	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R62	1810-0207	9		NETWORK-RES 8-SIP22.0K OHM X 7	01121	208A223
A5R63	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R64	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R65	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R66	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R67	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R68	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R69	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R70	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R71	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A5R72	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R73	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R74	0683-5615	1	15	RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R75	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5R76	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R77	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R78	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R79	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R80	0683-3315	6	4	RESISTOR 330 5% .25W FC TC=-400/+600	01121	
A5R81	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R82	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R83	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R84	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R85	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R86	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R87	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R88	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R89	0683-3315	6		RESISTOR 330 5% .25W FC TC=-400/+600	01121	
A5R90	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A5R91	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A5R92	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R93	0757-0444	1	4	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R94	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R95	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A5R96	0757-0316	6	2	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A5R97	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A5R98	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A5R99	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R100	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R101	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R102	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A5R103	0757-0440	7	3	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A5R104	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A5R105	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R106	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R107	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A5R108	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A5R109	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A5R110	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R111	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R112	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A5R113	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A5R114	0698-3158	4	2	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A5R115	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A5R116	0698-4158	1	2	RESISTOR 100K -1% .125W F TC=0+-25	28480	
A5R117	0698-4158	1		RESISTOR 100K -1% .125W F TC=0+-25	28480	
A5R118	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A5R119	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R120	2100-3350	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
A5R121	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R122	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R123	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R124	0698-6943	3		RESISTOR 20K 1% .125W F TC=0+-100	24546	
A5R125	0698-6943	3		RESISTOR 20K -1% .125W F TC=0+-100	24546	
A5R126	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A5R127	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R128	0757-0482	7	1	RESISTOR 511K 1% .125W F TC=0+-100	28480	0757-0482
A5R129	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A5R130	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R131	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R132	0683-0275	9		RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A5R133	0683-0275	9		RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A5R134	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R135	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R136	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R137	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R138	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R139	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5T1	9100-0822	7		TRANSFORMER;PULSE(11307)	28480	9100-0822
A5T2	9100-0822	7		TRANSFORMER;PULSE(11307)	28480	9100-0822
A5U1	1820-0817	8	6	IC FF ECL D-M/S DUAL	04713	MC10131P
A5U2	1820-0808	7	4	IC GATE ECL NOR DUAL 3-INP	04713	MC10111P
A5U3	1820-0808	7		IC GATE ECL NOR DUAL 3-INP	04713	MC10111P
A5U4	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A5U5	1820-0809	8	1	IC RCVR ECL LINE RCVR QUAD 2-INP	04713	MC10115P
A5U6	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A5U7	1820-0808	7		IC GATE ECL NOR DUAL 3-INP	04713	MC10111P
A5U8	1820-0808	7		IC GATE ECL NOR DUAL 3-INP	04713	MC10111P
A5U9	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A5U10	1820-0806	5	1	IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5U11	1826-0013	8	2	IC OP AMP LOW-NOISE TO-99	06665	SSS741CJ
A5U12	1826-0013	8		IC OP AMP LOW-NOISE TO-99	06665	SSS741CJ
A5U13	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
A5U14	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A5U15	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
A5U16	1826-0035	4	1	IC OP AMP LOW-DRIFT TO-99	27014	LM308AH
A5U17	1826-0081	0	1	IC OP AMP WB TO-99	27014	LM318H
A5U18	1826-0319	7		IC OP AMP TO-99	27014	LF356H
A5U19	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A5U20	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A5U21	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A5U22	1826-0210	7	1	IC COMPARATOR HS 14-DIP-P	27014	LM361N
				A5 MISCELLANEOUS PARTS		
	04275-00614	7	1	PLATE-SHIELD	28480	04275-00614
A6	04275-66506	4	1	OSCILLATOR BOARD ASSEMBLY	28480	04275-66506
	04275-26506	0		PC BOARD, BLANK	28480	04275-26506
A6C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C2	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C4	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C6	0160-2217	4		CAPACITOR-FXD 910PF +-5% 300VDC MICA	28480	
A6C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C8	0160-2203	4		CAPACITOR-FXD 91PF +-5% 300VDC MICA	72136	
A6C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C11	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C12	0180-0374	3	7	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C13	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A6C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C18	0180-0376	5	4	CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6C19	0180-0376	5		CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6C20	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A6C21	0180-1050	4	3	CAPACITOR-FXD 470uF +50-10% 16VDC	28480	0180-1050
A6C22	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A6C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C24	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C26	0160-2217	4		CAPACITOR-FXD 910PF +-5% 300VDC MICA	28480	
A6C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C28	0160-2203	4		CAPACITOR-FXD 91PF +-5% 300VDC MICA	72136	
A6C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C31	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C32	0180-1050	4		CAPACITOR-FXD 470uF +50-10% 16VDC	28480	0180-1050
A6C33	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C34	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A6C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C36	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C37	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C38	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C39	0180-0376	5		CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6C40	0180-0376	5		CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6C41	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C42	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C43	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A6C44	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C45	0180-1050	4		CAPACITOR-FXD 470uF +50-10% 16VDC	28480	0180-1050
A6C46	0140-0208	8	2	CAPACITOR-FXD 680PF +-5% 300VDC MICA	72136	DM15F681J0300WV1CR
A6C47	0140-0197	4		CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A6C48	0140-0208	8		CAPACITOR-FXD 680PF +-5% 300VDC MICA	72136	DM15F681J0300WV1CR
A6C49	0160-2206	2		CAPACITOR-FXD 160PF +-5% 300VDC MICA	28480	0160-2206
A6C50	0140-0200	0	1	CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
A6C51	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C52	0180-1085	5		CAPACITOR-FXD 4.7uF 20% 16VDC	28480	0180-1085
A6C53	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A6C54	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C55	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6C56	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C57	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C58	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C59	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C60	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C61	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C62	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C63	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C64	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A6C65	0160-2259	5		CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A6C66	0160-2249	3		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A6C67	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A6C68	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C69	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A6C70	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C71	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C72	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C73	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C74	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C75	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C76	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6CP1	1990-0104	5		PHOTOCELL LAMP	28480	1990-0104
A6CR1	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A6CR2	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A6CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR6	1902-0041	4		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A6CR7	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A6CR8	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A6CR9	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A6CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR18	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6CR19	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6CR20	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6CR21	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6CR22	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6CR23	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6CR24	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6CR25	1902-3082	9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A6J1	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A6J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A6L1	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A6L2	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A6L3	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A6L4	9100-1629	4		COIL-MLD 47UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1629
A6L5	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A6L6	9100-1629	4		COIL-MLD 47UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1629
A6L7	9140-0179	1		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A6L8	9100-1629	4		COIL-MLD 47UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1629
A6L9	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A6L10	9100-2254	3	2	COIL-MLD 390NH 10% Q=35 .095DX.25LG-NOM	28480	9100-2254
A6L11	9100-2254	3		COIL-MLD 390NH 10% Q=35 .095DX.25LG-NOM	28480	9100-2254
A6L12	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A6L13	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A6L14	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A6L15	9100-3139	5	1	COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A6L16	9140-0129	1		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A6L17	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A6L18	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A6L19	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A6L20	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A6L21	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A6L22	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A6L23	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6Q1	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q3	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A6Q4	1854-0129	6	4	TRANSISTOR NPN Si PD=300mW FT=30MHz	28480	1854-0129
A6Q5	1854-0129	6		TRANSISTOR NPN Si PD=300mW FT=30MHz	28480	1854-0129
A6Q6	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q7	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q8	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q9	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A6Q10	1854-0129	6		TRANSISTOR NPN Si PD=300mW FT=30MHz	28480	1854-0129
A6Q11	1854-0129	6		TRANSISTOR NPN Si PD=300mW FT=30MHz	28480	1854-0129
A6Q12	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q13	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q14	1853-0036	2	2	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A6Q15	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A6Q16	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A6Q17	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A6Q18	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A6Q19	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6Q20	1854-0389	0		TRANSISTOR NPN 2N4922 SI PD=30W FT=3MHZ	04713	2N4922
A6Q21	1853-0084	0		TRANSISTOR PNP 2N4918 SI PD=30W FT=3MHZ	04713	2N4918
A6R1	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A6R2	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R3	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R4	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R5	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A6R6	0683-6815	5	4	RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A6R7	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A6R8	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A6R9	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A6R10	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R11	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A6R12	0683-4745	6	3	RESISTOR 470K 5% .25W FC TC=-800/+900	01121	CB4745
A6R13	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R14	0683-4745	6		RESISTOR 470K 5% .25W FC TC=-800/+900	01121	CB4745
A6R15	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R16	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R17	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R18	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A6R19	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A6R20	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R21	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R22	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A6R23	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R24	0698-3433	8	1	RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A6R25	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R26	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R27	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R28	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A6R29	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A6R30	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A6R31	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A6R32	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A6R33	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A6R35	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R36	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A6R37	0683-4745	6		RESISTOR 470K 5% .25W FC TC=-800/+900	01121	CB4745
A6R38	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R39	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A6R40	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R41	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R42	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R43	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A6R44	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A6R45	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R46	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R47	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A6R48	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A6R49	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R50	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R51	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A6R52	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A6R53	0683-2715	6		RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A6R54	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A6R55	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A6R56	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R57	0683-2715	6		RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A6R58	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A6R59	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R60	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A6R61	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R62	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R63	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R64	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R66	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R67	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R68	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A6R69	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R70	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R71	0757-0410	1		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A6R72	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R73	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R74	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R75	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A6R76	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A6R77	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A6R78	0757-0379	1	1	RESISTOR 12.1 1% .125W F TC=0+-100	19701	MF4C1/8-T0-12R1-F
A6R79	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A6R80	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A6R81	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A6R82	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A6R83	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A6R84	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A6R85	1810-0203	5	5	NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A6R86	1810-0203	5		NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A6R87	1810-0203	5		NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A6R88	1810-0305	8	1	NETWORK-RES 9-SIP4.7K OHM X 8	28480	1810-0305
A6R89	1810-0269	3	1	NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0269
A6R90	1810-0203	5		NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A6R91	1810-0207	9		NETWORK-RES 8-SIP22.0K OHM X 7	01121	208A223
A6R92	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A6R93	1810-0203	5		NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A6R94	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A6R95	0757-0316	6		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A6R96	0683-8205	1	1	RESISTOR 82 5% .25W FC TC=-400/+500	01121	CB8205
A6U1	1826-0139	9		IC OP AMP GP DUAL 8-DIP-P	01928	CA1458G
A6U2	1826-0139	9		IC OP AMP GP DUAL 8-DIP-P	01928	CA1458G
A6U3	1826-0215	2	1	IC V RGLTR TO-220	04713	MC7905.2CT
A6U4	1826-0174	2	1	IC COMPARATOR GP QUAD 14-DIP-P	28480	1826-0174
A6U5	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U6	1820-0802	1	5	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U7	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U8	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U9	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A6U10	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A6U11	1820-1383	5	4	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A6U12	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A6U13	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A6U14	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U15	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A6U16	1820-1399	5	1	IC MUXR/DATA-SEL ECL 4-TO-1-LINE DUAL	04713	MC10174P
A6U17	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U18	1820-1950	2	1	IC GATE ECL OR-NOR 3-INP	04713	MC10212P
A6Y1	0410-0213	8	1	CRYSTAL-QUARTZ 80.000MHz +-20ppm	28480	0410-0213
A6Y2	0410-0214	9	1	CRYSTAL-QUARTZ 32.000MHz +-20ppm	28480	0410-0214
				A6 MISCELLANEOUS PARTS		
	04275-00615	8	1	PLATE-SHIELD	28480	04275-00615
	04275-00616	9	2	PLATE-SHIELD A5	28480	04275-00616
	04275-00617	0	3	PLATE-SHIELD	28480	04275-00617
				OPTION 004		
A6Y2	0410-0215		1	CRYSTAL-QUARTZ 24.000 MHz		
A6C67	0140-0196		1	CAPACITOR-FXD 150pF 5%		
A6C69	0140-0197		1	CAPACITOR-FXD 180pF 5%		

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	04275-66507	4	1	PERIPHERAL CONTROL BOARD ASSEMBLY	28480	04275-66507
A7	04275-66537	0	1	PERIPHERAL CONTROL BOARD ASSEMBLY (FOR OPTION 004 ONLY)	28480	04275-66537
A7C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C2	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A7C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C12	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A7C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C14	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A7C15	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C17	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A7C18	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A7C19	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A7C20	0160-2247					
A7CR1	1902-0041	4		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A7J2	1200-0608	1	5	SOCKET-IC 40-CONT	28480	1200-0608
A7J3	1200-0613	8	1	SOCKET-IC 28-CONT DIP-SLDR	28480	1200-0613
A7L1	9100-1788	6	6	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A7L2	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A7L3	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A7L4	9100-3139	5		COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A7R1	1810-0269	3	15	NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A7R2	0683-1235	3	13	RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A7R3	0683-6825	7	1	RESISTOR 6.8K 5% .25W FC TC=-400/+700	01121	CB6825
A7R4	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A7R5	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A7R6	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A7R7	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A7R8	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A7R9	0683-5615	1	6	RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A7R10	0683-2215	1	2	RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A7R11	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A7R12	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A7T1	9100-0822	7	2	TRANSFORMER, PULSE	28480	9100-0822
A7T2	9100-0822	7		TRANSFORMER, PULSE	28480	9100-0822
A7U1	1820-0909	9	1	IC MULTR TTL	01295	SN74167N
A7U2	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A7U3	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A7U4	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A7U5	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A7U6	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A7U7	1820-1201	6	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A7U8	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A7U9	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A7U10	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A7U11	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A7U12	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A7U13	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A7U15	1820-0054	9		IC GATE TTL LS NAND QUAD 2-INP	01295	
A7U16	1820-1828	3	4	IC DRVR TTL BUS DRVR QUAD	18324	N8T28N
A7U17	1820-1481	4	3	IC PIA NMOS	04713	MC6821L
A7U18	1820-1828	3		IC DRVR TTL BUS DRVR QUAD	18324	N8T28N
A7U19	1820-1470	1	2	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
A7U20	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A7U21	1820-1206	1	1	IC GATE TTL LS NOR TPL 3-INP	01295	SN74LS27N
A7U22	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A7U23	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A7U24	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A7U25	1820-2255	6	1	IC CNTR C-MOS	28480	U20-IS1
A7U26	1820-1210	7		IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A7U27	1820-1828	3		IC DRVR TTL BUS DRVR QUAD	18324	N8T28N
A7U28	1820-1828	3		IC DRVR TTL BUS DRVR QUAD	18324	N8T28N
A7U29	1820-1470	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
A7U30	1820-1216	3	4	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A7U31	1820-0495	8	3	IC DCDR TTL 4-TO-16-LINE 4-INP	01295	SN74154N
A7U32	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A7U33	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A7W4	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A7W5	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A7W6	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A7W7	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A7W9	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A7Y1	0410-0211	6	1	CRYSTAL, QUARTZ 9.95 MHZ	28480	0410-0211
				A7 MISCELLANEOUS PARTS		
	04274-26507	0		PC BOARD, BLANK	28480	04274-26507
A8	04274-66508	5	1	DISPLAY AND KEY CONTROL BOARD ASSEMBLY	28480	04274-66508
A8C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C10	0160-0155	8		CAPACITOR-FXD 3.3NF +-10% 200VDC POLYE	56289	
A8C11	0160-0155	8		CAPACITOR-FXD 3.3NF +-10% 200VDC POLYE	56289	
A8C12	0160-0155	8		CAPACITPR-FXD 3.3NF +-10% 200VDC POLYE	56289	
A8C13	0180-1050	4		CAPACITOR, FXD 100 UF 25VDCW	28480	0180-1050
A8C14	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A8C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C23	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A8C24	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A8L1	9100-3139	5		COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A8L2	9100-3139	5		COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A8L3	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A8Q1	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8R1	1810-0205	7		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	01121	208A472
A8R2	1810-0205	7		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	01121	208A472
A8R3	1810-0205	7		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	01121	208A472
A8R6	1810-0301	4	3	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	01121	316B510
A8R7	1810-0301	4		NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	01121	316B510
A8R8	1810-0301	4		NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	01121	316B510
A8R9	1810-0205	7		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	01121	208A472
A8R10	0683-1205	2		RESISTOR 12 5% .25W FC TC=400/+600	01121	
A8R11	0683-1205	2		RESISTOR 12 5% .25W FC TC=400/+600	01121	
A8R12	0683-1205	2		RESISTOR 12 5% .25W FC TC=400/+600	01121	
A8S1	3101-2061	6	1	SWITCH, TOGGLE DIP-ROCKER	28480	3101-2061
A8U1	1858-0023	7	3	TRANSISTOR ARRAY	01928	CA3081E
A8U2	1858-0023	7		TRANSISTOR ARRAY	01928	CA3081E
A8U3	1858-0023	7		TRANSISTOR ARRAY	01928	CA3081E
A8U4	1820-0628	9	6	IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A8U5	1820-0628	9		IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A8U6	1820-0628	9		IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A8U7	1820-1194	6	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A8U8	1820-1278	7	2	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS191N
A8U9	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A8U10	1820-0628	9		IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A8U11	1820-0628	9		IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A8U12	1820-0628	9		IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A8U13	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A8U14	1820-1415	4	1	IC SCHMITT-TRIG TTL LS NAND DUAL 4-INP	01295	SN74LS13N
A8U15	1820-1278	7		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS191N
A8U16	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
				A8 MISCELLANEOUS PARTS		
A8Z1	04274-26508	1		PC BOARD, BLANK	28480	04274-26508
A9						
A9						
A9	04275-66509	6		MPU BOARD ASSEMBLY (FOR OPT. 101 ONLY) FOR OPT. 101 USE U10 ONLY	28480	
A9	04275-66519	7	1	MPU BOARD ASSEMBLY (FOR OPT. 003 PLUS 101 ONLY) FOR OPT. 003 PLUS 101 USE U14, U15, U25, AND U10)	28480	
A9C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C7	0160-0134	1		CAPACITOR-FXD 220PF +-5% 300VDC MICA	28480	0160-0134
A9C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C9	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A9C10	0160-2307	4	2	CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9C11	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A9C12	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A9C13	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A9C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C21	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A9C22	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A9C23	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A9C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C25	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A9C26	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A9C27	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A9C28	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A9CR1	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A9CR2	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
A9CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A9CR4	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A9CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A9J12	1200-0608	1		SOCKET-IC 40-CONT	28480	1200-0608
A9L1	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A9L2	9100-3139	5		COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A9Q1	1853-0015	7	2	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A9Q2	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A9R1	1810-0305	8	3	NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0305
A9R2	1810-0305	8		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0305
A9R3	1810-0305	8		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0305
A9R4	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A9R5	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A9R6	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A9R7	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A9R8	0683-1205	7		RESISTOR 12 5% .25W FC TC=-400/+500	01121	CB1205
A9R9	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A9R10	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A9R11	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A9R12	0683-2715	6		RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A9R13	0683-2715	6		RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A9R14	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A9R15	0698-4501	3	1	RESISTOR 59K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5902-F
A9R17	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A9R18	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A9R19	0683-4745	6		RESISTOR 470K 5% .25W FC TC=-800/+900	01121	CB4745
A9R20	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A9R21	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A9R22	0683-4745	6		RESISTOR 470K 5% .25W FC TC=-800/+900	01121	CB4745
A9R23	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A9R24	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A9R25	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A9S1	3101-1973	7	2	SWITCH, SLIDE 7-1A-NS	28480	3101-1973
A9U1	1818-1134	7	1	IC, MASK-ROM	28480	
A9U3	1818-1135	7	1	IC, MASK-ROM	28480	
A9U5	1818-1136	9	1	IC, MASK-ROM	28480	
A9U7	1818-1137	1	1	IC, MASK-ROM	28480	
A9U10	1818-1139	3	1	IC, MASK-ROM	28480	
A9U12	1818-0438	4	2	IC NMOS 4K RAM STAT 450-NS 3-S	34649	P2114
A9U13	1818-0438	4		IC NMOS 4K RAM STAT 450-NS 3-S	34649	P2114
A9U14	1818-0796	7	2	IC CMOS 1K RAM STAT 350-NS 3-S	28480	1818-0796
A9U15	1818-0796	7		IC CMOS 1K RAM STAT 350-NS 3-S	28480	1818-0796
A9U16	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A9U17	1820-2024	3	6	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A9U18	1820-1480	3	1	IC MICPROC NMOS 8-BIT	04713	MC6800L
A9U19	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A9U20	1820-0683	6	1	IC INV TTL S HEX 1-INP	01295	SN74S04N
A9U21	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A9U22	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
BT	1420-0125			BATTERY LITHIUM 2.8V		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9U23	1820-1491	6	2	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A9U25	1826-0408	5	1	8-DIP-P	32293	ICL8212CPA
A9U26	1820-0661	0	1	IC GATE TTL OR QUAD 2-INP	01295	SN7432N
A9U27	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A9U28	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A9U29	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A9U30	1906-0075	2	1	DIODE-ARRAY 40V 400MA	28480	1906-0075
A9U31	1820-1994	4	2	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS243N
A9U32	1820-1994	4		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS243N
A9U33	1820-1491	6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A9U34	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A9U35	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	04713	MC1455P1
A9W1	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A9W2	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A9W3	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A9W4	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A9W5	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A9W6	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
				A9 MISCELLANEOUS PARTS		
	04274-26509	2		PC BOARD, BLANK	28480	04274-26509
A10	04275-66520	9	1	DISPLAY AND KEYBOARD ASSEMBLY	28480	04275-66520
A10C1	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A10C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10DS1	1990-0486	6	35	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS2	1990-0540	3	12	DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS3	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS4	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS5	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS6	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS7	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS8	1990-0617	5	4	DISPLAY-AN-DOT MAT 1-CHAR .3-H	28480	1990-0617
A10DS9	1990-0617	5		DISPLAY-AN-DOT MAT 1-CHAR .3-H	28480	1990-0617
A10DS10	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS11	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS12	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS13	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS14	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS15	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A10DS16	1990-0617	5		DISPLAY-AN-DOT MAT 1-CHAR .3-H	28480	1990-0617
A10DS17	1990-0617	5		DISPLAY-AN-DOT MAT 1-CHAR .3-H	28480	1990-0617
A10DS18	1990-0434	4	3	DISPLAY-NUM-SEG 1-CHAR .3-H	28480	5082-7730, CAT B-E
A10DS19	1990-0434	4		DISPLAY-NUM-SEG 1-CHAR .3-H	28480	5082-7730, CAT B-E
A10DS20	1990-0434	4		DISPLAY-NUM-SEG 1-CHAR .3-H	28480	5082-7730, CAT B-E
A10DS21	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS22	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS23	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS24	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS25	1990-0517	4	1	LED-VISIBLE LUM-INT=3MCD IF=20MA-MAX	28480	5082-4655
A10DS26	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS27	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS28	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS29	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS30	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS31	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS32	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS33	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS34	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS35	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10DS36	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS37	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS38	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS39	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS40	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS41	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS42	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS43	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS44	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS45	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS46	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS47	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS48	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS49	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS50	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS51	1990-0665	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	
A10DS52	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS53	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS54	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10DS55	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A10J2	1200-0638	9	12	SOCKET-IC 14-CONT DIP-SLDR SOCKET FOR DS2 THROUGH DS7	28480	
A10J3	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J4	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J5	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J6	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J7	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J8	1200-0424	9	4	SOCKET-ELEC (MISC ITEM) 14-PIN SOCKET FOR DS8, 9, 16, AND 17	28480	1200-0424
A10J9	1200-0424	9		SOCKET-ELEC (MISC ITEM)	28480	1200-0424
A10J10	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J11	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J12	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J13	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J14	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J15	1200-0638	9		SOCKET-IC 14-CONT DIP-SLDR	28480	
A10J16	1200-0424	9		SOCKET-ELEC (MISC ITEM)	28480	1200-0424
A10J17	1200-0424	9		SOCKET-ELEC (MISC ITEM)	28480	1200-0424
A10J18	1200-0508	0	3	SOCKET-IC 14-CONT DIP-SLDR SOCKET FOR DS18 THROUGH DS20	28480	1200-0508
A10J19	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A10J20	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A10KC1	5041-0252	7	6	KEY CAP	28480	5041-0252
A10KC2	5041-0252	7		KEY CAP	28480	5041-0252
A10KC3	5041-0351	7	3	KEY CAP	28480	5041-0351
A10KC4	5041-0252	7		KEY CAP	28480	5041-0252
A10KC5	5041-0252	7		KEY CAP	28480	5041-0252
A10KC6	5041-0252	7		KEY CAP	28480	5041-0252
A10KC7	5041-0252	7		KEY CAP	28480	5041-0252
A10KC8	5041-0351	7		KEY CAP	28480	5041-0351
A10KC9	5041-0351	7		KEY CAP	28480	5041-0351
A10KC10	5041-0309	5	8	KEY CAP	28480	5041-0309
A10KC11	5041-0309	5		KEY CAP	28480	5041-0309
A10KC12	5041-0318	6	15	*LK CAP- PTY GRAY	28480	5041-0318
A10KC13	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC14	5041-0309	5		KEY CAP	28480	5041-0309
A10KC15	5041-0309	5		KEY CAP	28480	5041-0309
A10KC16	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC17	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC18	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC19	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC20	5041-0309	5		KEY CAP	28480	5041-0309
A10KC21	5041-0309	5		KEY CAP	28480	5041-0309
A10KC22	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC23	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC24	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC25	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC30	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC31	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC32	5041-0309	5		KEY CAP	28480	5041-0309
A10KC33	5041-0309	5		KEY CAP	28480	5041-0309
A10KC34	5041-0375	5	1	KEY-Q-SMOKE GRAY	28480	5041-0375
A10KC35	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC36	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC37	5041-0318	6		*LK CAP- PTY GRAY	28480	5041-0318
A10KC38	5041-0384	6	1	KEY-Q-SMOKE GRAY	28480	5041-0384

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10R1	0757-0400	9	14	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R2	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R3	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R4	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R5	1810-0205	7		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	01121	208A472
A10R6	1810-0205	7		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	01121	208A472
A10R7	1810-0205	7		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	01121	208A472
A10R8	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A10R9	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R10	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R11	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R12	0683-1215	9	16	RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R13	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R14	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R15	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R16	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R17	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R18	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R19	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R20	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R21	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R22	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R23	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R24	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R25	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R26	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R27	0683-1215	9		RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A10R28	2100-1174	7	1	RESISTOR, VAR 2K 10%	28480	2100-1174
A10R29	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R30	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R31	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R32	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R33	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R34	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10R35	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A10S1- A10S25	5060-9436	7	33	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A10S27	3101-2046	7	1	SWITCH, SLIDE DPDT-NS	28480	3101-2046
A10S28	3101-1074	9	2	SWITCH, PUSHBUTTON SPST NO	28480	3101-1074
A10S29	3101-1074	9		SWITCH, PUSHBUTTON SPST NO	28480	3101-1074
A10S26	3101-2046			SWITCH, SLIDE DPDT-NS		
A10S30- A10S38	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A10U1	1858-0038	4	4	TRANSISTOR ARRAY	28480	1858-0038
A10U2	1858-0038	4		TRANSISTOR ARRAY	28480	1858-0038
A10U3	1858-0038	4		TRANSISTOR ARRAY	28480	1858-0038
A10U4	1858-0038	4		TRANSISTOR ARRAY	28480	1858-0038
A10U5	1820-0668	7	3	IC BFR TTL NON-INV HEX 1-INP	01295	SN7407N
A10U6	1820-0668	7		IC BFR TTL NON-INV HEX 1-INP	01295	SN7407N
A10U7	1820-0668	7		IC BFR TTL NON-INV HEX 1-INP	01295	SN7407N
A10U8	1820-0495	8		IC DCDR TTL 4-TO-16-LINE 4-INP	01295	SN74154N
A10U9	1820-0495	8		IC DCDR TTL 4-TO-16-LINE 4-INP	01295	SN74154N
A10W1	04274-61621	3	1	WIRING ASSEMBLY	28480	04274-61621
	0360-1706	9	1	CABLE TRANSITION	28480	0360-1706
				A10 MISCELLANEOUS PARTS		
	04274-26510	5		PC BOARD, BLANK	28480	04274-26510
A11	04274-66511	0	1	POWER SUPPLY BOARD ASSEMBLY	28480	04274-66511
A11C1	0180-1073	1	1	CAPACITOR-FXD 22000uF +30-10% 16VDC	28480	0180-1073
A11C2	0180-1071	9	1	CAPACITOR-FXD 15000uF +30-10% 16VDC	28480	0180-1071
A11C3	0180-1072	0	2	CAPACITOR-FXD 10000uF +30-10% 25VDC	28480	0180-1072
A11C4	0180-1072	0		CAPACITOR-FXD 10000uF +30-10% 25VDC	28480	0180-1072
A11C5	0180-1074	2	2	CAPACITOR-FXD 470uF +5075-10% 100VDC	28480	0180-1074
A11C6	0180-1074	2		CAPACITOR-FXD 470uF +50-10% 100VDC	28480	0180-1074
A11C7	0180-1076	4	6	CAPACITOR-FXD 470uF +50-10% 35VDC	28480	0180-1076
A11C8	0180-1076	4		CAPACITOR-FXD 470uF +50-10% 35VDC	28480	0180-1076
A11C9	0180-1076	4		CAPACITOR-FXD 470uF +50-10% 35VDC	28480	0180-1076
A11C10	0180-1076	4		CAPACITOR-FXD 470uF +50-10% 35VDC	28480	0180-1076
A11C11	0180-1076	4		CAPACITOR-FXD 470uF +50-10% 35VDC	28480	0180-1076
A11C12	0180-1051	5	1	CAPACITOR, FXD 100 UF 16V M	28480	0180-1051
A11C13	0180-1076	4		CAPACITOR-FXD 470uF +50-10% 35VDC	28480	0180-1076
A11C14	0180-1075	3	4	CAPACITOR-FXD 2200uF +30-10% 16VDC	28480	0180-1075
A11C15	0180-1075	3		CAPACITOR-FXD 2200uF +30-10% 16VDC	28480	0180-1075

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11C16	0180-1075	3		CAPACITOR-FXD 2200uF +30-10% 16VDC	28480	0180-1075
A11C17	0180-1075	3		CAPACITOR-FXD 2200uF +30-10% 16VDC	28480	0180-1075
A11CR1	1901-0416	5	10	DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR2	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR3	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR4	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR5	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR6	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR7	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR8	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR9	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR10	1901-0416	5		DIODE-PWR RECT 200V 1.5A	28480	1901-0416
A11CR11	1902-0021	0	2	DIODE-ZNR 1N2992RB 39V 5% DO-4 PD=10W	04713	1N2992RB
A11CR12	1902-0021	0		DIODE-ZNR 1N2992RB 39V 5% DO-4 PD=10W	04713	1N2992RB
A11CR13	1901-0364	2	2	DIODE-FW BRDG 200V 1A	28480	1901-0364
A11CR14	1901-0364	2		DIODE-FW BRDG 200V 1A	28480	1901-0364
A11CR15	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR16	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR17	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR18	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR19	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR20	1902-3094	3	1	DIODE-ZNR 5.11V 2% DO-7 PD=.4W TC=-.009%	28480	1902-3094
A11CR21	1902-0033	4	1	DIODE-ZNR 1N823 6.2V 5% DO-7 PD=.4W	24046	1N823
A11CR22	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR23	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR24	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR25	1901-0028	5	2	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A11CR26	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A11CR27	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR28	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR29	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A11CR30	1902-1200	9	2	DIODE-ZNR 1N2980B 16V 5% DO-4 PD=10W	12954	1N2980B
A11CR31	1902-1200	9		DIODE-ZNR 1N2980B 16V 5% DO-4 PD=10W	12954	1N2980B
A11CR32	1902-1232	7	2	DIODE-ZNR 1N3997AR 5.6V 5% DO-4 PD=10W	04713	1N3997AR
A11CR33	1902-1232	7		DIODE-ZNR 1N3997AR 5.6V 5% DO-4 PD=10W	04713	1N3997AR
A11DP1	1970-0076	8	1	TUBE-ELECTRON SURGE V PTCTR	28480	1970-0076
A11F1	2110-0007	4	3	FUSE 1A 250V SLO-BLO 1.25X.25 UL	75915	313001
A11F2	2110-0007	4		FUSE 1A 250V SLO-BLO 1.25X.25 UL	75915	313001
A11F3	2110-0303	3	1	FUSE 2A 250V SLO-BLO 1.25X.25 UL	28480	2110-0303
A11F4	2110-0014	3	1	FUSE 4A 250V SLO-BLO 1.25X.25 UL	75915	313004
A11F5	2110-0201	0	1	FUSE .25A 250V SLO-BLO 1.25X.25 UL	75915	313.250
A11F6	2110-0012	1	1	FUSE .5A 250V FAST-BLO 1.25X.25 UL	28480	2110-0012
A11F7	2110-0007	4		FUSE 1A 250V SLO-BLO 1.25X.25 UL	75915	313001
A11K1	0490-0238	5	1	RELAY-REED	28480	0490-0238
A11Q1	1853-0027	1		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0027
A11Q2	1853-0027	1		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0027
A11Q3	1854-0023	7	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A11Q4	1854-0448	2		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0448
A11Q5	1854-0448	2		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0448
A11Q6	1853-0281	9	4	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A11Q7	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A11Q8	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A11Q9	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A11R1	0690-1541	9	1	RESISTOR 150K 10% 1W CC TC=0+882	01121	GB1541
A11R2	0768-0001	9	1	RESISTOR 1K 10% 3W MO TC=0+-250	27167	FP3-3-250-1001-K
A11R3	2100-3212	8	1	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	28480	2100-3212
A11R4	0812-0072	9	2	RESISTOR .23 5% 3W PW TC=0+-90	28480	0812-0072
A11R5	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A11R6	0812-0072	9		RESISTOR .23 5% 3W PW TC=0+-90	28480	0812-0072
A11R7	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A11R8	0683-1525	4	3	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A11R9	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A11R10	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A11R11	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A11R12	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A11R13	0811-2771	7	1	RESISTOR .18 3% 3W PW TC=0+-90	28480	0811-2771
A11R14	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A11R15	0811-3290	7	2	RESISTOR .1 5% 2W PW TC=0+-800	28480	0811-3290
A11R16	0811-3290	7		RESISTOR .1 5% 2W PW TC=0+-800	28480	0811-3290
A11R17	0683-8215	3	3	RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A11R18	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A11R19	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A11R20	0686-1235	9	1	RESISTOR 12K 5% .5W CC TC=0+765	01121	EB1235

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R21	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A11R22	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A11R23	0683-0475	1		RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A11R24	0683-0475	1		RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A11R25	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A11R26	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A11R27	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R29	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A11R30	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A11R31	0698-4471	6	1	RESISTOR 7.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7151-F
A11R32	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A11R33	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R34	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A11R35	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A11R36	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A11R37	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A11R38	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A11R39	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A11R40	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11U1	1820-0493	6	5	OP AMP GP 8-DIP-P	27014	LM307N
A11U2	1820-0493	6		OP AMP GP 8-DIP-P	27014	LM307N
A11U3	1820-0493	6		OP AMP GP 8-DIP-P	27014	LM307N
A11U4	1820-0493	6		OP AMP GP 8-DIP-P	27014	LM307N
A11U5	1820-0493	6		OP AMP GP 8-DIP-P	27014	LM307N
A11W1	1251-3198	7	2	CONNECTOR 15-PIN M POST TYPE	28480	1251-3198
A11W2	1251-3198	7		CONNECTOR 15-PIN M POST TYPE	28480	1251-3198
A11W3	1251-3197	6	1	CONNECTOR 12-PIN M POST TYPE	28480	1251-3197
				A11 MISCELLANEOUS PARTS		
	04274-26511	6		PC BOARD, BLANK	28480	04274-26511
A12	04274-66512	1	1	MOTHER BOARD ASSEMBLY	28480	04274-66512
A12J1	1251-3141	0	1	CONNECTOR 50-PIN M RECTANGULAR	28480	1251-3141
A12XA1L	1251-5564	7	22	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA1R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA2L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA2R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA3L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA3R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA4L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA4R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA5L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA5R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA6L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA6R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA7L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA7R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA8L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA8R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA9L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA9R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA11L	1251-4189	8	2	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-4189
A12XA11R	1251-4189	8		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-4189
A12XA21L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA21R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA22L	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
A12XA22R	1251-5564	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	
				A12 MISCELLANEOUS PARTS		
	04274-26512	7		PC BOARD, BLANK	28480	04274-26512
A13				NOT ASSIGNED		
A14				NOT ASSIGNED		
A15	04274-66515	4	1	HP-IB CONNECTOR BOARD ASSEMBLY	28480	04274-66515
A15J1	1251-3283	1	1	CONNECTOR 24-PIN F MICRORIBBON	28480	1251-3283
A15J2	1251-2159	8	2	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-2159

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	04274-26515	0		PC BOARD, BLANK	28480	04274-26515
A16	04274-66516	5	1	DC BIAS CONNECTOR BOARD ASSEMBLY	28480	04274-66516
A16J1	1251-0292	6	1	CONNECTOR 24-PIN F MICRO RIBBON	28480	1251-0292
A16J2	1251-2159	8		CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-2159
	04274-26515	0		PC BOARD, BLANK	28480	04274-26515
A17				NOT ASSIGNED		
A18				NOT ASSIGNED		
A19				NOT ASSIGNED		
A20				NOT ASSIGNED		
A21	04274-66521	2	1	DC BIAS(+/-35V) BOARD ASSEMBLY (OPTION 001 ONLY)	28480	04274-66521
A21C1	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A21C2	0160-2242	6	1	CAPACITOR-FXD 2.4PF +-.25PF 500VDC CER	28480	0160-2242
A21C3	0160-2257	3		CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A21C5	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A21C9	0140-0191	8	1	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A21C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C11	0180-1050	4		CAPACITOR, FXD 100 UF 25VDCW	28480	0180-1050
A21C12	0180-1050	4		CAPACITOR, FXD 100 UF 25VDCW	28480	0180-1050
A21C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C14	0160-0859	7	1	CAPACITOR-FXD 1UF +-10% 50VDC POLYE	28480	0160-0859
A21C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C15	0180-1084	4	1	CAPACITOR, FXD 100 UF 50VDCW BI	28480	0180-1084
A21C16	0180-1081	1	9	CAPACITOR, FXD 47 UF 50 VDCW AL	28480	0180-1081
A21C18	0180-1081	1		CAPACITOR, FXD 47 UF 50 VDCW AL	28480	0180-1081
A21C19	0180-1081	1		CAPACITOR, FXD 47 UF 50 VDCW AL	28480	0180-1081
A21C20	0180-1082	2	6	CAPACITOR, FXD 10 UF 100VDCW AL	28480	0180-1082
A21C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C22	0180-1050	4		CAPACITOR, FXD 100 UF 25VDCW	28480	0180-1050
A21C23	0180-1081	1		CAPACITOR, FXD 47 UF 50 VDCW AL	28480	0180-1081
A21C24	0180-1050	4		CAPACITOR, FXD 100 UF 25VDCW	28480	0180-1050
A21C25	0180-1050	4		CAPACITOR, FXD 100 UF 25VDCW	28480	0180-1050
A21C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C27	0180-2951	6	6	CAPACITOR-FXD 33UF+-20% 16VDC AL	28480	0180-2951
A21C28	0180-2951	6		CAPACITOR-FXD 33UF+-20% 16VDC AL	28480	0180-2951
A21C29	0180-2951	6		CAPACITOR-FXD 33UF+-20% 16VDC AL	28480	0180-2951
A21C30	0180-1082	2		CAPACITOR, FXD 10 UF 100VDCW AL	28480	0180-1082
A21CR1	1902-3234	3	4	DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	28480	1902-3234
A21CR2	1902-3234	3		DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	28480	1902-3234
A21CR3	1902-3234	3		DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	28480	1902-3234
A21CR4	1902-3234	3		DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	28480	1902-3234
A21CR5	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR6	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR7	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR8	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR9	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR10	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR11	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR12	1902-1259	8	4	DIODE-ZNR 1N5357B 20V 5% PD=5W IR=500NA	04713	1N5357B
A21CR13	1902-1259	8		DIODE-ZNR 1N5357B 20V 5% PD=5W IR=500NA	04713	1N5357B
A21CR14	1902-1259	8		DIODE-ZNR 1N5357B 20V 5% PD=5W IR=500NA	04713	1N5357B
A21CR15	1902-1259	8		DIODE-ZNR 1N5357B 20V 5% PD=5W IR=500NA	04713	1N5357B
A21CR16	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR17	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR18	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR19	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR20	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR21	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR22	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR23	1901-0460	9	2	DIODE-STABISTOR 30V 150MA DO-7	28480	1901-0460
A21CR24	1901-0460	9		DIODE-STABISTOR 30V 150MA DO-7	28480	1901-0460
A21CR25	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR26	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR27	1902-3122	8	2	DIODE-ZNR 6.65V 2% DO-7 PD=.4W TC=+.038%	28480	1902-3122
A21CR28	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A21CR29	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21J1	1200-0473	8	4	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0473
A21J2	1200-0473	8		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0473
A21J3	1200-0608	1		SOCKET-IC 40-CONT	28480	1200-0608
A21J4	1200-0658	1	2	SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0658
A21K1	0490-0240	9		RELAY-REED 1A	28480	0490-0240
A21K2	0490-0242	1	1	RELAY-REED	28480	0490-0242
A21L1	9100-1618	1	4	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A21L2	9100-1618	1		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A21L3	9100-3139	5		COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A21Q1	1853-0204	6	7	TRANSISTOR PNP 2N4920 SI PD=30W FT=3MHZ	04713	2N4920
A21Q1	1854-0271	9	2	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0271
A21Q2	1853-0232	0	1	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A21Q3	1853-0080	6	12	TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A21Q4	1854-0474	4	12	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A21Q5	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A21Q6	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A21Q7	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A21Q8	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A21Q9	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A21Q10	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A21Q11	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A21Q12	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A21Q13	1853-0204	6		TRANSISTOR PNP 2N4920 SI PD=30W FT=3MHZ	04713	2N4920
A21Q14	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A21Q15	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A21Q16	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A21Q17	1853-0204	6		TRANSISTOR PNP 2N4920 SI PD=30W FT=3MHZ	04713	2N4920
A21Q18	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A21Q19	1853-0204	6		TRANSISTOR PNP 2N4920 SI PD=30W FT=3MHZ	04713	2N4920
A21Q20	1854-0347	0	4	TRANSISTOR NPN 2N4923 SI PD=30W FT=3MHZ	04713	2N4923
A21Q21	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A21Q22	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A21Q23	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A21Q24	1854-0347	0		TRANSISTOR NPN 2N4923 SI PD=30W FT=3MHZ	04713	2N4923
A21Q25	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A21Q26	1854-0347	0		TRANSISTOR NPN 2N4923 SI PD=30W FT=3MHZ	04713	2N4923
A21Q27	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A21Q28	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A21Q29	1853-0204	6		TRANSISTOR PNP 2N4920 SI PD=30W FT=3MHZ	04713	2N4920
A21R1	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A21R3	0683-8215	3		RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A21R4	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A21R5	0683-1225	1	11	RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A21R6	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R7	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A21R8	2100-3274	2		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A21R9	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A21R10	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A21R11	2100-3274	2		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A21R12	2100-3274	2		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A21R13	2100-3426	6		RESISTOR-TRMR 20 10% C SIDE-ADJ 1-TRN	28480	2100-3426
A21R14	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A21R16	0683-8215	3		RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A21R17	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A21R18	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A21R19	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R20	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A21R21	0698-3260	9	2	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A21R22	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A21R23	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A21R24	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A21R25	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A21R26	0699-0391	3	4	RESISTOR 25K .1% .125W F TC=0+-25	28480	0699-0391
A21R27	0699-0391	3		RESISTOR 25K .1% .125W F TC=0+-25	28480	0699-0391
A21R28	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A21R29	0698-3442	9	4	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A21R30	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A21R33	0699-0390	2	2	RESISTOR 450K .1% .125W F TC=0+-25	28480	0699-0390
A21R34	0698-2198	0	2	R:FXD MET FLM 50K OHM 0.1% 1/8W	28480	0698-2198
A21R35	0683-8205	1	1	RESISTOR 82 5% .25W FC TC=-400/+500	01121	CB8205
A21R36	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A21R37	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A21R38	0698-2198	0		R:FXD MET FLM 50K OHM 0.1% 1/8W	28480	0698-2198
A21R39	0699-0390	2		RESISTOR 450K .1% .125W F TC=0+-25	28480	0699-0390

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21R40	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A21R41	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A21R42	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A21R43	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A21R44	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R45	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R46	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A21R47	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A21R48	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-203
A21R49	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A21R50	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A21R51	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A21R52	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A21R53	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A21R54	0683-1505	0	2	RESISTOR 15 5% .25W FC TC=-400/+500	01121	CB1505
A21R55	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A21R56	0683-5605	9	3	RESISTOR 56 5% .25W FC TC=-400/+500	01121	CB5605
A21R57	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A21R58	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A21R59	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A21R60	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A21R61	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R62	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R63	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A21R64	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A21R65	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A21R66	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A21R67	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A21R68	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A21R69	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A21R70	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A21R71	0683-1505	0		RESISTOR 15 5% .25W FC TC=-400/+500	01121	CB1505
A21R72	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A21R73	0683-5605	9		RESISTOR 56 5% .25W FC TC=-400/+500	01121	CB5605
A21R74	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A21R75	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A21R76	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A21R77	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A21R78	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R79	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A21R80	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A21R81	0683-5605	9		RESISTOR 56 5% .25W FC TC=-400/+500	01121	CB5605
A21R82	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A21R83	2100-3252	6	2	RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	28480	2100-3252
A21R84	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A21R85	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A21R86	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A21U1	1826-0319	7		OP AMP BIFET TO-99	27014	LF356H
A21U2	1826-0357	3		OP AMP WB TO-99	27014	LF357H
A21U3	1826-0319	7		OP AMP BIFET TO-99	27014	LF356H
A21U4	1820-1856	7	2	CONV 12-B-D/A 24-DIP-C	24355	AD563KD/BCD
A21U5	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A21U6	1826-0122	0		IC 7805 V RGLTR TO-220	07263	7805UC
A21U7	1826-0174	2		COMPARATOR GP QUAD 14-DIP-P	28480	1826-0174
A21U8	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A21U9	1826-0222	1		OP AMP GP QUAD 14-DIP-P	07263	UA4136PC
A21U10	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A21U11	1820-1481	4		IC PIA NMOS	04713	MC6821L
A21U12	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A21U13	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
				A21 MISCELLANEOUS PARTS		
	04274-26521	8		PC BOARD, BLANK	28480	04274-26521
A22	04274-66522	3	1	HP-IB INTERFACE BOARD ASSEMBLY (OPTION 101 ONLY)	28480	04274-66522
A22C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C5	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A22J1	1200-0608	1		SOCKET-IC 40-CONT	28480	1200-0608

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22L1	9100-3139	5		COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A22L2	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A22R1	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A22R2	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A22R3	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A22R4	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A22R5	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A22R6	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A22R7	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A22S1	3101-1973	7		SWITCH-SL 7-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1973
A22U1	1820-1873	8	1	IC BFR TTL LS INV OCTL 2-INP	27014	DM81LS98N
A22U2	1820-1204	9	1	IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A22U3	1820-2113	1	1	IC MICPROC-ACCESS NMOS	04713	MC68488L
A22U4	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A22U5	1820-2058	3	4	IC MISC TTL S QUAD	28480	1820-2058
A22U6	1820-2058	3		IC MISC TTL S QUAD	28480	1820-2058
A22U8	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A22U9	1820-2058	3		IC MISC TTL S QUAD	28480	1820-2058
A22U10	1820-2058	3		IC MISC TTL S QUAD	28480	1820-2058
A22W1	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A22W2	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
				A22 MISCELLANEOUS PARTS		
	04274-26522	9		PC BOARD, BLANK	28480	04274-26522
A23	04274-66523	4	1	DC BIAS (+/-100V) BOARD ASSEMBLY (OPTION 002 ONLY)	28480	04274-66523
A23C1	0140-0210	2	1	CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A23C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C5	0180-1050	4		CAPACITOR-FXD 100uF +50-10% 25VDC	28480	0180-1050
A23C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C7	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A23C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C10	0180-1080	0	2	CAPACITOR-FXD 4.7uF +100-10% 160VDC	28480	0180-1080
A23C11	0180-1080	0		CAPACITOR-FXD 4.7uF +100-10% 160VDC	28480	0180-1080
A23C12	0180-1082	2		CAPACITOR-FXD 10uF +50-10% 100VDC	28480	0180-1082
A23C13	0180-1082	2		CAPACITOR-FXD 10uF +50-10% 100VDC	28480	0180-1082
A23C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C15	0180-1050	4		CAPACITOR-FXD 100uF +50-10% 25VDC	28480	0180-1050
A23C16	0170-0066	9	2	CAPACITOR-FXD .027UF +-10% 200VDC POLYE	28480	0170-0066
A23C17	0170-0066	9		CAPACITOR-FXD .027UF +-10% 200VDC POLYE	28480	0170-0066
A23C18	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A23C19	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A23C20	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A23C21	0180-1050	4		CAPACITOR-FXD 100uF +50-10% 25VDC	28480	0180-1050
A23C22	0180-1050	4		CAPACITOR-FXD 100uF +50-10% 25VDC	28480	0180-1050
A23C23	0180-1081	1		CAPACITOR-FXD 47uF +50-10% 50VDC	28480	0180-1081
A23C24	0180-1081	1		CAPACITOR-FXD 47uF +50-10% 50VDC	28480	0180-1081
A23C25	0180-1081	1		CAPACITOR-FXD 47uF +50-10% 50VDC	28480	0180-1081
A23C26	0180-1081	1		CAPACITOR-FXD 47uF +50-10% 50VDC	28480	0180-1081
A23C27	0180-1082	2		CAPACITOR-FXD 10uF +50-10% 100VDC	28480	0180-1082
A23C28	0180-1082	2		CAPACITOR-FXD 10uF +50-10% 100VDC	28480	0180-1082
A23C29	0180-1050	4		CAPACITOR-FXD 100uF +50-10% 25VDC	28480	0180-1050
A23C30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C31	0180-1081	1		CAPACITOR-FXD 47uF +50-10% 50VDC	28480	0180-1081
A23C32	0180-1050	4		CAPACITOR-FXD 100uF +50-10% 25DC	28480	0180-1050
A23C33	0180-1050	4		CAPACITOR-FXD 100uF +50-10% 25DC	28480	0180-1050
A23C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A23C35	0180-2951	6		CAPACITOR-FXD 33UF+-20% 16VDC AL	28480	0180-2951
A23C36	0180-2951	6		CAPACITOR-FXD 33UF+-20% 16VDC AL	28480	0180-2951
A23C37	0180-2951	6		CAPACITOR-FXD 33UF+-20% 16VDC AL	28480	0180-2951
A23CR1	1902-3385	5	4	DIODE-ZNR 69.8V 2% DO-7 PD=.4W TC=+.079%	28480	1902-3385
A23CR2	1902-3385	5		DIODE-ZNR 69.8V 2% DO-7 PD=.4W TC=+.079%	28480	1902-3385
A23CR3	1902-3385	5		DIODE-ZNR 69.8V 2% DO-7 PD=.4W TC=+.079%	28480	1902-3385
A23CR4	1902-3385	5		DIODE-ZNR 69.8V 2% DO-7 PD=.4W TC=+.079%	28480	1902-3385
A23CR5	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A23CR6	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A23CR7	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A23CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A23CR9	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A23CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23CR11	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A23CR12	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A23CR13	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A23CR14	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A23CR15	1902-3122	8		DIODE-ZNR 6.65V 2% DO-7 PD=.4W TC=+.038%	28480	1902-3122
A23J1	1200-0473	8		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0473
A23J2	1200-0473	8		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0473
A23J3	1200-0608	1		SOCKET-IC 40-CONT	28480	1200-0608
A23J4	1200-0658	1		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0658
A23L1	9140-0137	1	6	COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A23L2	9140-0137	1		COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A23L3	9140-0137	1		COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A23L4	9140-0137	1		COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A23L5	9140-0137	1		COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A23L6	9140-0137	1		COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A23L7	9100-1618	1		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A23L8	9100-1618	1		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A23L9	9100-3139	5		COIL 75UH 15% .5DX.875LG-NOM	28480	9100-3139
A23Q1	1853-0414	0	1	TRANSISTOR PNP 2N6423 SI TO-66 PD=35W	04713	2N6423
A23Q2	1854-0324	3	1	TRANSISTOR NPN 2N3739 SI TO-66 PD=20W	04713	2N3739
A23Q3	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A23Q4	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A23Q5	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A23Q6	1855-0111	8		TRANSISTOR J-FET N-CHAN Si	28480	1855-0111
A23Q7	1853-0204	6		TRANSISTOR PNP 2N4920 SI PD=30W FT=3MHZ	04713	2N4920
A23Q8	1853-0037	3	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0037
A23Q9	1854-0271	9		TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0271
A23Q10	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A23Q11	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A23Q12	1854-0347	0		TRANSISTOR NPN 2N4923 SI PD=30W FT=3MHZ	04713	2N4923
A23Q13	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A23Q14	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A23Q15	1853-0204	6		TRANSISTOR PNP 2N4920 SI PD=30W FT=3MHZ	04713	2N4920
A23Q16	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A23Q17	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A23Q18	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A23Q19	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A23R1	0683-2725	8	2	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A23R2	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A23R4	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A23R5	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A23R6	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A23R7	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A23R8	2100-3274	2		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A23R9	2100-3207	1		RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A23R10	0683-4755	8	2	RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A23R10	2100-3274	2		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A23R11	0683-4755	8		RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A23R11	2100-3274	2		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A23R12	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A23R13	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A23R14	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A23R15	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A23R17	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A23R18	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A23R19	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A23R20	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A23R22	0757-0464	5	2	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R23	0699-0391	3		RESISTOR 25K .1% .125W F TC=0+-25	28480	0699-0391
A23R24	0699-0391	3		RESISTOR 25K .1% .125W F TC=0+-25	28480	0699-0391
A23R25	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A23R26	0698-4486	3	2	RESISTOR 24.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2492-F
A23R27	0698-4486	3		RESISTOR 24.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2492-F
A23R29	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R30	0757-0488	3		RESISTOR 909K 1% .125W F TC=0+-100	28480	0757-0488
A23R31	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R32	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A23R33	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A23R34	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A23R35	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A23R36	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R37	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R38	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A23R39	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A23R40	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A23R41	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A23R42	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23R43	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A23R44	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A23R45	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R46	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R47	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A23R48	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A23R49	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A23R50	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A23R51	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A23R52	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A23R53	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A23R54	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A23R55	2100-3252	6		RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	28480	2100-3252
A23R56	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A23R57	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A23R58	0683-5615	1		RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A23R59	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A23R60	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A23R61	0683-1835	9		RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A23R62	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A23R63	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A23R64	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A23R65	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A23R66	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A23R67	1810-0269	3		NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A23R68	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A23R69	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A23R70	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A23R71	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A23U1	1826-0319	7		OP AMP BIFET TO-99	27014	LF356H
A23U2	1826-0319	7		OP AMP BIFET TO-99	27014	LF356H
A23U3	1826-0319	7		OP AMP BIFET TO-99	27014	LF356H
A23U4	1820-1856	7		CONV 12-B-D/A 24-DIP-C	24355	AD563KD/BCD
A23U5	1826-0122	0		IC 7805 V RGLTR TO-220	07263	7805UC
A23U6	1826-0161	7	3	OP AMP GP QUAD 14-DIP-P	04713	MLM324P
A23U7	1826-0161	7		OP AMP GP QUAD 14-DIP-P	04713	MLM324P
A23U8	1826-0161	7		OP AMP GP QUAD 14-DIP-P	04713	MLM324P
A23U9	1826-0174	2		COMPARATOR GP QUAD 14-DIP-P	28480	1826-0174
A23U10	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A23U11	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A23U12	1826-0319	7		OP AMP BIFET TO-99	27014	LF356H
A23U13	1826-0222	1		OP AMP GP QUAD 14-DIP-P	07263	UA4136PC
A23U14	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A23U15	1820-1481	4		IC PIA NMOS	04713	MC6821L
A23U16*	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A23U17	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
				A23 MISCELLANEOUS PARTS		
	04274-26523	0		PC BOARD, BLANK	28480	04274-26523
				CHASSIS MOUNTED COMPONENTS		
C1	0160-4259	9	1	CAPACITOR, FXD .22UF +/-10% 250VDCW	C0633	PME271M622
C2	0140-0200	0	4	CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
C3	0140-0200	0		CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
C4	0140-0200	0		CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
C5	0140-0200	0		CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
C6	0150-0070	3	3	CAPACITOR-FXD .02UF +-20% 500VDC CER	28480	0150-0070
C7	0150-0070	3		CAPACITOR-FXD .02UF +-20% 500VDC CER	28480	0150-0070
C8	0150-0070	3		CAPACITOR-FXD .02UF +-20% 500VDC CER	28480	0150-0070
CR1	1901-0496	1		DIODE-PWR RECT 100V 12A DO-4	04713	MR1121
CR2	1901-0496	1		DIODE-PWR RECT 100V 12A DO-4	04713	MR1121
F1	2110-0059	5	1	FUSE 1.5A 250V SLO-BLO 1.25X.25 UL	75915	
	2110-0360	5	1	FUSE 0.75A 250V SLO-BLO 1.25X.25 UL	75915	
FL1	9135-0035	7	1	FILTER-LINE WIRES-TERMS	28480	9135-0035
L1	04274-85008	0	1	COIL ASSEMBLY	28480	04274-85008
Q1	1854-0313	0	1	TRANSISTOR NPN 2N3771 SI TO-3 PD=150W	01928	2N3771
Q2	1854-0063	7	1	TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	28480	1854-0063
Q3	1853-0252	4	2	TRANSISTOR PNP SI TO-3 PD=150W FT=4MHZ	28480	1853-0252
Q4	1853-0252	4		TRANSISTOR PNP SI TO-3 PD=150W FT=4MHZ	28480	1853-0252
S2	3101-2298	1	2	SWITCH, SLIDE DPDT-NS	28480	3101-2298
S3	3101-2298	1		SWITCH, SLIDE DPDT-NS	28480	3101-2298
B1	3160-0311			BLOWER		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W1	04275-61601	9	1	CABLE ASSEMBLY, INPUT(LC) (40 CM)	28480	04275-61601
W2	04275-61602	0	1	CABLE ASSEMBLY, INPUT(LP) (32 CM)	28480	04275-61602
W3	04275-61603	1	1	CABLE ASSEMBLY, INPUT(HC) (50 CM)	28480	04275-61603
W4	04275-61604	2	1	CABLE ASSEMBLY, INPUT (HP) (40 CM)	28480	04275-61604
W5	04275-61605	3	1	CABLE ASSEMBLY, INPUT(A1 THRU A3)(40 CM)	28480	04275-61605
W6	04275-61606		1	CABLE ASSEMBLY, INPUT (A1 THRU A4) (48 CM)	28480	04275-61606
W7	04275-61607	4	1	CABLE ASSEMBLY, INPUT (A5 THRU A6) (36 CM)	28480	04275-61607
W8	04275-61608	5	1	CABLE ASSEMBLY, INPUT (A5 THRU A6) (31 CM)	28480	04275-61608
XF1	2110-0565	9	2	FUSEHOLDER CAP 12A MAX FOR UL	28480	2110-0565
XF1	2110-0565	9		FUSEHOLDER CAP 12A MAX FOR UL	28480	2110-0565
				MISCELLANEOUS PARTS		
1	5040-7219	8	2	FRONT CAP	28480	5040-7219
2	5060-9805	4	2	HANDLE	28480	5060-9805
3	5060-9943	1	2	SIDE COVER	28480	5060-9943
4	5040-7220	1	2	REAR CAP	28480	5040-7220
5	2680-0172	1	4	SCREW-MACH 10-32 .375-IN-LG 100 DEG	28480	2680-0172
6	3101-2216	3	1	SWITCH-PB DPDT ALTNG 4A 250VAC	28480	3101-2216
7	0570-0368	2	2	SCREW	28480	0570-0368
8	2190-0225	6	2	WASHER	28480	2190-0225
9	1200-0080	3	4	INSULATOR-DIO ALUMINUM HD-ANDZ	28480	1200-0080
10	3050-0226	2	4	WASHER-FL MTLC NO. 10 .203-IN-ID	28480	3050-0226
11	2740-0003	5	2	NUT-HEX-W/LKWR 10-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
12	1901-0496	1	4	DIODE-PWR RECT 100V 12A DO-4	04713	MR1121
13	9100-0870	5	1	TRANSFORMER	28480	9100-0870
14	1250-0118	2	4	CONNECTOR RF BNC	28480	1250-0118
15	5040-0345	7	6	INSULATOR;CONNECTOR	28480	5040-0345
16	0624-0260	8	8	SCREW-TPG 6-20 .5-IN-LG PAN-HD-PHL STL	00000	ORDER BY DESCRIPTION
17	2190-0020	9	8	WASHER-LK HLCL NO. 5 .128-IN-ID	28480	2190-0020
18	0340-0833	9	4	INSULATOR-XSTR NYLON BLACK	28480	0340-0833
19	0624-0248	2	4	SCREW-TPG 8-32 .75-IN-LG HEX WSHR-HD STL	28480	0624-0248
20	0370-2994	0	1	KNOB	28480	0370-2994
21	2510-0045	8	4	SCREW-MACH 8-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
22	0360-0270	0	1	TERMINAL-SLDR LUG LK-MTG FOR-#10-SCR	28480	0360-0270
23	3100-1205	6	1	SWITCH-ROTARY	28480	3100-1205
24	0360-1190	5	4	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
25	2950-0001	8	4	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
26	5020-8806	9	1	REAR FRAME	28480	5020-8806
27	5060-9836	1	1	TOP COVER	28480	5060-9836
28	04274-00617	9	1	PLATE	28480	04274-00617
29	04274-00602	2	2	PLATE SHIELD	28480	04274-00602
30	5040-7202	9	1	TRIM, TOP	28480	5040-7202
31	5020-8805	8	1	FRONT FRAME	28480	5020-8805
32	04274-25002	8	1	WINDOW (FREQ)	28480	04274-25002
33	0370-1097	2	1	KNOB	28480	0370-1097
34	04275-00201	9	1	FRONT PANEL (YHP)	28480	04275-00201
34	04275-00211	0	1	FRONT PANEL (HP)	28480	04275-00211
35	04274-25001	7	2	WINDOW DISP. A,B)	28480	04274-25001
36	7120-1254	1	1	NAMEPLATE .312-IN-WD .54-IN-LG AL	28480	7120-1254
36	7120-0478	9	1	TRADE MARK (YHP)	28480	7120-0478
37	04271-50024	4	4	INSULATOR	28480	04271-50024
38	2950-0035	8	4	NUT-HEX-DBL-CHAM 15/32-32-THD	00000	ORDER BY DESCRIPTION
39	1510-0038	8	1	BINDING POST ASSY SGL THD-STUD	28480	1510-0038
40	1250-0252	6	4	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0252
41	04271-50025	5	4	INSULATOR	28480	04271-50025
42	5041-0564	4	1	KEY CAP	28480	5041-0564
43	0370-0451	0	2	BEZEL	28480	0370-0451
44	1460-1345	5	2	TILT STAND SST	28480	1460-1345
45	5040-7201	8	4	FOOT(STANDARD)	28480	5040-7201
46	5020-8838	7	4	STRUT	28480	5020-8838
47	04274-40001	9	1	ROD (POWER SWITCH)	28480	04274-40001
48	04274-01202	0	1	ANGLE (POWER SWITCH)	28480	04274-01202
49	04274-40002	0	3	GUIDE (ANGLE)	28480	04274-40002
50	04274-00618	0	3	PLATE, SHIELD	28480	04274-00618
51	04274-00601	1	5	PLATE, SHIELD	28480	04274-00601
52	5060-9848	5	1	BOTTOM COVER	28480	5060-9848
53	04274-00205			SUB PANEL		
54	04275-60203			REAR PANEL		

See introduction to this section for ordering information
*Indicates factory selected value

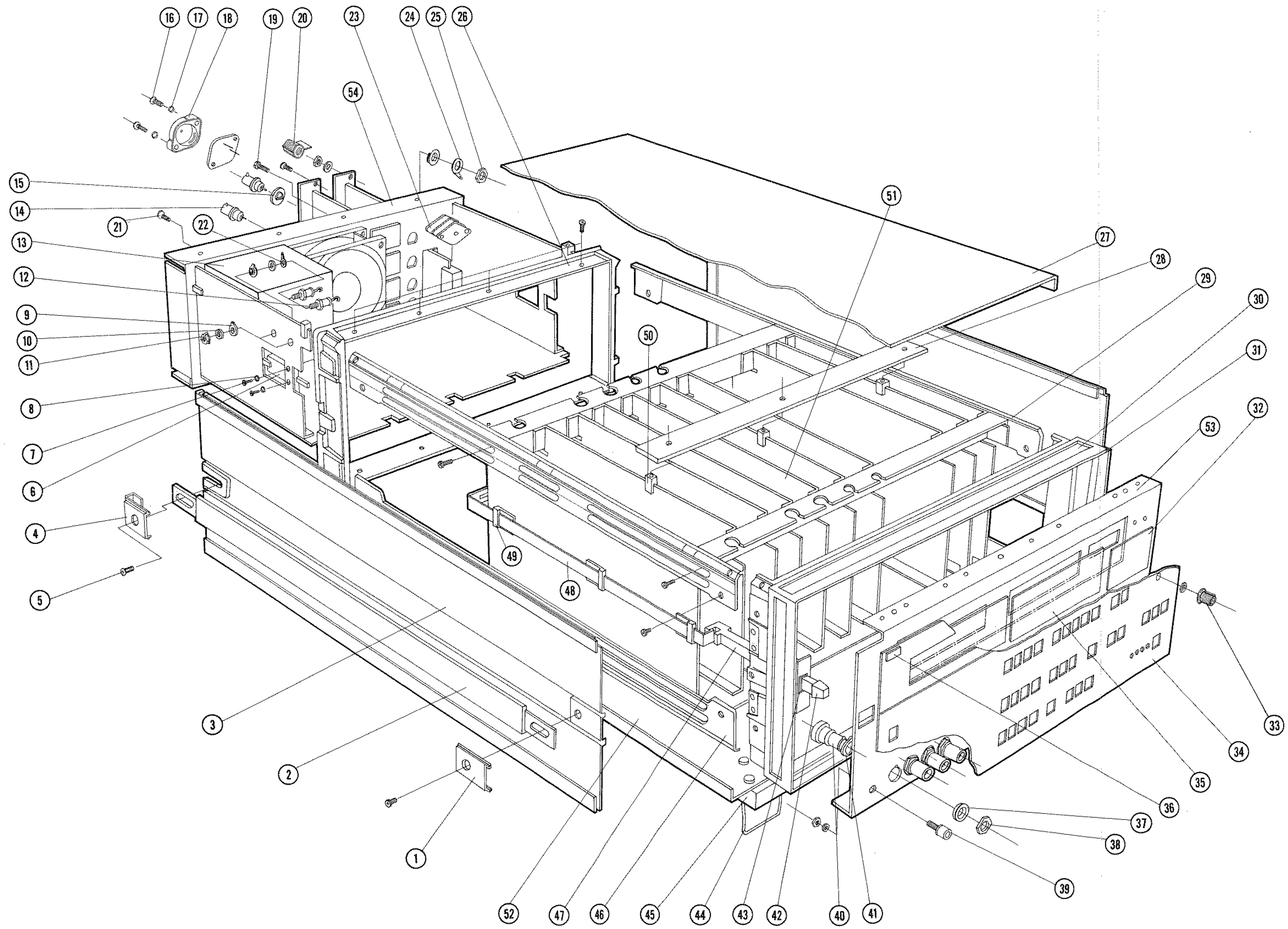


Figure 6-1. Major Mechanical Parts - Exploded View.

