TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS) FOR

MULTIMETER ME-498/U (HEWLETT-PACKARD MODEL 34702A) (NSN 6625-00-538-9794) AND INDICATOR ID-2101/U (HEWLETT-PACKARD MODEL 34750A) (NSN 6625-00-538-9758)

HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1979

TECHNICAL MANUAL

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HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC *14June1979*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS) FOR MULTIMETER ME-4981U (HEWLETT-PACKARD MODEL 34702A) (NSN 6625-00-538-9794) AND INDICATOR ID-21011U (HEWLETT-PACKARD MODEL 34750A) (NSN 6625-00-538-9758)

REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028-2 located in the back of the manual. Simply tear out the self-addressed form, fill it out as shown on the sample, fold it where shown, and drop it in the mail.

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In either case a reply will be forwarded direct to you.

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared In accordance with military specifications and AR 310-3, the format has not been structured to consider levels of maintenance.

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PART ONE

OPERATING AND SERVICE MANUAL

Binder part No. 34740-90011
(Includes cover sheet)
Manual Part No. 34740-90012 or 34750-90012
(Binder, System Introduction and Display Manual)

MODEL 3470

MEASUREMENT SYSTEM

IMPORTANT NOTICE

This instruction manual requires no change sheet. Any change information has already been integrated into the manual by page revisions. Revised pages have a revision letter which can be found on the lower corner of the page. Reference may also be made to Section VIII of each manual where backdating information for earlier instruments can be found.

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

Printed: June 1973

HEWLETT ***PACKARD***

CERTIFICATION

Hewlett-Packard Company certifies that this instrument met its published specifications at the time of shipment from the factory. Hewlett-Packard Company further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of one year from the date of shipment, except that in the case of certain components, if any, listed in Section I of this operating manual, the warranty shall be for the specified period. Hewlett-Packard will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard, and provided the proper preventive maintenance procedures as listed in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

If this product is sold as part of a Hewlett-Packard integrated instrument system, the above warranty shall not be applicable, and this product shall be covered only by the system warranty.

Service contracts or customer assistance agreements are available for Hewlett-Packard products.

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

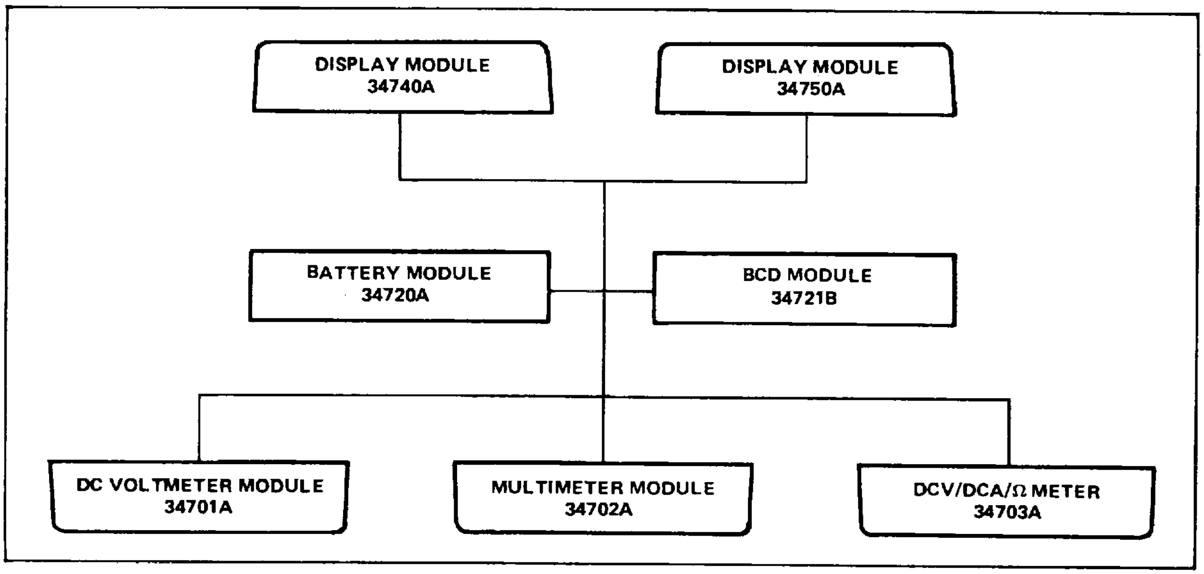
INTRODUCTION

The 3470 Measurement System is a series of modules that may be plugged together to form several different measuring instruments, including both line powered and battery powered versions.

A mainframe display module is connected to a bottom plug-on function module to form a complete instrument.

The BCD and/or Battery plug-on module may be added between the display and function modules as desired.

Refer to the Operating and Service Manual of the plug-on module to be used with the display module for the operating instructions, incoming inspection, and adjustment procedures of the instrument as a whole.



Possible Instrument Configurations

SECTION 0
INTRODUCTION

0-1. SCOPE.

a. This manual in Part 1, describes Multimeter ME-498/U (fig. 3-1) and provides instructions for operation and maintenance. Throughout this manual the ME-498/U is referred to as the Hewlett-Packard Model 34702A.

b. Part 2 describes Indicator ID-2101/U (fig.1-1, Part 2). This display module is referred to as the Hewlett-Packard Model 34750A.

0-2. INDEXES OF PUBLICATIONS.

a. *DA Pam 310-4.* Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. *DA Pam 310-7.* Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

0-3. FORMS AND RECORDS.

a. *Reports of Maintenance and Unsatisfactory Equipment.* Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. *Report of Packaging and Handling Deficiencies.* Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 70058/NAVSUPINST 4030.29/AFR 71-13/MCOP40 30.29A and DLAR 4145.8.

c. *Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in* Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 7518/MCO P4610.19C and DLAR 4500.15.

0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

EIR's will be prepared using SF 368 (Quality Deficiency Report). Instructions for preparing EIR's are provided in TM 38-750, the Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Communication and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ A reply will be furnished direct to you.

0-5. ADMINISTRATIVE STORAGE.

Administrative storage of equipment issued to and used by Army activities shall be in accordance with TM 740-90-1 and paragraph 2-8.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual contains installation and operating instructions as well as maintenance information which includes performance checks for the Model 34702A. A schematic diagram, theory of operation, and troubleshooting information are provided for use in maintaining the 34702A Multimeter Module.

1-3. DESCRIPTION.

1-4. The Hewlett-Packard Model 34702A Multimeter is a signal conditioning module that may be connected to a Model 34740A or 34750A Display Module, to measure AC Voltage, DC Voltage, or resistance. The AC and DC volts functions provide four decade ranges from I V to 1000 V. Six resistance ranges from 100 full scale to 10 MQ full scale are provided by the "Ω (fy)" function. Each available range of the Model 34702A has 100% overranging capability except the 1000 V range which has 20%.

CAUTION

Overload protection circuits allow up to 1200 V peak to be applied to the INPUT V terminals without damaging the instrument. Up to 350 V can be applied to the INPUT S terminals without damaging the instrument. No more than 500 V should be applied between LO and Chassis. Do not apply voltage between LO and Chassis when using the 34721A or 34721B BCD Module. These modules connect LO to Chassis when attached to the Model 34 702A.

1-5. SPECIFICATIONS AND GENERAL INFORMATION.

1-6. Table 1-1 lists specifications for the Model 34702A Multimeter. This table supersedes all other previously printed specifications. Procedures are provided in Section V to verify performance of the instrument to its specifications and to readjust the instrument if required. The accuracy specifications apply for ambient temperatures of 23^{0}C$\pm$ 5^{0}C. For temperatures outside this range, a temperature coefficient factor (listed in Table 1-1) must be used.

1-7. Table 1-2 lists general information relating to the instrument.

1-8. INSTRUMENT AND MANUAL IDENTIFICATION.

1-9. A three-section serial number (xxxxAxxxxx) is used to identify your Model 34702A. Figure 1-1 illustrates the meaning of the three parts of the number.

1-10. This manual is kept up-to-date with revised pages. If the serial number of your instrument is lower than the one on the title page of this manual, refer to the backdating information in Appendix A which adapts this manual to your instrument. All correspondence with Hewlett-Packard Company should include the complete serial number.

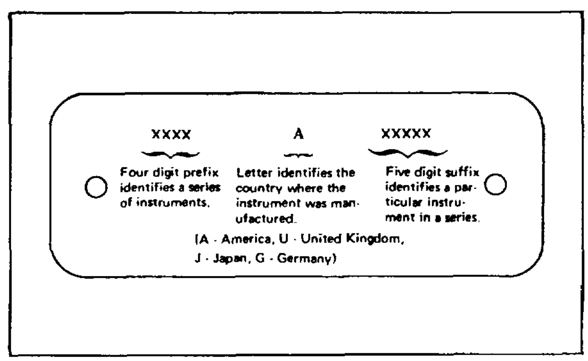


Figure 1-1. Instrument Serial Number.

Table 1-1. Specifications. (Measured using 34740A or 34750A Display Unit)

DC VOLTAGE
34740A
Performance:
Accuracy (+ 23^{0}C t 5^{0}C), < 95% RH)
30 days + (0.03% of reading + .01% of range)
90 days + (0.04% of reading + .01% of range)
6 mo. + (0.05% of reading + .02% of range)
1 yr. + (0.06% of reading + .02% of range)

Stability (24 hours, + 23^{0}C + 1°C)
+ (0.01% of reading + 0.005% of range)

Temperature Coefficient (0^0 C to + 50^{0}C)
DC voltage: t (0.0035% of reading + 0.001% of range)/^{o}C.

Input Characteristics:
Input resistance
1 and 10 V ranges: 11.11 M + 0.2%
100 V range: 10.1 M + 0.2%
1000 V range: 10 M + 02%

Effective Common Mode Rejection (1 k unbalance)
DC: > 80 dB.*

Normal Mode Rejection
50 Hz (Option 050): >60dB (50 Hz + 0.1%)
60 Hz (Option 060): >60dB (60 Hz + 0.1%)
*Does not apply when BCD Module is used.

AC VOLTAGE
34740A
Performance:
Accuracy (+ 23°C + 5^{0}C, <95% RH)
30 days
45 Hz to 20 kHz + (0.25% of reading + .05% of range)
20 kHz to 100 kHz + (0 75% of reading + .05% of range)
90 days
45 Hz to 20 kHz + (0.30% of reading + .05% of range)
20 kHz to 100 kHz + (0.80% of reading + .05% of range)
6mo.
45 Hz to 20 kHz + (0.35% of reading + .05% of range)
20 kHz to 100 kHz + (085% of reading + .05% of range)
1 yr.
45 Hz to 20 kHz + (0.50% of reading + 0.05% of range)
20 kHz to 100 kHz + (1.0% of reading + 0.05% of range)
Temperature Coefficient (0°C to + 50^{0}C)
AC voltage: ± (0,03% of reading + 0.001% of range) /^{0}C.

Stability (24 hours, + 23°C + 1°C)
AC voltage: 45 Hz to 20 kHz: ± (0.15% of reading + 0.05% of range)
20 kHz to 100 kHz: + (0.4% of reading + 0.05% of range)

Response Time: < 2 s within + 0.3% of final value or 20 counts, whichever is greater.

Input Characteristics:
Input impedance
1 and 10 V ranges: 11.11 M + 02%/ /80 pF max.
100 V range: 10.1 M ± 0.2%/ /80 pF max.
1000 V range: 10 M + 0.2%/180 pF max.

OHMS
34740A
Performance:
Accuracy (+ 23^{0}C ± 5^{0}C,< 95% RH)
30 days
10 MO range + (0.25% of reading + 0.02% of range)
All other ranges + (0.05% of reading + 0.02% of range)
90 days
10 M range + (0.30% of reading + 0.02% of range)
All other ranges + (0.06% of reading + 0.02% of range)
6 mo.
10 M range + (0.35% of reading + 0.03% of range)
All other ranges + (0.07% of reading + 0.03% of range)

1 yr.
10 M range ± (0.50% of reading + 0.03% of range)
All other ranges t (0.11% of reading + 0.03% of range)
Stability (24 hours, 23°C + 1^{0}C)
10 Mn range + (0.1% of reading + 0.01% of range)
All other ranges + (0.02% of reading + 0.02% of range)

Temperature Coefficient (0^{0}C to + 50^{0}C)
Ω
10 Ml range: + (0.035% of reading + 0.001% of range) / C.
All other ranges' t (0.006% of reading + 0.001% of range) / C.

DC VOLTAGE
34750A
Performance:
Accuracy (+ 23°C + 5^{0}C), < 95% RH)
30 days ± (0.025% of reading + .005% of range)
90 days + (0.035% of reading + .005% of range)
6 mo. + (0.045% of reading + .007% of range)
1 yr. + (0.06% of reading + .01% of range)

NOTE: Due to temperature change inside the instrument between line and battery operation, the references must be adjusted when changing modes to achieve these specifications
Stability (24 hours, + 23^{0}C + 1^{0}C)
DC voltage: + (.008% of reading i .004% of range)
Temperature Coefficient (0°C to + 50^{0}C)
DC voltage: ± (0.0025% of reading + 0.0002% of range) / C
Input Characteristics
Input resistance
1 and 10 V ranges: 11.11 M + 0.2%
100 V range: 10.1 M +.0.2%
1000 V range: 10 M + 0.2%
Effective Common Mode Rejection (1 kO unbalance)
DC: >80 dB.*
*Does not apply when BCD Module is used

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

Normal Mode Rejection
50 Hz (Option 050): >60 dB (50 Hz ± 0.1%)
60 Hz (Option 060): >60 dB (60 Hz ± 0.1%)

AC VOLTAGE
34750A
Performance:

Accuracy (+ 230 + 5C, A 95% RH)
30 days
45 Hz to 20 kHz ±(0.25% of reading + .05% of range)
20 kHz to 100 kHz ± (.75% of reading + .05% of range)

90 days
45 Hz to 20 kHz ± (.3% of reading + .05% of range)
20 kHz to 100 kHz ± (.8% of reading + .05% of range)

6 mo.
45 Hz to 20 kHz ± (.35% of reading + .05% of range)
20 kHz to 100 kHz ± (.85% of reading + .05% of range)

1 yr.
45 Hz to 20 kHz ± (0.50% of reading + 0.05% of range)
20 kHz to 100 kHz ± (1.0% of reading + 0.05% of range)

Stability (24 hours, + 23^{0}C ± 1^{0} C)
AC voltage: 45 Hz to 20 kHz: ± (0.15% of reading + 0.05% of range)
20 kHz to 100 kHz: ± (0.4% of reading + 0.05% of range)

Temperature Coefficient (0^{o}C to + 50°C)
AC voltage: + (0.03% of reading + 0.001% of range) /°C
Response Time: < 2 s within ± 0.3% of final value or 200 counts, whichever is greater.

Input Characteristics:
Input impedance
1 and 10 V ranges: 11.11 M ± 0.2%/1 /80 pF max.
100 V range: 10.1 M ± 0.2%1/80 pF max.
1000 V range: 10 M ± 0.2%/ /80 pF max.

OHMS
34750A
Performance:
Accuracy (+ 23^{o}C ± 5°C, ≤ 95% RH)
30 days
10 M range ±(0.25% of reading + 0.015% of range)
All other ranges ± (0.045% of reading + 0.015% of range)
90 days
10 M range ± (0.3% of reading + 0.015% of range)
All other ranges ± (0.055% of reading + 0.015% of range)
6 mo.
10 M range ± (0.35% of reading + 0.02% of range)
All other ranges ± (0.065% of reading + 0.02% of range)
1 yr
10 M range ± (0.50% of reading + 0.02% of range)
All other ranges ± (0.11% of reading + 0.02% of range)

NOTE: Due to temperature change inside the instrument between line and battery operation, the references must be adjusted when changing modes to achieve these specifications.

Stability (24 hours, 23°C ± 1^{o}C)
10 M range ± (0.1% of reading + 0.009% of range)
All other ranges ± (0.2% of reading + 0.015% of range)

Temperature Coefficient (0^{o} C to + 50^{o} C)
10 M range: ± (0.035% of reading + 0.001% of range) /°C
All other ranges: ±(0.006% of reading + 0.001% of range) /^{o}C

Table 1-2. General Information.

DC VOLTAGE
34740A
Ranges:

Range	Full Scale Reading	Maximum Reading
1 V	± 1.0000 V	± 1.9999 V
10 V	± 10.000 V	± 19.999 V
100 V	± 100.00	±199.99 V
1000 V	+ 1.0000 V	±1200.0 V

Overrange
1000 V range: 20%.
All other ranges: 100% (19999 max reading)
Range Selection: manual pushbuttons

Performance:

Reading Rate
Option 050 (50 Hz): 8/s fixed
Option 060 (60 Hz): 5/s fixed

Input Characteristics:

Input terminals: floating pair.*

Maximum input voltage
High to low 1200 V
Low to Chassis ± 500V*
*Does not apply when BCD Module is used.

AC VOLTAGE

34740A

Ranges:

Range	Full Scale Reading	Maximum Reading
1 V	1.0000 V	1.9999 V
10 V	10.000 V	19.999 V
100 V	100.001	199.99 V
1000 V	1.0000 V	1200.0 V

Table 1-2. General Information (Cont'd).

Overrange
1000 V range: 20%
All other ranges: 100% (19999 max reading)

Range selection- manual pushbuttons

Performance:

Frequency range: 45 Hz to 100 kHz

Input Characteristics:
input terminals: floating pair. *
Maximum input voltage
High to low: 1200 V rms. Except 1 V range.
1 V Range:
1200 V rms maximum 45 Hz - 200 Hz
300 V rms maximum 200 Hz - 100 kHz

Low to Chassis: ± 500 V *
* Does not apply when BCD Module is used.

Ω
34740A
Ranges:

Range	Full Scale Reading	Maximum Reading
100 Ω	100.00 Ω	199.99 Ω
1 kΩ	1.0000 KΩ	1.9999 KΩ
10 kΩ	10.000 KΩ	19.999 KΩ
100 kΩ	100.00 KΩ	199.99 KΩ
1000 kΩ	1000.0 KΩ	1999.9 KΩ
10 MΩ	10.000 MΩ	19.999 MΩ

Overrange: 100% on all ranges

Range selection: manual pushbuttons

Input Characteristics:

Input terminals: floating pair (different from voltage input terminals).

Current through measured resistor: 10 mA on 100 Ω range decreasing one decade per successively higher range.

Effective Common Mode Rejection: same as dc specifications.

Overload protection: ± 350 V peak (248 V rms sine wave).

Other:

Operating temperature: 0°C to + 50°C.

Storage temperature: - 40°C to + 75°C.

Line requirements: 100/120/220/240 V
- 10%, + 5% switchable:
48 Hz to 440 Hz; ≤ 8.7 VA.

DC VOLTAGE
34750A
Ranges:

Range	Full Scale Reading	Maximum Reading
1 V	± 1.00000 V	± 1.99999 V
10 V	± 10.0000 V	± 19.9999 V
100 V	± 100.000 V	± 199.999 V
!000 V	± 1000.00 V	± 1200.00 V

Overrange
1000V range: 20%
All other ranges 100% (199999 max reading)

Range selection: manual pushbuttons

Reading rate
Option 050 (50 Hz): 4/s fixed
Option 060 (60 Hz). 5/s fixed

Input terminals: floating pair *

Maximum Input voltage
High to Low: ± 1200 V
Low to Chassis: ± 500 V·*
* Does not apply when BCD Module is used.

AC VOLTAGE
34750A
Ranges:

Range	Full Scale Reading	Maximum Reading
1 V	1.00000 V	1.99999 V
10 V	10.0000 V	19.9999 V
100 V	100.000 V	199.999 V
1000 V	1000.00 V	1200.00 V

Overrange
1000 V range: 20%
All other ranges. 100% (199999 max reading)

Range selection: manual pushbuttons

Frequency range: 45 Hz to 100 kHz

Input terminals: floating pair

Maximum input voltage
High to Low: 1200 V rms except on 1 V range.
On 1 V range 2.5 x 10^5 V Hz limit with minimum protection of 300 V rms.
Low Chassis: ± 500 V

Ω
34750A
Ranges:

100 Ω	100.000 Ω	199.99 Ω
1 kΩ	1.00000 kΩ	1.99999 kΩ
10 kΩ	10.0000 kΩ	19.9999 kΩ
100 kΩ	100.000 kΩ	199.999 kΩ
1000 kΩ	1000.00 kΩ	1999.99 kΩ
10 MΩ	10.0000 MΩ	19.9999 MΩ

Overrange: 100% on all ranges

Range: selection manual pushbuttons

Input terminals: floating pair (different from voltage input terminals).

Current through measured resistor: 10 mA on 100 Ω range decreasing one decade per successively higher range.

Effective Common Mode Rejection: same as dc specifications.

Overload protection- t 350 V peak (248 V rms sine wave).

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains installation and shipping information for the Model 34702A.

2-3. INITIAL INSPECTION.

2-4. The Model 34702A should be inspected upon receipt for damage that might have occurred in transit. If there is damage due to shipping, file a claim with the carrier. If there are other electrical or mechanical deficiencies refer to the warranty statement on the back of the title page. Use the procedures provided in Section V to check instrument performance.

2-5. CONNECTION TO THE DISPLAY MODULE.

2-6. Referring to Figure 2-1, connect the Model 34702A to the Display Module using the following procedure:

a. Pull the side locks on the Display Module to the rear.

b. Position the Display Module and 34702A together so that the tabs and slots on the sides of the two units interlock.

c. Push the side locks toward the Display Module. This pulls the two units together and locks them.

2-7. If a 34720A Battery Module or a 34721B BCD Module is to be used between the display module and the 34702A then the side locks on this middle module hold the 34702A.

2-8. REPACKAGING FOR SHIPMENT.

2-9. If the instrument is to be shipped to Hewlett-Packard for service or repair, attach a tag to the instrument describing the work to be accomplished and identifying the owner of the instrument. Identify the instrument by serial number, model number and name in any correspondence. If you have any questions, contact your local Hewlett-Packard Sales and Service Office.

2-10. If the original shipping container is to be used, place the instrument in the container with appropriate packing material and seal the container well with strong tape or metal bands.

2-11. If an -hp- container is not to be used, use a heavy carton or wooden box with an inner container. Wrap the instrument with heavy paper or plastic and place cardboard strips across the face for protection before placing the instrument in the inner container. Use packing material around all sides of the inner container, and seal the outer container well with strong tape or metal bands. Mark the container with "DELICATE INSTRUMENT" or "FRAG-
ILE."

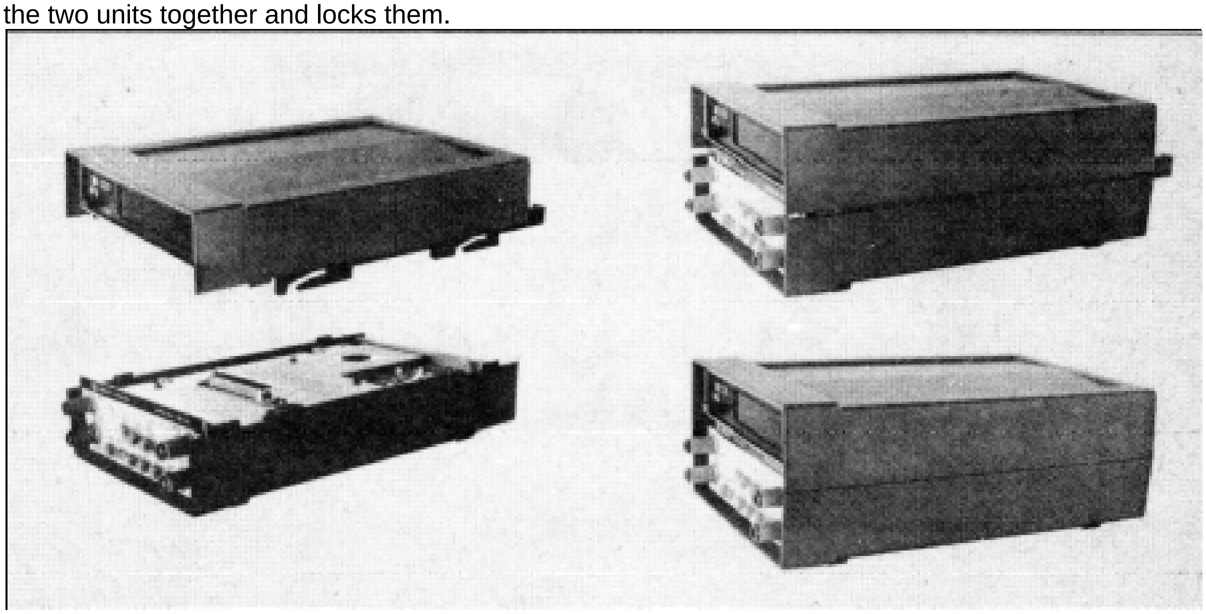


Figure 2-1. Installation of the Model 34702A

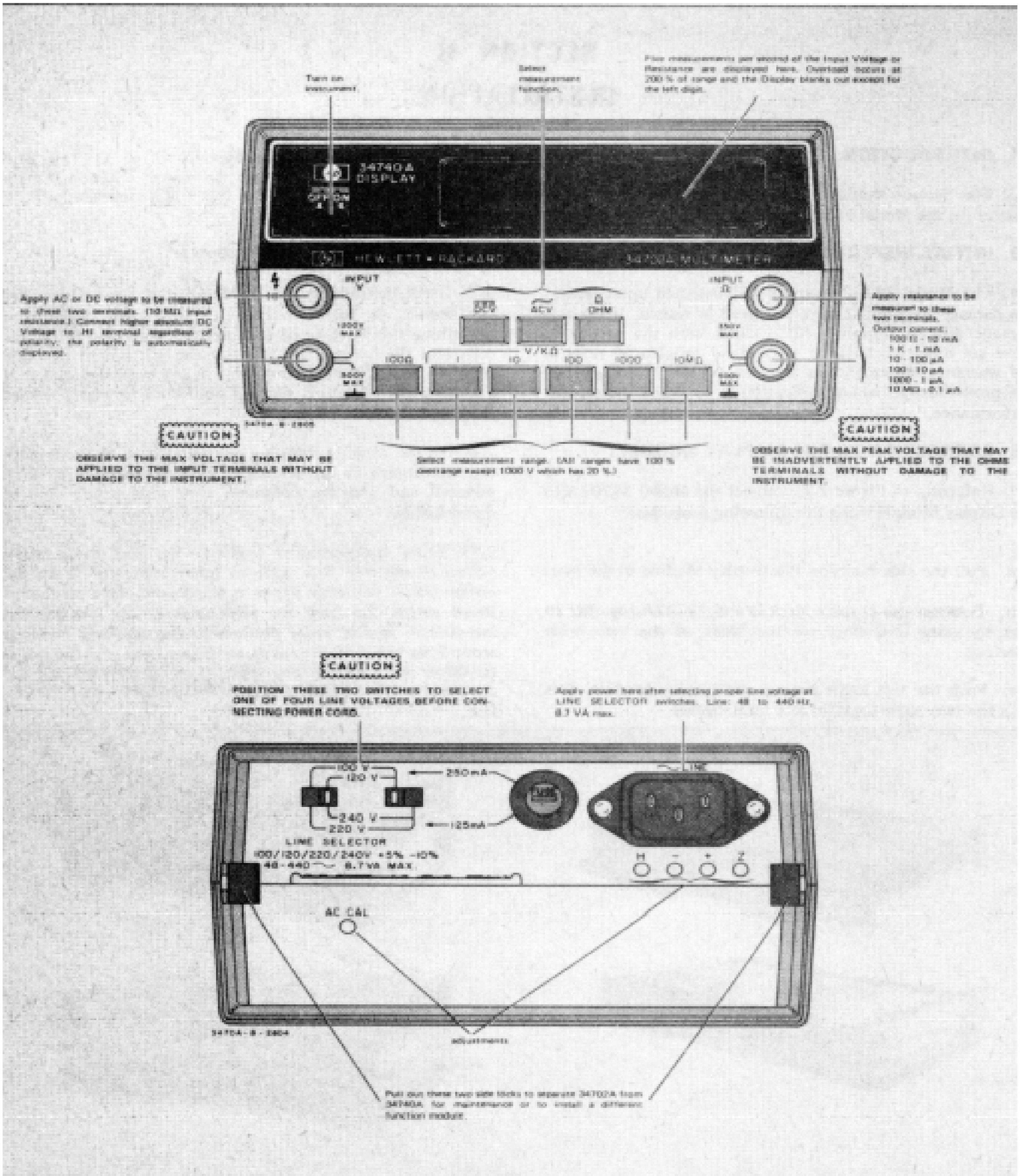


Figure 3-1. Front and Rear Panel Features.

SECTION III

OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains instructions and information which will assist you in proper operation of the Model 34702A Multimeter Module. A Model 34740A or 34750A Display Module is required to operate the Model 34702A. Included in this section is identification of controls, indicators and connectors; operating procedures; and BCD output code information (for use in conjunction with the 34721B BCD Module).

3-3. PANEL FEATURES.

3-4. The panel features of the instrument are described in Figure 3-1.

3-5. FRONT PANEL OPERATION.

3-6. There are two manual controls; the function switch and the range switch (See Figure 3-1). Each range, except the 1000V range, has 100% overranging capability; e.g. using a four digit display module 1.9999 V can be measured on the I V range. The display blanks at 200% of range, indicating an overload.

CAUTION

Overload protection circuits allow up to 1200 V peak to be applied to the INPUT V terminals without damaging the instrument. Up to 350 V can be applied to the INPUT Ω terminals without damaging the instrument. No more than 500 V should be applied between LO and Chassis (Grnd.). Do not apply voltage between LO and Chassis when using the 34721A or 34721B BCD Module. These modules connect LO to Chassis when attached to the Model 34702A.

3-7. DC Voltage Measurement.

3-8. Set the Function switch to DCV, select the required voltage range, and apply the voltage to be measured to the INPUT V terminals.

3-9. AC Voltage Measurement.

3-10. Set the function switch to ACV, select the required voltage range, and apply the voltage to be measured to the INPUT V terminals.

3-11. Resistance Measurement.

3-12. Set the function switch to Ω (92), select the required resistance range, and connect the device to be measured to the INPUT Ω terminals.

3-13. 34721B/5055A OUTPUT CODES.

3-14. Output codes obtained from a 34721B BCD Module when used in conjunction with the Model 34702A and a display module are listed in Table 3-1. Refer to the 34721B Operating and Service Manual for further information regarding the BCD Module
.

Table 3-1. 34721B5055A Output Codes

Number Printed	Polarity Overload Column 9	Range Column 8		Function Column 7	Overrange Column 6	Digits Columns 1 through 5
		k Ω	Volts			
0				DCV	underrange	O
1	+	10000		ACV	overrange	1
2		1000	1000	k Ω		2
3		100	100			3
4		10	10			4
5		1	1			5
6		.1	.1			6
7						7
8						8
9						9

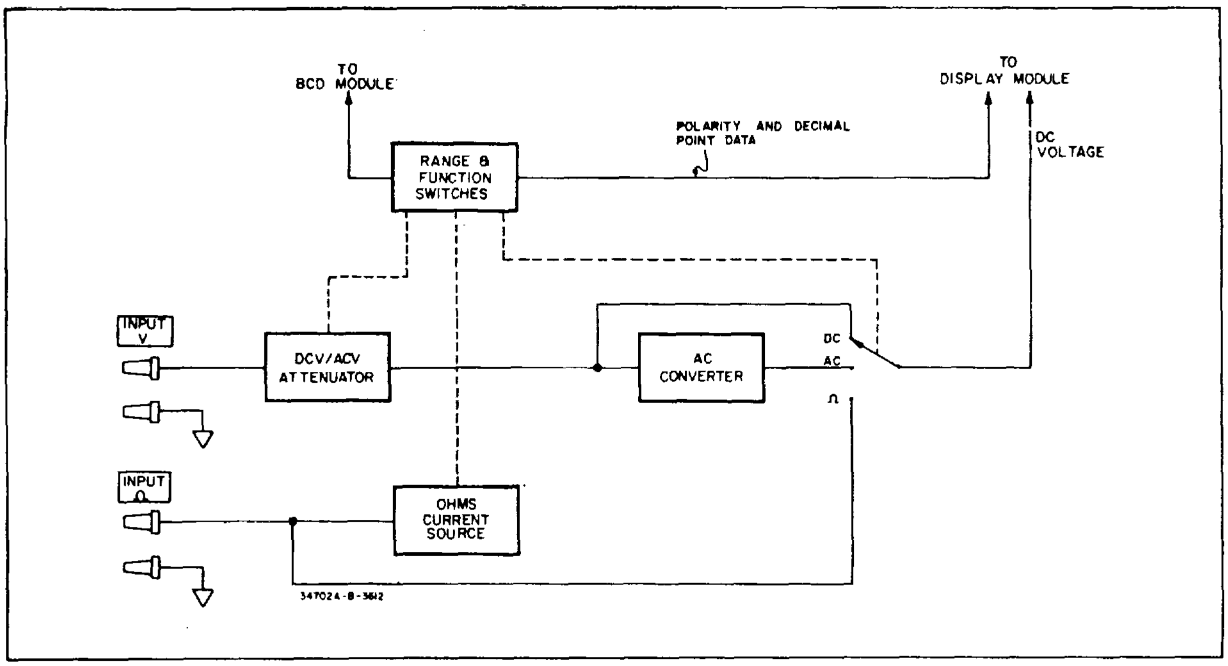


Figure 4-1. Block Diagram.

SECTION IV

THEORY OF OPERATION

4-1. **INTRODUCTION**.

4-2. This section contains a description of the Model 34702 Multimeter in simplified form followed by a more detailed functional description. A detailed circuit schematic is shown in Figure 7-3.

4-3. BLOCK DIAGRAM DESCRIPTION.

