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Errata

Title & Document Type:

Manual Part Number:

Revision Date:

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

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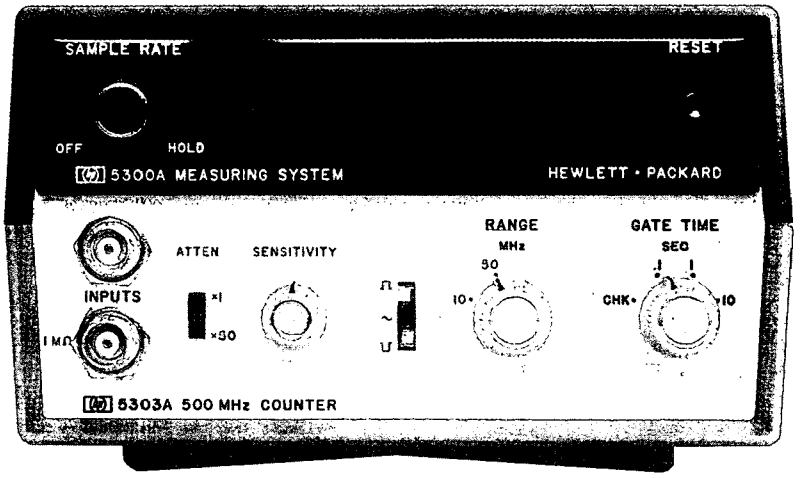
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OPERATING AND SERVICE MANUAL

MEASURING SYSTEM 5300A



HEWLETT PACKARD

HP 5300A

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MEASURING SYSTEM

5300A

5300A, SERIAL PREFIX 1320A
5310A, SERIAL PREFIX 1312A
10533A, SERIES 1128A

This manual applies directly to HP Model 5300A Measuring System Mainframes having serial prefix number 1320A, to HP Model 5310A Battery Packs having serial prefix number 1312A, and to HP Model 10533A Digital Recorder Interfaces having circuit-board series number 1128A.

Section IX of this manual is reserved for the addition of various plug-on module information. The documentation is shipped with the modules and must be inserted into Section IX by the user. The serial prefix numbers to which this information applies is listed on the title page of the plug-on module documentation.

NEWER INSTRUMENTS

This manual with enclosed "Manual Changes" sheets applies directly to units having serial prefix numbers or series numbers higher than those listed above.

OLDER INSTRUMENTS

Changes required to back date this manual for older instruments are in Section VII.

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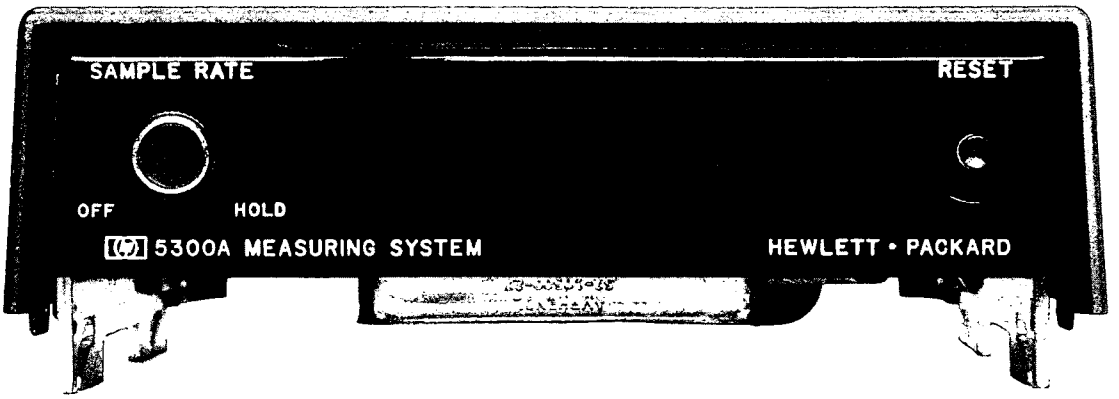
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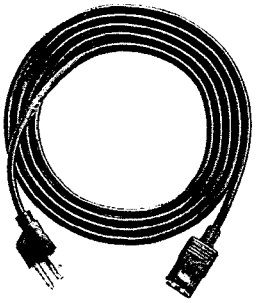
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Figure 1-1. Model 5300A Measuring System Mainframe

5300A MEASURING SYSTEM



POWER CORD



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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. Description

1-3. The Hewlett-Packard Model 5300A Measuring System Mainframe is a rugged, compact, all solid state measuring instrument that is used with a variety of plug-on modules to measure a wide range of parameters. The system has a six-digit light-emitting-diode (LED) display assembly. The plug-on feature enables the user to select plug-ons which will provide him with a maximum measurement capability for a particular need. The electrical and mechanical specifications for the 5300A Measuring System, 5310A Battery Pack, and 10533A Recorder Interface are listed in Tables 1-3, 1-4, and 1-5, respectively. Several plug-ons are available for the 5300A Measuring System, some of these are shown in Figure 1-2.

a. HP Model 5301A 10 MHz Counter. When combined with the 5300A, frequency measurements to 10 MHz can be made.

b. HP Model 5302A 50 MHz Universal Counter. When combined with the 5300A, Frequency, Period, Period Average, Time Interval, Ratio, and Totalizing measurements can be made.

c. HP Model 5303A 500 MHz Counter. When combined with the 5300A, frequency measurements to 500 MHz can be made.

d. HP Model 5304A Timer/Counter. When combined with the 5300A, frequency measurements to 10 MHz and time interval measurements to 500 nsec can be made.

e. HP Model 5306A Multimeter/Counter. When combined with the 5300A, ac and dc voltages, resistance, and frequency to 10 MHz can be measured.

f. HP Model 5307A High Resolution Counter. When combined with the 5300A, frequencies from 5 Hz to 2 MHz (or pulses from 50 counts per minute to 10,000,000 counts per minute) can be displayed with six digits of resolution.

g. HP Model 5310A Battery Pack (available accessory). When installed between the 5300A and a plug-on, a completely portable instrument is available with 4 to 8 hours of operating time.

h. HP Model 5311A Digital-Analog Converter. When installed between the 5300A and a measurement plug-on, any three, or the least significant two, display digits can be converted to an analog signal.

1-4. Purpose and Use of Manual

1-5. This manual provides operating and service instructions for the 5300A Measuring System. When the information package which is included with the plug-on purchased is inserted into Section IX, the manual becomes an operating and service manual for the 5300A Measuring System and its respective plug-ons.

1-6. The manual is intended to familiarize the user with his unit. Included are operation, theory, maintenance information and schematic diagrams, component locators, and parts lists.

1-7. APPLICATIONS

1-8. The 5300A Measuring System can be used in airborne and ground radio communications and radar servicing, industrial electronics servicing, and various other electronics-related fields. The Battery Pack (HP 5310A) enables the 5300A Measuring System to be used in field-service situations where ac power is not available or in applications which require isolation from power lines.

1-9. INSTRUMENT IDENTIFICATION

1-10. Hewlett-Packard uses a two-section nine-digit serial number (0000A00000), mounted internally near the power transformer, to identify the instrument.

1-11. The first four digits specify the serial prefix and the last five digits refer to the specific instrument. If the serial prefix on your instrument differs from that listed on the title page of the manual, there are differences between the manual and your instrument.

1-12. Lower serial prefixes are documented in Section VII and higher serial prefixes are covered by a manual change sheet included with the manual. If the change sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed in Section VI of this manual.

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1-13. MANUAL CHANGES AND OPTIONS

1-14. The title page lists the serial prefix number to which this manual directly applies. If the serial prefix number is different from the one listed, a manual change sheet is included, describing the required changes. If the change sheet is missing the information can be supplied by a Hewlett-Packard Sales and Service Office listed in Section VI of this manual. Options are listed in Section VII of this manual.

1-15 EQUIPMENT SUPPLIED AND ACCESSORIES AVAILABLE

1-16. Table 1-1 lists equipment supplied and Table 1-2 lists accessories available.

Table 1-1. Equipment Supplied

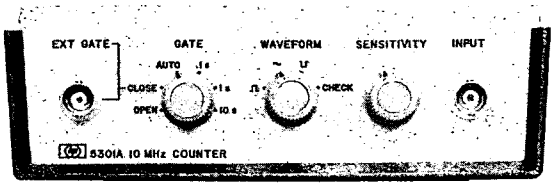
DESCRIPTION	HP PART NO.
Detachable Power Cord (I.E.C. type approved)	8120-1348

Table 1-2. Accessories Available

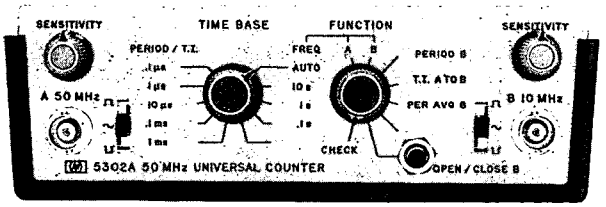
DESCRIPTION	HP PART NO.
Digital Recorder Interface	10533A
Service Support Package	10547A
Diagnostic Cards	10548A
Battery Pack: 12 Vdc, 4 — 8 hrs. operating time	5310A
Rack Mount Kits:	
5300 and plug-on	10573A
5300 and plug-on (half width)	10576A
Two 5300's with two plug-ons	10574A
5300, plug-on, and plug-between	11457A
Two 5300's, two plug-ons, and two plug-betweens	11457B

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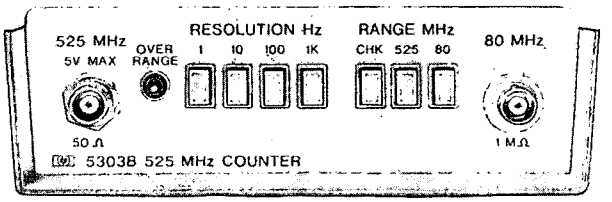
Figure 1-2. Available Plug-Ons



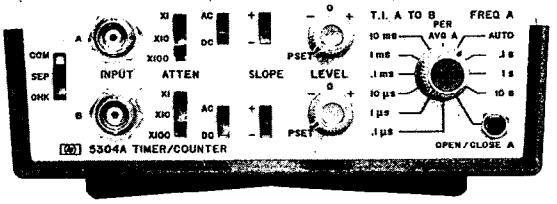
5301A



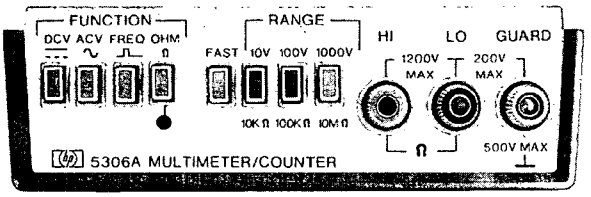
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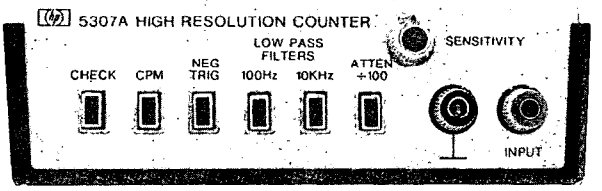
5303B



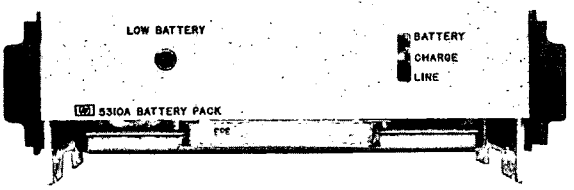
5304A



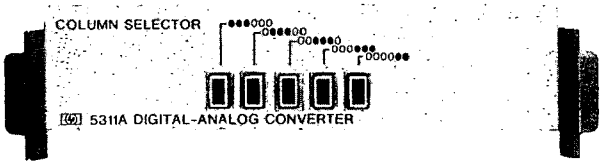
5306A



5307A



5310A



5311A

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Table 1-3. Model 5300A Measuring System when used with Available Plug-Ons Specifications

Mainframe unit provides system with power, reference frequency, display, counting logic, and timing control.

TIME BASE

Crystal frequency: 10 MHz

Stability: Aging rate <3 parts in 10^7/month

Temperature <± 5 parts in 10^6, 0°C to 50°C

Line voltage <± 1 part in 10^7 for 10% line variation

Oscillator output: 10 MHz, 1 Vrms at rear panel BNC. 100Ω source impedance

External input: 100 kHz to 10 MHz, 1 V rms into 500Ω

GENERAL

SAMPLE RATE: Sample rate control adjusts the delay from the end of one measurement to the start of a new measurement. Continuously variable from less than 50 msec to approximately 5 seconds.

In HOLD position the display can be held indefinitely. HOLD input on rear panel connector also provides sample rate control or hold by contact closure to ground.

RESET: Front panel pushbutton switch resets all registers and initiates new measurement. Reset input by contact closure to ground also available on rear panel connector.

DISPLAY: 6-digit all solid-state LED display (gallium arsenide phosphide light-emitting diodes) including decimal points and units.

LED overflow light indicates when display range is exceeded.

OPERATING TEMPERATURE: 0° to 50°C

POWER REQUIREMENTS: 115 or 230 volts ± 10%, 50 to 400 Hz, 25 VA maximum (depends on plug-on module).

Mainframe power without plug-ons typically 5 watts

BATTERY OPERATION: With 5310A rechargeable pack, a minimum of 3 hours (typically 5 hours) of operation at 20°C to 30°C operating and charging temperatures, depending on the plug-in used. Battery pack may be recharged from the 5300A power supply.

DIGITAL OUTPUT: Digit serial, 4-bit BCD parallel available at rear panel connector.

Code: 4-line 1-2-4-8 BCD, "1" state low, TTL logic levels.

Decimal point: Decimal point code (Binary 1111) automatically inserted at correct digit position.

Print Command: Positive step, TTL output

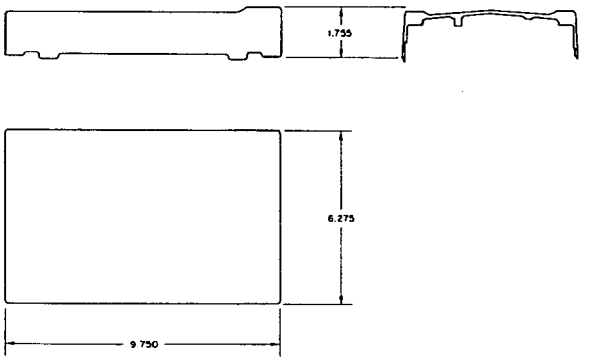
Holdoff: Contact closure to ground or TTL low level inhibits start of new measurement cycle.

Connector: 20 pin pc connector. Mating connector Viking 2VH10/1JN or equivalent.

Parallel Data Output: Available with recorder interface accessory, 10533A (Table 1-5).

WEIGHT: (Without plug-on module.)
Net 3.3 lbs. (1.5 kg).
Shipping 5.5 lbs. (2.5 kg).

DIMENSIONS: (With plug-on module.)
Height: 3-1/2 inches (89 mm)
Width: 6-1/4 inches (160 mm)
Depth: 9-3/4 inches (248 mm)



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Table 1-4. Accessory Battery Pack Specifications

5310A BATTERY PACK

Provides battery power to 5300A mainframe and plug-on modules from rechargeable Nickel-Cadmium cells.

Battery voltage: 12 Vdc.

Battery capacity: Nominal 48-watt hours.

Operating time: Minimum of 3 hours operation (typically 5 hours) at 20°C to 30°C operating and charging temperatures, depending on plug-on used.

Recharging Power: Provided by 5300A mainframe. 18 hours recharge time from minimum level (indicated by LOW BATTERY indicator) to full charge.

CAUTION

Maximum recharge time is 24 hours.

Low voltage indicator: Solid state warning light begins to glow when battery voltage drops below minimum level (approximately 10% remaining charge).

Line failure protection: Allows instrument to be operated in LINE position with automatic switch-over to batteries if line voltage fails.

Operating temperature: Operating 0 to 50°C. Charging 0 to 40°C, mainframe not operating.

Power requirements: Charging power via 5300A mainframe nominal 7.5 watts.

Weight: Net 5 lbs. (2.3 kg). Shipping 6-1/4 lbs. (2.9 kg).

Dimensions: When battery pack is installed between 5300A mainframe and plug-on module. Overall height is increased by 1.5 inches (38.4 mm).

WARRANTY: BATTERIES ARE NOT WARRANTED.

Table 1-5. Accessory Recorder Interface Specifications

10533A RECORDER INTERFACE

The 10533A interface accessory provides an interface between the 5300A system mainframe and a standard parallel-input recorder such as HP 5050B, when used with an option 050 or 051 only, or 5055A. The interface module is connected to the 5300A by 6-feet of flexible cable, and provides the conversion from the 5300A serial data output to a standard parallel format which includes floating decimal point, overflow indication and units expressed as a true exponent.

Output Format: 10 parallel digits, including 6 data, 1 decimal point, 1 overflow, 1 exponent and 1 exponent sign.

Code: 4-line 1-2-4-8 BCD, "1" state low, TTL levels.

Decimal Point: Floating decimal point automatically inserted at correct digit position. Coded 1111 ("*" on standard 5050B or 5055A print wheel). Internal jumper wire can remove decimal point from data format if required.

Overflow: Code 1111 ("*") printed in first printer column when 5300A overflow light is on.

Exponent: ±0,±3,±6 corresponding with 5300A measurement units.

Print command: Negative step, TTL levels.

Inhibit Input: +2.0 V or higher prevents the 5300A from recycling.

Power requirements: 100 mA at 5 volts provided by 5300A.

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SECTION II

INSTALLATION

2-1. UNPACKING AND INSPECTION

2-2. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage, such as, scratches, dents, broken knobs, etc. If the instrument is damaged or fails to operate when used with the respective plug-on, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately. Operating procedures are located in Section IX and Sales and Service Offices are listed in Section VI of this manual. Retain the shipping carton and the padding material for the carrier's inspection. The Sales and Service Office will arrange for the repair or replacement of the instrument without waiting for the claim against the carrier to be settled.

2-3. STORAGE AND SHIPMENT

2-4. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard Sales and Service Office can provide packaging material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here is one recommended packaging method:

a. The original container is a corrugated card-board box with 200 lbs. burst test (HP Part No. 9211-1619). The instrument is secured and protected while in the box by a top and bottom molded frame of polystyrene foam (HP Part No. 9220-1545). Also included with the instrument is a plastic dust-protection cover (HP Part No. 05300-80004) and up to two card-board filler pads for the top of the package (HP Part No. 9220-1736). These filler pads are designed to take up the space formerly used by the operating and service manual(s).

2-5. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

a. Maximum altitude: 25,000 feet.
b. Minimum temperature: -40°F (-40°C).
c. Maximum temperature: +167°F (+75°C).

2-6. POWER CONNECTION (I.E.C. Approved) (International Electronics Consortium)

CAUTION

Before plugging instrument into ac power line, be sure the slide switch is properly positioned and the correct fuse is installed.

2-7. LINE VOLTAGE. The counter may be operated from either 115 Vac or 230 Vac ±10%. The instrument is supplied with a 115 V fuse; be sure to change this fuse for 230 V operation (see Table 2-1). The Input Power Line Module is designed so that the 115V/230V switch cannot be changed unless the ac power cord is disconnected and the fuse is removed.

Table 2-1. 115/230 Volt Conversion

	115 V	230 V
Slide AC Line Fuse	115 .3 Amp slow-blow (HP 2110-0044)	230 .15 Amp slow-blow (HP 2110-0320)

2-8. The unit is shipped ready for 115 Vac operation; check the line voltage in use prior to applying ac power to the 5300A. To change the 115V/230V switch and the fuse proceed as follows:

a. Disconnect power cord from 5300A.

b. Move sliding plastic door to the left until it covers ac power receptacle.

c. Pull fuse extractor handle (marked "pull") to remove fuse.

d. With fuse extractor handle pulled out, slide the 115V/230V switch (located just below the extractor handle) to the desired position (left or right).

2-9. POWER CABLE. The instrument is equipped with a detachable 3-wire power cable. Refer to CAUTION NOTE in Paragraph 2-6, then install cable as follows:

a. Connect the plug (3-socket connector) to ac line jack at the rear of the instrument. Ensure fuse and voltage setting are correct.

b. Connect the plug (2-blade with round ground pin) to 3-wire (grounded) power outlet.

2-10. Instrument chassis is grounded through the round pin on the plug; if a two-blade outlet is available use connector adapter (HP Part No. 1251-0048), then connect the short wire from side of the adapter to the ground.

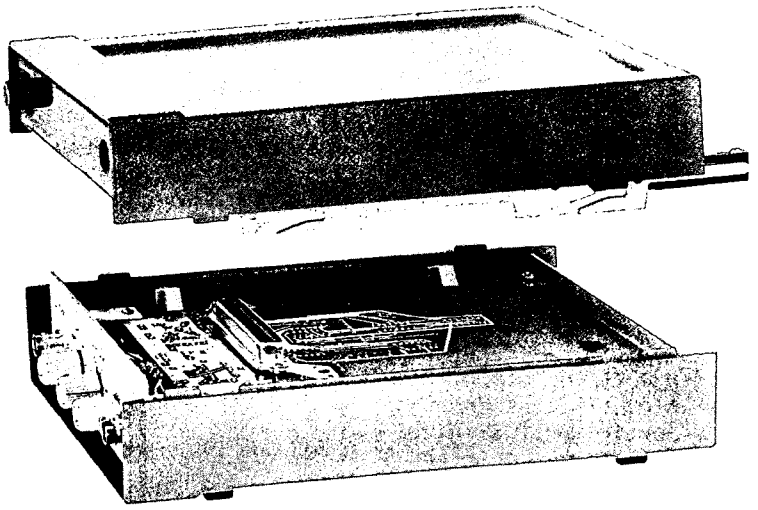
2-11. INSTALLATION AND REMOVAL OF PLUG-ON MODULES

2-12. The 5300A Measuring System must be used with a mating plug-on before any measurements can be made. To mate the 5300A Measuring System with a plug-on, use Figure 2-1, steps a to c, and proceed as follows:

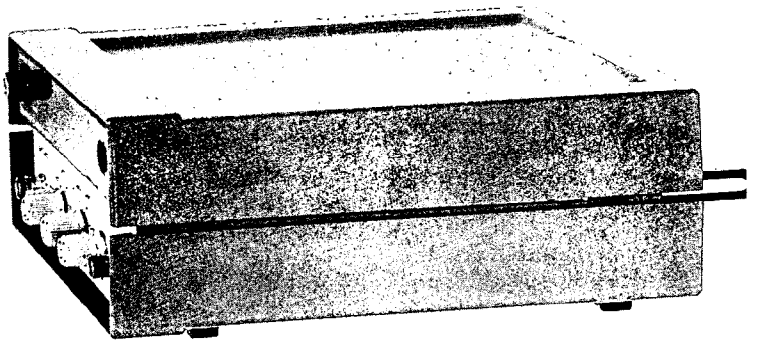
a. Disconnect ac power and set the plug-on (on its feet) on a flat surface with the front-panel facing you.

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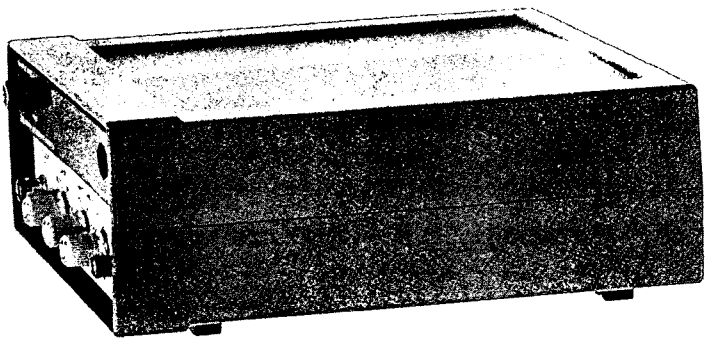
Figure 2-1. Plug-on Installation



STEP A



STEP B



STEP C

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b. Turn the 5300A right-side up with front-panel facing you (ON-OFF-SAMPLE RATE on left side) and slide the side-casting latches all the way to the rear of the unit. The latch handles must be pressed gently away from the center of the unit to "unlock" them before sliding rearward.

c. With latch handles fully extended rearward, mate the 5300A to the plug-on by placing the 5300A on top of the plug-on.

d. With the latches fully extended rearward and the 5300A properly positioned on the plug-on, an equal space should be visible (about 1/8-inch wide) where castings meet.

CAUTION

In the following step, DO NOT force latches forward; if difficulty is encountered, check latches and castings for obstructions.

e. Press down gently on top of 5300A casting and push the left and right latches forward. Castings will be brought together.

f. Check the position of the latches to ensure that castings are properly mated and latched. When properly latched, latches should not protrude past rear-edge of casting and there should be a paper-thin space between plug-on and 5300A.

g. To separate the 5300A from the plug-on, pull the two-side casting latches fully rearward, (again it is necessary to press the latch handles gently away from the center of the instrument to unlock them).

h. When latches are fully extended rearward, the 5300A and plug-on castings should be separated by about 1/8-inch.

i. Lift 5300A gently away from plug-on.

2-13. DIGITAL RECORDER OUTPUT

2-14. To supply the 5300A Measuring System display information to HP Models 5050B and 5055A Digital Recorders, the HP 10533A Recorder Interface cable must be used. The cable converts the serial-form data from the 5300A to parallel-form data for processing by the digital recorders. The HP 10533A Recorder Interface cable is listed in Tables 1-2 and 1-5 as an available accessory. Documentation is also included in Section IV through VIII of this manual.

2-15. PORTABLE OPERATION

2-16. The HP Model 5310A Battery Pack enables the Measuring System to be used in areas removed from ac power sources. The Battery Pack provides up to 8 hours portable operating time before recharging. Tables 1-2 and 1-4 list the HP 5310A Battery Pack as an available accessory. Documentation is also included in Sections IV through VIII of this manual.

2-17. To prepare the 5300A for portable operation, turn POWER to OFF (full ccw), disconnect ac power cord, refer to Figure 2-2 and proceed as follows:

a. Set the plug-on, on its feet, on a flat surface with the front-panel facing you.

b. Turn the 5310A Battery Pack right-side up (LOW BATTERY LAMP on the left) with front-panel facing you and slide the side-casting latches all the way to the rear of the unit. The latch handles must be pressed gently away from the center of the unit to "unlock" them before sliding rearward.

c. With the latches extended rearward, mate the plug-on to the 5310A Battery Pack by placing the 5310A on top of the plug-on.

d. With the 5310A properly positioned on the plug-on and the latches fully extended rearward, an equal space should be visible (about 1/8-inch wide) where castings meet.

e. Press down gently on top of the 5310A and push the left and right latches forward. Castings will be brought together (see CAUTION in Paragraph 2-12).

f. Check the position of the latches to ensure that castings are properly mated and latched. When properly latched, latches should not protrude past rear-edge of casting and there should be a paper-thin space between plug-on and 5310A Battery Pack.

g. Turn the 5300A right-side up with front-panel facing you (ON-OFF-SAMPLE-RATE on left side) and slide the side-casting latches all the way to the rear of the unit. The latch handles must be pressed gently away from the center of the unit to "unlock" them before sliding rearward.

h. With latch handles fully extended rearward, mate the 5300A to the 5310A by placing the 5300A on top of the Battery Pack.

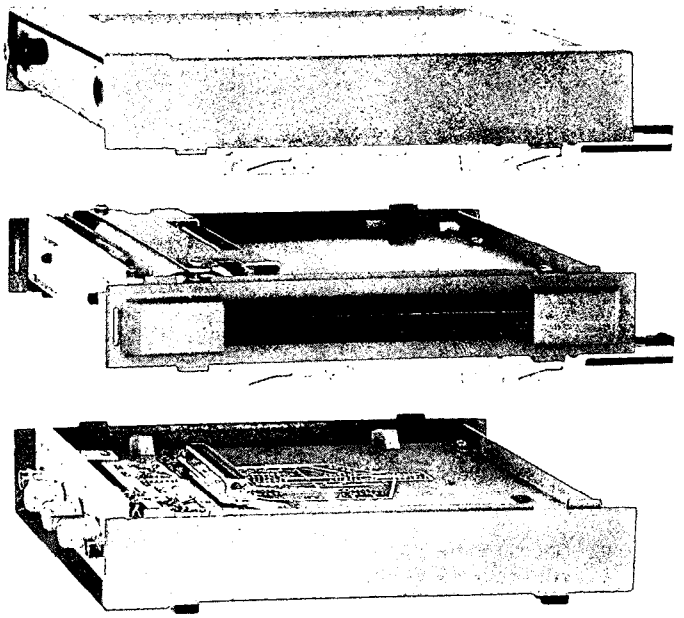
i. With the latches fully extended rearward and the 5300A properly positioned on the 5310A Battery Pack, an equal space should be visible (about 1/8-inch wide) where castings meet.

j. Press down gently on top of 5300A casting and push the left and right latches forward; castings will be brought together (see CAUTION in Paragraph 2-12).

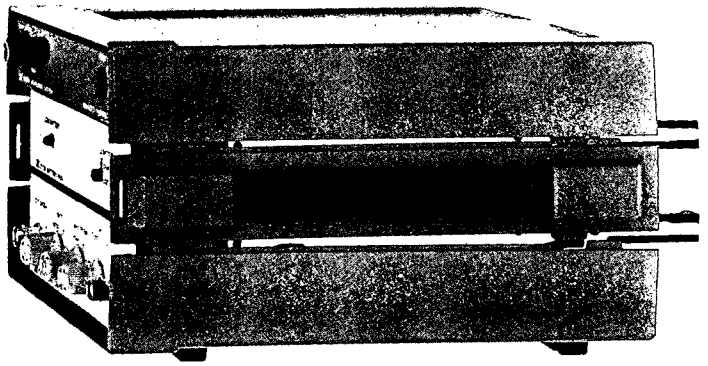
k. Check the position of the latches to ensure that castings are properly mated and latched. When properly latched, latches should not protrude past rear-edge of casting and there should be a paper-thin space between 5310A Battery Pack and 5300A.

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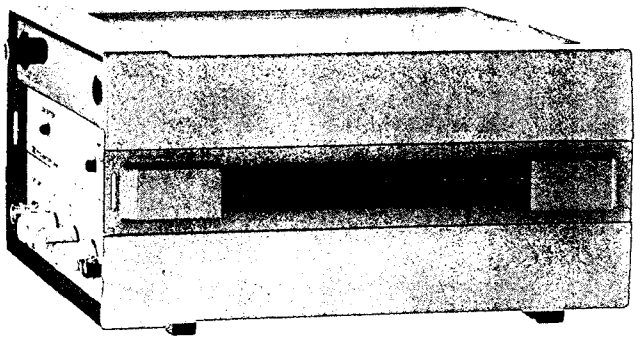
Figure 2-2. Preparing for Portable Operation



STEP A



STEP B



STEP C

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l. When the selected plug-on, the 5310A Battery Pack and the 5300A Measuring System are interconnected and securely latched, perform the check-out procedure as follows:

1. Set 5310A BATTERY-LINE-CHARGE switch to BATTERY.

2. Turn 5300A POWER switch to ON (ccw out of OFF) and ensure that 5310A BATTERY LOW lamp is OFF.

3. If BATTERY LOW lamp is on, turn 5300A POWER to OFF and connect ac power to 5300A and set 5310A BATTERY switch to CHARGE for 18 hours minimum.

4. If unit fails to operate, check interconnection of 5300A, 5310A, and plug-on in use (if problem persists, refer to Section V, MAINTENANCE, Paragraph 5-61, HP 5310A Battery Pack).

5. Refer to Section IX for the plug-on module used and perform the performance check procedures for that plug-on.

6. 5300A display should be as listed in the respective plug-on performance check.

m. To separate the 5300A, 5310A, and plug-on, pull the two-side casting latches on the 5300A fully rearward, (again it is necessary to press the latch handles gently away from the center of the unit to "unlock" them).

n. When latches are fully extended rearward, the 5300A and 5310A castings should be separated by about 1/8-inch.

o. Lift the 5300A gently way from the 5310A.

p. To separate the 5310A Battery Pack from the plug-on, repeat steps m, n, and o.

2-18. SERVICE AIDS (Table 2-2)

2-19. To assist you in maintaining and servicing the 5300A Measuring System mainframe, the following list of components and equipment is recommended.

Table 2-2. Diagnostic Service Kit (HP Part No. 10548A)

COMPONENT/EQUIPMENT	HP PART NO.	USE
Shorting Plug	5080-0058, 2 ea.	Implements codes on Diagnostic Cards.
Diagnostic Interface Connector	05300-60004, 1 ea.	Interface between 50-pin connector and 44-pin connector.
Diagnostic Card "A" Diagnostic Card "B" Diagnostic Card "C" Diagnostic Card "D"	05300-20011 05300-20012 05300-20013 05300-20014 1 ea.	Provides fixed tests to check 5300A circuits, including the display.

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SECTION III

OPERATION

3-1. INTRODUCTION

3-2. Operation of the 5300 is simplified through the use of only two controls. By itself, the 5300A is not useable for measurements, therefore refer to the pertinent operating information for the 5300A and plug-on used in Section IX.

3-3. ACCURACY

3-4. The basic measuring accuracy is determined by the plug-on module in use. Refer to Section IX for more information on specific plug-on accuracy.

3-5. FRONT PANEL

3-6. The 5300A front panel (Figure 3-1) contains the ON-OFF switch and SAMPLE RATE control, the RESET switch, the Solid State Display, and the Annunciators.

3-7. REAR PANEL

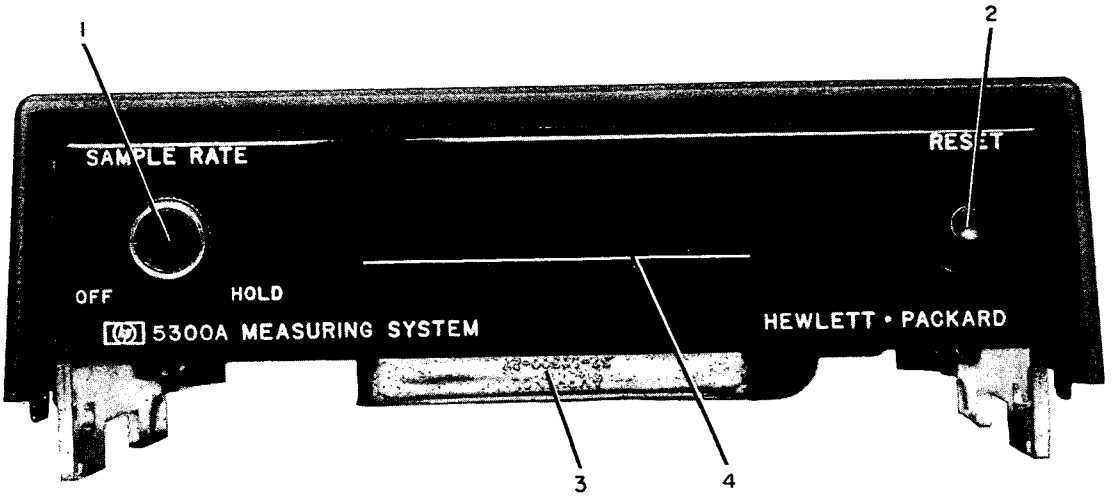
3-8. The 5300A rear panel (Figure 3-2) contains the ac Input Power Module and Fuse, the External Clock jack and the Digital Recorder Connector.

3-9. INT-EXT Switch. The INT-EXT switch located near the power transformer allows the use of an external 10 MHz frequency source instead of the internal oscillator.

3-10. OPERATING PROCEDURES

3-11. The operating procedures for the 5300A Measuring System and its plug-ons are located in the documentation supplied for the respective plug-on in Section IX. For example, the operating information for HP Model 5301A 10 MHz Counter is Section IXA. The operating information for the HP Model 5302A 50 MHz Universal Counter is Section IXB.

Figure 3-1. 5300A Front Panel Controls and Indicators



1. **SAMPLE RATE.** Ac power is turned on or off.

   SAMPLE RATE is adjustable from less than 50 msec to more than 5 seconds.

   HOLD position retains the display information

2. **RESET.** When pressed, the instrument circuits are reset and a new measurement is initiated.

3. **A1J1.** 50-pin connector provides interconnection with plug-on used.

4. Display/Annunciator. Hz, kHz, MHz: lights when measurement occurs in Hz, kHz, or MHz range respectively.

   S, MS, μS: lights when measurements occur in seconds, milliseconds, or microseconds, respectively.

