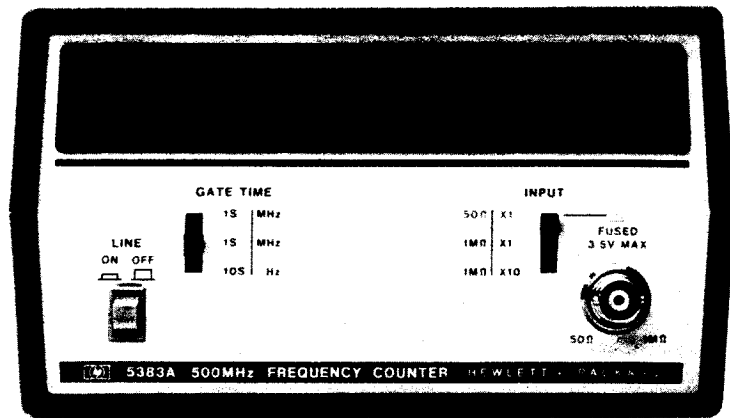


OPERATING AND SERVICE MANUAL

FREQUENCY COUNTER

5383A



HEWLETT  PACKARD

FREQUENCY COUNTER

5383A

OPERATING AND SERVICE MANUAL

SERIAL PREFIX: 1508A, 1516A

This manual applies directly to HP Model 5383A Frequency Counters having serial number prefixes 1508A and 1516A.

NEWER INSTRUMENTS

This manual, with enclosed "Manual Changes" sheet, applies to HP Model 5383A Frequency Counters having serial number prefixes as listed on the "Manual Changes" sheet.

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HEWLETT  PACKARD

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SAFETY CONSIDERATIONS

GENERAL

This is a Safety Class I instrument. This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring Apparatus," and has been supplied in safe condition.

OPERATION

BEFORE APPLYING POWER verify that the power transformer primary is matched to the available line voltage and the correct fuse is installed (see Section II, Paragraphs 2-8 through 2-10). Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.


SERVICE

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

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



This symbol: , which appears on the instrument in several places means: Read the instruction manual before operating the instrument. If the instrument is operated without reading the instructions, it may not operate correctly.

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This section of the manual gives a description of the instrument, information on instrument identification and available options, and complete specifications.

1-3. INSTRUMENT DESCRIPTION

1-4. The HP Model 5383A (see Figure 1-1) is a direct-counting frequency counter that has a range of 10 Hz to 512 MHz. Nine display digits provide a resolution of one Hz per second for inputs up to 512 MHz. Front panel controls allow a selection of gate times, input impedances, and attenuators. A rear panel connector and associated selector switch allow either an external time base oscillator input, or monitoring of the internal time base oscillator. When the optional temperature compensated crystal oscillator (TCXO) is installed, the rear panel connector serves only as a time base monitor. In addition, a rear panel power selector switch permits the 5383A Counter to operate with line voltages ranging from 90V to 252V (line frequency range: 48 to 440 Hz).

1-5. ACCESSORIES AND OPTIONS

1-6. Two accessories are available for mounting the 5383A counter onto the user's rack. The 10851A kit permits the mounting of a single counter, while the 10852A kit is used for mounting two counters in a side-by-side configuration. Refer to Section II for detailed rack mounting kit information.

1-7. Option 001 provides a more accurate and stable time base oscillator. This Temperature Compensated Crystal Oscillator (TCXO) installation modifies the rear panel so that the connector is used only as a MONITOR output. As a result, an external standard (i.e., time base) cannot be applied to the Option 001 counter.

1-8. INSTRUMENT IDENTIFICATION

1-9. Hewlett-Packard uses a 2-section, 10-character serial number (0000A00000) mounted on the rear panel to identify the instrument. The first four digits are the serial prefix and the last five digits refer to the specific instrument. The alphabetical character identifies the country of manufacture. If the serial prefix on your instrument differs from that listed on the title page of this manual, there are differences between the manual and your instrument. Any lower serial prefixes are documented separately in this manual, and higher serial prefixes are covered by a manual change sheet included with the manual.

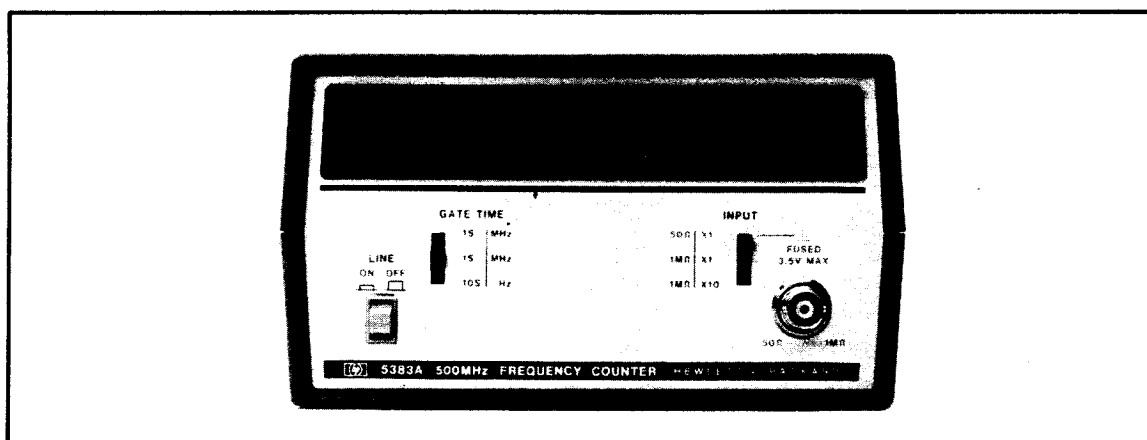


Figure 1-1. Model 5383A Frequency Counter

Model 5383A
General Information

1-10. The printed circuit boards within the instrument are identified by a 2-section, 10-digit part number (e.g., 05383-60001) and a 4-digit series number (e.g., "SERIES 1508"). The series number identifies the electrical characteristics of the complete printed-circuit assembly. A replacement circuit-board assembly may have a different series number than the assembly originally supplied with the instrument. Therefore, when troubleshooting a circuit-board assembly, ensure that the series number on the schematic diagram matches the series number on the board assembly. If the series number of the assembly is lower than the number on the schematic diagram in Section VIII, refer to backdating information in this manual for change information. If the series number on the assembly is higher than the number on the schematic diagram, the change information is provided in a manual change sheet which is available from the nearest Hewlett-Packard Sales and Service Office.

1-11. MICROFICHE NUMBER

1-12. On the title page of this manual, below the manual part number, is the microfiche part number. This number may be used to order 4 x 6 transparencies of the manual. The microfiche package also includes the latest Manual Change Supplements as well as all pertinent Service Notes.

1-13. RECOMMENDED TEST EQUIPMENT

1-14. Table 1-1 lists test equipment which is recommended for confirming instrument specifications (i.e., in-cabinet performance tests), as well as troubleshooting and adjusting the instrument.

Table 1-1. Recommended Test Equipment

Equipment Type	Required Characteristics	Suggested Model	Use*
Oscilloscope	50 MHz Bandwidth	HP 180A System	A,T
Test Oscillator	10 Hz to 10 MHz 50 mV Output	HP 651B	P,T
Signal Generator	10 MHz to 512 MHz 50 mV Output	HP 8654A	P,T
DVM	0-25V Range	HP 970A	T
Frequency Counter	High stability 10 MHz frequency standard	HP 5328A with Option 10 or HP 5345A	A,P
50 Ohm Feedthru Connector	50 Ohm Termination	HP 11048C	P,T
*A = Adjustments, P = Performance Test, T = Troubleshooting			

1-15. SPECIFICATIONS

1-16. Table 1-2 lists the 5383A specifications.

Table 1-2. Specifications

FREQUENCY RANGE: 10 Hz to 512 MHz

DISPLAY: 9-segmented (LED) digits

INPUT IMPEDANCE: Three selections:

50Ω X1 (nominal)

1MΩ X1 (<40 pf shunt)

1MΩ X10 (<40 pf shunt, attenuation factor of 10)

SENSITIVITY:

INPUT Switch Position	Frequency Range	Sensitivity (RMS)
50Ω X1	20 Hz to 100 MHz	25 mV
	100 MHz to 512 MHz	50 mV
1MΩ X1	10 Hz to 10 MHz	25 mV
	10 MHz to 50 MHz	50 mV

MAXIMUM INPUT:

INPUT Switch Position	Frequency Range	Maximum
50Ω X1 (Fuse protected)	20 Hz to 512 MHz	3.5V rms (+24 dBm)
1MΩ X1	10 Hz to 40 Hz	200V (Sum of dc + peak ac)
	40 Hz to 100 kHz	200V dc + 250V rms (ac)
	100 kHz to 5 MHz	200V dc + $\frac{2.5 \times 10^7 \text{V rms (ac)}}{\text{Freq. (in Hz)}}$
	5 MHz to 512 MHz	200V dc + 5V rms (ac)
1MΩ X10	10 Hz to 40 Hz	200V (Sum of dc + peak ac)
	40 Hz to 1 MHz	200V dc + 250V rms (ac)
	1 MHz to 50 MHz	200V dc + $\frac{2.5 \times 10^8 \text{V rms (ac)}}{\text{Freq. (in Hz)}}$
	50 MHz to 512 MHz	200V dc + 5V rms (ac)

ATTENUATION: X10 in 1MΩ

ACCURACY: ±1 Count ± Time Base Accuracy

GATE TIME: Manually selected .1 second, 1 second, 10 seconds

RESOLUTION:

GATE TIME	Least Significant Digit Value
.1s/MHz	10 Hz
1s/MHz	1.0 Hz
10s/Hz	0.1 Hz

*For example: The maximum signal level (when 1MΩ X1 input impedance is selected) for a 100 kHz input is:

$$100 \times 10^3 \left[\frac{2.5 \times 10^7}{100 \times 10^3} \right] = 250 \text{V (rms)} + 200 \text{V dc}$$

Table 1-2. Specifications (Continued)

TIMEBASE DATA:

Standard

Frequency: 10 MHz (Xtal Oscillator)

Accuracy: $<\pm 3$ ppm per month due to aging

$<\pm 2.5$ ppm due to temperature variations between 0°C and 40°C

$<\pm 0.5$ ppm due to $\pm 10\%$ line (power) variation

Rear Panel Ratio Input: 100 kHz to 10 MHz

External Frequency Standard Input (rear panel): 10 MHz

Sensitivity: 250 mV rms

Impedance: $>500\Omega$

Maximum Input: 10 Vrms

Monitor Output: Frequency: 10 MHz Timebase

Voltage: 200 mV peak-to-peak into 50Ω

Control: Active when the INT/EXT switch is the INT position.

Option 001

(Does not provide a rear panel external timebase input capability)

Frequency: 10 MHz (Temperature Compensated Xtal Oscillator)

Accuracy: $<\pm 0.1$ ppm per month due to aging

$<\pm 1$ ppm due to temperature variations between 0°C and 40°C

$<\pm 0.1$ ppm due to $\pm 10\%$ line (power) variation

OPERATING TEMPERATURE: 0°C to 40°C

POWER REQUIREMENTS: 100, 120, 220, and 240 Vrms; 48 Hz to 440 Hz, +5%, 10%;
20 VA max.

WEIGHT: Net: 2.2 kg (4.75 lb). Shipping: 2.7 kg (6 lb)

DIMENSIONS: 89 mm H x 159 mm W x 248 mm D (3.5 in H x 6.25 in. W x 9.75 in. D)

SECTION II INSTALLATION

2-1. INTRODUCTION

2-2. This section of the manual provides information about unpacking, inspecting, storing, and shipping the frequency counter.

2-3. UNPACKING AND INSPECTION

2-4. 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 switches, etc. If the instrument is damaged or fails to meet performance tests, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately. Performance check procedures are located in Section V, and Sales and Service Offices are listed at the back 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.

2-5. STORAGE AND SHIPMENT

2-6. 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.

2-7. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

- a. Maximum altitude: 25,000 ft.
- b. Minimum temperature: -40°F (-40°C).
- c. Maximum temperature: $+167^{\circ}\text{F}$ ($+75^{\circ}\text{C}$).

2-8. LINE VOLTAGE SELECTION

2-9. The counter is supplied from the factory with the LINE VOLTAGE SELECTOR switches set for 120-volt. If any other supply voltage is to be used, change the rear-panel switch settings as follows:

- a. Using a small screwdriver, a pencil, or other suitable tool, set the LINE VOLTAGE SELECTOR switches on the counter's rear panel to the positions shown next to the desired voltage marking on the rear panel.
- b. Ensure that the correct fuse is installed. Use a Listed, 0.250 ampere, slow-blow fuse for 100-volt or 120-volt operation or a Listed, 0.125 ampere, slow-blow fuse for 220-volt or 240-volt operation.

2-10. If the counter is to be used in the USA with a 240-volt, 60 Hz power source, use a power cord with a Listed connector of the type shown in Figure 2-1.

2-11. MOUNTING

2-12. The 5383A Frequency Counter is built to be portable, and may be used at any test bench position. Two kits are available for the user who desires to mount his counter on a rack. Kit 10851A permits one counter to be mounted in the center of a rack, while Kit 10852A allows the user to mount two counters, side-by-side on a rack. Figure 2-2 describes how to mount the counter onto the rack provided. Figure 2-3 shows these kits and provides a component parts list.