4-4. The circuits of the Model 34702A can be divided into four major blocks shown in Figure 4-1.

4-5. ACV And DCV Attenuator.

4-6. The ACV/DCV Attenuator reduces the level of the signal applied to the input so that it can be measured by the 34740A or 34750A Display Module. The signal can be attenuated by a factor of I, 10, 100 or 1000.

4-7. Current Source.

4-8. Resistance measurements are made by passing a known current through the resistor being measured and then measuring the voltage developed across the resistor. The current source supplies five different currents used by the six available ohmmeter ranges. Resistance of an unknown is measured by connecting it across the Ω terminals and selecting Ω function.

4-9-. Range/Function Switches

4-10. Range and Function switching is accomplished by manual selection. Data from the Range and Function switches is supplied to the Display Module, and to the BCD Module when it is connected.

4-11. AC Converter.

4-12. The AC Converter accepts ac voltage from the attenuator and changes it to a dc voltage proportional to the level of the applied signal.

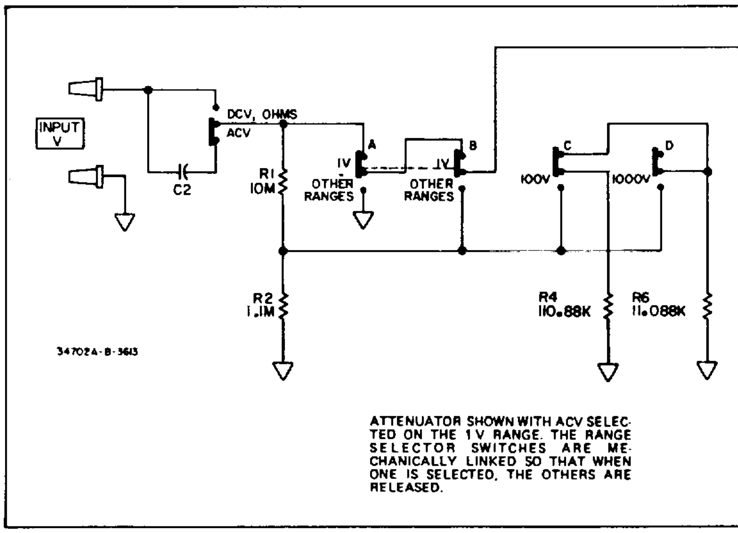
4-13. DETAILED THEORY OF OPERATION.

4-14 ACV/DCV Attenuator.

4-15. Figure 4-2 shows the ACV/DCV Attenuator with its AC and DC voltage accuracy adjustments deleted. Resistors R3, R5, and R7, shown in Figure 7.3 are dc adjustments. Capacitors C3 through Cl 1, also shown in Figure 7-j provide ac compensation for the attenuator.

4-16. Ω Converter.

4-17. Current Source. A simplified diagram of the Ωmeter current source is shown in Figure 4-3a. Zener diode CRI6 is the voltage reference for the current source.



Range Selection Table

Range Selected	A & B	C	D
1 V	up	up	up
10 V	down	up	up
100 V	down	down	up
1000 V	down	up	down

Figure 4-2. ACV/DCV Attenuator.

Amplifier A is connected in a non-inverting configuration and R_b is adjusted such that 1 V (.1 V for the 10MIO range) is developed across R_a and R_b. Amplifier B has its + input connected to a stable dc voltage of -6.2 V. The - input is connected to the output of Amplifier A through the range reference resistors R52 - R56. The I V across R_a and R_b causes the output of Amplifier B to become more positive. This allows the current through Qx to vary such that the - input of Amplifier B becomes approximately -6.2 V. The input current to Amplifier B is very small. Consequently the current that flows through the range reference resistors is the same as the current supplied by the source of Qx. The drain current of Qx is almost identical to its source current because the gate current is extremely small. The drain current flows through Rx and develops a dc voltage which is applied to the Display Module input. The output current, I_x, is changed for different resistance ranges by changing the value of R_a. On the 10 M Ω range

Switch Sb is in the 10 M Ω position which reduces the voltage between points 4 and 5 to .1 V.

4-18. Ohms Protection Circuit. The actual circuit represented by Q_x in Figure 4-3a is shown in Figure 4-3b. The ohmmeter circuits are protected for voltages applied to the "Ω (f')" input up to 350 V peak. Large negative voltages are blocked by CR12. Large positive voltages are blocked by the high collector to base breakdown voltages of Q13 and Q14. CR13 conducts for positive voltages greater than approximately 2 V, causing CR14 to conduct.

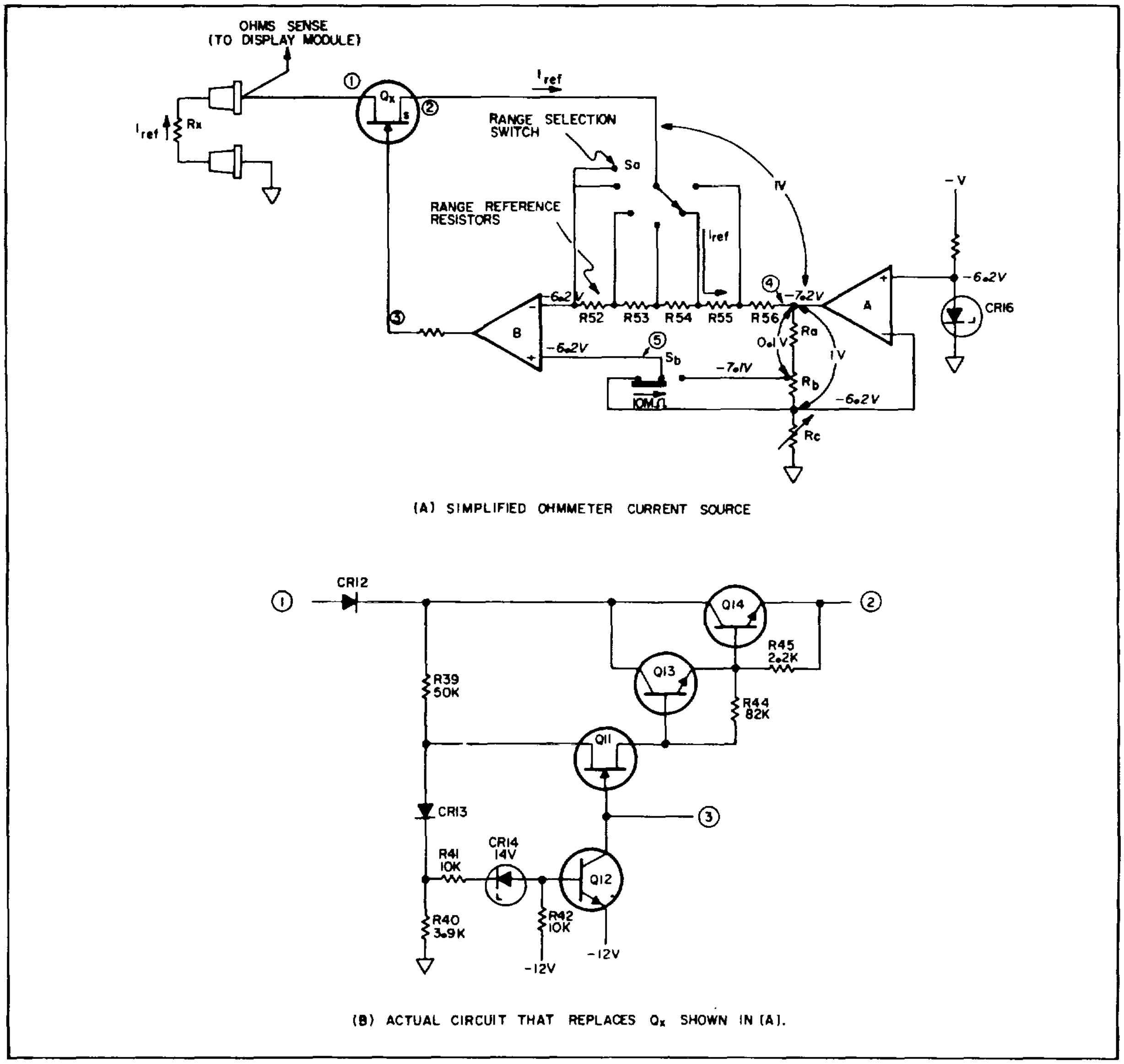


Figure 4-3. Ohms Converter.

turning on Q12. This places - 12 V at the collector of Q12 which turns off transistors QI 1, Q13, and Q14.

419. AC Measuring Circuits.

420. A simplified diagram of the circuits used to measure ac voltage is shown in Figure 4-4.

The attenuation of the input signal by the Attenuator for the four ac voltage ranges is:

Range	Attenuation Factor
1V	X 1
1OV	X 0.1
100V	X 0.01
1000V	X 0.001

The output voltage of the attenuator is buffered by the Impedance Converter. The voltage gain of the Impedance Converter is adjustable and is approximately one. Its input impedance is very high to minimize loading of the Attenuator and its output resistance is low to drive the Converter Amplifier. The AC Converter yields a dc output voltage that is proportional to the average value of the negative half-wave rectified input signal. The resulting voltage is filtered and measured by the Display Module.

4-21. Impedance Converter. A simplified diagram of the Impedance Converter is shown in Figure 4-5. The input transistor Q1 is a source follower. Transistors Q2 and Q3 constitute an amplifier that provides bias current to Q1 and a high input resistance (load resistance) for Q1. A positive going voltage at point 1 causes the voltage at point 2 to increase. This increased voltage at point 2 increases the

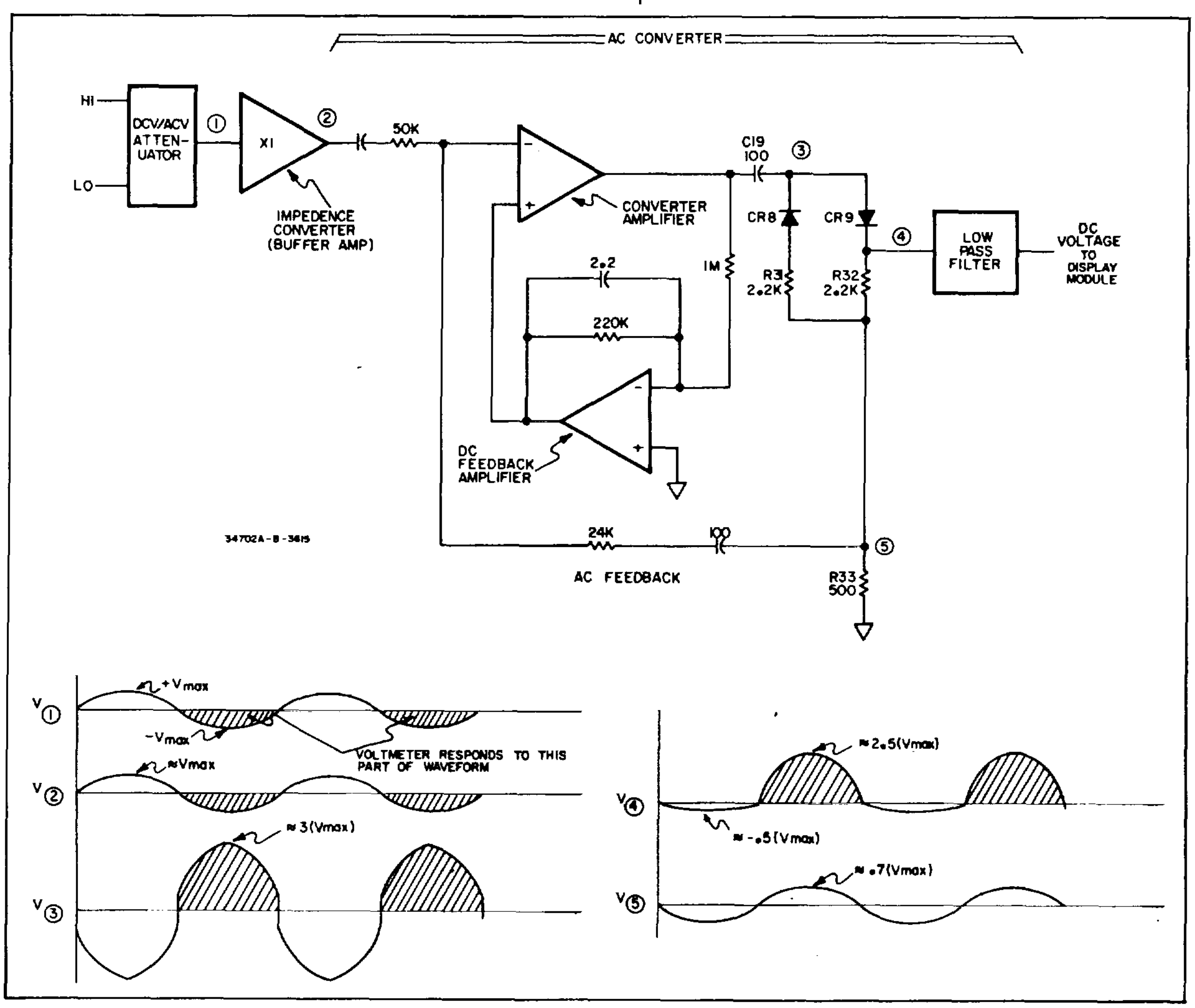


Figure 4-4. Ac/DC Converter.

current through Q2. The increased current causes the voltage at point 4 to increase. Since Q3 is an emitter follower, point 3 will also increase and follow very closely the voltage at point 2. Since the output voltage is taken at the emitter of Q3, RI3 may be increased to make the gain of the amplifier greater than unity.

4-22. **AC Converter**. Refer to Figure 4-4 for the following discussion. Overall ac feedback is supplied from point 5 back to the inverting input. The voltage at point 5 is similar in shape to the voltage at point 2, inverted and about one-half the amplitude. Current for the negative half of the waveform at point 5 flows through CR8, R31 and R33. Current for the positive half of this waveform flows through CR9, R32 and R33. The output voltage is taken at the cathode of CR9, filtered by the Low Pass Filter and measured by the Display Module. The DC Feedback Amplifier provides a low frequency feedback path around the Converter Amplifier to keep the Converter Amplifier biased properly.

Model 34702A

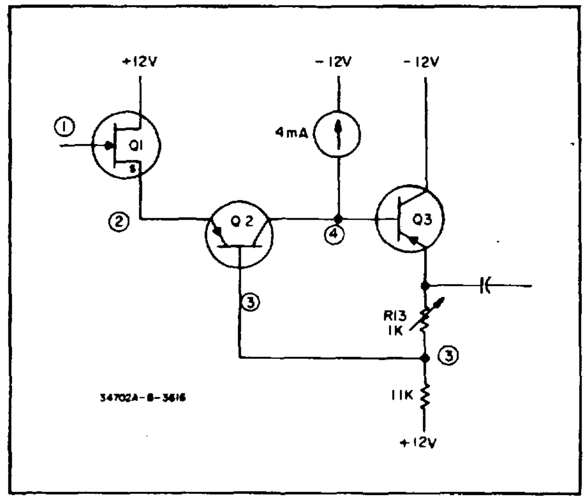


Figure 4-5. Impedance Converter.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

SECTION V.

MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains information necessary for maintenance of the -hp- Model 34702A Multimeter. Included are Performance Tests and Adjustment Procedures for the 30 day, 90 day, 6 month, and I year intervals referred to in Table 1-1. To determine the optimum calibration interval for your instrument, refer to MIL Specification MILC-45662A. If, after completing the Performance Checks, you find that the instrument does not meet its required specifications, refer to the Adjustment Procedure (Paragraph 5-16). Attempt to readjust the instrument to bring it into specification. If, after adjusting the instrument, it is still out of specification, refer to troubleshooting in Section VII.

5-3. RECOMMENDED TEST EQUIPMENT.

5-4. The test equipment that is recommended for maintaining the Model 34702A is listed in Table 5-1. If the recommended model is not available, use equipment that has specifications equal to or better than those listed.

Table 5-1. Recommended Test Equipment.

Instrument Type	Required Characteristics	Recommended Model
AC Calibrator	1 V, 10 V, 100 V 1000 V, 45 Hz to 100 kHz Accuracy: ±0.04% of setting (45 Hz to 20 kHz) ± 0.15% of setting (100 kHz)	-hp- Model 745A/746A
100 Ω, 1KΩ 10KΩ, 100KΩ 1MΩ, 10MΩ standard resistors	Accuracy: ±0.01%	General Radio Model GR 1433-Z Decade Resistor
DC Standard	1 V, 10 V, 100 V, 1000 V Ranges Accuracy: ±0.008%	-hp- 740B
Electronic Counter	Capable of measuring the period of 50 Hz or 60 Hz to within ± .01%	-hp- Model 5300A/ 5302A

5-5. PERFORMANCE TESTS.

5-6. The following tests verify that the Model 34702A is operating properly and meets the specifications listed in Table 1-1 of this manual. These tests should be completed before any attempt is made to adjust the instrument.

5-7. A Performance Test Record is provided at the end of this section for recording the results of the Performance Tests.

5-8. All of the following tests have been written to include the use of either a 34740A or 34750A Display Module.

5-9. DC Accuracy Test (DCV Function).

DESCRIPTION:
This test verifies the ability of the Model 34702A to measure dc voltage accurately within the specification limits.
SPECIFICATION.
34740A
Accuracy (+ 23^{o} C ± 5^{o} C), ≤ 95% RH):

30 days	± (0.03% of reading + .01% of range)
90 days	± (0.04% of reading + .01% of range)
6 mo.	± (0.05% of reading + .02% of range)
1 yr	.± (0.06% of reading + .02% of range)

34750A

Accuracy (+ 23^{o}C ± 5^{o}C), ≤95% RH):

30 days	±(0.025% of reading + .005% of range)
90 days	±(0.035% of reading + .005% of range)
6 mo.	±(0.045% of reading + .007% of range)
1 yr.	±(0.06% of reading + .01% of range)

RECOMMENDED TEST EQUIPMENT:

DC Standard, -hp- Model 740B

TEST PROCEDURE:

a. Select the DCV function of the Model 34702A and connect a dc standard (-hp- Model 740B or equivalent) to the 34702A INPUT V terminals.

b. Check dc accuracy for both polarities of input according to Table 5-2. Apply short to 34702A input to check 0 V reading on all ranges.

NOTE

With 1000 V applied only the positive polarity is checked due to the possibility of arcing within the Model 740B.

Table 5-2. DC Accuracy.

DC Standard	34702A Range	34740A Display			
		30 Day	90 Day	6 Months	1 Year
0 V	1 V	- .0001 to + .0001	- .0001 to + .0001	- .0002 to + .0002	- .0002 to + .0002
± 1 V	1 V	± .9996 to ± 1.0004	± .9995 to ± 1 0005	± .9993 to ± 1.0007	± .9992 to ± 1.0008
± 1.9 V	1 V	± 1.8993 to ± 1.9007	± 1.8991 to ± 1.9009	± 1.8989 to ± 1.9012	± 1.8987 to ± 1.9013
± 1.998 V	1 V	± 1.9973 to ± 1.9987	± 1.9971 to ± 1.9989	± 1.9968 to ± 1.9962	± 1.9965 to ± 1.9995
0 V	10 V	- 0.001 to + 0.001	- 0.001 to + 0.001	- 0.002 to + 0.002	- 0.002 to + 0.002
± 10 V	10 V	± 9.996 to ± 10.004	± 9.995 to ± 10.005	± 9.993 to ± 10.007	± 9.992 to ± 10.008
± 19 V	10 V	± 18.993 to ± 19.007	± 18.991 to ± 19.009	± 18.989 to ± 19.012	± 18.987 to ± 19.013
0 V	100 V	- 00.01 to + 00.01	- 00.01 to + 00.01	- 00.02 to + 00.02	- 00.02 to + 00.02
± 100 V	100 V	±99.96 to ± 100.04	± 99.95 to ± 100.05	± 99.93 to ± 100 07	± 99.92 to ± 100.08
± 190 V	100 V	± 189.93 to ± 190.07	± 189.91 to ± 190.09	± 189.89 to ± 190.12	± 189.87 to ± 190.13
0 V	1000 V	- 000.1 to + 000.1	- 000.1 to + 000.1	- 000.2 to + 000.2	- 000.2 to + 000.2
+ 1000 V	1000 V	+ 999.6 to + 1000.4	+ 999.5 to + 1000.5	+ 999.3 to + 1000.7	+ 999.2 to + 1000.8

DC Standard	34702A Range	34750A Display			
		30 Day	90 Day	6 Months	1 Year
0 V	1 V	- .00004 to + .00004	- .00005 to + .00005	- .00007 to + .00007	- .00010 to + .00010
± 1 V	1 V	± .99971 to ± 1.00029	± .99960 to ± 1.00040	± .99948 to ± 1.00052	± .99930 to ± 1.00070
± 1.9 V	1 V	± 1.89948 to ± 1.90052	± 1.89929 to ± 1.90072	± 1.89908 to ± 1.90093	± 1.89876 to ± 1.90124
± 1.998 V	1 V	± 1.99746 to ± 1.99854	± 1.99725 to ± 1.99875	± 1.99703 to ± 1.99897	± 1.99660 to ± 1.99940
0 V	10 V	- 0.0004 to + 0.0004	- 0.0005 to + 0.0005	- 0.0007 to + 0.0007	- 0.0010 to + 0.0010
± 10 V	10 V	± 9.9971 to ± 10.0029	± 9.9960 to ± 10.0040	± 9.9948 to ± 10 0052	± 9.9939 to ± 10.0070
± 19 V	10 V	± 18.9948 to ± 19.0052	± 18.9929 to ± 19.0072	± 18.9903 to ± 19.0093	± 18.9876 to ± 19.0124
0 V	100 V	- 00.004 to + 00.004	- 00.005 to + 00.005	- 00.007 to + 00.007	- 00.010 to + 00.010
± 100 V	100 V	± 99.971 to ± 100.029	± 99.960 to ± 100.040	± 99.948 to ± 100.052	± 99.930 to ± 100.070
± 190 V	100 V	± 189.948 to ± 190.052	± 189.929 to ± 190.072	± 189.908 to ± 190.093	± 189.876 to ± 190.124
0 V	1000 V	- 000.04 to + 000.04	- 000.05 to + 000.05	- 000.07 to + 000.07	- 000.10 to + 000.10
+ 1000 V	1000 V	+ 999.71 to + 1000.29	+ 999.60 to + 1000.40	+ 999.48 to + 1000.52	± 999.30 to ± 1000.70

5-10. Input Impedance Test (DCV and ACV Function).

DESCRIPTION:

Input impedance affects the ability of a voltmeter to accurately measure a given voltage because of loading effects caused by the impedance Normally, it is desirable to achieve as high an input impedance as possible. This check ensures that the input Impedance of the Model 34702A meets the specifications listed below.

SPECIFIC ATION:

Input Resistance

1 and 10 V ranges:	11.11 MΩ ± 0.2% ≤80 pF
100 V range:	10.1 MΩ ± 0.2% ≤80 pF
1000 V range:	10 MΩ ± 0.2% < 80 pF

RECOMMENDED TEST EQUIPMENT:

AC Calibrator, -hp- Model 745A
DC Standard, -hp- Model 740B
Resistance Decade, GR Model 1433-Z

TEST PROCEDURE:

a. Connect the equipment as shown ill Figure 5-1. The Model 34702A should be set to DCV on the 1 V range.

b. Set the resistance decade to 10 MΩ and then shunt it with a jumper lead. Set the DC standard for + 1.0000 V (34740A Display) or + 1.00000 V (34750A Display) as observed on the Display Module.

c. Remove the jumper lead and again observe the display. It should read between .5258V and .5268V (34740A) or between .52582 and .52681 (34750A).

NOTE

The 34702A is not checked on the 10 V range since the input circuit is equivalent for both the 1 V and the 10 V ranges.

d. Set the Model 34702A to the 100 V range and short the resistance box with a jumper lead.

e. Set the dc standard for + 100.00 V (34740A) or + 100.000 V (34750A) as observed on the Display Module.

WARNING

Use extreme caution when removing or replacing the jumper in Steps f, g and i to avoid electrical shock when performing the input impedance test on the 100 V' and 1000 V ranges.

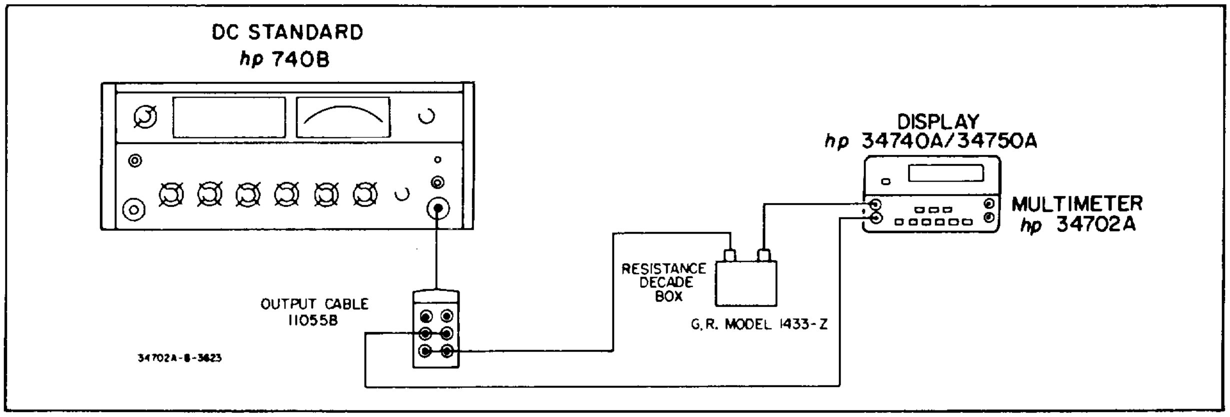


Figure 5-1. Input Impedence Test.

f. Turn the dc standard OUTPUT to OFF. Remove the jumper from the resistance box. Set dc standard OUTPUT to ON and again observe the display. It should read 50.20 to 50.30 (34740A) or 50.201 to 50.301 (34750A).

g. Turn the dc standard OUTPUT to OFF. Set the Model 34702A to the 1000 V range and short the resistance box with a jumper lead.

h. Turn the dc standard OUTPUT to ON. Set the dc standard for + 1000.0 V (34740A) or + 1000.00 V (34750A) as observed on the Display Module.

i. Turn the dc standard OUTPUT to OFF. Remove the jumper from the resistance box. Turn the dc standard OUTPUT to ON and again observe the display. It should read 499.7 to 500.7 (34740A) or 499.75 to 500.75 (34750A).

j. Set the dc standard OUTPUT to zero. Replace dc standard with the ac standard.

k. Set the Model 34702A to the 1 V range. Replace the resistance box with a 100 κΩ resistor (-hp- Part Number 0757-0465). Connect one end of the resistor directly to the HI terminal. Set the ac standard frequency to I kHz. Adjust the ac standard amplitude for + 1.0000 V i 1 count(34740A) or + 1.00000 V + 1 count (34750A) as observed on the Display Module.

l. Change the ac standard frequency to 20 kHz. The 34702A display should indicate >.7059 (34740A) or> .70594 (34750A). This verifies the 34702A input capacity specification.

5-1. DC Effective Common Mode Rejection.

DESCRIPTION:

Effective Common Mode Rejection (ECMR) is a measure of the effect of a common mode source on the measured value or readout of the instrument with a 1kohm unbalance. Typically ECMR is measured in decibels (dB) and can be calculated by the following formula:

$$\text{ECMR (dB)} = 20\log_{10}\left(\frac{\text{Common Mode Voltage Applied}}{\text{Change in Display Indication}}\right)$$

SPECIFICATION
:
Effective Common Mode Rejection (I κΩ unbalance): > 80 dB.

RECOMMENDED TEST EQUIPMENT:
DC Standard, -hp- Model 740B
Resistor, I κΩ t 1% (resistance decade may be used for this)

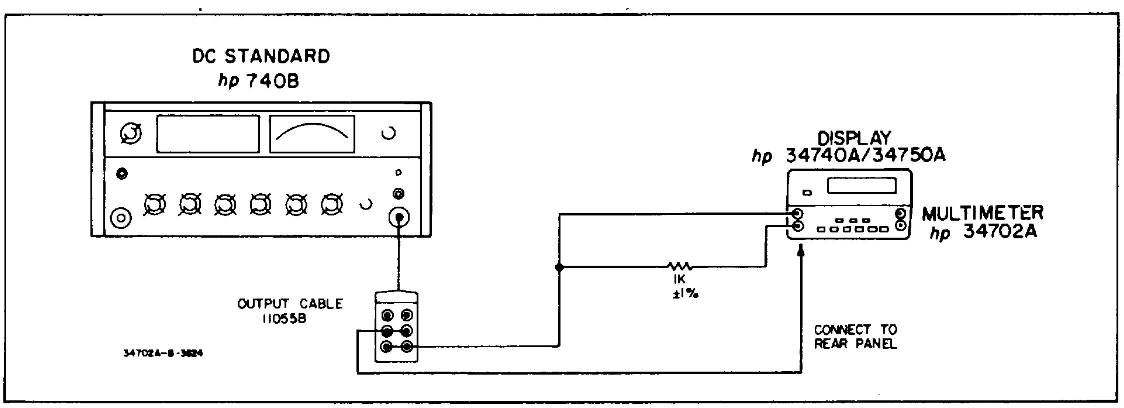


Figure 5-2. Effective Common Mode Rejection

TEST PROCEDURE

a. Disconnect all previous connections to the Model 34702A input and connect the equipment as shown in Figure 5-2. Set the dc standard for a +10 V output. Set the 34702A to the I V range.

b. Observe the voltmeter display. It should read less than 10 counts (34740A Display) or 100 counts (34750A Display). This verifies an effective common mode rejection at dc of > 80 dB.

5-12. Normal Mode Rejection.

DESCRIPTION:
Normal Mode Rejection (NMR) is a measure of the ability of the Model 34702A to reject ac signals applied to the INPUT V terminals while the instrument is operating in DCV function. NMR is measured in decibels (dB) and can be calculated by the following formula:

$$\text{NMR (dB)} = 20\log_{10}\left(\frac{\text{Peak Normal Mode Voltage}}{\text{Peak Display Indication}}\right)$$

SPECIFICATION:
Normal Mode Rejection: Greater than 60 dB (at 50 Hz t 0.1%or 60 Hz ± 0.1%).

RECOMMENDED TEST EQUIPMENT:

AC Calibrator, -hp- Model 745A
Electronic Counter, -hp- Model 5300A/5302A

TEST PROCEDURE:

a. Disconnect all previous connections to the 34702A input and connect the equipment as shown in Figure 5-3. Set the Model 34702A to DCV and the 1 V range.

b. Adjust the ac calibrator output for .707 V rms (1V peak).

c. Set the counter controls to measure period and adjust the ac calibrator frequency for a counter indication between 16.650 ms and 16.683 ms (19.980 ms to 20.020 ms for Option 050). The Display Module should read <10 counts (34740A Display) or <100 counts (34750A Display).

5-13. AC Accuracy.

DESCRIPTION:
This test verifies the ability of the Model 34702A to measure ac voltage accurately to within the specification tolerances.

SPECIFICATION:
34740A

Accuracy (+ 23°C ± 5°C, <95% RH)'

30 days		
	45 Hz to 20 kHz	±(0.25% of reading + .05% of range)
	20 kHz to 100 kHz	±(0.7*5%* of reading + .05% of range)
90 days		
	45 Hz to 20 kHz	±(0.30°c of reading + .05% of range)
	20 kHz to 100 kHz	±(0.80% of reading + .05% of range)
6 mo.		
	45 Hz to 20 kHz	±(0.35% of reading + .05% of range)
	20 kHz to 100 kHz	±(0.85% of reading + .05% of range)
I yr.		
	45 Hz to 20 kHz	±(0.50% of reading + 0.05% of range)
	20 kHz to 100 kHz	±(1.0% of reading + 0.05% of range)

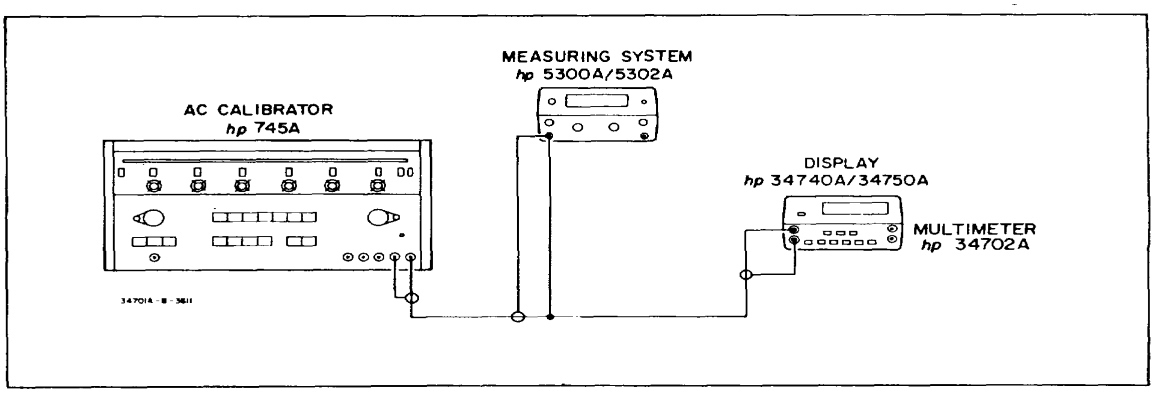


Figure 5-3. Normal Mode Rejection.