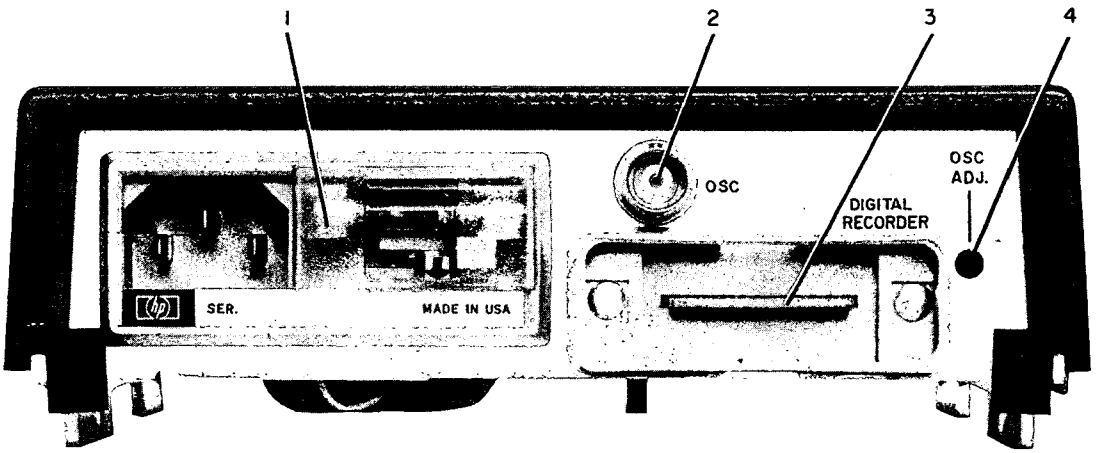
   C: lights when instrument Main Gate is open.

   Overflow Light: Lights when the measurement exceeds the display capacity.

   Display: 6-digit display of data.

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Figure 3-2. Rear Panel Connectors



1. **Ac Power Module.** Input Power module contains the I.E.C. approved connector, the fuse, (.3 Amp 115 Vac, .15 Amp 230 Vac), the 115/230 line voltage switch and filter capacitors. Design of module prevents fuse or switch change when ac power line is connected. The switch cannot be changed unless the fuse is pulled out.

2. **OSC Jack.** When INT-EXT switch located near the 5300A power transformer is in INT, the instrument uses its internal 10 MHz Oscillator, and a 10 MHz signal (1 V rms into 100-ohms) is available at the BNC jack. When the switch is in EXT, the internal oscillator is disabled and an external 100 kHz to 10 MHz, 1 V rms into 500-ohms frequency source can be used.

3. **DIGITAL RECORDER Connector.** BCD serial output with a floating decimal point is available.

4. **OSC ADJ.** Internal 10 MHz oscillator frequency can be adjusted to 1 part in 10^6.

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SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section describes the basic and overall instrument theory of operation and detailed individual assembly operation.

4-3. BINARY LOGIC AND GATING

4-4. The 5300A Measuring System and its associated plug-ons use integrated circuits. It is necessary to understand basic logic symbols and their application gating. In the circuit diagrams, AND gate, OR gate, NAND gate, NOR gate, Inverted Input gate, Inverter and Amplifier symbols are used. The following paragraphs and illustrations introduce logic symbols and their application.

4-5. Two states exist in the binary system, 1 and 0. HIGH (H) and LOW (L) are used to represent the levels of 1 and 0. HIGH always represents the more positive level whether it be positive or negative logic. Figure 4-1 shows four pairs of logic symbols that have the same truth tables and can be used interchangeably. The same function is performed by two different logic symbols.

4-6. GATES. Figure 4-2A represents a basic AND gate. The AND gate output is HIGH if all inputs are HIGH. An AND gate may have two or more inputs.

Figure 4-2B represents the basic OR gate. The OR gate output is HIGH if one or more of its inputs is HIGH. The OR gate may have two or more inputs.

Figure 4-2. Gate Symbols

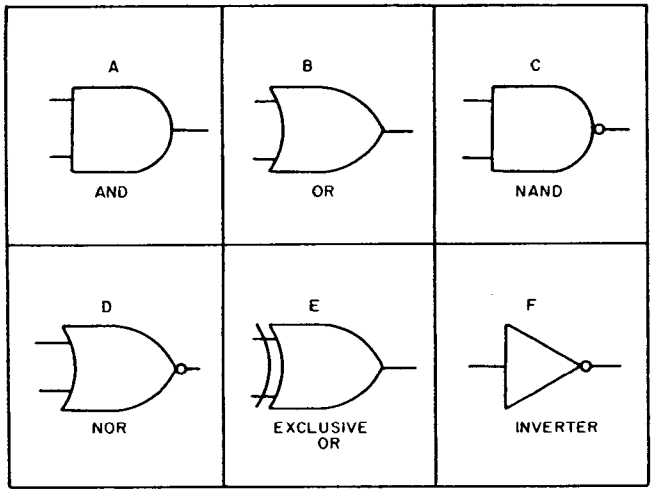
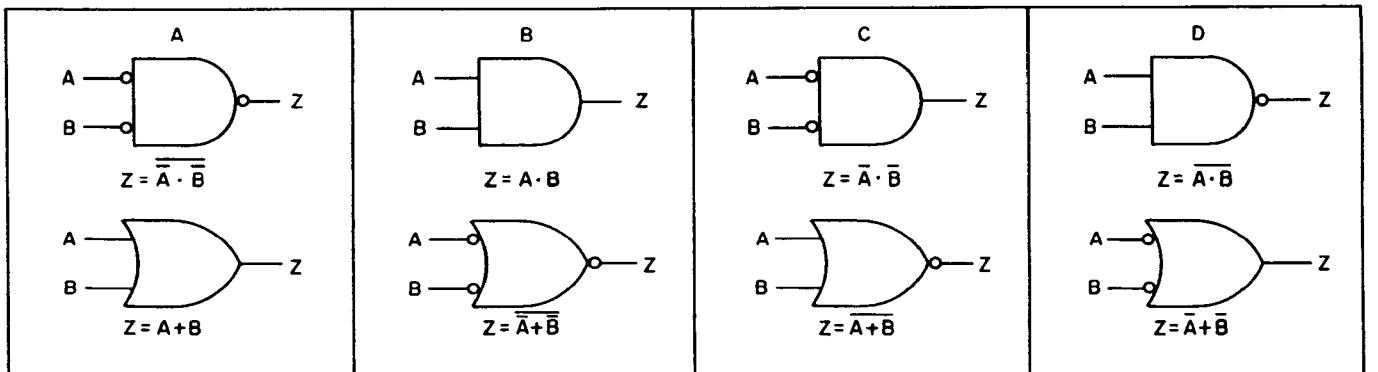


Figure 4-1. Logic Comparison Diagrams



A	B	Z	A	B	Z	A	B	Z	A	B	Z
L	L	L	L	L	L	L	L	H	L	L	H
L	H	H	L	H	L	L	H	L	L	H	H
H	L	H	H	L	L	H	L	L	H	L	H
H	H	H	H	H	H	H	H	L	H	H	L

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4-7. INVERSION. AND and OR gates are shown in Figure 4-2 (A, B). The circle on the output of a logic symbol indicates a LOW when activated, as shown in Figure 4-2 (C, D). Thus, a circle indicates inversion. An AND gate with an inverted output is called a NAND gate; an OR gate with an inverted output is called a NOR gate. The unit gain amplifier with an inverted output is called an inverter, Figure 4-2 (F).

4-8. FIELD EFFECT TRANSISTOR (FET)

4-9. Field effect transistors have three terminals: source, drain, and gate which correspond in function to emitter, collector, and base of junction transistors. Source and drain leads are attached to the same block (channel) of N or P semiconductor material. A band of oppositely doped material around the channel (between the source and drain leads) is connected to the gate lead.

4-10. In normal FET operation, the gate-source voltage reverse-biases the PN junction, causing an electric field that creates a depletion region in the source-drain channel. In the depletion region the number of available current carriers is reduced as the reverse-biasing voltage increases, making source-drain current a function of gate-source voltage. With the input (gate-source) circuit reverse-biased, the FET presents a high impedance to its signal sources (as compared with the low impedance of the forward-biased junction transistor base-emitter circuit). Because there is no input current, FET's have less noise than junction transistors. Figure 4-3 shows the schematic symbol and biasing for N channel and P channel field effect transistors.

4-11. LIGHT EMITTING DIODES

4-12. A light emitting diode (LED) is a p-n junction device which is designed to emit visible radiation (light) when its p-n junction is forward biased.

4-13. The type of diodes used in the 5300A Display are Gallium Arsenide Phosphide LED's which emit radiation in the red region (6400 Angstroms). The addition of the red front-panel filter enhances the visibility of emitted radiation. Additional subject information is available from the HP Journal, July 1970, and HP Applications Note 931.

4-14. INTEGRATED CIRCUIT OPERATION

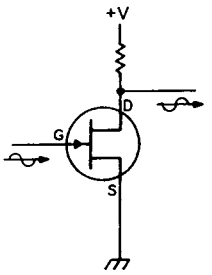
4-15. The operation of integrated circuits A1U1, A1U2, A1U3, A1U4, and A1U5 is found in paragraphs 4-30 through 4-40.

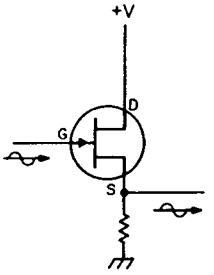
4-16. OVERALL OPERATION

4-17. Figure 4-4 is an overall block diagram of the 5300A Measuring System and a typical plug-on (5301A Plug-On). The 5300A Measuring System mainframe contains the major counting, timing, and display circuitry which is the basis of all measurements in the 5300A Measuring System.

Figure 4-3. Field Effect Transistor Operation

A. FET Amplifier Characteristics





CHARACTERISTIC	COMMON SOURCE	COMMON DRAIN (Source Follower)
Input Impedance	IMΩ-15MΩ	IMΩ-15MΩ
Output Impedance	50KΩ-100KΩ	IKΩ-10KΩ
Voltage Gain	10-200	<1
Power Gain	60dB-100dB	40dB-80dB

B. FET Biasing

TYPE		
N-CHANNEL DRAIN GATE SOURCE	+V OV 0 CONTROL VOLTAGE MAXIMUM CURRENT FLOW	+V -V INCREASING CONTROL VOLTAGE DECREASES CURRENT FLOW
P-CHANNEL DRAIN GATE SOURCE	-V OV 0 CONTROL VOLTAGE MAXIMUM CURRENT FLOW	-V +V INCREASING CONTROL VOLTAGE DECREASES CURRENT FLOW

4-18. The functional modules of the mainframe are shown in Figure 4-4 simplified block diagram. These are:

a. Display A1A1DS7. A six-digit scanned solid-state LED display.

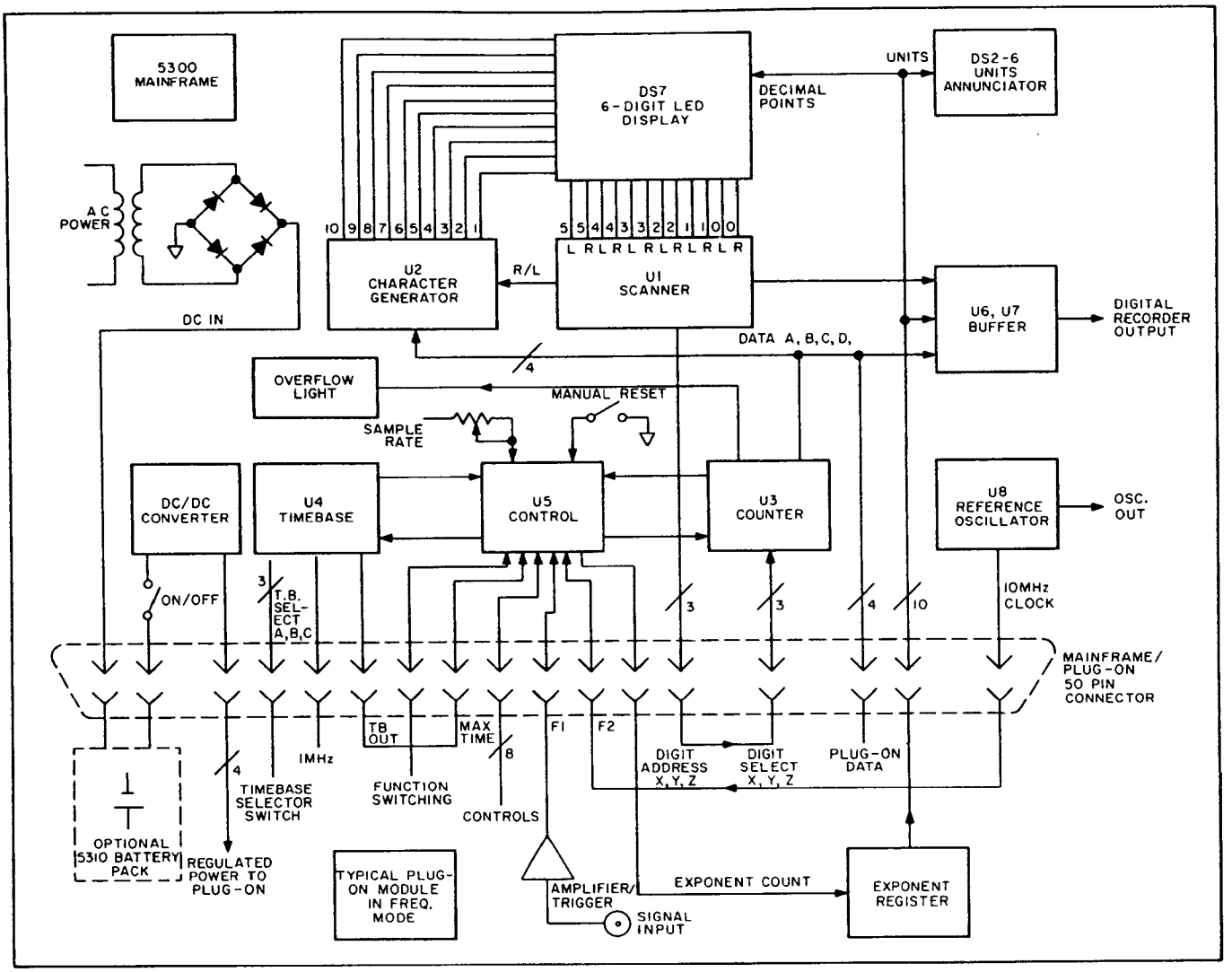
b. Scanner (A1U1). A self-contained scanning circuit which drives the vertical columns of the display and provides an address code used to identify the displayed digit.

c. Character Generator (A1U2). A decoding and driving circuit which converts the four-line data code to a 10-line pattern used to drive the horizontal lines of the display matrix.

d. Counter (A1U3). A six-digit, 10 MHz counting and storage register.

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Figure 4-4. 5300A Simplified Block Diagram



e. Time base (A1U4). An eight-decade 10 MHz, automatic time-base divider.

f. Control (A1U5). Provides the basic control functions and gating for counting and timing measurement cycles, including auto-ranging, transfer, reset, and sample rate control.

g. Reference Oscillator (A1U8 and Y1). A 10 MHz crystal-controlled oscillator which provides the basic frequency and time references for the system.

h. Power Supply. Provides regulated voltages to the mainframe and all plug-on modules and charging power to the optional battery pack module. Power Supply Input can be 115 Vac or 230 Vac line voltage or dc power from the battery pack.

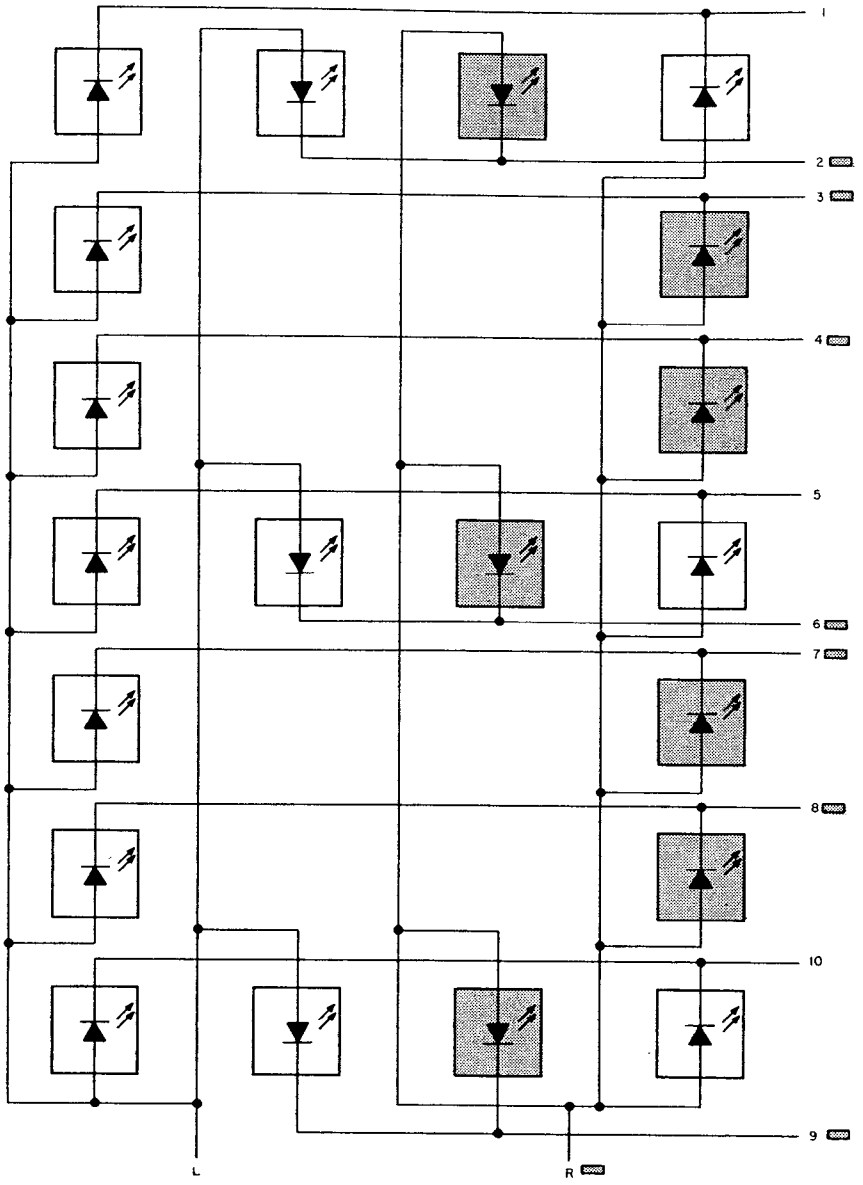
4-19. These basic functional blocks of the mainframe may be interconnected in many ways to provide different measurement capabilities. A typical system interconnected for frequency measurement is shown in the block diagram, Figure 4-4. The major signal and control lines are all routed via the plug-on connector and the plug-on module, which determines measurement function as well as providing the input signal interfaces.

4-20. The four-wire data bus carries the system data between modules in a binary-coded-decimal, digit-serial format. Data can flow from A1U3 counter to DS7 display, to the digital recorder output, and to the plug-on module, or from the plug-on module to DS7 display and to the digital recorder output. The transfer of data to the display is controlled by a 3-bit binary code (Digit Address) which is generated by the scanner, A1U1. A 3-bit code (Digit Select) controls the data output from the counter. With most plug-on modules the displayed information is the stored contents of A1U3 counter. In these modules, the digit address lines are wired directly to the digit select lines with the modules.

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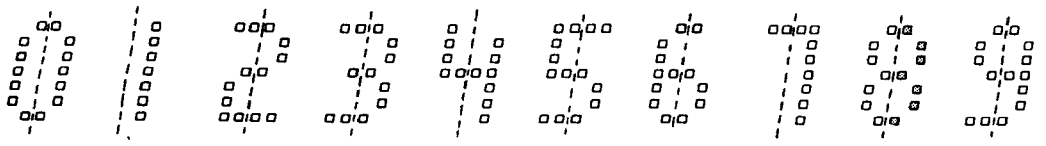
Figure 4-5. Light Emitting Diode Matrix

A



ONE OF SIX DIGITS SHOWN. LINES 1 THRU 10 ARE COMMON TO ALL SIX DIGITS; SEPARATE L AND R LINES DRIVE EACH HALF-DIGIT. SHADING SHOWS ENABLE LINES AND LEDs ASSOCIATED WITH DISPLAYING THE RIGHT HALF OF THE DIGIT 8.

B



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4-21. The A1U4 time base is also programmed by a 3-bit time base code which can select any time base division factor in powers of 10, from 10 to 10^8. The time base output may also be selected automatically over the same range. In the auto-ranging mode the range is indicated by the number of exponent pulses generated by the time base and the control module. These pulses are counted, stored, and decoded by an exponent register in the plug-on module, which then provides the drive to the appropriate decimal point and units indicators in the mainframe.

4-22. The input signals to the counter and the time base are routed through the control module. For a typical frequency measurement as shown in the block diagram, the F1 input to the counter is derived from the input amplifier of the plug-on module, and the time base input F2 is the reference frequency from the crystal oscillator. In a period average measurement, which is the reciprocal of frequency, these signals are reversed. In addition to the F2 input, a 1 MHz input to the time base is provided which bypasses the first time base decade and the control module and allows auto-ranging down to a single cycle of the input signal.

4-23. 10 MHz OSCILLATOR OPERATION

4-24. The 10 MHz oscillator (Figure 8-2) generates 10 MHz clock signals for the 5300A Measuring System and is plug-ons. The oscillator section consists of U8A, Y1, buffer amplifier U8B, and output amplifier Q1. U8A operates as a positive feed-back amplifier. The noninverted output maintains signals to 10 MHz crystal Y1.

4-25. The inverted output from U8A is sent through buffer amplifier U8B and output amplifier Q1. The output from Q1 connects through the INT-EXT switch to the input of U7A. The output from U7A is sent to A1J1 where it is available to plug-ons as the "CLOCK" signal. A second output from U7A is sent through U7B and the INT-EXT switch to the rear-panel OSC jack. The OSC jack provides 1 volt rms.

4-26. A1A1 LIGHT EMITTING DIODE ASSEMBLY (LED)

4-27. The display in the 5300A is a 6-digit, scanned, light-emitting-diode display. The display is formed by a matrix of dots, each dot consisting of a gallium arsenide diode which emits red light when current is passed through it in a forward direction.

4-28. Twenty diodes are used for each digit position, with the diodes arranged in a 4 x 7 matrix as shown in Figure 4-5A. For ease of driving, the diodes are rearranged electrically into a 2 x 10 matrix.

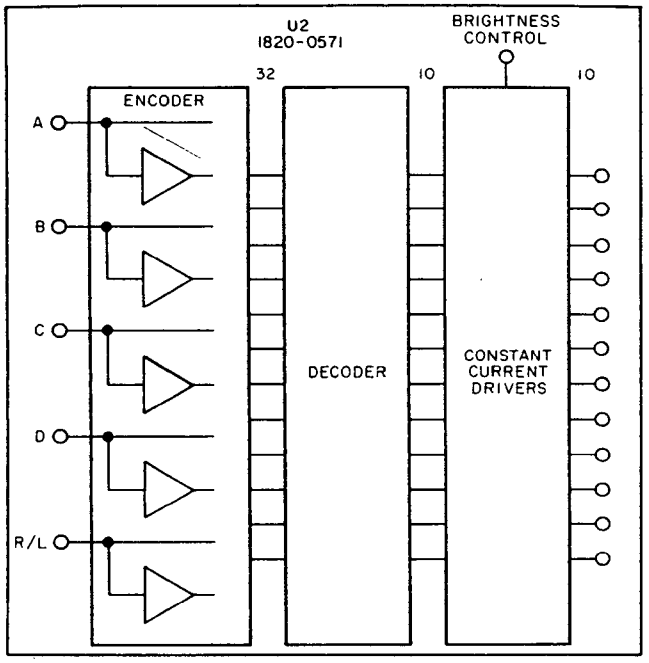
4-29. This divides the digit into symmetrical left and right halves as in Figure 4-5B. Each half digit has a column drive line connected to the anodes of all 10 diodes and 10 cathode drive lines which are connected to the same diode position in every half digit.

4-30. A1U1 SCANNER

4-31. In operation each half-digit is scanned by the circuitry shown in Figure 4-6B. The display is scanned from right to left with each half-digit position being driven for 1/12 the total cycle time. Integrated circuit U1 generates the scanning sequence to drive the display via 12 buffer drive transistors, Q6 to Q17. The scanner has a free-running internal clock whose frequency is set by the external capacitor C17. The scanning frequency is approximately 10 kHz so that the complete display is refreshed in about 1.2 milliseconds. The scanner also provides a four-bit code which identifies the half-digit being driven. The first bit identifies the right and left hand halves of each digit and is high when the right hand half is on. The other three bits, lines X, Y, and Z, identify the digit being displayed. These address the digit location in the data source which sends the digit information as a binary coded decimal code to the character generator, U2.

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Figure 4-6A. U2 Character Generator

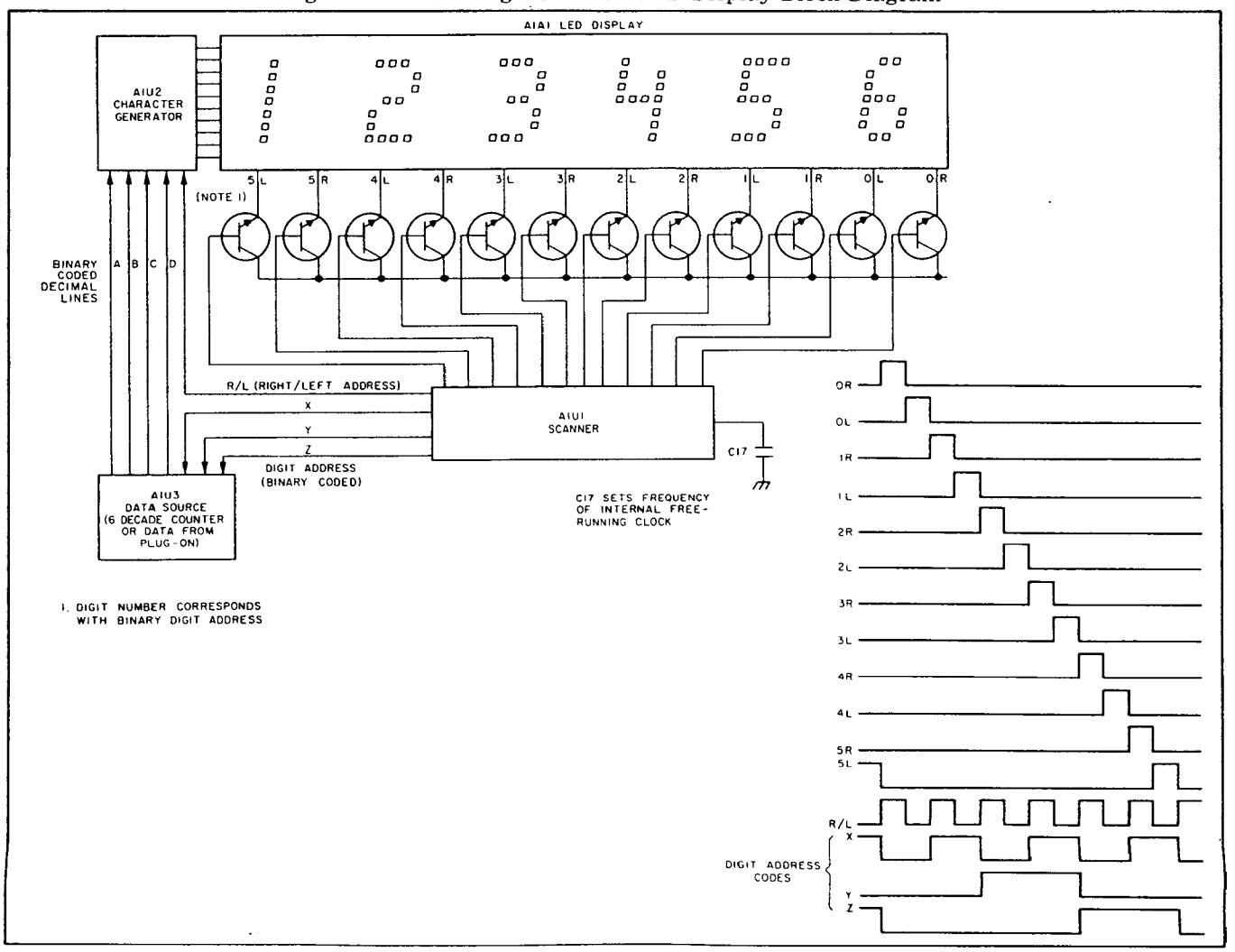


4-32. A1U2 CHARACTER GENERATOR

4-33. The character generator decodes the digit information along with the right/left code and generates the pattern on its 10 output lines for the half-digit being addressed. A list of output codes for all allowable input codes is shown in Table 4-1 and should be used in conjunction with Figure 4-5. A diagram is shown in Figure 4-6A and B. The character generator also controls the brightness of the display by regulating the current provided to each diode.

4-34. In the 5300A the data source can be in the plug-on module but is normally the six decade counter, A1U3. If A1U3 Counter is to be used, the digit address lines X, Y, and Z are connected to the digit select lines X, Y, and Z via the plug-on connector. This automatically connects the counter data to the character generator as well as to the plug-on module.

Figure 4-6B. Six-Digit Scanned LED Display Block Diagram



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If the digit select lines are left open or held high, the counter will be disconnected from the character generator allowing data from the plug-on module to be displayed. Mainframe and plug-on data can also be combined in the display with the correct combination of digit address code and digit select code. The digit address code identifies the digit position in the display, with digit 0 being the least significant digit. The digit select code selects the digit position in the mainframe counter with zero selecting the least significant digit position.

4-35. A1U3 COUNTER

CAUTION

This counter is a large-scale MOS integrated circuit. Its inputs are susceptible to damage by high voltages (+5.6 volts) and static charges. Particular care should be exercised when servicing this circuit or handling it under conditions where static charges can build up.

4-36. The information displayed on the 5300A is normally counted in A1U3 Counter integrated circuit. This circuit consists of six decade-counting elements, an overflow register, a 25-bit latch, and output multiplexing circuits. Figure 4-7 is a basic block diagram of A1U3. The counter can accumulate and store up to 1 million pulses at its input. The input triggers on the positive-going edge of the input pulse, which is derived from the control circuit, A1U5. The A1U5 input signal is the F1 signal from the plug-on. The $\overline{\text{TRANSFER}}$ input at A1U3(4) transfers data from the decade counters to the latch circuits when the $\overline{\text{TRANSFER}}$ line is low. When the $\overline{\text{TRANSFER}}$ line is high, data is stored in the latch circuits. The RESET input at pin 11 resets the decades when the RESET signal is high. One million or more input counts into the counter sets the overflow register, which causes the $\overline{\text{OVERFLOW}}$ output at pin 7 to go high following a $\overline{\text{TRANSFER}}$ signal.

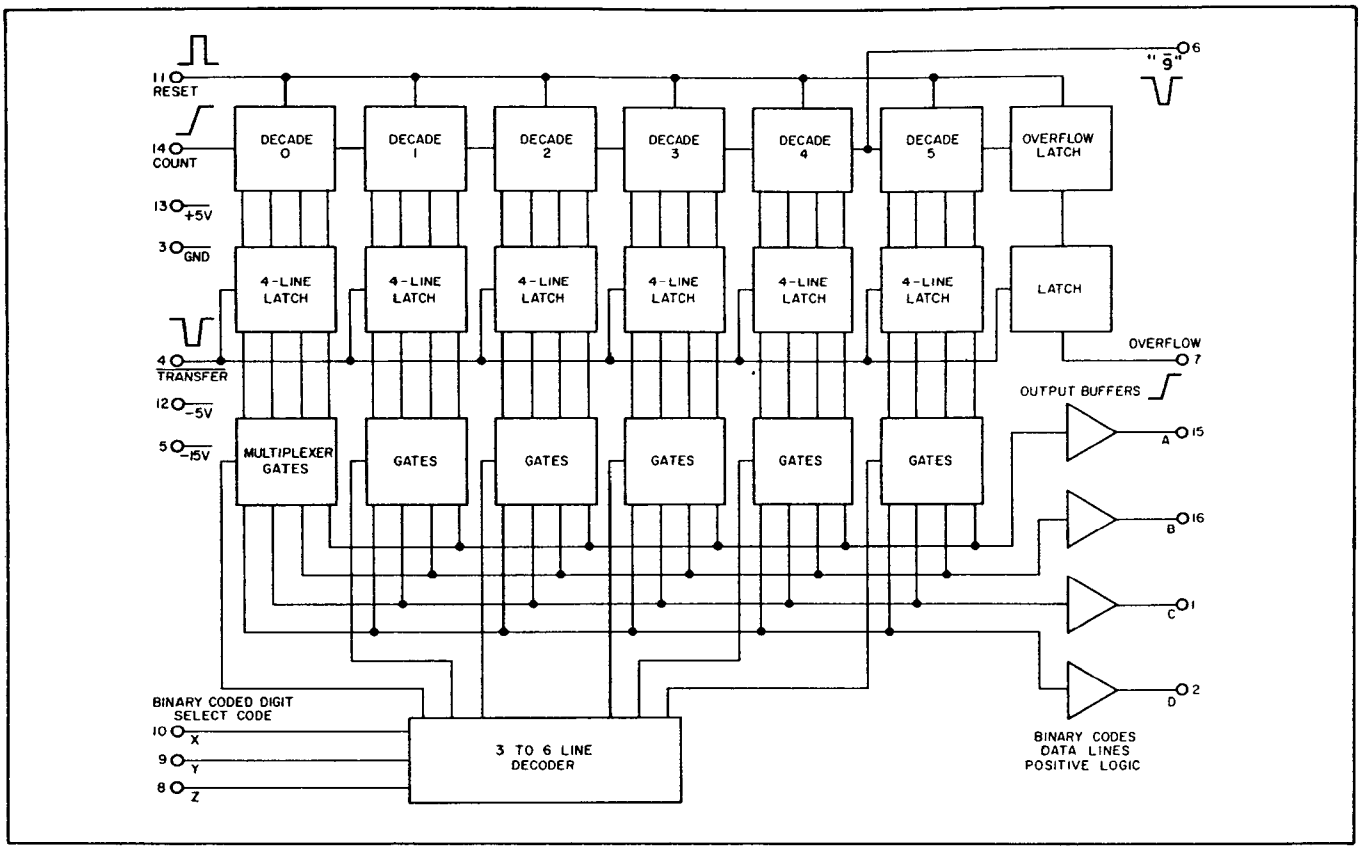
4-37. The counter output is available one-digit at a time as a four-bit, binary-coded-decimal signal (logical 1 is high). The digit selected at the output is determined by the binary-coded digit select code at pins 8, 9, and 10. Binary 0 (all low) selects the least significant decade. Binary 5 selects the most significant decade in the register. A select code of binary 7

Table 4-1. Character Generator Coding

CHARACTER (NUMBER DISPLAYED)	A1U2 INPUTS					A1U2 OUTPUTS (LED INPUTS) X = ENABLED									
	A	B	C	D	R/L	1	2	3	4	5	6	7	8	9	10
U2 PINS →	17	14	15	16	18	5	6	7	10	11	9	4	20	2	1
0	L	L	L	L	-		X	X	X	X		X	X	X	
1 LEFT	H	L	L	L	L										
1 RIGHT	H	L	L	L	H	X		X	X	X		X	X		X
2 LEFT	L	H	L	L	L	X	X				X	X	X	X	X
2 RIGHT	L	H	L	L	H		X	X	X		X			X	X
3 LEFT	H	H	L	L	L	X	X				X			X	X
3 RIGHT	H	H	L	L	H		X	X	X		X	X	X		X
4 LEFT	L	L	H	L	L	X		X	X	X	X				
4 RIGHT	L	L	H	L	H			X	X	X	X	X	X		X
5 LEFT	H	L	H	L	L	X	X	X	X	X	X			X	X
5 RIGHT	H	L	H	L	H	X	X				X	X	X	X	
6 LEFT	L	H	H	L	L		X	X	X	X	X	X	X	X	
6 RIGHT	L	H	H	L	H		X				X	X	X	X	
7 LEFT	H	H	H	L	L	X	X								
7 RIGHT	H	H	H	L	H	X	X	X	X	X		X	X		X
8	L	L	L	H	-		X	X	X		X	X	X	X	
9 LEFT	H	L	L	H	L		X	X	X		X			X	
9 RIGHT	H	L	L	H	H		X	X	X	X	X	X	X	X	
MINUS	L	L	H	H	-					X	X				
BLANK	-	H	H	H	-										

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Figure 4-7. A1U3 6-Decade Counter Block Diagram



will set all outputs high which allows other data from the plug-on to be inserted in place of the counter data. If no other data is presented, the display remains blank. In normal operation, the digit select lines X, Y, and Z are driven by the digit address lines X, Y, and Z from the display scanner. This multiplexes the six decades of information into the six digit positions of the display. When a count of 90,000 has been registered in the counter (decades 0 to 4), the output labeled "9" goes low. This signal is used during auto-ranging, to register a reading of 9% or greater of full scale.