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION.

7-2. This section contains information for adapting this manual to instruments to which the contents do not directly apply. The following paragraphs explain how to adapt this manual to apply to other instruments with lower serial prefixes.

7-3. MANUAL CHANGES.

7-4. To adapt this manual to your particular instrument, refer to Table 7-1 and make all of the manual changes listed opposite your instrument serial number. Perform these changes in the summary by assembly.

7-5. If your instrument serial number is not listed on the title page of this manual or in Table 7-1 to the right, it may be documented in a yellow MANUAL CHANGES supplement. For additional information about serial number coverage, refer to INSTRUMENT COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes by Serial Number.

Serial Prefix or Number	Make Manual Changes
1851J00232 and below	A, B, C, D, E, F, G
1851J00262 and below	B, C, D, E, F, G
1851J00299 and below	C, D, E, F, G
1851J00392 and below	D, E, F, G
1851J00527 and below	E, F, G
1851J00577 and below	F, G
2016J00862 and below	G

Table 7-2. Summary of Changes by Assembly (Sheet 1 of 2).

CHANGE	Assembly									
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
A									U1, U5 C70*	
B		C25∿28								
C		C9, C14 R11,R12 R55,R60	C59,C61 R93							
D		C98,C99 C100				C10,C30 C6, C26				
E					S1					
F		R174								
G									U1∿U10 W7	

Table 7-2. Summary of Changes by Assembly (Sheet 2 of 2).

CHANGE	Assembly						
	A11	A12	A15	A16	A21	A22	A23	No Prefix
A								
B								
C								
D								
E								
F								
G								

CHANGE A

Page 6-34, Table 6-3. Replaceable Parts, A9U1 and U5:
Change the part number for A9U1 and U5 to read:

A9U1; 04274-85021 (PROM)
A9U5; 04274-85015 (PROM)

Note

04274-85031 (new U1) cannot be used with 04274-85015 (old U5). Also, 04274-85025 (new U5) cannot be utilized with 04274-85021 (old U1).

Page 6-22, Table 6-3. Replaceable Part:
Delete the following part:

A5C70*; 0140-0197 CAPACITOR-FXD 180PF +-5% 300WVDC MICA

CHANGE B

Page 6-9, Table 6-3. Replaceable Parts:
Delete the following parts:

A2CR25 to CR28 1901-0040 DIODE-SWITCHING

Page 8-63, Figure 8-45. A2 Component Locations:
Partially change the diagram as follows:

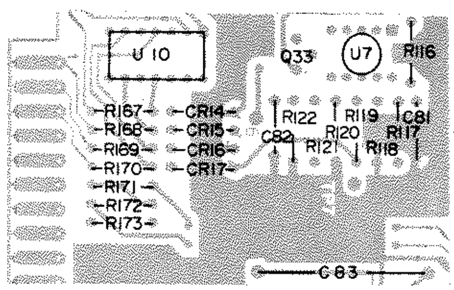


Figure 8-45. A2 Component Locations.

CHANGE C

Page 6-8, Table 6-3. Replaceable Parts, A2C9 and C14:
Change the part numbers and descriptions for A2C9 and C14 to read:

0121-0059 CAPACITOR-V TRMR-CER 2 8PF

Page 6-10, Table 6-3. Replaceable Parts, A2R11 and R12:
Change the part numbers and descriptions for A2R11 and R12 to read:

0757-0280 RESISTOR 1K 1%

Page 6-11, Table 6-3. Replaceable Parts, A2R55 and R60:
Change the part numbers and descriptions for A2R55 and R60 to read:

0757-0280 RESISTOR 1K 1%

Page 6-13, Table 6-3. Replaceable Parts, A3C59 and C61:
Change the part numbers and descriptions for A3C59 and C61 to read:

A3C59; 0160-2203 CAPACITOR-FXD 91PF
A3C61; 0160-0134 CAPACITOR-FXD 220PF

Page 6-16, Table 6-3. Replaceable Parts, A3R93:
Change the part number and description for A3R93 to read:

0698-0084 RESISTOR 2.15K 1%

CHANGE D

Page 6-9, Table 6-3. Replaceable Parts:
Add the following part:

A2C98; 0160-2261 CAPACITOR-FXD 15PF +-5%

Change the part numbers and descriptions for A2C99 and C100 to read:

A2C99; 0140-0197 CAPACITOR-FXD 180PF +-5%
A2C100; 0160-2224 CAPACITOR-FXD 1800PF +-5%

Page 6-26, Table 6-3. Replaceable Parts:
Add the following parts:

A6C10; 0160-2262 CAPACITOR-FXD 16PF +-5%
A6C30; 0160-2262 CAPACITOR-FXD 16PF +-5%

Change the part numbers and descriptions for A6C6 and C26 to read:

0160-2224 CAPACITOR-FXD 1800PF +-5%

Change the part numbers and descriptions for A6C8 and C28 to read:

0140-0197 CAPACITOR-FXD 180PF +-5%

Page 8-63, Figure 8-45. A2 Component Locations:
Partially change the diagram as follows:

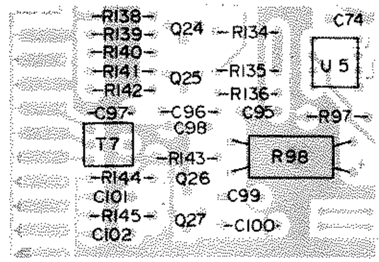


Figure 8-45. A2 Component Locations:

Page 8-63, Figure 8-46. A2 Schematic Diagram:
Partially change the diagram as follows:

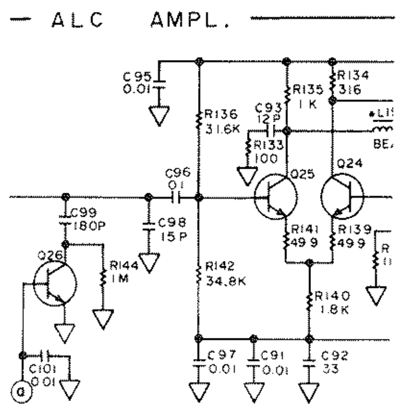


Figure 8-46. A2 Schematic Diagram.

Page 8-71, Figure 8-57. A6 Component Locations:
Partially change the diagram as follows:

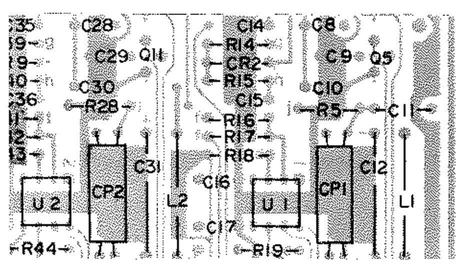


Figure 8-57. A6 Component Locations.

Page 8-72, Figure 8-58 (B). A6 Schematic Diagram (Sheet 2 of 2):
Partially change the diagram as follows:

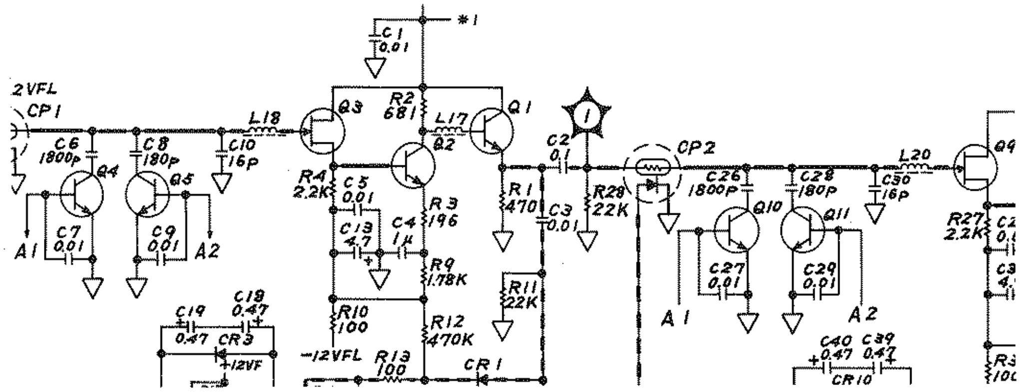


Figure 8-58 (B). A6 Schematic Diagram.

CHANGE E

Page 6-25, Table 6-3. Replaceable Parts, A5S1:
Add the following part:

A5S1; 3101-1274 SWITCH-SL SPOT

Page 8-69, Figure 8-54. A5 Component Locations:
Partially change the diagram as follows:

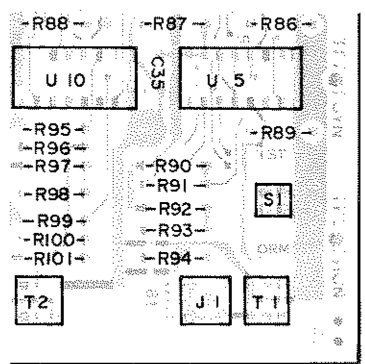


Figure 8-54. A5 Component Locations.

Page 8-69, Figure 8-55. A5 Schematic Diagram:
Partially change the diagram as follows:

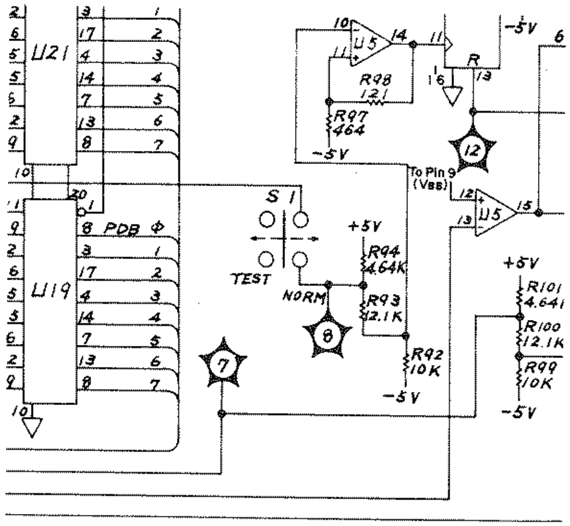


Figure 8-55. A5 Schematic Diagram:

CHANGE F

Page 6-12, Table 6-3. Replaceable Parts, A2R174:
Delete the following part:

A2R174; 0683-1015 RESISTOR 100+-5%

CHANGE G

Page 6-33, Table 6-3. Replaceable Parts:
Change the part number for A9MPU BOARD ASSEMBLY (STANDARD) to read:

04275-66513

Page 6-34, Table 6-3. Replaceable Parts:
Add the following parts:

A9U2; 04274-85022 IC, PROM, PROGRAMMED
A9U4; 04274-85014 IC, PROM, PROGRAMMED
A9U6; 04274-85016 IC, PROM, PROGRAMMED
A9U8; 04275-85058 IC, PROM, PROGRAMMED

Change the part numbers and descriptions for A9U1/U3/U5/U7/U10 to read:

A9U1; 04274-85031 IC, PROM, PROGRAMMED
A9U3; 04274-85013 IC, PROM, PROGRAMMED
A9U5; 04274-85025 IC, PROM, PROGRAMMED
A9U7; 04275-85057 IC, PROM, PROGRAMMED
A9U10; 04274-85019 IC, PROM, PROGRAMMED

Page 6-35, Table 6-3. Replaceable Parts:
Add the following parts:

A9W7 to W10 8159-0005 WIRE 22AWG W PVC 1 x 22 80C

Page 8-50 and 8-76, signatures table:
Change the table as follows:

This table can be used to check signatures at A9U1 thru A9U10 ROM's. Signature test point is established at input of Data Buffer (pins 8 thru 6 of A9U31 and A9U32) instead of the respective ROM outputs (A9U1 thru A9U10). This signature list can be used for units with its serial number suffixes of -00266 and above.

For other instruments whose serial number suffixes are earlier than 00266, check that unstable signature display appears or that output states of these ROM's pull up and pull down. If you find above states active in earlier instruments, the program contents in these ROM may be alive.

TEST PIN NO \ DSA NAME		DSA-12	DSA-14	DSA-15	DSA-16	DSA-17	DSA-18	DSA-19	DSA-20	DSA-21	DSA-13
SIGNAL NAME	TEST POINT \ ROM NO.	A9U1	A9U1 A9U2	A9U3 A9U4	A9U5 A9U6	A9U7 A9U8	A9U1	A9U3	A9U5	A9U7	A9U10
WINDOW(+5V)	U1 pin-24	755U	P254	P254	P254	P254	826P	826P	826P	826P	826P
DB0	U31 pin-3	475P	853H	7994	264C	0H5H	H084	1FFU	4840	00AC	UUPA
DB1	pin-4	594H	A0AH	307F	08CA	U02C	UU0F	H20P	63UF	69F4	HAUH
DB2	pin-5	F997	57U9	HPF4	9FBF	8102	A41A	7303	CP67	FA15	A63F
DB3	pin-6	H561	H926	379A	CP1U	741F	6927	23FF	9587	2110	3094
DB4	U32 pin-3	897F	C6U0	2U43	5H23	A2H2	A0FP	3987	F598	4HCH	565C
DB5	pin-4	8F6H	2562	5410	U899	2UHU	6824	HF08	UF80	F389	501H
DB6	pin-5	2116	AF61	69HH	89PP	3265	FF7P	U888	521H	A092	39A1
DB7	pin-6	UFF8	56PC	0P76	FP5F	52AC	UA7H	A33H	5H5C	AU4F	F454

Page 8-76, Signature Connections tables:
Add the tables for DSA-18, DSA-19, DSA-20 and DSA-21 as follows:
Change the table for DSA-12, DSA-14, DSA-15, DSA-16 and DSA-17 as follows:

Signature Connections — Window (+5V): CCC3

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-10 IRQ	A9Tp-13 ↓	A9Tp-13 ↓	A9Tp-7 ↑	OFF ON

Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-16 NOP (U5,6)	A9U16-13 ↓	A9U16-12 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : 0003

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-11 NOP ADDRESS	A9Tp- 3 ↓	A9Tp- 3 ↓	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-17 NOP (U7,8)	A9U16-15 ↓	A9U16-14 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : 755U

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-12 NOP (U1~U8)	A9U27-11 ↓	A9U16-5 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-18 NOP (U1)	A9U16-9 ↑	A9U16-7 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-13 NOP (U10)	A9 U22-9 ↓	A9U10-20 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-19 NOP (U3)	A9U16-11 ↑	A9U16-10 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-14 NOP (U1,2)	A9U16-9 ↓	A9U16-7 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-20 NOP (U5)	A9U16-13 ↑	A9U16-12 ↑	A9Tp-6 ↓	OFF ON

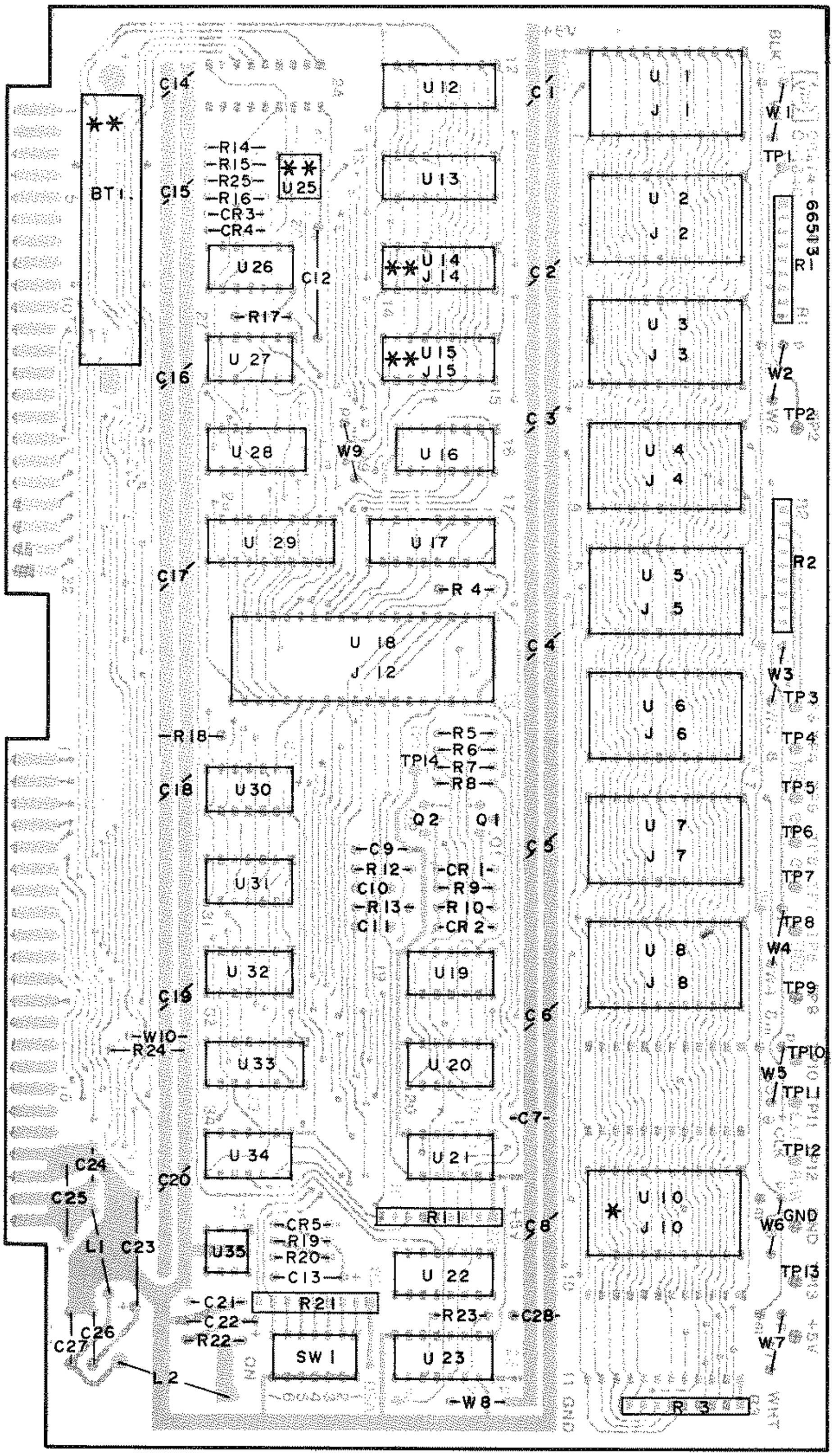
Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-15 NOP (U3,4)	A9U16-11 ↓	A9U16-10 ↑	A9Tp-6 ↓	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-21 NOP (U7)	A9U16-15 ↑	A9U16-14 ↑	A9TP-6 ↓	OFF ON

Page 8-77, Figure 8-63. A9 Component Locations:
Partially change the diagram as follows:



* U10...ONLY FOR OPT 101
** U14,15,25...ONLY FOR OPT 003

Figure 8-63. A9 Component Locations.

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This manual section provides the information and instructions required for servicing the HP Model 4275A MULTI-FREQUENCY LCR Meter. Included are Theory of Operation and Troubleshooting Guide with Circuit Schematics. The Theory of Operation describes fundamental principles and circuit operating theory of the 4275A with block diagrams. Circuit schematics, locator illustrations, troubleshooting guide, and other technical data necessary for repairs are integrated into the service sheet foldouts. An illustration of the instrument interior is shown in Figure 8-49.

Note

When the instrument circuitry includes expanded capabilities provided by optional equipment, refer to paragraphs entitled OPTIONS for specific option service information.

WARNING

TROUBLESHOOTING AND REPAIR ARE ALLOWED FOR QUALIFIED TECHNICAL PERSONNEL ONLY. IF YOUR INSTRUMENT FAILS, REFER INSTRUMENT TO SERVICE PERSONNEL. H-P SERVICE OFFICES OFFER YOU THE BEST ANSWER TO YOUR PROBLEM. A GUIDE TO YOUR LOCAL H-P SERVICE OFFICES MAY BE FOUND ON THE BACK COVER OF THIS MANUAL.

8-3. THEORY OF OPERATION.

8-4. This theory of operation has been organized into three sections: basic theory, a block diagram discussion, and circuit analysis. The basic theory, beginning with paragraph 8-11, explains the concepts and fundamental theory of the 4275A instrument technique adapted for accurately measuring the DUT and for fully achieving automated measurement performance. The block diagram discussion describes the overall circuit operating theory of the 4275A with block-to-block signal flow. Included are block and timing diagrams. The circuit analysis provides a detailed description of how the circuit on each board functions. For reference convenience, when servicing the instrument, a circuit description is included in the service sheets.

8-5. TROUBLESHOOTING.

8-6. This troubleshooting guide provides instructions and information for locating a faulty circuit instrument component that requires service. All instructions consider the safety of service personnel who will perform the procedures. These diagnostic guides are in the form of step-by-step procedures with flow diagrams. The board level troubleshooting diagrams are the procedures for isolating the problem to an individual malfunctioning circuit board assembly.
The guides for locating a defective component are given on the individual board service sheets and integrate service support data -- test point locations, waveform illustrations, voltage data, timing diagrams, and other technical information in addititon to providing schematic diagrams for each board.

8-7. RECOMMENDED TEST EQUIPMENT.

8-8. The test equipment required to perform operations outlined in this section is listed in Table 5-0. The table includes: type of instrument required, critical specifications, use, and recommended model. If the recommended model is not available, equipment which meets or exceeds critical specifications listed may be substituted.

8-9. REPAIR.

8-10. Repair explanations tell how to replace defective circuit components. The recommended replacement procedures for components and parts which require special repair, replacement tools, or test equipment should be observed. Correct disassembly and the exchange procedures for such special parts are outlined in Paragraphs 8-89.
To prevent damage from inproper repair procedure, refer to the appropriate manual section before proceeding with repair.

8-11. BASIC THEORY

8-12. To ascertain unknown ac impedance values, most modern instruments use a bridge circuit or the vector voltage-current measurement method. The vector voltage-current method applies a test frequency signal to the sample to be measured and calculates the unknown impedance as the ratio of the test signal voltage to the sample current detected. As this method permits a multi-terminal measurement circuit configuration (three terminal, kelvin connection, or four terminal pair) which can eliminate the effects of residual impedances in the measuring circuit and, in addition, because the measurement circuit is relatively simple, wide range capabilities can be featured. Furthermore, the balance control that is typically used in a bridge circuit is not required. This hardware advantage facilitates high speed measurement and ease of operation. The 4275A employs vector voltage current measurement architecture in its measuring circuit.

8-13. Figure 8-1 is the block diagram of the 4275A. In the figure, the measuring circuit is denoted as a bridge circuit consisting of the unknown sample, a Range Resistor, Null Detector and Modulator. Actually, the 4275A incorporates the advantages of an auto-balance (controlled) bridge to extend the measurement capability of the vector voltage-current measurement method at high frequencies. The principle of the 4275A vector measurement method is outlined in Figure 8-2 comparing it to an ordinary vector voltage-current measurement method.

8-14. If the range resistor value is appropriately set, the "bridge" circuit is automatically balanced for the DUT impedance under control of the Null Detector and Modulator. When the bridge is balanced, the potential at Lpot (Lcur) terminal is zero volts. The current flowing through the DUT is then equal to that flowing through the range resistor. The DUT current is related to the voltage across the range resistor by the following equation:

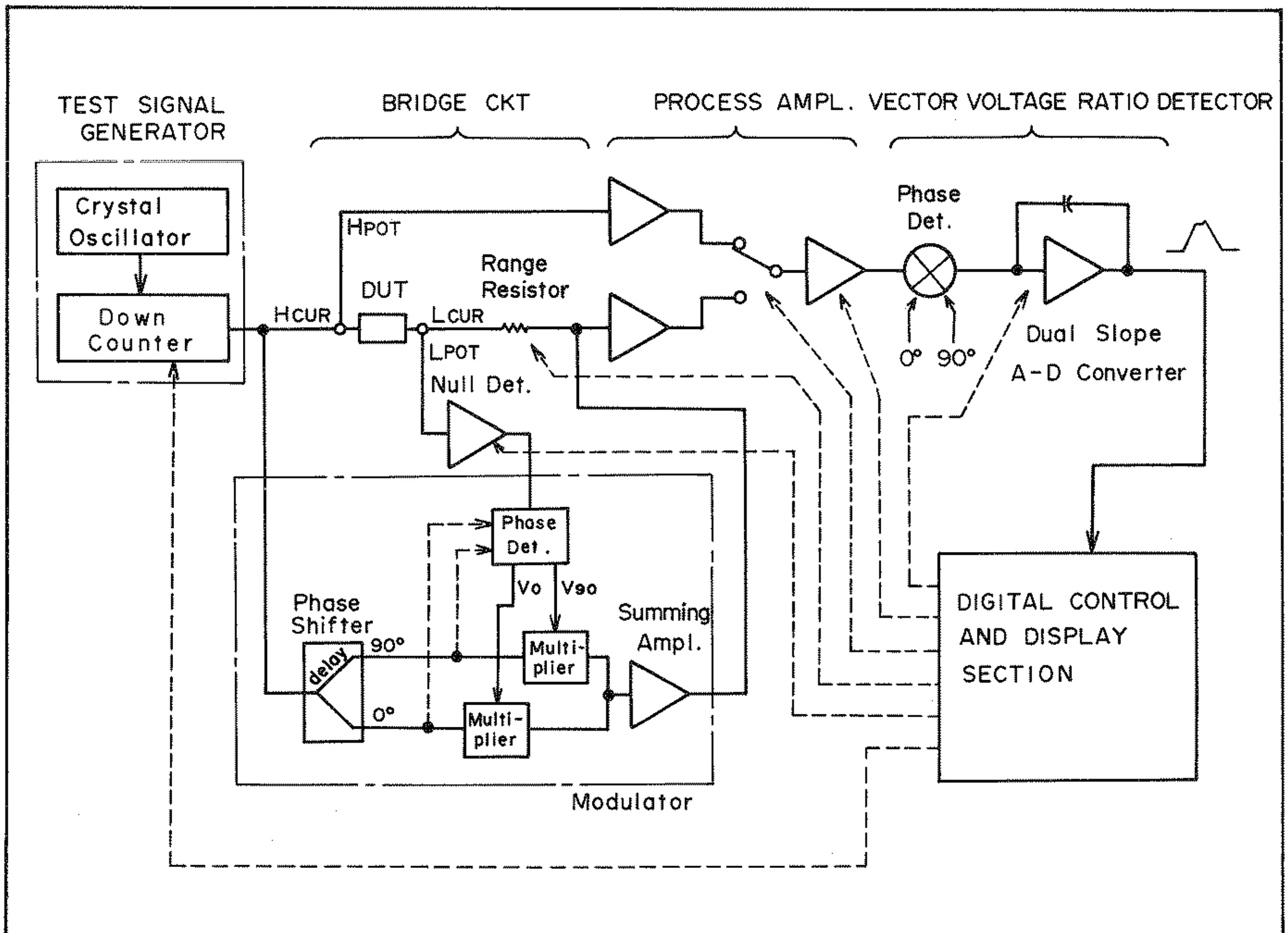


Figure 8-1. 4275A block Diagram.

$$ix = \frac{Edut}{Zx} = \frac{Err}{Rr} \text{ ---------- } (8\text{-}1)$$

Where Edut is the voltage applied to the DUT (that is, the test signal voltage).
Zx is DUT impedance value.
Err is voltage across range resistor.
Rr is range resistor value.

The unknown impedance Zx (or admittance Yx) can be calculated from the measured Edut and Err signals as:

$$Zx = Rr\,\frac{Edut}{Err} \text{ ---------- } (8\text{-}2)$$

or

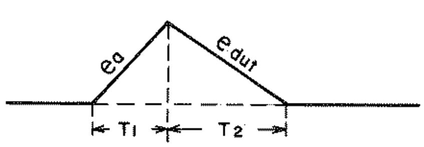
$$Yx = \frac{1}{Rr}\,\frac{Err}{Edut} \text{ ---------- } (8\text{-}3)$$

The Process Amplifier selectively and serially feeds the Edut or Err signal in sequence to the Vector Voltage Ratio Detector section. Selection rules and timing for this operation are described in paragraph 8-16.

8-15. In general, the vector voltage ratio Err/Edut (or Edut/Err) is measured in the following manner:
Figure 8-3 is a graphic representation of the Edut and Err signal vectors (Edut signal is taken as the reference for the phase angle of the Err signal). The Err signal vector can be divided into its real and imaginary components:

$$Err = Ea + jEb \text{ ---------- } (8\text{-}4)$$

The vector ratios Ea/Edut and Eb/Edut represent the real and imaginary components of the unknown admittance, that is, the conductance and susceptance value of the sample, respectively. The vector voltage components Ea and Eb are obtained by phase detecting the Err signal using detection phase signals which have 0° and 90° phase angles referenced to the Edut signal. A dual slope integration technique is used for measuring the ratio of the Ea (or Eb) and Edut signals In a typical voltage ratio measurement, an integrator charges and discharges in proportion to the Ea and Edut signals, respectively, as illustrated below:



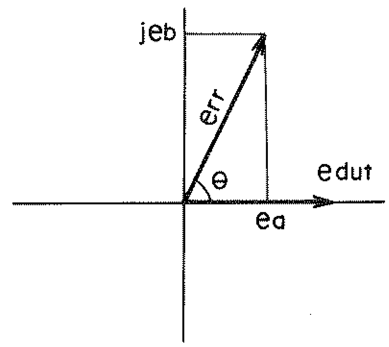
T1: Charge period by Ea signal
T2: Discharge period by Edut signal

The charge and discharge relationship is represented by the following equations:

$$k1 \cdot Ea \cdot T1 + k2 \cdot Edut \cdot T2 = 0$$

$$k\,\frac{Ea}{Edut} = \frac{T2}{T1} \qquad (k = \text{constant})$$

As the charge time T1 is fixed, the Ea/Edut value (conductance value) can be derived by counting time T2. The ratio for the Eb and Edut signals are also derived in the same manner. Thus, basically, two integrator operating cycles are performed in one measurement.



Basic Vector Detection

Figure 8-3. Usual Vector Voltage Ratio Measurement.

8-16. The 4275A employs a relative phase detection method to enhance its measurement accuracy over a broad measurement frequency region. The basic vector ratio measurement method, outlined in the above paragraph, requires that the detection phase signals must be exactly in phase or at right angles with respect to the Edut (or Err) signal. However, in actuality, it is difficult to produce detection phases with high accuracy at the multiple test frequencies ranging from 10kHz to 10MHz at which the instrument operates. This is because of the phase shifts in the detection phases that are incident to the amplifiers, lines and other circuits. Furthermore, the S/N ratio of the Edut signal is apt to be degraded because measuring circuit is exposed to external fields. The relative phase detection method improves vector component detection accuracy by eliminating performance limitations attributable to these effects.

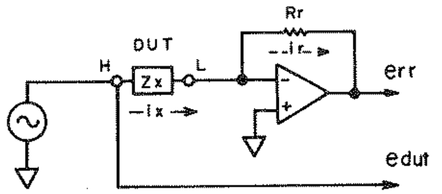


Figure A. Low Frequency Vector Voltage-Current Method with Feedback Amplifier.

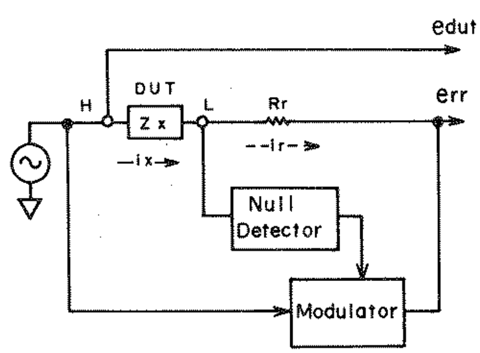
In the low frequency vector voltage-current method, a high gain amplifier which has a feedback resistor (range resistor) Rr operates as current-to-voltage (I-V) converter. The feedback amplifier causes a range resistor current Ir equal to DUT current Ix to flow (irrespective of the range resistor value). Amplifier output voltage Err is equal to the product of Rr and Ir values. Thus, the Err voltage is proportional to DUT current Ix. The Ix value is calculated as follows:

$$Ix = \frac{Edut}{Zx} = \frac{Err}{Rr}$$

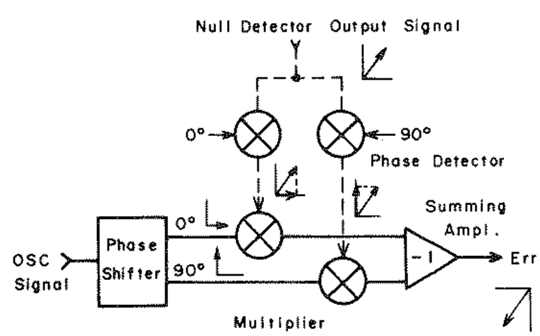
Accordingly, the DUT impedance value Zx can be derived by measuring the Edut and Err voltages:

$$Zx = Rr\frac{Edut}{Err}$$

As is explained in the feedback theory, the voltage at the "L" terminal is approximately zero volts (virtual ground). Thus, the range resistor value has no effect on DUT current Ix (the Ix value is determined only by the test signal voltage and DUT value). Though this method features simple circuit configuration and a relatively high accuracy, it is difficult to design a range resistor amplifier which can cause the range resistor feedback current to be in exact proportion to the DUT current (with negligibly low phase shift) at high frequencies.



An auto-balance bridge employed in the 4275A operates to establish accurate DUT current-range resistor current relationships such as outlined above. To cause an accurate range resistor current to flow (at high frequencies), the amplitude and phase of the Err signal is appropriately controlled by the Modulator. See Figure 8-2B. When the bridge circuit is unbalanced, the Null Detector picks up the unbalance current through the UNKNOWN "L" terminal. The null detector output vector indicates how the bridge is unbalanced for the real and imaginary vector components of the Err signal. The Multipliers develop products of the null detector output vector components and the orthogonal vector signals which are produced from test frequency input signal. As a result of this multiplication, the real and imaginary vector component magnitudes of the null detector output signal are transferred to the orthogonal vectors of the test frequency input signal. The summing amplifier compounds the multiplier output signal vectors to establish the Err signal. The Err signal is, consequently, a reverse directional vector for the null detector input, that is an unbalance current (the summing amplifier performs an inverting amplification). The Err signal responds to the unbalance current so as to suppress an increase in the unbalance current. The Err signal vector is controlled with respect to the individual magnitude of the real and imaginary components of the unbalance current. Thus, the unbalance current approaches exact zero (for both vector components). This balance control loop operates quickly and continuously.



4275A Modulator Operating Principle.

Figure B. 4275A Vector Voltage-Current Method with Auto-balance Bridge.

Figure 8-2. 4275A Vector Voltage-current Method.

This method uses a set of detection phase signals each different by exactly 90 degrees in phase from the other. Neither of the detection phase signals need be in phase with the Edut (or Err) signal. With these detection phase signals, both Err and Edut signals are respectively divided into orthogonal phase components. See Figure 8-4. Impedance or admittance values of the DUT are calculated from the four phase components Ea, Eb, Ec and Ed in accord with the following equations:

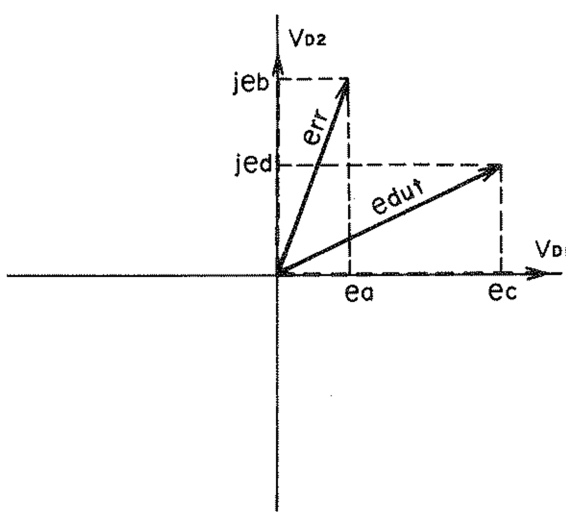
$$Zx = Rr \frac{Edut}{Err} = Rr \frac{Ec + jEd}{Ea + jEb}$$

$$= Rr \frac{EaEc + EbEd + j(EaEd - EbEc)}{Ea^2 + Eb^2} \quad \text{----} \quad (8\text{-}6)$$

$$Yx = \frac{1}{Rr} \frac{Err}{Edut} = \frac{1}{Rr} \frac{Ea + jEb}{Ec + jEd}$$

$$= Rr \frac{EaEc + EbEd + j(EbEc - EaEd)}{Ec^2 + Ed^2} \quad \text{----} \quad (8\text{-}7)$$

The calculated Zx and Yx values are constant for the rotation of the coordinate axes around the origin. Therefore, the phase relationships of the detection phase signals and measurement signals (Err and Edut) have no effect on the calculation results if the relative phase angle of the detection phase signals is exactly 90 degrees. Since any possible phase shift in the circuits rotates both the 0° and 90° detection phases by the same angle, an exact orthogonal phase relationship is maintained. Consequently, accurate detection of the vector components over the entire test frequency range is enabled.



VD1 , VD2 : Orthogonal phase detection signals

Figure 8-4. 4275A Relative Vector Detection.

Resistance and reactance (conductance and susceptance) values of the sample are calculated as follows:

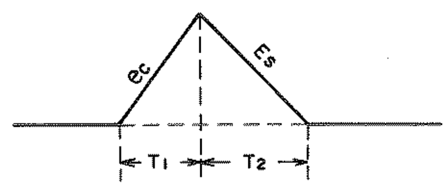
$$Rx = Zx \mid real = Rr \frac{EaEc + EbEd}{Ea^2 + Eb^2} \quad \text{--------} \quad (8\text{-}8)$$

$$Xx = Zx \mid imaginary = Rr \frac{EaEd - EbEc}{Ea^2 + Eb^2} \quad \text{----} \quad (8\text{-}9)$$

$$Gx = Yx \mid real = Rr \frac{EaEc + EbEd}{Ec^2 + Ed^2} \quad \text{-------} \quad (8\text{-}10)$$

$$Bx = Yx \mid imaginary = Rr \frac{EbEc - EaEd}{Ec^2 + Ed^2} \quad \text{---} \quad (8\text{-}11)$$

To measure the magnitude of each vector component (Ea, Eb, Ec and Ed), the phase detected vector voltages are sequentially converted to time periods. In the first integration cycle, for example, the Ec voltage charges the integrator for a constant time T1. The decay slope in the integrator discharge period is developed by using a dc reference voltage (Es or -Es) as in the popular dual slope DVM method. Relationship of the integrator input voltages and time periods are:



$$k1EcT1 = k2EsT2$$

$$Ec = k \cdot Es \frac{T2}{T1} \qquad Ec \propto T2 \quad \text{-----} \quad (8\text{-}12)$$

Where, constant k is the product of: (process amplifier gain) x (phase detector efficiency) x (integrator time constant).

Note

The integrator charge time constant (T1) is set to a multiple of the selected test frequency cycle period and is approximately 10ms. This supresses the effects of any phase detector output ripple voltage which can not be fully filtered out because a small filtering time constant is used for shortening transient response time. The result of charge time (T1) control is stable measurement display outputs with low fluctuation.

The dual slope integration operation is done in four cycles to measure times T2 for Ea, Eb, Ec and Ed vector components (Ta, Tb, Tc and Td) in one measurement. The timing of the vector voltage ratio detector input/output signal is illustrated in Figure 8-5.

8-17. Equations 8-8 through 8-11 can be represented in terms of the counted time periods Ta, Tb, Tc and Td as follows:

$$Rx = \frac{TaTc + TbTd}{Ta^2 + Tb^2} \quad \text{----------} \quad (8\text{-}13)$$

$$Xx = \frac{TaTd - TbTc}{Ta^2 + Tb^2} \quad \text{----------} \quad (8\text{-}14)$$

$$Gx = \frac{TaTc + TbTd}{Tc^2 + Td^2} \quad \text{----------} \quad (8\text{-}15)$$

$$Bx = \frac{TbTc - TaTd}{Tc^2 + Td^2} \quad \text{----------} \quad (8\text{-}16)$$

When the sample impedance value is measured on a range below 100Ω, the 4275A calculates the vector impedance component values Rx and Xx. For samples which have higher impedance values, the 4275A calculates the vector admittance component values Gx and Bx. Other measurement parameter values are subsequently calculated from the measured Rx and Xx (Gx and Bx) values using memorized parameter conversion formulas.

8-18. When a high impedance sample is measured, a constant test signal voltage is applied to the sample irrespective of the sample value. Therefore, the Eref voltage is constant and the voltage across range resistor (Err) changes in proportion to the sample value. On the other hand, when a low impedance sample is measured, a 100Ω source resistor (test signal generator output resistor) causes a constant test signal current to flow through the sample. In this case, the range resistor voltage Err is constant and, the voltage across the sample (Edut) is proportional to the sample value. The relationship of the test signal voltage and current to the sample impedance value is given in Figure 8-6.

8-19. The dual slope A-D conversion sequence adds two auto offset cycles to eliminate the effects of residual dc offset voltages in the Vector Voltage Ratio Detector. One offset cycle precedes the four vector measurement cycles each time a measurement is taken. When (and only when) the test frequency is set at 2MHz or a higher frequency, another offset cycle follows after completion of the vector measurement cycles. During the offset measurement periods, the process amplifier (Edut and Err) selector switches are opened to accept no input. The integrator develops a low level dual slope waveform and time T0 (T5) is proportional to the comprehensive residual offset voltage at the integrator output. At high frequencies, the offset measurement is performed for each of the 0° and 90° detection phase operations because the residual dc offset voltage differs for the respective detection phases. Times T0 and T5 are arithmetically subtracted from the counted vector measurement time values as:

$$Ta' = Ta - T0$$
$$Tb' = Tb - T0$$
$$Tc' = Tc - T5$$
$$Td' = Td - T5$$

where the prime mark (') indicates compensated time values. When an offset measurement cycle (T5) is not implemented, time value T0 is used for (instead of) T5.

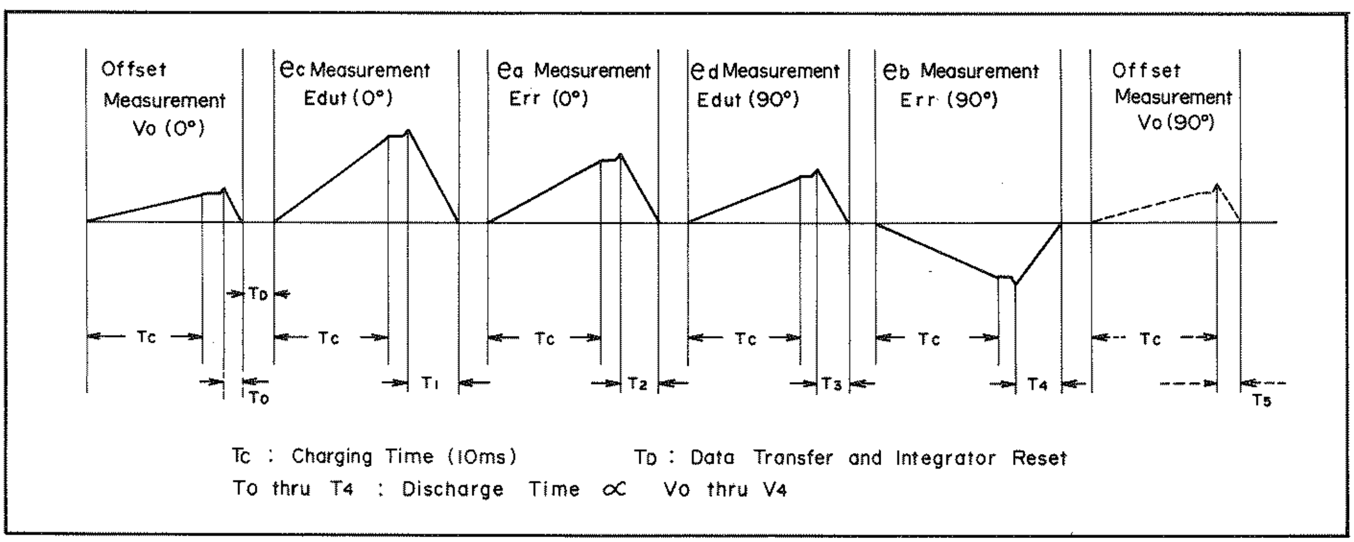


Figure 8-5. Integrator Vector Voltage Ratio Detection Timing.

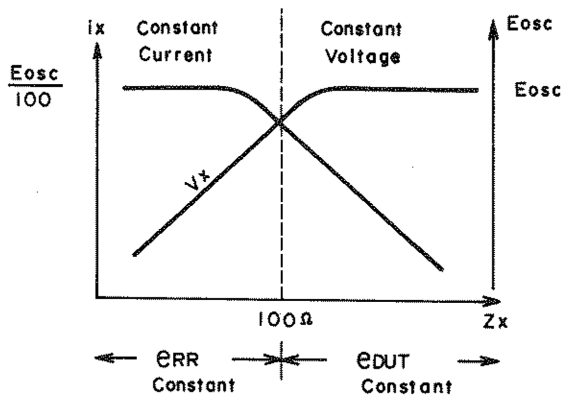


Figure 8-6. Test Signal Voltage and Current Relationship to Sample Impedance.

8-20. Range resistor value is selected as either 100Ω, 1kΩ, 10kΩ and 100kΩ depending on the DUT value. To magnify measurement range capabilities, the process amplifier gain can be attenuated by 1/10 or 1/100. This permits developing vector voltage ratios equivalent to that obtained when lower or higher range resistor values are used. For example, when the process amplifier gain is decreased by 1/10 during integrator charge or discharge periods, the calculated Rx and Xx values are 10 times that measured without the attenuation process.

Note

When Ea and Eb signals are attenuated by 1/10 in Process Amplifier, calcurated resistance value Rx is magnified and is given by the equation below:

$$Rx' = Rr\frac{0.1\ EaEc + 0.1\ EbEd}{(0.1\ Ea)^2 + (0.1\ Eb)^2}$$

$$= 10Rr\frac{EaEc + EbEd}{Ea^2 + Eb^2} = 10Rx$$

8-21. Zero Offset Adjustment (Open and Short) function measures residual impedance of the test fixture under short-circuit conditions and residual admittance under open-circuited conditions. Correction calculations in the subsequent DUT measurements are made using the following equations:

$$Zc = \frac{Zm - Zo}{1 - YoZm} \quad \text{---------(8-17)}$$

$$Yc = \frac{Ym - Yo}{1 - ZoYm} \quad \text{---------(8-18)}$$

Where, Zc: Corrected impedance value
Yc: Corrected admittance value
Zo: Residual impedance value
Yo: Residual admittance value
Zm: Measured DUT impedance value
Ym: Measured DUT admittance value

8-22. BLOCK DIAGRAM DISCUSSION

8-23. A6 OSCILLATOR

8-24. Demands for accurate and high resolution measurements necessitate a stable test frequency signal of high accuracy with low distortion (including minimum harmonics and noise). To generate 10 standard spot test frequencies, the 80MHz and 32MHz crystal oscillator frequencies are first counted down to 8f (8 times the selected frequency) signal. The 80MHz oscillator provides the source frequency for the 10kHz, 20kHz 100kHz 200kHz, 1MHz, 2MHz and 10MHz test frequencies. For 20kHz, 200kHz and 2MHz frequencies, a 16MHz source frequency divided down (by 5) from 80MHz oscillator frequency is used. On the other hand, a 32MHz oscillator provides the source frequency for the 40kHz, 400kHz and 4MHz test frequencies. The source frequency signals are gated for selecting the decade down-counter input frequency signal (to be divided into lower test frequency signals). Source frequency selection and frequency count-down rules are summarized in Table 8-1.

8-25. The sinusoidal waveform synthesizer generates a periodic staircase waveform whose envelope is similar to a sinusoidal waveform. The staircase waveform has appropriate step voltages developed by level synthesis circuitry in synchronism with the "8f" pulse signal. See Figure 8-8. A Harmonic Supressor Adjustment control permits adjusting the step voltage levels so that the periodic staircase signal, whose cyclic period is that of the selected test frequency, includes only lower order magnitudes of the third and the fifth harmonics (theoretically, even degree harmonics are not included in the signal).

8-26. The three LPF(Low Pass Filter) stages pass the fundamental of the sinusoidal waveform synthesizer output signal and eliminate the harmonics to a level of -50dB or more from the fundamental. The filter roll-off frequency automatically follows the input fundamental frequency so that the filtered output (sinusoidal waveform) is maintained at a constant level. Operating theory for the frequency follow-up filter circuit is illustrated in Figure 8-9. The roll-off frequency control range is varied to cover all test frequencies in three decade ranges as follows:

Range 1: 10kHz to 100kHz
Range 2: 100kHz to 1MHz (excludes 100kHz)
Range 3: 1MHz to 10MHz (excludes 1MHz)

Because the test frequency always comes at a particular point on the characteristic slope of the filter, the filtering effect(harmonic rejection) is constant for all test frequencies.

8-27. 1-3-5 step test frequency (Opt. 004). Option 004 unit employs 24MHz instead of the standard 32MHz crystal oscillator frequency and 40MHz divided down from 80MHz (by 2) instead of the 16MHz source frequency. Frequency selection method for option 004 test frequencies is summarized in Table 8-2.

8-28. Installation of a special test frequency option adds a crystal resonator to the oscillator circuit which has a resonant frequency which is appropriate for use at the optional frequency. Additionally, appropriate inductor and capacitor values are used as blank circuitry to complete the optional oscillator circuit.

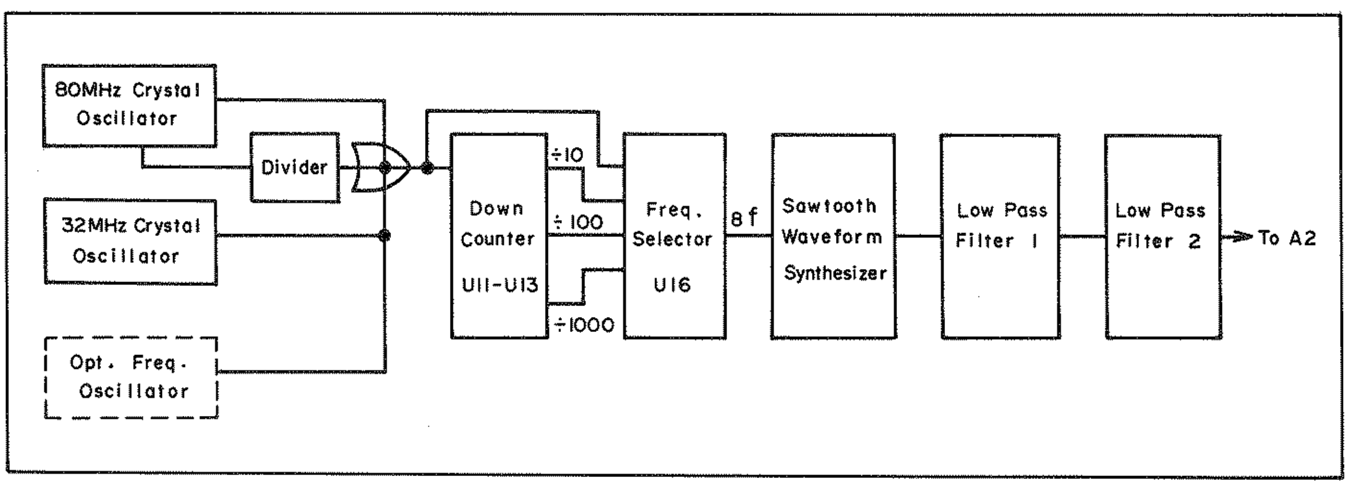


Figure 8-7. A6 Oscillator Block Diagram.

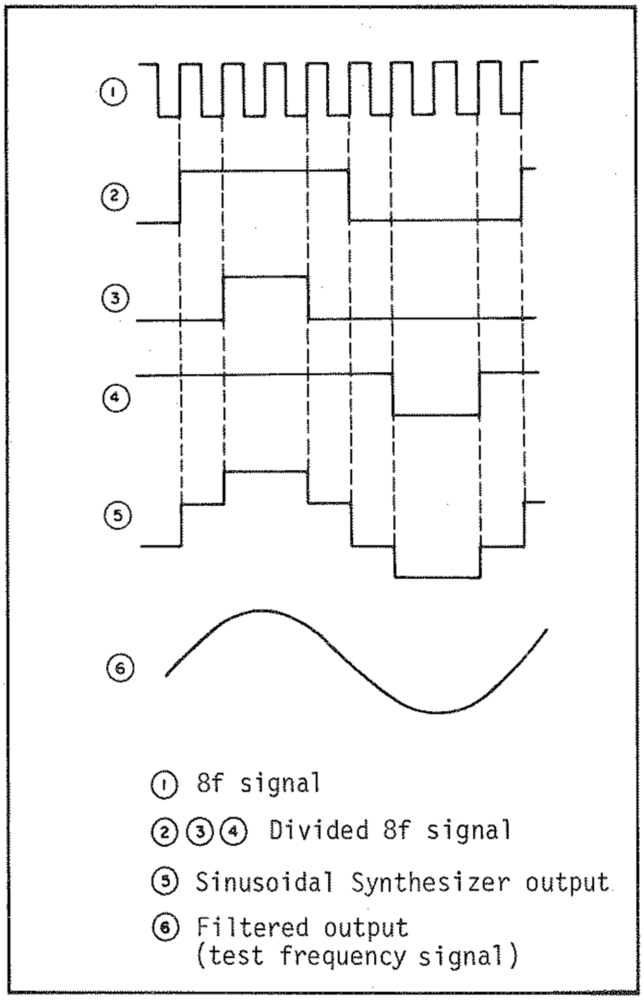


Figure 8-8. Sinusoidal Synthesizer Waveforms.

8-29. A3 POWER AMPLIFIER

8-30. The sinusoidal test frequency signal of 500mVrms is processed in the Power Amplifier section to allow control of test signal amplitude and the application of any desired dc bias. Additionally, the modulator output signal (Err) flows in the other amplifier channel which has almost the same circuit configuration as that for the test signal channel. The modulator output signal amplitude is also controlled in proportion to the test signal amplitude to maintain the bridge balance condition constant. The 1/10 and 1/100 attenuators in the middle stage amplifiers provide attenuation linked to the test signal level MULTIPLIER control. Front panel OSC LEVEL control changes feedback amplification gain of the preamplifier stages. The power amplifier circuit feeds the test frequency signal to the DUT and the modulator signal to the range resistor circuit with low amplifier output impedance.

8-31. A1 RANGE RESISTOR/NULL DETECTOR

8-32. The A1 board assembly combines two circuit sections: the Range Resistor circuit (on the upper part) and the Null Detector (on the lower part of the circuit board).

1) Range Resistor circuit.
To ensure accurate range resistor value and minimum residual reactance (mainly stray capacitance) effects, an adjustment potentiometer and a phase compensation trimmer capacitor are provided in association with in-

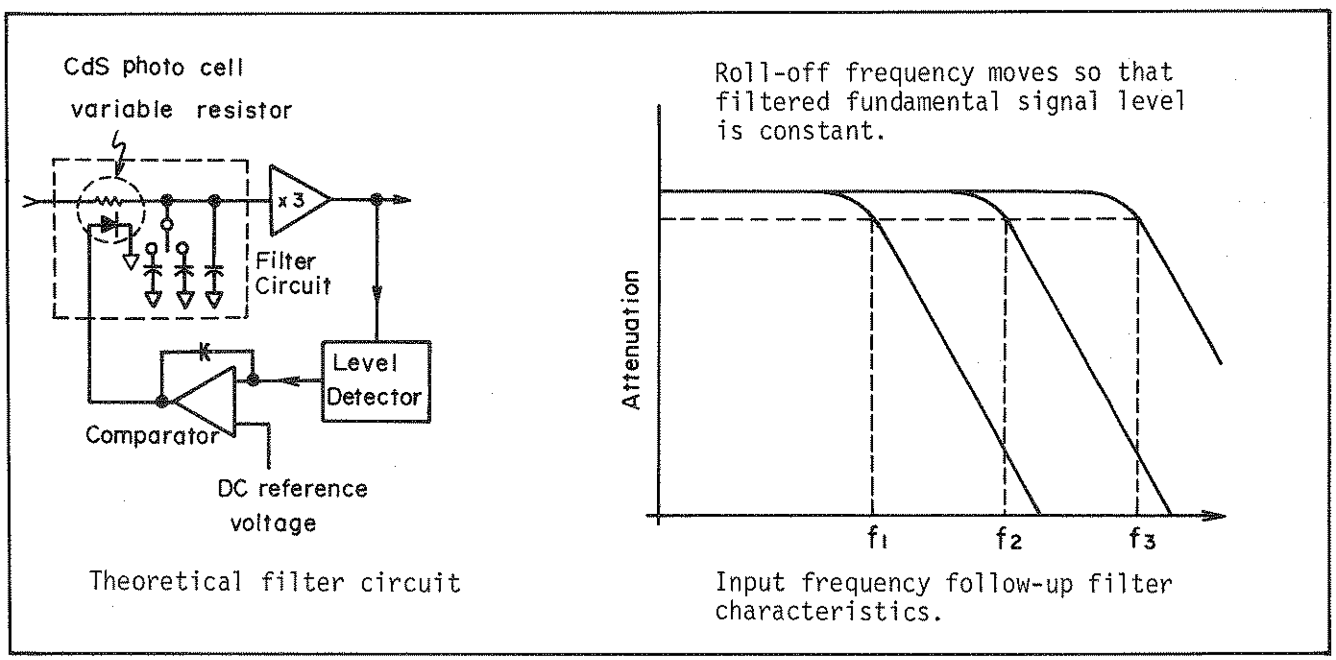


Figure 8-9. Frequency Follow-up Filter Operating Theory.

dividual range resistors. The CMR (Common Mode Rejection) amplifier properly compensates for any voltage drop in the range resistor signal which is caused by impedance inherent in the internal cabling. The Cable Length Compensator delays the range resistor signal to offset the effect of long test cables (when 1m test cables are used).

