OPERATING AND SERVICE MANUAL

Manual Part No. 03403-90002
Microfiche Part No. 03403-90052

MODEL 3403A
MODEL 3403B

TRUE RMS VOLTMETER

3403A Serials Prefixed: 1223-
3403B Serials Prefixed: 1135-

Appendix C, Manual Backdating Changes, adapts this manual to 3403A serial prefixes 1124- and 1151-.

P.O. Box 301, Loveland, Colorado 80537 U.S.A.

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GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Hewlett-Packard Models 3403A and 3403B True RMS Voltmeters make ac voltage measurements on six ranges of 10 mV to 1000 V full range, with overrange capability of up to 190 % of range except as limited by maximum allowable input voltage. In addition, the Model 3403A makes dc voltage and dc + ac measurements on five ranges. Options listed in Paragraph 1-6 are available to increase the usefulness of both models.

1-3. Throughout this manual the term 3403A/B will be used when no distinction between instruments is made. Any information that applies to one model only will be clearly indicated.

1-4. SPECIFICATIONS.

1-5. Specifications for both the Model 3403A and 3403B are shown in Table 1-1. Table 1-2 lists a number of typical operating characteristics.

1-6. OPTIONS.

1-7. The following options are available for the Model 3403A:

Option 001: Autoranging
Option 002: Digital Output (Non-isolated)
Option 003: Digital Output + Remote Control (both Non-isolated) + Autoranging
Option 004: Isolated Digital Output
Option 005: Isolated Digital Output + Isolated Remote Control + Autoranging
Option 006: dB Display

1-8. Option 002, Non-isolated Digital Output, and Option 006, dB Display are available for the Model 3403B.

1-9. ACCESSORY EQUIPMENT SUPPLIED.

1-10. A "banana plug to BNC" adapter, -hp- Part No. 5040-5847, is supplied with the Model 3403A only. Use of this adapter disconnects input common from chassis ground, so that floating measurements may be made. Floating measurements or power line measurements cannot be made with the Model 3403B, since input common is permanently connected to chassis ground. A printed circuit extender, -hp- Part No. 5060-5984, is supplied with either model as an aid to servicing the digital panel meter assembly.

1-11. ACCESSORIES AVAILABLE.

1-12. Available accessories include a 50 Ω feed-thru termination, -hp- 11048B, and a 75 Ω feed-thru termination, -hp- 11094B. An output cable, -hp- 11184A, is available for connecting the BCD output to a digital recorder such as the -hp- Model 5055A or 5050B. An adapter frame, -hp- 5060-8752, is available for rack mounting the Model 3403A/B or any half-module instrument. The -hp- 11096A high frequency, peak responding probe may be used to reduce the input capacitance to 2 pF and permit relative measurements up to 1 GHz.

1-13. INSTRUMENT AND MANUAL IDENTIFICATION.

1-14. Instrument identification by serial number is located on the rear panel. Hewlett-Packard uses a two-section serial number consisting of a four-digit prefix and a five-digit suffix, separated by a letter designating the country in which the instrument was manufactured. (A = U.S.A.; G = Germany; J = Japan; U = United Kingdom.) If the four-digit prefix of the serial number of your instrument is higher than the prefix shown on the title page of this manual, change sheets supplied with the manual will define the differences between your instrument and the Model 3403A/B described in this manual. Appendix C, Back-dating, adapts the manual to instruments with lower serial prefixes.

Table 1-1. Specifications.

Ranges:
.01 V (ac only)
.1 V
1 V
10 V
100 V
1000 V

Functions:
AC: Responds to true RMS value of ac coupled input signal.
DC (3403A only): Responds to dc component of input signal.
DC + AC (3403A only): Responds to true RMS value of dc and ac signal; Reading is:

$$\sqrt{(dc)^2 + (ac\ RMS)^2}$$

Effective Common-Mode Rejection (1 kΩ unbalance in either lead):
AC Function: > 60 dB at 60 Hz.
DC Function: > 120 dB at 60 Hz.

Normal-Mode Rejection:
DC Function: > 60 dB at 60 Hz.

Voltage Measurement Accuracy: (25° C ± 5° C; < 95 % relative humidity).
AC or DC + AC voltage measurement accuracy is not specified below the point on any range where the RNG ↓ indicators light.
DC function accuracy is specified over the entire range.

Voltage Reading Accuracy = ± (% of Range + % of Reading)**

Range	Function			Frequency in Hz							
	DC (3403A)	DC + AC (3403A)	AC	DC (3403A only)	2	25	100 k	1 M	10 M	20 M	50 M	100 M
1000 V	0.3	0.3	0.3	0.2	0.4*	0.2						
100 V	0.2	0.2	0.2	0.2	0.4*	0.2	1.0					
10 V	0.2	0.2	0.2	0.2	0.4*	0.2	0.5	1.0				
1 V	0.2	0.2	0.2	0.2	0.4*	0.2	0.5	1.0	2.0	5.0	10.0	
.1 V	0.6	0.6	.04 V $\frac{0.2}{0.4}$	0.2	0.4*	0.2	0.5	2.0	2.0	5.0	10.0	
.01 V			.004 V $\frac{0.2}{0.4}$			0.3	1.0	3.0	2 M			

* DC + AC Function and Slow Response Time only.
** % of Reading Specification is representative of typical flatness.
Frequencies and Ranges in shaded areas may result in invalid readings without ranging information.

dB Measurement Accuracy (Option 006): (25° C ± 5° C; < 95 % relative humidity).
dB measurement accuracy is not specified below the point on any range where the RNG ↓ indicators light.

dB Reading Accuracy = ± dB + dB**

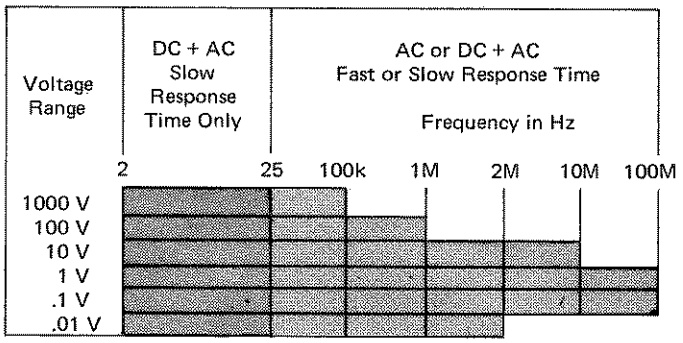
Range	Function		Frequency in Hz								
	AC	DC + AC (3403A)	DC (3403A only)	2	25	100 k	1 M	10 M	20 M	50 M	100 M
1000 V	0.15	0.15	0.02	0.04*	0.02						
100 V	0.15	0.15	0.02	0.04*	0.02	0.1					
10 V	0.15	0.15	0.02	0.04*	0.02	0.05	0.1				
1 V	0.15	0.15	0.02	0.04*	0.02	0.05	0.1	0.2	0.5	1.0	
.1 V	0.15	0.15	0.02	0.04*	0.02	0.05	0.2	0.2	0.5	1.0	
.01 V	0.15					0.1	0.3	2 M			

*DC + AC Function and Slow Response Time only.
**Specification is representative of typical flatness.
Frequencies and Ranges in shaded areas may result in invalid readings without ranging information.

Temperature Coefficient (0° C to 20° C and 30° C to 50° C): TC = 0.1 x Reading accuracy (from charts)/° C.

Table 1-2. Typical Operating Characteristics.

Frequency Range:



Response Time:
Fast: 1 second
Slow (3403A only): 10 seconds

Instrument reads final reading ± 0.1 % of input voltage change in stated response time.

Reading Rate:
Fast response time: 4 per second
Slow response time (3403A only): 1 per second

Maximum Input Voltage:
High to Low:
1000 V rms, 1500 V peak or 10^8 V Hz on any range.
Maximum dc in ac function: ± 500 V dc.

Low to Chassis (3403A only):
± 500 V peak, when floated with special banana jack-to-BNC adapter.

Input Impedance:
Below 10 MHz
1 V to 1000 V ranges: 10 MΩ ± 10 % in parallel with 19 pF ± 10 %.

.01 V and .1 V ranges: 20 MΩ ± 10 % in parallel with 16 pF ± 10 %.

1 MHz to 100 MHz: The following table gives maximum loading error due to input shunt impedance across a terminated source.

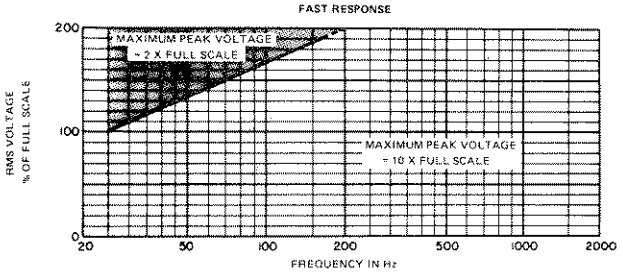
System Impedance (Source and Load)	Frequency 10 MHz	100 MHz
50 Ω	1 %	10 %
75 Ω	2 %	20 %

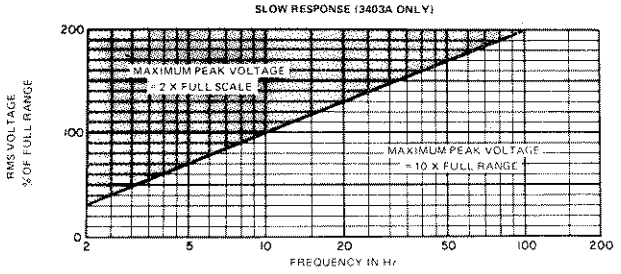
Autoranging (Options 001, 003, and 005, 3403A only):
Upranging occurs at approximately 190 % of range, downranging at approximately 17 % of range.

Autorange operating frequency range: Input signals above the frequencies indicated by the Frequency Range chart in this table may result in erroneous readings and improper autorange operation.

Autorange time per range change:
Fast response time: 1 second
Slow response time: 10 seconds

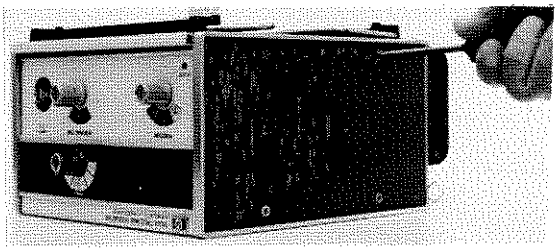
Crest Factor: Peak Voltage Limits:





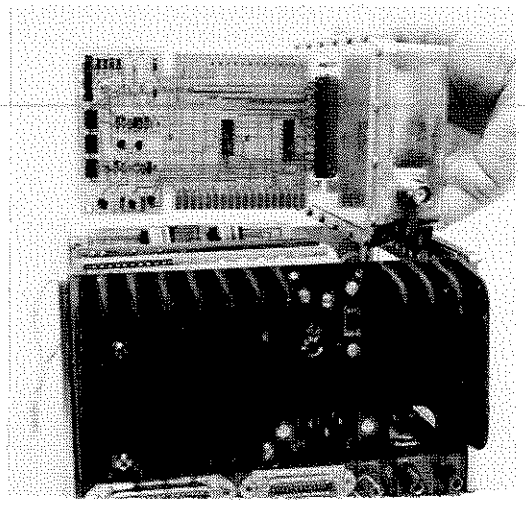
Crest Factor:
The Crest Factor capabilities of the Model 3403A and 3403B are limited by two things: the dynamic range of the Input Amplifier and the Overload Protection circuitry which protects the thermopile. The dynamic range of the Input Amplifier is sufficient to handle peaks of at least 10 times full range. The Overload Protection circuit, which limits the peak temperature of the thermopile, is dependent on both the voltage level and frequency. The following figures show the ranges of frequency and level at which the RMS Converter will accept signals with peaks of 10 times full range without being limited by the Overload Protection circuit. As the frequency is reduced (or the RMS value is increased) beyond the limits shown, the maximum peak voltage allowable makes a fairly abrupt transition from 10 times to 2 times full range.

Step A



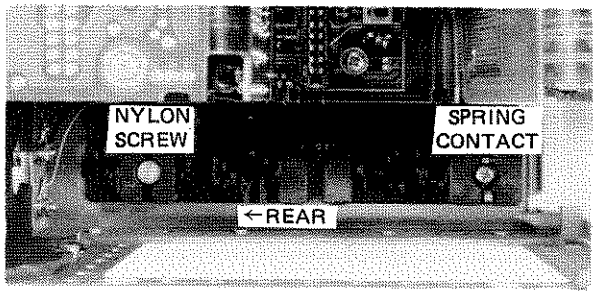
Turn 3403A upside down and remove all four screws in each side to remove side and bottom covers.

Step B



Remove AC Converter and Connector Assembly. Remove hole plug from rear panel.

Step C
(Eliminate this step for 3403B and for 3403A serial numbers 1151A00401 and higher)



Move spring grounding contact to corresponding position at rear of plastic holder. Be sure to use metal screw to secure spring and nylon screw at opposite end.

Step D

Turn AC Converter and Connector Assembly over and insert with input connector toward rear of instrument.

Replace bottom and side covers. Place hole plug in front panel.

Figure 2-1. Changing Input from Front to Rear.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information and instructions necessary for installing the Model 3403A/B True RMS Voltmeter and for installing certain options within the instrument. Included are initial inspection procedures, power and grounding requirements, installation and interface information, and instructions for repackaging for shipment.

2-3. INITIAL INSPECTION.

2-4. This instrument was carefully inspected both mechanically and electrically before shipment. It should be free of mars or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage in transit, and the electrical performance should be tested using the procedure outlined in Section V of this manual. If there is damage or deficiency, see the warranty in the front of this manual.

2-5. POWER REQUIREMENTS.

2-6. The Model 3403A/B can be operated from any source of 115 or 230 volts at 48 to 440 Hz. Power dissipation is a maximum of 50 VA, depending upon options installed.

2-7. POWER CORDS AND RECEPTACLES.

2-8. Figure 2-2 illustrates the standard power receptacle (wall outlet) configurations that are used throughout the United States and in other countries. The -hp- Part Number shown directly above each receptacle drawing is the part number for a 3403A/B power cord equipped with the appropriate mating plug for that receptacle. If the appropriate power cord is not included with the instrument, notify the nearest -hp- Sales and Service Office and a replacement cord will be provided.

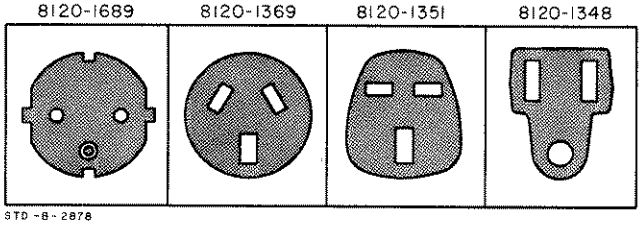


Figure 2-2. Power Cord Receptacles.

2-9. GROUNDING REQUIREMENTS.

2-10. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument panel and cabinet be grounded. The Model 3403A/B is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable is the ground wire. To preserve the protection feature when operating the instrument from a two-contact output, use a three-contact to two-contact adapter and connect the green wire on the adapter to power line (earth) ground.

2-11. INSTALLATION.

2-12. The Model 3403A/B is fully transistorized and no special cooling equipment is required. However, the instrument should not be mounted in a manner that would obstruct the free flow of air around the instrument, particularly around the rear panel cooling fins. It should not be operated where the ambient temperature exceeds 50° C (122° F) or the relative humidity exceeds 95 %. Power dissipation is 50 VA maximum.

2-13. Bench Mounting.

2-14. The Model 3403A/B is shipped with plastic feet and tilt stands in place, ready for use as a bench instrument.

2-15. Rack Mounting.

2-16. The 3403A/B may be rack mounted by using an adapter frame, -hp- Part No. 5060-8762. This adapter frame accepts a combination of submodular units for rack mounting only.

2-17. REAR PANEL INPUT.

2-18. The design of the 3403A/B permits the input connector to be located either at the front panel or rear panel. Instructions for changing the input from the usual front panel location to the rear panel are given in Figure 2-1.

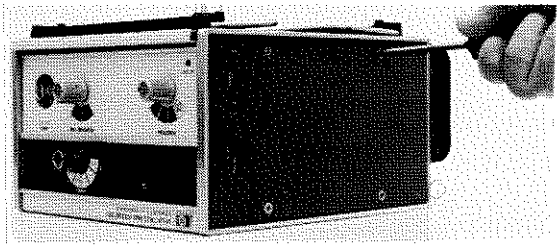
2-19. INSTALLATION OF OPTIONS.

2-20. Instructions for installing Options 001, 002, and 003 are contained in Figure 2-3. Follow only those steps which apply to the option you are installing. Of these three, only Option 002 may be installed in the Model 3403B. Options 004, 005, and 006 are available only as factory installed options.

2-21. REPACKAGING FOR SHIPMENT.

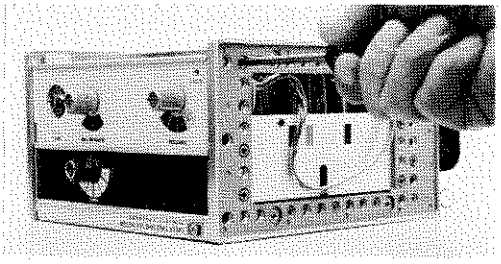
2-22. The following paragraphs contain a general guide for repackaging the instrument for shipment. Refer to Paragraph 2-23 if the original container is to be used; 2-24 if it is not. If you have any questions, contact your nearest -hp- Sales and Service Office (see Appendix B).

Step A
Options 001, 002, 003



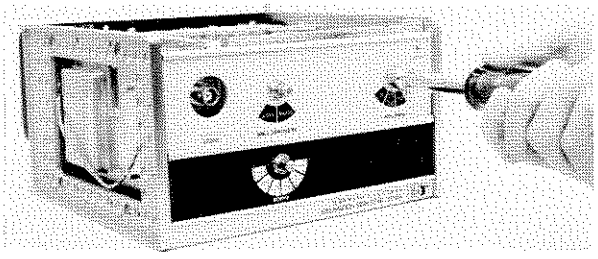
Turn 3403A/B upside down and remove all four screws in each side to remove side and bottom covers.

Step B
Options 001, 003



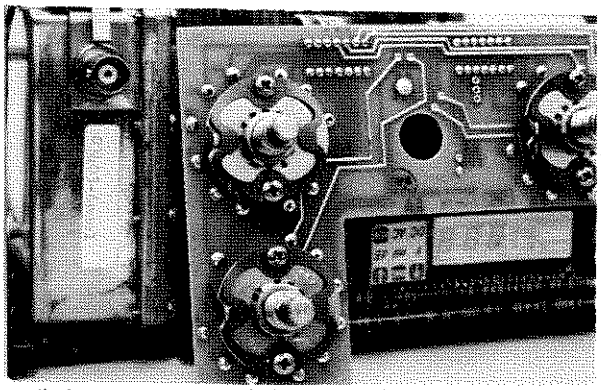
Remove one screw in each side to release front panel.

Step C
Options 001, 003



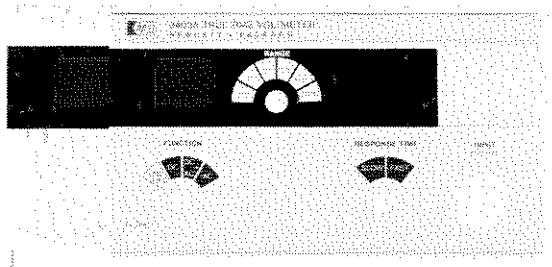
Remove all front panel control knobs. Remove mounting nuts from all front panel controls. Remove front panel from switches and board assembly carefully to avoid moving switch limit stops.

Step D
Options 001, 003



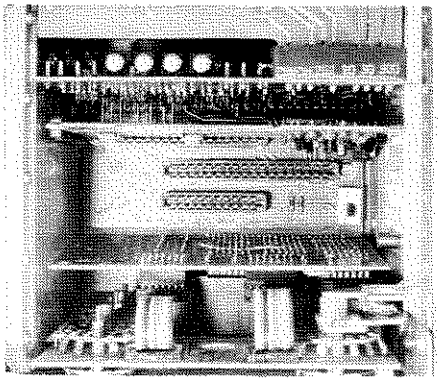
Move limit stop on range switch one position clockwise for Option 001, two positions clockwise for Option 003. Detent plates may be mounted opposite (180°) to the position shown. Place drop of fingernail polish or other quick-drying substance on limit stop and allow to set.

Step E
Options 001, 003



Slide window from front panel and replace with window supplied with option. Place front panel in position, making sure switch limit stops are in correct position. Replace control mounting nuts. Secure front panel in position. Replace control knobs.

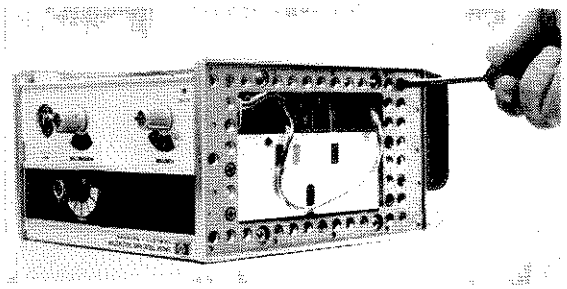
Step F
Option 001, 003



Place Autorange Assembly (Option 001) or Remote and Autorange Assembly (Option 003) into J5, with components toward front of instrument.

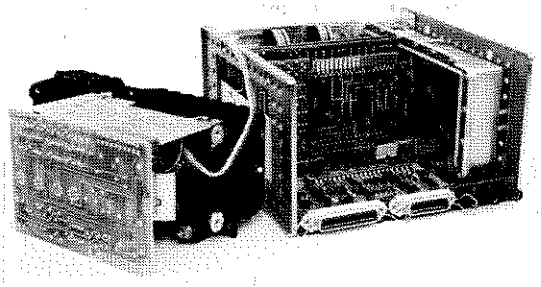
Figure 2-3. Installation of Options.

Step G
Option 002, 003



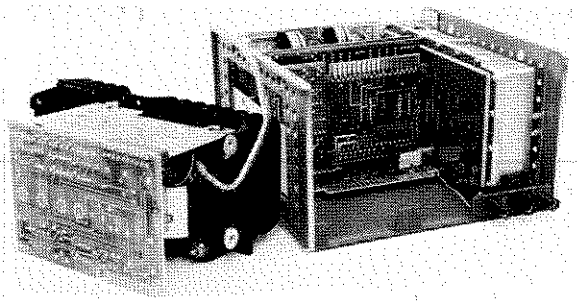
Remove two screws from each side to release rear panel.

Step I
Options 002, 003



Remove plate from flange of top cover and insert Input/Output Assembly into connector on edge of Master Board. Secure connectors to flange.

Step H
Option 002, 003



Remove rear panel with power supply attached.

Step J
Options 002, 003

Place rear panel assembly in position and secure. Replace side and bottom covers.

Figure 2-3. Installation of Options (Cont'd).

NOTE

If the instrument is to be shipped to Hewlett-Packard for service or repair, attach a tag to the instrument identifying the owner and indicating the service or repair to be accomplished. Include the model number and full serial number of the instrument. In any correspondence, identify the instrument by model number and full serial number.

2-23. Place instrument in original container with appropriate packing material and seal well with strong tape or metal bands. If original container is not available, one can be purchased from your nearest -hp- Sales and Service Office.

2-24. If original container is not be be used, proceed as follows:

a. Wrap instrument in heavy paper or plastic before placing in an inner container.

b. Place packing material around all sides of instrument and protect panel face with cardboard strips.

c. Place instrument and inner container in a heavy carton and seal with strong tape or metal bands.

d. Mark shipping container "DELICATE INSTRUMENT", "FRAGILE", etc.

2-25. INTERFACE CONNECTIONS.

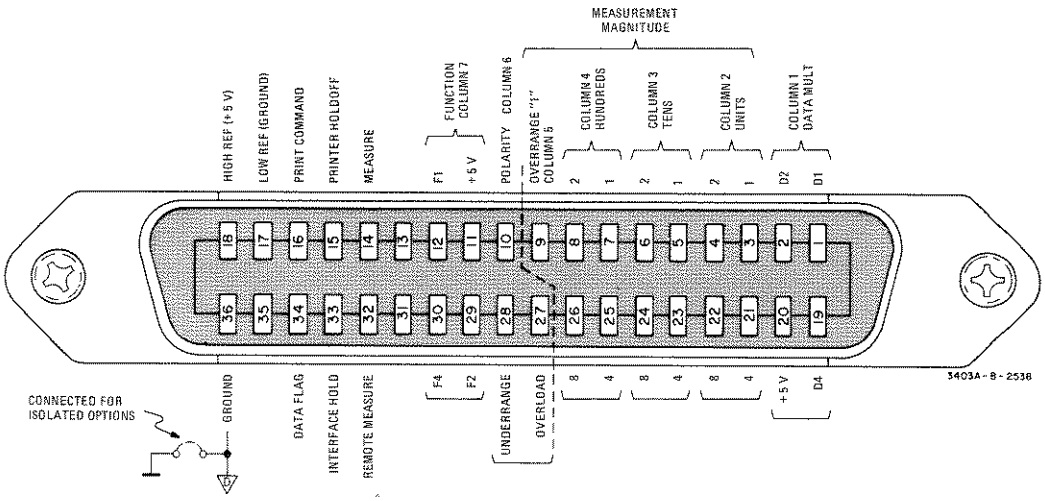
2-26. Digital Output.

2-27. If the Model 3403A/B is equipped with a Digital Output option, 7 columns of 1-2-4-8 coded BCD information are provided, LOW state true. In addition to 4 columns of measurement magnitude information, range, function, polarity, and out-of-range information are provided. Positive reference is + 5 V and negative reference is 0 V (ground), available at the rear panel connector. In addition to the coded information, connections are provided for several input and output signals. Figure 2-4 shows the BCD Output Connector J2 and gives required interface information. The mating connector for J2 is -hp- Part No. 1251-0084 (Amphenol No. 57-30360-375). A cable, -hp-11184A, is available for connection to -hp- digital recorders.

2-28. Remote Control.

2-29. Options 003 and 005, available only in the Model 3403A, permit remote programming of function, range, autorange, and response time. Lines are also provided for remote control of sampling. Figure 2-5 shows the Remote Program Connector J3 and gives required interface information. The mating connector for J3 is -hp- Part No. 1251-0293 (Amphenol No. 57-30240).

BCD OUTPUT CONNECTOR J2



OUTPUT SIGNAL LEVELS

LOW = < + 0.5 V, 12 mA max sink current
HIGH = + 5 V, 6 kΩ source resistance
Data output signals are LOW true.
Printer columns are numbered right to left.

OUTPUT SIGNALS

Column 1: Readout Magnitude Multiplier is Decimal position in negative power of 10 beginning at a point between columns 1 and 2 (0000.0×10^{-n}). Multiplier is 1 for all dB measurements.

Print	Voltage Range
0	1000. V
1	100.0 V
2	10.00 V
3	1.000 V
4	.1000 V
5	.01000 V

Columns 2 through 5: Readout Magnitude.

Column 6: Polarity, Overload, and Underrange.

Print	Conditions
0	-
1	+
2	-, Overload
3	+, Overload
4	-, Underrange
5	+, Underrange
6	-, Underrange, Overload
7	+, Underrange, Overload

Column 7: Function.

Print	Function
0	DC + AC Volts
1	DC Volts
2	AC Volts

Column 7: Function. (cont'd)

Print	Function
3	Not used
4	DC + AC dB
5	Not used
6	AC dB
7	Not used

Print Command:
Positive- or negative-going pulse between 0 V and - 10 V. Polarity is selected by connection on Input/Output Assembly. First Transition acknowledges receipt of Remote Measure signal when in Remote mode of operation. Second transition indicates valid data available.

Data Flag:
Positive- or negative-going pulse between 0 V and + 5 V. Polarity is selected by connection on Input/Output Assembly. First transition acknowledges receipt of Remote Measure signal when in Remote mode of operation. Second transition indicates valid data available.

Print Command and Data Flag are identical except for voltage.

INPUT SIGNALS:

Interface Hold:
LOW level disables automatic sampling.

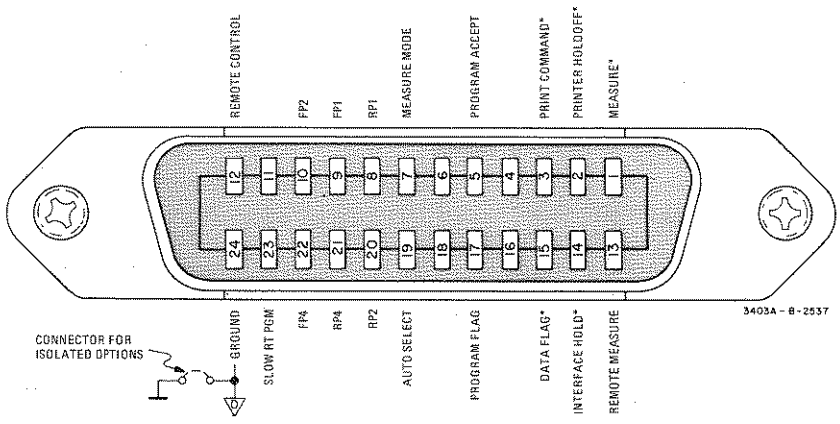
Printer Holdoff:
Level $\geqslant$ + 2.0 V and $\leqslant$ + 20 V disables automatic sampling.

Measure:
LOW > 2 microseconds initiates measurement.

Remote Measure:
LOW > 50 microseconds initiates measurement when in Remote operating mode.

Figure 2-4. BCD Output Connector J2.

REMOTE PROGRAM CONNECTOR J3



*These signals available with or without Remote option installed.

INPUT SIGNAL LEVELS

LOW = + 0.5 V, 12 mA max sink current, or contact closure to ground through < 600 Ω.
HIGH = + 5 V, 6 kΩ source resistance, or open circuit.

INPUT SIGNALS

Remote Control:
LOW level enables remote programming and disables front panel Function, Range, and Response Time Controls. Disables automatic sampling.

Remote Measure:
LOW > 50 microseconds initiates measurement when in Remote operating mode.

Interface Hold*:
LOW level disables automatic sampling.

Printer Holdoff*:
Level ⩾ + 2 V and ⩽ + 20 V disables automatic sampling.

Measure*:
LOW > 2 microseconds initiates measurement.

Program Accept:
LOW > 50 microseconds accepts remote program word.

Function Program:

Function	FP1	FP2	FP4	
D C + AC Volts	H	H	H	
DC Volts	L	H	H	
AC Volts	H	L	H	
Not used	L	L	H	
DC + AC dB	H	H	L	If dB Option not installed these states not used.
Not used	L	H	L	
AC dB	H	L	L	
Not used	L	L	L	

Range Program:

Range	RP1	RP2	RP4
1000 V	H	H	H
100 V	L	H	H
10 V	H	L	H
1 V	L	L	H
.1 V	H	H	L
.01 V	L	H	L

Auto Select:
LOW level selects autoranging when in Remote mode.

Response Time Program:
LOW = Slow; HIGH = Fast

Measure Mode Program:
LOW = Non-delayed; HIGH = Delayed

OUTPUT SIGNALS:

Program Flag:
Positive - or negative - going pulse between 0 V and + 5 V. Polarity selected by connection on Remote Assembly. First transition acknowledges receipt of Program Accept. Second transition indicated program stored.

Print Command*:
Positive - or negative - going pulse between 0 V and - 10 V. Polarity selected by connection on Input/Output Assembly. First transition acknowledges receipt of Remote Measure command when in Remote mode of operation. Second transition indicates valid data available.

Data Flag:
Positive - or negative - going pulse between 0 V and + 5 V. Polarity selected by connection on Input/Output Assembly. First transition acknowledges receipt of Remote Measure command when in Remote mode. Second transition indicates valid data available.

Figure 2-5. Remote Program Connector J3.

SECTION III
OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. The -hp- Model 3403A/B True RMS voltmeter makes ac voltage measurements on six ranges from 10 mV to 1000 V full range. The Model 3403A also makes dc and dc + ac true rms measurements on five ranges from 100 mV to 1000 V full range. The dc + ac true rms measurement is equal to $\sqrt{(\text{dc})^2 + (\text{ac rms})^2}$. Overrange readings of greater than 190 % of range are possible on all except the 1000 V range. *The accuracy of readings in AC and DC + AC Functions is not specified below the point on any range where downrange indication occurs.*

3-3. In addition to voltage measurements, the dB option 006 permits measurements of ac and dc + ac to be read directly in dB. Other options, listed in Paragraph 1-6, provide autoranging, remote programming, digital output, and isolated operation.

3-4. FRONT AND REAR PANEL DESCRIPTION.

3-5. Figure 3-1 shows the front and rear panel controls and connectors and gives a brief description of each. Some of the features shown are available only with certain options.

3-6. MAXIMUM INPUT VOLTAGES.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT VOLTAGES OR DAMAGE TO THE INSTRUMENT MAY RESULT.

BETWEEN INPUT HIGH AND LOW:

AC FUNCTION: 1500 VAC PEAK, 500 VDC

DC FUNCTION: ± 1000 V

DC + AC FUNCTION: 1000 VRMS, 1500 V PEAK DC + AC

BETWEEN INPUT LOW AND CHASSIS (FLOATING MEASUREMENTS): ± 500 V PEAK (3403A ONLY).

3-7. GENERAL OPERATING CHARACTERISTICS.

3-8. Turn-on and Warm-up.

3-9. Make sure the rear panel 115/230 slide switch is set to the proper line voltage before connecting the Model 3403A/B. To obtain readings within the specified measurement accuracy, turn the instrument on and allow to warm up for at least 15 minutes.

3-10. DC Zero.

3-11. For maximum accuracy when making dc measurements with the Model 3403A, short the input and adjust the front panel DC ZERO control for zero display.

3-12. Floating Measurements.

CAUTION

FLOATING OR POWER LINE VOLTAGE MEASUREMENTS CANNOT BE MADE WITH THE 3403B.

TO MAKE FLOATING OR POWER LINE VOLTAGE MEASUREMENTS WITH THE 3403A, THE BANANA JACK TO BNC ADAPTER (-hp- PART NO. 5040-5847) SUPPLIED WITH THE INSTRUMENT MUST BE USED TO DISCONNECT INPUT LOW FROM CHASSIS.

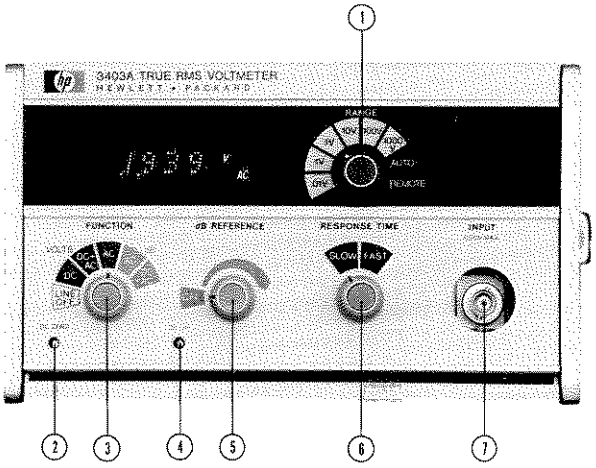
3-13. Normally, the 3403A input Low is connected to chassis (power line) ground. The banana jack to BNC adapter breaks this ground connection. *Be sure the adapter is inserted correctly and turned fully clockwise on the BNC bayonet connector.* Floating measurements may then be made of inputs up to ± 500 V peak above chassis ground, provided that any input or output equipment connected to the 3403A is also floating. If the 3403A is equipped with the Isolated Digital Output, refer to Paragraph 3-47.

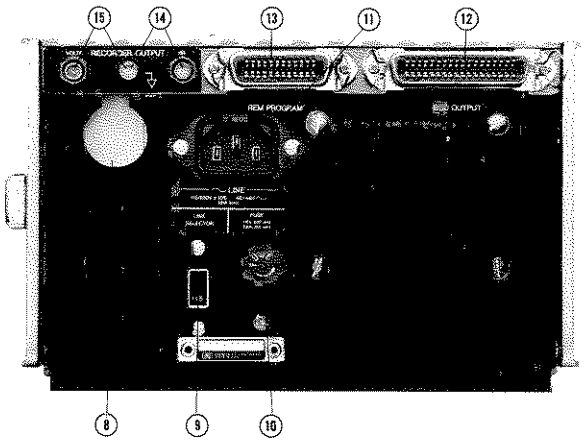
3-14. High Frequency Measurements.

3-15. At frequencies below approximately 10 MHz, input impedance is 10 MΩ ± 10 % shunted by 19 pF ± 10 % on the 1 V through 1000 V ranges, and 20 MΩ ± 10 % shunted by 16 pF ± 10 % on the .01 V and .1 V ranges. At frequencies of approximately 10 MHz and higher the input impedance is not accurately represented by the above description. When measuring signals above approximately 10 MHz, a termination should be used at the 3403A/B input equal to the characteristic impedance of the signal source, as shown in Figure 3-2. The impedance of the cable used should also match the source impedance. This is necessary to minimize the loading effect of mismatched impedances and standing waves. Maximum loading error due to input shunt impedance across a terminated source is shown in Table 3-1. Feed-thru terminations of 50 Ω (-hp- 11048B) and 75 Ω (-hp- 11094B) are available.

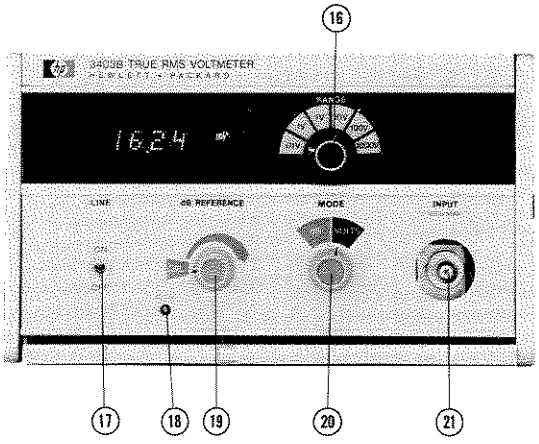
Table 3-1. Maximum Input Loading Error.

System Impedance (Source and Load)	Frequency	
	10 MHz	100 MHz
50 Ω	1 %	10 %
75 Ω	2 %	20 %





1. Range Switch. Also selects optional Autorange and Remote Control.
2. DC Zero. Corrects dc offset.
3. Function Switch and Power Line Switch.
4. dB Cal. Calibrates optional dB function to dBV or dBM 600 Ω.
5. dB Reference. Shifts dB reference level downward at least 10 dB.
6. Response Time Control. Slow selects 10 second response time and 1/s sample rate. Fast selects 1 second response time and 4/s sample rate.
7. BNC input connector. May be changed to rear panel input.
8. Location of rear panel input. See Paragraph 2-17.
9. Line voltage selector.
10. Line fuse.
11. Power input connector.
12. Digital output connector (optional).
13. Remote Control connector (optional).
14. dB Analog Recorder output terminals (optional).
15. Volts Analog Recorder output terminals.



16. Range Switch, S3.
17. Power Line Switch, S6.
18. dB Cal (Option 006). Calibrates dB function to dBV or dBm 600 Ω.
19. dB Reference (Option 006). Shifts dB reference level downward at least 10 dB.
20. Mode Switch, S2 (Option 006).
21. BNC input connector. May be changed to rear panel input. Connector shell is connected to chassis at all times. Do NOT attempt measurement of power line voltages or floating voltages, or damage to the instrument may result.

Figure 3-1. Front and Rear Panels.

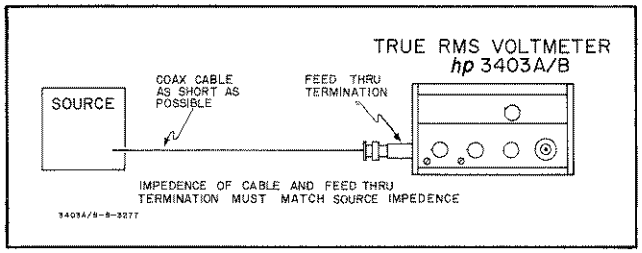


Figure 3-2. High Frequency Measurements.

3-16. Response Time.

3-17. 3403A. The Model 3403A reaches final reading ± 0.1 % of an input voltage change within the stated response time. The 3403A provides a choice of two response times. SLOW response time is approximately 10 seconds, and must be used with DC + AC Function for input frequencies below 25 Hz. FAST response time is approximately 1 second and may be used for frequencies higher than 25 Hz.

3-18. 3403B. The Model 3403B reaches final reading ± 0.1 % of an input voltage change within 1 second.

3-19. Automatic Sampling Rate.

3-20. The automatic sampling rate of the 3403B is fixed at 4 per second. The RESPONSE TIME control of the 3403A selects the automatic sampling rate. In the SLOW position, the reading rate is 1 per second, and 4 per second in FAST position. In both instruments, the reading rate is faster than the response, resulting in one or more erroneous readings when a large step input voltage is applied. However, the faster reading rates provided are desirable when small voltage changes are being observed.

3-21. Measure Command Input.

3-22. This input connection is available in either the 3403A or 3403B equipped with a Digital Output option. When the Interface Hold line is grounded (continuous LOW), a LOW connection at the Measure input for $> 2\ \mu s$ initiates a measurement. In this method of operation, the maximum reading rate is 15 per second.

3-23. Remote Measure Command Input.

3-24. This input connection is available only in the 3403A equipped with a Remote Control option.

3-25. Non-Delayed Measure Mode. The non-delayed mode must be programmed by a LOW signal at the Measure Mode connection, J3 Pin 7. See Figure 2-5 and Paragraph 3-53. In this mode of operation, a Remote Measure command (LOW $> 50\ \mu s$ at the Remote Measure input of either J2 or J3) initiates a measurement within a few microseconds. The maximum reading rate in the non-delayed mode is 15 per second; however, it may be desirable to consider the 3403A response time in determining the optimum reading rate.

3-26. Delayed Measure Mode. A HIGH signal (or open circuit) at the Measure Mode connection, J3 Pin 7, selects the delayed measure mode of operation. In this mode, the Remote Measure command is delayed for a length of time determined by the 3403A response time programmed. See Figure 2-5 and Paragraph 3-53. If Fast response time is selected, the delay is a minimum of 1 second, and 10 seconds minimum for Slow response time. The reading rate, then, is determined by the response time selected. A Remote Measure command may be applied following the second transition of the Print Command or Data Flag signal, which indicates that the previous measurement has been completed. A Remote Measure command applied between the first and second transition of these signals will have no effect. The measurement sequence is illustrated in Figure 3-3.

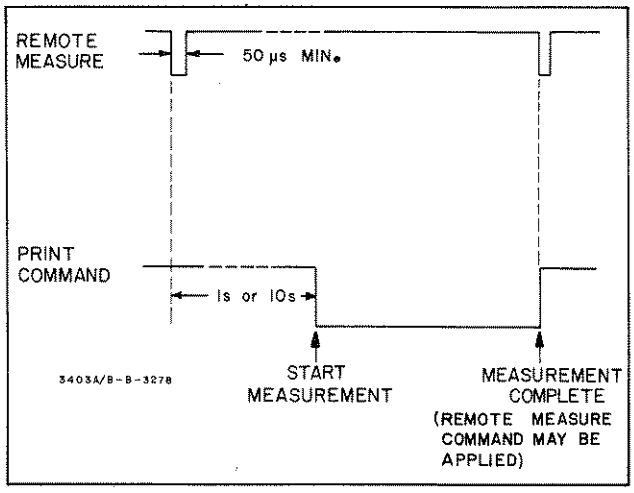


Figure 3-3. Remote Measure Sequence.

3-27. Overrange Measurements.

3-28. The Model 3403A/B is capable of readings greater than 190 % of full range on all except the 1000 V range. The fourth digit "1" lights for all measurements of 1000 or higher.

3-29. Out-of-Range Indication.

3-30. If any or all of the ↑, RNG, or ↓ annunciators are lit, the reading is not valid. In voltage measurements, this out-of-range indication occurs for readings below approximately 17 % of range or above approximately 190 % of range. If a measurement is overrange, the RNG annunciator or the three least significant digits may blank. If the digits are lit, the numbers displayed are not accurate. In dB measurements, the out-of-range limits on the two lower ranges are approximately 34 % and 380 % of range. On the four higher ranges, the limits are 17 % and 190 %.

3-31. Autoranging (3403A).

3-32. When autoranging operation (Option 001, 003 or 005) is selected, autoranging occurs at the points where the uprange and downrange indications occur. Autoranging

time per range change is 1 second minimum when fast response time is selected, and 10 seconds minimum for slow response time. If a step input voltage greater than approximately 220 % of range is applied, the instrument will go to the 1000 V range and then downrange to the proper range. Due to the frequency response design of the attenuator, autoranging may not operate properly above certain frequencies on some ranges. These limits are shown in Table 3-2.

Table 3-2. Autorange/Frequency Limits.

Range	Maximum Frequency
.01 V	2 MHz
.1 V	100 MHz
1 V	100 MHz
10 V	10 MHz
100 V	1 MHz
1000 V	100 kHz

3-33. Analog Recorder Output.

3-34. Volts. The Volts Recorder Output at the rear panel of the Model 3403A/B is + 1 V for a full-range input on any range in the AC function. A full-range DC + AC input (3403A) also gives + 1 V output. In the DC function (3403A), the output is ± 1 V for a full-range + or - dc input. The Volts Recorder Output resistance is 1 kΩ ± 10 %.

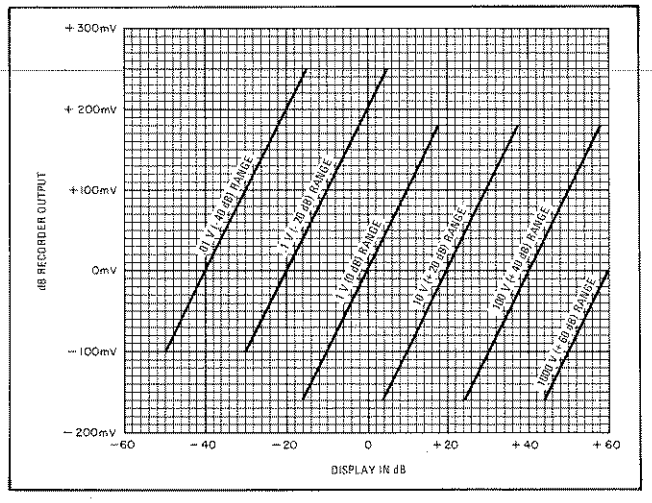
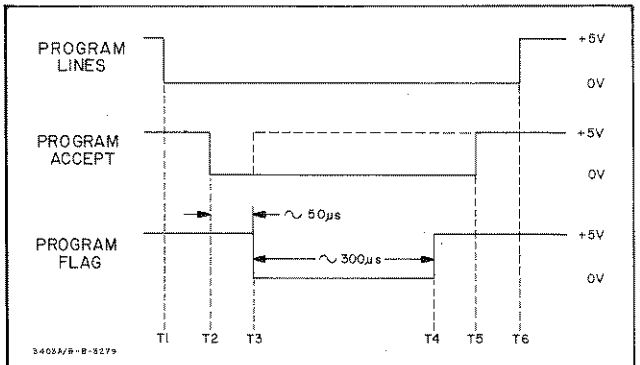


Figure 3-4. dB Analog Recorder Output.