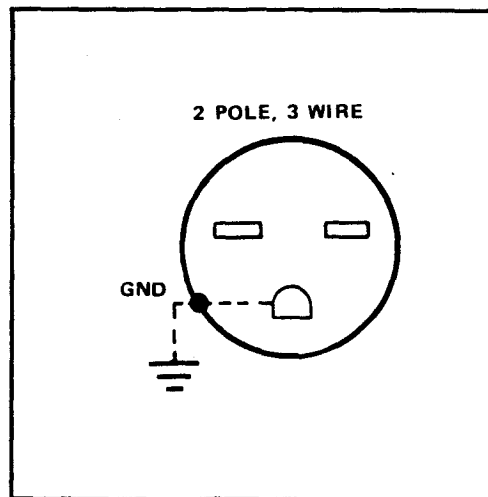


Figure 2-1. Power Cord Connector for 240-Volt Operation

1. REMOVE BOTH PLASTIC FEET FROM INSTRUMENT.
2. LOOSELY INSTALL STANDOFFS BETWEEN SCREW HOLES IN BRACKET.
3. PUSH INSTRUMENT THRU PROFILED CUTOUT IN BRACKET.
4. TIGHTEN CLAMPING SCREWS.

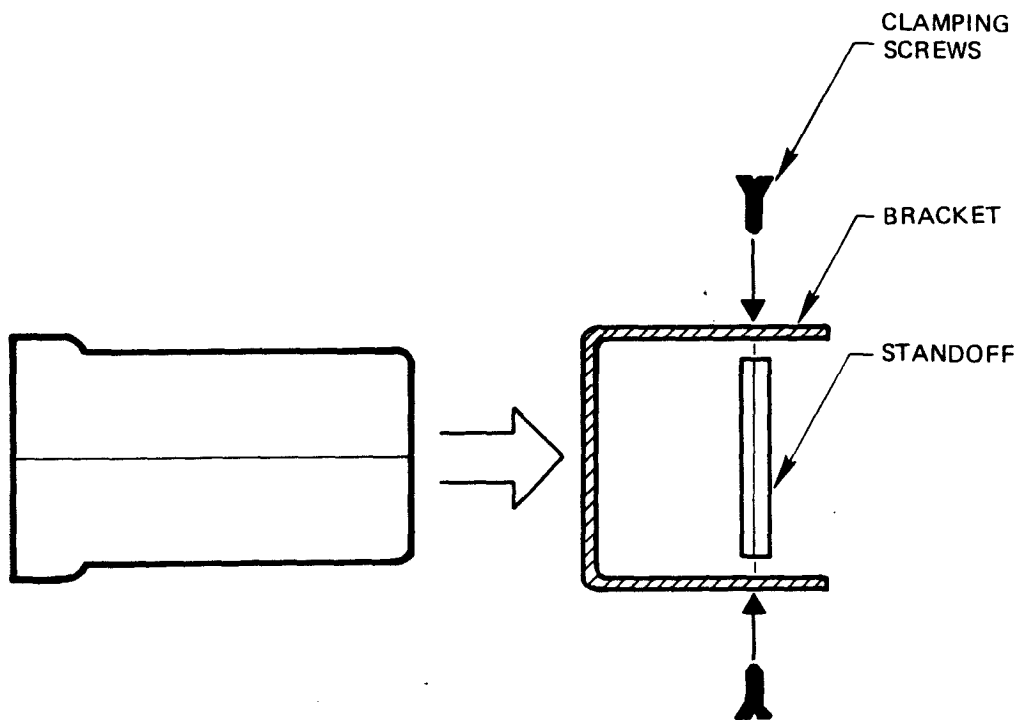


Figure 2-2. Rack Mounting Instructions

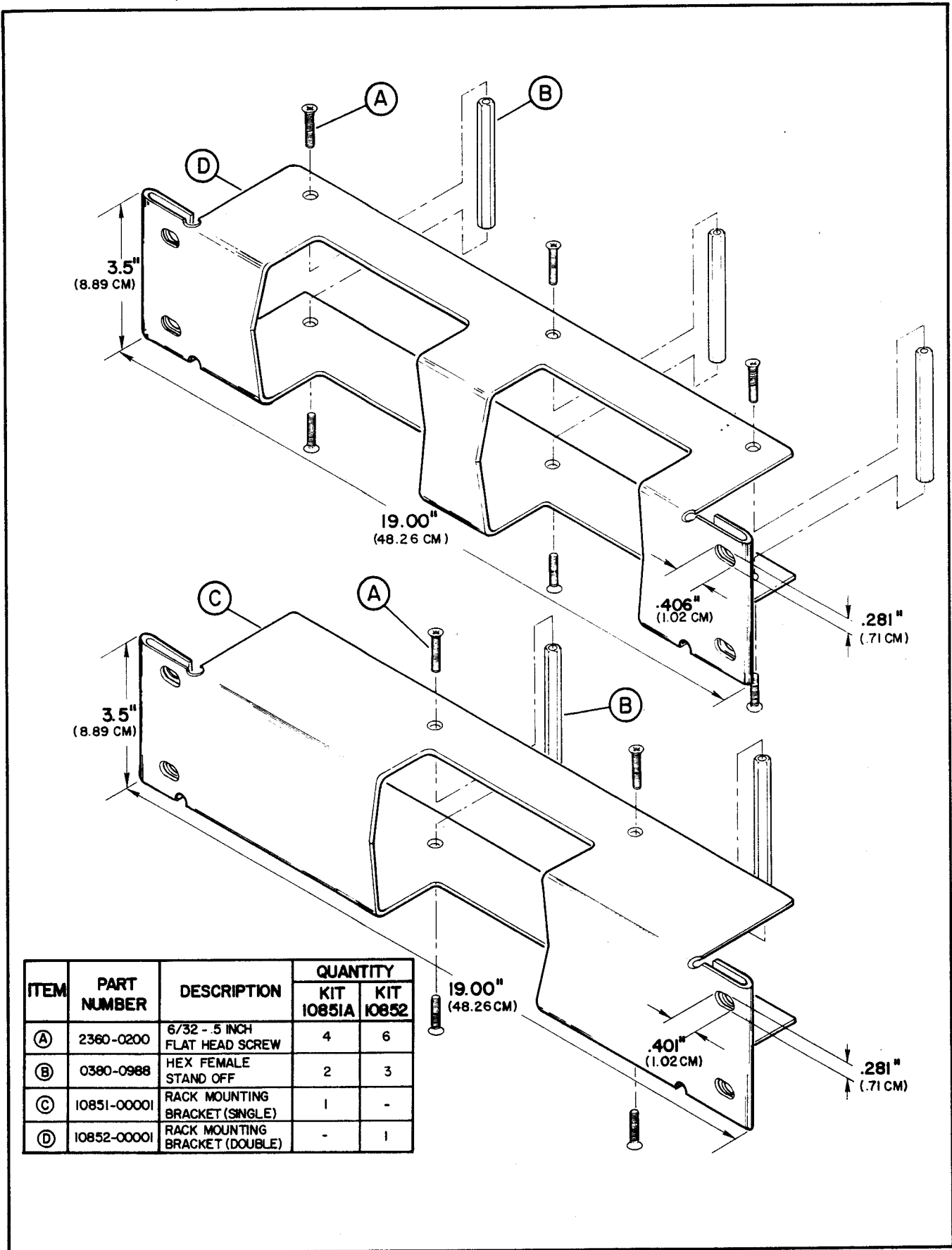


Figure 2-3. Rack Mounting Kit

SECTION III

OPERATION

3-1. INTRODUCTION

3-2. This section contains descriptions of the controls, connectors and indicators, measurement techniques, and operator checks.

3-3. CONTROLS, CONNECTORS AND INDICATORS

3-4. Figures 3-1 and 3-2 describe the operation of the 5383A controls and the function of the various connectors and indicators. The following paragraphs also provide operating guidelines and brief operator maintenance procedures for the frequency counter.

3-5. MEASUREMENT TECHNIQUES

3-6. Noise riding on the input signal can cause erroneous or unstable frequency measurements. Using the internal X10 attenuator, or external attenuators minimizes this problem. Proper selection of the input impedance also allows for stable and accurate frequency measurements. When there is a difference between the signal source impedance and the counter input impedance, ringing may appear on the signal. This ringing could interfere with, and degrade the capability of the counter. Knowledge of the signal source circuit characteristics and selection of compatible 5383A input impedances and attenuation permits proper measurements. Table 3-1 (page 3-2) provides some suggested measurement techniques to help the user obtain maximum use of the frequency counter.

3-7. Ratio Measurements (Standard Counter Only)

3-8. The standard counter will measure the ratio between the frequencies of two signals if one of the signals is applied to the rear-panel OSCILLATOR-EXT IN connector and the other signal is applied to the front-panel INPUT connector. (The Option 001 counter does not have an external oscillator input connector.) Be sure to refer to Table 1-2 for signal level and frequency limits. The displayed value is in units which represent the ratio of one frequency to the other as shown by the following formula:

$$\frac{\text{frequency at front panel INPUT}}{\text{freq at rear panel OSCILLATOR -EXT IN}} = \frac{\text{Display Value}}{X}$$

$$\text{where } X = \begin{cases} 10 & \text{if GATE TIME is .1s} \\ 10 & \text{if GATE TIME is 1s} \\ 10^7 & \text{if GATE TIME is 10s} \end{cases}$$

3-9. Note that in the above formula the term "X" changes by a factor of 10^7 when a 10s GATE TIME is set. The GATE TIME is the same when 1s and .1s selections are made. Note, also, that actual measurement time increases as the frequency applied to the OSCILLATOR-EXT IN connector decreases. If the frequency applied to the OSCILLATOR-EXT IN connector is 1 MHz, for example, and GATE TIME is set to 1s, actual measurement time will be 10 seconds.

Table 3-1. Measurement Techniques

Signal Source	Recommended Connection	Recommended 5383A Impedance/Attenuator Selection
<p>1. Signal Generators, or circuits with output:</p> <p>a. Frequency range from 10 MHz to 500 MHz</p> <p>b. Level less than 3.5V (rms) or +24 dBm</p> <p>c. Impedance of 50Ω</p>	Via Coaxial cable or 50 ohm oscilloscope probe system (e.g., HP 10020A or equivalent)	50Ω X1
<p>2. Signal Generators, or circuits with output:</p> <p>a. Frequency range from 10 MHz to 500 MHz</p> <p>b. Level exceeding 3.5V (rms) or more than +24 dBm</p> <p>c. Impedance of 50Ω</p>	Via external 50 ohm coaxial attenuator and coaxial cable	50Ω X1
3. Signal Generators, circuits with output frequency less than 50 MHz, or high voltage circuits	Via appropriately terminated coaxial cable, 1 MΩ oscilloscope probe (e.g., HP 10004D or equivalent)	1MΩ X1 1MΩ X10
4. 10 Hz to 100 kHz signals with high frequency noise components	Via coaxial cable or oscilloscope probes	1MΩ X1, or 1MΩ X10 with internal 100 kHz low pass filter selected (see Figure 3-1, item 6)
5. Transmitter or other high voltage oscillator circuits	DO NOT CONNECT DIRECTLY TO COUNTER INPUT! Use a pick-up antenna and proper attenuators. NOT THE TRANSMITTER ANTENNA!	50Ω X1
6. High frequency, high power, high impedance circuits	DO NOT CONNECT DIRECTLY TO COUNTER INPUT! Use an inductive loop pick-up device and appropriate attenuators	50Ω X1
7. High frequency, high impedance low power output	Active probe system (e.g., HP 1120A or equivalent) NOTE: A probe power supply (e.g., HP 1122A or equivalent) is required, passive attenuator probes	50Ω X1
8. High frequency signals with a dc level other than zero volts	Coaxial cable with dc blocking capacitor (e.g., HP 10240B or equivalent)	50Ω X1

3-10. OPERATOR CHECKS

3-11. These quick preliminary checks should be performed by the operator when an instrument failure is suspected:

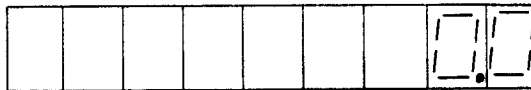


Problem I. No display digits are illuminated

CHECK

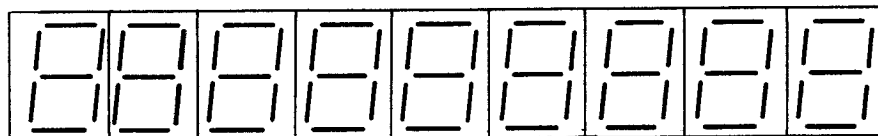
- a. Equipment cable plugged in?
- b. Proper line voltage selected on rear panel? (Refer to Paragraph 2-8.)
- c. Rear panel fuse blown? Replace blown fuse with a $\frac{1}{4}$ amp 3AG fuse (HP Part Number 2110-0018) for 100-120 volt operation or a $\frac{1}{8}$ amp (HP Part Number 2110-0318) 3AG fuse for 220-240 volt operation.

Problem II. All display digits are not illuminated.

- a. This is normal, The counter provides a leading zero blanking feature which blanks non-significant display digits. The following displays are correct when a signal is not applied to the counter input:

<u>GATE TIME Switch Position</u>	<u>DISPLAY</u>
10 S/Hz	
1 S/MHz	
.1 S/MHz	

- b. For further assurance, set the GATE TIME switch between any two positions. The following display indicates that all display digit circuits are operating correctly:



NOTE

When positioned for the display digits test function, GATE TIME switch A1S2 may or may not open the ground lead to the decimal point input of the display LED. For this reason the decimal point may or may not be illuminated during this digit test.