34750A

Accuracy (+ 23°C ± 5°C, ≤ 95% RH):

30 days
- 45 Hz to 20 kHz ±(0.25% of reading + .05% of range)
- 20 kHz to 100 kHz ±(.75% of reading + .05% of range)

90 days
- 45 Hz to 20 kHz ±(.3% of reading + .05% of range)
- 20 kHz to 100 kHz ±(.8% of reading + .05% of range)

6 mo.
- 45 Hz to 20 kHz ±(.35% of reading + .05% of range)
- 20 kHz to 100 kHz ±(.85% of reading + .05% of range)

1 yr.
- 45 Hz to 20 kHz ±(0.50% of reading + 0.05% of range)
- 20 kHz to 100 kHz ±(1.0% of reading + 0.05% of range)

RECOMMENDED TEST EQUIPMENT:

AC Calibrator/High Voltage Amplifier, -hp- Model 745A/746A or equivalent.

TEST PROCEDURE:

a. Set the Model 34702A function switch to ACV and select the I V range. Apply short to 34702A input and check 0 V reading on all ranges.

b. Using an ac calibrator and a high voltage amplifier (-hp- Model *745A/746A* recommended), check the accuracy of the Model 34702A for inputs other than 0 V at 45 Hz and 20 kHz using Table 5-3(a). Also check the accuracy for these inputs at 100 kHz using Table 5-3(b). All readings should be within the limits specified by the tables.

514. Response Time.

DESCRIPTION:

This test verifies the ability of the Model 34702A to respond quickly to changes in input voltage.

SPECIFICATION:

34740A

Response time: < 2 s to within ± 0.3% of final value or 20 counts, whichever is greater.

Table 5-3. (a). AC Accuracy (45Hz and 20 kHz).

AC Standard	34702A Range	34740A Display			
		30 Day	90 Day	6 Months	1 Year
0 V	1 V	.0005	.0005	.0005	.0005
1 V	1 V	.9970 to 1.0030	.9965 to 1.0035	.9960 to 1.0040	.9945 to 1.0055
1.9 V	1 V	1.8948 to 1.9053	1.8938 to 1.9062	1.8929 to 1.9072	1.8900 to 1.9100
1.990 V	1 V	1.9845 to 1.9955	1.9835 to 1.9965	1.9825 to 1.9975	———
0 V	10 V	0.005	0.005	0.005	0.005
10 V	10 V	9.970 to 10.030	9.965 to 10.035	9.960 to 10.040	9.945 to 10.055
19 V	10 V	18.948 to 19.053	18.938 to 19.062	18.929 to 19.072	18.900 to 19.100
0 V	100 V	00.05	00.05	00.05	00.05
100 V	100 V	99.70 to 100.30	99.65 to 100.35	99.60 to 100.40	99.45 to 100.55
190 V	100 V	189.48 to 190.53	189.38 to 190.62	189.29 to 190.72	189.00 to 191.00
0 V	1000 V	000.5	000.5	000.5	000.5
1000 V	1000 V	997.0 to 1003.0	996.5 to 1003.5	996.0 to 1004.0	994.5 to 1005.5

AC Standard	34702A Range	34750A Display			
		30 Day	90 Day	6 Months	1 Year
0 V	1 V	.00040	.00050	.00050	.00050
1 V	1 V	.99710 to 1.00290	.99650 to 1.00350	.99600 to 1.00400	.99550 to 1.00550
1.9 V	1 V	1.89485 to 1.90515	1.89380 1.90620	1.89285 to 1.90715	1.89000 to 1.91000
1.990 V	1 V	1.98463 to 1.99538	1.98353 to 1.99647	1.98254 to 1.99747	———
0 V	10 V	0.0040	0.0050	0.0050	0.0050
10 V	10 V	9.9710 to 10.0290	9.9650 to 10.0350	9.9600 to 10.0400	9.9550 to 10.0550
19 V	10 V	18.9485 to 19.0515	18.9380 to 19.0620	18.9285 to 19.0715	18.9000 to 19.1000
0 V	100 V	00.040	00.050	00.050	00.050
100 V	100 V	99.710 to 100.290	99.650 to 100.350	99.600 to 100.400	99.550 to 100.550
190 V	100 V	189.485 to 190.515	189.380 to 190.620	189.285 to 190.715	189.000 to 191.000
0 V	1000 V	000.40	000.50	000.50	000.50
1000 V	1000 V	997.10 to 1002.90	996.50 to 1003.50	996.00 to 1004.00	995.50 to 1005.50

Table 5-3(b). AC Accuracy (100 kHz).

AC Standard	34702A Range	34740A Display				AC Standard	34702A Range	34750A Display			
		30 Day	90 Day	6 Months	1 Year			30 Day	90 Day	6 Months	1 Year
0 V	1 V	.0005	.0005	.0005	.0005	0 V	1 V	.00050	.00050	.00050	.00050
1 V	1 V	.9920 to 1.0080	.9915 to 1.0085	.9910 to 1.0090	.9895 to 1.0105	1 V	1V	.99200 to 1.00800	.99150 to 1.00850	.99100 to 1.00900	.98950 to 1.01050
1.9 V	1 V	1.8853 to 1.9148	1.8839 to 1.9162	1.8829 to 1.9171	1.8801 to 1.9200	1.9 V	1 V	1.88525 to 1.91475	1.88430 to 1.91570	1.88335 to 1.91665	1.88050 to 1.91950
0 V	10 V	0.005	0.005	0.005	0.005	0 V	10 V	0.0050	0.0050	0.0050	0.0050
10 V	10 V	9.920 to 10.080	9.915 to 10.085	9.910 to 10.090	9.895 to 10.105	10 V	10 V	9.9200 to 10.0800	9.9150 to 10.0850	9.9100 to 10.0900	9.8950 to 10.1050
19 V	10 V	18.853 to 19.148	18.839 to 19.016	18.829 to 19.171	18.801 to 19.200	19 V	10 V	18.8525 to 19.1475	18.8430 to 19.1570	18.8335 to 19.1665	18.8050 to 19.1950
0 V	100 V	00.05	00.05	00.05	00.05	0 V	100 V	00.050	00.050	00.050	00.050
100 V	100 V	99.20 to 100.80	99.15 to 100.85	99.10 to 100.90	98.95 to 101.05	100 V	100 V	99.200 to 100.800	99.150 to 100.850	99.100 to 100.900	98.950 to 101.050
190 V	100 V	188.53 to 191.48	188.39 to 190.16	188.29 to 191.71	188.01 to 192.00	190 V	100 V	188.525 to 191.475	188.430 to 191.570	188.335 to 191.665	188.050 to 191.950
0 V	1000 V	000.5	000.5	000.5	000.5	0 V	1000 V	000.50	000.50	000.50	000.50
1000 V	1000 V	992.0 to 1008.0	991.5 to 1008.5	991.0 to 1009.0	989.5 to 1010.5	1000 V	1000 V	992.00 to 1008.00	991.50 to 1008.50	991.00 to 1009.00	989.50 to 1010.50

34750A

Response time: <2 s to within t 0.3% of final value or 200 counts, whichever is greater.
RECOMMENDED TEST EQUIPMENT:

AC Calibrator, -hp- Model 745A or equivalent

TEST PROCEDURE:

a. Set the ac calibrator output to 10 V at I kHz. Set the 34702A to ACV on the 10 V range.

b. Connect the output of the ac calibrator to the 34702A INPUT V terminals while observing the 34740A/34750A Display Module. The display indication should read within 30 counts (34740A) or 300 counts (34750A) of its final value within two seconds after the 34702A is connected to the ac calibrator.

5-15. Ohms Accuracy.

DESCRIPTION:

This test verifies the ability of the Model 34702A to accurately measure resistance to within the limits of the specification given below.
SPECIFICATION:

34740A
Accuracy ($\pm$ 23°C $\pm$ 5°C, $\leq$ 95% RH):

30 days

10 MΩ range	±(0.25% of reading + 0.02% of range)
All other ranges	±(0.05% of reading + 0.02% of range)

90 days

10 MΩ range	±(0.30% of reading + 0.02% of range)
All other ranges	±(0.06% of reading + 0.02% of range)

6 mo.

10 MΩ range	±(0.35% of reading + 0.03% of range)
All other ranges	±(0.07% of reading + 0.03% of range)

1 yr.

10 MΩ range	±(0.50% of reading + 0.03% of range)
All other ranges	±(0.1 1% of reading + 0.03% of range)

34750A
Accuracy (+ 23°C + 5°C, $\leq$95% RH):

30 days

10 MΩ range	±(0.25% of reading + 0.015% of range)
All other ranges	±(0.045% of reading + 0.015% of range)

90 days

10 MΩ range	±(0.3% of reading + 0.015% of range)
All other ranges	±(0.055% of reading + 0.015% of range)

6 mo.

10 MΩ range	±(0.35% of reading + 0.02% of range)
All other ranges	±(0.065% of reading + 0.02% of range)

1 yr.

10 MΩ range	±(0.50% of reading + 0.02% of range)
All other ranges	±(0.1 1% of reading + 0.02% of range)

RECOMMENDED TEST EQUIPMENT:

Resistance Decade, GR Model 1433-Z or equivalent.

NOTE

Due to temperature change inside the instrument between line and battery operation, the voltage references in the Display Module must be adjusted when changing modes to achieve these specifications.

TEST PROCEDURE:

a. Connect a resistance decade with 100 f through MΩ steps to the INPUT i2 terminals of the Model 34702A.

b. Refer to Table 5-4 and check the accuracy of the 34702A on the 100 Ω through 10 MΩ ranges.

Table 5-4. Ohms Accuracy Test.

Resistance Standard	34702A Range	34740A Display 30 Day	34740A Display 90 Day	34740A Display 6 Months	34740A Display 1 Year	DC Standard	34702A Range	34750A Display 30 Day	34750A Display 90 Day	34750A Display 6 Months	34750A Display 1 Year
0 Ω	100 Ω	00.02	00.02	00.03	00.03	0 Ω	100 Ω	00.015	00.015	00.020	00.020
100 Ω	100 Ω	99.93 to 100.07	99.92 to 100.08	99.90 to 100.10	99.86 to 100.14	100 Ω	100 Ω	99.940 to 100.060	99.930 to 100.070	99.915 to 100.085	99.870 to 100.130
190 Ω	100 Ω	189.89 to 190.12	189.87 to 190.13	189.84 to 190.16	189.76 to 190.24	190 Ω	100 Ω	189.900 to 190.101	189.881 to 190.120	189.877 to 190.124	189.771 to 190.229
0 Ω	1 kΩ	.0002	.0002	.0003	.0003	0 Ω	1 kΩ	.00015	.00015	.00020	.00020
1000 Ω	1 kΩ	.9993 to 1.0007	.9992 to 1.0008	.9990 to 1.0010	.9986 to 1.0014	1000 Ω	1 kΩ	.99940 to 1.00060	.99930 to 1.00070	.99915 to 1.00085	.99870 to 1.00130
1900 Ω	1 kΩ	1.8989 to 1.9012	1.8987 to 1.9013	1.8984 to 1.9016	1.8976 to 1.9024	1900 Ω	1 kΩ	1.89900 to 1.90101	1.89881 to 1.90120	1.89877 to 1.90124	1.89771 to 1.90229
1990 Ω	1 kΩ	1.9888 to 1.9912	1.9886 to 1.9914	1.9883 to 1.9917	1.9875 to 1.9925	1990 Ω	1 kΩ	1.98895 to 1.99105	1.98891 to 1.99109	1.98871 to 1.99129	1.98761 to 1.99239
0 Ω	10 kΩ	0.002	0.002	0.003	0.003	0 Ω	10 kΩ	0.0015	0.0015	0.0020	0.0020
10 kΩ	10 kΩ	9.993 to 10.007	9.992 to 10.008	9.990 to 10.010	9.986 to 10.014	10 kΩ	10 kΩ	9.9940 to 10.0060	9.9930 to 10.0070	9.9915 to 10.0085	9.9870 to 10.0130
19 kΩ	10 kΩ	18.989 to 19.012	18.987 to 19.013	18.984 to 19.016	18.976 to 19.024	19 kΩ	10 kΩ	18.9900 to 19.0101	18.9881 to 19.0120	18.9877 to 19.0124	18.9771 to 19.0229
0 Ω	100 kΩ	00.02	00.02	00.03	00.03	0 Ω	100 kΩ	00.015	00.015	00.020	00.020
100 kΩ	100 kΩ	99.93 to 100.07	99.92 to 100.08	99.90 to 100.10	99.86 to 100.14	100 kΩ	100 kΩ	99.940 to 190.060	99.930 to 100.070	99.915 to 100.085	99.870 to 100.130
190 kΩ	100 kΩ	189.89 to 190.12	189.87 to 190.13	189.84 to 190.16	189.76 to 190.24	190 kΩ	100 kΩ	189.900 to 190.101	189.881 to 190.120	189.877 to 190.124	189.771 to 190.229
0 Ω	1000 kΩ	000.2	000.2	000.3	000.3	0 Ω	1000 kΩ	000.15	000.15	000.20	000.20
1 MΩ	1000 kΩ	999.3 to 1000.7	999.2 to 1000.8	999.0 to 1001.0	998.86 to 1001.4	1 MΩ	1000 kΩ	999.40 to 1900.60	999.30 to 1000.70	999.15 to 1000.85	998.70 to 1001.30
1.9 MΩ	1000 kΩ	1898.9 to 1991.2	1898.7 to 1901.3	1898.4 to 1901.6	1897.6 to 1902.4	1.9 MΩ	1000 kΩ	1899.00 to 1901.01	1898.81 to 1901.20	1898.77 to 1901.24	1897.71 to 1902.29
0 Ω	10 MΩ	0.002	0.002	0.003	0.003	0 Ω	10 MΩ	0.0015	0.0015	0.0020	0.0020
10 MΩ	10 MΩ	9.973 to 10.027	9.968 to 10.032	9.961 to 10.038	9.947 to 10.053	10 MΩ	10 MΩ	.99745 to 1.00265	.99685 to 1.00315	.99630 to 1.00370	.99480 to 1.00520

5-16. ADJUSTMENT PROCEDURE.

5-17.The following is a complete adjustment procedure for the Model 34702A.

NOTE

Before proceeding, it should be ascertained that the display module is operating properly and is calibrated.

5-18. Cover Removal.

5-19. Disconnect the power cord. Separate the 34702A from the display module by pulling the two side locks at the back of the instrument rearward and lifting the mainframe from the 34702A. Separate the 34702A main assembly from its cover by spreading apart two sets of plastic fingers, as shown in Figure 5-4, and removing the cover. After removing the cover reconnect the 34702A to the mainframe and attach the power cord.

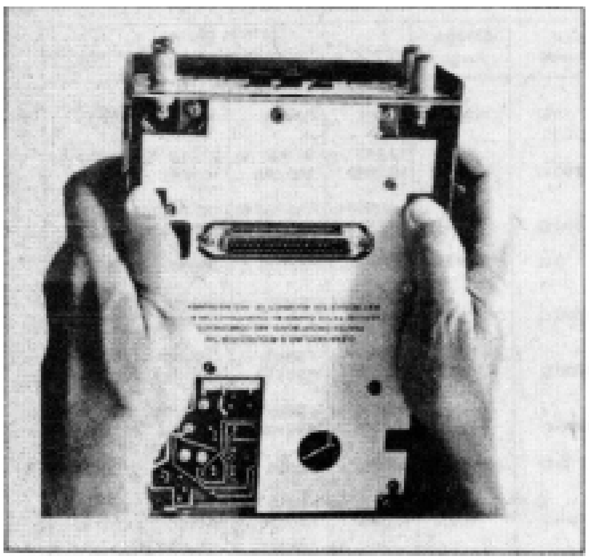


Figure 5-4. Removal From Case

NOTE

It will be necessary to turn the instrument upside down to obtain access to the 34702A adjustments. Figure 5-5 shows the location of all adjustments in the Model 34702A.

5-20. DC Adjustments.

DESCRIPTION:

These adjustments affect dc accuracy of the Model 34702A.

RECOMMENDED TEST EQUIPMENT:

DC Standard, -hp- Model 740B or equivalent

CALIBRATION PROCEDURE:

WARNING

1000 V is used in the following procedure. Contact with this voltage can cause death or serious injury.

a. Select the 10 V range of the 34702A and connect a dc standard to the INPUT V terminals.

b. Set the output of the dc standard to 10 V and adjust 41R3 for a 10.000V readout (34740A), or a 10.0000 V readout (34750A).

c. Select the 100 V range of the 34702A and set the dc standard to 100 V output. Adjust R5 to obtain a 100.00 V readout (34740A) or a 100.000 V readout (34750A).

d. Select the 1000 V range of the 34702A and set the dc standard to 1000 V output. Adjust R7 to give a 1000.OV readout (34740A), or a 1OOO.00V readout 34750A).

5-21. 34702A AC Adjustments

DESCRIPTION:

These adjustments affect ac accuracy of the Model 34702A.

RECOMMENDED TEST EQUIPMENT:
AC Calibrator, -hp- Model 745A
High Voltage Amplifier, -hp- Model 746A
CALIBRATION PROCEDURE:

WARNING

1000 V ac is used in the following procedure Contact with this voltage can cause death or serious injury.

a. Select the ACV function of the Model 34702A and set it to the I V range.

b. Apply I V at 10 kHz from the ac calibrator to the 34702A INPUT V terminals and adjust AIR13 for a 1.0000 V readout (34740A), or a 1.00000 readout (34750A).

c. Select the 1000 V range of the Model 34702A and apply 1000 V from the ac calibrator/high voltage amplifier to the 34702A.

d. Adjust AIC5 (coarse adj.) for a IO0O.OV readout (34740A), or a 1000.00 V readout (34750A).

e. Select the IOV range of the Model 34702A and set the ac calibrator to the 10 V range.

f. Adjust AIC6 for a 10.000 V readout (34740A), or a 10.0000 V readout (34750A).

g. Select the 100 V range of the Model 34702A and set the ac calibrator for 100 V output.

h. Adjust A1C9 for a 100.00 V readout (34740A), or a lO0.000 V readout (34750A).

i. Select the 1000V range of the Model 34702A and apply 1000 V from the ac calibrator/high voltage amplifier.

j. Adjust AICII (fine adj.) for a I000.OV readout (34740A), or a 1000.00 V readout (34750A).

WARNING

To avoid possible electrical shock, turn off the high voltage amplifier before disconnecting it from the Model 34702A.

5-22. 34702A Ohms Adjustments

DESCRIPTION:

These adjustments affect the Ω Accuracy of the Model 34702A.

RECOMMENDED TEST EQUIPMENT:

Decade Resistor, General Radio Model 1433-Z or equivalent.

CALIBRATION PROCEDURE:

a. Connect the resistance decade to the 34702A INPUT Ω terminals using two short lengths of copper wire. Set the resistance decade to 10 κΩ.

b. Select the Ω function of the Model 34702A and set it to the 1OκΩ range. Adjust AIR64 to give a 10.000 kt readout (34740A), or a 10.0000Okf readout (34750A).

c. Set the resistance decade to 10 Mt. Select the 10 MΩ range of the 34702A and turn AIR59 to give a 10.000 MΩ readout (34740A) or a 10.0000 MΩ readout (34750A).

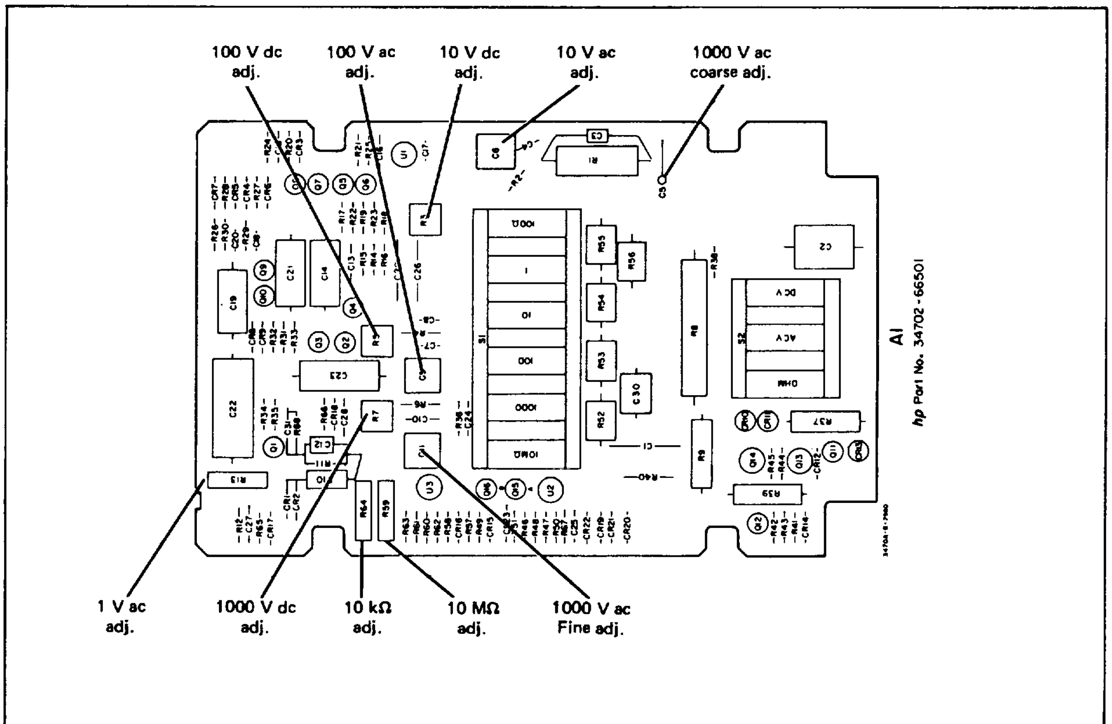


Figure 5-5. Adjustment Locator.

PERFORMANCE TEST CARD

Hewlett-Packard Model 34740A/34702A
Multimeter
Serial Number____________________

Tests Performed By_______________

Date___________________________

Paragraph Number	Test	Results Minimum	Results Actual	Results Maximum
5-9	DC Accuracy (30 Days)			
		.0001		+ .0001
	1 V	± .9996		± 1.0004
	Range	± 1.8993		± 1.9007
		± 1.9973		± 1.9987
		- 0.001		+ 0.001
	10V	± 9.996		± 10.004
	Range	± 18.993		± 19.007
		- 00.01		+ 00.01
	100 V	± 99.96		± 100.04
	Range	± 189.93		± 190.07
	1000 V	- .000.1		+ .0001
	Range	+ 999.6		+ 1.0004
	(90 Days)			
		- .0001		+ .0001
	1 V	± .9995		± 1.0005
	Range	± 1.8991		± 1.9009
		± 1.9971		± 1.9989
		- 0.001		+ 0.001
	10 V	± 9.996		± 10.004
	Range	± 18.993		± 19.007
		- 00.01		± 00.01
	100 V	± 99.96		± 100.04
	Range	± 189.93		± 190.07
	1000 V	- 000.1		+ 000.1
	Range	+ 999.5		+ 1000.5
	(6 months)			
		- .0002		+ .0002
	1 V	+ .9993		± 1.0007
	Range	+ 1.8989		± 1.9012
		+ 1.9968		± 1.9992
		- 0.002		+ 0.002
	10 V	± 9.993		± 10.007
	Range	± 18.989		± 19.012
		- 00.02		+ 00.02
	100 V	± 99.93		± 100.07
	Range	± 189.89		± 190.12
	1000 V	- 000.2		+ 000.2
	Range	+ 999.3		+ 1000.7

Paragraph Number	Test	Results Minimum	Actual	Maximum
5-9 (Cont'd)	(1 Year)			
	1 V Range	- .0002 ± .9992 ± 1.8987 ± 1.9966		+ .0002 ± 1.0008 ± 1.9013 ± 1.9994
	10 V Range	- 0.002 ± 9.992 ± 18.987		+ 0.002 ± 10.008 ± 19.013
	100 V Range	- 00.02 ± 99.92 ± 189.87		+ 00.02 ± 100.08 ± 190.14
	1000 V Range	- 000.2 ± 999.2		+ 000.2 + 1000.8
5-10	Input Impedence 1 V and 10 V Ranges 100 V Range 1000 V Range Capacitance	.5258 50.20 499.7		.5268 50.30 500.7 ≤80 pF
5-11	DC Effective Common Mode Rejection			<10 counts
5-12	Normal Mode Rejection			<10 counts
5-13	AC Accuracy 45 Hz to 20 kHz (30 Days)			
	1 V Range	. 9970 1.8948 1.9845		.0005 1.0030 1.9053 1.9955
	10 V Range	9.970 18.948		0.005 10.030 19.053
	100 V Range	99.70 189.48		00.05 100.30 190.53
	1000 V Range	000.5 997.0		000.5 1003.0
	(90 Days)			
	1 V Range	.9965 1.8938 1.9835		.0005 10.035 1.9062 1.9965
	10 V Range	9.965 18.938		0.005 10.035 19.062
	100 V Range	99.65 189.38		00.05 100.35 190.62

Paragraph Number	Test	Results		
		Minimum	Actual	Maximum
5-13 (Cont'd)	100 V Range	996.5		000.5 1003.5
	(6 Months)			
	1 V Range	.9960 1.8929 1.9825		.0005 1.0040 1.9072 1.9975
	10 V Range	9.960 18.929		0.005 10.040 19.072
	100 V Range	99.60 189.29		00.05 100.40 190.72
	1000 V Range	994.5		000.5 1005.5
	(1 Year)			
	1 V Range	.9945 1.8900		.0005 1.0055 1.9100
	10 V Range	9.945 18.900		0.005 10.055 19.100
	100 V Range	99.45 189.00		00.05 100.55 191.00
	1000 V Range	994.5		000.5 1005.5
	AC Accuracy 100 kHz (30 Days)			
	1 V Range	.9920 1.8853		.0005 1.0080 1.9148
	10 V Range	9.920 18.853		0.005 10.080 19.148
	100 V Range	99.20 188.53		00.05 100.80 191.48
	1000 V Range	992.0		000.5 1008.0
	(90 Days)			
	1 V Range	.9915 1.8839		.0005 1.0085 1.9162

Paragraph Number	Test	Results Minimum	Results Actual	Results Maximum
5-13 (Cont'd)	10 V Range	9.915 18.839	________ ________ ________	0.005 10.085 19.162
	100 V Range	99.15 188.39	________ ________ ________	00.05 100.85 190.16
	1000 V Range	991.5	________ ________	000.5 1008.5
	(6 Months			
	1 V Range	.9910 1.8819	________ ________ ________	.0005 1.0090 1.9171
	10 V Range	9.910 18.829	________ ________ ________	0.005 10.090 19.171
	100 V Range	99.10 188.29	________ ________ ________	00.05 100.90 191.71
	1000 V Range	991.0	________ ________	000.5 1009.0
	(1 Year)			
	1 V Range	.9895 1.8801	________ ________ ________	.0005 1.0105 1.9200
	10 V Range	9.895 18.801	________ ________ ________	0.005 10.105 19.200
	100 V Range	98.95 188.01	________ ________ ________	00.05 101.05 192.00
	1000 V Range	989.5	________ ________	000.5 1010.5
5-14	Response Time		________	≤ 30 counts
5-15	Ω Accuracy (30 Day)			
	100 Ω Range	99.93 189.89	________ ________ ________	00.02 100.07 190.12
	1 κΩ Range	.9993 1.8989 1.9888	________ ________ ________ ________	.0002 1.0007 1.9012 1.9912
	10 κΩ Range	9.993 18.989	________ ________ ________	0.002 10.007 19.912

Paragraph Number	Test	Results Minimum	Results Actual	Results Maximum
5-15 (Cont'd)				00.02
	100 κΩ Range	99.93		100.07
		189.89		199.12
	1000 κΩ Range			000.2
		999.3		1000.7
		1898.9		1991.2
	10 MΩ Range			0.002
		9.973		10.027
	(90 Day)			
	100 Ω Range			00.02
		99.92		100.08
		189.87		190.13
	1 κΩ Range			.0002
		.9992		1.0008
		1.8987		1.9013
		1.9886		1.9914
	10 κΩ Range			0.002
		9.992		10.008
		18.987		19.013
	100 κΩ Range			00.02
		99.92		100.08
		189.87		190.13
	1000 κΩ Range			000.2
		999.2		1000.8
		1898.7		1901.3
	10 MΩ Range			0.002
		9.973		10.027
	(6 Months)			
	100 Ω Range			00.03
		99.90		100.10
		189.84		190.16
	1 κΩ Range			.0003
		.9990		1.0010
		1.8984		1.9016
		1.9883		1.9917
	10 κΩ Range			0.002
		9.990		10.010
		19.883		19.917
	100 κΩ Range			00.03
		99.90		100.10
		198.83		199.17
	1000 κΩ Range			000.3
		999.0		1001.0
		1988.3		1991.7
	10 MΩ Range			0.003
		9.961		10.038

Paragraph Number	Test	Results Minimum	Actual	Maximum
5-15 (Cont'd)	(1 Year)			
	100 Ω Range			00.03
		99.86		100.14
		189.76		190.24
	1 kΩ Range			.0003
		.9986		1.0014
		1.8976		1.9024
		1.9875		1.9925
	10 kΩ Range			0.003
		9.986		10.014
		18.976		19.024
	100 kΩ Range			00.03
		99.86		100.14
		189.76		190.24
	1000 kΩ Range			000.3
		998.86		1001.4
		1897.6		1902.4
	10 MΩ Range			0.003
		9.947		10.053

PERFORMANCE TEST CARD

Hewlett-Packard Model 34750A/34702A
Multimeter

Tests Performed by________________

Serial No.________________________

Date___________________________

Paragraph Numger	Test	Results: Minimum	Actual	Maximum
5-9	DC Accuracy (30 Days)			
		- .00004	________	+ .00004
	1 V	± .99971	________	±1.00029
	Range	±1.89948	________	±1.90052
		±1.99746	________	±1.99854
		- 0.0004	________	+ 0.0004
	10 V	± 9.9971	________	±10.0029
	Range	±18.9948	________	±19.0052
		- 00.004	________	+ 00.004
	100 V	± 99.971	________	±100.029
	Range	±189.948	________	±190.052
	1000 V	- 000.04	________	+ 000.04
	Range	+ 999.71	________	+1000.29
	(90 Days)			
		- .00005	________	+ .00005
	1 V	± .99960	________	±1.00040
	Range	±1.89929	________	±1.90072
		±1.99725	________	±1.99875
		- 0.0005	________	+ 0.0005
	10 V	± .99960	________	±10.0040
	Range	±18.9929	________	±19.0072
		- 00.005	________	+ 00.005
	100 V	± 99.960	________	±100.040
	Range	±189.929	________	±190.072
	1000 V	- 000.05	________	+ 000.05
	Range	+ 999.60	________	+10000.40
	(6 Months)			
		- .00007	________	+ .00007
	1 V	± .99948	________	±1.00052
	Range	±1.89908	________	±1.90093
		±1.99703	________	±1.99897
		- 0.0007	________	+ 0.0007
	10 V	± 9.9948	________	±10.0052
	Range	±18.9908	________	±19.0093
		- 00.007	________	+ 00.007
	100 V	± 99.948	________	±100.052
	Range	±189.908	________	±190.093
	1000 V	- 000.07	________	+ 000.07
	Range	+ 999.48	________	+1000.52

Paragraph Number	Test	Results Minimum	 Actual	 Maximum
5-9 (Cont'd)				
	(1 Year)			
		- .00010	______	+ .00010
		± .99930	______	±1.00070
	1 V	±1.89876	______	±1.90124
	Range	±1.99660	______	±1.99940
		- 0.0010	______	+ 0.0010
	10 V	± 9.9930	______	±10.0070
	Range	±18.9876	______	±19.0124
		- 00.010	______	+ 00.010
	100 V	± 99.930	______	±100.070
	Range	±189.876	______	±190.124
	1000 V	- 000.10	______	+ 000.10
	Range	+ 999.30	______	+1000.70
5-10	Input Impedance: Resistance			
	1 V and 10 V Rangers	.52582	______	.52682
	100 V Ranges	50.201	______	50.301
	1000 V Ranges	499.75	______	500.75
	Capacities		______	≤ 80 pF
5-11	DC Effective Common Mode Rejection		______	≤ 100 counts
5-12	Normal Mode Rejection		______	≤ 100 counts
5-13	AC Accuracy 45 Hz to 20 kHz (30 Days)		______	.00040
		.99710	______	1.00290
	1 V	1.89485	______	1.90515
	Range	1.98463	______	1.99538
			______	0.0040
	10 V	9.9710	______	10.0290
	Range	18.9485	______	19.0515
			______	00.040
	100 V	99.710	______	100.290
	Range	189.485	______	190.515
	1000 V		______	000.40
	Range	997.10	______	1002.90
	(90 Days)			
			______	.00050
		.99650	______	1.00350
	1 V	1.89380	______	1.90620
	Range	1.98353	______	1.99647
			______	0.0050
	10 V	9.9650	______	10.0350
	Range	18.9380		19.0620
			______	00.050
	100 V	99.650	______	100.350
	Range	189.380	______	190.620

Paragraph Number	Test	Results Minimum	Results Actual	Results Maximum
5-13 (Cont'd)				
	1000 V		________	000.50
	Range	996.50	________	1003.50
	(6 Months)			
			________	.00050
		.99600	________	1.00400
	1 V	1.89285	________	1.90715
	Range	1.98254	________	1.99747
			________	0.0050
	10 V	9.9600	________	10.0400
	Range	18.9285	________	19.0715
			________	00.050
	100 V	99.600	________	100.400
	Range	189.285	________	190.715
	1000 V		________	000.50
	Range	996.00	________	1004.00
	(1 Year)			
			________	.00050
	1 V	.99550	________	1.00550
	Range	1.89000	________	1.91000
			________	0.0050
	10 V	9.9550	________	10.0550
	Range	18.9000	________	19.1000
			________	00.050
	100 V	99.550	________	100.550
	Range	189.000	________	191.000
	1000 V		________	000.50
	Range	995.50	________	1005.50
	AC Accuracy 100 kHz (30 Days)			
			________	.00050
	1 V	.99200	________	1.00800
	Range	1.88525	________	1.91475
			________	0.0050
	10 V	9.9200	________	10.0800
	Range	18.8525	________	19.1475
			________	00.050
	100 V	99.200	________	100.800
	Range	188.525	________	191.475
	1000 V		________	000.50
	Range	992.00	________	1008.00

Paragraph Number	Test	Results Minimum	Results Actual	Results Maximum
5-13 (Cont'd)				
	(90 Days)			
			________	.00050
	1 V	.99150	________	1.00850
	Range	1.88430	________	1.91570
			________	0.0050
	10 V	9.9150	________	10.0850
	Range	18.8430	________	19.1570
			________	00.050
	100 V	99.150	________	100.850
	Range	188.430	________	191.570
	1000 V		________	000.50
	Range	991.50	________	1008.50
	(6 Months)			
			________	.00050
	1 V	.99100	________	1.00900
	Range	1.88335	________	1.91665
			________	0.0050
	10 V	9.9100	________	10.0900
	Range	18.8335	________	19.1665
			________	00.050
	100 V	99.100	________	100.900
	Range	188.335	________	191.665
	1000 V		________	000.50
	Range	991.00	________	1009.00
	(1 Year)			
			________	.00050
	1 V	.98950	________	1.01050
	Range	1.88050	________	1.91950
			________	0.0050
	10 V	9.8950	________	1.01050
	Range	18.8050	________	19.1950
			________	00.050
	100 V	98.950	________	101.050
	Range	188.050		191.950
	1000 V			000.50
	Range	989.50		1010.50
5-14	Response Time		________	< 300 counts
5-15	Ω Accuracy (30 Day)			
			________	00.015
	100 Ω	99.940	________	100.060
	Range	189.900	________	190.101
			________	.00015
		.99940	________	1.00060
	1kΩ	1.89900	________	1.90101
	Range	1.98895	________	1.99105

Paragraph Number	Test	Results Minimum	Actual	Maximum
5-15 (Cont'd)				0.0015
	10 kΩ Range	9.9940		10.0060
		18.9900		19.0101
				00.015
	100 kΩ Range	99.940		100.060
		189.900		190.101
				000.15
	1000 kΩ Range	999.40		1000.60
		1899.00		1901.01
				0.0015
	10 MΩ Range	.99940		1.00060
	(90 Day)			00.015
	100 Ω Range	99.930		100.070
		189.881		190.120
				.00015
	1 kΩ Range	.99930		1.00070
		1.89881		1.90120
		1.98891		1.99109
				0.0015
	10 kΩ Range	9.9930		10.0070
		18.9881		19.0120
				00.015
	100 kΩ Range	99.930		100.070
		189.881		190.124
				000.15
	1000 kΩ Range	999.30		1000.70
		1898.81		1901.20
				0.0015
	10 MΩ Range	.99685		1.00315
	(6 Months)			00.020
	100 Ω Range	99.915		100.085
		189.877		190.124
				.00020
	1 kΩ Range	.99915		1.00085
		1.89877		1.90124
		1.98871		1.99129
				0.0020
	10 kΩ Range	9.9915		10.0085
		18.9877		19.0124
				00.020
	100 kΩ Range	99.915		100.085
		189.877		190.124
				000.20
	1000 kΩ Range	998.70		1001.30
		1897.71		1902.29

Paragraph Number	Test	Results		
		Minimum	Actual	Maximum
5-15 (Cont'd)				
	10 MΩ Range	.99630		0.0020 1.00370
	(1 Year)			
	100 Ω Range	99.870 189.771		00.020 100.130 190.229
	1 kΩ Range	.99870 1.89771 1.98761		.00020 1.00130 1.90229 1.99239
	10 kΩ Range	9.9870 18.9771		0.0020 10.0130 19.0229
	100 kΩ Range	99.870 189.771		00.020 100.130 190.229
	1000 kΩ Range	998.70 1897.71		000.20 1001.30 1902.39
	10 MΩ Range	.99480		0.0020 1.00520

SECTION VI.