3-35. dB. If the instrument incorporates the dB option, a dB Analog Output is provided in addition to the voltage output. The voltage level at the dB Recorder Output is 0 mV for a display of 00.0 dB. For readings above or below 0 dB, the recorder output varies ± 10 mV per dB. Figure 3-4 shows the relationship between the dB Recorder Output, the display, and the range selected. Output resistance is 1000 Ω ± 500 Ω.



T1 - Selection of desired range, function, response time, and measure mode lines.

T2 - Program accept command. T1 and T2 may occur simultaneously.

T3 - First transition of Program Flag acknowledges receipt of Program Accept command. Program accept line may be returned HIGH. Must go HIGH before next program information is to be stored. (Program Flag signal may be inverted by changing connection of W1 on Remote Assembly A14.)

T4 - Second transition of Program Flag indicates program has been stored. If the Delayed Measure Mode is selected, a Remote Measure command may be applied. Refer to Paragraph 3-23.

T5 - Program Accept must go HIGH before next program information is to be stored.

T6 - Program selection lines may be returned HIGH. A line need not be returned HIGH unless a subsequent program change is desired. T5 and T6 may occur simultaneously.

Figure 3-5. Remote Programming Sequence.

3-36. Non-Sinusoidal Input Signals.

3-37. The Model 3403A/B makes true rms measurements of non-sinusoidal input signals as shown in the Crest Factor information in Table 1-2. When the frequency and rms value of the signal fall within the shaded portion of the Crest Factor graphs (Table 1-2), a peak voltage greater than 2 times full range will cause the ↑ indicator and the 3 least significant digits to flash, indicating that the peak voltage is beyond the limit of the instrument. When operating the 3403A in the autorange mode, this condition will cause the instrument to go to the 1000 V range and then range downward to the proper range.

3-38. DIGITAL OUTPUT.

3-39. Output Signals and Levels.

3-40. Coded Data. The Model 3403A/B equipped with a Digital Output option provides 7 columns of 1-2-4-8 coded BCD information, LOW state true. LOW = < + 0.5 V, 12 mA maximum sink current; HIGH = + 5 V, 6 kΩ source resistance. In addition to measurement magnitude, coded output information includes range, function, polarity, and

out-of-range conditions. Figure 2-4 shows the print codes for a standard -hp- 5050B print wheel, -1248.

3-41. Print Command and Data Flag (3403A only). These two pulse outputs occur simultaneously, and are both either positive-going or negative-going. Pulse polarity is selected by a connection on the Input/Output Assembly, A15. If the jumper, W1, is in position A (see Figure 7-20), the pulses are negative-going, and are positive-going if W1 is in position B. The Print Command signal goes between 0 V and - 10 V, and Data Flag between 0 V and + 5 V. The first transition of either pulse acknowledges receipt of a Remote Measure command when operating in the Remote mode, and the second transition indicates that valid data is available.

3-42. Input Signals and Levels.

3-43. Interface Hold. A continuous LOW level disables automatic sampling. LOW = + 0.5 V, 12 mA maximum sink current; or contact closure to ground through $< 600\ \Omega$. HIGH = + 5 V, 6 kΩ source resistance; or open circuit.

3-44. Printer Holdoff. A voltage level between + 2 V and + 20 V disables automatic sampling. A LOW level (< 0.5 V) or an open circuit permits automatic sampling.

3-45. Measure. A LOW > 2 microseconds initiates a measurement when the Interface Hold input is LOW. This input may be used whether the instrument has the Remote option or not. LOW = < + 0.5 V, 12 mA maximum sink current; or contact closure to ground through $< 600\ \Omega$. HIGH = + 5 V, 6 kΩ source resistance; or open circuit.

3-46. Remote Measure. A LOW input > 50 microseconds initiates a measurement when operating in the Remote mode. The measurement may be delayed or non-delayed (see Paragraphs 3-23 and 3-53). LOW = < + 0.5 V, 12 mA maximum sink current; or contact closure to ground through $< 600\ \Omega$. HIGH = + 5 V, 6 kΩ source resistance; or open circuit.

3-47. Digital Output Isolation Characteristics.

3-48. Option 002 (3403B). Output data lines and input control lines are referenced to a ground line that is electrically common with the measurement input Low. Input Low is connected to chassis (power line) ground at all times.

3-49. Option 002, 003 (3403A). Output data lines and input control lines are referenced to a ground line that is electrically common with the measurement input Low. Input Low is normally connected to chassis (power line) ground, but may be disconnected from chassis ground by use of the banana jack to BNC adapter provided with the instrument (-hp- Part No. 5040-5847). *Make sure the adapter is inserted correctly and turned fully clockwise on the BNC bayonet connector.* With the use of this input adapter, floating measurements may be made only if the printer or other interface equipment can be floated. However, under these operating conditions, common-mode rejection characteristics may be degraded.

3-50. Option 004 and 005 (3403A). Output data and input control lines are referenced to chassis (power line) ground. The banana jack to BNC adapter (-hp- Part No. 5040-5847) supplied with the 3403A must be used at the input to disconnect input Low from chassis ground in order to make floating measurement. *Make sure the adapter is inserted correctly and turned fully clockwise on the BNC bayonet connector.* The instrument will maintain all normal- and common-mode rejection characteristics under these conditions.

3-51. REMOTE CONTROL (3403A).

3-52. Options 003 and 005 permit remote programming of function, range, autorange, and response time. Lines are also provided for remote control of sampling. Isolation characteristics for Remote Control Option 003 are the same as those given for Digital Output in Paragraph 3-49, and those for Option 005 are the same as in Paragraph 3-50. Figure 2-5 shows the Remote Program Connector J3 and gives required interface information. For all input signals, LOW = < + 0.5 V, 12 mA maximum sink current; or contact closure to ground through $< 600\ \Omega$. HIGH = + 5 V, 6 kΩ source resistance; or open circuit.

3-53. Remote Programming.

3-54. The remote mode of operation may be selected either by the front panel switch or by a continuous LOW connection at the rear panel connector, J3. Either method enables remote programming and disables the front panel function range, and response time controls. Programming of Range, Function, Response Time, and Measure Mode must be entered and stored in the instrument by application of a Program Accept command. The remote programming sequence is shown in Figure 3-5. Autorange and Non-Delayed Measure Mode must not be programmed at the same time, or the instrument will not autorange.

3-55. Remote Measurement Control.

3-56. The remote measurement rate is affected by the programmed response time and measurement mode, and is discussed in Paragraph 3-23.

3-57. Output Signals.

3-58. Program Flag. This signal is a positive- or negative-going pulse between 0 V and + 5 V. The pulse polarity is selected by a connection, W1, on the Remote Assembly, A14. The first transition acknowledges receipt of a Program Accept command, and the second transition indicates that the program is stored.

3-59. Print Command and Data Flag. These signals are described in Paragraph 3-41.

3-60. dB DISPLAY.

3-61. Option 006 provides a choice of either a voltage or dB display. The dB display is normally calibrated in dBV (1 V = 0 dB). However, the front panel dB CAL screwdriver adjustment allows calibration in dBm 600 Ω (.7746 V = 0 dB). To accomplish dBm 600 Ω calibration, set the 3403A/B FUNCTION to AC dB, RANGE to 1 V, and apply an accurate .7746 V at 100 Hz from an ac calibrator (-hp- 745A). Adjust the dB CAL control for a display of 00.0 dB. A variable dB REFERENCE control is provided with which the reference level may be shifted downward at least 10 dB for comparison measurements. This range of reference levels includes dBm 75 Ω and dBm 50 Ω.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. A block diagram of the Model 3403A/B is shown in Figure 7-2. The following paragraphs give a brief description of circuit operation.

4-3. AC CONVERTER ASSEMBLY.

4-4. Attenuator.

4-5. In addition to input signal attenuation, the Attenuator provides frequency compensation on all ranges. When a dc function is selected, the input blocking capacitor is bypassed by a reed relay. Attenuation ratio is also selected by reed relays. These relays are driven by signals which are initiated by the front panel switches or by optional autorange or remote program circuits. Table 4-1 shows attenuator and amplifier gains for each range.

4-6. Input Amplifier.

4-7. The Input Amplifier circuit is contained in one integrated circuit package, except for a feedback amplifier circuit which is used on all ac functions. This feedback amplifier is connected into the circuit by Field Effect Transistor (FET) switches. On the .01 V range, the Input Amplifier gain is 50 and an additional feedback capacitor is switched into the circuit. On all other ranges the gain is 5. There are two signal outputs from the Input Amplifier; one goes to the rms Converter Amplifier, and the other by-passes the Converter and is used when the "dc only" function is selected (3403A).

4-8. Converter Amplifier.

4-9. A specially designed dual thermocouple called a thermopile is used in the Converter Amplifier. Each half of the thermopile consists of 30 thermocouples in series, resulting in high sensitivity. The low thermal mass of the thin-film construction permits rapid response to input signal changes. One half of the dual thermocouple converts the ac to dc, and the other half is used in the dc feedback loop of the Converter Amplifier. Since a thermocouple is a non-linear device (output proportional to power input), the feedback offsets the non-linearity of the input to the amplifier, resulting in a linear dc output. Using the dual unit in this manner also minimizes the effect of ambient temperature drift. An integrating ac feedback loop is employed to filter out the ripple in the converter thermocouple output. A square-law amplifier in this loop offsets the non-linearity of the thermocouple output to provide a linear integrating action. In the 3403A, integrating capacitance is increased when Slow Response Time is selected, to permit measurement of signals down in 2 Hz.

4-10. Thermopile Protection.

4-11. The Converter Thermopile is extremely sensitive to overload voltages and is easily destroyed. Consequently, a means of protection has been devised which cuts off the input to the thermopile when overload conditions exist. This is accomplished by removing the supply voltages to the output stage of the Input Amplifier. A comparator amplifier senses the voltage drop across a resistor in the Converter Amplifier integrating feedback loop. If this voltage drop indicates an excessive input, the comparator activates the protection circuit. The protection circuit is also employed when switching to Slow Response Time, since additional capacitance added to the integrating circuit may result in an overload to the thermopile. The protection circuit also prevents a surge through the thermopile at instrument turn-on.

4-12. DC Amplifier.

4-13. The DC Amplifier has a gain of 4 on the .01 V and .1 V ranges, and a gain of 2 on all other ranges. However, this circuit is designed primarily as a filter amplifier. The DC Amplifier output is ± 1 V for a full-range input in the "dc only" function, and + 1 V for full range input on all

Table 4-1. Attenuator and Amplifier Gain.

RANGE	APPROXIMATE GAIN				TOTAL GAIN OUT/RMS IN
	ATTEN-UATOR	INPUT AMP	CONVERTER AMP	DC AMP	
.01 V	.5	50	1	4	100
.1 V	.5	5	1	4	10
1 V	.1	5	1	2	1
10 V	.01	5	1	2	.1
100 V	.001	5	1	2	.01
1000V	.0001	5	1	2	.001

ranges when an ac function is selected. Final gain adjustments for all ranges are made in the feedback circuit of this amplifier.

4-14. Converter Logic.

4-15. The converter Logic circuits translate the Range, Function and Response Time selection signals into voltages which drive the proper reed relays and FET switches.

4-16. CONNECTOR ASSEMBLY.

4-17. The Connector Assembly carries signals and supply voltages between the AC Converter Assembly and the Master Board Assembly. In addition, comparator amplifiers on this assembly determine when the input signal is above or below the proper level for the range selected, and activate uprange or downrange indicators (3403A only) through logic circuits located on the Master Board. These signals are also used to initiate autoranging if the instrument incorporates this option. Buffer amplifiers are used in the range and function control lines. If the instrument incorporates the Isolated BCD option, photo-isolators are also used in all signal lines.

4-18. DIGITAL PANEL METER.

4-19. Analog Circuits.

4-20. Measurement Technique. The Digital Panel Meter uses the dual-slope integration method of analog-to-digital conversion. The integrator charges toward a voltage proportional to the input voltage for a fixed time of 1/60 second, as shown in Figure 4-1. Consequently, the charging rate and resulting charge are proportional to the input voltage. The integrator is then discharged at a fixed rate toward a known reference voltage. Since the discharge rate is constant, the discharge time is proportional to the amplitude of the charge (and the input voltage). The Counter accumulates the number of clock pulses received during the discharge time, and this number is displayed as the measurement amplitude.

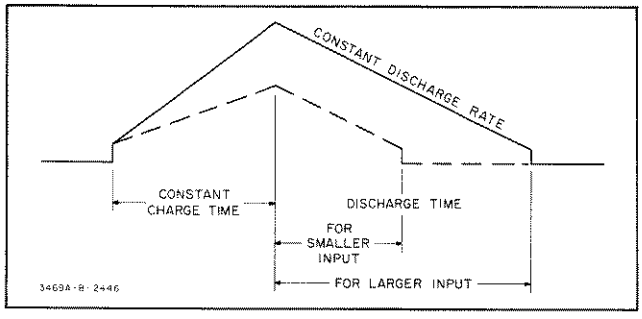


Figure 4-1. Dual-Slope Integration.

4-21. Analog Circuit Outputs. The Analog Circuits are almost entirely contained in an integrated circuit package. In addition to the integrator, this package contains a switching circuit which causes the integrator to charge and discharge. The "Zero Detect" output to the Control Logic is the output of a ground comparator circuit and is negative during the measurement period. This negative portion of the output is also used to turn on the sample indicator. Polarity of the input signal is determined in the Analog Circuits.

4-22. Control Logic.

4-23. To begin a measurement, the sample rate circuit (in the Logic IC) generates a Reset pulse which resets the counter to zero. The trailing edge of the Reset pulse makes the Switch Drive signal go negative to cause the Integrator to begin charging. The Clock is disabled during the Reset pulse. Following the Reset pulse, the Counter accumulates 1000 counts (1/60 second) and then causes another Reset pulse to be generated, again resetting the Counter to zero. This pulse also changes the Switch Drive signal to positive, causing the Integrator to begin discharging. The Clock is again disabled during the Reset pulse. During the discharge time, the Counter accumulates Clock pulses until the Integrator discharges to zero, at which time a Transfer pulse is generated, transferring the accumulated count into storage. The Transfer pulse also places the polarity information in storage.

4-24. Counter/Storage.

4-25. The three decade counters accumulate the number of clock pulses between the trailing edge of one reset pulse and the leading edge of the next. The transfer pulse at the end of a measurement transfers the 1-2-4-8 BCD information contained in the Counters into the Storage units. The "b" and "c" scan signals from the Scanner unit cause the BCD information to be placed on the output lines digit by digit, beginning with the least significant (right hand) digit. Scanning is continuous, and the display changes only when a transfer pulse occurs.

4-26. Scanner.

4-27. The "a", "b" and "c" scan signals are produced by three binary stages driven by a 10 kHz oscillator. These three signals are gated and the resulting coded signals are used to turn on six transistors in sequence, through which positive voltage is supplied to the three-digit display. The three digits are scanned, one-half digit at a time, beginning at the right. All three digits are scanned in approximately 0.65 milliseconds, and scanning is continuous. The "a" scan signal is also applied to the Read Only Memory to ensure that the correct information is read at the proper time for the right and left half of each digit. The "b" and "c" scan signals to the Storage units cause the correct BCD information to be supplied to the Read Only Memory at the proper time for each digit.

4-28. Memory.

4-29. The Read Only Memory accepts the BCD information from the Storage units for each digit, and translates it into a ten-line code. This ten-line output is coordinated with the right-left scan for each digit to provide a ground

connection to the proper light emitting diodes. Blanking of the three digits during an overload condition is accomplished by disabling the ground path through the Read Only Memory.

4-30. Display.

4-31. The display is made up of light emitting diodes. In addition to the three digits controlled by the Scanner and Memory, an overrange "1" lights when the measurement is 1000 or higher. The "1" is controlled by an Overrange signal from the Control Logic. The horizontal bar of the polarity symbol is lighted continuously when the "dc only" function or a dB function is selected. Then, when the input signal is positive or a dB measurement is greater than 0 dB, the vertical bar lights. Decimals are controlled by logic circuits on the Master Board Assembly, and the sample indicator is on during a measurement period.

4-32. Annunciators.

4-33. The annunciators are light emitting diodes controlled by logic circuits on the Master Board Assembly.

4-34. Measurement Data Output.

4-35. BCD measurement data for the three digits is produced serially, beginning with the right-hand digit. If the instrument incorporates one of the digital output options, the serial information is converted to parallel data on the Input/Output Assembly. In addition, the overrange "1" and polarity information are supplied continuously.

4-36. LOCAL CONTROL.

4-37. Local selection of function, range, or response time is made by switch contact to ground. This contact to ground is made through the output stage of integrated circuit inverters. If remote program operation has been selected, the output transistors of these inverters are turned off, disabling the front panel switches.

4-38. REMOTE PROGRAMMING OPTION (3403A).

4-39. Range, function, and response time may be selected remotely if the instrument has the Remote Control option. Programming of range and function is accomplished by contact to ground of coded program lines. Decoding is done on the Remote Assembly A14. A "Program Accept" signal is required to initiate or change a program. Range, function and response time programming is stored until a succeeding Program Accept command is applied. When the range switch is set to Remote, the Automatic sampling circuit is disabled, and an external trigger signal must be applied.

4-40. DISPLAY LOGIC.

4-41. Polarity Display.

4-42. The horizontal and veritcal bars of the polarity symbol are controlled separately. If the dc voltage function is selected (3403A), the control logic causes the horizontal bar to remain on continuously. Also, a gate is enabled which allows the Auto Polarity signal to turn on the vertical bar when the input is positive. If an ac function is selected, the control logic prevents any polarity display. However, if a dB function is selected, the polarity display is again enabled. The dB Adder circuit then influences the polarity decision of the Digital Panel Meter, and the polarity symbol indicates whether the measurement is above or below 0 dB.

4-43. Decimal Location.

4-44. The range selection signals are gated in such a manner that the correct decimal is lit for each voltage range. No decimal point is used for the 1000 V range. If a dB function is selected, the third, or right hand decimal is forced to remain on.

4-45. Up/Down Range Indication (3403A).

4-46. The Out of Range Detectors on the Connector Assembly are adjusted so that the Uprange line goes LOW if the input is greater than approximately 190 % of range, and the Downrange line goes low if the input is less than approximately 17 % of range. If either condition exists, the RNG annunciator will light, along with the up or down arrow to indicate the need to select a higher or lower range. If the peak value of a non-symmetrical input signal is greater than the rms value to the extent that the peaks are too high for the range in use, a detection circuit in the Converter Amplifier produces a Crest Factor signal. This signal input to the range indication logic may cause the three least significant digits to blank and the Uprange arrow to light. If the range and function switches are set to .01 V DC, the RNG annunciator and both arrows will light.

4-47. dB Display.

4-48. The dB Adder Control logic provides control signals to the dB Adder circuit in the Digital Panel Meter if the instrument has the dB Option 006. This enables the Digital Panel Meter to add or subtract 20, 40 or 60 dB, according to the range selected.

4-49. AUTORANGE OPTION (3403A).

4-50. When Autorange is selected, an Autorange Clock provides pulses to Uprange and Downrange gates. If either of these gates is enabled by an autorange (Uprange or Downrange) signal, the clock pulse is allowed to pass through to an Up-Down Counter. Outputs from the counter are applied to a Decoder, which selects the correct range. The Counter Preset Gate "clears" the counter to the 1000 V range when a Crest Factor signal is received. The minimum Autorange Clock period is 1 second when Fast Response Time is selected, and 10 seconds for Slow Response Time.

4-51. REMOTE AND AUTORANGE OPTION (3403A).

4-52. If the instrument has the Remote and Autorange option, Autorange may be selected remotely. In this case,

since automatic sampling is disabled during remote operation, the autorange clock pulse is also applied to a gate which initiates a measurement after the correct range has been reached. Remote programming of range is accomplished by forcing the Up-Down Counter into the correct state.

4-53. DIGITAL OUTPUT OPTION.

4-54. The serial BCD information from the Digital Panel Meter is converted to 1-2-4-8 parallel BCD information, using the "b" and "c" scan signals provided by the panel meter. Range and Function information is also coded into BCD information. These lines, along with the overrange "1", polarity, out of range information and a Print Command signal are available at the BCD Output Connector.

4-55. dB OPTION.

4-56. The output of the AC Converter is a dc voltage which is directly proportional to the rms value of the input signal. When a dB function is selected, the Log Converter output is a dc voltage having a logarithmic relationship to the input, enabling the Digital Panel Meter to display the measurement in decibels. Normally, the amplifier is adjusted so that 1 V input = 0 dB. However, the front panel dB CAL control may be adjusted for a dBm (0 dBm = 0.775 V) indication.

4-57. POWER SUPPLIES.

4-58. Analog Circuit Supplies.

4-59. The AC Converter, Log Converter, and the analog circuits in the Digital Panel Meter are powered by regulated + and - 12 V supplies. Sensing terminals for these regulators are located in the AC Converter Assembly. The + and - 12 V supplies are referenced to analog ground, and are voltage regulated and current limited.

4-60. Digital Circuit Supplies.

4-61. Regulated voltages of + 5 V, - 5 V and - 10 V are supplied to the digital circuits, In addition, a supply of approximately + 4 V is provided for the light emitting diodes in the display. The + 4 V supply is taken from the emitter of the series pass transistor of the + 5 V supply, and is not current limited. The - 10 V, - 5 V and + 5 V supplies are voltage regulated and current limited. The - 5 V supply is developed from the regulated - 10 V supply. An overvoltage protection circuit is added to the + 5 V supply for the protection of the integrated circuits in the instrument. The digital circuit supplies are referenced to digital ground.

4-62. GROUND CIRCUITS.

4-63. Standard Instrument Ground.

4-64. In the standard 3403A/B, the analog and digital ground circuits are connected together. The connection is made on the Standard Connector Assembly A7, as shown in Figure 4-2. Also, in the 3403A, analog ground is normally connected to chassis ground through S6 on the AC Converter Assembly. In the 3403B, analog ground is permanently connected to chassis.

4-65. Isolated Instrument Ground.

4-66. In the isolated 3403A, digital ground is connected to chassis ground on the Regulator Assembly A6. In addition, an adapter (-hp- Part No. 5040-5847) must be used at the input connector to open S6, breaking the connection between analog and chassis grounds. As a result, the input (analog) ground is isolated from digital and chassis grounds.

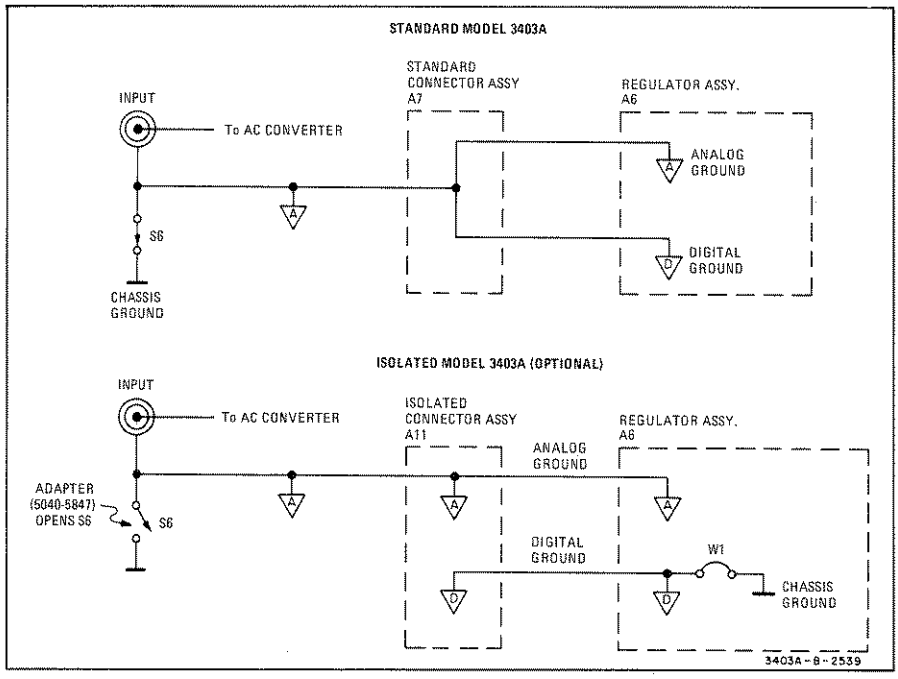


Figure 4-2. 3403A Ground Circuits.

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains information necessary to maintain the Model 3403A/B True RMS Voltmeter. The following paragraphs describe the Performance Checks, Adjustment Procedures, Servicing and Troubleshooting. Schematic diagrams are in Section VII.

5-3. TEST EQUIPMENT REQUIRED.

5-4. Recommended test equipment for maintaining and checking the performance of the 3403A/B is listed in Table 5-1. Test instruments other than those listed may be used if their specifications equal or exceed the required characteristics.

5-5. PERFORMANCE CHECK PROCEDURE.

5-6. Use the following procedures to verify proper operation of the Model 3403A/B True RMS Voltmeter. The 3403A/B and test equipment should be operated at a line voltage of 115 Vac (or 230 Vac) and ambient temperature of 20° C to 30° C unless otherwise stated. It is recommended that the performance of the 3403A/B be checked upon receipt and at regular intervals thereafter. A Performance Check Card is provided at the rear of this section for recording the performance of the 3403A/B. This card may be removed from the manual and used as a permanent record of the incoming inspection or of a routine performance check. If the 3403A/B is found to be out of specifications at any point, refer to the Adjustment Procedures or to the Troubleshooting Information. Allow sufficient warm-up for the 3403A/B and test equipment before proceeding with the Performance Checks. Some of the following procedures apply to both the 3403A and the 3403B. Others apply to the 3403A only, as indicated.

5-7. AC VOLTAGE ACCURACY CHECKS.

5-8. Mid-Band Frequency Measurements.

5-9. The ac voltage measurement accuracy of the 3403A/B at frequencies between 10 Hz and 100 kHz may be checked using an ac calibrator (-hp- 745A) and a high voltage amplifier (-hp- 746A) as the signal source. Use the input voltages shown in Table 5-2 to verify the ac voltage accuracy at the frequencies listed. The display should be within the limits given for each measurement.

5-10. 100 kHz to 10 MHz Measurements.

5-11. AC voltage accuracy at frequencies between 100 kHz and about 10 MHz may be checked using the test set-up shown in Figure 5-1 and the test equipment recommended in Table 5-3. Recommended test equipment models are: -hp- Model 8601A Generator/Sweeper; Optimation Model PA-25 Power Amplifier; -hp- 11051A 0.45 V Thermal Converter; -hp- 11050A 1 V Thermal Converter; -hp- 11049A 3 V Thermal Converter; Englehard Model 36850 or Holt Model 6A, 11 10 V and 100 V Thermal Converters;

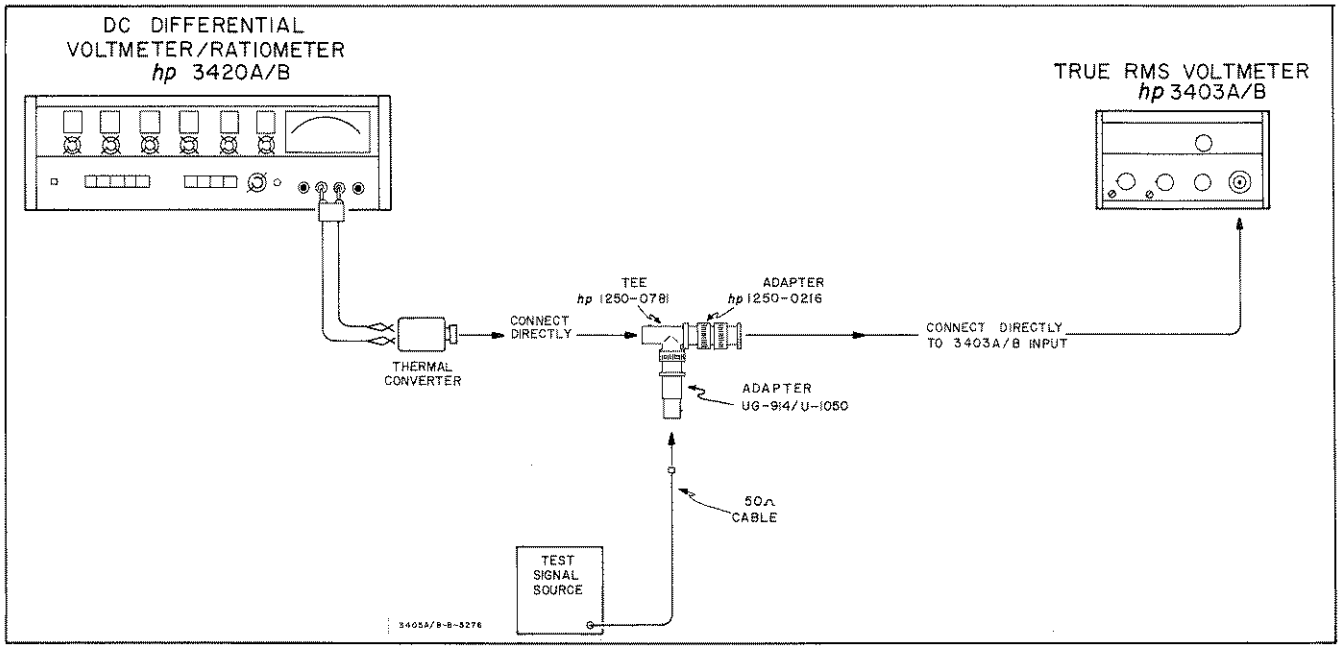


Figure 5-1. High Frequency Voltage Accuracy Check.

Table 5-1. Required Test Equipment.

Instrument Type	Required Characteristics	Use	Recommended Model
DC Voltage Standard	Voltage: 1 mV to 1000 V	Performance Checks Adjustments Troubleshooting	-hp- Model 740B DC Standard/ Differential Voltmeter
AC Calibrator/High Voltage Amplifier	Frequency: 10 Hz to 100 kHz Output Level: 1 mV to 1000 V Accuracy (mid-band): ± 0.1 % Voltage Stability: ± 0.02 % for six months	Performance Checks Adjustments Troubleshooting	-hp- Model 745A AC Calibrator/ -hp- Model 746A High Voltage Amplifier
Function Generator	Frequency: 5 Hz minimum Output Level: 10 V rms sine wave	Performance Checks	-hp- Model 3310A Function Generator
Test Oscillator	Frequency: 1 MHz to 10 MHz Output Level: 3 V rms Amplitude Flatness: ± 0.25 % (1 V and 3 V output)	Performance Checks	-hp- Model 652A Test Oscillator
AC Amplifier	Output Voltage: 10 V to 100 V Frequency: 100 kHz to 1 MHz Voltage Gain: 20 Output Power: 25 VA	Performance Checks	Optimation Inc. Model PA-25 Power Amplifier
Signal Generator	Frequency: 100 kHz - 100 MHz Output Level: 2 V rms	Performance Checks Adjustments	-hp- Model 8601A Generator/ Sweeper
DC Differential Voltmeter	Range: 1 V Resolution: 1 μV	Performance Checks Adjustments	-hp- Model 3420A/B DC Differential Voltmeter
Thermal Converters or Thermal Transfer Standards	Accuracy: Correction Factor Chart to 100 MHz Voltages: 450 mV 1 V 3 V 10 V 100 V	Performance Checks Adjustments	 -hp- Model 11051A -hp- Model 11050A -hp- Model 11049A Holt Model 6A, 11; or Englehard Model 36850
DC Digital Voltmeter	Voltage Range: 10 mV to 10 V Resolution: 0.01 mV	Adjustments Troubleshooting	-hp- Model 3480A/3482A Digital Voltmeter/DC Range Unit
Oscilloscope	Bandwidth: dc to 10 MHz Sweep: 0.2 μs to 5 s/div Sensitivity: 1 mV/div	Troubleshooting	-hp- Model 140A/1402A/1423A Oscilloscope
Capacitor	Capacitance: 1.0 μF Voltage: 20 vdcw	Performance Checks	-hp- Part No. 0160-2611
Resistors	Resistances: 1 kΩ ± 10 % 1/4 W 100 Ω ± 10 % 1/2 W 39 % ± 10 1 W	Performance Checks Troubleshooting	-hp- Part Nos. 0684-1021 0687-1011 0698-5083
Printed Circuit Extender Board	20-pin (2 x 10)	Adjustments (Option 006)	-hp- Part No. 5060-0091
Digital Recorder	Code and Standard Print Wheel: -1248	Performance Checks	-hp- Model 5055A Digital Recorder
Printer Cable	36-pin to 50-pin	Performance Checks	-hp- 11184A Printer Cable
BNC Connectors and Adapters	 Tee Adapter, male to male Adapter, female to female	Performance Checks Adjustments	 -hp- 1250-0781 -hp- 1250-0216 Amphenol, UG-914/U-1050

Table 5-2. Mid-Band AC Voltage Checks.

Function 3403A	Function 3403B	Range	Test Signal Voltage	Test Signal Frequency	Maximum Display Error	Test Signal Source
AC	Volts	.01 V	10 mV	100 Hz	±5 counts	AC Calibrator
AC	Volts	.01 V	10 mV	100 kHz	±5 counts	
AC	Volts	.1 V	20 mV	100 kHz	±4 counts	
AC	Volts	.1 V	100 mV	1 kHz	±4 counts	
AC	Volts	1 V	0.5 V	200 Hz	±3 counts	
AC	Volts	1 V	1 V	20 kHz	±4 counts	
AC	Volts	10 V	10 V	100 kHz	±4 counts	
AC	Volts	10 V	15 V	100 Hz	±5 counts	
AC	Volts	100 V	20 V	50 Hz	±2 counts	
AC	Volts	100 V	100 V	50 kHz	±4 counts	
*DC + AC	--	100 V	100 V	20 Hz	±6 counts	
*DC + AC	--	1 V	1 V	10 Hz	±6 counts	
*DC + AC	--	.1 V	100 mV	20 Hz	±10 counts	
AC	Volts	1000 V	1000 V	100 Hz	±5 counts	AC Calibrator and High Voltage Amplifier
AC	Volts	1000 V	1000 V	10 kHz	±5 counts	

* Slow response time (3403A only).

-hp- Model 3420A/B DC Voltmeter/Ratiometer. Use the following procedure for each measurement in Table 5-3. The measurement uncertainty of the thermal converter must be taken into account in each measurement.

a. Set 3403A FUNCTION to AC, 3403B MODE to VOLTS. Select proper range. Set 3403A RESPONSE TIME to FAST.

b. Set signal generator frequency to 100 kHz and adjust output level to obtain correct 3403A/B display according to voltage measurement to be checked.

c. Adjust dc differential voltmeter for null indication.

d. Change signal generator to frequency to be checked.

e. Adjust signal generator output level to return dc differential voltmeter to null indication.

f. 3403A/B display should be within limits shown for each check.

5-12. 10 MHz to 100 MHz Measurements.

5-13. Making voltage measurements in the upper frequency range of the 3403A/B involves significant problems that are not present at the frequencies covered by other general purpose ac voltmeters. At high frequencies, any measurement involves transmission line problems of impedance mismatch, standing waves, etc. Even minor variations in the hardware connections can cause significant differences. For these reasons, even the National Bureau of Standards

Table 5-3. 100 kHz to 10 MHz Checks.

Range	Test Signal Voltage	Test Signal Frequency	Maximum Display Error	Test Signal Source	Other Equipment Required
.1 V	100 mV	1 MHz	± 22 counts	Signal Generator	0.45 V Thermal Converter, DC Differential Voltmeter
.1 V	100 mV	10 MHz	± 22 counts		
1 V	1 V	2 MHz	± 12 counts	Signal Generator	1 V Thermal Converter, DC Differential Volmteter
1 V	1 V	8 MHz	± 12 counts		
10 V	3 V	500 kHz	± 4 counts	Signal Generator	3 V Thermal Converter, DC Differential Voltmeter
10 V	3 V	5 MHz	± 5 counts		
10 V	10 V	1 MHz	± 12 counts	Signal Generator, Power Amplifier	10 V Thermal Converter, DC Differential Voltmeter
10 V	10 V	5 MHz	± 12 counts		
100 V	100 V	500 kHz	± 12 counts	Signal Generator, Power Amplifier	100 V Thermal Converter, DC Differential Voltmeter
100 V	100 V	1 MHz	± 12 counts		

calibration of the thermal converters used as references for the 3403A/B accuracy checks includes an uncertainty of up to ± 1.5 % when measured in a specific hardware configuration.

5-14. For optimum accuracy, high frequency measurements should be made using matched source, load, and cable impedances. Since the 3403A/B input is unterminated, the most satisfactory configuration is shown in Figure 5-1, where the reference thermal converter is electrically as close as possible to the 3403A/B input. This is the method used at the factory for calibration and test of the instrument. Because of the difficulties described in Paragraph 5-13, the accuracy specifications at frequencies above about 10 MHz are defined using the input hardware connections shown. Measurement in any other configuration can be expected to give different results.

5-15. The .1 V and 1 V ranges should be checked at the frequencies shown in Table 5-4, using the test set-up and hardware configuration shown in Figure 5-1. The recommended signal generator is -hp- Model 8601A Generator/Sweeper, and the other equipment is the same as listed in Paragraph 5-11. Use the procedure in Paragraph 5-11 for each check.

5-16. Low Frequency Measurements (3403A).

5-17. The accuracy of the Model 3403A may be checked on the .1 V, 1 V, and 10 V ranges at frequencies down to 5 Hz using a function generator (-hp- Model 3310A) as a signal source. The thermal converter cannot be used at frequencies below 5 Hz. Connect the equipment as shown in Figure 5-1 and use the following procedure, which checks the 1 V range as an example.

a. Set 3403A FUNCTION to AC VOLTS, RESPONSE TIME to SLOW, RANGE to 1 V.

b. Set function generator frequency to 100 Hz and adjust output level to obtain 3403A display of 1.000 V.

c. Adjust dc differential voltmeter for null indication.

d. Change frequency to 5 Hz and adjust function generator output level for null indication on differential voltmeter.

e. Display should be 1.000 V ± 6 counts.

f. The .1 V and 10 V ranges may be checked in the same manner.

5-18. dB ACCURACY CHECK (Option 006).

5-19. The input to the Log Converter is the dc output of the AC Converter, and is + 1 V for a full-range input on any range. Since the accuracy and flatness of the AC Converter have been verified by the preceding checks, the dB measurement accuracy may be verified by checking the calibration and linearity of the Log Converter and the operation of the adder circuit in the Digital Panel Meter. An ac calibrator and a high voltage amplifier are required for this check.

a. 3403A: Set FUNCTION to AC dB, RANGE to 1 V, dB REFERENCE control fully counterclockwise to CAL position, RESPONSE TIME to FAST. 3403B: Set MODE to dB, RANGE to 1 V, dB REFERENCE fully counterclockwise to CAL position.

b. Connect ac calibrator to 3403A/B input and set calibrator output to 1.0000 V and 100 Hz. 3403A/B display should be - 00.2 dB to + 00.2 dB. If not, adjust front panel dB CAL screwdriver adjustment for display of 00.0 dB, with polarity symbol alternating between + and -

c. Select ranges and input voltages listed in Table 5-5, leaving ac calibrator frequency set at 100 Hz. 3403A/B display should be within limits shown in each case.

d. Reduce ac calibrator output and disconnect.

5-20. DC VOLTAGE ACCURACY CHECK (3403A).

5-21. A dc standard (-hp- 740B) is required for this check.

a. Set 3403A FUNCTION to DC VOLTS, RANGE to .1 V, RESPONSE TIME to FAST. Short input and adjust front panel DC ZERO control.

b. Connect dc standard to 3403A input and adjust standard output voltage to + .100000 V. 3403A display should be + 99.2 mV to + 100.8 mV.

Table 5-4. 10 MHz to 100 MHz Checks.

Range	Test Signal		Maximum Display Error	Test Signal Source	Other Equipment Required
	Voltage	Frequency			
.1 V	100 mV	20 MHz	± 22 counts	Signal Generator	0.45 V Thermal Converter, DC Differential Voltmeter
.1 V	100 mV	40 MHz	± 52 counts		
.1 V	100 mV	100 MHz	± 102 counts		
1 V	1 V	20 MHz	± 22 counts	Signal Generator	1 V Thermal Converter, DC Differential Voltmeter
1 V	1 V	40 MHz	± 52 counts		
1 V	1 V	100 MHz	± 102 counts		

Table 5-5. dB Accuracy Check.

3403B Range	Input Voltage	Display Limits
1 V	0.31620 V	- 09.8 dB to - 10.2 dB
.1 V	0.10000 V	- 19.8 dB to - 20.2 dB
.01 V	0.01000 V	- 39.8 dB to - 40.2 dB
10 V	10.0000 V	+ 19.8 dB to + 20.2 dB
10 V	15.0000 V	+ 23.3 dB to + 23.7 dB
100 V	100.000 V	+ 39.8 dB to + 40.2 dB
1000 V	100.000 V	+ 39.8 dB to + 40.2 dB

c. Set RANGE to 10 V, short input, and adjust DC ZERO.

d. Select ranges and positive and negative input voltages shown in Table 5-6. Display should be within limits indicated in each case.

Table 5-6. DC Voltage Accuracy Check.

3403A Range	Input Voltage	Display Limits
.1 V	± .100000 V	± 99.2 mV to 100.8 mV
.1 V	± .070000 V	± 69.2 mV to 70.8 mV
.1 V	± .040000 V	± 39.3 mV to 40.7 mV
.1 V	± 010000 V	± 09.3 mV to 10.7 mV
1 V	± 0.10000 V	± .097 V to .103 V
1 V	± 0.50000 V	± .496 V to .504 V
1 V	± 1.00000 V	± .996 V to 1.004 V
10 V	± 1.00000 V	± 0.97 V to 1.03 V
10 V	± 5.00000 V	± 4.96 V to 5.04 V
10 V	± 10.0000 V	± 9.96 V to 10.04 V
100 V	± 10.0000 V	± 09.7 V to 10.3 V
100 V	± 50.0000 V	± 49.6 V to 50.4 V
100 V	± 100.000 V	± 99.6 V to 100.4 V
1000 V	± 100.000 V	± 096 V to 104 V
1000 V	± 500.000 V	± 495 V to 505 V
1000 V	+ 1000.00 V*	+ 995 V to 1005 V

* If -hp- Model 740B is used as dc standard, do not apply negative voltage greater than - 500 V.

5-22. AC NORMAL-MODE REJECTION CHECK (3403A).

5-23. This check indicates the ability of the 3403A to reject ac signals of 60 Hz and greater in the DC function. An ac calibrator (-hp- 745A) is required for this check.

a. Set FUNCTION to DC VOLTS, RANGE to 10 V, RESPONSE TIME to FAST.

b. Short 3403A input and adjust front panel DC ZERO until display is at least 50 counts (positive or negative). Note reading.

c. Disconnect input short and connect ac calibrator to 3403A input. Set calibrator output to 20.0000 V at 60 Hz.

d. 3403A display should not vary more than ± 0.02 V from reading noted in step b, indicating normal-mode rejection of 60 dB, where:

$$\text{NMR} = 20 \log \frac{\text{normal-mode voltage}}{\text{effects on reading (volts)}}$$

e. Disconnect ac calibrator, short 3403A input and readjust DC ZERO for zero display.

5-24. AC COMMON-MODE REJECTION CHECK (3403A).

5-25. Effective common-mode rejection is the ratio of the common-mode voltage to the resultant error in reading with 1 kΩ unbalance in either lead. An ac calibrator, a 1 kΩ resistor, and an input adapter (-hp- Part No. 5040-5847) are required. (See Figure 5-2).

5-26. AC Volts Function.

a. Attach input adapter (supplied with 3403A) to 3403A input. This adapter is necessary to make floating measurements.

b. Connect 1 kΩ resistor and ac calibrator to 3403A as shown in Figure 5-2.

c. Set 3403A FUNCTION to AC VOLTS, RANGE to .1 V, RESPONSE TIME to FAST.

d. Adjust ac calibrator output to 100 V at 60 Hz. 3403A display should be less than 100.0 mV, verifying effective common-mode rejection greater than 60 dB, where:

$$\text{ECMR} = 20 \log \frac{\text{common-mode voltage}}{\text{effect on reading (volts)}}$$

5-27. DC Volts Function.

5-28. Effective common-mode rejection in the DC VOLTS function is the sum of the common-mode rejection in the AC VOLTS function and the ac normal-mode rejection.

5-29. DIGITAL OUTPUT CHECK.

5-30. The digital output of the 3403A Options 002, 003, 004 or 005, and the 3403B Option 002 may be checked by the following procedure. An ac calibrator (-hp- 745A), a dc standard (-hp- 740B), a digital recorder (-hp- 5055A), and a printer cable (-hp- 11184A) are required for this check.

a. Connect ac calibrator to 3403A/B input, digital recorder to BCD output. Recorder must accept -8421 input.

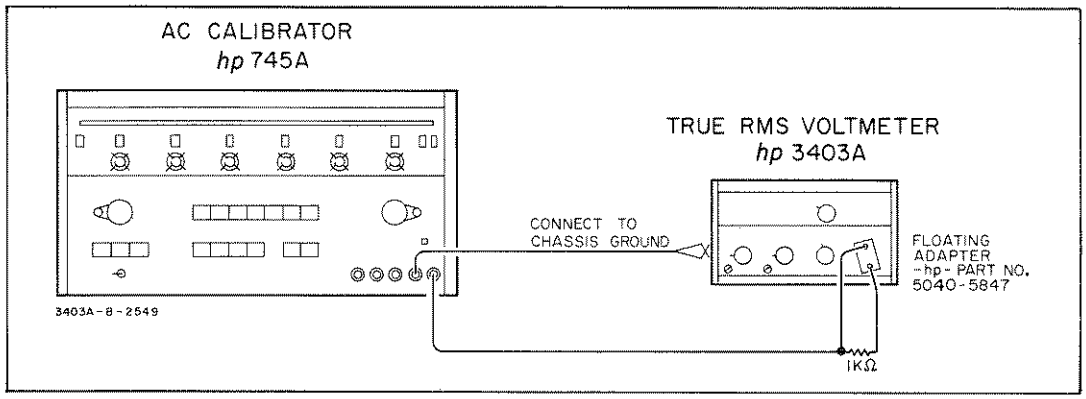


Figure 5-2. AC Common-Mode Voltage Check.

b. 3403A: Set FUNCTION to AC VOLTS, RANGE to .01 V, RESPONSE TIME to FAST. 3403B: Set RANGE to .01 V; if instrument has dB option, set MODE to VOLTS.

c. Adjust ac calibrator output for 3403A/B display of 10.00 mV.

d. Allow recorder to print at least one reading. Printout should be as indicated in first line of Table 5-7.

e. Adjust ac calibrator output for 3403A/B display of 17.77 mV. Printout should be as shown in line 2 of Table 5-7.

f. Select function, range and input as shown in the remainder of Table 5-7, within the capabilities of your instrument, and compare printout in each case. "x" in printout column of Table 5-7 indicates that the number printed is immaterial to this test.

5-31. REMOTE CONTROL CHECK (3403A).