Problem III. The frequency counter is not counting the input signal.

CHECK:

- a. Is the rear panel INT/EXT switch in the INT position? (This switch exists in the standard counter only.)
- b. Does this problem occur only when the front panel INPUT switch is in the 50 Ω X1 or 1M Ω X1 position? This indicates that the internal fuse, A1F1, is blown. Remove instrument covers to gain access to this fuse (refer to Paragraph 5-17, note WARNING). Replace fuse with spare provided on the Main Board Assembly. Order another fuse (HP Part Number 2110-0436).

NOTE

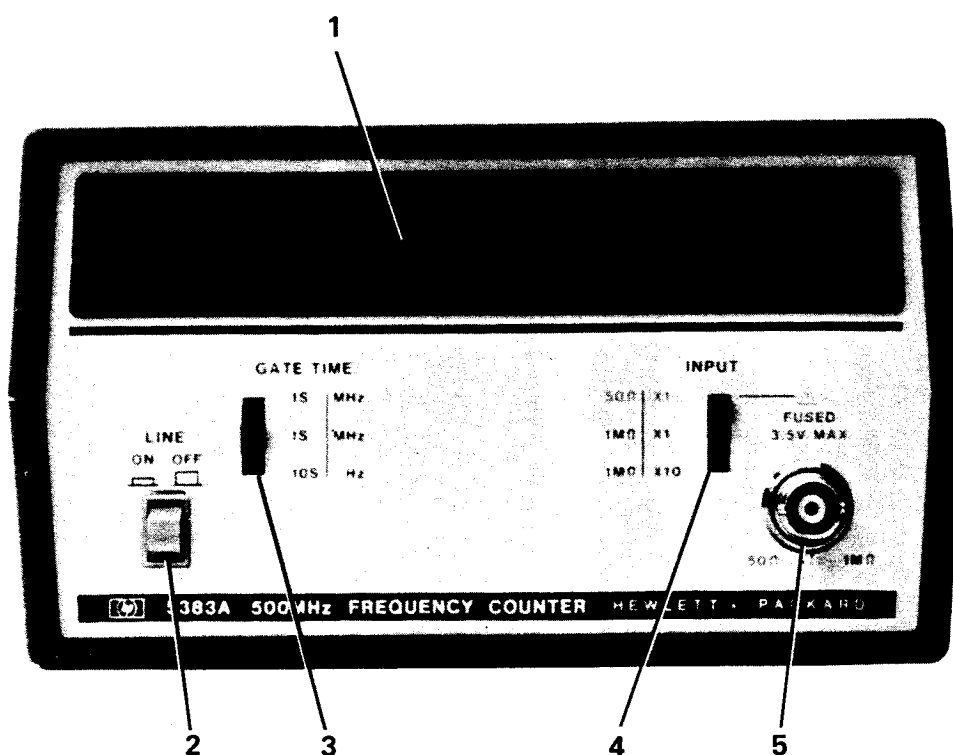
REMEMBER TO KEEP THE INPUT SIGNAL LEVEL BELOW 3.5V (RMS) OR +24 DBM WHEN THE INPUT SWITCH IS IN THE 50 Ω X1!

- c. Does this problem occur only when the INPUT switch is in the 1M Ω X1 or X10 positions and the input frequency goes higher than 100 kHz? Remove the covers (refer to Paragraph 5-17, note the WARNING). Set the board-mounted FILTER switch to the left (i.e., away from the ">").

3-12. Finally, this quick and convenient loop-around check is provided to verify normal operation of the instrument:

- a. Set the rear panel INT/EXT switch (exists on the standard counter only) to the INT position.
- b. Set the front panel INPUT switch to the 50 Ω X1 position.
- c. Connect a coaxial cable between the rear panel OSCILLATOR jack and the front panel INPUT jack.
- d. 10 MHz display (± 1 least-significant digit) indicates that the counter is operating normally.
- e. For loop-around check of the 1M Ω X1, or X10 INPUT paths, use a 50 Ω Feedthru connector (see Table 5-1, test 2 items e, f, g.).

3-13. If, after these operator checks are performed, the counter does not operate normally, refer to the Troubleshooting Charts: Figure 5-1 and 5-2 in Section V for fault analysis procedures.



1. DISPLAY:

- a. Nine LED (light emitting diode) display digits are provided.
- b. A decimal point indicates display resolution for each GATE TIME selection.
- c. An overflow indicator (dot at the upper left position) shows when the input frequency has exceeded the counting capability of the instrument.
- d. Leading zero blanking suppresses display of non-significant digits (refer to Paragraph 3-11).

2. LINE switch: The ac power LINE switch is a push ON, push OFF type. When ON, the pushbutton is set further into the front panel.

3. GATE TIME switch:

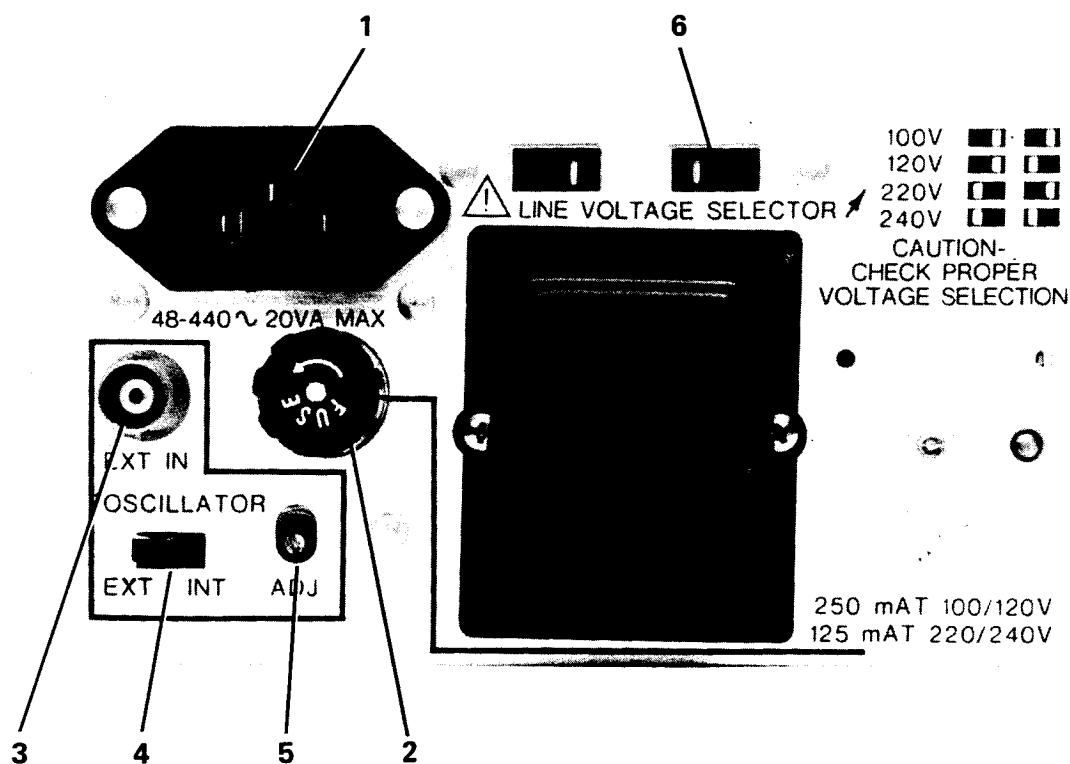
- a. Measurement Time selects one of the following measurement times and display resolutions:

GATE TIME Switch Position	Measurement Time	The Decimal Point is Positioned so that Display Reads IN:
.1 S/MHz	1/10 second	MHz
1 S/MHz	1 second	MHz
10 S/Hz	10 seconds	Hz

Figure 3-1. Front Panel and Internal Controls, Indicators and Connectors

- b. When this switch position is changed, the frequency counting circuits are automatically reset to zero count. The new frequency count is then displayed after a delay which is determined by the GATE TIME position (i.e., the measurement time).
 - c. Digit self-test provides a display digit self-test capability. When this switch is set between two GATE TIME positions, all display digits should shown "8" (see NOTE in Paragraph 3-11).
4. **INPUT switch:** Selects one of the following input impedances and attenuations:
- 50 Ω X1 This input is protected from input signals that exceed 3.5V rms (+24 dBm) by an internal 0.1 amp fuse (refer to Paragraph 3-11).
 - 1M Ω X1 Shunt capacity: less than 40 pf.
 - 1M Ω X10 Shunt capacity: less than 40 pf.
5. **INPUT connector:** Connects signal to be measured to internal circuits. Impedance and attenuation at this jack is selected by INPUT switch.
6. **INTERNAL FILTER switch (not shown, see Figure 8-1):** This switch is positioned in the direction of the arrow (">") to select a 100 kHz low pass filter. This filter permits stable frequency measurements in the 10 Hz to 100 kHz range when the input contains higher frequency noise.

Figure 3-1. Front Panel and Internal Controls, Indicators and Connectors (Continued)



STANDARD REAR PANEL

1. **POWER connector:** Connect the source of ac power to the rear-panel power connector.
2. **FUSE:** A Listed, 0.250 ampere, slow-blow fuse is required for 100-volt or 120-volt operation; a Listed, 0.125 ampere, slow-blow fuse is required for 220-volt or 240-volt operation.
3. **OSCILLATOR connector:** Serves as a monitoring point for the internal time base oscillator, or provides an input path for an external time base oscillator, depending on the EXT/INT switch setting.

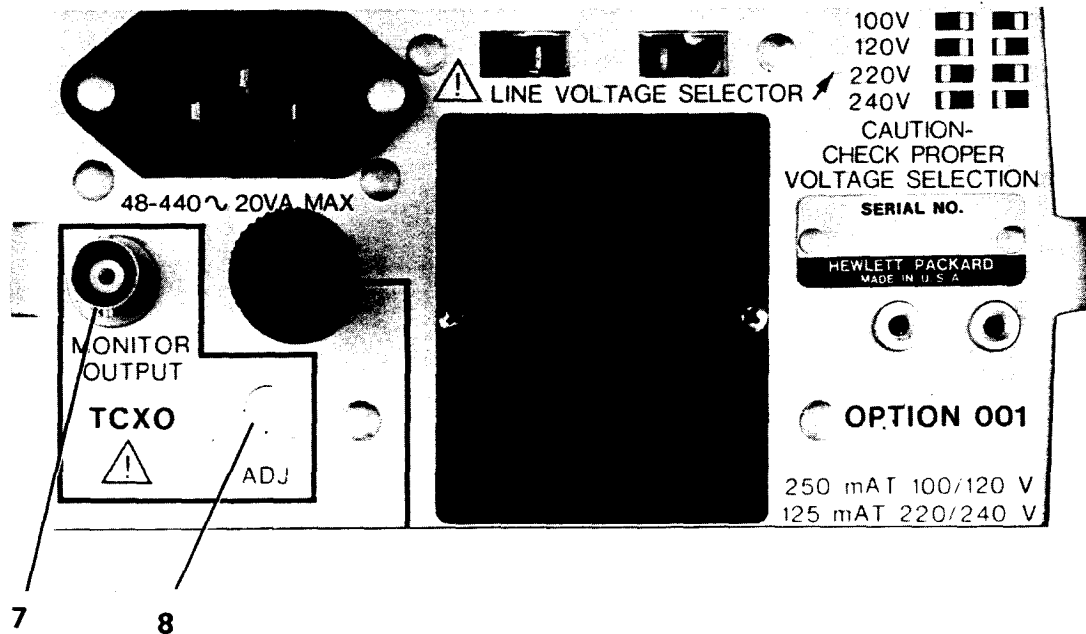
NOTE

- a. The monitor output is designed to drive a 50Ω load.
- b. The internal time base oscillator output may be connected to the front panel input jack (with INPUT switch in the 50Ω X1 position) to provide a convenient counter self-check operation.

4. **EXT/INT switch:** Selects the function of the OSCILLATOR connector:

Switch Position	OSCILLATOR Connector Function
EXT	Provides a nominal 50Ω input impedance path for an external 10 MHz time base or ratio input.
INT	Monitors the internal timebase oscillator. An optimum signal is obtained when the output drives a 50Ω load (>200 mV peak-to-peak).

Figure 3-2. Rear Panel Operating Controls and Indicators



OPTION 001 REAR PANEL

5. **OSCILLATOR-ADJ control:** The ADJ control is used to set the frequency of the internal time base oscillator. Refer to the *Adjustment* paragraphs 5-10 or 5-13, in Section V for information.
6. **LINE VOLTAGE SELECTOR switches:** Set the switches to correspond with the voltage of the ac power source. (Refer to Paragraph 2-8 for instructions.)
7. **MONITOR OUTPUT connector:** Serves as an internal time base oscillator monitor output connector only (see NOTE under item 3).
8. **ADJ control:** Same as 5, above.

Figure 3-2. Rear Panel Operating Controls and Indicators (Continued)

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. The theory of operation is written primarily at a functional block level. Some detailed circuit theory is provided as an aid to troubleshooting when circuit complexity requires it. In addition, brief circuit explanations are given for two unique integrated circuit packages: the Variable Time Base Counter and the Hex Multiplexed Counters.

4-3. FUNCTIONAL DESCRIPTION

4-4. The 5383A is a direct frequency counting instrument which computes input frequency "f" by counting the number of cycles "n" that occurs during an internally generated time base interval "t". This frequency measurement function is described simply by the following equation:

$$n = f \times t$$

n = number of cycles

f = frequency of input signal

t = internally generated time base interval

Once calculated, "n" data must be sampled and correctly transferred to the 9-digit counter display.