IDENTIFICATION OF PARTS

6-1. INTRODUCTION.

6-2. This section contains information to identify parts. Table 6-1 lists parts in alphanumeric order of their reference designators and indicates the description, -hp-Part Number of each part, together with any applicable notes, and provides 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.

d. Manufacturers part number.

6-3. Miscellaneous parts are listed at the end of Table 6-1.

6-4 DELETED

6-5 DELETED

6-6. DELETED

6-7. DELETED

6-8. PARTS CHANGES

6-9. Components which have been changed are so marked by one of three symbols; i.e. Δ, Δ with a letter subscript, e.g. Δ_a, or Δ with a number subscript e.g. Δ_{10}. A Δ with no subscript indicates the component listed is the preferred replacement for an earlier component. A Δ with a letter subscript indicates a change which is explained in a note at the bottom of the page. A Δ with a number subscript indicates the related change is discussed in backdating (Appx A). The number of the subscript indicates the number of the change in backdating which should be referred to.

6-10. PROPRIETARY PARTS.

6-11. 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 film	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

® Dupont de Nemours

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. Identification of Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	34702-66501+a	1			
A1C1	0160-3965	1	C:FXD 0.001 UF 20%	28480	0160-3965
A1C2	0170-0022	1	C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24
A1C3	0160-3930	1	C:FXD 10 PF 2500 VDCW	28480	0160-3930
A1C4	0160-4425	1	C:FXD MICA 47 PF 5%	28480	0160-4425
A1C5	0121-0168	1	C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A1C6	0121-0127	2	C:VAR AIR TRIMMER 1.7 TO 14.1 PF	28480	0121-0127
A1C7	0160-3972	1	C:FXD 1012 PF	28480	0160-3972
A1C8*	0140-0145	1	C:FXD MICA 22 PF 5%	28480	0140-0145
A1C9	0121-0478	1	C:VAR AIR 2.4-34.0 PF 650VDCW	74970	193-0010-005
A1C10	0160-3973	1	C:FXD 10350 PF	28480	0160-3973
A1C11	0121-0147	1	C:VAR AIR 2.0/19.3 PF	28480	0121-0147
A1C12	0170-0043	2	C:FXD MY .022 UF 10% 600 VDCW	28480	0170-0043
A1C13	0180-0210	1	C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A1C14	0180-1800	3	C:FXD ELECT 100 UF +100-10% 6VDCW	56289	300603(NP)
A1C15	0150-0014	1	C: FXD CER 0.005 UF 500 VDCW	96095	01-4
A1C16	0180-0197	1	C: FXD ELECT 2.2 UF 10 % 20 VDCW	56289	150D225X9020A2-DYS
A1C17	0160-2199	1	C: FXD MICA 30 pF 5 %	72136	08D
A1C18	0140-0196	2	C:FXD MICA 150 PF 1%	72136	DM15F151J0300WV1CR
A1C19	0180-1800		C:FXD ELECT 100 UF +100-10% 6VDCW	56289	300603(NP)
A1C20	0140-0196		C:FXD MICA 150 PF 1%	72136	DM15F151J0300WV1CR
A1C21	0180-1800		C:FXD ELECT 100 UF +100-10% 6VDCW	56289	300603(NP)
A1C22	0160-2132	1	C:FXD MY 0.55 UF 10% 50VDCW	56289	410P SPEC
A1C23	0170-0038	1	C:FXD MY 0.22 UF 10% 200VDCW	56289	148P22492 PUM
A1C24	0170-0040	1	C:FXD MY 0.047UF 10% 200 VDCW	56289	292P47392-PTS
A1C25	0180-0291	1	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
		2			
A1C26	0180-0228	2	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C27, C28	0180-1701	2	C:FXD ELECT 6.8 UF 20% 6 VDCW	28480	0180-1701
A1C29	0180-0228		C:FXD ELECT 22 UF 10% 15 VDCW	56289	150D226X9015B2-DYS
A1C30	0160-3992	1	C:FXD 300 PF 10% 300 VDCW	95275	VY13C301-K
A1C31	0170-0043		C:FXD MY .022 UF 10% 600 VDCW	84411	HEW-93
A1CR1	1901-0376	2	DIODE: SILICON 35 V	28480	1901-0376
A1CR2	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A1CR3	1902-0049	2	DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A1CR4	1901-0040	6	DIODE:SILICON 50MA 30WV	07263	FDG1088
A1CR5	1902-0049		DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A1CR6	1902-3182	1	DIODE BREAKDOWN:SILICON 12.1V 5%	28480	1902-3182
A1CR7	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A1CR8	1901-0518	2	DIODE:HOT CARRIER	28480	1901-0518
A1CR9	1901-0518		DIODE:HOT CARRIER	28480	1901-0518
A1CR10	1901-0546 +b	2	DIODE:SI 30 WV 1.0 PA LEAKAGE	17856	FN1705
A1CR11	1901-0546		DIODE:SI 30 WV 1.0 PA LEAKAGE	17856	FN1705
A1CR12	1901-0029	1	DIODE:SILICON 500 PIV	28480	1901-0029
A1CR13	1901-0586	1	DIODE:SI 30 WV 10 PA LEAKAGE	28480	1901-0586
A1CR14	1902-0040	1	DIODE BREAKDOWN:14.0V 5%	28480	1902-0040
A1CR15	1902-0041	3	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR16	1902-0777	1	DIODE:BREAKDOWN 6.2V 5%	04713	1N825
A1CR17	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR18	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR19	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A1CR20	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A1CR21	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A1CR22	1901-0040		DIODE: SILICON 50MA 30 WV	07263	FDG1088
A1CR23	1902-3149		DIODE: BREAKDOWN 9.09 V 5 %	04713	SZ 10939-170
A1Q1	1855-0412	2	TSTR:FET SI N-CHANNEL	17856	FN2960
A1Q2	1853-0010	3	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A1Q3	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A1Q4	1854-0071	8	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q5	1854-0404		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0404
A1Q6	1854-0215		TSTR:SI NPN(SELECTED FROM 2N3704)	04713	SPS 3611
A1Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q8	1854-0215		TSTR:SI NPN(SELECTED FROM 2N3704)	04713	SPS 3611
A1Q9	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A1Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q11	1855-0412		TSTR:FET SI N-CHANNEL	17856	FN2960
A1Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q13	1854-0629	2	TSTR:SI NPN	12040	NS48030
A1Q14	1854-0629		TSTR:SI NPN	12040	NS48030
A1Q16	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1R1	0698-8233	4	RESISTOR:MATCHED SET	28480	0698-8233
A1R2	0698-8233		RESISTOR:MATCHED SET	28480	0698-8233
A1R3	2100-3250	1	R:VAR 5K OHM	28480	2100-3250
A1R4	0698-8233		RESISTOR:MATCHED SET	28480	0698-8233
A1R5	2100-3248	1	R:VAR COMP 500 OHM	28480	2100-3248
A1R6	0698-8233		RESISTOR:MATCHED SET	28480	0698-8233
A1R7	2100-3259	1	R:VAR COMP 50 OHM	28480	2100-3259
A1R8	0811-3029	1	R:FXD WW 100K OHM 5% 10W	28480	0811-3029

+a This Part No. does not include A1Q15

+b -hp- Part No. 1901-0586 can also be used for CR10 and CR11. However both diodes should have the same part number.

Rev. A 6-3

Table 6-1. Identification of Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R9	0698-3648	1	R:FXD MET OX 20K OHM 5% 2W	28480	0698-3648
A1R10 Δ	0698-8425	1	R: FXD MET FLM 20K OHM 10% 5W	28480	0698-8425
A1R11	0698-5100	2	R:FXD COMP 22 MEGOHM 10% 1/4W	28480	0698-5100
A1R12	0757-0443	1	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A1R13	2100-3154	1	R:VAR CERMET 1000 OHM 10% TYPE P 3/4W	28480	2100-3154
A1R14	0698-4523	1	R:FXD FLM 169K OHM 1% 1/8W	28480	0698-4523
A1R15	0757-0461	1	R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A1R16	0757-0451	1	R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A1R17	0757-0442	1	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R18	0698-7652	1	R:FXD FLM 49.9K OHM 1.0% 1/8W	28480	0698-7652
A1R19	0698-8249	1	R:FXD FLM 23.7K OHM 1%	28480	0698-8249
A1R20	0698-3515	1	R:FXD FLM 5900 OHM 1% 1/8W	28480	0698-3515
A1R21	0698-3264	1	R:FXD FLM 11.8K OHM 1% 1/8W	28480	0698-3264
A1R22	0757-0449	1	R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A1R23	0698-3499	1	R:FXD FLM 40.2K OHM 1% 1/8W	28480	0698-3499
A1R24	0684-4721	1	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A1R25	0684-2241	1	R:FXD COMP 220K OHM 10% 1/4W	01121	CB 2241
A1R26	0684-1051	2	R:FXD COMP 1MEGOHM 1% 1/4W	01121	CB 1051
A1R27	0684-1821	1	R:FXD COMP 1800 OHM 10% 1/4W	01121	CB 1821
A1R28	0684-1021	1	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A1R29	0698-4123	2	R:FXD MET FLM 499 OHM 1% 1/8W	28480	0698-4123
A1R30	0698-4123		R:FXD MET FLM 499 OHM 1% 1/8W	28480	0698-4123
A1R31	0757-0430	1	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A1R32	0698-8182	1	R:FXD FLM 2.21K OHM 1% 1/8W	28480	0698-8182
A1R33	0698-8183	1	R:FXD FLM 499 OHM 1.0% 1/8W	28480	0698-8183
A1R34	0698-3243	1	R:FXD MET FLM 178K OHM 1% 1/8W	28480	0698-3243
A1R35	0698-7803	1	R:FXD FLM 575K OHM 1% 1/8W	28480	0698-7803
A1R36	0757-0486	1	R:FXD MET FLM 750K OHM 1% 1/8W	28480	0757-0486
A1R37	0813-0032	2	R:FXD WW 50K OHM 10% 5W	28480	0813-0032
A1R38	0684-1221	1	R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A1R39	0813-0032		R:FXD WW 50K OHM 10% 5W	28480	0813-0032
A1R40	0687-3921	1	R:FXD COMP 3900 OHM 10% 1/2W	01121	EB 3921
A1R41	0684-1031	3	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R42	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R43	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R44	0684-8231	1	R:FXD COMP 82K OHM 10% 1/4W	01121	CB 8231
A1R45	0684-2221	1	R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A1R46	0757-0446	2	R: FXD FLM 15 K OHM 1% 1/8 W	91637	CMF-1/10-32 T-1
A1R47	0684-4711	2	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A1R48	0757-0446		R: FXD FLM 15 K OHM 1% 1/8 W	91637	CMF-1/10-32 T-1
A1R49	0684-2731	1	R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A1R50	0698-3274	1	R:FXD MET FLM 10K OHM 1% 1/8W	28480	0698-3274
A1R51	0684-1051		R:FXD COMP 1MEGOHM 1% 1/4W	01121	CB 1051
A1R52	0698-8218	5	RESISTOR:MATCHED SET	28480	0698-8218
A1R53	0698-8218		RESISTOR:MATCHED SET	28480	0698-8218
A1R54	0698-8218		RESISTOR:MATCHED SET	28480	0698-8218
A1R55	0698-8218		RESISTOR:MATCHED SET	28480	0698-8218
A1R56	0698-8218		RESISTOR:MATCHED SET	28480	0698-8218
A1R57	0684-4711		R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A1R58	0698-6391	1	R:FXD FLM 350 OHM 1% 1/8W	28480	0698-6391
A1R59	2100-3103	1	R:VAR CERMET 10K OHM 10% TYPE P 3/4W	28480	2100-3103
A1R60	0698-6350	1	R:FXD FLM 110 OHM 1% 1/8W	28480	0698-6350
A1R61	0698-5673	1	R:FXD MET FLM 3.9K OHM 1% 1/8W	28480	0698-5673
A1R62	0698-3437	1	R:FXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A1R63	0698-8181	1	R:FXD FLM 24.3K OHM 1% 1/8W	28480	0698-8181
A1R64	2100-3154	1	R:VAR CERMET 1K OHM 10% TYPE P 3/4W	28480	2100-3154
A1R65	0684-6821	2	R:FXD COMP 6.8K OHM 10% 1/4W	01121	CB6821
A1R66	0684-6821		R:FXD COMP 6.8K OHM 10% 1/4W	01121	CB6821
A1R67	0684-3921		R:FXD COMP 3900 OHM 10% 1/4W	01121	CB3921
A1R68	0698-5100		R:FXD 22 MEGOHM 10% 1/4W	28480	0698-5100
A1R69*	0698-999P		PADDING LIST	28480	0698-999P
	0698-3700		RESISTOR 715 OHM 1% .125W	16299	C4-1/8-T0-715R-F
	0698-4424		RESISTOR 1400 OHM 1% .125W	16299	C4-1/8-T0-1401-F
	0698-4436		RESISTOR 2800 OHM 1% .125W	16299	C4-1/8-T0-2801-F
	0698-3493		RESISTOR 4120 OHM 1% .125W	16299	C4-1/8-T0-4121-F
	0698-4432		RESISTOR 2.10K OHM 1% .125W	16299	C4-1/8-T0-2101-F
	0698-3152		RESISTOR 3.48K OHM 1% .125W	16299	C4-1/8-T0-3481-F
A1S1	3101-1724	1	SWITCH: PUSHBUTTON	28480	3101-1724
A1S2	3101-1725	1	SWITCH: PUSHBUTTON	28480	3101-1725
A1U1	1820-0223	3	IC:OPERATIONAL AMPLIFIER	12040	SLB641
A1U2	1820-0203		IC:OPERATIONAL AMPLIFIER	07263	SL8940
A1U3	1820-0203		IC:OPERATIONAL AMPLIFIER	07263	SL8940
A1W1	34702-61601 1		CABLE ASSY:(ACV SWITCH TO R10)	14493	34702-61601
A1W2	34702-61602 1		CABLE ASSY:(DCV SWITCH TO 1 V SWITCH)	14493	34702-61602
A1W3	34702-61603 1		CABLE ASSY:(1 V SWITCH TO ACV SWITCH)	14493	34702-61603

Δ use for all replacement

Table 6-1. Identification of Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			MISCELLANEOUS		
	5040-7023		PUSHROD	28480	5040-7023
	5040-7032		FOOT-REAR	28480	5040-7032
	3050–0593	4	WASHER–SPRING	28480	3050–0593
	Δa 0370-2486	9	KNOB:PUSHBUTTON SWITCH,	71590	J52305
	0370-0914	9	BEZEL:PUSHBUTTON KNOB, JADE GREY	28480	0370-0914
	5020–8315	2	CASE–BOTTOM	28480	5020–8315
	05300-40003	8	SUPPORT:BOARD	28480	05300-40003
	05300-40004	8	GUIDE:SLIDE	28480	05300-40004
	1460–1357	1	STAND:TILT	28480	05301-20005
	05301-40001	2	FOOT	28480	05301-40001
	1510–0091	4	BINDING POST	28480	1510–0091
	34702-00201	1	PANEL:FRONT	14493	34702-00201
	34702-01201	1	BRACKET:LEFT HAND	14493	34702-01201
	34702-01202	1	BRACKET:RIGHT HAND	14493	34702-01202
	34702-05501	1	SHIELD:PLATE	14493	34702-05501
	34702-05502	1	SHIELD:BOX	14493	34702-05502
	34702–60205	1	PANEL ASSY:REAR	28480	34702–60205
	1460-1311	1	SPRING:GROUND	00000	05D
	1460-1312	1	SPRING:CLIP	00000	08D
	34702–90002	1	MANUAL	28480	34702-90002
	1855–0308	1	TSTR:SI DUAL N-CHANNEL (Q15 ON A1ASSY)	28480	1855-0308
	3131–0347	2	SPRING CLIP: BRASS (FOR A1S1 AND A1S2)	28480	3131–0347
	1200–0474	1	14 PIN IC SOCKET	28480	1200–0474

Δa Instrument serial No's. 1212A00735 and below used -hp- Part No. 0370-0450

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PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
CB-36G5	01121	5905-00-458-4406	1810-0173	28480	5905-01-042-5043
CB2721	01121	5905-00-111-4727	1820-0203	28480	5962-00-483-1956
CB6821	01121	5905-00-721-0671	1820-0571	28480	5962-00-329-4583
DM74LO2N	12040	5962-00-257-9226	1820-0583	28480	5962-00-390-7958
DM74L74N	12040	5962-00-369-7607	1820-0586	28480	5962-00-390-7970
DM74L86N	12040	5962-00-172-5578	1820-0587	28480	5962-00-396-2262
RDM15F391-J3C	72136	5910-00-018-0918	1820-0635	28480	5962-00-329-4569
SL8940	07263	5962-00-483-1956	1820-0668	28480	5962-00-369-9839
SN74175N	01295	5962-00-163-0145	1853-0010	28480	5961-00-931-6998
SZ10939-122	04713	5961-00-752-6121	1853-0089	28480	5961-00-179-8478
SZ10939-98	04713	5961-00-821-2309	1854-0039	28480	5961-00-985-9073
0121-0127	28480	5910-00-828-2061	1854-0404	28480	5961-00-408-9807
0121-0168	28480	5910-00-244-8375	1901-0029	28480	5961-00-950-0537
0140-0145	28480	5910-00-257-0227	1902-0040	28480	5961-00-059-1215
0140-0196	28480	5910-00-774-7294	1902-0041	28480	5961-00-858-7372
0140-0204	28480	5910-00-069-0362	1902-0049	28480	5961-00-911-9277
0150-0014	28480	5910-00-834-5013	1902-3149	28480	5961-00-833-3043
0160-3930	28480	5910-00-378-0588	1902-3182	28480	5961-00-229-1966
0170-0022	28480	5910-00-826-1162	192P39292-PTS	56289	5910-00-921-0275
0170-0038	28480	5910-00-817-7275	193-0010-005	74970	5910-00-378-0646
0170-0040	28480	5910-00-829-0245	1990-0413	28480	5961-01-042-5332
0170-0043	28480	5910-00-993-8535	2N4117A	80131	5961-01-017-6023
0180-0197	28480	5910-00-850-5355	2100-3154	28480	5905-00-615-8111
0180-0291	28480	5910-00-931-7055	3101-1723	28480	5930-01-035-8847
0180-1800	28480	5910-00-126-1696	312.500	75915	5920-00-280-8344
0340-0782	28480	5970-01-025-0262	8131-100-651-104	72982	5910-00-451-5671
0370-2159	28480	5975-01-007-9111	9100-3223	28480	5950-01-042-1970
0683-1025	28480	5905-00-110-7620			
0683-1525	28480	5905-00-106-1356			
0684-1021	28480	5905-00-056-0531			
0684-1051	28480	5905-00-116-8554			
0684-1221	28480	5905-00-407-2151			
0684-2221	28480	5905-00-105-7764			
0684-2731	28480	5905-00-119-3504			
0684-3921	28480	5905-00-141-0743			
0687-1201	28480	5905-00-110-0196			
0698-3152	28480	5905-00-420-7130			
0698-3159	28480	5905-00-407-0053			
0698-3243	28480	5905-00-891-4227			
0698-3264	28480	5905-00-138-5051			
0698-3274	28480	5905-00-483-0226			
0698-3437	28480	5905-00-402-7080			
0698-3499	28480	5905-00-478-7468			
0698-3515	28480	5905-00-478-7469			
0698-3558	28480	5905-00-407-0061			
0698-3700	28480	5905-00-138-5052			
-698-4123	28480	5905-00-998-1915			
0698-4470	28480	5905-00-759-1539			
0698-6391	28480	5905-00-306-0740			
0757-0443	28480	5905-00-891-4252			
0757-0451	28480	5905-00-981-7478			
0757-0461	28480	5905-00-089-7577			
0757-0486	28480	5905-00-982-3777			
0813-0032	28480	5905-00-490-3946			
1N825	04713	5961-00-923-3940			
150D105X9035A2-D	56289	5910-00-456-4474			
1510-0091	28480	5940-01-035-6148			
1810-0151	28480	5905-01-023-2750			
1810-0171	28480	5905-01-042-7499			
1810-0172	28480	5905-01-043-0514			

SECTION VII.
TROUBLESHOOTING AND CIRCUIT DIAGRAMS

7-1. INTRODUCTION.

7-2. This section of the Operating and Service Manual contains troubleshooting information and circuit diagrams for the Model 34702A Multimeter. Included are trouble shooting trees, a schematic diagram and a component locator.

7-3. SCHEMATIC DIAGRAM.

74. The circuits contained within the Model 34702A are shown on the schematic diagram (Figure 7-3). This diagram can be used to assist in understanding of the theory of operation as well as aid in troubleshooting the instrument. DC voltages and ac waveforms are given on the schematic.

7-5. COMPONENT LOCATION DIAGRAM.

7-6. The Component Location Diagram associated with the schematic shows the position of each part mounted on the pc assembly. Each part is identified by a reference designator.

7-7. TROUBLESHOOTING.

7-8. Troubleshooting Trees.

7-9. Figures 7-1 and 7-2 are troubleshooting trees designed to assist in the isolation of malfunctions. Figure 7-1 is a troubleshooting tree for the ac converter, Figure 7-2 is a troubleshooting tree for the Ω converter.

7-10. Troubleshooting Procedure.

7-11. The following procedure is recommended for troubleshooting the Model 34702A:

a. Ensure the mainframe plug-on (Display Module) is functioning properly.

b. Perform the following preliminary tests:

1. Apply t 1.0000 V dc to the INPUT V terminals. Check for turnover error.

2. Apply full-scale voltages to the 10 V, 100 V, and 1000 V scales. Check for proper numerical display and decimal point location.

NOTE

The above checks verify proper functioning of many display module interconnections, range switches, and coaxial wiring.

c. Check the ac converter as follows:

1. Apply I V ac at 01kHz to the INPUT V terminals.

2. Trace the propagation of this signal through the impedance converter, ac converter amplifier and filter circuitry.

3. If these circuits appear to be working, check the Input Attenuator.

   (a) Apply full-scale voltages to the 34702A on the IO V, 100 V, and 1000 V ranges. Do this at 10 kHz and 100 kHz.

   (b) Note any inaccuracies in the readout. Any error is probably due to the input attenuator.

NOTE

Most frequency response problems are in the input attenuator.

4. Typical Problem Areas.

   (a) Noise-check ac converter amplifier.

   (b) Low output or zero output-check the ac converter amplifier.

   (c) Any type of inaccuracy-check dc feedback amplifier Ul by replacement. Also, check Q1 for leakage (by replacement).

d. Check the dc section of the instrument:

1. Check for shorted trimmer capacitors.

2. Using an Ωmeter, measure the contact resistance of the switches. Each switch should indicate a short circuit. Dirty switches can be cleaned with MS-1 80 Freon Degreaser.

3. Coax cables may be shorted or open.

4. Resistors in the dc attenuator may change value.

e. Check the ohms current source:

1. Place the 34702A in Ω function and verify that an overload indication occurs (overrange "1" illuminates and rest of display blanks) with no resistance applied.

2. Check all ohms ranges at full-scale to determine which ranges are bad. When only the two highest ranges are inaccurate, check Q11 if the display indication is high. Check CR13 if the indication is low.

3. Referring to the schematic diagram, check the voltages on the two operational amplifiers. If the- 7.2 V and - 6.2 V references are incorrect or absent, check U3 and CR16.

f. Attempt the Performance Tests (Section V) in order to characterize the trouble. Also try the Adjustment Procedures. Some apparent malfunctions can be corrected by these adjustments. Also, inability to obtain correct adjustment will help localize the problem.

g. Check for burned or loose components, loose connections, or other conditions which might be the source of the trouble.

h. If the problem exists on the DCV and ACV functions but not on the Ω function, troubleshoot the DCV/ACV attenuator. If the trouble exists only on the Ω or ACV function, refer to the respective troubleshooting tree.

GENERAL SCHEMATIC NOTES

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH ASSEMBLY OR SUB-ASSEMBLY DESIGNATION(S) OR BOTH FOR COMPLETE DESIGNATION.

2. COMPONENT VALUES ARE SHOWN AS FOLLOWS UNLESS OTHERWISE NOTED.

   RESISTANCE IN OHMS
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MILLIHENRIES

3. DENOTES EARTH GROUND. USED FOR TERMINALS WITH NO LESS THAN A NO. 18 GAUGE WIRE CONNECTED BETWEEN TERMINAL AND EARTH GROUND TERMINAL OR AC POWER RECEPTACLE.

4. DENOTES FRAME GROUND. USED FOR TERMINALS WHICH ARE PERMANENTLY CONNECTED WITHIN APPROXIMATELY 0.1 OHM OF EARTH GROUND.

5. DENOTES GROUND ON PRINTED CIRCUIT ASSEMBLY. (PERMANENTLY CONNECTED TO FRAME GROUND.)

6. 2 ANY LETTER OR NUMBER IN TRIANGLE DENOTES A SPECIAL GROUND.

7. DENOTES ASSEMBLY.

8. DENOTES MAIN SIGNAL PATH.

9. DENOTES FEEDBACK PATH.

10. DENOTES FRONT PANEL MARKING.

11. DENOTES REAR PANEL MARKING.

12. DENOTES SCREWDRIVER ADJUST.

13. * AVERAGE VALUE SHOWN. OPTIMUM VALUE SELECTED AT FACTORY. THE VALUE OF THESE COMPONENTS MAY VARY FROM ONE INSTRUMENT TO ANOTHER.

14. DENOTES SECOND APPEARANCE OF A CONNECTOR PIN.

15. 92 DENOTES WIRE COLOR: COLOR CODE SAME AS RESISTOR COLOR CODE. FIRST NUMBER IDENTIFIES BASE COLOR, SECOND NUMBER IDENTIFIES STRIP.

16. ALL RELAYS ARE SHOWN DEENERGIZED.

17. WAVEFORMS AND AC VOLTAGE MEASUREMENTS WERE MADE WITH RESPECT TO CHASSIS GROUND USING AN OSCILLOSCOPE WITH A 10:1 DIVIDER PROBE (10 MEGOHM, 10 pF). THE VOLTAGE LEVELS SHOWN ON THE WAVEFORMS ARE ACTUAL VOLTAGE LEVELS AND ARE NOT TO BE CONFUSED WITH OSCILLOSCOPE SETTING. THE VOLTAGE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER. A VARIATION OF ± 10% IN MEASUREMENTS SHOULD BE ALLOWED.

18. DC VOLTAGE LEVELS WERE MEASURED WITH RESPECT TO CIRCUIT GROUND USING A VTVM WITH 10 MEGOHM INPUT IMPEDANCE. THE VOLTAGE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER DUE TO CHANGE IN TRANSISTOR CHARACTERISTICS. A VARIATION OF ± 10% SHOULD BE ALLOWED.

APPENDIX A
DATA DIFFERENCE SHEET

A-1. INTRODUCTION.

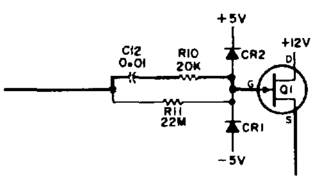
A-2. This section makes your manual applicable to earlier instruments. Where component values or part numbers in an instrument differ from the replaceable parts list, yet are not listed in this section, the part numbers and values listed in the parts list should be used for replacement.

A-3. Where practical, backdating entries have been incorporated into the text of the manual rather than into this section. If a backdating change is too long or otherwise impractical to incorporate in the text, the entry to be changed will be flagged with a delta having a number subscript; e.g. (Δ_1). The subscript refers to the number of the corresponding change in backdating. Make all changes listed in this backdating which apply to your instrument.

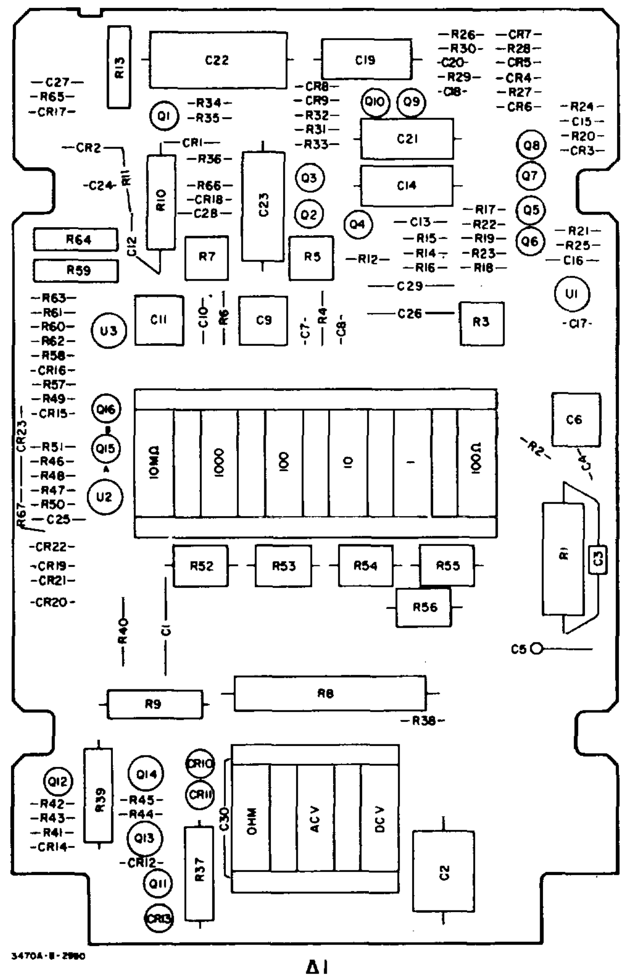
CHANGE NO. Δ_1: Applies to serial numbers
1212A0335 and below
Table 6-1:
Delete A1C31, A1R68, and A1C8
Change A1C12 to C:fxd, .01 µF $\pm$ 20%
2000 vdcw, -h p-Part No. 0160-0996

Figure 7-3, Page 7-5 & 7-6:

Change the input circuit to AIQI as follows:



Change the component locator for the A1 Assembly as follows:



3470A-B-2990

A1

***hp** Part No. 34702-66501*

APPENDIX B
REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals, (Type 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX C
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations for ME-498/U. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e, to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by brining into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared,

g. Install. The act of emplacing, seating, or fixing into position an item, part, module *(component or assembly) in a manner to* allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, teste, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

C-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate" work time" figures will be shown for each category. The number of task-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C — Operator/Crew
O — Organizational
F — Direct Support
H — General Support
D — Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Not applicable.