5-32. The following procedure checks remote operation of the 3403A Option 003 or 005. Remote program signal requirements are shown in Figure 2-5. The mating connector for the Remote Program Connector J3 is -hp- Part No. 1251-0293 (Amphenol No. 57-30240). No input signal is required except for step g.

a. Program Remote Control. Observe that REM annunciator is on and that the Sample Rate indicator does not flash. Continue to program Remote Control throughout the remaining checks.

b. Program each function and verify proper operation by observing AC, DC and dB annunciators.

NOTE

A Program Accept command is required to initiate or change a remote program.

c. Disconnect function programming and program each range. Verify proper range selection by observing decimals and V/mV annunciators.

d. Program Delayed Measure Mode and Fast Response Time. Range and function program lines may be left open, thus programming the 1000 V range and DC + AC Volts. Initiate a measurement with a Remote Measure command. Verify that the Sample Rate indicator lights about 1 second after Remote Measure command is applied.

Table 5-7. Digital Output Check.

Function	Range	Input	Printer Column 7	6	5	4	3	2	1
AC Volts	.01 V	10.000 mV	2	1	1	0	0	0	5
AC Volts	.01 V	17.770 mV	2	1	1	7	7	7	5
AC Volts	.01 V	20.000 mV	2	3	1	x	x	x	5
AC Volts	.01 V	1.000 mV	2	5	0	x	x	x	5
AC Volts	.1 V	none	2	5	0	x	x	x	4
AC Volts	1 V	none	2	5	0	x	x	x	3
AC Volts	10 V	none	2	5	0	x	x	x	2
AC Volts	100 V	none	2	5	0	x	x	x	1
AC Volts	1000 V	none	2	5	0	x	x	x	0
AC dB	1 V	none	6	5	x	x	x	x	3
DC + AC dB	1 V	none	4	5	x	x	x	x	3
DC + AC Volts	1 V	none	0	5	x	x	x	x	3
DC Volts	1 V	+ 1.0000 V	1	1	x	x	x	x	3
DC Volts	1 V	- 1.0000 V	1	0	x	x	x	x	3
DC Volts	1 V	- 2.0000 V	1	2	x	x	x	x	3
DC Volts	1 V	+ 2.0000 V	1	3	x	x	x	x	3
DC Volts	1 V	+ .1000 V	1	5	x	x	x	x	3
DC Volts	1 V	- .1000 V	1	4	x	x	x	x	3

PERFORMANCE CHECK CARD

Hewlett-Packard Model 3403A/B
True RMS Voltmeter
Serial Number _____

Tests Performed by _____

Date _____

Paragraph	Description			Reading	Test Limits	
5-8	Mid-Band Frequencies					
	Range	Input	Frequency		Min.	Max.
	.01 V	10 mV	100 Hz	_____	9.95	10.05
	.01 V	10 mV	100 kHz	_____	9.95	10.05
	.1 V	20 mV	100 kHz	_____	19.6	20.4
	.1 V	100 mV	1 kHz	_____	99.6	100.4
	1 V	0.5 V	200 Hz	_____	.497	.503
	1 V	1 V	20 kHz	_____	.996	1.004
	10 V	10 V	100 kHz	_____	9.96	10.04
	10 V	15 V	100 Hz	_____	14.95	15.05
	100 V	20 V	50 Hz	_____	19.8	20.2
	100 V	100 V	50 kHz	_____	99.6	100.4
	100 V	100 V	*20 Hz	_____	99.4	100.6
	1 V	1 V	*10 Hz	_____	.994	1.006
	.1 V	100 mV	*20 Hz	_____	99.0	101.0
	1000 V	1000 V	100 Hz	_____	995	1005
	1000 V	1000 V	10 kHz	_____	995	1005

* Slow response time, 3403A only.

PERFORMANCE CHECK CARD (Cont'd)

Paragraph	Description			Reading	Test Limits	
5-10	100 kHz to 10 MHz					
	Range	Input	Frequency		Min.	Max.
	.1 V	100 mV	1 MHz	_____	97.8	102.2
	.1 V	100 mV	10 MHz	_____	97.8	102.2
	1 V	1 V	2 MHz	_____	.988	1.012
	1 V	1 V	8 MHz	_____	.988	1.012
	10 V	3 V	500 kHz	_____	2.96	3.04
	10 V	3 V	5 MHz	_____	2.95	3.05
	10 V	10 V	1 MHz	_____	9.88	10.12
	10 V	10 V	5 MHz	_____	9.88	10.12
	100 V	100 V	500 kHz	_____	98.8	101.2
	100 V	100 V	1 MHz	_____	98.8	101.2
5-12	10 MHz to 100 MHz					
	.1 V	100 mV	20 MHz	_____	97.8	102.2
	.1 V	100 mV	40 MHz	_____	94.8	105.2
	.1 V	100 mV	100 MHz	_____	89.8	110.2
	1 V	1 V	20 MHz	_____	.978	1.022
	1 V	1 V	40 MHz	_____	.948	1.052
	1 V	1 V	100 MHz	_____	.898	1.102
5-16	Low Frequency					
	1 V	1 V	5 Hz	_____	.994	1.006
5-18	dB Accuracy (Optional)					
	Range	Input		Reading	Min.	Max.
	1 V	0.31620 V		_____	- 09.8	- 10.2
	.1 V	0.10000 V		_____	- 19.8	- 20.2
	.01 V	0.01000 V		_____	- 39.8	- 40.2
	10 V	10.0000 V		_____	+ 19.8	+ 20.2
	10 V	15.0000 V		_____	+ 23.3	+ 23.7
	100 V	100.000 V		_____	+ 39.8	+ 40.2
	1000 V	1000.00 V		_____	+ 59.8	+ 60.2

PERFORMANCE CHECK CARD (Cont'd)

Paragraph	Description		Reading		Test Limits	
5-20	DC Voltage Accuracy (3403A)					
	Range	Input	Pos.	Neg.	Min.	Max.
	.1 V	± .100000 V	_____	_____	99.2	100.8
	.1 V	± .070000 V	_____	_____	69.2	70.8
	.1 V	± .040000 V	_____	_____	39.3	40.7
	.1 V	± .010000 V	_____	_____	09.3	10.7
	1 V	± 0.10000 V	_____	_____	.097	.103
	1 V	± 0.50000 V	_____	_____	.496	.504
	1 V	± 1.00000 V	_____	_____	.996	1.004
	10 V	± 1.00000 V	_____	_____	0.97	1.03
	10 V	± 5.00000 V	_____	_____	4.96	5.04
	10 V	± 10.0000 V	_____	_____	9.96	10.04
	100 V	± 10.0000 V	_____	_____	09.7	10.3
	100 V	± 50.0000 V	_____	_____	49.6	50.4
	100 V	± 100.000 V	_____	_____	99.6	100.4
	1000 V	± 100.000 V	_____	_____	096	104
	1000 V	± 500.000 V	_____	_____	495	505
	1000 V	± 1000.00 V	_____	_____	995	1005
5-22	AC Normal-Mode Rejection (3403A)		_____		± 0.02 V	
5-24	AC Common-Mode Rejection (3403A)		_____		100.0 mV	
5-29	Digital Output Check (Optional)					
	Column 1, Data Multiplier		_____			
	Columns 2 - 5, Data		_____			
	Column 6, Polarity, OL, Underrange		_____			
	Column 7, Function		_____			
5-31	Remote Control Check (3403A Option)					
	Range		_____			
	Function		_____			
	Response Time		_____			
	Delayed Mode		_____			
	Non-delayed Mode		_____			
	Autorange		_____			

e. Change Response Time program to Slow and repeat test in step d. Verify that the Sample Rate indicator lights about 10 seconds after Remote Measure command is applied.

f. Program Non-delayed Measure Mode and Fast Response Time. Repeat previous test and observe that the Sample Rate indicator lights immediately when measure command is applied.

g. Apply input of 1 V at 100 Hz. Program AC Volts, 1000 V range, Delayed Measure Mode, Fast Response Time, and Autorange. Initiate a measurement and verify that the instrument ranges to the 1 V range and reads correctly. After instrument has completed autoranging, disconnect input and verify that instrument remains on the 1 V range (do not initiate a measurement).

5-33. ADJUSTMENT SEQUENCE.

5-34. The following procedures should be performed only after it has been determined from the performance checks that the Model 3403A/B is out of specifications. If any adjustment in this procedure cannot be made correctly, refer to the Troubleshooting Procedures. Cover removal and access to adjustments are shown in Figure 5-3, and the location of adjustments is given in Figure 5-4.

5-35. If the Performance Checks indicate an error only below approximately 30 % of range, and only in AC functions, it may be possible to correct this error by adjusting the RMS Converter Balance. Refer to Paragraph 5-66, Final Converter Balance Adjustment.

5-36. If an error is present that is consistent from range to range and on all functions, it may be possible to correct the error by adjustment of the Digital Panel Meter. To determine if the error is in the AC Converter or the Digital Panel Meter, perform the following check. An ac calibrator and a dc digital voltmeter are required.

a. 3403A: Set FUNCTION to AC VOLTS, RANGE to 1 V, RESPONSE TIME to FAST. 3403B: Set MODE to VOLTS, RANGE to 1 V.

b. Connect ac calibrator to 3403A/B input and adjust calibrator output to 1.0000 V at 100 Hz.

c. Measure voltage at rear panel VOLTS recorder output terminals with a digital voltmeter.

d. If the digital voltmeter reading is + 1.0000 V ± 0.0040, proceed to the Digital Panel Meter Adjustments, Paragraph 5-56. If the error is greater than ± 0.0040 V, perform the complete adjustment procedures.

5-37. With the exception of the above conditions, the Adjustment procedures must be performed in the order given unless otherwise stated within the procedure.

5-38. ACCESS TO ADJUSTMENTS.

5-39. Open the 3403A/B and the AC Converter Assembly as shown in Figure 5-3. Turn the instrument on and allow to warm up for at least 1 hour.

CAUTION

THE COMPONENTS AND PRINTED CIRCUIT BOARDS WITHIN THE AC CONVERTER ASSEMBLY MUST BE KEPT CLEAN AND FREE FROM FINGERPRINTS OR OTHER CONTAMINATION, OR PERFORMANCE MAY BE DEGRADED. IF COMPONENTS OR WIRES IN THE ATTENUATOR AREA ARE MOVED, CALIBRATION AT HIGH FREQUENCIES MAY BE ALTERED.

5-40. POWER SUPPLY ADJUSTMENTS.

5-41. A digital voltmeter having 5-digit resolution (for 12 V measurement) is required for these adjustments. Test points and adjustments are on the Regulator Assembly, A6.

a. Connect digital voltmeter between + 5 test point and digital ground ▽D . Adjust A6R22 for voltmeter reading of + 5.000 V ± 0.050 V.

b. Connect digital voltmeter between - 10 test point and digital ground. Adjust A6R14 for digital voltmeter reading of - 10.000 V ± 0.010 V.

c. Measure voltage at - 5 test point (to digital ground). Voltage should be - 5.00 V ± 0.40 V. If not, troubleshoot - 5 V regulator circuit (A6Q5).

d. Connect digital voltmeter between + 12 test point and analog ground ▽A . Adjust A6R4 for voltmeter reading of + 12.000 V ± 0.010 V.

e. Connect digital voltmeter between - 12 test point and analog ground. Adjust A6R9 for voltmeter reading of - 12.000 V ± 0.010 V.

5-42. ZERO ADJUSTMENTS.

5-43. 3403A Amplifier.

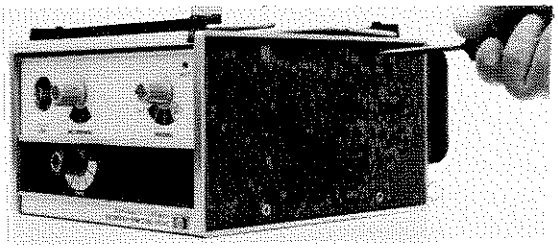
5-44. A digital voltmeter having 0.01 mV resolution is required for these adjustments. All adjustments must be made in the order given.

a. Set 3403A FUNCITON to DC, RANGE to 10 V, RESPONSE TIME to FAST, INPUT open.

b. Connect digital voltmeter between test point H (A2) and analog ground. The AC Converter box is analog ground.

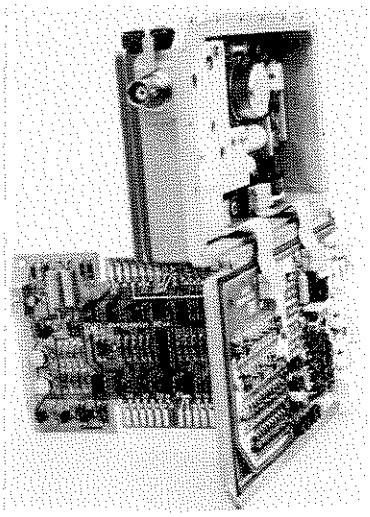
c. Connect short circuit between pins 7 and 8 of J10, which is the printed circuit connector at the center of A3, providing connections to and from the converter assembly.

Step A



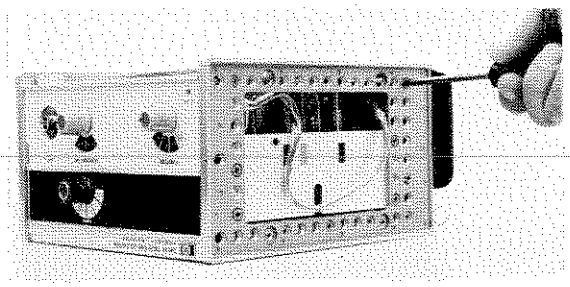
Turn instrument upside down and remove all four screws in each side to remove side and bottom covers.

Step C



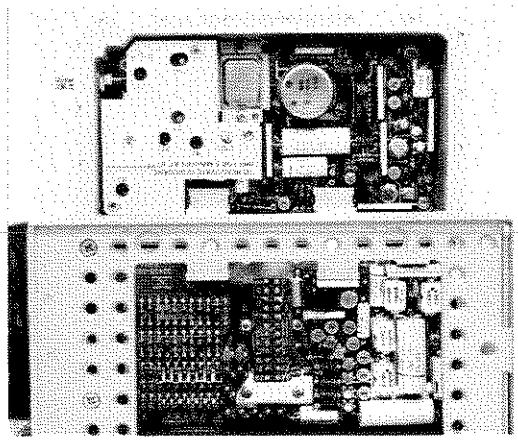
Remove AC Converter from instrument. Remove screws around casting and carefully open lid. Attach the two parts in the manner shown, using two or three screws.

Step B



Remove one screw from each side frame to release front panel.

Step D



Replace AC Converter and Connector Assembly in instrument in position shown.

Figure 5-3. Access to Adjustments.

d. Adjust A2R11 for digital voltmeter reading of 0 ± 1.0 mV. Remove short circuit.

e. Adjust front panel DC ZERO for digital voltmeter reading of 0 ± 0.05 mV.

f. Set FUNCTION to AC VOLTS. Adjust A2R18 for digital voltmeter reading of 0 ± 0.1 mV.

g. Set FUNCTION to DC VOLTS. Connect digital voltmeter to test point D (A3). Short test point H to analog ground.

h. Adjust A3R8 for digital voltmeter reading of 0 ± 0.1 mV. Remove short from test point H.

5-45. 3403B Amplifier.

5-46. A digital voltmeter having 0.1 mV resolution is required for these adjustments. All adjustments must be made in the order given.

a. Set 3403B MODE to VOLTS, RANGE to 10 V, INPUT open.

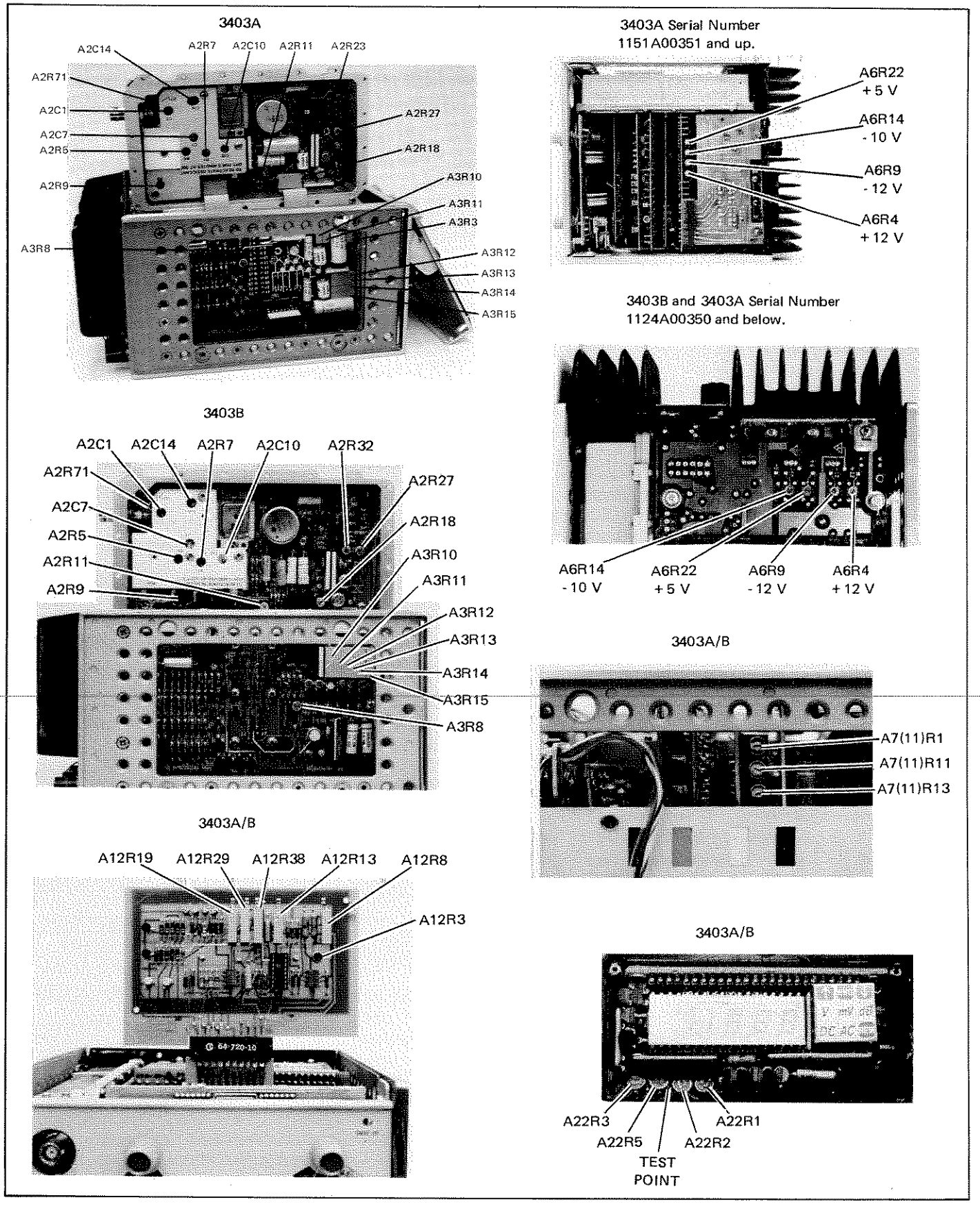


Figure 5-4. Location of Adjustments.

2) With input of 10.000 V at 30 kHz (as in step o), adjust A2C10 for minimum reading on the digital voltmeter.

3) If digital voltmeter reading is less than 0.981, adjust A2C10 for reading of 1.0000 V ± 0.0002 V and proceed to step p.

4) If digital voltmeter reading is greater than 0.981, replace A2C9 with the value indicated in Table 5-8.

Table 5-8. Selection of A2C9.

Reading	A2C9 Value
0.981 to 1.011	12 pF
1.012 to 1.024	24 pF
1.025 to 1.036	33 pF
1.037 to 1.048	43 pF
1.049 or greater	51 pF

p. Set 3403A RANGE to 100 V. Adjust input to 160 V at 30 kHz.

q. Adjust A3R14 for digital voltmeter reading of 1.6000 V ± 0.0003 V.

r. Change input frequency to 100 Hz. Adjust A2R9 for digital voltmeter reading of 1.6000 V ± 0.0003 V.

5-54. HIGH FREQUENCY ADJUSTMENTS.

5-55. All the previous adjustments must be correct before beginning this procedure. The attenuator shield must be left in place while these adjustments are made. A high frequency signal generator (-hp- 8601A), an ac calibrator (-hp-745A), a digital voltmeter (-hp- 3480A/3482A), and two thermal converters, .45 V (-hp- 11051A), and 3 V (-hp-11049A) are required for these adjustments.

CAUTION

IF COMPONENTS OR WIRES IN THE ATTENUATOR AREA ARE MOVED, CALIBRATION AT HIGH FREQUENCIES MAY BE ALTERED.

a. Using ac calibrator as test signal source, connect calibrator to 3403A/B as shown in Figure 5-1. This is the configuration used at the factory for testing and calibrating the 3403A/B. Any other configuration can be expected to give different results. Do not connect thermal converter at this time.

b. 3403A: Set FUNCTION to AC VOLTS, RANGE to .1 V, RESPONSE TIME to FAST. 3403B: Set MODE to VOLTS, RANGE to .1 V.

c. Connect digital voltmeter between test point D on A3 and analog ground (converter box).

d. Adjust ac calibrator output to 0.10000 V at 100 kHz. Note digital voltmeter reading.

e. Disconnect ac calibrator and replace with high frequency signal generator. Connect .45 V thermal converter as shown in Figure 5-1.

f. Set signal generator frequency to 100 kHz and adjust output amplitude so that digital voltmeter reading is the same as noted in step d.

g. Disconnect digital voltmeter from AC Converter and connect to thermal converter. Note reading.

NOTE

The measurement error of the thermal converter at the test signal frequency must be taken into account in each step where the thermal converter output is measured.

h. Change signal generator frequency to 90 MHz and adjust output amplitude for digital voltmeter reading noted in step g.

i. Disconnect digital voltmeter from thermal converter and connect between test point D and analog ground. Adjust A2R71 for digital voltmeter reading of 1.000 V ± 0.002 V.

j. Disconnect thermal converter. Replace signal generator with ac calibrator.

k. Set 3403A/B RANGE to 1 V. Adjust ac calibrator output to 0.4000 V at 100 kHz. Note digital voltmeter reading at test point D.

l. Replace ac calibrator with signal generator. Connect .45 V thermal converter to test set-up.

m. Set signal generator frequency to 100 kHz and adjust output amplitude for digital voltmeter reading noted in step k.

n. Disconnect digital voltmeter from AC Converter and connect to thermal converter. Note reading.

o. Change signal generator frequency to 90 MHz and adjust output amplitude for digital voltmeter reading noted in step n.

p. Disconnect digital voltmeter from thermal converter and connect between test point D and analog ground. Adjust A2R5 for digital voltmeter reading of 0.4000 V ± 0.0002 V.

q. Disconnect thermal converter. Replace signal generator with ac calibrator.

r. Set 3403A/B RANGE to 10 V. Adjust ac calibrator output to 2.000 V at 100 kHz. Note digital voltmeter reading at test point D.

s. Replace ac calibrator with signal generator. Connect 3 V thermal converter to test set-up.

t. Set signal generator frequency to 100 kHz and adjust output amplitude for digital voltmeter reading noted in step r.

u. Disconnect digital voltmeter from AC Converter and connect to thermal converter. Note reading.

v. Change signal generator frequency to 90 MHz and adjust output amplitude for digital voltmeter reading noted in step u.

w. Disconnect digital voltmeter from thermal converter and connect between test point D and analog ground. Adjust A2R7 for digital voltmeter reading of 0.2000 V ± 0.0004 V.

x. Disconnect test set-up. Turn 3403A/B off. Close AC Converter box, making sure seal is in place, and replace all screws. Replace AC Converter in instrument and turn on.

5-56. DIGITAL PANEL METER ADJUSTMENTS.

5-57. All preceding adjustments (with the exception of the High Frequency Adjustments if required test equipment is not available) must be completed before performing the Digital Panel Meter Adjustments, unless these adjustments are being performed as a result of the check given in Paragraph 5-36.

5-58. 3043A Panel Meter.

5-59. A dc standard and a digital voltmeter having 0.01 mV resolution are required for these adjustments. All adjustments except front panel DC ZERO are available from the front of the Digital Panel Meter Assembly and are on the Analog Assembly. This assembly may be either A22 or A23, depending upon the options included in the instrument. The designation A22 used in this procedure applies to all instruments, since the adjustments are identical.

a. Set 3403A FUNCTION to DC, RANGE to 10 V, RESPONSE TIME to FAST, INPUT shorted. Connect digital voltmeter to Volts Recorder output on rear panel.

b. Adjust front panel DC ZERO for digital voltmeter reading of 0 ± 0.10 mV.

c. Connect digital voltmeter to test point between A22R5 and A22R2. Adjust A22R1 for digital voltmeter reading of 0 ± 0.3 mV.

d. Adjust A22R2 so that 3403A polarity symbol flashes equally between + and -.

e. Connect digital voltmeter to volts recorder output. Adjust front panel DC ZERO for digital voltmeter reading of 0.5 mV ± 0.05 mV.

f. Adjust A22R5 so that 3403A display flashes equally between 0.00 and 0.01.

g. Remove short from input and apply + 15.000 V from dc standard.

h. Adjust front panel DC ZERO for digital voltmeter reading of 1.5005 V ± 0.0001 V.

i. Adjust A22R3 so that 3403A display flashes equally between 15.00 and 15.01.

j. Repeat steps e through i one time. Disconnect dc standard.

k. Short input. Adjust front panel DC ZERO so that 3403A display is 0.00 and polarity symbol flashes equally between + and -.

5-60. 3403B Panel Meter.

5-61. An ac calibrator and a dc digital voltmeter are required for these adjustments. All preceding adjustments (with the exception of the High Frequency Adjustments if proper equipment is not available) must be completed before performing the Digital Panel Meter Adjustments, unless these adjustments are being performed as a result of the check given in Paragraph 5-36.

a. Set 3403B MODE to VOLTS, RANGE to 10 V, INPUT open.

b. Connect digital voltmeter to volts recorder output.

c. Adjust A22R1 and A22R2 to mechanical center.

d. Connect ac calibrator to input and adjust calibrator frequency to 100 Hz. Adjust output level to obtain digital voltmeter reading of + 0.1705 V ± 0.0005 V.

e. Adjust A22R5 so that 3403B display alternates equally between 1.70 V and 1.71 V.

f. Adjust calibrator output level to obtain digital voltmeter reading of + 1.7005 V ± 0.0005 V.

g. Adjust A22R3 so that 3403B display alternates equally between 17.00 V and 17.01 V.

h. Repeat steps d through g.

5-62. OUT-OF-RANGE ADJUSTMENTS.

5-63. An ac calibrator is required for these adjustments which set the points at which uprange and downrange blanking occurs. Both adjustments are on the Connector Assembly. This assembly is A7 in the 3403B, and may be either A7 or A11 in the 3403A, depending on the options included. The A7 designation used in this procedure applies to all instruments, since the adjustments are identical.

a. 3403A: Set FUNCTION to AC VOLTS, RANGE to 10 V, RESPONSE TIME to FAST. 3403B: Set MODE to VOLTS, RANGE to 10 V.

b. Apply input of 19.500 V at 100 Hz from ac calibrator.

c. Adjust A7R11 to the point where the 3-digit display goes from on to off. (The overrange "1" should remain on.)

d. Reduce input voltage to 1.650 V and adjust A7R13 to the point where the display goes from on to off.

5-64. LOG CONVERTER ADJUSTMENTS.

5-65. The Log Converter (Option 006) may be adjusted at any time after the Gain Adjustments, Paragraph 5-52, have been completed. An ac calibrator, a digital voltmeter able to resolve 0.01 mV, and a 20-pin (2 X 10) printed circuit extender board (-hp- Part No. 5060-0091) are required for this procedure.

a. 3403A: Set FUNCTION to AC VOLTS, RANGE to 1 V, RESPONSE TIME to FAST, dB REFERENCE fully counterclockwise to CAL position. 3403B: Set MODE to VOLTS, RANGE to 1 V, dB REFERENCE fully counterclockwise to CAL position.

b. Short test point Z to ground (at top end of A12C1 or C2). Connect digital voltmeter between test point ET and ground.

c. Apply input of 0.7746 V at 100 Hz from ac calibrator. Digital voltmeter reading should be either positive or negative approximately 0.7 V. If the reading is negative, then adjust A12R8 clockwise until reading changes to positive, then adjust counterclockwise slowly until reading goes negative. (Because of the high gain of the amplifier, reading cannot be adjusted to zero.) If the first reading is positive, rotate A12R8 counterclockwise until reading is negative, then proceed as instructed above. Then remove short from test point Z.

d. Adjust front panel dB CAL multi-turn screwdriver adjustment fully clockwise. A faint click can be heard for each rotation when wiper is at limit of travel.

e. Adjust A12R13 for digital voltmeter reading (at test point ET) of - 480 mV ± 0.2 mV.

f. Connect digital voltmeter between test points ET and ED. Voltmeter reading should be 0 to - 3 mV. (If not, see Paragraph 5-89.) Adjust front panel dB CAL for digital voltmeter reading of 0 ± 0.05 mV.

g. Connect digital voltmeter between rear panel dB recorder output terminal and ground terminal. Adjust A12R29 for voltmeter reading of 0 ± 0.05 mV.

h. Set 3403A FUNCTION to AC dB; 3403B MODE to dB. Connect digital voltmeter between Log Converter output at J6 pin 7 and ground.

i. Reduce ac calibrator output to 0.10000 V (3403A/B on 1 V range). Adjust A12R19 for digital voltmeter reading of - 0.1778 V ± 0.0001 V.

j. Set RANGE to .1 V. Adjust ac calibrator output to 0.4000 V.

k. Digital voltmeter reading should be + 0.1426 V ± 0.0003 V. If not, adjust A12R3 to obtain this reading.

l. If necessary to adjust A12R3 in step k, repeat steps i, j and k until readings are correct without further adjustment.

m. Set 3403A/B RANGE to 1 V, ac calibrator output to 0.1000 V. Note digital voltmeter reading (at J6 pin 7).

n. Connect digital voltmeter between rear panel dB recorder output terminal and ground terminal. Adjust A12R38 for digital voltmeter reading noted in step n ± 0.0001 V.

o. The preceding steps adjust the Log Converter for dBm 600 Ω readings. If it is preferred to have the instrument display dBV (1 V = 0 dB), apply an input of 1.0000 V and adjust front panel dB CAL screwdriver adjustment for digital voltmeter reading (at dB recorder output) of 0 ± 0.0001 V.

5-66. FINAL CONVERTER BALANCE ADJUSTMENT.

5-67. An ac calibrator and digital voltmeter are required for this adjustment. Secure the front panel and replace bottom and side covers. Allow the instrument to warm up for at least 1 hour before proceding.

a. 3403A: Set FUNCTION to AC VOLTS, RANGE to .1 V, RESPONSE TIME to FAST. 3403B: Set MODE to VOLTS, RANGE to .1 V.

b. Connect digital voltmeter to rear panel VOLTS recorder output terminals.

c. Apply input of 100.000 mV at 100 Hz from ac calibrator. Note digital voltmeter reading.

d. Reduce input to 10.000 mV.

e. Remove left side cover and adjust A7R1 for voltmeter reading of 1/10 the reading noted in step c.

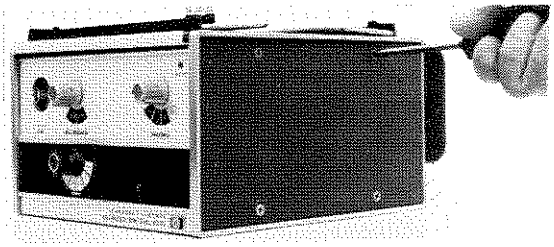
5-68. PRELIMINARY TROUBLESHOOTING.

5-69. If the Model 3403A/B operates incorrectly and the trouble cannot be corrected by the Adjustment Procedures, the following troubleshooting information should be used. Check for loose wires or other obvious sources of trouble, such as burned or loose components. Make sure printed circuit boards are seated firmly in connectors, and integrated circuit packages are firmly seated in sockets.

5-70. ACCESS FOR SERVICING.

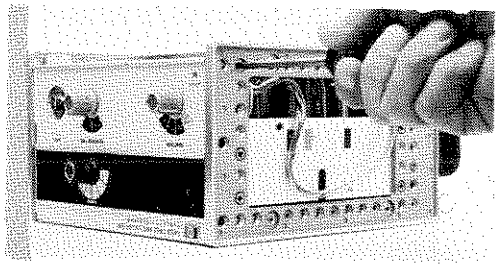
5-71. Figure 5-5 illustrates the procedure for removing covers and releasing front and rear panels to gain access to the various assemblies and circuits.

Step A



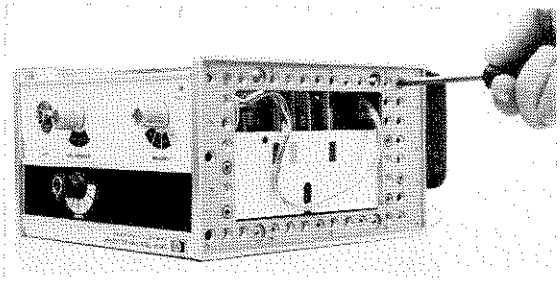
Remove four screws in each side to remove side and bottom covers. AC Converter and Connector assemblies may be removed from instrument.

Step B



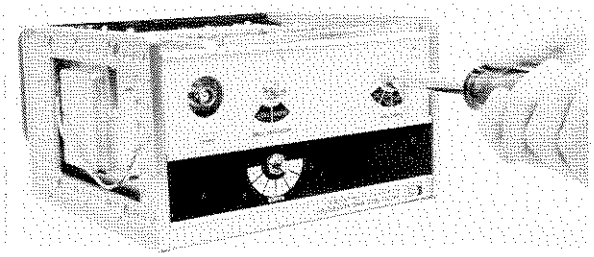
Remove one screw in each side frame to release front panel. Provides access to switching logic circuits and digital panel meter.

Step C



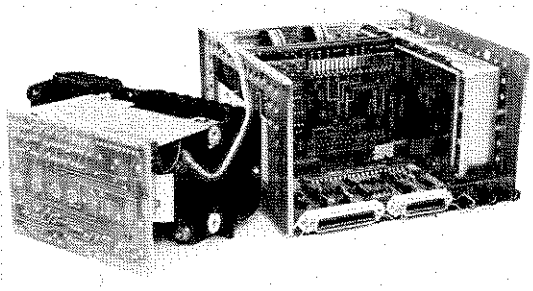
Remove two screws in each side frame to release rear panel and power supply assembly.

Step D



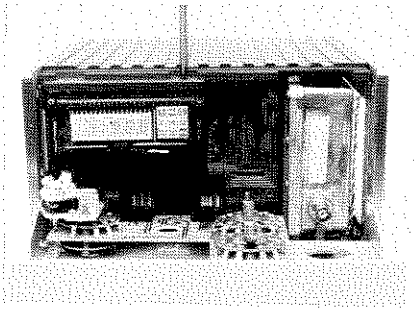
Remove control knobs and mounting nuts to remove front panel from master board assembly.

Step E

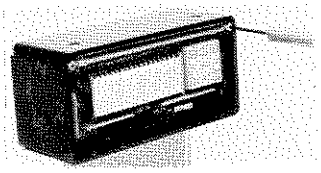


Power supply may be removed from instrument (with rear panel) and operated separately outside the instrument for power supply troubleshooting.

Step F & G



Remove digital panel meter by removing two screws.



Remove panel meter PC assemblies from case by removing two allen screws.

Figure 5-5. Access For Servicing.

5-72. TROUBLESHOOTING TREES.

5-73. The Basic Troubleshooting Tree, Figure 5-6, should be used to locate the area of difficulty. Additional troubleshooting information for the various circuits is given in the following paragraphs, in the Digital Panel Meter Troubleshooting Tree, Figure 5-7, and in the Autorange Troubleshooting Tree, Figure 5-8.

5-74. AC CONVERTER SERVICE.

5-75. AC Converter Exchange.

5-76. If the AC Converter Assembly is defective, replacement may be more practical than repair, The replacement assembly for the 3403A is -hp- Part No. 03403-69501, and the replacement assembly for the 3403B is -hp- Part No. 03403-69502. These assemblies are available on an exchange basis. Contact your nearest -hp- Sales and Service Office for details.

5-77. AC Converter Input/Output Checks.

5-78. The AC Converter Assembly contains the Input Attenuator and Amplifier, The Converter Amplifier and Thermopile, and the DC Amplifier, as well as the logic circuits which drive the range and function selection relays. Signals to and from the AC Converter Assembly may be checked at printed circuit board connector J10 on the side of the converter box. Figure 5-5 shows the method of access to this connector. If the instrument is equipped with Autorange or dB Options, these printed circuit boards must be removed to provide access to J10. When the Log Converter Assembly is removed, the small slide switch beside the connector on the Master Board must be switched toward the rear of the instrument to provide an output connection from the AC Converter to the Digital Panel Meter. If a signal is not correct at J10, check the proper pin at the top edge of the Connector Assembly. Connections to the pins at the top and bottom of this printed circuit board are identical.

5-79. AC Converter Service Precautions.

5-80. The AC Converter may be opened and operated for servicing as illustrated in Figure 5-3. Certain components are easily damaged by excessive voltage; consequently, extreme care must be exercised when using a voltmeter or oscilloscope probe within the assembly. In addition, calibration may be altered by movement of components or wires in the attenuator area.

CAUTION

THE COMPONENTS AND PRINTED CIRCUIT BOARDS WITHIN THE AC CONVERTER ASSEMBLY MUST BE KEPT CLEAN AND FREE FROM FINGERPRINTS OR OTHER CONTAMINATION, OR PERFORMANCE MAY BE DEGRADED.

5-81. POWER SUPPLY CHECKS.

5-82. Remove the rear panel and power supply from the instrument as indicated in Figure 5-5, and operate power supply outside the instrument.

WARNING

KEEP HANDS AND TOOLS AWAY FROM THE AC POWER INPUT CONNECTOR, THE FUSEHOLDER, AND THE 115/230 SWITCH WHILE POWER SUPPLY IS CONNECTED TO POWER LINE.

5-83. Measure power supply voltages. If a supply voltage is very low, or zero, first check the bridge rectifier output for that supply. The voltage should be approximately as shown on the schematic diagram, Figure 7-13 or 7-14. If the rectifier output is correct, the problem is usually either the series pass transistor or the regulator IC. The trouble can usually be isolated by removing the series pass transistor and shorting the base and emitter connections on the printed circuit board. If the power supply output is then nearly correct, the regulator IC is good and the series pass transistor is defective. However, if the output voltage is still incorrect with the above check, the regulator is probably defective.

5-84. The 3403B and the 3403A Serial No. 1124A00350 and below have an overvoltage protection circuit at the +5 V supply output (unless the power supply assemblies have been replaced with Part Nos. 03403-66551 and 03403-66561). If the protection circuit fails, the +5 V supply will probably be in current limit. The supply is in current limit when the voltage drop across A6R19 is greater than 0.5 V. Disable the protection circuit by removing A6CR6. If the +5 V output is still not correct, proceed as in Paragraph 5-83.

5-85. CONNECTOR ASSEMBLY CHECKS.

5-86. Voltage levels of signals to and from the Master Board (at J7) may be checked at the printed circuit connector strip at the exposed edge of the A7 (or A11) assembly, since connections at both edges of the board are identical. Logic levels for the function and range selection inputs to A7 (or A11) are approximately 0 V = select, +5 V = not select. Output levels to the AC Converter assembly are approximately 0 V = select, +12 V = not select.

5-87. AUTORANGE CHECKS (3403A).

5-88. The Autorange Troubleshooting Tree, Figure 5-8, checks the operation of the Autorange Assembly, A13, used in 3403A Option 002. The operation of the autorange circuits of the Remote and Autorange Assembly A14, used in 3403A Options 003 and 005, is essentially the same, with the addition of the remote programming logic.

5-89. LOG CONVERTER ZERO ERROR.

5-90. If A12CR2 or A12IC2 has been replaced, it may be necessary to reselect the proper jumpers across A12R11, 12 and 14. If the digital voltmeter reading in Paragraph 5-65, step f, is not 0 to - 3 mV, perform the following selection procedure.

a. Connect a clip lead across all three jumper positions at the top edge of A12. Note digital voltmeter reading between test points ET and ED. (Digital voltmeter HIGH connected to ET, LOW to ED.) Reading should be between + 14.1 mV and - 3 mV.

b. Determine voltage change necessary to bring reading to between 0 and - 3 mV.

c. Use Table 5-9 to determine which jumper positions should be open.

d. Proceed with adjustment procedures in Paragraph 5-65.

Table 5-9. Log Converter Zero.

Voltage Change Required	Jumper Positions * Open	Shorted
2.0 mV or less	1	2, 3
2.0 mV to 4.0 mV	2	1, 3
4.0 mV to 5.9 mV	1, 2	3
5.9 mV to 7.7 mV	3	1, 2
7.7 mV to 9.4 mV	1, 3	2
9.4 mV to 11.1 mV	2, 3	1
11.1 mV to 14.1 mV	1, 2, 3	---

* Due to component tolerance it may be necessary to select one position higher or lower than indicated.

5-91. FACTORY SELECTED COMPONENTS.

5-92. The values of certain components are selected at the factory for optimum performance. These components are designated on the schematic diagram and the replaceable parts list by an asterisk (*), and the average value is shown. The following paragraphs describe the selection procedure in the event one of these components must be replaced.

5-93. A2CR1 and A2R4.

5-94. These components are matched for temperature coefficient and matched to the Input Amplifier A2IC1. If it is necesasary to replace A2IC1, the diode and resistor are supplied with the IC and must be replaced at the same time.

5-95. A24C1, A25C1 or A26C1.

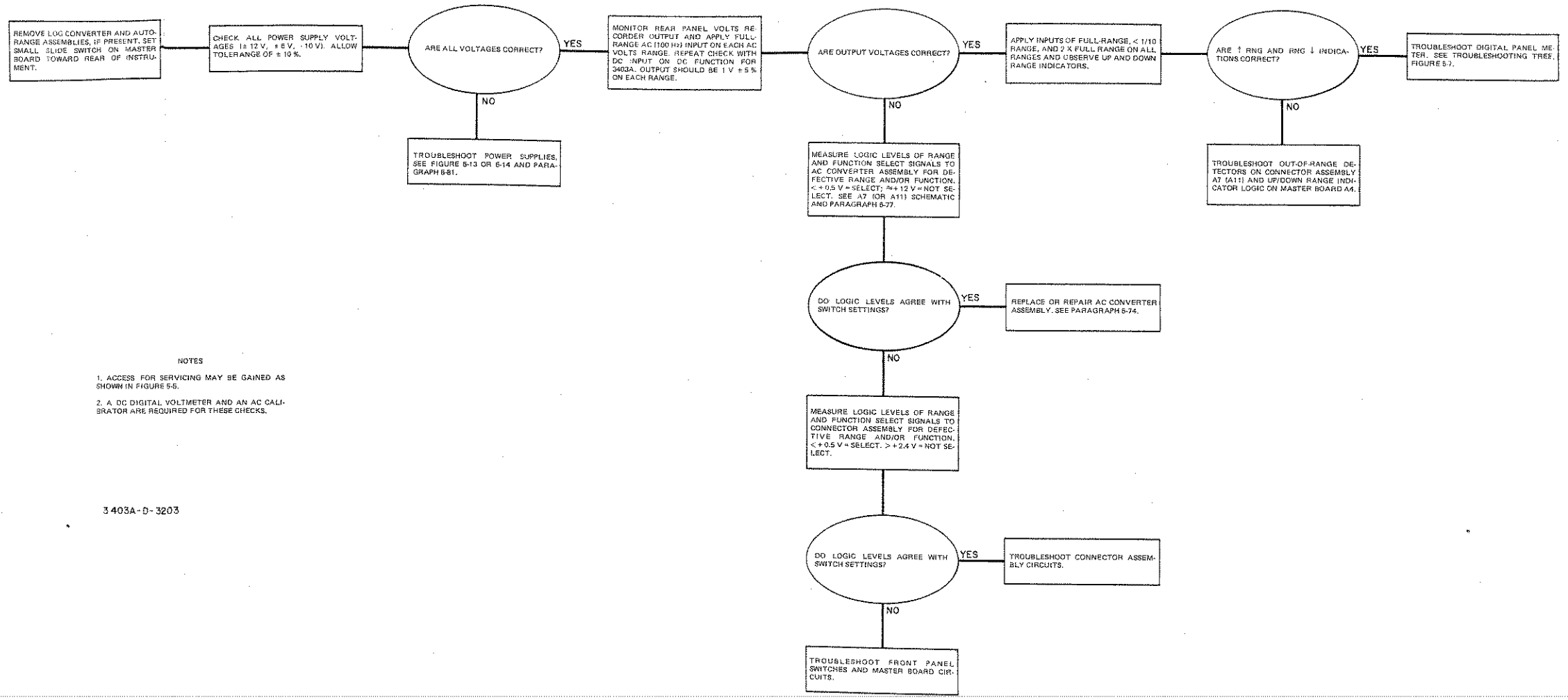
5-96. The value of this capacitor is selected to adjust the Logic Clock frequency to 60 kHz. If the Control Logic IC, A24 (A25, A26) IC1 has been replaced, it may be necessary to select a different value for C1, using the following procedure. An electronic counter able to measure pulse width is required (-hp- Model 5300A/5304A Measuring System).

a. Short Digital Panel Meter input to ground. This input connection is available at pin 25 of the exposed edge of the Connector Assembly, A7 or A11.

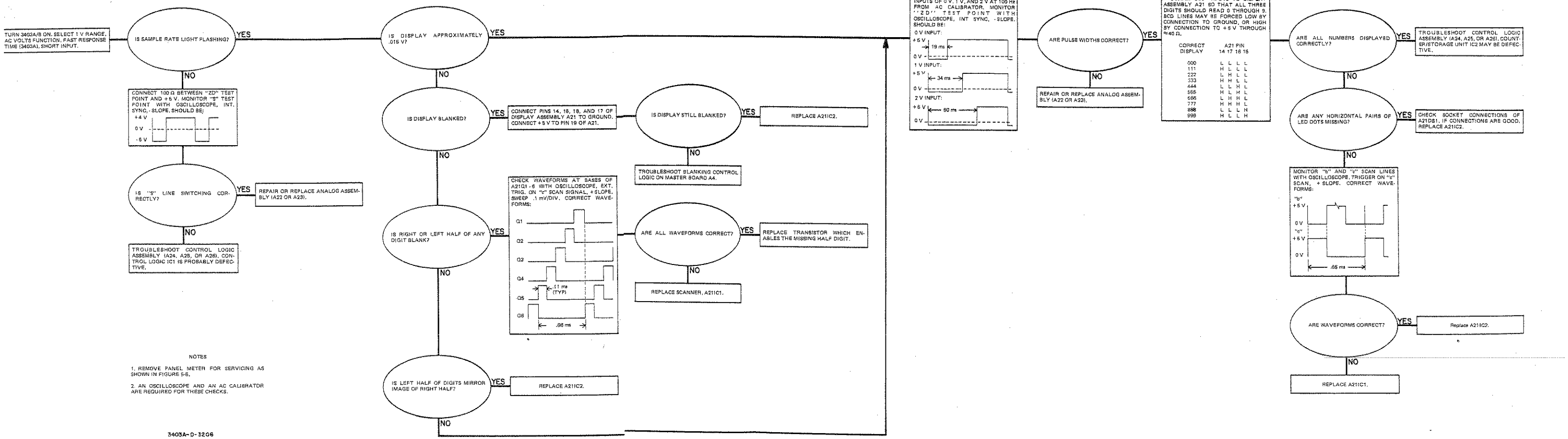
b. Connect electronic counter to S test point on top side of Digital Panel Meter Logic Control Assembly A24A1 (A25A1, A26A1).

c. Set counter controls to measure width (time interval) of a negative-going pulse (approximately + 5 V to - 5 V).