4-5. INPUT CIRCUIT

4-6. (Refer to Figure 4-1 and to schematic.) Signal "f" is applied to the input circuits consisting of A2S2, A1Q15, and A1Q14. Input switch S2 routes the signal to either the 1M Ω X1, X10 path, or the the 50 Ω path. Q14 and Q15 biases these signal paths, allowing the Balanced Input Amplifier to accept either the 50 Ω or the 1M Ω signal (refer to the schematic for detailed biasing information and corresponding signal path selection). A2S2 can also select a 1M Ω X10 attenuator consisting of a 1:10 voltage divider network.

The 50 Ω signal path consists of:

- a. 0.1 amp fuse A1F1 (3.5V rms maximum input).
- b. Clamping and limiting diodes (A1CR12 and CR13; and A1CR8 thru CR11) which limit the input to 1 volt peak-to-peak.

The 1M Ω X1, X10 path consists of:

- a. FET's A1Q17, Q18, and Emitter follower A1Q16.
- b. A switchable low pass filter consisting of A1R55 and C44. Board-mounted switch A1S2 ("FILTER") switches this filter in or out.

4-7. BALANCED INPUT AMPLIFIER

4-8. (Refer to Figure 4-1 and schematic.) This circuit provides approximately 24 dBm of signal gain for the Schmitt trigger input. In addition, the balanced input amplifier uses a feedback circuit to ensure that the dc level of the Schmitt Trigger input remains constant in spite of input circuit or temperature variations. Dc offsets, that result from these variations are sensed by feedback comparator, A1U5 and compared with the level set by balance potentiometer A1R32. A difference results in compensating voltage drive to a differential terminal of A1U8. This compensating voltage ultimately drives the output of A1U6 in a direction which nulls the original offset voltage. For example; if, due to temperature or circuit variations, the input dc level to the Schmitt Trigger becomes more positive; A1U5 senses the change at its input. The comparator responds by providing a negative voltage which is proportional to this positive offset. This negative voltage drives a differential terminal of A1U8; forcing its output in a more positive direction. This positive increase causes the inverting output of A1U6 to go more negative; nulling the original positive offset. This consistent dc level ensures that a sine wave input to the Schmitt trigger (A1U2) produces a symmetrical square wave output.

4-9. TBO AND MAIN GATE CIRCUITS

4-10. (Refer to Figure 4-1 and schematic.) As a result of the Schmitt trigger, signal "f" is now an EECL square wave that is compatible to the digital counter circuits. This square wave is applied to the Main Gate (part of A1U1). The Main Gate is enabled by the low MGE signal which is derived from the T.B. (Time Base) circuits. The width of MGE, or "t", is determined by the setting of the front panel GATE TIME switch. The TBO count down circuits respond to the switch input by counting down the 10 MHz TBO to provide a 0.1, 1.0, or 10 second MG ("t") width (refer to Figure 4-5). It is during this "t" interval, that the enabled Main Gate passes signal "f" through to the Decade Counters. These counters count the number of cycles (during interval "t") and provide the resulting "n" data in the form of nine (4 bit) BCD characters. This accumulated data is transferred to 9 storage latches when a TR (transfer) pulse is received from the Scan Timing circuits.

4-11. SCAN TIMING CIRCUITS

4-12. (Refer to Figure 4-1 or schematic.) A1U24, the Scan Oscillator, is a nominal 2 kHz timing signal generator. The 2 kHz output drives the Scan Timing Circuits which provide update, sample, and display timing signals to the counter storage latches and the display circuits. Figure 4-2 shows the waveforms associated with the Scan Timing circuits.

4-13. The update signals are held off until the measuring time interval, "t", ends. At this time MG goes high enabling generation of the following signals: RSTB (Reset Time Base), TR (Transfer "n" data) and RSC (Reset Counters). These signals are synchronous with the 2 kHz Scan Oscillator. RSTB occurs first and remains active during the entire up date sequence. Typically this sequence lasts approximately 0.4 milliseconds. During this brief time (i.e., brief in proportion to the 0.1, 1.0, or 10 second MG interval):

- ① RSTB disables the TBO count down circuits (holding MG high).
- ② The TR pulse is generated, transferring all nine "n" data BCD characters to the storage latches. The storage latches are isolated from the Decade counters at all times, except during TR pulse time.
- ③ The RSC pulse is generated (after the TR pulse terminates) to reset all counters to zero.

4-14. After RSC pulse time, the RSTB signal changes state, releasing the T.B. count down circuits so they can initiate another frequency measurement cycle. Figure 4-3 (on page 4-6) provides waveforms and a detailed circuit description of the display update sequence.

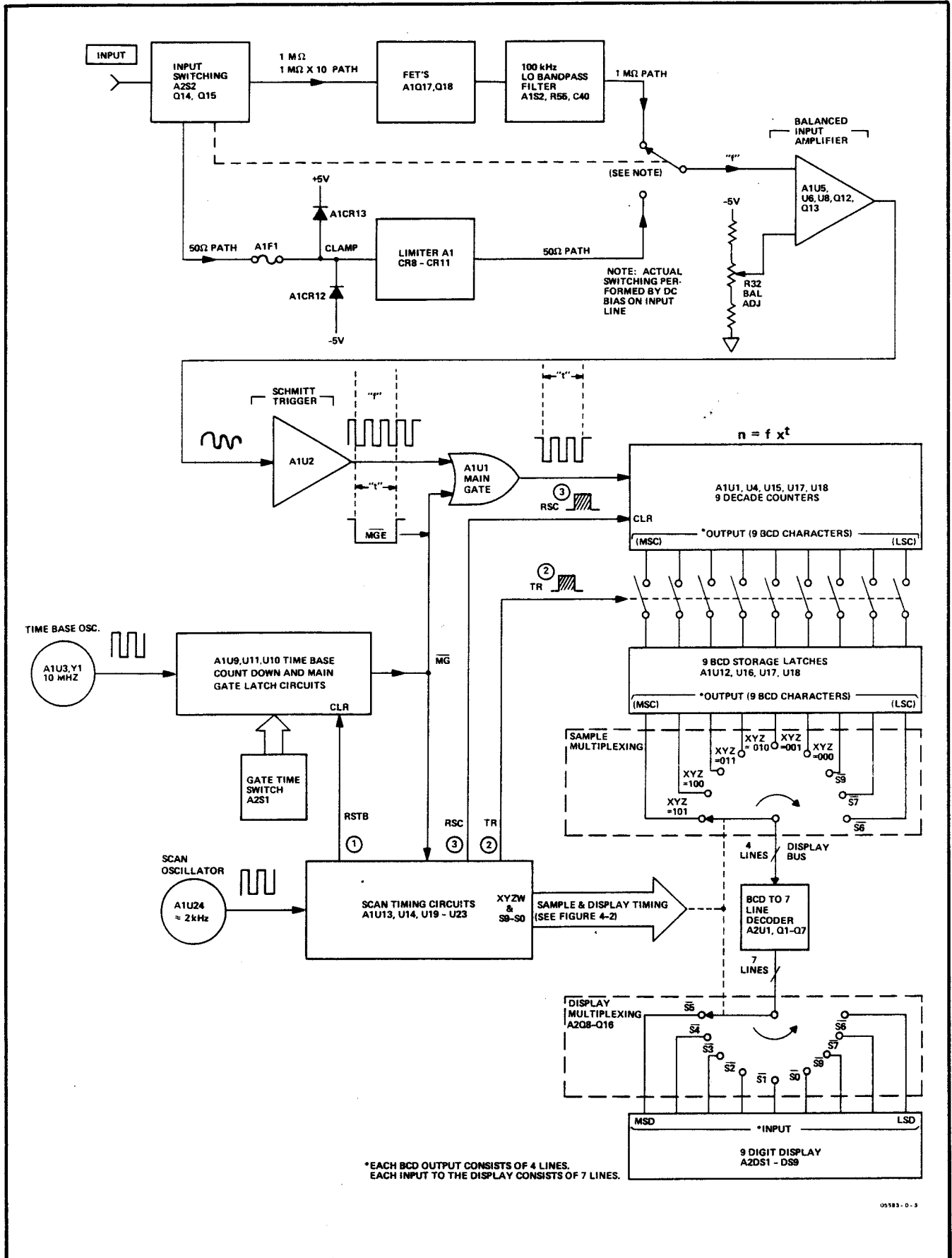


Figure 4-1. Simplified Block Diagram

4-15. MULTIPLEXED DISPLAY FUNCTION

4-16. The sample and display timing circuits provide signals WXYZ, and S0 through S9. These signals sequentially transfer counter data, one (BCD) character at a time to the appropriate display digit. Figure 4-1 shows a mechanical representation of the actual electronic multiplexing function. The wiper arms of the multiplexer "switches" are linked so that when a BCD character is sampled, the correct display digit is activated. For example, during time S5, the most significant character (MSC) is sampled at the counter latches as a result of an XYZ "101" (BCD "5") signal. At the same time a low S5 signal activates the most significant counter display digit (i.e., the left-most display digit). Therefore, during time S5, the MSC is transferred to the BCD-to-seven line decoder via the display bus. The resulting decoder output drives the activated left-most display digit. In a similar manner, lower significant characters are transferred and lower significant display digits are activated during subsequent scan times. Table 4-1 shows correlation between scan times, multiplexing signals, the characters sampled, and the display digits that are activated. Also refer to the scan signal timing diagram (Figure 4-2).

4-17. LEADING ZERO BLANKING

4-18. (Refer to schematic.) The Scan Timing circuits also provides the logic for the leading zero blanking function. Figure 4-4 (page 4-7) describes this function in detail. When the GATE TIME switch is in the 10 S/MHz position the circuit operates as shown. A 1 S/MHz or 10 S/MHz GATE TIME selection changes the RBI gate width and corresponding events to respective 0.4 millisecond or 0.6 millisecond time durations.

4-19. UNIQUE INTEGRATED CIRCUITS

4-20. Figure 4-5 (page 4-8) and 4-6 (page 4-8) contain circuit descriptions of Variable Time Base Counter A1U11 and Hex Multiplexed Counter A1U18. These descriptions pertain to the direct application of these integrated circuits in the 5383A Frequency Counter.

Table 4-1. Sample and Display Timing

		SCAN TIME									
		S5	S4	S3	S2	S1	S0	S9	S8	S7	S6
Sample	W	0	0	0	0	0	0	1		0	0
	X	1	0	1	0	1	0				
Multiplexing Control Signal	Y	0	0	1	1	0	0	S9		S7	S6
	Z	1	1	0	0	0	0				
Counter/Latch	Cntr.	A1U18	A1U18	A1U18	A1U18	A1U18	A1U18	A1U15		A1U4 A1U15	A1U1 A1U4
	Latch	A1U18	A1U18	A1U18	A1U18	A1U18	A1U18	A1U15		A1U16	A1U12
Display Activated		DS1 (MSD)	DS2	DS3	DS4	DS5	DS6	DS7		DS8	DS9 (LSD)
MSD = Most significant display digit. LSD = Least significant display digit.											