2) Null Detector
Bridge unbalance vector current is converted into a vector voltage at the I-V converter output. To improve amplifier gain at high frequencies, the I-V converter employs a staggered amplifier circuit configuration. Because I-V converter feedback magnitude varies depending on the DUT impedance, the feedback circuit element value is changed in response to selection of measurement range.

The Level Normalizer Amplifier amplifies the unbalance signal vector voltage maintaining the output signal level constant (irrespective of the OSC LEVEL control setting). These gain controls (in the I-V Converter and the Level Normalizer Amplifier) suppress variations in the bridge balance control loop gain. Consequently, bridge balance settling time (transient response time when bringing the bridge into balance) is almost equal for various measurement conditions.

Table 8-1. Test Frequency Selection (Standard).

Test Signal frequency	Oscillator source frequency	Division fraction			Total division fraction	8f frequency
		1st	2nd	3rd		
10kHz	80MHz	1/10	1/10	1/10	1/1000	80kHz
20kHz	16MHz	1/10	1/10	—	1/100	160kHz
40kHz	32MHz	1/10	1/10	—	1/100	320kHz
100kHz	80MHz	1/10	1/10	—	1/100	800kHz
200kHz	16MHz	1/10	—	—	1/10	1.6MHz
400kHz	32MHz	1/10	—	—	1/10	3.2MHz
1MHz	80MHz	1/10	—	—	1/10	8MHz
2MHz	16MHz	—	—	—	—	16MHz
4MHz	32MHz	—	—	—	—	32MHz
10MHz	80MHz	—	—	—	—	80MHz

Table 8-2. Test Frequency Selection (Opt. 004).

Test signal frequency	Oscillator source frequency	Division fraction			Total division fraction	8f frequency
		1st	2nd	3rd		
10kHz	80MHz	1/10	1/10	1/10	1/1000	80kHz
30kHz	24MHz	1/10	1/10	—	1/100	240kHz
50kHz	40MHz	1/10	1/10	—	1/100	400kHz
100kHz	80MHz	1/10	1/10	—	1/100	800kHz
300kHz	24MHz	1/10	—	—	1/10	2.4MHz
500kHz	40MHz	1/10	—	—	1/10	4MHz
1MHz	80MHz	1/10	—	—	1/10	8MHz
3MHz	24MHz	—	—	—	—	24MHz
5MHz	40MHz	—	—	—	—	40MHz
10MHz	80MHz	—	—	—	—	80MHz

8-33. A2 MODULATOR

8-34. Simplified block diagram of the A2 Modulator is shown in Figure 8-10. The test frequency input signal, which is transformed into a range resistor signal (Err) for counter-balancing the bridge circuit, splits into 0° and 90° phase signals at the Phase Shifter output. The auto-phase adjustment circuit adopted in the phase shifter continuously operates to bring the relative difference in phase of the phase shifter output signals to an accurate 90 degrees. Discrimination of the phase difference is performed by phase detecting the 90° phase signal using the 0° phase signal as the detection signal. When an accurate 90° phase difference occurs, the detector signal level is zero. The phase detecter output voltage controls the 90° phase shifter so that the phase error is minimum.

8-35. Null detector output signal is phase detected to extract the vector components of the unbalance current. DC levels at the integrator outputs are proportional to magnitudes of the null detector signal vector components. These dc voltages, proportional to the 0° and 90° phase components of the unbalance current, are the control signals for transforming the test frequency signal (divided into 0° and 90° phase signals) into the required Err signal. The Phase Tracking Amplifiers compensate for any phase shift in detection phase signals to ensure accurate phase detector outputs over the entire test frequency range.

8-36. The Multipliers are the key circuits for controlling the Err signal vector voltage. The multipliers provide individual outputs proportional to the product of their input signals. Thus, the two multipliers produce outputs which can be represented by the following equations:

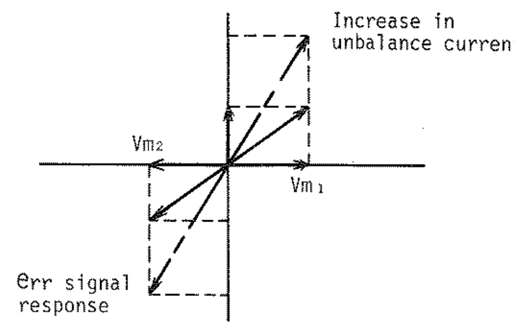
1) Vs (0) x Vc (0) = Vm1
2) Vs (90) x Vc (90) = Vm2

Where, Vs(0): 0° phase test frequency signal
Vs(90): 90° phase test frequency signal
Vc (0): Null detector output 0° phase component (dc)
Vc(90): Null detector output 90° phase component (dc)
Vm1, Vm2: Multiplier output signals

The Summing Amplifier sums the Vm1 and Vm2 signals which are the products of the null detector output (unbalance current). The blended signal comprises the Err signal and may be represented as:

Err = -(Vm1 + Vm2)

8-37. If the imaginary component of the unbalance current increases, it causes the Vc (90) signal level to simultaneously increase. Thereupon, the Err signal changes to a new vector voltage which is composed of a greater -Vm2 vector component magnitude. Note that the Err signal is the reverse vector of the composite vector Vm1 plus Vm2. See illustration below:



The response of the Err signal increases the reverse vector of the unbalance current and, thus, the unbalance current is reduced (approaches zero).

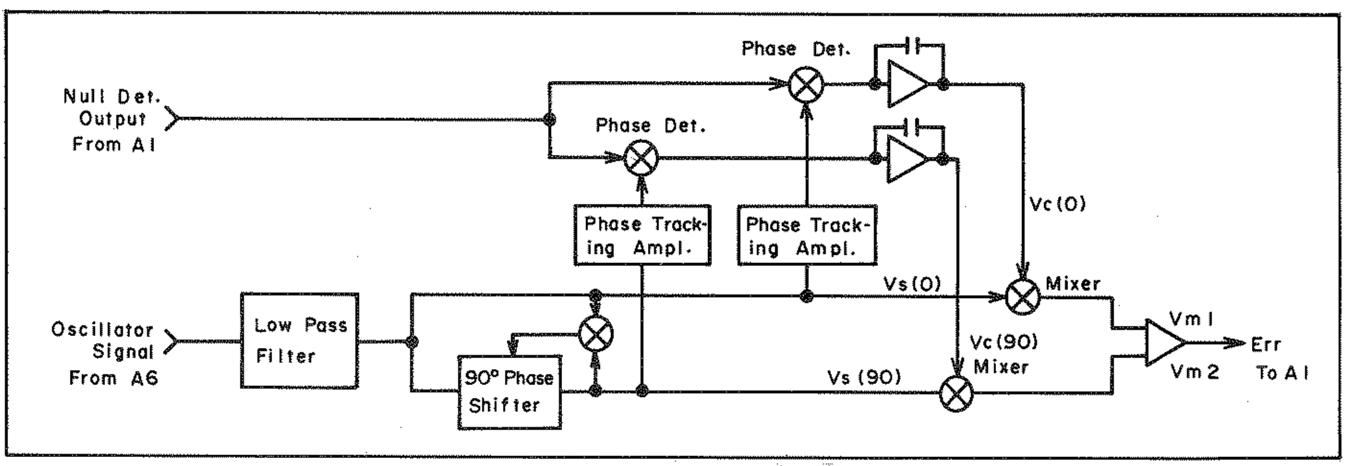


Figure 8-10. A2 Modulator Block Diagram.

8-38. A4 PROCESS AMPLIFIER

8-39. The Err and Edut Buffer Amplifier (A4A1 and A4A2) detect the bridge circuit measurement signals (Err and Edut) with a minimum phase error (to 10MHz). The signal selector switches at the output stage of the Buffer Amplifiers turn on and off according to the measurement sequence and allow transmission of either the Err or Edut signal to the later amplifier stages. For switch control timing, refer to Figure 8-17 Timing Diagram.

The signal selector switches channel the test frequency input signal which is fed at 10mVrms from the A6 Oscillator when TEST SIGNAL LEVEL CHECK function is activated. Test signal voltage or current is calculated from the detected Edut, Err and the 10mV reference test signal level (by the microprocessor). These selector switches do not connect with any input channel during the A-D converter offset control period.

8-40. The AM Amplifier (A4A3 and A4A4) expand measurement range capabilities and compress variations of the Err and Edut signals in relation to the test frequency signal level. The two 1/10 attenuators located between the series amplifier stages are used for the following purposes:

1) They change the attenuation factors in conjunction with the test signal level MULTIPLIER settings as follows:

MULTIPLIER setting	Attenuation factor
x 1	1/100 (1/10 x 1/10)
x 0.1	1/10 (1/10 x 1)
x 0.01	1 (1 x 1)

2) Their attenuation only applies to the Err or Edut signal depending on the selected range. This selective attenuation magnifies the ratio of the Err and Edut signal levels to 10 or 100 times the normal ratio. Thereby, the measurement range can be multiplied by the same factors.

The Level Comparator monitors the OSC LEVEL control setting to compare the control signal level with the four step voltage ranges. When the OSC LEVEL control is rotated from its minimum to maximum position, the Level Comparator changes its output logic at the "A" to "D" outputs from low to high level (in D to A order). The comparator outputs an amplification gain change to the individual x10 amplifiers (x10, x4 or x2). The relationship of the OSC LEVEL control setting and the amplification gain is illustrated in Figure 8-12.

As the result of the attenuation (amplification) control for a desired change of test signal level, the amplitude of the AM amplifier output is corrected at an approximately constant level. This maintains the A-D converter input signal level constant and improves vector ratio detection accuracy for low level test signal measurements. Note that the ratio of the Err and Edut signal levels are preserved throughout these processes.

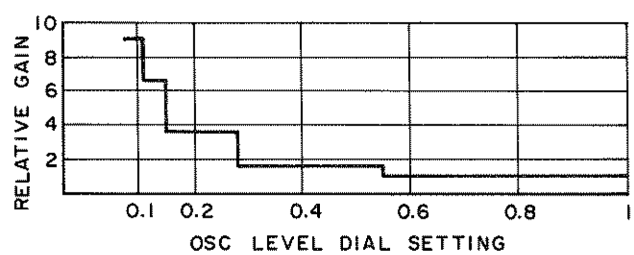


Figure 8-12. AM Amplifier Gain Control.

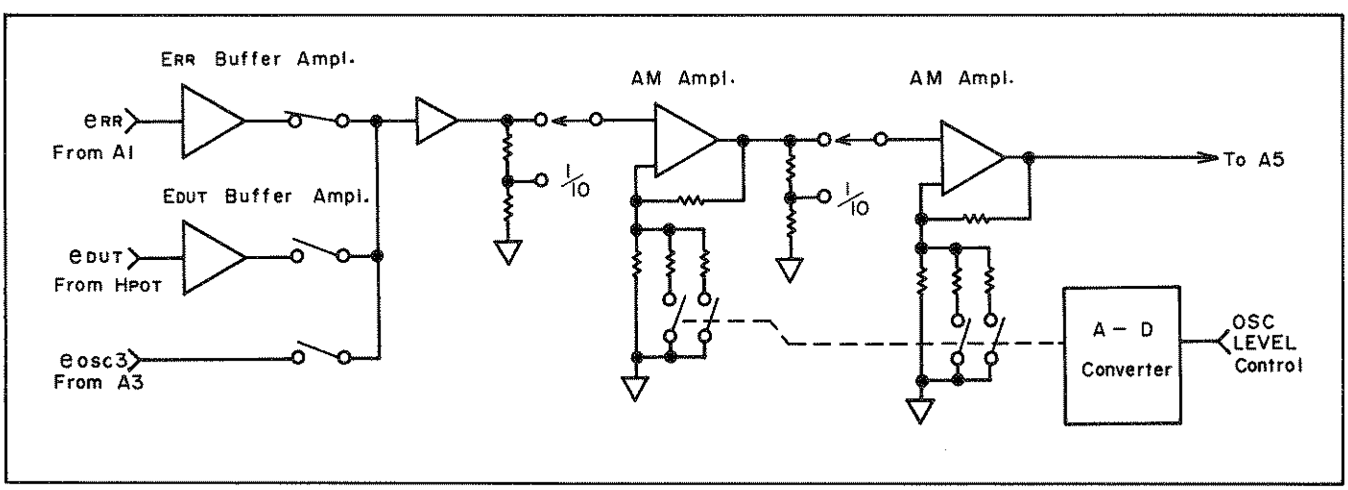
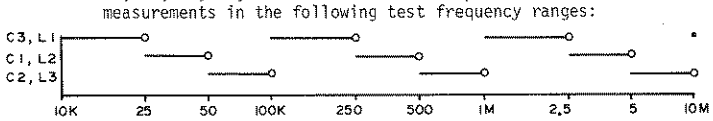


Figure 8-11. A4 Process Amplifier Block Diagram.

Table 8-3. Range Resistor and AM Attenuator Control Matrix.

Function	Test Frequency		Z-1	Z-2	Z-3	Y-5	Y-4	Y-3	Y-2	Y-1
			L, C, R, |Z| Range							
C Capacitance	10kHz~24.9kHz		100μF	10μF	1000nF	100mF	10nF	1000pF	100pF	10pF
	25kHz~249kHz		10μF	1000nF	100nF	10nF	1000pF	100pF	10pF	1000fF
	250kHz~2.49MHz		1000nF	100nF	10nF	1000pF	100pF	10pF	1000fF	—
	2.5MHz~10MHz		—	10nF	1000pF	100pF	10pF	1000fF	—	—
L Inductance	10kHz~99.9kHz		10μH	100μH	1000μH	10mH	100mH	1000mH	—	—
	100kHz~999kHz		1000nH	10μH	100μH	1000μH	10mH	100mH	—	—
	1MHz~9.99MHz		100nH	1000nH	10μH	100μH	1000μH	10mH	—	—
	10MHz		—	100nH	1000nH	10μH	100μH	—	—	—
R, |Z| Resistance Impedance	10kHz~10MHz		1000mΩ	10Ω	100Ω	1000Ω	10kΩ	100kΩ	1MΩ	10MΩ
Range resistor used			100Ω	100Ω	100Ω	100Ω	100Ω	1kΩ	10kΩ	100kΩ
Combination of AM and AF attenuator control	C1	AM	x10	x1	x1	x1	x10	x10	x10	x10
		AF	2	2	1	4	4	4	4	4
	C2	AM	x10	x1	x1	x1	x10	x10	x10	x10
		AF	4	4	1	2	2	2	2	2
	C3	AM	x100	x10	x1	x1	x10	x10	x10	x10
		AF	1	1	1	1	1	1	1	1
	L1	AM	x100	x10	x1	x1	x10	x10	x10	x10
		AF	1	1	1	1	1	1	1	1
	L2	AM	x10	x1	x1	x1	x10	x10	x10	x10
		AF	4	4	1	2	2	2	2	2
	L3	AM	x10	x1	x1	x1	x10	x10	x10	x10
		AF	2	2	1	4	4	4	4	4
	R, |Z|	AM	x100	x10	x1	x1	x10	x10	x10	x10
		AF	1	1	1	1	1	1	1	1

Note: C1, C2, C3, L1, L2 and L3 indicates capacitance and inductance measurements in the following test frequency ranges:



Test Frequency

This table applies only when MULTIPLIER is set to X1.

8-41. A5 A-D CONVERTER

8-42. For both capacitance and inductance measurements, the attenuator at the input stage of the A-D Converter equalizes the input signal (Edut and Err) level for any test frequency. The Edut or Err signal level detected for the same sample value (capacitance or inductance) changes in proportion to (or in inverse proportion to) the test signal frequency. The attenuation factor is set to 1/2 or 1/4 so that the Edut and Err input signal levels are, respectively, almost equal in one decade frequency range (for example, at 100kHz, 200kHz and 400kHz). In the same manner, the input signal levels are also equalized for other decade frequency ranges in combination with different range resistor values or process amplifier attenuation factors.

8-43. The Phase Detector extracts 0° phase and 90° phase vector components independently with appropriate timing from the Edut and Err input signals. The phase detector employs an unique circuit configuration for decreasing odd order harmonic component signals which may occur in the output signal. When a square waveform detection signal is used (as is popular), the phase detector output signal also includes low amplitude harmonics corresponding to their vector products [harmonics (distortion) of the input signal multiplied by harmonic components of the square waveform detection signal (in the same frequency vector)]. These harmonic signals, mainly consisting of odd order components, cause a measurement error to occur. Use of a sinusoidal waveform detection signal ensures less harmonics but offers more difficulty in achieving detection phase accuracy in comparison to the square waveform operation.

The phase detector employed in the vector ratio detector uses a periodic staircase waveform detection signal synthesized into a sinusoidal waveform. See Figure 8-14. The quasi-sinusoidal waveform detection signal generates lower order third and fifth degree harmonics. This new phase detector circuit configuration is a parallel connection of two ordinary phase detectors. To accomplish phase detection on the basis of this concept, four switching signals operate in synchronization for each detection phase (0° and 90°). The combined circuit operation of these switching signals is in consonance with theoretical phase detection. The phase detector output current waveform is the sum of the input signal segments detected for the individual switching time periods (as shown in Figure 8-14).

8-44. The Detection Phase Generator develops the synchronized switching signals by counting down the frequency of the 8f pulse signal(fed from A6 Oscillator). The switching pulses generate one cycle for each 8 cycle period of the 8f signal. Thus, the 0° and 90° detection phase signals are exactly synchronized with the test frequency signal. Selection of the detection phase is performed by shifting the timing of the down counter by 2 cycle periods of the 8f signal.

8-45. A dual slope A-D converter charges on the phase detector output signal (a vector component of the Edut or Err signal) during the time the input switch is closed for a constant period (approximately 10ms). The charge time interval is set to an exact multiple of the test signal cycle period. See Figure 8-17 Timing Diagram. A short hold time is provided before beginning charge and before beginning with the discharge period. During the hold time, the integrator input switch is opened to intercept any transient response signals incident to switching of measurement vector signal. A small triangular precharge waveform done before going into the discharge period improves measurement accuracy when input signal is of extremely low level. The integrator discharges at a constant decay rate until the output voltage reaches zero volts. The reference voltage supply circuit feeds a positive or negative dc voltage to discharge the integrator depending on the polarity of the charge input. The positive and negative reference voltages do not effect measurement results if their absolute values are equal. The Zero Detector reverses its output logic the moment the integrator output crosses the zero level. This signals completion of the discharge to the digital section. The amplifier combined with the integrator magnifies the integrator output waveform to facilitate detection of crossing the zero level point with minimum time error. The feedback loop switch(A5Q36) closes to keep the integrator discharged except when a dual slope integration operation is being performed.

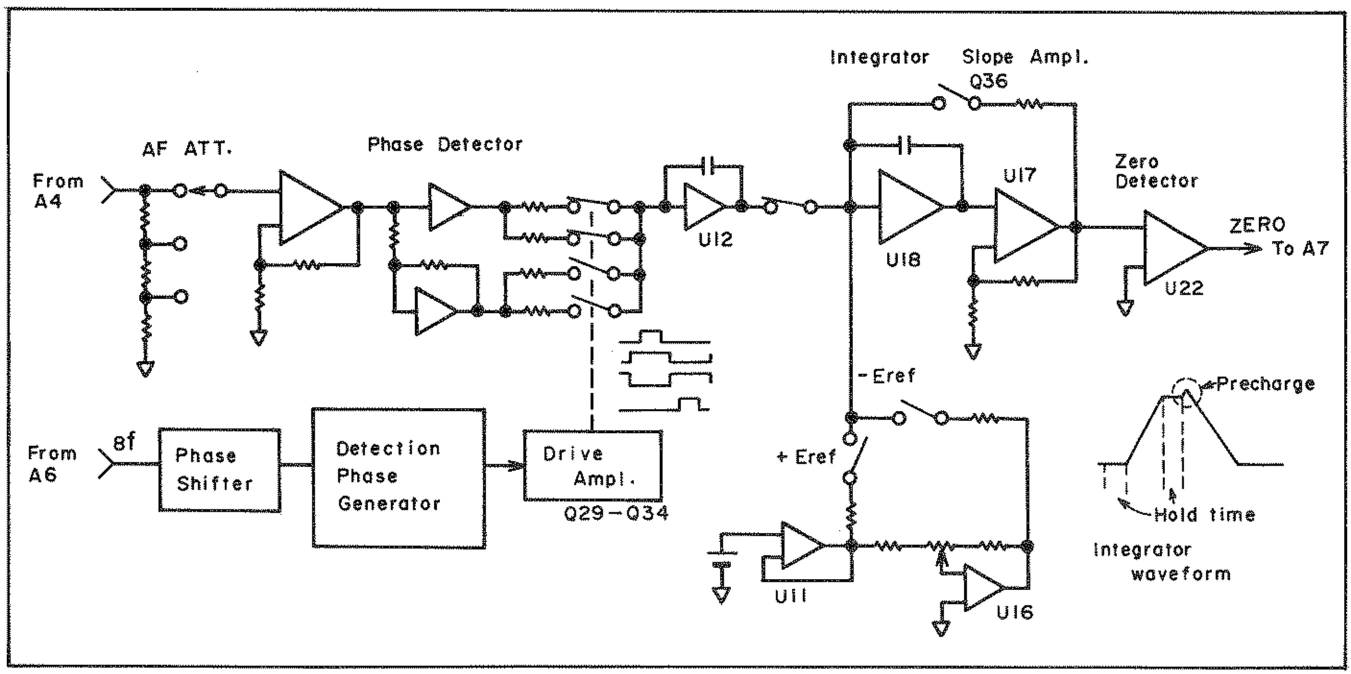
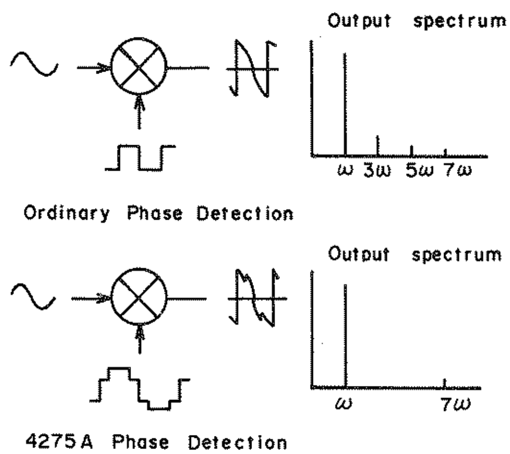
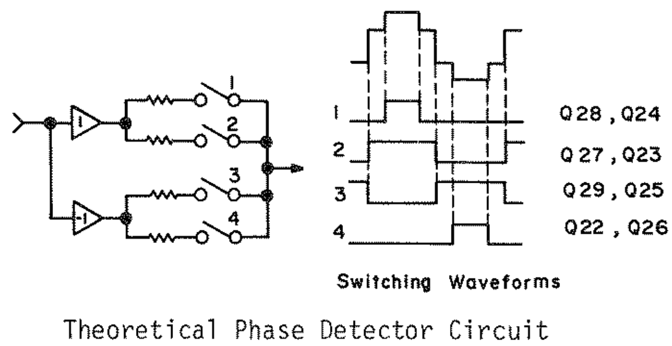


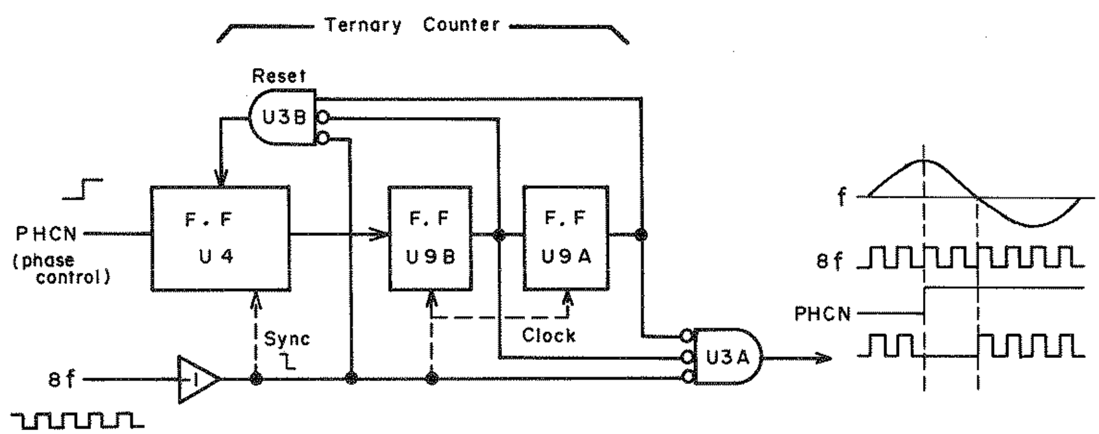
Figure 8-13. A5 A-D Converter Block Diagram.





The phase detector output signal is the product of the input signal multiplied by the detection phase signal. If either input signal has harmonics that are of lower amplitude, the output signal harmonics are also lower. Quasi-sinusoidal detection signal yields lesser 3rd and 5th harmonic signal components.

Figure 8-14. 4275A Phase Detector Operating Principle.



2 periods of
8f signal =
90° phase of
measurement
frequency signal

When the detection phase signal must be shifted by 90 degrees, the PHCN signal actuates flip flop U4. U4 activates the ternary counter U9 in synchronism with 8f signal. The ternary counter counts two cycle period of the 8f signal and automatically resets itself after completion of counting. During this two cycle period, Gate U3A intercepts 8f signal flow to the Detection Phase Generator. This action delays the detection phase by exactly 90 degrees with reference to the measurement frequency signal.

Figure 8-15. Detection Phase Shifter Operating Principle.

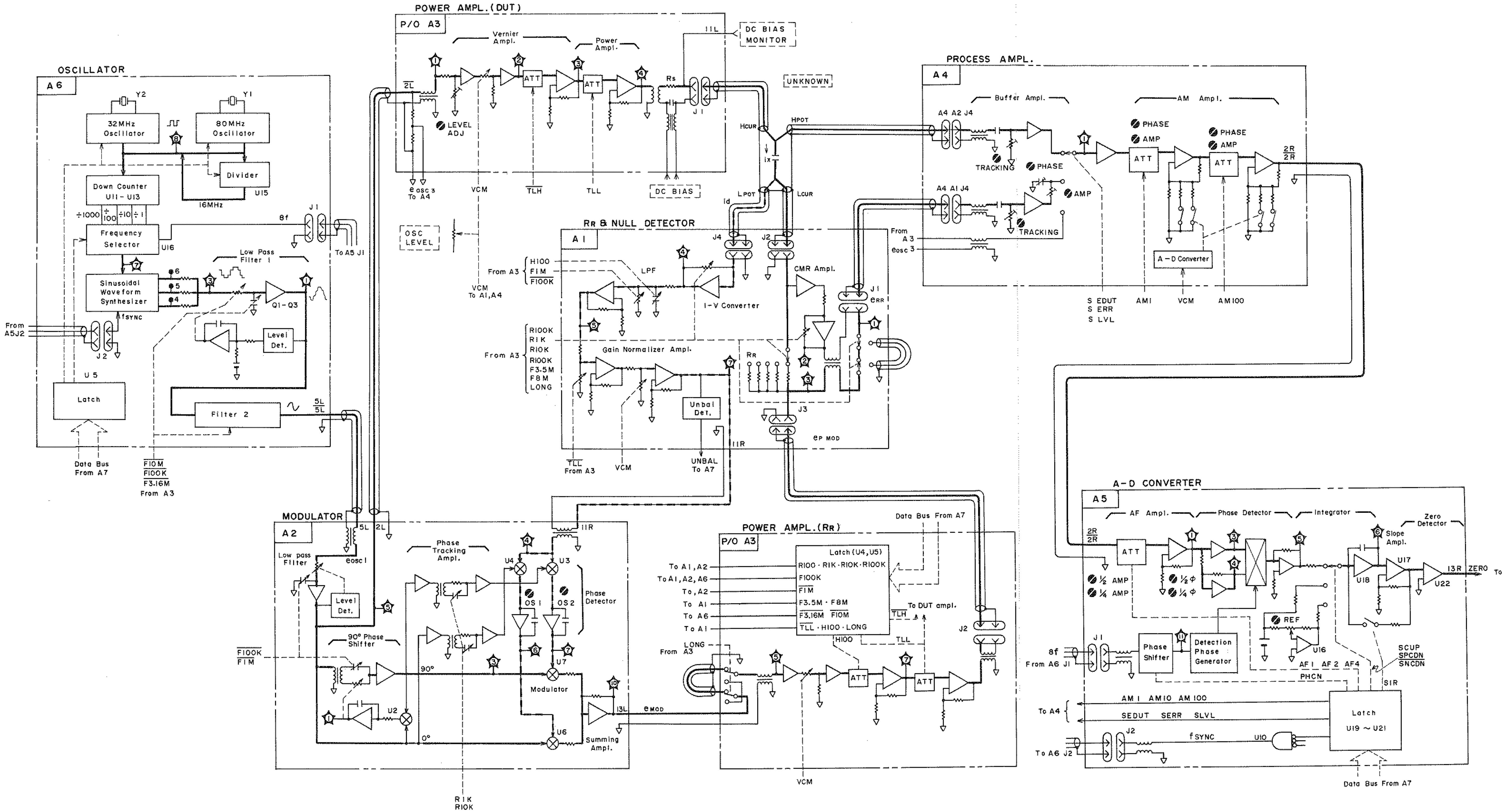


Figure 8-16. Analog Measurement Section Schematic Block Diagram.

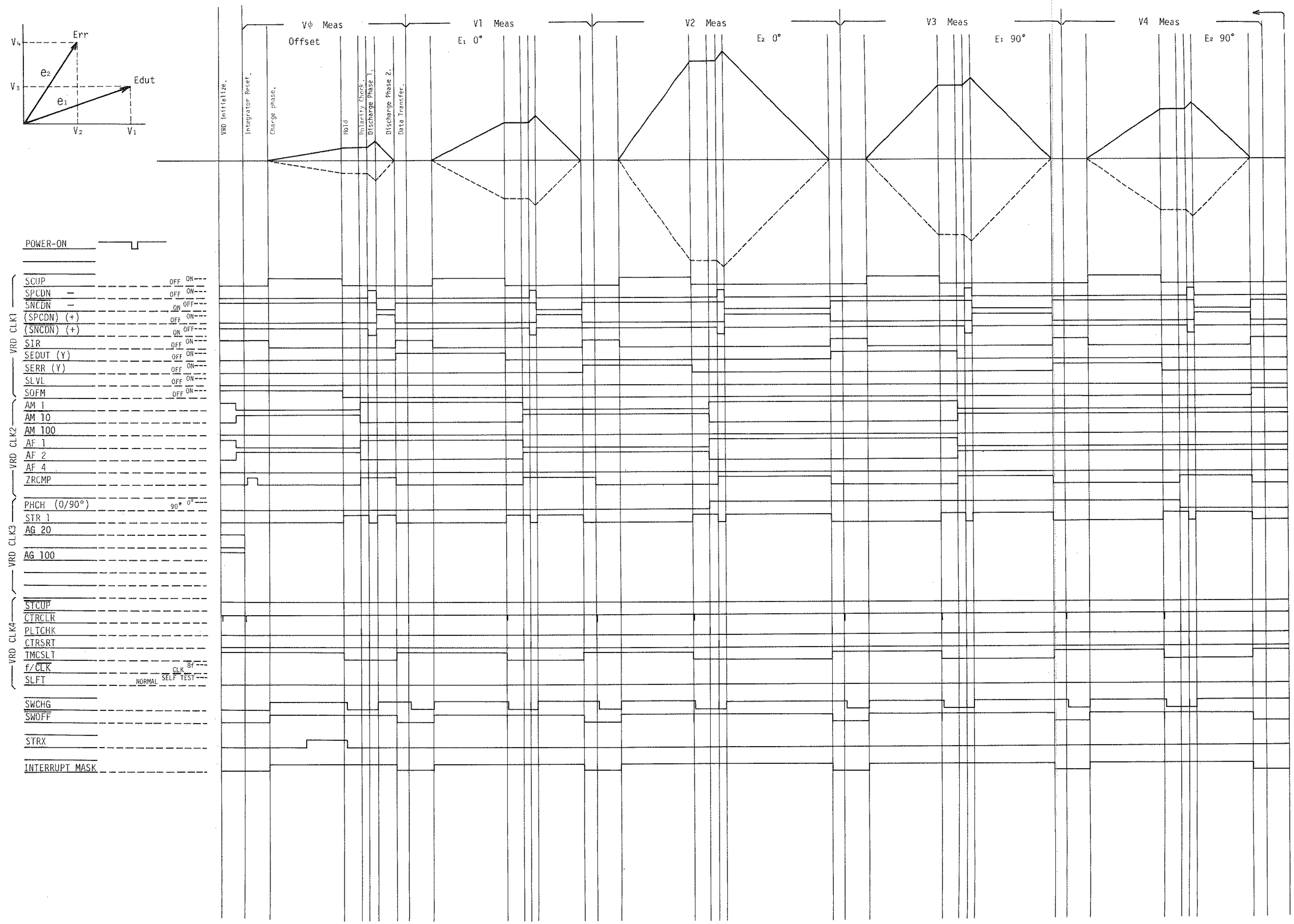


Figure 8-17. Timing Diagram.

8-46. DIGITAL CONTROL SECTION.

8-47. Figure 8-24 is the block diagram of the 4275A digital control section. The basic instrument includes three logic circuit boards and an operational keyboard combined with displays. These are integrated as necessary to handle their various functions and comprise the following assembly units:

A7 Peripheral Control Board Assembly.
A8 Microprocessor Unit Board Assembly.
A9 Display and Keyboard Control Board Assembly.
A11 Display and Keyboard Assembly.

The instruments allow the installation of one or two additional board assemblies for adding optional capabilities. These boards provide the circuits necessary for equipping the instrument with the following options:

A21 DC Bias Supply Board Assembly (Option 001)
A22 HP-IB Board Assembly (Option 101)
A23 DC Bias Supply Board Assembly (Option 002)

Optional boards can not offer their utility without the installation of an additional ROM on the microprocessor board for memorizing optional control programs. Installation of an optional board without the requisite program ROM disables normal operation of the instrument.

8-48. A9 MICROPROCESSOR UNIT.

8-49. The microprocessor interfaces with other devices through the three data bus lines and governs all digital data processing as well as providing analog measurement circuit timing control. These bus lines are alloted for the following purposes:

Data Bus Line (8 bit): Bidirectional bus line for transfer of program and measurement data from/to the microprocessor.

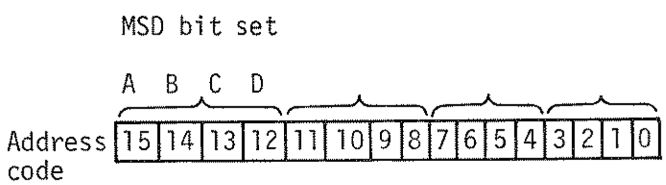
Address Bus Line (16 bit): Unidirectional bus line from microprocessor for addressing program ROM and data RAM. Additionally, sets PIA (Peripheral Interface Adapter) or Microport to enable data transfer to/from microprocessor.

Control Bus Line (VMA, R/$\overline{W}$, $\phi 1$, $\phi 2$, $\overline{RST}$): Unidirectional bus line for transfer of digital section control signals. VMA line controls synchronous access timing of RAM, PIA and Microport in conjunction with clock signal. R/$\overline{W}$ control line sets RAM, PIA or Microport to "read" or "write" operating mode to control data transfer direction (in time sharing) on the Data Bus Line from/to the microprocessor (definition for the R/$\overline{W}$ control logic is described in paragraph 8-53). $\phi 1$ and $\phi 2$ signal lines offer a set of clock pulse trains for mutual timing synchronization in the digital control circuits. $\overline{RST}$ line resets PIA's and Microport devices to their initial "clear" states after power-on and each time before the measurement is taken.

8-50. Program Control ROM has an 18 kilobyte total memory capacity and has already memorized the analog section control programs along with digital data processing routines (counting, calculation, transfer and storage of data). To accept the measurement control instructions from the Program ROM, the microprocessor sequentially addresses the ROM through the address bus line. The measurement control instructions, timely outputted from the ROM, are stored in the latches in the analog section via A7 Peripheral Control. The microprocessor also addresses the Data RAM and bus line control devices (PIA's and Microport) to sequentially excute microprocessor program steps in accord with the program given by the ROM.

A 16 bit address code comprises an unique 4 digit number (from 0000 to FFFF). Each digit number of the address is represented by a 4 bit code set (from 0 to F). The two more significant bits of the most significant digit address number assign a particular memory group or bus control devices as shown below:

Designation	Address code	MSD bit status ABCD
ROM	FFFF C000	11xx
PIA or Microport	↑ 8000	10xx
ROM (for option)	↑ 4000	01xx
RAM	↑ 0000	00xx



A program ROM is accessible while the status for AB of the MSD (most significant digit) bit set, ABCD, is 11 (or 01). The two lesser significant bits of the set (C D) of the MSD assign each individual ROM device. When both 15th and 14th bit states are 1 (AB = 11) Gate A9U27D turns its output logic to low level. This activates ROM Selector U16. The ROM selector decodes 13th, 12th and 11th bit address signals to 8 bit CSA (Chip Select A) signals which cause the appropriate ROM device to become valid (low level sets the RAM). When both the 15th and 14th bit states are 0 (AB = 00), the RAM Selector U28 is activated. The RAM selector decodes 11th and 10th bit address signals to 3 bit CSB (Chip Select B) signals. The CSB signals enable RAM devices or a data register in the following manner:

Designation	CSB control
DSA switch data register	CSB 3
Memory backup RAM (for option 003)	CSB 2
Data RAM	CSB 0

VMA (Valid Memory Address) and $\phi 2$ clock signals cooperate for securely addressing correct devices. A9U27A gates the VMA and $\phi 2$ clock signals to pull down its output to a low level only when both input signals are at high level. During this period, address bus data can be recognized by the addressed device. See Figure 8-18.

8-51. The Turn-on reset circuit (A9U35) always sets the microprocessor to its definite initial states after a 1 second delay when the instrument is turned on. The microprocessor initially accesses ROM address FFFF to read the memory data. The microprocessor program sequential steps progress in synchronism with a pair of 995 kHz complementary clock signals ($\phi 1$ and $\phi 2$ fed from A7 board). High level intervals of the clock signal must extend over the low level intervals of the other clock (as shown in Figure 8-18).

8-52. IRQ (Interrupt Request) control line transmits the response demand to the function control input from keyboard or from the HP-IB control line. When a 4275A function is selected or changed, the IRQ line goes to low level. The regular measurement sequence control of the microprocessor immediately pauses to determine the nature of the control input except during integrator operating periods (dual slope A-D conversion operation). Program address jumps to IRQ service program routine to manage the function control prior to program processes. The IRQ control line is always active so as to allow for servicing of interrupt requests.

8-53. A Read/Write (R/$\overline{W}$) timing control signal manipulates memory devices, registers, PIA's and microport in the following manner:

Read: Causes Register or Memory to output data or sets PIA or Microport to driver mode. Microprocessor accesses (reads) the data sent from the addressed device.

$\overline{\text{Write}}$: Enables Register or RAM to store data or set PIA or Microport to receiver mode. Microprocessor sends (writes out) data to the device.

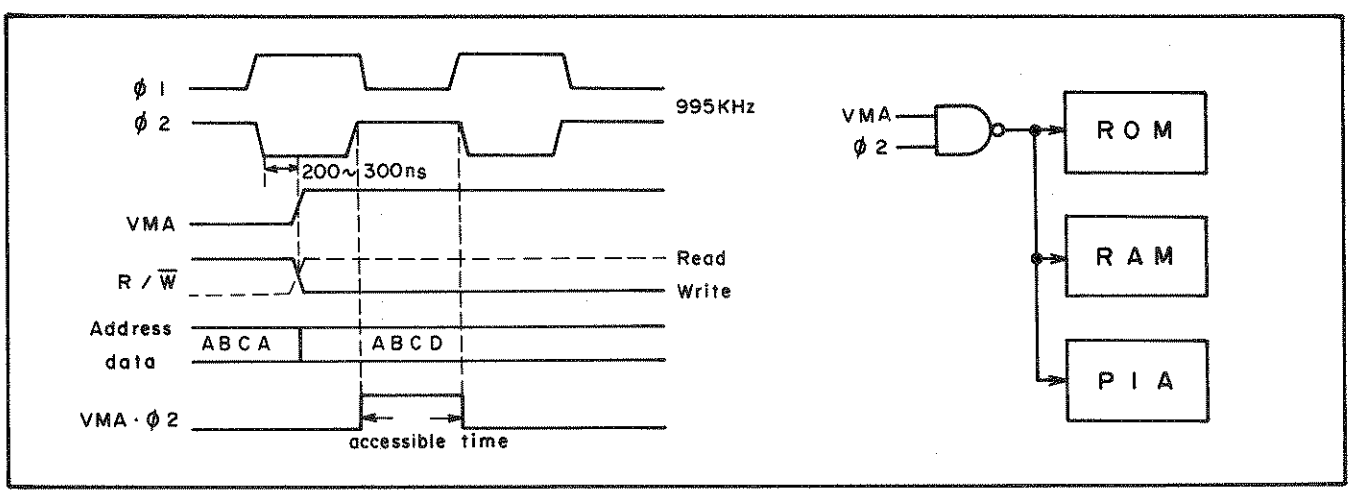


Figure 8-18. Address Timing Control.

The read/write control is performed in conjunction with address signals to qualify the valid device for the data transfer.

8-54. Optional Circuits.

8-55. The ROM selector A9U22 decodes its address bus inputs (11th, 12th and 13th bit set) to select optional program ROM (U9, U10 or U11) when 15th and 14th address bit states are 01. The Memory Backup RAM (U14 and U15) stores 8 bit data (4 bits for each RAM device) which are continuously protected by a lithium battery. When instrument operating power is lost, the battery feeds minimum power sufficient for preservation of the stored memory in the RAM. Simultaneously the Level Detector (U25) disables writing to the RAM to avoid memorizing random data at the moment the power line voltage drops.

8-56. A7 PERIPHERAL CONTROL.

8-57. The key function of the A7 Peripheral Control is to manage the analog section control signals and to count the measurement quantities transferred in the form of time intervals. The PIA (Peripheral Interface Adapter) directs the incoming or outgoing data stream to/from the A7 board. Internal circuit configuration of the PIA is illustrated in Figure 8-19. When the 15th, 14th and third bit states of the address signal are set to (1, 0, 1), the PIA has access to the microprocessor. Address bus AB0 and AB1 bit set selects internal control register and data output register in the PIA which momentarily stores the input data. When R/$\overline{W}$ control line is pulled down to low level, the PIA allows transfer of data from the microprocessor to Bus Buffer/Data Control (U16, U18, U27 and U28) in channels A or B. PA7 and CA2 (PIA control output) signals control the direction of the input/output data which can flow through the Bus Buffer/Data control. Measurement control signals are transferred through the 8 bit PDB bus line and are registered in the latches (of A3, A5 and A6 boards). These control signals designate the states of the analog switches to be set for the temporary measurement phase. For accurate measurement timing control, the Strobe Clock Decoder (U31) transfers properly timed measurement clock signals to the latches. The measurement clock signals cause specific latch(es) to store the data and to output the control signals to individual analog switches. Additionally, the Strobe Clock Decoder also acts to enable the display data RAM of A8 Display Control to store measurement display data which are transferred from the microprocessor.

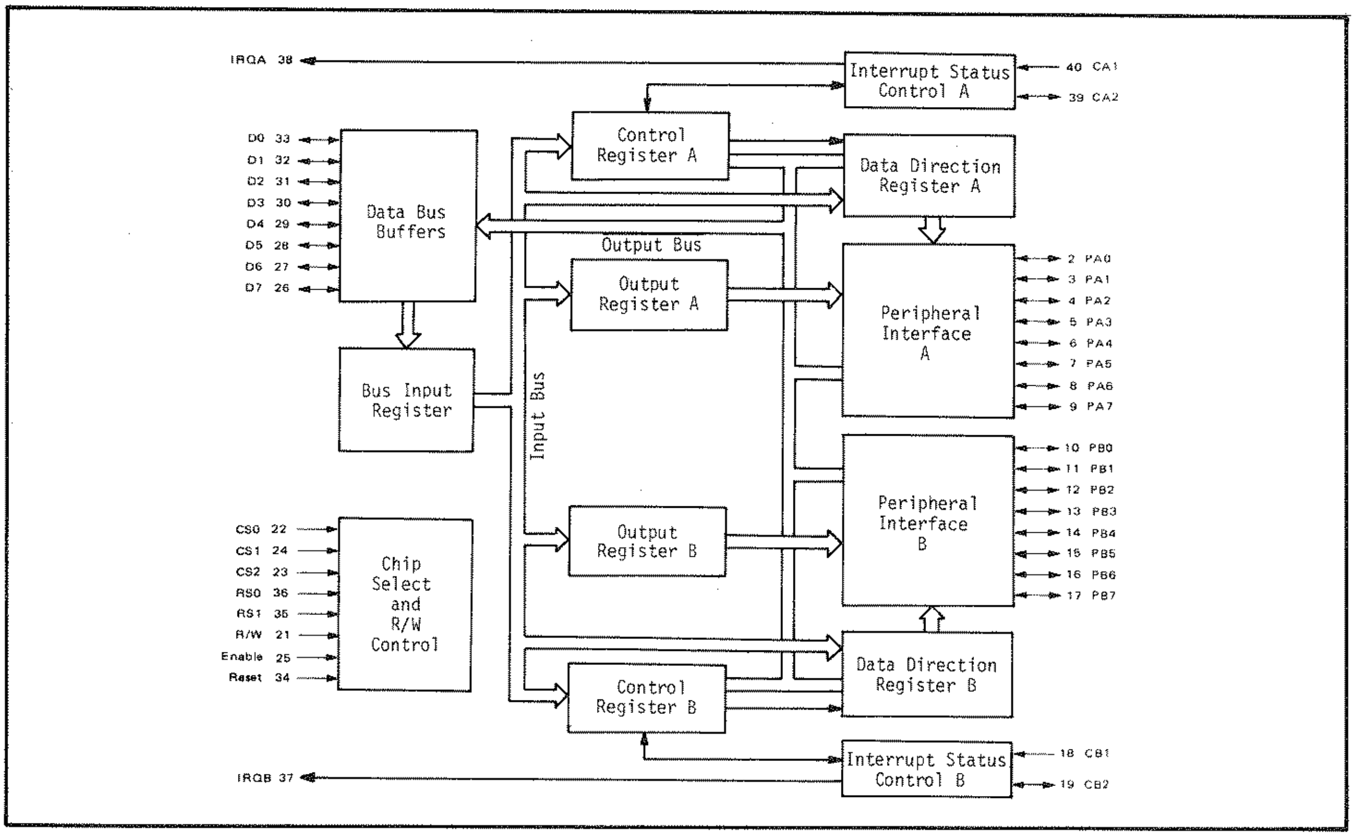


Figure 8-19. PIA Internal Circuit Configuration.

8-58. The Timer Counter (U22, U32, U23 and U33) generates an integrator charge time (approximately 10ms) by counting a *1MHz clock signal. This programmable counter begins counting the clock from the preset number toward the maximum counts. The program number is first set to U22 and U32 in 8 bit data format and, successively, to U23 and U33 (thus, two LOAD control signals are used). When the Timer Counter overflows, TMEND output signal (at TP24) causes the Timing End Decoder (U6, U7A and U7B) to develop integrator switch control signals ($\overline{\text{SWOFF}}$ and SWCHG).

*Note

> When test frequency is 10kHz, the Timer Counter counts 8f signal (fed from A6 Oscillator) instead of the 1MHz clock.

The Clock Synchronizer gate circuit (U26) selects the timer counter clock signal from either the 8f signal or 1MHz clock generator signal. The 1MHz (actually 995kHz) clock signal is counted down from the 9.95MHz crystal oscillator (U15 A/D) signal. When the integrator charge period ends, the Data Counter (U25) begins counting the integrator discharge time interval using the 1MHz clock signal in response to a CTRSRT Signal (sent from U11). The Data Counter stops counting when a ZERO signal is transferred from the A5 board to signal that the integrator output has crossed the zero level. Successively, the Data Counter outputs the data towards the 4 bit bus line in series data transfer fashion in LSD to MSD order. If the counted number exceeds 199999 counts, flip flop U12 generates an $\overline{\text{OVFW}}$ (overflow) signal. To accommodate the measurement data, R/$\overline{\text{W}}$ signal sets the PIA to driver mode. The microprocessor accesses the data counter output through the PIA.

8-59. The Polarity Detector (U8) monitors the ZERO signal level to discriminate between positive and negative going integrator ramps in the integrator charge period. During the charge period, the microprocessor accesses the polarity data and determines the polarity of the reference voltage used for discharging the integrator. When the bridge circuit is unbalanced, an UNBAL input signal turns output logic of Flip-flop U20. The UNBAL signal is detected at the charge period of the first integrator operating cycle. When a keyboard function control button is pushed, $\overline{\text{KYIPT}}$ line (TP7) goes to low level. The PIA pulls down the IRQ line (TP8) to low level to annunciate the interrupt request to the microprocessor.

8-60. A8 DISPLAY CONTROL.

8-61. The Display Control section consists of three major circuits: Display Decoder RAMs, Display Drivers and Key Scan Counter. The Display Decoder RAM (U4, U5, U6, U10, U11 and U12) does conversion and storage of measured data to be displayed on the seven segment numeric (and dot matrix alphanumeric) displays. Before beginning transfer of the measurement display data to the RAM, the RAM address for initially storing the data is sent to the RAM Address/Anode Counter U7. Successively, the display data is transferred to the RAM as the Address/Anode Counter simultaneously advances the address (4 bit) from the preceding address for each incoming display data fraction (serially transferred from the microprocessor through A7 board). The 7 bit display data fractions are previously coded by the microprocessor as appropriate for driving the seven segment (or dot matrix) displays when the data is, in turn, written out from the RAM. Three pairs of 4 bit RAMs do the storage of the 7 bit display data in the following manner:

U4 and U10: Stores 7 segment numeric display data for DISPLAY A, DISPLAY B and FREQUENCY/TEST SIG LEVEL displays (including unit lamp indicator).

U5 and U11: Stores dot matrix display data for DISPLAY A unit indicator and part of pushbutton lamp annunciator data.

U6 and U11: Stores dot matrix display data for DISPLAY B unit indicator and part of pushbutton lamp annunciator data.

Write Enable ($\overline{\text{WE1}}$, $\overline{\text{WE2}}$ and $\overline{\text{WE3}}$) signals cause the appropriate pair of RAMs to become valid for the data store period. Since the RAM Address/Anode Counter can start counting from the desired address number, it is possible to change a part of the memory in the RAM to new display data.

8-62. Each Display Decoder RAM memorizes 16 sets of 7 bit display data fractions. When Write Enable signals are at high level, the Display Decoder RAM writes out the data as periodically addressed by the RAM Address/Anode Counter. The address number advances in the reverse direction of the memory store mode. The RAM outputs the display segment signals which alternately illuminate the numeric figure of each measured count digit of the displays. The RAM address signals are simultaneously decoded by the Anode Scan Decoder (A10U8) to periodic anode scan signals which activate, in sequence, the display for each digit (and for each dot matrix row segment). Synchronous operation of the display data RAM and the Anode Scan Decoder accomplishes matrix drive of the display.

8-63. The Clock Generator (U8 and U9) drives the RAM Address/Anode Counter with a 100kHz clock frequency counted down from the $\phi 2$ clock signal. Additionally, down counter U8 feeds a 1/32MHz clock pulse signal to drive the Key Scan Counter (U15). When the display data RAM is set to "write" mode, $\overline{\text{STPSCN}}$ signal stops the clock signal flow to reverse count input of the RAM Address/Anode Counter and blanks the display. After the instrument is turned on, $\overline{\text{RST}}$ signal actuates to blank display (so as to prevent a meaningless display from occuring) until all circuits are settled in their normal conditions.

8-64. The Key Scan Counter U15 outputs periodic KY signals (KY0 to KY3) to A10 board. These 4 bit output signals are decoded by the Multiplexer (A10U9) to keyboard scan signals which, in turn, cause individual keys of three particular key groups to become valid. Each control key in the key group is enabled, in sequence, to perform its function. When a keyboard pushbutton (for example, "Z" key) is pressed, one of the keyboard output lines KY4, KY5 or KY6 goes to low level at the moment the pushbutton switch input is pulled down to low level by keyboard scan signal (in this example, KY4 line goes to low level when the Multiplexer turns its K4 control output line to low level). The output logic of the Key Decoder U14A goes to low level and subsequently the Key Scan Counter stops. The contents of the Key Scan Counter and the keyboard output states given by KY4, KY5 and KY6 signals are coordinated with the address of the key depressed. Simultaneously, gate U13C outputs $\overline{\text{KYIPT}}$ signal causing the IRQ line to go to low level (interrupt request is set). The microprocessor reads the scan counter and keyboard output data to identify the pushbutton function actuated.

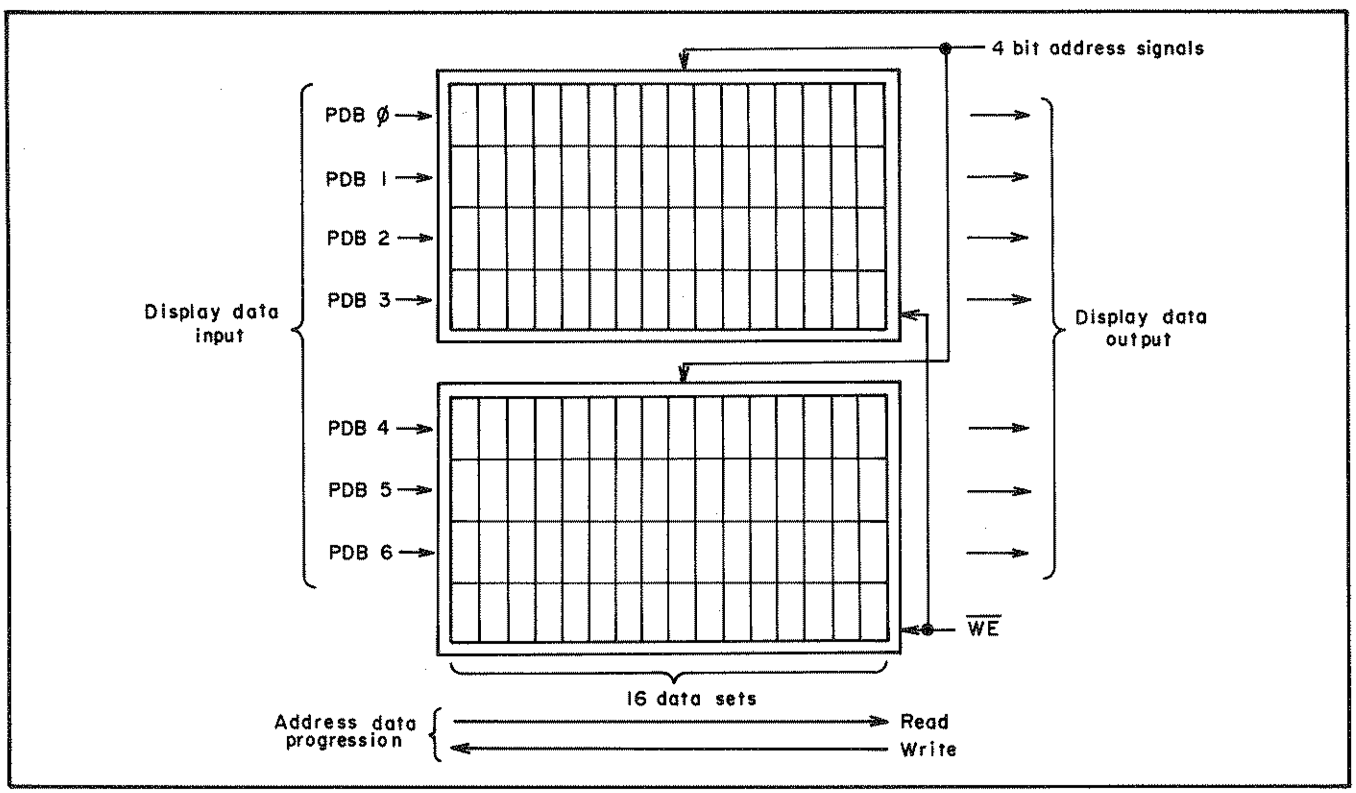


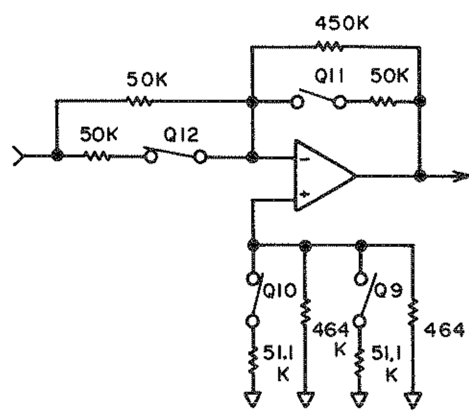
Figure 8-20. Display Data RAM Read/Write Operating Sequence.

8-65. OPTIONS.

8-66. OPTION 001: ±35V DC BIAS SUPPLY (A21).

8-67. The A21 DC Bias Supply is linked to the microprocessor control bus lines via PIA (U11) which manages bias control data input/output timing. External bias controller setting data is sent to Latches U12 and U13 through the rear panel INT DC BIAS CONTROL connector. When the bias controller ENTER button is depressed, LOAD line goes to low level causing the PIA to output IRQ signal. An R/$\overline{W}$ control signal sets the PIA to driver mode and the Latches hold the bias control input data. Subsequently, the microprocessor accesses the bias control input data to translate it to data appropriate for setting 12 bit DAC (Digital to Analog Converter) and voltage range/polarity selector of the DC Bias Supply. The bias supply control data, transferred from the microprocessor, is stored in Latches U5 and U8 (PIA is set to receiver mode).

8-68. The DAC (U4) outputs an accurate dc voltage in the range of 0 volts and 10 volts in accord with the voltage data assigned by 12 bit binary input code. The Polarity Selector switches (Q7 and Q8) permit selecting either positive or negative dc bias in response to bias controller polarity setting. The Output Amplifier is capable of changing its amplification factor to x1/10, x1 or x10 to magnify the bias output variable range depending on the bias controller MULTIPLIER setting. The simplified schematic for the output amplifier gain control circuit is shown in Figure 8-21. The filter circuit at the output stage of the amplifier eliminates pulse noises from the dc bias output. The filter capacitor is essentially located in series with the measurement circuit as illustrated in Figure 8-22. Note that the A21 board is of a floating bias supply design. Because this filter capacitor decreases the actual test signal level applied to the sample, the filter capacitor value must be selected (from 1μF and 100μF) so that capacitor impedance value is less than 1/10 times the sum of the sample impedance and source resistor impedance. Filter selection relays K1 and K2 are energized when rear panel DC BIAS Selector switch is set to its INT 35V/100V (≤.1μF) position. Sockets SC1 and SC2 configure a signature test circuit loop consisting of PIA and latches when a jumper element or a low value ladder resistor device (below 100Ω) is installed in each socket.



MULTIPLIER setting	Q 5	Q 10	Q 11	Q 12
x 10	OFF	ON	OFF	ON
x 1	ON	ON	ON	ON
x 0.1	ON	OFF	ON	OFF

Figure 8-21. Bias Output Amplifier Gain Control.

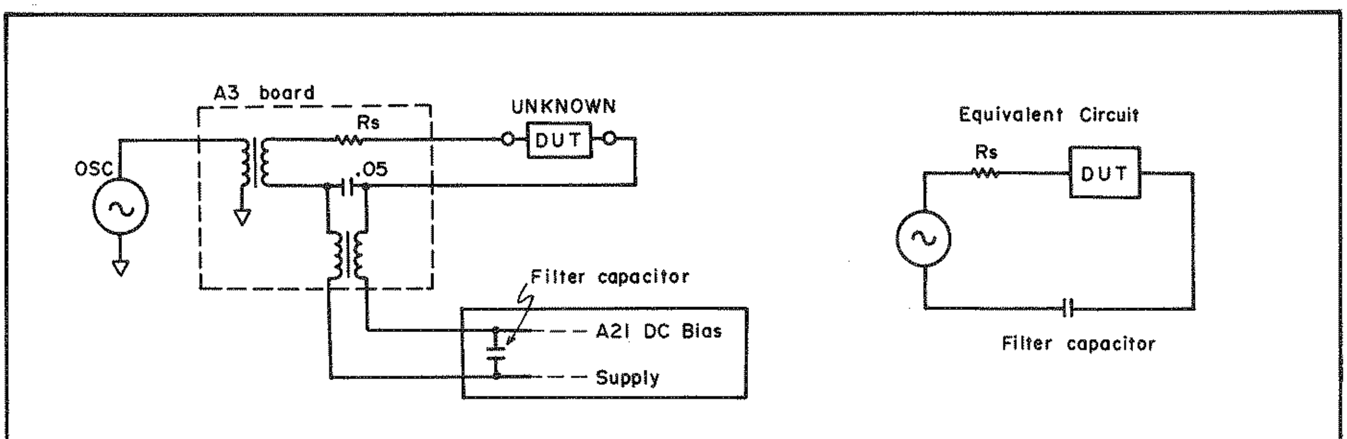


Figure 8-22. Equivalent DC Bias Circuit.

8-69. OPTION 002: ±100V DC BIAS SUPPLY (A23)

8-70. Option 002 DC BIAS Supply has a circuit configuration similar to the A21 circuit board (Option 001). This paragraph and that following describe only the circuit unique to Option 002. Therefore, it is suggested that you read paragraphs 8-66 and 8-67 to become acquainted with circuit operating theory common to both Option 001 and 002 before proceeding to the following paragraph.

8-71. Gate U14D resets latches U10 and U11 to their "clear" states when front panel DC BIAS switch is set to ±35V MAX position. Thereby, the DAC (U4) output voltage falls to zero volts in response to zero input. This inhibits a bias voltage from being fed to an inappropriate test fixture of 35V dc bias design. Comparators U6, U7 and U8 provide stable control input data to DAC and prevent digital pulse noises from appearing on DAC output voltage. The Output Amplifier multiplies the DAC output voltage by 10 to step up the bias voltage control range.

8-72. OPTION 101: HP-IB INTERFACE (A22).

8-73. All the HP-IB interface functions are accomplished by the integrated Microport device which mediate the "handshake" of the microprocessor and external HP-IB equipment on an HP-IB program basis. The microport circuit architecture is illustrated in Figure 8-23. The stack of 8 register pairs of the Microport connects the data transferred to/from external equipment as directed by asynchronous operation of the control bus signals. Each register pair stores the data fraction which flows through one of the 8 bit data bus lines. When the instrument is turned on, the Microport pulls down its $\overline{ASE}$ control line to low level. The microprocessor accesses the HP-IB address data in register U1 to display the instrument address number on the front panel display.