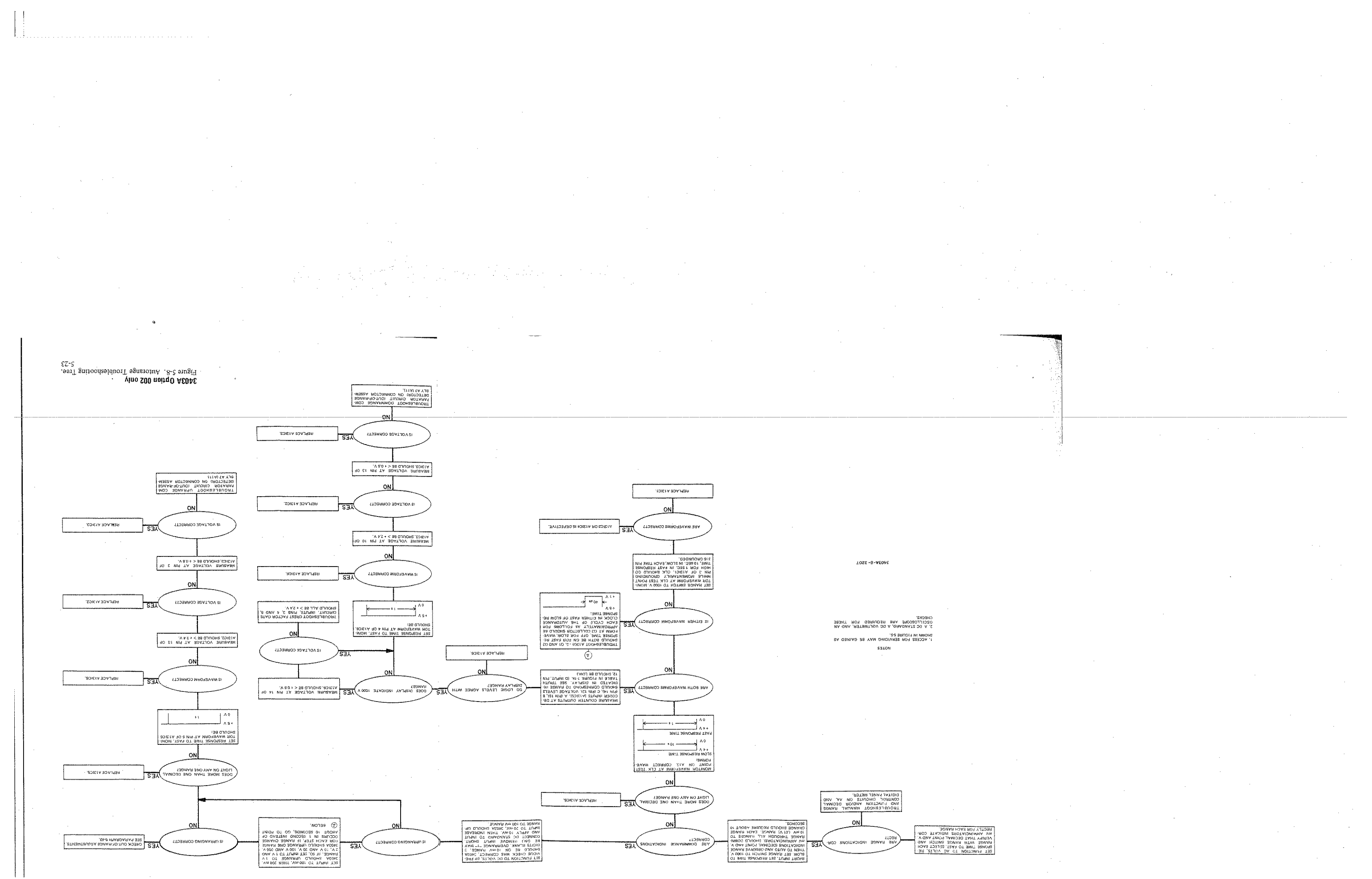
d. Pulse width should be 16.666 ms - 1.8 % + 4.4 %. If not, select value of C1 to bring pulse width within this tolerance. The capacitor used should be a 2 % dipped mica capacitor.



3403A/B
Figure 5-6. Basic Troubleshooting Tree.



3403A/B
Figure 5-7. Digital Panel Meter Troubleshooting Tree.



3403A Option 002 only

Figure 5-8. Autorange Troubleshooting Tree.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-1 lists replacement parts for Model 3403A, and Table 6-2 lists parts for Model 3403B. These tables list parts in alphameric order of their reference designators and indicate the description, -hp- Part Number of each part, together with any applicable notes, and provide the following:

a. Total quantity used in the instrument (Qty column). The total quantity of a part is given the first time the part number appears.

b. Description of the part. (See list of abbreviations below.)

c. Typical manufacturer of the part in a five-digit code. (See Appendix A for list of manufacturers.)

d. Manufacturers part number.

6-3. Miscellaneous parts are listed at the ends of Tables 6-1 and 6-2.

6-4. ORDERING INFORMATION.

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office. (See Appendix B for list of office locations.) Identify parts by their Hewlett-Packard part numbers. Include instrument model and serial numbers.

6-6. NON-LISTED PARTS.

6-7. To obtain a part that is not listed, include:

a. Instrument model number.
b. Instrument serial number.
c. Description of the part.
d. Function and location of the part.

6-8. PROPRIETARY PARTS.

6-9. Items marked by a dagger (†) in the reference designator column are available only for repair and service of Hewlett-Packard instruments.

ABBREVIATIONS

Ag . . . silver
Al . . . aluminum
A . . . ampere(s)
Au . . . gold

C . . . capacitor
cer . . . ceramic
coef . . . coefficient
com . . . common
comp . . . composition
conn . . . connection

dep . . . deposited
DPDT . . . double-pole double-throw
DPST . . . double-pole single-throw

elect . . . electrolytic
encap . . . encapsulated

F . . . farad(s)
FET . . . field effect transistor
fxd . . . fixed

GaAs . . . gallium arsenide
GHz . . . gigahertz = 10^{+9} hertz
gd . . . guard(ed)
Ge . . . germanium
gnd . . . ground(ed)

H . . . henry(ies)
Hg . . . mercury

Hz . . . hertz (cycle(s) per second)

ID . . . inside diameter
impg . . . impregnated
incd . . . incandescent
ins . . . insulation(ed)

kΩ . . . kilohm(s) = 10^{+3} ohms
kHz . . . kilohertz = 10^{+3} hertz

L . . . inductor
lin . . . linear taper
log . . . logarithmic taper

mA . . . milliampere(s) = 10^{-3} amperes
MHz . . . megahertz = 10^{+6} hertz
MΩ . . . megohm(s) = 10^{+6} ohms
met flm . . . metal film
mfr . . . manufacturer
ms . . . millisecond
mtg . . . mounting
mV . . . millivolt(s) = 10^{-3} volts
μF . . . microfarad(s)
μs . . . microsecond(s)
μV . . . microvolt(s) = 10^{-6} volts
my . . . Mylar®

nA . . . nanoampere(s) = 10^{-9} amperes
NC . . . normally closed
Ne . . . neon
NO . . . normally open

NPO . . . negative positive zero (zero temperature coefficient)
ns . . . nanosecond(s) = 10^{-9} seconds
nsr . . . not separately replaceable

Ω . . . ohm(s)
obd . . . order by description
OD . . . outside diameter

p . . . peak
pA . . . picoampere(s)
pc . . . printed circuit
pF . . . picofarad(s) 10^{-12} farads
piv . . . peak inverse voltage
p/o . . . part of
pos . . . position(s)
poly . . . polystyrene
pot . . . potentiometer
p-p . . . peak-to-peak
ppm . . . parts per million
prec . . . precision (temperature coeffient, long term stability and/or tolerance)

R . . . resistor
Rh . . . rhodium
rms . . . root-mean-square
rot . . . rotary

Se . . . selenium
sect . . . section(s)
Si . . . silicon

sl . . . slide
SPDT . . . single-pole double-throw
SPST . . . single-pole single-throw

Ta . . . tantalum
TC . . . temperature coefficient
TiO_2 . . . titanium dioxide
tog . . . toggle
tol . . . tolerance
trim . . . trimmer
TSTR . . . transistor

V . . . volt(s)
vacw . . . alternating current working voltage
var . . . variable
vdcw . . . direct current working voltage

W . . . watt(s)
w/ . . . with
wiv . . . working inverse voltage
w/o . . . without
ww . . . wirewound

* . . . optimum value selected at factory, average value shown (part may be omitted)
** . . . no standard type number assigned selected or special type

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DECIMAL MULTIPLIERS

Prefix	Symbols	Multiplier	Prefix	Symbols	Multiplier
tera	T	10^{12}	centi	c	10^{-2}
giga	G	10^{9}	milli	m	10^{-3}
mega	M or Meg	10^{6}	micro	μ	10^{-6}
kilo	K or k	10^{3}	nano	n	10^{-9}
hecto	h	10^{2}	pico	p	10^{-12}
deka	da	10	femto	f	10^{-15}
deci	d	10^{-1}	atto	a	10^{-18}

STD-B-2734

DESIGNATORS

A . . . assembly
B . . . motor
BT . . . battery
C . . . capacitor
CR . . . diode
DL . . . delay line
DS . . . lamp
E . . . misc electronic part
F . . . fuse

FL . . . filter
HR . . . heater
IC . . . integrated circuit
J . . . jack
K . . . relay
L . . . inductor
M . . . meter
MP . . . mechanical part
P . . . plug

Q . . . transistor
QCR . . . transistor-diode
R . . . resistor
RT . . . thermistor
S . . . switch
T . . . transformer
TB . . . terminal board
TC . . . thermocouple
TP . . . test point

TS . . . terminal strip
U . . . microcircuit
V . . . vacuum tube, neon bulb,photocell, etc.
W . . . cable
X . . . socket
XDS . . . lampholder
XF . . . fuseholder
Y . . . crystal
Z . . . network

Table 6-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
†A1	03403-60001	1	AC CONVERTER ASSY	28480	03403-60001
†A1	03403-69501	1	REBUILT AC CONVERTER	28480	03403-69501
A1J1	1250-0047	1	CONNECTOR:RF BULKHEAD JACK	95712	12682-1
A1MP1	03403-22004	1	BOX:CONVERTER	28480	03403-22004
A1MP2	03403-22003	1	LID:CONVERTER BOX	28480	03403-22003
A1MP3	03403-00603	1	SHIELD:ATTENUATOR	28480	03403-00603
A1MP4	03403-09101	1	SPRING:LEAF	28480	03403-09101
A1MP5	0340-0740	1	INSULATOR	13103	OBD#
A1MP6	0905-0429	1	SEAL:"O" RING 0.364" ID	83259	2-012N219-7
A1MP7	0905-0435	1	SEAL:"O" RING 1.487" ID	83259	2-128N219-7
A1MP8	0905-0431	1	SEAL:"O" RING 5.987" ID	83259	2-163N219-7
A1S6	3102-0006	1	SWITCH: SENSITIVE SPDT PIN PLUNGER	91929	22SM261
		2			
†A2	03403-66530		ASSY:AMPLIFIER	28480	03403-66530
A2C1	0121-0168	2	C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A2C2	0160-3841	1	C:FXD PORC 3.9+/-0.25 PF 1000WVAC	95275	VY13C3R9C
A2C3	0160-3842	1	C:FXD PORC 3.3+/-0.25 PF 1000WVAC	95275	VY10CA3R3CA
A2C4	0160-3662	1	C:FXD POLY 0.056 UF 10% 600VDCW	28480	0160-3662
A2C5	0160-3846	1	C:FXD MICA 39+/-0.5 PF 100VDCW	00853	RDM10E390DIS
A2C6	0160-3845	1	C:FXD MICA 22+/-0.5 PF 100VDCW	00853	RDM10E220DIS
A2C7	0121-0451	1	C:VAR TRIMMER 1.7-11.0 PF 250VDC	74970	187-0160-005
A2C8	0160-3844	1	C:FXD MICA 170 PF 1% 100VDCW	00853	RDM15E171FIS
A2C9*	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A2C10	0121-0114	1	C:VAR CER 7-25 PF	28480	0121-0114
A2C11	0160-3843	1	C:FXD MICA 560 PF 1% 100VDCW	00853	RDM15E561FIS
A2C12	0160-3840	1	C:FXD MICA 7800 PF 1% 100VDCW	00853	RDM19E782FIS
A2C13	0160-3851	1	C:FXD POLY 0.085 UF 1.0% 50VDCW	28480	0160-3851
A2C14	0121-0168		C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A2C15	0160-3501	1	C:FXD POLY 4 UF 10% 50VDCW	84411	HEW 138
A2C16	0160-3686	1	C:FXD POLY 0.27 UF 10% 50VDCW	28480	0160-3686
A2C17	0180-1835	2	C:FXD TA 68 UF 20% 15VDCW	56289	150D686X0015R2-DYS
A2C18	0180-1835		C:FXD TA 68 UF 20% 15VDCW	56289	150D686X0015R2-DYS
A2C19	0160-3830	1	C:FXD POLY 5.0 UF 10% 50VDCW	28480	0160-3830
A2C20	0160-3829	2	C:FXD POLY 0.47 UF 10% 50VDCW	28480	0160-3829
A2C21	0160-3787	1	C:FXD POLY 1.0 UF 10% 50VDCW	28480	0160-3787
A2C22	0160-0300	1	C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A2C23	0140-0198	1	C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A2C24	0150-0084	1	C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A2C25	0150-0050	6	C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C0678102E102ZS26-CDH
A2C26	0150-0046	1	C:FXD TI DIOX 0.68 PF 5% 500VDCW	78488	TYPE GA
A2CR2	1902-3002	1	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A2CR3	1901-0053	14	DIODE:SILICON 30VDCW	07263	FD3444
A2CR4	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A2CR5	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A2CR6	1902-3226	1	DIODE BREAKDOWN:18.2V 2%	28480	1902-3226
A2CR7	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
†A2IC1	0960-0173	1	IC: HYBRID AMPLIFIER	28480	0960-0173
A2IC2	1820-0203	2	IC:OPERATIONAL AMPLIFIER	07263	SL8940
A2IC3	1820-0203		IC:OPERATIONAL AMPLIFIER	07263	SL8940
†A2IC4	1826-0052	1	IC:LINEAR HYBRID AMP	28480	1826-0052
A2K1	0490-0969	1	RELAY:REED	28480	0490-0969
A2K3	0490-0978	2	RELAY:REED	28480	0490-0978
A2K4	0490-0978		RELAY:REED	28480	0490-0978
A2K5	0490-0968	5	RELAY:REED	28480	0490-0968
A2K6	0490-0968		RELAY:REED	28480	0490-0968
A2K7	0490-0968		RELAY:REED	28480	0490-0968
A2MP1	0340-0060	2	FEEDTHRU:INSULATED MOUNTING	28480	0340-0060
A2MP2	0340-0128	1	TERMINAL: STANDOFF	28480	0340-0128
A2MP3	1200-0423	1	SOCKET:IC BLK 16 CONTACT	23880	CSA2900-16B
A2MP4	1200-0424	4	SOCKET:IC BLK 14 CONTACT	23880	CSA2900-14B
A2MP5	1200-0432	14	SOCKET-CONTACT-DIP	27264	1938-4
A2Q1	1855-0368	12	TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A2Q2	1855-0082	1	TSTR:SI FET P-CHANNEL	28480	1855-0082
A2Q3	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A2Q4	1854-0071	15	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2Q5	1853-0020	21	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0757-0280	6	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R3	0698-7950	1	RESISTOR SET	28480	0698-7950
A2R5	2100-1984	1	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A2R6	0698-7521	1	R:FXD FLM 5.11K OHM 5% 1/4W	28480	0698-7521
A2R7	2100-1985	1	R:VAR CERMET 20 OHM 20% LIN 1/2W	28480	2100-1985
A2R8	0698-7985	1	R:FXD FLM 2 OHM 5% 1/4W	28480	0698-7985
A2R9	2100-1986	1	R:VAR CERMET 1000 OHM 10% LIN 1/2W	28480	2100-1986
A2R10	1810-0056	1	R:NETWORK 6 (4)=50K(2)= 5K OHM	28480	1810-0056
A2R11	2100-2497	3	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A2R12	0684-1001	7	R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A2R13	1810-0060	1	R:NETWORK 4(2)=1K(1)=5K(1)=620 OHM	28480	1810-0060
A2R14	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A2R15	0684-1031	47	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A2R16	0684-2241	1	R:FXD COMP 220K OHM 10% 1/4W	01121	CB 2241
A2R17	1810-0057	1	R:NETWORK 4(2)=2.6(1)=26(1)=24K OHM	28480	1810-0057
A2R18	2100-1738	6	R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A2R19	1810-0053	1	R:PACK 5=36/30/47/130/200K OHM 5%	28480	1810-0053
A2R20	0698-3572	1	R:FXD FLM 60.4K OHM 1% 1/8W	28480	0698-3572
A2R21	0757-0466	1	R:FXD MET FLM 110K OHM 1% 1/8W	28480	0757-0466
A2R22	0811-2960	2	R:FXD WW 650K OHM 1.0% 1/5W	28480	0811-2960
A2R23	0811-2960		R:FXD WW 650K OHM 1.0% 1/5W	28480	0811-2960
A2R24	0698-7653	1	R:FXD FLM 25.5K OHM 1.0% 1/8W	28480	0698-7653
A2R25	0757-0446	1	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R26	0698-4202	1	R:FXD FLM 8.87K OHM 1% 1/8W	28480	0698-4202
A2R27	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A2R28	1810-0059	1	R:NETWORK 4=2K/500/1K/4K OHM	28480	1810-0059
A2R29	0757-0346	3	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A2R30	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A2R31	0757-0442	6	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R32	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A2R33	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A2R34	0698-3433	1	R:FXD MET FLM 28.7 OHM 1% 1/8W	28480	0698-3433
A2R41	0757-0420	1	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A2R42	0684-1041	2	R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A2R71	2100-2061	1	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2061
†A2TC1	0853-0014	1	THERMOCOUPLE	28480	0853-0014
A3	03403-66540	1	ASSY:FILTER	28480	03403-66540
A3C1	0180-0116	1	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A3C2	0180-1794	1	C:FXD ELECT 22 UF 10% 35VDCW	56289	150D226X9035R2-DYS
A3C3	0160-3563	2	C:FXD POLY 10 UF 5% 500VDCW	84411	HEW 138
A3C4	0160-3402	2	C:FXD POLY 1.0 UF 5% 50VDCW	84411	HEW 138
A3C5	0150-0093	1	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C6	0160-3563		C:FXD POLY 10 UF 5% 500VDCW	84411	HEW 138
A3C7	0160-3402		C:FXD POLY 1.0 UF 5% 50VDCW	84411	HEW 138
A3CR1	1901-0040	41	DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR2	1901-0045	1	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3CR3	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR4	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR5	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR6	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR7	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR8	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR9	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR10	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR16	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR17	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR18	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR19	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR20	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR21	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR22	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR23	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR24	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR25	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR26	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR27	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR28	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR29	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR30	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3IC1	1826-0018	1	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0018
A3J10	1251-1626	1	CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A3K8	0490-0968		RELAY:REED	28480	0490-0968
A3K9	0490-0968		RELAY:REED	28480	0490-0968
A3Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q4	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q5	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q6	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q7	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q8	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q9	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q10	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q11	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q12	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q13	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q14	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q15	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q16	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q17	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q18	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q19	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q20	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3R1	1810-0054	1	R:PACK 4= 5/10/10/10K OHM 10%	28480	1810-0054
A3R2	0698-4195	1	R:FXD MET FLM 1.02K OHM 1% 1/8W	28480	0698-4195
A3R3	2100-3154	3	R:VAR CERMET 1000 OHM 10% TYPE P 3/4W	28480	2100-3154
A3R4	1810-0058	1	R:NETWORK 5 (2)=15(2)=47(1)=4.7K OHM	28480	1810-0058
A3R5	1810-0079	1	R:NETWORK	28480	1810-0079
A3R6	0684-1011	2	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3R7	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3R8	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A3R9	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R10	2100-3056	6	R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R11	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R12	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R13	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R14	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R15	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R16	1810-0062	1	R:NETWORK 4=355/342/159/671 OHM 1.0%	28480	1810-0062
A3R17	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R18	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R19	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R20	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R21	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R22	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R23	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R24	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R25	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R26	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R27	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R28	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R29	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R30	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R31	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R32	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R33	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R34	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R35	0684-2231	8	R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R36	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R37	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R38	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R39	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R40	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R41	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R42	0684-4731	6	R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A3R43	0757-0384	1	R:FXD FLM 20 OHM 1% 1/8W	28480	0757-0384
A3W1	8120-1718	4	CABLE ASSY	28480	8120-1718
A3W2	8120-1718		CABLE ASSY	28480	8120-1718
A4	03403-66511	1	ASSY:MASTER	28480	03403-66511
A4C1	0180-0309	3	C:FXD ELECT 4.7 UF 20% 10VDCW	56289	1500475X0010A2-DYS
A4IC1	1820-0307	10	IC:DTL HEX INVERTER	04713	MC836P
A4IC2	1820-0273	4	IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A4IC3	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A4IC4	1820-0094	10	IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A4IC5	1820-0086	2	IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A4IC6	1820-0310	5	IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A4IC7	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A4IC8	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A4IC9	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A4J4	1251-2825	1	CONNECTOR:50 PIN	28480	1251-2825
A4J5	1251-2026	2	CONNECTOR:PC 36 CONTACT	71785	252-18-30-300
A4J6	1251-2034	3	CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A4J7	1251-2026		CONNECTOR:PC 36 CONTACT	71785	252-18-30-300
A4J8	1251-2034		CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A4MP1	1200-0474	9	SOCKET:IC 14-PIN	28480	1200-0474
A4JA	1200-0424		SOCKET:IC BLK 14 CONTACT	23880	CSA2900-14B
A4JB	1200-0424		SOCKET:IC BLK 14 CONTACT	23880	CSA2900-14B
A4R1	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A4R2	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A4R3	0684-4721	32	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R4	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R5	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R6	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R7	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R8	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R9	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R10	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R11	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R12	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R13	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R14	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R15	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R16	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R17	0684-1821	1	R:FXD COMP 1800 OHM 10% 1/4W	01121	CB 1821
A4S1	3101-0982	1	SWITCH:SLIDE SPST 0.5A 125V	79727	GF124-0007
A4A1	03403-66513	1	ASSY:SWITCH	28480	03403-66513
A4A1MP1	3130-0392	3	SHAFT AND INDEX ASSY:30 DEGREE INDEX	28480	3130-0392
A4A1MP2	03403-04310	1	SWITCH PLATE:MOUNTING	28480	03403-04310
A4A1MP3	0380-0990	6	SPACER:0.375" LG	00000	OBD
A4A1MP4	0380-0991	6	SPACER:0.125" LG	00000	OBD
A4A1R3	2100-3282	1	R:VAR 50K OHM	28480	2100-3282
A4A1S1	3130-0395	1	SWITCH:WAFER	28480	3130-0395
A4A1S2	3130-0394	1	SWITCH:WAFER	28480	3130-0394
A4A1S3	3130-0393	1	SWITCH:WAFER	28480	3130-0393
A4A1W1	8120-1718		CABLE ASSY	28480	8120-1718
A4A1W2	8120-1718		CABLE ASSY	28480	8120-1718
A5	03403-66551	1	ASSY:RECTIFIER	28480	03403-66551
A5C9	0180-2428	1	C:FXD AL ELECT 250 UF +75-10% 25VDCW	56289	500D257G025EF7
A5C13	0180-2187	1	C:FXD ELECT 2500 UF +75-10% 15VDCW	56289	39D258G015GP4-DSB
A5CR1	1906-0023	1	DIODE ASSY:SI FULL WAVE BRIDGE	28480	1906-0023
A5CR2	1901-0363	3	DIODE ASSY:SI 100 PIV PER CELL	28480	1901-0363
A5CR3	1901-0363		DIODE ASSY:SI 100 PIV PER CELL	28480	1901-0363
A5CR4	1901-0363		DIODE ASSY:SI 100 PIV PER CELL	28480	1901-0363
A5MP1	1460-1269	1	SPRING:COMPRESSION, GROUND	00000	OBD
A5Q1	1854-0402	2	TSTR:SI NPN	28480	1854-0402
A5Q2	1854-0402		TSTR:SI NPN	28480	1854-0402
A5Q4	1854-0420	1	TSTR:SI NPN	28480	1854-0420
A6	03403-66561	1	ASSY:REGULATOR	28480	03403-66561
A6C1	0180-2506	2	C:FXD AL ELECT 470 UF +50-10% 40VDCW	73445	ET471X025A01
A6C2	0180-0049	4	C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C3	0160-0990	2	C:FXD MICA 100 PF 2% 300VDCW	00853	RDM15F101G3S
A6C5	0180-2506		C:FXD AL ELECT 470 UF +50-10% 40VDCW	73445	ET471X025A01
A6C6	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C7	0160-0990		C:FXD MICA 100 PF 2% 300VDCW	00853	RDM15F101G3S
A6C10	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C11	0160-0362	2	C:FXD MICA 510PF 5%	28480	0160-0362
A6C12	0180-0228	5	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A6C14	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C15	0160-0362		C:FXD MICA 510PF 5%	28480	0160-0362
A6C17	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A6CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A6CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR7	1902-3074	1	DIODE BREAKDOWN:4.32V 2%	28480	1902-3074
A6CR8	1901-0522	1	DIODE:SI 100V PIV	28480	1901-0522
A6IC1	1820-0196	4	IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6IC2	1820-0196		IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6IC3	1820-0196		IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6IC4	1820-0196		IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6J12	1251-2034		CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A6MP1	1205-0011	1	HEAT DISSIPATOR:FOR TO-5 AND TO-9 CASES	98978	TXBF-032-0258
A6Q3	1854-0039	1	TSTR:SI NPN	80131	2N3053
A6Q5	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6R1	0813-0029	2	R:FXD WW 1 OHM 3% 3W	28480	0813-0029
A6R2	0757-0431	2	R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A6R3	0698-3496	2	R:FXD FLM 3.57K OHM 1% 1/8W	28480	0698-3496
A6R4	2100-2633	4	R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A6R5	0698-3382	2	R:FXD MET FLM 5.49K OHM 1% 1/8W	28480	0698-3382
A6R6	0813-0029		R:FXD WW 1 OHM 3% 3W	28480	0813-0029
A6R7	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A6R8	0698-3496		R:FXD FLM 3.57K OHM 1% 1/8W	28480	0698-3496
A6R9	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A6R10	0698-3382		R:FXD MET FLM 5.49K OHM 1% 1/8W	28480	0698-3382
A6R11	0683-0335	1	R:FXD COMP 3.3 OHM 5% 1/4W	01121	CB 0335
A6R12	0757-0283	3	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A6R13	0698-4434	1	R:FXD FLM 2.32K OHM 1% 1/8W	28480	0698-4434
A6R14	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A6R15	0698-3484	1	R:FXD FLM 6650 OHM 1% 1/8W	28480	0698-3484
A6R16	0698-5101	1	R:FXD COMP 33 OHM 10% 1/4W	01121	CB 3301
A6R17	0684-3311	1	R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A6R18	0684-1021	3	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A6R19	0812-0017	1	R:FXD WW 0.25 OHM 5% 3W	28480	0812-0017
A6R20	0698-4432	1	R:FXD FLM 2.1K OHM 1% 1/8W	28480	0698-4432
A6R21	0698-4435	1	R:FXD FLM 2.49K OHM 1% 1/8W	28480	0698-4435
A6R22	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A6R23	0698-3226	1	R:FXD MET FLM 6.49K OHM 1% 1/8W	28480	0698-3226
A6R24	0684-4701	3	R:FXD COMP 47 OHM 10% 1/4W	01121	CB 4701
A6R25	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6R26	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6R27	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6R28	0812-0039	1	R:FXD WW 2.2 OHM 3% 3W	28480	0812-0039
A7	03403-66520	1	ASSY:CONNECTOR, STANDARD	28480	03403-66520
A7C1	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X901582-DYS
A7C2	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X901582-DYS
A7CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR6	1901-0376	2	DIODE:SILICON 35V	28480	1901-0376
A7CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7IC1	1826-0043	8	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A7IC2	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A7IC3	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A7IC4	1820-0668	4	IC:TTL HEX DRIVER W/OPEN COLL(30V)	01295	SN7407N
A7IC5	1820-0668		IC:TTL HEX DRIVER W/OPEN COLL(30V)	01295	SN7407N
A7Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q3	1855-0378	4	TSTR:FET SI N-CHANNEL	28480	1855-0378
A7Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7R1	2100-2522	6	R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A7R2	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R3	0684-1831	4	R:FXD COMP 18K OHM 10% 1/4W	01121	CB 1831
A7R4	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R5	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R6	0684-1831		R:FXD COMP 18K OHM 10% 1/4W	01121	CB 1831
A7R7	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R8	0757-0435	2	R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A7R9	0698-4445	2	R:FXD FLM 5.76K OHM 1% 1/8W	28480	0698-4445
A7R10	0757-0282	2	R:FXD MET FLM 221 OHM 1% 1/8W	28480	0757-0282
A7R11	2100-2413	2	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2413
A7R12	0757-0428	2	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A7R13	2100-2520	2	R:VAR CERMET 50 OHM 20% TYPE V 1/2W	28480	2100-2520

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A7R14	0698-4411	2	R:FXD FLM 140 OHM 1% 1/8W	28480	0698-4411
A7R15	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R16	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R17	0698-7394	4	R:FXD FLM 698 OHM 0.1% 1/8W	28480	0698-7394
A7R18	0698-7394		R:FXD FLM 698 OHM 0.1% 1/8W	28480	0698-7394
A7R19	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R20	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R21	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R22	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8	03403-61901	1	LINE SWITCH ASSY	28480	03403-61901
A8MP1	03403-04112	1	PLATE:SHIELD	28480	03403-04112
A8MP2	0340-0737	2	PLATE:INSULATOR	13103	OBD#
A8MP3	1600-0226	1	PLATE:RETAINER	28480	1600-0226
A8MP4	1400-0830	1	CLAMP:CABLE 0.375" W 0.625" LG	79963	#139 MODIFIED
A8MP5	5040-5846	1	CAM:POWER SWITCH	28480	5040-5846
A8S7	3101-1304	1	SWITCH:SENSITIVE SPDT 5 AMP	91929	111 SMI-T
A11	03403-66521	1	ASSY:CONNECTOR, ISOLATED	28480	03403-66521
A11C1	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X901582-DYS
A11C2	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X901582-DYS
A11CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A11CR7	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A11IC1	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A11IC2	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A11IC3	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A11IC4	1820-0668		IC:TTL HEX DRIVER W/OPEN COLL(30V)	01295	SN7407N
A11IC5	1820-0668		IC:TTL HEX DRIVER W/OPEN COLL(30V)	01295	SN7407N
A11IC6	1990-0312	16	TSTR:PHOTO	28480	1990-0312
A11IC7	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC8	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC9	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC10	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC11	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC12	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC13	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC14	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC15	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC16	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC17	1990-0312		TSTR:PHOTO	28480	1990-0312
A11IC18	1990-0312		TSTR:PHOTO	28480	1990-0312
A11Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A11Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A11Q3	1855-0378		TSTR:FET SI N-CHANNEL	28480	1855-0378
A11Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A11Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A11Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A11Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A11R1	2100-2522		R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A11R2	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A11R3	0684-1831		R:FXD COMP 18K OHM 10% 1/4W	01121	CB 1831
A11R4	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A11R5	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R6	0684-1831		R:FXD COMP 18K OHM 10% 1/4W	01121	CB 1831
A11R7	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R8	0757-0435		R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A11R9	0698-4445		R:FXD FLM 5.76K OHM 1% 1/8W	28480	0698-4445
A11R10	0757-0282		R:FXD MET FLM 221 OHM 1% 1/8W	28480	0757-0282
A11R11	2100-2413		R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2413
A11R12	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A11R13	2100-2520		R:VAR CERMET 50 OHM 20% TYPE V 1/2W	28480	2100-2520
A11R14	0698-4411		R:FXD FLM 140 OHM 1% 1/8W	28480	0698-4411
A11R15	0684-3321	3	R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A11R16	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R17	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R18	0698-7394		R:FXD FLM 698 OHM 0.1% 1/8W	28480	0698-7394

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A11R19	0698-7394		R:FXD FLM 698 OHM 0.1% 1/8W	28480	0698-7394
A11R20	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A11R21	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R22	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R23	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A11R24	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R25	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A11R26	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A11R27	0698-4453	10	R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R28	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R29	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R30	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R31	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R32	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R33	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R34	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R35	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A11R36	0698-4453		R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A12	03403-66591	1	ASSY:CONVERTER, LOG	28480	03403-66591
A12C1	0160-0161	2	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A12C2	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A12C3	0180-0374	2	C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X902082-DYS
A12C4	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X902082-DYS
A12CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A12CR2	1902-0777	1	DIODE:BREAKDOWN 6.2V 5%	04713	1N825
A12CR3	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A12CR4	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A12IC1	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
†A12IC2	1826-0024	1	IC:LIN POSITIVE VOLTAGE REGULATOR	04713	MC 1469R
A12IC3	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A12Q1	1853-0086	1	TSTR:SI PNP	80131	2N5087
A12Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A12Q3	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A12Q4	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A12R1	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A12R2	0698-3279	2	R:FXD MET FLM 4990 OHM 1% 1/8W	28480	0698-3279
A12R3	2100-2010	1	R:VAR FLM 10 OHM 20% LIN 1/2W	28480	2100-2010
A12R4	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A12R5	0757-0274	1	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A12R6	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A12R7	0698-3279		R:FXD MET FLM 4990 OHM 1% 1/8W	28480	0698-3279
A12R8	2100-3103	2	R:VAR CERMET 10K OHM 10% TYPE P 3/4W	28480	2100-3103
A12R9	0757-0465	1	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A12R10	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A12R11	0698-4443	1	R:FXD FLM 4.53K OHM 1% 1/8W	28480	0698-4443
A12R12	0698-4433	1	R:FXD FLM 2260 OHM 1% 1/8W	28480	0698-4433
A12R13	2100-3054	1	R:VAR CERMET 50K OHM 10% 3/4W	28480	2100-3054
A12R14	0698-4468	1	R:FXD FLM 113K OHM 1% 1/8W	28480	0698-4468
A12R15	0757-0448	1	R:FXD MET FLM 18.2K OHM 1% 1/8W	28480	0757-0448
A12R16	0698-8180	2	R:FXD FLM 4.22K OHM 0.1% 1/8W	28480	0698-8180
A12R17	0698-8180		R:FXD FLM 4.22K OHM 0.1% 1/8W	28480	0698-8180
A12R18	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A12R19	2100-3154		R:VAR CERMET 1000 OHM 10% TYPE P 3/4W	28480	2100-3154
A12R20	0698-7934	2	R:FXD MET FLM 12.1K OHM 0.1% 1/8W	28480	0698-7934
A12R21	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A12R22	0698-7934		R:FXD MET FLM 12.1K OHM 0.1% 1/8W	28480	0698-7934
A12R23	0757-0388	1	R:FXD FLM 30.1 OHM 1% 1/8W	28480	0757-0388
A12R24	0698-4442	2	R:FXD MET FLM 4.42K OHM 1% 1/8W	28480	0698-4442
A12R25	0698-4442		R:FXD MET FLM 4.42K OHM 1% 1/8W	28480	0698-4442
A12R26	0684-4711	1	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A12R27	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A12R28	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A12R29	2100-3103		R:VAR CERMET 10K OHM 10% TYPE P 3/4W	28480	2100-3103
A12R30	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A12R31	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A12R32	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A12R33	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A12R38	2100-3154		R:VAR CERMET 1000 OHM 10% TYPE P 3/4W	28480	2100-3154
A12Z1					
A12Z2					
A13	03403-66571	1	ASSY:AUTORANGE	28480	03403-66571
A13C1	0180-0309		C:FXD ELECT 4.7 UF 20% 10VDCW	56289	150D475X0010A2-DYS
A13C2	0160-2605	12	C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A13C3	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A13C4	0180-1715	2	C:FXD TA-ELECT 150 UF 10% 6VDCW	56289	150D157X9006R2-DYS
A13C5	0150-0073	4	C:FXD CER 100 PF 10% 1000VDCW	56289	C0288102E101KS27-CDH
A13CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A13IC1	1820-0207	2	IC:TTL MONOSTABLE MULTIVIBRATOR	28480	1820-0207
A13IC2	1820-0310		IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A13IC3	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A13IC4	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A13IC5	1820-0491	2	IC:TTL BCD/DEC. DECODER/DRIVER	01295	SN74145N
A13IC6	1820-0546	2	IC:DIGITAL TTL SYNC 4-BIT BCD	28480	1820-0546
A13Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A13Q2	1855-0378		TSTR:FET SI N-CHANNEL	28480	1855-0378
A13Q3	1854-0392	2	TSTR:SI NPN	80131	2N5088
A13R1	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A13R2	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A13R3	0698-4529	2	R:FXD FLM 226K OHM 1% 1/8W	28480	0698-4529
A13R4	0698-4486	2	R:FXD MET FLM 24.9K OHM 1% 1/8W	28480	0698-4486
A13R5	0684-2731	2	R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A13R6	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A14	03403-66572	1	ASSY:REMOTE AND AUTORANGE	28480	03403-66572
A14C1	0180-0309		C:FXD ELECT 4.7 UF 20% 10VDCW	56289	150D475X0010A2-DYS
A14C2	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A14C3	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A14C4	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A14C5	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A14C6	0150-0073		C:FXD CER 100 PF 10% 1000VDCW	56289	C0288102E101KS27-CDH
A14C7	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C0678102E102ZS26-CDH
A14C8	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A14C9	0180-0195	2	C:FXD ELECT 0.33 UF 20% 35VDCW	56289	150D334X0035A2-DYS
A14C10	0160-3486	1	C: FXD CER 0.47 UF +20+80% 500 VDCW	72982	8131-050-651-474Z
A14C11	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C0678102E102ZS26-CDH
A14C12	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A14C13	0180-1715		C:FXD TA-ELECT 150 UF 10% 6VDCW	56289	150D157X9006R2-DYS
A14C14	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A14C15	0150-0073		C:FXD CER 100 PF 10% 1000VDCW	56289	C0288102E101KS27-CDH
A14C16	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C0678102E102ZS26-CDH
A14CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A14CR2	1910-0016	4	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A14IC1	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A14IC2	1820-0310		IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A14IC3	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A14IC4	1820-0207		IC:TTL MONOSTABLE MULTIVIBRATOR	28480	1820-0207
A14IC5	1820-0310		IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A14IC6	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A14IC7	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A14IC8	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A14IC9	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A14IC10	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A14IC11	1820-0086		IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A14IC12	1820-0491		IC:TTL BCD/DEC. DECODER/DRIVER	01295	SN74145N
A14IC13	1820-0546		IC:DIGITAL TTL SYNC 4-BIT BCD	28480	1820-0546
A14IC14	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A14IC15	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A14IC16	1820-0301	2	IC:TTL QUAD BI-STABLE D-LATCH	01295	SN7475N
A14IC17	1820-0301		IC:TTL QUAD BI-STABLE D-LATCH	01295	SN7475N
A14Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A14Q2	1855-0378		TSTR:FET SI N-CHANNEL	28480	1855-0378
A14Q3	1854-0392		TSTR:SI NPN	80131	2N5088
A14R1	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A14R2	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R3	0684-5621	8	R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A14R4	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R5	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R6	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R7	0684-4701		R:FXD COMP 47 OHM 10% 1/4W	01121	CB 4701
A14R8	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R9	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A14R10	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R11	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A14R12	0698-4529		R:FXD FLM 226K OHM 1% 1/8W	28480	0698-4529
A14R13	0698-4486		R:FXD MET FLM 24.9K OHM 1% 1/8W	28480	0698-4486
A14R14	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A14R15	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A14R16	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R17	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A14R18	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R19	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R20	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R21	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R22	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R23	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A14R24	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A15	03403-66581	1	ASSY:INPUT/OUTPUT	28480	03403-66581
A15C1	0180-0210	1	C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A15C2	0180-1746	1	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A15C3	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CDH
A15C4	0180-0195		C:FXD ELECT 0.33 UF 20% 35VDCW	56289	150D334X0035A2-DYS
A15C5	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CDH
A15C6	0150-0073		C:FXD CER 100 PF 10% 1000VDCW	56289	C028B102E101KS27-CDH
A15C7	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A15C8	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A15C9	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A15CR1	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A15IC1	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A15IC2	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A15IC3	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A15IC4	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A15IC5	1820-0665	4	IC:DTL 4-BIT LATCH	04713	MC1814P
A15IC6	1820-0665		IC:DTL 4-BIT LATCH	04713	MC1814P
A15IC7	1820-0310		IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A15IC8	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A15IC9	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A15IC10	1820-0665		IC:DTL 4-BIT LATCH	04713	MC1814P
A15IC11	1820-0665		IC:DTL 4-BIT LATCH	04713	MC1814P
A15J2	1251-0085	1	CONNECTOR:FEMALE 36-PIN MINAT	28480	1251-0085
A15J3	1251-0292	1	CONNECTOR:FEMALE 24 PIN	28480	1251-0292
A15J9	1251-2875	1	CONNECTOR:PC (2 X 22) 44 CONTACT	71785	251-22-30-380
A15Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A15Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A15R1	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A15R2	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R3	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R4	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R5	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R6	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A15R7	0684-4701		R:FXD COMP 47 OHM 10% 1/4W	01121	CB 4701
A15R8	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A15R9	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R10	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R11	0684-2221	2	R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A15R12	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A15R13	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R14	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R15	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R16	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R17	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A21	03431-69501	1	ASSY:DISPLAY (DOES NOT INCLUDE DS1)	28480	03431-69501
†A21C1	0160-0155	1	C:FXD MY 0.0033 UF 10% 200VDCW	56289	192P33292-PTS
A21C2	0180-0106	1	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A21DS1	1990-0315	1	NUMERIC DISPLAY, SOLID STATE	28480	1990-0315
A21DS2	1990-0310	9	DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS3	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS4	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS5	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS6	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS7	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS8	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS9	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS10	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
†A21IC1	1820-0663	1	IC:DIGITAL SCANNER	28480	1820-0663
†A21IC2	1820-0571	1	IC:TTL NUMERIC DISPLAY CHARACTER GEN.	28480	1820-0571
A21MP1	5040-5839	1	HOUSING:ANNUNCIATOR	28480	5040-5839

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A21MP2	03403-24301	1	MASK:ANNUNCIATOR	28480	03403-24301
A21MP3	1200-0462	61	SOCKET:IC CONTACT	00779	3-116141-2
A21Q1	1854-0094	6	TSTR:SI NPN	80131	2N3646
A21Q2	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q3	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q4	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q5	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q6	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q7	1853-0016	13	TSTR:SI PNP	80131	2N3638
A21Q8	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q9	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q10	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q11	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q12	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q13	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q14	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q15	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q16	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q17	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q18	1853-0016		TSTR:SI PNP	80131	2N3638
A21R1	1810-0066	1	R:NETWORK 4 (2)=650(2)=350 OHM 10%	28480	1810-0066
A21R2	1810-0067	1	R:NETWORK 6(2)=190(3)=210(1)=510 OHM	28480	1810-0067
A21R3	1810-0068	1	R:NETWORK 3 X 410 OHM 10%	28480	1810-0068
A21R4	1810-0069	1	R:NETWORK 9 X 48 OHM 10% 0.05W EACH	28480	1810-0069
†A22	03431-66507	1	ASSY:ANALOG, STANDARD	28480	03431-66507
A22C1	0160-3674	2	C:FXD POLY 0.47 UF 5% 100VDCW	28480	0160-3674
A22CR1	1902-0686	4	DIODE BREAKDOWN:6.2V 2%	04713	1N825
A22CR2	1902-0686		DIODE BREAKDOWN:6.2V 2%	04713	1N825
†A22IC1	0960-0160	2	A-D HYBRID SUB	28480	0960-0160
A22R1	2100-2522		R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A22R2	2100-2522		R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A22R3	2100-2497		R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A22R4	0757-0488	2	R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A22R5	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
†A23	03431-66502	1	ASSY:ANALOG, ISOLATED	28480	03431-66502
A23C1	0160-3674		C:FXD POLY 0.47 UF 5% 100VDCW	28480	0160-3674
A23CR1	1902-0686		DIODE BREAKDOWN:6.2V 2%	04713	1N825
A23CR2	1902-0686		DIODE BREAKDOWN:6.2V 2%	04713	1N825
†A23IC1	0960-0160		A-D HYBRID SUB	28480	0960-0160
A23IC2	1990-0312		TSTR:PHOTO	28480	1990-0312
A23Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A23Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A23Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A23R1	2100-2030		R:VAR CERMET 20 K OHM 10% LIN 1/2W	28480	2100-2030
A23R2	2100-2030		R:VAR CERMET 20 K OHM 10% LIN 1/2W	28480	2100-2030
A23R3	2100-2497		R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A23R4	0757-0488		R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A23R5	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A23R6	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A23R7	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A23R8	0683-3915	1	R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915
A23R9	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A23R10	0683-2035	1	R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035
† A24	03431-60001	1	ASSY:LOGIC, STANDARD	28480	03431-60001
A24C1*	0160-0145	1	C: FXD MICA 82 PF 2 % 100 VDCW	84171	RDM15E820G15
A24C2	0160-2205	3	C:FXD MICA 120 PF 5%	28480	0160-2205
A24CR1	1910-0016		DIODE: GE 100 MA/0.85 V 60 PIV	93332	D2361
† A24IC1	1820-0671	3	IC:CONT-LOGIC	28480	1820-0671
† A24IC2	1820-0698	3	IC:TRI-DECADE	28480	1820-0698
A24R4	0698-4533	3	R:FXD FLM 294K OHM 1% 1/8W	28480	0698-4533
A24A1R1	0675-2221	27	R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R2	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R3	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R4	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R5	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R6	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R7	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R8	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A24A1R9	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
†A25	03431-60002		ASSY:LOGIC ISOLATED	28480	03431-60002
A25C1*	0160-0145	1	C: FXD MICA 82 PF 2 % 100 VDCW	84171	RDM15E820G15
A25C2	0160-2205		C: FXD MICA 120 PF 5 %	28480	0160-2205
A25CR1	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
†A25IC1	1820-0671		IC:CONT-LOGIC	28480	1820-0671
†A25IC2	1820-0698		IC:TRI-DECADE	28480	1820-0698
†A25IC3	1820-0699	2	IC:ADDER CHIP	28480	1820-0699
A25IC4	1990-0312		TSTR:PHOTO	28480	1990-0312
A25IC5	1990-0312		TSTR:PHOTO	28480	1990-0312
A25Q1	1853-0016		TSTR:SI PNP	80131	2N3638
A25R1	0683-1045	1	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A25R2	0683-1035	2	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A25R3	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A25R4	0698-4533		R:FXD FLM 294K OHM 1% 1/8W	28480	0698-4533
A25R5	0683-5125	10	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A25R6	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A25R7	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A25R8	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A25R9	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A25A1R1	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R2	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R3	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R4	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R5	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R6	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R7	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R8	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A25A1R9	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
† A26	03431-60003	1	ASSY:LOGIC, OB	28480	03431-60003
A26C1*	0160-0145	1	C:FXD MICA 82 PF 2% 100VDCW	84171	RDM15E820G1S
A26C2	0160-2205		C:FXD MICA 120 PF 5%	28480	0160-2205
† A26CR1	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
† A26IC1	1820-0671		IC:CONT-LOGIC	28480	1820-0671
A26IC2	1820-0698		IC:TRI-DECADE	28480	1820-0698
† A26IC3	1820-0699		IC:ADDER CHIP	28480	1820-0699
A26R4	0698-4533		R:FXD FLM 294K OHM 1% 1/8W	28480	0698-4533
A26R5	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R6	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R7	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R8	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R9	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26A1R1	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R2	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R3	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R4	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R5	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R6	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R7	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R8	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R9	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
			CHASSIS PARTS AND MISCELLANEOUS		
†A1	03403-60001		AC CONVERTER ASSY	28480	03403-60001
†A1	03403-69501		REBUILT AC CONVERTER ASSY	28480	03403-69501
†A2	03403-66530		ASSY:AMPLIFIER	28480	03403-66530
A3	03403-66540		ASSY:FILTER	28480	03403-66540
A4	03403-66511		ASSY:MASTER	28480	03403-66511
A4A1	03403-66513		ASSY: SWITCH	28480	03403-66513
A5	03403-66551		ASSY:RECTIFIER	28480	03403-66551
A6	03403-66561		ASSY:REGULATOR	28480	03403-66561
A7	03403-66520		ASSY:CONNECTOR, STANDARD	28480	03403-66520
A8	03403-61901		LINE SWITCH ASSY	28480	03403-61901
A11	03403-66521		ASSY:CONNECTOR, ISOLATED	28480	03403-66521