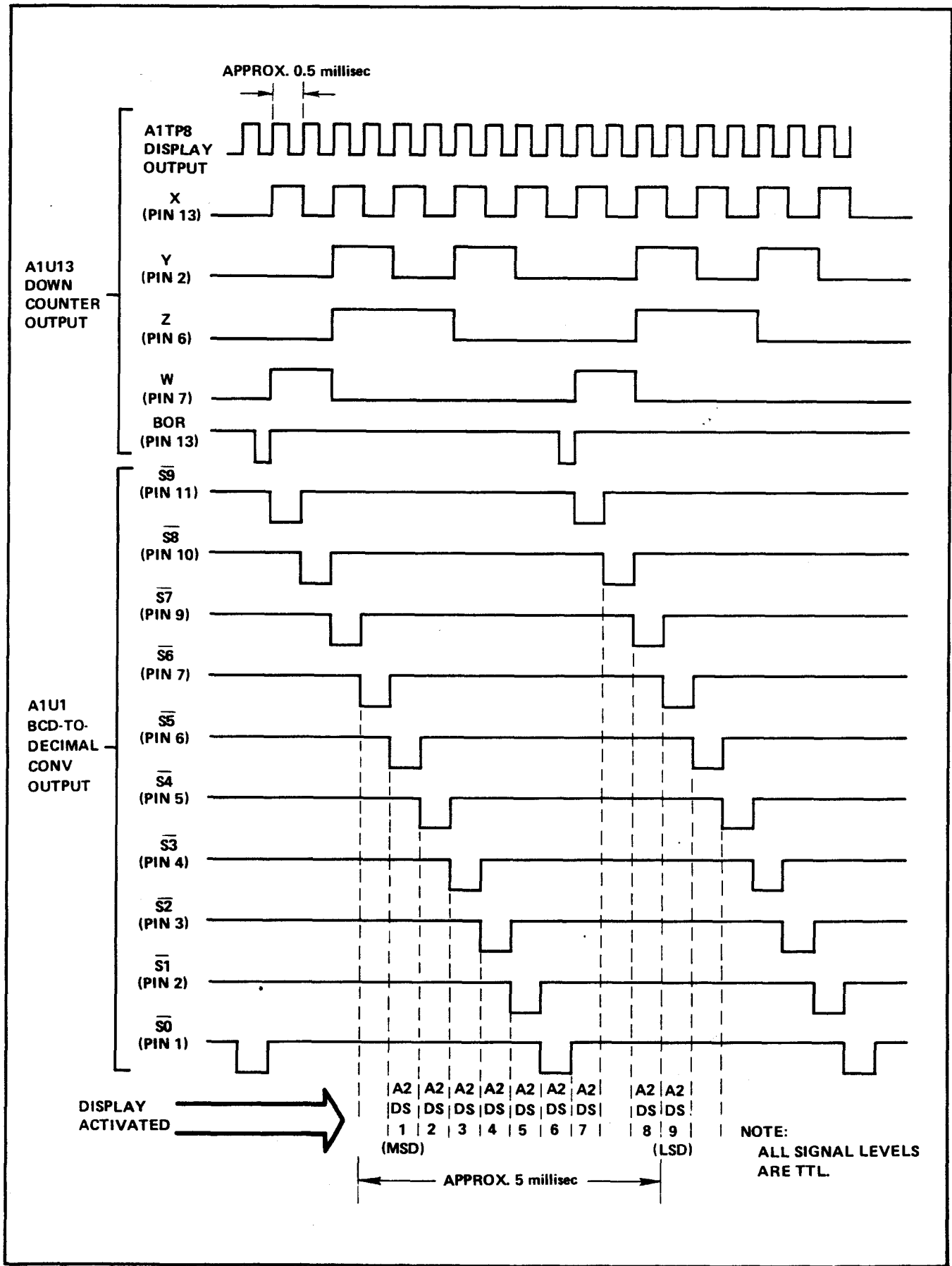
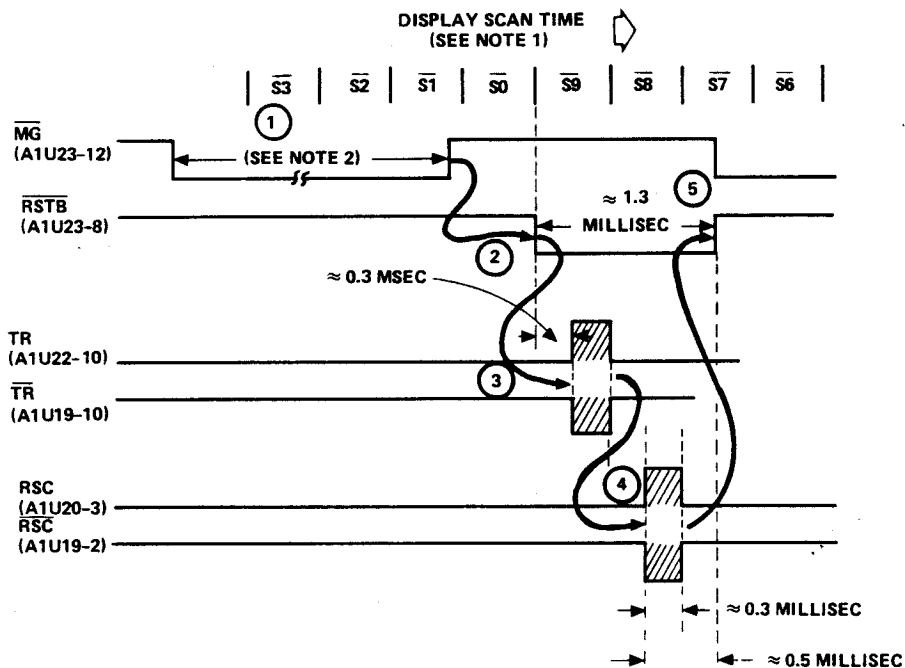


Figure 4-2. Scan Timing Waveforms

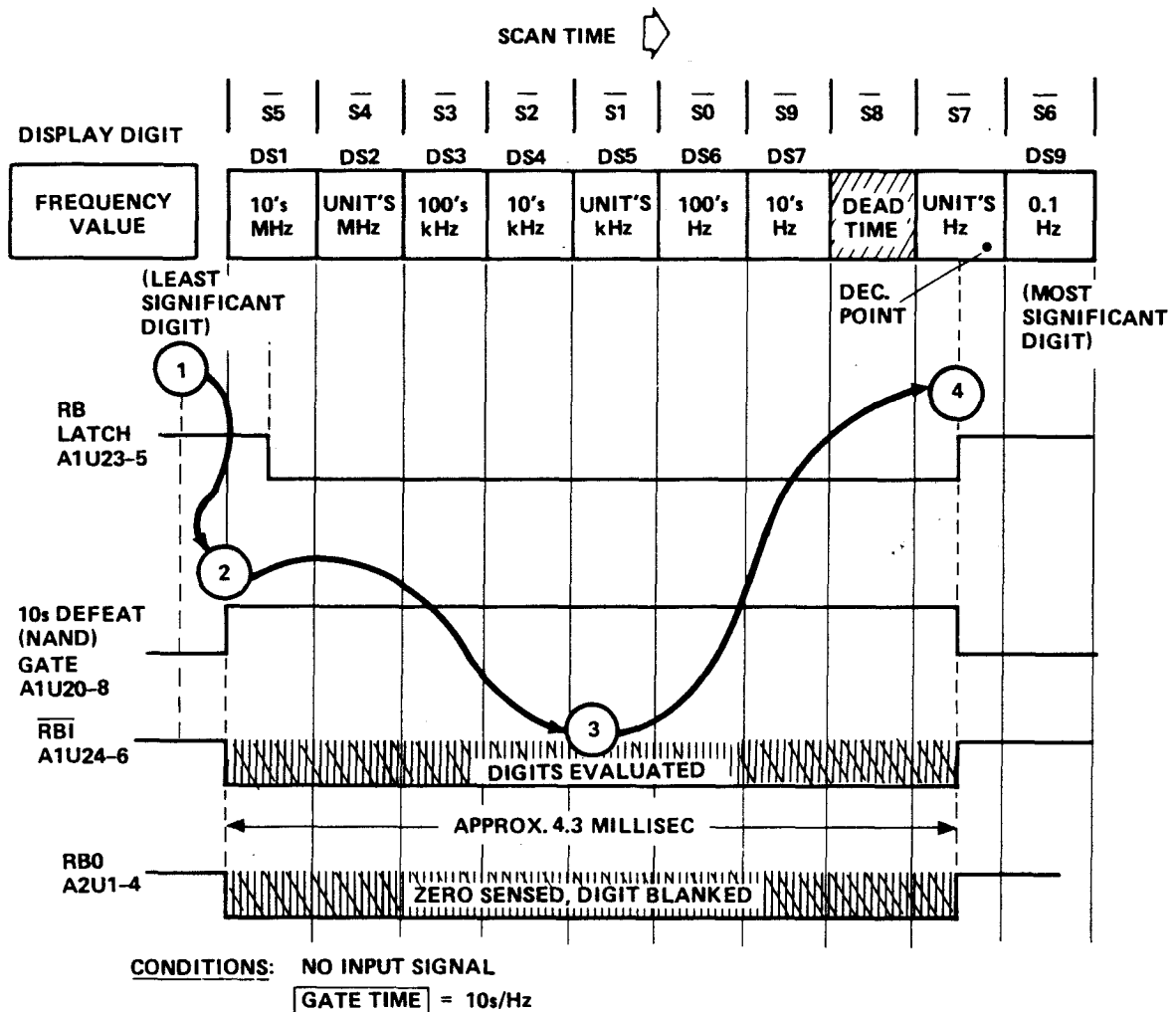


NOTES

1. \overline{MG} is an EECI version of the TTL \overline{MG} signal.
2. Display scan timing and the timing of the \overline{MG} (or \overline{MGE}) signal are asynchronous. Therefore, the positive transition of the \overline{MG} (or \overline{MGE}) signal (i.e., trailing edge) occurs during any random time.
3. \overline{MG} (or \overline{MGE}) width ("t") depends on the setting of the GATE TIME switch.

- ① \overline{MGE} is low during time "t", allowing the frequency counters to count the input signal frequency. The storage latches are isolated from the counters at this time.
- ② After the \overline{MG} signal terminates, the \overline{RSTB} latch is set at the beginning of scan time $\overline{S9}$. This initiates the update sequence. A \overline{RSTB} signal holds \overline{MGE} off (i.e., high) until the completion of the update sequence (approximately 0.5 milliseconds later).
- ③ During scan time $\overline{S9}$, \overline{TR} and \overline{TR} pulses are generated. These signals connect the counter outputs to the storage latches; resulting in the transfer of nine BCD characters to the latches. When the \overline{TR} and \overline{TR} pulses end, the latches are again isolated from the frequency counters.
- ④ During scan time $\overline{S8}$ \overline{RSC} and \overline{RSC} pulses reset the frequency counters to zero.
- ⑤ During scan time $\overline{S7}$, the \overline{RSTB} latch is cleared, ending the update sequence, and releasing \overline{MGE} (i.e., allowing it to go low) to allow another frequency count.

Figure 4-3. Update Function



- ① During scan time $\overline{S7}$, Ripple Blanking (RB) Latch A1U23 is preset. Pin 5 goes high; driving the output of enabled NAND GATE A1U20 low. The low output of U20 forces the Ripple Blanking Input (RBI) Gate output high. The display digits are not evaluated and no blanking occurs at this time.
- ② The low $\overline{S5}$ signal forces NAND GATE A1U20 high. This high drives enabled RBI gate U24 low, allowing the display digits to be evaluated. Zero is sensed, causing the most significant digit to be blanked during $\overline{S5}$ and the Ripple Blanking Output (RBO) to go low.
- ③ Low RBO clears the RB latch. The resulting low output keeps NAND GATE U20-8 high; which in turn keeps the \overline{RBI} signal active (low). Since there is no input signal to the counter, each digit evaluated is zero, causing RBO to remain low.
- ④ During scan time $\overline{S7}$, the RB latch is again preset, driving the output of NAND GATE U20 low. As a result, the RBI gate output is forced high; defeating the \overline{RBI} signal and allowing the unit's Hz zero digit, the decimal point, and the 0.1 Hz zero digit to be display (i.e., 0. 0).