C-4. Tool and Test Equipment Requirements (Sec III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers(5-digit) in parentheses.

C-5. Remarks (Sec IV)

Not applicable.

SECTION II. MAINTENANCE ALLOCATION CHART
FOR
MUTIMETER ME-498/U

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT	(6) REMARKS
00	MUTIMETER ME-498/U	Inspect		0.2				6	
	MODEL 34702A	Test				0.5		1 thru 5	
	DISPLAY MODEL	Service				0.6		1 thru 5	
		Install				0.3		1 thru 5	
		Replace				0.3		1 thru 5	
		Repair				1.2		1 thru 5	
		Overhaul					2.0	1 thru 5	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR MULTIMETER ME-498/U

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/ NATO STOCK NUMBER	TOOL NUMBER
1	H, D	AN/GSM-64 Digital Voltmeter Non Linear Systems V35A	6625-00-870-2264	
2	H, D	AN/USM-459 Frequency Counter HP 3662	6625-01-061-8928	
3	H, D	Resistor Decade ZM-16( )/U	6625-00-669-0266	
4	0	Tools and test equipment available to the technician for his/her **assigned** mission.		

APPENDIX D
OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST

NOTE

Refer to section VI, Identification of Parts, for all maintenance repair parts.

PART TWO

OPERATING AND SERVICE MANUAL

MODEL 34750A
DISPLAY

The main body of this instruction manual applies to

Serial Number 1304A00101

and higher. Any changes made in instruments having serial numbers higher than the above number are, or will be, integrated into the manual by page revision as they occur. Revised pages are identified by a revision letter in the lower corner of the page. You may receive subsequent revised pages by returning the questionaire in the front of the manual with the appropriate square marked. If a change is made that does not apply to all previously manufactured instruments, backdating information in Appendix A adapts the manual to the earlier instruments.

Manual Part No. 34750-90001

Microfiche Part No. 34750-90051

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Printed: JUNE 1973

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Hewlett-Packard Model 34750A Display Module is part of the low cost 3470 Measurement System designed to measure AC volts, DC volts, current and resistance. It can be combined with the Model 34701 A, Model 34702A or Model 34703A Plug-On Module, shown in Figure 1-1, to make these measurements. Table 1-1 lists the various plug-on modules which condition the input to the Model *34750*A, and indicates the functions of each.

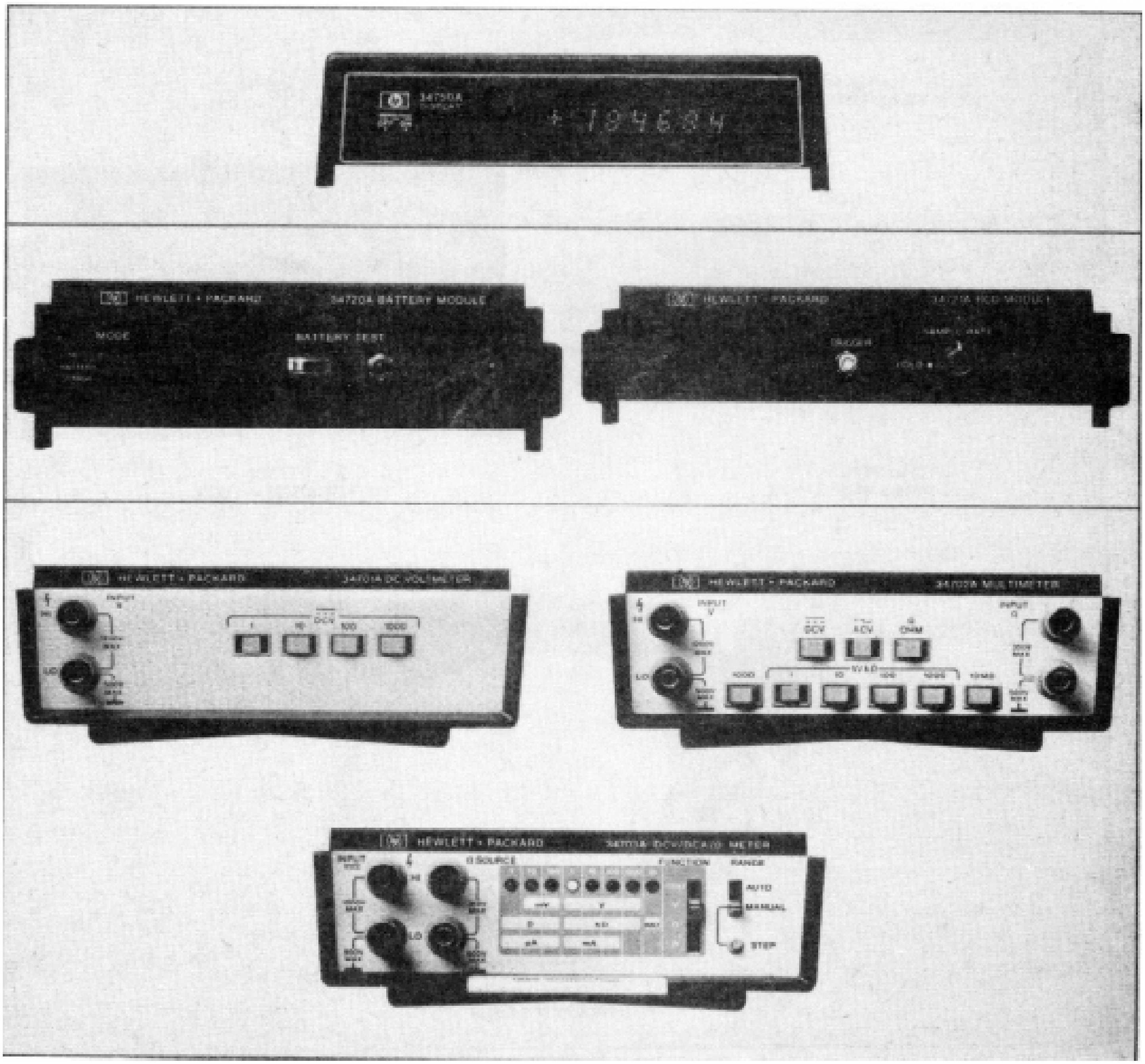


Figure 1-1. Plug-On Modules which can be used with the 34750A Display Module.

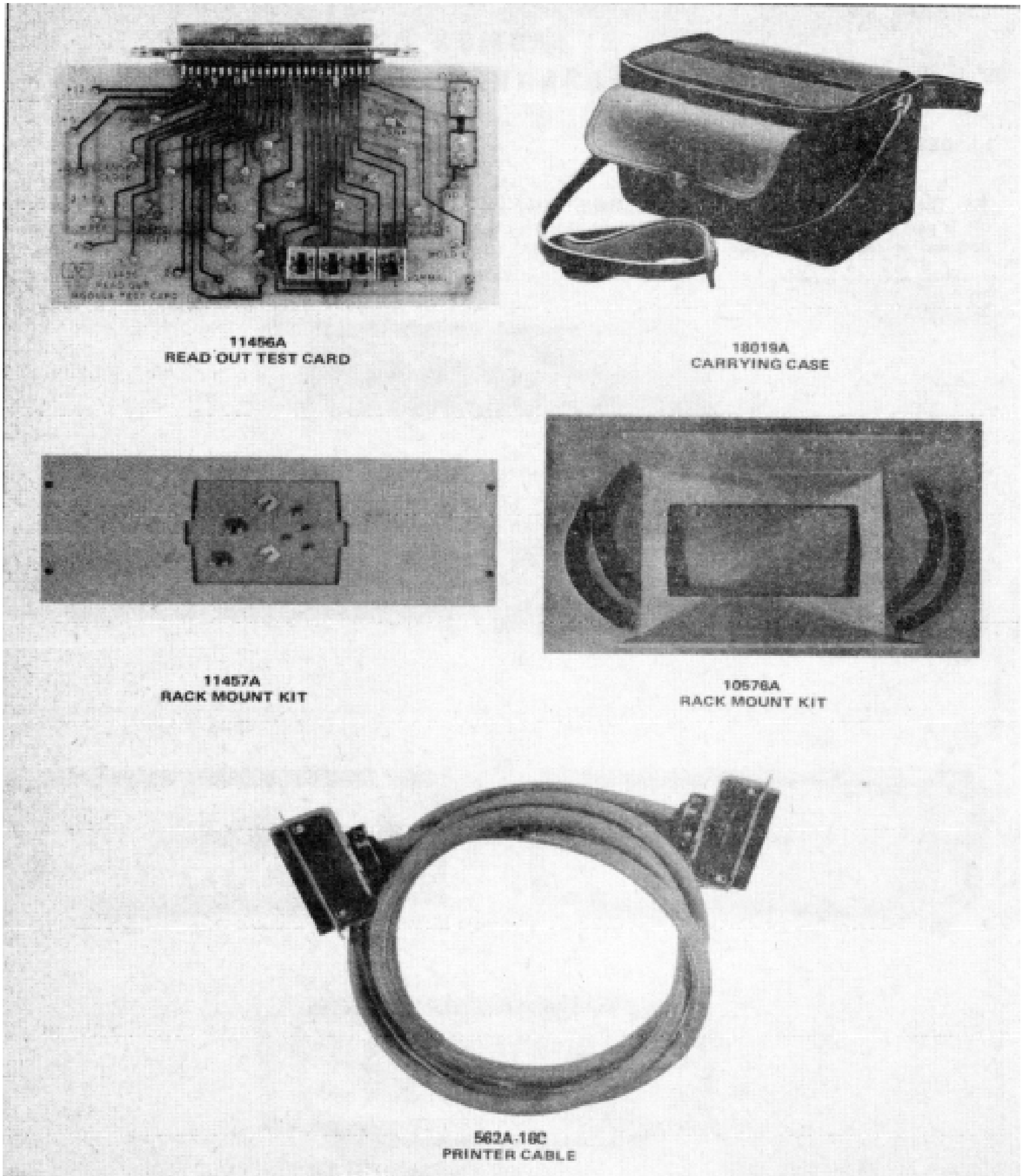


Figure 1-2. Accessories Available for use with 34750A.

Table 1-1. 3470A Series Signal Conditioning Modules.

Plug-On (Signal Conditioning) Module	Function				
	DCV	Ω	ACV	DCA	Auto Ranging
34701A DC Voltmeter	X				
34702A Multimeter	X	X	X		
34703A DCV/DCA/Ω Meter	X	X		X	X

1-3. Two center (sandwich) modules are also available for use with the Model 34750A and a signal conditioning module. These modules (Model 34720A and Model 34721A) add the capabilities of battery operation and BCD output to the 3470A measurement system. These modules are also shown in Figure 1-1.

1-4. The digital readout of the 34750A consists of five full digits plus an overrange "1". The LED (Light Emitting Diode) display provides a bright clear readout with a maximum display of 199999.

1-5. The Model 34750A has an internal jumper wire which may be positioned to test the logic and display circuits.

1-6. SPECIFICATIONS.

1-7. Specifications for the 34750A are included in Section I of the Operating and Service manuals for the "plug-on" modules.

1-8. OPTIONS.

1-9. Options available for the 34750A are listed in Table 1-2.

Table 1-2. Available Options.

Option	Purpose	Measurement Rate
060	Operation with 60 Hz line.	5/sec
050	Operation with 50 Hz line.	8/sec

1-10. ACCESSORIES AVAILABLE (See Figure 1-2).

a. 11456A - Read Out Test Card - Facilitates testing and troubleshooting the Model 34750A Display Module.

b. 18019A - Carrying Case - Accommodates the 34750A Display Module, a center module, and a " plug-on" module plus the power cord and input cables.

c. 11457A - Rack Mount Kit-Permits rack mounting of a 34750A Display Module, a 34721 B Center Module, and a "plug-on" module.

d. 10576A - Rack Mount Kit- Permits rack mounting of a 34750A Display Module and a "plug-on" module.

e. 562A-16C - Printer Cable - Connects the output of the Model 34721B BCD Module to a Model 5055A Digital Recorder.

1-11. INSTRUMENT AND MANUAL IDENTIFICATION.

1-12. A three-section serial number is used to identify your Model 34750A. Figure 1-3 illustrates the meaning of the three parts of the number.

1-13. This manual is kept up-to-date with revised pages. If the serial number of your instrument is lower than the one on the title page of this manual refer to the backdating information in Appendix A which adapts this manual to your instrument. All correspondence with Hewlett-Packard Company should include the complete serial number.

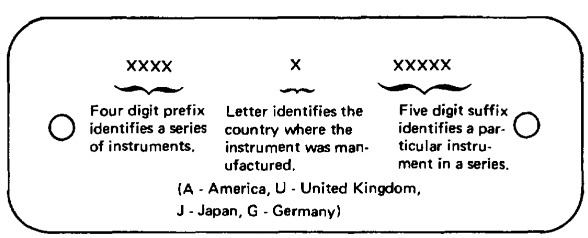


Figure 1-3. Instrument Serial Number (on rear panel).

SECTION II.
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information and instructions for the installation and shipping of the 34750A. Included are initial inspection procedures, power and grounding requirements, environmental information and repackaging for shipment.

2-3. INITIAL INSPECTION.

2-4. This instrument was carefully inspected both mechanically and electrically before shipment. It should be physically free of mars or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage incurred in transit. If the instrument was damaged in transit, file a claim with the carrier. Check to ensure you have received a power cord with the instrument. Using the performance test procedures referred to in Section V, test the electrical performance of the instrument. If there is damage or deficiency see the warranty on the reverse side of the title page of this manual.

2-5. POWER REQUIREMENTS.

2-6. The 34750A can be operated from the following nominal primary power sources:

Line Voltage	Tolerances	Frequency Range
100 V	+ 5% to - 10%	48 to 440 Hz
120 V	+ 5% to - 10%	48 to 440 Hz
220 V	+ 5% to - 10%	48 to 440 Hz
240 V	+ 5% to - 10%	48 to 440 Hz

The 34750A is set for 120 volt operation at the factory. Refer to Figure 2-1 for the procedure to change your unit for operation on a different voltage.

CAUTION

IF THE INSTRUMENT IS NOT SET FOR THE CORRECT PRIMARY POWER VOLTAGE IT MAY BE SERIOUSLY DAMAGED.

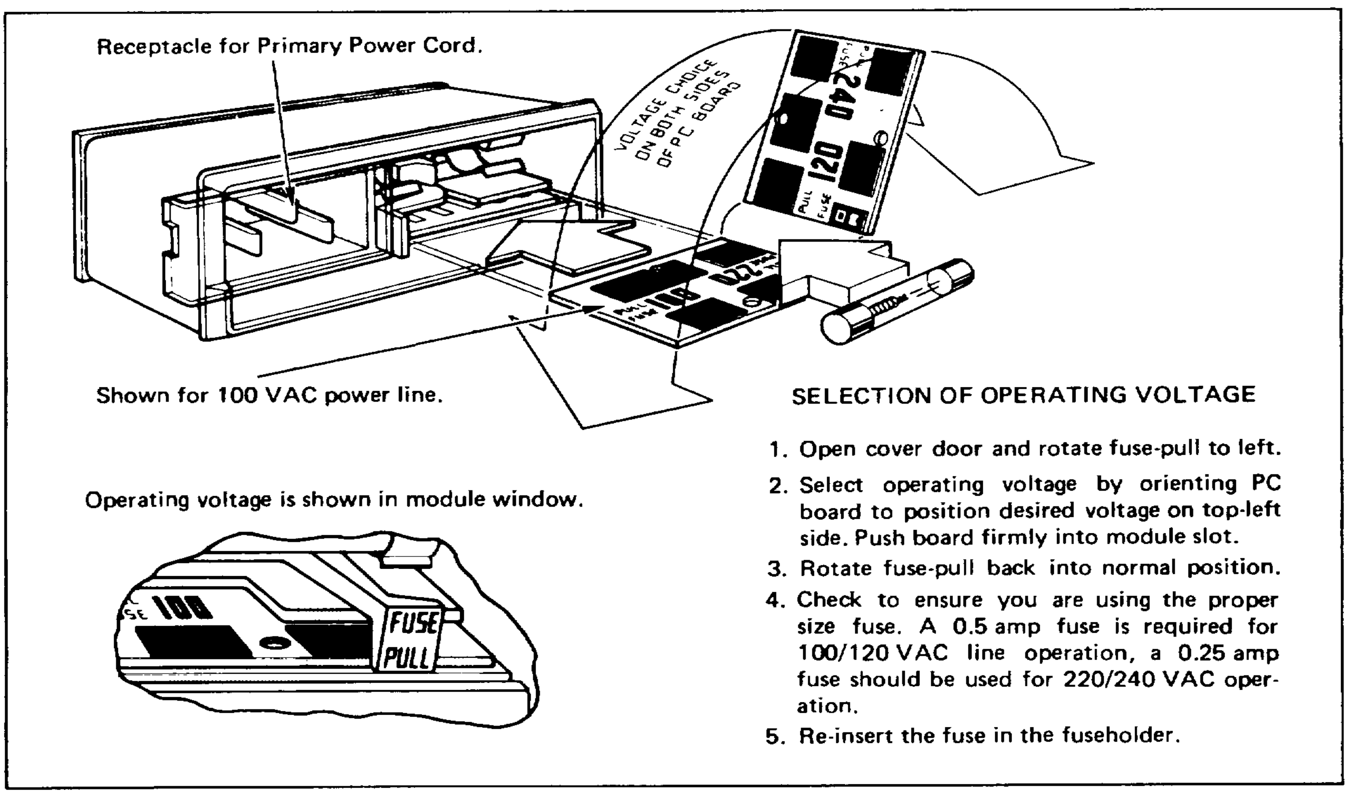


Figure 2-1. Voltage Selection.

The primary power voltage that is currently selected to operate your 34750A can be observed in the power module window. (See Figure 2-1).

2-7. GROUNDING REQUIREMENTS.

2-8. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument panel and cabinet be grounded. The Model 34750A is equipped with a three-conductor power cable that grounds the instrument when it is plugged into the appropriate receptacle. The offset pin on the power cable is the ground wire.

2-9. To preserve this protection feature when operating from a two-contact outlet, use a three-prong to two- prong adapter and connect the pigtail on the adapter to power line ground.

2-10. ENVIRONMENTAL REQUIREMENTS.

2-11. The 34750A should not be operated where the ambient temperature exceeds 00 C to 500 C (320 F to 1220° F) or stored where the ambient temperature exceeds - 400 C to 750 C (- 400 F to 1670 F).

2-12. INSTRUMENT MOUNTING.

2-13. Bench Use.

2-14. The front of the 34750A may be elevated for operating convenience by lowering the tilt stand on the bottom module.

2-15. Rack Use.

2-16. Figure 2-2 shows the available kits for rack mounting the various module combinations of the 3470 series of instruments.

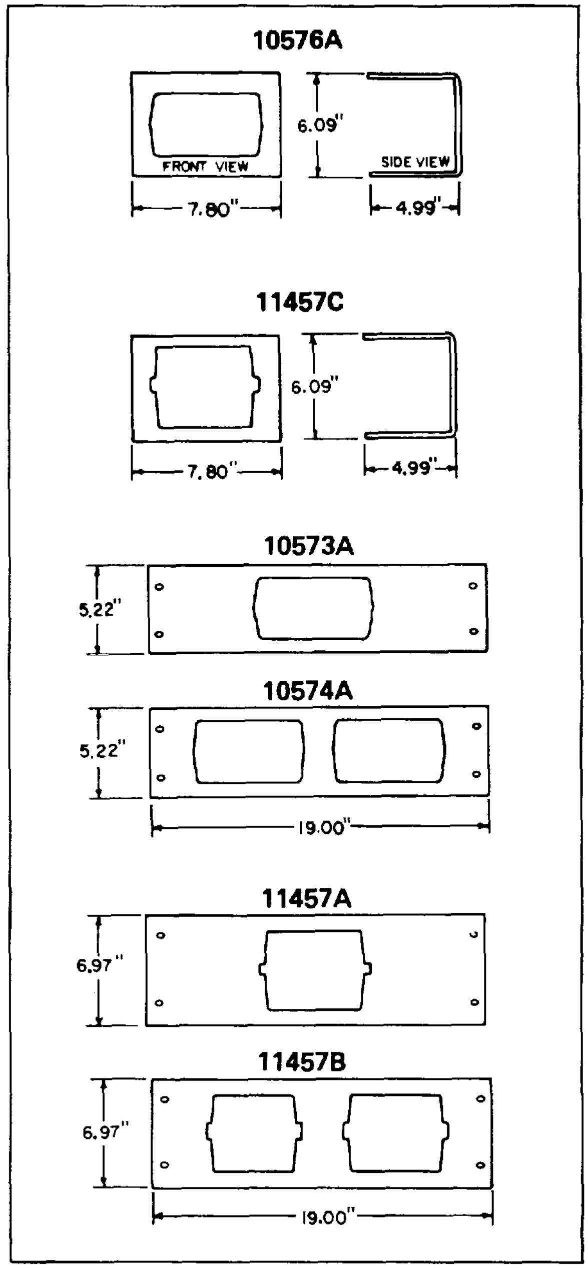


Figure 2-2. Rack Mount Kits

2-17. REPACKAGING FOR SHIPMENT.

2-18. The following paragraphs contain a general guide for repackaging the instrument for shipment. Refer to Paragraph 2-19 if the original container is to be used; 2-20 if it is not. If you have any questions, contact your nearest -hp- Sales and Service Office.

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 module number and full serial number of the instrument. In any correspondence, identify the instrument by model number and full serial number.

2-19. Place the instrument in the original container with appropriate packing material and seal well with strong tape or metal bands.

2-20. If the original container is not to be used, proceed as follows:

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

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

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

2-21. POWER CORDS AND RECEPTACLES.

2-22. Figure 2-3 illustrates power receptacle (wall outlet) configurations that are used throughout the United States and in other countries. The -hp- part number shown directly below each receptacle drawing is the part number for a 34750A 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. The 34750A power cord, power input receptacle and mating connectors meet the safety standards set forth by the International Electrotechnical Commission (IEC).

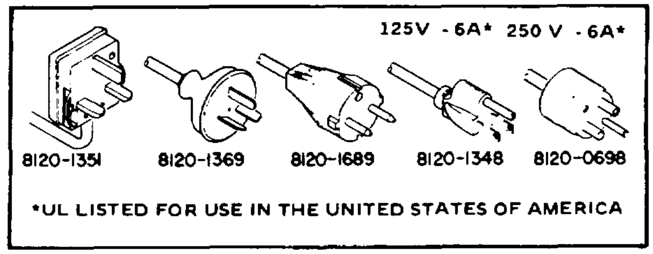


Figure 2-3. Power Receptacles.

SECTION III.
OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains instructions and information which will assist you in proper operation of your Model 34750A Display Module. A signal conditioning module (Model 34701A, 34702A or 34703A) is required for proper operation of the display module.

3-3. REAR PANEL FEATURES.

3-4. The rear panel of the Model 34750A is shown in Figure 3-1.

CAUTION

DO NOT PLUG IN THE POWER CORD WITHOUT FIRST SELECTING THE PROPER LINE VOL TAGE.

3-5 WARM-UP.

3-6. A warm-up period of 1 hour is normally required for the instrument to achieve specified accuracy. The instrument should be calibrated with the bottom and center modules to be used with the instrument.

NOTE

Due to temperature change inside the instrument between line and battery operation, the + and - references must be readjusted when changing modes to achieve specified accuracy. The nominal temperature change between line and battery operation is - 150 C

3-7. OPERATION WITH PLUG-ON MODULES.

3-8. Information regarding operation of the instrument with a plug-on module can be found in the Operating and Service Manual for the plug-on.

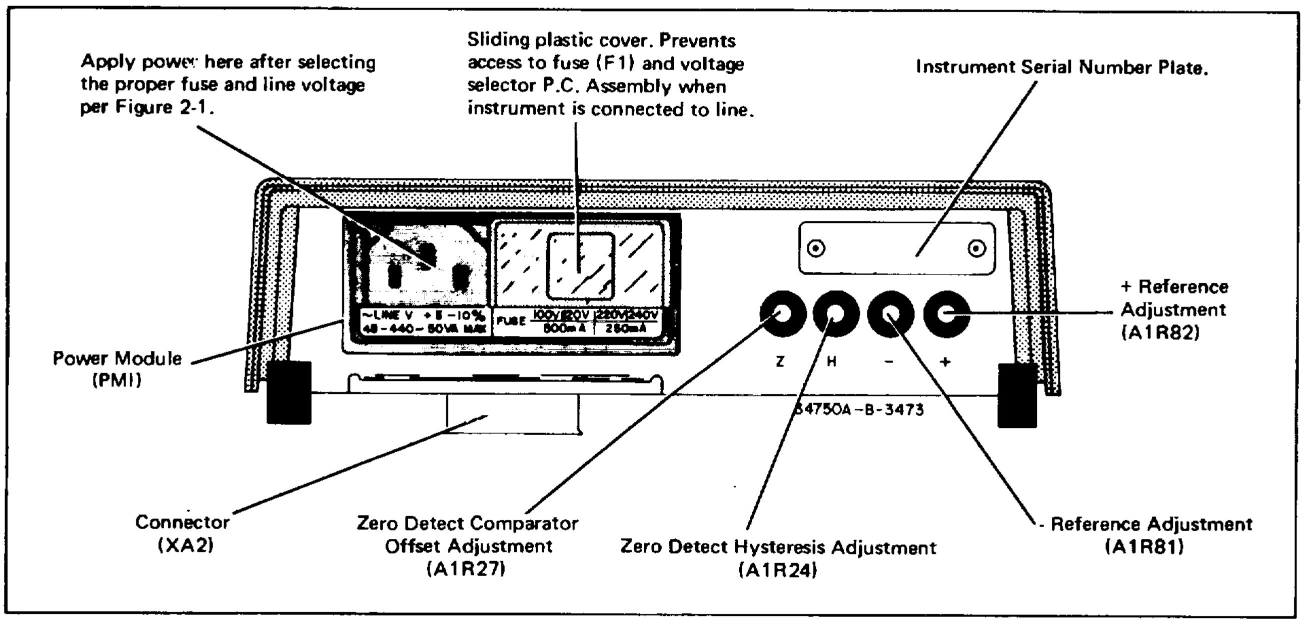
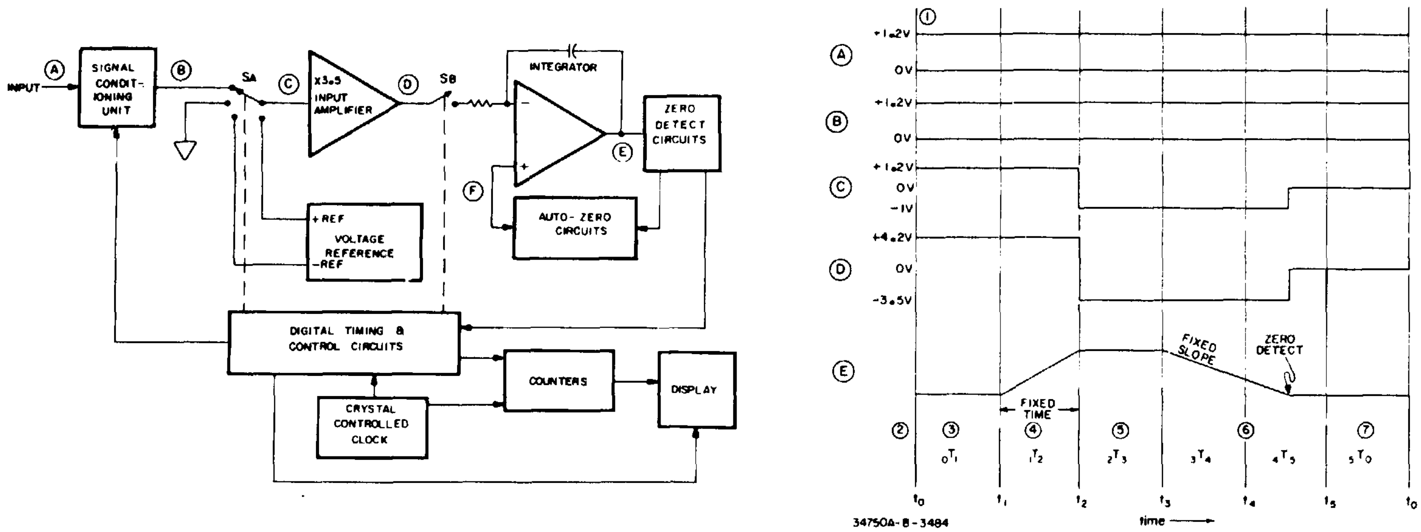


Figure 3-1. 34750A Rear Panel.

CAUTION

INSTALLATION OR REMOVAL OF PLUG-ON MODULES IS TO BE MADE BY QUALIFIED PERSONNEL ONLY.



1. This measurement example is for a dc voltage of + 1.2 volts measured on the 1 volt range of an -hp- Model 34701A. For this measurement the voltage at A and B is + 1.2 volts for the entire measurement sequence.

2. Prior to to (during $_5T_O$ of the previous measurement) S_A was connected to ground and S_B was closed. The Auto-Zero circuit was enabled and a voltage applied to the + input of the Integrator Amplifier (point F) that causes the voltage at E to be 0 volts. This voltage will stay at F until the Auto-Zero circuit is-again enabled after the value of the input voltage has been determined.

3. At t_o, S_A is switched to the output of the signal conditioning unit and the Input Amplifier is given time to respond to its new value during $_OT_1$. S_B is open during this time interval so the output of the Integrator remains at 0 volts.

4. S_B is closed at t_1 and the Integrator output ramps to a level proportional to the input voltage during $_1T_2$.

5. The output level of the Integrator remains constant during $_2T_3$ because S_B opens at t_2. S_A is switched to one of the reference voltage positions (- Ref. for a + voltage at B) and the Input Amplifier Is given time to achieve its new output level.

6. During $_3T_4$ and $_4T_5$, S_B is closed and the Integrator output ramps toward 0 volts. When zero detect occurs S_A is switched to ground and the Auto-Zero circuits are enabled. During the time interval from t_3 until zero detect occurs the output of a fixed frequency oscillator is counted. The counts accumulated during this time interval are transferred to storage buffers and displayed as measured result on the front panel.

7. The auto-zero cycle begins at zero detect. Zero detect can occur as late as t_5. The time interval $_5T_O$ provides adequate time for the Auto-Zero circuits to complete the auto-zero cycle.

Figure 4-1. Basic Block Diagram of 34750A

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. The 34750A Display is a five-digit analog-to-digital converter that utilizes the dual slope integrating technique and a LED (light-emitting diode) display. The 34750A is designed to operate with a signal-conditioning "Plug-On Module". The signal-conditioning unit converts the input signal to a dc voltage between ± 2 volts (± 1 volt full scale + 100% overrange) which is measured and displayed by the 34750A. A Basic Block Diagram of the 34750A (Figure 4-1) will be discussed in this section followed by a more detailed description of these blocks and the circuits involved.

4-3. Basic Measurement Sequence.

4-4. The dual slope integrating measurement technique employed by the 34750A is described with waveforms and a timing sequence in Figure 4-1. Each measurement sequence is divided into six time intervals of equal length. Figure 4-1 shows the designations that will be used to identify the beginning of each time interval, the time intervals and a description of the measurement cycle.

4-5. ANALOG CIRCUITS.

4-6. Input Amplifier.

4-7. A stable gain of ± 3.5 is provided by the Input Amplifier (see Figure 4-2). Only one of the FET switches Q1 through Q4 is conducting at a time to provide an input to the amplifier. Bias current is minimized by the FET input stage of the amplifier. Adjustment R8 sets the output at TP1 to 0 V with point 1 grounded. The FET Bias Network is discussed in Note 1 of Figure 4-2.