4-38. A1U4 TIME BASE

CAUTION

This time base is a large-scale MOS integrated circuit. Its inputs are susceptible to damage by high voltages and static charges. Particular care should be exercised when servicing this circuit or handling it under conditions where static charges can build up.

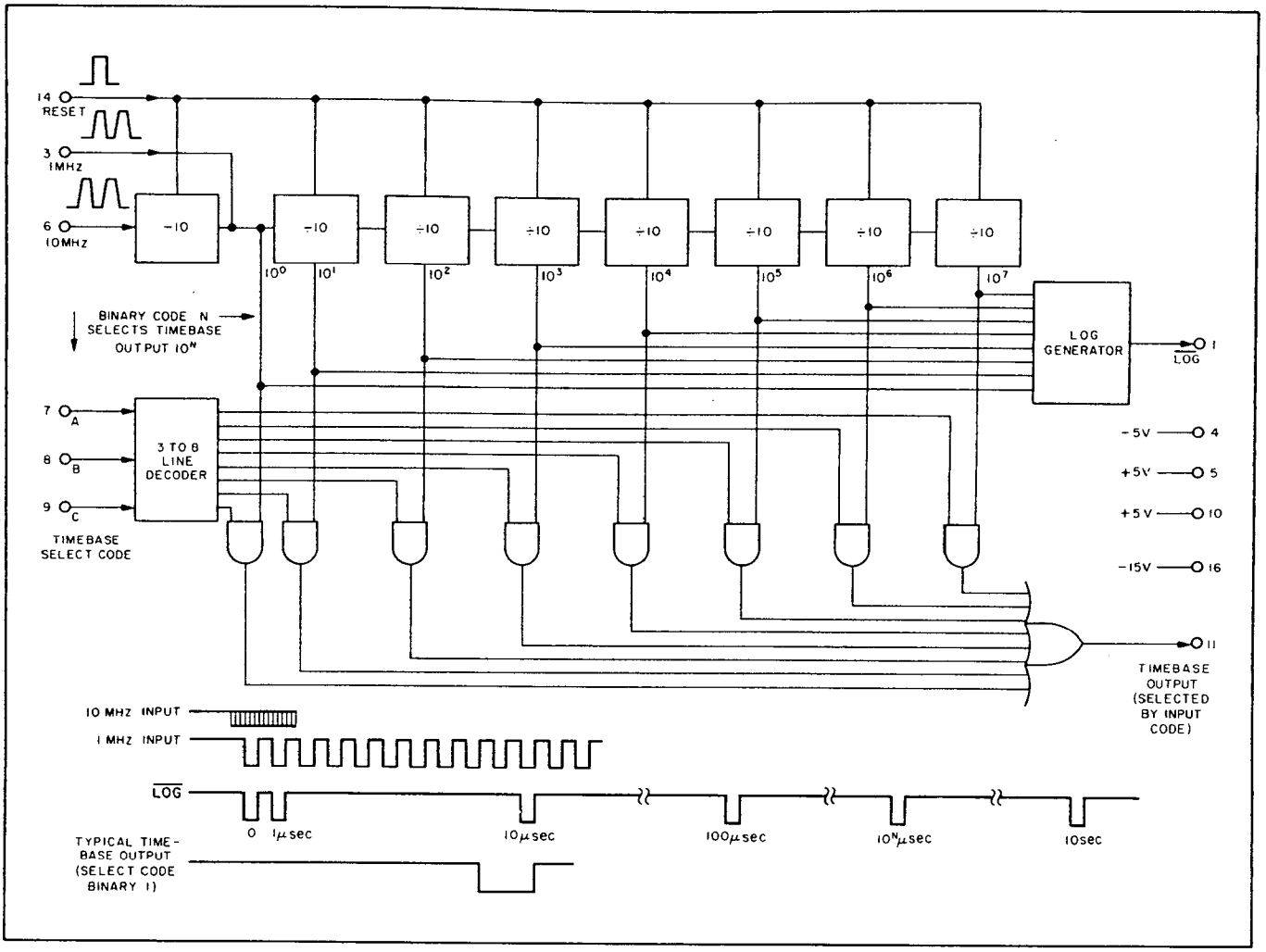
4-39. The A1U4 Time Base is a large scale integrated circuit containing eight decade-divider elements. Figure 4-8 shows a basic block diagram. It accepts a maximum input frequency of 10 MHz which gives an output of one pulse every 10 seconds from the last decade-divider. The outputs of all decade dividers are multiplexed into a single time-base output line at A1U4(11). The number of stages used to divide the input signal is determined by a 3-bit binary-coded select code (pins 7, 8, and 9). Division factors of 10 through 10^8 can be selected. The first decade stage may be bypassed by a second input whose maximum frequency is 1 MHz. This input can be divided by scaling factors of 1 through 10^7. The precision timing and auto-ranging required for frequency and period average measurements is provided by the LOG output at pin 1. During the first 10 seconds of a frequency measurement following reset, this output provides only 9 pulses. The first pulse triggers the gate opening at time 0, thereafter pulses are obtained at 1, 10, and 100 μsec, 1, 10, and 100 msec, 1 sec, and 10 sec. During auto-ranging, one of these pulses is automatically selected to trigger the gate closing. After the measurement is in progress, each pulse is precisely referenced to the Start Pulse at Time 0, which enables the Stop Pulse to be selected. The time base can be cleared to zero by a positive reset pulse at pin 14.

TIME BASE CODE/U4

GATE TIME	TBC	TBB	TBA
1 μs	0	0	0
10 μs	0	0	1
.1 ms	0	1	0
1 ms	0	1	1
10 ms	1	0	0
.1 S	1	0	1
1 S	1	1	0
10 S	1	1	1

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Figure 4-8. A1U4 Time Base Basic Block Diagram



4-40. A1U5 CONTROL CIRCUIT

4-41. The signal gating and measurement cycle control for the 5300A Measuring System is provided by A1U5 control integrated circuit. Figure 4-9 shows a basic block diagram. The functions provided are: gating of signals to the Counter and Time Base, sample rate control, and provision for RESET and $\overline{\text{TRANSFER}}$ signals.

4-42. The F1 and F2 inputs are shaped by Schmitt-Triggers and then gated to pins 5 and 20 as the TIME BASE INPUT and COUNTER INPUT signals. To maintain optimum drive to the MOS circuits, these outputs are not routed through the plug-on. During reset, each output remains in a high state until the opening of the gates.

CAUTION

Particular care should be taken during servicing to avoid excessive capacitive loading of these outputs with probes.

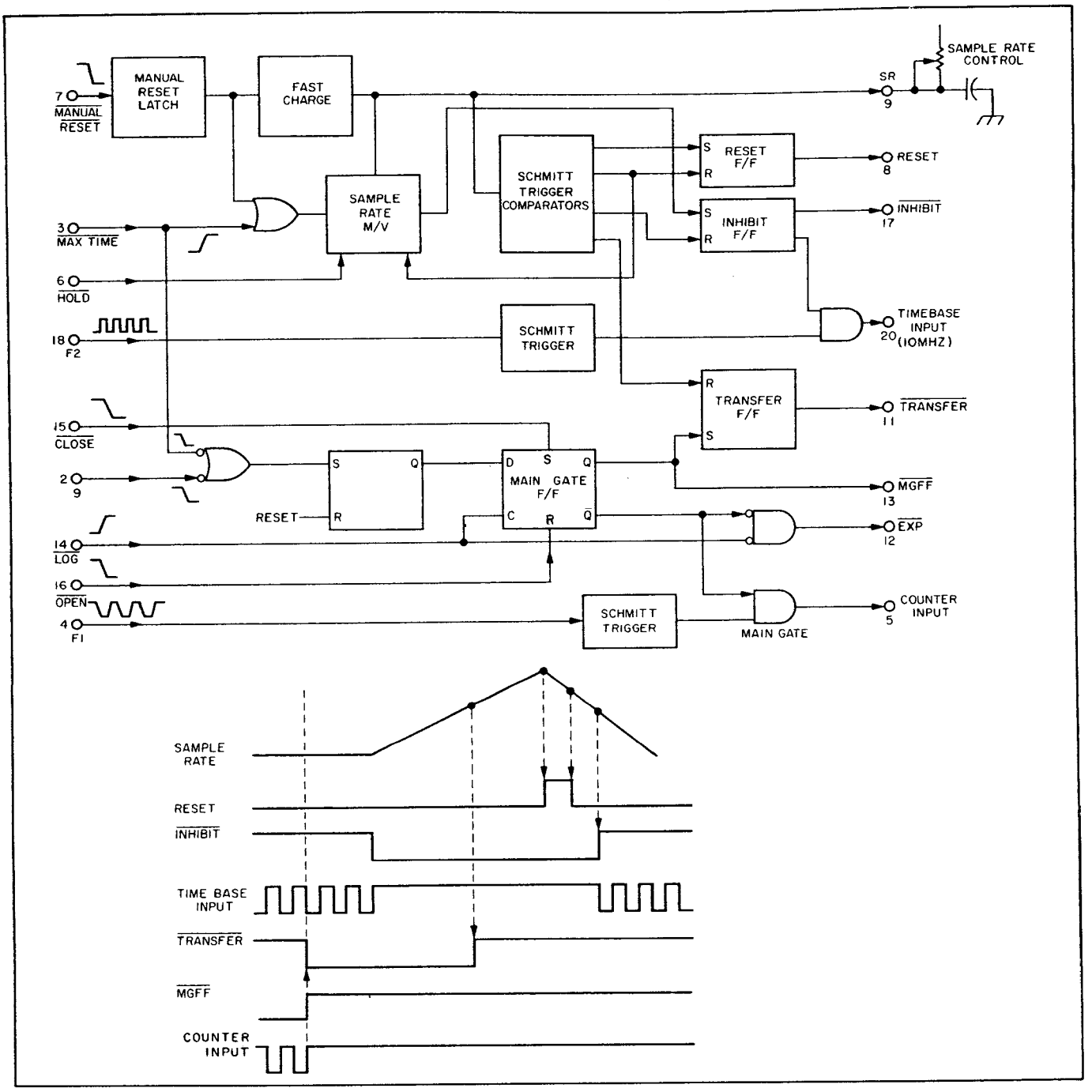
4-43. The Main Gate flip-flop controls gating of the counted signals. The flip-flop can be set or reset by low signals at the $\overline{\text{OPEN}}$ (pin 16) or $\overline{\text{CLOSE}}$ (pin 15) inputs, or can be triggered by a positive going edge at the $\overline{\text{LOG}}$ input (pin 14) which comes from the time base. Following reset, the first $\overline{\text{LOG}}$ input pulse opens the gate. Subsequent $\overline{\text{LOG}}$ inputs will not affect the flip-flop until the D input is driven from an enabling flip-flop which is set by the low signal at either the "9" input or the $\overline{\text{MAX TIME}}$ input. Setting this flip-flop enables the next $\overline{\text{LOG}}$ pulse to close the Main Gate and terminate the measurement.

4-44. During manual operation, the $\overline{\text{MAX TIME}}$ signal enables the closing of the gate at the predetermined gate time. During automatic operation after the counter has reached 9% of full scale, the "9" input enables the closing of the gate on the following $\overline{\text{LOG}}$ pulse, which always occurs before 90% full scale is reached. The number of $\overline{\text{LOG}}$ pulses occurring while the main gate is open appears at the $\overline{\text{EXP}}$ output (pin 12). This number of pulses indicates the number of ranges through which the Time Base has automatically stepped and is used to determine the correct decimal point and units indication.

4-45. As soon as the main gate closes, a Transfer flip-flop triggers to provide a low output to transfer data from the counter to the display. The display cycle is initiated by the rising edge at the $\overline{\text{MAX TIME}}$ input

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Figure 4-9. A1U5 Control Basic Diagram

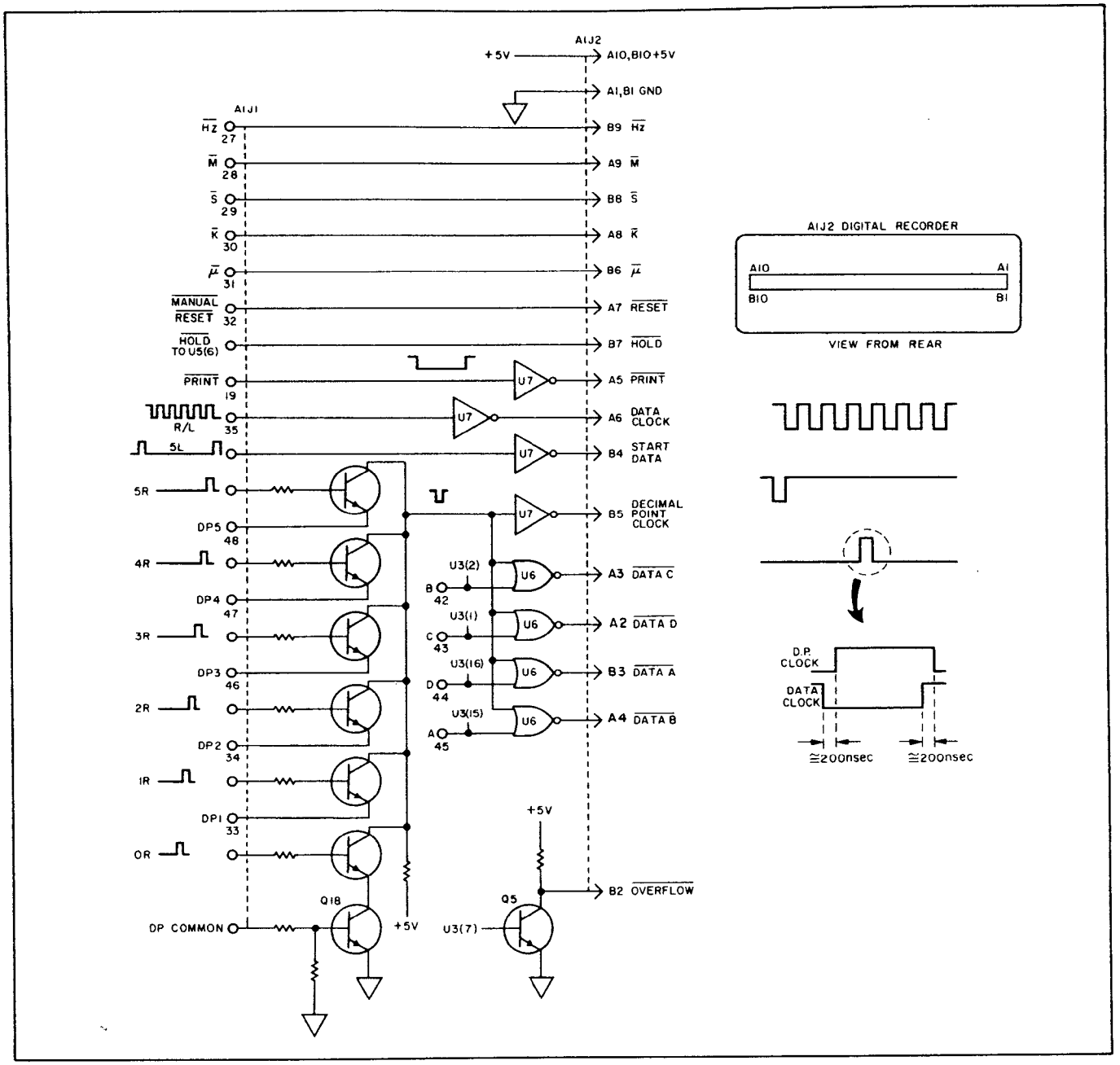


which triggers the Sample Rate M.V. The sample rate capacitor begins charging through the front-panel SAMPLE RATE control. At a point approximately halfway up the charging curve the TRANSFER signal is removed. When the peak charging voltage is reached, the Reset flip-flop triggers, providing a high signal at the RESET output. At this point the discharge of the sample rate capacitor is initiated, having a discharge time of a few milliseconds. At a point halfway down the discharge curve, the RESET signal is removed.

4-46. At the beginning of the display cycle, the time base input is gated off by an Inhibit flip-flop. The INHIBIT signal is removed at the end of the capacitor discharge. The time base input is then gated on, beginning a new measurement cycle. An INHIBIT signal is available to the plug-on, providing a low signal during the display cycle. The displayed information may be held indefinitely by switching to the HOLD position on the front panel. This opens the charging potentiometer circuits to the sample rate capacitor and prevents the capacitor from charging up.

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Figure 4-10. 5300A Mainframe Digital Recorder Output



The display may also be held by a contact closure to ground from the rear panel to the HOLD input. This allows the charging of the capacitor to take place, but inhibits the discharge and the reset cycle. If the HOLD signal is removed after the capacitor is fully charged, the reset and inhibit cycles are completed within a few milliseconds and a new measurement begins. The system can be cleared by a low signal at the MANUAL RESET input from the front panel RESET switch or from the rear panel.

4-47. A1J1 CONNECTOR

4-48. Inputs to the 5300A Measuring System mainframe and programming of its functions are provided from the plug-on module via a 50-pin connector (A1J1) in the center of the instrument. The connector signals are as listed in Table 4-2.

4-49. DIGITAL RECORDER OUTPUT

4-50. The 5300A rear-panel connector A1J2 provides data outputs to a digital recorder or similar device (Figure 4-10). The digital and decimal-point information is carried as a character-serial, four-bit parallel code, with the decimal point inserted at the correct position. Parallel output lines carry the units and overflow information and the output control signals. Data is derived from A1U3 Counter or from the plug-on module as a four-bit parallel code, and is buffered by the U6 gates. The displayed information

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Table 4-2. A1J1 Signals

PIN NO.	SIGNAL NAME	DESCRIPTION
1	+5 V	Circuit operating voltages
2	-5 V	
3	-17 V	
4	GROUND	Ground
5	F1	Signal to be accumulated in the counter after gating by the control circuit.
6	"$\overline{9}$"	Goes low when the counter reaches 9% full scale.
7	F2	Input signal to the time base gated by the control circuit.
8	$\overline{\text{INHIBIT}}$	High during the measurement cycle, low during the display cycle.
9	$\overline{\text{OPEN}}$	Low signal forces the main gate flip-flop to the open position.
10	$\overline{\text{CLOSE}}$	Low signal forces the main gate flip-flop to the close position.
11	$\overline{\text{LOG}}$	Logarithmic output pulse train from time base triggers main gate flip-flop on rising edge.
12	$\overline{\text{MGFF}}$	Main gate flip-flop signal is low when gate is open.
13	$\overline{\text{EXPONENT}}$	Inverted log pulses while main gate is open indicates number of auto-ranging steps.
14	NO CONNECTION	
15	RESET	High signal resets all registers.
16	CLOCK	10 MHz reference signal from crystal oscillator
17	$\overline{\text{MAX TIME}}$	Low signal enables closing of the gate on next log pulse. Rising edge initiates display cycle.
18	TIME BASE OUTPUT	Output from the time base decade position selected by the time base select code on pins 22, 23, and 24.
19	$\overline{\text{PRINT}}$	Low signal provides print command to rear panel connector.
20	$\overline{\text{TRANSFER}}$	Low signal transfers data to display. High signal stores data.
21	1 MHz TIME BASE INPUT	Input direct from plug-on bypasses control circuit.
22	TIME BASE SELECT A	Time base select code A, B, and C selects the time base division factor of the signal at the time base output at pin 18.
23	TIME BASE SELECT B	
24	TIME BASE SELECT C	
25	+22 V	Full wave rectified voltage from the power transformer secondary. Provides power to charge the battery pack. If no battery pack is used, pin 25 is connected via the plug-on to pin 50 (DC-IN).
26	+17 V	
27	$\overline{\text{Hz}}$	Pins 27 through 31 provide the drive to the annunciator lights on the front panel. A low signal lights the corresponding indicator.
28	$\overline{\text{M}}$	
29	$\overline{\text{S}}$	
30	$\overline{\text{K}}$	
31	$\overline{\mu}$	
32	$\overline{\text{MANUAL RESET}}$	Low signal from front panel pushbutton switch on rear panel input clears the system to zero.
33	$\overline{\text{DP1}}$	Low signal activates decimal point 1.

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Table 4-2. A1J1 Signals (Continued)

PIN NO.	SIGNAL NAME	DESCRIPTION
34	$\overline{\text{DP2}}$	Low signal activates decimal point 2.
35	RIGHT/LEFT	Code indicating half character which is being addressed. High when right-hand of character is displayed.
36	DIGIT ADDRESS X	Digit address code X, Y, Z from the display scanner indicates a digit being displayed.
37	DIGIT SELECT X	
38	DIGIT ADDRESS Y	
39	DIGIT SELECT Y	Digit select code X, Y, Z is the corresponding code which selects the digit at the output of the counter. If the main-from counter is displayed directly the corresponding lines of the digit address code and the digit select code are con-connected together.
40	DIGIT ADDRESS Z	
41	DIGIT SELECT Z	
42	DATA "D"	The data code A, B, C, D represents the digit to be displayed in binary coded decimal form. Data lines can carry the counter output information tothe plug-on as well as to the display or can bypass the counter and bring plug-on data to the display.
43	DATA "C"	
44	DATA "B"	
45	DATA "A"	
46	$\overline{\text{DP3}}$	Low signal activates decimal point 3.
47	$\overline{\text{DP4}}$	Low signal activates decimal point 4.
48	$\overline{\text{DP5}}$	Low signal activates decimal point 5.
49	GROUND	Ground
50	DC IN	DC power to power supply from battery pack or from 22 volt input power from pin 25.

is supplied, one digit at a time, starting with the least significant digit. The output information is synchronized with the display scan and is continuously recycled with the display. The buffered Data Clock signal at A1J2(A6) is derived from A1U1 Scanner right/left (R/L) code. The data changes immediately after the Data Clock goes low.

4-51. A START DATA signal at A1J2(B4) is derived from the A1U1 Scanner 5L output. This signal immediately precedes the start of a new scan cycle. Although the new scan may begin with a decimal point, the START DATA signal always corresponds with the last or most significant digit and never with a decimal point. The decimal point is included in the data sequence and is inserted at the correct position as a binary 15 code. This code corresponds with a printed asterisk (*) on the standard print wheel of HP Digital Recorders. The asterisk is used in place of a decimal point, and the decimal point code is inserted during the time when the right-hand half of the corresponding digit is being scanned. A positive decimal clock pulse is simultaneously generated by an array of common collector transistors, Q19 to Q24. The Q19 to Q24 emitters are tied to the decimal point driving lines and the bases are driven from the A1U1 Scanner outputs. The appropriate transistor is turned on when the Scanner reaches the decimal point position. This forces all outputs of A1U6 buffer gates to a high level (binary 15) and provides the decimal point clock to A1U7 buffer inverter. If no decimal point is lighted, the decimal-point-common voltage increases and turns on A1Q18. This inserts a decimal point to the right of the display.

4-52. The measurement units information (MHz, kHz, Hz, etc.) is sent to the digital recorder output as direct signals from the plug-on connector in parallel with the signals to the display annunciator. The print command from the plug-on connector, A1J1(19), is buffered to provide a positive print command to the digital recorder. This signal is normally derived from the A1U5 Control $\overline{\text{TRANSFER}}$ output and is connected via A1J1(19) and (20). The $\overline{\text{HOLD}}$ signal from the digital recorder output to A1U5 prevents the instrument from recycling until the digital recorder has accepted the data. A low signal on the $\overline{\text{HOLD}}$ line inhibits the display cycle prior to the RESET signal.

4-53. The RESET signal line is a bi-directional line in parallel with the Manual Reset button on the 5300A front panel. It may be used as an input to reset the instrument from the rear-panel or an output to inhibit the printing of all zeros when the instrument is reset. The overflow output is in parallel with the overflow light in the Display Assembly and goes low when display overflow occurs. The +5 volt supply line is available at A1J2 Digital Recorder Connector for external logic.

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4-54. A standard parallel output for use with digital recorders such as the HP 5055A or HP 5050B may be obtained with a recorder interface accessory, HP Model 10533A. This accessory provides the serial-to-parallel conversion and includes 6-feet of cable to connect between the 5300A and the digital recorder.

4-55. POWER SUPPLY

4-56. The power supply is a small, high efficiency power converter capable of supplying the necessary output voltages for the analog circuits, Light-Emitting-Diode (LED) Display, and digital circuits (see Figure 4-11). The unit will operate from 115 Vac or 230 Vac, 50 to 400 Hz or from an accessory battery pack, such as the HP 5310A, which has nominal output voltage of 12 V. The power supply consists of three basic sections, which are each described in subsequent paragraphs:

a. Power Input Section. Consists of input transformer T1 and bridge rectifiers A1CR1, CR2, CR3, CR4. This section converts ac input power to rectified dc.

b. Overvoltage Fail-Safe Circuit. Consists of A2Q4, Q6, Q8, Q9, and associated components. Shuts the power supply off if a component fails and causes excessively high output voltages.

c. Dc-to-Dc Converter. Consists of the remaining power supply components and operates from a dc voltage of 10 V to 30 V; provides ±17 Vdc, ±5 Vdc, and +3.5 Vdc output. The dc input voltage is from the rectified dc supplied by T1 or from the accessory battery pack (when used).

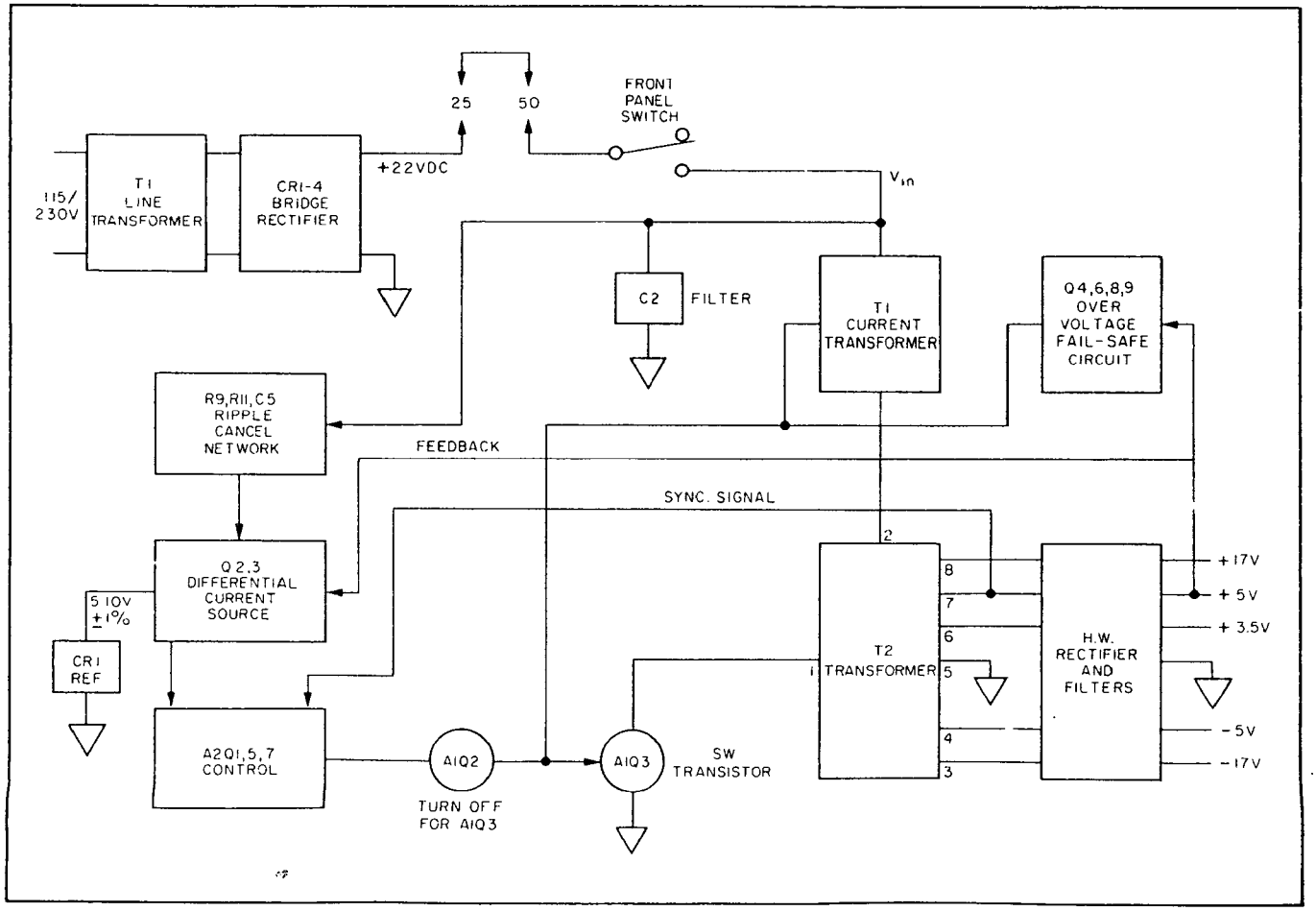
4-57. Power Input Section

4-58. Input power, 115 Vac or 230 Vac, is stepped down by T1 and rectified by bridge rectifiers A1CR1 to A1CR4. Capacitor A1C6 protects these rectifiers from high voltage transients in T1 and A1R14 prevents A1C6 from charging to an excessively high voltage. The dc output voltage from the bridge rectifiers is nominally +22 volts, when fully loaded by the mainframe dc-to-dc converter and the battery pack under CHARGE conditions.

4-59. Overvoltage Fail-Safe Circuit

4-60. If the +5 V supply increases to more than +5.8 V, emitter-to-collector current flows through A2Q4 and charges capacitor A2C3. For short transient overvoltages, A2C3 does not charge enough to activate A2Q6. For continuous overvoltages A2C3 continues to charge and current is coupled through A2CR3 into the gate element of SCR A2Q6. This causes A2Q6 to

Figure 4-11. 5300A Power Supply Block Diagram



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conduct, pulling its anode down to about zero volts. This turns on A2Q8, which turns on A2Q9. A1Q3 base current is then shunted through A2Q9 to ground, such that A1Q3 receives no drive voltage. This shuts the power supply off. A2Q6 remains on, however, as long as the input voltage is present. The circuit is reset by removing the ac input for about 5 seconds, which allows A1C2 to discharge through A2R15 and A2R16.

4-61. Dc-to-Dc Converter

4-62. This is basically a blocking oscillator converter using a single switch transistor, A1Q3, with the dc input voltage available across A1C2. Resisitor A1R11 supplies initial start current into the base of A1Q3 to start oscillations. Diode A1CR5 allows base current to flow to A1Q3 during normal operation with capacitor A1C4 as an ac bypass. Printed circuit wiring is such that no drive voltage is applied to A1Q3 if A2 Regulator Assembly is removed from its socket. During normal operation A1Q3 alternately switches on into saturation and then off. With A1Q3 "on", an increasing current flows through A1T1 and the primary of A1T2.

4-63. The polarity of the rectifiers on the secondary of A1T2 is such that when A1Q3 is turned on, they do not conduct. Thus, the dc input voltage sees only the primary inductances of A1T1 and A1T2. A1T1 is a small current transformer and drops very little voltage across primary pins 1 and 3. A2Q1 collector current builds up linearly when it is turned on. The impedance of A1T1 is such that about 1/15th the A1Q3 collector current flows into the base of A1Q3. This is sufficient to keep it in saturation. After a period of time, designated time T1 and controlled by the rest of the circuit (Figures 4-11 and 4-12), A1Q3 switches off. The magnetic energy stored in the core of A1T2 transfers into the secondaries and current flows through each of the rectifiers, A1CR7, 8, 9, 10, and 13, until the magnetic flux in the core of A1T2 is zero. This defines the end of time T2. Time T1 is the time A1Q3 is turned on and time T2 is the time A1Q3 is turned off. During time T1, energy builds up in the core of transformer A1T2. Time T2 is determined by the amount of time it takes the flux in transformer A1T2 to reach zero and is a function of the transformer and load only.

4-64. Time T1 is varied by the regulating circuit to provide the proper amount of enery storage so that secondary voltages are regulated at their proper value. The secondary voltages are all held in fixed ratios with respect to one another and are determined by the turns ratios of the secondary windings. The +5 V is compared to a reference voltage on regulator board A2 and regulated to +5 V ±.1 volts. This regulates the other voltages to their correct values. Capacitors A1C12, 9, 11, 13, and 14 filter the secondary voltages. The -15 V bias for the MOS circuits is provided by resistor A1R17 and zener diode A1CR11. A1CR12 is across the -17 volt supply to prevent the output voltage from overshooting a large amount when the supply is initally turned on; it does not conduct during normal operation.

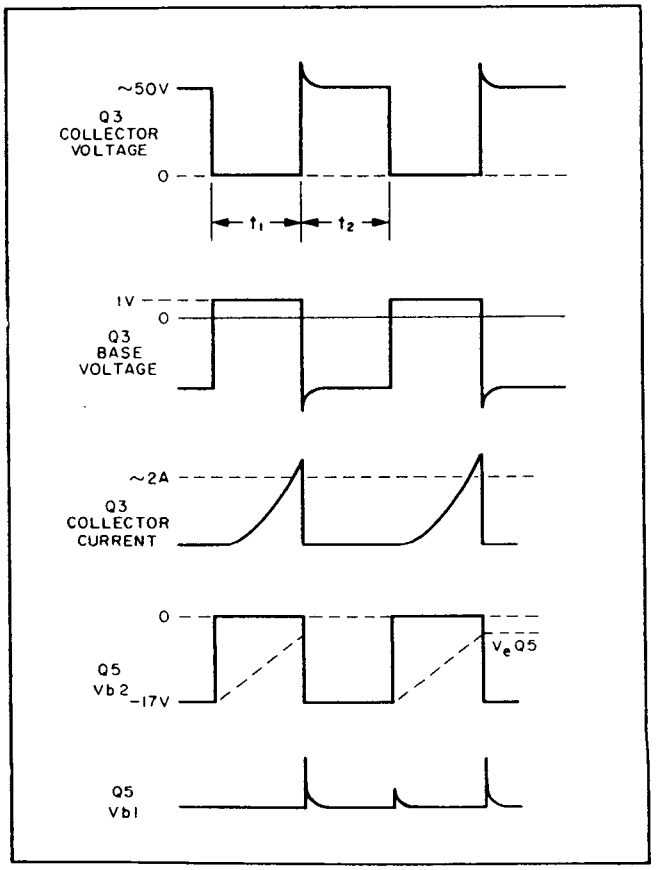
4-65. The regulation circuit must generate time T1 to properly regulate output voltages, and it must sense the end of time T2 so that a new cycle may be initiated.

4-66. A2CR1 generates the reference voltage which is compared with the +5 V supply. The comparison takes place in the differential current source A2Q2 and A2Q3. Resistors A2R12, A2R5, A2R3, and capacitor A2C2 provide a frequency-selective compensation network to ensure fast regulator response and prevent oscillation of the feedback loop. Resistor A2R1 biases zener diode A2CR1 from the +17 V supply, and A2R2 supplies a relatively constant current to the differential pair, A2Q2 and A2Q3. Resistor A2R9 helps keep the output voltages constant as the input voltage varies over a wide range. A2C6 and A2R11 provide instantaneous voltage compensation to minimize 120 Hz ripple on the regulated output voltages.

4-67. The collector of A2Q2 supplies a current to unijunction transistor A2Q5 and capacitor A2C4. This current varies depending on the difference between the regulated +5 V and the reference voltage from A2CR1.

4-68. A2Q1 is a series-gating transistor for unijunction transistor A2Q5. Its base is driven through resistor A2R4 which goes to the secondary of transformer A1T2. Diode A2CR2 protects the base-emitter junction of A2Q1 from excessive reverse bias. The phasing of the signal from transformer A1T2 to A2Q1 is such that UJT A2Q5 has a voltage from B1 to B2 during the time A1Q3 is turned on (Time T1).

Figure 4-12. Power Supply Waveforms



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4-69. During time T2, A2C4 cannot charge, since current flows through the diode junction of A2Q5 from the emitter to base 1. During time T1, A2C4 starts to charge at a rate determined by the current from the collector of A2Q2. If the regulated +5 V is high, A2Q2 collector current is also high. This causes the charging rate of A2C4 to be relatively high. When the voltage across A2C4 reaches about 12 V, A2Q5 fires and generates a 6 V, 1-microsecond pulse at base 1 of A2Q5 to terminate time T1. The greater the +5 V is, relative to the reference, the faster A2C4 charges and the sooner this pulse occurs. This shortens time T1 which serves to reduce the output voltages and, thus, regulation is achieved. This pulse is coupled through capacitor A2C5 and diode A2CR4 to the base of A2Q7. This turns A2Q7 on and turns A1Q2 on, pulling the A1Q2 collector low. This negative excursion is coupled through capacitor A1C3 which turns the transistor off and ends time T1. As A1Q3 turns off, all secondary voltages of A1T2 reverse. The voltage at A2R14 is in such a direction that A2Q7 is turned on through A2R14, after the initial pulse that was coupled through A2CR4. It is necessary to keep A2Q7 and A1Q2 conducting during the entire period of time T2.