See introduction to this section for ordering information

Table 6-1. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403A		
A12	03403-66591		ASSY:CONVERTER, LOG	28480	03403-66591
A13	03403-66571		ASSY:AUTORANGE	28480	03403-66571
A14	03403-66572		ASSY:REMOTE AND AUTORANGE	28480	03403-66572
A15	03403-66581		ASSY:INPUT/OUTPUT	28480	03403-66581
†A21	03431-69501		ASSY:DISPLAY (DOES NOT INCLUDE DS1)	28480	03431-69501
†A22	03431-66507		ASSY:ANALOG, STANDARD	28480	03431-66507
†A23	03431-66502		ASSY:ANALOG, ISOLATED	28480	03431-66502
†A24	03431-60001		ASSY:LOGIC, STANDARD	28480	03431-60001
†A25	03431-60002		ASSY:CONTROL LOGIC, ISOLATED	28480	03431-60002
†A26	03431-60003		ASSY:CONTROL LOGIC, DB	28480	03431-60003
F1	2110-0340	1	FUSE:0.4A AT 250V	71400	MDL 4/10
F2	2110-0235	1	FUSE:0.2A 250V SLOW-BLOW	71400	MDL 2/10
J13	1251-2357	1	SOCKET:3-PIN MALE POWER RECEPTACLE	82389	EAC-301
J14	1510-0059	2	BINDING POST ASSY:RED INSULATOR	28480	1510-0059
J15	1510-0058	1	BINDING POST ASSY:BLK INSULATOR	28480	1510-0058
J16	1510-0059		BINDING POST ASSY:RED INSULATOR	28480	1510-0059
MP1	03403-60201	1	FRONT PANEL ASSY	28480	03403-60201
MP3	03403-04103	1	COVER:SIDE	28480	03403-04103
MP4	03403-01203	1	BRACKET:PC GUIDE	28480	03403-01203
MP5	5020-6871	1	CASE:EXTRUSION	28480	5020-6871
MP7	03403-22002	1	PANEL:TOP	28480	03403-22002
MP9	6960-0060	1	PLUG-BUTTON:STL	90763	51050
MP10	03403-22001	1	PANEL:REAR	28480	03403-22001
MP11	03403-60301	1	COVER ASSY:SIDE	28480	03403-60301
MP12	1490-0032	2	STAND:TILT HALF-MODULE	28480	1490-0032
MP13	03403-27901	2	FOOT ASSY	28480	03403-27901
MP14	5040-5848	1	HOLDER:AC CONVERTER	28480	5040-5848
MP17	03403-60302	1	COVER ASSY:BOTTOM	28480	03403-60302
MP19	7120-2769	1	WINDOW(STANDARD)	28480	7120-2769
MP20	7120-2771	1	WINDOW(AUTORANGE)	28480	7120-2771
MP21	7120-2770	1	WINDOW(REMOTE & AUTORANGE)	28480	7120-2770
MP22	7120-2767	1	PANEL:INSERT, STD	28480	7120-2767
MP23	7120-2768		PANEL:INSERT DB	28480	7120-2768
MP24	0370-1103	2	KNOB:RANGE	28480	0370-1103
MP25	0370-1099	2	KNOB:JADE GREY	28480	0370-1099
MP26	0370-1097	1	KNOB:POINTER 0.50", JADE GRAY	28480	0370-1097
MP27	9320-1605	1	CARD: SPEC	28480	9320-1605
MP28	0340-0738	1	INSULATOR: OUTPUT	28480	0340-0738
MP29	03403-04104	1	FILLER PLATE:REAR PANEL	28480	03403-04104
MP31	5040-5847	1	ADAPTER:BNC TO GR	28480	5040-5847
MP32	5060-5984	1	PC EXTENDER:2 X 25	28480	5060-5984
MP33	03403-90002	1	MANUAL	28480	03403-90002
MP34	03403-20203	1	FRAME:LEFT SIDE	28480	03403-20203
MP35	03403-20204	1	FRAME:RIGHT SIDE	28480	03403-20204
MP36	0340-0424	1	INSULATOR:BINDING POST, BLACK	28480	0340-0424
MP37	0340-0425	1	INSULATOR:BINDING POST, RED	28480	0340-0425
MP38	0340-0739	2	INSULATOR: SERIES PASS TSTR	28480	0340-0739
MP39	5000-9520	1	INSULATOR: PC BOARD	28480	5000-9520
MP40	5020-6892	1	INSULATOR: PANEL METER CASE	28480	5020-6892
MP41	5060-5940	1	PC EXTENDER	28480	5060-5940
P2	1251-0084	1	PLUG:36-CONTACT MALE W/HOOD & CLAMP	28480	1251-0084
P3	1251-0293	1	CONNECTOR:24 CONTACT	28480	1251-0293
R1	2100-3269	1	R:VAR 75 OHM 20% 1/2 W LIN	28480	2100-3269
R2	2100-3083	1	R:VAR CERMET 500 OHM 10% LIN 1/2W	28480	2100-3083
S5	3101-1234	1	SWITCH:SLIDE DPDT	82389	11A-1242
T1	9100-3233	1	TRANSFORMER	28480	9100-3233
W1	8120-1521	1	CABLE ASSY:POWER CORD 7.5 FT.	70903	KH 7147
XF1	1400-0084	1	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014

See introduction to this section for ordering information

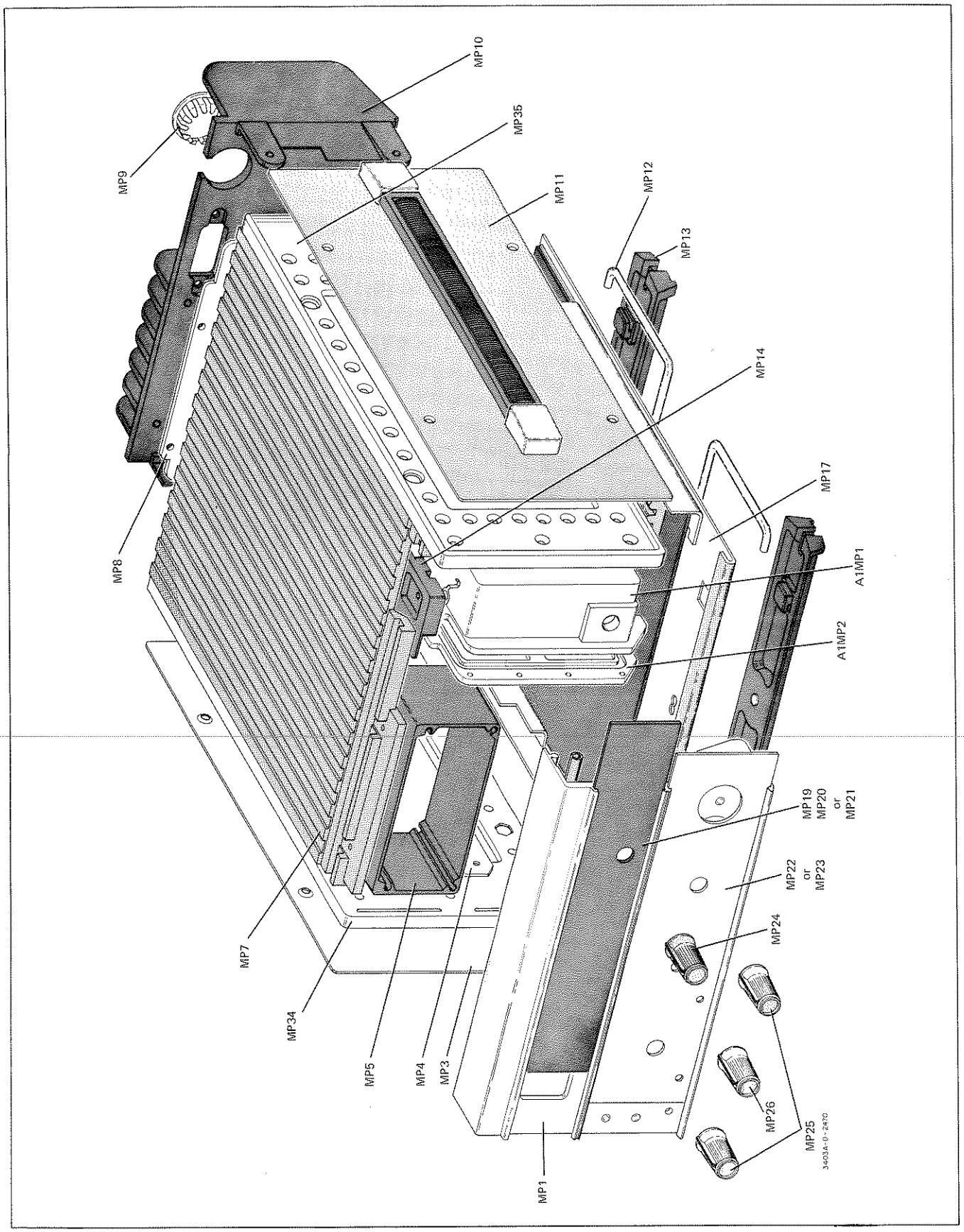


Figure 6-1. Location of Miscellaneous Parts.

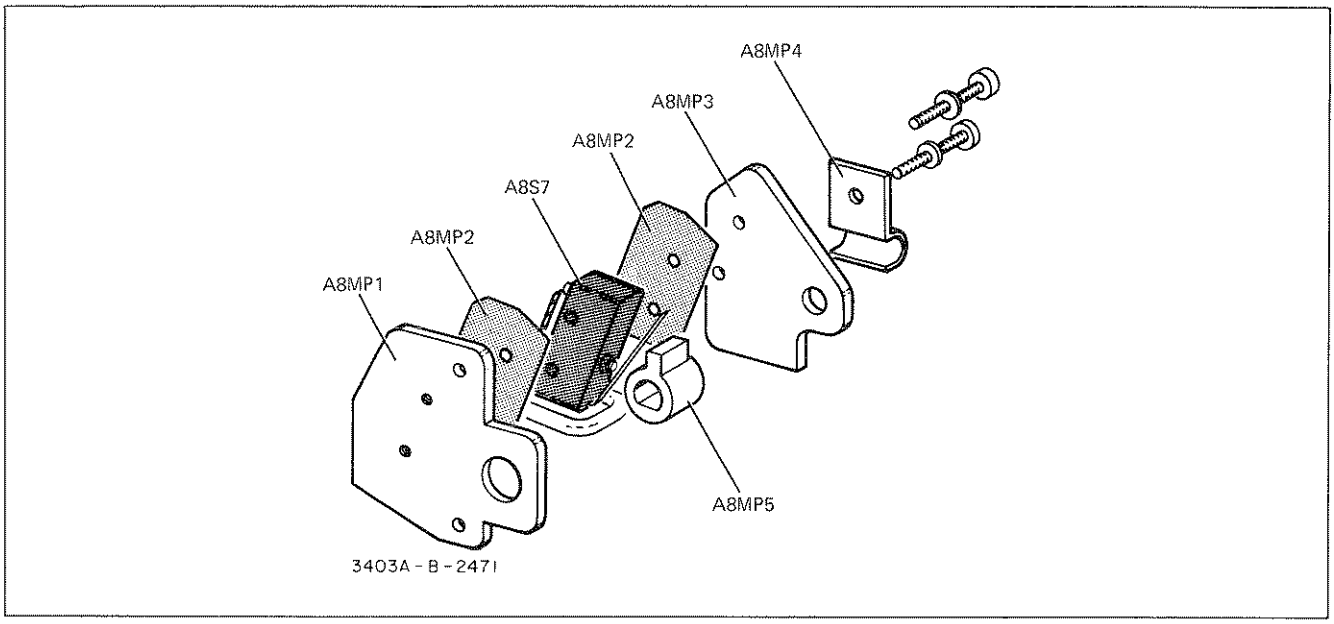


Figure 6-2. Line Switch Assembly A8.

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
†A1	03403-60002	1	AC CONVERTER ASSY	28480	03403-60002
†A1	03403-69502	1	REBUILT AC CONVERTER	28480	03403-69502
A1J1	1250-0047	1	CONNECTOR:RF BULKHEAD JACK	95712	12682-1
A1MP1	03403-22004	1	BOX:CONVERTER	28480	03403-22004
A1MP2	03403-22003	1	LID:CONVERTER BOX	28480	03403-22003
A1MP3	03403-00603	1	SHIELD:ATTENUATOR	28480	03403-00603
A1MP6	0905-0429	1	SEAL:"O" RING 0.364" ID	83259	2-012N219-7
A1MP7	0905-0435	1	SEAL:"O" RING 1.674" ID	83259	2-131-N219-7
A1MP8	0905-0431	1	SEAL:"O" RING 5.987" ID	83259	2-163N219-7
†A2	03403-66532	1	AMPLIFIER ASSY	28480	03403-66532
A2C2	0160-3841	1	C:FXD PORC 3.9+/-0.25 PF 1000WVAC	95275	VY13C3R9C
A2C3	0160-3842	1	C:FXD PORC 3.3+/-0.25 PF 1000WVAC	95275	VY10CA3R3CA
A2C4	0160-3662	1	C:FXD POLY 0.056 UF 10% 600VDCW	28480	0160-3662
A2C5	0160-3846	1	C:FXD MICA 39+/-0.5 PF 100VDCW	00853	RDM10E390DIS
A2C6	0160-3845	1	C:FXD MICA 22+/-0.5 PF 100VDCW	00853	RDM10E220DIS
A2C7	0121-0451	1	C:VAR TRIMMER 1.7-11.0 PF 250VDC	74970	187-0160-005
A2C8	0160-3844	1	C:FXD MICA 170 PF 1% 100VDCW	00853	RDM15E171FIS
A2C9*	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A2C10	0121-0114	2	C:VAR CER 7-25 PF	28480	0121-0114
A2C11	0160-3843	1	C:FXD MICA 560 PF 1% 100VDCW	00853	RDM15E561FIS
A2C12	0160-3840	1	C:FXD MICA 7800 PF 1% 100VDCW	00853	RDM19E782FIS
A2C13	0160-3851	1	C:FXD POLY 0.085 UF 1.0% 50VDCW	28480	0160-3851
A2C16	0160-3762	1	C:FXD POLY 0.68 UF 5% 50VDCW	28480	0160-3762
A2C17	0180-1835	2	C:FXD TA 68 UF 20% 15VDCW	56289	150D686X0015R2-DYS
A2C18	0180-1835		C:FXD TA 68 UF 20% 15VDCW	56289	150D686X0015R2-DYS
A2C20	0160-3829	1	C:FXD POLY 0.47 UF 10% 50VDCW	28480	0160-3829
A2C21	0160-3787	1	C:FXD POLY 1.0 UF 10% 50VDCW	28480	0160-3787
A2C22	0160-0300	1	C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A2C23	0140-0198	1	C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A2C24	0150-0084	1	C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A2C25	0150-0050	3	C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CDH
A2C26	0150-0046	1	C:FXD TI DIOX 0.68 PF 5% 500VDCW	78488	TYPE GA
A2C14	0121-0168	1	C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A2CR2	1902-3002	1	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A2CR6	1902-3226	1	DIODE BREAKDOWN:18.2V 2%	28480	1902-3226
A2CR7	1901-0053	9	DIODE:SILICON 30VDCW	07263	FD3444
†A2IC1	0960-0308	1	IC:HYBRID AMPLIFIER	28480	0960-0308
A2IC2	1820-0203	2	IC:OPERATIONAL AMPLIFIER	07263	SL8940
A2IC3	1820-0203		IC:OPERATIONAL AMPLIFIER	07263	SL8940
A2IC4	1826-0052	1	IC:LINEAR HYBRID AMP	28480	1826-0052
A2K3	0490-0978	2	RELAY:REED	28480	0490-0978
A2K4	0490-0978		RELAY:REED	28480	0490-0978
A2K5	0490-0968	2	RELAY:REED	28480	0490-0968
A2K7	0490-0968		RELAY:REED	28480	0490-0968
A2MP1	0340-0060	2	FEEDTHRU:INSULATED MOUNTING	28480	0340-0060
A2MP2	0340-0128	1	TERMINAL:STANDOFF 0.187" DIA	98291	ST-1500 SL
A2MP3	1200-0423	1	SOCKET:IC BLK 16 CONTACT	23880	CSA2900-16B
A2MP4	1200-0424	2	SOCKET:IC BLK 14 CONTACT	23880	CSA2900-14B
A2MP5	1200-0432	14	SOCKET-CONTACT-DIP	27264	1938-4
A2Q4	1854-0071	7	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2Q5	1853-0020	13	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0757-0280	2	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R3	0698-7950	1	RESISTOR SET	28480	0698-7950
A2R5	2100-1984	1	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984
A2R6	0698-8152	1	R:FXD FLM 4.32 OHM 5% 1/8W	28480	0698-8152
A2R7	2100-1985	1	R:VAR CERMET 20 OHM 20% LIN 1/2W	28480	2100-1985
A2R8	0698-8153	1	R:FXD FLM 1.21 OHM 5.0% 1/4W	28480	0698-8153
A2R9	2100-1986	1	R:VAR CERMET 1000 OHM 10% LIN 1/2W	28480	2100-1986
A2R11	2100-2497	2	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A2R12	0684-1001	7	R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A2R13	1810-0060	1	R:NETWORK 4(2)=1K(1)=5K(1)=620 OHM	28480	1810-0060
A2R14	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A2R15	0684-1031	30	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A2R18	2100-1738	5	R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A2R19	1810-0053	1	R:PACK 5=36/30/47/130/200K OHM 5%	28480	1810-0053
A2R20	0698-3572	1	R:FXD FLM 60.4K OHM 1% 1/8W	28480	0698-3572
A2R21	0757-0466	1	R:FXD MET FLM 110K OHM 1% 1/8W	28480	0757-0466
A2R22	0811-2960	2	R:FXD WW 650K OHM 1.0% 1/5W	28480	0811-2960
A2R23	0811-2960		R:FXD WW 650K OHM 1.0% 1/5W	28480	0811-2960
A2R24	0698-7653	1	R:FXD FLM 25.5K OHM 1.0% 1/8W	28480	0698-7653
A2R25	0757-0446	1	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
A2R26	0698-4202	1	R:FXD FLM 8.87K OHM 1% 1/8W	28480	0698-4202
A2R27	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A2R28	1810-0059	1	R:NETWORK 4=2K/500/1K/4K OHM	28480	1810-0059
A2R29	0757-0346	3	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A2R30	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A2R31	0757-0442	6	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R32	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A2R33	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A2R34	0698-3433	1	R:FXD MET FLM 28.7 OHM 1% 1/8W	28480	0698-3433
A2R35	0698-3228	2	R:FXD MET FLM 49.9K OHM 1% 1/8W	28480	0698-3228
A2R36	0698-3279	4	R:FXD MET FLM 4990 OHM 1% 1/8W	28480	0698-3279
A2R37	0698-3279		R:FXD MET FLM 4990 OHM 1% 1/8W	28480	0698-3279
A2R38	0698-3228		R:FXD MET FLM 49.9K OHM 1% 1/8W	28480	0698-3228
A2R39	0757-0451	1	R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A2R40	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A2R42	0698-3548	1	R:FXD FLM 732 OHM 1% 1/8W	28480	0698-3548
A2R71	2100-2061	1	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2061
†A2TC1	0853-0014	1	THERMOCOUPLE	28480	0853-0014
A3	03403-66542	1	FILTER ASSY	28480	03403-66542
A3C2	0180-1794	1	C:FXD ELECT 22 UF 10% 35VDCW	56289	150D226X9035R2-DYS
A3C4	0160-3402	2	C:FXD POLY 1.0 UF 5% 50VDCW	84411	HEW 138
A3C5	0150-0093	1	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C7	0160-3402		C:FXD POLY 1.0 UF 5% 50VDCW	84411	HEW 138
A3CR2	1901-0045	1	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3CR5	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR6	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR7	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR8	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR9	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR10	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A3CR11	1901-0040	27	DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR16	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR17	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR18	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR19	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR20	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR21	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR22	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR23	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR24	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR25	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR26	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3IC1	1826-0018	1	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0018
A3J10	1251-1626	1	CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A3Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q6	1855-0368	8	TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q7	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q8	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q9	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q10	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q11	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A3Q12	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q13	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q14	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q15	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q16	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q17	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3R5	1810-0079	1	R:NETWORK	28480	1810-0079
A3R8	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A3R9	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R10	2100-3056	6	R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R11	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R12	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R13	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R14	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R15	2100-3056		R:VAR CERMET 5K OHM 10% TYPE P 3/4W	28480	2100-3056
A3R16	1810-0062	1	R:NETWORK 4=355/342/159/671 OHM 1.0%	28480	1810-0062
A3R17	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R18	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
A3R19	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R20	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R21	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R22	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R26	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R27	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R28	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R29	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R30	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R31	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R35	0684-2231	7	R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R36	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R37	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R38	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R39	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R40	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A3R42	0684-4731	5	R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A3R43	0757-0384	1	R:FXD FLM 20 OHM 1% 1/8W	28480	0757-0384
A3R44	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R45	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3R46	0757-0401	1	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R47	0757-0407	1	R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A3R48	0698-4453	1	R:FXD FLM 402 OHM 1% 1/8W	28480	0698-4453
A3R49	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3W1	8120-1718	2	CABLE ASSY	28480	8120-1718
A3W2	8120-1718		CABLE ASSY	28480	8120-1718
A4	03403-66512	1	MASTER BOARD ASSY	28480	03403-66512
A4C1	0180-0309	1	C:FXD ELECT 4.7 UF 20% 10VDCW	56289	150D475X0010A2-DYS
A4CR1	1910-0016	9	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A4CR2	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A4CR3	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A4CR4	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A4CR5	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A4CR6	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A4IC2	1820-0094	3	IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A4IC4	1820-0086	1	IC:DTL DUAL 4-INPUT GATE (EXPANDABLE)	04713	SC6900PK
A4IC7	1820-0310	2	IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A4IC10	1820-0174	1	IC:TTL HEX INVERTER	01295	SN7404N
A4J4	1251-2825	1	CONNECTOR:50 PIN	28480	1251-2825
A4J6	1251-2034	3	CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A4J7	1251-2026	1	CONNECTOR:PC 36 CONTACT	71785	252-18-30-300
A4J8	1251-2034		CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A4MP1	3130-0392	2	SHAFT AND INDEX ASSY:30 DEGREE INDEX	28480	3130-0392
A4MP4	1200-0474	1	SOCKET:IC 14-PIN	28480	1200-0474
A4R1	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A4R2	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A4R4	1810-0041	1	R:NETWORK,8 RES. 2.7K OHM 5%	28480	1810-0041
A4R6	0687-1021	1	R:FXD COMP 1000 OHM 10% 1/2W	01121	EB 1021
A4R7	0684-4721	4	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4S2	3130-0394	1	SWITCH:WAFER	28480	3130-0394
A4S3	3130-0393	1	SWITCH:WAFER	28480	3130-0393
A4S4	3101-1341	1	SWITCH:SLIDE SPDT 0.5A 125V AC/DC	79727	C-111-0004
A4Z1					
A4Z2					
A5	03403-66550	1	ASSY:RECTIFIER	28480	03403-66550
A5CR1	1906-0023	1	DIODE ASSY:SI FULL WAVE BRIDGE	28480	1906-0023
A5CR2	1901-0363	3	DIODE ASSY:SI 100 PIV PER CELL	28480	1901-0363
A5CR3	1901-0363		DIODE ASSY:SI 100 PIV PER CELL	28480	1901-0363
A5CR4	1901-0363		DIODE ASSY:SI 100 PIV PER CELL	28480	1901-0363
A5MP1	0905-0493	1	INSULATOR:RED	28480	0905-0493
A5T1	9100-3233	1	TRANSFORMER:POWER	28480	9100-3233
A6	03403-66560	1	ASSY:REGULATOR	28480	03403-66560
A6C1	0180-1985	2	C:FXD ELECT 500 UF +75-10% 30VDCW	56289	39D507G030FL4-DSB
A6C2	0180-0049	4	C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C3	0160-0990	2	C:FXD MICA 100 PF 2% 300VDCW	00853	RDM15F101G3S
A6C5	0180-1985		C:FXD ELECT 500 UF +75-10% 30VDCW	56289	39D507G030FL4-DSB
A6C6	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C7	0160-0990		C:FXD MICA 100 PF 2% 300VDCW	00853	RDM15F101G3S
A6C9	0180-0094	1	C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A6C10	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C11	0160-0362	2	C:FXD MICA 510PF 5%	28480	0160-0362
A6C12	0180-0228	3	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A6C13	0180-2187	1	C:FXD ELECT 2500 UF +75-10% 15VDCW	56289	39D258G015GP4-DSB
A6C14	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A6C15	0160-0362		C:FXD MICA 510PF 5%	28480	0160-0362
A6C16	0180-0309		C:FXD ELECT 4.7 UF 20% 10VDCW	56289	150D475X0010A2-DYS

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
A6C17	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A6CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR5	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A6CR6	1884-0068	1	THRISTOR	28480	1884-0068
A6CR7	1902-3074	1	DIODE BREAKDOWN:4.32V 2%	28480	1902-3074
A6CR8	1901-0522	1	DIODE:SI 100V PIV	28480	1901-0522
A6IC1	1820-0196	4	IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6IC2	1820-0196		IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6IC3	1820-0196		IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6IC4	1820-0196		IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A6J12	1251-0472	1	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A6MP1	1205-0011	1	HEAT DISSIPATOR:FOR TO-5 AND TO-9 CASES	98978	TX8F-032-025B
A6Q1	1854-0402	2	TSTR:SI NPN	28480	1854-0402
A6Q2	1854-0402		TSTR:SI NPN	28480	1854-0402
A6Q3	1854-0039	1	TSTR:SI NPN	80131	2N3053
A6Q4	1854-0420	1	TSTR:SI NPN	28480	1854-0420
A6Q5	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6R1	0813-0029	2	R:FXD WW 1 OHM 3% 3W	28480	0813-0029
A6R2	0757-0431	3	R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A6R3	0698-3496	2	R:FXD FLM 3.57K OHM 1% 1/8W	28480	0698-3496
A6R4	2100-2945	4	R:VAR 1K OHM	28480	2100-2945
A6R5	0698-3382	2	R:FXD MET FLM 5.49K OHM 1% 1/8W	28480	0698-3382
A6R6	0813-0029		R:FXD WW 1 OHM 3% 3W	28480	0813-0029
A6R7	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A6R8	0698-3496		R:FXD FLM 3.57K OHM 1% 1/8W	28480	0698-3496
A6R9	2100-2945		R:VAR 1K OHM	28480	2100-2945
A6R10	0698-3382		R:FXD MET FLM 5.49K OHM 1% 1/8W	28480	0698-3382
A6R11	0683-0335	1	R:FXD COMP 3.3 OHM 5% 1/4W	01121	CB 0335
A6R12	0757-0283	3	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A6R13	0698-4434	1	R:FXD FLM 2.32K OHM 1% 1/8W	28480	0698-4434
A6R14	2100-2945		R:VAR 1K OHM	28480	2100-2945
A6R15	0698-3484	1	R:FXD FLM 6650 OHM 1% 1/8W	28480	0698-3484
A6R16	0698-5101	1	R:FXD COMP 33 OHM 10% 1/4W	01121	CB 3301
A6R17	0684-3311	1	R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A6R18	0684-1021	2	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A6R19	0812-0017	1	R:FXD WW 0.25 OHM 5% 3W	28480	0812-0017
A6R20	0698-4432	1	R:FXD FLM 2.1K OHM 1% 1/8W	28480	0698-4432
A6R21	0698-4435	1	R:FXD FLM 2.49K OHM 1% 1/8W	28480	0698-4435
A6R22	2100-2945		R:VAR 1K OHM	28480	2100-2945
A6R23	0698-3226	1	R:FXD MET FLM 6.49K OHM 1% 1/8W	28480	0698-3226
A6R24	0684-1011	1	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6R25	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6R26	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6R27	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6R28	0812-0039	1	R:FXD WW 2.2 OHM 3% 3W	28480	0812-0039
A7	03403-66520	1	ASSY:CONNECTOR, STANDARD	28480	03403-66520
A7C1	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A7C2	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A7CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR6	1901-0376	1	DIODE:SILICON 35V	28480	1901-0376
A7CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7IC1	1826-0043	5	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A7IC2	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A7IC3	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A7IC4	1820-0668	2	IC:TTL HEX DRIVER W/OPEN COLL(30V)	01295	SN7407N
A7IC5	1820-0668		IC:TTL HEX DRIVER W/OPEN COLL(30V)	01295	SN7407N
A7Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q3	1855-0378	1	TSTR:FET SI N-CHANNEL	28480	1855-0378
A7Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7R1	2100-2522	3	R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A7R2	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R3	0684-1831	2	R:FXD COMP 18K OHM 10% 1/4W	01121	CB 1831

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
A7R4	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R5	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R6	0684-1831		R:FXD COMP 18K OHM 10% 1/4W	01121	CB 1831
A7R7	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R8	0757-0435	1	R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A7R9	0698-4445	1	R:FXD FLM 5.76K OHM 1% 1/8W	28480	0698-4445
A7R10	0757-0282	1	R:FXD MET FLM 221 OHM 1% 1/8W	28480	0757-0282
A7R11	2100-2413	1	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2413
A7R12	0757-0428	1	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A7R13	2100-2520	1	R:VAR CERMET 50 OHM 20% TYPE V 1/2W	28480	2100-2520
A7R14	0698-4411	1	R:FXD FLM 140 OHM 1% 1/8W	28480	0698-4411
A7R15	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R16	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R17	0698-7394	2	R:FXD FLM 698 OHM 0.1% 1/8W	28480	0698-7394
A7R18	0698-7394		R:FXD FLM 698 OHM 0.1% 1/8W	28480	0698-7394
A7R19	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R20	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R21	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A7R22	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
†A12	03403-66591	1	ASSY:CONVERTER, LOG	28480	03403-66591
A12C1	0160-0161	2	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A12C2	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A12C3	0180-0374	2	C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A12C4	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A12CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A12CR2	1902-0777	1	DIODE:BREAKDOWN 6.2V 5%	04713	1N825
A12CR3	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A12CR4	1901-0053		DIODE:SILICON 30VDCW	07263	FD3444
A12IC1	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
†A12IC2	1826-0054	1	IC:LINEAR	28480	1826-0054
A12IC3	1826-0043		IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A12MP1	1200-0473	1	SOCKET:IC 16-PIN	28480	1200-0473
A12Q1	1853-0086	1	TSTR:SI PNP	80131	2N5087
A12Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A12Q3	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A12Q4	1855-0368		TSTR:FET SI NPN N-CHANNEL	28480	1855-0368
A12R1	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A12R2	0698-3279		R:FXD MET FLM 4990 OHM 1% 1/8W	28480	0698-3279
A12R3	2100-2010	1	R:VAR FLM 10 OHM 20% LIN 1/2W	28480	2100-2010
A12R4	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A12R5	0757-0274	1	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A12R6	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A12R7	0698-3279		R:FXD MET FLM 4990 OHM 1% 1/8W	28480	0698-3279
A12R8	2100-3103	2	R:VAR CERMET 10K OHM 10% TYPE P 3/4W	28480	2100-3103
A12R9	0757-0465	1	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A12R10	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A12R11	0698-4443	1	R:FXD FLM 4.53K OHM 1% 1/8W	28480	0698-4443
A12R12	0698-4433	1	R:FXD FLM 2260 OHM 1% 1/8W	28480	0698-4433
A12R13	2100-3054	1	R:VAR CERMET 50K OHM 10% 3/4W	28480	2100-3054
A12R14	0698-4468	1	R:FXD FLM 113K OHM 1% 1/8W	28480	0698-4468
A12R15	0757-0448	1	R:FXD MET FLM 18.2K OHM 1% 1/8W	28480	0757-0448
A12R16	0698-8180	2	R:FXD FLM 4.22K OHM 0.1% 1/8W	28480	0698-8180
A12R17	0698-8180		R:FXD FLM 4.22K OHM 0.1% 1/8W	28480	0698-8180
A12R18	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A12R19	2100-3154	2	R:VAR CERMET 1000 OHM 10% TYPE P 3/4W	28480	2100-3154
A12R20	0698-7934	2	R:FXD MET FLM 12.1K OHM 0.1% 1/8W	28480	0698-7934
A12R21	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A12R22	0698-7934		R:FXD MET FLM 12.1K OHM 0.1% 1/8W	28480	0698-7934
A12R23	0757-0388	1	R:FXD FLM 30.1 OHM 1% 1/8W	28480	0757-0388
A12R24	0698-4442	2	R:FXD MET FLM 4.42K OHM 1% 1/8W	28480	0698-4442
A12R25	0698-4442		R:FXD MET FLM 4.42K OHM 1% 1/8W	28480	0698-4442
A12R26	0684-4711	1	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A12R27	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A12R28	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A12R29	2100-3103		R:VAR CERMET 10K OHM 10% TYPE P 3/4W	28480	2100-3103
A12R30	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A12R31	0684-1041	1	R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A12R32	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A12R33	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
A12R38	2100-3154		R:VAR CERMET 1000 OHM 10% TYPE P 3/4W	28480	2100-3154
A15	03403-66581	1	ASSY:INPUT/OUTPUT	28480	03403-66581
A15C1	0180-0210	1	C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A15C2	0180-1746	1	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A15C3	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C0678102E102ZS26-CDH
A15C4	0180-0195	1	C:FXD ELECT 0.33 UF 20% 35VDCW	56289	150D334X0035A2-DYS
A15C5	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C0678102E102ZS26-CDH
A15C6	0150-0073	1	C:FXD CER 100 PF 10% 1000VDCW	56289	C0288102E101KS27-CDH
A15C7	0160-2605	3	C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A15C8	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A15C9	0160-2605		C:FXD CER 0.02 MFD +80-20% 25VDCW	72982	5835000-Y5U 203Z
A15CR1	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A15IC1	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A15IC2	1820-0273	2	IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A15IC3	1820-0307	2	IC:DTL HEX INVERTER	04713	MC836P
A15IC4	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A15IC5	1820-0665	4	IC:DTL 4-BIT LATCH	04713	MC1814P
A15IC6	1820-0665		IC:DTL 4-BIT LATCH	04713	MC1814P
A15IC7	1820-0310		IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A15IC8	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A15IC9	1820-0307		IC:DTL HEX INVERTER	04713	MC836P
A15IC10	1820-0665		IC:DTL 4-BIT LATCH	04713	MC1814P
A15IC11	1820-0665		IC:DTL 4-BIT LATCH	04713	MC1814P
A15J2	1251-0085	1	CONNECTOR:FEMALE 36-PIN MINAT	28480	1251-0085
A15J3	1251-0292	1	CONNECTOR:FEMALE 24 PIN	28480	1251-0292
A15J9	1251-2875	1	CONNECTOR:PC (2 X 22) 44 CONTACT	71785	251-22-30-380
A15Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A15Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A15R1	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A15R2	0684-5621	5	R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R3	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R4	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R5	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R6	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A15R7	0684-4701		R:FXD COMP 47 OHM 10% 1/4W	01121	CB 4701
A15R8	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A15R9	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R10	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R11	0684-2221	2	R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A15R12	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A15R13	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R14	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A15R15	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R16	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A15R17	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
†A21	03431-66516	1	ASSY:DISPLAY	28480	03431-66516
A21C1	0160-0155	1	C:FXD MY 0.0033 UF 10% 200VDCW	56289	192P33292-PTS
A21C2	0180-0106	1	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A21DS1	1990-0315	1	NUMERIC DISPLAY, SOLID STATE	28480	1990-0315
A21DS5	1990-0310	3	DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS6	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
A21DS7	1990-0310		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0310
†A21IC1	1820-0663	1	IC:DIGITAL SCANNER	28480	1820-0663
†A21IC2	1820-0571	1	IC:TTL NUMERIC DISPLAY CHARACTER GEN.	28480	1820-0571
A21MP1	5040-5914	1	HOUSING:ANN	28480	5040-5914
A21MP2	03403-24302	1	MASK:ANNUNCIATOR	28480	03403-24302
A21MP3	1200-0462	61	SOCKET:IC CONTACT	00779	3-116141-2
A21Q1	1854-0094	6	TSTR:SI NPN	80131	2N3646
A21Q2	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q3	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q4	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q5	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q6	1854-0094		TSTR:SI NPN	80131	2N3646
A21Q7	1853-0016	6	TSTR:SI PNP	80131	2N3638

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
A21Q8	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q9	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q13	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q14	1853-0016		TSTR:SI PNP	80131	2N3638
A21Q15	1853-0016		TSTR:SI PNP	80131	2N3638
A21R1	1810-0066	1	R:NETWORK 4 (2)=650(2)=350 OHM 10%	28480	1810-0066
A21R2	1810-0067	1	R:NETWORK 6(2)=190(3)=210(1)=510 OHM	28480	1810-0067
A21R3	1810-0068	1	R:NETWORK 3 X 410 OHM 10%	28480	1810-0068
A21R4	1810-0069	1	R:NETWORK 9 X 48 OHM 10% 0.05W EACH	28480	1810-0069
†A22	03431-66507	1	ASSY:ANALOG, STANDARD	28480	03431-66507
A22C1	0160-3674	1	C:FXD POLY 0.47 UF 5% 100VDCW	28480	0160-3674
A22CR1	1902-0686	2	DIODE BREAKDOWN:6.2V 2%	04713	1N825
A22CR2	1902-0686		DIODE BREAKDOWN:6.2V 2%	04713	1N825
†A22IC1	0960-0160	1	A-D HYBRID SUB	28480	0960-0160
A22R1	2100-2522		R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A22R2	2100-2522		R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A22R3	2100-2497		R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A22R4	0757-0488	1	R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A22R5	2100-1738		R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
†A24	03431-60001	1	ASSY:LOGIC, STANDARD	28480	03431-60001
A24C1*	0160-0145	1	C: FXD MICA 82 PF 2% 100 VDCW	84171	RDM15E820G1S
A24C2	0160-2205	2	C:FXD MICA 120 PF 5%	28480	0160-2205
A24CR1	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
†A24IC1	1820-0671	2	IC:CONT-LOGIC	28480	1820-0671
†A24IC2	1820-0698	2	IC:TRI-DECADE	28480	1820-0698
A24R4	0698-4533	2	R:FXD FLM 294K OHM 1% 1/8W	28480	0698-4533
A24Z1					
A24Z2					
A24A1R1	0675-2221	18	R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R2	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R3	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R4	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R5	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R6	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R7	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R8	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A24A1R9	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
†A26	03431-60003	1	ASSY:LOGIC, DB	28480	03431-60003
A26C1*	0160-0145	1	C:FXD MICA 82 PF 2% 100VDCW	84171	RDM15E820G1S
A26C2	0160-2205		C:FXD MICA 120 PF 5%	28480	0160-2205
A26CR1	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
†A26IC1	1820-0671		IC:CONT-LOGIC	28480	1820-0671
†A26IC2	1820-0698		IC:TRI-DECADE	28480	1820-0698
†A26IC3	1820-0699	1	IC:ADDER CHIP	28480	1820-0699
A26R4	0698-4533		R:FXD FLM 294K OHM 1% 1/8W	28480	0698-4533
A26R5	0683-5125	5	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R6	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R7	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R8	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26R9	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A26A1R1	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R2	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R3	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R4	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R5	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R6	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R7	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R8	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
A26A1R9	0675-2221		R:FXD COMP 2.2K OHM 10% 1/8W	01121	BB 2221
			CHASSIS AND MISCELLANEOUS PARTS		
† A1	03403-60002		AC CONVERTER ASSY	28480	03403-60002
† A1	03403-69502		REBUILT AC CONVERTER	28480	03403-69502
† A2	03403-66532		AMPLIFIER ASSY	28480	03403-66532
A3	03403-66542		FILTER ASSY	28480	03403-66542

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			3403B		
A4	03403-66512		MASTER BOARD ASSY	28480	03403-66512
A5	03403-66550		ASSY:RECTIFIER	28480	03403-66550
A6	03403-66560		ASSY:REGULATOR	28480	03403-66560
A7	03403-66520		ASSY:CONNECTOR, STANDARD	28480	03403-66520
A12	03403-66591		ASSY:CONVERTER, LOG	28480	03403-66591
A15	03403-66581		ASSY:INPUT/OUTPUT	28480	03403-66581
†A21	03431-66516		ASSY:DISPLAY	28480	03431-66516
†A22	03431-66507		ASSY:ANALOG, STANDARD	28480	03431-66507
†A24	03431-60001		ASSY:LOGIC, STANDARD	28480	03431-60001
†A26	03431-60003		ASSY:LOGIC, DB	28480	03431-60003
F1	2110-0340	1	FUSE:0.4A AT 250V	71400	MDL 4/10
F2	2110-0235	1	FUSE:0.2A 250V SLOW-BLOW	71400	MDL 2/10
J13	1251-2357	1	SOCKET:3-PIN MALE POWER RECEPTACLE	82389	EAC-301
J14	1510-0059	2	BINDING POST ASSY:RED INSULATOR	28480	1510-0059
J15	1510-0058	1	BINDING POST ASSY:BLK INSULATOR	28480	1510-0058
J16	1510-0059		BINDING POST ASSY:RED INSULATOR	28480	1510-0059
MP1	03403-60202	1	PANEL ASSY:FRONT	28480	03403-60202
MP3	03403-04103	1	COVER:SIDE	28480	03403-04103
MP4	03403-01203	1	BRACKET:PC GUIDE	28480	03403-01203
MP5	5020-6871	1	CASE:EXTRUSION	28480	5020-6871
MP7	03403-22002	1	PANEL:TOP	28480	03403-22002
MP9	6960-0060	1	PLUG-BUTTON:STL	90763	51050
MP10	03403-22001	1	PANEL:REAR	28480	03403-22001
MP11	03403-60301	1	COVER ASSY:SIDE	28480	03403-60301
MP12	1490-0032	2	STAND:TILT HALF-MODULE	28480	1490-0032
MP13	03403-27901	2	FOOT ASSY	28480	03403-27901
MP14	5040-5848	1	HOLDER:AC CONVERTER	28480	5040-5848
MP15	03403-09102	1	SPRING:GROUND	28480	03403-09102
MP17	03403-60302	1	COVER ASSY:BOTTOM	28480	03403-60302
MP19	7120-2769	1	WINDOW(STANDARD)	28480	7120-2769
MP24	0370-1103	1	KNOB:RANGE	28480	0370-1103
MP25	0370-1099	1	KNOB:JADE GREY	28480	0370-1099
MP26	0370-1097	1	KNOB:POINTER 0.50", JADE GRAY	28480	0370-1097
MP27	9320-1611	1	CARD: SPEC	28480	9320-1611
MP28	0340-0738	1	INSULATOR: OUTPUT	28480	0340-0738
MP29	03403-04104	1	FILLER PLATE:REAR PANEL	28480	03403-04104
MP32	5060-5984	1	PC EXTENDER:2 X 25	28480	5060-5984
MP33	03403-90002	1	MANUAL	28480	03403-90002
MP34	03403-20203	1	FRAME:LEFT SIDE	28480	03403-20203
MP35	03403-20204	1	FRAME:RIGHT SIDE	28480	03403-20204
MP36	0340-0424	1	INSULATOR:BINDING POST, BLACK	28480	0340-0424
MP37	0340-0425	1	INSULATOR:BINDING POST, RED	28480	0340-0425
MP38	0340-0739	2	INSULATOR: SERIES PASS TSTR	28480	0340-0739
MP39	5000-9520	1	INSULATOR: PC BOARD	28480	5000-9520
MP40	5020-6892	1	INSULATOR: PANEL METER CASE	28480	5020-6892
MP41	5060-5940	1	PC EXTENDER	28480	5060-5940
P2	1251-0084	1	PLUG:36-CONTACT MALE W/HOOD & CLAMP	28480	1251-0084
R1	2100-3269	1	R:VAR 75 K OHM 20 % 1/2 † LIN	28480	2100-3269
R2	2100-3083	1	R:VAR CERMET 500 OHM 10% LIN 1/2W	28480	2100-3083
S5	3101-1234	1	SWITCH:SLIDE DPDT	82389	11A-1242
S6	3101-1258	1	SWITCH:TOGGLE SPDT(POWER)	28480	3101-1258
T1	9100-3233	1	TRANSFORMER	28480	9100-3233
W1	8120-1521	1	CABLE ASSY:POWER CORD 7.5 FT.	70903	KH 7147
XF1	1400-0084	1	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014

See introduction to this section for ordering information

SECTION VII
CIRCUIT DIAGRAMS

7-1. INTRODUCTION.