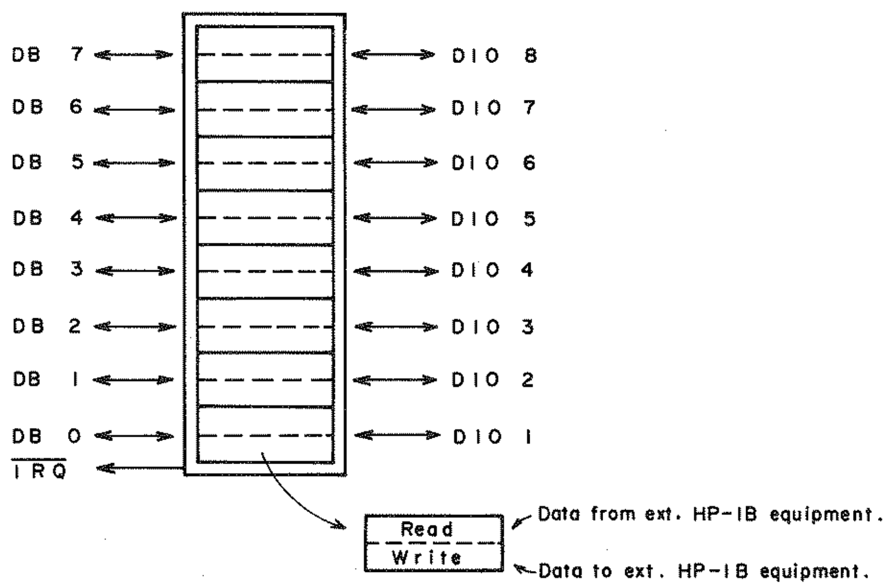


Figure 8-23. Microport Internal Register Configuration.

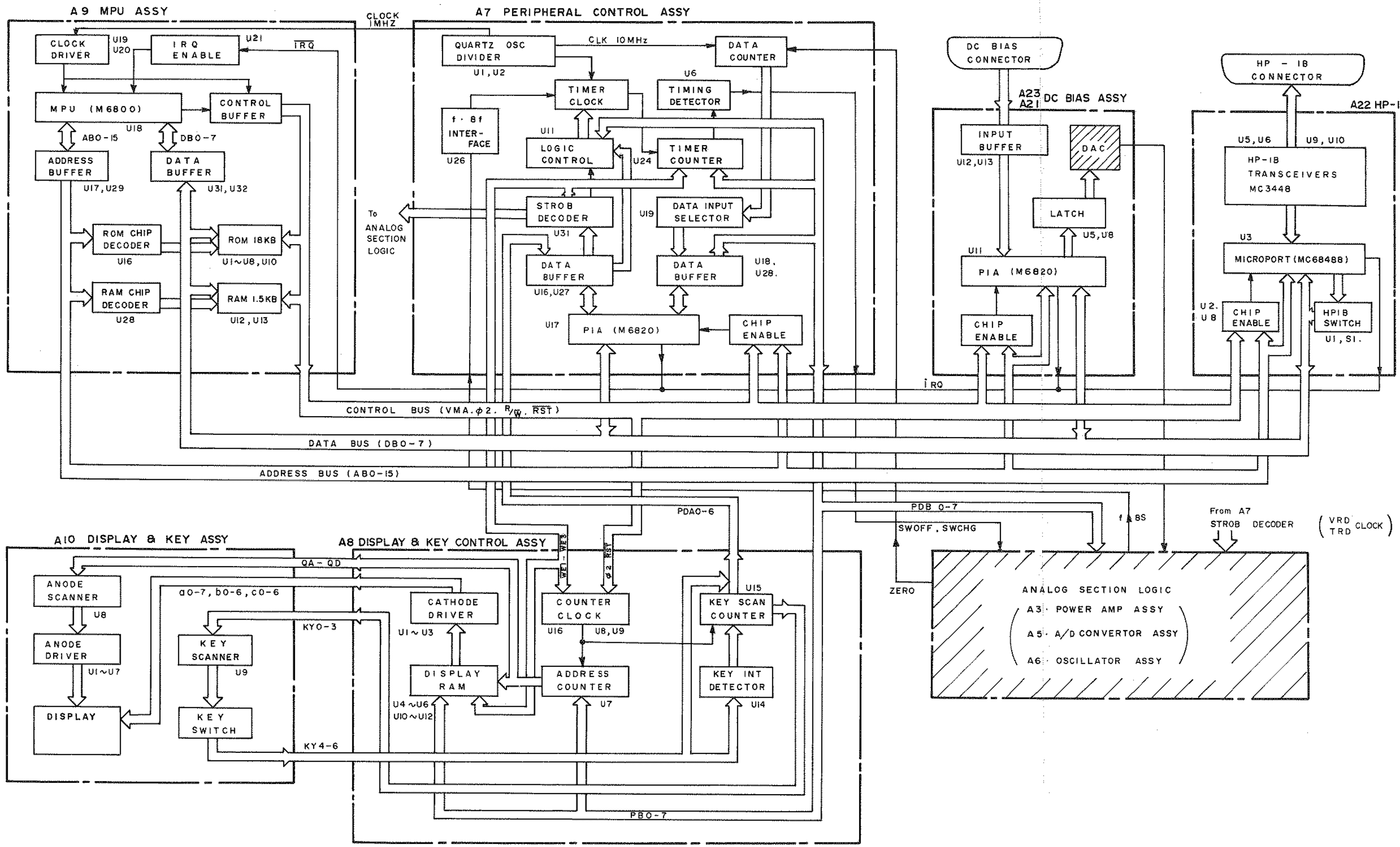


Figure 8-24. Digital Control Section Block Diagram.

8-74. TROUBLESHOOTING.

CAUTION

THE OPENING OF COVERS OR REMOVAL OF PARTS, EXCEPT THOSE TO WHICH ACCESS CAN BE GAINED BY HAND, IS LIKELY TO EXPOSE LIVE PARTS; IN ADDITION, ACCESSIBLE TERMINALS MAY ALSO BE LIVE.

THE APPARATUS SHALL BE DISCONNECTED FROM ALL VOLTAGE SOURCES BEFORE ANY ADJUSTMENT, PARTS REPLACEMENT OR MAINTENANCE AND REPAIR ARE PERFORMED FOR WHICH THE APPARATUS MUST BE OPENED.

IF, AFTERWARDS, ANY ADJUSTMENT, MAINTENANCE OR REPAIR OF THE OPENED APPARATUS UNDER VOLTAGE IS REQUIRED, IT SHALL BE CARRIED OUT ONLY BY A SKILLED PERSON WHO IS AWARE OF THE HAZARD INVOLVED.

8-75. Figure 8-25 "How to Use Troubleshooting Guides" is helpful when starting to troubleshoot the 4275A. As the analog boards include the latches which are controlled through bus lines by the MPU, the signature analysis technique is useful for analog board troubleshooting. The sequence of the digital section troubleshooting depends upon the program routine and it is difficult to provide individual flow diagrams. AL thru GL all contain digital section troubleshooting aids.

8-76. Follow the troubleshooting procedure in Figure 8-29 which provides specific instructions for isolating the Analog and Digital section from each other.

WARNING

WHENEVER IT IS LIKELY THAT THE PROTECTION PROVIDED BY THE FUSES HAS BEEN IMPAIRED, THE INSTRUMENT MUST BE MADE IN OPERATING AND MUST BE SECURED AGAINST ANY UNINTENDED OPERATION.

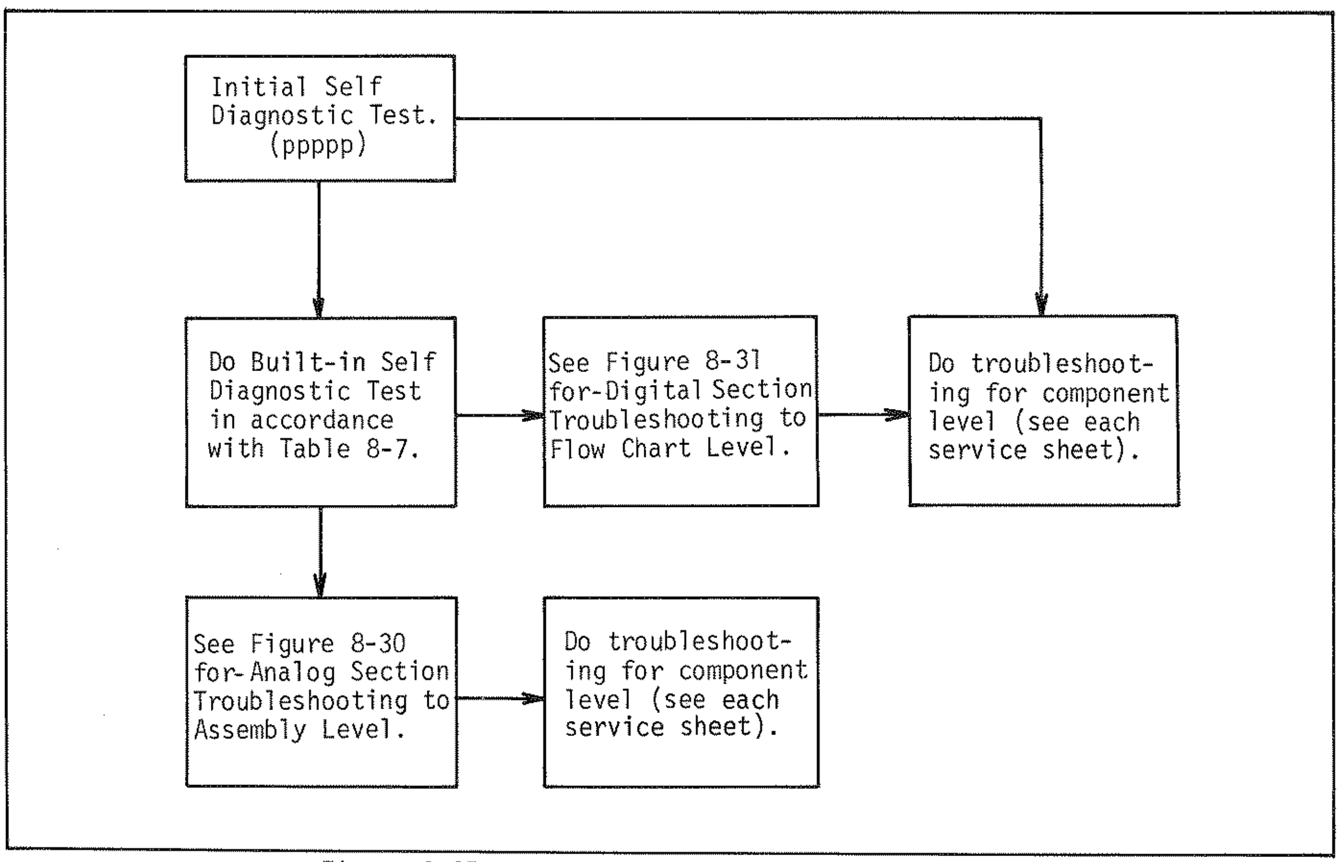


Figure 8-25. How to Use Troubleshooting guids.

CAUTION

CAPACITORS INSIDE THE INSTRUMENT MAY STILL BE CHARGED EVEN IF THE INSTRUMENT HAS BEEN DISCONNECTED FROM ALL VOLTAGE SOURCES.

BE SURE THAT ONLY FUSES OF THE REQUIRED RATED CURRENT AND OF THE SPECIFIED TYPE ARE USED FOR REPLACEMENT. THE USE OF MENDED FUSES AND THE SHORT-CIRCUITING OF FUSE HOLDERS MUST BE AVOIDED.

8-77. Troubleshooting Analog Section to Assembly Level. Follow the troubleshooting procedure in Figure 8-30 Analog Section Troubleshooting Guide to isolate an analog fault to a board assembly. Troubleshootig to component level is covered in the service sheet for each assembly.

8-78. Digital Section Troubleshooting
Figure 8-31 is helpful in speeding the troubleshooting. The signals circulate through the bus line and the flow diagrams are given in accordance with the main instructions of the 4275A for efficient problem isolation. The signature analysis technique is a most helpful method for following the component isolation flows AL thru GL (A Logic flow thru G Logic flow). Except for the HP 5004A Signature Analyzer, no additional boards or equipment are necessary.

8-79. INITIAL MEMORY TEST.

8-80. The initial operating program of the 4275A is a brief memory test routine begun immediately after the instrument power is turned on. This memory test confirms integral memory of the measurement control programs stored in the program ROM and the normal read/write operating capability of the data RAM. The program memory test is accomplished in a short time (about 1 second) by using the popular "check sum" method.

Before proceeding with the initial measurement function control, the microprocessor calculates the sum of the binary numbers of the program codes for all memory addresses and checks this result with the correct number.

The check sum procedure proves the memory of each individual ROM to be faultless. As the last of the memory test, test data is memorized in the RAM and is written out to verify its complete data registration capability.

8-81. The instrument indicates the normal test result by the display of five P figures when a perfect test result is identified. The P figures appear in DISPLAY A and progress in a left to right direction. If not all the tests are passed with normal results, the process test stops halfway and the instrument can not go through the subsequent automatic control settings. In such case, the number of P figures displayed indicates the ROM or RAM in which an abnormality is detected as follows:

*No display A9U10
P .... A9U7 or U8
PP .... A9U5 or U6
PPP .... A9U3 or U4
PPPP .... A9U1 or U2
PPPPP .... A9U12 or U13

*Note

No P figure also appears in the following cases:

1) Microprocessor malfunctions.
2) A faulty component obstructs normal addressing of the ROM (RAM) or a function of the data bus line.
3) Self test program ROM (A9U3) is defective. There is also the rare possibility of a defective A9U1

8-82. SELF TEST INSTRUCTIONS.

8-83. The built-in self diagnostic test function which is operated from front panel keys provides various display outputs helpful in maintenance of the 4275A. This automatic diagnostic test capability, featured in the 4275A decreases the loading of users and service personnel who are concerned with performance testing, adjustment, calibration and repair.

The self diagnostic test function is designd to perform functional testing of the major circuit sections of the sophisticated 4275A measurement circuit in accord with programmed procedures and to display the diagnostic test results for each test.

The test program is organized in a total of 19 test routines (sequentially executed) for the automatic test. Nine independent tests can be done selectively from these automatic tests or exclusively by manual operation. The self test program organization is given in Table 8-4.

8-84. Automatic Self Diagnostic Test.

8-85. The automatic self diagnostic test function sequentially performs all test steps and displays the decision results of go/no-go comparisons with the memorized test limits. The test items are divided into two sequential routines which requre different UNKNOWN terminal connection configurations (Open an Short tests). These tests are accomplished by pressing the front panel SELF TEST button using the test setup given in Table 8-5. Normal diagnostic results are indicated by a display of OP for open test or of SH for the short test on DISPLAY A. If an abnormal result occurs during an open or short test, the number of the abnormal test step is displayed in DISPLAY A as OP3 or SH24. For detailed instructions of the automatic self test procedure, refer to 4275A Operating Manual Page 3-0.

8-86. Manual Step Selection of Self Diagnostic Tests.

8-87. The circuit test operating modes which can be independently set by front panel pushbutton operation are used for supplemental accuracy checks of performance testing as well as for facilitating adjustment procedures. Furthermore, display outputs of the test results offer considerable clues and hints useful in troubleshooting. If the analog measurement section malfunctions, the abnormal measurement outputs which arise from the faulty circuit sometimes obstructs the process of the normal measurement control sequence and, therefore, measurement triggering stops. In such cases, uncontrolled circuits cause some difficulty in attempts at trouble isolation. The self test function relieves service personnel from this kind of blind alley troubleshooting. During the circuit test mode of operation, periodic triggering never stops because of any trouble in the analog measurement section and thus the analog circuits are operated under the regular control signals of test program. This allows checking circuits by means of signal flow tracing using defined control rules. For setting individual test function modes, press SELF TEST button beforehand (to activate SELF TEST function) then press a pushbutton selected from Table 8-6.

Table 8-6. Self Test Step Selection.

Test step	1	2	3	4	5	6	7	8	9
Selection button	D	Q	ESR/G	X/B	L/C	Δ	Δ%	RECALL	STORE

Note: The number of the selected test step, except for step 9, is displayed in DISPLAY A unit indicator.

8-88. Display outputs for manually selected test steps are the numbers of the measurement results obtained by the test condition. The circuit tested, test circuit operation, meanings of the display outputs for each individual test steps are outlined in the tabulation below.

Note

Test limit values in the table are comparison reference values used in automatic diagnosis. In the automatic test, test step numbers for the abnormal test steps are displayed in DISPLAY A (instead of measurement data).

Note

OSC LEVEL control should be set to its fully cw position for all self test steps.

Table 8-4. Self Test Program Organization.

Test step		Item
Auto test	Manual test	
OP 1 (≤100kHz)	1	A-D converter test (A4 and A5)
OP 2	2	AF4 attenuator test (A5)
OP 3	3	AF2 attenuator test (A5)
OP 4	4	AM10 attenuator test (A4)
OP 5	5	AM100 attenuator test (A4)
Test step 6 is non-existent		
OP 7 (≤1MHz)	7	Modulator phase offset test (A2)
Manual test only	8	CMR amplifier test (A1)
Manual test only	9	Range control and Z or Y measurement test (all analog boards)
OP10 (≤1MHz)	Auto test only	1V test signal level test (A3 and A6)
OP11 (≤1MHz)	Auto test only	0.1V test signal level test (A3)
OP12 (≤1MHz)	Auto test only	0.01V test signal level test (A3)
OP13 (≤1MHz)	Auto test only	Bridge balance test on 10μS Y range at MULTIPLIER x1 setting (A1)
OP14	Auto test only	Bridge balance test on 100μS Y range MULTIPLIER x1 setting (A1)
OP15	Auto test only	Bridge balance test on 1000μS Y range at MULTIPLIER x1 setting (A1)
OP16	Auto test only	Bridge balance test on 1000μS Y range at MULTIPLIER x0.1 setting (A1)
OP17 (≤1MHz)	Auto test only	Bridge balance test on 10mS Y range at MULTIPLIER x0.01 setting (A1)
SH21	Auto test only	Bridge balance test on 100Ω Z range at MULTIPLIER x0.1 setting (A1)
SH22 (≤100kHz)	Auto test only	Bridge balance test on 100Ω Z range at MULTIPLIER x0.01 setting (A1)
SH23	Auto test only	Bridge balance test on 100Ω Z range at MULTIPLIER x1 setting (A1)
SH24 (≤1MHz)	Auto test only	Test signal current test (A4)
SH25 (≤1MHz)	Auto test only	100Ω, 1kΩ and 10kΩ range resistor check (A1)

Note: When the test frequency setting is higher than the limit frequency given for the specific test steps, such test steps are omitted from automatic diagnostic test sequence.

Table 8-5. Automatic Self Test Setups.

Test step	UNKNOWN terminals	DISPLAY A function	OSC LEVEL control
Open test (steps 1 to 17)	Open Connect 16047A Test Fixture with nothing as DUT.	C	fully cw
Short test (steps 21 to 25)	Short Connect 16047A Test Fixture with a shorting strap.	L or R	fully cw

Table 8-7. Self Diagnostic Test Instructions.

Test step 1 — A-D Converter test (A4, A5)

Test condition: Integrator develops small precharge waveforms for two integrator operating cycles under a no input signal condition (A4 AM Amplifier input is grounded). For the other two integrator operating cycles, a dc -Eref voltage charges the integrator and the +Eref voltage causes it to discharge (integrator input switch A5Q35 is open). Test signal frequency should be below 100kHz to obtain correct DISPLAY A display output.

Note: The integrator section (Integrator, Slope Amplifier, Zero Detector, DC Reference Voltage Supply and associated control switches) is operated independent of prior circuit stages (Phase Detector etc.) with respect to DISPLAY B display output. Thus this test positively isolates possible integrator trouble from any other sections.

Display section	Display meanings	Test limits
DISPLAY A	Total operating delay time of the integrator slope amplifier and zero detector.	.00±160 counts
DISPLAY B	Difference in absolute values between dc -Eref and +Eref voltages.	.00±160 counts

ADJUSTMENT: A5R120 and *A5C70.

TROUBLESHOOTING HINTS:

If DISPLAY B output is abnormal, check A5 Integrator, Zero Detector, DC Reference Voltage Supply and Decoder/Latch. If only DISPLAY A output is abnormal, check dc offset error of AM Amplifier (A4) and AF Amplifier (A5).

Test step 2.	AF 4 Attenuator test (A5)
Test step 3.	AF 2 Attenuator test (A5)

Test condition: UNKNOWN H_{CUR} and H_{POT} terminals must be connectd to each other. MULTIPIER should be set to x1. Edut signal is timely attenuated by AF2 attenuator (or alternately with AF4 attenuator for step 2) and is phase detected to compare the vector voltage ratio of the attenuated signal to the original (non-attenuated) signal by the integrator.

Display section	Display meanings	Test limits
DISPLAY A	Attenuation accuracy of in-phase signal component.	-100000 ±*160 counts
DISPLAY B	Attenuation phase error represented by magnitude of 90 degree out-of-phase signal component.	.00±*160 counts

Note: *1280 counts for test frequencies above 1MHz.

ADJUSTMENT: A5R11, A5R16, A5R4 and A5C15.

TROUBLESHOOTING HINTS:

If a failue is located in the A6, A3, A4 or A5 circuit boards ahead of the integrator, an abnormal test result may first occur in step 2 and for all subsequent test steps. If step 3 is normal, A5 AF4 attenuator is faulty.

Test step 4	AM10 Attenuator test (A4).
Test step 5	AM100 Attenuator test (A4).

Test condition: UNKNOWN H_{CUR} and H_{POT} terminals must be connected to each other. MULTIPLIER should be set to x0.1 for step 4 and to x0.01 for step 5. Edut signal is timely attenuated by A4A3 AM attenuator (or altemately with A4A4 AM attenuator for step 5) and is phase detected to compare the vector voltage ratio of the attenuated signal with the original (non-attenuated)signal by the integrator.

Display section	Display meanings	Test limits
DISPLAY A	Attenuation accuracy of in-phase signal component.	-100000 ±*160 counts
DISPLAY B	Attenuation phase error represented by magnitude of 90 degree out-of-phase signal component.	.00±*160 counts

Note: *1280 counts for test frequencies above 1MHz.

ADJUSTMENT: A4A3R10 and A4A4R2.

TROUBLESHOOTING HINTS:

The attenuation and phase errors indicated on displays are cumulative values which represent both AM and AF attenuators.

Test step 7	Modulator phase offset test (A2)	
Test condition: UNKNOWN terminals must be so connected as to constitute an open measurement condition (attach 16047A test fixture with nothing connected as DUT). Test frequency should be below 1MHz. Measurement is taken to detect the bridge balance error which arises from phase detector residual offset voltage in the Modulator. To maximize the offset voltage effects on the displays (to facilitate detection), null detector amplification gain is set to minimum. Range resistor value is automatically set to 100Ω		
Display section	Display meanings	Test limits
DISPLAY A	Bridge balance error for in-phase (real) vector signal component.	.00±1280 counts
DISPLAY B	Bridge balance error for 90 degree out-of-phase (imaginary) vector signal component.	.00±1280 counts
ADJUSTMENT: A2R13 and R14. TROUBLESHOOTING HINTS. If display outputs are quite different from normal values, bridge circuit is not being balanced. A1, A2 or A3 board is faulty.		

Test step 8	CMR Amplifier test (A1)	
Test condition: UNKNOWN H_{CUR} and H_{POT} terminals are connected to each other (no connection to L_{CUR} and L_{POT} terminals). Test frequency should be below 100kHz. Err signal is fed to CMR Amplifier input through 100Ω range resistor from A2 Modulator. Because DUT current is zero, the Err signal detected by A4 Process Amplifier must also be zero. If CMR amplifier gain is appropriate, the amplifier output transformer current completely offsets the Err signal current to zero. This test measures the Err voltage detected by the Process Amplifier to determine CMR amplifier gain error.		
Display section	Display meanings	Test limits
DISPLAY A	Err signal offset error which arises from CMR amplifier gain misadjustment.	(.00±10 counts at well adjusted condition)
ADJUSTMENT: A1R3 TROUBLESHOOTING HINTS: If test step 7 is passed with a normal result, A1 CMR Amplifier is faulty.		

Test step 9	Range control and Z or Y measurement test.

This self test mode enables selecting the desired range resistor value and AM attenuator setting by pressing LCRZ RANGE UP and DOWN keys. DISPLAY B unit indicator provides a display of 2 digit numeric codes which indicate the selected range resistor and AM attenuator settings as shown below:

code	Range Resistor Value
2	100Ω
3	1kΩ
4	10kΩ
5	100kΩ

code	AM attenuator setting	
	A4A3 board	A4A4 board
0	x1/10	x1/10
1	x1/10	x1
2	x1	x1

When 100Ω range resistor value is selected, DISPLAY A and B provide display outputs for resistance and reactance values, respectively, of the measurement result taken under the test condition. When a 1kΩ (or greater) range resistor value is selected, conductance and susceptance measurement values are displayed. This test helps troubleshoot the bridge circuit and process amplifier sections.

Test step 10	1V test signal level test (A3 and A6)
Test step 11	0.1V test signal level test (A3)
Test step 12	0.01V test signal level test (A3)

Test condition: UNKNOWN terminals must be so connected as to constitute an open measurement condition (attach 16047A test fixture with nothing connected as DUT). Test frequency should be below 1MHz. Test signal voltage is measured for each MULTIPLIER setting (x1, x0.1 and x0.01).

Display section	Display meanings	Test limits
DISPLAY B	OP10, OP11 or OP12 figure appears when the test signal level is too high or too low.	1V (0.1V or 0.01V) ±20%

ADJUSTMENT: A3R1 and A3R9

TROUBLESHOOTING HINTS:

A3, A4 or A6 board is faulty. If abnormal test results occur only on test steps 10, 11, 12 and 24 (all), E_{osc3} input channel of A4 board is faulty.

Test step 13	10μS bridge balance test (MULTIPLIER: x1)
Test step 14	100μS bridge balance test (MULTIPLIER: x1)
Test step 15	1000μS bridge balance test (MULTIPLIER: x1)
Test step 16	1000μS bridge balance test (MULTIPLIER: x0.1)
Test step 17	10mS bridge balance test (MULTIPLIER: x0.01)

Test condition: UNKNOWN terminals must be so connected as to constitute an open measurement condition (attach 16047A test fixture with nothing connected as DUT) Test steps 13 and 17 should be done at a test frequency below 1MHz.
Admittance measurements (G-B) are taken for ascertaining bridge balance condition at a given range and MULTIPLIER control setting.

Display section	Display meanings	Step	Test limits
DISPLAY B	One or more of OP13 through OP17 annunciations appear when an abnormal bridge balance error is detected.	13	.00±(160+200πf)* counts
		14	.00±(160+20πf)* counts
		15	.00±(160+2πf)* counts
		16	.00±(160+2πf)* counts
		17	.00±1280 counts

*f: Test frequency in kHz.

TROUBLESHOOTING HINTS:

If abnormal test result occurs at a specific test step in steps 13 through 17, a range resistor is open (OS) or shorted (0Ω). Otherwise, a range resistor selection relay is not properly operating. The range resistors associated with the individual test steps are listed below:

Test step	Range resistor	MULTIPLIER setting
13	100kΩ	x1
14	100kΩ	x1
15	10kΩ	x1
16	10kΩ	x0.1
17	1kΩ	x0.01

If abnormality occurs only on step 16 and/or 17, a defective MULTIPLIER function control (TLL or TLH) switch in the A1 or A3 board is the probable cause of trouble.

Test step 21	100Ω bridge balance test (MULTIPLIER: x0.1)
Test step 22	100Ω bridge balance test (MULTIPLIER: x0.01)
Test step 23	100Ω bridge balance test (MULTIPLIER: x1)

Test condition: UNKNOWN terminals must be so connected as to constitute a short circuit condition (attach 16047A test fixture with a shorting strap). Test step 22 should be done at a test frequency below 100kHz.
Impedance measurements (R-X) are taken for ascertaining bridge balance condition at a given range and MULTIPLIER control setting.

Display section	Display meanings	Step	Test limits
DISPLAY B	SH21, SH22 or SH23 figure appears when an abnormal bridge balance error is detected.	21	.00±(160+20πf)* counts
		22	.00±1280 counts
		23	.00±(160+20πf)* counts

*f: test frequency in kHz.

TROUBLESHOOTING HINTS:

If abnormal test result occurs on all of these test steps, the 100Ω range resistor is open (OS) or shorted (0Ω). Otherwise, the associated range resistor selection relay is not properly operating. If the abnormality occurs on specific test step(s), a defective MULTIPLIER function control (TLL or TLH) switch in the A1 or A3 board is the probable cause of trouble.

Test step 24	Test signal current test (A3, A4)

Test condition: UNKNOWN terminals must be so connected as to constitute a short circuit condition (attach 16047A test fixture with a shorting strap). Test frequency should be below 1MHz. Test signal current across the short circuited UNKNOWN terminals for MULTIPLIER setting of x1 is measured.

Display section	Display meanings	Test limits
DISPLAY B	SH24 figure appears when test signal current detected is abnormally low or high.	10±2mA

TROUBLESHOOTING HINTS:

If abnormal test result only occurs on this test step, source resistor on A3 board is defective.

Test step 25	100Ω, 1kΩ and 10kΩ range resistor test	
Test condition: UNKNOWN terminals must be so connected as to constitute a short circuit condition (attach 16047A test fixture with a shorting strap). Test frequency should be below 1MHz.		
This test compares the Err signal voltages detected for a range resistance of 100Ω and for the parallel synthetic resistance of 100Ω, 1kΩ and 10kΩ range resistors. This comparison test helps check range resistor selection relay operations and to find a range resistor which may be open.		
Display section	Display meanings	Test limits
DISPLAY B	SH25 figure appears when the parallel synthetic resistance is too high in comparison with the 100Ω range resistor.	Parallel synthetic resistance value must be less than 90.75% of 100Ω range resistor.
TROUBLESHOOTING HINTS: The 100Ω, 1kΩ and 10kΩ range resistors should be checked for change from their nominal values.		

8-89. Disassembly of A10 (Display and Key) Board.

To replace the parts mounted on A10 board assembly, the front panel has to be removed from the front frame of the 4275A. The procedure is as follows:

1. Carefully remove trim strip from top of front frame (without bending trim strip).

2. Remove the three screws from top of front frame.

3. Remove the two foot assemblies and three screws from bottom of front frame.

4. Press front panel assembly forward (from inside) without adding strong stress to the cable assemblies which are connected between front panel and main body.

5. Remove the nine (9) screws from A10 board assembly and the now accessable associated parts around the front panel and the A10 board assembly.

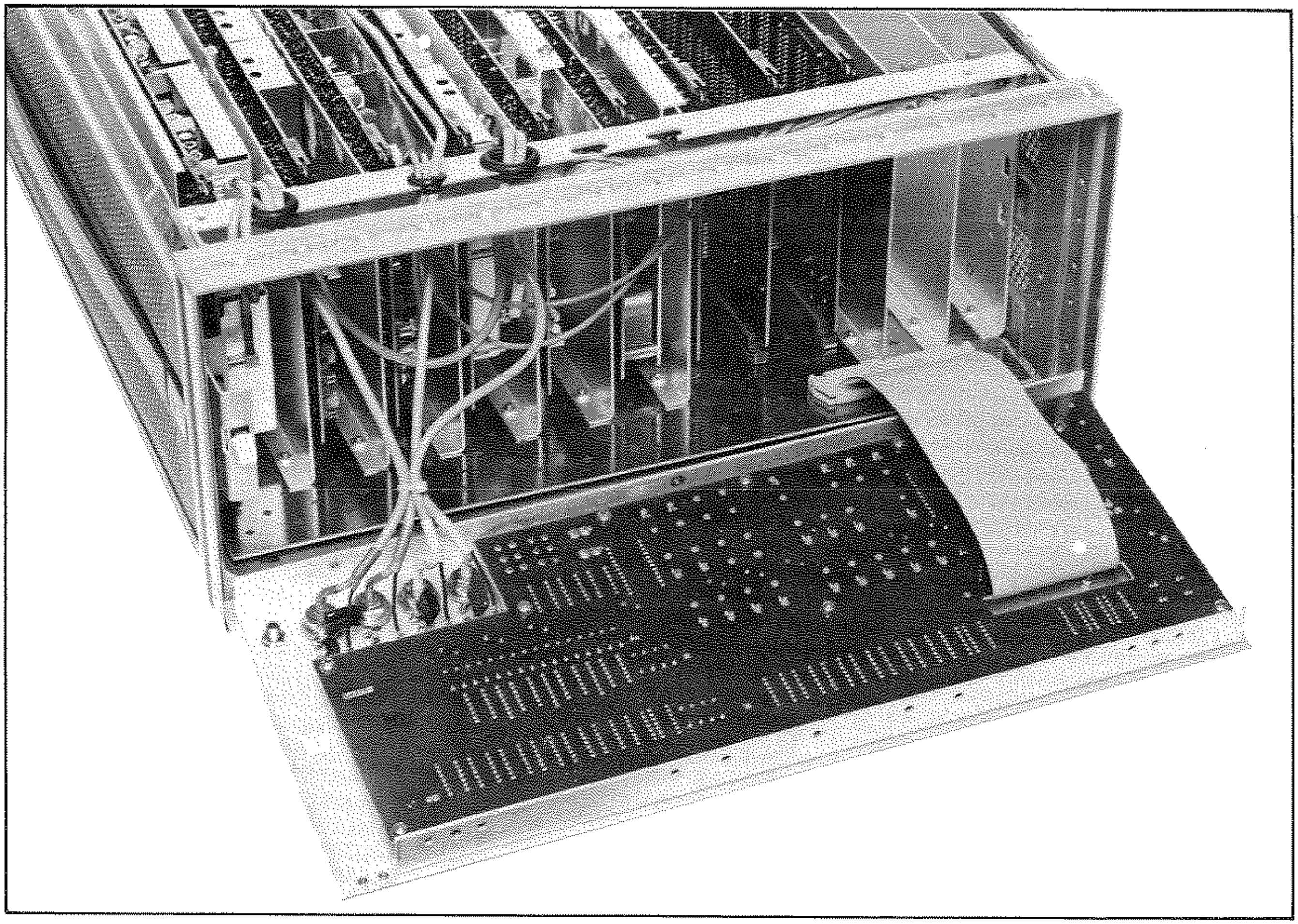


Figure 8-26. A10 Display and Key Board Disassembly.

8-90. PRODUCT SAFETY CHECKS.

WARNING

WHENEVER IT APPEARS LIKELY THAT SAFETY PROTECTIVE PROVISIONS HAVE BEEN IMPAIRED, THE APPARATUS SHALL BE MADE INOPERATIVE AND BE SECURED AGAINST ANY UNINTENDED OPERATION. THE PROTECTION IS LIKELY TO BE COMPROMISED IF, FOR EXAMPLE:

--- THE APPARATUS SHOWS VISIBLE DAMAGE.

--- THE INSTRUMENT FAILS TO PERFORM THE INTENDED MEASUREMENT.

--- THE UNIT HAS UNDERGONE PROLONGED STORAGE UNDER UNFAVORABLE CONDITIONS.

--- THE INSTRUMENT HAS SUFFERED SEVERE TRANSPORT STRESS.

8-91. The following five checks are recommended to verify the product safety of the 4275A LCR Meter (these checks may also be done to check for product safety after troubleshooting and repair). When such checks are needed, perform the following:

1. Visually inspect interior of instrument for any signs of abnormal internally generated heat such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy cause of any such condition.

2. Using a suitable ohmmeter, check resistance from instrument enclosure to ground pin on power cord plug. The reading must be less than 0.5 ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist.

3. Check GUARD terminal on front panel using procedure (2).

4. Disconnect instrument from power source. Turn power switch to on. Check resistance from instrument enclosure to line and neutral (tied together). The minimum acceptable resistance is two megohms. Replace any component which fails or causes a failure.

5. Check line fuse to verify that a correctly rated fuse is installed.

Digital Section Troubleshooting Using Signature Analyzer.

The advantage of troubleshooting based on "Signature Analysis" is accuracy and ease in finding failures. It is generally difficult to search for an error by means of observing waveforms on an oscilloscope for the reason that bit trains in a digital circuit seem to be much the same whichever is observed. Specifically, to find the errors in a stream of large bit size (or word length) data takes much time and requires the use of an instrument such as a logic state analyzer. Hewlett-Packard has proposed a method called "Signature Analysis" which recognizes the bit pattern measured in a 4 digit hexa-decimal code (signature) for running an easy diagnostic test program. With the Signature Analyzer (HP 5004A), the signatures are displayed in a readable 4 digit-figure set of alphanumeric figures (0 1 2 3 4 5 6 7 8 9 A C F H P U). The signature analysis is based the usual signal tracing method followed in troubleshooting an analog circuit. According to signature analysis, devices in a digital circuit are checked with the signal analyzer by comparing signal input and output signatures to and from each device for the "correct" signature denoted in the service manual signature map. If a signature is not identical, the troubleshooter need only trace the bit train in opposite direction to the signal flow and, when a device is noted which generates an erratic signature despite a correct input, the component may be regarded as faulty.

Signature Analysis for the 4275A.

For doing signature analysis, a DSA (Data Stream Analysis) switch is provided on the A9 (MPU) board of the 4275A. No additional test board is required.
There are twenty-one (21) kinds of DSA for performing signature troubleshootings and they are identified by the abbreviated names of DSA-1 thru DSA-21. These names are denoted around the signature pattern in the respective schematic and troubleshooting trees for setting the signature analyzer and the 4275A for appropriate control settings, window setting, DSA switch position of A9 board and other necessary conditions of the 4275A.

SIGNATURE ANALYZER TECHNIQUE.

An active digital hand-held logic tracer coupled with an active pod (with four miniature clip connection leads) is sufficient for detecting the test signal and for development of the signature on the Signature Analyzer display. The active probe has access to the desired node in the circuit being tested and transfers this input data to the analyzer. The four input leads of the test cable active pod connect the gate signals --- START, STOP and CLOCK --- from the instrument being tested to the analyzer. The remaining lead is connected to instrument GND. The START signal is an open "window" (measurement gate) signal which causes the signature analyzer to prepare for receiving data via the active probe. The STOP signal causes the window to close. The CLOCK is taken from the time base of the instrument and permits receiving input data and gate signals in synchronization. Polarity of the gate signal active (enable) edges (positive or negative) can be selected by the front panel controls of the signature analyzer. Probing points and connection locations of START, STOP and CLOCK leads are designated on the troubleshooting flow diagrams.

Figure 8-27. Signature Analysis Guide (Sheet 1 of 2).

Signature Analysis Diagnostic Flow Diagram Notes.

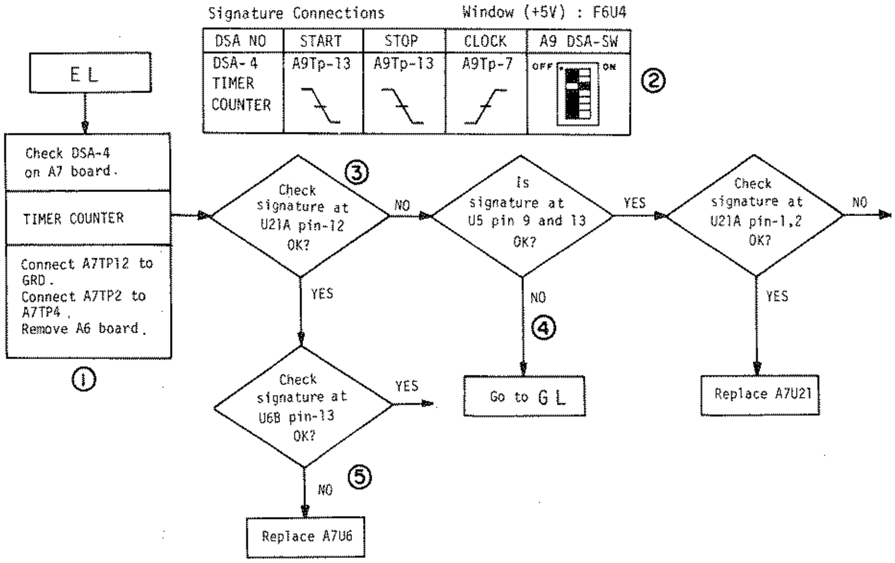


Figure A.

1. For doing Signature Analysis in an EL flow chart, arrange the settings as given in bottom box.
2. Set DSA switch of A9 MPU board as shown in right box. Both START and STOP signals are taken from A9TP13. CLOCK signal is taken from A9TP7. Front panel control settings for Signature Analyzer are:

   START button: depressed

   STOP button: depressed

   CLOCK button: released

   Check that signature of +5V supply is F6U4 (this step is omitted from step by step flow chart.
3. Compare actual signatures with signatures of DSA-4 signature map (see Figure-B). If not identical, go to step 4.
4. In like manner, compare actual signature and if not identical, go to GL flow chart.
5. In like manner, compare actual signature and if not identical, replace A7U6.

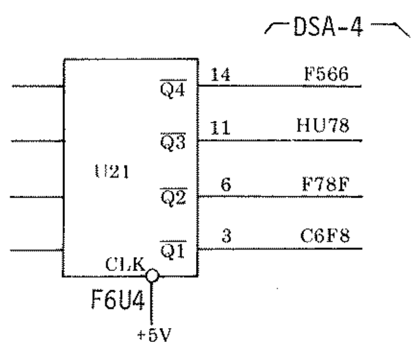
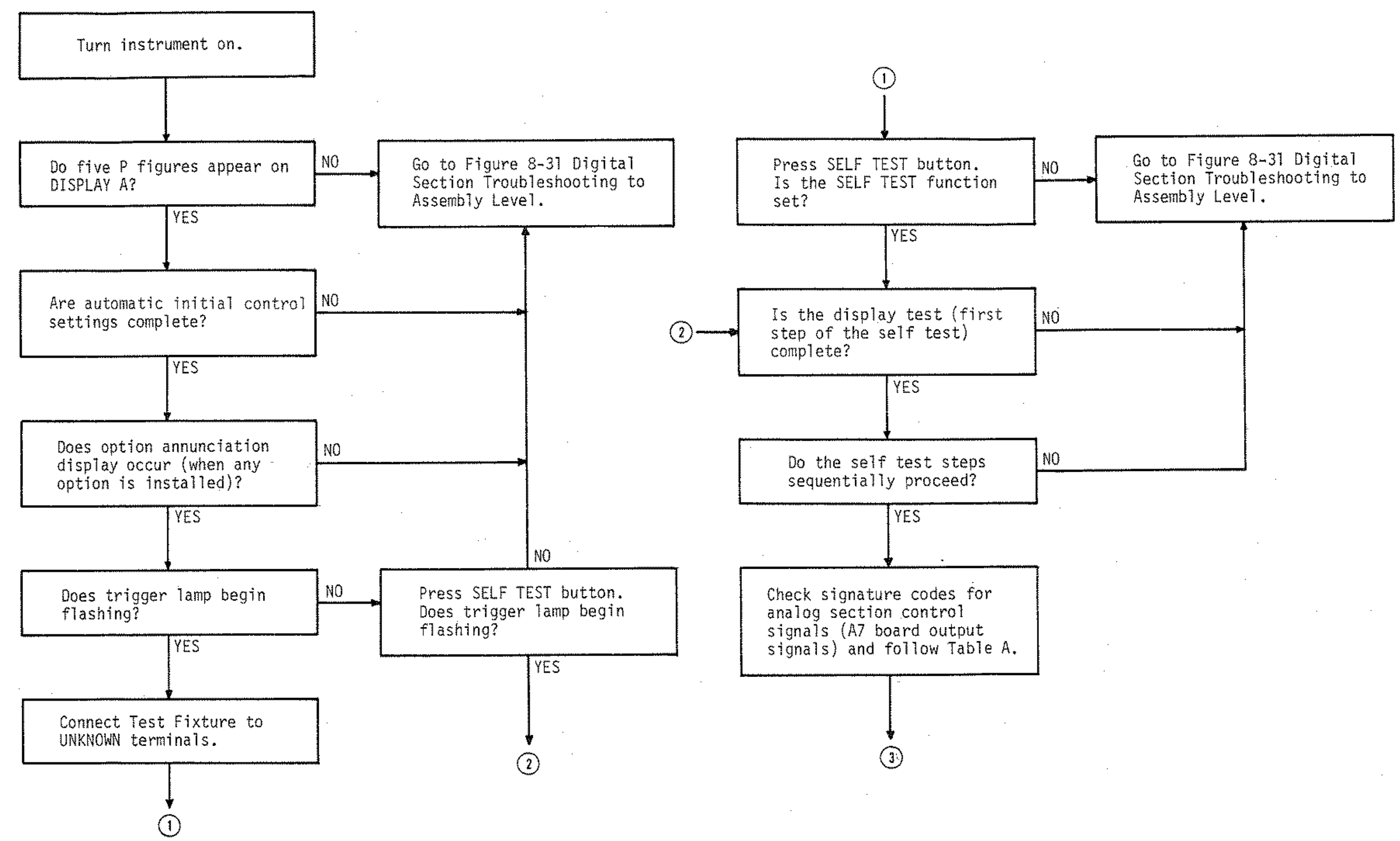


Figure B.

Figure 8-27. Signature Analysis Guide (Sheet 2 of 2).

Table 8-8. Front Panel Troubleshooting Guide.

Symptom	Probable faulty board
Measured value is incorrect at a particular range setting.	A1, A4
Measurement is not made correctly at particular MULTIPLIER setting(s).	A2, A3
Measurement is not made correctly at particular test frequency setting(s).	A6
Measurement is not made correctly only at 10kHz test frequency.	A1, A7
Measured value is 1/100, 1/10, 10, or 100 times the normal value.	A4
OF annunciation display occurs on all ranges.	A1, A2, A3
Trigger lamp does not light or stays lit but bigins flashing when SELF TEST function is set.	A5, A6
Figure(s) in numeric (or alphanumeric) display is (are) defective.	A8, A9
An indicator lamp does not light or stays lit.	A8, A10
SELF TEST function can not be activated (triggering stops).	A7, A9
Pushbutton controls do not work (always invalid).	A8, A7
All numeric displays or all except one digit are blank.	A9, A10
Autorange control mulfunctions.	A7


Turn instrument on.
Do five P figures appear on DISPLAY A?
NO
YES
Go to Figure 8-31 Digital Section Troubleshooting to Assembly Level.
Are automatic initial control settings complete?
NO
YES
Does option annunciation display occur (when any option is installed)?
NO
YES
Does trigger lamp begin flashing?
NO
YES
Press SELF TEST button. Does trigger lamp begin flashing?
NO
YES
Connect Test Fixture to UNKNOWN terminals.
1
2
1
Press SELF TEST button. Is the SELF TEST function set?
NO
YES
Go to Figure 8-31 Digital Section Troubleshooting to Assembly Level.
2
Is the display test (first step of the self test) complete?
NO
YES
Do the self test steps sequentially proceed?
NO
YES
Check signature codes for analog section control signals (A7 board output signals) and follow Table A.
3

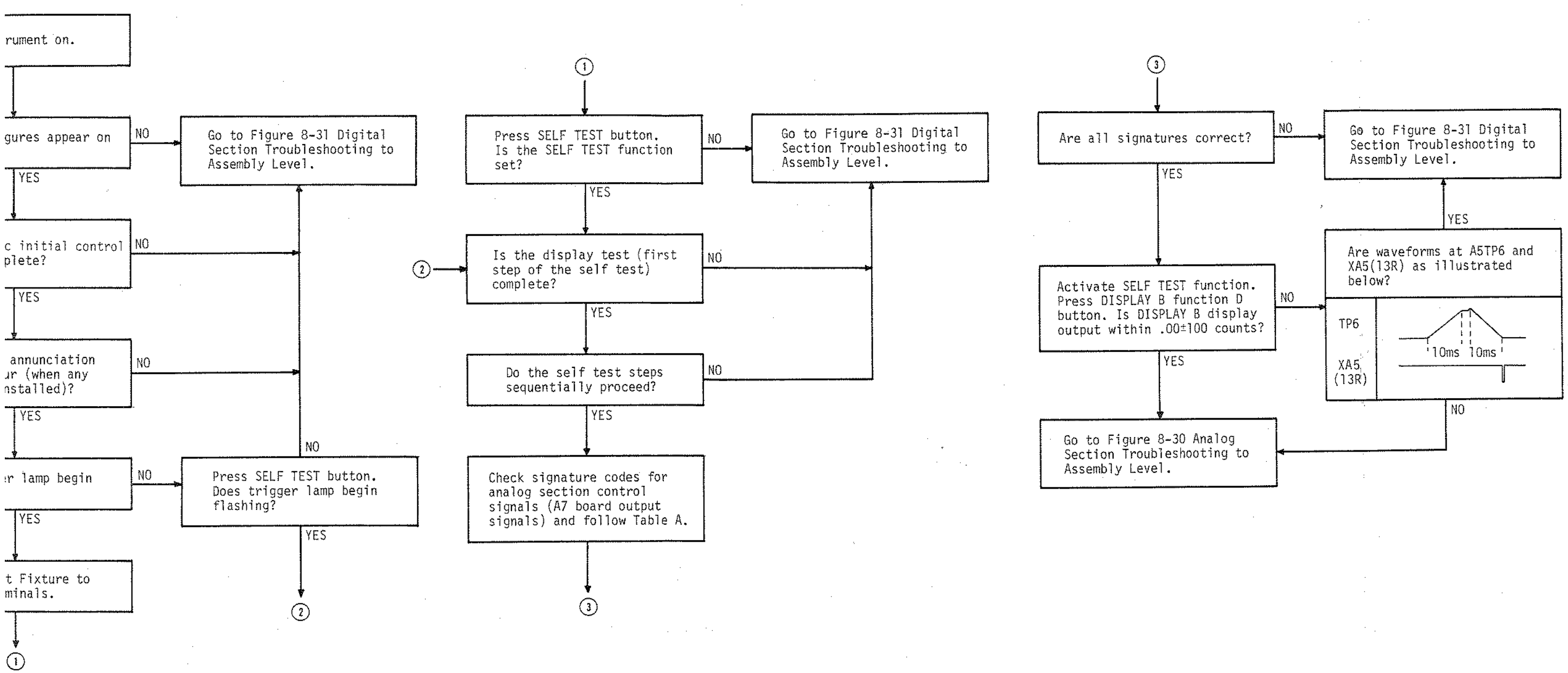


Table A. Signature Test Codes.

Signature Connections — Window (+5V) :U216

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-2 PIA/LATCH	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON

Signature Connections — Window (+5V) : 8C0A

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-4 TIMER COUNTER	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON

Other Settings:
Remove A6 ASSY.
Connect TP12 to GRD with shorting clip.
Connect A7TP2 to A7TP4 with shorting clip.

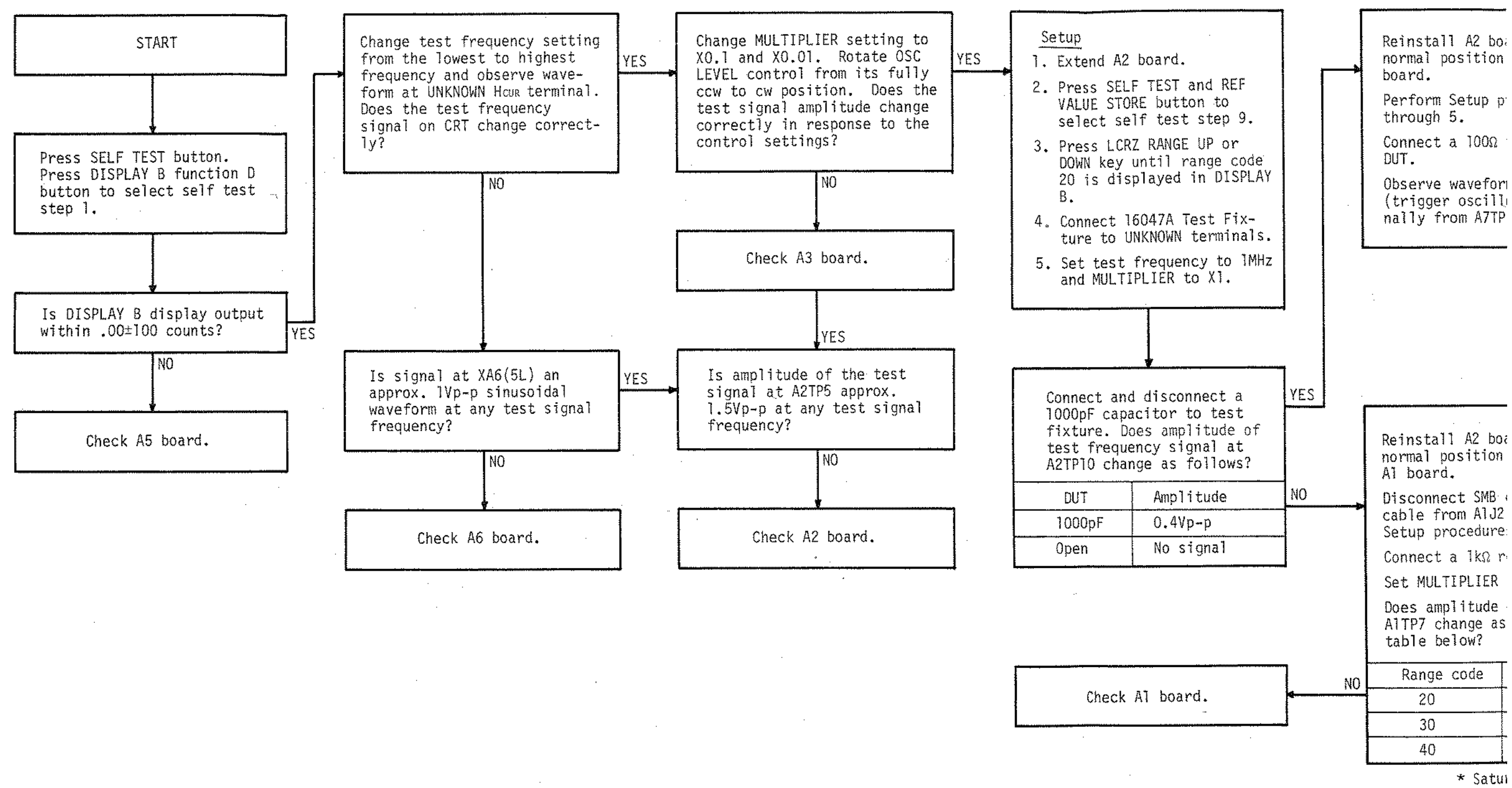
(DSA-2)

XA7 pin	Signature
13R	7F0P
$\overline{13R}$	FH86
14R	7118
$\overline{13L}$	2U90
$\overline{14L}$	5546
$\overline{15L}$	8PHP
16L	673P
$\overline{16L}$	5716
17L	4940
$\overline{17L}$	8245

(DSA-4)

XA7 pin	Signature
12R	8496
$\overline{12R}$	0U9F

Figure 8-29. Analog and Digital Section Isolation Procedure.


START
Press SELF TEST button. Press DISPLAY B function D button to select self test step 1.
Is DISPLAY B display output within .00±100 counts?
YES
NO
Check A5 board.
Change test frequency setting from the lowest to highest frequency and observe wave-form at UNKNOWN Hcur terminal. Does the test frequency signal on CRT change correct-ly?
YES
NO
Is signal at XA6(5L) an approx. 1Vp-p sinusoidal waveform at any test signal frequency?
YES
NO
Check A6 board.
Change MULTIPLIER setting to X0.1 and X0.01. Rotate OSC LEVEL control from its fully ccw to cw position. Does the test signal amplitude change correctly in response to the control settings?
YES
NO
Check A3 board.
YES
Is amplitude of the test signal at A2TP5 approx. 1.5Vp-p at any test signal frequency?
NO
Check A2 board.
Setup
1. Extend A2 board.
2. Press SELF TEST and REF VALUE STORE button to select self test step 9.
3. Press LCRZ RANGE UP or DOWN key until range code 20 is displayed in DISPLAY B.
4. Connect 16047A Test Fix-ture to UNKNOWN terminals.
5. Set test frequency to 1MHz and MULTIPLIER to X1.
Connect and disconnect a 1000pF capacitor to test fixture. Does amplitude of test frequency signal at A2TP10 change as follows?
DUT
Amplitude
1000pF
0.4Vp-p
Open
No signal
YES
NO
Reinstall A2 bo
normal position
board.
Perform Setup p
through 5.
Connect a 100Ω
DUT.
Observe wavefor
(trigger oscill
nally from A7TP
Reinstall A2 bo
normal position
A1 board.
Disconnect SMB
cable from A1J2
Setup procedure
Connect a 1kΩ r
Set MULTIPLIER
Does amplitude
A1TP7 change as
table below?
Range code
20
30
40
NO
Check A1 board.
* Satu

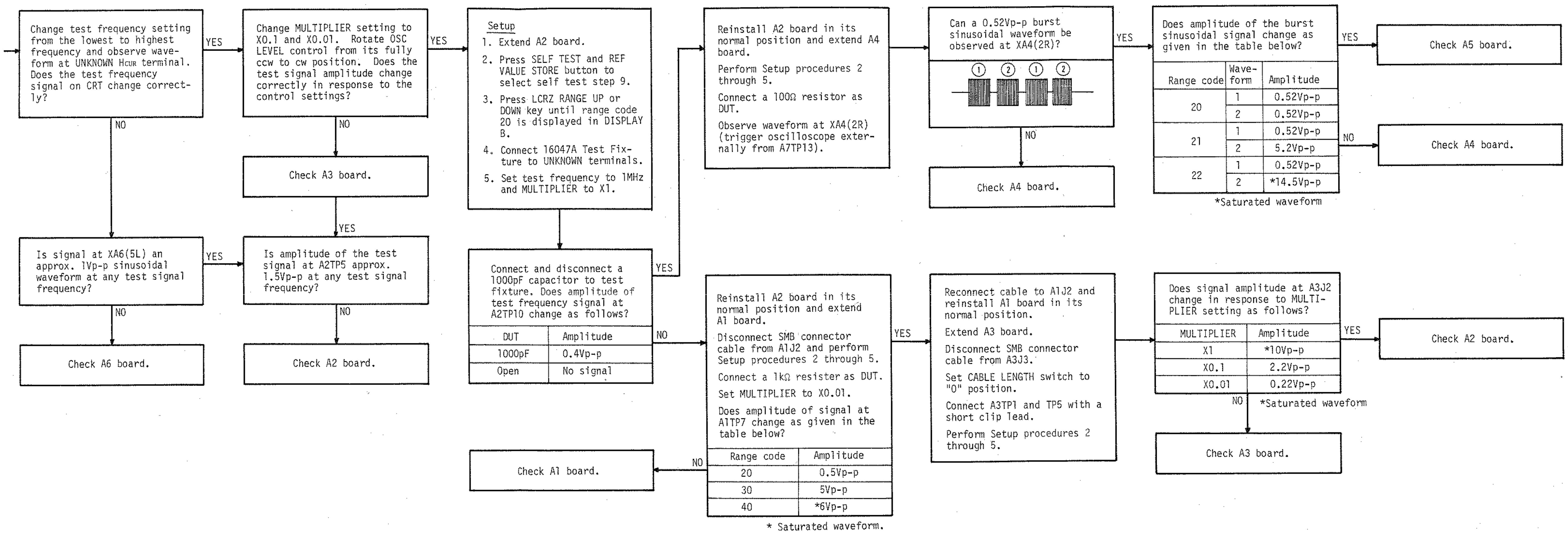
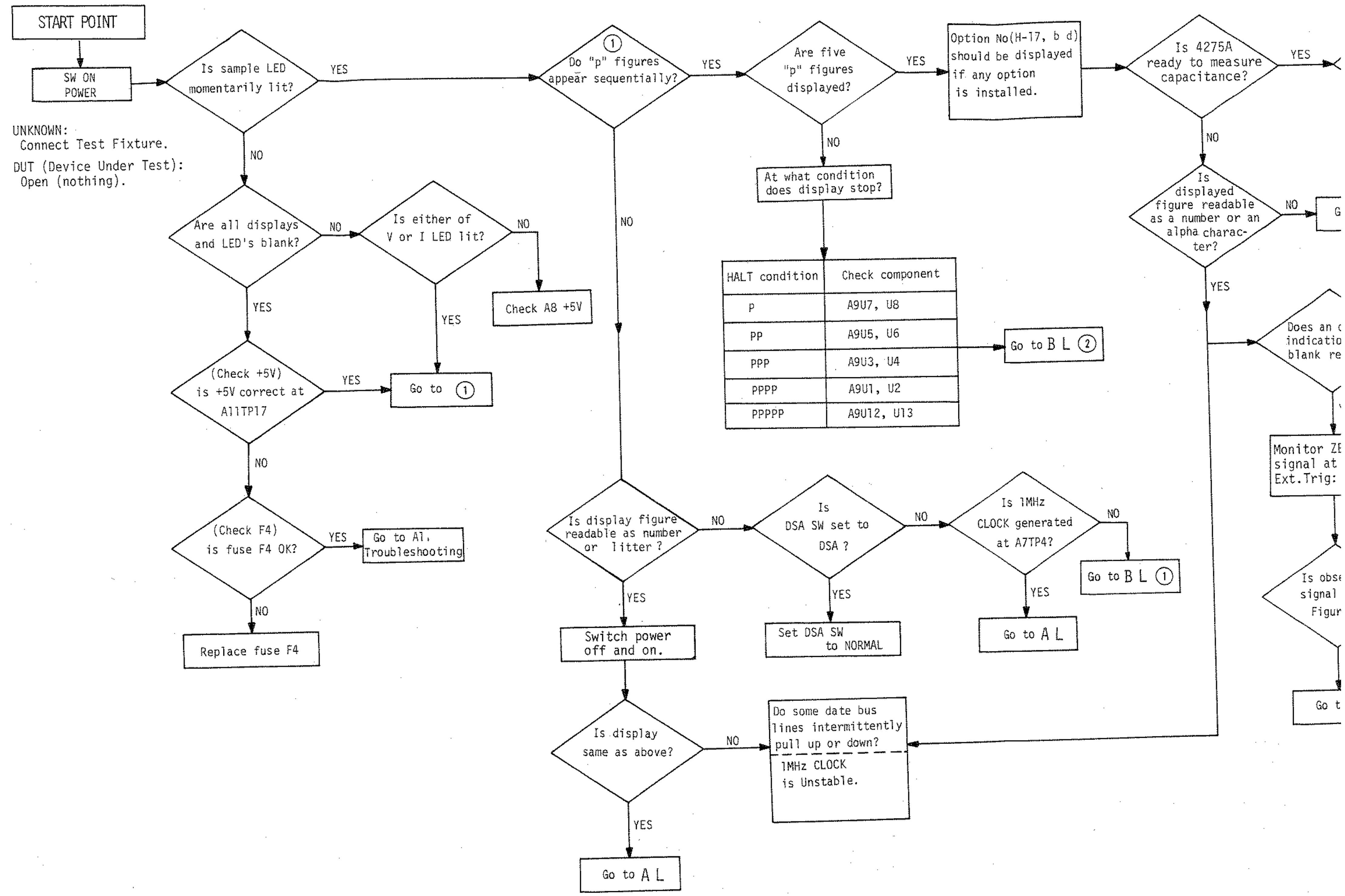


Figure 8-30. Analog Section Troubleshooting to Assembly Level.