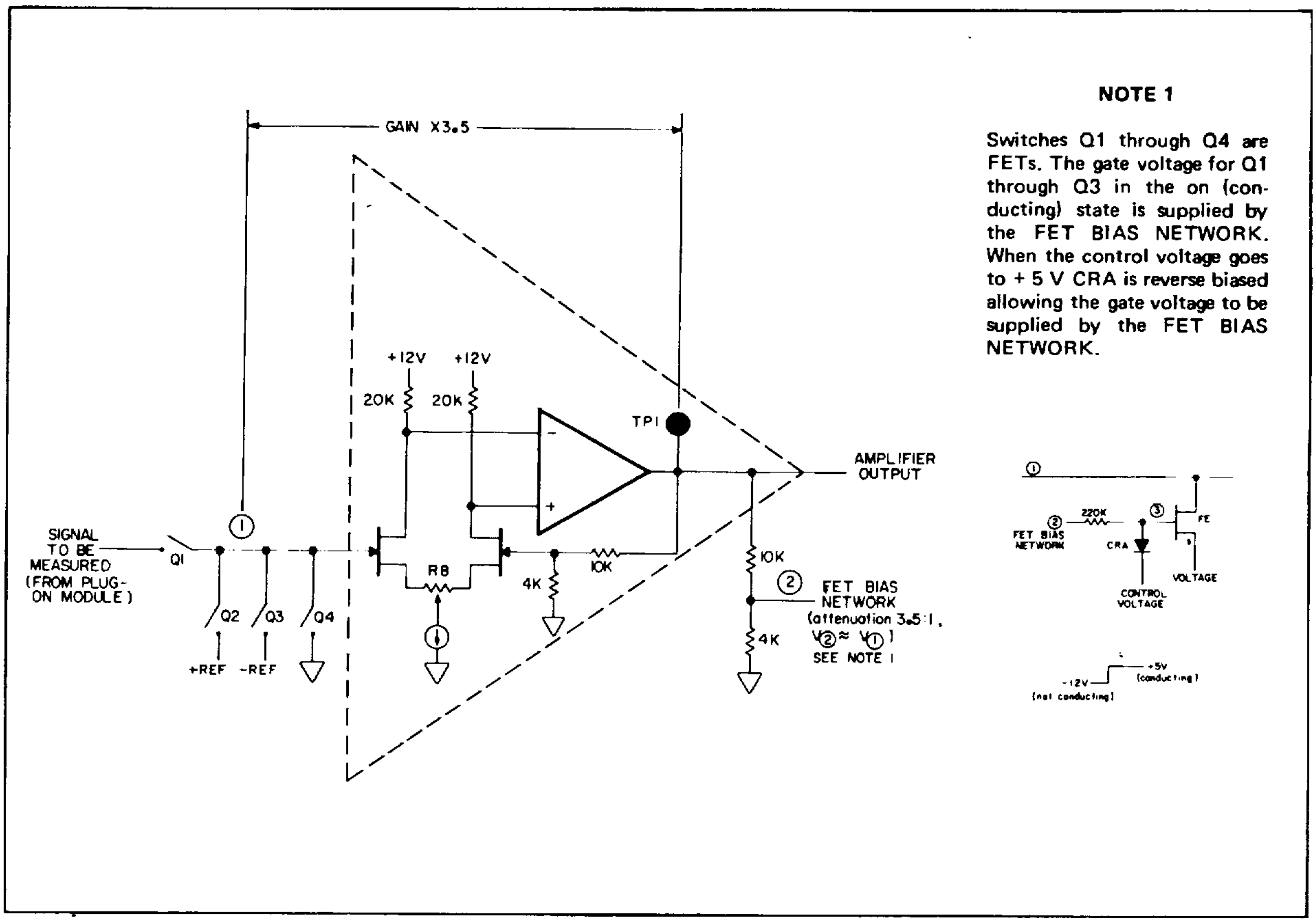


Figure 4-2. Simplified Diagram of the Input Amplifier.

4-8. Integrator.

4-9. The Integrator utilizes a high gain amplifier and a FET input stage to minimize the input current required by the amplifier. A simplified diagram of the Integrator is shown in Figure 4-3. Switch Q6 enables the Integrator during a measurement cycle. FET switch Q13 conducts during the auto-zero cycle to speed up the circuit response during auto-zero. This rapid response is required to quickly recover from overload conditions. The Auto-Zero feedback voltage for the Integrator and the Slope Amplifiers is stored on the Auto-Zero Capacitor. This voltage is applied to the gate of Q7B during the measurement cycle. The auto-zero cycle is discussed in more detail in Paragraph 4-12.

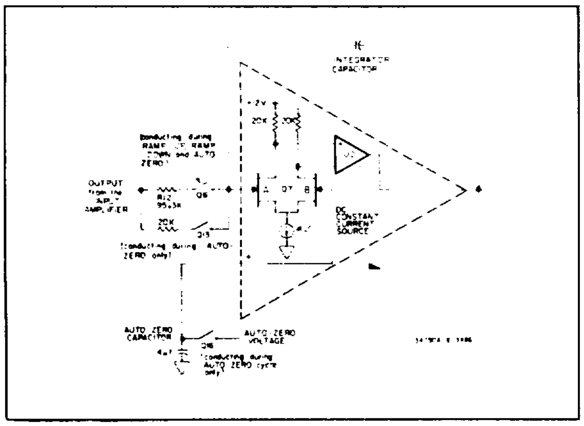


Figure 4-3. Simplified Diagram of the Integrator Circuit.

4-10. Zero Detect Circuits.

4-11. The Zero Detect circuits consist of two amplifiers, each with a gain of 10, and a high gain comparator shown in Figure 4-4. The second amplifier has diode clamps between its output and the inverting input to prevent amplifier saturation. Depending on the polarity of the input at point 1 with respect to point 2 the Comparator output is either + 3 V or 0 V*. The polarity of the voltage at point 2 is determined by the output of the Input Amplifier. At zero detect the Integrator output passes through 0 V. This causes the signal at point 1 to momentarily swing to the polarity opposite that at point 2. Accordingly, the Comparator Amplifier output switches to the level opposite the one that it previously held (i.e. + 3 V to O V or O V to + 3 V). Adjustments R24 and R27 are used to calibrate the instrument for small input voltages.

4-12. Auto-Zero Cycle.

4-13. Figure 4-5 shows the 34750A circuits in the auto-zero mode. FET switch Q13 is conducting, which speeds up the recovery of the Integrator to a 0 volt output level (this is important when recovery from overload is required). When Q16 conducts the voltage on the Auto-Zero Capacitor becomes equal to the offset at point 2 with point 1 grounded. After the auto-zero cycle, Q13 and Q16 do not conduct until the next auto-zero cycle. The voltage acquired on the Auto-Zero Capacitor during the auto-zero cycle remains as offset compensation for the rest of the measurement cycle.

4-14. DIGITAL PROCESSING CIRCUITS.

4-15. The Model 34750A Digital Processing Circuits comprise an Algorithmic State Machine (ASM). Figure 4-6 shows a typical simplified block diagram of an ASM. The ASM is a sequential logic circuit that can be described completely with a flow chart. The "Next State Function" and "Output Function" blocks are combinational logic networks. A combinational network is a

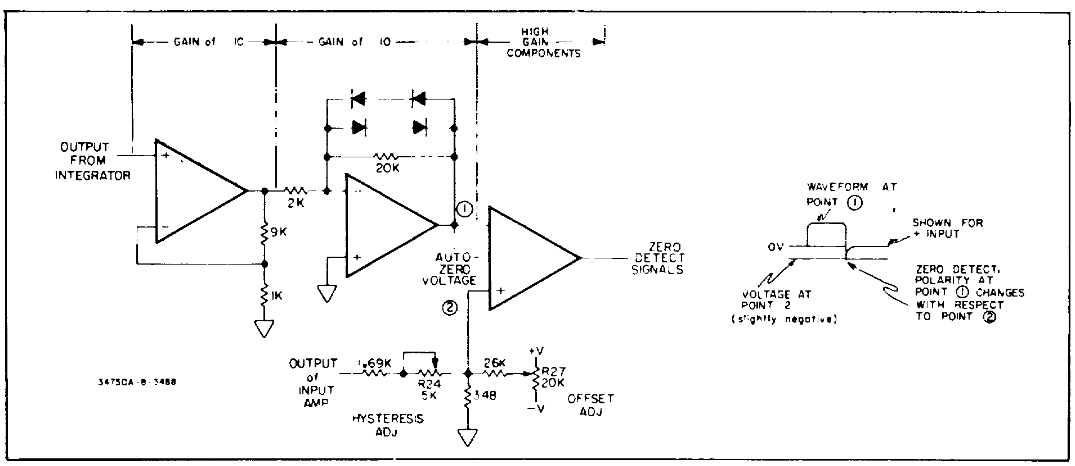


Figure 4-4. Simplified Diagram of Zero Detect Circuits.

*The Comparator Amplifier is clamped internally to prevent it from swinging to the + and - power supply voltages

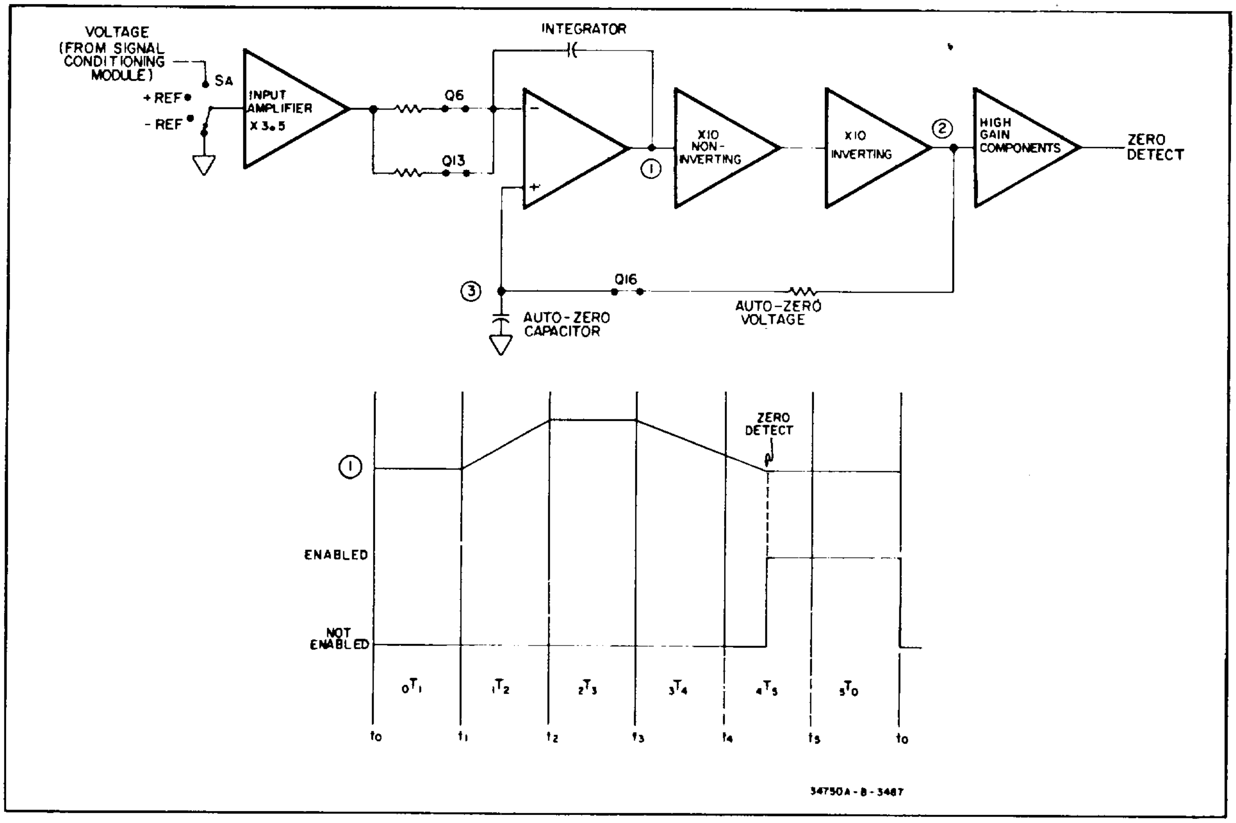


Figure 4-5. 34750A Circuits shown in Auto-Zero Mode.

logical network whose output is completely determined by its present input states. Sequential logic circuits contain memory or storage elements such as flip-flops. As the circuits operate the state of the memory changes The memory elements may have one state at first and later take on another state. The "Next State" that the memory goes to is dependent on the "Present State", the Clock and the external inputs that are supplied to the logic circuit. The output is dependent on the external inputs and the "Present State" of the memory. The "Present State" of the memory is dependent on the past sequence of inputs that have been applied.

4-16. The Algorithmic State Machine (ASM). The State Machine in the Model 34750A is shown in Figure 4-7 in block form. The inputs to the State Machine come from the Analog Circuits and the plug-on modules. The output consists of the Data Display of the instrument and logic signals which are applied to the various plug-on modules.

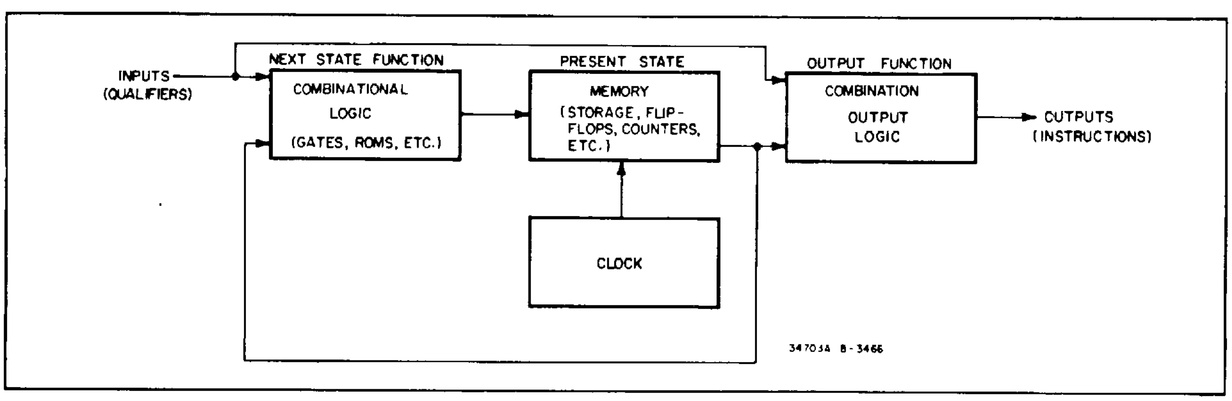


Figure 4-6. Block Diagram of Typical ASM.

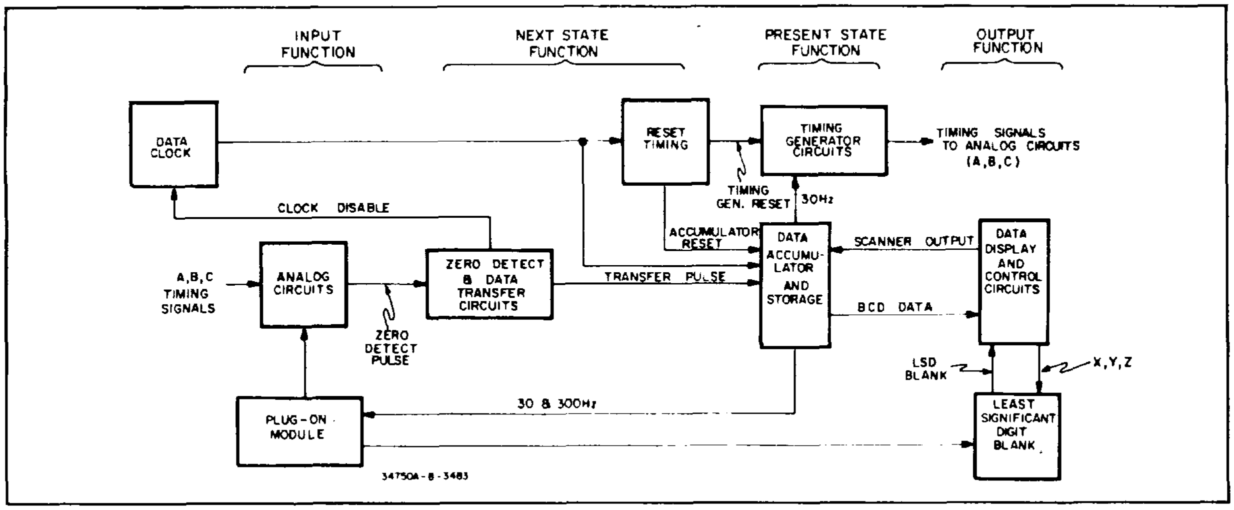


Figure 4-7. ASM Simplified Block Diagram

4-17. Data Clock (Refer to Figure 4-8).

418. The Data Clock generates controlled pulses to which the timing of the analog to digital converter of the Model 34750A is synchronized.* Its frequency is determined by Crystal Y1. The crystal output is amplified by two inverting amplifiers (U6). The output of these amplifiers is then applied to the crystal to sustain oscillations. Buffer U7 is a unity gain amplifier which isolates the clock circuit and prevents loading of the clock by the external circuitry.

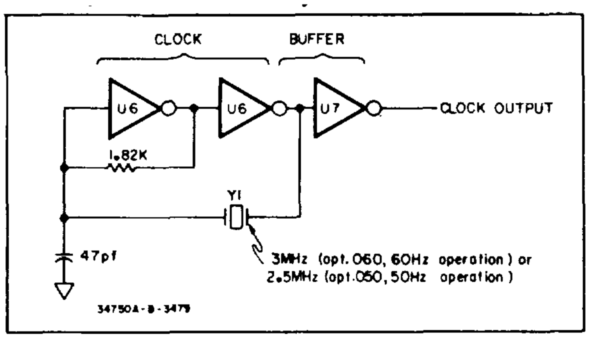


Figure 4-8. Data Clock.

4-19. Timing Generator Circuit (See Figure 7-8).

4-20. The Timing Generator consists of three D flip-flops which generate signals A, B and C. Signal A is used to generate signal B, and signal B is used to generate signal C. The inverse of signal C (i.e., C) is then used to produce signal A (via gates U16 and U8). The various combinations of signals A, B and C determine the "State Codes" of the instrument timing. Figure 4-9 shows the timing relationships for the Timing Generator and provides a flow chart indicating the sequence in which events occur within the instrument. State Codes 101 and 010 are illegal and will be entered only if caused to do so by transient pulses generated when the instrument is turned on. If an illegal state is entered, the Timing Generator flip-flops will be cleared on the next reset pulse. This sets the instrument to state 000, at which time an auto-zero cycle occurs. The timing sequence then continues in its normal fashion.

4-21. Zero Detect and Data Transfer Circuits (Refer to Figure 410).

4-22. The Zero Detect circuits generate a voltage transition when the integrator waveform reaches approximately 0 V. The polarity of the transition is determined by the polarity of the input. This pulse is then used by the Data Transfer circuits to initiate the following sequence of events:

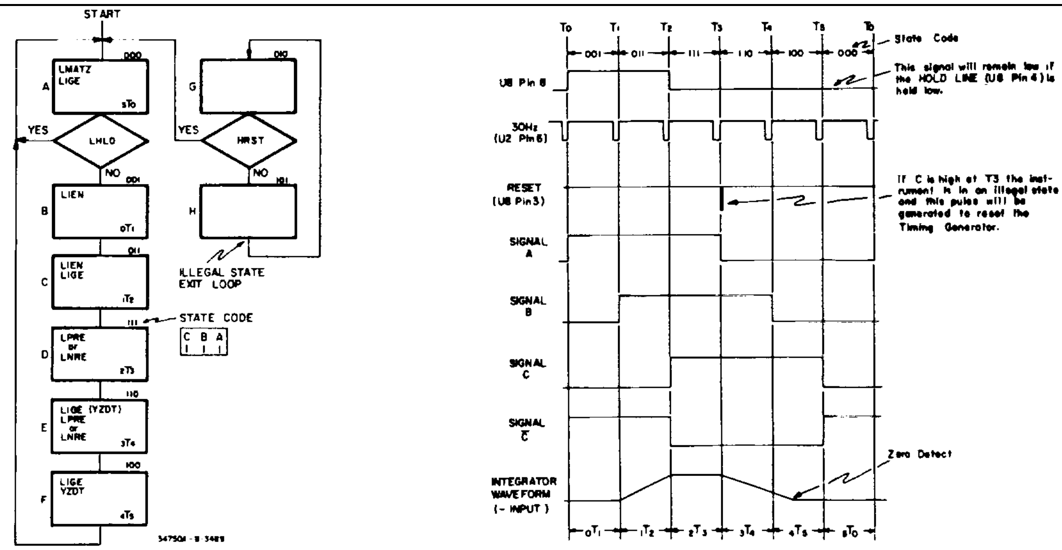
The polarity of voltage on the D input of Flip-Flop U18 during input enable determines whether the flip-flop is set or reset. If a negative voltage is connected to the 34750A input, the Q output of the flip-flop is high (> 3 V). The zero detect pulse, in this instance, is a negative transition. For a positive input the Q output of the flip-flop is high and the zero detect pulse is a positive transition. If the Q output is high the + Reference Gate is enabled. If Q is high the - Reference Gate is enabled. The zero detect pulse is applied to the Zero Detect Gates. These gates generate a positive going transition regardless of the polarity of the Zero Detect Pulse. Normally, oscillations occur on the Zero Detect waveform after the initial transition at zero detect. The Zero Detect Catcher is a flip-flop which responds to only

* This does not include the scanning system which has its own clock.

the first transition of the positive pulse from the zero detect gates. It provides a negative going pulse to the Data Transfer Timing circuits. The Data Transfer Tuning circuits inhibit the main clock during the period of data transfer within the Data Accumulator. The Transfer Tuning Waveforms in Figure 4-10 show the relationship between the Data Clock Disable pulse and the Transfer Pulse.

The length of the Data Clock Disable TM 11-6625-2809-14 & P pulse is set by the time constant of C23 and R52. The length of the Transfer pulse is set by the time constant of C26 and R53. Since the time constant of C23 and R52 is larger than that for C26 and R53 the Data Clock Disable pulse remains low for a longer period than the Transfer Pulse.

This prevents the Data clock from altering the count in the Data Accumulator during a transfer cycle.



A. State 000
1. Mainframe auto-zero cycle occurs (LMATZ).
2. Integrator enabled.
3. Cycle in auto-zero if "Hold" line is low.

B. State 001
1. Input enabled (LIEN).
2. Integrator disabled.

C. State 011
1. Input enabled (LIEN).
2. Integrator enabled (LIGE) starts run-up.
3. Polarity of input determined.

D. State 111
1. Input disabled.
2. Integrator disabled.
3. Proper reference voltage selected (LNRE or LPRE).
   a. - reference selected for + input.
   b. + reference selected for - Input.

E. State 110
1. Input disabled.
2. Reset for about 128 counts (t 40 /as).
3. Integrator enabled and run-down begins.
4. Proper reference voltage enabled (LNRE or LPRE).
5. Zero Detect Catcher enabled. Zero detect during this interval causes the following events to occur:
   a. Data Clock Disable pulse generated.
   b. Transfer pulse occurs.
   c. Reference voltage disabled.
   d. Auto-Zero Cycle begins.

F. State 100
1. Input disabled.
2. Integrator enabled and rundown continues.
3. Proper reference voltage enabled.
4. Overrange "1" illuminated.
5. Zero Detect Catcher enabled. Zero detect during this interval causes the following events to occur:
   a. Data Clock Disable pulse generated.
   b. Transfer pulse occurs.
   c. Reference voltage disabled.
   d. Auto-Zero Cycle begins.

G&H. States 010 and 101
These are illegal states and are not normally entered. If the instrument enters an illegal state, it cycles through states 010 and 101 until the reset pulse occurs. At reset, the Timing Generator is cl**eared** to state 000 **and** a normal measurement cycle begins.

Figure 4-9. 34750A Flow Chart.

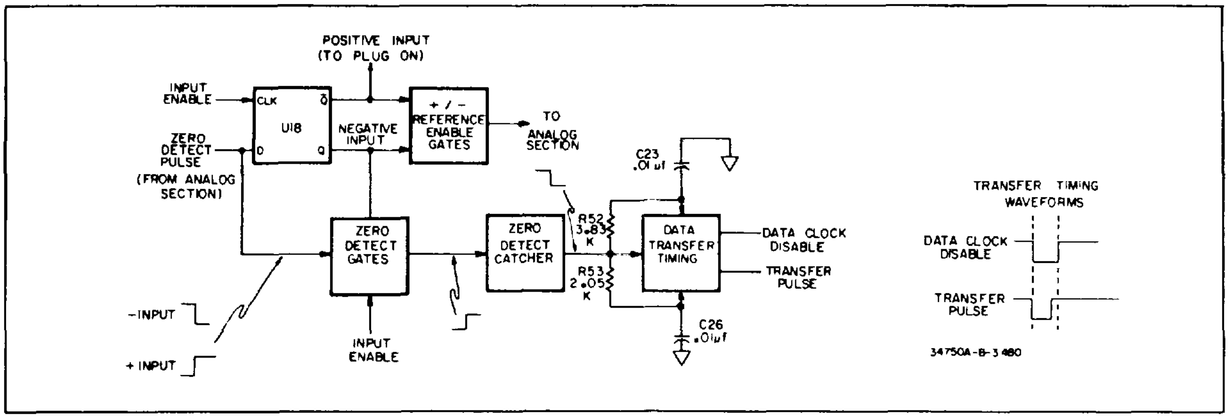


Figure 4-10. Zero Detect and Data Transfer Timing

4-23. Data Accumulator and Storage (Refer to Figure 7-7).

4-24. The Data Accumulator counts pulses from the Data Clock starting at the beginning of run-down (T3 on Figure 4-9) and continuing until zero detect. The Data Accumulator reset pulse is generated at the beginning of run-down. This pulse resets the 5 decades of the Data Accumulator Counter. At zero detect the Transfer Pulse goes low and the Data Clock is inhibited. Each decade of the accumulated count is then transferred in 8421 parallel BCD form to storage elements within the Data Accumulator. This data is then scanned a decade at a time by signals X, Y and Z, and applied to the BCD output lines.

4-25. Data Display and Control Circuits (Refer to Figure 4-11).

4-26. The Data Scanner controls the timing of the Display circuits. Signal X occurs at a 3 kHz rate. Signals Y and Z occur at a 1.5 kHz rate. Scanner clock and

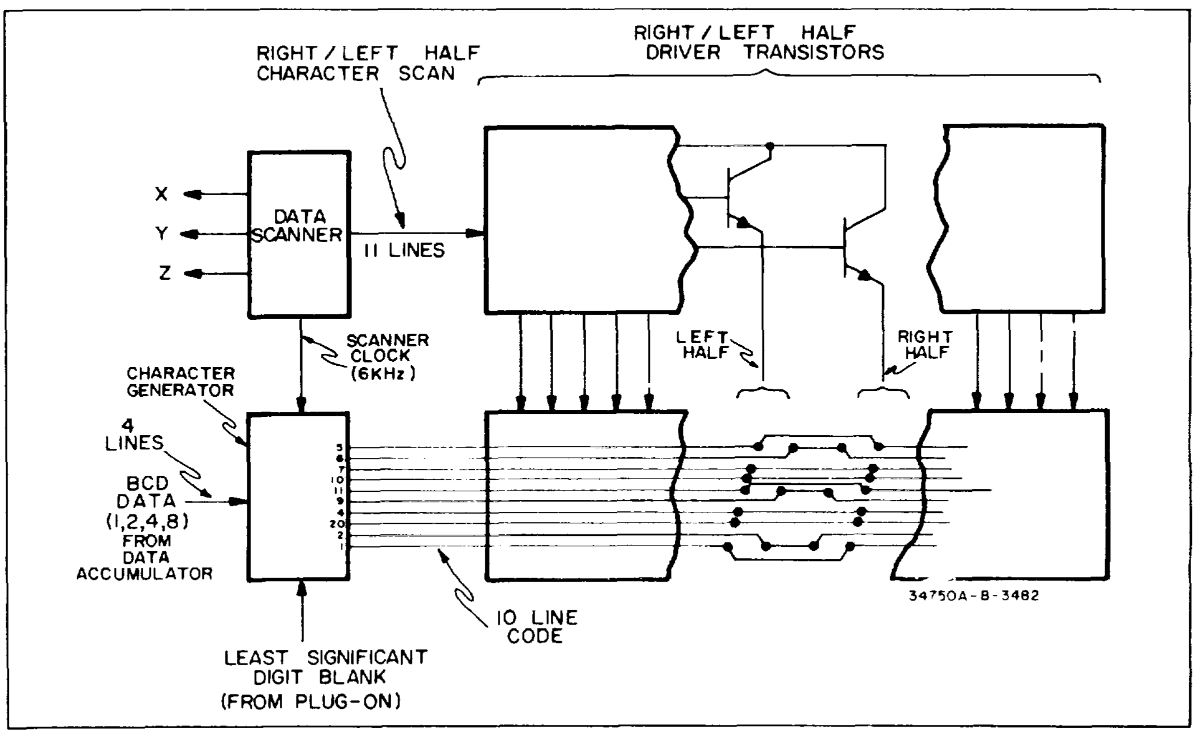


Figure 4-11. Data Display Circuits.

Right Half/Left Half character scan occur at a 6 kHz rate. The BCD data from the Data Accumulator is converted to a 10 line code. The desired lines go low (ground) when selected, providing a ground path for current through the Right Half/Left Half Driver Transistors and the LED chips connected to the lines. Each character is individually scanned beginning with the least significant and proceeding to the most significant (right to left as you face the instrument). Each character is also divided into a left and right half. The selected LED's of the right half are illuminated first followed by those of the left half.

4-27. Reset Timing (See Figure 4-12).

4-28. The Reset Timing circuits generate a reset pulse at the beginning of run-down (T3) in the measurement cycle. When signal "A" goes low the + 32 counter (U12) is reset causing Pin 2 of U8 to go low and pin 1 to go high. This initiates the Reset Pulse and enables the flip-flops in the -4 counter (U11). Figure 4-12 shows the timing relationship of the reset pulse to signal A of the Timing Generator. The Data Clock is divided by a factor of 128 (4x32). Pin 2 of U8 goes high after approximately 128 counts of the Data Clock causing Pin I of U8 to go low. This completes the reset sequence for one measurement cycle.

4-29. Least Significant Digit Blank (Refer to Figure 7-7).

4-30. Depending upon the signal conditioning module used it is sometimes necessary to blank the last digit of the Model 34750A. This is accomplished by grounding Pin 12 of the character generator during the time the least significant digit is scanned. Two "Nor" Gates (U13) and one "Nand" Gate (UI4) are used to do this. As indicated on the schematic diagram, all inputs to the Nor Gates (Pins 5, 6, 9 and 8) must be low in order to obtain a low at Pin 11 of U14. A low at Pin 11 of U14 will blank the digit.

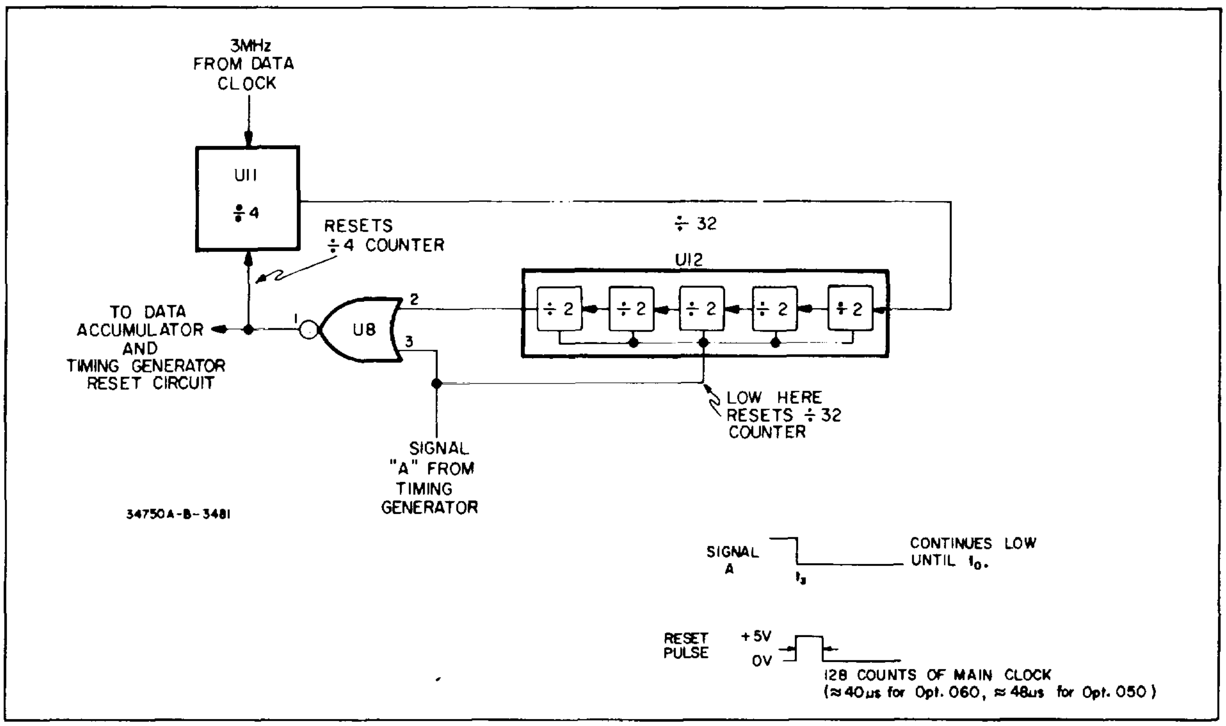


Figure 4-12. Reset Timing.

SECTION V.
MAINTENANCE

5-1. INTRODUCTION.

5-2. Operational checks and Adjustment Procedures for the Model 34750A are contained in this section of the manual. Performance tests relating to the operation of a 34750A and a plug-on module are contained in the manual for the plug-on module (34701A, 34702A or 34703 A).

CAUTION

INSTALLATION OR REMOVAL OF PL UG-ON MODULES IS TO BE MADE BY QUALIFIED PERSONNEL ONL Y.

5-3. OPERATIONAL CHECKS.

5-4. The following checks will assist in determining if your instrument is functioning correctly. These tests are not intended to check instrument specifications.

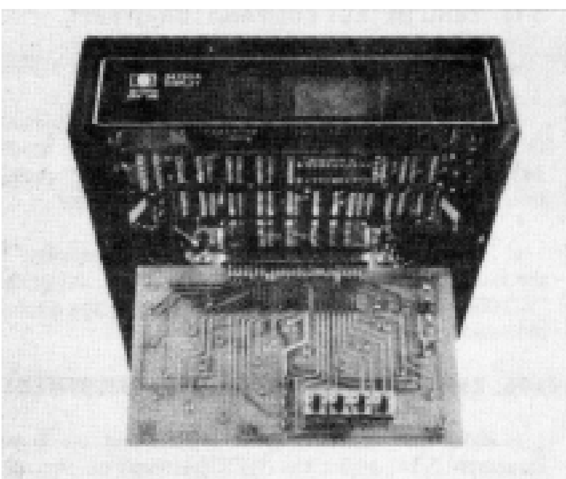


Figure 5-1. 11456A Readout Test Card.