7-2. This section contains the diagrams necessary to maintain the Model 3403A/B. Both schematic diagrams and pictorial views of the circuit boards are included. Figure 7-1 shows the location of the various assemblies, and schematic diagrams are in order by assembly number. Figure 7-2 is a block diagram. The following assemblies, including options, are used in the 3403A/B:

A1 AC Converter Assembly (includes A2 and A3)
A2 Amplifier Assembly
A3 Filter Assembly
A4 Master Board Assembly
A5 Rectifier Assembly

A6 Regulator Assembly
A7 Standard Connector Assembly
A8 Line Switch Assembly
A11 Isolated Connector Assembly
A12 Log Converter Assembly

A13 Autorange Assembly
A14 Remote and Autorange Assembly
A15 Input/Output Assembly
A21 Display Assembly
A22 Analog Assembly

A23 Analog Assembly (Options 004, 005)
A24 Control Logic Assembly
A25 Control Logic Assembly (Options 004, 005)
A26 Control Logic Assembly (Option 006)

7-3. NOTES.

7-4. The following notes apply in general to all schematic diagrams:

a. Partial reference designators are shown within assembly outlines. Prefix with assembly number for complete designator.

b. Component values are shown as follows unless otherwise noted:

Capacitance in microfarads
Resistance in ohms
Inductance in microhenries

c. * Average value shown. Optimum value selected at factory.

d. —— — — —— Denotes assembly.

e. ———————— Denotes main signal path.

f. — — — — — — Denotes feedback path.

g.  Denotes screwdriver adjustment.

h. All relays shown de-energized.

i. Rotary switches shown in extreme counterclockwise position.

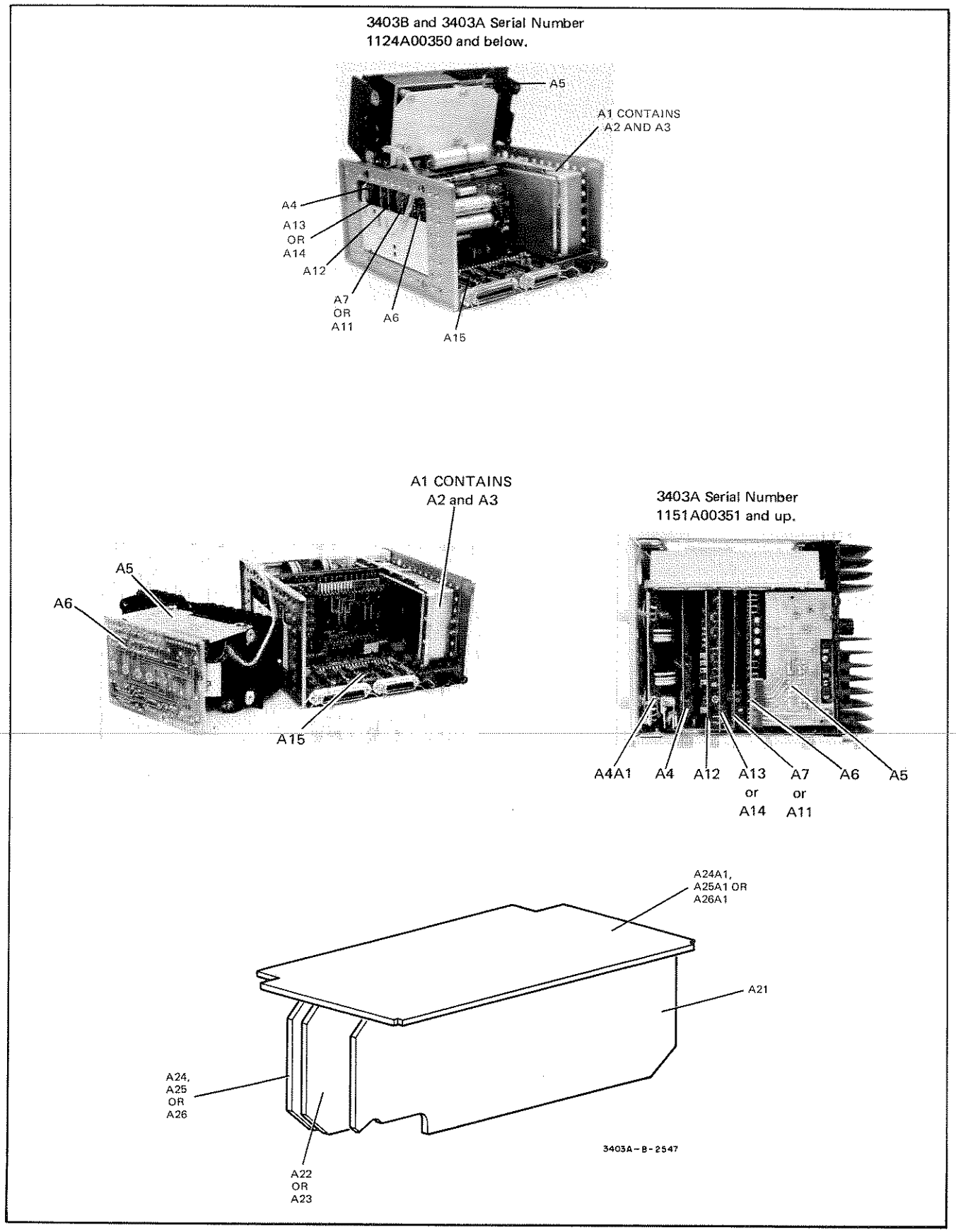
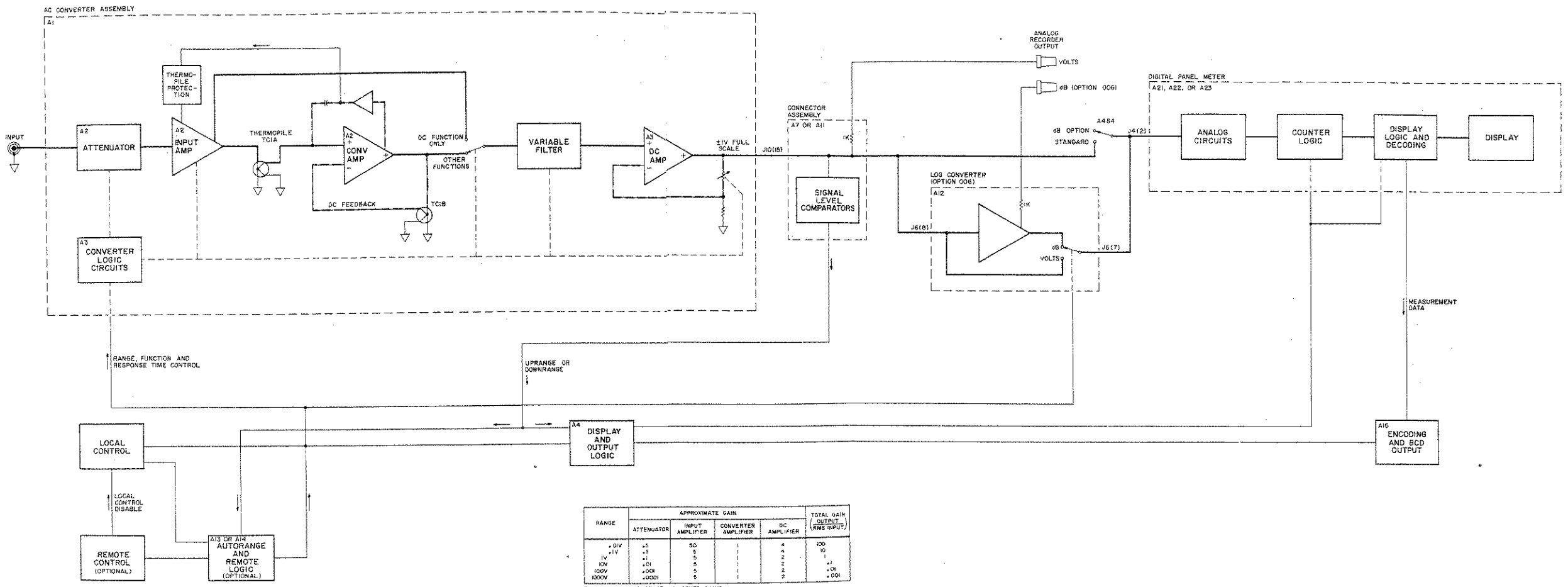


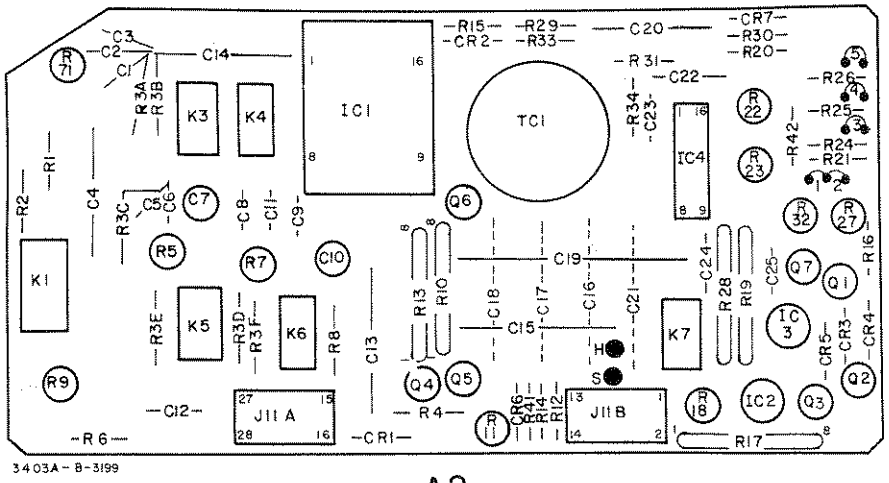
Figure 7-1. Assembly Locations.



RANGE	APPROXIMATE GAIN				TOTAL GAIN (OUTPUT / RMS INPUT)
	ATTENUATOR	INPUT AMPLIFIER	CONVERTER AMPLIFIER	DC AMPLIFIER	
.1DIV	x5	50	1	4	200
1V	x3	5	1	4	10
1V	x1	5	1	2	1
10V	x.01	5	1	2	x1
100V	x.001	5	1	2	x.01
1000V	x.0001	5	1	2	x.001

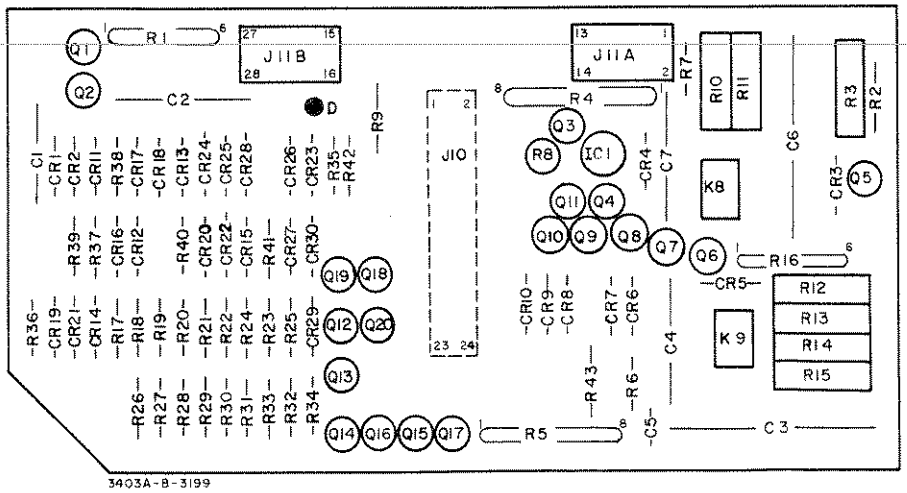
TOTAL GAIN = PRODUCT OF ALL OTHER GAINS

3403A/B
Figure 7-2. Block Diagram.



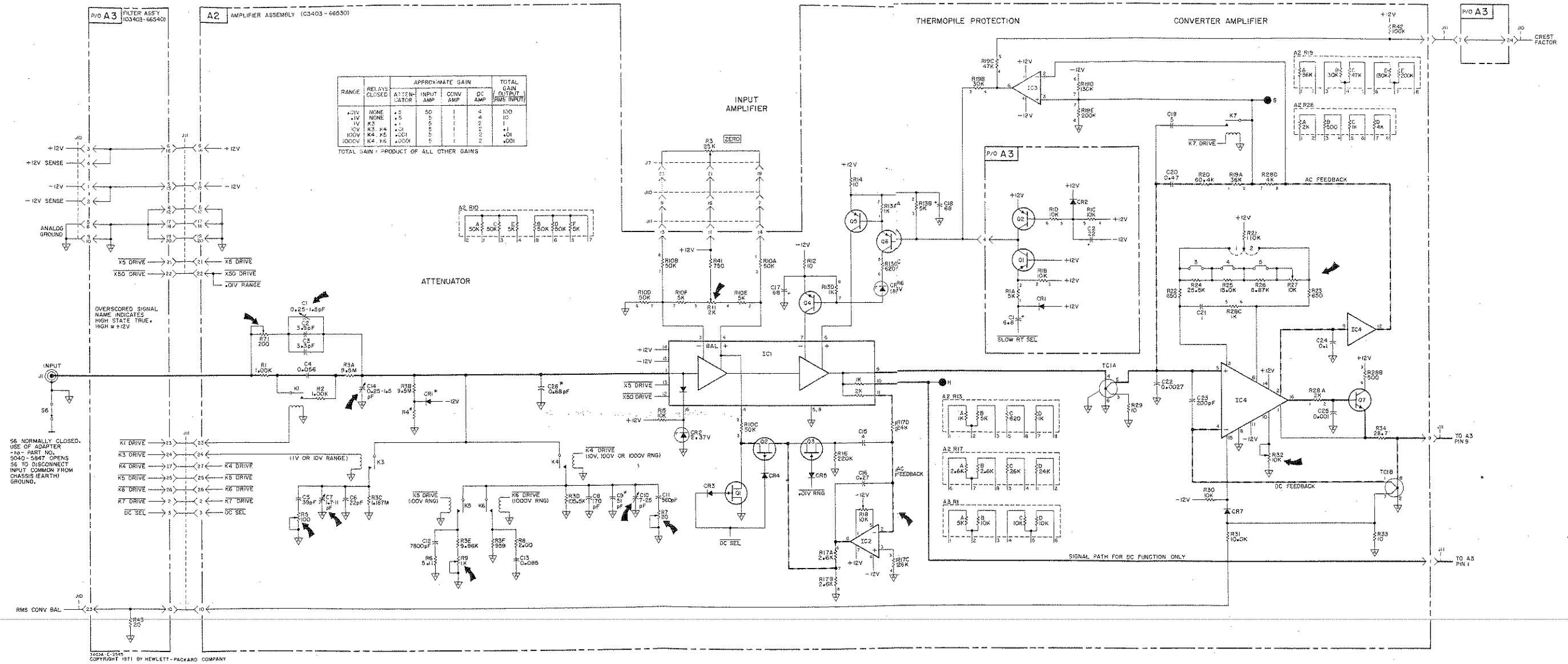
A2

hp Part No. 03403-66530



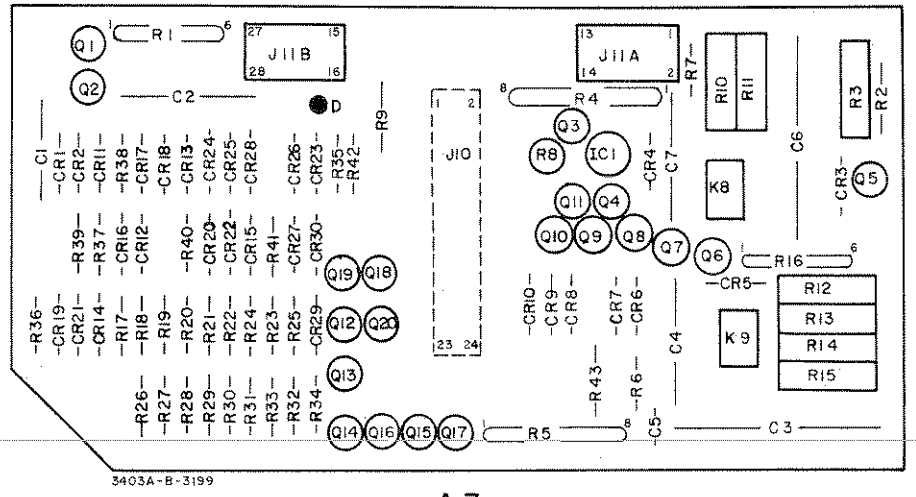
A3

hp Part No. 03403-66540



3403A only

Figure 7-3. Schematic Diagram, AC Converter Amplifier Circuits, A2.

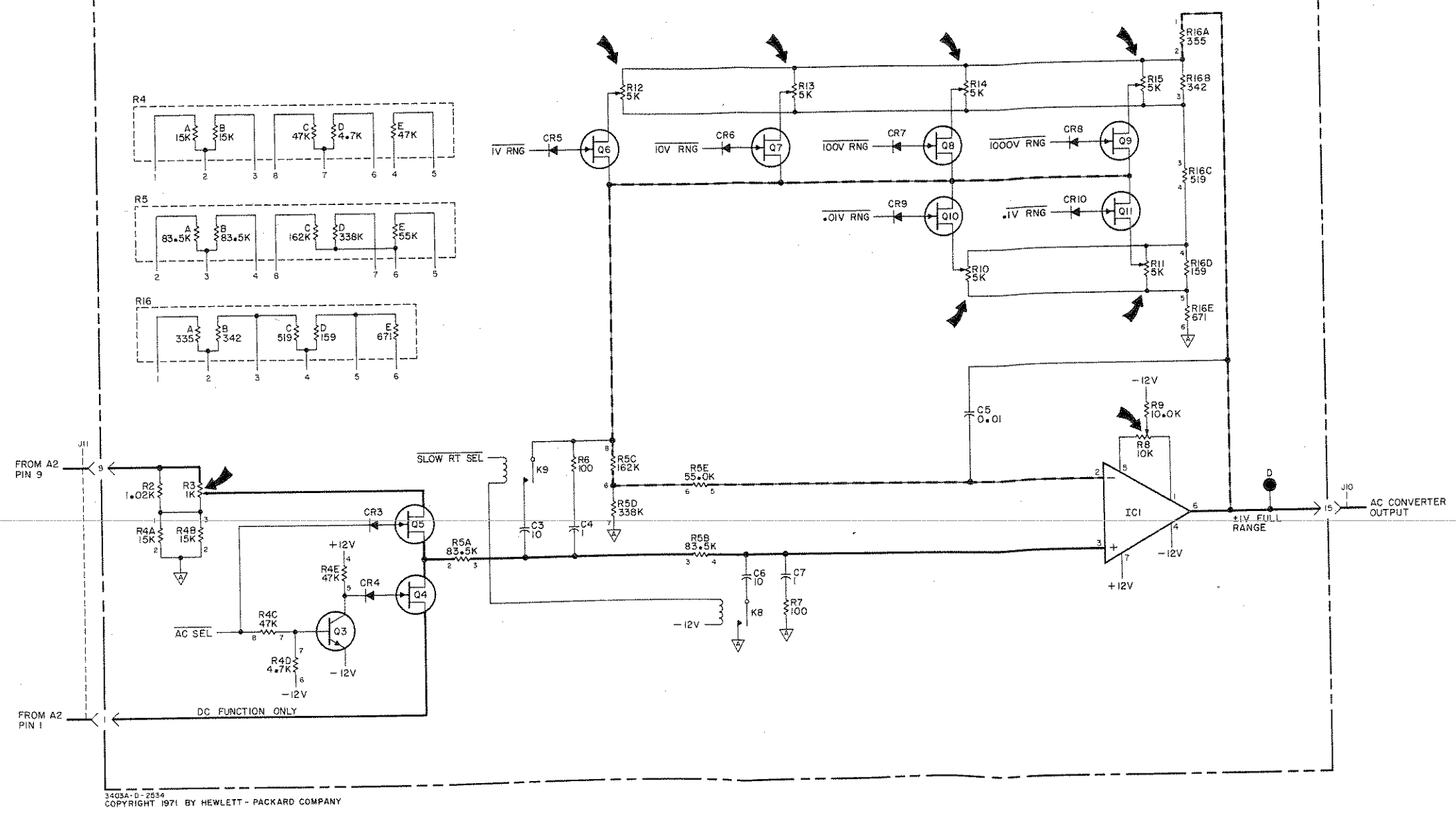


A3

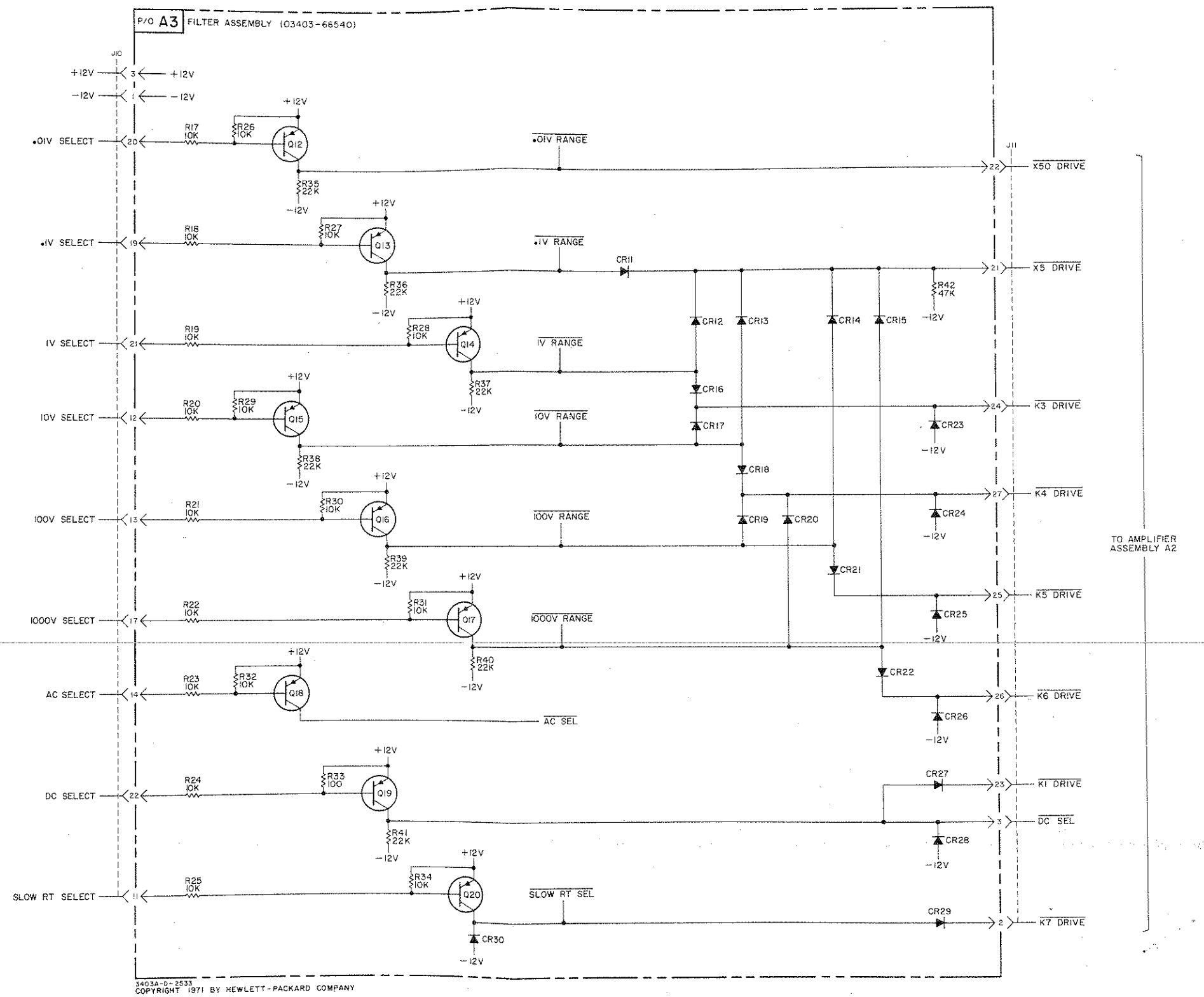
hp Part No. 03403-66540

P/O A3 FILTER ASSEMBLY (03403-66540)

DC AMPLIFIER

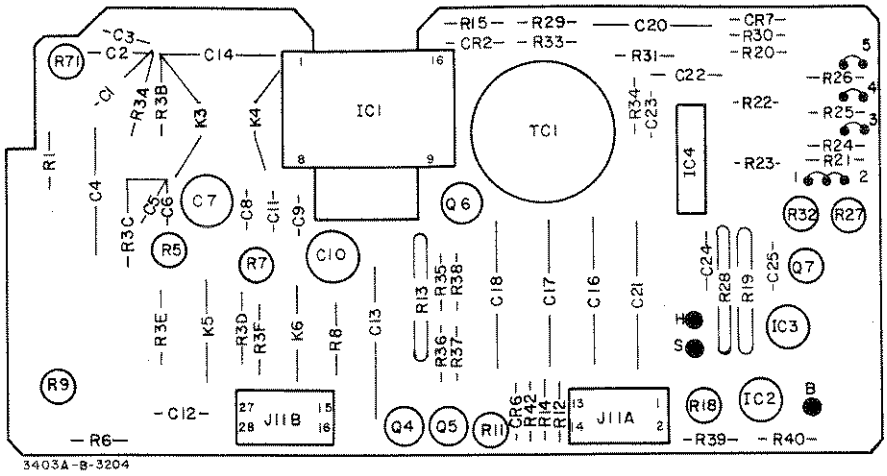


3403A-0-2534



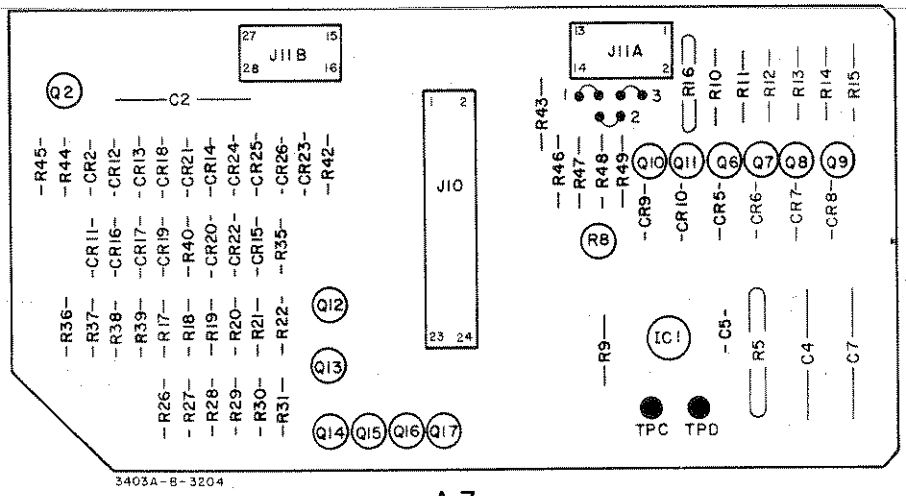
3403A only

Figure 7-4. Schematic Diagram, AC Converter DC Amp. and Logic Circuits, A3.



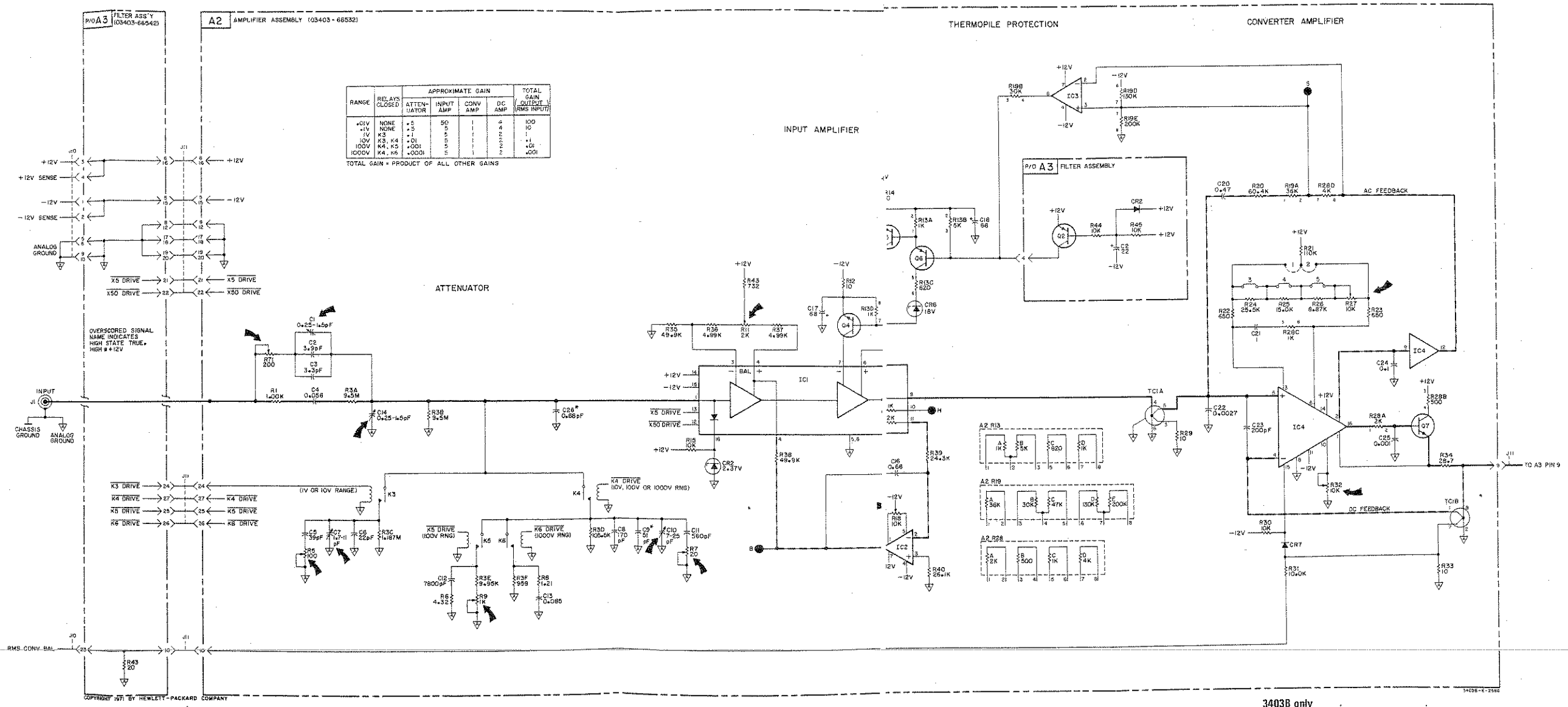
A2

hp Part No. 03403-66532



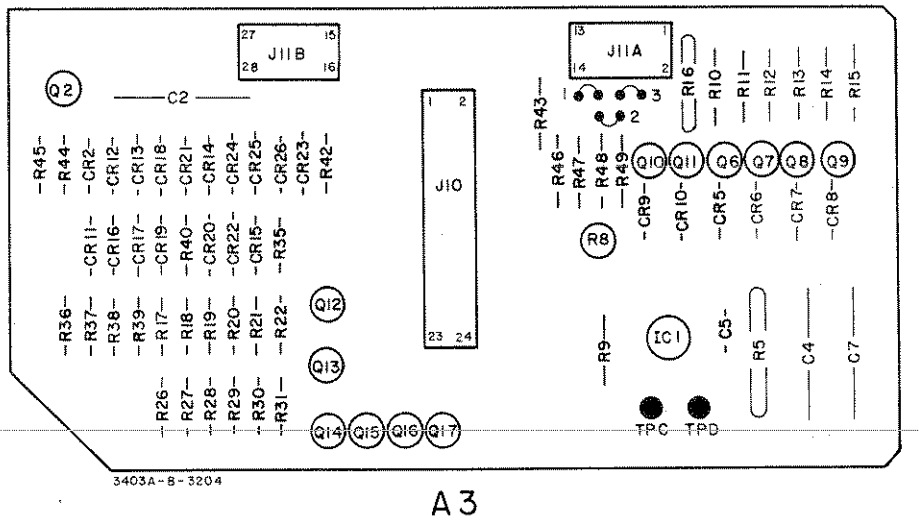
A3

hp Part No. 03403-66542



3403B only

Figure 7-5. Schematic Diagram, AC Converter Amplifier Circuits, A2.

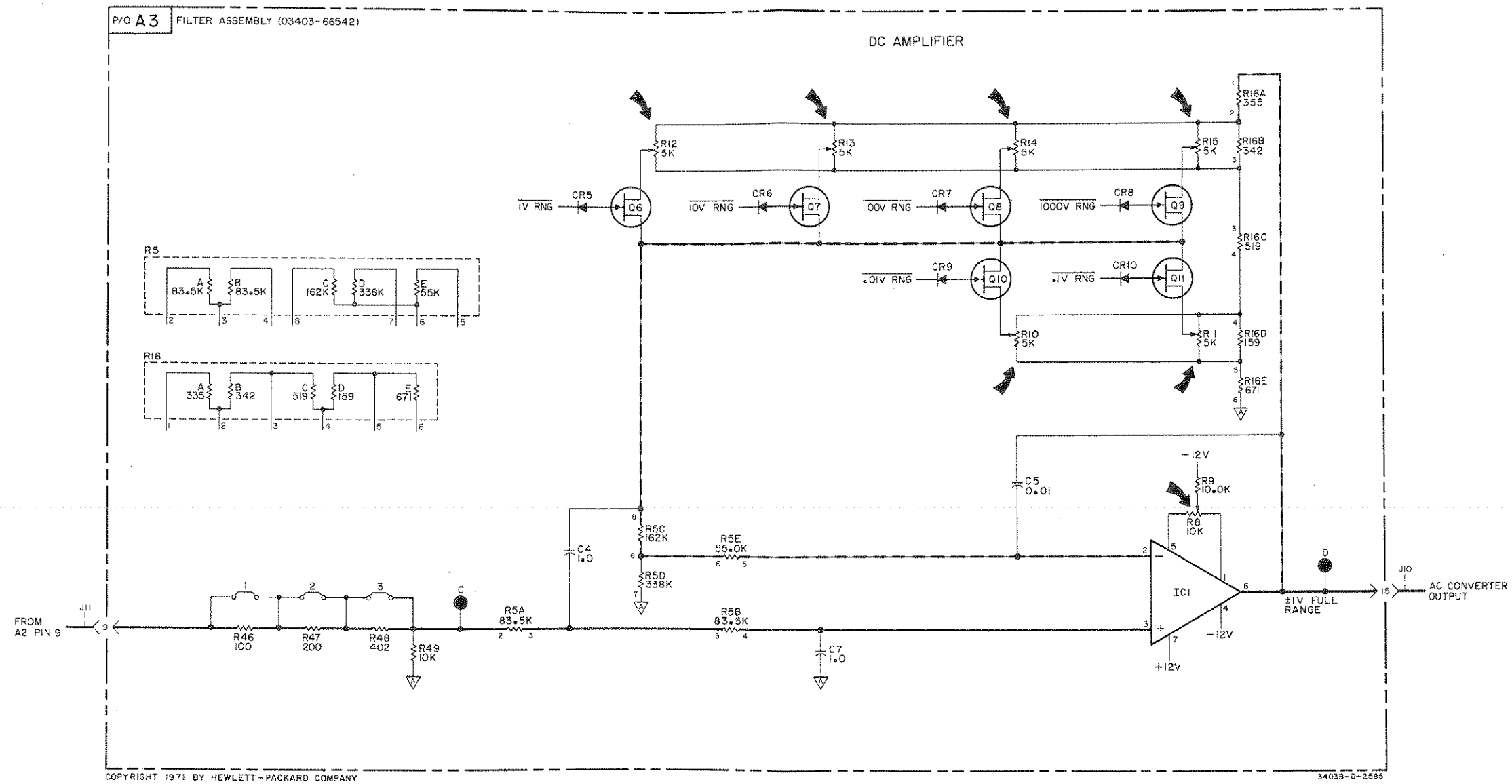


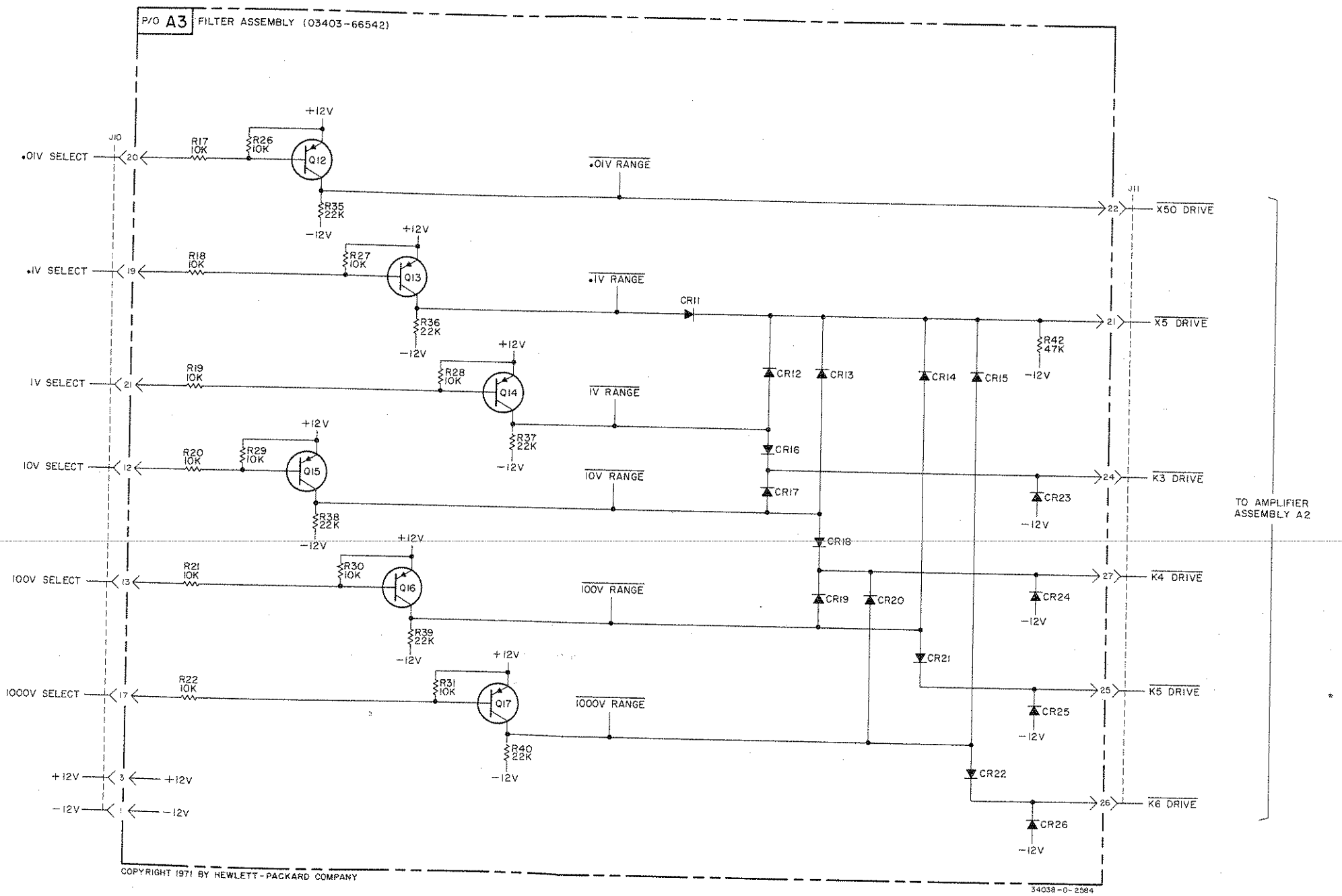
A3

hp Part No. 03403-66542

P/O A3 FILTER ASSEMBLY (03403-66542)

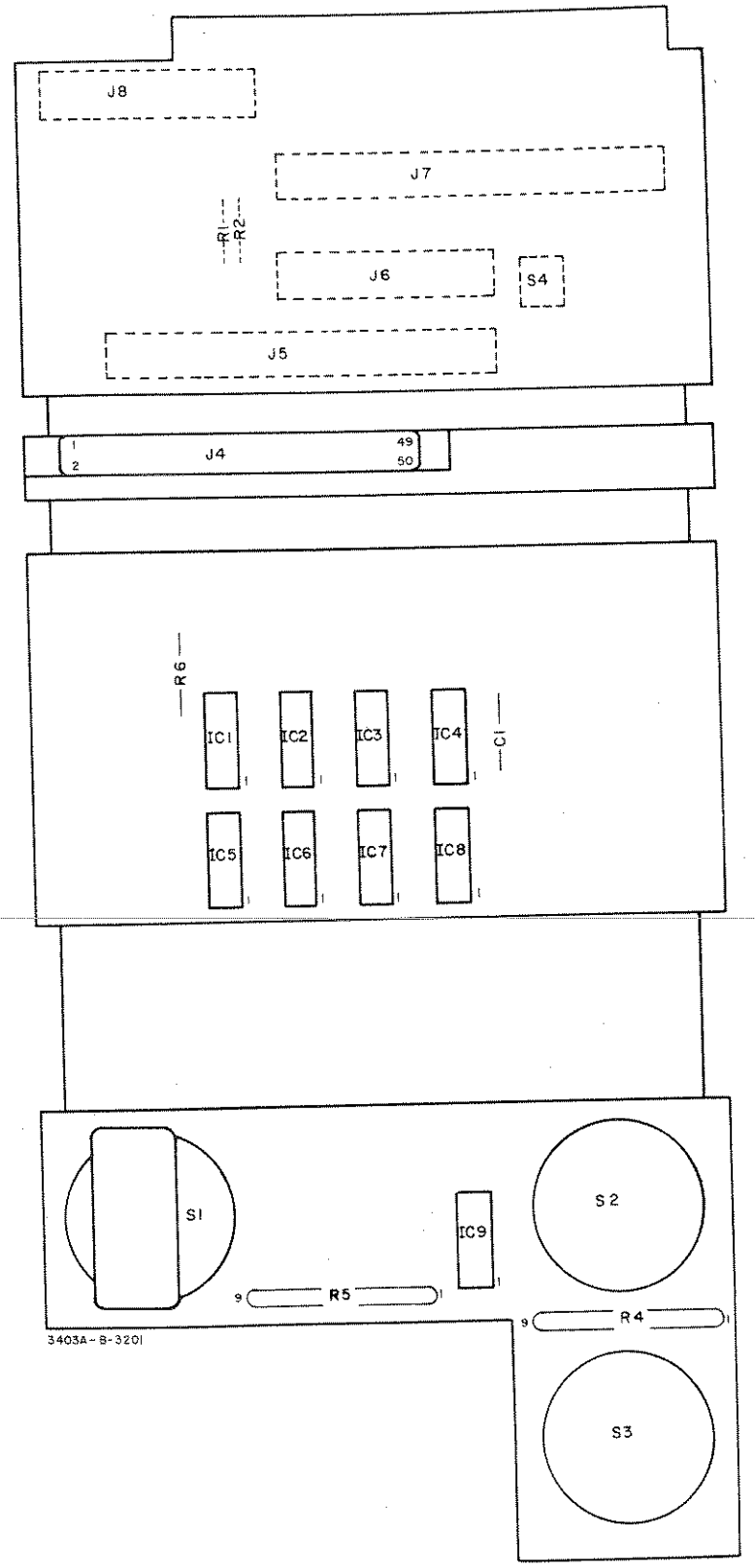
DC AMPLIFIER





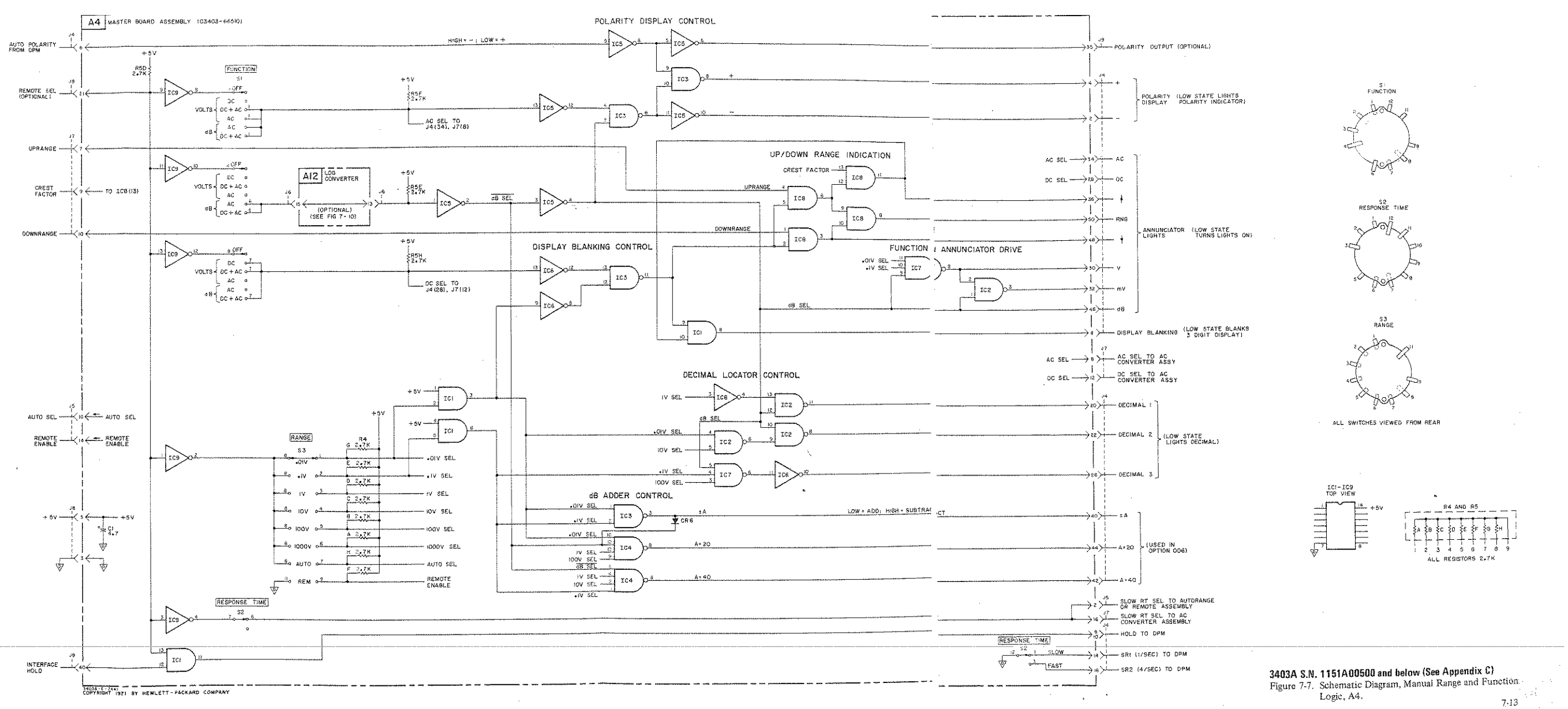
3403B only

Figure 7-6. Schematic Diagram, AC Converter DC Amp. and Logic Circuits, A3.