Figure 4-4. 10 S/Hz Leading Zero Blanking Function

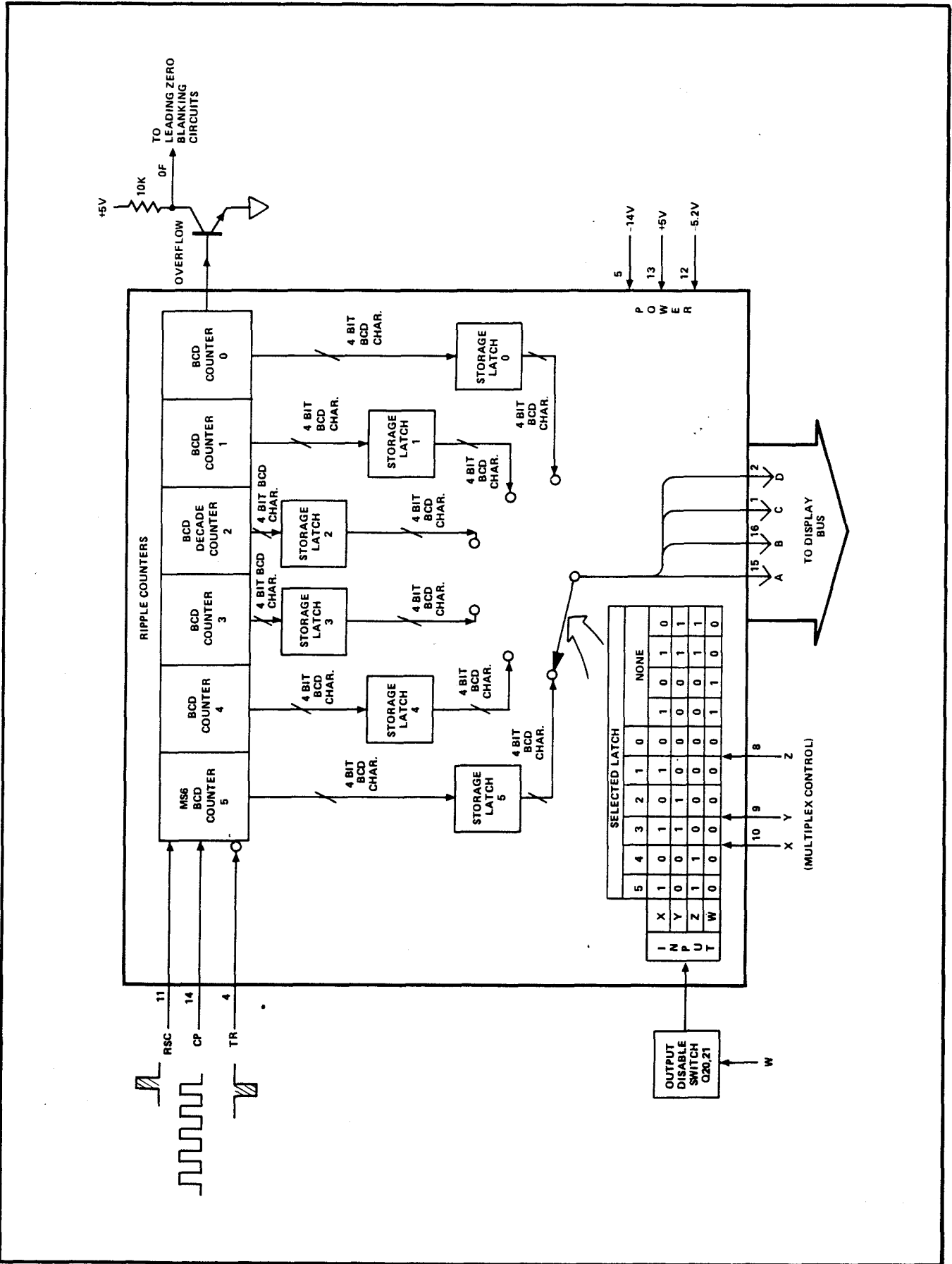


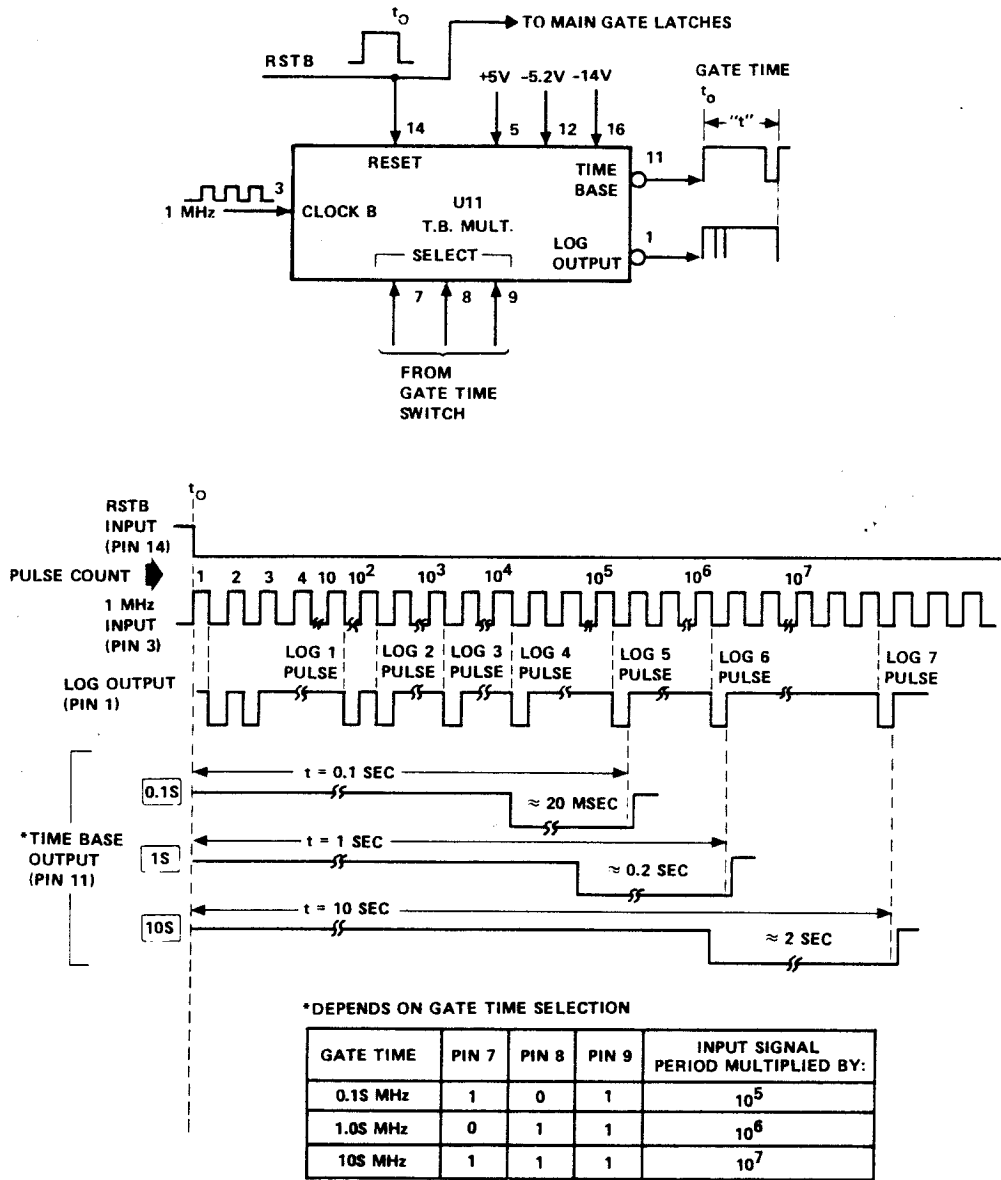
Figure 4-5. Hex Multiplexed Counter A1U18

HEX MULTIPLEXED COUNTER A1U18

The Hex multiplexed counter integrated circuit package consists of six BCD ripple counters, six corresponding storage latches and a multiplex selector circuit. It functions in the following manner:

- a. The clock pulse (C_p) input is counted by the six BCD counters: Counter "5" through Counter "0".
- b. The six (4-bit) BCD characters that result from the counting operation are transferred to the storage latches when the \overline{TR} (transfer) pulse is applied. Otherwise i.e., when no \overline{TR} pulse is applied), the counter outputs are isolated from the storage latches.
- c. After the transfer operation, a reset counters (RSC) pulse clears all the BCD counters to zero.
- d. The BCD characters in the storage latches are sequentially addressed and transferred, one character at a time, to the display bus according to the XYZ multiplexing control signal. A binary XYZ input of six (110) and seven (111) are not recognized by the counter. These inputs result in the isolation of the counter output from the display bus. A high "W" signal also isolates the counter during scan times S8 and S9 to avoid interaction on the display bus between its output and the output of Counter/Storage Latch A1U15.
- e. The Hex Multiplexed Counter generates a high OF (overflow) signal when all six BCD counters reach a terminal nine count. This output is inverted by Q19 to provide the OF which:
 1. Lights the overflow light on the left-most front panel display digit.
 2. Disables the leading zero blanking circuits.

Figure 4-5. Hex Multiplexed Counter A1U18 (Continued)



VARIABLE TIME BASE COUNTER U11

The variable time base counter responds to a 3-bit binary input (controlled by the front panel GATE TIME switch) by multiplying the one microsecond period of the input signal by a factor of 10^5 , 10^6 , or 10^7 . The resulting time base output gate drives the Main Gate Latches which are clocked by the Log pulse outputs of this integrated circuit. These output Log pulses are spaced according to a logarithmic function of the input signal count. As a result of these signals, an accurate and stable main gate (MGE) is provided for the frequency counting function. A logic high Reset Time Base (RSTB) signal resets the variable time base counter and the Main Gate Latches (resulting in a High MGE) while the frequency counters are transferring data.

Figure 4-6. Variable Time Base Counter A1U11

SECTION V MAINTENANCE

5-1. INTRODUCTION

5-2. This section provides data to:

- Verify correct counter operation.
- Define a counter failure.
- Establish guidelines to restore normal counter operation.

The following information is included:

- a. Performance checks.
- b. Adjustment procedures.
- c. Assembly/Dissassembly procedures.
- d. Troubleshooting procedures.

5-3. IN-CABINET PERFORMANCE CHECK

5-4. Use the performance check in Table 5-1 to verify proper operation of counter. This check should be used when improper operation or nonconformance to specifications is suspected.

Table 5-1. In-Cabinet Performance Check

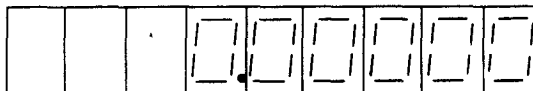
1. DISPLAY

- a. Set the GATE TIME switch between any two positions. Observe all nine display digits read "8" (see NOTE at the bottom of page 3-3 in Section III).
- b. Set the GATE TIME to the .1s MHz, 1s MHz, and 10s MHz positions while observing the display for the correct indication as shown below:

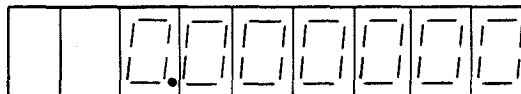
GATE TIME

DISPLAY

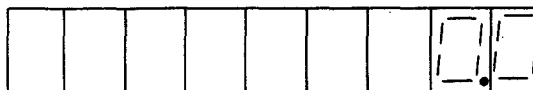
.1S/MHz



1S/MHz



10S/Hz



- c. If your instrument does not meet the above specifications perform the troubleshooting procedures provided in Figure 5-1.

Table 5-1. In-Cabinet Performance Check (Continued)

2. LOOP-AROUND (SELF-CHECK)

- a. (Standard Counter only) set the counter rear panel INT/EXT switch to the INT position.
- b. Set the counter front panel INPUT switch to 50Ω X1.
- c. Connect a coaxial cable between the rear panel connector and the front panel connector.
- d. The counter display should indicate 10 MHz ±1 count in all GATE TIME switch positions.
- e. Obtain a 50Ω Feedthru connector (HP 11048C or equivalent).
- f. Disconnect the coaxial cable from the front panel INPUT connector and reconnect to INPUT via a 50Ω Feedthru connector.
- g. The counter display should indicate 10 MHz ±1 count in the 1MΩ X1 and the 1MΩ X10 INPUT switch positions.

3. SENSITIVITY

- a. Obtain the following test equipment:
 - HP 11048C or equivalent 50Ω Feedthru connector
 - HP 8654B Signal Generator or equivalent
 - HP 651B Test Oscillator or equivalent
- b. Connect a coaxial cable between the output of the test equipment and the 5383A front panel INPUT connector.
- c. Set up switches, test equipment, and the 5383A as described in Table A. Observe that the counter displays the correct frequency, and that the display is stable (see NOTE).

TABLE A

TEST EQUIPMENT	FREQUENCY	OUTPUT LEVEL (RMS)	5383A INPUT SWITCH POSITION
HP 8654B or equivalent	512 MHz	50 mV	50Ω X1
	100 MHz	25 mV	50Ω X1
	50 MHz	50 mV	*1MΩ X1
	10 MHz	25 mV	*1MΩ X1
HP 651B or equivalent	20 Hz	25 mV	*1MΩ X1 and 50Ω X1
	10 Hz	25 mV	*1MΩ X1
*Through a 50Ω Feedthru connector.			

Table 5-1. In-Cabinet Performance Check (Continued)

NOTE

The stability of the counter display depends on the stability of the test equipment being used. The HP 8654B, for example, has a short term stability which should cause at least the first five most-significant display digits of the counter to be stable.

4. EXTERNAL TIME BASE INPUT

- a. Obtain the following test equipment:

HP 651B Test Oscillator
BNC "TEE" Connector

- b. At the counter front panel:

Set the INPUT Switch to 50Ω X1
Set the GATE TIME Switch to .1s/MHz

- c. At the counter rear panel, set the INT/EXT switch to EXT.

- d. Connect the 50Ω output of the HP 651B to the 5383A counter via the "TEE" connector as shown in Figure A.

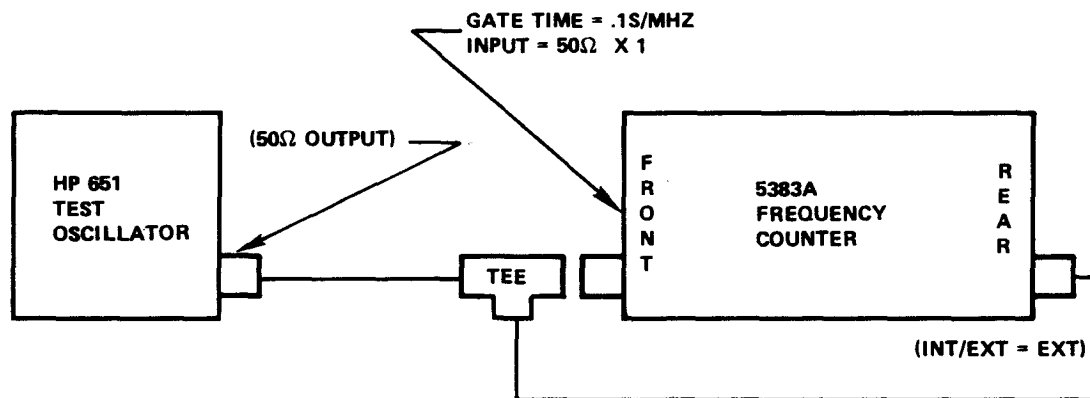


Figure A

- e. Set the HP 651B for an output of 10 MHz at 250 mV rms. The counter's display should be 10.00000 ± 1 count.
- f. Set the HP 651B for an output of 100 kHz at 250 mV rms. The counter's display should be 10.00000 ± 1 count. **NOTE** Because of the input time base, the gate time (i.e., time to make a frequency measurement) is 10 seconds.

5. STANDARD TIME BASE OSCILLATOR

- a. Obtain the following test equipment:

HP 5328A (Option 010) Universal Counter, or
HP 5345A Electronic Counter

- b. At the 5383A front panel:

Set the INPUT switch to 50Ω X1
Set the GATE TIME switch to 1s/MHz

Table 5-1. In-Cabinet Performance Check (Continued)

- c. Connect a coaxial cable to:

The HP 5345A rear panel FREQ STD OUTPUT 10 MHz, or
The HP 5328A (Option 010) rear panel OSC connector

NOTE

The rear panel EXT/INT switch should be in the INT position

- d. Connect the other end of the cable to the 5383A front panel connector.
- e. Observe the 5383A Frequency Counter for a displayed value of 10.000000 MHz \pm 25 Hz. If this value is not observed, perform the adjustment procedures in Paragraph 5-10.