4-70. At the end of time T2, when the flux in the core of transformer A1T2 is zero, the secondary voltages automatically reverse. This voltage again is coupled through A2R14 and turns A2Q7 off, which allows A1Q3 to turn on again, continuing the cycle. Diode A2CR5 prevents excessive reverse bias across the base-emitter junction of A1Q3. To ensure that A2Q5 is definitely off, A2C1 couples a negative spike to its emitter at the beginning of time T1.

4-71. 5310A BATTERY PACK

4-72. The 5310A Battery Pack is an accessory for the 5300A Measuring System. It connects between the 5300A Measuring System Mainframe and any of the 5300 series plug-ons. The batteries are sealed Nickel Cadmium type which provide about 48-watt hours capacity with a normal output voltage of +12 volts. When the battery pack is locked between the two halves of the system, all connections are made to charge the batteries or supply power to the instrument.

4-73. Typically, a battery use-time greater than 4 hours-per-charge can be expected, depending on the particular plug-on used. Recharge time for completely discharged batteries is 18 hours. However, to achieve full charge in this time the batteries must be recharged with the mainframe power switch set to OFF. The 5300A mainframe must be plugged into an ac source and the battery pack switch set to CHARGE.

4-74. A light-emitting diode on the battery pack front-panel glows when batteries are nearing the end of discharge.

4-75. When the batteries are fully charged they should not be left charging while operating the mainframe. For optimum long-term battery life the instrument should not be used for more than 10 minutes *after* the LOW BATTERY lamp begins to glow.

4-76. The three-position slide switch on the front panel has the following functions:

a. BATTERY. The instrument gets its power from the internal batteries whether the ac line cord is plugged in or not.

b. CHARGE. The batteries are charged when the line cord is plugged in.

c. LINE. The batteries are charged at a trickle-charge rate. This is the normal position when the batteries are fully charged.

4-77. In either the LINE or CHARGE position, with the line cord plugged in, a power failure switches operation to the battery pack automatically. Battery life will be approximately 10% shorter than it would be if the front panel switch were in BATTERY position. The three positions of the front panel switch are used as follows:

a. BATTERY. When instrument is used away from ac line power.

b. CHARGE. When instrument batteries are charged, regardless of whether the mainframe is used or not.

c. LINE. For normal operation from the ac power line.

4-78. The 5310A circuitry can be divided into two parts.

a. The current regulator for charging the battery.

b. The circuit to indicate when the battery voltage is low.

4-79. Transistors A2Q1, A2Q2, and A2Q3 in combination with A2R2, A2R1 perform the function of a current regulator. Unregulated voltage from the 5300A mainframe, which is present whenever the line cord is plugged in, is applied to TOP connector A1P1 (25). In the CHARGE position this voltage is applied to the current regulator. Normal voltage is about +22 volts; the battery voltage in CHARGE position is typically +14 volts. The current regulator supplies a constant current of about .3 Amp, independent of line voltage to the batteries when the switch is in CHARGE position. A2R2 is the current sample resistor. A2CR1 prevents base-to-emitter breakdown of A1Q1 due to current flowing out of the battery backwards through A1Q1, when the line power is turned off.

4-80. A trickle-current of about 10 mA is supplied to the battery through A2R4 when the front-panel switch is set to LINE. Diodes A2CR4, A2CR3, and light-emitting diode DS1, with resistors A2R3, A2R5 and transistor A2Q4, indicate when battery voltage is getting low and nearing the end of discharge. A regulated +5.0 volts from the mainframe is supplied to the emitter of A2Q4. Battery voltage is sent, through A2CR2 and A2CR3, to A2Q4 base. When battery

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voltage becomes low, A2Q4 turns on through A2R3 and A2CR3. Diode A2CR3 protects A2Q4 from base-to-emitter breakdown in the reverse direction when the battery voltage is high.

4-81. When the battery voltage drops below 11-1/2 to 12 volts, A2Q4 turns on. This completes a path for the +5 volts from the mainframe, through A2R5, and the light-emitting diode glows. Normally, this occurs for a few minutes at the beginning of a charge cycle. Fuse F1 is in series with the battery to prevent damage from accidental shorts. A2CR4 allows current to flow from the battery into the mainframe if line power fails. A2C2 is in parallel with the 5300A filter capacitor on the unregulated 22 V line from the 5300A mainframe. It provides additional filtering for the additional current drawn by the batteries when the battery pack is being used. For longest life it is recommended that the batteries are not continuously overcharged for long periods of time. Discharging far past the point where the front panel light comes on is also undersiderable.

4-82. 10533A DIGITAL RECORDER INTERFACE ASSEMBLY

NOTE

HP Model 10533A does not work with 5050B unless an Option 050 or 051 is used.

4-83. The digital recorder output from the 5300A provides data in a character serial format. The serial method allows flexibility in adapting to many different serial or parallel output interfaces. The most common interface is a standard parallel BCD output as used in the HP 5050B or 5055A Digital Recorders. This standard conversion can be obtained with the 10533A Digital Recorder Interface accessory. The 10533A accessory accepts serial information from the 5300A and stores it in parallel latches which drive the digital recorder. The units information from the 5300A is decoded in the 10533A to provide exponent magnitude and sign.

4-84. Ten columns of information are available to the digital recorder in binary-coded-decimal form. Negative logic is used with logic 0 about 3 volts and logic 1 about 0 volts:

a. Column 10 (leftmost) overflow digit. An asterisk is presented when the overflow light in the 5300A display is on.

b. Columns 3 through 9. Six digits of data and the decimal point. The decimal point is coded binary 15 and is inserted at the correct position. On the standard HP digital recorder wheel, this is decoded and printed as an asterisk (*).

c. Column 2. Exponent sign, either + or -. Coded binary 10 for +, binary 11 for -.

d. Column 1. Exponent magnitude, either 0, 3, or 6. The exponent information is coded as follows:

Hz:	+0
kHz:	+3
MHz:	+6
sec:	-0
msec:	-3
μsec:	-6
no units:	-0
M:	-3
μ:	-6

(These are the only allowable combinations of units in the 5300A.)

4-85. Each column of data is stored in a 4-bit latch. The data is scanned into the locations by the outputs from the shift register, U1. The shift register is scanned by the Data Clock and the Decimal Point Clock via the exclusive-OR gate, U2. The Decimal Point Clock is always delayed with respect to the Data Clock, by about 200 nsec, and is high when the Data Clock is low. Therefore, the output from the exclusive OR gate is a short pulse at the beginning and after the end of the Decimal Point Clock. The pulse width is equal to the 200 nsec delay between the two clock lines. The leading pulse "clocks" the decimal-point-code into the corresponding latches and the trailing pulse "clocks" the data into the next digit position. The scan sequence is synchronized with the scanning of the 5300A display by the START DATA signal which inserts a low state into the shift register. The low state is then scanned by the clock pulses through the seven outputs of the shift register.

4-86. A positive print command is received and digitally delayed by U3B. The delay allows one complete scan cycle to occur and enter new data into the latches. After a delay of one-scan cycle, a print command is sent from U3B to the digital recorder. If a RESET signal is received the print command to the digital recorder is inhibited.

4-87. The 5300A may be inhibited from beginning a new measurement cycle by a saturated-transistor inhibit signal from the digital recorder. The output from the 10533A is a 50-pin Amphenol microribbon connector which mates directly with the input connector of digital recorders such as the HP 5050B or HP 5055A. The input to the 10533A is a 20-pin connector which mates directly with the A1J2 rear-panel connector on the 5300A. It is connected to the plastic housing containing the logic module by a 6-foot length of screened cable. Nonstandard interface modules for use with other recorder systems may be obtained on special order from Hewlett-Packard.

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SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. This section contains maintenance and service information for Model 5300A Measuring System. Included are adjustment procedures, tests, troubleshooting tables and diagrams to localize, isolate and locate defective components. Performance check procedures are not included, since a plug-on must be used. These procedures are included with the respective plug-on.

5-3. RECOMMENDED TEST EQUIPMENT

5-4. Test equipment recommended for maintaining, troubleshooting, and servicing the 5300A Measuring System is listed in Table 5-1. Test equipment with equivalent characteristics may be substituted for equipment listed.

Table 5-1. Recommended Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
Oscilloscope	50 MHz Band Width 5 mV cm	HP 180A/HP 1801A/HP 1820A
Test Oscillator	Range: 10 Hz to 10 MHz Output: 5 V p-p into 50-Ohm	HP 651B
Feed-thru Termination	50-Ohm male to female BNC connectors	HP 11048B
Pulse Generator	Repetition Rate: 10 Hz to 10 MHz Peak Voltage: 10 V into 50-Ohm Pulse Width: 30 nsec to 5 msec Pulse Polarity: + or -	HP 222A
Digital Recorder	Accuracy: Equal to input device used Printing Rate: 10 lines/sec (min) Data Input: Parallel entry, BCD (-8 4 2 1)	HP 5050B (Opt. 050 or 051) or 5055A
Digital Recorder Interface	Serial to Parallel conversion for 5300A Recorder output information	HP 10533A
Logic Probe	Indicate logic levels	HP 10525A
Electronic Counter	.1 Hz to 10 MHz frequency measurements	HP 5245L/M
DC Voltmeter	0 to 200 Vdc, 1% accuracy	HP 412A
DC Power Supply	0 to 20 V at 1.5 AMP	HP 6200B
Diagnostic Test Cards A, B, C, and D	Preset tests for 5300A Mainframe	HP Part Number's 05300-20011 05300-20012 05300-20013 05300-20014
50-Pin Female Connector	50-pin Female blue-ribbon connector	HP Part Number 1251-0101 (CINCH 57-20500-375)
Diagnostic Interface Card	50-pin blue-ribbon to 22-pin Printed Circuit	HP Part Number 05300-60004

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5-5. INSTRUMENT ACCESS

5-6. For access to mainframe assembly, separate the 5300A from plug-on used as follows:

a. Turn ac power OFF and disconnect power cord.

b. Pull the two side casting latches fully rearward (it is necessary to press the latch handles gently away from the center of the instrument to unlock them).

c. When latches are fully extended rearward, the 5300A and plug-on castings should be separated by about 1/8-inch.

d. Lift the 5300A gently away from the plug-on.

e. Separate 5300A Logic Board Assembly from 5300A casting as follows (refer to Figure 5-1):

1. Remove retaining screw located near power transformer.

2. Press rear, plastic-nylon retaining clips on each side of the 5300A casting and lift the rear of the Logic Board Assembly to release it from the casting.

3. Press front plastic-nylon retaining clips on each side of 5300A casting and lift the front of the Logic Board Assembly to release it from the casting.

f. Mate the 5300A Logic Board Assembly to the plug-on used and reapply ac power.

5-7. PERIODIC MAINTENANCE

5-8. To determine if the 5300A is operating within specifications, perform the In-Cabinet Performance Checks listed in the documentation for the specific plug-on used and the troubleshooting methods and procedures listed in Paragraph 5-13.

5-9. MAINTENANCE AND REPAIR

CAUTION

A1U3, A1U4, A1U5 are large-scale MOS integrated circuits whose inputs are susceptible to damage from high voltage and static charges. Particular care should be taken to avoid excessive capacitive loading with probes or when handling under conditions where static charges can build up.

5-10. BOARD REMOVAL. When removing the printed circuit board for replacement, repair, or servicing, always remove ac power and separate the board from the casting using steps a to e of Paragraph 5-6.

5-11. COMPONENT REPLACEMENT. When replacing a circuit board component use a low heat soldering iron. Heat must be used sparingly as damage to the circuit foil may result. Mounting holes may be cleaned out with a toothpick while heat is applied. Connection should be cleaned with a cleaning solution after component removal and replacement.

5-12. INTEGRATED CIRCUIT REPLACEMENT. Two methods are recommended for removing integrated circuits (with exception of U1, U2, U3, U4, and U5):

a. Solder Gobbler. Solder is removed from board by a soldering iron with a hollow tip connected to a vacuum source. The IC is removed intact so it may be reinstalled if diagnosis is wrong.

b. Clip Out. This method is used when an IC is proven defective. Clip leads close to case, apply heat and remove leads with long nose pliers. Clean board holes with toothpick and cleaning solution.

5-13. INSTRUMENT TROUBLESHOOTING

5-14. GENERAL. Trouble isolation can best be accomplished by first obtaining all possible information from controls, connectors, and indicators, then logically using this information to locate the defective component.

5-15. MODULE SUBSTITUTION. Maintenance procedures in the 5300A may be simplified by isolating the problem to one or a group of the Integrated Circuits and replacing the suspected bad IC's with known good spares. Here is a recommended list of spares which will assist you in quickly troubleshooting and servicing the 5300A:

		HP Part No.
U1, L.S.I.	LED Scanner (Light-Emitting-Diode)	1820-1060
U2, L.S.I.	Character Generator	1820-0571
U3, MOS	6-Decade Counter	1820-0634
U4, MOS	Time Base	1820-0633
U5, L.S.I.	Control	1820-0632
A2	Power Supply Regulator Board	05300-60003
A1Q3	Power Transistor	1854-0487
A1A1 DS1-DS6 and DS8	Light Emitting Diodes	1990-0325

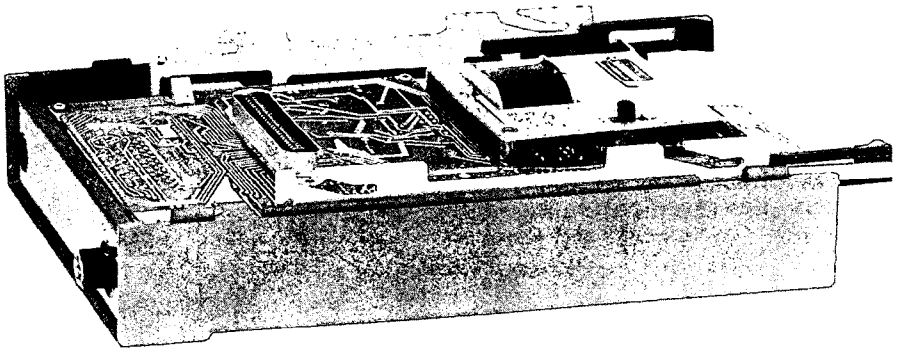
5-16. TROUBLESHOOTING. Three methods of troubleshooting are available. There are:

a. 5300A mated to the plug-on in use. Tests located in Paragraph 5-20 and Figures 5-2 and 5-3A (steps 6 to 13) can be performed with plug-on mated to the mainframe. Additional tests can be performed with a plug-on, using performance and maintenance checks in the plug-on section.

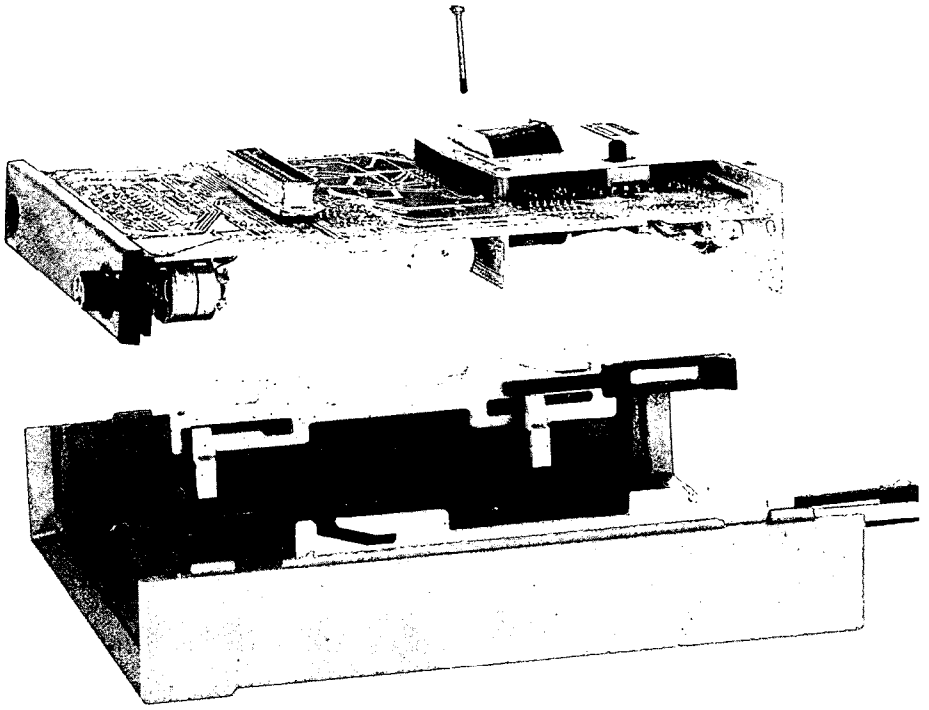
b. Diagnostic Test Cards. Test Cards 05300-20011, 20012, 20013, and 20014, and Diagnostic Interface card 05300-60004 are factory available cards which have fixed programs used in exercising the

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Figure 5-1. Separation Procedures



STEP A



STEP B

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5300A circuits. This is the preferred and recommended method. This method enables the user to troubleshoot the 5300A without a plug-on.

c. Alternate Method. This is the second preferred method. The user can hard wire certain connections on the 5300A 50-pin connector and can troubleshoot the 5300A without having a plug-on connected.

5-17. The following paragraphs and tables are procedures and tests designed to exercise the various circuits in the 5300A mainframe and to logically isolate the defective component(s) or assembly. The tests are also designed to be performed using a 5300A mainframe by itself. Equipment required for these tests is listed in Table 5-1.

5-18. Subsequent tests are made using Diagnostic Test Cards A through D (HP Part No. 05300-20011, 20012, 20013, 20014, respectively). These cards are mated to a Diagnostic Interface extender card HP Part No. 05300-60004. When a malfunction is suspected or failure occurs, separate the 5300A mainframe from the plug-on, and remove the casting as instructed in Paragraph 5-5.

5-19. Power Supply Checks. Power Supply voltages may be checked by connecting pins 50 and 25 together. The preferred method, however, is to use the Diagnostic Interface Card, HP Part No. 05300-60004, and Diagnostic Test Card "B," HP Part No. 05300-20012. Perform Power Supply Checks and oscillator checks using Figure 5-2 troubleshooting chart as an aid. Voltages should be:

+5 Vdc ±.15 V at A1J1(1)
-5 Vdc ±.25 V at A1J1(2)
-17.5 Vdc ±1.7 V at A1J1(3)
+17.5 Vdc ±1.7 V at A1J1(26)
+24 Vdc ±2 V at A1J1(25, 50)

5-20. DIAGNOSTIC TEST CARDS. Diagnostic Test Card "A," tests 1 through 4, check out the display circuitry to its fullest extent. Circuits tested are:

NOTE

Tests performed with the "Test Cards" can be related to tests on Pages 5-12, 5-13, and 5-14. If a failure occurs when using the "test cards," use the description listed on Pages 5-12, 5-13, 5-14 in conjunction with the "test cards" to determine which program lines are faulty.

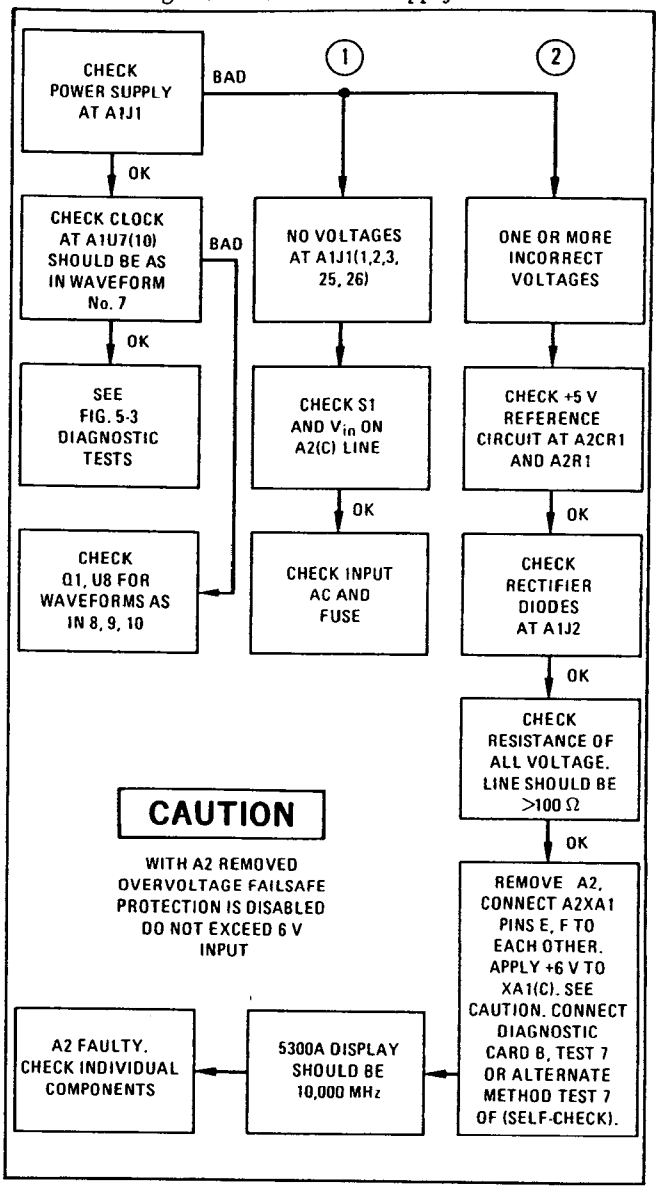
a. U1 Scanner circuits to test vertical column lines (left or right), and digit address lines X, Y, and Z.

b. U2 Character Generator circuits to test horizontal lines (upper or lower).

c. Q6 to Q17 Buffer Drivers for the LED Display columns.

d. A1A1DS7 light-emitting diode matrix.

Figure 5-2. Power Supply Check



5-21. Diagnostic Test Card"B" tests 5, 6, and 7 check out the majority of inputs and outputs to U3, U4, and U5 for the various modes of operation that can be performed with a plug-on. Test number 8 checks out the Annunciators and Decimal Point lines of the Display Assembly.

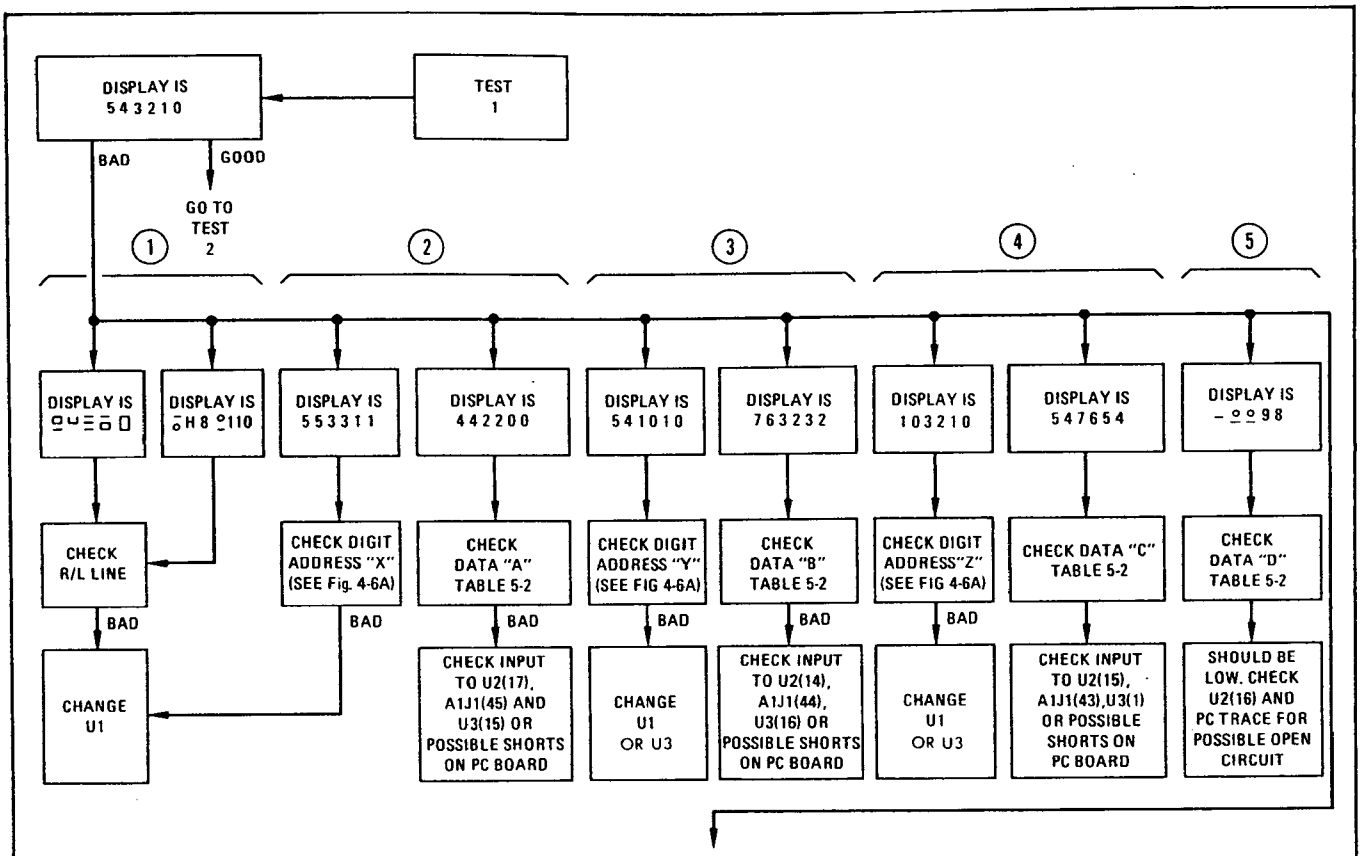
5-22. Diagnostic Test Card "C" tests 9 through 12 and Diagnostic Test Card "D" tests 13 through 16 check out the MOS Time Base Circuitry and the MOS Decade Counter. By varying the input and outputs on U3 and U4 with a fixed program, the special circuits are exercised.

5-23. Diagnostic Test Card "A"

5-24. Insert Test 1. To use the Diagnostic Test Card "A," connect this card through the Interface Card, HP Part No. 05300-60004, to 5300A A1J1 mainframe connector. Prior to each test, press RESET and refer to Figure 5-3A. Display should read 543210 only.

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Figure 5-3A. Display Checks



DISPLAY CONDITION	CHECK PROCEDURE	POSSIBLE CAUSE
6. Any row and/or any group of "dots" missing.	See Table 4-1 and Figure 4-5A/B, monitor U2 level with an oscilloscope thru a 220Ω resistor to gnd.	U2, Mechanical connections at U2, A1A1DS7 or A1A1DS7 circuit foil.
7. Any or all rows always on.	See Table 5-3 and mointor U2 level change with oscilloscope.	U2 Mechanical connections at U2, A1A1DS7 circuit foil.
8. Any or all columns missing (vertical lines).	See Figure 4-6-A and monitor A1 outputs with oscilloscope.	U1, C16, Q6 to Q17 Mechanical connections at U1, A1A1DS7.
9. Two adjacent columns show mirror image.	See Figure 4-6-A and monitor A1 outputs with oscilloscope.	U1, short between A1A1DS7 adjacent pins.
10. One or more A1A1DS7 diodes not on.	See Fig. 4-5 and Table 4-1, monitor output codes vs. input codes on U2.	A1A1DS7, U2, poor socket connection on U2 or A1A1DS7.
11. Incorrect diodes glowing dimly		U2, A1A1DS7
12. Very bright half-digit "on".	Monitor U1(13) with oscilloscope. Should be 1.4 V p-p, sawtooth waveform, 4 kHz to 8 kHz.	U1, C17
13. Uneven diode brightness.		U2
14. Decimal point shifts incorrectly and wrong annunciator lights.		Incorrect exponent from U5. Change U5.
15. Display is all "zeros" for tests 1, 2 and 3, but works with test 4.	Check BCD lines on U3; if all are low, change U3.	U3

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Table 5-2. Character Generator Input Codes

CHARACTER (NUMBER DISPLAYED)	A1U2 INPUTS A	B	C	D	R/L
	17	14	15	16	18
0	L	L	L	L	-
1 LEFT	H	L	L	L	L
1 RIGHT	H	L	L	L	H
2 LEFT	L	H	L	L	L
2 RIGHT	L	H	L	L	H
3 LEFT	H	H	L	L	L
3 RIGHT	H	H	L	L	H
4 LEFT	L	L	H	L	L
4 RIGHT	L	L	H	L	H
5 LEFT	H	L	H	L	L
5 RIGHT	H	L	H	L	H

5-25. Insert Test 2. Tests the remaining numerical digits. Display should read 987610 only. If display is 107610, check DATA D line for a low level. Replace U2 to repair. If display has a bad character replace U2.

5-26. Insert Test 3. Tests the remaining character codes. Display should read X 9 X º - 8 (blank, 9, blank, º, –, 8). Refer to Table 5-4. For any bad characters, replace U2.

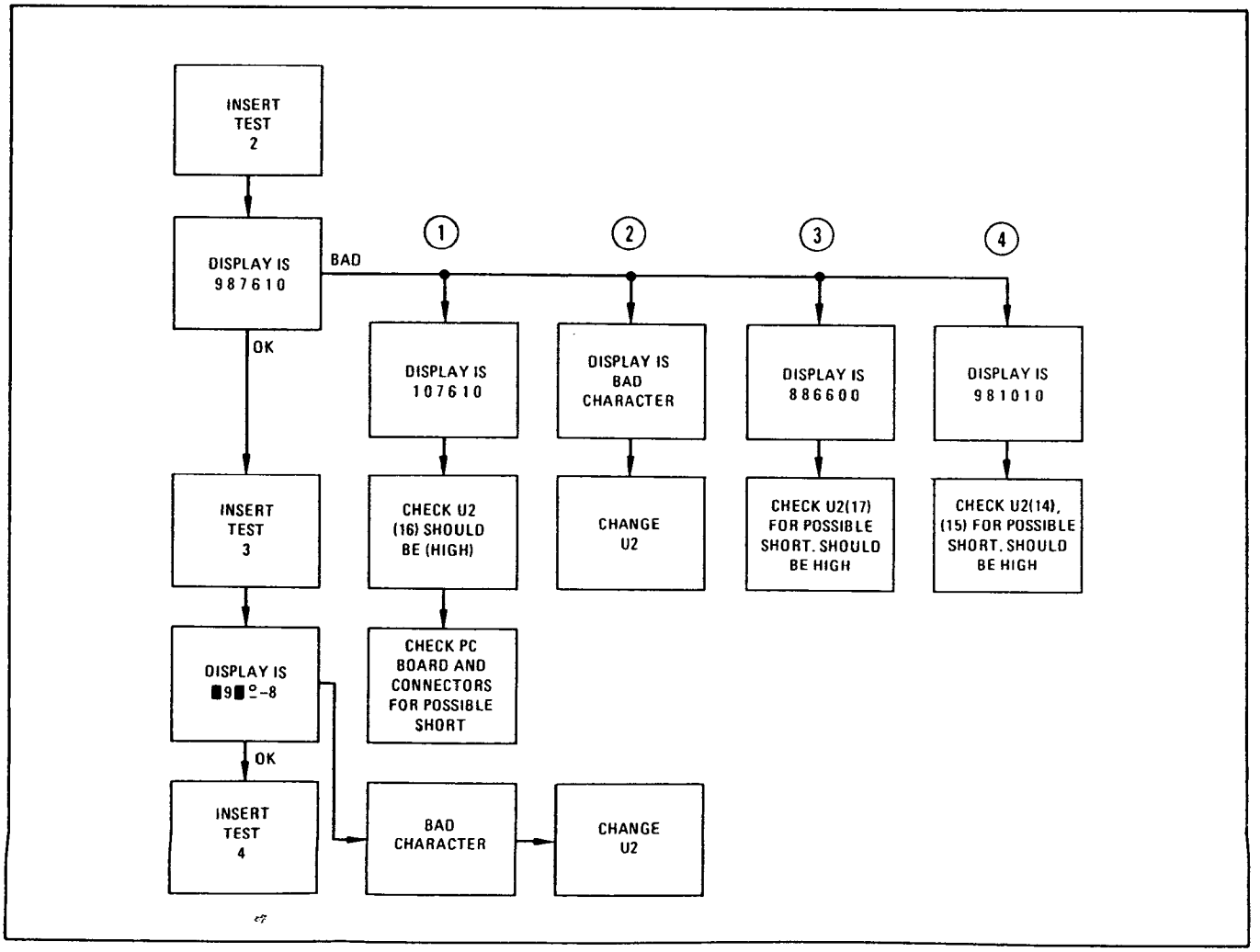
5-27. Insert Test 4. Tests U2, U3, F1 input to U5, and A1A1DS7 to display 6 digits simultaneously and to cycle them (6 at a time) from 0 to 9. Refer to Figure 5-3C, Test 4. "C" lamp is on all the time.

5-28. Diagnostic Test Card "B"

5-29. Insert Test 5. Checks U3, U4, U5. Display should be ⊛ 888888 (⊛ = overflow). "C" lamp and overflow should cycle.

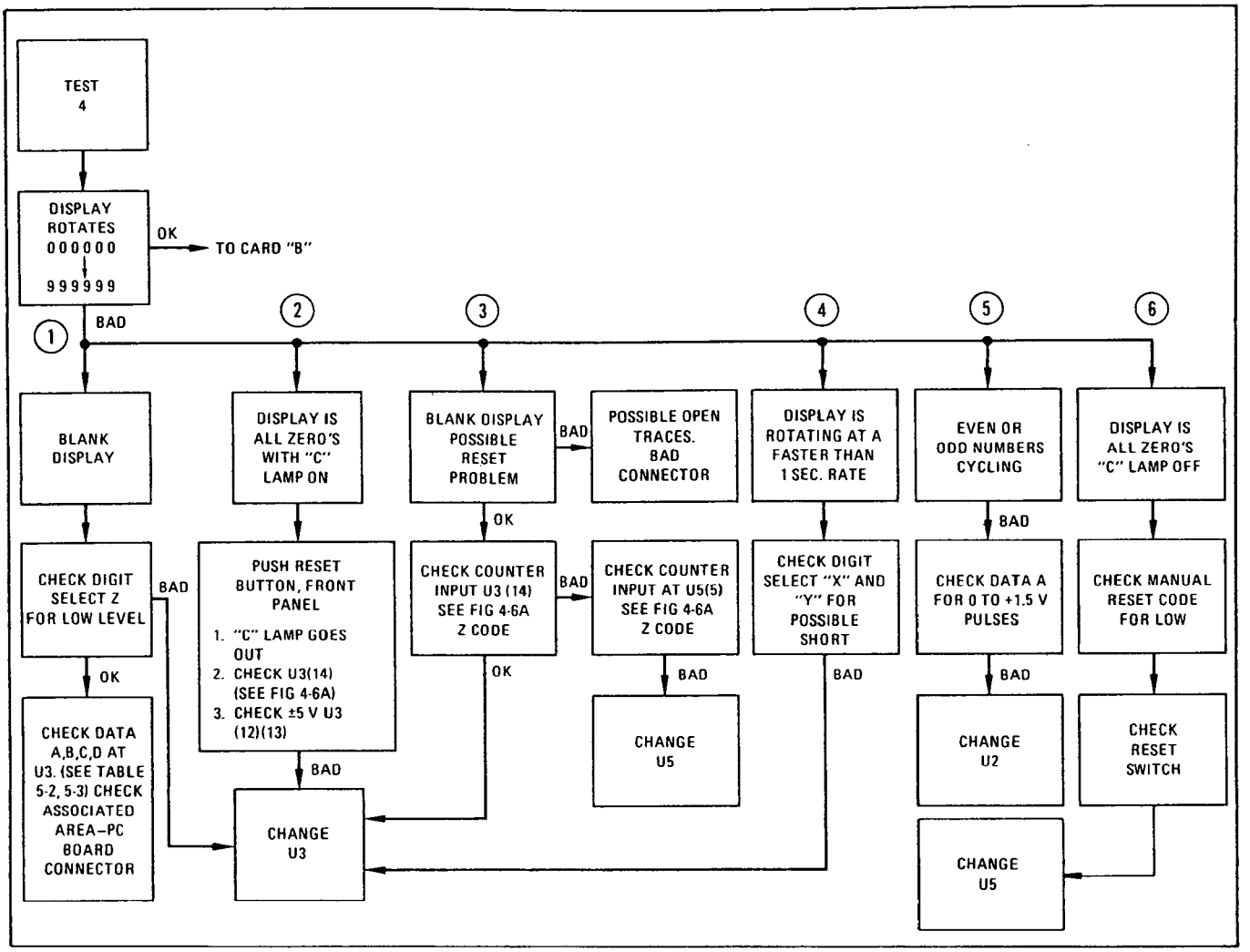
5-30. To use Diagnostic Test Card "B," connect this card through the interface card, HP Part No. 05300-60004, to 5300A mainframe A1J1 connector. Prior to each test, press RESET and refer to Figure 5-4A.