START POINT
SW ON POWER
UNKNOWN: Connect Test Fixture.
DUT (Device Under Test): Open (nothing).
Is sample LED momentarily lit?
YES
NO
Are all displays and LED's blank?
NO
Is either of V or I LED lit?
NO
Check A8 +5V
YES
Go to 1
YES
(Check +5V) is +5V correct at A11TP17
YES
NO
(Check F4) is fuse F4 OK?
YES
Go to A1. Troubleshooting
NO
Replace fuse F4
1 Do "p" figures appear sequentially?
YES
NO
Are five "p" figures displayed?
YES
NO
At what condition does display stop?
HALT condition | Check component
P | A9U7, U8
PP | A9U5, U6
PPP | A9U3, U4
PPPP | A9U1, U2
PPPPP | A9U12, U13
Go to B L 2
Option No(H-17, b d) should be displayed if any option is installed.
Is 4275A ready to measure capacitance?
YES
NO
Is displayed figure readable as a number or an alpha charac-ter?
NO
YES
Does an
indicatio
blank re
Monitor ZE
signal at
Ext.Trig:
Is obse
signal
Figur
Go t
Is display figure readable as number or litter ?
NO
YES
Is DSA SW set to DSA ?
NO
YES
Set DSA SW to NORMAL
Is 1MHz CLOCK generated at A7TP4?
NO
Go to B L 1
YES
Go to A L
Switch power off and on.
Is display same as above?
NO
YES
Go to A L
Do some date bus lines intermittently pull up or down?
1MHz CLOCK is Unstable.

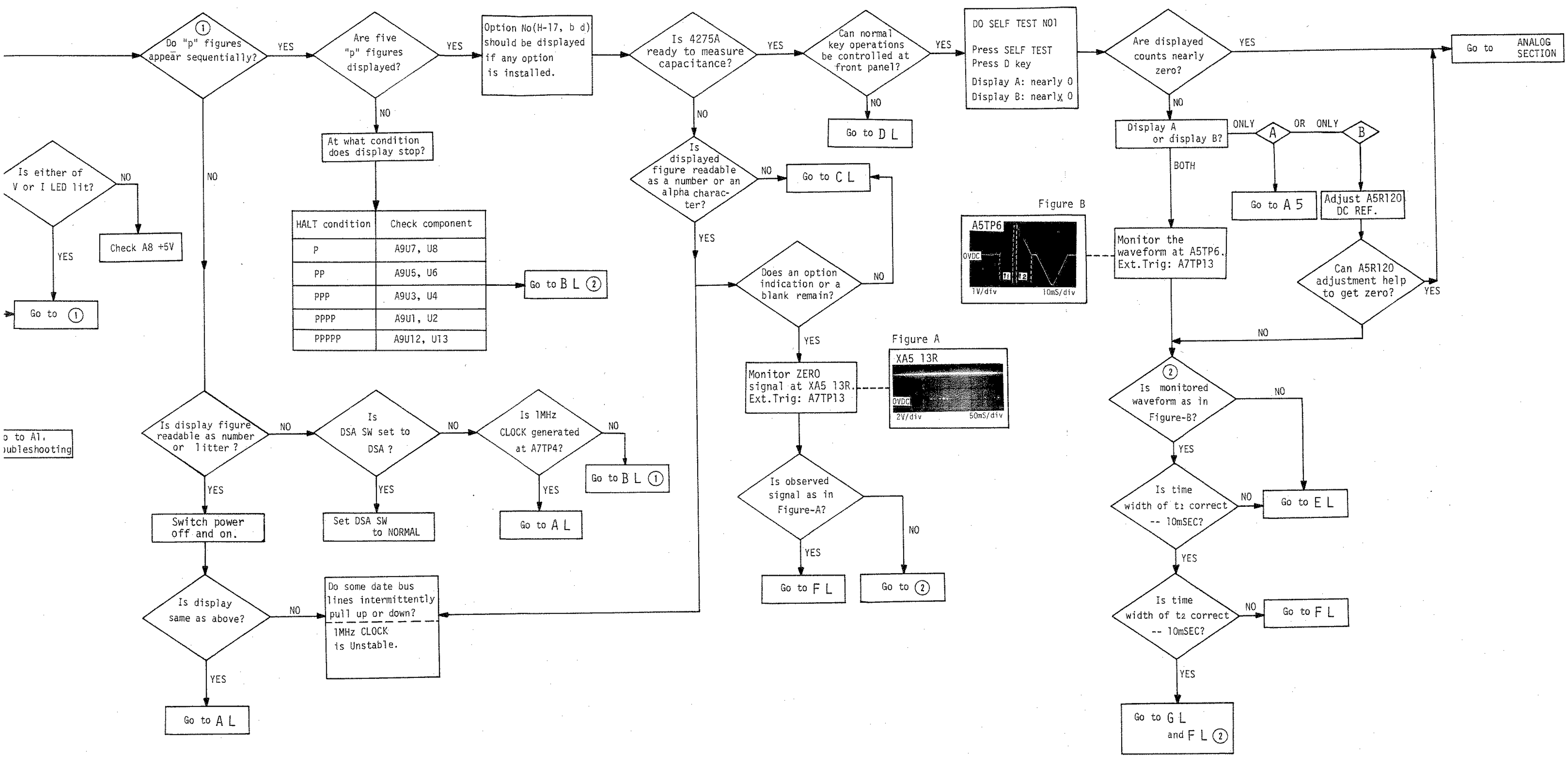


Figure 8-31. Digital Section Troubleshooting to Assembly Level.

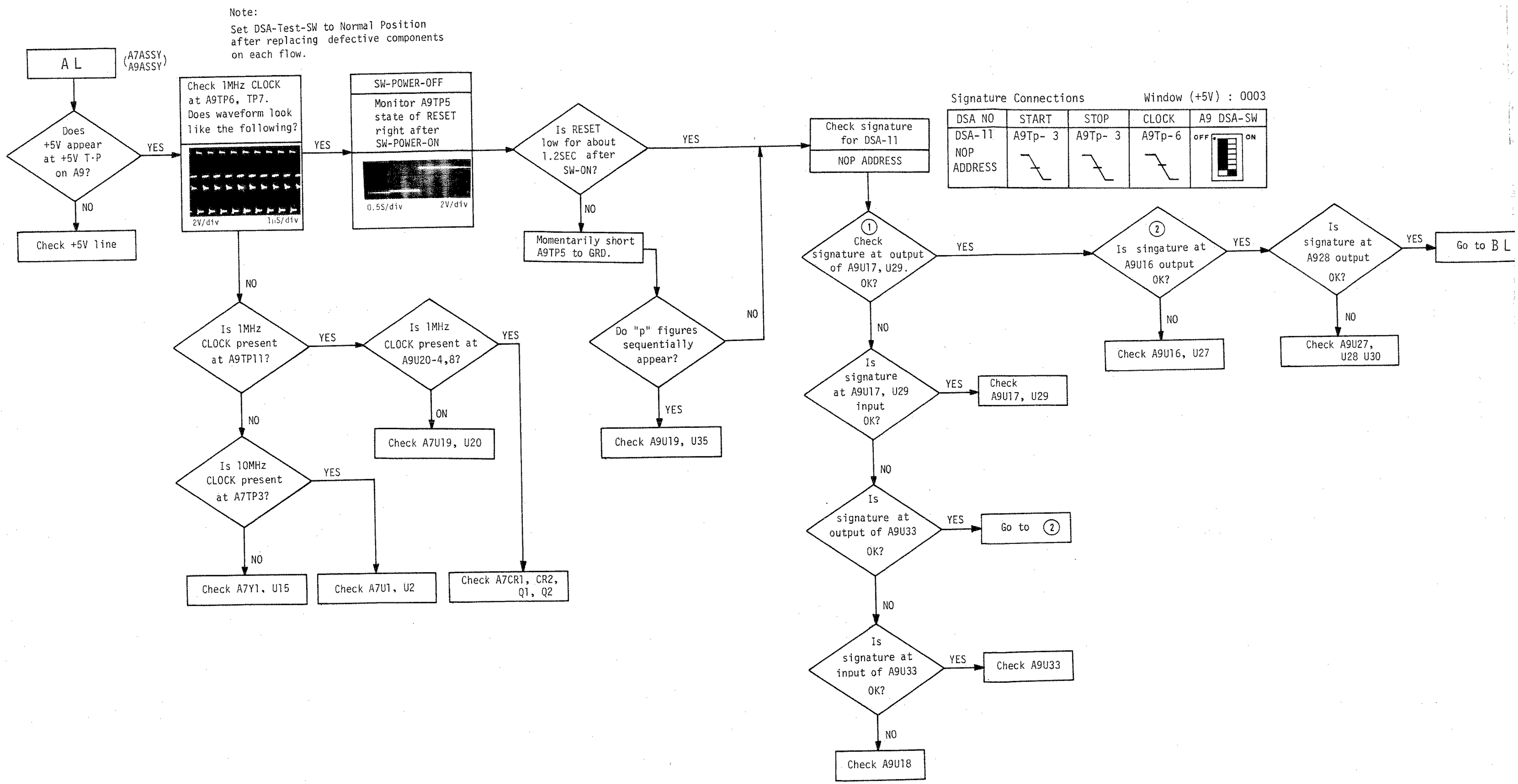
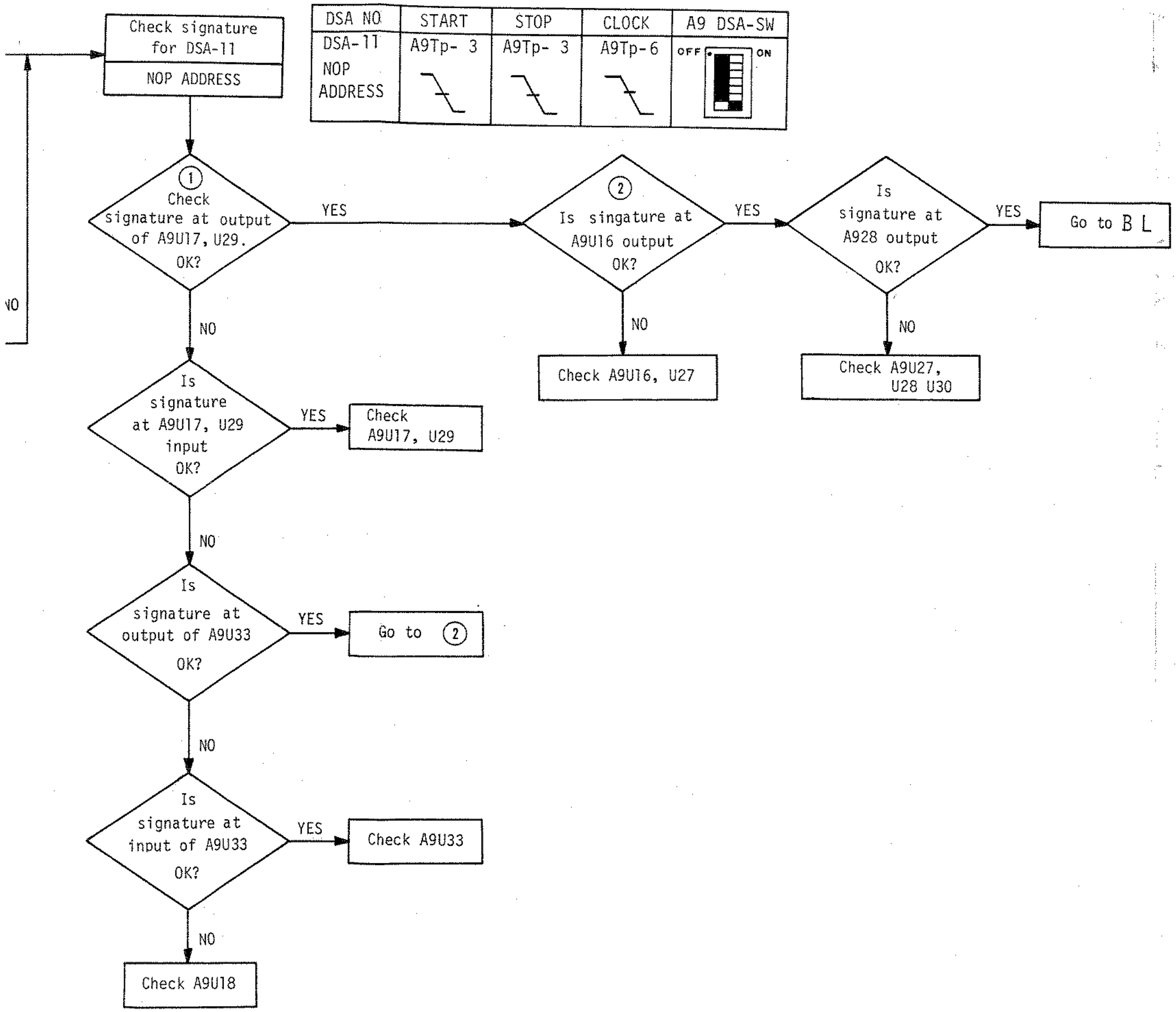


Figure 8-32. Digital Section Troubleshooting Flow Diagram AL.

Signature Connections   Window (+5V) : 0003

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-11 NOP ADDRESS	A9Tp- 3	A9Tp- 3	A9Tp-6	OFF ON



Troubleshooting Flow Diagram AL.

This table can be used to check signatures at A9U1 thru A9U10 ROM's. Signature test point is established at input of Data Buffer (pins 8 thru 6 of A9U31 and A9U32) instead of the respective ROM outputs (A9U1 thru A9U10). This signature list can be used for units with its serial number suffixes of -00266 and above.

For other instruments whose serial number suffixes are earlier than 00266, check that unstable signature display appears or that output states of these ROM's pull up and pull down. If you find above states active in earlier instruments, the program contents in these ROM may be alive.

TEST PIN NO / DSA NAME		DSA-12	DSA-14	DSA-15	DSA-16	DSA-17	DSA-13
SIGNAL NAME	TEST POINT / ROM NO.	A9U1	A9U1	A9U3	A9U5	A9U7	A9U10
WINDOW(+5V)	U1 pin-24	755U	P254	P254	P254	P254	826P
DB0	U31 pin-3	8081	42P2	7994	264C	0H5H	UUPA
DB1	pin-4	60A9	9949	307F	08CA	U02C	HAUH
DB2	pin-5	11C6	8UH8	HPF4	9FBF	8102	A63F
DB3	pin-6	P54P	P909	379A	CP1U	741F	3094
DB4	U32 pin-3	C375	8FU9	2U43	5H23	A2H2	565C
DB5	pin-4	615C	F854	5410	U899	2UHU	501H
DB6	pin-5	P3CU	6PF8	69HH	89PP	3265	39A1
DB7	pin-6	AUOH	052P	0P76	FP5F	52AC	F454

Signature Connections for DSA-1 and DSA-12 thru DSA-21.

Signature Connections — Window (+5V) : APC4

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-1 RAM DATA BUS	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON

Signature Connections — Window (+5V) : 755U

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-12 NOP (U1~U8)	A9U27-11	A9U16-5	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-13 NOP (U10)	A9 U22-9	A9U10-20	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-14 NOP (U1,2)	A9U16-9	A9U16-7	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-15 NOP (U3,4)	A9 U16-11	A9U16-10	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-16 NOP (U5,6)	A9U16-13	A9U16-12	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-17 NOP (U7,8)	A9U16-15	A9U16-14	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-18 NOP (U1)	A9U16-9	A9 U16-7	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : 826P

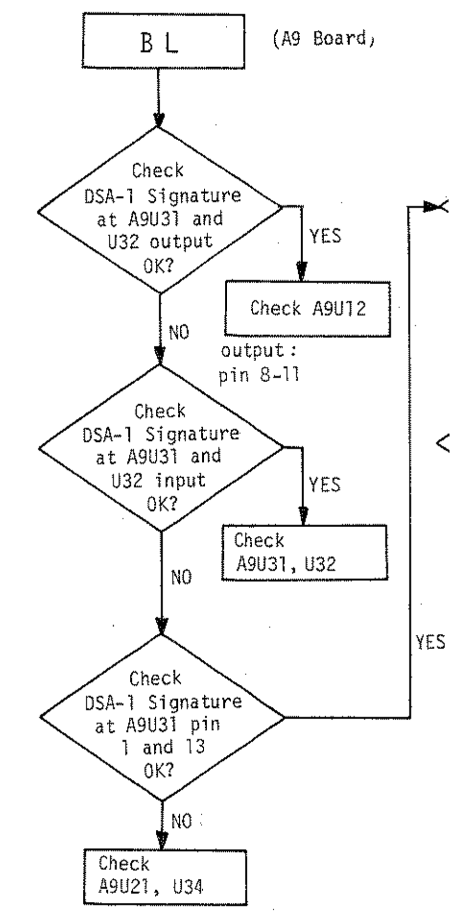
DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-19 NOP (U3)	A9 U16-11	A9U16-10	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-20 NOP (U5)	A9U16-13	A9U16-12	A9Tp-6	OFF ON

Signature Connections — Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-21 NOP (U7)	A9U16-15	A9U16-14	A9TP-6	OFF ON



Note: Remove all boards (other than A9 board) to avoid interference on Bus line from other boards.

...nnections for DSA-1 and DSA-12 thru DSA-21.

...nnections Window (+5V) : APC4

...ART	STOP	CLOCK	A9 DSA-SW
...p-13	A9Tp-13	A9Tp-7	OFF ON

...nnections Window (+5V) : 755U

...ART	STOP	CLOCK	A9 DSA-SW
...U27-11	A9U16-5	A9Tp-6	OFF ON

...nnections Window (+5V) : 826P

...TART	STOP	CLOCK	A9 DSA-SW
...U22-9	A9U10-20	A9Tp-6	OFF ON

...nnections Window (+5V) : P254

...TART	STOP	CLOCK	A9 DSA-SW
...U16-9	A9U16-7	A9Tp-6	OFF ON

...nnections Window (+5V) : P254

...TART	STOP	CLOCK	A9 DSA-SW
...U16-11	A9U16-10	A9Tp-6	OFF ON

...nnections Window (+5V) : P254

...TART	STOP	CLOCK	A9 DSA-SW
...U16-13	A9U16-12	A9Tp-6	OFF ON

Signature Connections Window (+5V) : P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-17 NOP (U7,8)	A9U16-15	A9U16-14	A9Tp-6	OFF ON

Signature Connections Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-18 NOP (U1)	A9U16-9	A9 U16-7	A9Tp-6	OFF ON

Signature Connections Window (+5V) : 826P

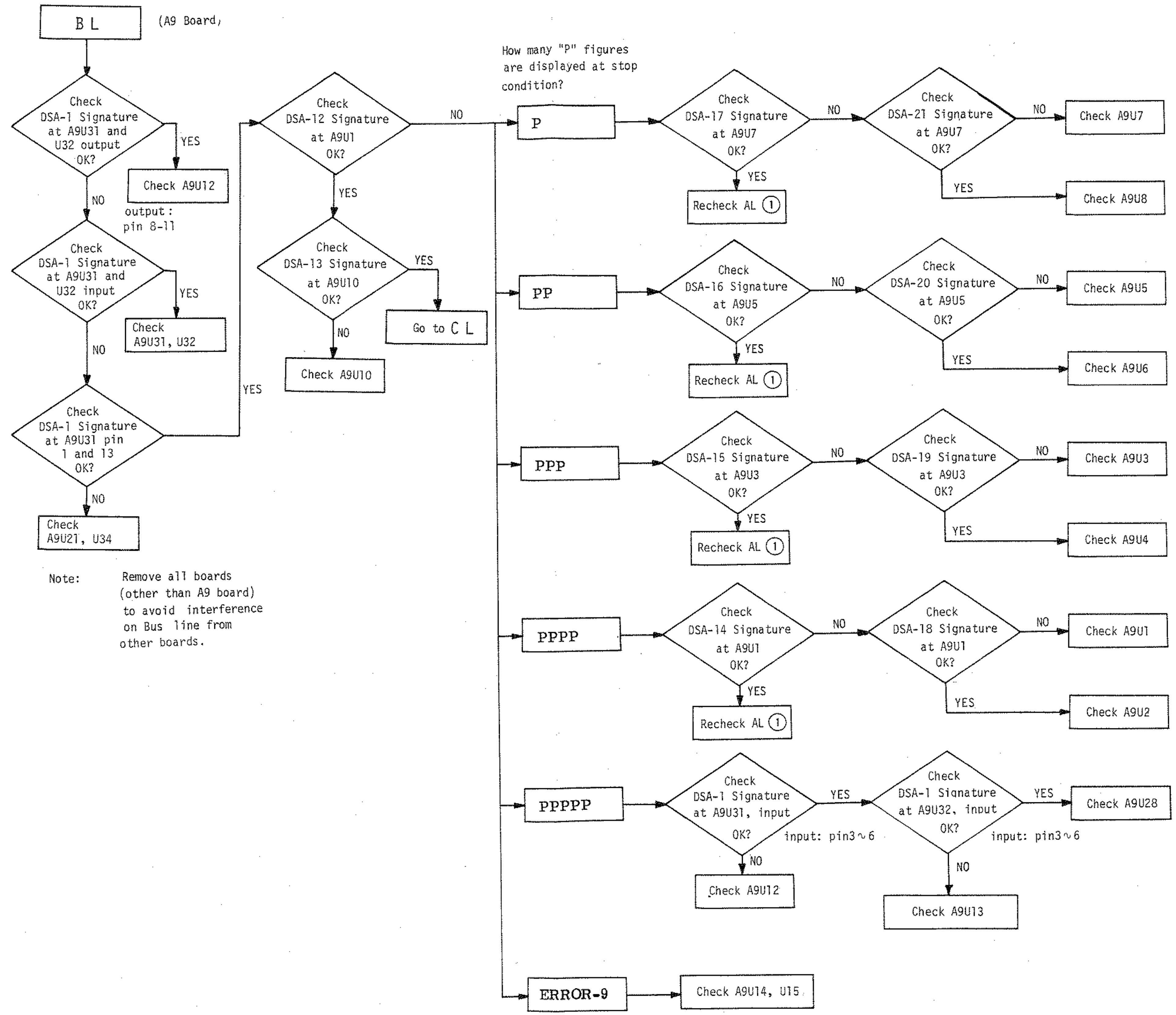
DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-19 NOP (U3)	A9 U16-11	A9U16-10	A9Tp-6	OFF ON

Signature Connections Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-20 NOP (U5)	A9U16-13	A9U16-12	A9Tp-6	OFF ON

Signature Connections Window (+5V) : 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-21 NOP (U7)	A9U16-15	A9U16-14	A9TP-6	OFF ON



Note: Remove all boards (other than A9 board) to avoid interference on Bus line from other boards.

Figure 8-33. Digital Section Troubleshooting Flow Diagram BL.

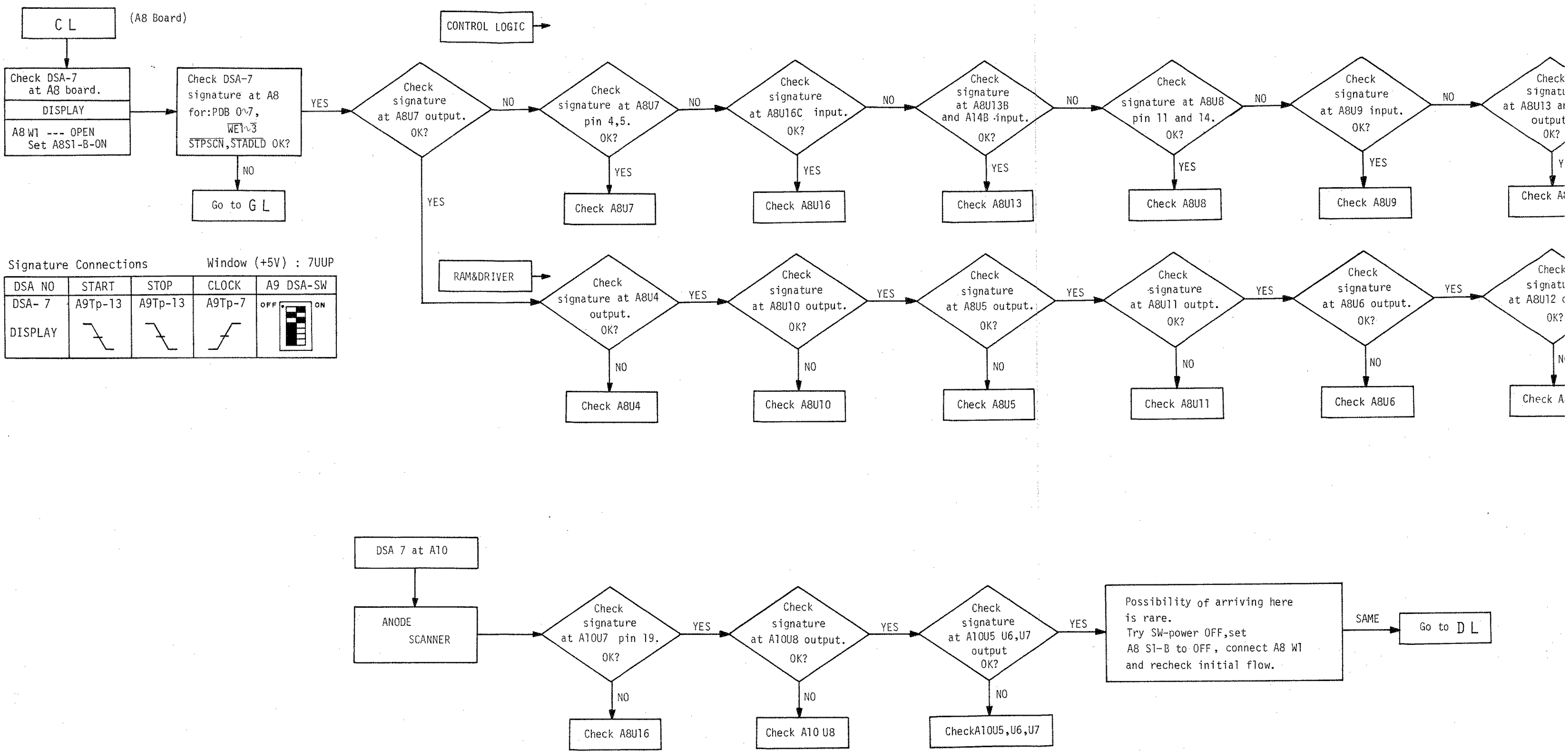
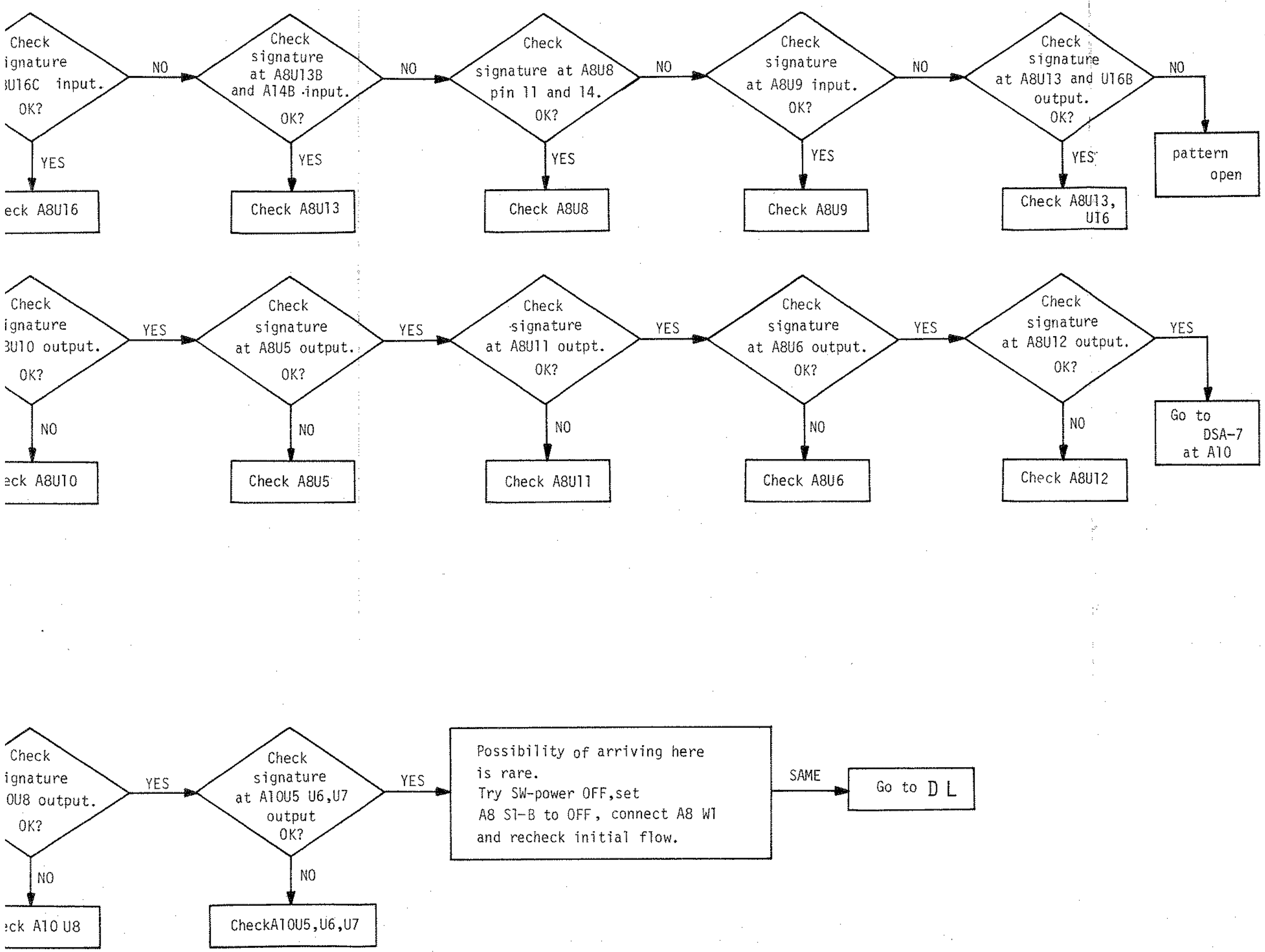


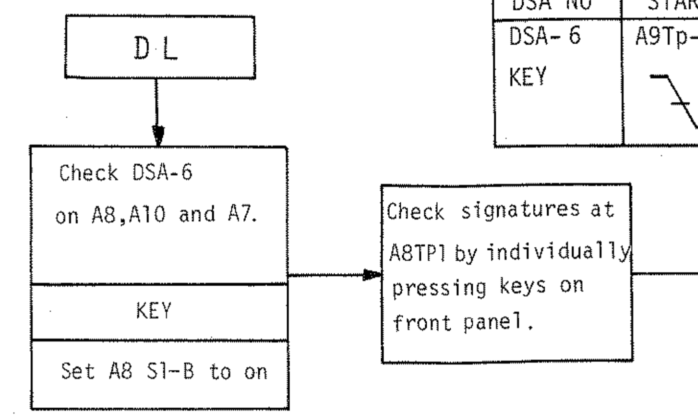
Figure 8-34. Digital Section Troubleshooting Flow Diagram CL.



Section Troubleshooting Flow Diagram CL.

Signature Connections Window (+5

DSA NO	START	STOP	CLOCK	A
DSA-6 KEY	A9Tp-13	A9Tp-13	A9Tp-7	OF



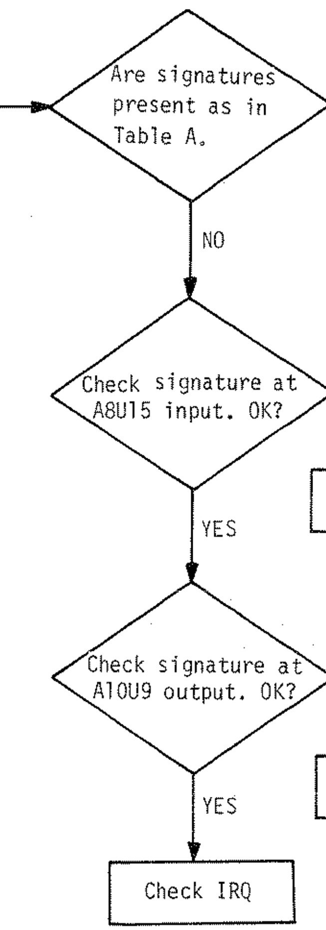


Table-1. A8Tp-1 Signatures

L	5245		TRIG.INT	72H5
C	C35A		EXT	5462
R	9CA0		HOLD/MANU	H07U
Z	0H7U			
Δ	83C4		FREQ.DOWN	HU0U
Δ%	7364		UP	72H5
RECALL	221F		V	221F
STORE	78C2		mA	78C2
D	5245		X0.01	HU0U
Q	C35A			
ESR/G	9CA0		X0.1	5462
X/B	0H7U		X1	H07U
L/C	A5AA			
			ZERO OPEN	A5AA
CIRCUIT AUTO	5245		SHORT	83HF
(series circuit symbol)	C35A			
(parallel circuit symbol)	9CA0			
H.R	7UUP			
AUTO R	78C2			
MANUAL	221F			
DOWN	83C4			
UP	7364			
SELF.T	7UUP			

Signature Connections   Window (+5V) : 7UUP

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-6 KEY	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON

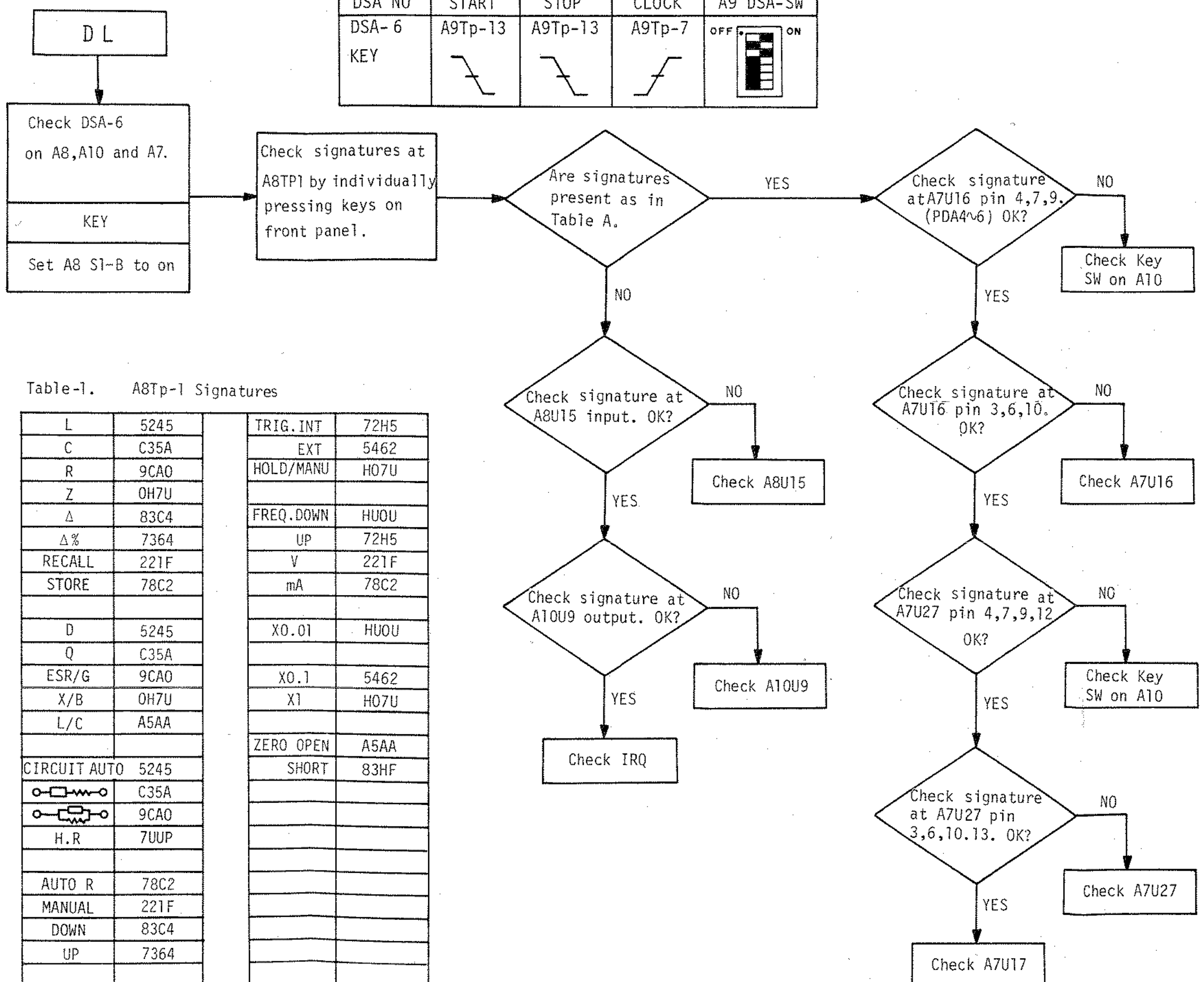


Table-1. A8Tp-1 Signatures

L	5245	TRIG.INT	72H5
C	C35A	EXT	5462
R	9CA0	HOLD/MANU	H07U
Z	0H7U		
Δ	83C4	FREQ.DOWN	HUOU
Δ%	7364	UP	72H5
RECALL	221F	V	221F
STORE	78C2	mA	78C2
D	5245	X0.01	HUOU
Q	C35A		
ESR/G	9CA0	X0.1	5462
X/B	0H7U	X1	H07U
L/C	A5AA		
		ZERO OPEN	A5AA
CIRCUIT AUTO	5245	SHORT	83HF
	C35A		
	9CA0		
H.R	7UUP		
AUTO R	78C2		
MANUAL	221F		
DOWN	83C4		
UP	7364		
SELF.T	7UUP		

Table 2. A10U9 Signatures

Pin	Key	signature	pin	Key	signature
1	SELF TEST	0000	9	STORE	074F
2	L	2HCC	10	Δ	UF4A
3	C	FFA4	11	Δ%	0F9A
4	R	P45P			
5	Z	7281	15	X0.01	0H2C
6	L/C	HA54	16	X0.1	2C9F
7	SHORT	UF22	17	X1	AU81
8	RECALL	5HP2			

Table 3. A7U16,U27 Signatures

SIGNAL	TEST PIN	SIGNATURE	TEST PIN	SIGNATURE
PDA 0	U27-4	P48F	U27-3	7686
1	-7	7CAA	-6	H68U
2	-9	1067	-10	7FUF
3	-12	C704	-13	PP7U
4	U16-4	0000	U16-3	PP7U
5	-7	0000	-6	PP7U
6	-9	0000	-10	PP7U

Figure 8-35. Digital Section Troubleshooting Flow Diagram DL.

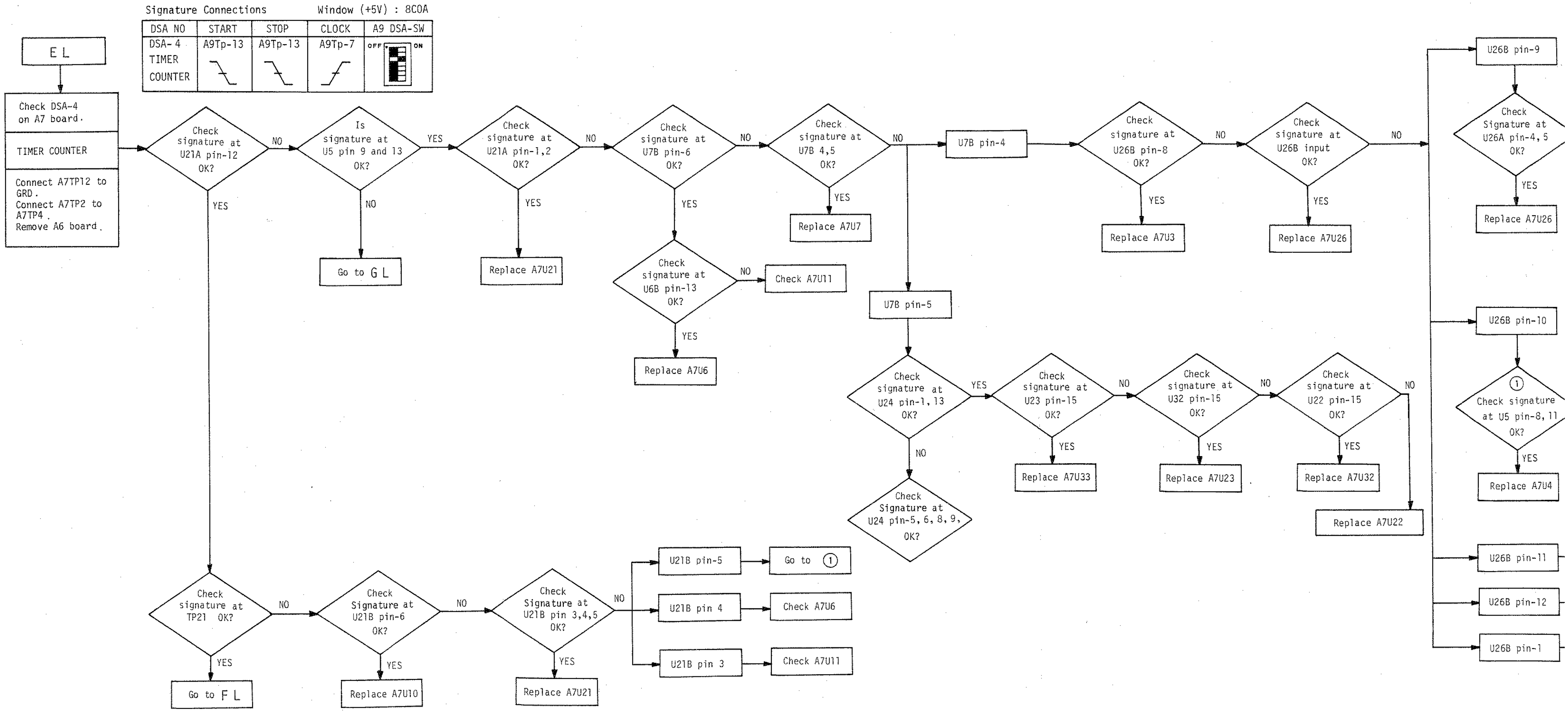
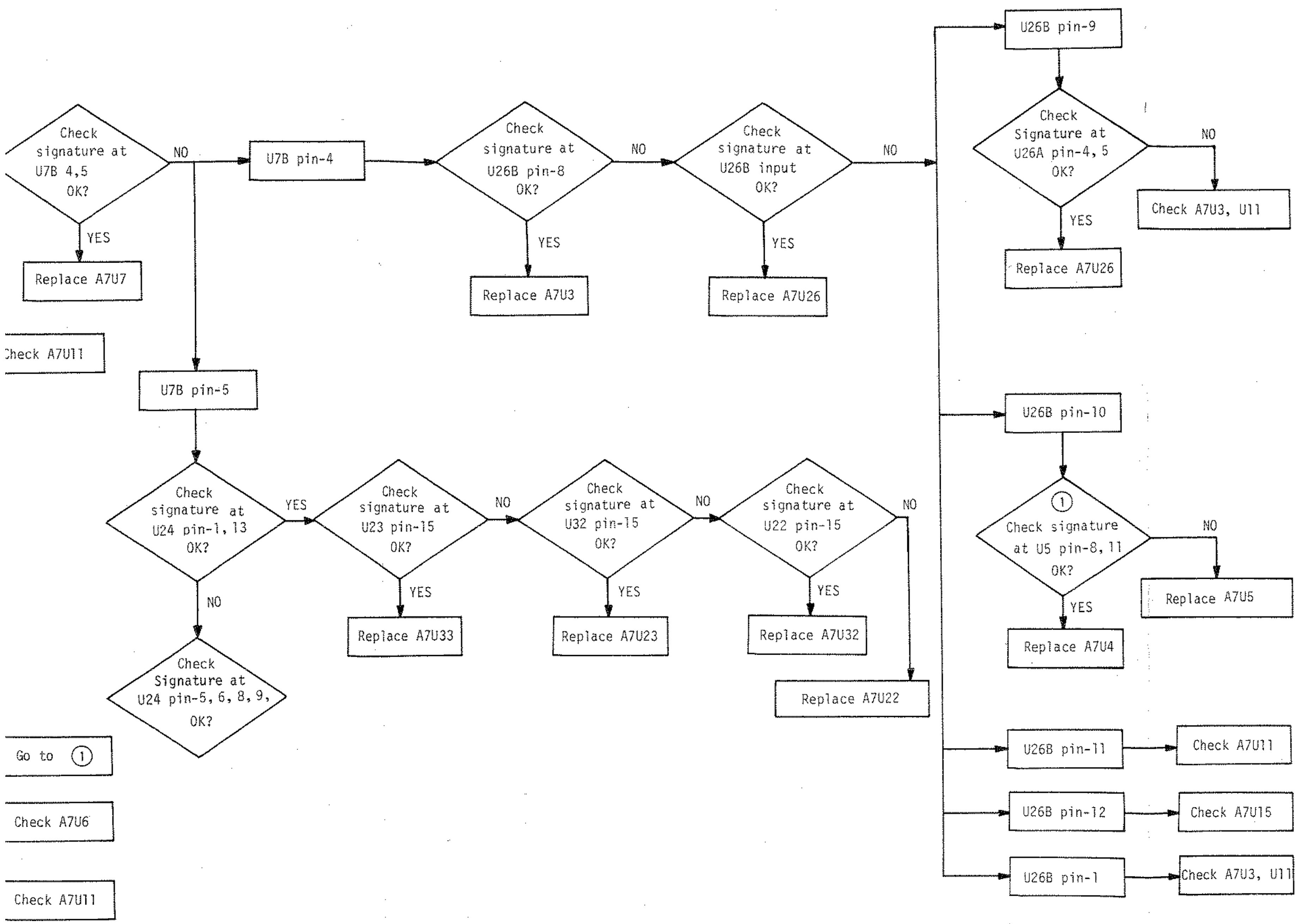
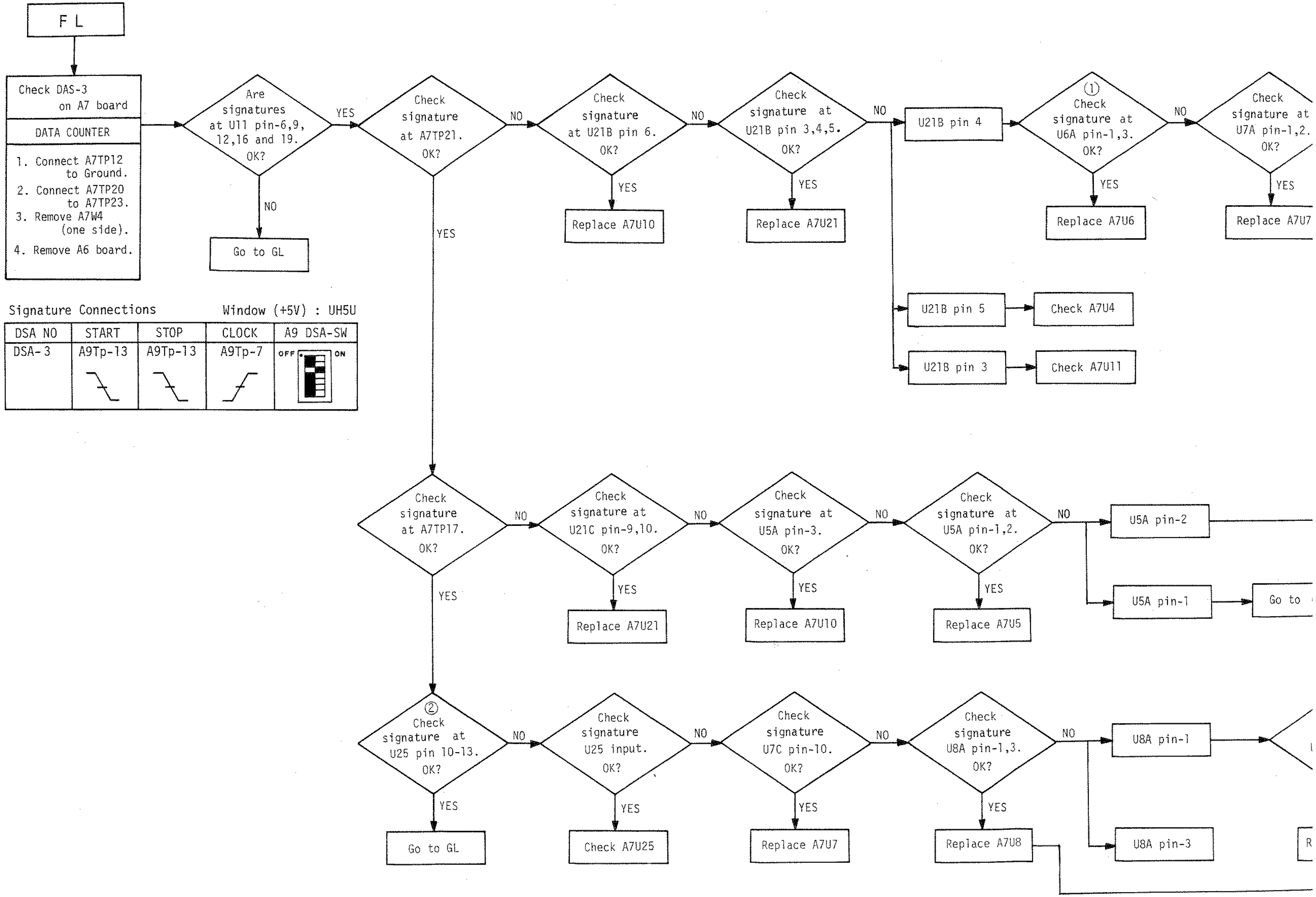


Figure 8-36. Digital Section Troubleshooting Flow Diagram EL.



Section Troubleshooting Flow Diagram EL.



Signature Connections Window (+5V) : UH5U

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-3	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON

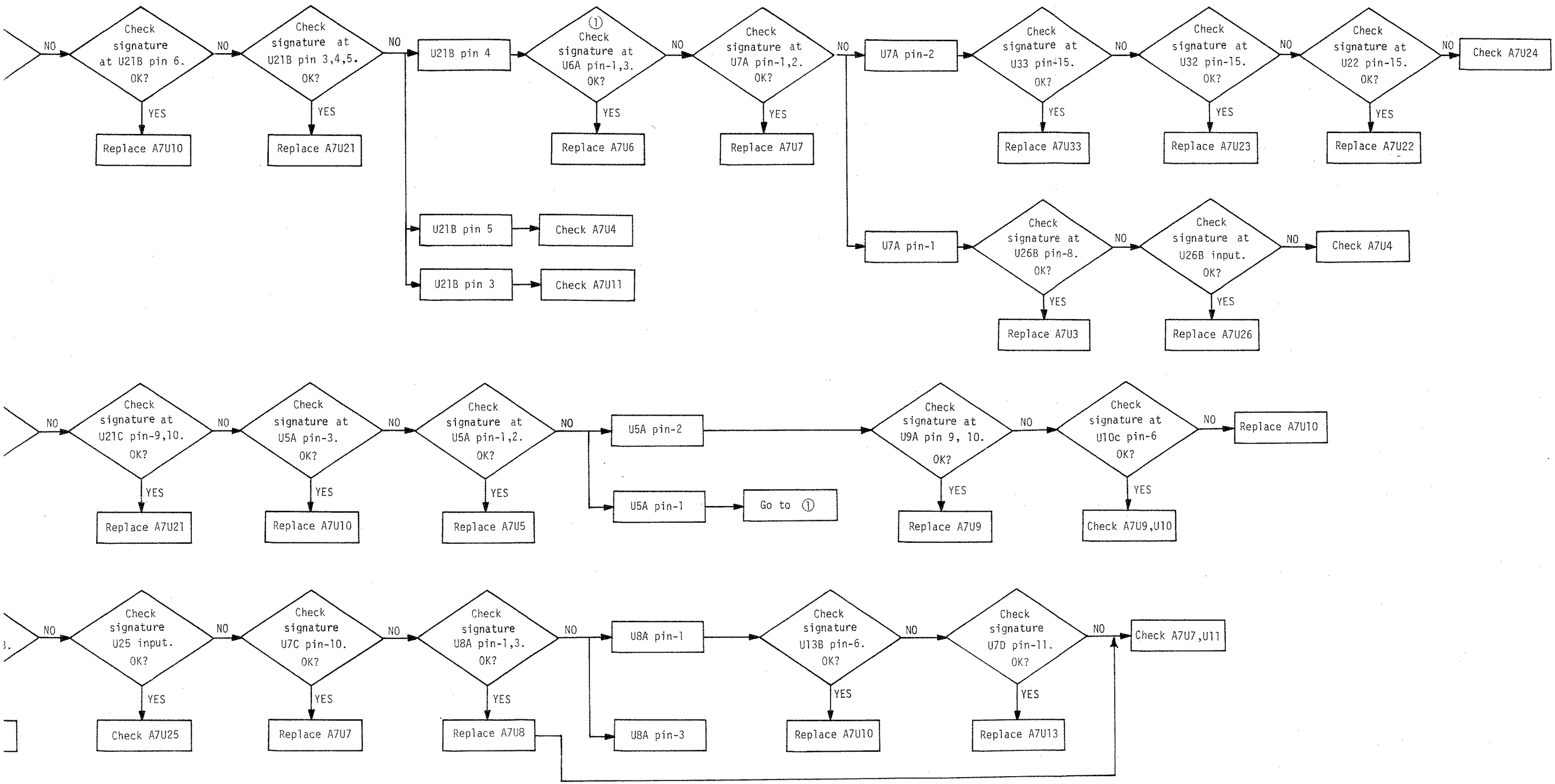
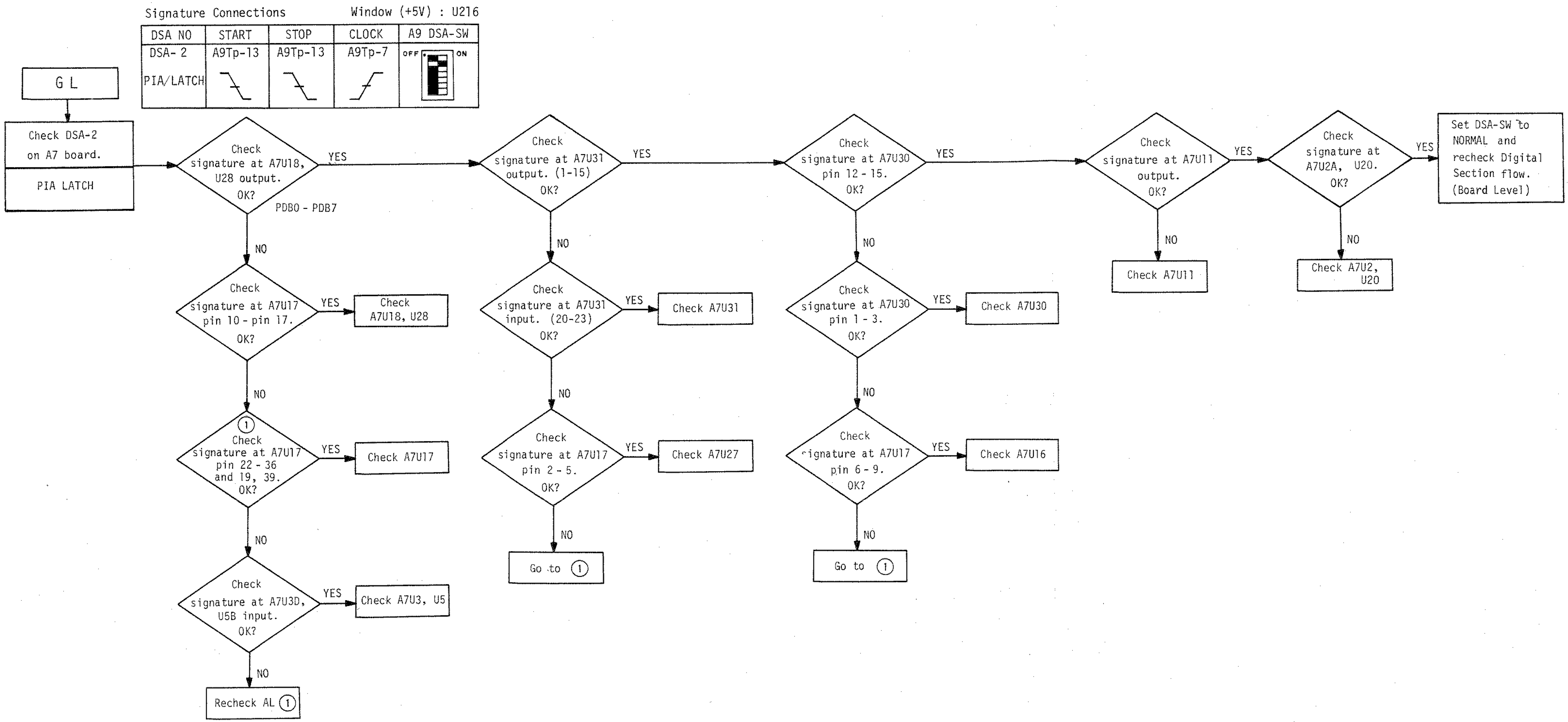
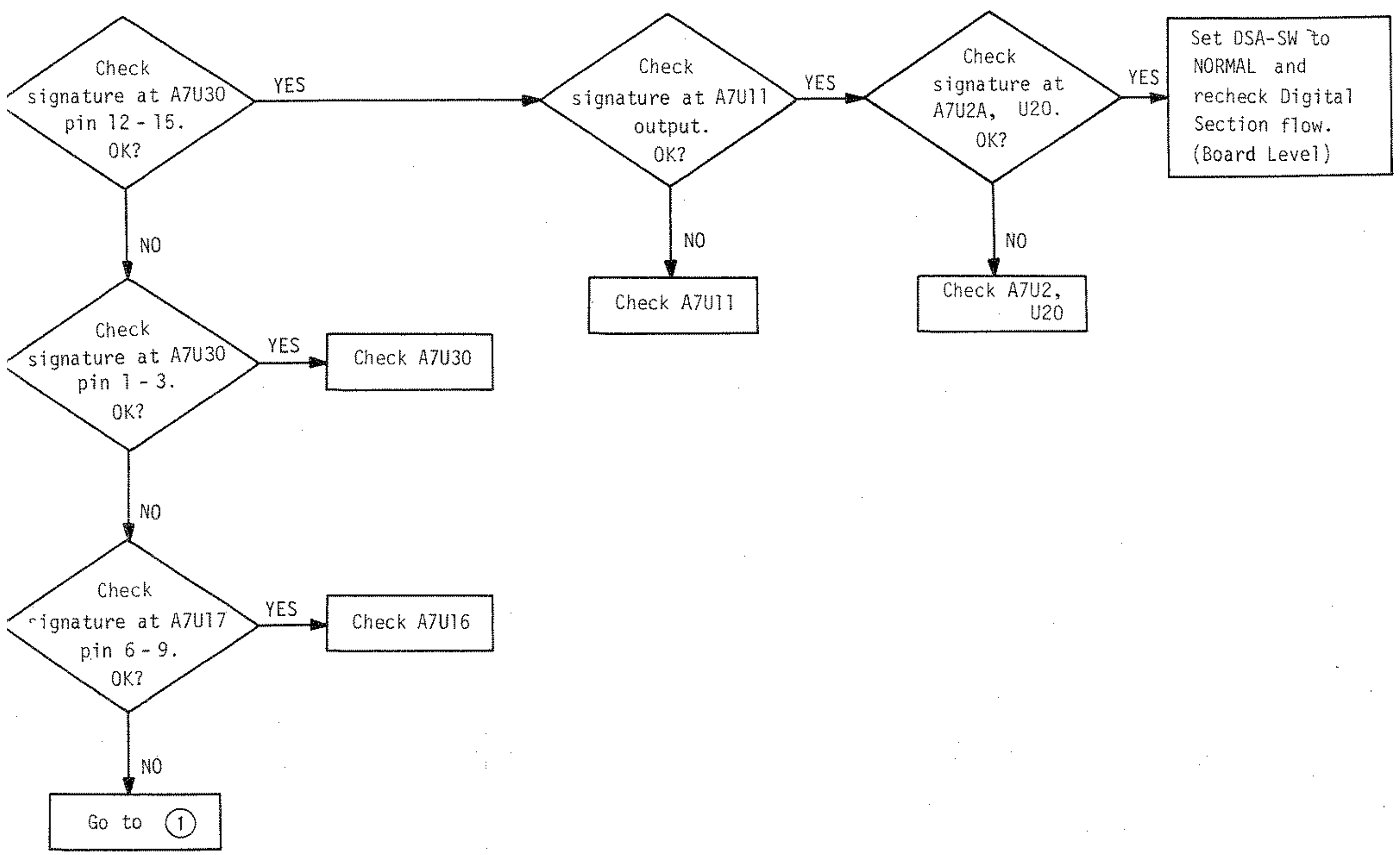


Figure 8-37. Digital Section Troubleshooting Flow Diagram FL.