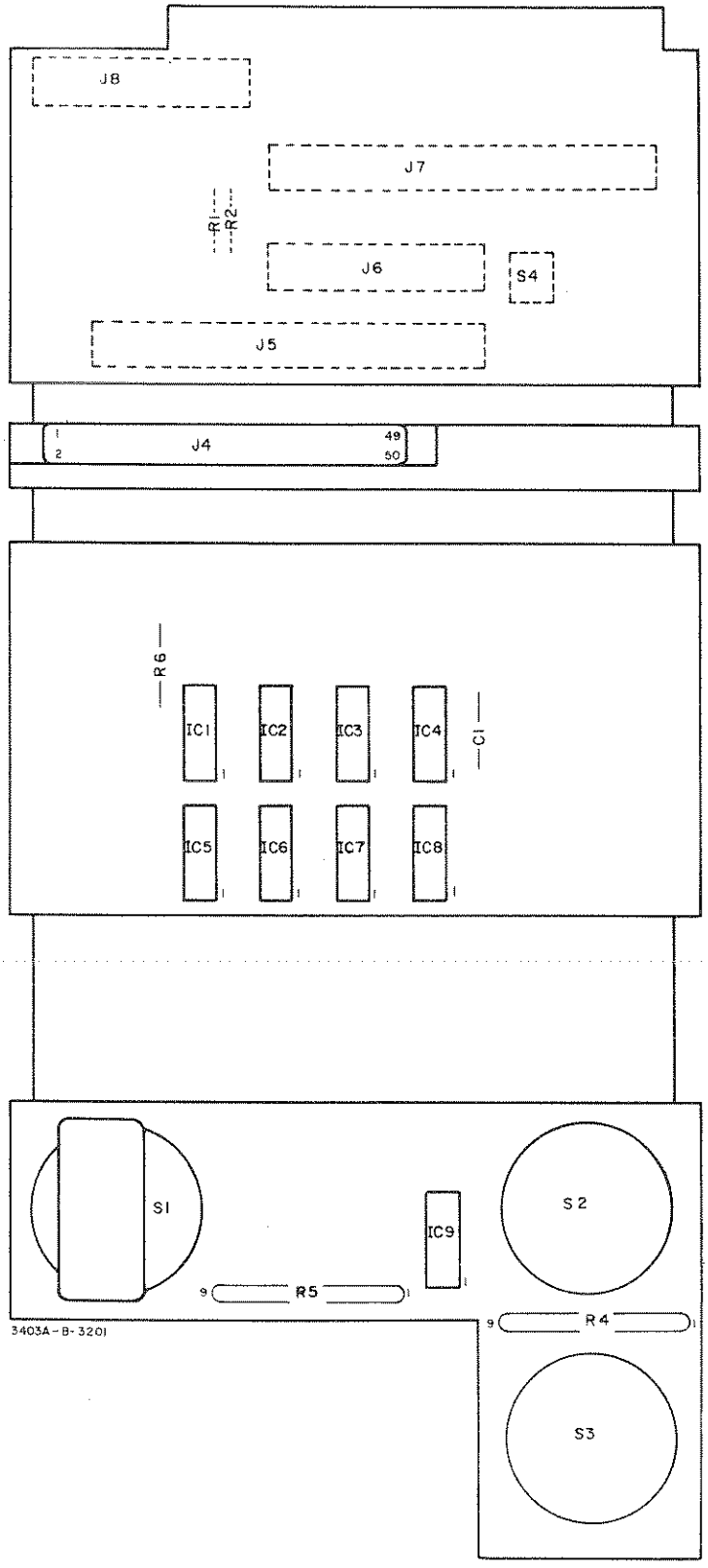
A4

hp Part No. 03403-66510



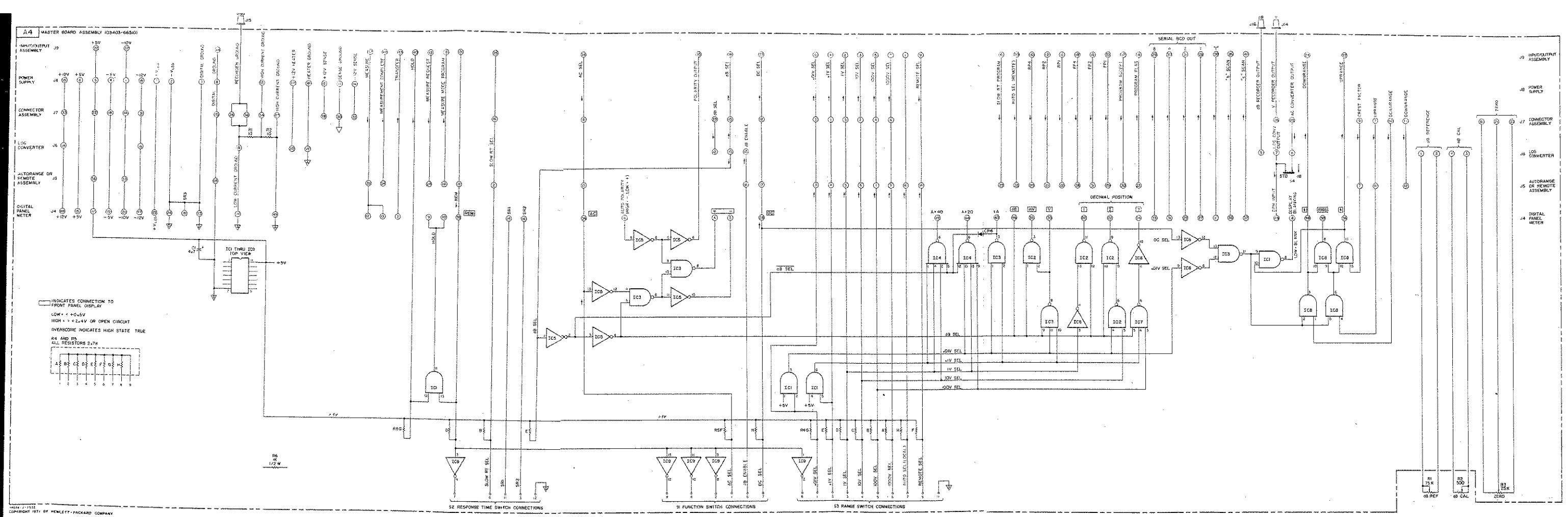
3403A S.N. 1151A00500 and below (See Appendix C)

Figure 7-7. Schematic Diagram, Manual Range and Function Logic, A4.

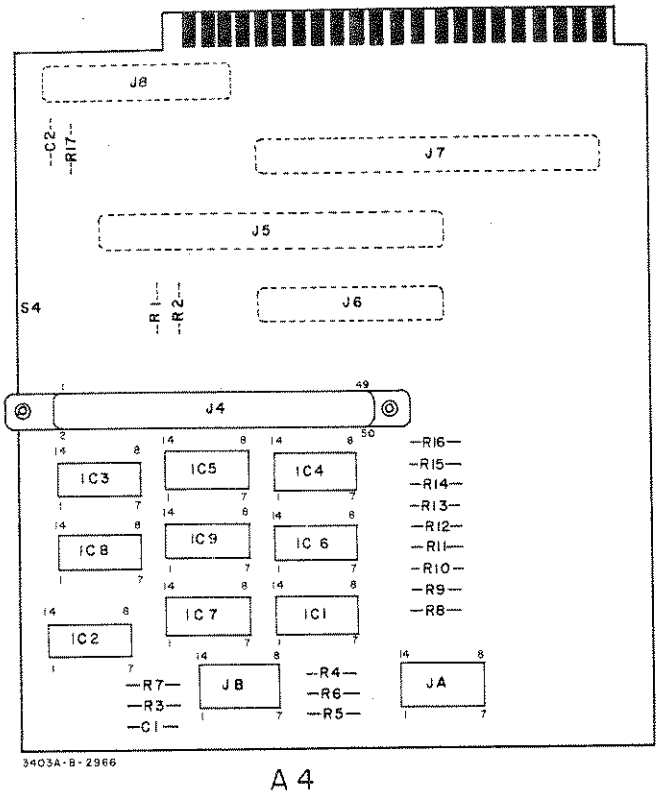


A4

hp Part No. 03403-66510

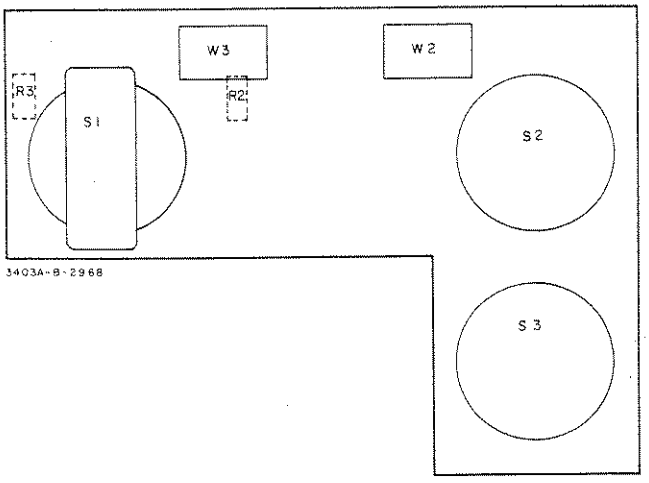


3403A S.N. 1151A00500 and below (See Appendix C)
Figure 7-8. Master Board Wiring Diagram, A4.



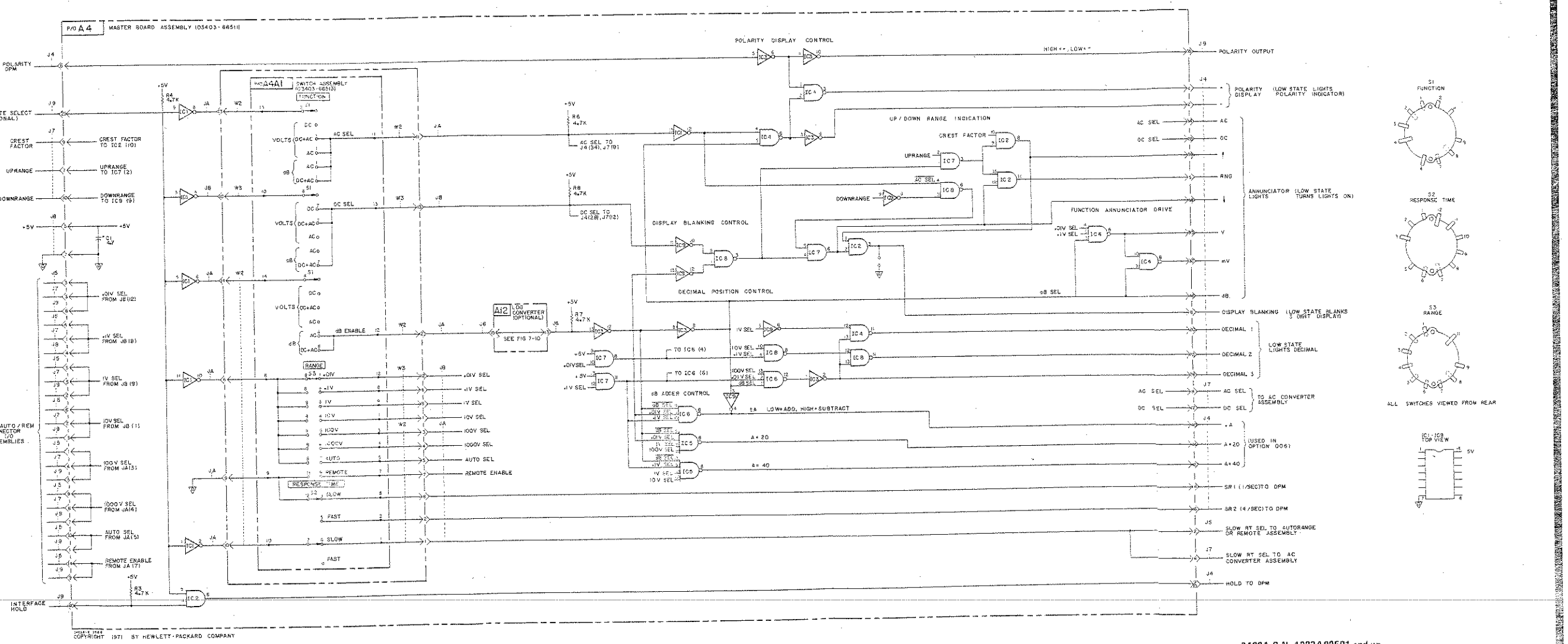
A 4

hp Part No. 03403-66511



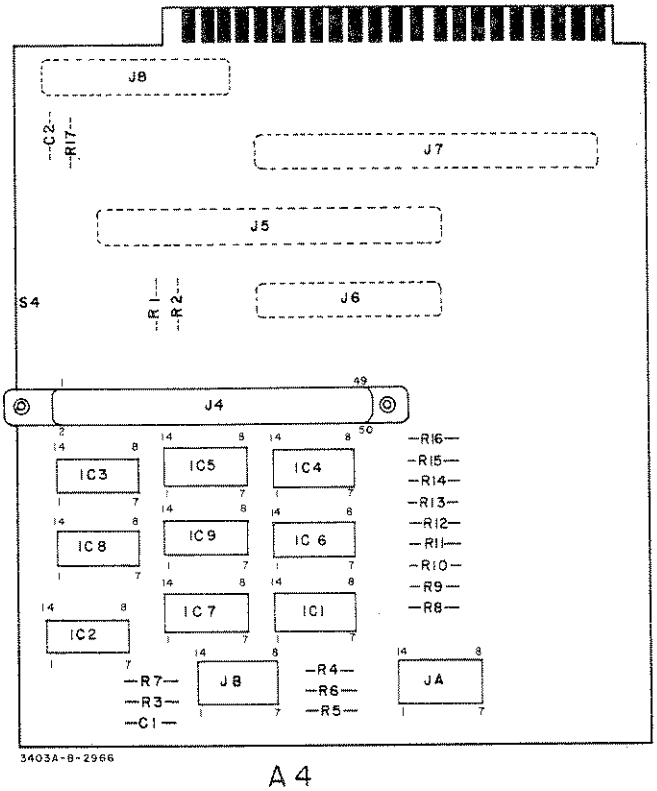
A4A1

hp Part No. 03403-66513



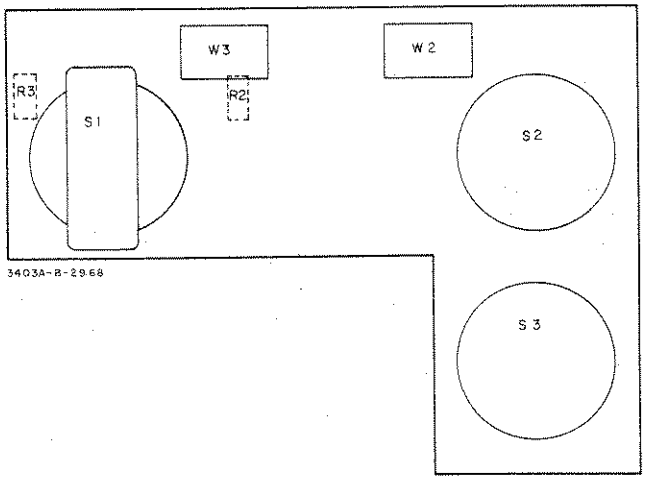
3403A S.N. 1223A00501 and up

Figure 7-9. Schematic Diagram, Manual Range and Function Logic, A4.



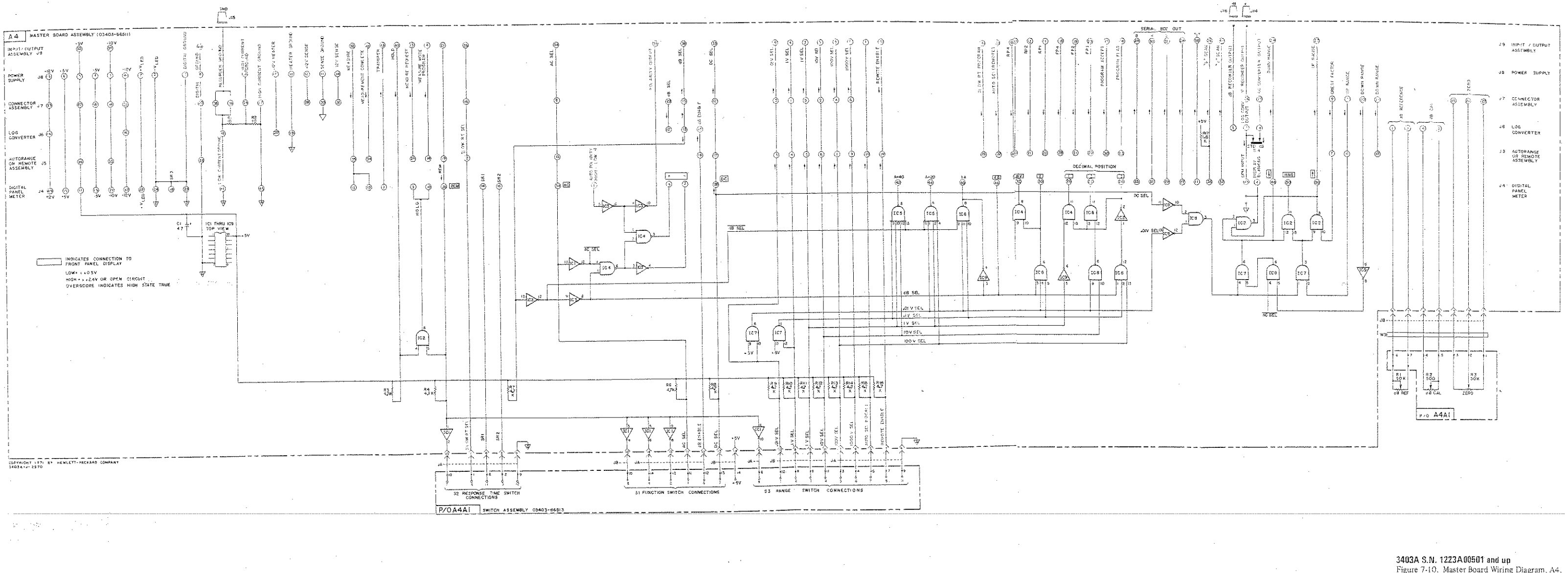
A 4

hp Part No. 03403-66511

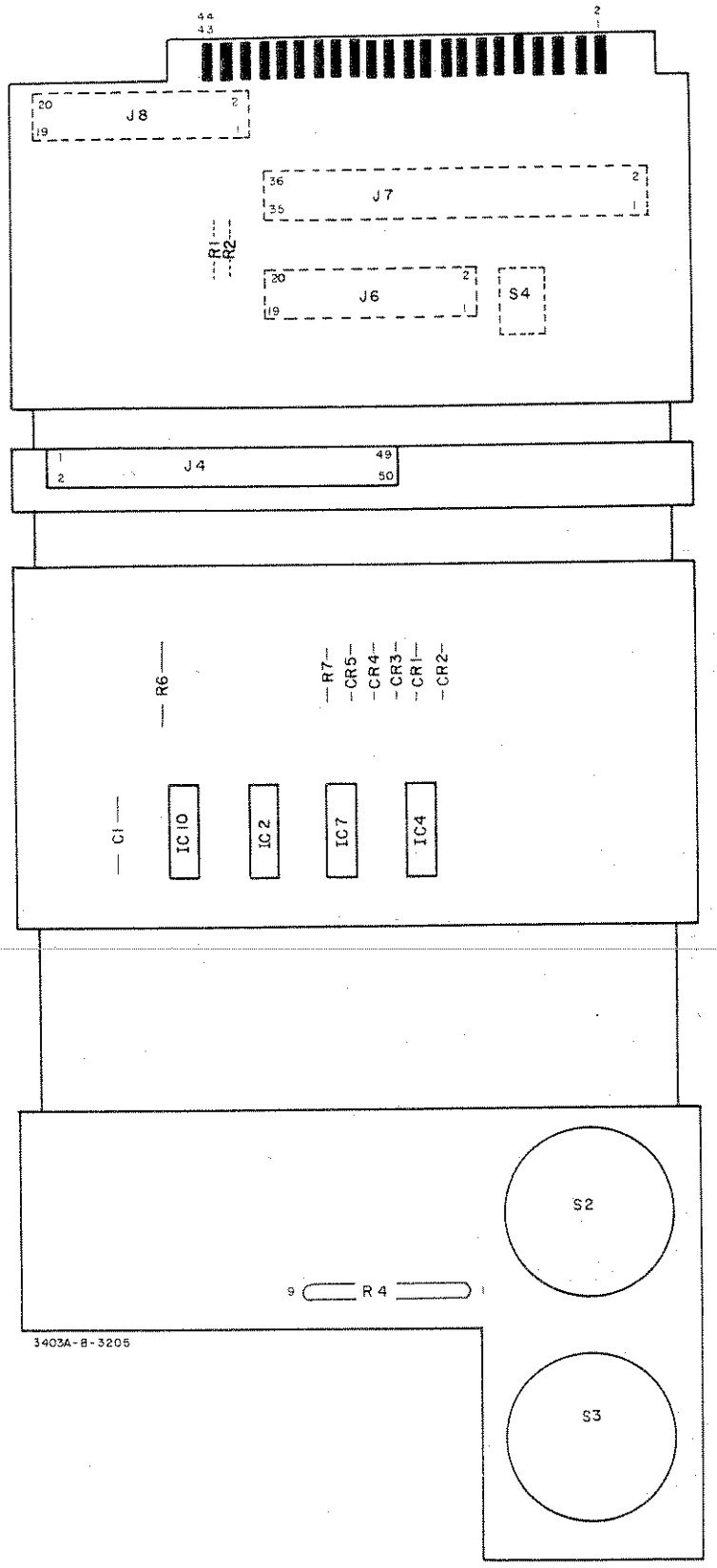


A4A1

hp Part No. 03403-66513

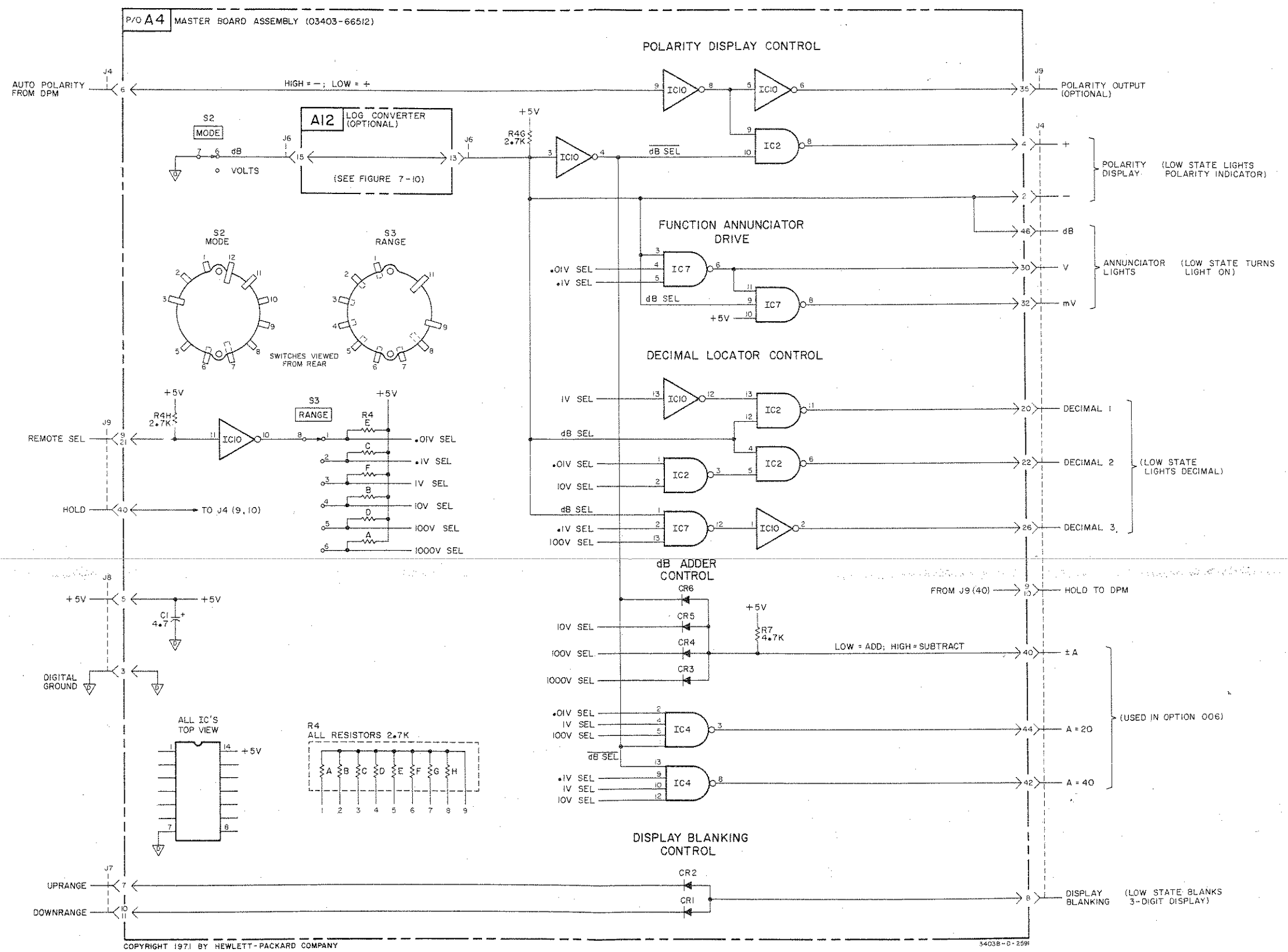


3403A S.N. 1223A00501 and up
Figure 7-10. Master Board Wiring Diagram, A4.



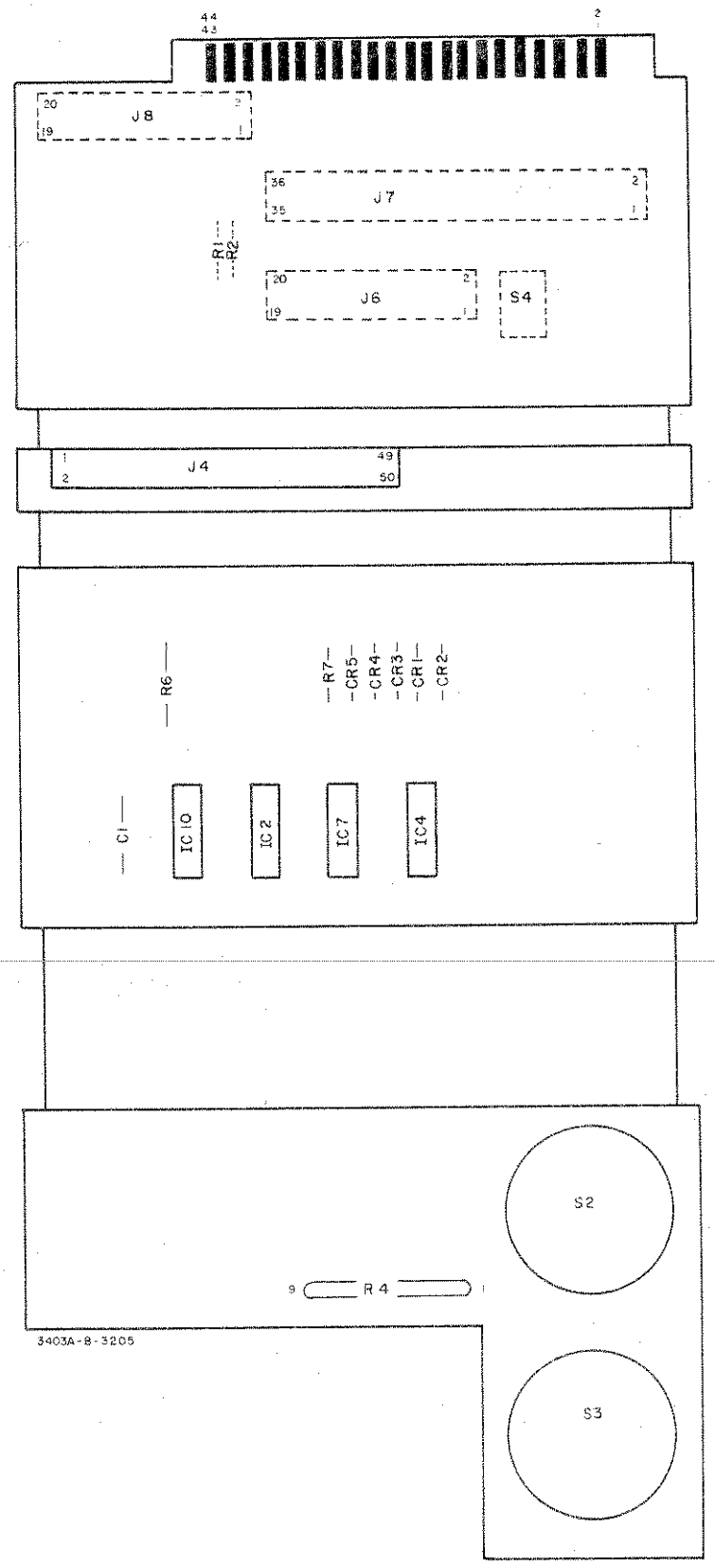
A4

hp Part No. 03403-66512



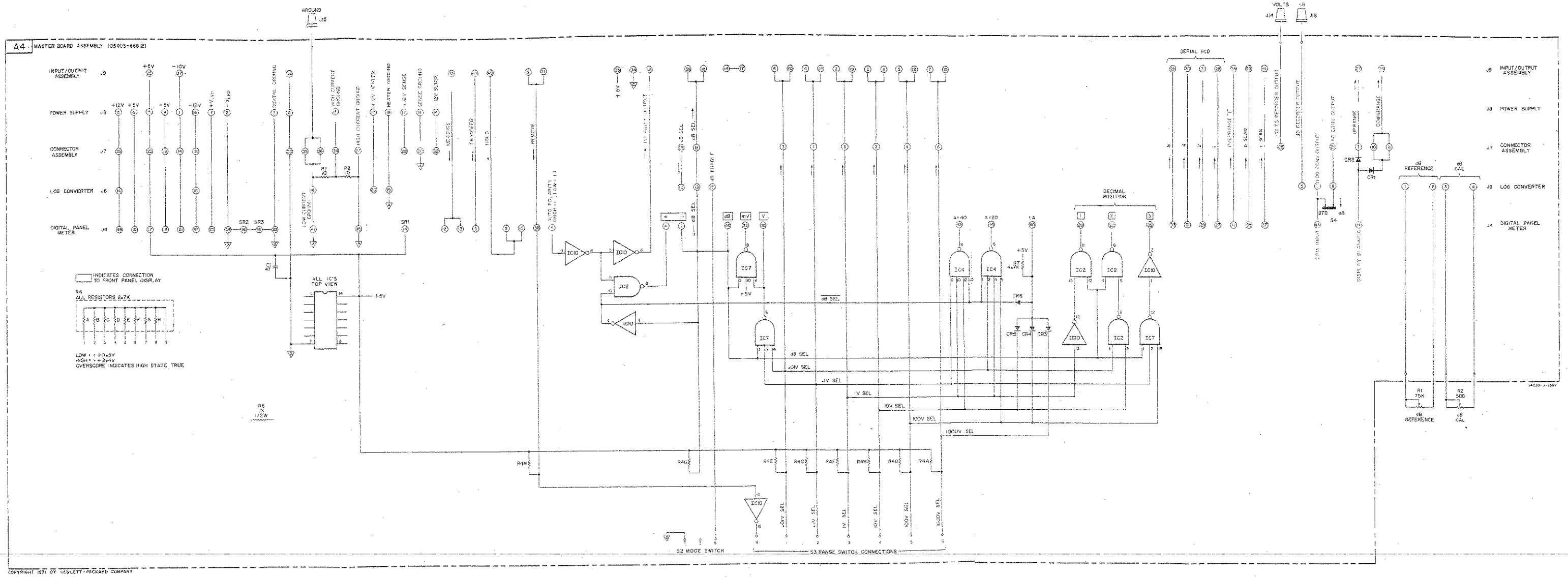
3403B only

Figure 7-11. Schematic Diagram, 3403B Range and Function Logic, A4.



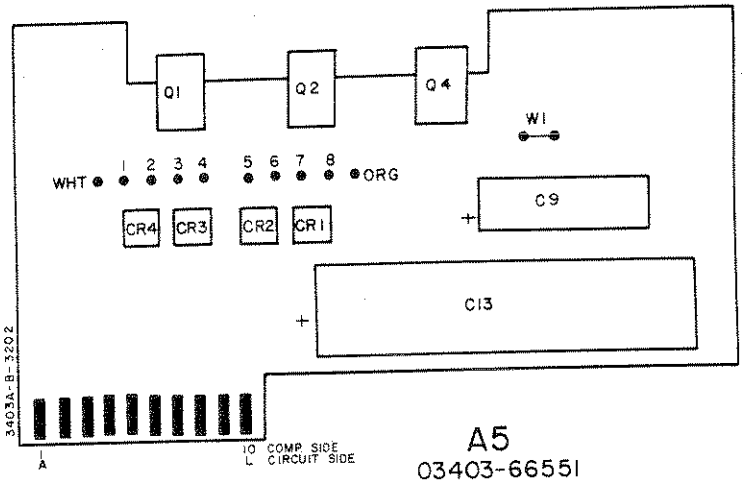
A4

hp Part No. 03403-66512

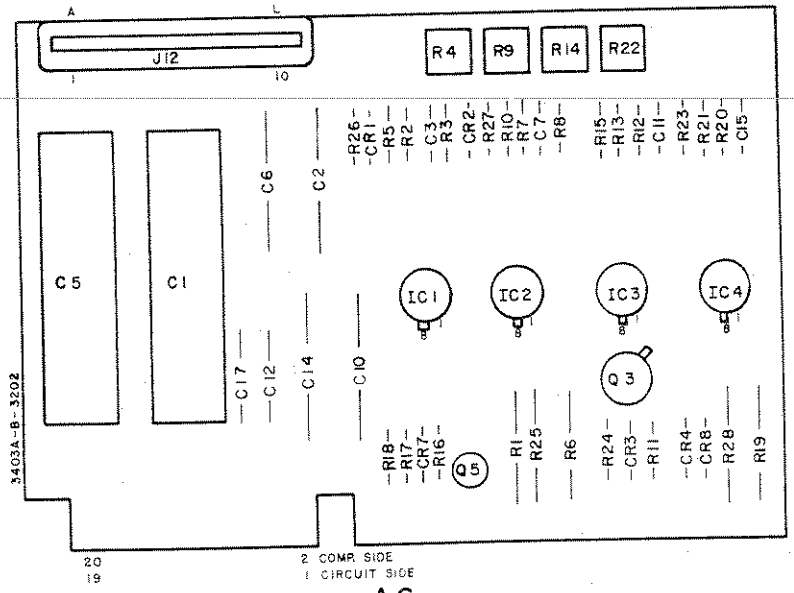


3403B only

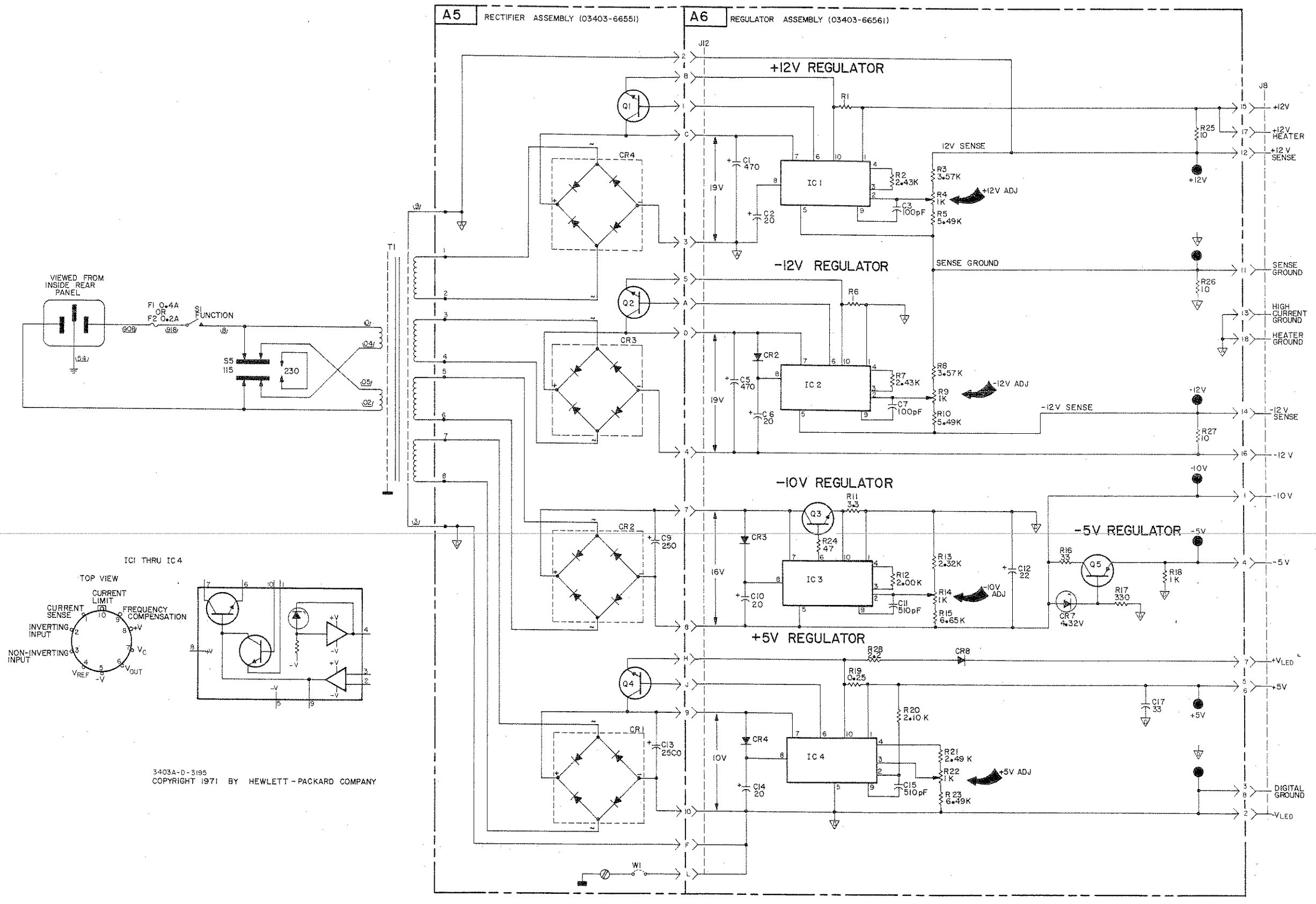
Figure 7-12. 3403B Master Board Wiring Diagram, A4.



A5
03403-66551

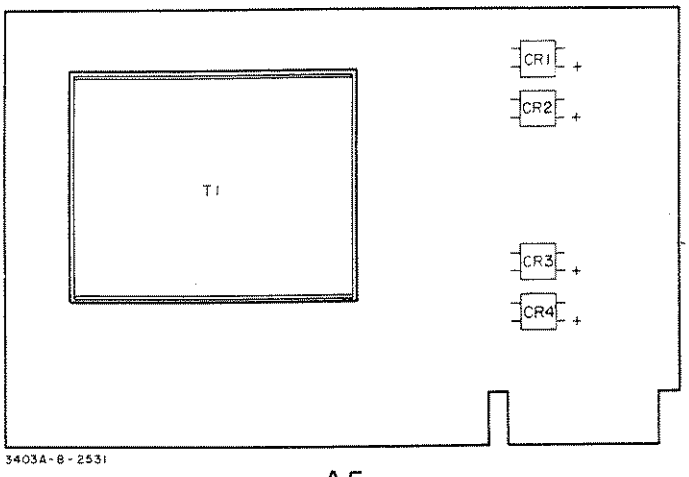


A6
03403-66561



3403A S.N. 1151A00351 and up

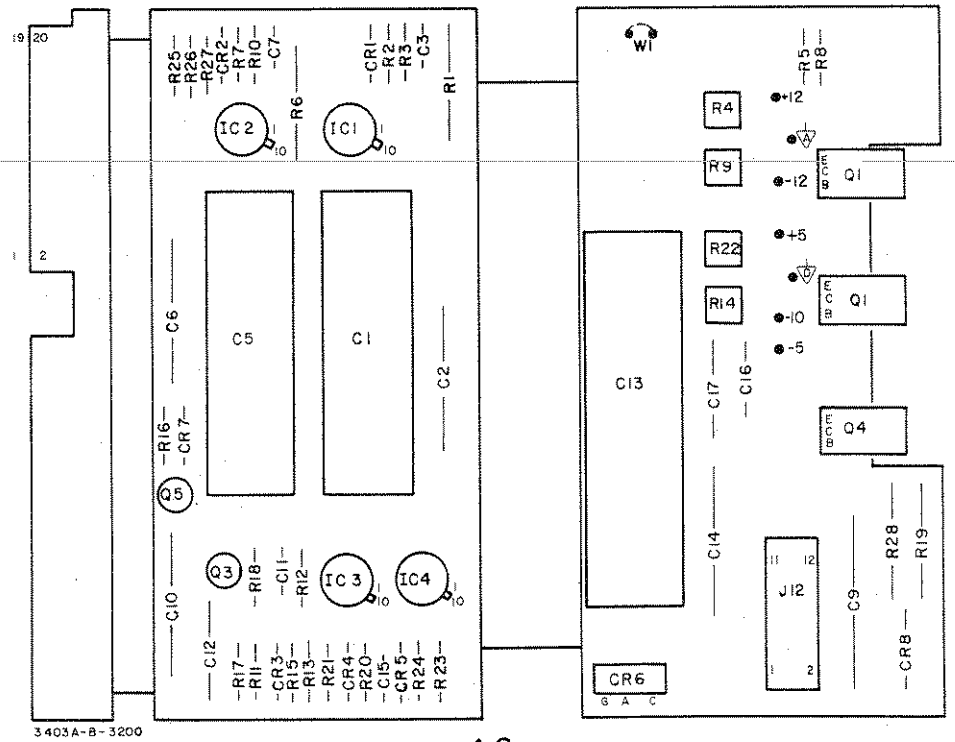
Figure 7-13. Schematic Diagram, Power Supplies, A5, A6.



A5

hp Part No. 03403-66550

Rev. A



A6

hp Part No. 03403-66560

A5 RECTIFIER ASSEMBLY (03403-66550)

A6 REGULATOR ASSEMBLY (03403-66560)

+12V REGULATOR

−12V REGULATOR

−10V REGULATOR

+5V REGULATOR

-5V REGULATOR

VIEWED FROM INSIDE REAR PANEL

J13

S1 FUNCTION

F1 0.4A OR F2 0.2A

S5 115 230

T1

CR4 CR3 CR2 CR1

Q1 Q2 Q3 Q4 Q5

IC1 IC2 IC3 IC4

R1 R2 2.43K R3 3.57K R4 1K +12V ADJ R5 5.49K

R6 R7 2.43K R8 3.57K R9 1K −12V ADJ R10 5.49K

R11 3.3 R12 2.00K R13 2.32K R14 1K −10V ADJ R15 6.65K

R16 33 R17 330 R18 1K

R19 0.25 R20 2.10K R21 2.49K R22 1K +5V ADJ R23 6.49K

R24 100 R25 10 R26 10 R27 10 R28 2.2

C1 500 C2 20 C3 100pF

C5 500 C6 20 C7 100pF

C9 100 C10 20 C11 510pF C12 22

C13 2500 C14 20 C15 510pF C16 4.7 C17 33

CR5 5.11V CR6 CR7 4.32V CR8

19V 19V 16V 10V

+12V SENSE −12V SENSE SENSE GROUND

OVERVOLTAGE PROTECTION

W1

J8

+12V +12V HEATER +12V SENSE SENSE GROUND HIGH CURRENT GROUND HEATER GROUND −12V SENSE −12V −10V −5V +V LED +5V DIGITAL GROUND −V LED

IC1 THRU IC4

TOP VIEW

CURRENT LIMIT

CURRENT SENSE

FREQUENCY COMPENSATION

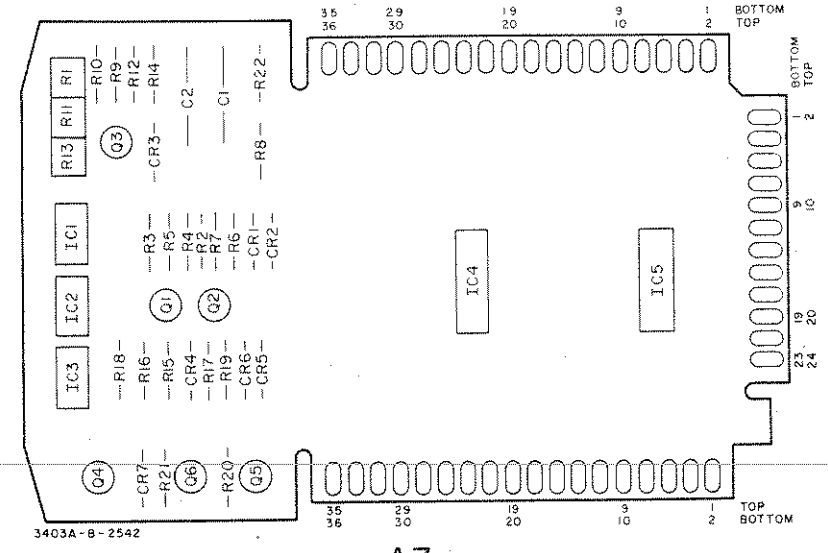
INVERTING INPUT

NON-INVERTING INPUT

+V V_O V_{REF} V_{OUT} −V

3403B; 3403A S.N. 1124A00350 and below

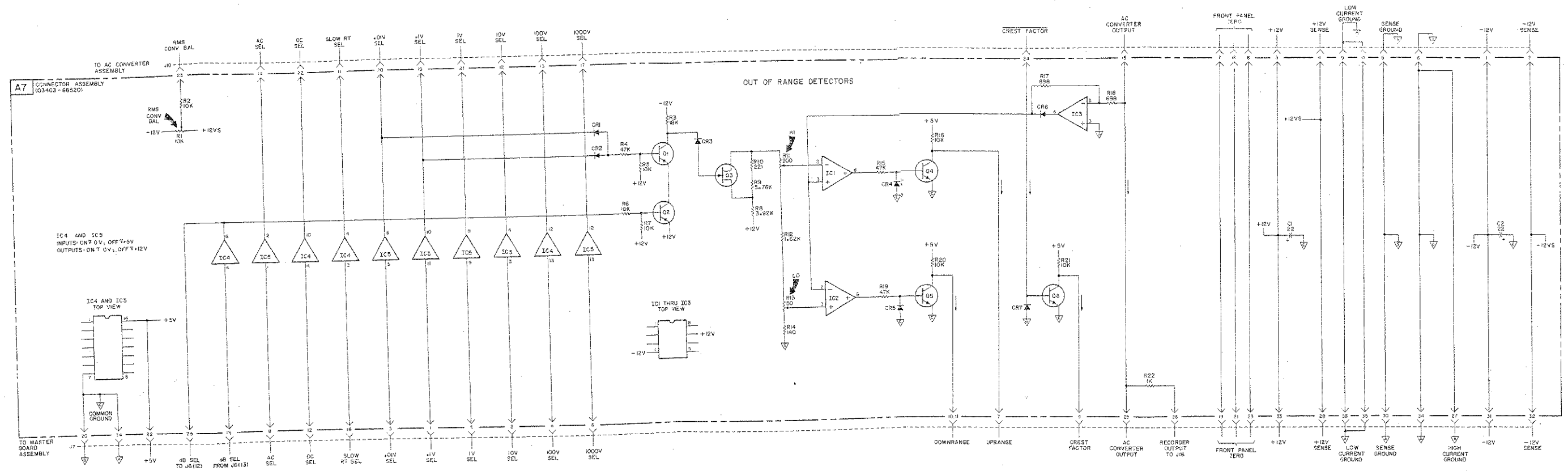
Figure 7-14. Schematic Diagram, Power Supplies, A5, A6.