5-5. Connect an 11456A Readout Test Card to the model 34750A as shown in Figure 5-1. Use a short clip lead to make the required connections listed in Table 5-2. and compare the test results with those indicated.

5-6. ADJUSTMENT PROCEDURE.

5-7. Paragraphs 5-12 through 5-16 are adjustment procedures for the Model 34750A Display. These procedures require the use of a 34701 A, 34702A or 34703A plug-on module. We recommend that these procedures be performed only if the performance checks show that the instrument does not meet its specifications. If the instrument cannot be adjusted to meet its specifications, refer to Troubleshooting (Paragraph 7-3) in Section VII. Table 5-1 lists test equipment recommended for the adjustment procedures and troubleshooting.

WARNING

DISCONNECT THE POWER CORD BEFORE RE-MOVING THE COVERS.

Table 5-1. Recommended Test Equipment.

Instrument Type	Required Specifications	Recommended Model
DC Digital Voltmeter	4 digit resolution Accuracy: ± (.03% of reading ± 0.01% of range)	-hp- Model 34740A
DC Standard	1 V Range Accuracy: ± (0.002% of setting ± 0.004% of Range)	-hp- Model 740B

Table 5-2. Operational Checks.

Connections on 11456A Assembly	Display Expected	Refer to the following Areas of the Manual if the Correct Display is not obtained.
Input Pin to + Ref.	**+ 1.00000 (+ 2 counts)**	**Paragraph 5-16, Figure 7-3**
Input Pin to - Ref.	**- 1.00000 (+ 2 counts)**	**Paragraph 5-16, Figure 7-3**
DP1 to GND3	**XXX.XX**	**Figure 7-3**
DP2 to GND3	**XX.XXX**	**Figure 7-3**
DP3 to GND3	**X.XXXX**	**Figure 7-3**
DP4 to GND3	**.XXXXX**	**Figure 7-3**
	NOTE X represents any digit between 0 and 9.	

5-8. Cover Removal.

5-9. In order to perform two of the adjustments in this section, it will be necessary to obtain access to the interior of the instrument. If your Display Module is connected to a plug-on module separate the two modules by pulling the slide lock levers, shown in Figure 3-1, to the rear and lifting the Display Module from the plug-on module. The 34750A Cover can then be removed by unscrewing a mounting bolt near the transformer (see Figure 5-2) and spreading apart two sets of plastic fingers which hold the Display printed circuit assembly in place. The printed circuit (p.c.) assembly is covered by a black metal shield which must also be removed. This is accomplished by unscrewing the four bolts holding it in place and lifting it off the p.c. assembly. Connect a plug-on module to the 34750A and apply power.

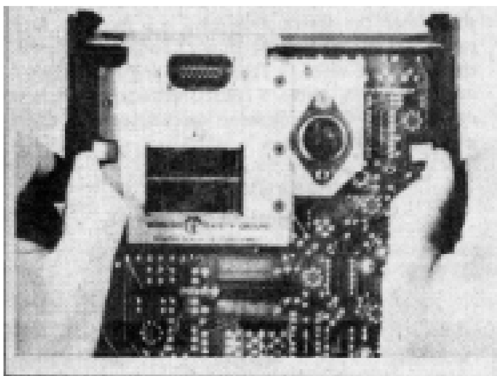


Figure 5-2. Cover Removal.

WARNING

A NUMBER OF BRASS TERMINAL.S EXTENDED FROM THE POWER MODULE (PMI) INTO THE INSTRUMENT (SEE FIGURE 5-4). A PLASTIC COVER HAS BEEN PLACED OVER THE TERMINALS TO PREVEIVT ELECTRICAL SHOCK WHEN WORKING IN THE AREA OF THE POWER MODULE. EXTREME CARE SHOULD BE EXERCISED. PARTICULARLY IF THIS COVER IS REMOVED, TO AVOID CONTACT WITH THE TERMINALS. THIS WARNING APPLIES WHENEVER THE INSTRUMENT IS CONNECTED TO THE POWER LINE

5-10. Adjustment Locator.

5-11. Figure 5-4. shows the location of all adjustments within the Model 34750A.

NOTE

The following procedures require a properly functioning plug-on module. Refer to the Operating and Service manual of the associated plug-on module if it appears to be malfunctioning.

5-12. Power Supply Adjustment.

a. Connect a dc voltmeter (-hp- Model 34740A/ 34701A or equivalent) between AIGNDI and the cathode of AICR25.

b. Observe the voltmeter and adjust AlR69 for + 12 V ± 10 mV.

5-13. INPUT AMP. OFFSET ADJUSTMENT.

a. Connect TP4 of the Al assembly to GNDI.

b. Connect a digital voltmeter (-hp Model 34740A/ 34701 A or equivalent) to TPI, using GNDI as reference, and adjust Al R8 for 0 V ± 1 mV.

NOTE

Before proceeding, all covers removed in Paragraph 5-8 should be reinstalled. The instrument should then be allowed to warm up for approximately 2 hours. See Paragraph 3-5 for information on instrument warm-up time.

5-14. ZERO DETECT COMPARATOR OFFSET.

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

b. Set the plug-on module to the 1000 V range and the DC STANDARD for a .20000 V output. (If a Model 34703A plug-on is used, set i; for "MANUAL" operation.) Note the indication of the voltmeter display.

c. Invert the input and again observe the display. If the indications in steps b and c do not agree, adjust the "Z" (ZERO) control on the rear panel until the display indication for both polarities is the same.

5-15. ZERO DETECT HYSTERESIS ADJUSTMENT.

a. With the instruments connected and set as in Paragraph 5-14, adjust the "H" Hysteresis on the rear panel to give a display indication of 20 counts.

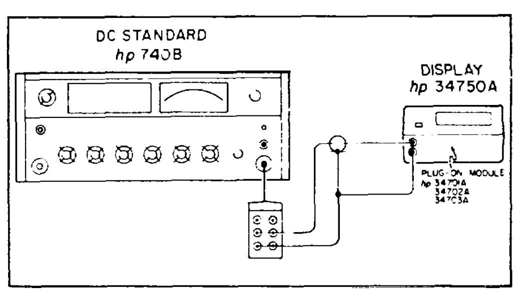


Figure 5-3. Zero Detect Comparator Offset Adjustment

5-16. REFERENCE VOLTAGE ADJUSTMENTS.

a. Apply + 1.00000 V to the plug-on module input from the DC STANDARD. The plug-on module should be set to the 1 V range.

b. Adjust the "+" control on the rear panel of the instrument for + 1 V ± ! count.

c. Apply - 1.00000 V to the Model 34750A input
from the DC STANDARD.

d. Adjust the "-" control on the rear panel of the
instrument for - 1 V + 1 count.

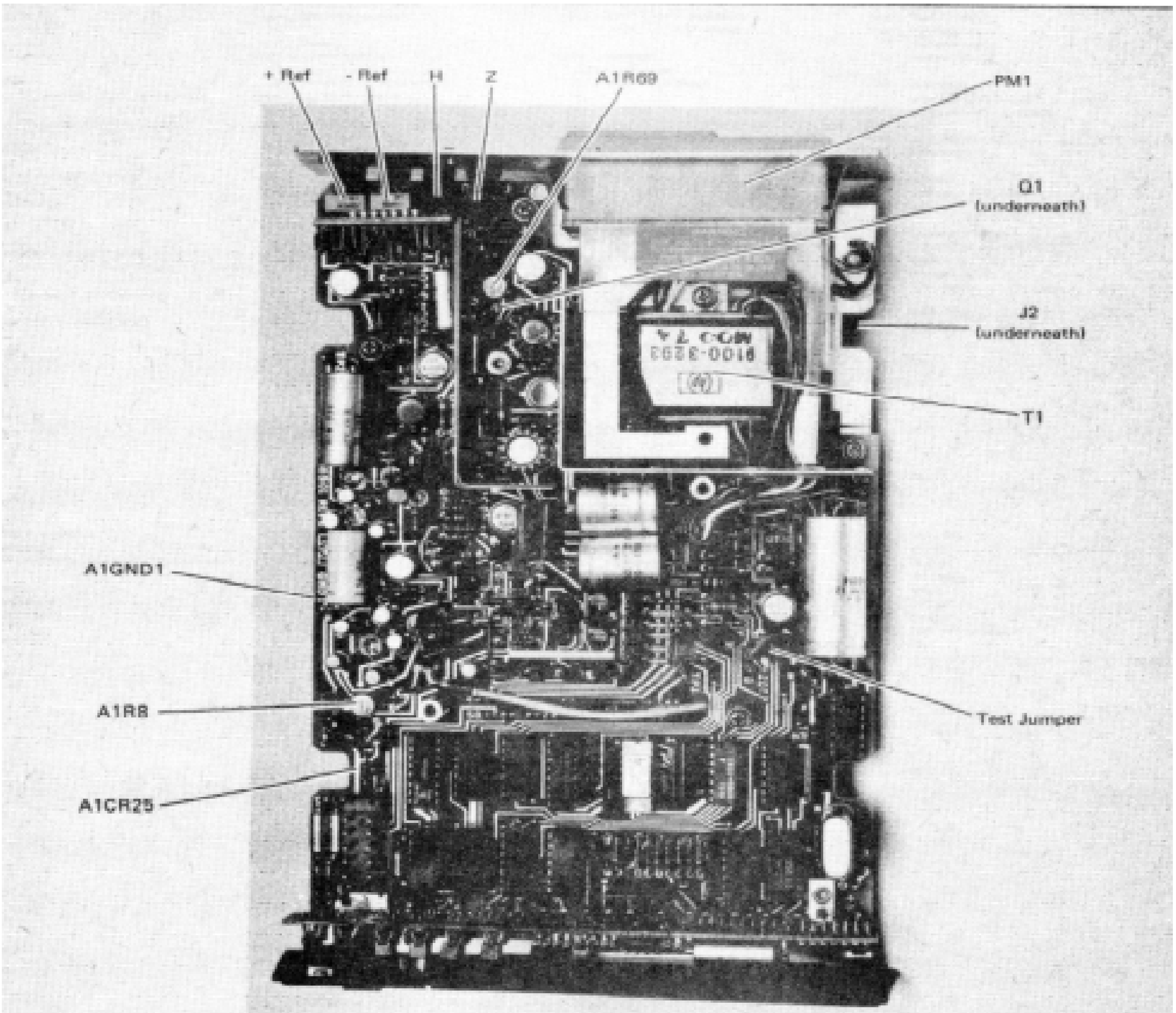


Figure 5-4. Chassis Mounted Component and Adjustment Locator.

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

SECTION VI
IDENTIFICATION OF PARTS

6-1. INTRODUCTION.

6-2. This section contains information to identify parts Table 6-1 lists parts in alphameric order of their reference designators and indicates the description, -hp- Part Number of each part, together with any applicable notes, and provides 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.

d. Manufacturers part number.

6-3. Miscellaneous parts are listed at the end of Table 6-1.

6-4. DELETED

6-5. DELETED

6-6. DELETED

6-7. DELETED

6-8. PARTS CHANGES.

6-9. Components which have been changed are so marked by one of three symbols; i.e. Δ, Δ with a letter subscript, e.g. $\Delta_{a,}$ or Δ with a number subscript e.g. Δ_{10}. A Δ with no subscript indicates the component listed is the preferred replacement for an earlier component. A Δ with a letter subscript indicates a change which is explained in a note at the bottom of the page. A Δ with a number subscript indicates the related change is discussed in backdating IAppx A). The number of the subscript indicates the number of the change in backdating which should be referred to.

6-10. PROPRIETARY PARTS.

6-11. Items marked by a dagger (t) in the reference designator column are available only for repair and service of Hewlett-Packard instruments.

Table 6.1 IDENTIFICATION OF PARTS

Table 6-1. IDENTIFICATION OF PARTS

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	34750-66501	1	BOARD ASSY:MAIN (INCLUDES A2)	28480	34750-66501
A1C1	0140-0204	3	C:FXD MICA 47PF 500V	72136	DM15E470J0500WV1CR
A1C2	0160-2207	2	C:FXD MICA 300 PF 5%	28480	0160-2207
A1C3	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A1C4	0160-3622	10	C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C5	0140-0204	2	C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A1C6	0160-2199	2	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A1C7	0150-0045	1	C:FXD TI 8.2 PF 5% 500VDCW	78488	TYPE GA
A1C8	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C9	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C10	0160-4025	1	C:FXD 0.33 UF 10%	28480	0160-4025
A1C11	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A1C12	0160-3501	1	C:FXD POLY 4 UF 10% 50VDCW	84411	HEW 138
A1C13	0160-0820	1	C:FXD CER 0.05 UF +80-20% 25VDCW	72982	5855 Y5U 503Z
A1C14	0150-0050	2	C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CDH
A1C15	0180-1794	1	C:FXD ELECT 22 UF 10% 35VDCW	56289	150D226X9035R2-DYS
A1C16	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A1C17	0160-3077	2	C:FXD MY 0.027 UF 10% 100VDCW	56289	225P2739WB1-PWM
A1C18	0160-3077		C:FXD MY 0.027 UF 10% 100VDCW	56289	225P2739WB1-PWM
A1C19	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C21	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C22	0140-0204		C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A1C23	0160-3847	2	C:FXD CER 0.01 UF +100-10% 25VDCW	72982	8005-01ACB-W5R-103P
A1C24	0180-1701	2	C:FXD ELECT 6.8 UF 20% 6VDCW	28480	0180-1701
A1C25	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C26	0160-3847		C:FXD CER 0.01 UF +100-10% 25VDCW	72982	8005-01ACB-W5R-103P
A1C27	0140-0200	1	C:FXD MICA 390 PF 5%	72136	RDM15F391J3C
A1C28	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A1C29	0160-0362		C:FXD MICA 510 PF 5%	28480	0160-0362
A1C31	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C32	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C33	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C34	0180-0228	2	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C35	0180-0465	2	C:FXD 500 UF 30VDCW	28480	0160-4080
A1C36	0180-0465		C:FXD 500 UF 30VDCW	28480	0160-4080
A1C37	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C38	0160-3622		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A1C39	0180-0466	1	C:FXD 2200 UF 15VDCW	28480	0160-4081
A1C41	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CDH
A1C42	0180-1701		C:FXD ELECT 6.8 UF 20% 6VDCW	28480	0180-1701
Δ_b A1C43	0180-4095		C:FXD .5 PF 500V	95275	VY13COR5B
A1CR1, 2	1901-0040	10	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR5	1901-0376	3	DIODE:SILICON 35V	28480	1901-0376
A1CR6	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR7	1902-0041	2	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR8	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR9	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR10	1901-0586	1	DIODE:SI 30 WV 10 PA LEAKAGE	28480	1901-0586
A1CR11	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A1CR12	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR13	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A1CR14	1902-0048	3	DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A1CR15	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR16	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR17	1901-0518	1	DIODE:HOT CARRIER	28480	1901-0518
A1CR18	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A1CR19	1901-0028	7	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR21	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR22	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR23	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR24	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A1CR25, CR26	1902-0202	2	DIODE BREAKDOWN:15.0V 5% 1W	28480	1902-0202
A1CR27, CR28			DIODE BREAKDOWN:6.43V (MATCHED WITH A1U25 AS A SET, SEE A1U25 FOR PART NUMBER TO ORDER)		
A1CR29, CR31	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR32	1902-0551	1	DIODE BREAKDOWN:6.19V 5%	28480	1902-0551
A1CR33	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR34	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1L1	9100-3223	2	COIL:FXD 220 UH	28480	9100-3223
A1L2	9100-3223		COIL:FXD 220 UH	28480	9100-3223
A1L3	9170-0894		BEAD SHIELDING	02114	56-59-65/4A6

See introduction to this section for ordering information

Δ_b This component did not exist on instrument Serial No's. 1304A00275 and below.

Table 6-1. IDENTIFICATION OF PARTS - Continued

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1L4	9170-0894		BEAD:SHIELDING	28480	9170-0894
A1L5	9170-0894		BEAD:SHIELDING	28480	9170-0894
A1L6	9170-0894		BEAD:SHIELDING	28480	9170-0894
A1L7	9170-0894		BEAD:SHIELDING	28480	9170-0894
A1Q1	1855-0208	6	TSTR: SI	17856	2N4117
A1Q2	1855-0305		TSTR:SI	80131	2N4117A
A1Q3	1855-0305		TSTR:SI	80131	2N4117A
A1Q4	1855-0305		TSTR:SI	80131	2N4117A
A1Q5	1855-0418	1	TRANSISTOR:FET	28480	1855-0418
A1Q6	1855-0093	1	TSTR:FET N-CHANNEL	28480	1855-0093
A1Q7	1855-0308	1	TSTR:SI NPN DUAL	28480	1855-0308
A1Q8	1853-0020	5	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A1Q9	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A1Q11	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A1Q12	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A1Q13	1855-0412		TSTR:FET	28480	1855-0412
A1Q14	1854-0071	5	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q15	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q16	1855-0412		TSTR:FET	28480	1855-0412
A1Q17	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A1Q18	1853-0089	1	TSTR:SI PNP	80131	2N4917
A1Q19	1854-0094	1	TSTR: SI NPN	80131	2N3848
A1Q21	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q22	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q23	1854-0039	1	TSTR:SI NPN	80131	2N3053
A1Q24	1853-0016	1	TSTR:SI PNP	80131	2N3638
A1Q25	1853-0051	1	TSTR:SI PNP	80131	2N4037
A1R1	0684-5641	1	R:FXD COMP 560K OHM 10% 1/4W	01121	CB 5641
A1R2	0684-2241	3	R:FXD COMP 220K OHM 10% 1/4W	01121	CB 2241
A1R3	0684-2241		R:FXD COMP 220K OHM 10% 1/4W	01121	CB 2241
A1R4	0684-2241		R:FXD COMP 220K OHM 10% 1/4W	01121	CB 2241
A1R5	0684-3331	2	R:FXD COMP 33K OHM 10% 1/4W	01121	CB 3331
Δ_a A1R6	0757-0448	6	R:FXD FLM 15K OHM 1% 1/8W	28480	0757-0449
Δ_a A1R7	0757-0448		R:FXD FLM 15K OHM 1% 1/8W	28480	0757-0449
A1R8	2100-2061	1	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2061
A1R9	0757-0442	5	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R11	0698-3558	3	R:FXD MET FLM 4.02K OHM 1% 1/8W	28480	0698-3558
A1R12	0757-0978	1	R:FXD FLM 95.3K OHM 1% 1/8W	28480	0757-0978
				28480	0698-3271
A1R13	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A1R14	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A1R15	0684-2701	1	R:FXD COMP 27 OHM 10% 1/4W	01121	CB 2701
A1R16	0684-2711	1	R:FXD COMP 270 OHM 10% 1/4W	01121	CB 2711
A1R17	0757-0283	1	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1R18	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A1R19	0698-3443	1	R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A1R21	0757-0280	1	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R22	0757-0288	1	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A1R23	0698-4428	1	R:FXD FLM 1.69K OHM 1% 1/8W	28480	0698-4428
A1R24	2100-3207	1	R:VAR CERMET 5K OHM 10% LIN 1/2W	28480	2100-3207
A1R25	0698-3445	1	R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A1R26	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A1R27	2100-3353	1	R:VAR CERMET 20K OHM 10% 1/2W	28480	2100-3353
A1R28	1810-0171	1	RES. NETWORK 5 X 2.7K OHM	28480	1810-0171
A1R29	0684-1031	5	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R31	1810-0151	1	RESISTIVE NETWORK	28480	1810-0151
A1R32	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R33	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R34	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R35	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A1R36	0684-5631	2	R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
Δ_a A1R37	0698-3268		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R38	0757-0430	1	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A1R39	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R41	0698-3558		R:FXD MET FLM 4.02K OHM 1% 1/8W	28480	0698-3558
A1R42	0698-3268	1	R:FXD FLM 11.5K OHM 1% 1/8W	28480	0698-3268
A1R43	0684-5631		R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A1R44	0698-3499	1	R:FXD FLM 40.2K OHM 1% 1/8W	28480	0698-3499
A1R45	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R46	0684-3321	3	R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A1R47	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A1R48	1810-0139	4	RES. NETWORK 4 X 22K OHM 5% 0.125W EA.	28480	1810-0139
A1R49	1810-0172	1	RES. NETWORK	28480	1810-0172
A1R51	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A1R52	0698-3153		R:FXD MET FLM 3.83 K OHM 1% 1/8W	28480	0698-3153

See introduction to this section for ordering information

Δ_a Use for all replacement. Replace all components marked A_a if any one is replaced

Table 6-1. IDENTIFICATION OF PARTS - Continued

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R53	0698-4431	2	R:FXD MET FLM 2.05 K OHM 1% 1/8W	28480	0698-4431
A1R54	1810-0173	1	RES. NETWORK	28480	1810-0173
A1R55	0684-3331		R:FXD COMP 33K OHM 10% 1/4W	01121	CB 3331
A1R56	1810-0139		RES. NETWORK 4 X 22K OHM 5% 0.125W EA.	28480	1810-0139
A1R57	1810-0139		RES. NETWORK 4 X 22K OHM 5% 0.125W EA.	28480	1810-0139
A1R58	1810-0139		RES. NETWORK 4 X 22K OHM 5% 0.125W EA.	28480	1810-0139
A1R59	0684-3311	4	R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A1R61	0684-3311		R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A1R62	0684-3311		R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A1R63	0684-3311		R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A1R64	0757-0429	1	R:FXD MET FLM 1.82K OHM 1% 1/8W	28480	0757-0429
A1R65	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A1R66	0687-2701	1	R:FXD COMP 27 OHM 10% 1/2W	01121	EB 2701
A1R67	0683-0365	1	R:FXD COMP 3.6 OHM 5% 1/4W	01121	CB-3665
A1R68	0698-4441	1	R:FXD MET FLM 3.74K OHM 1% 1/8W	28480	0698-4441
A1R69	2100-2497	1	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A1R71	0757-0290	1	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R72	0812-0040	1	R:FXD WW 0.27 OHM 5% 1/2W	28480	0812-0040
A1R73	0683-1025	1	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1R74	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R75	0698-4470	1	R:FXD FLM 6.98K OHM 1% 1/8W	28480	0698-4470
A1R76	0698-3279	1	R:FXD MET FLM 4990 OHM 1% 1/8W	28480	0698-3279
A1R77	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R78	0684-0271	1	R:FXD COMP 2.7 OHM 10% 1/4W	01121	CB 2701
A1R79	0687-1201	1	R:FXD COMP 12 OHM 10% 1/2W	01121	EB 1201
A1R80	0683-1525		R:FXD 1.5K OHM 5% 1/4 W	01121	CB1525
A1R81	2100-3274	2	R:VAR CER 10K OHM 10% LIN 1/2W	28480	2100-3274
A1R82	2100-3274		R:VAR CER 10K OHM 10% LIN 1/2W	28480	2100-3274
Δ_b A1R83, 84	0811-0639		R:FXD 51 OHM 5% 1½W	75042	BW-20
Δ_b A1R85	0684-2721		R:FXD 2700 OHM 10% 1/4W	01121	CB2721
A1S1	3101-1723	1	SWITCH:PUSHBUTTON 4PDT SINGLE STA.	71590	A-3101-1723-1
A1U1	1820-0223	3	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A1U2	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A1U3	1826-0009	1	IC:LINEAR OP. AMPL.	28480	1826-0009
A1U4	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A1U5	1820-0321	1	INTEGRATED CIRCUIT:HI-SPEED COMPARATOR	01295	SN72 710L
A1U6	1820-0586	1	IC:TTL LP HEX INVERTER	12040	DM74L04N
A1U7	1820-0668	1	IC:TTL HEX DRIVER W/OPEN COLL(30V)	01295	SN7407N
A1U8	1820-0583	4	IC:TTL LP QUAD 2-INPT NAND GATE	12040	DM74L00N
A1U9	1820-0839	1	IC:TTL QUAD D-TYPE F/F	01295	SN74175N
A1U11	1820-0596	2	IC:TTL LP DUAL EDGE TRIG. D F/F	12040	DM74L74N
A1U12	1820-1150	1	IC:RESET COUNTER	28480	1820-1150
A1U13	1820-0584	1	IC:TTL LP QUAD 2-INPT NOR GATE	12040	DM74L02N
A1U14	1820-0583		IC:TTL LP QUAD 2-INPT NAND GATE	12040	DM74L00N
A1U15	1820-0598	1	IC:TTL LP QUAD 2-INPT EXCL. OR GATE	12040	DM74L86N
A1U16	1820-0583		IC:TTL LP QUAD 2-INPT NAND GATE	12040	DM74L00N
A1U17	1820-0587	1	IC:TTL LP TRIPLE 3-INPT NAND GATE	12040	DM74L10N
A1U18	1820-0596		IC:TTL LP DUAL EDGE TRIG. D F/F	12040	DM74L74N
A1U19	1820-0585	1	IC:TTL LP QUAD 2-INPT NAND GATE	12040	DM74L03N
A1U21†	1820-0798	1	IC:TTL SIX DECADE	28480	1820-0798
A1U22	1820-0196	2	IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A1U23	1826-0043	1	IC:LINEAR OPERATIONAL AMPLIFIER	28480	1826-0043
A1U24	1820-0196		IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A1U25†	1813-0032	1	REFERENCE:HYBRID	28480	1813-0032
A1XA1	1251-2564	1	CONNECTOR:R & P, 50 CONTACT PLUG	74868	57-10500-27
A1Y1	0410-0467	1	CRYSTAL (FOR 60 HZ OPERATION)	28480	0410-0467
A1Y1	0410-0490	1	CRYSTAL:QUARTZ (FOR 50 HZ OPERATION)	28480	0410-0490
A2	34750-66502	1	BOARD ASSY: HPA (PART OF A1 ASSY)	28480	34750-66502
A2C1	0180-1714	1	C:FXD ELECT 330 UF 10% 6VDCW	28480	0180-1714
A2C2	0160-0156	1	C:FXD MY 0.0039 UF 10% 200VDCW	56289	192P39292-PTS
A2Q1	1854-0215	11	TSTR:SI NPN	80131	2N3904
A2Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q3	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q4	1854-0215		TSTR:SI NPN	80131	2N3904

See introduction to this section for ordering information

Δ_b These components did not exist on instrument Serial No's. 1304A00275 and below.

Table 6-1. IDENTIFICATION OF PARTS - Continued

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2Q5	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q6	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q7	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q8	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q9	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q11	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q12	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q13	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0684-4721	1	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A2R2	0684-8201	2	R:FXD COMP 82 OHM 10% 1/4W	01121	CB 8201
A2R3	0684-8201		R:FXD COMP 82 OHM 10% 1/4W	01121	CB 8201
A2U1 †	1820-0635	1	IC:DIGITAL	28480	1820-0635
A2U2 †	1990-0413	1	NUMERIC DISPLAY:LED	28480	1990-0413
A2U3	1990-0405	1	NUMERIC DISPLAY:LED(PLUS-MINUS)	28480	1990-0405
A2U4	1820-0583		IC:TTL LP QUAD 2-INPT NAND GATE	12040	DM74L00N
A2U5 †	1820-0571	1	IC:TTL NUMERIC DISPLAY CHARACTER GEN.	28480	1820-0571
			CHASSIS MOUNTED COMPONENTS		
F1	2110-0012	1	FUSE:0.5 AMP 250V	75915	312.500
F1	2110-0004	1	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
XA2	1251-0291	1	CONNECTOR:14 PIN	02660	57-10140
PM1	34750-28801	1	POWER MODULE	28480	34750-28801
Q1	1854-0245	1	TRANSISTOR:SI NPN	80131	2N3771
T1	9100-3293	1	TRANSFORMER:POWER	28480	9100-3293
W1	8120-1348	1	CABLE ASSY:POWER, DETACHABLE	70903	KHS-7041
			MISCELLANEOUS		
	05300-20010	1	CASE	28480	05300-20010
	34750-00601	1	SHIELD:POWER INPUT PROTECTION	28480	34750-00601
	34750-61601	1	CABLE(FROM XA2TO MOTHER BOARD)	28480	34750-61601
	4040-0920	1	PANEL:FRONT	28480	4040-0920
	7120-3265	1	NAMEPLATE	28480	7120-3265
	7120-3534	1	DECAL	28480	7120-3534
	7122-0058	1	PLATE:SERIAL	28480	7122-0058
	7124-2308	1	LABEL:INFORMATION	28480	7124-2308
	0370-2159	1	KNOB: PUSHBUTTON	28480	0370-2159
	1600-0421	1	SHIELD: ANALOG (L - SHAPED)	28480	1600-0421
	0340-0787	1	INSULATOR: POWER SWITCH	28480	0340-0787
	1200-0423	1	SOCKET: IC BLK 16 CONTACT	23880	CSA2900 - 16B
	1205-0002	2	HEAT SINK: TRANSISTOR	07387	3AL-635-2R
	34750-60601	1	SHIELD ASSY: TRANSFORMER	28480	34750-60601
	34750-61602	1	CABLE: INPUT	28480	34750-61602
	1200-0462	48	SOCKET: IC CONTACT (FOR DISPLAY)	00779	3-116141-2
	9170-0894		BEAD: SHIELDING (USED ON A2 ASSEMBLY)	28480	9170-0894
	0340-0782	1	INSULATOR:TRANSISTOR } FOR Q1	28480	0340-0782
	0340-0783	2	INSULATOR:SPRING } FOR Q1	28480	0340-0783
	5040-7001	1	SLIDE LOCK, BLACK, RIGHT	28480	5040-7001
	5040-6000	1	SLIDE LOCK, BALCK, LEFT	28480	5040-6000

See introduction to this section for ordering information

Δ Use for all replacement.

SECTION VII
CIRCUIT DIAGRAMS
TROUBLESHOOTING

7-1. INTRODUCTION.

7-2. This section of the Operating and Service Manual contains troubleshooting information and circuit diagrams for the Model 34750A Display Module. Included are troubleshooting trees, a functional block diagram, schematic and component location diagrams and timing diagrams

7-3. TROUBLESHOOTING.

7-4. Troubleshooting Trees.

7-5. Figures 7-1 through 7-3 are troubleshooting trees designed to assist in the isolation of malfunctions. Table 7-1 lists the troubleshooting trees and their respective figure numbers.

Table 7-1. Troubleshooting Trees.

Figure	Troubleshooting Trees
7-1	Power Supply Troubleshooting Tree
7-2	Analog Troubleshooting Tree
7-3	Digital Troubleshooting Tree

7-6. Troubleshooting Procedures

7-7. The following procedure is recommended for troubleshooting the Model 34750A.

a. Ensure the signal conditioning plug-on is functioning properly. Normally, if the Model 34750A passes the operational checks given in Paragraph 5-3, the Display Module is functioning properly and the signal conditioning module is malfunctioning. If you have checked the signal conditioning module and found it to be good proceed to step b.

b. Determine the exact symptoms of the failure. This can usually be accomplished by attempting the performance tests for the instrument. These procedures are found in the Operating and Service Manual for the signal conditioning plug-on module. Often this method will isolate the trouble to a particular circuit which affects the parameter under test.

c. Once the problem has been characterized, assuming the instrument is not completely dead, attempt the Adjustment Procedures outlined in Section V. Some apparent malfunctions can be corrected by these adjustments. Inability to obtain a correct adjustment can also help in localizing the problem.

d. Check for burned or loose components, or other conditions which might be the source of trouble.

e. Begin with the Power Supply Troubleshooting Tree (No. 1). If the power supplies are functioning properly the tree will quickly lead to the troubleshooting tree for either the analog or the digital portion of the instrument.

f. If the end of a tree is reached without finding the trouble, carefully recheck the symptoms to ensure you have interpreted them properly. Using the schematics, voltages and timing waveforms in Section VII (Figures 7-5 through 7-8) attempt to localize the malfunction. The problem can usually be isolated to the analog or digital section by connecting the test jumper shown in Figure 5-4 to "B". A + 1.00000 should be displayed. If it is not, the digital section is malfunctioning.

7-8. FUNCTIONAL BLOCK DIAGRAM (Figure 7-4).

7-9. The Functional Block Diagram is a detailed block diagram showing the overall relationship between circuit elements of the Model *34750*A. The diagram shows all adjustments within the Model 34750A and provides waveforms that should be helpful in troubleshooting.

7-10. TIMING DIAGRAM (Figure 7-5).

7-11. Figure 7-5 shows the timing relationships between the major signals generated within the Model 34750A. Each signal has been assigned a number within a circle, e.g. (3) , which corresponds to an identical number on one of the schematic diagrams. Illustrations of the 34750-66501 and 34750-66502 printed circuit assemblies, showing the physical location of each signal is also provided.

7-12. SCHEMATIC DIAGRAMS (Figures 7-6, 7-7 and 7-8).

7-13. The circuits contained within the Model 34750A are shown in the schematic diagrams. These diagrams are provided to assist in troubleshooting the instrument.

7-14. COMPONENT LOCATION DIAGRAMS.

7-15. Component Location Diagrams are provided with each schematic to show the location of the various components mounted on the printed circuit assemblies. Each component is identified by a reference designator.

GENERAL SCHEMATIC NOTES

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH ASSEMBLY OR SUB-ASSEMBLY DESIGNATION(S) OR BOTH FOR COMPLETE DESIGNATION.

2. COMPONENT VALUES ARE SHOWN AS FOLLOWS UNLESS OTHERWISE NOTED.

   RESISTANCE IN OHMS
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MILLIHENRIES

3.  DENOTES EARTH GROUND. USED FOR TERMINALS WITH NO LESS THAN A NO. 18 GAUGE WIRE CONNECTED BETWEEN TERMINAL AND EARTH GROUND TERMINAL OR AC POWER RECEPTACLE.