Signature Connections
Window (+5V) : U216
DSA NO | START | STOP | CLOCK | A9 DSA-SW
DSA-2 | A9Tp-13 | A9Tp-13 | A9Tp-7 | OFF ON
PIA/LATCH
G L
Check DSA-2 on A7 board.
PIA LATCH
Check signature at A7U18, U28 output. OK?
PDB0 - PDB7
YES
NO
Check signature at A7U17 pin 10 - pin 17. OK?
Check A7U18, U28
1
Check signature at A7U17 pin 22 - 36 and 19, 39. OK?
Check A7U17
Check signature at A7U3D, U5B input. OK?
Check A7U3, U5
Recheck AL 1
Check signature at A7U31 output. (1-15) OK?
Check signature at A7U31 input. (20-23) OK?
Check A7U31
Check signature at A7U17 pin 2 - 5. OK?
Check A7U27
Go to 1
Check signature at A7U30 pin 12 - 15. OK?
Check signature at A7U30 pin 1 - 3. OK?
Check A7U30
Check signature at A7U17 pin 6 - 9. OK?
Check A7U16
Go to 1
Check signature at A7U11 output. OK?
Check A7U11
Check signature at A7U2A, U20. OK?
Check A7U2, U20
Set DSA-SW to NORMAL and recheck Digital Section flow. (Board Level)


Check signature at A7U30 pin 12 - 15. OK?
YES
NO
Check signature at A7U11 output. OK?
YES
NO
Check A7U11
Check signature at A7U2A, U20. OK?
YES
NO
Check A7U2, U20
Set DSA-SW to NORMAL and recheck Digital Section flow. (Board Level)
Check signature at A7U30 pin 1 - 3. OK?
Check A7U30
Check signature at A7U17 pin 6 - 9. OK?
Check A7U16
Go to 1

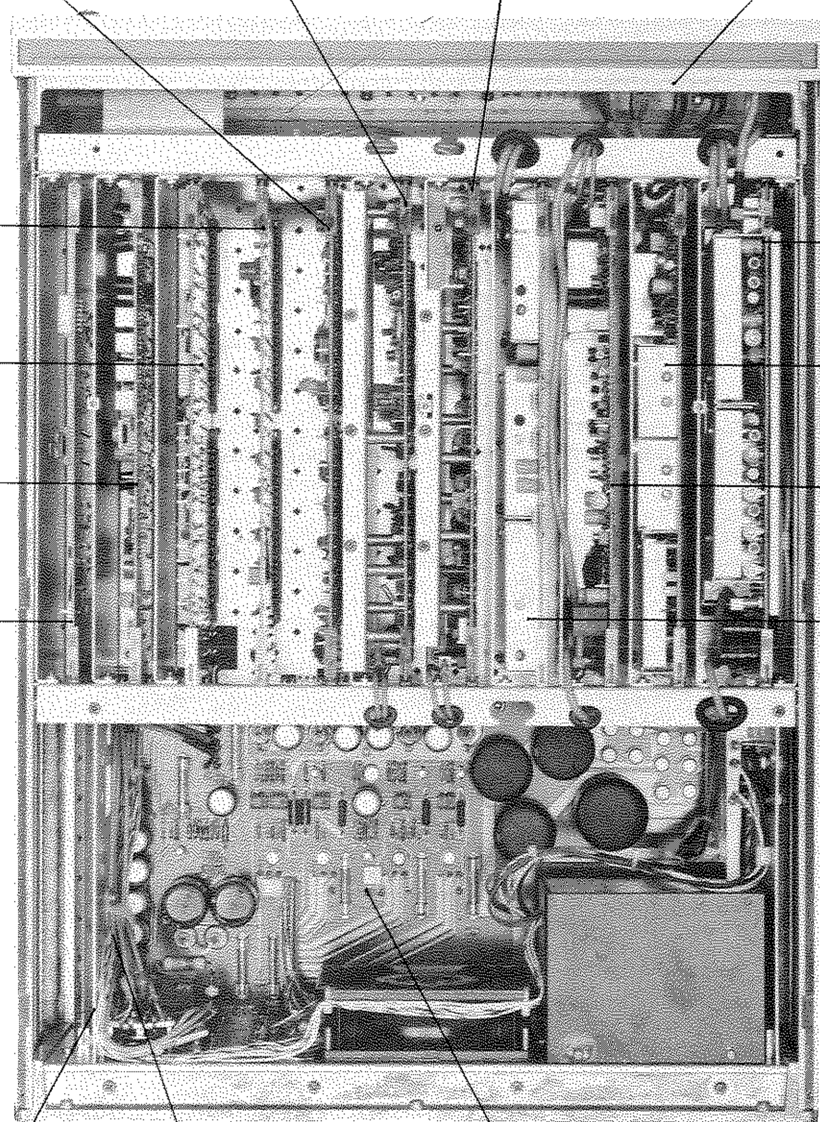


Figure 8-39. Assembly Locations.

P/O	Part of.
○	Knob control.
	Screwdriver adjustment.
	Circuit assembly borderline.
*	Asterisk denotes a factory selected value. Value shown is typical (part many be omitted).
	Heavy line indicates main signal path.
	Heavy dashed line indicates main feedback path.
CW	Wiper moves towards CW with clockwise rotation of control (as viewed from shaft or knob).
1 TP1	Numbered test point. Measurement aid provided.
	Denotes wire color code. Code used is the same as the resistor color code (e.g., 9.4.7 denotes white/yellow/violet).
	Indicates direct conducting connection to the earth.
	Indicates conducting connection to chassis or frame.
	Indicates circuit common connection.
	Encloses front panel designations.
	Encloses rear panel designations.

Figure 8-40. Schematic Diagram Notes.

A1 Board Troubleshooting Flow Diagram Notes.

1. If the instrument malfunctions or measurement error increases under CABLE LENGTH switch settings of either "0" or "1 m" positions, check Q15 collector voltage, K1 and K2.

CABLE LENGTH setting	Q15 collector	K1	K2
0	12V	OFF	OFF
1 m	0V	ON	ON

If normal voltage is observed, check relays A1K1 and K2.

2. If measurement error increases at specific test frequency setting(s), check the following control signals:

Check points	Test frequency setting			
	100 kHz	1 MHz	*4 MHz	10 MHz
Q13 collector	+12V	+12V	+12V	0V
Q14 collector	+12V	+12V	0V	+12V
Q37 collector	− 3V	+ 2V	−4.3V	−4.3V
Q38 collector	+ 2V	− 3V	−4.3V	−4.3V

*5 MHz for option 004

If these voltages are normal, check the following components associated with these control signals:

K3	Turns on at 4 MHz
K4	Turns on at 10 MHz
Q27	Turns on at 10 kHz, 20 kHz 40 kHz and 100 kHz
Q28	Turns on at 200 kHz, 400 kHz and 1 MHz

Check that signal waveforms at Q27 and Q28 collector leads individually disappear when the respective transistors are on.

3. If measurement error increases on low impedance measurement ranges (high capacitance and low inductance ranges), check CMR Amplifier circuit (A1Q1 through Q8).

4. States of the range resistor relays are summarized in the tabulation below:
Condition – Function: R-X, Test frequency: 10 kHz

Range	Relay states (drive transistors)						
	K5, K6 (Q12)	K7, K8 (Q11)	K9, K10 (Q10)	K11 (Q9)	K12 (Q41)	K13 (Q40)	K14 (Q39)
10 kΩ	ON	OFF	OFF	OFF	OFF	OFF	ON
100 kΩ	OFF	ON	OFF	OFF	OFF	ON	OFF
1 MΩ	OFF	OFF	ON	OFF	ON	OFF	OFF
10 MΩ	OFF	OFF	OFF	ON	OFF	OFF	OFF

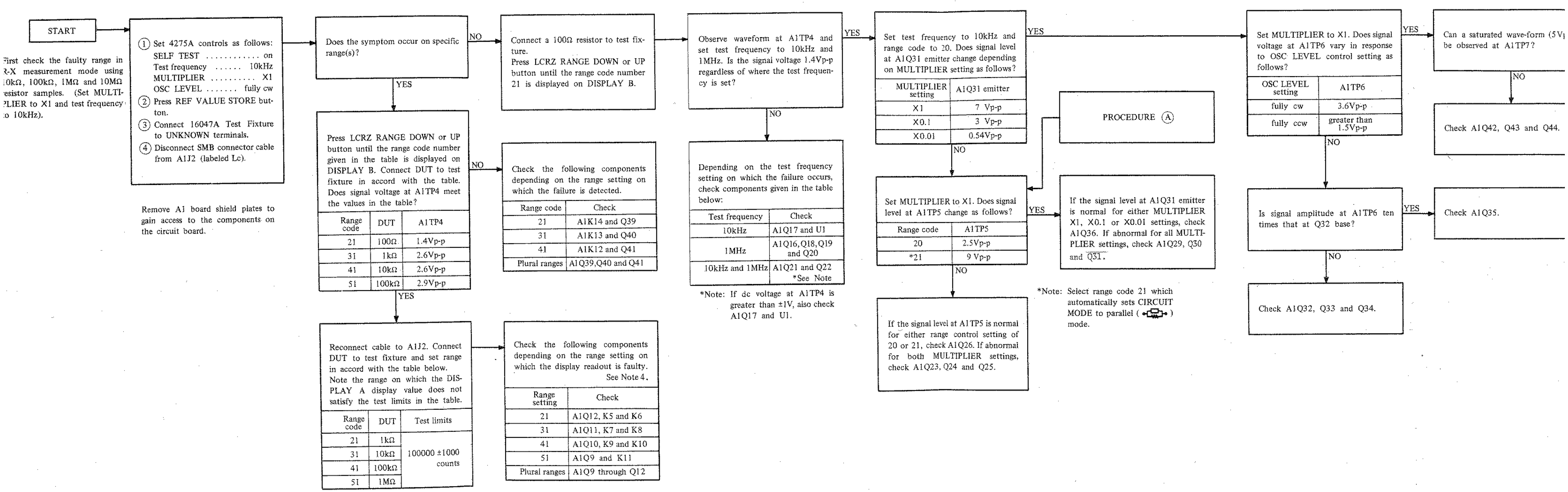
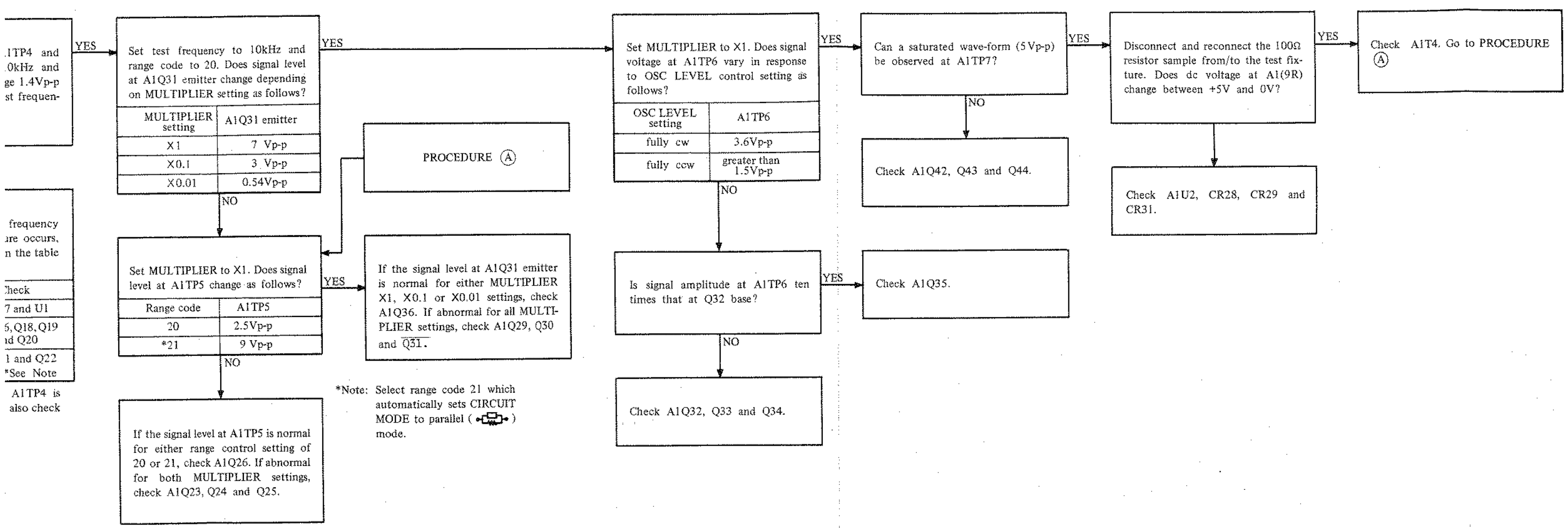


Figure 8-41. A1 Range Resistor and Null Detector Board Troubleshooting Tree.



. A1 Range Resistor and Null Detector Board Troubleshooting Tree.

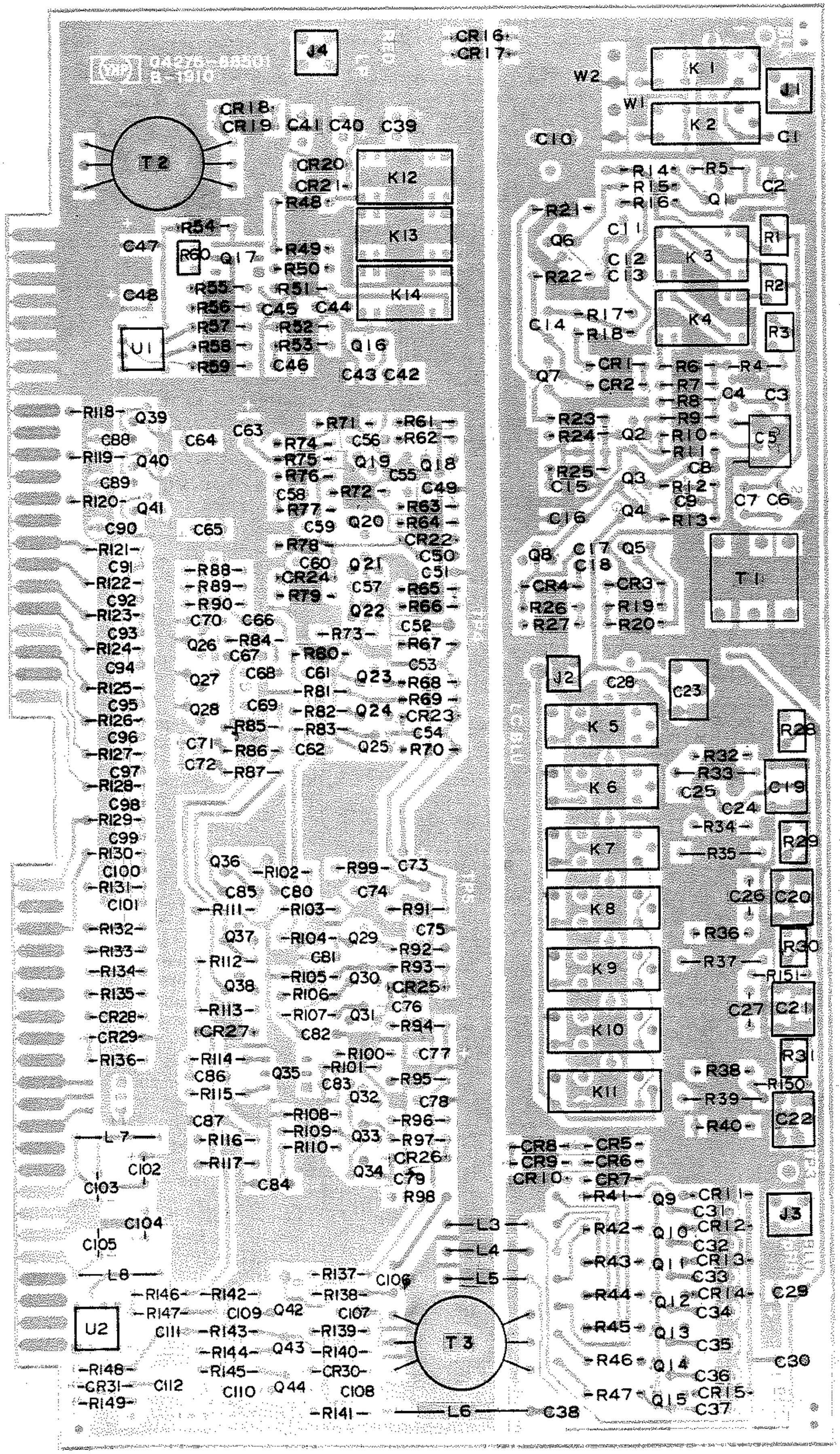


Figure 8-42. A1 Range Resister and Null Detector Board Assembly Component Locations.

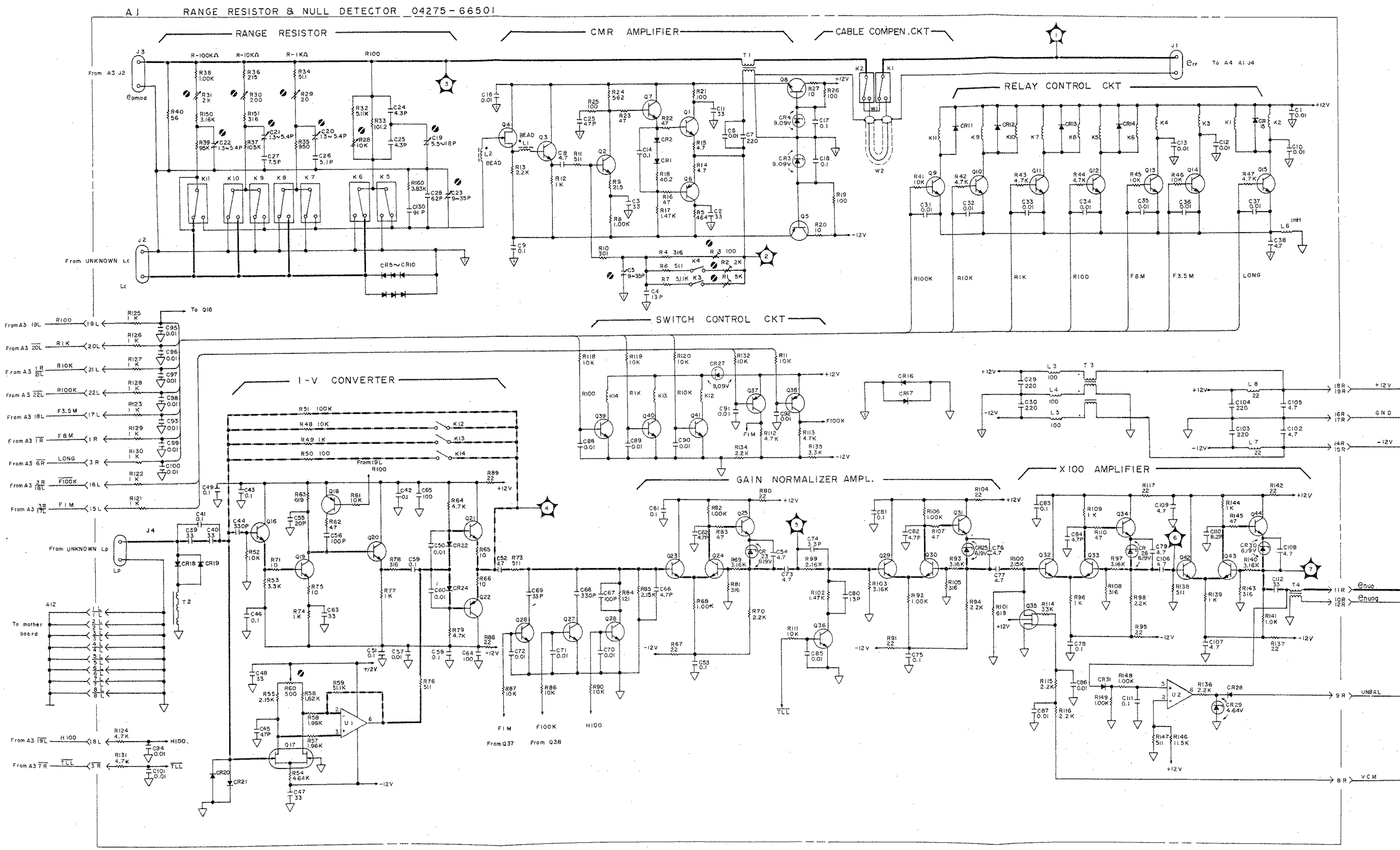


Figure 8-43. A1 Range Resistor and Null Detector Board Assembly Schematic Diagram.

A2 Board Troubleshooting Flow Diagram Notes.

1. If the instrument malfunctions or measurement error increases at specific test frequencies or on specific range settings, first check A2U1 using the table below:
   Condition – Function: R-X, Test frequency: 10 kHz

		Control output signals					
		a	b	c	d	e	f
Frequency Setting	100 kHz	−1.1 V	+0.7 V	−11 V	0V	–	–
	1 MHz	+0.7V	−1.1 V	0V	−11 V	–	–
Range Setting	100 kΩ	–	–	–	–	−11 V	+0.7 V
	1000 kΩ	–	–	–	–	+11 V	−1.1 V

2. The ALC Amplifier performs leveling of the test frequency input signal using an automatic level control operation in the frequency follow-up filter circuit. For the frequency follow-up filter operating theory, see Figure 8-9.

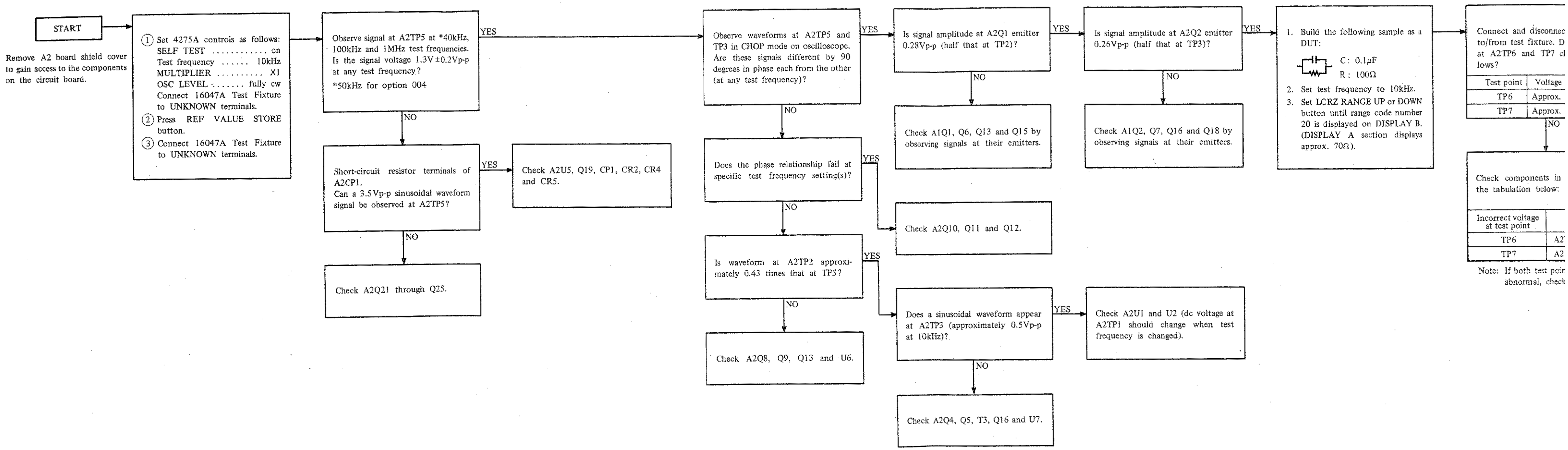


Figure 8-44. A2 Modulator Board Troubleshooting Tree.

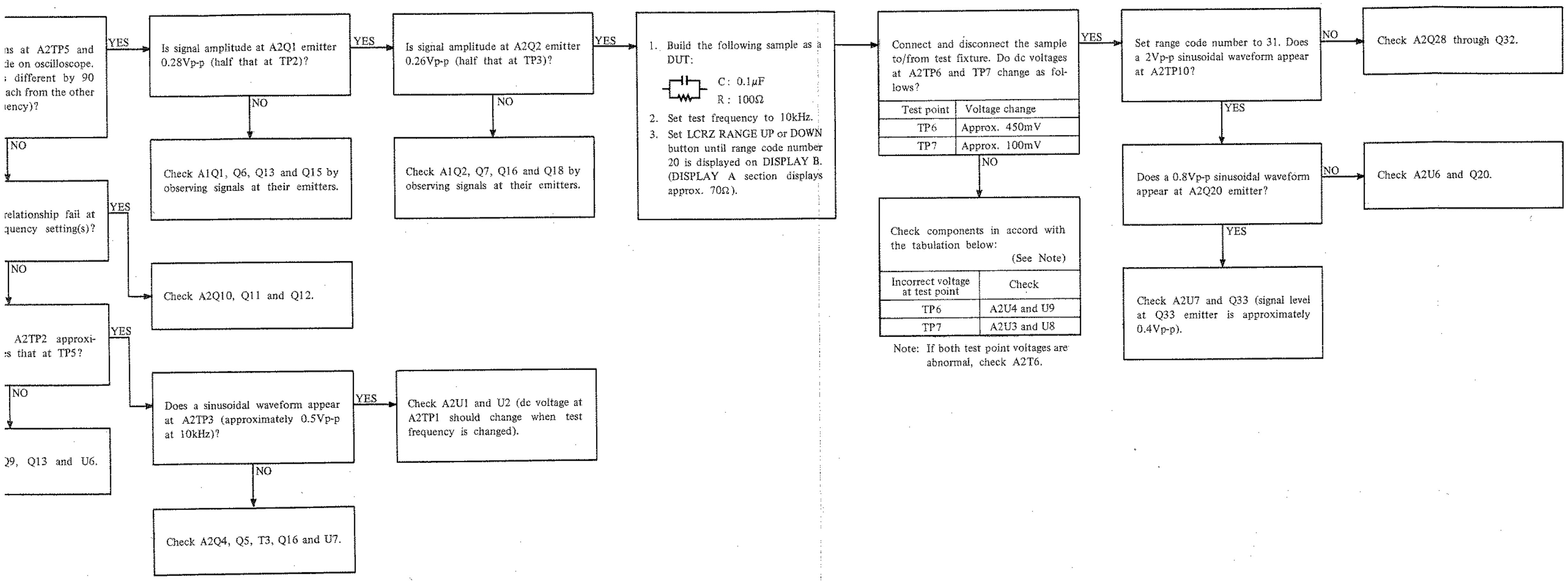


Figure 8-44. A2 Modulator Board Troubleshooting Tree.

A1 SEE INSIDE RANGE RESISTOR AND NULL DETECTOR
Service Sheet 1

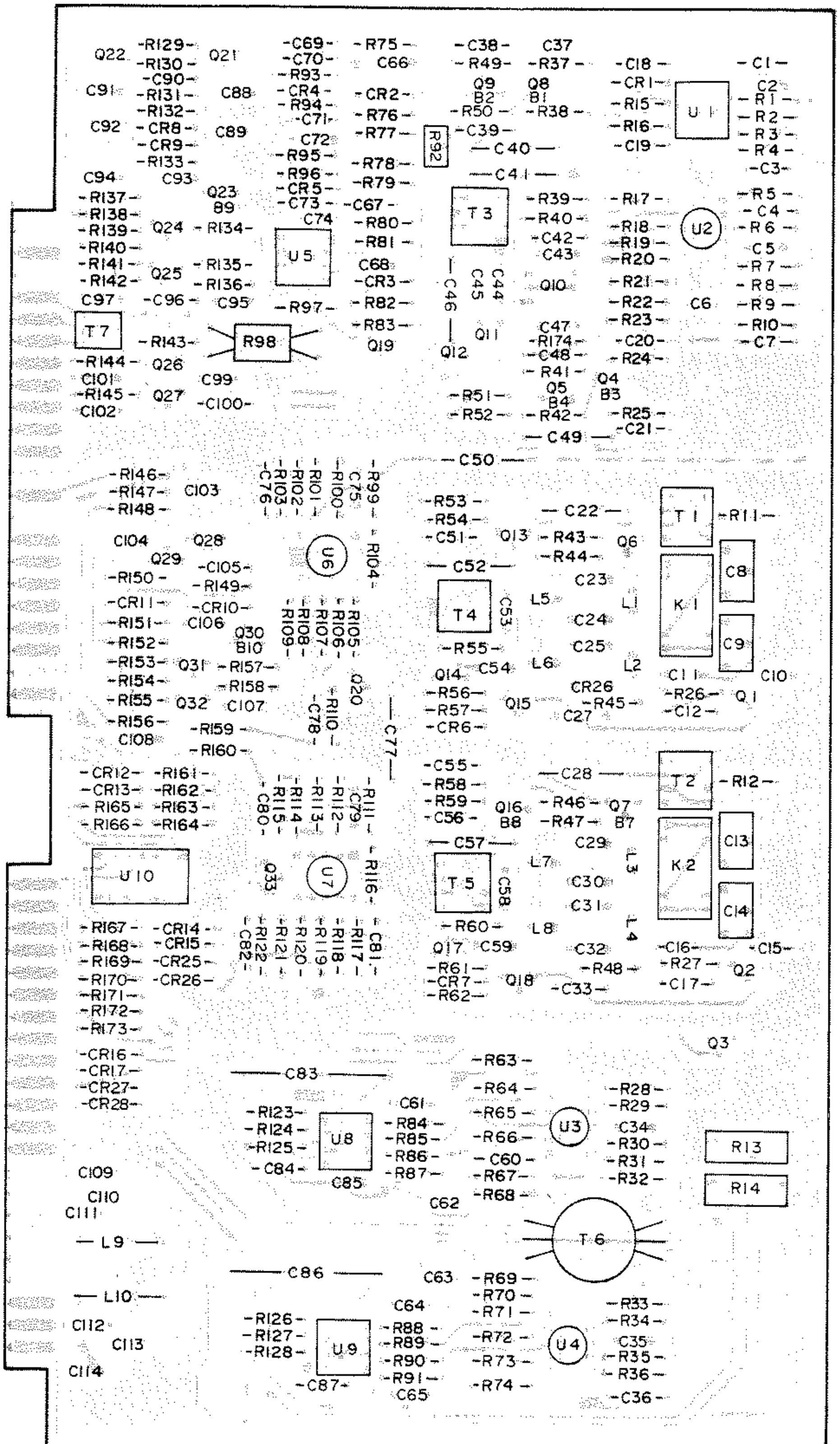
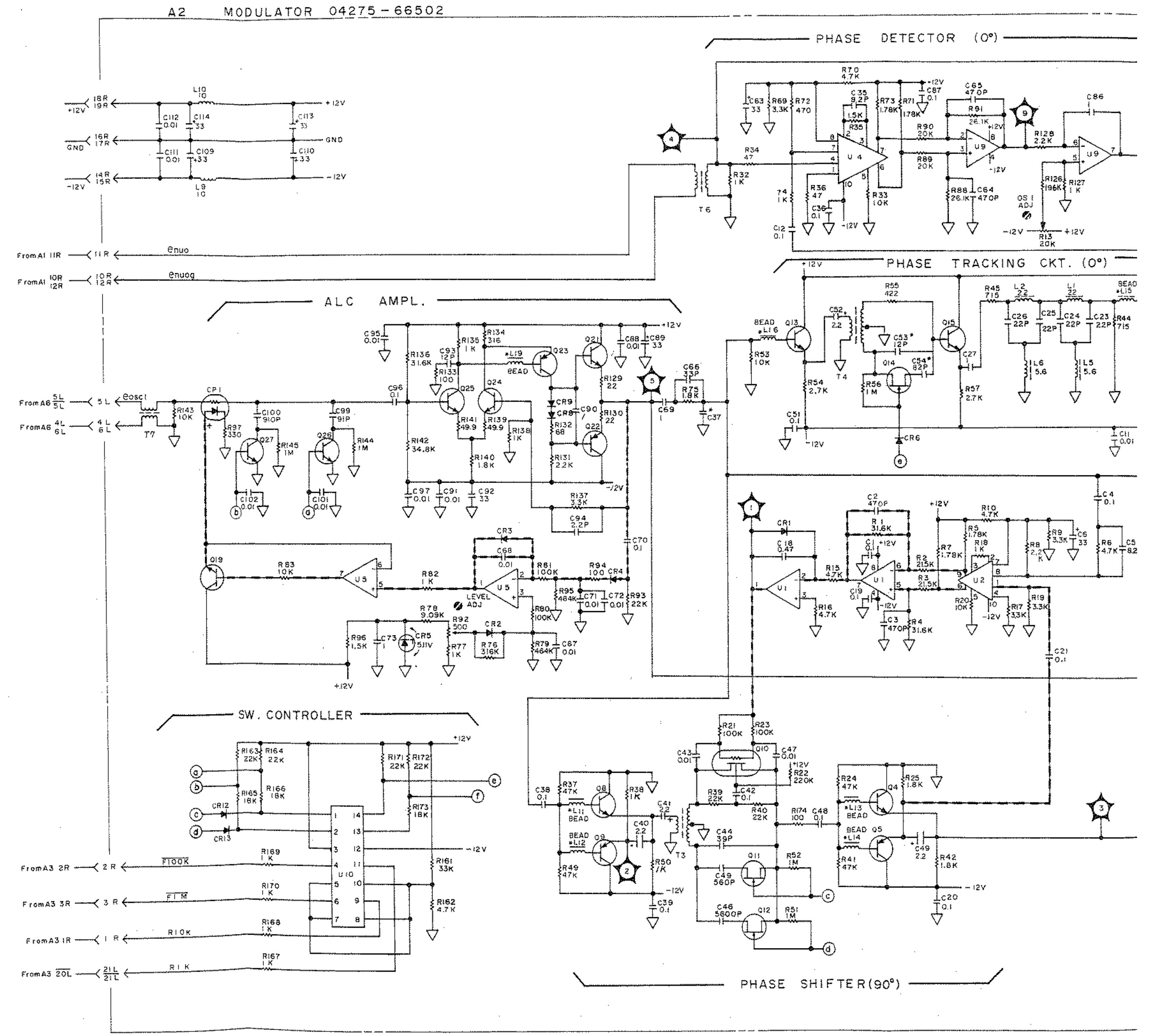


Figure 8-45. A2 Modulator Board Assembly Component Locations.


A2 MODULATOR 04275-66502
PHASE DETECTOR (0°)
PHASE TRACKING CKT. (0°)
ALC AMPL.
SW. CONTROLLER
PHASE SHIFTER(90°)
From A1 11R
From A1 10R 12R
From A6 5L
From A6 4L 6L
From A3 2R
From A3 3R
From A3 1R
From A3 20L
LEVEL ADJ
OS1 ADJ

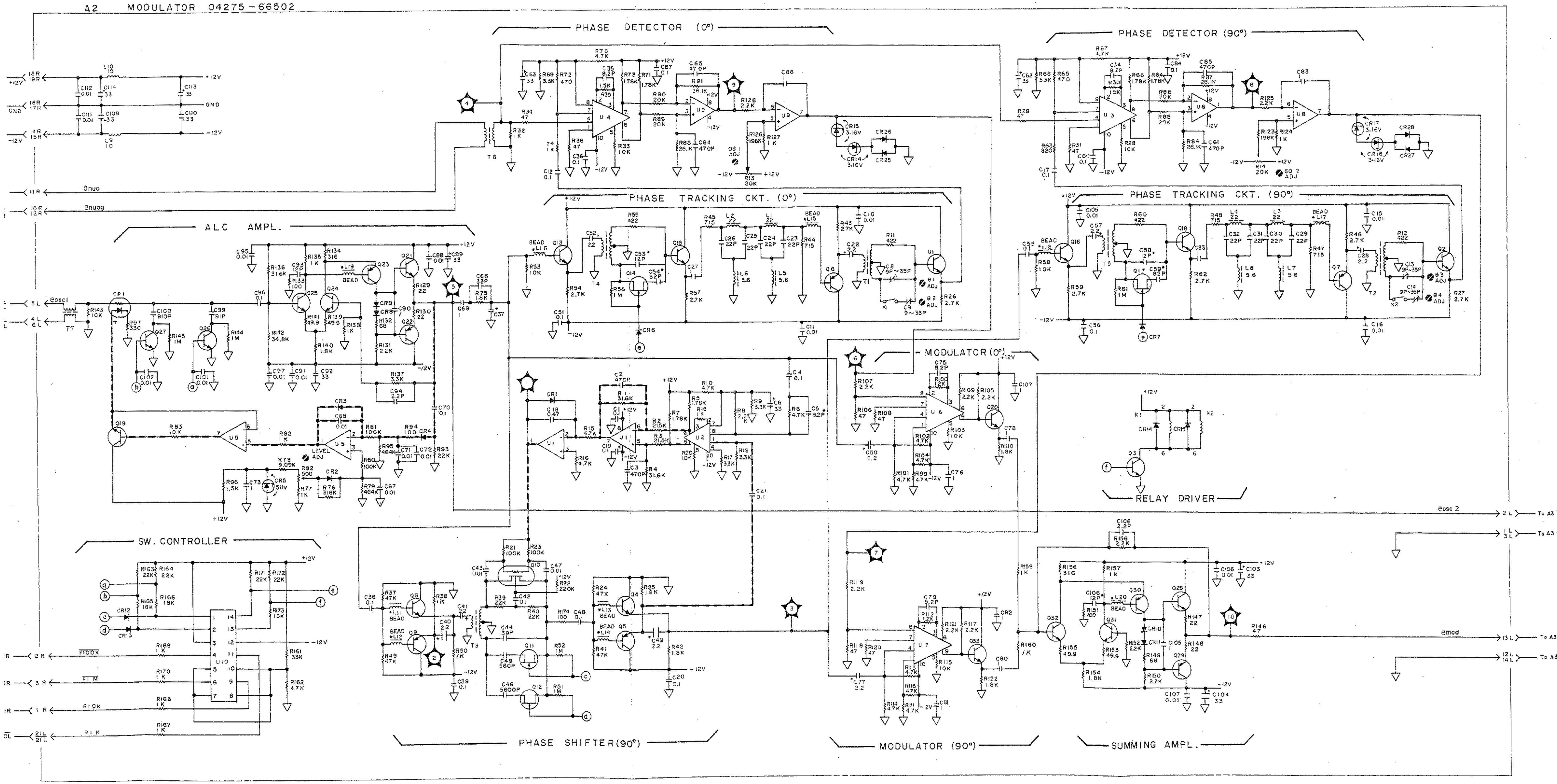


Figure 8-46. A2 Modulator Board Assembly Schematic Diagram.

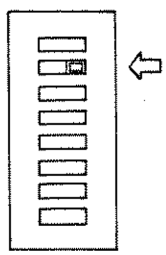
A3 Board Troubleshoohing Flow Diagram Notes.

1. If measurement error increases under CABLE LENGTH switch settings of either the "0" or "1 m" positions, first check Phase Delay circuit in accord with the tabulation below:

CABLE LENGTH setting	Q35 collector	K1	K2
0	12V	OFF	OFF
1 m	0V	ON	ON

2. If no dc bias can be applied to sample, check A3T3 for open-circuit.

3. To check level shifters and latch circuitry (A3U1 through U5), set DSA switch on A9 board (A9S1) as follows:



Set second bit switch to on
and the others to off.

Verify that periodic pulse waveforms can be observed at U4 and U5 outputs. If OK, observe waveforms at U1, U2 and U3 outputs (similar or inverted waveforms with respect to U4 and U5 outputs). After these checks are completed, reset the DSA switch to its normal position.

4. $\overline{\text{TLH}}$ and $\overline{\text{H100}}$ control signal logic is given in the table below:

	$\overline{\text{TLH}}$		*$\overline{\text{H100}}$	
MULTIPLIER setting	A3Q5	U1 pin 2	A3Q21	U1 pin 13
X1	OFF	-4V	OFF	-4V
X0.1	ON	+4.2V	ON	+4.2V
X0.01	ON	+4.2V	ON	+4.2V

* Activate SELF TEST function. Press REF VALUE STORE button. Press LCRZ RANGE UP or DOWN button until range code number 20 is displayed on DISPLAY B.

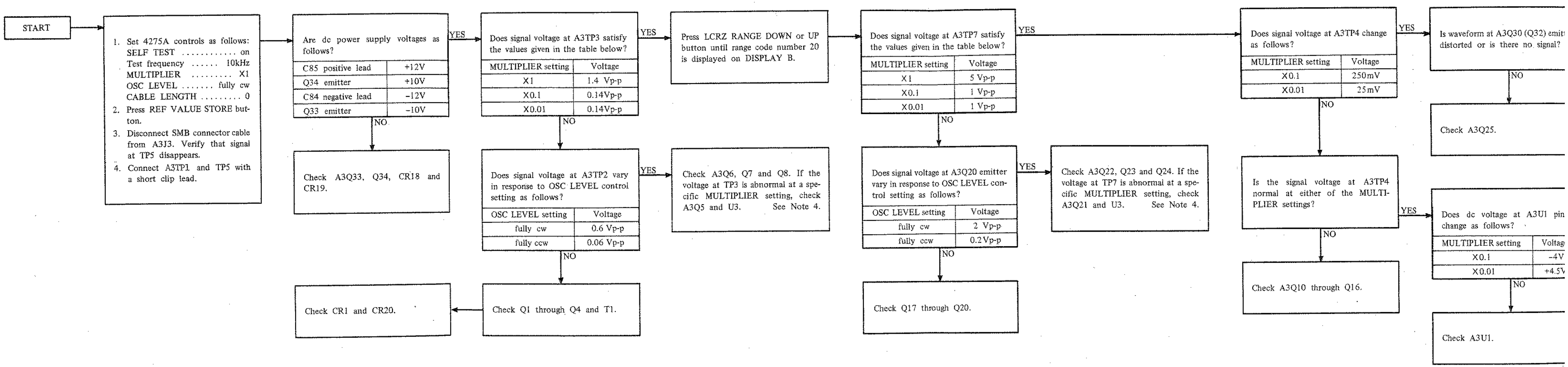
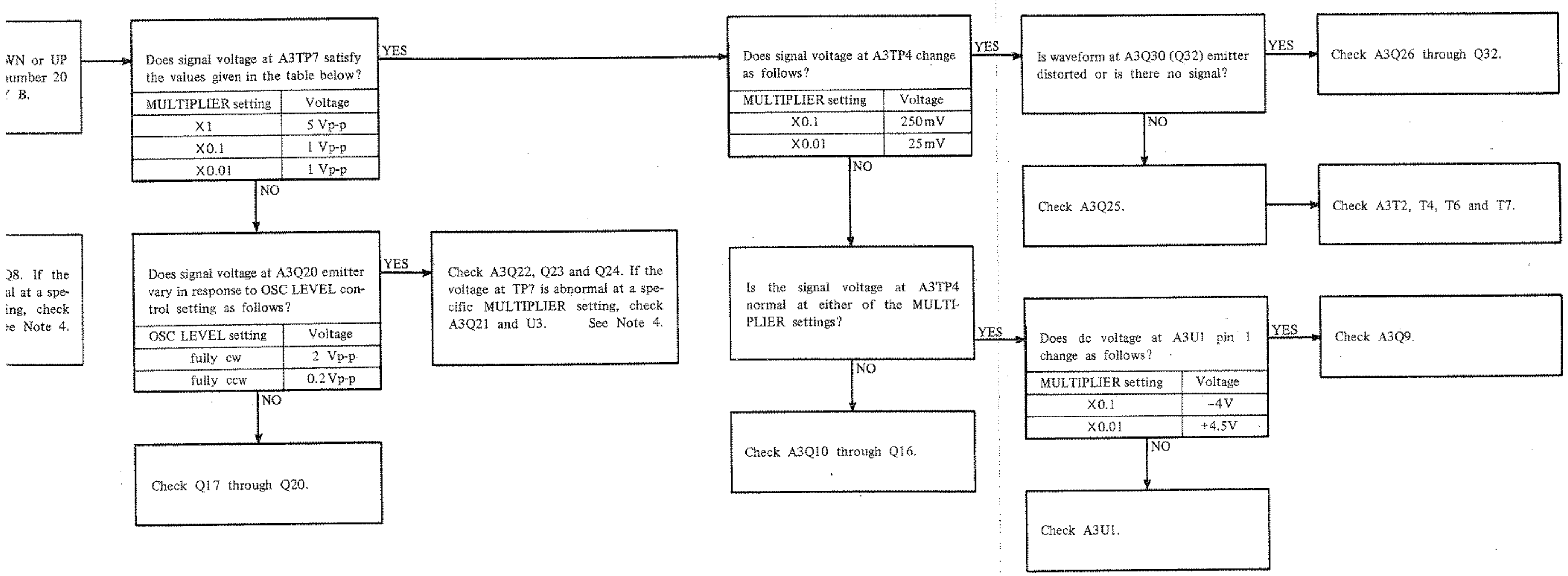


Figure 8-47. A3 Power Amplifier Board Troubleshooting Tree.



3 Power Amplifier Board Troubleshooting Tree.

A2 SEE INSIDE MODULATOR Service Sheet 2

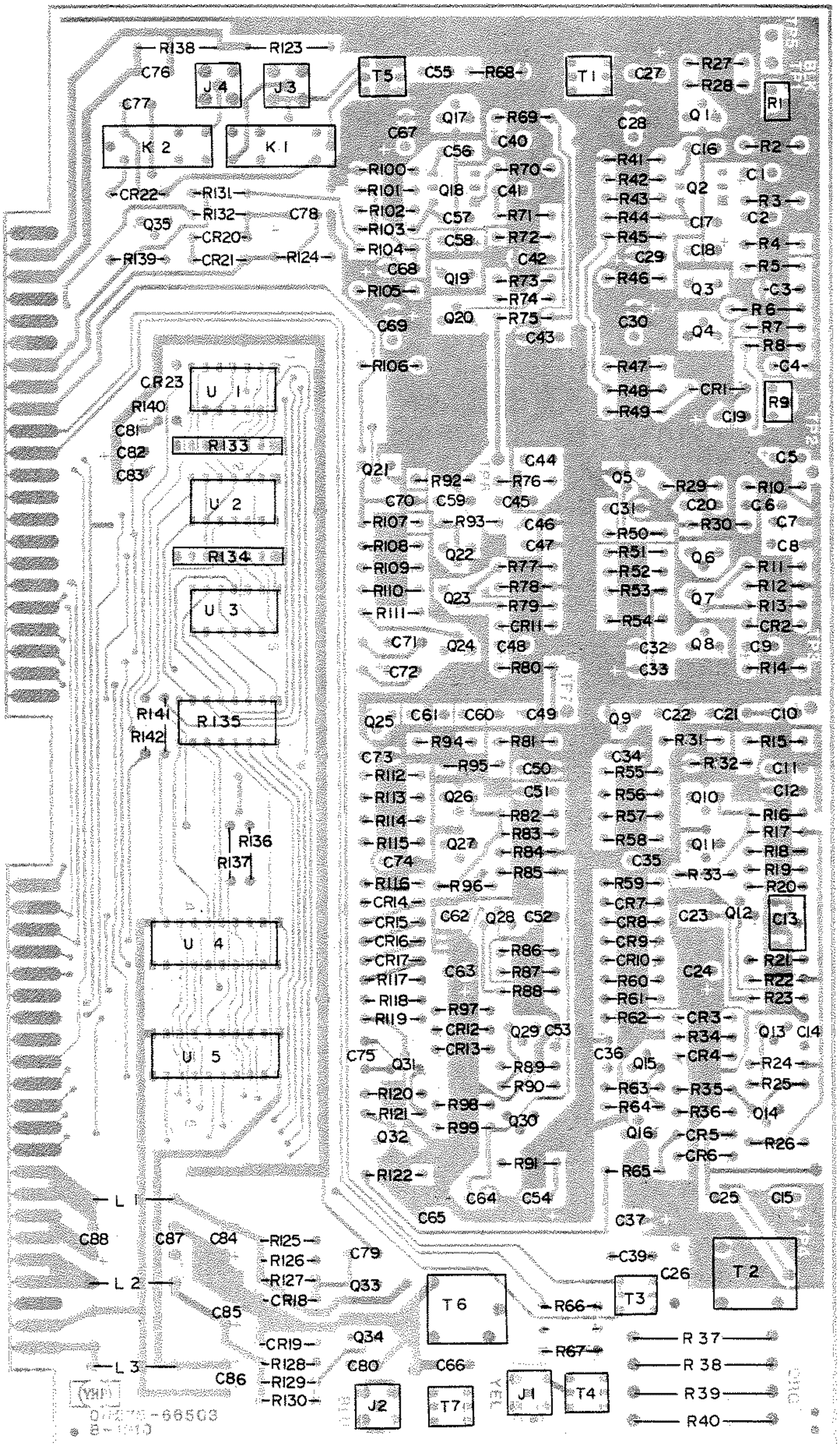


Figure 8-48. A3 Power Amplifier Board Assembly Component Locations.

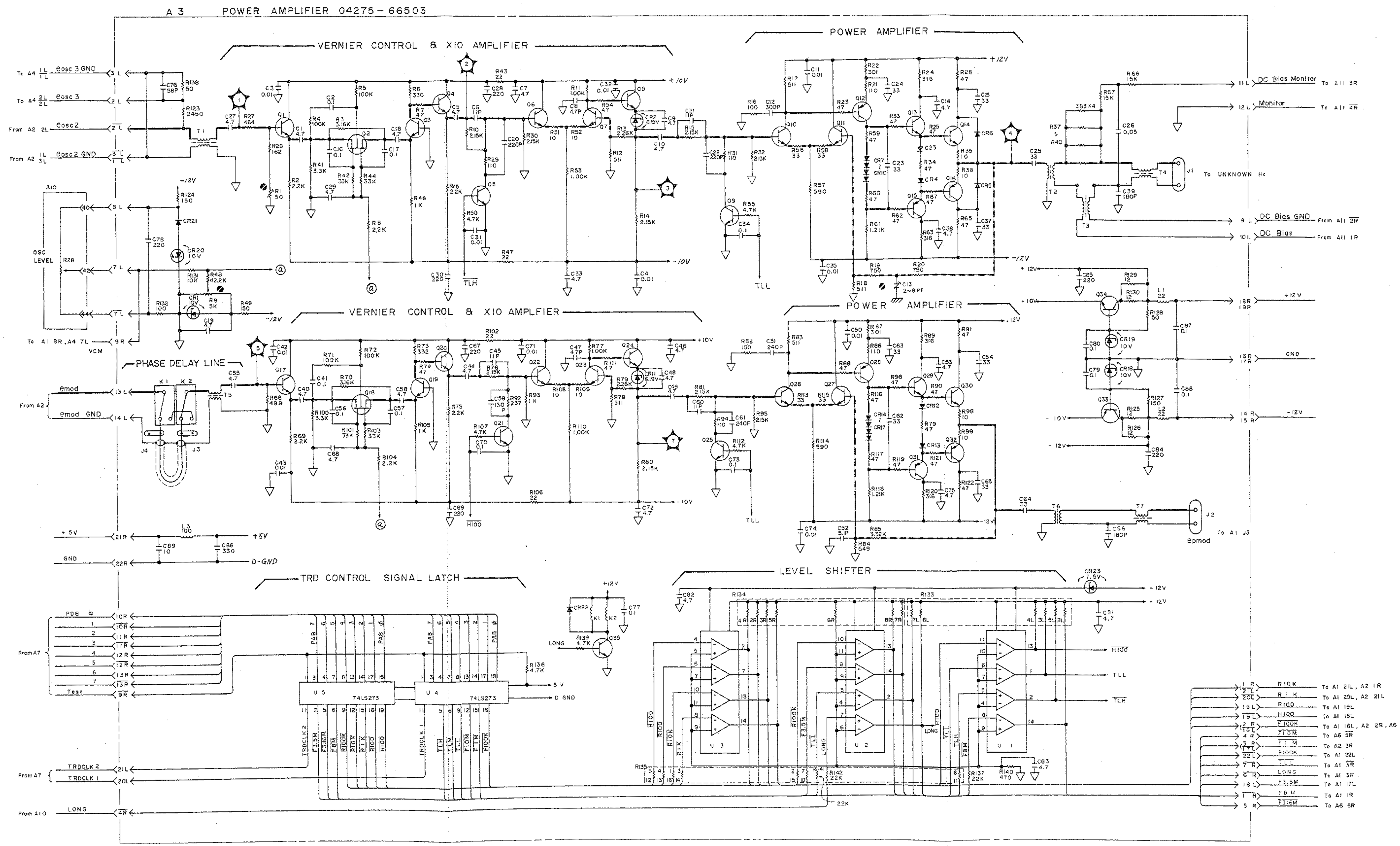


Figure 8-49. A3 Power Amplifier Board Assembly Schematic Diagram.

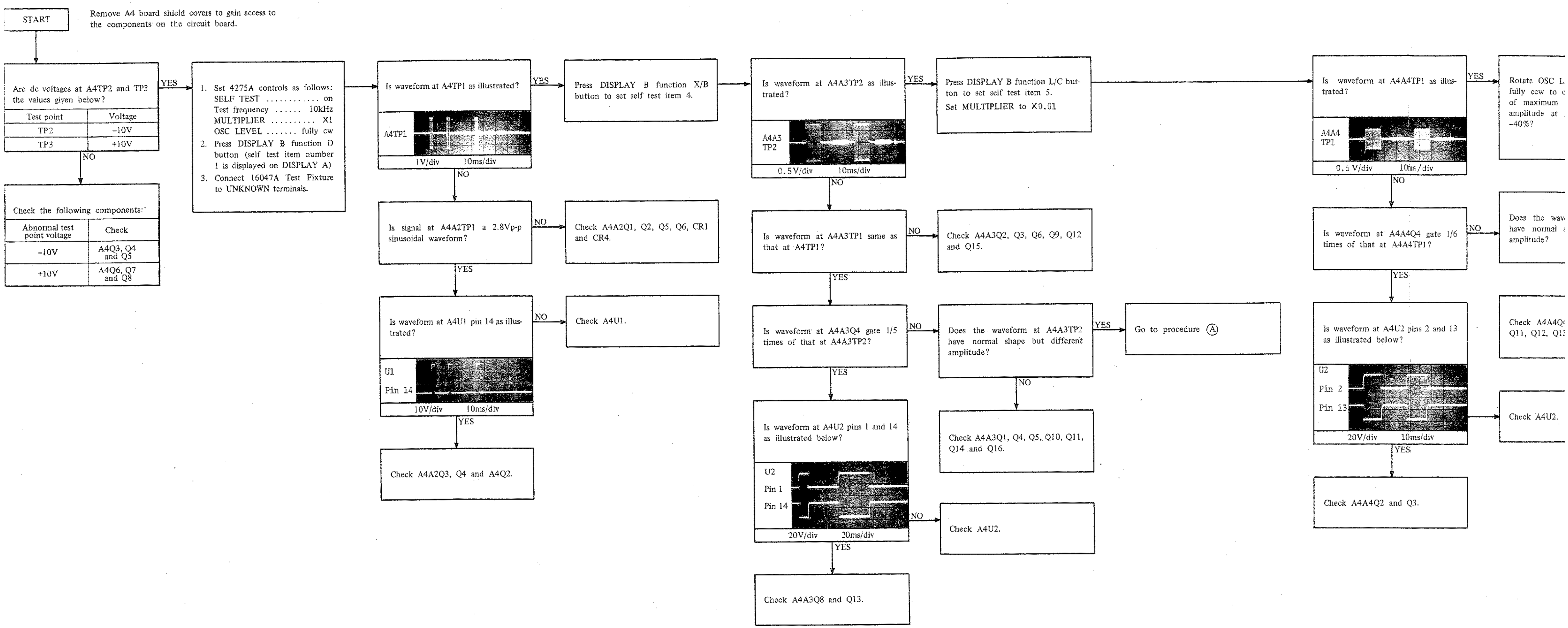


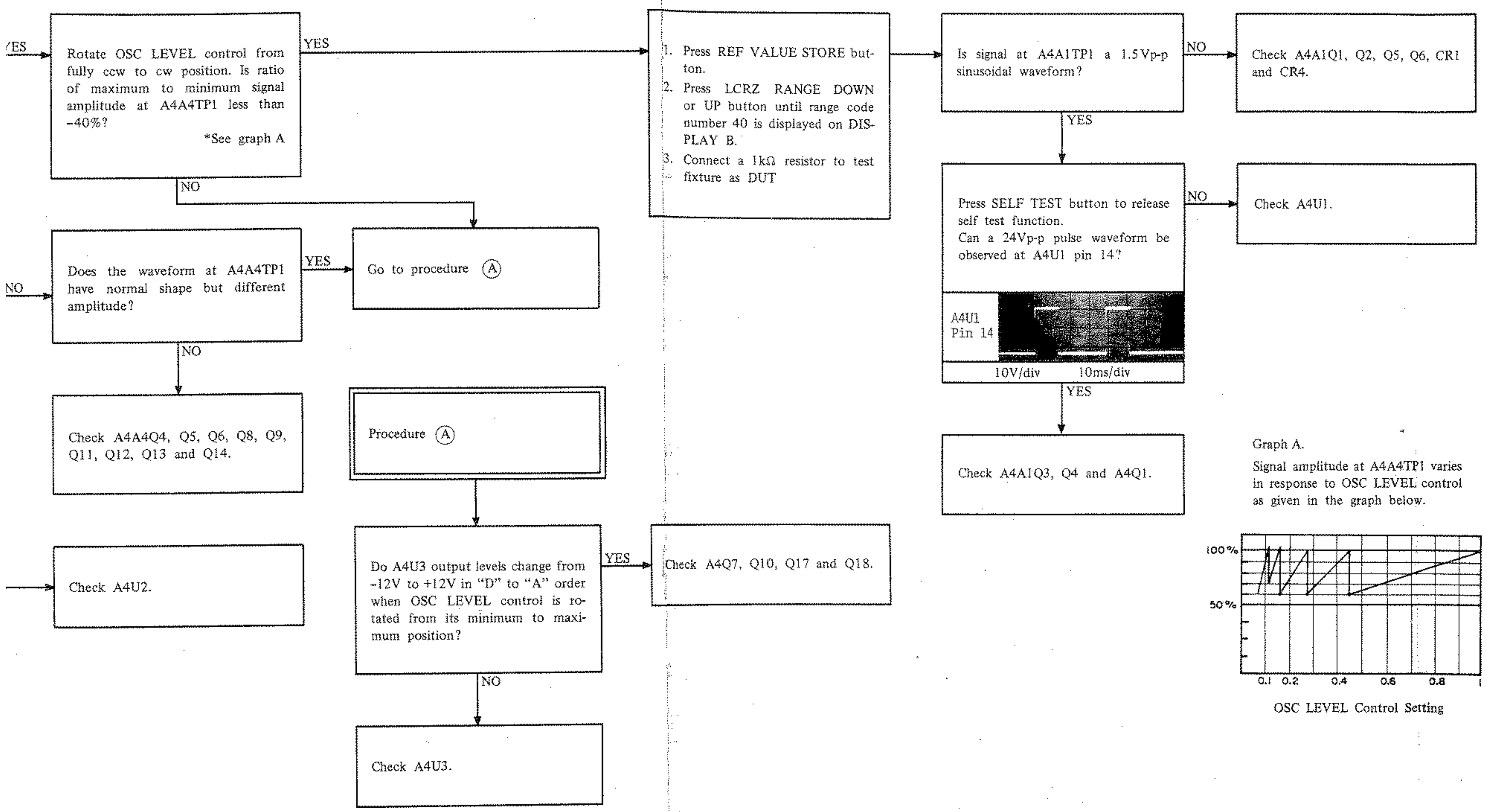
Figure 8-50. A4 Process Amplifier Board Troubleshooting Tree.

A4 Board Troubleshooting Flow Diagram Notes.

1. If measurement functions are normal but TEST SIG LEVEL CHECK function is faulty, first check that voltage at A4U1 pin 2 changes from −12V to +12V when TEST SIG LEVEL "V" or "mA" button is pusl normal, check A4Q9, Q10 and Q11.

2. If the waveform at A4TP1 shows a 20 mVp-p sinusoidal signal superposed on the normal signal, check (pin 2 should normally be at −12V).

3. Signal waveforms at A4Q7, Q10, Q17 and Q18 collector leads individually disappear when the respective tran turn on.



A3 POWER AMPLIFIER Service Sheet 3
SEE INSIDE

A4 Board Troubleshooting Flow Diagram Notes.

1. If measurement functions are normal but TEST SIG LEVEL CHECK function is faulty, first check that the dc voltage at A4U1 pin 2 changes from −12V to +12V when TEST SIG LEVEL "V" or "mA" button is pushed. If normal, check A4Q9, Q10 and Q11.

2. If the waveform at A4TP1 shows a 20 mVp-p sinusoidal signal superposed on the normal signal, check A4U1 (pin 2 should normally be at −12V).

3. Signal waveforms at A4Q7, Q10, Q17 and Q18 collector leads individually disappear when the respective transistors turn on.

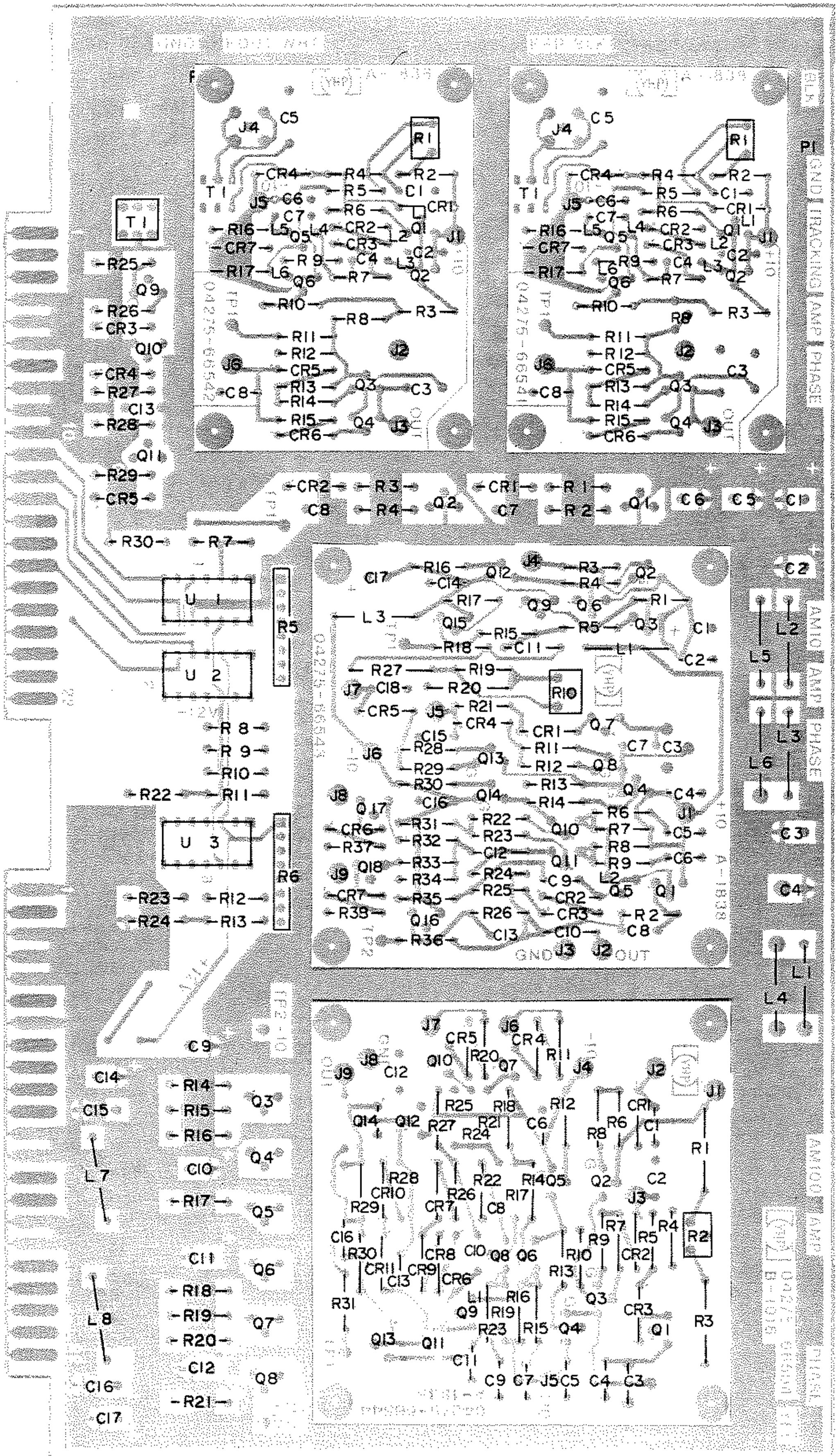


Figure 8-51. A4 Process Amplifier Board Assembly Component Locations.