Figure 5-3B. Display Checks (Continued)



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Figure 5-3C. Display Checks (Continued)



5-31. Insert Test 6. Checks U3, U4, U5. Refer to Figure 5-4B. SAMPLE RATE set to 1/2 cw from power OFF. "C" lamp cycles, "*" cycles. Display should read at turn on 000007, 1 second later 000008, and 10 seconds later 000009.

5-32. Insert Test 7. Checks U3, U4, U5. Refer to Figure 5-4C. Turn sample rate 1/2 cw. Display should be 10.0000 MHz ±1 count. "C" lamp cycling.

5-33. Insert Test 8. Checks Annunciators and Decimal Points 1 through 5. Display should be 10.0000 MHz ±1 count. "C" lamp cycling.

5-34. By using a shorting plug (HP Part No. 5080-0058) to connect various points on test card B, test 8, the Annunciators (Hz, M, S, K, μ) and decimal points 1 through 5 can be verified. See Figure 8-2 for schematic information. To light a particular annunciator or decimal point, plug shorting bar into the corresponding holes for that annunciator or decimal point. "C" lamp off.

5-35. Diagnostic Test Card "C"

5-36. Insert Test 9 through 12. To use Diagnostic Test Card "C," connect this card through the interface card, HP Part No. 05300-60004, to 5300A mainframe A1J1 connector. Prior to each test, press RESET.

5-37. These tests check U3 and U4 by programming the Time Base input codes to provide Time Base output signals in decade steps.

5-38. Test No. 9. Fixed program tests the 10-second Time Base output. Display should accumulate one count every 10 seconds starting with digit 0, least-significant digit. "C" lamp on.

5-39. Test No. 10. Fixed program tests the 1-second Time Base output. Display should accumulate one count every second starting with digit 0, least-significant digit. "C" lamp on.

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Table 5-3. Character Generator Output Line Codes

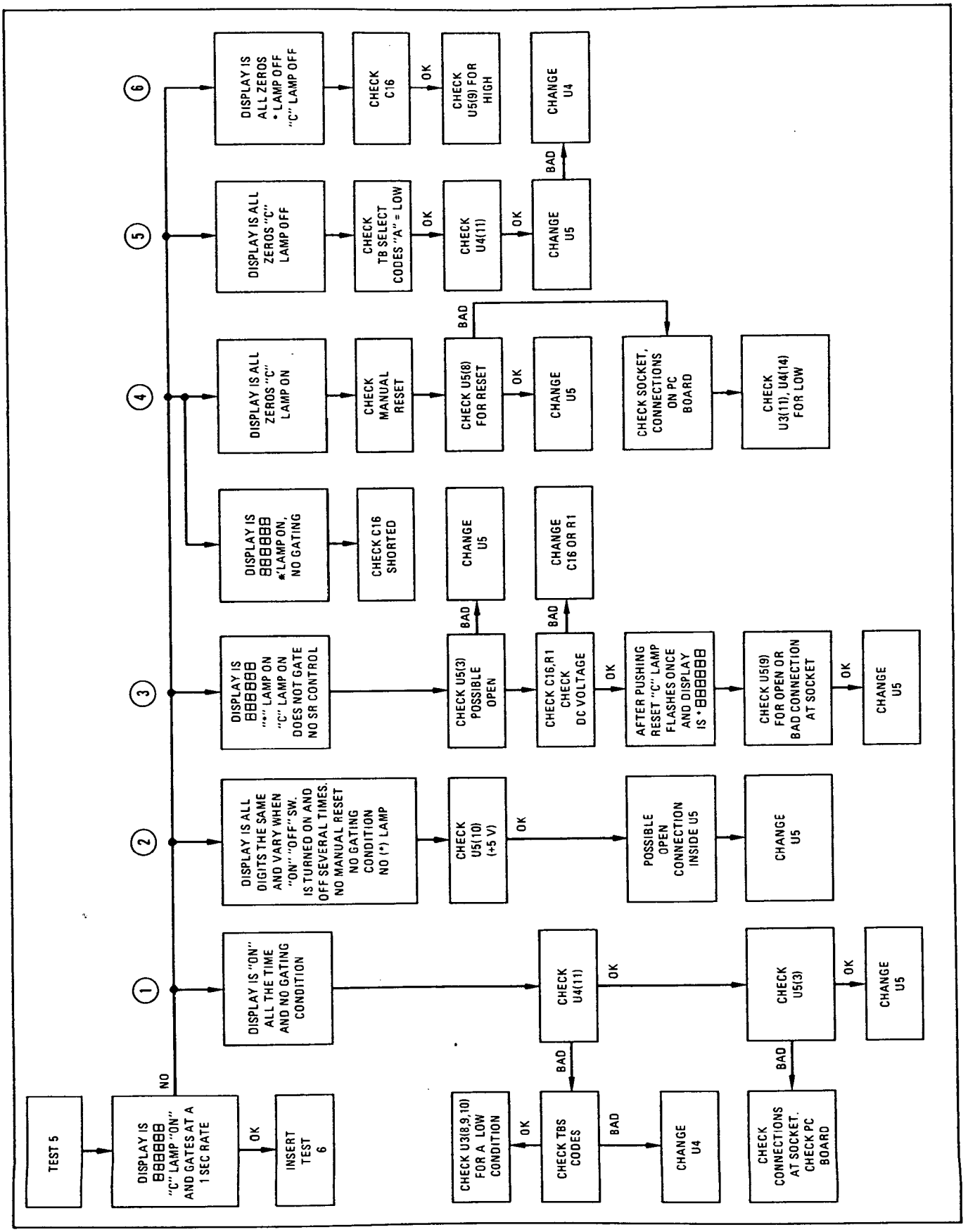
CHARACTER (NUMBER DISPLAYED)	A1U2 OUTPUTS (LED INPUTS) X = ENABLED									
LINE	1	2	3	4	5	6	7	8	9	10
PIN	5	6	7	10	11	9	4	20	2	1
0		X	X	X	X		X	X	X	
1 LEFT										
1 RIGHT	X		X	X	X		X	X		X
2 LEFT	X	X				X	X	X	X	X
2 RIGHT		X	X	X		X			X	X
3 LEFT	X	X				X			X	X
3 RIGHT		X	X	X		X	X	X		X
4 LEFT	X		X	X	X	X				
4 RIGHT			X	X	X	X	X	X		X
5 LEFT	X	X	X	X	X	X			X	X
5 RIGHT	X	X				X	X	X	X	

Table 5-4. Character Generator Input/Output Codes for Remaining Characters

CHARCTER NUMBER DISPLAY	A1U2 INPUTS					A12U2 OUTPUTS "ON" (LED INPUTS)										
	A	B	C	D	R/L	Line	1	2	3	4	5	6	7	8	9	10
PIN	17	14	13	16	18	PIN	5	6	7	10	11	9	4	20	2	1
6 LEFT	L	H	H	L	L			X	X	X	X	X	X	X	X	
6 RIGHT	L	H	H	L	H			X				X	X	X	X	
7 LEFT	H	H	H	L	L		X	X								
7 RIGHT	H	H	H	L	H		X	X	X	X	X		X	X		X
8	L	L	L	H	-			X	X	X		X	X	X	X	
9 LEFT	H	L	L	H	L			X	X	X		X			X	
9 RIGHT	H	L	L	H	H			X	X	X	X	X	X	X	X	
MINUS	L	L	H	H	-						X	X				
BLANK	-	H	H	H	-											
REMAINING CHARACTERS AVAILABLE	A	B	C	D		DISPLAY										
10 (0 Degree 0)	0	1	0	1			0	X	X	0						
11 (0 Degree)	1	1	0	1			0	X	X	X						
12 (- Minus -)	0	0	1	1			-	X	X	-						
13 (Blank)	1	0	1	1			B	X	X	X						
14 (Blank-Blank)	0	1	1	1			B	X	X	B						
15 (Blank)	1	1	1	1			B	X	X	X						
X = any character B = blank																

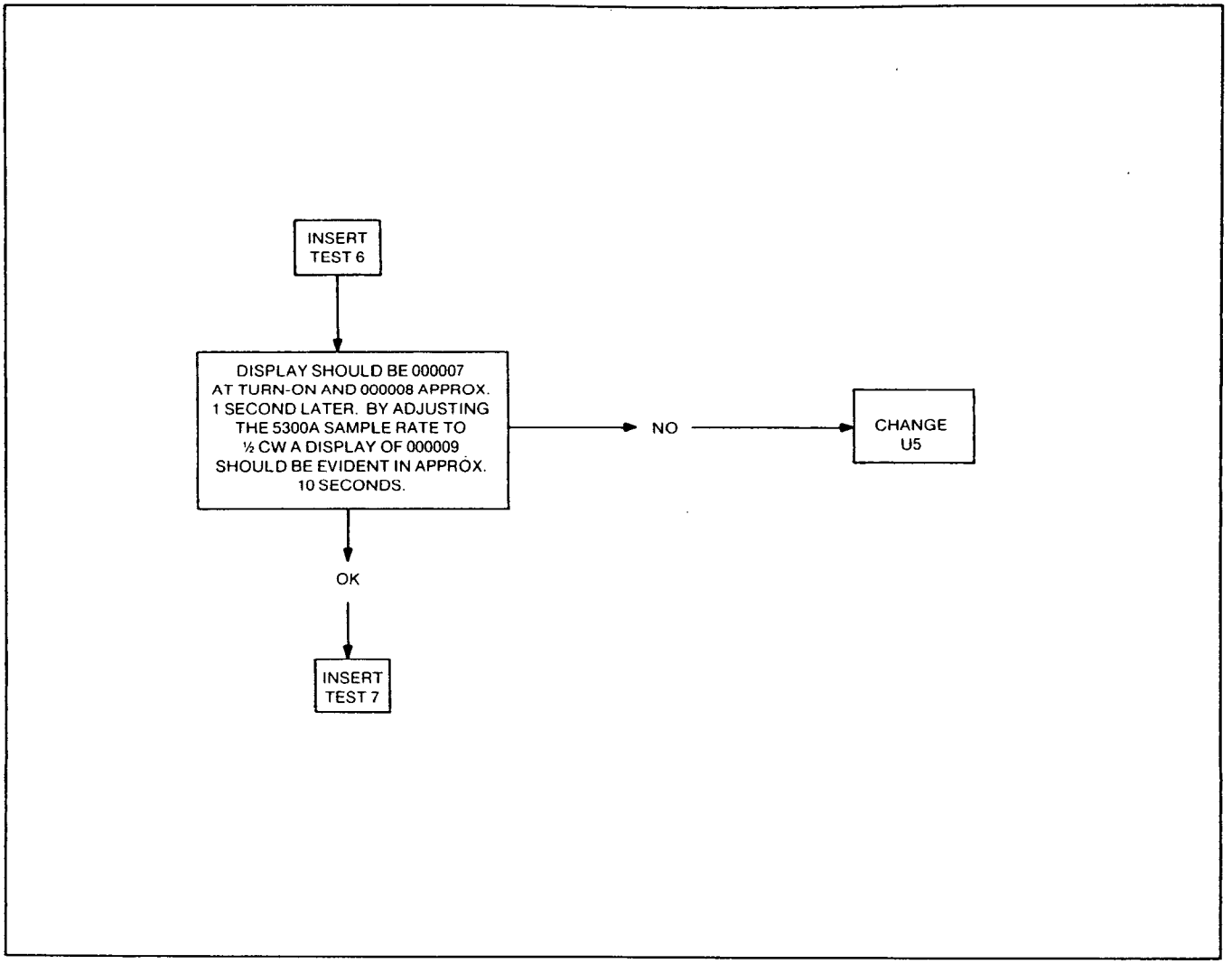
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Figure 5-4A. A1U3 Counter, A1U4 Time Base, and A1U5 Control Checks



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Figure 5-4B. A1U3 Counter, A1U4 Time Base, and A1U5 Control Checks (Continued)



5-40. Test No. 11. Fixed program tests the .1-second Time Base output. Display should accumulate one count every second in digit 1 (second from the right). "C" lamp on.

5-41. Test No. 12. Fixed program tests the 10 msec Time Base output. Display should accumulate one count every second in digit 2 (third from the right). "C" lamp on.

5-42. Diagnostic Test Card "D"

5-43. Insert Test 13 through 16. To use Diagnostic Test Card "D," connect the card through the interface card, HP Part No. 05300-60004, to 5300A mainframe A1J1 connector. Prior to each test, press RESET. These tests check U3 and U4 by programming the time base input codes to provide Time Base output signals in decade steps.

5-44. Test No. 13. Fixed program tests the 1 msec Time Base output. Display should accumulate one count every second in digit 3 (fourth from the right). "C" lamp on.

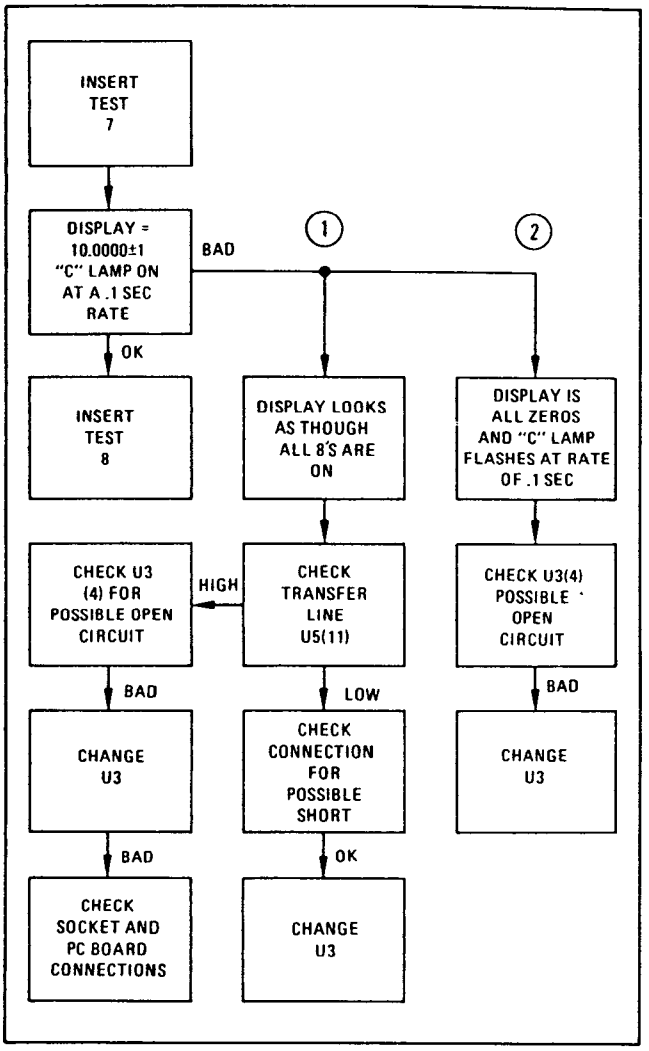
5-45. Test No. 14. Fixed program tests the .1 msec Time Base output. Display should accumulate one count every second in digit 4 (fifth from the right). "C" lamp on.

5-46. Test No. 15. Fixed program tests the 10 μsec Time Base output. Display should accumulate one count every second in digit 5 (sixth from the right). "C" lamp on. * = overflow lamp on after 10 seconds.

5-47. Test No. 16. Fixed program tests the 1 μsec Time Base output. *Overflow lamp should light* and remain on after 1 second. "C" lamp on.

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Figure 5-4C. A1U3 Counter, A1U4 Time Base, and A1U5 Control Checks (Continued)



5-48. ALTERNATE METHOD OF TROUBLE ISOLATION

5-49. Obtain a female 50-pin connector, HP Part No. 1251-0101 (CINCH 57-20500-375), and hard-wire the following listed programs by soldering short pieces of wire to the selected pins (observe CAUTION during soldering and use).

CAUTION

During soldering and use, do not short adjacent pins to each other or to the connector case. Damage to the 5300A may result.

5-50. The following hard wired programs, tests 1 through 4, check out the display circuitry to its fullest extent. Circuits tested are:

a. U1 Scanner circuits to test vertical column lines (left or right).

b. U2 Character Generator circuits to test horizontal lines (upper or lower).

c. Q6 to Q17 Buffer Drivers for the LED Display columns.

d. A1A1DS7 light-emitting-diode matrix.

e. Integrated circuit sockets and mechanical connections.

5-51. Tests 5, 6, and 7 check the majority of inputs and outputs to U3, U4, and U5 for the various modes of operation that can be performed with a plug-on. Test number 8 checks out the Annunciators and Decimal Point lines of the Display Assembly.

5-52. Test 9 through 12 and tests 13 through 16 check the MOS Time Base Circuitry and the MOS Decade Counter. By varying the input codes and outputs on U3 and U4 with a fixed program, the special circuits are exercised.

5-53. Inputs to the 5300A system mainframe and programming of its functions are provided from the plug-on module via a 50-pin connector in the center of the instrument. For the alternate method of troubleshooting, perform tests listed on Pages 5-12 to 5-14 (connector signals are listed in Table 4-2, A1J1 Signals).

5-54. OSCILLATOR ADJUSTMENT

5-55. Two methods of oscillator adjustment are available:

a. Using an electronic counter to measure the 5300A 10 MHz oscillator frequency at the 5300A rear-panel OSC jack.

b. Using the oscilloscope-drift method to compare the 5300A oscillator drift against a reference or "house" standard.

5-56. Oscillator Measurement

5-57. The 5300A oscillator can be easily measured by connecting an electronic counter, whose time base oscillator stability is at least 10 times better than the 5300A oscillator, to the 5300A rear-panel OSC jack. To measure the 5300A oscillator frequency proceed as follows:

a. Obtain an HP Model 5245L/M Electronic Counter and connect the 5300A OSC jack to the 5245L/M input.

b. Set 5245L/M controls for a minimum 7-digit stable display.

c. The 5245L/M display should read 10.00000 MHz ±1 count.

d. If the 5245L/M does not indicate this frequency, adjust the 5300A OSC adjustment until the display is correct.

5-58. The 5300A 10 MHz oscillator can be adjusted through the rear panel access hole. Adjustment should be made with the 5300A mated to a plug-on as part of a periodic maintenance cycle.

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TEST 1 (SAME AS DIAGNOSTIC CARD NO. A)			
Pin No.	Connected To Pin No.	Description	Display Should Be
(4)	→ (42)	Gnd/Data "D"	543210
(36)	→ (45)	Digit Address "X"/Data "A"	
(38)	→ (44)	Digit Address "Y"/Data "B"	
(40)	→ (43)	Digit Address "Z"/Data "C"	
(50)	→ (25)	DC-IN (+22 V)	
		TEST 2 (SAME AS DIAGNOSTIC CARD NO. A)	987610
(36)	→ (45)	Digit Address "X"/Data "A"	
(38)	→ (43) (44)	Digit Address "Y"/Data "B", "C"	
(40)	→ (42)	Digit Address "Z"/Data "D"	
(50)	→ (25)	DC-IN (+22 V)	
		TEST 3 (SAME AS DIAGNOSTIC CARD NO. A)	▮9▮9-8
(36)	→ (43)	Digit Address "X"/Data "C"	
(38)	→ (44)	Digit Address "Y"/Data "B"	
(40)	→ (45)	Digit Address "Z"/Data "A"	
(50)	→ (25)	DC-IN (+22 V)	
		TEST 4 (SAME AS DIAGNOSTIC CARD NO. A)	000000 cycle to 999999
(4)	→ (9) (41) (20), (19)	Gnd/Open, Digit Select "Z", Print and Transfer	
(38)	→ (5)	Digit Address "Y"/F_1	
(50)	→ (25)	DC-IN (+22 V)	
		TEST 5 (SAME AS DIAGNOSTIC CARD NO. B)	* 888888 c
(4)	→ (9) (37) (39) (41) (20), (19) (22)	Gnd/Open, DS "X", DS "Y", DS "Z", Print and Transfer, TBS "A"	
(5)	→ (16)	F_1/Clock	
(17)	→ (18)	MAXTIME/Time Base Output	
(43)	→ (21)	Data "C"/1 MHz Input	
(50)	→ (25)	DC-IN (+22 V)	

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Pin No.	Connected To Pin No.	Description	Display Should Be
TEST 6 (SAME AS DIAGNOSTIC CARD NO. B)			
(4)	→ (9), (20), (19)	Gnd/Open, $\overline{\text{Print}}$ and $\overline{\text{Transfer}}$,	At turn on: 000007
(5)	→ (13)	F_1/Exponent	1 sec after turn on: 000008
(7)	→ (16)	F_2/Clock	Adjust Sample Rate 1/2 cw
(36)	→ (37)	Digit Address "X"/Digit Select "X"	10 sec after turn on: 000009
(38)	→ (39)	Digit Address "Y"/Digit Select "Y"	
(40)	→ (41)	Digit Address "Z"/Digit Select "Z"	
(50)	→ (25)	DC-IN (+22 V)	
	TEST 7 SELF-CHECK (SAME AS DIAGNOSTIC CARD NO. B)		
(1)	→ (6)	+5 V/9	
(4)	→ (27), (28), (22), (23), (47)	Gnd/TBS "A", "B", $\overline{\text{Hz}}$, $\overline{\text{M}}$, $\overline{\text{DP4}}$	
(5)	→ (7), (16)	F_1/F_2, Clock	* 10.0000 MHz (±1 Count)
(17)	→ (18)	MAXTIME/Time Base Output	
(36)	→ (37)	Digit Address "X"/Digit Select "X"	
(38)	→ (39)	Digit Address "Y"/Digit Select "Y"	
(40)	→ (41)	Digit Address "Z"/Digit Select "Z"	
(50)	→ (25)	DC-IN (+22 V)	
	TEST 8 (SAME AS DIAGNOSTIC CARD NO. B)		
(4)	→ (42)	Gnd/Data "D"	
(36)	→ (45)	Digit Address "X"/Data "A"	
a. (38)	→ (44)	Digit Address "Y"/Data "B"	543210
(40)	→ (43)	Digit Address "Z"/Data "C"	
(50)	→ (25)	DC-IN (+22 V)	
(4)	→ (27)	Gnd (4) ↔ $\overline{\text{Hz}}$	Hz
	(28)	$\overline{\text{M}}$	M
	(29)	$\overline{\text{S}}$	S
	(30)	$\overline{\text{K}}$	K
b.	(31)	$\overline{\mu}$	μ
	(33)	$\overline{\text{DP1}}$	54321.0
	(34)	$\overline{\text{DP2}}$	5432.10
	(46)	$\overline{\text{DP3}}$	543.210
	(47)	$\overline{\text{DP4}}$	54.3210
	(48)	$\overline{\text{DP5}}$	5.43210

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TEST 9 (SAME AS DIAGNOSTIC CARD NO. C) MOS "TIME BASE AND COUNTER CHECK"			
Pin No.	Connected To Pin No.	Description	Display Should Be
(4)	→ (9) (20), (19)	Gnd/Open, $\overline{\text{Print}}$ and $\overline{\text{Transfer}}$	Same as Paragraph 5-38
(5)	→ (18)	F_1/Time Base Output	
(7)	→ (16)	F_2/Clock	
(36)	→ (37)	Digit Address "X"/Digit Select "X"	
(38)	→ (39)	Digit Address "Y"/Digit Select "Y"	
(40)	→ (41)	Digit Address "Z"/Digit Select "Z"	
(50)	→ (25)	DC-IN (+22 V)	
TEST 10 (SAME AS DIAGNOSTIC CARD NO. C) or Test 9. Connect pins listed in TEST 9 and ground pin 22, Time Base Select "A".			Same as Paragraph 5-39
TEST 11 (SAME AS DIAGNOSTIC CARD NO. C) or Test 9. Connect pins listed in TEST 9 and ground pin 23, Time Base Select "B".			Same as Paragraph 5-40
TEST 12 (SAME AS DIAGNOSTIC CARD NO. C) or Test 9. Connect pins listed in TEST 9 and ground pins 22 and 23, Time Base Select "A", "B".			Same as Paragraph 5-41
TEST 13 (SAME AS DIAGNOSTIC CARD NO. D) or Test 9. Connect pins listed in TEST 9 and ground pin 24, Time Base Select "C"			Same as Paragraph 5-44
TEST 14 (SAME AS DIAGNOSTIC CARD NO. D) or Test 9. Connect pins listed in TEST 9 and ground pins 22 and 24, Time Base Select "A", "C".			Same as Paragraph 5-45
TEST 15 (SAME AS DIAGNOSTIC CARD NO. D) or Test 9. Connect pins listed in TEST 9 and ground pins 23 and 24, Time Base Select "B", "C".			Same as Paragraph 5-46
TEST 16 (SAME AS DIAGNOSTIC CARD NO. D) or Test 9. Connect pins listed in TEST 9 and ground pins 22, 23, and 24, Time Base Select "A", "B", "C".			Same as Paragraph 5-47

5-59. Oscilloscope Drift Method

5-60. The 5300A oscillator may be adjusted against a reference or "house" standard using the oscilloscope drift method. With this method, drift in "parts in 10^8" can be monitored. To adjust the oscillator proceed as follows:

a. Connect 5300A rear panel OSC jack to oscilloscope vertical input.

b. Connect the Standard Reference 5 MHz source to the oscilloscope external input jack.

c. Set the oscilloscope time/cm to its fastest sweep time. Set the oscilloscope triggering to external.

d. Adjust the oscilloscope vertical amplifier controls and the time base controls until the oscilloscope display is exactly 10 cycles of the oscillator waveforms.

e. The oscilloscope display should be a stationary pattern. Unless the 5300A oscillator frequency and reference standard frequency are identical, the display on the oscilloscope will drift left or right. A

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left drift indicates the counter oscillator frequency is higher than the standard frequency. A right drift indicates the counter oscillator frequency is lower than the standard frequency. The rate of movement is related to the frequency difference between the 5300A oscillator and the standard frequency as shown in the following example.

Example. A 5 MHz frequency is used to trigger the oscilloscope sweep; the oscilloscope vertical amplifier signal is the 5300A oscillator frequency. The time required for the pattern to drift the width of one cycle for the display is (in this example) 10 seconds. The frequency error is:

$$\frac{\Delta f}{f} = \frac{\Delta t}{t} = \frac{2 \times 10^{-7}}{1 \times 10} = 2 \times 10^{-8} = 2 \text{ parts in } 10^8 \text{ error.}$$

f. Longer measurement periods are required to observe smaller frequency differences.

g. If frequency difference (drift) is excessive adjust 5300A rear-panel OSC ADJ.

5-61. HP 5310A BATTERY PACK

5-62. Battery Capacity Check

CAUTION

Maximum recharge time is 24 hours. Batteries may be damaged by heat if limit is exceeded.

5-63. The condition of the batteries in Model 5310A Battery Pack can be checked using equipment listed in Table 5-1 as follows:

a. Mate the 5310A Battery Pack to the 5300A Measuring System mainframe and the plug-on in use using procedure in Paragraphs 2-15, 2-16, and 2-17.

b. Unplug the 5300A ac line cord and set 5310A switch to BATTERY so that the battery pack is operating with normal load and supplying power to the Measuring System/Plug-on combination.

c. If the LOW BATTERY lamp starts to glow or if short battery life has been experienced, the Battery Pack should be recharged as follows:

1. Connect ac line power to 5300A. (Note: it is not necessary to have plug-on connected to charge batteries.
2. Set panel switch to CHARGE for 18 hours.
3. After 18 hours, disconnect ac power and set panel switch to LINE.

d. Ensure that the panel switch is set to LINE, then separate the Battery Pack from the 5300A and plug-on combination.

e. Connect a load across Battery Pack as follows:

1. Remove the Battery Pack top cover by removing the six attaching screws.
2. Obtain a 10-ohm, 25 W resistor and a 50-pin, female connector, HP Part No. 1251-0101 (CINCH 57-20500-375).
3. Solder the resistor between pins 25 and 49 of this connector.
4. Connect the loaded female connector to the Battery Pack bottom connector, A1J1.

f. Set Battery Pack switch to BATTERY.

g. Check the voltage conditions of each of the five batteries with a dc voltmeter. The normal voltage for each battery should be greater than 2 volts (about 2.3 to 2.8 V depending on time since charge) and each battery should be nearly the same level. A difference in voltage level between batteries is an indication that the lower voltage batteries are faulty and should be replaced.

h. Following an 18-hour charge, the Battery Pack should operate with a 10-ohm load for about 2.5 hours. The total battery voltage after this time should be greater than +10 volts dc.

i. If above tests indicate that battery capacity is lower than normal, full capacity can sometimes be regained by exercising the batteries through several charge-discharge cycles. Batteries may be loaded separately with 10-ohm, 25-watt resistors, for various lengths of time, until the capacities of all batteries are the same (all batteries measure 1.5 volts under load, for example). In some cases, full capacity may be obtained after charging the entire Battery Pack for 18 hours in the normal manner.

j. The battery pack should be checked and recharged every 30 days as part of a regular maintenance cycle.

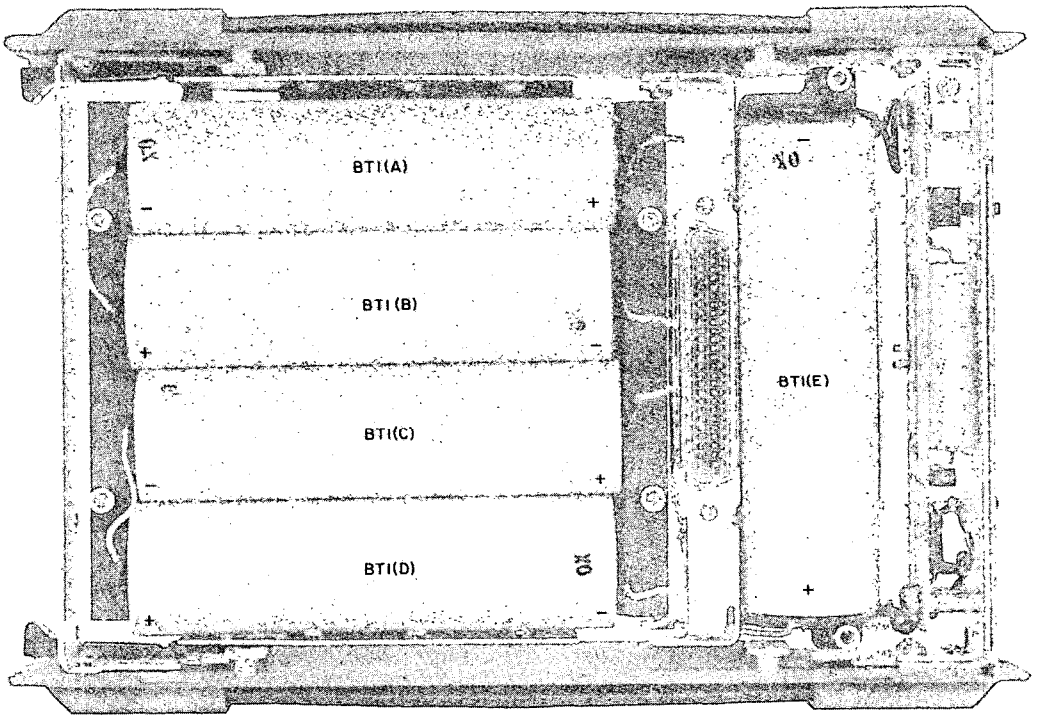
k. On days when the Battery Pack is used continuously for 3 to 8 hours (depending on plug-on used), it should be recharged over night.

5-64. Replacing Internal Battery Supply
(see Figure 5-5)

5-65. If the procedure of Paragraph 5-62 establishes that the 5310A internal batteries do not provide power for the normal operating time, replace the batteries. The batteries must be replaced with power removed and battery pack separated from the 5300A and plug-on used. Hewlett-Packard recommends replacing all five batteries. Installing only one new battery may result in decreased operating life of the older batteries or the newer replacement due to differences in battery capacity with age. If single battery

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Figure 5-5. Battery Removal



replacement is attempted, however, batteries from different manufacturers must not be intermixed. This unit contains one of the following battery types:

HP Part No.	Manufacturer	Mfg. No.
1420-0084 (no identifying numbers on battery)	Union Carbide Corp. Elect. Div.	Y 5816
1420-0209 (Part number located on battery)	Gould-National Batteries, Inc.	-----

Replace batteries as follows:

WARNING

WHILE PERFORMING THE FOLLOWING STEPS, ENSURE THAT THE BATTERY LEADS ARE NOT SHORTED TO EACH OTHER OR TO THE INSTRUMENT CHASSIS. INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT MAY OTHERWISE OCCUR.

a. Remove fuse F1 (located on A1 Assembly at front of 5310A) using a nonconductive tool.

b. Remove six screws in top cover plate and lift off plate to expose the five batteries.

c. Unsolder WHT-BLK-RED wire, at BT1A(+), which leads from A2(H) to BT1A(+).

d. Unsolder WHT wire at BT1D(-). Four batteries, BT1A, B, C, and D will be free for removal.

e. Unsolder WHT wire at BT1E(+) and BLK wire at BT1E(-). The last section of the battery will be free for removal.

f. Interconnections between the four sections of BT1A, B, C, and D can be made with the batteries out of the casting.

g. The battery sections can be reinstalled by reversing steps a through e.

h. When the five sections of BT1 have been installed, the plate removed in step b can be replaced and the six screws installed.

i. Mate the 5310A Battery Pack to the 5300A and the plug-on used as in Paragraph 2-15.

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5-66. Removing A2 Power Supply Board

5-67. To remove the A2 Power Supply Board, remove the batteries using procedures in Paragraph 5-65, steps a to e. Remove the A2 board as follows:

a. Unsolder the BLK wire connected to A2(A).

b. Unsolder the WHT-BLK-ORN wire connected to A2(C).

c. Unsolder the BLK wire from LOW BATTERY lamp connected to A2(D) and the GRN wire connected to A2(E).

d. Unsolder WHT-RED wire connected to A2(F).

e. Unsolder the WHT-BRN-RED wire connected to A2(G).

f. Unsolder the WHT-BLK-RED wire connected to A2(H).

g. Unsolder the BLK wire connected to A2(B).

h. Using an offset pozidriv* screwdriver, remove the three screws securing A2. Loosen screw securing the plastic power transistor.

i. The A2 Assembly should now be free for removal.

j. To install A2 Assembly, reverse the procedures of steps a to i.

5-68. DIGITAL RECORDER OUTPUT AND HP 10533A RECORDER INTERFACE

5-69. The operation of Model 10533A Recorder Interface and the 5300A DIGITAL RECORDER output can be checked as follows (refer to Table 5-1 for test equipment requirement):

a. Connect ac power to 5300A ac receptacle.

b. Connect the small interface cable connector to the 5300A rear-panel DIGITAL RECORDER connector.

d. Connect the opposite end of the cable containing the 50-pin male connector to the HP 5055A Digital Recorder. Ensure that the recorder is set to -8421 code.

d. Obtain a 50-pin female connector as listed in Table 5-1. Interconnect the following pins:

Pin 4 to Pins 5, 9, 15, 37, 39, 41
Pin 8 to Pin 17
Pin 19 to Pin 20
Pin 25 to Pin 50.

e. Connect the hard-wired, 50-pin connector to the 5300A A1J1 connector.

f. Turn 5300A ac power on with SAMPLE RATE control then press RESET. The 5300A display will initially be 000000 and will continuously cycle as follows:

111111	444444	777777
222222	555555	888888
333333	666666	999999

g. Turn on the HP 5055A Digital Recorder. The recorder will print out lines of digits corresponding to the particular digits being displayed on the 5300A. A 10- to 15-second printout should be sufficient to record the complete cycle of 5300A display data.

*Registered trademark, Stanley Company.

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SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Tables 6-1, 6-2, and 6-3 list parts used in the HP 5300A, 5310A, and 10533A respectively. The table lists parts in alphanumeric order of their reference designations and provides the following information on each part:

a. Hewlett-Packard part number.

b. Description of part (see abbreviations below).

c. Total quantity used in the instrument (the first time that the part appears in the list, the total quantity of that part number is printed).

d. Typical manufacturer of the part in a five-digit code (see list of manufacturers in Table 6-4).

e. Manufacturer's part number.

6-3. Miscellaneous parts are listed at the end of Table 6-1, 6-2, and 6-3.