6. OPTION 001 TIME BASE OSCILLATOR

- a. Obtain the following test equipment:

HP 5328A (Option 010) Universal Counter, or
HP 5345A Electronic Counter

- b. Set the 5383A front panel switches as follows:

INPUT switch to 50 Ω X1
GATE TIME switch to 10s/Hz

- c. Connect a coaxial cable between the 5383A front panel and:

The HP 5345A rear panel FREQ STD OUTPUT 10 MHz connector, or
The HP 5328A (Option 010) rear panel OSC connector

NOTE

Rear panel INT/EXT switch should be in the INT position.

- d. Observe the 5383A Frequency Counter for a displayed value of 10000000.0 Hz \pm 10.1 Hz. If this value is not observed, perform the adjustment procedure in Paragraph 5-13.

PERFORMANCE CHECK RECORD SHEET

HEWLETT-PACKARD MODEL 5383A
FREQUENCY COUNTER

Test Performed by _____
Date _____

Serial No. _____

TESTS

RESULTS

(NOTE: Enter your initials to indicate passed or failed.)

- | | PASSED | FAILED |
|-------------------------------------|--------|--------|
| 1. DISPLAY CHECK (Table 5-1, 1) | _____ | _____ |
| 2. LOOP AROUND CHECK (Table 5-1, 2) | _____ | _____ |
| 3. SENSITIVITY CHECK (Table 5-1, 3) | | |

FREQUENCY	OUTPUT LEVEL (RMS)	5383A INPUT SWITCH POSITION	PASSED	FAILED
512 MHz	50 mV	50Ω X1		
100 MHz	25 mV	50Ω X1		
50 MHz	50 mV	*1MΩ X1		
10 MHz	25 mV	*1MΩ X1		
20 Hz	25 mV	50Ω X1		
20 Hz	25 mV	*1MΩ X1		
10 Hz	25 mV	*1MΩ X1		

*Through a 50Ω Feedthru connector.

- | | PASSED | FAILED |
|--|--------|--------|
| 4. EXTERNAL TIME BASE INPUT (Table 5-1, 4)
(Standard Counter Only) | _____ | _____ |
| 5. STANDARD TIME BASE OSCILLATOR (Table 5-1, 5)
(Standard Counter Only) | _____ | _____ |
| 6. OPTION 001 TIME BASE OSCILLATOR (Table 5-1, 6)
(Option 001 Only) | _____ | _____ |

5-5. ADJUSTMENTS

5-6. The counter requires two circuit adjustments: The Balanced Input Amplifier adjustment, and the Time Base Oscillator adjustment. Perform these adjustments according to the following procedures:

5-7. Balanced Input Amplifier

5-8. The input amplifier positive and negative triggering thresholds are adjusted with the following recommended test equipment:

HP 180A Oscilloscope
HP 1801A Oscilloscope Plug-in
HP 651B Test Oscillator

5-9. Perform the adjustment as follows:

- a. Remove the top and bottom covers from the counter as described in Paragraph 5-16. Observe WARNING note.
- b. Connect the oscilloscope to A1TP1 of the Main Board Assembly.
- c. Connect the Test Oscillator 50 Ohm output to the front panel 50 Ω /1M Ω input connector of the counter. Set the counter INPUT switch to 50 Ω X1.
- d. Set the Test Oscillator for a 1 MHz output at a 15 mV level.
- e. Connect AC power to the counter. Observe WARNING note. Set the counter LINE switch to ON.
- f. Adjust the oscilloscope sweep time vernier so that one cycle takes up the complete width of the oscilloscope display.
- g. On the counter, adjust potentiometer A1R32 until the signal on the oscilloscope shows a 50% duty cycle.
- h. Remove test equipment, ac power from the counter, and install the top and bottom counter covers per Paragraph 5-16.

5-10. Standard Time Base Oscillator Adjustment

5-11. The standard time base oscillator is adjusted with the following test equipment:

HP 5328A Universal Counter with Option 10
HP 11048C or equivalent 50 Ω Feedthru connector
OR
HP 5345A Electronic Counter

5-12. Perform the adjustment procedure as follows:

NOTE

1. Ensure that the ambient (room) temperature is 25°C.
 2. Allow 1-hour for the 5383A time base oscillator to stabilize before making adjustment.
- a. Set the 5383A INT/EXT switch at the rear panel to the INT position.
 - b. Connect a coaxial cable between the 5383A rear panel oscillator and the test counter front panel input connector (described in Table 5-2).
 - c. Set up the test counter according to the procedures in Table 5-2.
 - d. Adjust the 5383A rear panel OSC ADJ control for the following test counter display:

<u>TEST COUNTER</u>	<u>DISPLAY</u>
HP 5328A (with Option 010)	10000.000 kHz
HP 5345A	10.000000 MHz

5-13. Option 001 Time Base Oscillator Adjustment

5-14. The Option 001 time base oscillator uses the same test equipment called out in Paragraph 5-10.

5-15. Perform the adjustment procedures as follows:

NOTE

Ensure that the ambient temperature is 25°C (normal room temperature).

- a. Disconnect power from the 5383A and remove the top and bottom covers per Paragraph 5-16. Observe WARNING note.
- b. Connect ac power to the 5383A and set the LINE switch to ON. Allow at least 5 minutes for the TCXO to stabilize.
- c. Connect a coaxial cable between the 5383A rear panel MONITOR connector and the test counter front panel connector (refer to Table 5-2).
- d. Set up the test counter per Table 5-2.
- e. Observe the 25°C frequency offset that is stamped on the **side** of the 5383A TCXO Assembly (A1U25).
- f. Adjust the TCXO Assembly ADJ control so that the value displayed on the test counter equals 10 MHz plus the 25°C frequency offset. FOR EXAMPLE, if +4 Hz is stamped on the side of the TCXO, set the TCXO ADJ control for the following test counter display:

<u>TEST COUNTER</u>	<u>DISPLAY (example)</u>
HP 5328A (with Option 010)	10000.004 K Hz
HP 5345A	10.000004 M Hz

Table 5-2. Test Counter Set-Up

HP 5328A UNIVERSAL COUNTER (with Option 010)

NOTE

HP 11048C or equivalent 50 Ω Feedthru connector is also required.

1. Connect the coaxial cable to INPUT A through the 50 Ω Feedthru connector (HP 11048C).
2. Set ATTEN switch to "1".
3. Set LEVEL A to PRESET (fully CCW).
4. Set FUNCTION switch to FREQ A.
5. Set FREQ RESOLUTION to 1 Hz (10⁶).

HP 5345A ELECTRONIC COUNTER

1. Connect coaxial cable to front panel CHANNEL A input connector.
2. Set CHANNEL A input impedance to 50 Ω .
3. Set CHANNEL A ATTEN switch to "X1".
4. Set CHANNEL A "- LEVEL +" control to PRESET (fully CCW).
5. Set FUNCTION switch to FREQ A.
6. Set GATE TIME (outer) control knob to 100 mS.
7. Set /DISPLAY POSITION (inner blue) control knob to AUTO.

5-16. INSTRUMENT ACCESS

5-17. Most maintenance operations require that the top and bottom covers be removed from the counter. Remove the covers according to the following procedure:

WARNING

DISCONNECT THE AC POWER CORD FROM THE COUNTER PRIOR TO REMOVING THE COVERS. EXPOSED TERMINALS WITHIN THE COUNTER (INCLUDING SEVERAL POINTS ON THE PRINTED CIRCUIT BOARD) HAVE VOLTAGES PRESENT WHICH ARE SUFFICIENT TO CAUSE INJURY OR DEATH.

- a. Position the instrument upside down and remove the four flat head screws from the bottom of the instrument.
- b. Lift the bottom cover from the instrument, then remove the printed circuit board (with the front and rear panels attached) by pulling the boards straight out of the top cover.
- c. Reassemble in reverse order of disassembly. While mating the top and bottom covers, **MAKE SURE** that:
 1. The standoff spacers (attached to the top cover) are properly inserted into corresponding holes on the Main Board Assembly and the bottom cover.
 2. Wires on the Main Board Assembly are clear of the standoff spacers and the Main Board Assembly holes.
 3. The front and rear panels are properly inserted into the grooves of the top and bottom covers.

CAUTION

Failure to comply with items 1, 2, and 3 may result in damage to the Main Board Assembly.

- d. Insert and tighten the four flat head screws at the bottom of the counter.

5-18. TROUBLESHOOTING

5-19. If the instrument fails Performance Test one on Table 5-1 (i.e., the Display Test) perform the checks listed on the troubleshooting flowchart, Figure 5-1. If the instrument fails Performance Test Two, refer to the troubleshooting flowchart in Figure 5-2.

START

CONDITIONS:
1. POWER ON
2. NO INPUT SIGNAL TO COUNTER

ARE ALL DISPLAY DIGITS BLANKED?

NO

ARE ONE OR MORE DISPLAY DIGITS BLANKED?

NO

?

YES

CHECK REAR PANEL FUSE (AIF2) TROUBLESHOOT AND REPAIR POWER SUPPLIES

NO

ANY DECIMAL POINTS ILLUMINATED?

?

YES

DO NOT CONFUSE THIS SYMPTOM WITH NORMAL LEADING ZERO BLANKING (SEE TABLE 5-1 TEST 1)

CHECK AND REPLACE OR THE FAILED SE DRIVER TRANSI

ISOLATE FAULT AIU24, AIU13, AIU14

NO

$\overline{S0}$ THRU $\overline{S9}$ SCAN WAVEFORMS (FIGURE 4-2) CORRECT?

?

YES

\overline{XYZW} , $\overline{S0}$ THRU $\overline{S9}$ WAVEFORMS (FIGURE 4-2) CORRECT?

?

NO

ISOLATE FAULT TO DISPLAY DIGIT OR PER TABLE

SET GATE TIME SWITCH TO 10S/HZ CHECK LEADING BLANKING ZERO FUNCTION PER FIGURE 4-4

ISOLATE FAULT TO AIU24, AIU13, AIU14

USING WAVEFORM DIAGRAMS (FIGURE 4-4) AND SCHEMATIC, ISOLATE FAULT TO AIU21, AIU23 OR AIU24

NO

WAVEFORMS CORRECT?

?

YES

REPLACE A2U1

CHECK AND REPI FAILED STORAGE COUNTER ASSOCI INCORRECT DI (FIGURE 5

ALL ILLUMI
DIGITS SHO

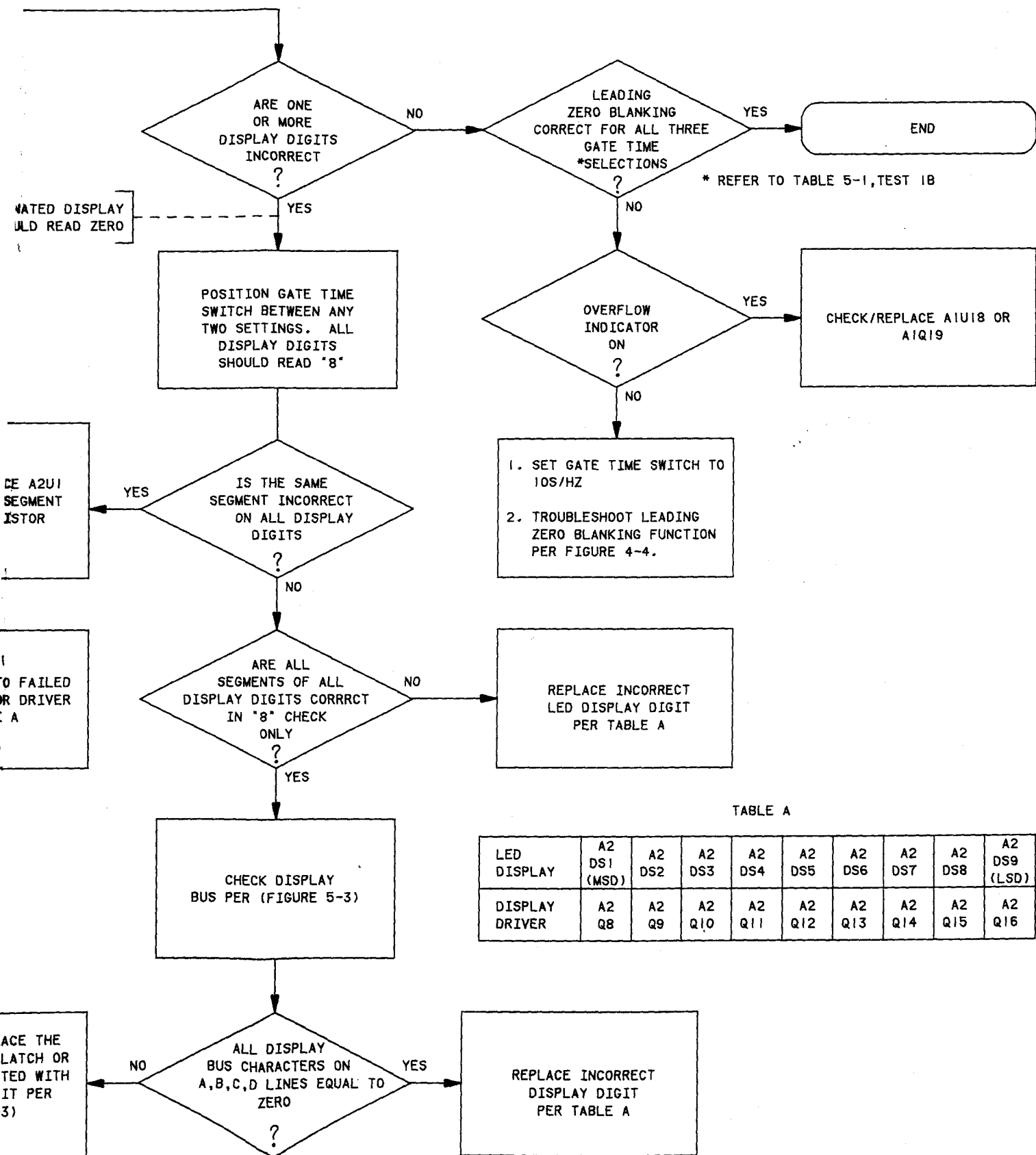


TABLE A

LED DISPLAY	A2 DS1 (MSD)	A2 DS2	A2 DS3	A2 DS4	A2 DS5	A2 DS6	A2 DS7	A2 DS8	A2 DS9 (LSD)
DISPLAY DRIVER	A2 Q8	A2 Q9	A2 Q10	A2 Q11	A2 Q12	A2 Q13	A2 Q14	A2 Q15	A2 Q16

Figure 5-1. Display Function Troubleshooting Flowchart

START

DISPLAY FUNCTION NORMAL PER TABLE 5-1, TEST 1

TROUBLESHOOT DISPLAY PER FIGURE 5-1.