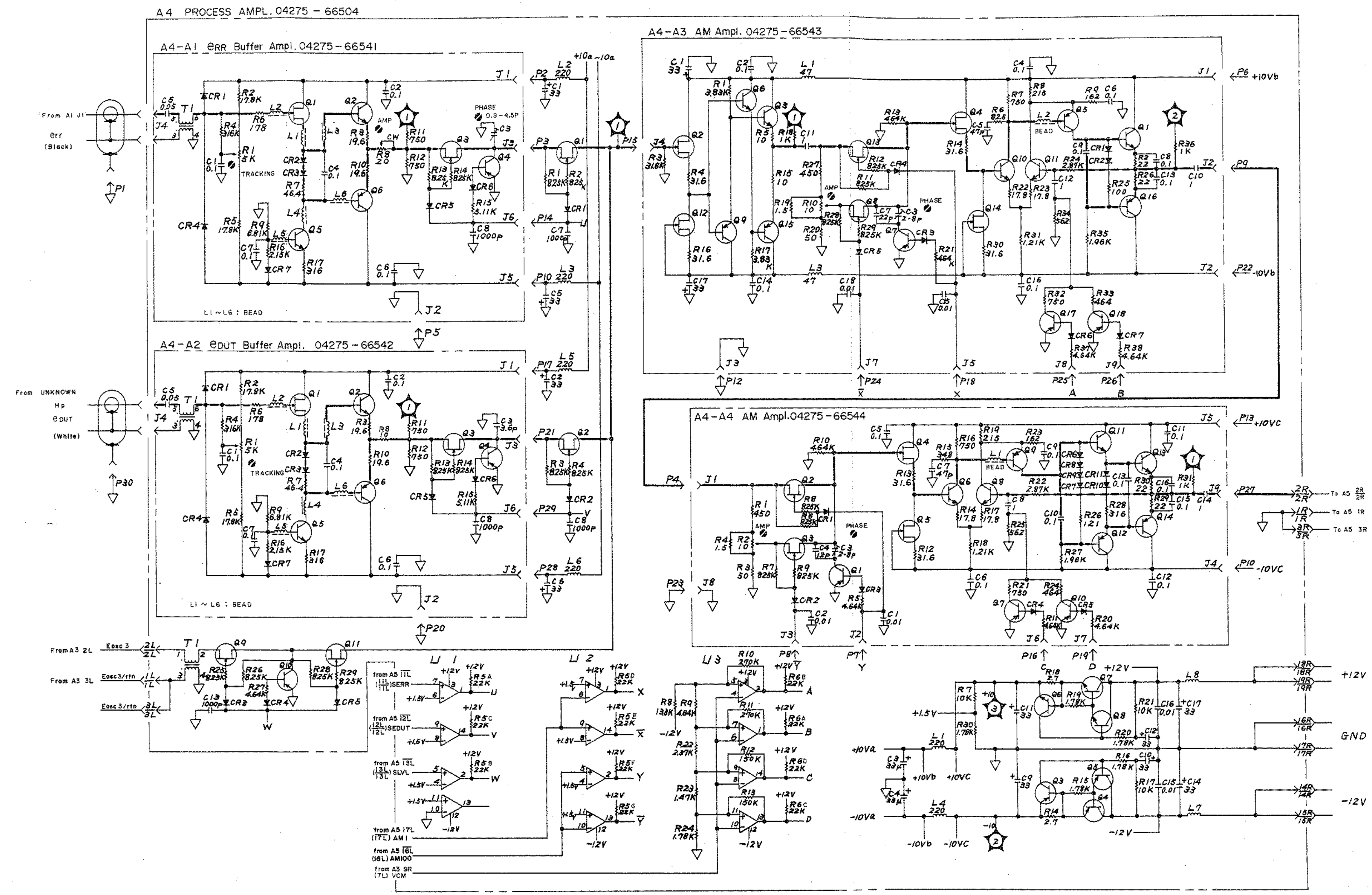


Figure 8-52. A4 Process Amplifier Board Assembly Schematic Diagram.

A5 Board Troubleshooting Flow Diagram Notes.

1. Connect A5TP11 to circuit common. Check that all "Q" outputs of flip flops U1 and U6 are at high level. These flip flops output 0V as high level (−5V as low level). This check allows locating the defective flip flop component with a 50% possibility.

2. Connect A5TP12 to circuit common. Check that all "Q" outputs of flip flops U4 and U9 are at high level. These flip flops outputs 0V as high level (−5V as low level). This check allows locating the defective flip flop with a 50% possibility.

3. A6U10 outputs a single pulse when the instrument is turned on or test frequency setting is changed. The pulse width is equal to that of 8f input signal (at A5J1). This signal synchronizes the phase detector detection signals with the oscillator signal (of A6 board) to enhance stability of the measurement results at high frequencies (in MHz region). If this circuit fails, measurement display output will sometimes differ approximately 0.5% (at 10 MHz) when the test frequency is changed and is again set to the preceding frequency.

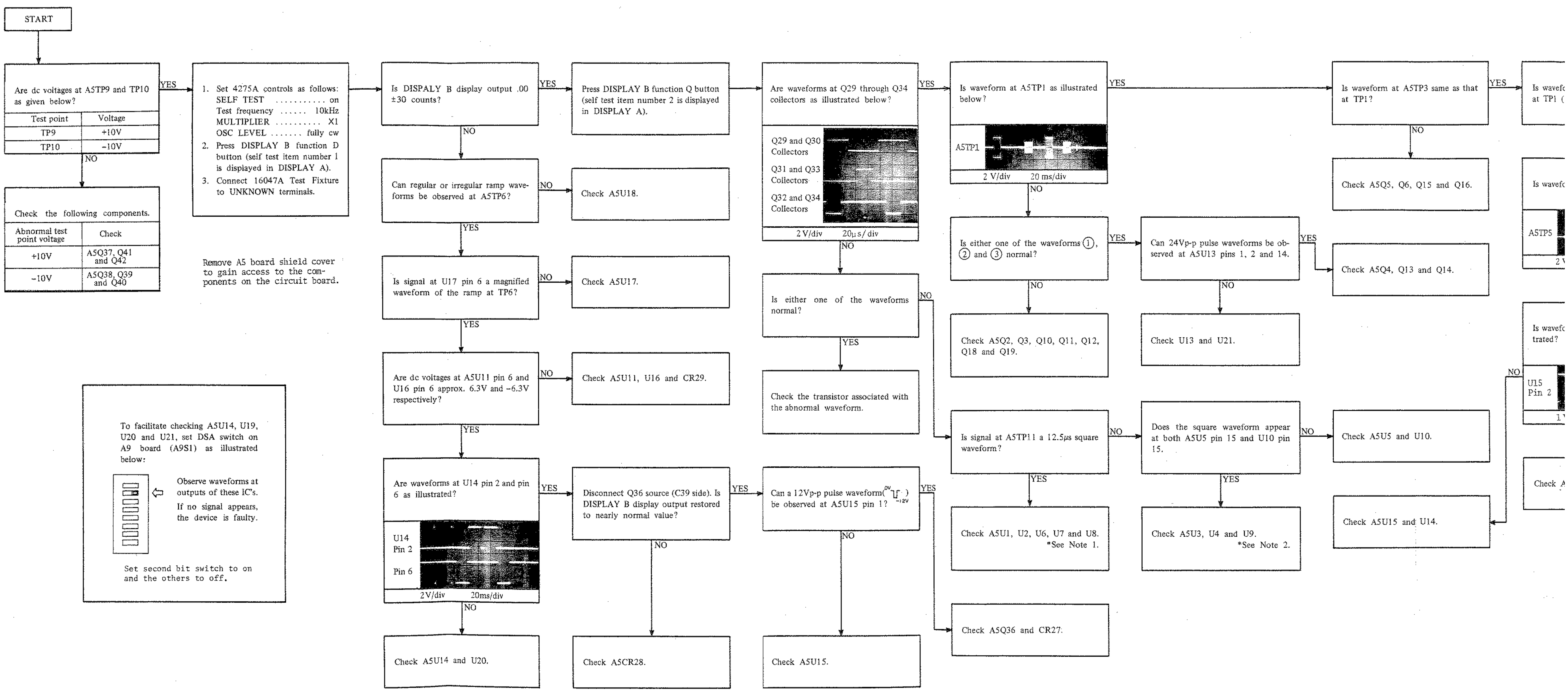


Figure 8-53. A5 A-D Converter Board Troubleshooting Tree.

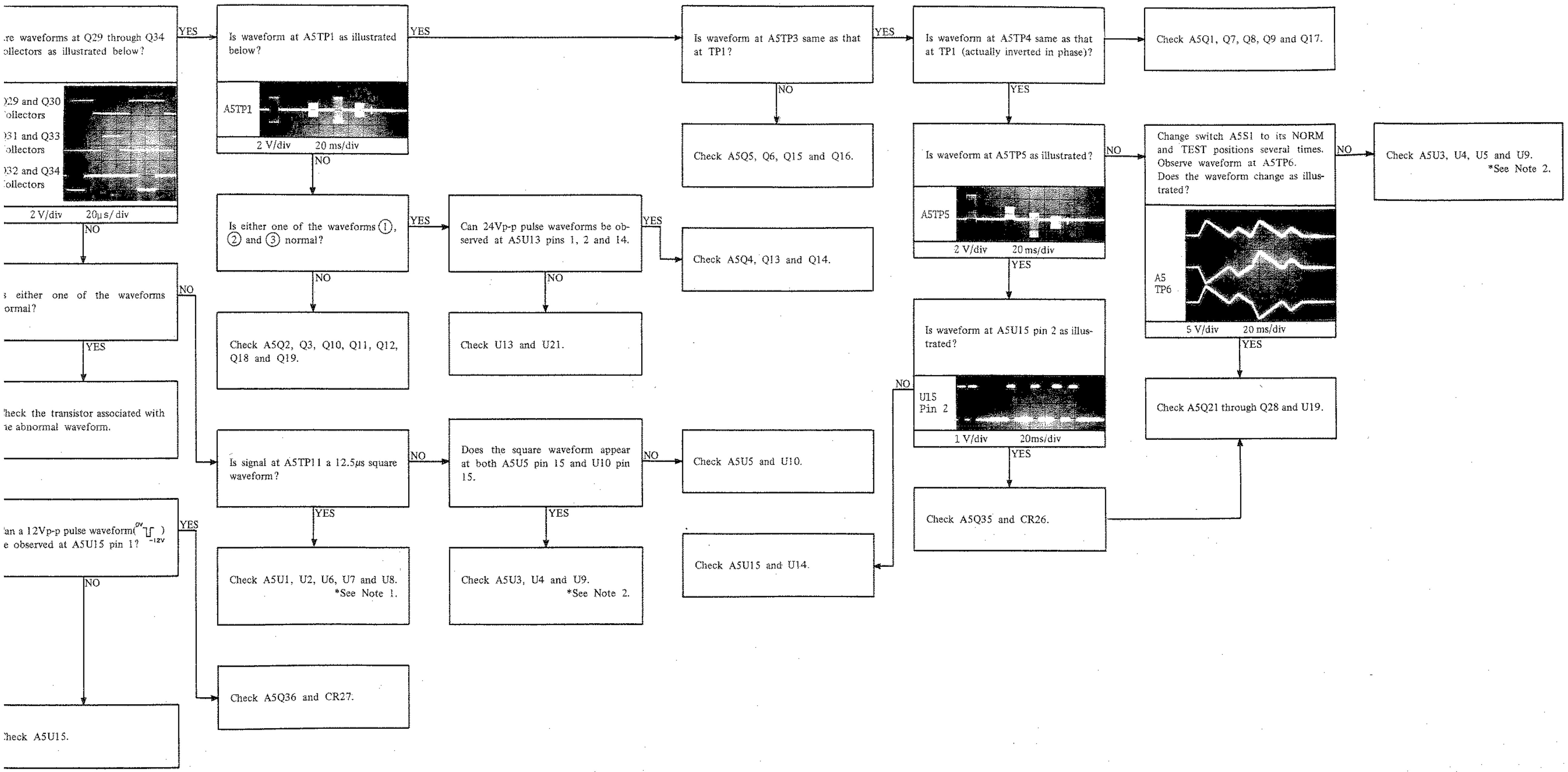


Figure 8-53. A5 A-D Converter Board Troubleshooting Tree.

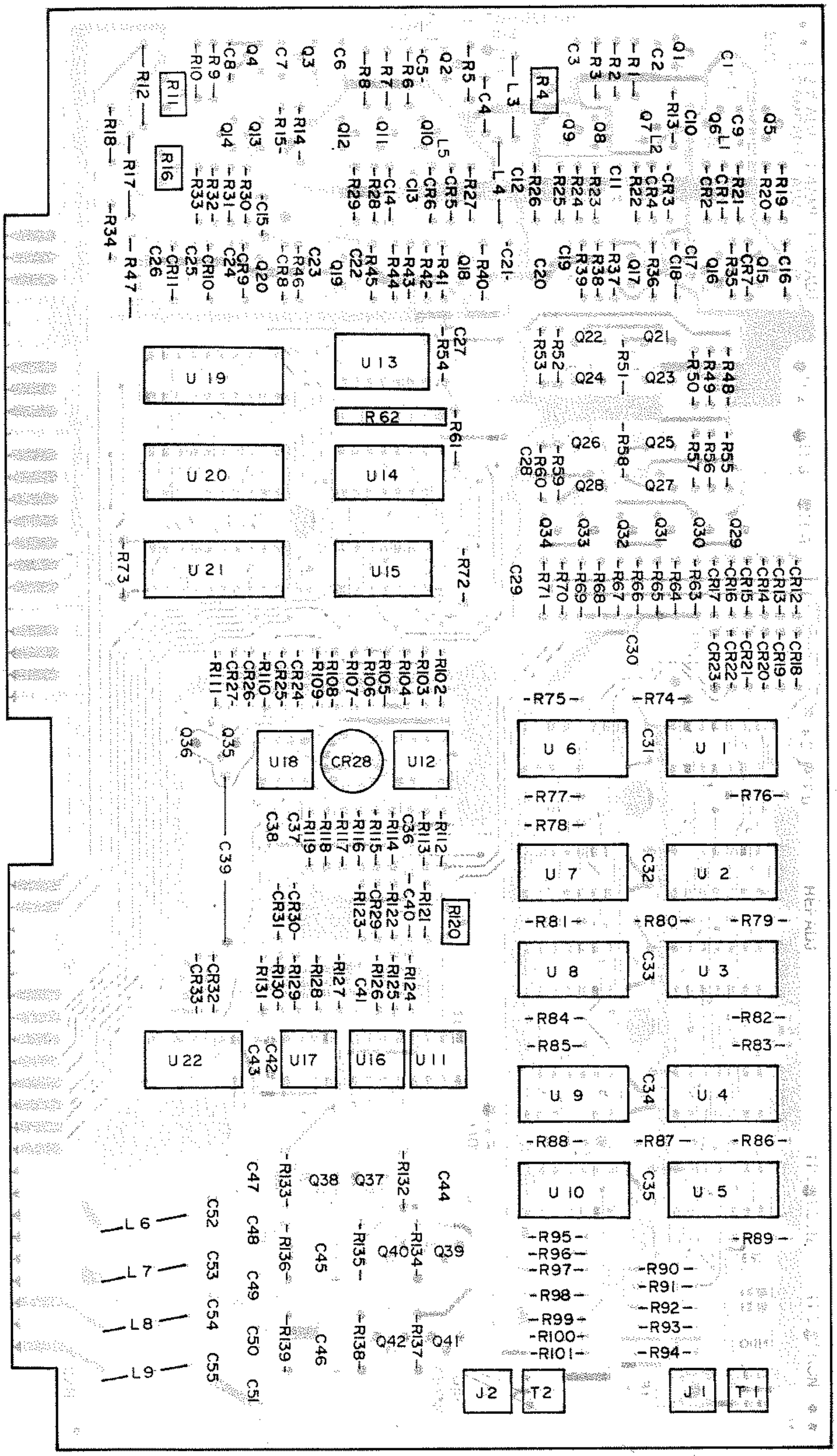


Figure 8-54. A5 A-D Converter Board Assembly Component Locations.

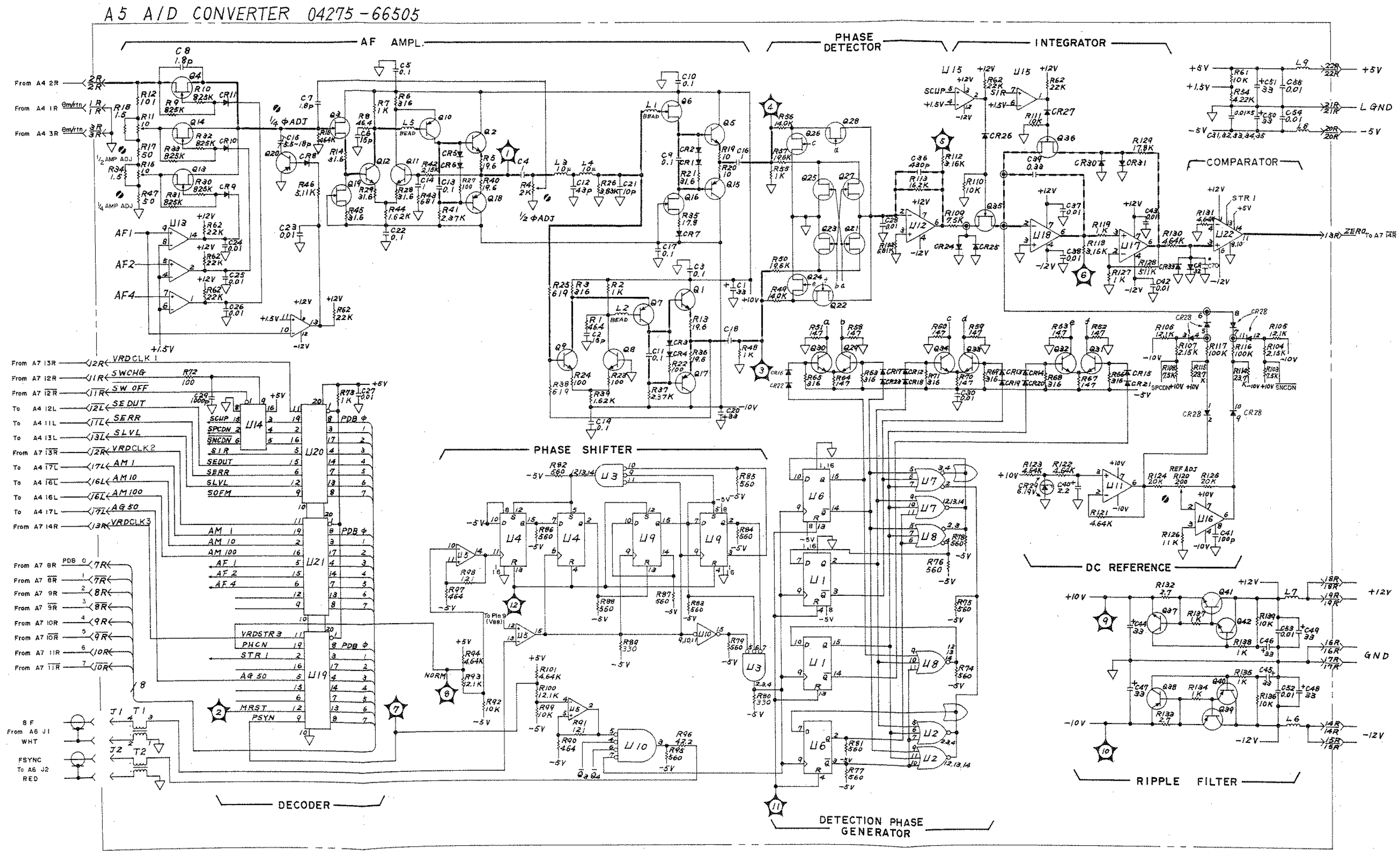


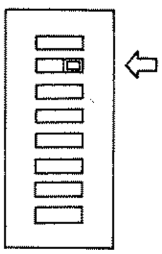
Figure 8-55. A5 A-D Converter Board Assembly Schematic Diagram.

A6 Board Troubleshooting Flow Diagram Notes.

1. A6U16 control input logic (at pins 7 and 9) is given in the table below:

Test frequency	U16 pin 7	U16 pin 9
10 kHz	H	H
20 kHz, 40 kHz (30 kHz, 50 kHz) and 100 kHz	L	H
200 kHz, 400 kHz (300 kHz, 500 kHz) and 1 MHz	H	L
2 MHz, 4 MHz (3 MHz, 5 MHz) and 10 MHz	L	L

2. To facilitate checking operation of A6U5 decoder, set DSA switch (A9S1) on A9 board as illustrated below:



Set second bit switch to on and the others to off.

Check that periodic pulse waveforms appear at U5 output pins.

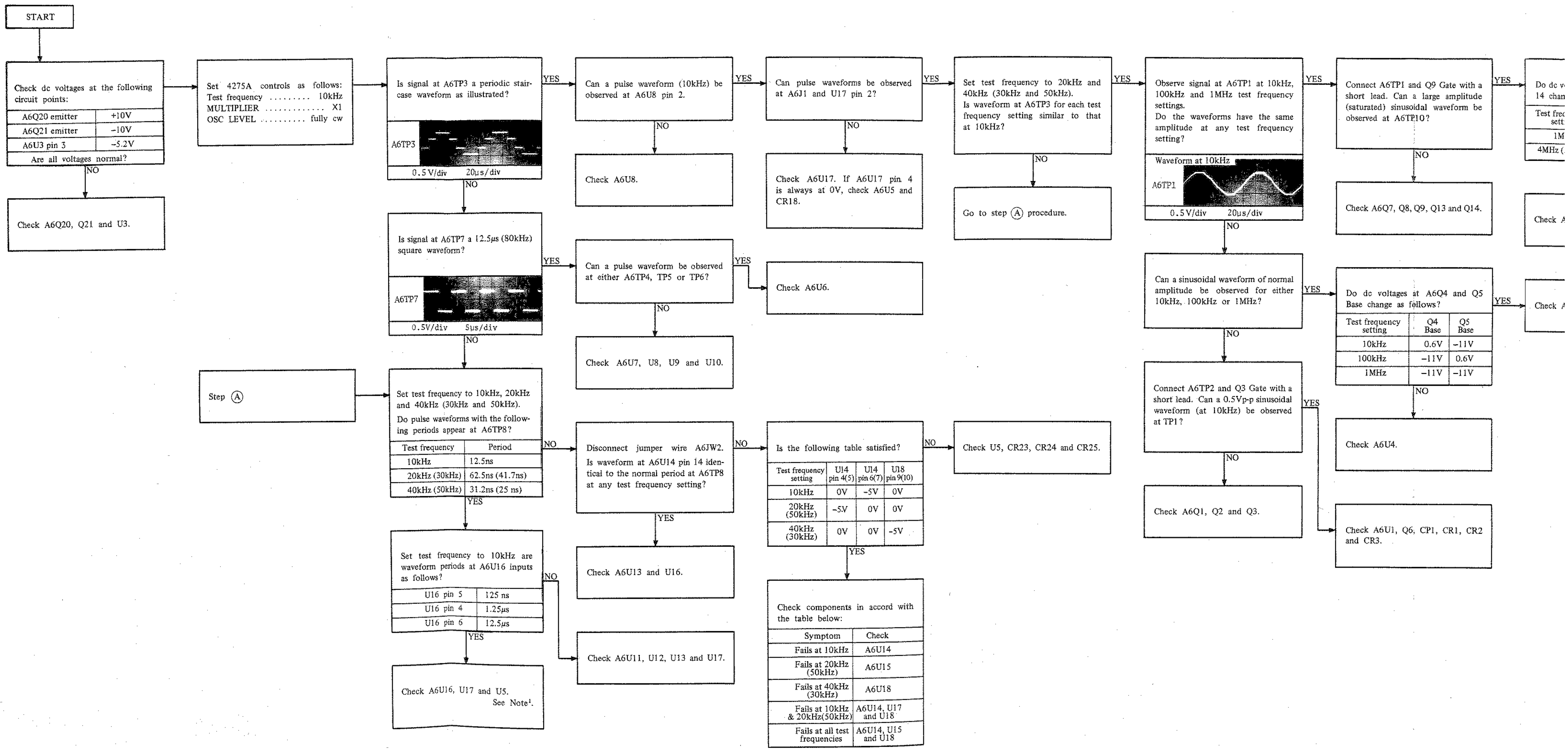


Figure 8-56. A6 Oscillator Board Troubleshooting Tree.

Can pulse waveforms be observed at A6J1 and U17 pin 2?

YES → Set test frequency to 20kHz and 40kHz (30kHz and 50kHz). Is waveform at A6TP3 for each test frequency setting similar to that at 10kHz?

NO → Check A6U17. If A6U17 pin 4 is always at 0V, check A6U5 and CR18.

Check A6U6.

Set test frequency to 20kHz and 40kHz (30kHz and 50kHz). Is waveform at A6TP3 for each test frequency setting similar to that at 10kHz?

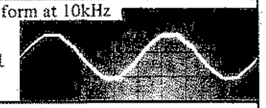
YES → Observe signal at A6TP1 at 10kHz, 100kHz and 1MHz test frequency settings. Do the waveforms have the same amplitude at any test frequency setting?

NO → Go to step (A) procedure.

Observe signal at A6TP1 at 10kHz, 100kHz and 1MHz test frequency settings. Do the waveforms have the same amplitude at any test frequency setting?

Waveform at 10kHz

A6TP1



0.5 V/div 20μs/div

YES → Connect A6TP1 and Q9 Gate with a short lead. Can a large amplitude (saturated) sinusoidal waveform be observed at A6TP10?

NO → Can a sinusoidal waveform of normal amplitude be observed for either 10kHz, 100kHz or 1MHz?

Can a sinusoidal waveform of normal amplitude be observed for either 10kHz, 100kHz or 1MHz?

YES → Do dc voltages at A6Q4 and Q5 Base change as follows?

NO → Connect A6TP2 and Q3 Gate with a short lead. Can a 0.5Vp-p sinusoidal waveform (at 10kHz) be observed at TP1?

Connect A6TP2 and Q3 Gate with a short lead. Can a 0.5Vp-p sinusoidal waveform (at 10kHz) be observed at TP1?

YES → Check A6U1, Q6, CP1, CR1, CR2 and CR3.

NO → Check A6Q1, Q2 and Q3.

Connect A6TP1 and Q9 Gate with a short lead. Can a large amplitude (saturated) sinusoidal waveform be observed at A6TP10?

YES → Do dc voltages at A6U4 pins 13 and 14 change as follows?

NO → Check A6Q7, Q8, Q9, Q13 and Q14.

Do dc voltages at A6Q4 and Q5 Base change as follows?

Test frequency setting	Q4 Base	Q5 Base
10kHz	0.6V	-11V
100kHz	-11V	0.6V
1MHz	-11V	-11V

YES → Check A6Q4 and Q5.

NO → Check A6U4.

Do dc voltages at A6U4 pins 13 and 14 change as follows?

Test frequency setting	U4 pin 13	U4 pin 14
1MHz	-12V	+12V
4MHz (5MHz)	+12V	-12V

YES → Does a large amplitude waveform appear at A6Q19 emitter at both 1MHz and 4MHz (5MHz)?

NO → Check A6U4.

Does a large amplitude waveform appear at A6Q19 emitter at both 1MHz and 4MHz (5MHz)?

YES → Remove short lead. Is waveform at A6TP10 approximately 1.4Vp-p for either 10kHz, 100kHz or 1MHz?

NO → Check components given in the table depending on the symptom.

Symptom	Check
faulty at 1MHz	A6Q18
faulty at 4MHz (5MHz)	A6Q15, Q16 and Q17
faulty at both frequencies	A6Q19

Remove short lead. Is waveform at A6TP10 approximately 1.4Vp-p for either 10kHz, 100kHz or 1MHz?

YES → Check A6Q10 and Q11.

NO → Check A6U2, Q12, CP2, CR8, CR9 or CR10.

Is the following table satisfied?

Test frequency setting	U14 pin 4(5)	U14 pin 6(7)	U18 pin 9(10)
10kHz	0V	-5V	0V
20kHz (50kHz)	-5V	0V	0V
40kHz (30kHz)	0V	0V	-5V

NO → Check U5, CR23, CR24 and CR25.

YES → Check components in accord with the table below:

Symptom	Check
Fails at 10kHz	A6U14
Fails at 20kHz (50kHz)	A6U15
Fails at 40kHz (30kHz)	A6U18
Fails at 10kHz & 20kHz(50kHz)	A6U14, U17 and U18
Fails at all test frequencies	A6U14, U15 and U18

Figure 8-56. A6 Oscillator Board Troubleshooting Tree.

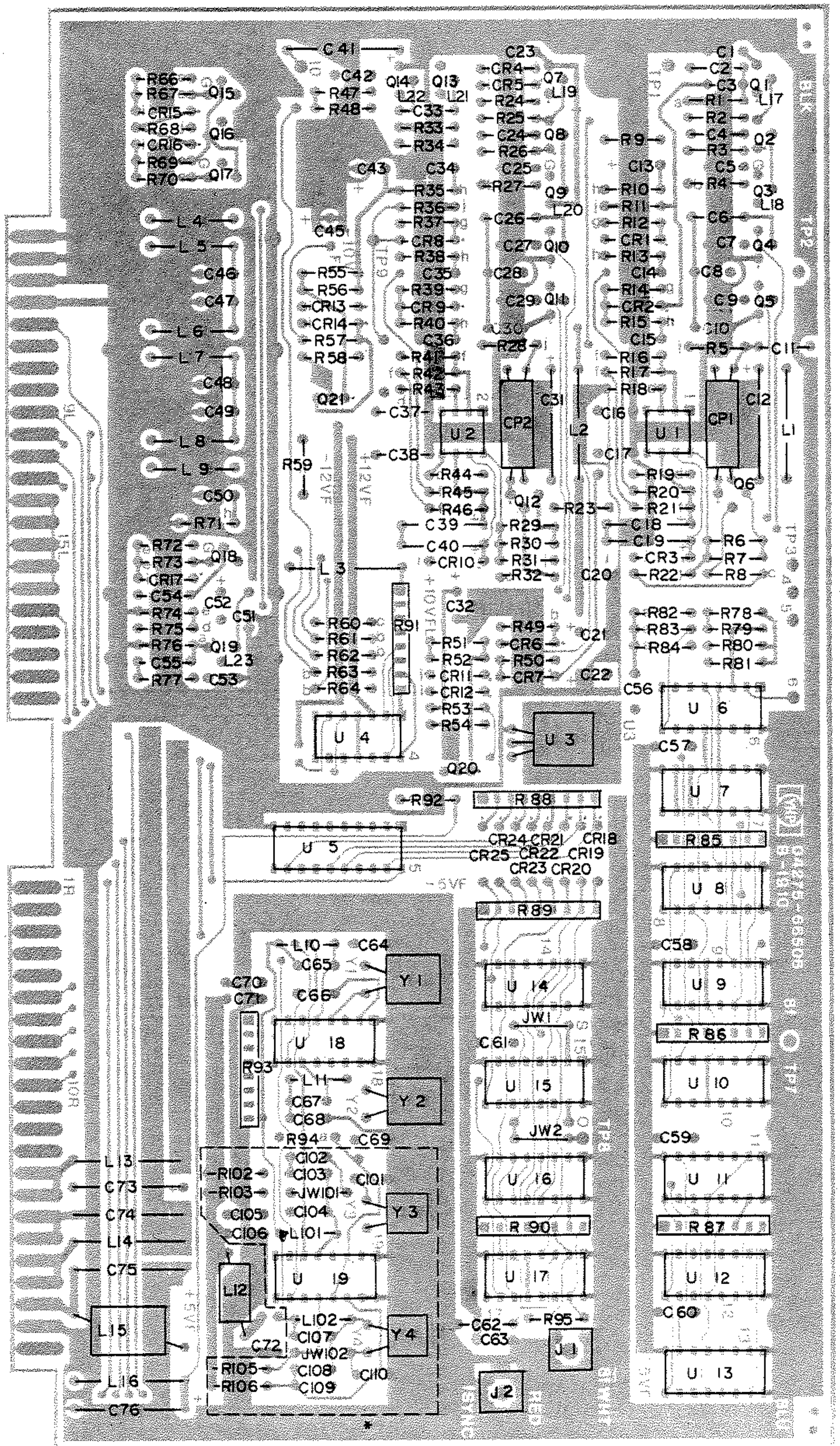


Figure 8-57. A6 Oscillator Board Assembly Component Locations.

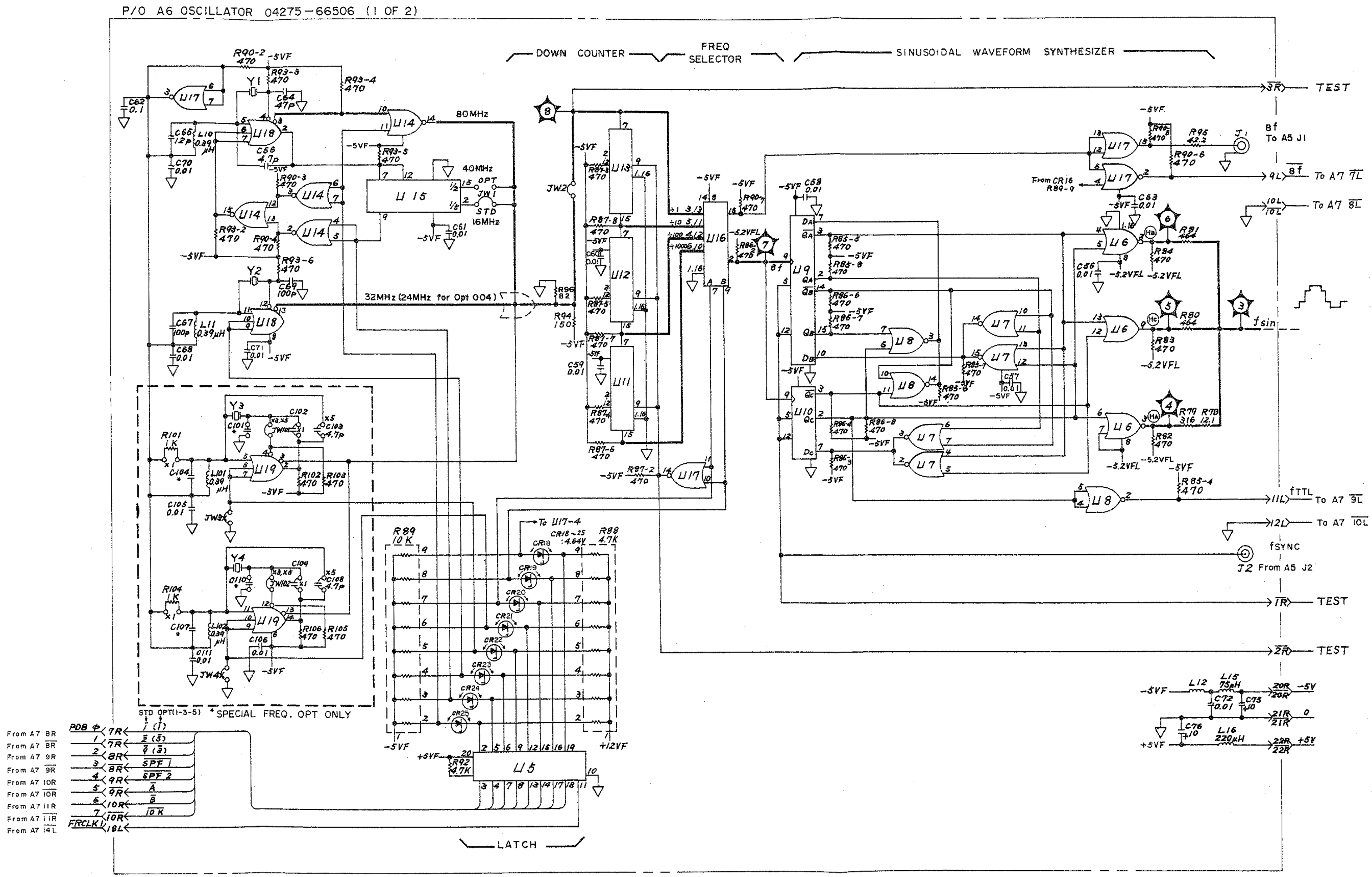
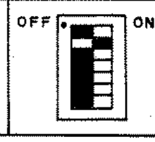
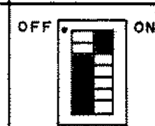


Figure 8-58(A). A6 Oscillator Board Assembly Schematic Diagram (Sheet 1 of 2).

Signature Connections Window (+5V): U216

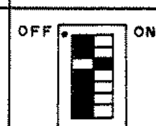
DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA- 2 PIA/LATCH	A9Tp-13	A9Tp-13	A9Tp-7	

Signature Connections Window (+5V): UH5U

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA- 3	A9Tp-13	A9Tp-13	A9Tp-7	

Other Settings:
- Remove A6 ASSY.
- Connect TP12 to GRD with shorting clip.
- Connect TP20 to TP23 with shorting clip.
- Remove A7W4 one side.
- Remove A7U14 from the socket.

Signature Connections Window (+5V): 8C0A

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA- 4 TIMER COUNTER	A9Tp-13	A9Tp-13	A9Tp-7	

Other Settings:
- Remove A6 ASSY.
- Connect TP12 to GRD with shorting clip.
- Connect A7TP2 to A7TP4 with shorting clip.
- Remove A7U14 from the socket.

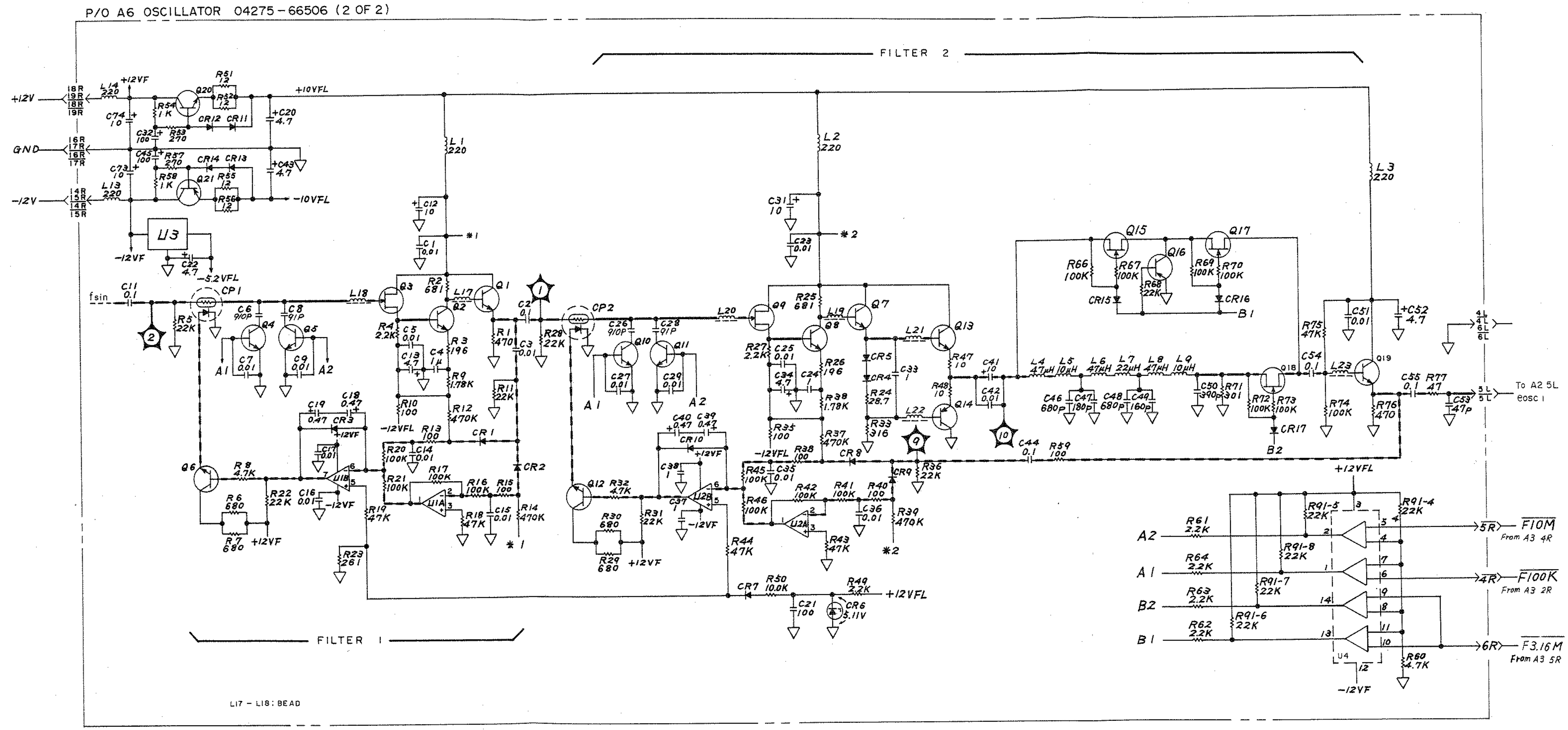


Figure 8-58(B). A6 Oscillator Board Assembly Schematic Diagram (Sheet 2 of 2).

A6 SEE INSIDE
OSCILLATOR
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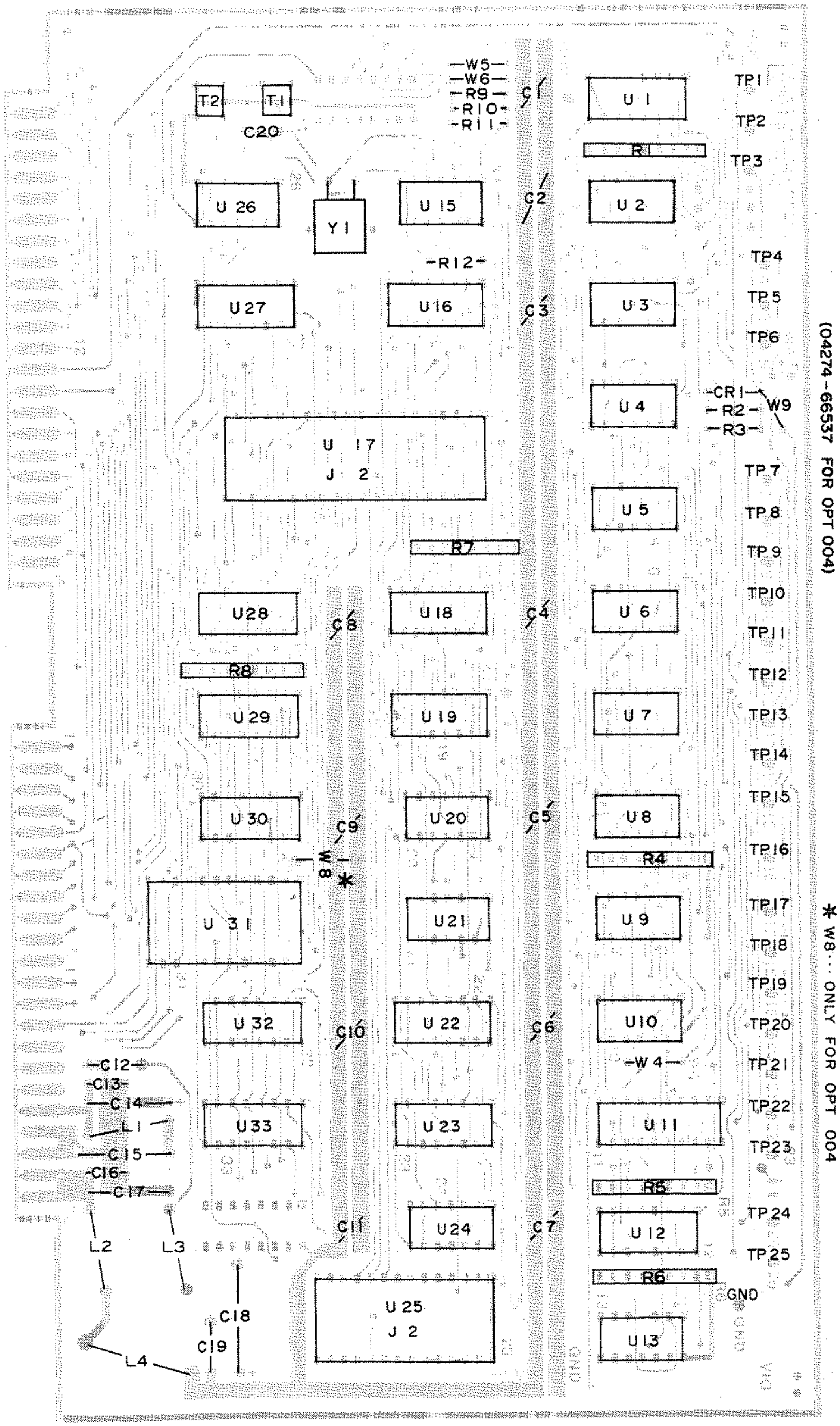
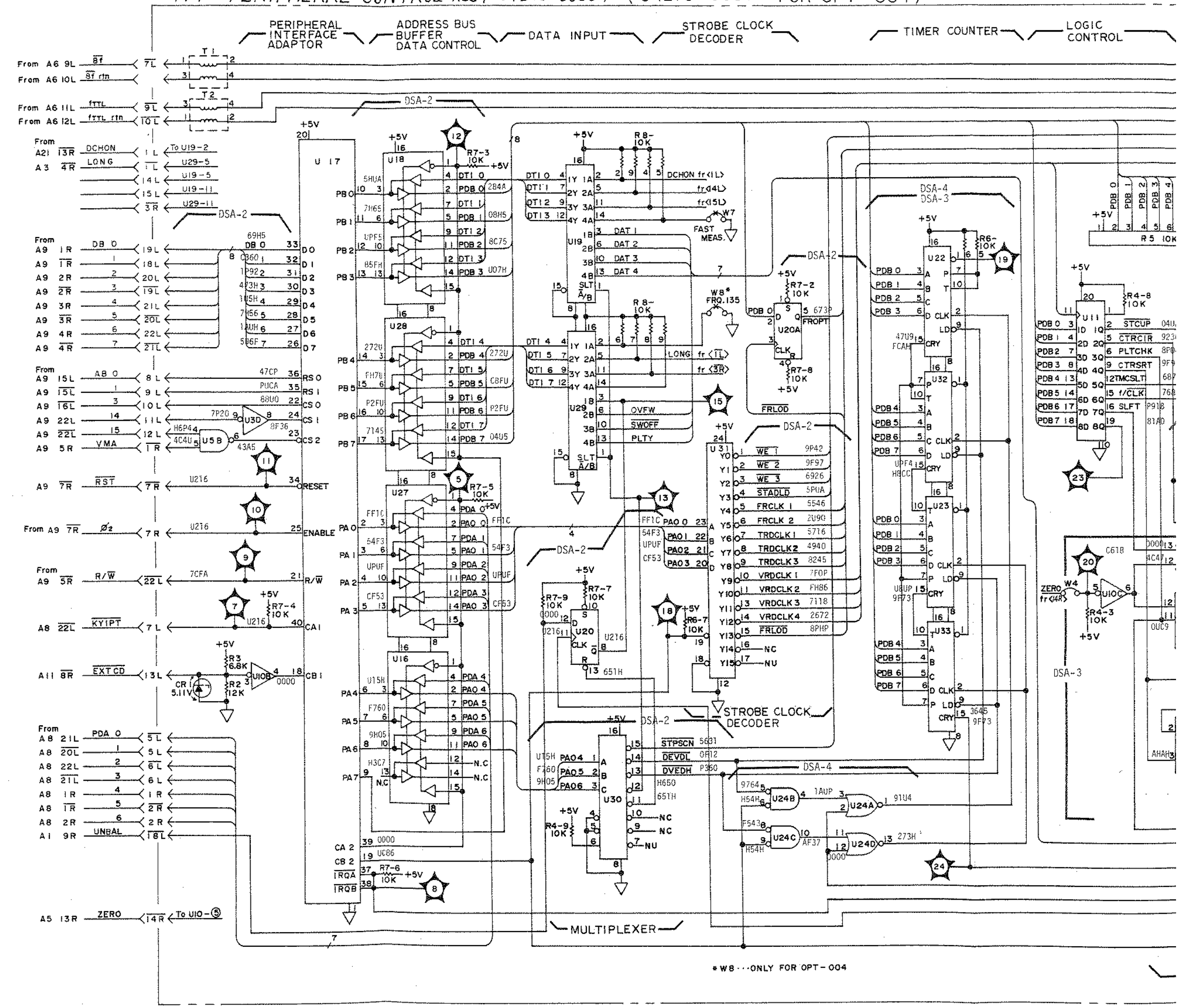


Figure 8-59. A7 Peripheral Control Board Assembly Component Locations.

A7 PERIPHERAL CONTROL ASSY 04275-66507 (04275-66537 FOR OPT-004)



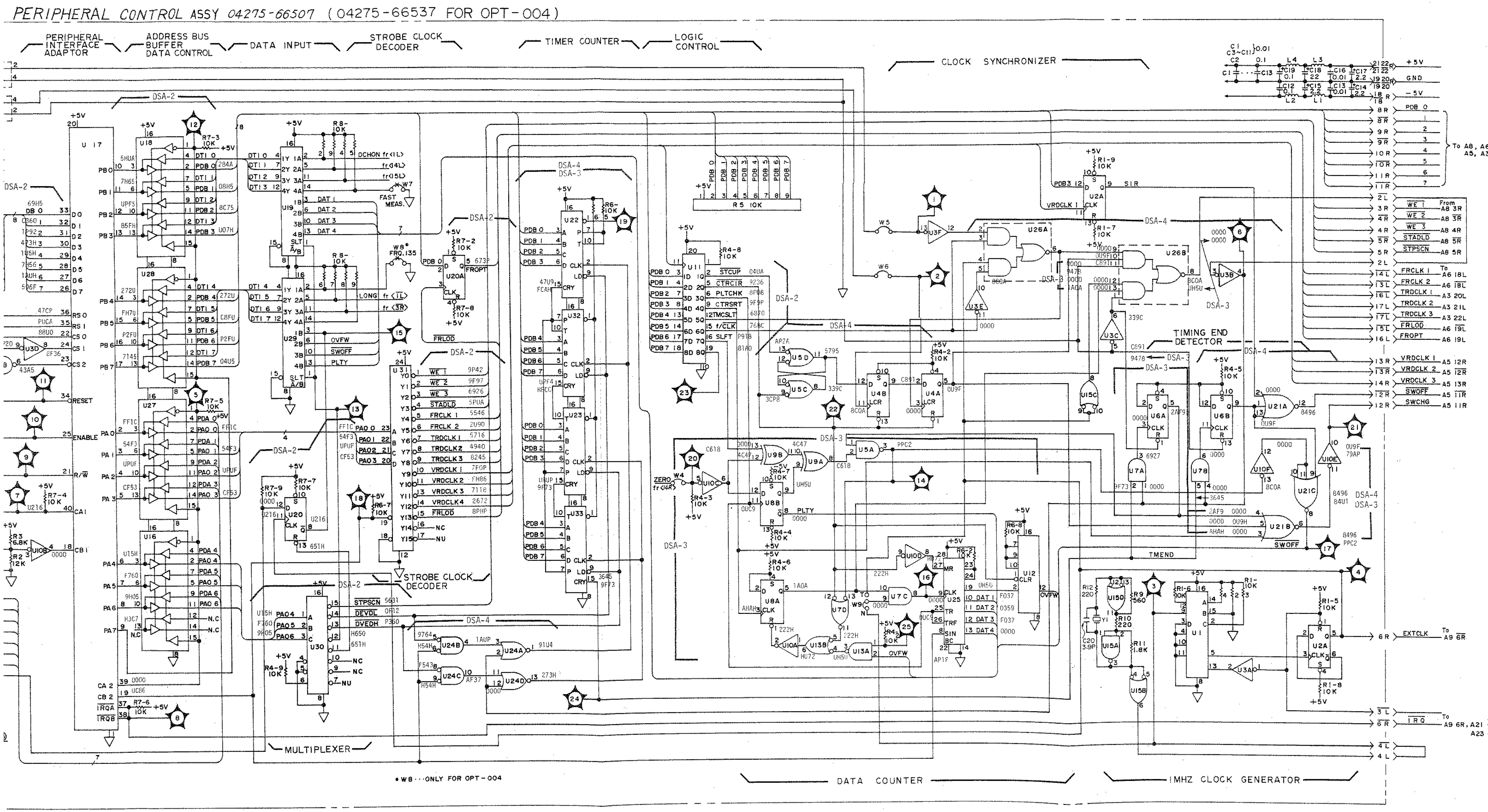
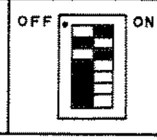


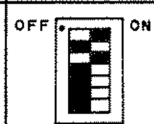
Figure 8-60. A7 Peripheral Control Board Assembly Schematic Diagram.

Signature Connections Window (+5V) : 7UUP

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA- 6 KEY	A9Tp-13	A9Tp-13	A9Tp-7	

Other settings:
Set A8S1-B switch to ON.
Observe respective signatures at A8TP1
for every key on front panel (push in turn).

Signature Connections Window (+5V) : 7UUP

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA- 7 DISPLAY	A9Tp-13	A9Tp-13	A9Tp-7	

Other Settings:
Set A8S1-B switch to ON.
Disconnect one side of A8W1.

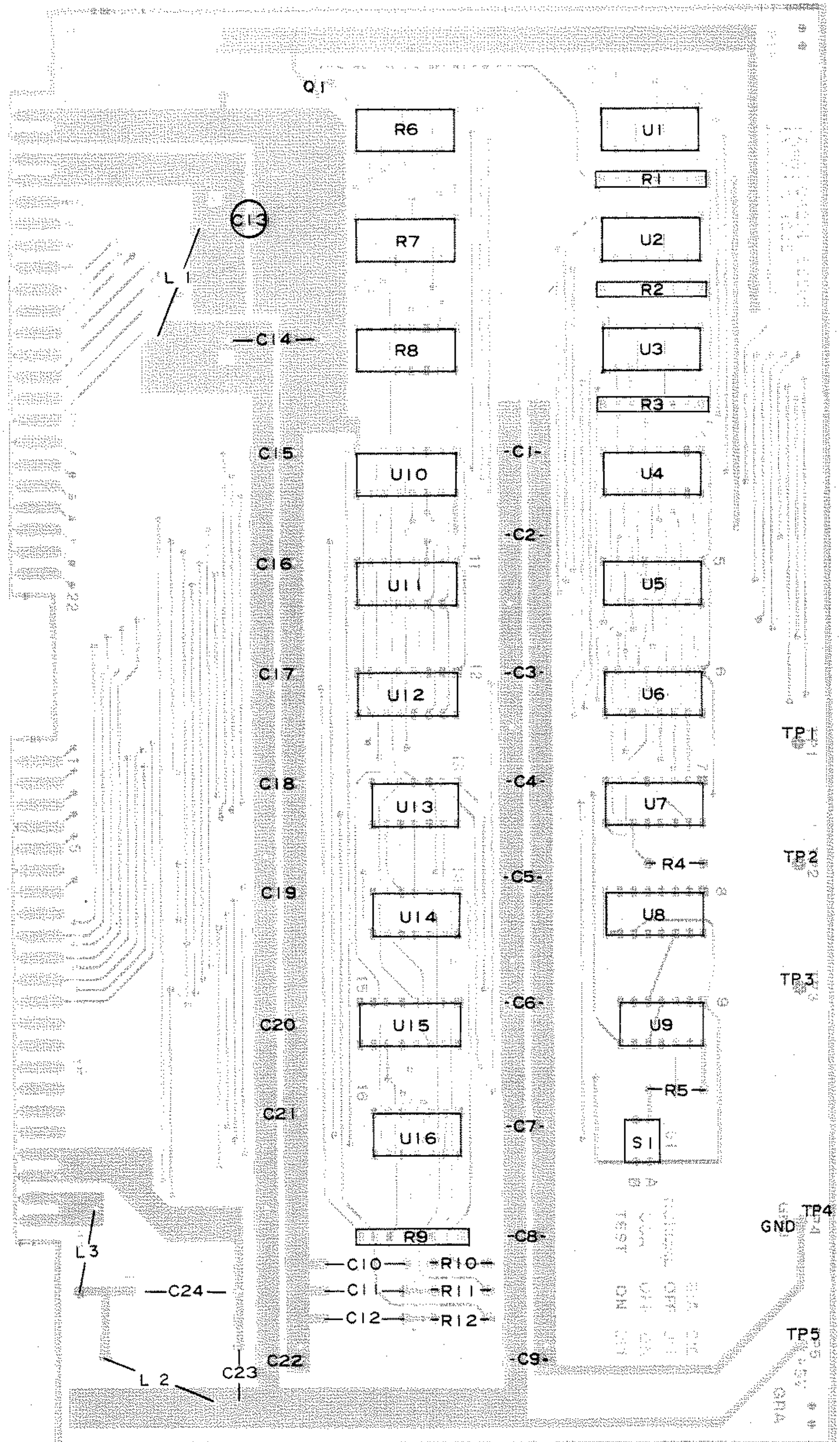


Figure 8-61. A8 Display Control Board Assembly Component Locations.

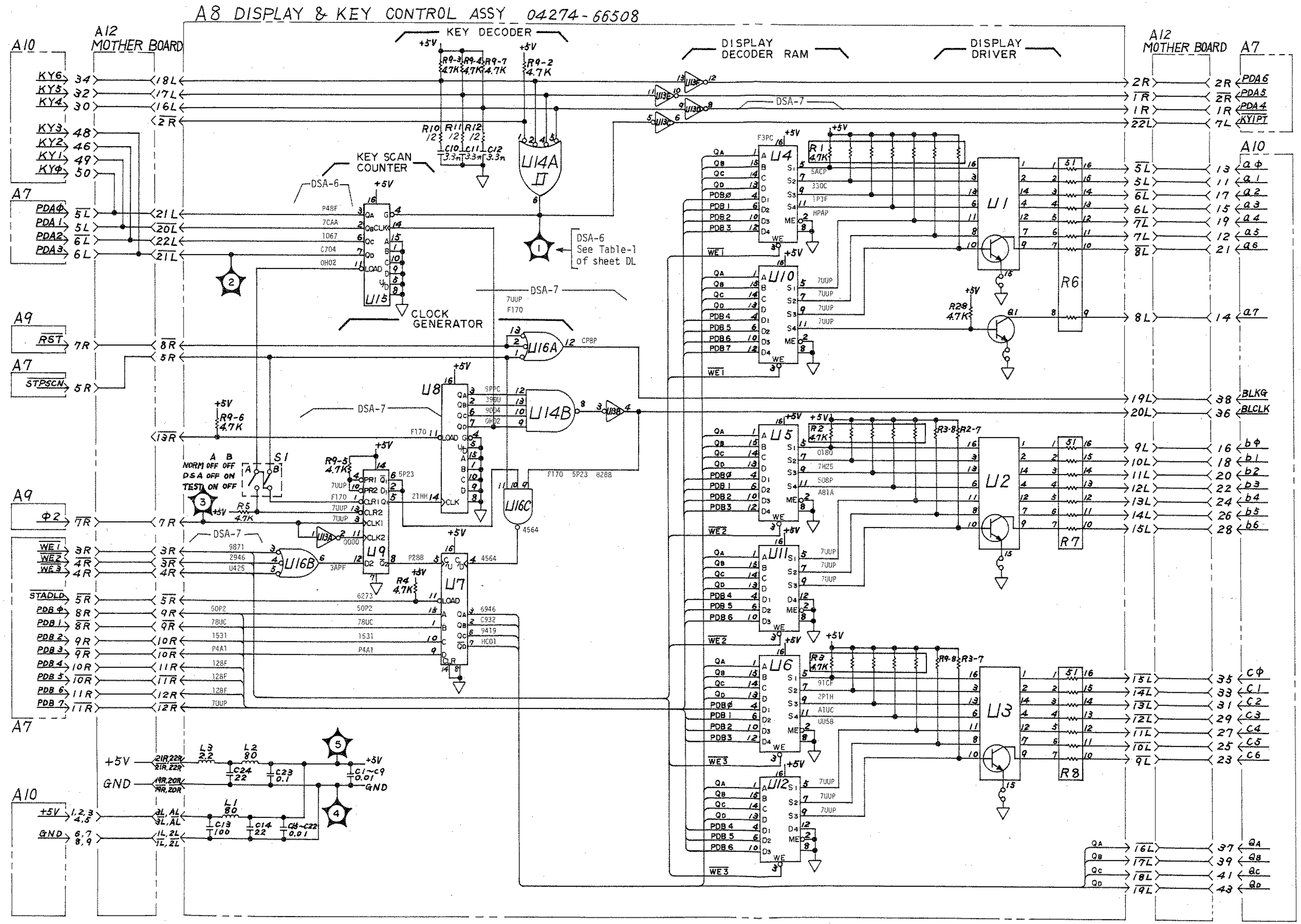


Figure 8-62. A8 Display Control Board Assembly Schematic Diagram.

This table can be used to check signatures at A9U1 thru A9U10 ROM's. Signature test point is established at input of Data Buffer (pins 8 thru 6 of A9U31 and A9U32) instead of the respective ROM outputs (A9U1 thru A9U10). This signature list can be used for units with its serial number suffixes of -00266 and above.

For other instruments whose serial number suffixes are earlier than 00266, check that unstable signature display appears or that output states of these ROM's pull up and pull down. If you find above states active in earlier instruments, the program contents in these ROM may be alive.