4.  DENOTES FRAME GROUND. USED FOR TERMINALS WHICH ARE PERMANENTLY CONNECTED WITHIN APPROXIMATELY 0.1 OHM OF EARTH GROUND.

5.  DENOTES GROUND ON PRINTED CIRCUIT ASSEMBLY. (PERMANENTLY CONNECTED TO FRAME GROUND).

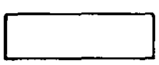
6. 

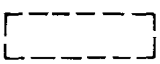
ANY LETTER OR NUMBER IN TRIANGLE DENOTES A SPECIAL GROUND.

7. DENOTES ASSEMBLY.

8.  DENOTES MAIN SIGNAL PATH.

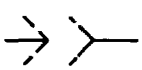
9. DENOTES FEEDBACK PATH.

10.  DENOTES FRONT PANEL MARKING.

11.  DENOTES REAR PANEL MARKING.

12.  DENOTES SCREWDRIVER ADJUST.

13. * AVERAGE VALUE SHOWN. OPTIMUM VALUE SELECTED AT FACTORY. THE VALUE OF THESE COMPONENTS MAY VARY FROM ONE INSTRUMENT TO ANOTHER.

14.  DENOTES SECOND APPEARANCE OF A CONNECTOR PIN.

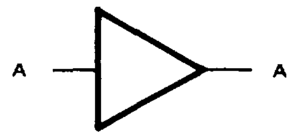
15. 

DENOTES WIRE COLOR: COLOR CODE SAME AS RESISTOR COLOR CODE. FIRST NUMBER IDENTIFIES BASE COLOR, SECOND NUMBER IDENTIFIES STRIP.

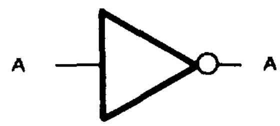
16. ALL RELAYS ARE SHOWN DEENERGIZED.

17. WAVEFORMS AND AC VOLTAGE MEASUREMENTS WERE MADE WITH RESPECT TO CHASSIS GROUND USING AN OSCILLOSCOPE WITH A 10:1 DIVIDER PROBE (10 MEGOHM, 10 pF). THE VOLTAGE LEVELS SHOWN ON THE WAVEFORMS ARE ACTUAL VOLTAGE LEVELS AND ARE NOT TO BE CONFUSED WITH OSCILLOSCOPE SETTING. THE VOLTAGE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER. A VARIATION OF ± 10% IN MEASUREMENTS SHOULD BE ALLOWED.

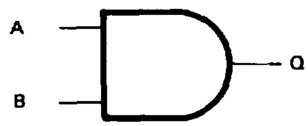
18. DC VOLTAGE LEVELS WERE MEASURED WITH RESPECT TO CIRCUIT GROUND USING A VTVM WITH 10 MEGOHM INPUT IMPEDANCE. THE VOLTAGE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER DUE TO CHANGE IN TRANSISTOR CHARACTERISTICS. A VARIATION OF ± 10% SHOULD BE ALLOWED.



DENOTES BUFFER

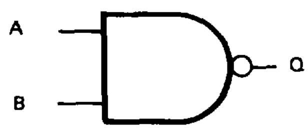


DENOTES INVERTER



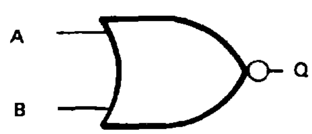
DENOTES AND GATE

A	B	Q
1	1	1
1	0	0
0	1	0
0	0	0



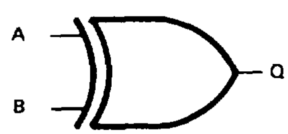
DENOTES NAND GATE

A	B	Q
1	1	0
1	0	1
0	1	1
0	0	1



DENOTES NOR GATE

A	B	Q
1	1	0
1	0	0
0	1	0
0	0	1



DENOTES "EXCLUSIVE" OR GATE

A	B	Q
1	1	0
1	0	1
0	1	1
0	0	0

APPENDIX A

DIFFERENCE DATA SHEET

A-1. INTRODUCTION.

A-2. This section contains backdating information which adapts this manual to instruments with serial numbers lower than that shown on the title page.

A-3. CHANGE SEQUENCE.

A-4. Changes are listed in the serial number order that they occurred in the manufacture of the instrument. However, in adapting this manual to an instrument with a particular serial number, apply the changes in reverse order. That is, begin with the latest change and progress to the earliest change that applies to the serial number in question. Table A-1 lists the serial numbers to which each change applies.

A-5. PARTS NOT INCLUDED IN BACKDATING.

A-6. When replacing a part whose value or part number differs from the schematic diagram or parts list in this manual, yet is not listed in the following changes, use the replacement part number shown in Section VI. These parts are identified by the symbol Δ.

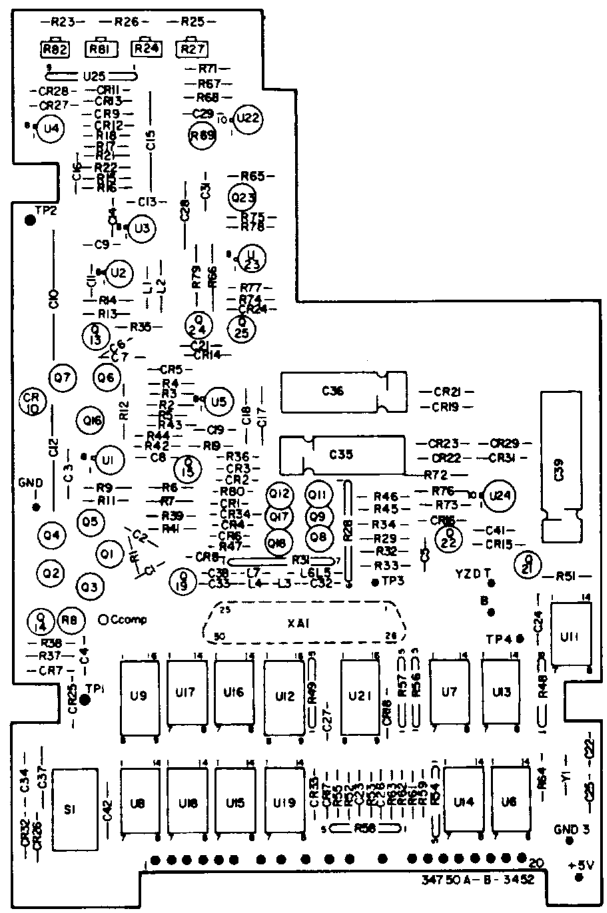
Table A-1. Manual Backdating Changes.

Instrument Serial Prefix	Make Manual Changes
1304A00275 and below	1

CHANGE NO. 1

Applies to instrument Serial No's 1304A00275 & below.

Change the 34750-90001 Component Locator as shown below:



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Rev C

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USACC-SO (2)
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Svc Colleges (l)
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USAADS (2)
USAFAS (2)
USAARMS (2)
USAIS (2)
USAES (2)
USAICS (3)
MAAG (1)
USARMIS (1)
USAERDAA (1)
USAERDAW (1)
Ft Gordon (10)
Ft Huachuca (10)
Ft Carson (5)
Army Dep (1) except:
LBAD (14)
SAAD (30)
TOAD (14)
SHAD (3)
Ft Gillem 10)
USA Dep (1)
Sig Sec USA Dep (l)
Ft Richardson (CERCOM Ofc) (2)
Units Org under fol TOE:
(2 copies each unit)
29-207
29-610

ARNG & USAR: None

For explanation of abbreviations used, see AR 310-50.

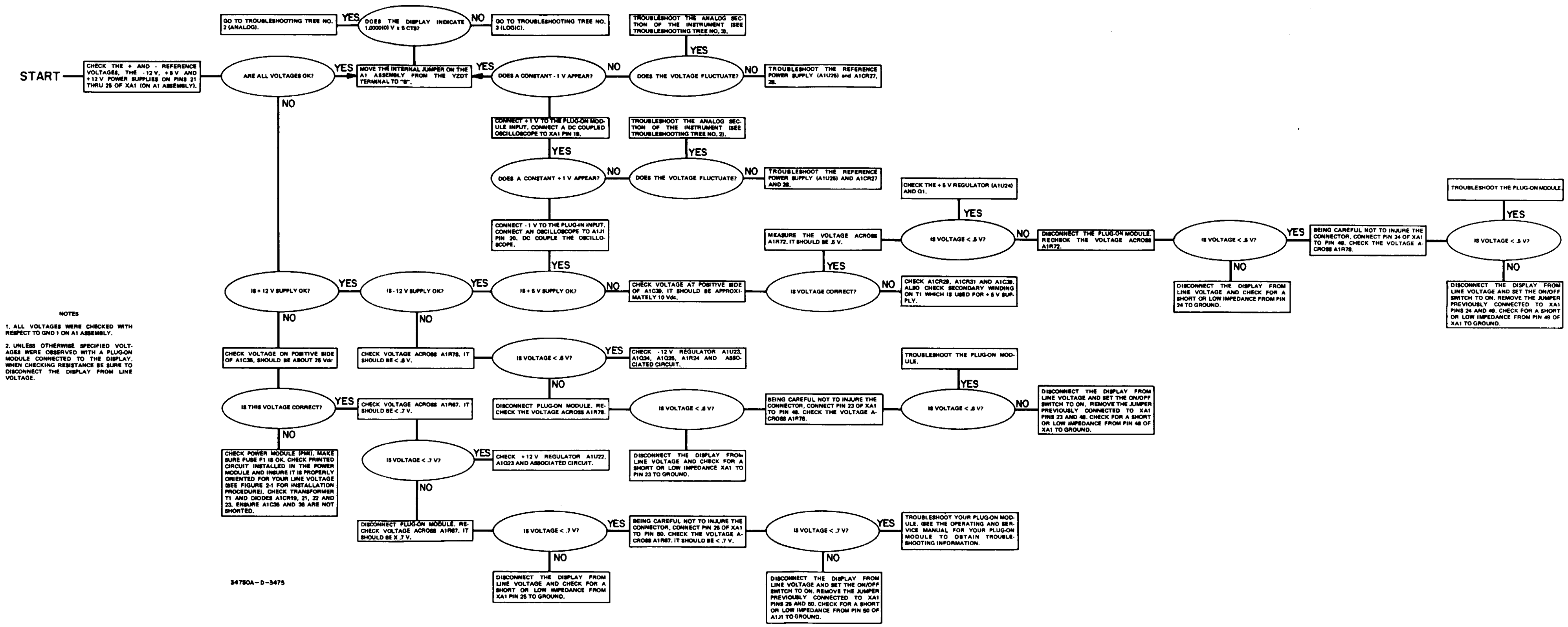


Figure 7-1. Power Supply Troubleshooting Tree.

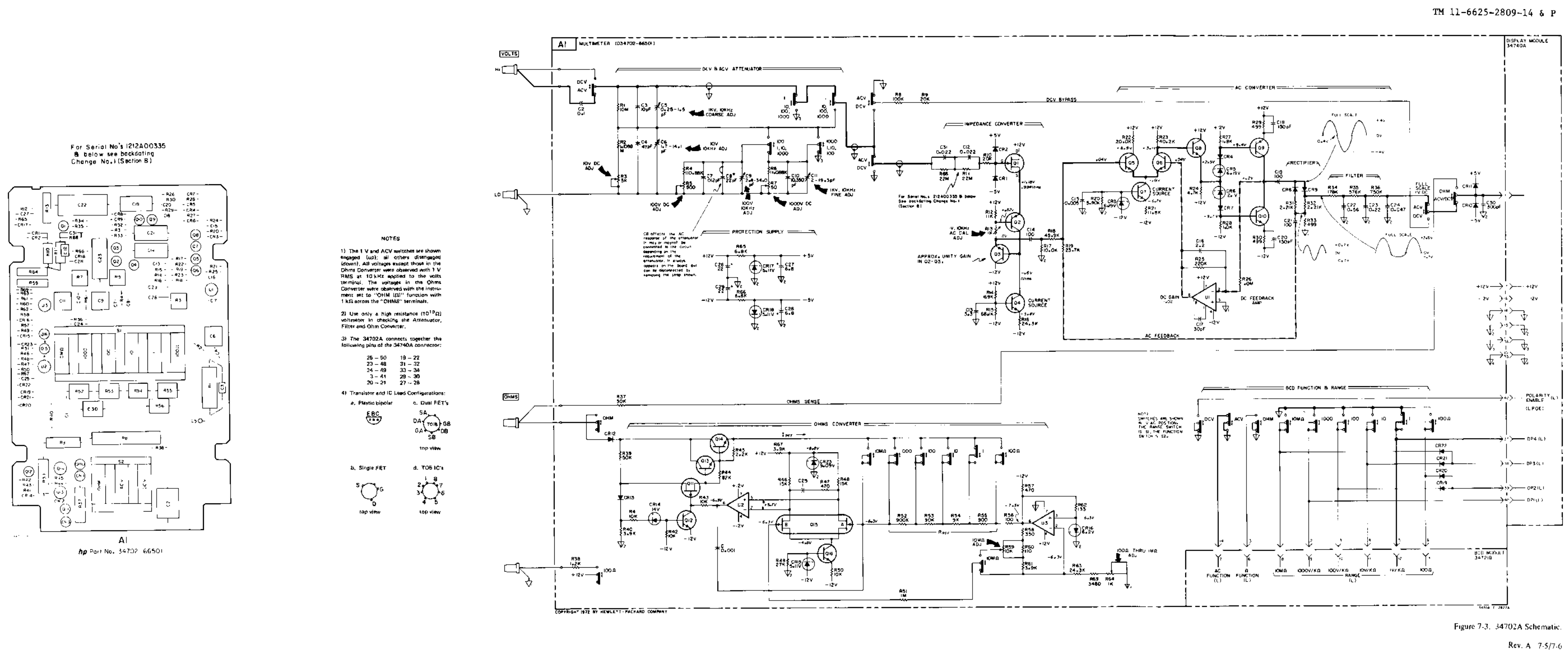


Figure 7-2   24702A Schematic.

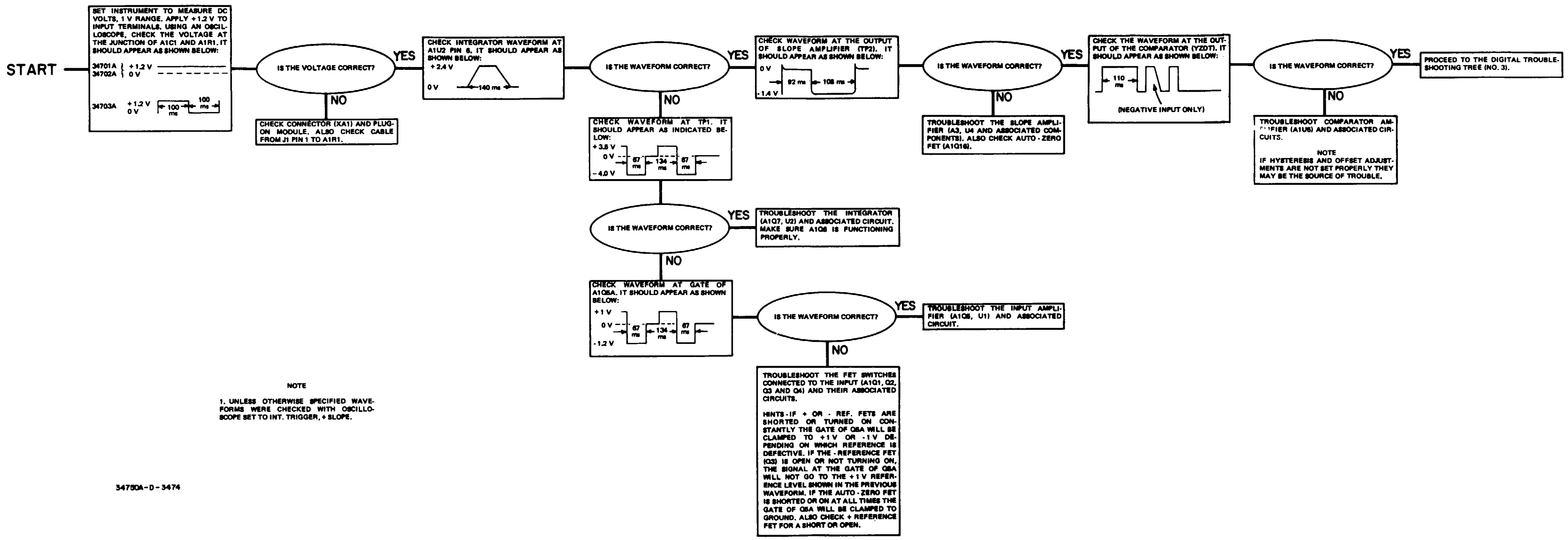


Figure 7-3. Analog Troubleshooting Tree.

TM 11-6625-2809-14 & P

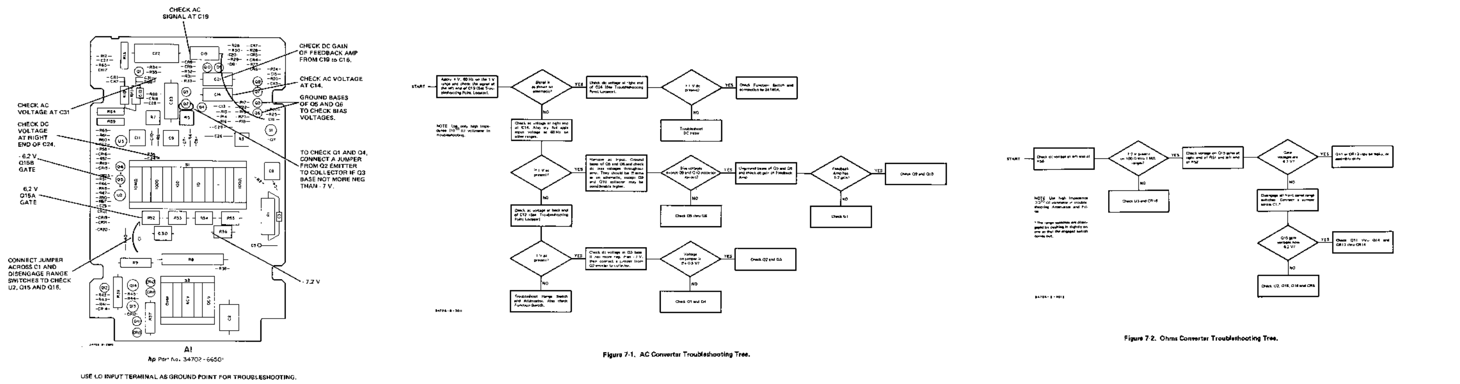


Figure 7-4. Ohms Converter Troubleshooting Tree.

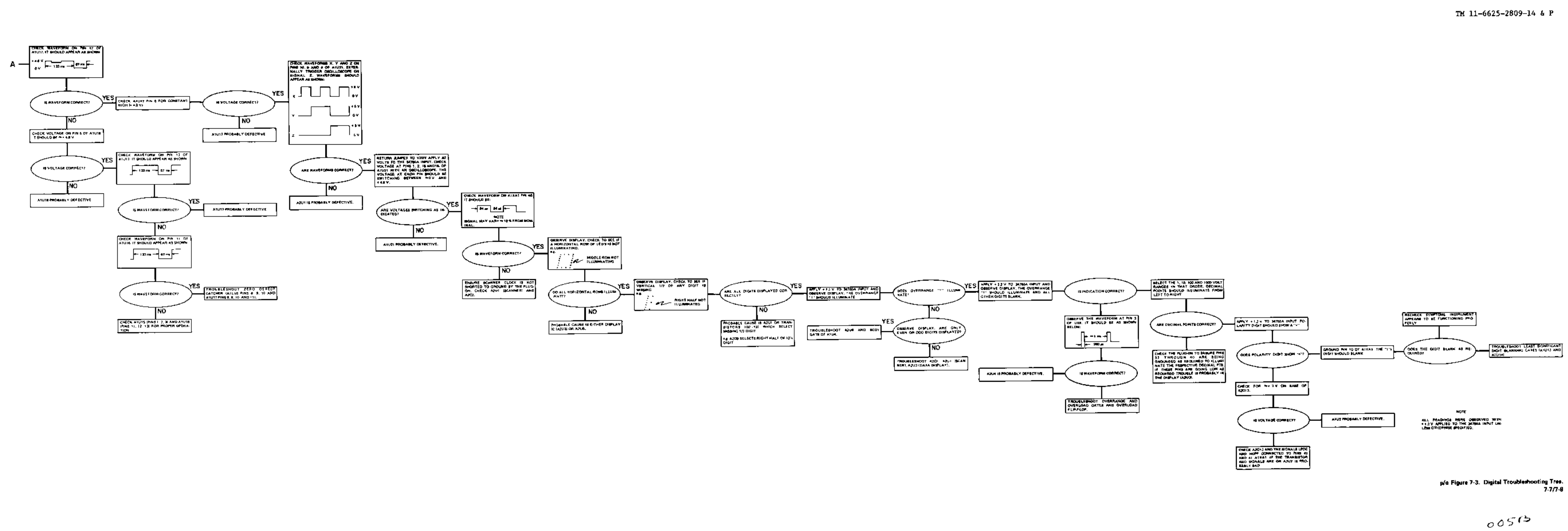


Figure 7-5. Digital Troubleshooting Tree.

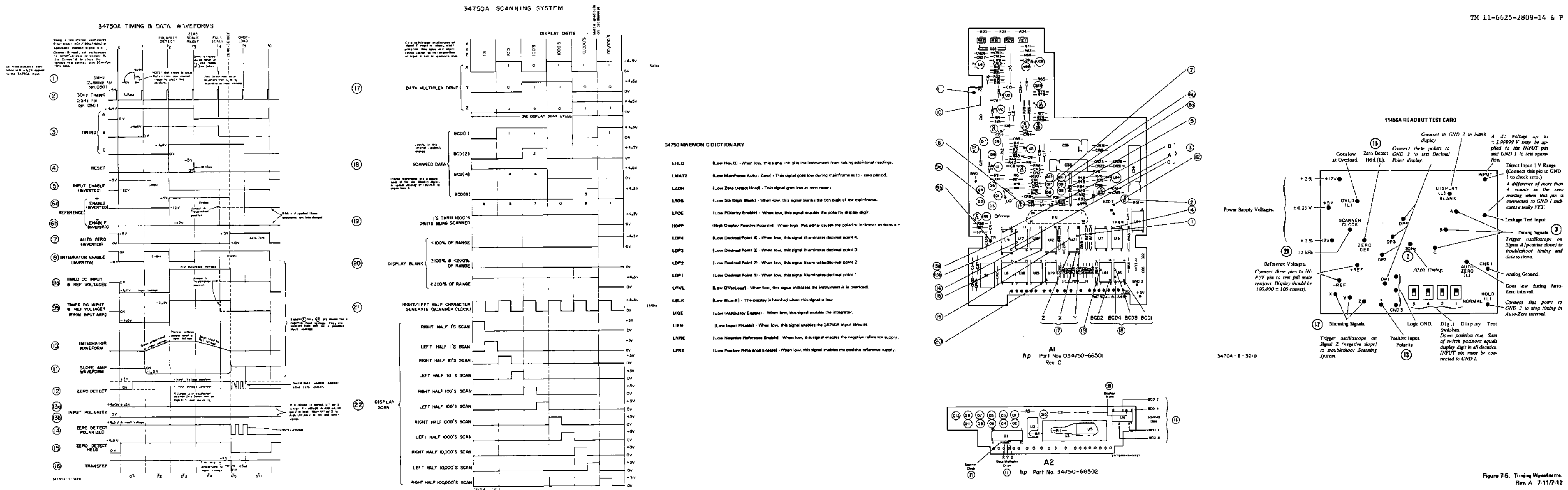
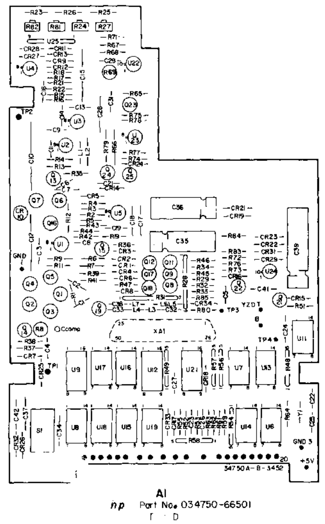


Figure 7-5. Timing Waveforms.



NOTES

1. | DENOTES SCHEMATIC ON WHICH SIGNAL CONNECTION IS MADE.

2. 3 NUMBERS IN CIRCLES REFER TO WAVEFORMS ON FIGURE 7-5.

Δ_a USE FOR ALL REPLACEMENT IF EITHER R6, R7, OR R37 IS REPLACED, ALL SHOULD BE REPLACED.

Δ_h INSTRUMENT SERIAL NO's. 1304A00275 AND BELOW DID NOT CONTAIN R85. IT WAS PART OF RESISTOR PACK R28.

Δ_i REFER TO CHANGE NO.1 IN SECTION 8 FOR INSTRUMENT SERIAL NO.'s 1304A00275 AND BELOW.

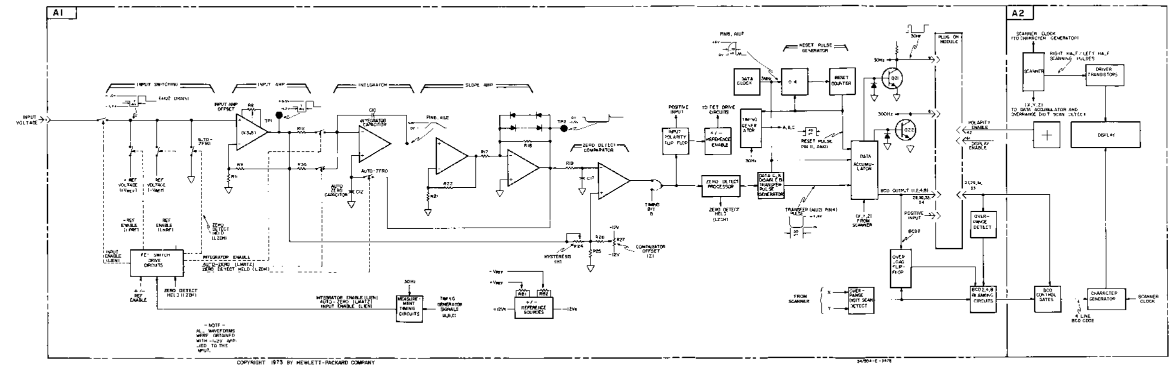
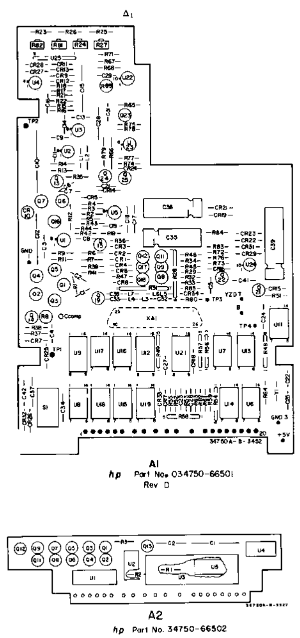


Figure 7-4. Functional Block Diagram

Figure 7-6. Analog Signal Processor.



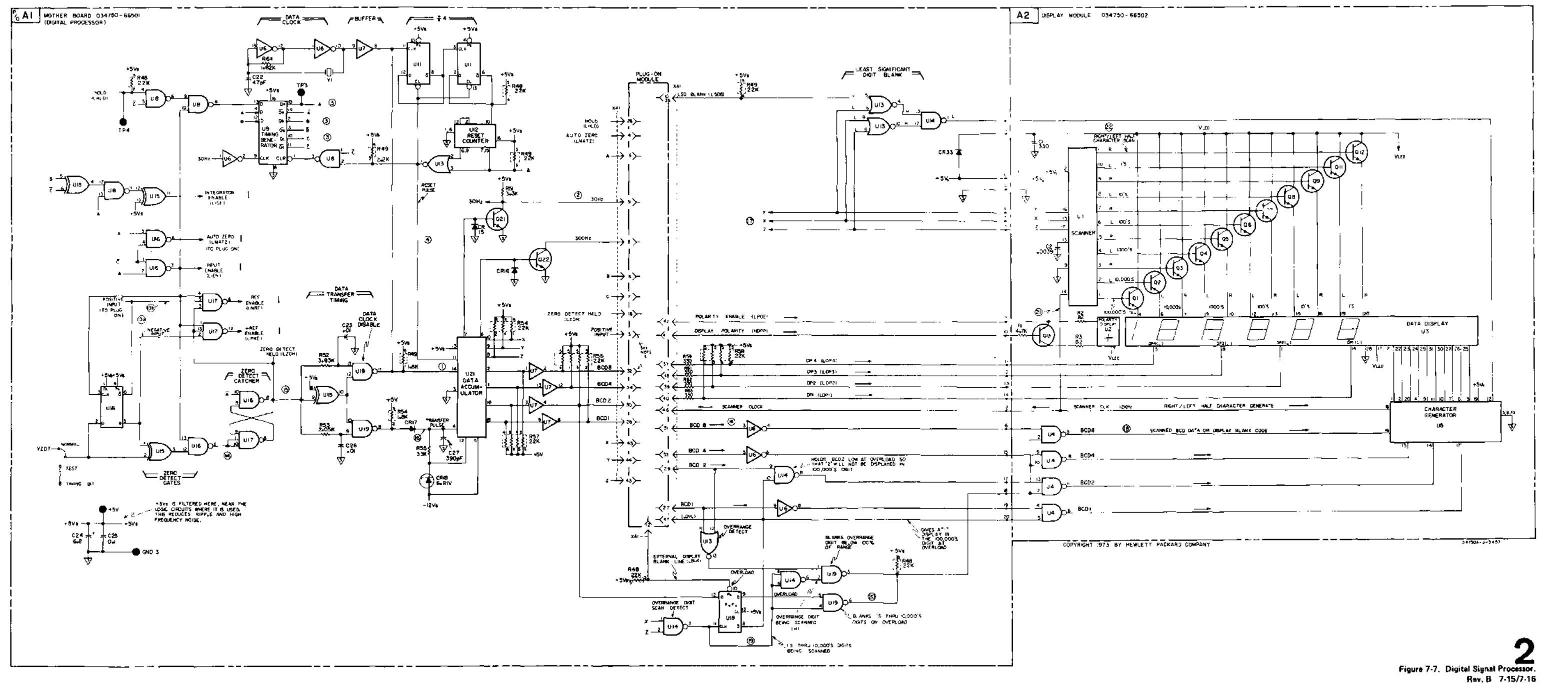


Figure 7-7. Digital Signal Processor.

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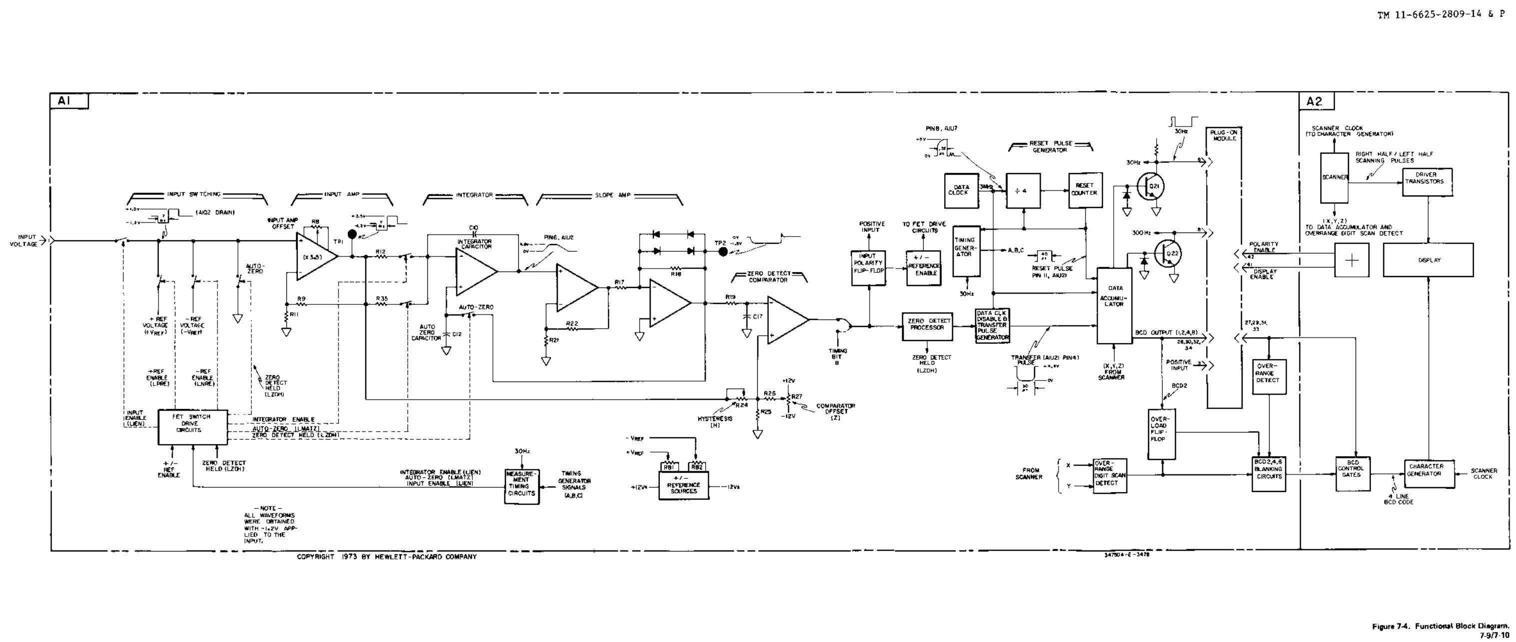

Figure 7-8. Functional Block Diagram.

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