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Sales and Service Office (see lists at rear of this Section for addresses). Identify parts by their Hewlett-Packard part number. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

REFERENCE DESIGNATORS

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

ABBREVIATIONS

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

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Table 6-1. Replaceable Parts for 5300A

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05300-60001	1	BOARD ASSY:LOGIC	28480	05300-60001
A1C1	0150-0012	1	C:FXD CER 0.01 UF 20% 1000VDCW	56289	29C214A3
A1C2	0180-2357	1	C:FXD TA 950 UF 90VDCW	28480	0180-2357
A1C3	0180-0210	1	C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A1C4	0180-0291	1	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C5	0180-0197	2	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C6	0150-0075	2	C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C7	0121-0059	2	C:VAR CER 2-8 PF 300VDCW	28480	0121-0059
A1C8	0160-2265	1	C:FXD CER 22 PF 5% 50CVDCW FACTORY SELECTED PART	72982	301-NPO-22PF
A1C9	0180-2208	2	C:FXD ELECT 220 UF 10% 10VDCW	56289	150D227X9010S2-DYS
A1C10	0160-0161	1	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A1C11	0180-1702	1	C:FXD ELECT 180 UF 20% 6VDCW	56289	150D187X0006R2-DYS
A1C12	0180-1794	2	C:FXD ELECT 22 UF 10% 35VDCW	56289	150D226X9035R2-DYS
A1C13	0180-2208		C:FXD ELECT 220 UF 10% 10VDCW	56289	150D227X9010S2-DYS
A1C14	0180-1794		C:FXD ELECT 22 UF 10% 35VDCW	56289	150D226X9035R2-DYS
A1C15	0150-0075		C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C16	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A1C17	0160-0156	1	C:FXD MY 0.0039 UF 10% 200VDCW	56289	192P39292-PTS
A1C18	0180-0106	2	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A1C19	0140-0198	1	C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A1C20	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1CR1	1901-0028	9	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR2	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR3	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR4	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR5	1901-0050	2	DIODE:SI 200 MA AT 1V	07263	FDA 6308
A1CR6	1902-3381	1	DIODE BREAKDOWN:68.1V 400MW	28480	1902-3381
A1CR7	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR8	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR9	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR10	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1CR11	1902-3205	1	DIODE BREAKDOWN:15.0V 5%	28480	1902-3205
A1CR12	1902-1259	1	DIODE BREAKDOWN	28480	1902-1259
A1CR13	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1E1	1810-0041	1	R:NETWORK,8 RES. 2.7K OHM 5%	28480	1810-0041
A1E1			(INCLUDES R2, 5, 6, 8, 10, 12, 16, 301.		
A1J1	1251-2564	1	CONNECTOR:R & P, 50 CONTACT PLUG	74868	57-10500-27
A1J2	1251-0472	1	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A1Q1	1854-0094	1	TSTR:SI NPN	80131	2N3646
A1Q2	1854-0492	14	TSTR:SI NPN	28480	1854-0492
A1Q3	1854-0487	1	TSTR:SI NPN	28480	1854-0487
A1Q4	1853-0020	3	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A1Q5	1854-0071	8	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q6	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q7	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q8	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q9	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q10	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q11	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q12	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q13	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q14	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q15	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q16	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q17	1854-0492		TSTR:SI NPN	28480	1854-0492
A1Q18	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q19	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q20	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
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	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q24	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1R1	0683-2715	2	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A1R2			(PART OF E1).		
A1R3	0683-2025	2	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A1R4	0683-1025	3	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1R5			(PART OF E1).		
A1R6			(PART OF E1).		
A1R7	0683-6215	1	R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A1R8			(PART OF E1).		

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Table 6-1. Replaceable Parts for 5300A (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R9	0683-6815	1	R:FXD COMP 680 OHM 5% 1/4W	C1121	CB 6815
A1R10			(PART OF E1).		
A1R11	0683-2035	1	R:FXD COMP 2CK OHM 5% 1/4W	01121	CB 2C35
A1R12			(PART OF E1).		
A1R13	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1C25
A1R14	0683-1055	1	R:FXD COMP 1 MEGOHM 5% 1/4W	C1121	CB 1C55
A1R15	0698-4037	1	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A1R16			(PART OF E1).		
A1R17	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1R18	0683-1525	1	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A1R19	0683-6805	1	R:FXD COMP 68 OHM 5% 1/4W	C1121	CB 6805
A1R20	0683-1035	9	R:FXD COMP 10K OHM 5% 1/4W	C1121	CB 1035
A1R21	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	C1121	CB 1035
A1R22	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A1R23	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	C1121	CB 1C35
A1R24	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A1R25	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1C35
A1R26	0683-2725	1	R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725
A1R27	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1C35
A1R28	0683-1015	1	R:FXD COMP 100 OHM 5% 1/4W	C1121	CB 1015
A1R29	0683-3315	1	R:FXD COMP 330 OHM 5% 1/4W	C1121	CB 3315
A1R30			(PART OF E1).		
A1R31	0698-6241	2	R:FXD COMP 750 OHM 5% 1/8W	C1121	BB 7515
A1R32	0698-6241		R:FXD COMP 750 OHM 5% 1/8W	01121	BB 7515
A1R33	0684-1031	1	R:FXD COMP 10K OHM 10% 1/4W	28480	0684-1031
A1S1	3101-1596	1	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	78488	SS-91-1
A1T1	9100-3012	1	TRANSFORMER	28480	9100-3012
A1T2	9100-3011	1	TRANSFORMER:DRIVER	28480	9100-3011
A1U1	1820-1060	1	IC:TTL DISPLAY SCANNER	28480	1820-1060
A1U2	1820-0571	1	IC:TTL NUMERIC DISPLAY CHARACTER GEN.	28480	1820-0571
A1U3	1820-0634	1	IC:M.O.S.,6-DECADE COUNTER	28480	1820-0634
A1U4	1820-0633	1	IC:M.O.S. TIME BASE	28480	1820-0633
A1U5	1820-0632	1	IC:LSI CONTROL	28480	1820-0632
A1U6	1820-0584	1	IC:TTL LP QUAD 2-INPT NOR GATE	12040	DM74L02N
A1U7	1820-0174	1	IC:TTL HEX INVERTER	01295	SN7404N
A1U8	1820-0578	1	IC:ECL DUAL 2-INPT EXP. GR/NOR GATE	04713	MC1024P
A1Y1	0410-0423	1	CRYSTAL:QUARTZ	28480	0410-0423
A1A1					
A1A1					
A1A1	05300-60002	1	BOARD ASSY:DISPLAY	28480	05300-60002
A1A1					
A1A1					
A1A1DS1	1990-0325	7	DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A1A1DS2	1990-0325		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A1A1DS3	1990-0325		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A1A1DS4	1990-0325		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A1A1DS5	1990-0325		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A1A1DS6	1990-0325		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A1A1DS7	1990-0311	1	ARRAY:LIGHT EMITTING DIODE,6 DIGITS	28480	1990-0311
A1A1DS8	1990-0325		DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A1A1R1	0683-3305	2	R:FXD COMP 33 OHM 5% 1/4W	01121	CB 3305
A1A1R2	0683-3305		R:FXD COMP 33 OHM 5% 1/4W	01121	CB 3305
A2	05300-60003	1	BOARD ASSY:POWER SUPPLY REGULATOR	28480	05300-60003
A2C1	0140-0149	1	C:FXD MICA 470 PF 5%	72136	DM15F471J3S
A2C2	0180-2355	1	C:FXD TA 7.5 UF 5% 20VDCW	56289	150D755X5020B2-DYS
A2C3	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A2C4	0160-0299	1	C:FXD MY 1800 PF 10% 200VDCW	56289	192P18292-PTS
A2C5	0160-0155	1	C:FXD MY 0.0033 UF 10% 200VDCW	56289	192P33292-PTS
A2C6	0160-0180	1	C:FXD MY 0.033 UF 5%	28480	0160-0180
A2C7	0160-2327	1	C:FXD CER 1000 PF 20% 100VDCW	56733	B1000X102M
A2CR1	1902-0689	1	DIODE BREAKDOWN	28480	1902-0689
A2CR2	1901-0040	3	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR4	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR5	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A2Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q2	1853-0086	2	TSTR:SI PNP	80131	2N5087
A2Q3	1853-0086		TSTR:SI PNP	80131	2N5087
A2Q4	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q5	1855-0367	1	TSTR:UNIJUNCTION (PN)	04713	2N4871-5
A2Q6	1884-0201	1	THYRISTOR:SCR(JEDEC 2N5061)	28480	1884-0201
A2Q7	1854-0023	1	TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023

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Table 6-1. Replaceable Parts for 5300A (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2Q8	1853-0058	1	TSTR:SI PNP	80131	2N3644
A2Q9	1854-0492		TSTR:SI NPN	28480	1854-0492
A2R1	0757-0444	1	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A2R2	0698-0085	1	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A2R3	0757-0420	2	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A2R4	0683-1535	2	R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535
A2R5	0683-3605	1	R:FXD COMP 36 OHM 5% 1/4W	01121	CB 3605
A2R6	0683-2015	1	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A2R7	0683-1625	2	R:FXD COMP 1600 OHM 5% 1/4W	01121	CB 1625
A2R8	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R9	0698-3456	1	R:FXD MET FLM 287K OHM 1% 1/8W	28480	0698-3456
A2R10	0683-2025		R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A2R11	0698-3515	1	R:FXD FLM 5900 OHM 1% 1/8W	28480	0698-3515
A2R12	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A2R13	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R14	0683-1535		R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535
A2R15	0686-5115	2	R:FXD COMP 510 OHM 5% 1/2W	01121	EB 5115
A2R16	0686-5115		R:FXD COMP 510 OHM 5% 1/2W	01121	EB 5115
A2R17	0683-2715		R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A2R18	0683-1625		R:FXD COMP 1600 OHM 5% 1/4W	01121	CB 1625
A3	5060-1189	1	POWER LINE MODULE, NON-FILTERED	28480	5060-1189
A3C1	0160-3333	2	C:FXD CER 5000 PF 20% 250WVAC	28480	0160-3333
A3C2	0160-3333		C:FXD CER 5000 PF 20% 250WVAC	28480	0160-3333
A3F1	2110-0044	1	FUSE:0.30A 250V SLOW-BLOW	28480	2110-0044
A3F1	2110-0320	1	FUSE:0.15A 250V SLOW-BLOW	71400	MDL15/100
A3W1	8120-1378	1	CABLE ASSY:AC POWER CORD	70903	KH-7081
			CHASSIS AND MISCELLANEOUS PARTS		
J1	1250-0083	1	CONNECTOR:BNC	02660	31-221-1020
MP1	05300-00001	1	PANEL:FRONT	28480	05300-00001
MP2	5040-6000	1	CATCH:LEFT SIDE	28480	5040-6000
MP3	05300-00004	1	PANEL:REAR	28480	05300-00004
MP4	05300-20005	1	WINDOW	28480	05300-20005
MP5	05300-20010	1	CASE	28480	05300-20010
MP6	05300-40002	2	BLOCK:ANNUNCIATOR	28480	05300-40002
MP7	05300-40003	4	SUPPORT:BOARD	28480	05300-40003
MP8	05300-40004	4	GUIDE:SLIDE	28480	05300-40004
MP9	5040-7001	1	CATCH:RIGHT SIDE	28480	5040-7001
MP10	05300-40006	1	SOCKET:CONNECTOR	28480	05300-40006
MP11	05300-80002	1	MASK:ANNUNCIATOR, UPPER	28480	05300-80002
MP12	05300-80003	1	MASK:ANNUNCIATOR, LOWER	28480	05300-80003
MP13	2200-0180	1	SCREW:PAN HD POZI DR 4-40 X 1.375" LG	00000	OBD
MP14	2190-0003	1	WASHER:LOCK FOR #4 HWD	28480	2190-0003
MP15	0624-0208	1	SCREW:PAN HD POZI DR 6-32 X 0.500" LG	00000	OBD
R1	2100-0318	1	R:VAR 250K OHM 20% 1/4W/SPST SW	28480	2100-0318
S2	3101-0052	1	SWITCH:PUSHBUTTON SPST	82389	961 LESS HWD
	0370-2101	1	KNOB:BASE, ROUND, SAMPLE RATE	28480	0370-2101
	0510-0207	1	NUT:CAPTIVE 4-40 X 0.188 LG	28480	0510-0207
	1200-0525	3	SOCKET:IC 20 PIN (FOR A1U1, 2, 5).	00779	583640-2
	0905-0479	1	GASKET	28480	0905-0479
	1200-0473	2	SOCKET:IC 16-PIN (FOR A1U3, U4).	28480	1200-0473
	1200-0513	2	SOCKET:IC, 20 PIN STRIP CONTACT (FOR A1A1DS7).	23880	CSA3000-20BC
	05300-20007	36	CONNECTOR PINS:PRINTED CIRCUIT (FOR A1A1).	28480	05300-20007
	1205-0012	1	HEAT DISSIPATOR:SEMICONDUCTOR	05820	MODEL 201CB
	7122-0097	1	NAMEPLATE	28480	7122-0097
	7124-1759	1	LABEL:INFO	28480	7124-1759
	7124-2017	1	LABEL "POWER LINE"	28480	7124-2017

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Table 6-2. Replaceable Parts for 5310A

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05310-60002	1	BOARD ASSY:INTERCONNECT	28480	05310-60002
A1J1	1251-0099	1	CONNECTOR:R & P 50 CONTACT (MALE, BOTTOM)	0266C	57-10500-375
A1P1	1251-0101	1	CONNECTOR:R & P 50 CONTACT (FEMALE, TOP)	0266C	57-20500-375
A2	05310-60001	1	BOARD ASSY:POWER SUPPLY	28480	05310-60001
A2C2	0180-2373	2	C:FXD AL ELECT 580 UF +150-10% 35VDCW	90201	TT581H035P3E1N
A2CR1	1901-0028	2	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A2CR2	1902-0693	1	DIODE BREAKDOWN	28480	1902-0693
A2CR3	1901-0044	1	DIODE:SILICON 20MA/1V	28480	1901-0044
A2CR4	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A2DS1	1990-0325	1	DIODE:VISIBLE LIGHT EMITTER	28480	1990-0325
A2F1	2110-0332	1	FUSE:3A	71400	GMW 3
A2J1	1251-1636	2	CONNECTOR:SINGLE MALE CONTACT	28480	1251-1636
A2J2	1251-1636		CONNECTOR:SINGLE MALE CONTACT	28480	1251-1636
A2Q1	1853-0086	3	TSTR:SI PNP	80131	2N5087
A2Q2	1853-0086		TSTR:SI PNP	80131	2N5087
A2Q4	1853-0086		TSTR:SI PNP	80131	2N5087
A2R1	0683-2745	1	R:FXD COMP 270K OHM 5% 1/4W	01121	CB 2745
A2R2	0813-0034	1	R:FXD WW 1.8 OHM 3% 1W	28480	0813-0034
A2R3	0683-3935	1	R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935
A2R4	0761-0015	1	R:FXD MET OX 1500 OHM 5% 1W	28480	0761-0015
A2R5	0683-3315	1	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A2R6	0698-3547	1	R:FXD COMP 1 OHM 5% 1/2W	01121	EB 1065
A2R7	0683-5115	1	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A2R8	0683-2015	1	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A2R8	0550-0051	2	SCREW:PAN HD POZI DR 3-48 X 0.375" LG	00000	OBD
A2R8	2200-0103	14	SCREW:SST PHH POZI DR 4-40 X 1/4"W/LK	00000	OBD
A2R8	2200-0107	5	SCREW:POZI DR 4-40 X 3/8 W/LOCK	00000	OBD
A2R8	2200-0164	12	SCREW:FLAT HD POZI 4-40 X 3/16	00000	OBD
A2R8	2360-0113	3	SCREW:PAN HD POZI 6-32 X 1/4 W/LK	00000	OBD
A2R8	2360-0117	6	SCREW:PAN HD POZI 6-32 X 3/8 W/LK	00000	OBD
A2S1	3101-0543	1	SWITCH:SLIDE DP3T MINIATURE	78488	SS-93
			CHASSIS AND MISCELLANEOUS PARTS		
BT1	1420-0084 OR	5	BATTERY:2.50V	05397	Y5916
	1420-0209	5	BATTERY:2.50V	28480	1420-0209
MP1	1440-0075	1	CARRY STRAP	28480	1440-0075
MP2	1440-0096	1	HANDLE:STRAP	28480	1440-0096
MP3	1440-0097	1	HANDLE:SHOULDER	28480	1440-0097
MP4	5040-6000	2	CATCH:LEFT SIDE	28480	5040-6000
MP4	05300-80004	2	COVER:PLASTIC PROTECTIVE	28480	05300-80004
MP5	5040-7001	2	CATCH:RIGHT SIDE	28480	5040-7001
MP6	05310-00001	1	PANEL:FRONT	28480	05310-00001
MP7	05310-00002	1	PANEL:REAR	28480	05310-00002
MP8	05310-00011	1	PANEL:SUB	28480	05310-00011
MP9	05310-00004	1	BRACKET:LEFT	28480	05310-00004
MP10	05310-00005	1	CASE:BATTERY	28480	05310-00005
MP11	05310-00006	1	HOLDER:BATTERY	28480	05310-00006
MP12	05310-00007	1	COVER:BATTERY	28480	05310-00007
MP13	05310-00008	1	BRACKET:RIGHT	28480	05310-00008
MP14	05310-40001	4	GUIDE:SLIDE	28480	05310-40001
MP15	05310-20004	2	FRAME:SIDE	28480	05310-20004
MP16	0340-0765	1	INSULATOR:TRANSISTOR	01295	A-0340-0765-1
MP17	1400-0808	1	MOUNTING CLIP	28480	1400-0808
MP18	3050-0791	1	WASHER:SHOULDER 0.115" ID, NYLON	28480	3050-0791
MP19	05310-00012	1	PANEL:SUB	28480	05310-00012
MP20	1460-1312	1	SPRING:LEAF	28480	1460-1312
Q3	1854-0420	1	TSTR:SI NPN	28480	1854-0420

See introduction to this section for ordering information

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Table 6-3. Replaceable Parts for 10533A

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	10533-60001	1	BOARD ASSY:	28480	10533-60001
A1C1	0180-0197	1	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A1C2	0180-0106	1	C:FXD ELECT 68 UF 20% 6VDCW	28480	0180-0106
A1C3	0150-0172	1	C:FXD CER 200 PF 5% 1000VDCW	56289	C028B102E201JS27-CDH
A1CR1	1901-0050	2	DIODE:SI 200 MA AT 1V	07263	FDA 6308
A1CR2	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A1Q1	1854-0094	1	TSTR:SI NPN	80131	2N3646
A1R1	0683-1025	3	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1R2	0683-1035	2	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A1R3	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A1R4	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1U1	1820-0602	1	IC:TTL LP 8-BIT SHIFT REGISTER	12040	DM86L70N
A1U2	1820-0282	1	IC:TTL QUAD 2-INPT EXCL. OR GATE	01295	SN7486N
A1U3	1820-0614	4	IC:TTL DUAL 4-BIT LATCH(LOW POWER)	07263	U6N93L0859
A1U4	1820-0614		IC:TTL DUAL 4-BIT LATCH(LOW POWER)	07263	U6N93L0859
A1U5	1820-0614		IC:TTL DUAL 4-BIT LATCH(LOW POWER)	07263	U6N93L0859
A1U6	1820-0614		IC:TTL DUAL 4-BIT LATCH(LOW POWER)	07263	U6N93L0859
A1U7	1820-0274	1	IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
			CHASSIS & MISCELLANEOUS PARTS		
MP1	0400-0010	1	GROMMET:VINYL 0.250" ID	00000	GBD#
MP2	1400-0024	1	CLAMP,CABLE NYLON 1/4" DIA	71616	CPC-1953-4A
MP3	2200-0170	2	SCREW:SST POZI DR 4-40 X 0.625" LG	00000	OBD
MP4	2360-0119	1	SCREW:SST PAN HD POZ DR 6-32 X 7/16"	00000	OBD
MP5	5040-4601	1	CONNECTOR HOOD	28480	5040-4601
MP6	10533-20002	1	CASE:PLASTIC	28480	10533-20002
MP7	10533-20003	1	COVER:PLASTIC	28480	10533-20003
MP7	10533-80001	1	LABEL	28480	10533-80001
MP8	10533-20001	1	BOARD:BLANK P.C.	28480	10533-20001
MP9	1251-3135	1	KEY:POLARIZING	05574	091-0086-000
P1	1251-0132	1	INSERT:R & P CONNECTOR 50 MALE CONTACT	02660	57-0993-01-375
P2	1251-2314	1	CONNECTOR:PC (2 X 10)20 CONTACT	05574	2VH10/1JV5(079)
R1	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
W1	10533-60002	1	CABLE ASSY	28480	10533-60002

See introduction to this section for ordering information

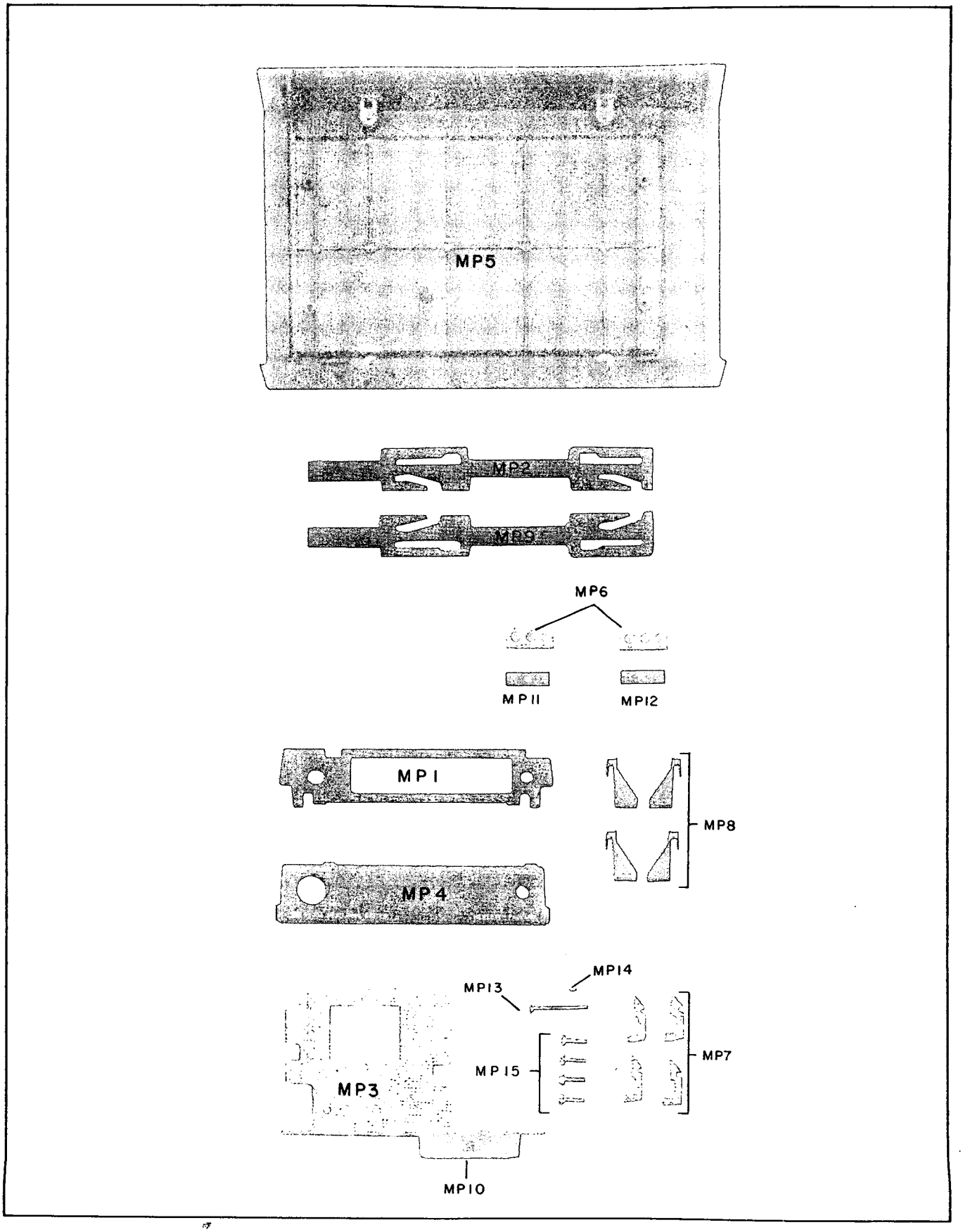
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Table 6-4. Code List of Manufacturers

Mfr. No.	Manufacturer Name, Address, and Zip Code
00000	U.S.A. Common, Any Supplier of U.S.A.
00779	Amp Inc., (Aircraft Marine Prod.), Harrisburg, Pa. 17101
01121	Allen Bradley Co., Milwaukee, Wis. 53204
01295	Texas Instruments, Inc., Semiconductor Components Div., Dallas, Tex. 75231
02660	Amphenol Corp., Broadview, Ill. 60153
04713	Motorola Semiconductor Prod. Inc., Phoenix, Ariz. 85008
05397	Union Carbide Corp. Elect. Div., New York, N.Y. 10017
05574	Viking Ind. Inc., Chatsworth, Calif. 91311
05820	Wakefield Engineering Inc., Wakefield, Mass. 01880
07263	Fairchild Camera and Inst. Corp. Semiconductor Div., Mountain View, Calif. 94040
12040	National Semiconductor Corp., Danbury, Conn. 06810
23880	Stanford Applied Engrg., Santa Clara, Calif. 95050
28480	Hewlett-Packard Co., Corporate Hq., Your Nearest HP Office
56289	Sprague Electric Co., N. Adams, Mass. 01247
70903	Belden Corp., Chicago, Ill. 60644
70998	Bird Electronics Corp., Cleveland, Ohio 44139
71400	Bussmann Mfg. Div. McGraw-Edison Co., St. Louis, Mo. 63017
71616	Commercial Plastics Co., Mundelein, Ill. 60060
71785	Cinch Mfg. Co. Div. TRW Inc., Elk Grove Village, Ill.
72136	Electro Motive Mfg. Co. Inc., Willimantic, Conn. 06226
72982	Erie Technological Prod. Inc., Erie, Pa. 16512
74868	Amphenol Corp. RF Div., Danbury, Conn. 06810
78488	Stackpole Carbon Co., St. Marys, Pa. 15857
80131	Electronic Industries Association, Washington, D.C. 20006
82389	Switchcraft Inc., Chicago, Ill. 60630
90201	Mallory Capacitor Co., Indianapolis, Ind. 46206
96733	San Fernando Elect. Mfg. Co., San Fernando, Calif. 91341

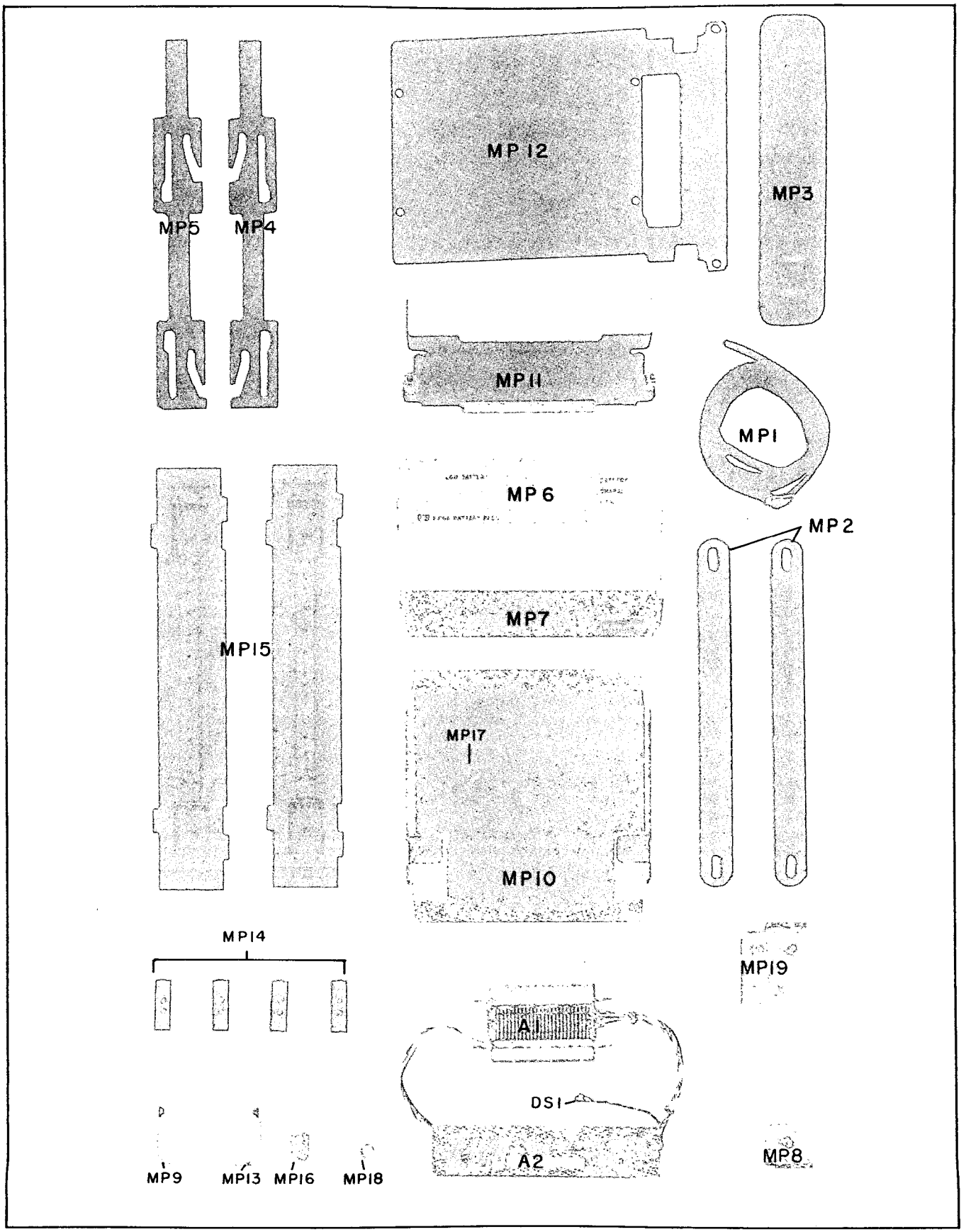
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Figure 6-1. 5300A Mainframe Mechanical Parts Location



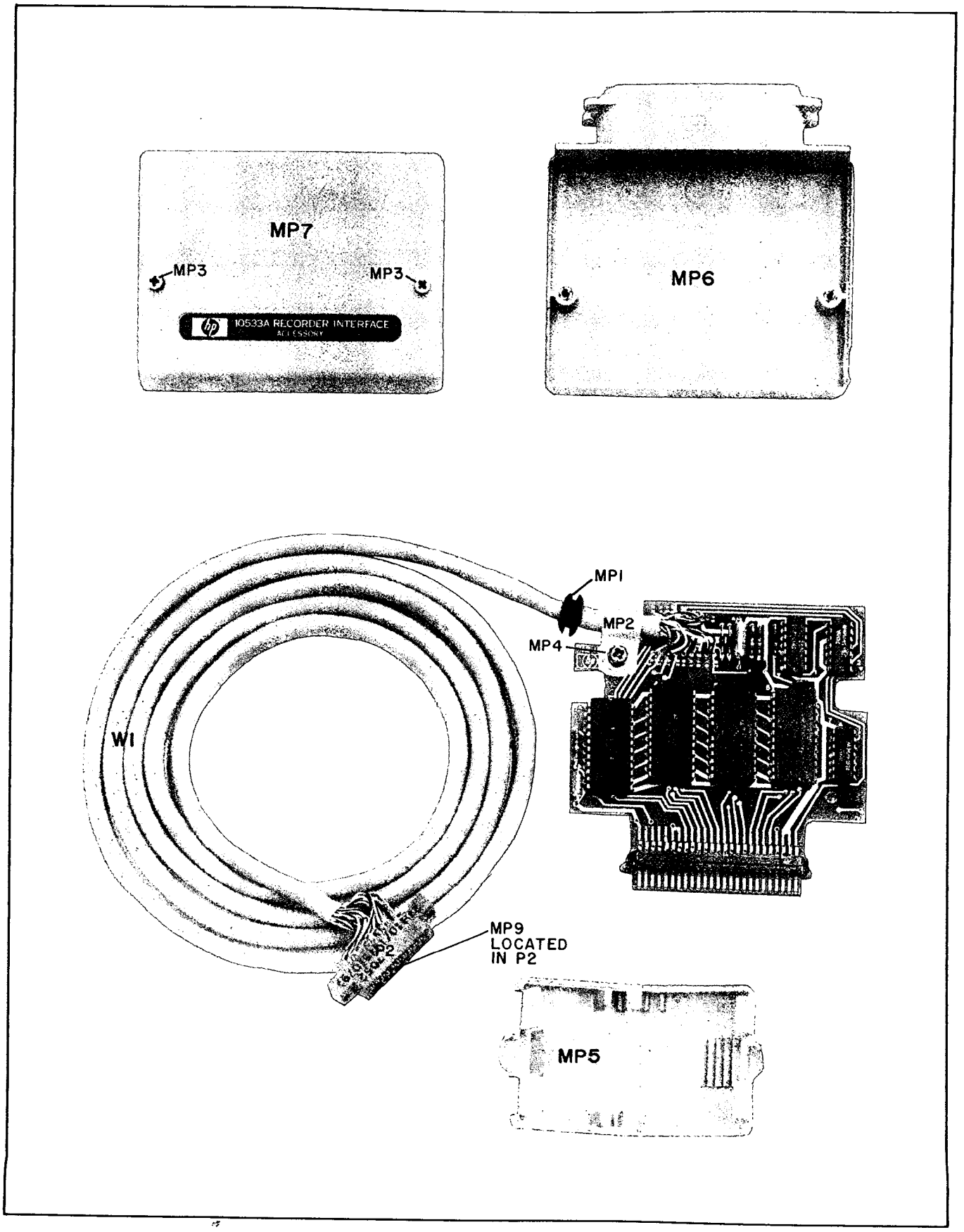
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Figure 6-2. 5310A Battery Pack Mechanical Parts Location



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Figure 6-3. 10533A Recorder Interface Mechanical Parts Location



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SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. MANUAL CHANGES

7-2. This manual applies directly to Model 5300A Measuring Systems with serial number prefix 1320A, to Model 5310A Battery Packs with serial number prefix 1312A, and to Model 10533A Digital Recorder Interfaces with circuit-board series number 1128A. For information about manual changes for newer or older units, refer to the following paragraphs.

7-3. Newer Instruments

7-4. As engineering changes are made, newer instruments may have serial prefix numbers higher than those listed on the title page of this manual. The manuals for these instruments will be supplied with "manual changes" sheets containing the required information. Replace affected pages or modify existing manual information as directed in the "manual changes" pages. Contact the nearest Hewlett-Packard Sales and Service Office if the change information is missing.

7-5. Older Instruments

7-6. The following paragraphs list the manual changes required to backdate this manual to cover Model 5300A Measuring Systems and Model 5310A Battery Packs with lower serial number prefixes than those listed on the title page of this manual. Make the manual changes given in the paragraph that corresponds to the serial number prefix of your instrument.

7-7. 5300A, serial prefix 1312A: On the schematic diagram and the component locator illustration of Figure 8-2, delete A1R33 and the connection between R1, the SAMPLE RATE control, and the circuit common return line (ground). Delete A1R33 from the replaceable parts list of Table 6-1.

7-8. 5300A, serial prefix 1232A. Make the change given in Paragraph 7-7. On Page 6-4, Table 6-1, change the part number of the 60 integrated circuit sockets (for A1U1, 2, and 5) from "1200-0475" to "1200-0464".

7-9. 5300A, serial prefix 1208A. Make the changes given in Paragraphs 7-7 and 7-8. On these and older instruments, two-piece catch-slides were used in place of the newer one-piece parts listed on Page 6-4, Table 6-1 (MP2 and MP9). The newer parts (part numbers 5040-6000 and 5040-7001) should be used, however, if replacement is required.

7-10. 5300A, serial prefix 1148A. Make the changes given in Paragraphs 7-7 through 7-9. Delete capacitor A2C7 from the schematic diagram and the component locator illustration of Figure 8-2 and from the replaceable parts list of Table 6-1.