TEST PIN NO / DSA NAME		DSA-12	DSA-14	DSA-15	DSA-16	DSA-17	DSA-13
SIGNAL NAME	TEST POINT / ROM NO.	A9U1	A9U1	A9U3	A9U5	A9U7	A9U10
WINDOW(+5V)	U1 pin-24	755U	P254	P254	P254	P254	826P
DB0	U31 pin-3	8081	42P2	7994	264C	0H5H	UUPA
DB1	pin-4	60A9	9949	307F	08CA	U02C	HAUH
DB2	pin-5	11C6	8UH8	HPF4	9FBF	8102	A63F
DB3	pin-6	P54P	P909	379A	CP1U	741F	3094
DB4	U32 pin-3	C375	8FU9	2U43	5H23	A2H2	565C
DB5	pin-4	615C	F854	5410	U899	2UHU	501H
DB6	pin-5	P3CU	6PF8	69HH	89PP	3265	39A1
DB7	pin-6	AUOH	052P	0P76	FP5F	52AC	F454

Signature Connections Window (+5V): CCC3

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-10 IRQ	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON

Signature Connections Window (+5V): P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-14 NOP (U1)	A9U16-10	A9U16-7	A9Tp-6	OFF ON

Signature Connections Window (+5V): 0003

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-11 NOP ADDRESS	A9Tp-3	A9Tp-3	A9Tp-6	OFF ON

Signature Connections Window (+5V): P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-15 NOP (U3)	A9U16-11	A9U16-7	A9Tp-6	OFF ON

Signature Connections Window (+5V): 755U

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-12 NOP (U1~U7)	A9U27-11	A9U16-5	A9Tp-6	OFF ON

Signature Connections Window (+5V): P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-16 NOP (U5)	A9U16-13	A9U16-10	A9Tp-6	OFF ON

Signature Connections Window (+5V): 826P

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-13 NOP (U10)	A9U22-9	A9U10-20	A9Tp-6	OFF ON

Signature Connections Window (+5V): P254

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-17 NOP (U7)	A9U16-15	A9U16-12	A9Tp-6	OFF ON

A8 SEE INSIDE

DISPLAY CONTROL
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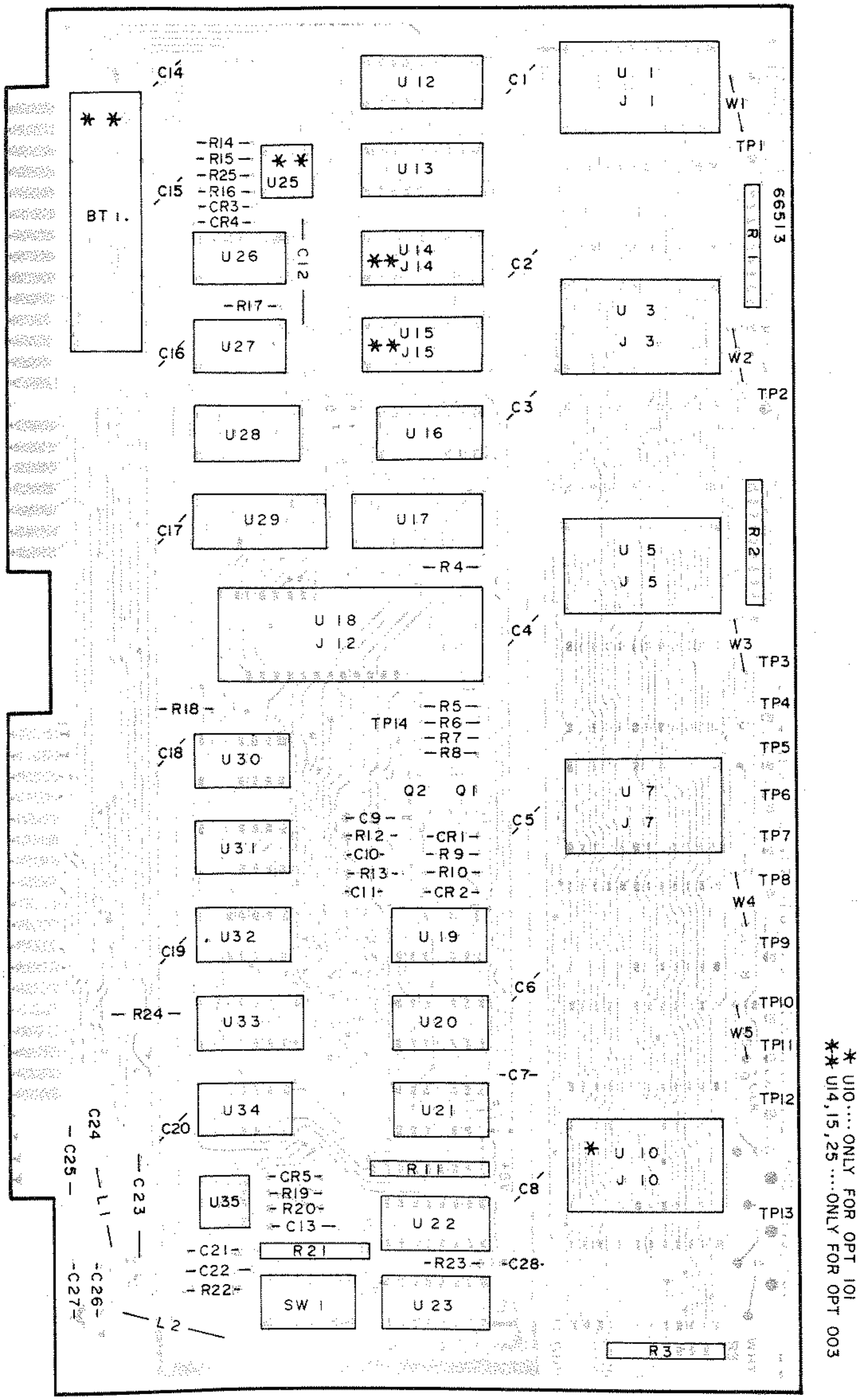
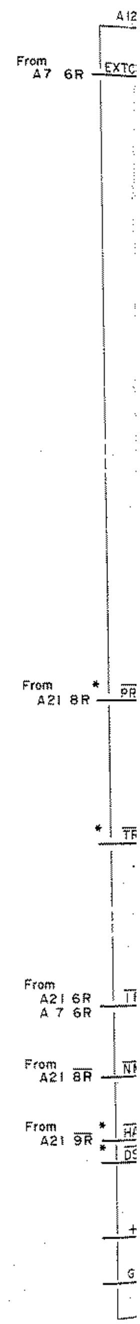


Figure 8-63. A9 Microprocessor Unit Board Assembly Component Locations.



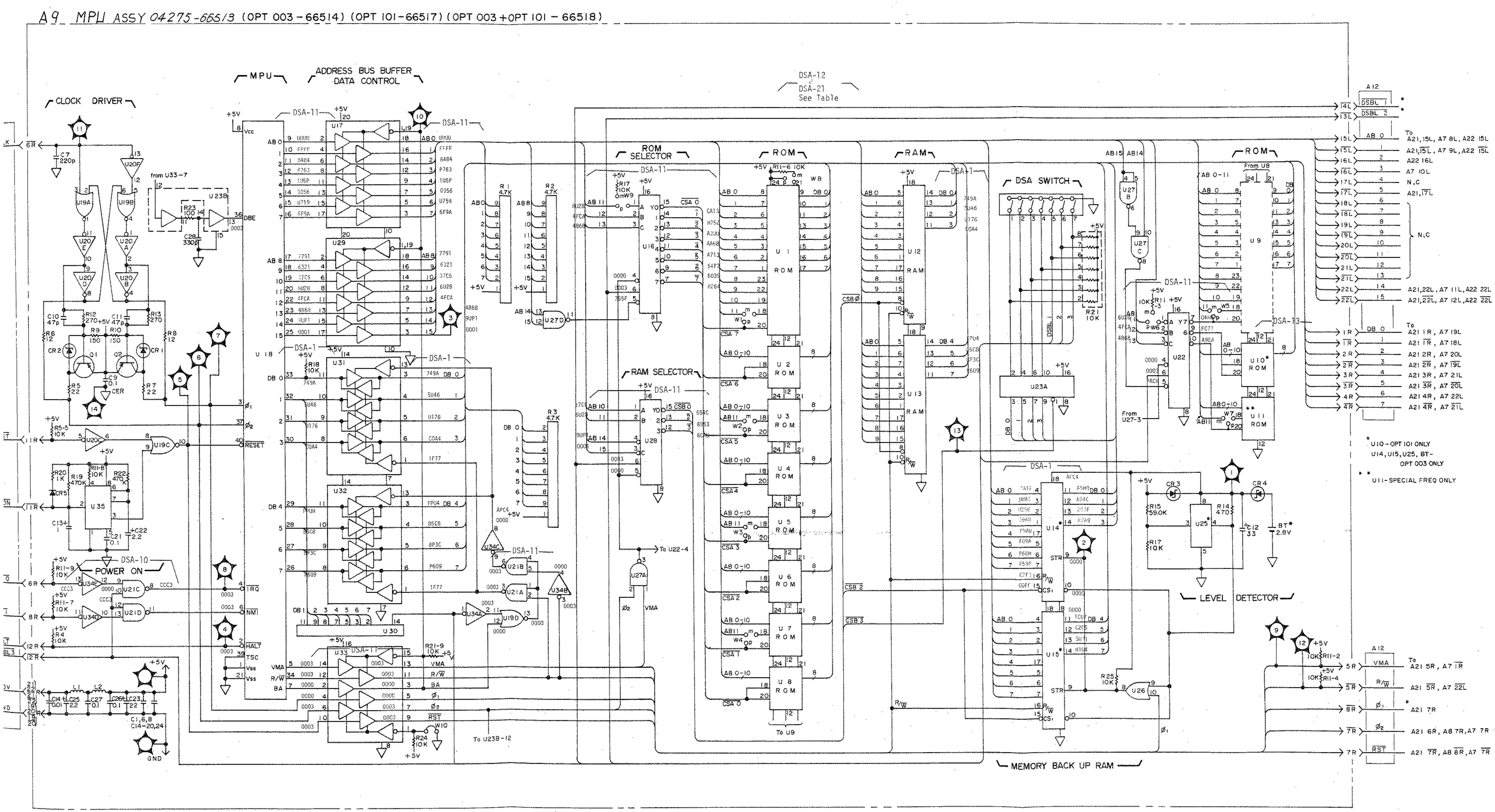
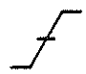
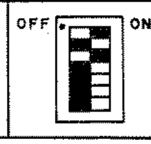


Figure 8-64. A9 Microprocessor Unit Board Assembly Schematic Diagram.

Signature Connections Window (+5V) : 7UUP

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-7 DISPLAY	A9Tp-13 	A9Tp-13 	A9Tp-7 	

Other Settings:
- Set A8S1-B switch to ON.
- Disconnect one side of A8W1.

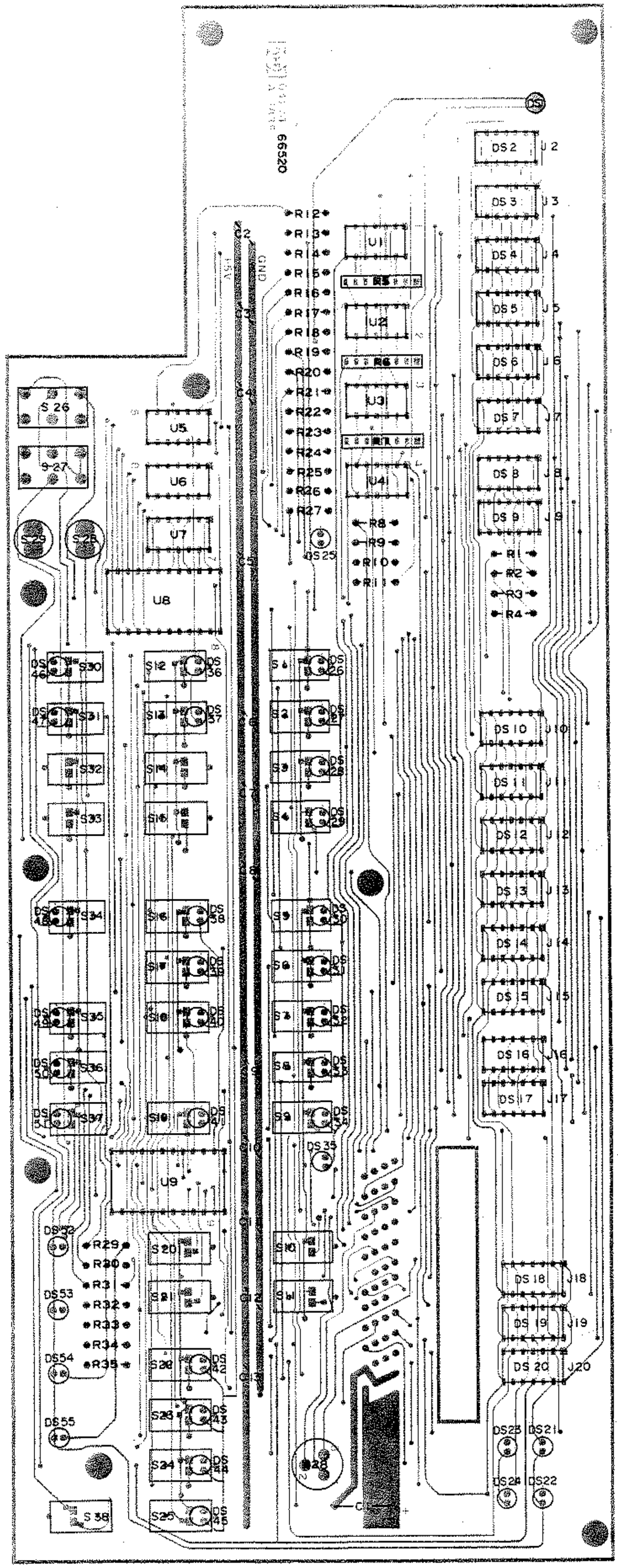


Figure 8-65. A10 Display and Keyboard Assembly Component Locations.

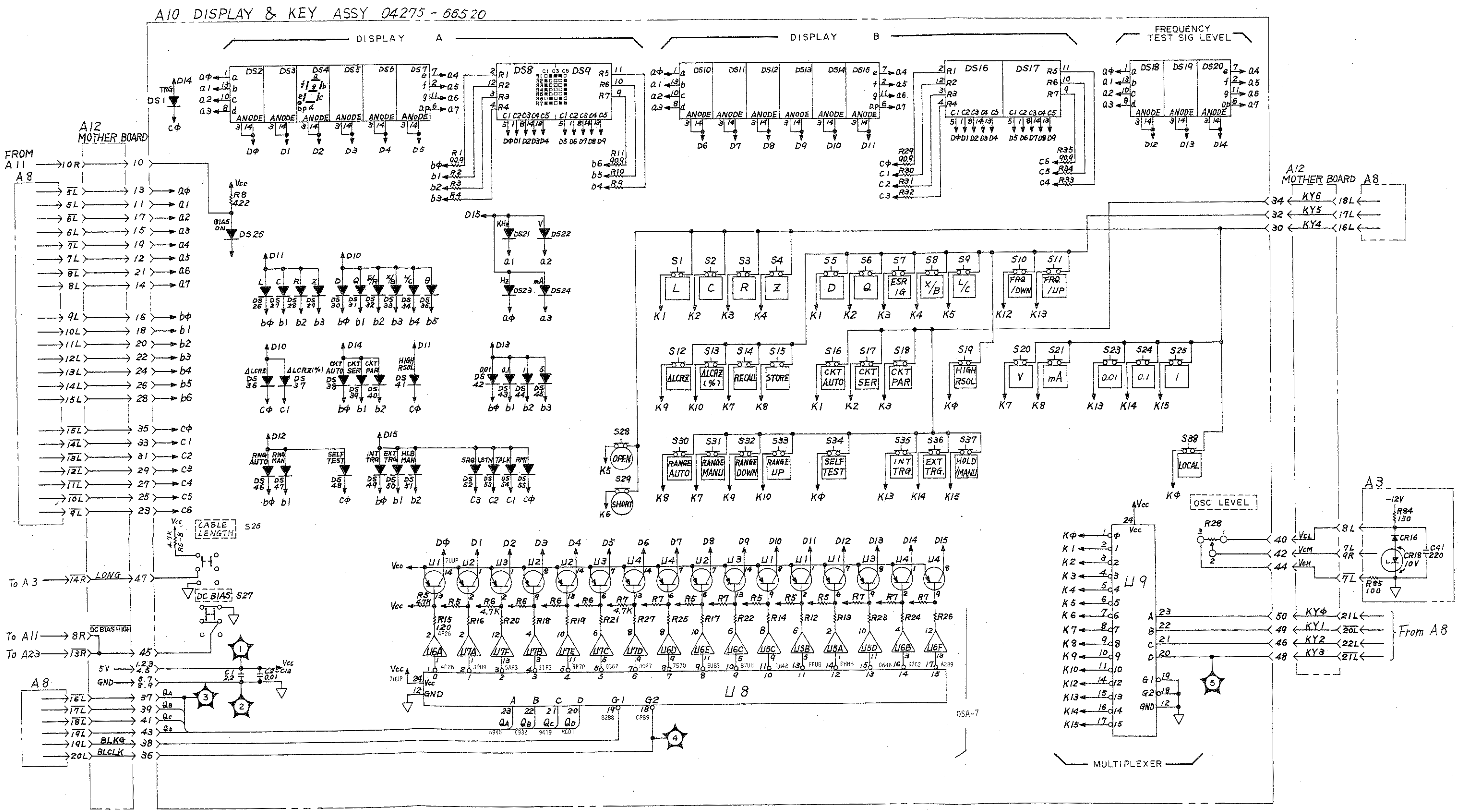


Figure 8-66. A10 Display and Keyboard Assembly Schematic Diagram.

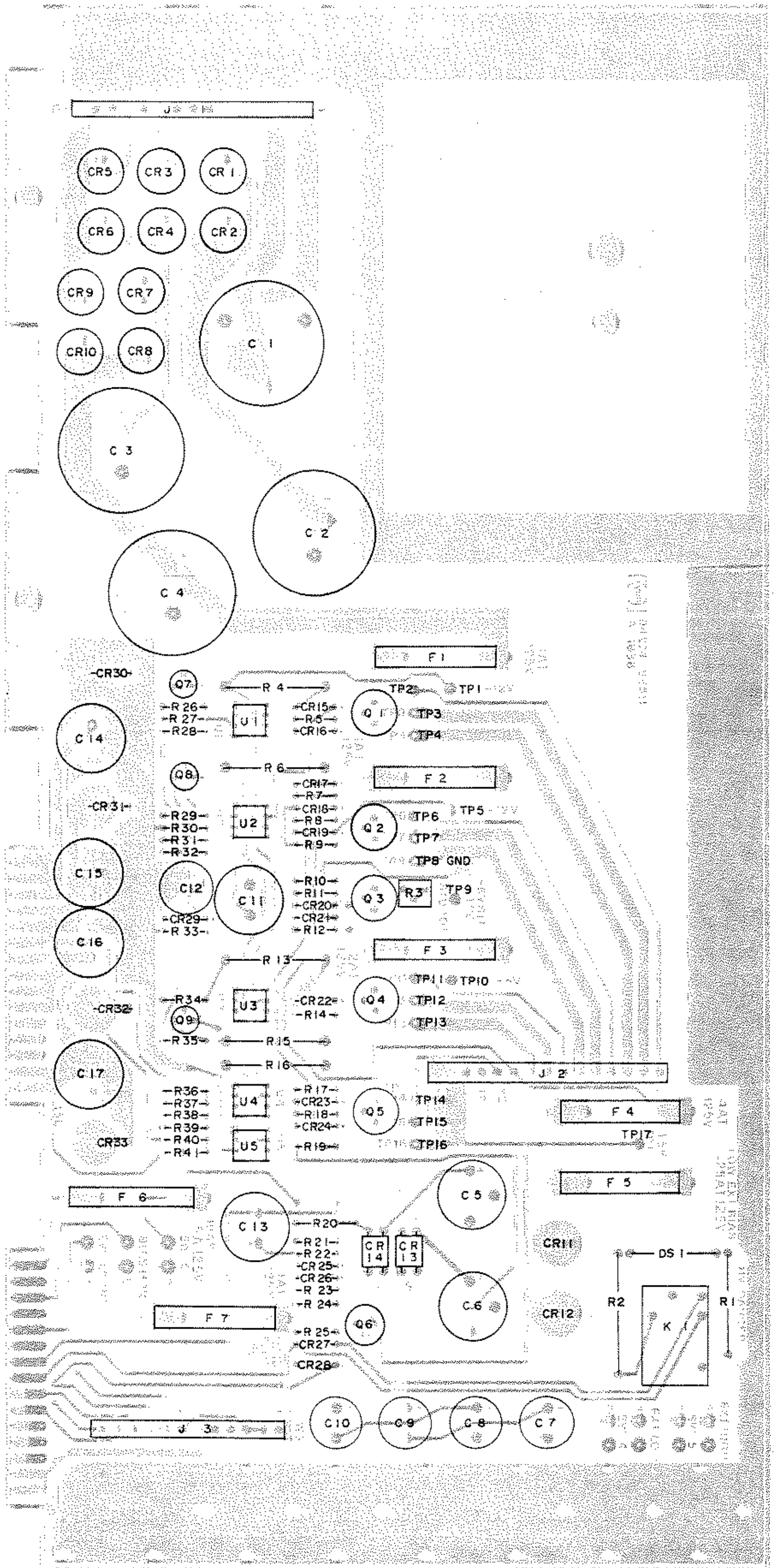


Figure 8-67. All Power Supply Board Assembly Component Locations.

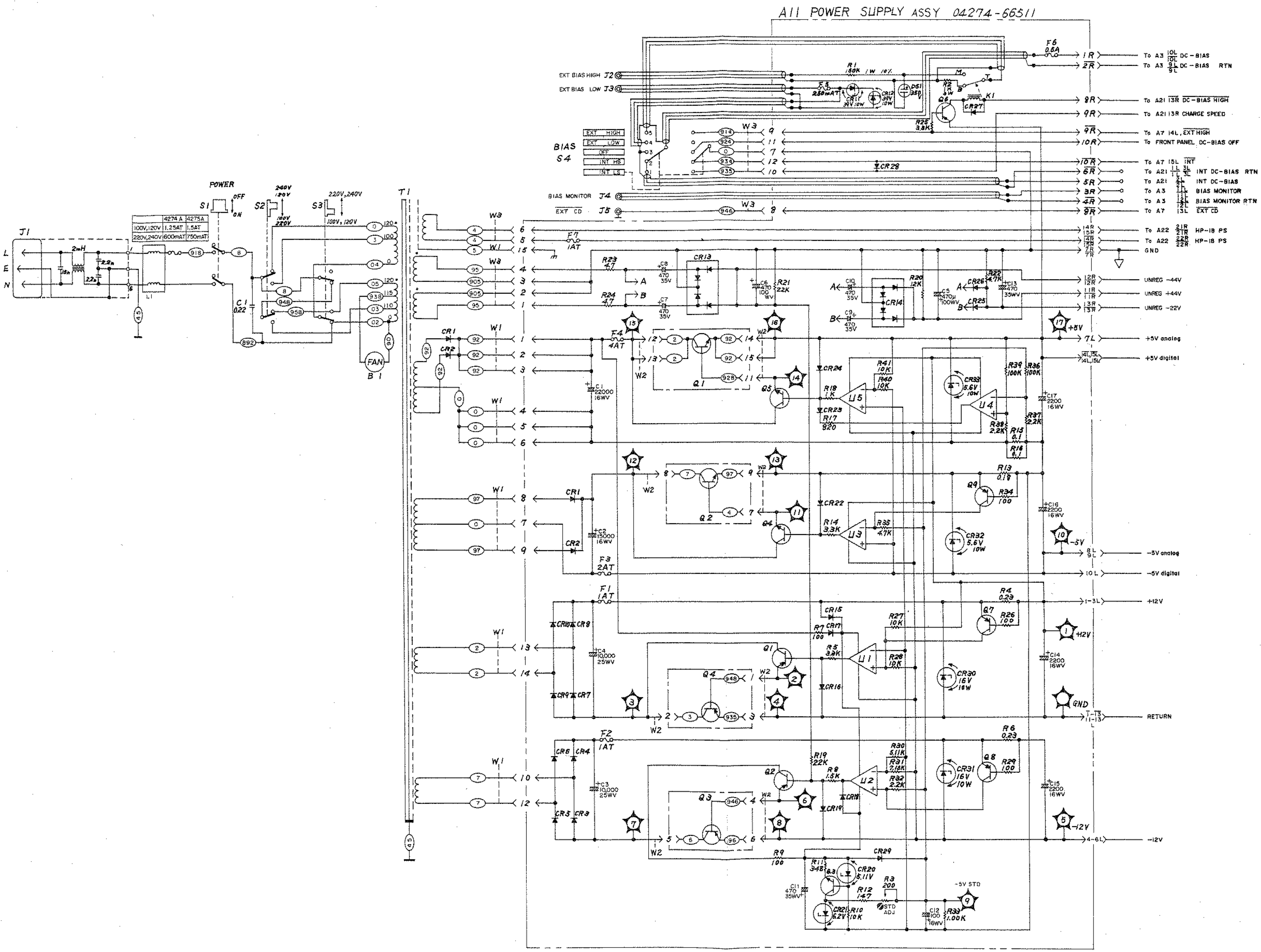


Figure 8-68. A11 Power Supply Board Assembly Schematic Diagram.

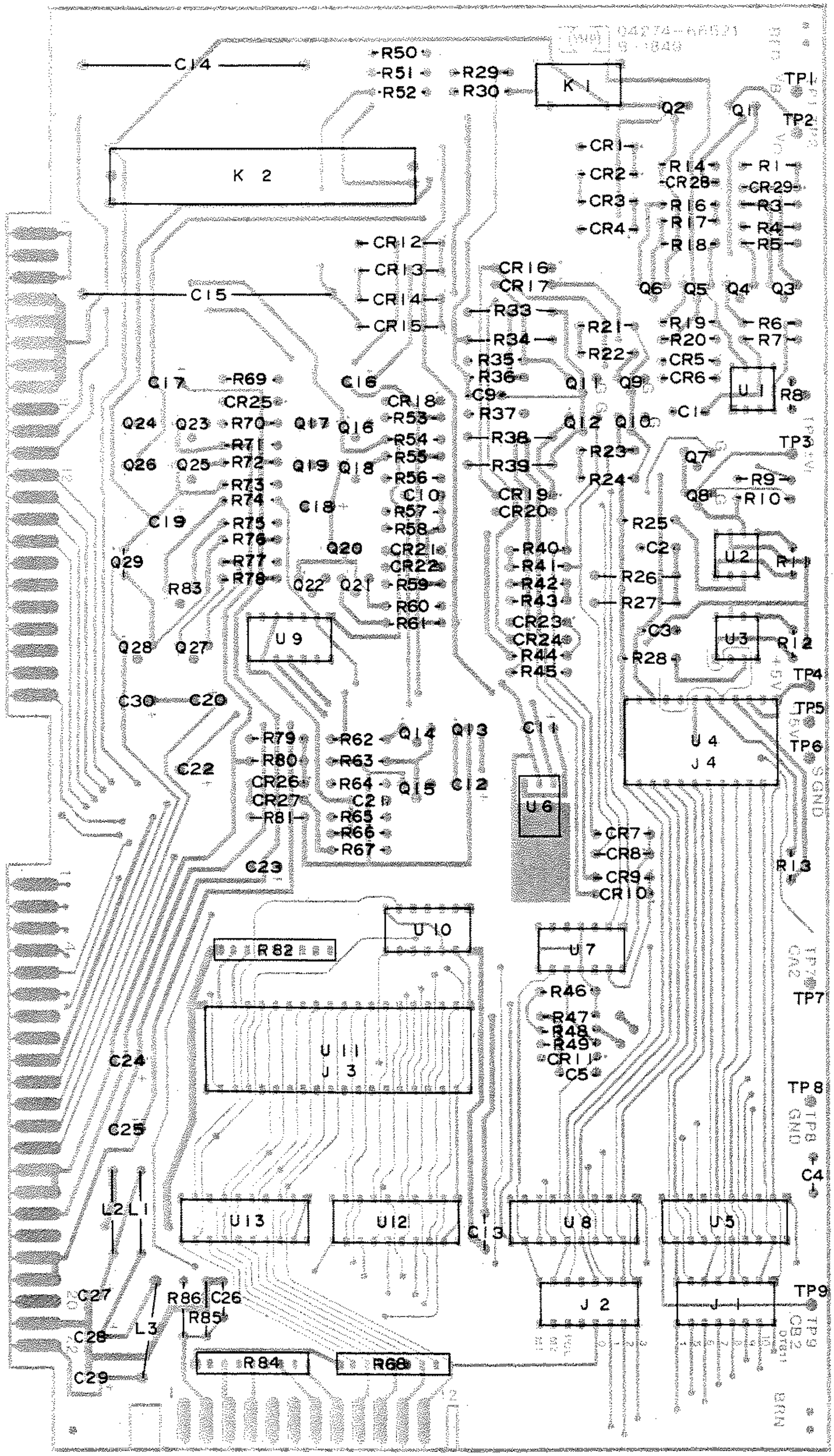


Figure 8-69. A21 DC Bias Supply Board Assembly Component Locations.

Signature Connections Window (+5V): 3U8U

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-8	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON
DC-Bias				

Other Settings:
Connect dual in-line jumpers to A21SC1 (J1) and SC2 (J2).
If the jumper module is not available, use a dual in-line resistor pack below 100Ω.

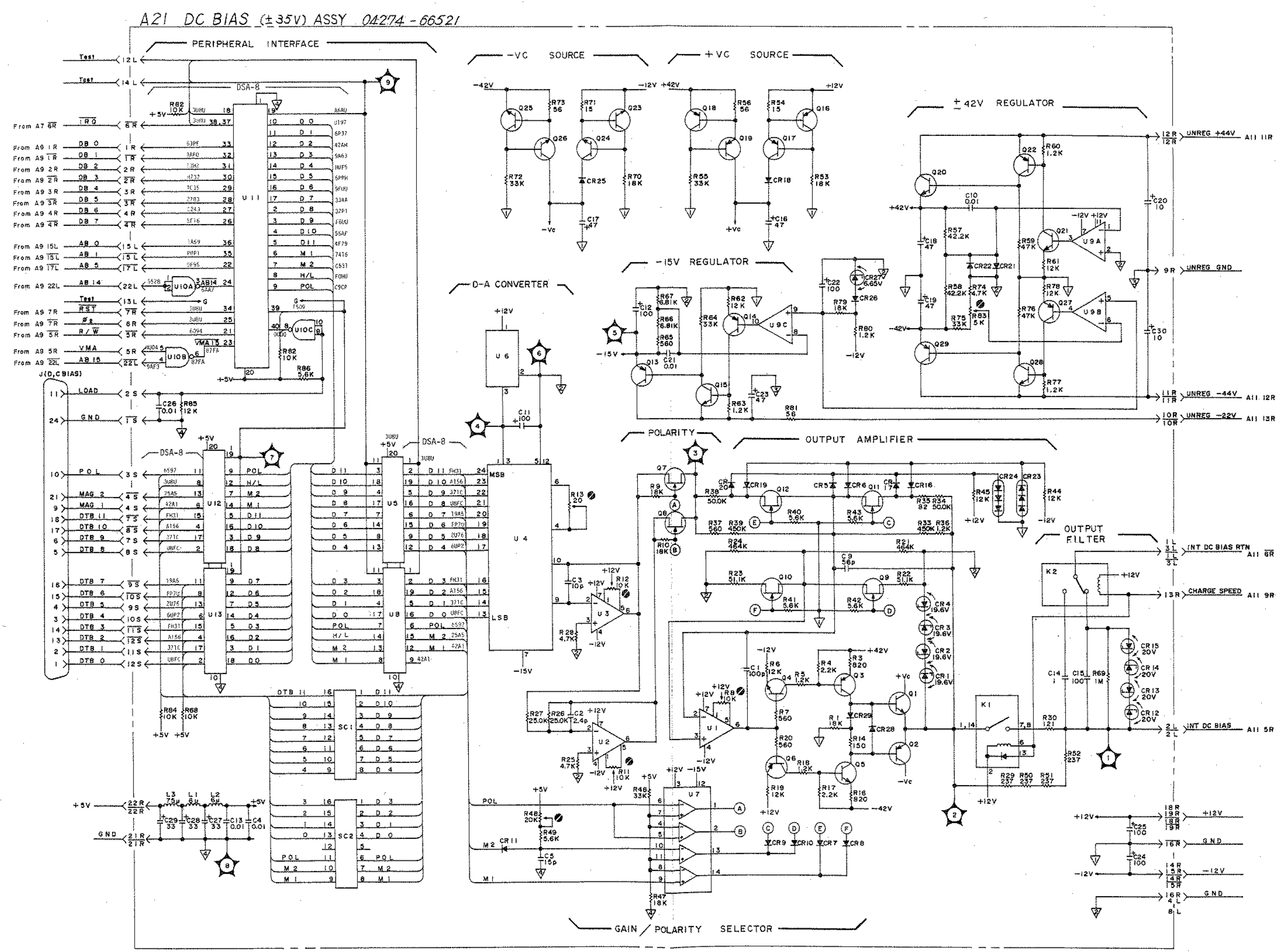


Figure 8-70. A21 DC Bias Supply Board Assembly Schematic Diagram.

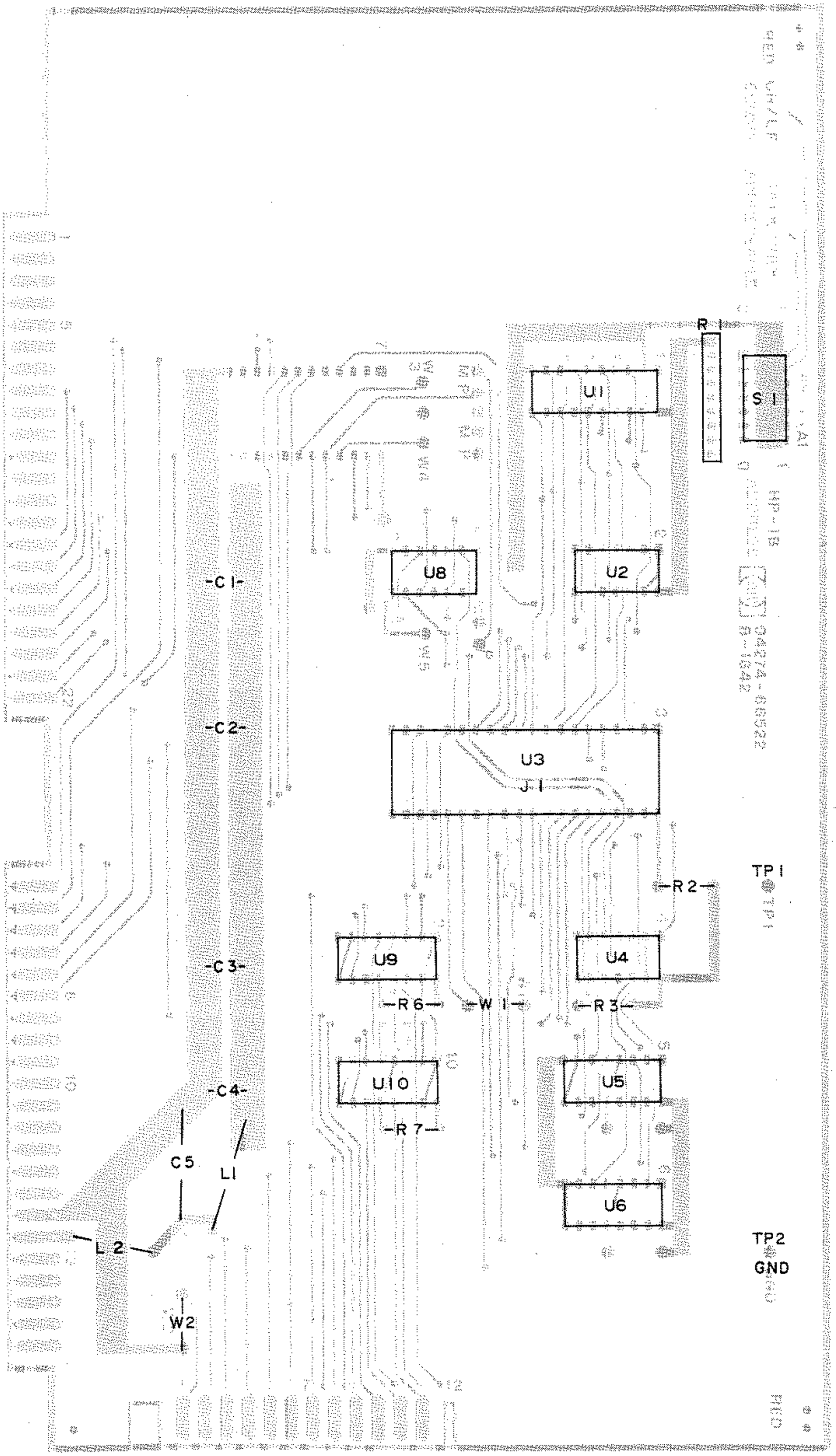


Figure 8-71. A22 HP-IB Interface Board Assembly Component Locations.

...nature Connections			Window (+5V) :3U8U	
...A NO	START	STOP	CLOCK	A9 DSA-SW
A- 9	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON
-IB				

...er Settings:
Set A22S switch (DSA-SW) as shown in schematic.

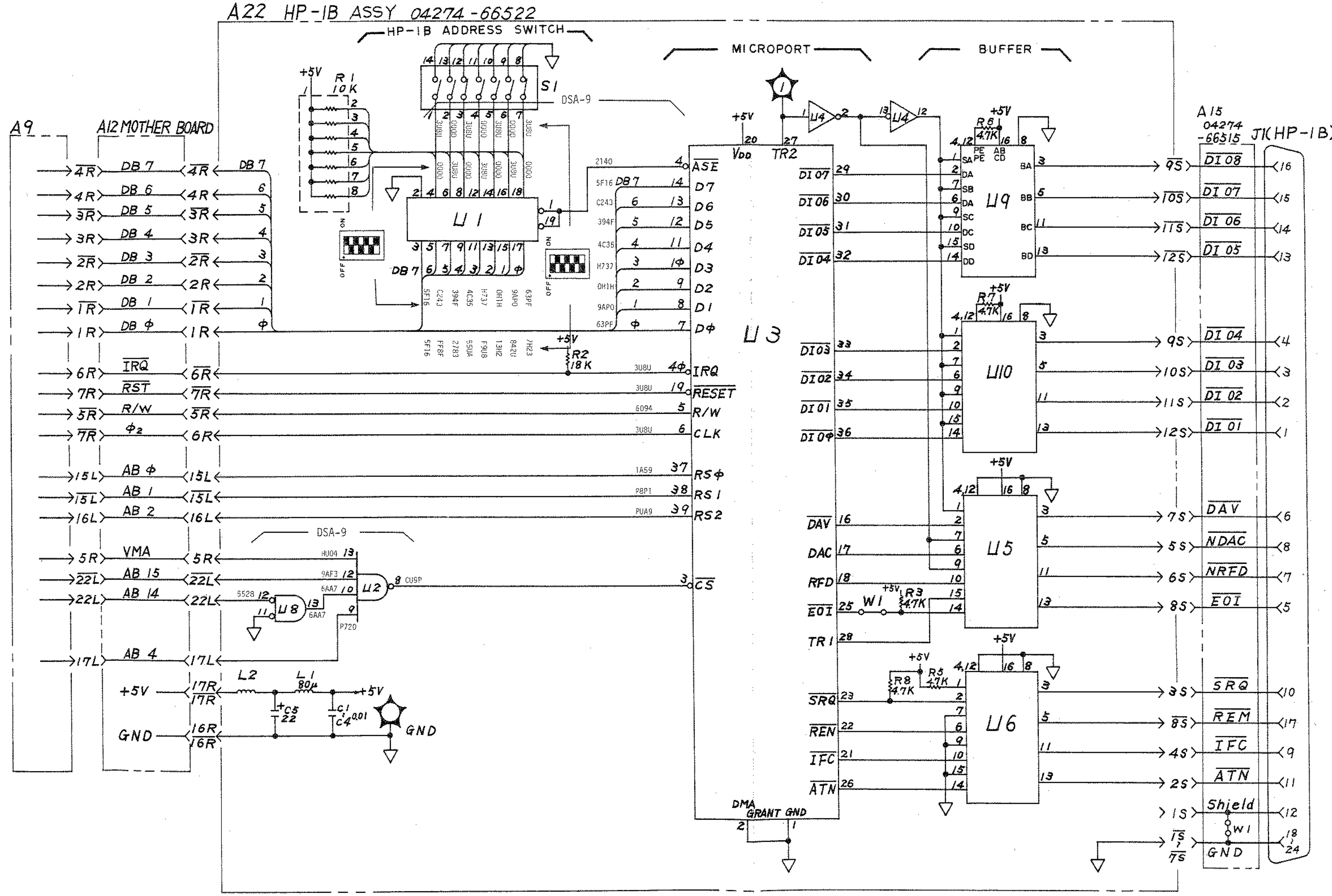


Figure 8-72. A22 HP-IB Interface Board Assembly Schematic Diagram.

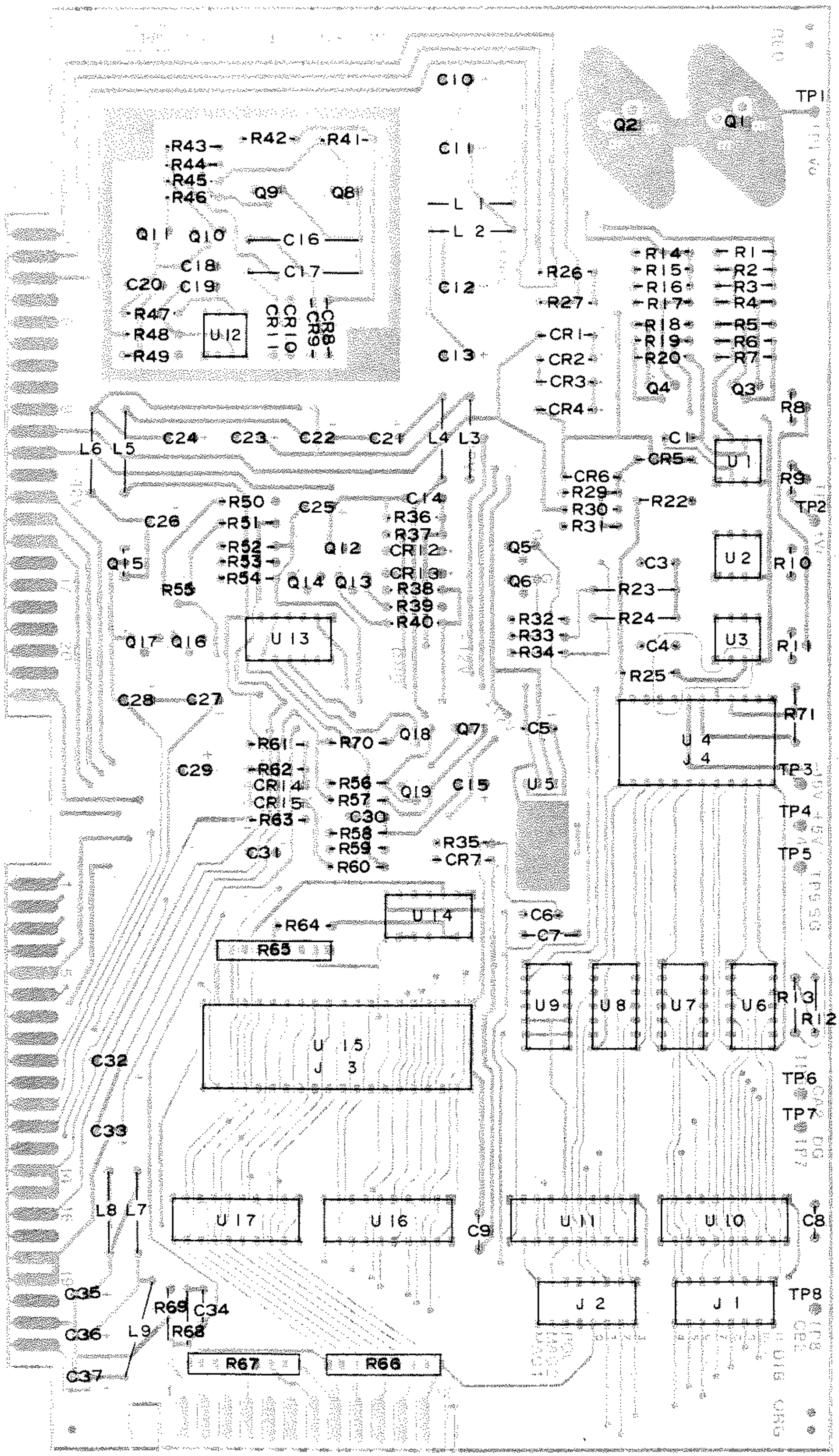


Figure 8-73. A23 DC Bias Supply Board Assembly Component Locations.

Signature Connections — Window (+5V): 3U8U

DSA NO	START	STOP	CLOCK	A9 DSA-SW
DSA-8	A9Tp-13	A9Tp-13	A9Tp-7	OFF ON
DC-Bias				

Other Settings:
Connect a dual in-line jumper to A23SC1 (J1) and SC2 (J2). If the jumper module is not available, use a dual in-line resistor pack below 100Ω.

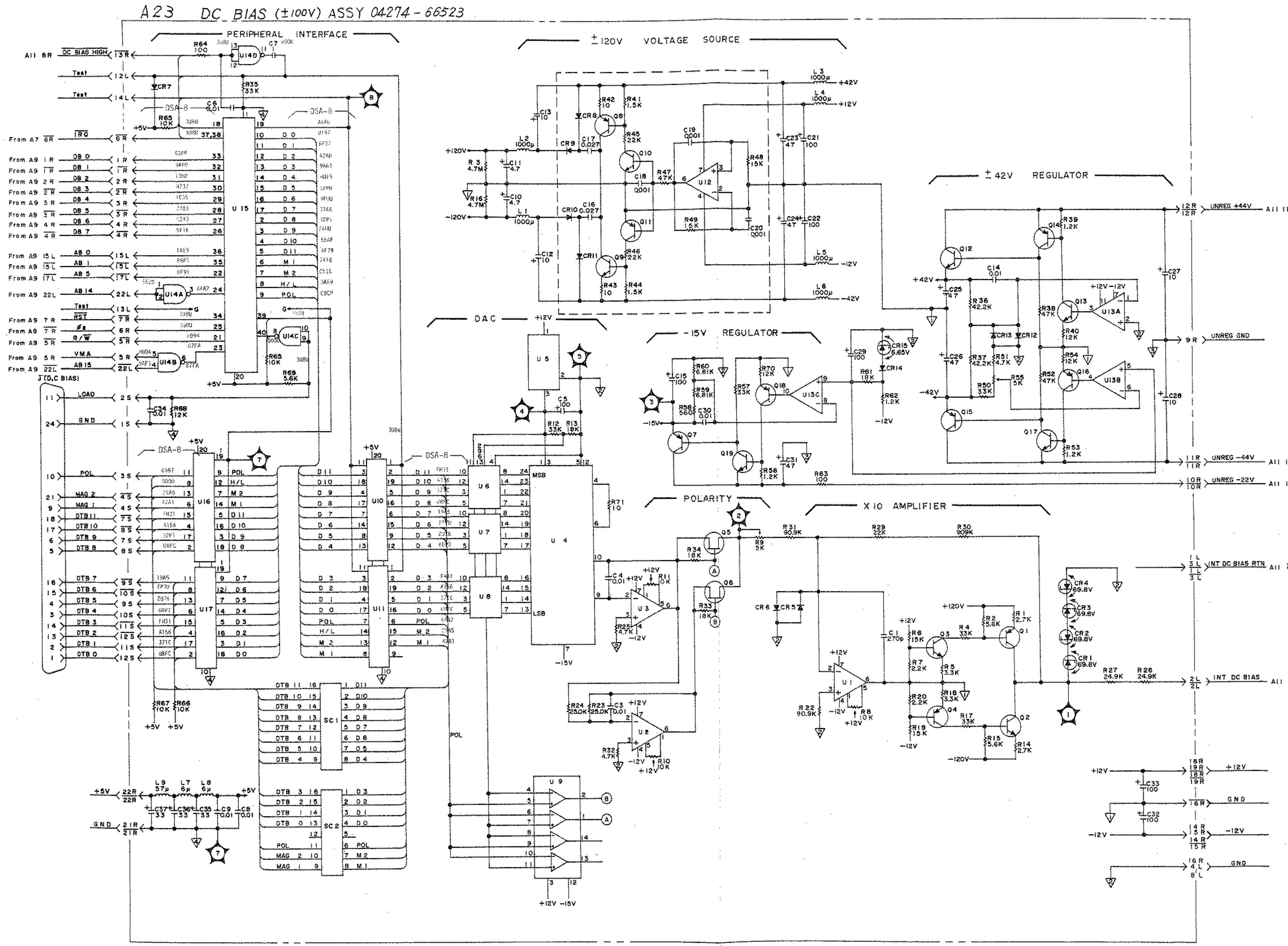


Figure 8-74. A23 DC Bias Supply Board Assembly Schematic Diagram.

4275A

MULTI-FREQUENCY LCR METER

MANUAL IDENTIFICATION	
Model Number:	4275A (SVC)
Date Printed:	AUG. 1980 FEB., OCT. 1981
Part Number:	04275-90012

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:
Make all ERRATA corrections.
Make all appropriate serial number related changes indicated in the tables below.

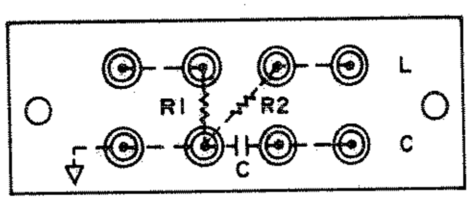
SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
ALL	ERRATA
ALL	1
1851J00702 and above	2
2016J00743 and above	3
2045J00923 and above	4
2045J01043 and above	5

► NEW ITEM

ERRATA

► Page 4-16, Figure 4-6,

Change the figure of the 16074A Quasi-inductor as shown below:



NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

HEWLETT PACKARD

Printed in Japan

MANUAL CHANGES

▶ Page 4-24, TEST PROGRAM 1:
Change program listing as follows:

```
0: "REMOTE/LOCAL TEST":
1: dim A$[1]
2: 0>A
3: rds(717)>B
4: prt "REMOTE/LOCAL TEST";spc 3
5: rem 7
6: wrt 717,"T1";ent "LISTEN=1, TALK=0, REMOTE=1",A$
7: if A$="n";1>A
8: cli 7;ent "LISTEN=0, TALK=0, REMOTE=1",A$
9: if A$="n";1>A
10: lcl 7;ent "LISTEN=0, TALK=0, REMOTE=0",A$
11: if A$="n";1>A
12: rem 717;ent " REMOTE=1",A$
13: if A$="n";1>A
14: llo 7
15: lcl 717;ent " REMOTE=0",A$
16: if A$="n";1>A
17: wrt 717,"T1";ent "LISTEN=1, TALK=0, REMOTE=1",A$
18: if A$="n";1>A
19: if A=1;prt "REMOTE/LOCAL TEST           FAIL";spc 3;jmp 2
20: prt "REMOTE/LOCAL TEST          PASS";spc 3
21: 0>A
22: prt "LISTEN/TALK TEST";spc 3
23: red 717,A,B;ent "LISTEN=0, TALK=1, REMOTE=1",A$
24: if A$="n";1>A
25: wrt 717,"T1";ent "LISTEN=1, TALK=0, REMOTE=1",A$
26: if A$="n";1>A
27: if A=1;prt "LISTEN/TALK TEST            FAIL";spc 3;jmp 2
28: prt "LISTEN/TALK TEST           PASS";spc 3
29: prt "END";spc 3
30: cli 7
31: lcl 7
32: end
*3023
```

▶ Page 4-25, Table 4-10, Controller Instructions and Operator Responses for Test Program 1:

Controller Instructions		Operator Response
Displays	Printout	
	REMOTE/LOCAL TEST	
LISTEN = 1, TALK = 0, REMOTE = 1		If 4275A HP-IB Status Indicators and Controller Display are same, press "[Y], [CONTINUE]" in each step. If not, press "[n], [CONTINUE]".
LISTEN = 0, TALK = 0, REMOTE = 1		
LISTEN = 0, TALK = 0, REMOTE = 0		
REMOTE = 1		
REMOTE = 0		
LISTEN = 1, TALK = 0, REMOTE = 1		
	REMOTE/LOCAL TEST PASS	If all steps are correct, this message is output.
	REMOTE/LOCAL TEST FAIL	If any step fails, this message is output.
	LISTEN/TALK TEST	
LISTEN = 0, TALK = 1, REMOTE = 1		If 4275A HP-IB Status Indicators and Controller Display are same, press "[y], [CONTINUE]" in each step. If not, press "[n], [CONTINUE]".
LISTEN = 1, TALK = 0, REMOTE = 1		
	LISTEN/TALK TEST PASS	If both steps are correct, this message is output.
	LISTEN/TALK TEST FAIL	If any step fails, this message is output.
	END	

Page 6-19, Table 6-3,
Change A4A2CR3 listed with part number 1901-0376 as follows:

A4A2CR4: P/N 1901-0050; DIODE-SWITCHING 80V 200MA 2NS DO-35

Change A4A2CR4 as follows:

A4A2CR5: P/N 1901-0376; DIODE-GEN PRP 35V 50MA DO-35

Change reference designation (only) of A4A2CR5 to A4A2CR6.

▶ Page 8-5, Paragraph 8-16,
Change equations 8-7, 8-10 and 8-11 as follows:

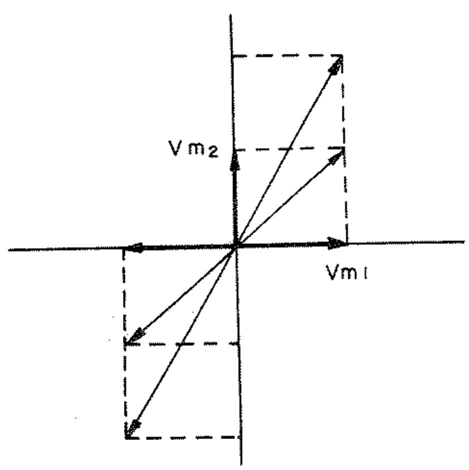
$$\left(\frac{1}{R_r}\right) \frac{E_aE_c + E_bE_d + j(E_bE_c - E_aE_d)}{E_c^2 + E_d^2} \text{ ---------- } (8\text{-}7)$$

$$G_X = Y_X|_{real} = \left(\frac{1}{R_r}\right) \frac{E_aE_c + E_bE_d}{E_c^2 + E_d^2} \text{ ------------ } (8\text{-}10)$$

$$B_X = Y_X|_{imaginary} = \left(\frac{1}{R_r}\right) \frac{E_bE_c - E_aE_d}{E_c^2 + E_d^2} \text{ ------ } (8\text{-}11)$$

▶ Page 8-8, Figure 8-7,
Change "Sawtooth Waveform Synthesizer" in the figure to read "Sinusoidal Waveform Synthesizer".

▶ Page 8-11, Paragraph 8-37,
Change the vector diagram as shown below:

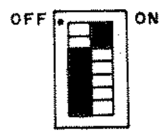


Pages 8-50 and 8-76, line 4,
Change the serial number -00266 to read -00863

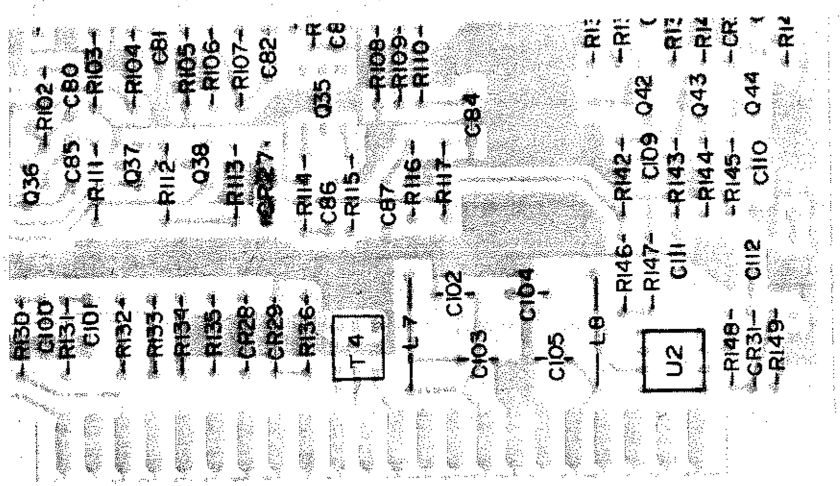
Page 8-55, Figure 8-37,
Add the following description to the first step of the Digital Section Troubleshooting Flow Diagram, FL:

5. Remove A7U14 from socket.

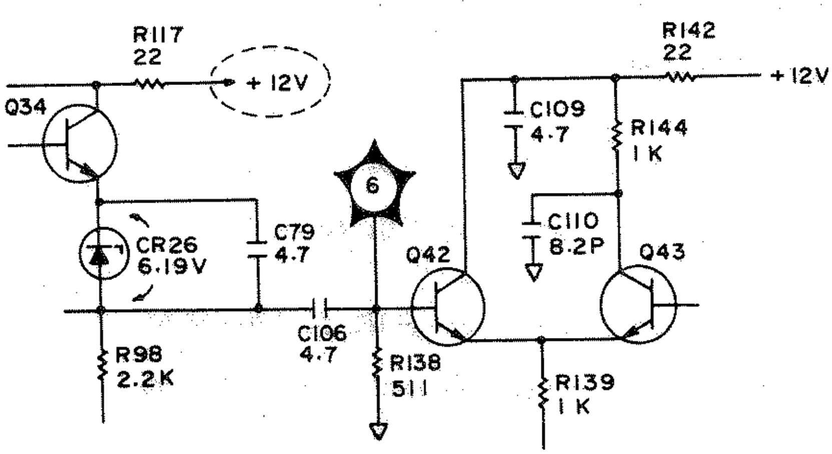
Change the A9 DSA-SW setting in the table of the Signature Connections as follows:



Page 8-61, Figure 8-42,
Add the transformer T4 to the figure of the A1 Board Component Locations as follows:



Page 8-61, Figure 8-43,
Change the schematic of the x100 Amplifier in Figure 8-43 as follows:



Page 8-63, Figure 8-45,
Change R98 in Figure 8-45 to CP1.

Page 8-77, Figure 8-63,
Change the part number of the board assembly shown in Figure 8-63 to 04275-66509.

Page 8-77, Figure 8-64,
Change the part number of the board assembly shown in the schematic diagram as follows:

A9 MPU Ass'y 04275-66509 (Opt. 003 - 66519).

Change signature code 8264 for A9U16 pin 7 (CSA 7) to 826H.

Page 8-83, Figure 8-70,
Add the following example of the dual in-line resistor pack required for signature analysis troubleshooting:

P/N 1810-0493 (contains eitht 5Ω resistors).

Page 8-85, Figure 8-72,
Change signature code FF8F for A22U1 pin 5 (DB6) to AF8F.

CHANGE 1

Page 6-3, Table 6-3. Replaceable Parts:
Change the part number and description for A1C27 to read:

A1C27: P/N 0160-2261; CAPACITOR-FXD 15pF +-.25pF 500VDC CER

Page 6-5, Table 6-3. Replaceable Parts:
Change the part number for A1K1/K2 and K5 to K11 to read:

0490-1269

Change the part number for A1Q17 to read:

1855-0125

Page 6-14, Table 6-3. Replaceable Parts, A3K1 and K2:
Change the part number for A3K1 and K2 to read:

0490-1269

Page 6-32, Table 6-3,
Change the part number of A7J2 to 1200-0654.

Change the part number of A7J3 to 1200-0567.

Page 6-34, Table 6-3,
Change the part number of A9J12 to 1200-0654.

Change the part number of A9U10 to 1818-1548.

Page 6-40, Table 6-3,
Change the part numbers of A21CR5, CR6, CR16, CR17, CR19 and CR20 to 1901-0033.

Page 6-41, Table 6-3,
Change the part number of A21J3 to 1200-0654.

Page 6-42, Table 6-3 and Page 8-83, Figure 8-70,
Change the part number and description for A21R48 as follows:

A21R48: P/N 2100-3354; RESISTOR-TRMR 50K 10%

Page 6-42, Table 6-3,
Change the part number of A22J1 to 1200-0654.

Page 6-44, Table 6-3,
Change the part number of A23J3 to 1200-0654.

CHANGE 2

Page 6-8, Table 6-3,
Change the part numbers and descriptions for A2C54 and C59 as follows:

A2C54: P/N 0160-2206; CAPACITOR-FXD 160pF ±5% 300VDC MICA
A2C59: P/N 0160-2206; CAPACITOR-FXD 160pF ±5% 300VDC MICA

CHANGE 3

Page 6-37, Table 6-3 and Page 8-79, Figure 8-66,
Change the part numbers and descriptions for A10R5, R6 and R7 as follows:

A10R5: P/N 1810-0203; NETWORK-RES 470Ω 8-PIN-SIP
A10R6: P/N 1810-0203; NETWORK-RES 470Ω 8-PIN-SIP
A10R7: P/N 1810-0203; NETWORK-RES 470Ω 8-PIN-SIP

Page 6-37, Table 6-3 and Page 8-81, Figure 8-68,
Change the part number of the A11 board assembly to 04274-66551.

Note: The new 04274-66551 is not replaceable with the old 04274-66511 (and vice versa).

Page 6-39, Table 6-3,
Change the part numbaer for the blank PC board of the A11 board assembly to 04274-26551.

Change the part number of the A12 board assembly to 04274-66552.

Note: The new 04274-66552 is not replaceable with the old 04274-66512 (and vice versa).

Chagne the part numbers of A12XA11L and A12XA11R to 1251-4978.

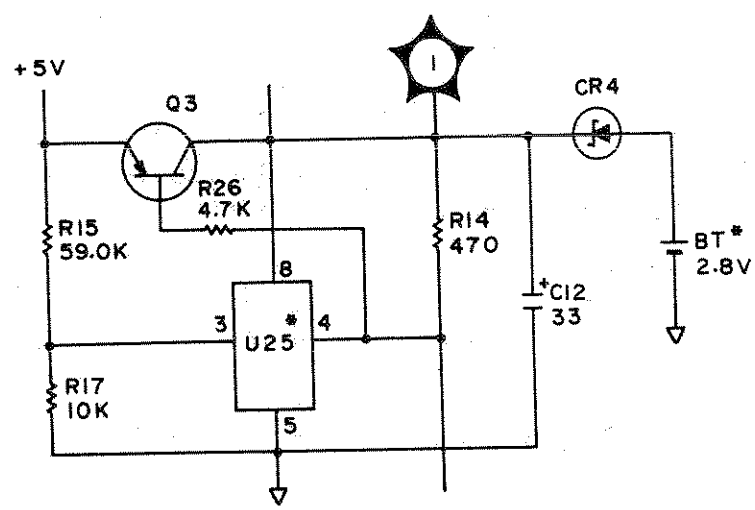
Change the part number for the blank PC board of the A12 board to 04274-26552.

CHANGE 4

Page 6-34, TAble 6-3,
Add the following parts:

A9Q3: P/N 1853-0405; TRANSISTOR PNP SI PD=700mW
A9R26: P/N 0683-4725; RESISTOR 4.7K 5% 0.25W TC=-400/+700

Page 8-77, Figure 8-64,
Change the schematic of the Level Detector circuit as follows:



CHANGE 5

Pages 8-50 and 8-76,
Change the signature table for DSA-13 as follows:

DSA NAME →	DSA-13
ROM NO. →	A9U10
WINDOW	826P
DB0	1H62
DB1	F0AP
DB2	46A9
DB3	2UFA
DB4	54F9
DB5	F63A
DB6	9208
DB7	F15P

Note: Apply these signatures to the instruments with the listed serial numbers and to those which have had A9U10 ROM replaced with P/N 1818-1548.