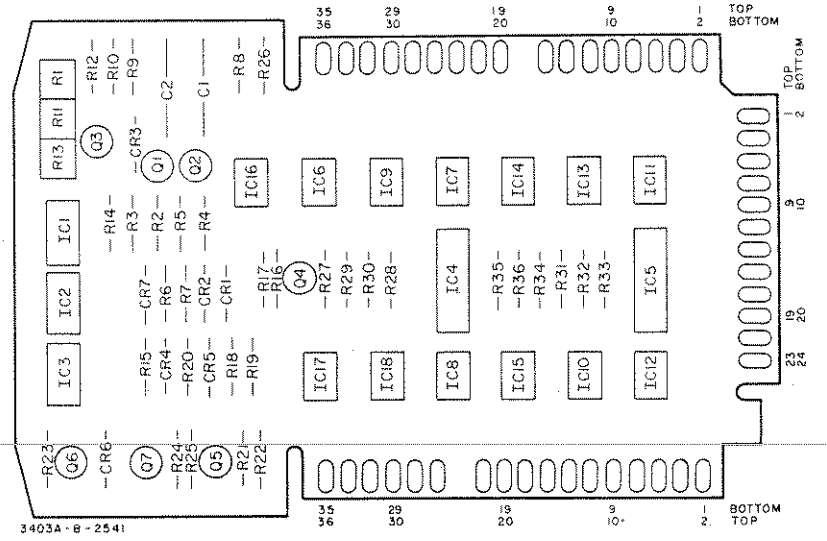
A7

hp Part No. 03403-66520

Rev. C



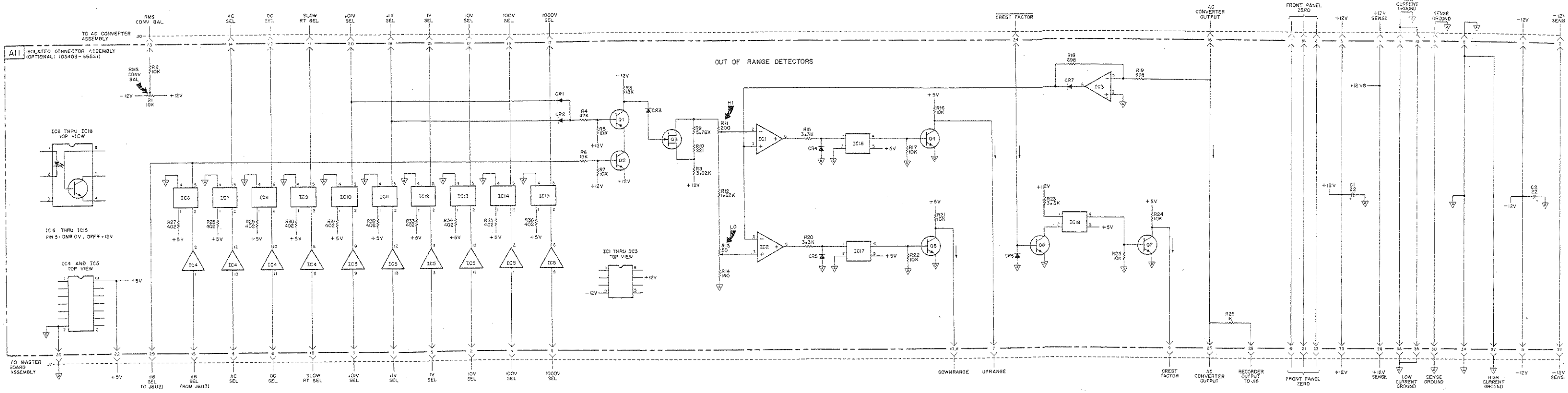
3403A/B
Figure 7-15. Schematic Diagram, Standard Connector Assembly, A7.



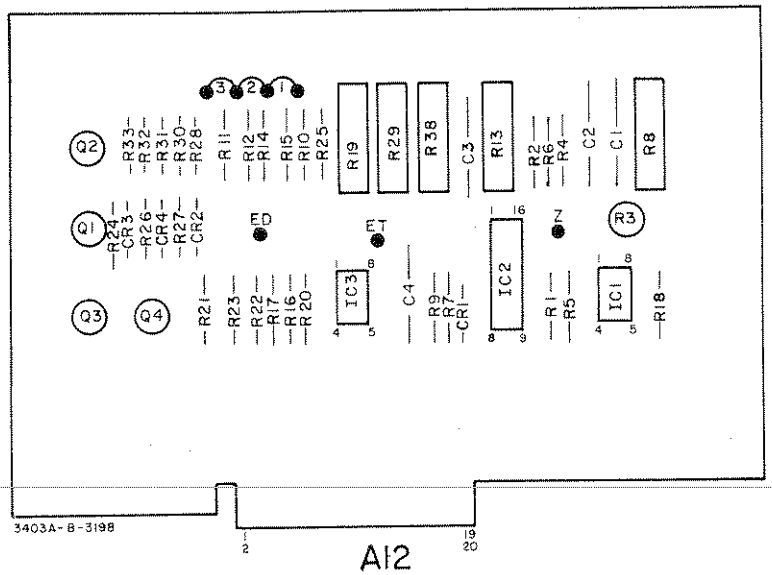
All

hp Part No. 03403-66521

Rev. C

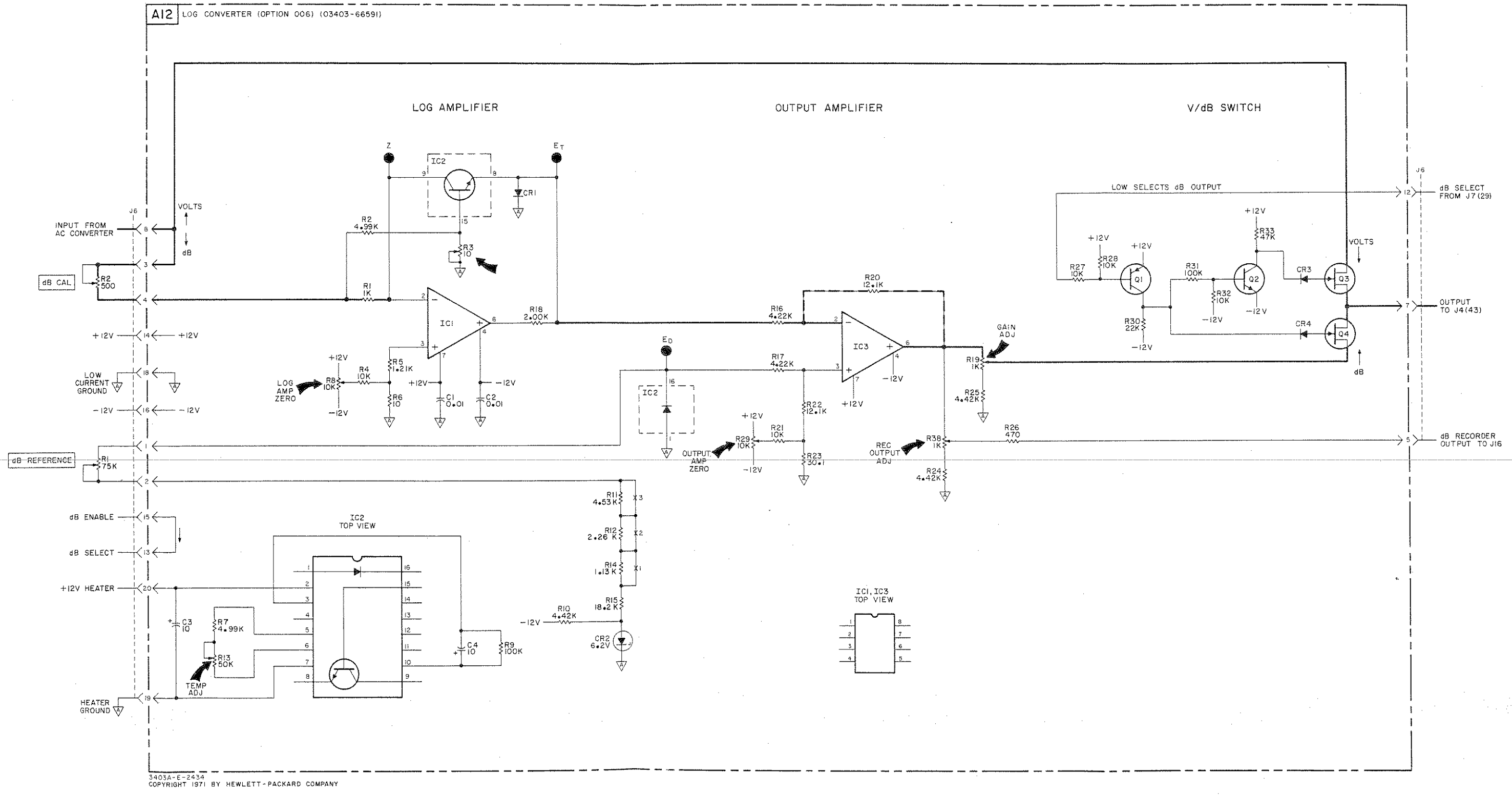


3403A only
Figure 7-16. Schematic Diagram, Isolated Connector Assembly



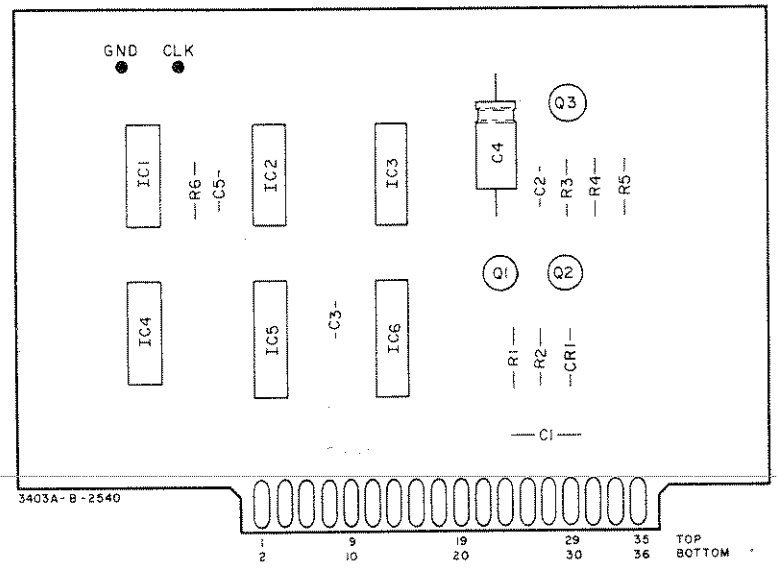
A12

hp Part No. 03403-66591



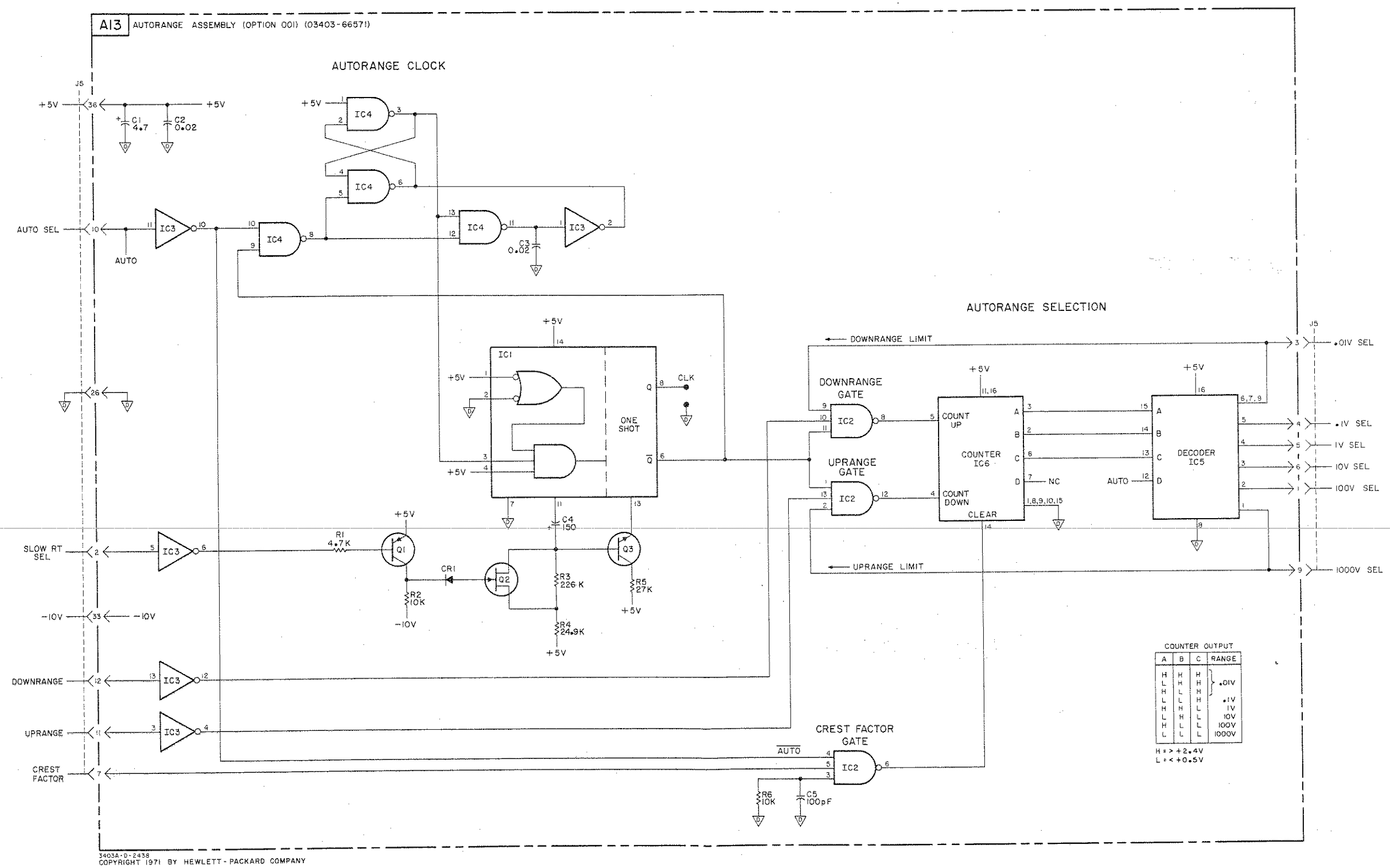
3403A/B

Figure 7-17. Schematic Diagram, Log Converter, A12.



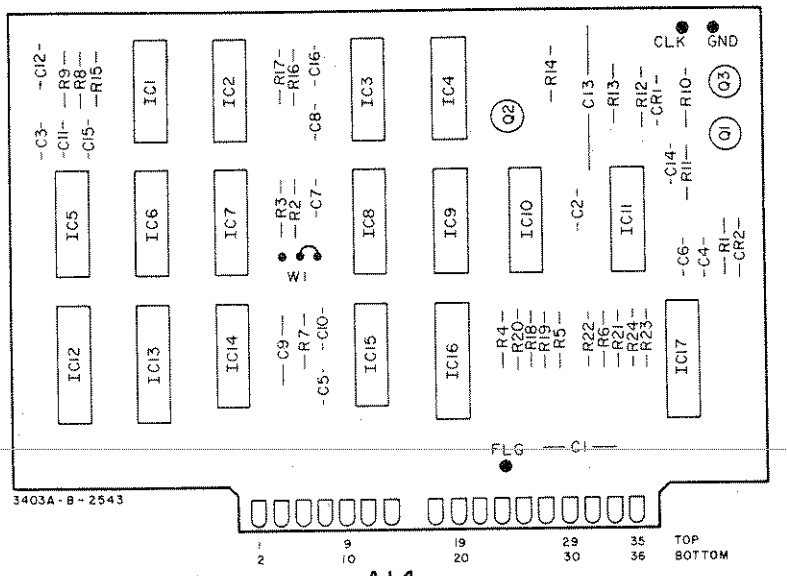
A13

hp Part No. 03403-66571



3403A only

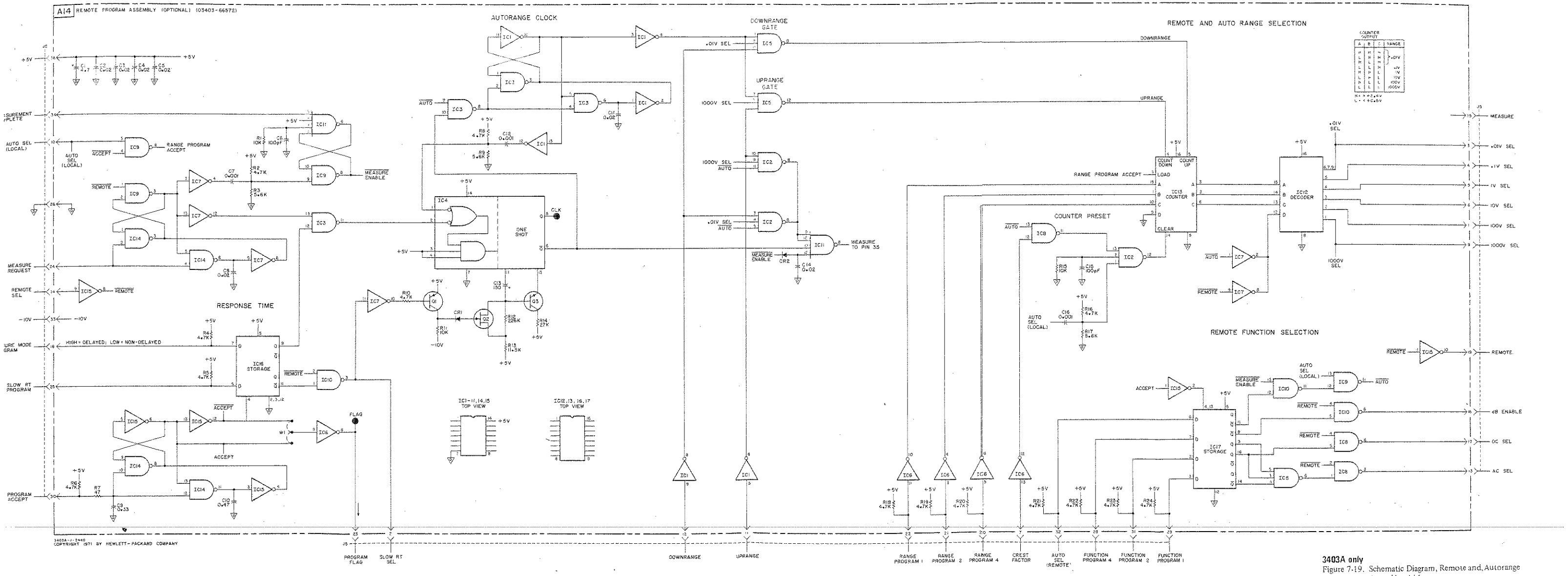
Figure 7-18. Schematic Diagram, Autorange Assembly, A13.



A14

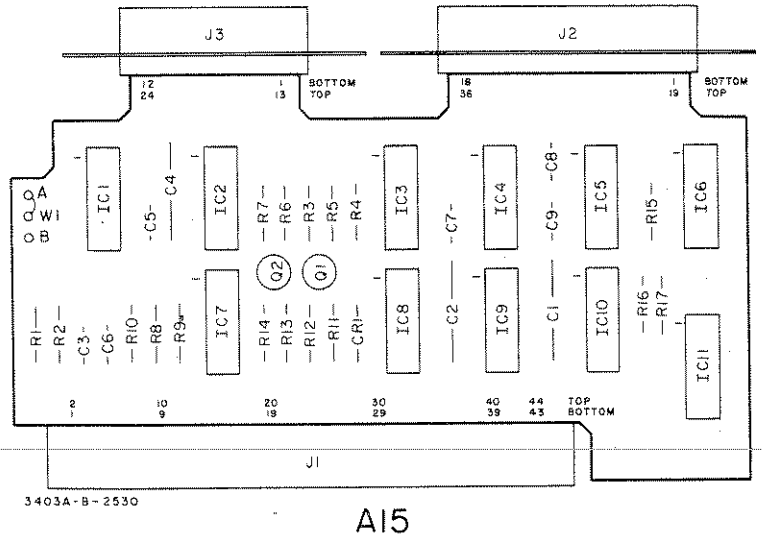
hp Part No. 03403-66572

Rev. B



3403A only

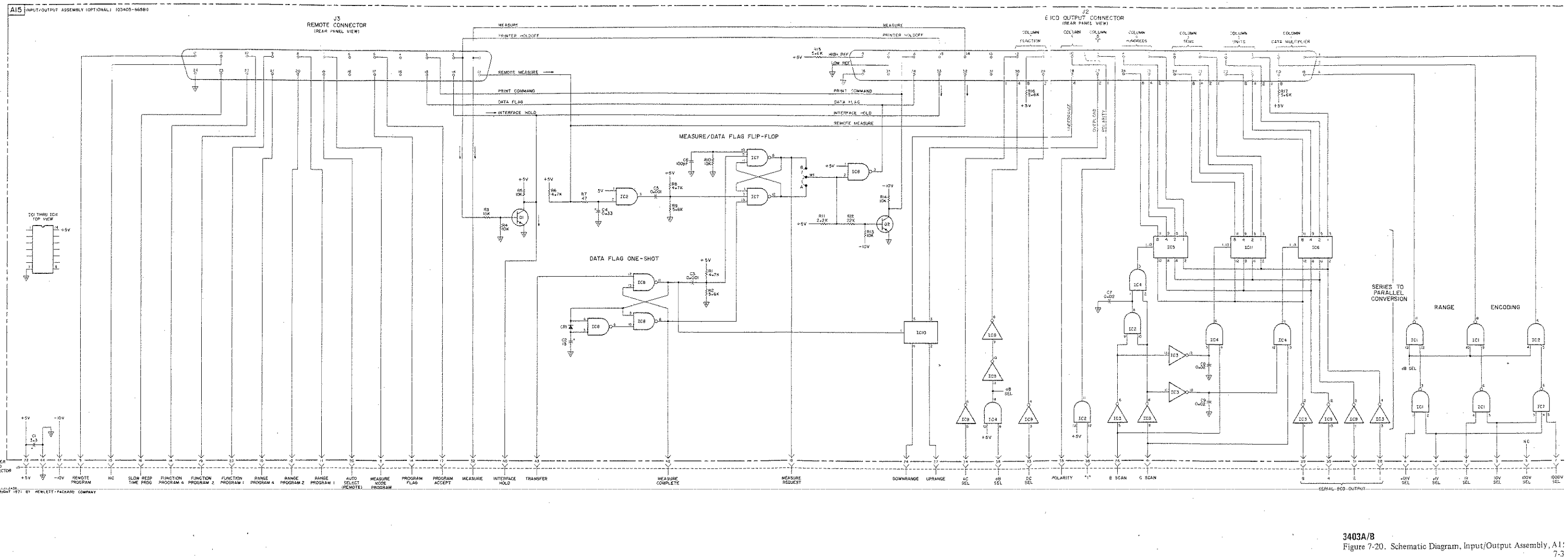
Figure 7-19. Schematic Diagram, Remote and Autorange Assembly, A14.



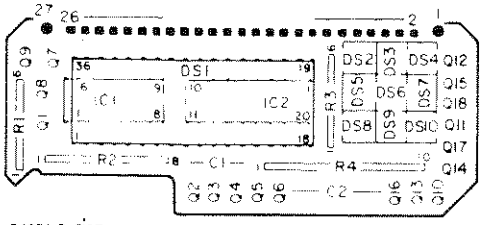
A15

hp Part No. 03403-66581

Rev. A

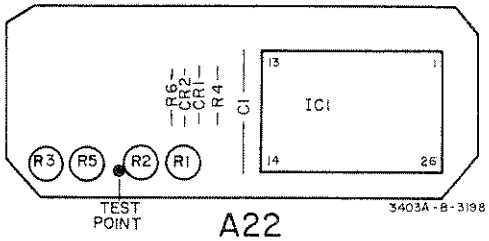


3403A/B
Figure 7-20. Schematic Diagram, Input/Output Assembly, A1



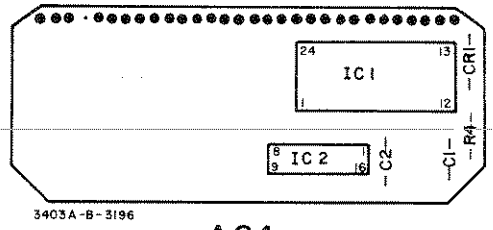
A21

hp Part No. 03431-69501



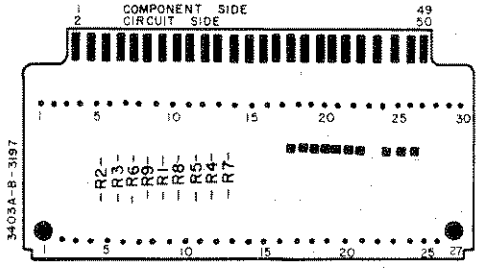
A22

hp Part No. 03431-66507



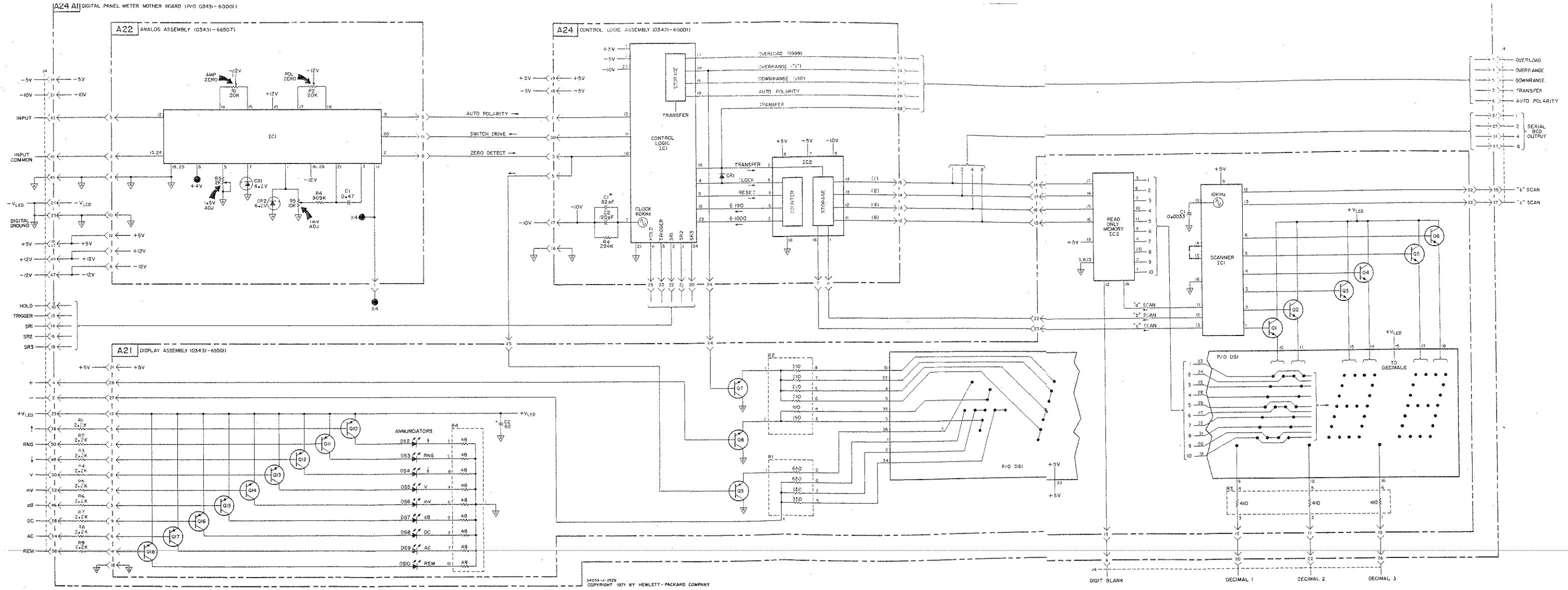
A24

Part of 03431-60001



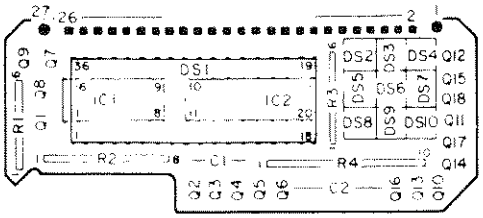
A24A1

Part of 03431-60001
COMPONENT SIDE



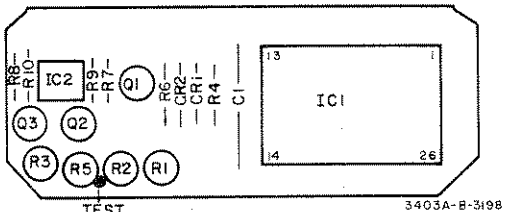
3403A/B

Figure 7-21. Schematic Diagram, Digital Panel Meter (Standard).



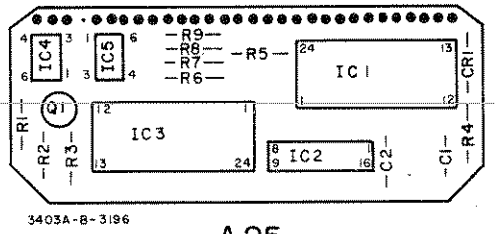
A21

hp Part No. 03431-69501



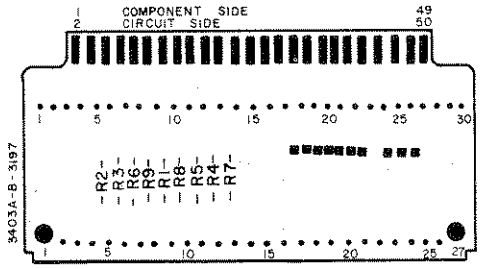
A23

hp Part No. 03431-66502



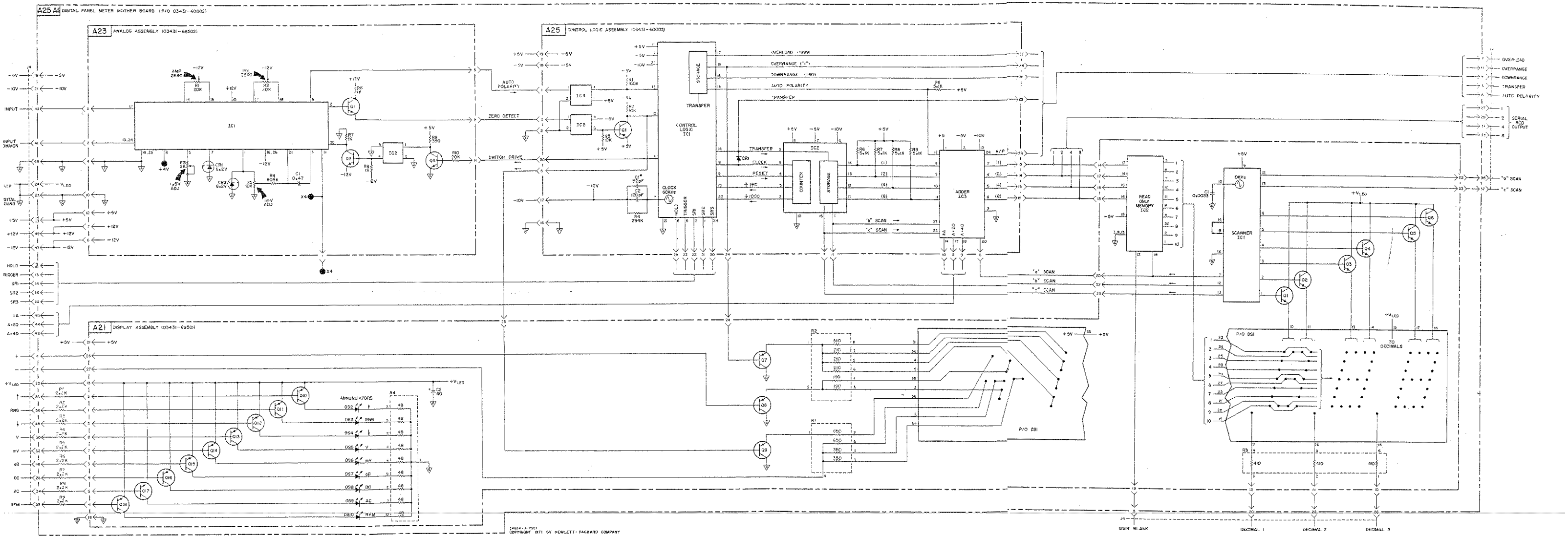
A25

Part of 03431-60002



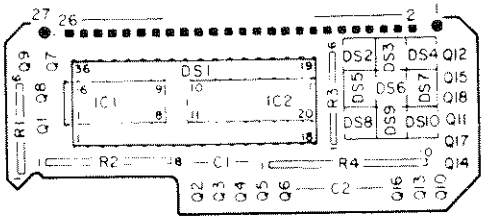
A25A1

Part of 03431-60002
COMPONENT SIDE



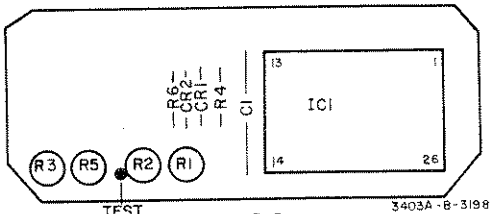
3403A only

Figure 7-22. Schematic Diagram, Digital Panel Meter (Isolated and dB).



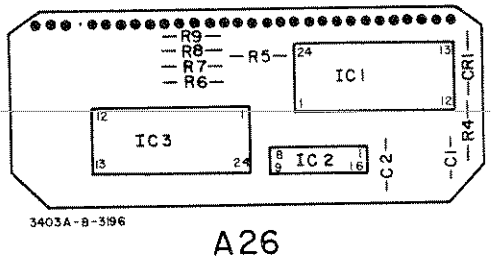
A21

hp Part No. 03431-69501



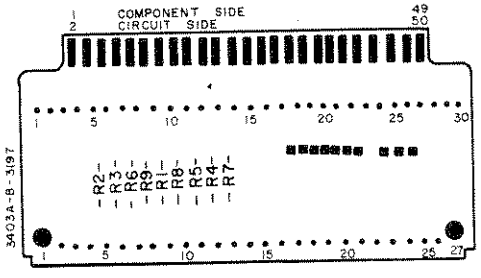
A22

hp Part No. 03431-66507



A26

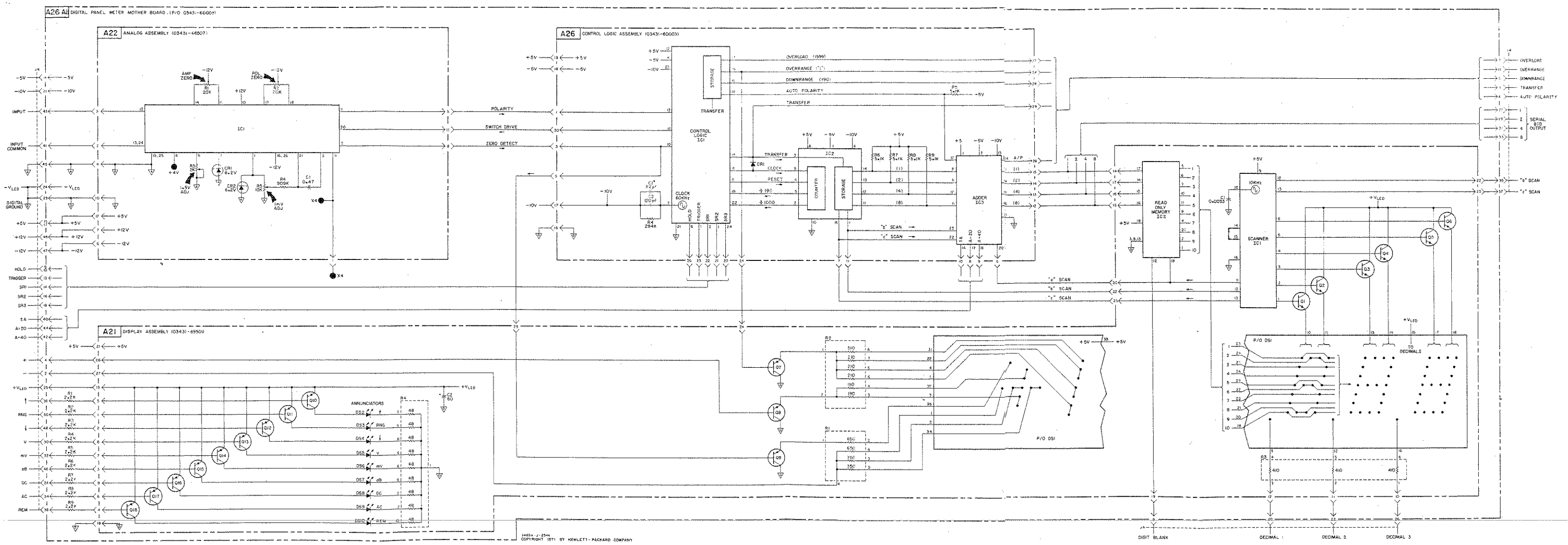
Part of 03431-60003



A26A1

Part of 03431-60003

COMPONENT SIDE



3403A/B
Figure 7-23. Schematic Diagram, Digital Panel Meter (dB).

CODE LIST OF MANUFACTURERS

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

Code No.	Manufacturer	Address
00000	U.S.A Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00287	Cemco, Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Mictron, Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc.	Cherry Hill, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00809	Croven, Ltd.	Whitby, Ontario, Canada
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Cal.
00929	Microlab Inc.	Livingston, N.J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Cal.
01281	TRW Semiconductors, Inc.	Lawndale, Cal.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co	Alliance, Ohio
01538	Small Parts Inc.	Los Angeles, Cal.
01589	Pacific Relays, Inc.	Van Nuys, Cal.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp.	Rockford, Ill.
01960	Pulse Engineering Co	Santa Clara, Cal.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc	Sunnyvale, Cal.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Division	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Cal.
02875	Hudson Tool & Die	Newark, N.J.
03296	Nylon Molding Corp.	Springfield, N.J.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Cal.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div., Finderne Plant	Sumerville, N.J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taruus Corp.	Lambertville, N.J.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04217	Essex Wire	Los Angeles, Cal.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Palo Alto Division of Hewlett-Packard Co.	Palo Alto, Cal.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Cal.
04673	Dakota Engr. Inc.	Culver City, Cal.
04713	Motorola Inc. Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Cal.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Cal.
04811	Precision Coil Spring Co.	El Monte, Cal.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Cal.
05277	Westinghouse Electric Corp. Semiconductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Cal.
05397	Union Carbine Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind. Inc.	Canoga Park, Cal.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Cal.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Cal.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Cal.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Ariz. Div.	Phoenix, Arizona
06812	Torrington Mfg. Co., West Div.	Van Nuys, Cal.
06980	Varian Assoc. Etmac Div.	San Carlos, Cal.
07088	Kelvin Electric Co.	Van Nuys, Cal.
07126	Digitran Co.	Pasadena, Cal.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp., Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Cal.
07256	Silicon Transistor Corp.	Carle Place, N.Y.
07261	Avnet Corp.	Culver City, Cal.
07263	Fairchild Camera & Inst. Corp., Semiconductor Div.	Mountain View, Cal.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Birtcher Corp, The	Monterey Park, Cal.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Cal.
07700	Technical Wire Products Inc.	Cranford, N.J.
07829	Bodine Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Cal.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Cal.
07980	Hewlett-Packard Co., New Jersey Division	Rockaway, N.J.
08145	U.S. Engineering Co.	Los Angeles, Cal.
08289	Blinn, Delbert Co.	Pomona, Cal.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Cal.
08664	Bristol Co., The	Waterbury, Conn
08717	Sloan Company	Sun Valley, Cal.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div. of CBS Inc	Lowell, Mass.
08806	General Electric Co., Miniature Lamp Dept.	Cleveland, Ohio
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Cal.
09097	Electronic Enclosures Inc.	Los Angeles, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Cal.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09795	Pennsylvania Florocarbon. Clifton Heights, Penn.	
09922	Burndy Corp.	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Cal.
10411	Ti-Tal, Inc.	Berkeley, Cal.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Cal.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Cal.
11314	National Seal	Downey, Cal.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Cal.
11711	General Instrument Corp., Semiconductor Division Products Group	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Cal.
11870	Melabs, Inc.	Palo Alto, Cal.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc., Data System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elmar Filter Corp	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N.J.
12930	Delta Semiconductor Inc.	Newport Beach, Cal.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13019	Airco Supply Co., Inc.	Witchita, Kansas
13061	Wilco Products	Detroit, Mich.
13103	Thermolloy	Dallas, Texas
13327	Solitron Devices Inc.	Tappan, N.Y.
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Cal.
14193	Calif. Resistor Corp	Santa Monica, Cal.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, a Div. of Int. Telephone and Telegraph Corporation	West Palm Beach, Fla.
14493	Hewlett-Packard Company.	Loveland, Colo.
14655	Cornell Dublier Electric Corp	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Cal.
14960	Williams Mfg. Co.	San Jose, Cal.
15106	The Sphere Co., Inc.	Little Falls, N.J.
15203	Webster Electronics Co.	New York, N.Y.
15287	Scionics Corp.	Northridge, Cal.
15291	Adjustable Bushing Co.	N. Hollywood, Cal.
15558	Micron Electronics.	Garden City, Long Island, N.Y.
15566	Amprobe Inst. Corp.	Lynbrook, N.Y.
15631	Cabletronics	Costa Mesa, Cal.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Cal.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mountain View, Cal.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Omni-Spectra Inc.	Detroit, Ill.
16352	Computer Diode Corp.	Lodi, N.J.
16554	Electroid Co.	Union, N.J.
16585	Boots Aircraft Nut Corp.	Pasadena, Cal.
16688	Ideal Prec. Meter Co., Inc., De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Cal.
17474	Tranex Company	Mountain View, Cal.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Cal.
17856	Siliconix Inc.	Sunnyvale, Cal.
17870	McGraw-Edison Co.	Manchester, N.H.
18042	Power Design Pacific Inc.	Palo Alto, Cal.
18083	Clevite Corp. Semiconductor Div.	Palo Alto, Cal.
18324	Signetics Corp.	Sunnyvale, Cal.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18565	Chomerics	Plainville, Mass.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18612	Vishay Instruments Inc.	Malvern, Pa.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison	West Orange, N.J.
19589	Concoa	Baldwin Park, Cal.

CHANGE NO. 3

This change applies to Serial No. 1151A00498 and below with the following exceptions:

1151A00497	1151A00487	1151A00478	1151A00468
1151A00495	1151A00486	1151A00477	1151A00466
1151A00494	1151A00485	1151A00476	1151A00464
1151A00493	1151A00484	1151A00475	1151A00463
1151A00492	1151A00483	1151A00474	1151A00462
1151A00490	1151A00482	1151A00473	1151A00461
1151A00489	1151A00480	1151A00472	1151A00460
1151A00488	1151A00479	1151A00470	

Instruments with Serial No. 1151A00498 and below, with the above exceptions, used one assembly, 03403-66510, instead of 03403-66511 and 03403-66513. Schematic diagrams, Figure 7-7 and 7-8 apply to 03403-66510 and the replaceable parts are shown in Table C-1.

Table C-1. Replaceable Parts.

Ref. Des.	-hp- Part No.	Qty	Description	Mfr.	Mfr. Part No.
A4	03403-66510	1	Board Assembly: Master	28480	03403-66510
A4CR1 - CR6	1910-0016		Diode: germanium 100 MA/0.85 V 60 piv	93332	D2361
A4C1	0180-0309	4	C: fxd elect 4.7 μF 20 % 10 vdcw	56289	150D475X0010A2-DYS
A4IC1	1820-0273	4	IC: DTL Quad 2 - Input AND Gate	28480	1820-0273
A4IC2	1820-0094	10	IC: DTL Quad 2 - Input Gate	28480	1820-0094
A4IC3	1820-0094		IC: DTL Quad 2 - Input Gate	28480	1820-0094
A4IC4	1820-0086	2	IC: DTL Dual 4 - Input Gate (expandable)	28480	1820-0086
A4IC5	1820-0307	10	IC: Digital DTL Hex Inverter	28480	1820-0307
A4IC6	1820-0307		IC: Digital DTL Hex Inverter	28480	1820-0307
A4IC7	1820-0310	5	IC: DTL Triple 3 - Input NAND Gate	28480	1820-0310
A4IC8	1820-0273		IC: DTL Quad 2 - Input AND Gate	28480	1820-0273
A4IC9	1820-0307		IC: Digital DTL Hex Inverter	28480	1820-0307
A4J4	1251-2825	1	Connector: 50 pin	28480	1251-2825
A4J5	1251-2026	2	Connector: 36 contact	71785	252-18-30-300
A4J6	1251-2034	2	Connector: PC 20 (2 X 10) contacts	76530	65-716C
A4J7	1251-2026		Connector: PC 36 contact	71785	252-18-30-300
A4J8	1251-2034		Connector: PC 20 (2 X 10) contacts	76530	65-716C
A4R1	0684-1001		R: fxd comp 10 ohm 10 % 1/4 W	01121	CB 1001
A4R2	0684-1001		R: fxd comp 10 ohm 10 % 1/4 W	01121	CB 1001
A4R3	2100-3096	1	R: var cermet 50 kohm 10 % lin 1/2 W	28480	2100-3096
A4R4	1810-0041	2	R: Network, 8 res. 2.7 kohm 5 %	28480	1810-0041
A4R5	1810-0041		R: Network, 8 res. 2.7 kohm 5 %	28480	1810-0041
A4R6	0687-1021	1	R: fxd comp 1000 ohm 10 % 1/2 W	01121	EB 1021
A4S1	3130-0395	1	Switch: wafer (Function)	28480	3130-0395
A4S2	3130-0394	1	Switch: wafer (response time)	28480	3130-0394
A4S3	3130-0393	1	Switch: wafer (range)	28480	3130-0393
A3S4	3101-1341	1	Switch: slide SPDT 0.5 A 125 V AC/DC (dB/volts)	79727	C-111-0392
A4MP1	3130-0392	3	Shaft and Index Assembly: 30 degree index	28480	3130-0392
A4MP2	03403-04310	1	Switch Plate: mounting	28480	03403-04310
A4MP3	1200-0432		Socket: Integrated Circuit	27264	1938-4