7-11. 5300A, serial prefix 1104A. Makes the changes given in Paragraphs 7-7 through 7-10. On Page 6-2, Table 6-1, change the entry for A1C1 (part number 0150-0012) to the following: "A1C1, 0160-0153, 1, C:FXD MY 0.001 UF 10% 200VDCW, 56289, 192P10292-PTS". On the schematic diagram of Figure 8-2, change the value of A1C1 from ".01μF" to ".001μF"

7-12. 5310A, serial prefix 1232A. On Page 6-5, Table 6-2, delete the entries for MP8 and MP19; add the following: "MP8, 05310-00003, 1, PANEL:SUB, 28480, 05310-00003".

7-13. 5310A, serial prefix 1128A. Make the changes given in Paragraph 7-12. On these and older instruments two-piece catch-slides were used in place of the newer one-piece parts listed on Page 6-5, Table 6-2 (MP4 and MP5). The newer parts (part numbers 5040-6000 and 5040-7001) should be used, however, if replacement is required.

7-14. OPTIONS

7-15. No options available at time of printing.

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MODEL NUMBER: **5300A**
Measuring System

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	SECTION	I	II	III	IV	V	VI	VII	VIII
1. DOES EACH SECTION CONTAIN THE INFORMATION YOU NEED?	YES	☐	☐	☐	☐	☐	☐	☐	☐
	NO	☐	☐	☐	☐	☐	☐	☐	☐
2. IS THE PRESENTATION OF MATERIAL CLEAR AND EASY TO UNDERSTAND?	YES	☐	☐	☐	☐	☐	☐	☐	☐
	NO	☐	☐	☐	☐	☐	☐	☐	☐
3. IS THE ORGANIZATION OF EACH SECTION SATISFACTORY FOR YOUR PURPOSES?	YES	☐	☐	☐	☐	☐	☐	☐	☐
	NO	☐	☐	☐	☐	☐	☐	☐	☐
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- PARTS LIST INFORMATION ☐
- SPECIFICATIONS ☐
- PERFORMANCE TESTS ☐
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SECTION VIII

CIRCUIT DIAGRAMS

8-1. GENERAL

8-2. Section VIII contains:

a. Schematic Diagram Notes.

b. A Reference Designation/Signal Name List that shows sources and destinations of all signal lines within the mainframe.

c. Component locators and circuit diagrams of assemblies.

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Figure 8-1. Schematic Diagram Notes

SYMBOLS

FRONT PANEL

REAR PANEL

INTERIOR AND PC BOARDS

WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE

POWER LINE GROUND

CIRCUIT COMMON

FLOATING COMMON

CHASSIS COMMON

KNOB CONTROL

SCREWDRIVER ADJUST

MAIN SIGNAL PATH

FEEDBACK PATH

TEST POINT

"AND" GATE

"OR" GATE

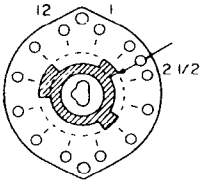
INVERTER

NAND GATE

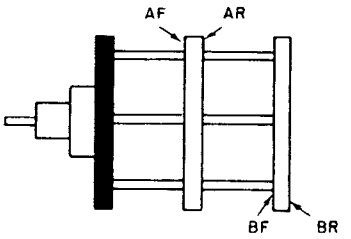
NOR GATE

EXCLUSIVE NOR

SWITCH DESIGNATIONS



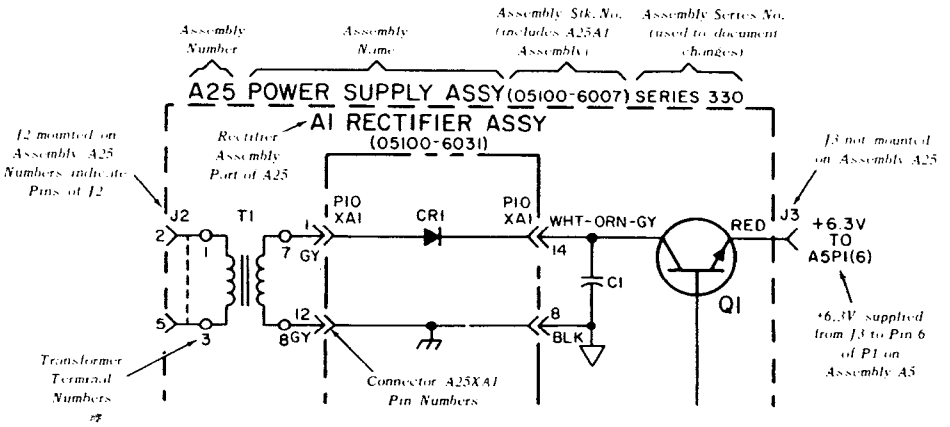
A3S1		SWITCH S1 WITHIN ASSEMBLY A3
B		2ND WAFER FROM FRONT (A=1ST, ETC)
R		REAR OF WAFER (F=FRONT)
A3S1BR(2-1/2)	**(2-1/2)**	TERMINAL LOCATION ($2\frac{1}{2}$) (VIEWED FROM FRONT)



REFERENCE DESIGNATIONS

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION. JACKS ARE THE STATIONARY CONNECTORS AND PLUGS ARE THE MORE MOVEABLE OF TWO CONNECTORS.

ASSEMBLY	ABBREVIATION	COMPLETE DESCRIPTION
A25	C1	A25C1
A25A1	CR1	A25A1CR1
NO PREFIX	J3	J3



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Table 8-1. Reference Designation/Signal Name List

REFERENCE DESIG.	PIN NO.	SIGNAL NAME	REFERENCE DESIG.	PIN NO.	SIGNAL NAME
A1A1DS7	1	NC	A1J1	1	+5V
A1A1DS7	2	NC	A1J1	2	-5V
A1A1DS7	3	COLUMN (5L)+	A1J1	3	-17V
A1A1DS7	4	COLUMN (5R)+	A1J1	4	GND
A1A1DS7	5	$\overline{DP(5)}$-	A1J1	5	F1
A1A1DS7	6	COLUMN(4L)+	A1J1	6	$\overline{"9"}$
A1A1DS7	7	COLUMN(4R)+	A1J1	7	F2
A1A1DS7	8	$\overline{DP(4)}$-	A1J1	8	$\overline{INHIBIT}$
A1A1DS7	9	COLUMN(3L)+	A1J1	9	$\overline{OPEN}$
A1A1DS7	10	COLUMN(3R)+	A1J1	10	$\overline{CLOSE}$
A1A1DS7	11	$\overline{DP(3)}$-	A1J1	11	$\overline{LOG\ OUTPUT}$
A1A1DS7	12	COLUMN(2L)+	A1J1	12	$\overline{MGFF}$
A1A1DS7	13	COLUMN(2R)+	A1J1	13	$\overline{EXP}$
A1A1DS7	14	$\overline{DP(2)}$-	A1J1	14	NC
A1A1DS7	15	COLUMN(1L)+	A1J1	15	RESET
A1A1DS7	16	COLUMN(1R)+	A1J1	16	CLOCK
A1A1DS7	17	DP COMMON+	A1J1	17	$\overline{MAX\ TIME}$
A1A1DS7	18	$\overline{DP(1)}$-	A1J1	18	TIME BASE OUTPUT
A1A1DS7	19	COLUMN(OL)+	A1J1	19	$\overline{PRINT}$
A1A1DS7	20	COLUMN(OR)+	A1J1	20	$\overline{TRANSFER}$
A1A1DS7	21	LINE(10)-	A1J1	21	TIME BASE INPUT (1 MHz)
A1A1DS7	22	LINE(9)-	A1J1	22	TIME BASE SELECT "A"
A1A1DS7	23	LINE(8)-	A1J1	23	TIME BASE SELECT "B"
A1A1DS7	24	LINE(7)-	A1J1	24	TIME BASE SELECT "C"
A1A1DS7	25	LINE(1)-	A1J1	25	+22V
A1A1DS7	26	LINE(2)-	A1J1	26	+17V
A1A1DS7	27	LINE(3)-	A1J1	27	$\overline{HZ}$
A1A1DS7	28	NC	A1J1	28	$\overline{M}$
A1A1DS7	29	LINE(6)-	A1J1	29	$\overline{S}$
A1A1DS7	30	LINE(4)-	A1J1	30	$\overline{K}$
A1A1DS7	31	LINE(5)-	A1J1	31	$\overline{U}$
A1A1DS7	32	NC	A1J1	32	$\overline{MAN\ RESET}$
A1A1DS7	33	NC	A1J1	33	$\overline{DP(1)}$-
A1A1DS7	34	NC	A1J1	34	$\overline{DP(2)}$-
A1A1DS7	35	NC	A1J1	35	RIGHT/LEFT
A1A1DS7	36	NC	A1J1	36	DIGIT ADDRESS "X"
A1A1DS7	37	NC	A1J1	37	DIGIT SELECT "X"
A1A1DS7	38	$\overline{DP(6)}$ (not used)	A1J1	38	DIGIT ADDRESS "Y"
A1A1DS7	39	NC			
A1A1DS7	40	NC			

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Table 8-1. Reference Designation/Signal Name List (Continued)

REFERENCE DESIG.	PIN NO.	SIGNAL NAME
A1J1	39	DIGIT SELECT "Y"
A1J1	40	DIGIT ADDRESS "Z"
A1J1	41	DIGIT SELECT "Z"
A1J1	42	DATA "D"
A1J1	43	DATA "C"
A1J1	44	DATA "B"
A1J1	45	DATA "A"
A1J1	46	$\overline{DP(3)}$-
A1J1	47	$\overline{DP(4)}$-
A1J1	48	$\overline{DP(5)}$-
A1J1	49	GND
A1J1	50	DC IN (BATTERY/EXT)
A1U1	1 *	COLUMN (5R)+
A1U1	2 *	COLUMN(4L)+
A1U1	3 *	COLUMN(4R)+
A1U1	4 *	COLUMN(3L)+
A1U1	5 *	COLUMN(3R)+
A1U1	6 *	COLUMN(2L)+
A1U1	7 *	COLUMN(2R)+
A1U1	8 *	COLUMN(1L)+
A1U1	9 *	COLUMN(1R)+
A1U1	10 *	COLUMN (0L)+
A1U1	11 *	COLUMN(0R)+
A1U1	12	+5V
A1U1	13	TIMING CAPACITOR
A1U1	14 *	RIGHT/LEFT
A1U1	15 *	DIGIT ADDRESS "X"
A1U1	16 *	DIGIT ADDRESS "Y"
A1U1	17 *	DIGIT ADDRESS "Z"
A1U1	18	NC
A1U1	19	GND
A1U1	20 *	COLUMN(5L)+
A1U2	1 *	LINE(10)-
A1U2	2 *	LINE (9)-
A1U2	3	GND
A1U2	4 *	LINE(7)-
A1U2	5 *	LINE(1)-
A1U2	6 *	LINE(2)-
A1U2	7 *	LINE(3)-
A1U2	8	GND
A1U2	9 *	LINE(5)-
A1U2	10 *	LINE(4)-
A1U2	11 *	LINE(6)-
A1U2	12	BRIGHTNESS
A1U2	13	GND
A1U2	14	DATA "B"
A1U2	15	DATA "C"
A1U2	16	DATA "D"
A1U2	17	DATA "A"
A1U2	18	RIGHT/LEFT
A1U2	19	+5V
A1U2	20 *	LINE(8)-
A1U3	1 *	DATA "C"
A1U3	2 *	DATA "D"
A1U3	3	GND
A1U3	4	$\overline{TRANSFER}$
A1U3	5	-15V
A1U3	6 *	$\overline{"9"}$
A1U3	7 *	OVERFLOW
A1U3	8	DIGIT SELECT "Z"
A1U3	9	DIGIT SELECT "Y"
A1U3	10	DIGIT SELECT "X"
A1U3	11	RESET
A1U3	12	-5V
A1U3	13	+5V
A1U3	14	COUNTER INPUT
A1U3	15 *	DATA "A"
A1U3	16 *	DATA "B"
A1U4	1 *	$\overline{LOG\ OUTPUT}$
A1U4	2	NC
A1U4	3	TIME BASE INPUT (1 MHz)
A1U4	4	-5V
A1U4	5	+5V
A1U4	6	TIME BASE INPUT (10 MHz)
A1U4	7	TIME BASE SELECT "A"

*Asterisk indicates source of signal.

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Table 8-1. Reference Designation/Signal Name List (Continued)

REFERENCE DESIG.	PIN NO.	SIGNAL NAME
A1U4	8	TIME BASE SELECT "B"
A1U4	9	TIME BASE SELECT "C"
A1U4	10	+5V
A1U4	11 *	TIME BASE OUTPUT
A1U4	12	NC
A1U4	13	NC
A1U4	14	RESET
A1U4	15	NC
A1U4	16	-15V
A1U5	1	GND
A1U5	2	"9"
A1U5	3	$\overline{\text{MAX TIME}}$
A1U5	4	F1
A1U5	5 *	COUNTER INPUT
A1U5	6	$\overline{\text{HOLD}}$
A1U5	7	$\overline{\text{MAN RESET}}$
A1U5	8 *	RESET
A1U5	9	SAMPLE RATE CONTROL
A1U5	10	+5V
A1U5	11 *	$\overline{\text{TRANSFER}}$
A1U5	12 *	$\overline{\text{EXP}}$
A1U5	13 *	$\overline{\text{MGFF}}$
A1U5	14	$\overline{\text{LOG OUTPUT}}$
A1U5	15	$\overline{\text{CLOSE}}$
A1U5	16	$\overline{\text{OPEN}}$
A1U5	17 *	$\overline{\text{INHIBIT}}$
A1U5	18	F2
A1U5	19	NC
A1U5	20 *	TIME BASE INPUT (10 MHz)

*Asterisk indicates source of signal.

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Table 8-2. Signal Name/Reference Designation List

SIGNAL NAME	REFERENCE DESIG.	PIN NO.
+17V	A1J1	26
+22V	A1J1	25
+5V	A1J1	1
+5V	A1U1	12
+5V	A1U2	19
+5V	A1U3	13
+5V	A1U4	5
+5V	A1U4	10
+5V	A1U5	10
-15V	A1U3	5
-15V	A1U4	16
-17V	A1J1	3
-5V	A1J1	2
-5V	A1U3	12
-5V	A1U4	4
$\overline{\text{"9"}}$	A1J1	6
$\overline{\text{"9"}}$	A1U3	6 *
$\overline{\text{"9"}}$	A1U5	2
BRIGHTNESS	A1U2	12
CLOCK	A1J1	16
$\overline{\text{CLOSE}}$	A1J1	10
$\overline{\text{CLOSE}}$	A1U5	15
COLUMN(0L)+	A1U1	10 *
COLUMN(0L)+	A1A1DS7	19
COLUMN(0R)+	A1U1	11 *
COLUMN(0R)+	A1A1DS7	20
COLUMN(1L)+	A1U1	8
COLUMN(1L)+	A1A1DS7	15
COLUMN(1R)+	A1U1	9 *
COLUMN(1R)+	A1A1DS7	16
COLUMN(2L)+	A1U1	6 *
COLUMN(2L)+	A1A1DS7	12
COLUMN(2R)+	A1U1	7 *
COLUMN(2R)+	A1A1DS7	13
COLUMN(3L)+	A1U1	4 *
COLUMN(3L)+	A1A1DS7	9
COLUMN(3R)+	A1U1	5 *
COLUMN(3R)+	A1A1DS7	10
COLUMN(4L)+	A1U1	2 *
COLUMN(4L)+	A1A1DS7	6
COLUMN(4R)+	A1U1	3 *
COLUMN(4R)+	A1A1DS7	7
COLUMN(5L)+	A1U1	20 *
COLUMN(5L)+	A1A1DS7	3
COLUMN(5R)+	A1U1	1 *
COLUMN(5R)+	A1A1DS7	4
COUNTER INPUT	A1U3	14
COUNTER INPUT	A1U5	5 *
DATA "A"	A1J1	45
DATA "A"	A1U2	17
DATA "A"	A1U3	15 *
DATA "B"	A1J1	42
DATA "B"	A1U2	14
DATA "B"	A1U3	16 *
DATA "C"	A1J1	43
DATA "C"	A1U2	15
DATA "C"	A1U3	1 *
DATA "D"	A1J1	44
DATA "D"	A1U2	16
DATA "D"	A1U3	2 *
DC IN (BATTERY/EXT)	A1J1	50
DIGIT ADDRESS "X"	A1U1	15
DIGIT ADDRESS "X"	A1J1	36
DIGIT ADDRESS "Y"	A1U1	16
DIGIT ADDRESS "Y"	A1J1	38
DIGIT ADDRESS "Z"	A1U1	17
DIGIT ADDRESS "Z"	A1J1	40
DIGIT SELECT "X"	A1J1	37
DIGIT SELECT "X"	A1U3	10
DIGIT SELECT "Y"	A1J1	39
DIGIT SELECT "Y"	A1U3	9
DIGIT SELECT "Z"	A1J1	41
DIGIT SELECT "Z"	A1U3	8
DP COMMON +	A1A1DS7	17
$\overline{\text{DP(1)}}$-	A1J1	33
$\overline{\text{DP(1)}}$-	A1A1DS7	18
$\overline{\text{DP(2)}}$-	A1J1	34
$\overline{\text{DP(2)}}$-	A1A1DS7	14
$\overline{\text{DP(3)}}$-	A1J1	46

*Asterisk indicates sources of signal.

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Table 8-2. Signal Name/Reference Designation List (Continued)

SIGNAL NAME	REFERENCE DESIG.	PIN NO.
$\overline{DP(3)}$ -	A1A1DS7	11
$\overline{DP(4)}$ -	A1J1	47
$\overline{DP(4)}$ -	A1A1DS7	8
$\overline{DP(5)}$ -	A1J1	48
$\overline{DP(5)}$ -	A1A1DS7	5
$\overline{DP(6)}$ (not used)	A1A1DS7	38
$\overline{EXP}$	A1J1	13
$\overline{EXP}$	A1U5	12 *
F1	A1J1	5
F1	A1U5	4
F2	A1J1	7
F2	A1U5	18
GND	A1J1	4
GND	A1U1	19
GND	A1J1	49
GND	A1U2	3
GND	A1U2	13
GND	A1U2	8
GND	A1U3	3
GND	A1U5	1
$\overline{HOLD}$	A1U5	6
$\overline{HOLD}$	A1J2	B7
$\overline{HZ}$	A1J1	27
$\overline{HZ}$	A1J2	B9
$\overline{INHIBIT}$	A1J1	8
$\overline{INHIBIT}$	A1U5	17 *
$\overline{K}$	A1J1	30
$\overline{K}$	A1J2	A8
LINE(1) -	A1U2	5 *
LINE(1) -	A1A1DS7	25
LINE(2) -	A1U2	6 *
LINE(2) -	A1A1DS7	26
LINE(3) -	A1U2	7 *
LINE(3) -	A1A1DS7	27
LINE(4) -	A1U2	10 *
LINE(4) -	A1A1DS7	30
LINE(5) -	A1U2	11 *
LINE(5) -	A1A1DS7	31
LINE(6) -	A1U2	9 *
LINE(6) -	A1A1DS7	29
LINE(7) -	A1U2	4 *
LINE(7) -	A1A1DS7	24
LINE(8) -	A1U2	20 *
LINE(8) -	A1A1DS7	23
LINE(9) -	A1U2	2 *
LINE(9) -	A1A1DS7	22
LINE(10) -	A1U2	1 *
LINE(10) -	A1A1DS7	21
$\overline{LOG\ OUTPUT}$	A1J1	11
$\overline{LOG\ OUTPUT}$	A1U4	1
$\overline{LOG\ OUTPUT}$	A1U5	13
$\overline{M}$	A1J1	28
$\overline{M}$	A1J2	A9
$\overline{MAN\ RESET}$	A1J1	32
$\overline{MAN\ RESET}$	A1J2	A7
$\overline{MAN\ RESET}$	A1U5	7
$\overline{MAX\ TIME}$	A1J1	17
$\overline{MAX\ TIME}$	A1U5	3
MGFF	A1J1	12
MGFF	A1U5	14*
NC	A1J1	14
NC	A1U1	18
NC	A1A1DS7	1
NC	A1A1DS7	2
NC	A1A1DS7	28
NC	A1A1DS7	32
NC	A1A1DS7	33
NC	A1A1DS7	34
NC	A1A1DS7	35
NC	A1A1DS7	36
NC	A1A1DS7	37
NC	A1A1DS7	39
NC	A1A1DS7	40
NC	A1U4	2
NC	A1U4	12
NC	A1U4	13
NC	A1U4	15
NC	A1U5	19
$\overline{OPEN}$	A1J1	9
$\overline{OPEN}$	A1U5	16
OVERFLOW	A1U3	7 *
OVERFLOW	A1J2	B2
$\overline{PRINT}$	A1J1	19
$\overline{PRINT}$	A1J2	A5
RESET	A1J1	15

*Asterisk indicates sources of signal.

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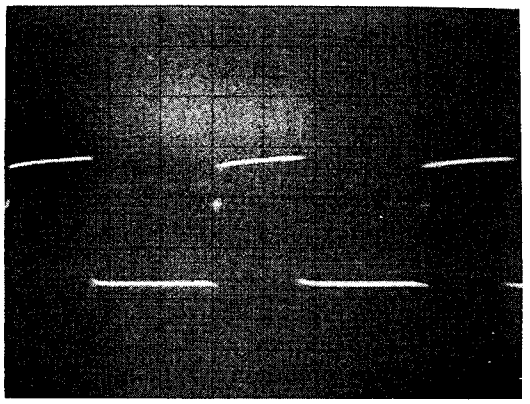
Table 8-2. Signal Name/Reference Designation List (Continued)

SIGNAL NAME	REFERENCE DESIG.	PIN NO.
RESET	A1U2	18
RESET	A1U3	11
RESET	A1U4	14
RESET	A1U5	8 *
RIGHT/LEFT	A1U1	14 *
RIGHT/LEFT	A1J1	35
$\overline{S}$	A1J1	29
$\overline{S}$	A1J2	B8
SAMPLE RATE CONTROL	A1U5	9
TIME BASE INPUT (1 MHz)	A1J1	21
TIME BASE INPUT (1 MHz)	A1U4	3
TIME BASE INPUT (10 MHz)	A1U4	6
TIME BASE INPUT (10 MHz)	A1U5	20 *
TIME BASE OUTPUT	A1J1	18
TIME BASE OUTPUT	A1U4	11 *
TIME BASE SELECT "A"	A1J1	22
TIME BASE SELECT "A"	A1U4	7
TIME BASE SELECT "B"	A1J1	23
TIME BASE SELECT "B"	A1U4	8
TIME BASE SELECT "C"	A1J1	24
TIME BASE SELECT "C"	A1U4	9
TIMING CAPACITOR	A1U1	13
$\overline{\text{TRANSFER}}$	A1J1	20
$\overline{\text{TRANSFER}}$	A1U3	4
$\overline{\text{TRANSFER}}$	A1U5	11 *
$\overline{\mu}$	A1J1	31
$\overline{\mu}$	A1J2	B6

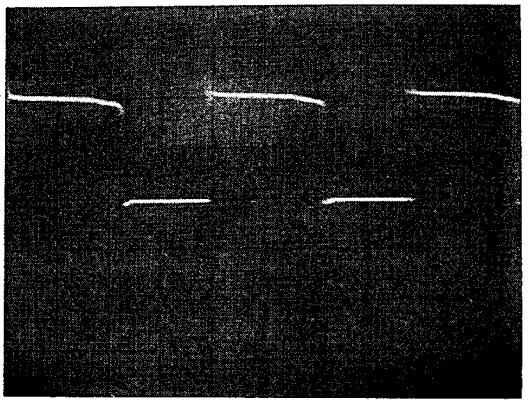
*Asterisk indicates sources of signal.

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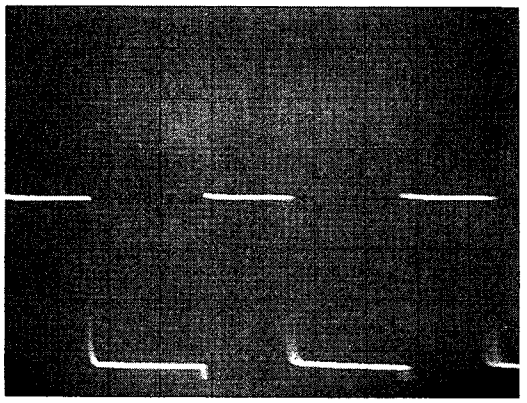
Part of Figure 8-2. 5300A Measuring System A1, A1A1, A2, A3



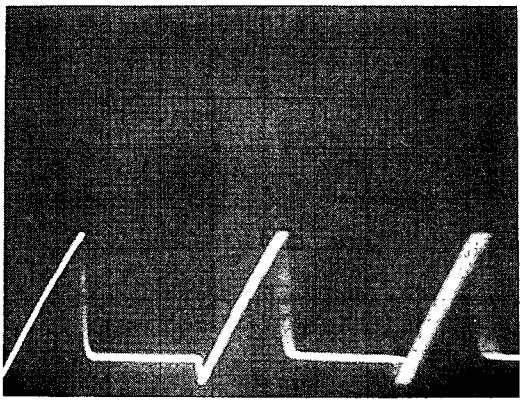
1



2



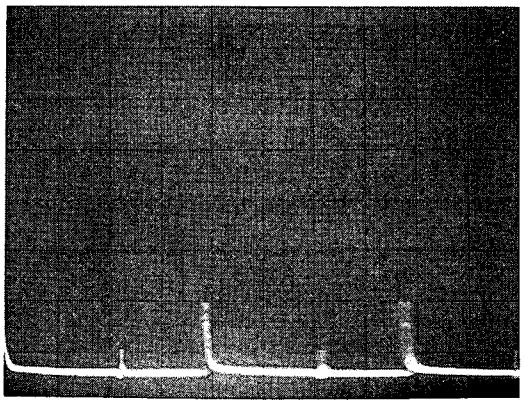
3



4

Oscilloscope: All waveforms dc coupled (except where noted) through 10:1 divider probe; + Slope, INT Triggering.

5300A: Separated from any plug-on; Diagnostic Test Card B, Test 7 (HP Part No. 05300-20012) installed or "Alternate Method" Test No. 7, hard-wired.



5

Oscilloscope settings with 10:1 divider probe:

No. 1. .1V/cm, 10 μsec/cm

No. 2. 2V/cm, 10 μsec/cm

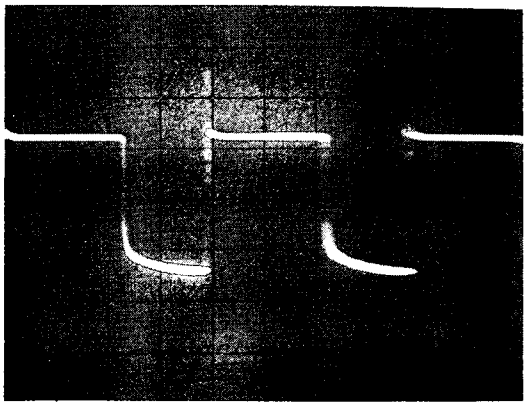
No. 3. .5V/cm, 10 μsec/cm

No. 4. .5V/cm, 10 μsec/cm

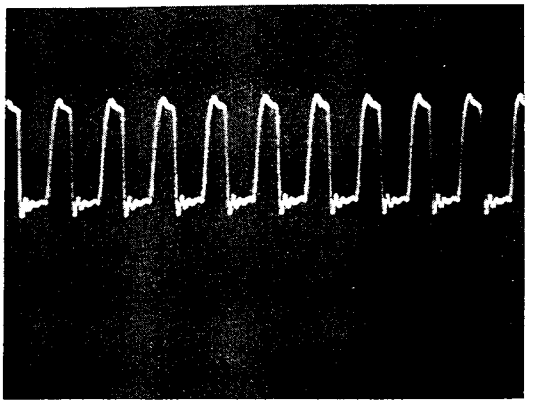
No. 5. .5V/cm, 10 μsec/cm

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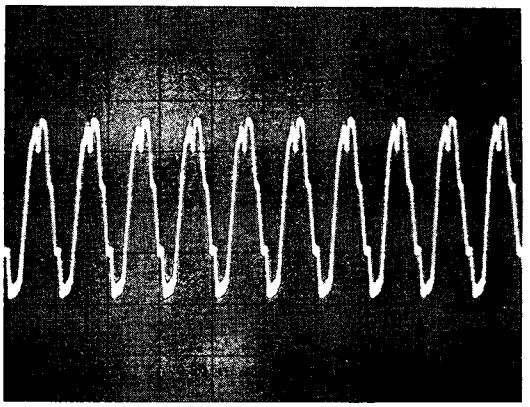
Part of Figure 8-2. 5300A Measuring System A1, A1A1, A2, A3



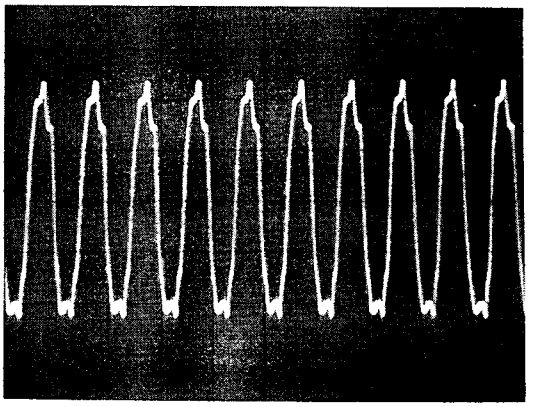
6



7



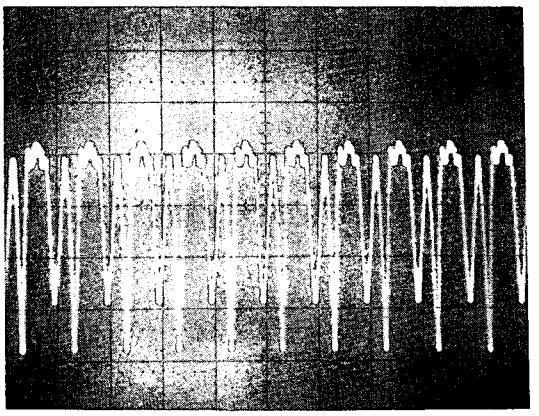
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9

Oscilloscope: All waveforms dc coupled (except where noted) through 10:1 divider probe; + Slope, INT Triggering.

5300A: Separated from any plug-on; Diagnostic Test Card B, Test 7 (HP Part No. 05300-20012) installed or "Alternate Method" Test No. 7, hard-wired.



10

Oscilloscope settings with 10:1 divider probe:

No. 6. .1V/cm, 10 μsec/cm

No. 7. .2V/cm, .1 μsec/cm

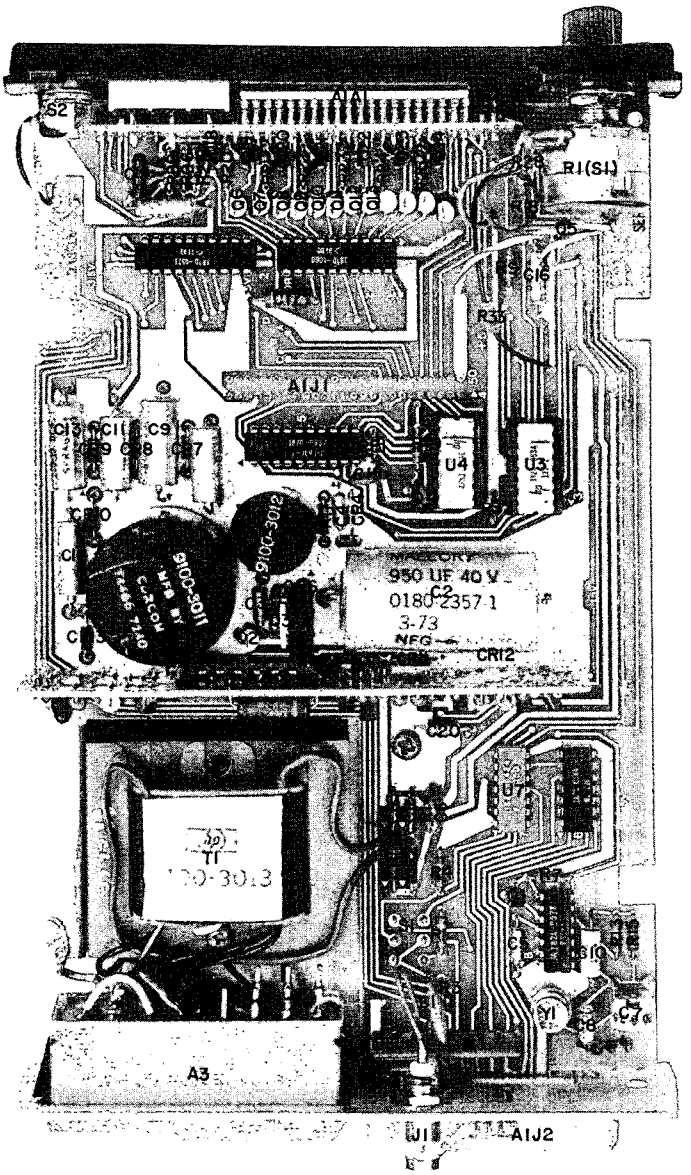
No. 8. .02V/cm, .1 μsec/cm ac coupled

No. 9. .02V/cm, .1 μsec/cm ac coupled

No. 10. .02V/cm, .1 μsec/cm ac coupled

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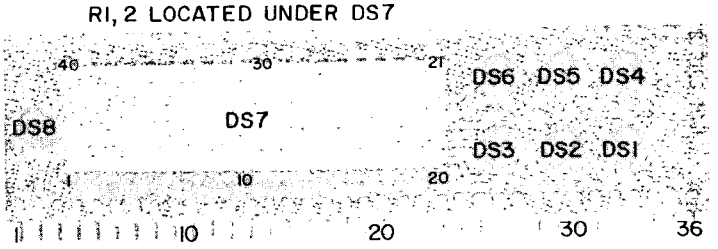
Part of Figure 8-2. 5300A Measuring System A1, A1A1, A2, A3



R2,5,6,8,10,12,16,30
LOCATED IN E1

A1

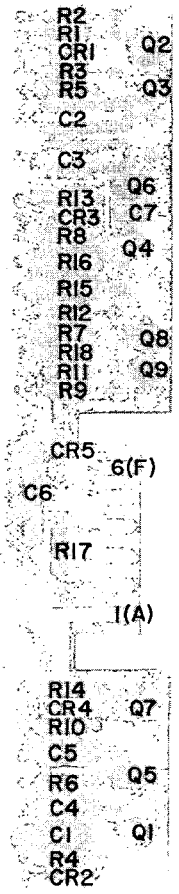
RI, 2 LOCATED UNDER DS7



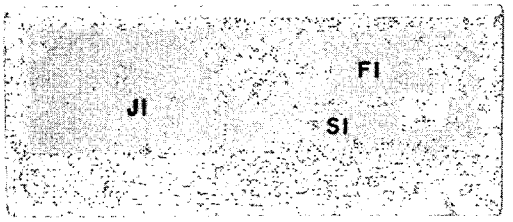
A1A1

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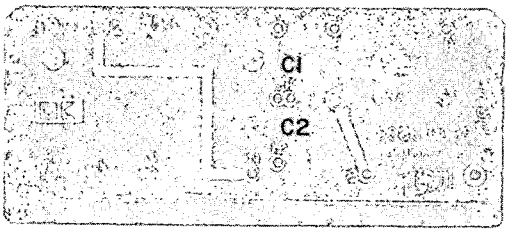
Part of Figure 8-2. 5300A Measuring System A1, A1A1, A2, A3



A2



A3 (FRONT)



A3 (REAR)

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS;
3. DISPLAY CONNECTIONS ARE FROM REAR CIRCUIT SIDE
4. AN ASTERISK (*) INDICATES A FACTORY SELECTED COMPONENT. A1R31 AND A1R32 MAY NOT BE SUPPLIED ON SOME UNITS.

REFERENCE DESIGNATIONS

NO PREFIX	A1	A1A1	A2	A3
	C1-20 CR1-13 E1	DS1-8	C1-7 CR1-5	C1,2 F1
J1	J1,2 Q1-24		Q1-9	J1
R1 S1,2 T1	R1-32 S1 T1,2	R1,2	R1-18	S1
W1	U1-8 Y1			

5300-D-1

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBER
A1	
CR1-4,7-10,13	1901-0028
CR5	1901-0050
CR6	1902-3381
CR11	1902-3205
CR12	1902-1259
Q1	1854-0094
Q2,6-17	1854-0492
Q3	1854-0487
Q4	1853-0020
Q5,18-24	1854-0071
U1	1820-1060
U2	1820-0571
U3	1820-0634
U4	1820-0633
U5	1820-0632
U6	1820-0584
U7	1820-0424
U8	1820-0578
Y1	0410-0423
A1A1	
DS1-6,8	1990-0325
DS7	1990-0311
A2	
CR1	1902-0689
CR2,3,4	1901-0040
CR5	1901-0050
Q1,8	1853-0058
Q2,3	1853-0086
Q4	1853-0020
Q5	1855-0367
Q6	1884-0201
Q7	1854-0071
Q9	1854-0492

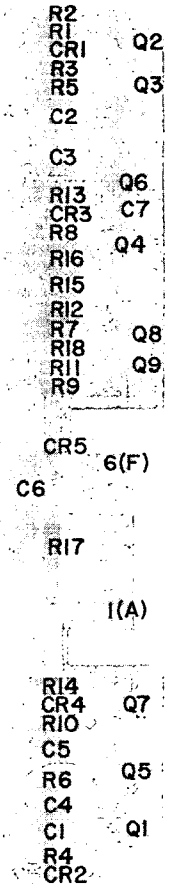
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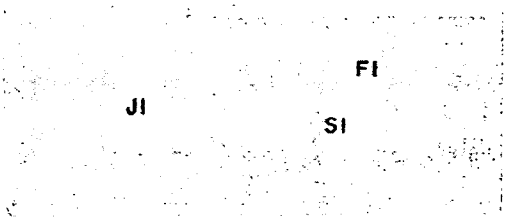
Figure 8-2
5300A MEASURING SYSTEM A1, A1A1, A2, A3

(See Page 8-13)

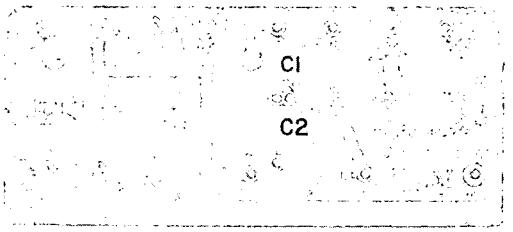
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Part of Figure 8-2. 5300A Measuring System A1, A1A1, A2, A3





A3 (FRONT)



A3 (REAR)

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS;
3. DISPLAY CONNECTIONS ARE FROM REAR CIRCUIT SIDE
4. AN ASTERISK (*) INDICATES A FACTORY SELECTED COMPONENT. A1R31 AND A1R32 MAY NOT BE SUPPLIED ON SOME UNITS.

REFERENCE DESIGNATIONS

NO PREFIX	A1	A1A1	A2	A3
	C1 - 20		C1 - 7	C1,2
	CR1 - 13		CR1 - 5	
		DS1 - 8		
	E1			
				F1
J1	J1,2			J1
	Q1 - 24		Q1 - 9	
R1	R1 - 32	R1,2	R1 - 18	
S1,2	S1			S1
T1	T1,2			
	U1 - 8			
W1				
	Y1			

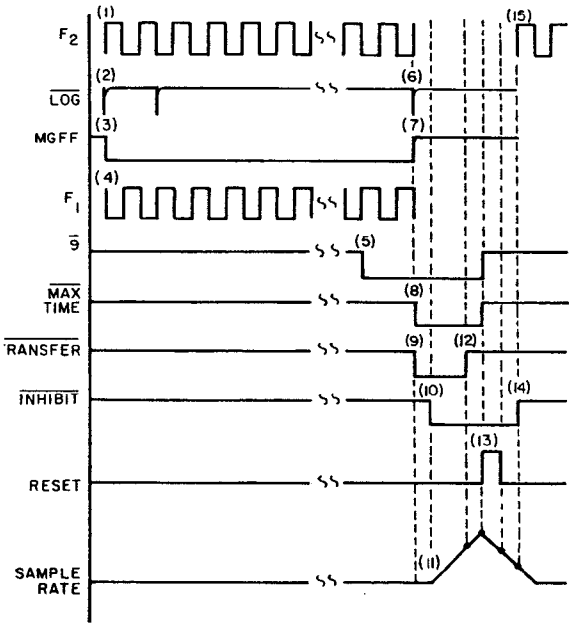
5300-D-1

TABLE OF ACTIVE COMPONENTS

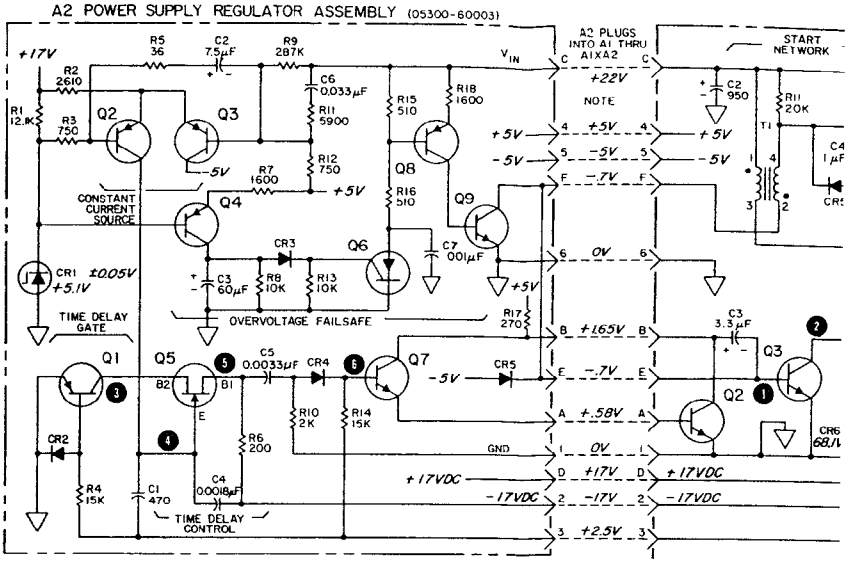
REFERENCE DESIGNATIONS	HP PART NUMBER
A1	
CR1-4,7-10,13	1901-0028
CR5	1901-0050
CR6	1902-3381
CR11	1902-3205
CR12	1902-1259
Q1	1854-0094
Q2,6-17	1854-0492
Q3	1854-0487
Q4	1853-0020
Q5,18-24	1854-0071
U1	1820-1060
U2	1820-0571
U3	1820-0634
U4	1820-0633
U5	1820-0632
U6	1820-0584
U7	1820-0424
U8	1820-0578
Y1	0410-0423
A1A1	
DS1-6,8	1990-0325
DS7	1990-0311
A2	
CR1	1902-0689
CR2,3,4	1901-0040
CR5	1901-0050
Q1,8	1853-0058
Q2,3	1853-0086
Q4	1853-0020
Q5	1855-0367
Q6	1884-0201
Q7	1854-0071
Q9	1854-0492

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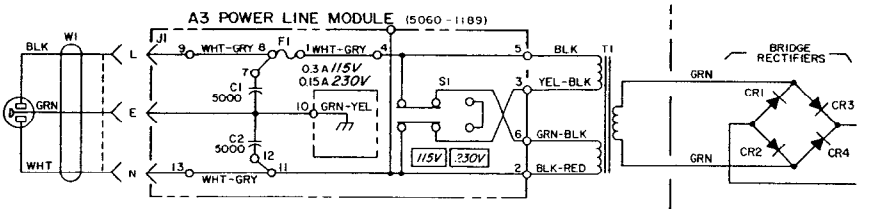
FREQUENCY AUTO TIMING

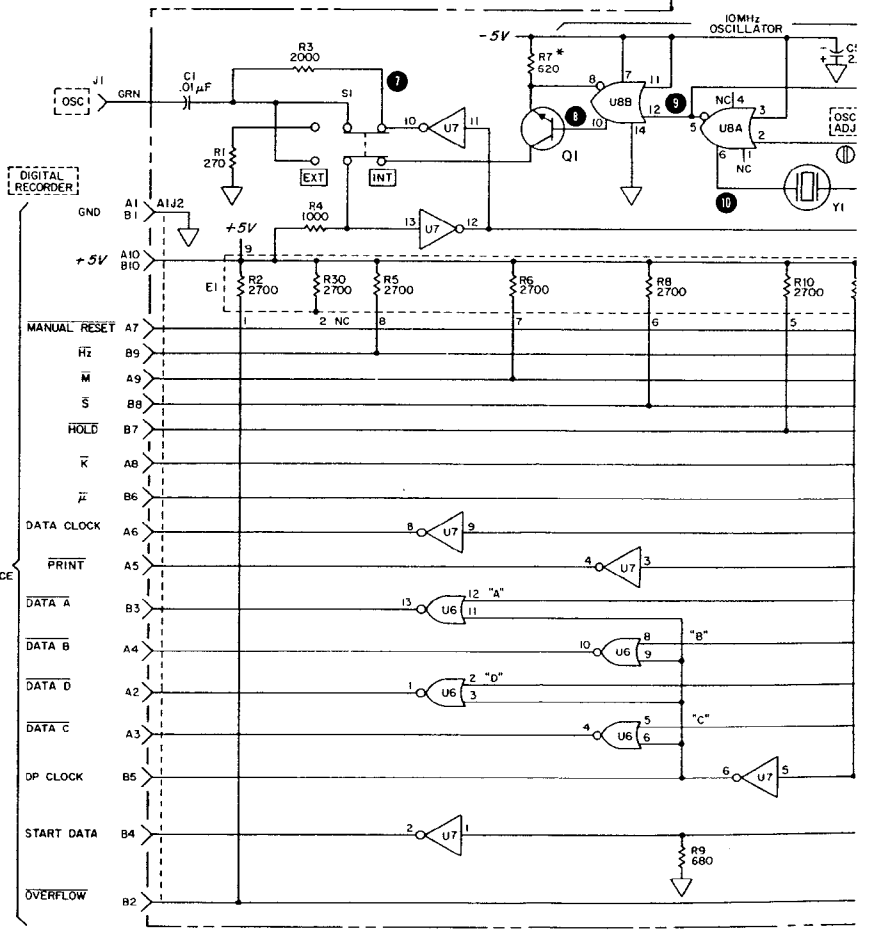


A2 POWER SUPPLY REGULATOR ASSEMBLY (05300-60003)

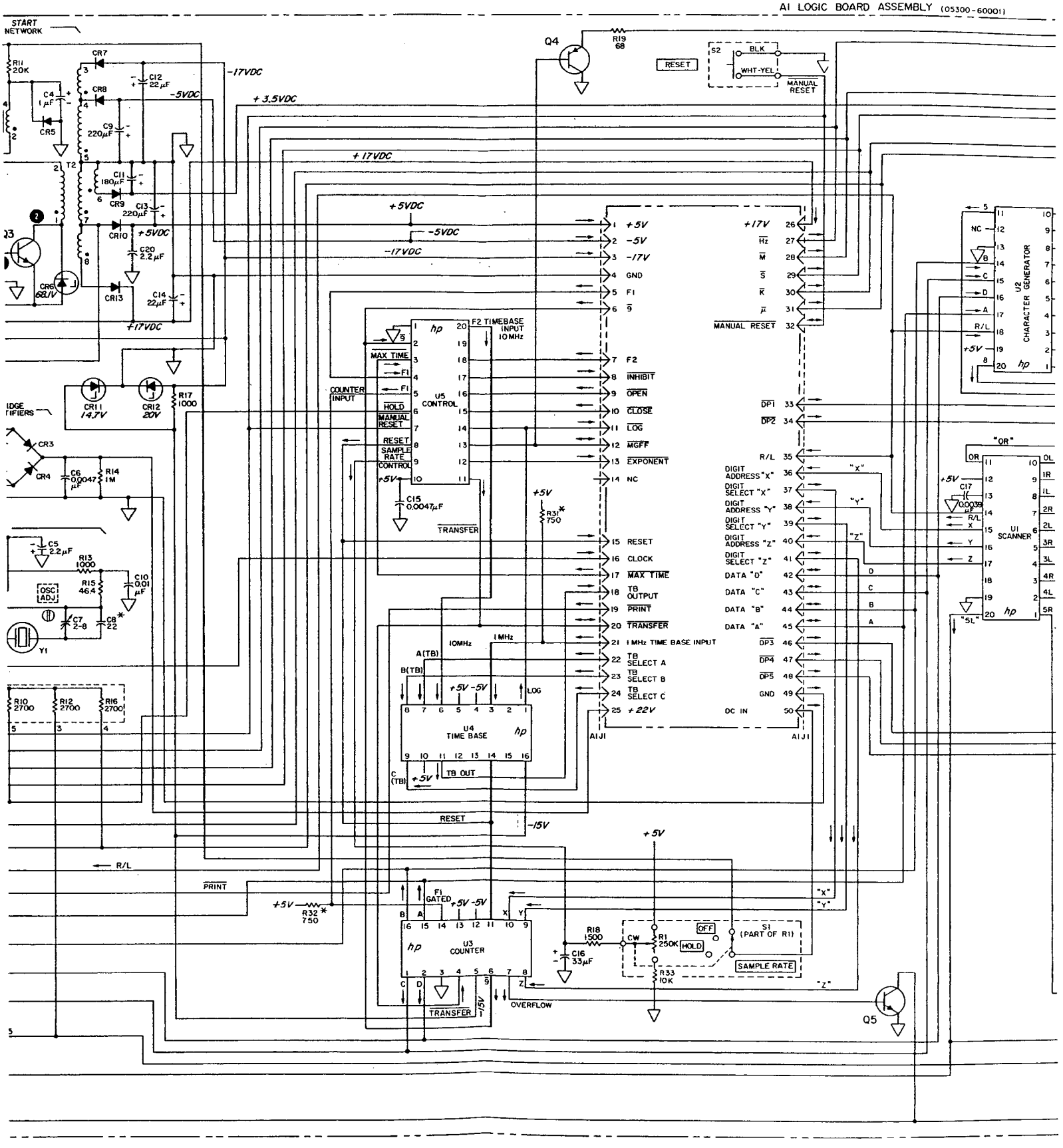


A3 POWER LINE MODULE (5060-1189)





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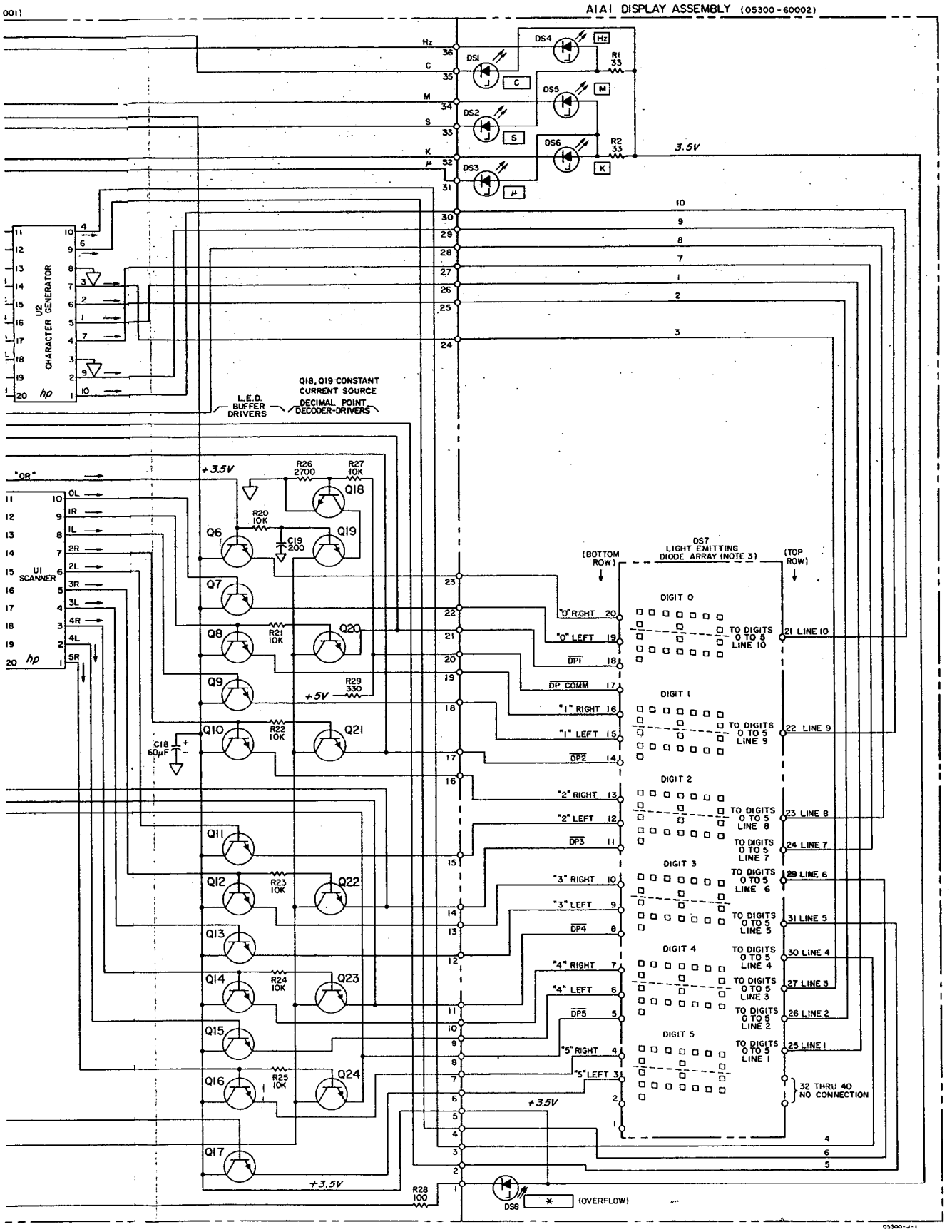


Figure 8-2
5300A Measuring System
A1, A1A1, A2, A3

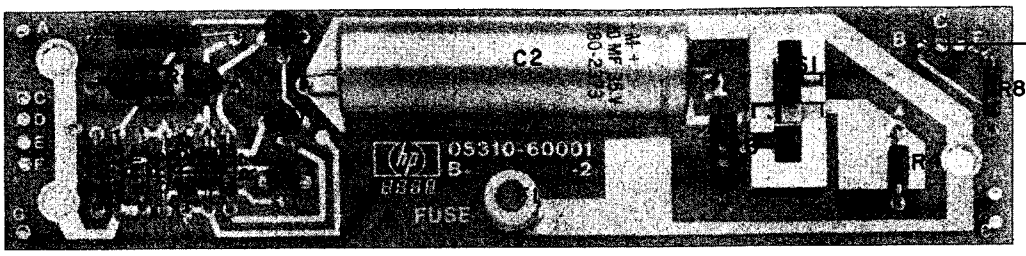
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Figure 8-3
5310A BATTERY PACK
(AVAILABLE AS ACCESSORY ONLY)

(See Page 8-15)

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A2



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;

REFERENCE DESIGNATIONS

NO PREFIX	A1	A2
BT1		C2
		CR1-4
DS1		F1
	J1	
	P1	
		Q1-2,4
		R1-8
		S1

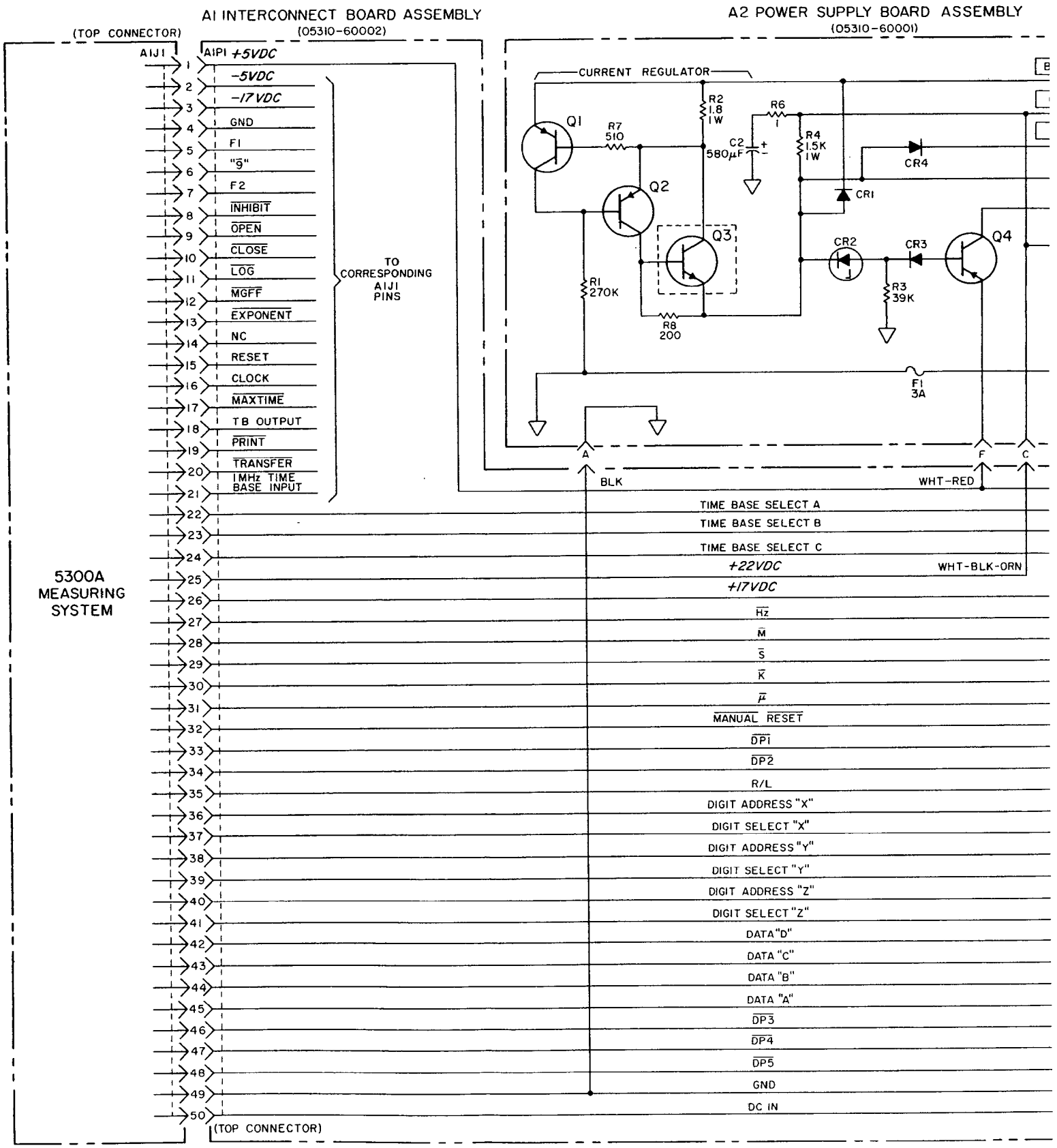
A2C1 DELETED
A2Q3 DELETED

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBER
NO PREFIX	
DS1	1990-0325
Q3	1854-0420
A2	
CR1,4	1901-0028
CR2	1902-0693
CR3	1901-0044
Q1,2,4	1853-0086

05310-D-1

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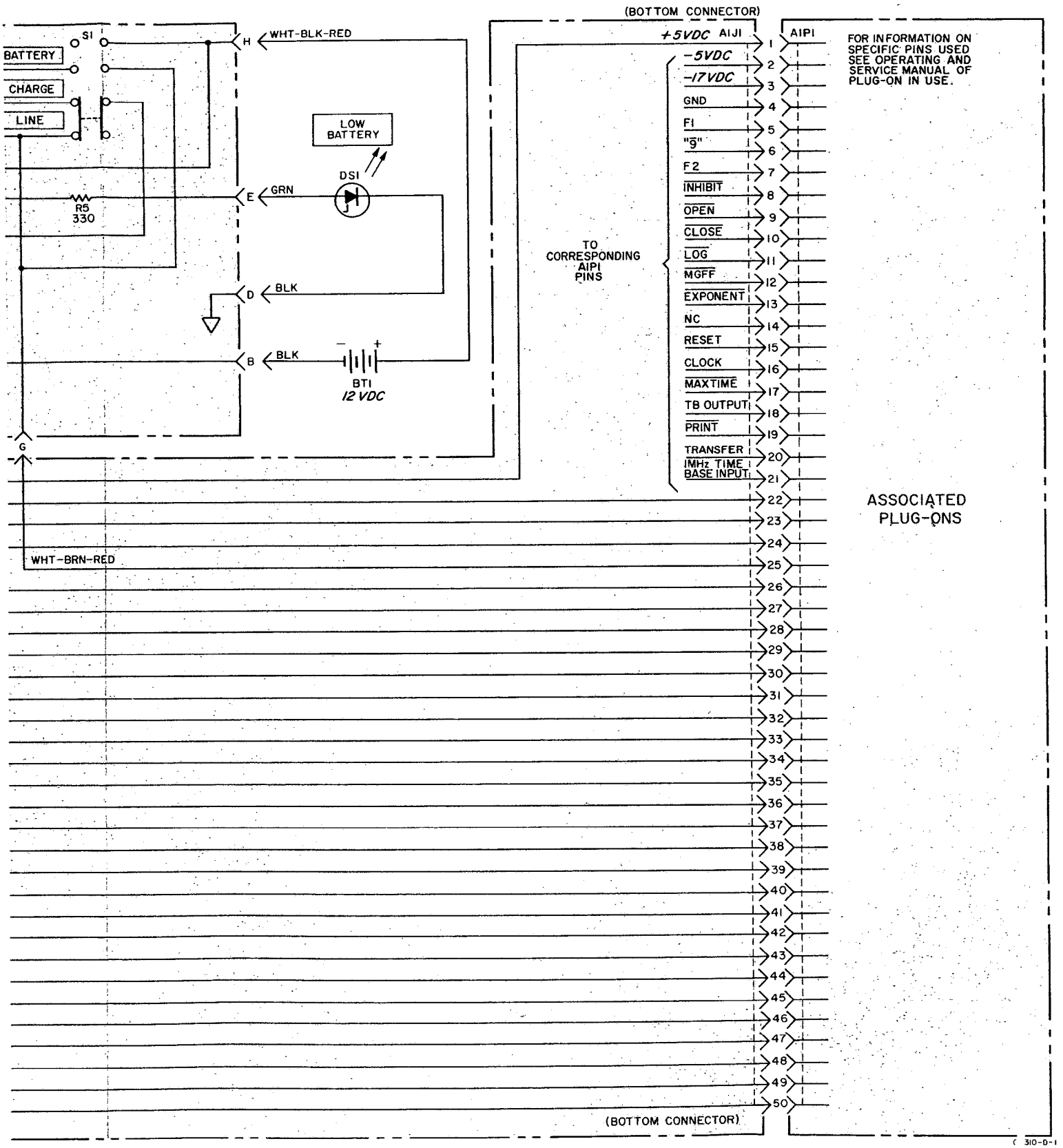


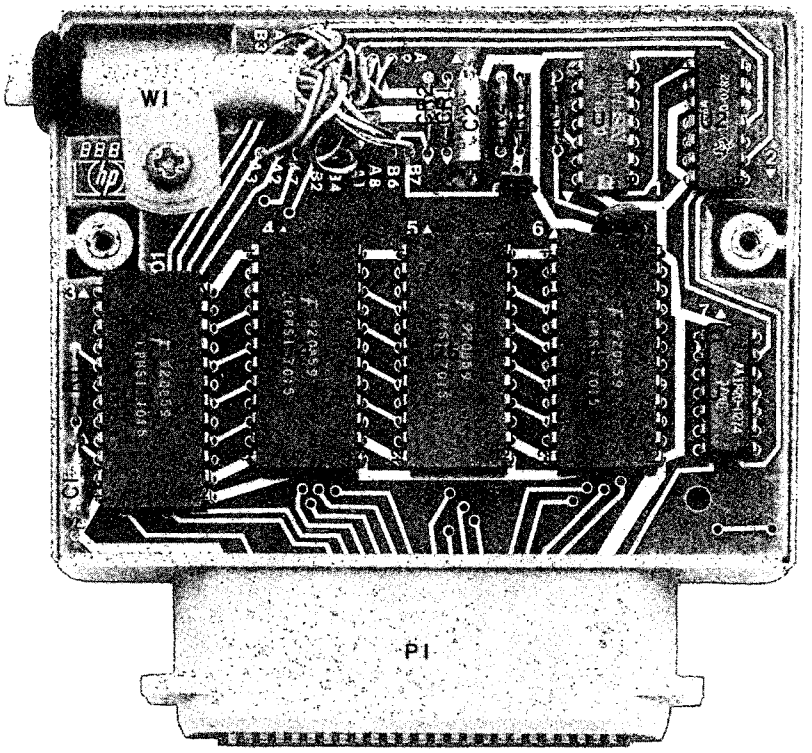
Figure 8-3
5310A Battery Pack
(Available as Accessory Only)

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Figure 8-4
10533A DIGITAL RECORDER INTERFACE
(AVAILABLE AS ACCESSORY ONLY)

(See Page 8-17)

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NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
3. TO BE USED WITH HP 5050B OPT 050, 051 AND 5055A RECORDERS
   DATA SWING = 3.8V TO 4V

TABLE OF ACTIVE COMPONENTS

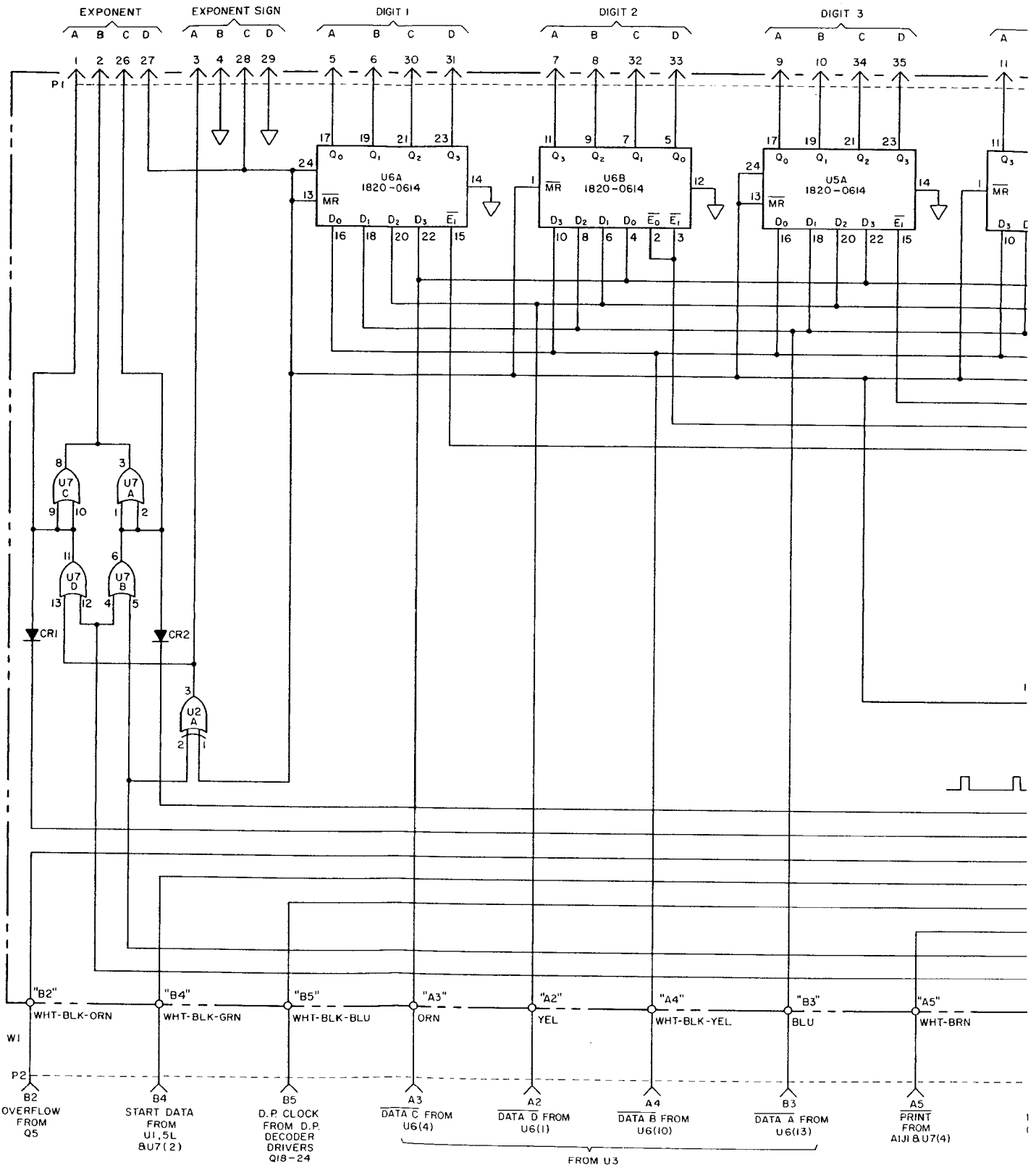
REFERENCE DESIGNATIONS	HP PART NUMBERS
A1	
CR1,2	1901-0050
Q1	1854-0094
U1	1820-0602
U2	1820-0282
U3,4,5,6	1820-0614
U7	1820-0274

10533-D-1

REFERENCE DESIGNATIONS

NO PREFIX	A1
	C1-3
	CR1,2
P2	P1
	Q1
R:	R1-4
	U1-7
W1	

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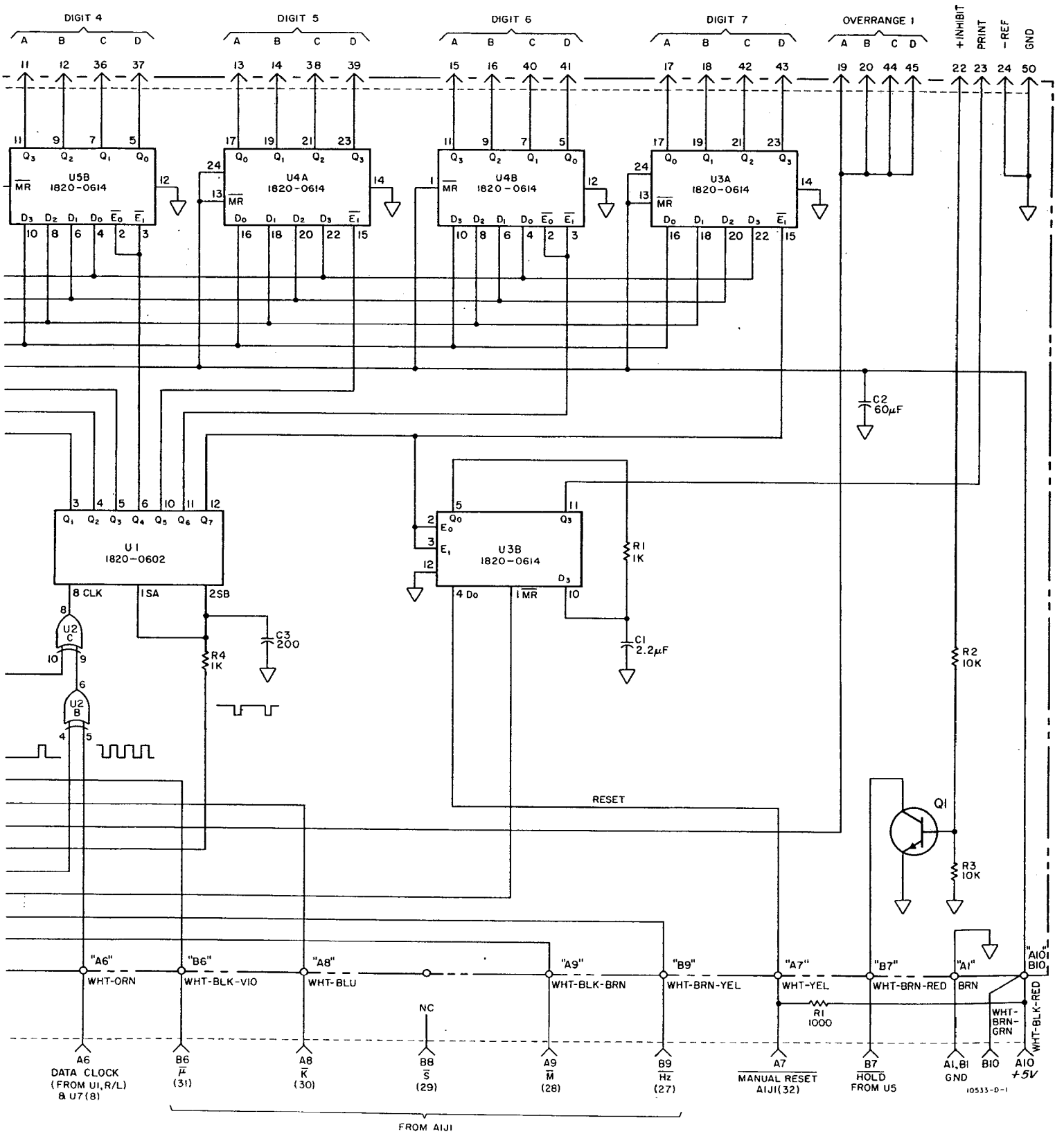


Figure 8-4
10533A Digital Recorder Interface
(Available as Accessory Only)

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