1. SET UP INITIAL CONDITIONS PER TABLE A
2. CONNECT A 50 Ω FEED-THRU CONNECTOR (HP 11048A OR EQUIVILANT) TO FRONT PANEL INPUT CONNECTOR
3. CONNECT A COAX CABLE BETWEEN THE REAR PANEL CONNECTOR AND THE 50 Ω FEED-THRU CONNECTOR.
4. SET FRONT PANEL INPUT SWITCH TO IMAX 10.

TABLE A

1. SET REAR PANEL INT/EXT OSCILLATOR SWITCH TO INT.
2. CHECK T.B.O. PER TABLE 5-1 TEST 3 OR 4.
3. IF COUNTER FAILS TEST, CHECK OR REPLACE:

STANDARD	OPTION 001
AIU3, AIY1, AIQ1, AIQ2 AND ASSOC. COMPONENTS	U25, Q22 AND ASSOC. COMPONENTS

DISPLAY SHOWS 10 MHZ ±1 COUNT ON ALL GATE TIME SELECTIONS

END

WAVEFORM AT AITP1 CORRECT PER SCHEMATIC

MAIN GATE AND TIME BASE CHECK

MGE (AIU1-14) CORRECT PER SCHEMATIC

CHECK SCANNER BOR SIGNAL (AIU13-13) PER FIGURE 4-2 TO ISOLATE FAILURE TO AIU13 OR U23

RSTB, RSTB SIGNALS AIU23-8,9 CORRECT PER FIGURE 4-3

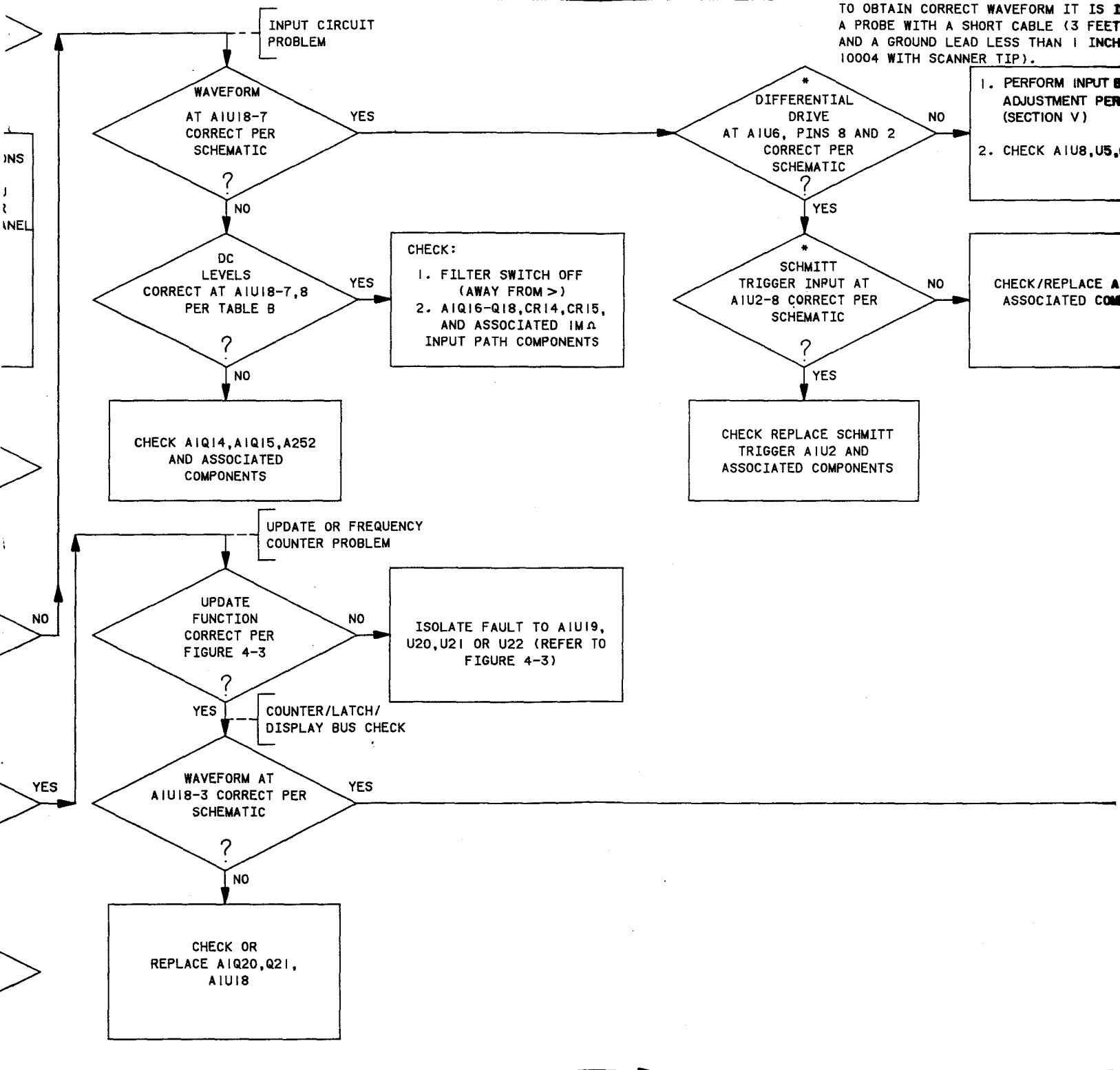
YES

TABLE B

INPUT SW. POSITION	AIU8		TOLERANCE
	PIN 7	PIN 8	
500Ω X I	-2.0 V DC	-3.4 V DC	±0.2V
1MΩ X I OR 1MΩ X IO	-3.4 V DC	-2.0 V DC	

* NOTE:

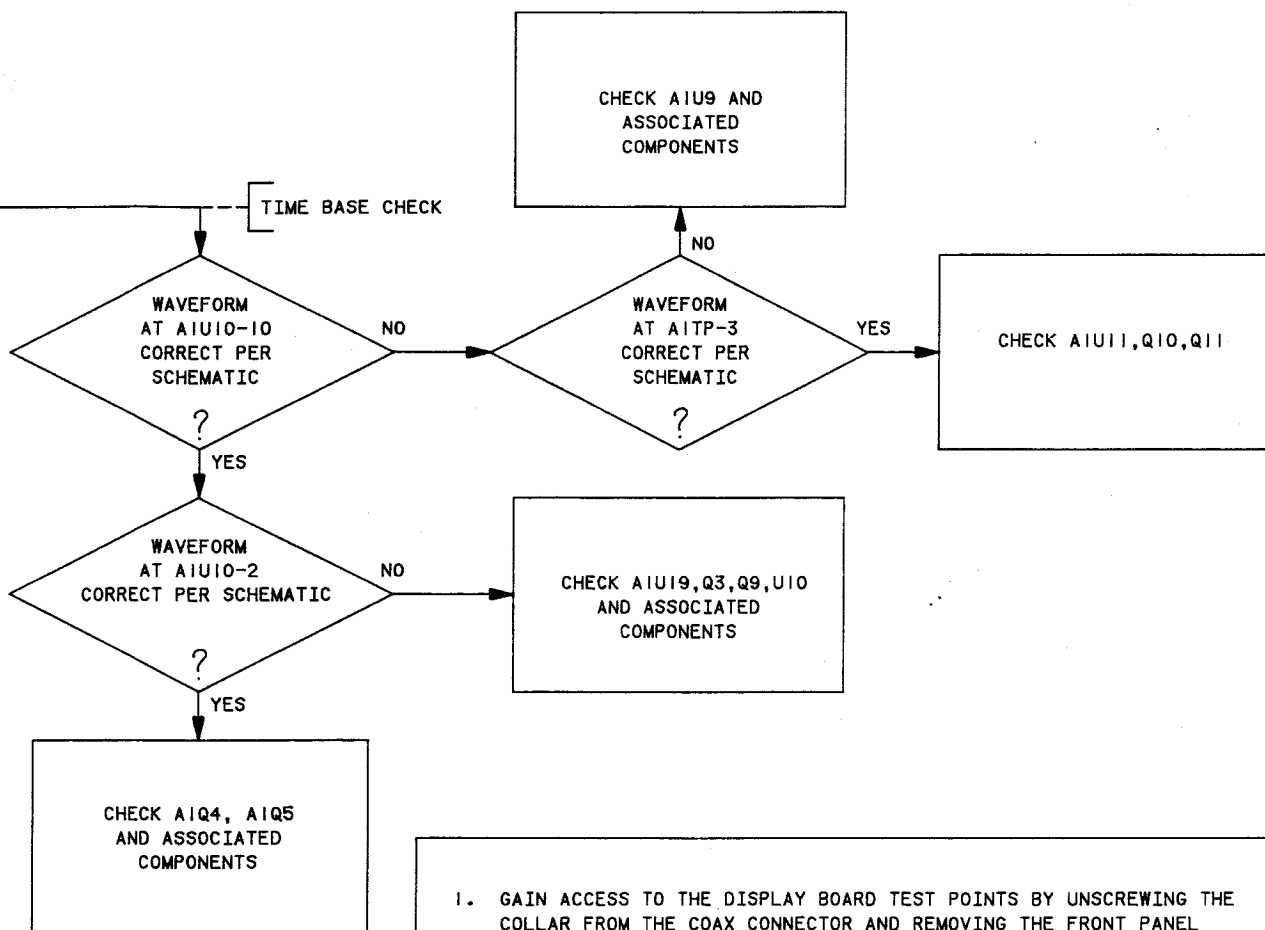
TO OBTAIN CORRECT WAVEFORM IT IS I
A PROBE WITH A SHORT CABLE (3 FEET
AND A GROUND LEAD LESS THAN 1 INCH
10004 WITH SCANNER TIP).



IMPORTANT TO USE
(OR LESS)
(E.G. HP-

BALANCE
PARA. 5-7
Q12, Q13

U6 AND
COMPONENTS



1. GAIN ACCESS TO THE DISPLAY BOARD TEST POINTS BY UNSCREWING THE COLLAR FROM THE COAX CONNECTOR AND REMOVING THE FRONT PANEL PLATE.
2. CHECK THE MULTIPLEXED DISPLAY BUS PER FIGURE 5-3. CHECK ONE BCD DISPLAY BUS CHARACTER AT A TIME, STARTING AT SCAN TIME S6 (FOR THE LEAST SIGNIFICANT CHARACTER, OR LSC). ANY ONE OF THE THREE DISPLAY BUS DATA VALUES SHOWN BELOW IS CORRECT:

a. COUNT = 9999999.9 HZ

SCAN TIME		S6 (LSC)	S7	S9	S0	S1	S2	S3	S4	S5 (MSC)
BCD DISPLAY BUS LINE	A	1	1	1	1	1	1	1	1	1
	B	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0
	D	1	1	1	1	1	1	1	1	1

b. COUNT = 10000000.0 HZ

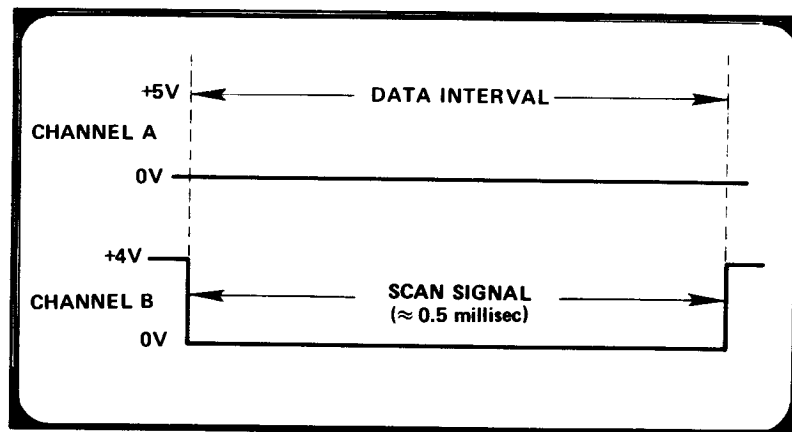
SCAN TIME		S6 (LSC)	S7	S9	S0	S1	S2	S3	S4	S5 (MSC)
BCD DISPLAY BUS LINE	A	0	0	0	0	0	0	0	0	1
	B	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0

c. COUNT = 10000000.1 HZ

SCAN TIME		S6 (LSC)	S7	S9	S0	S1	S2	S3	S4	S5 (MSC)
BCD DISPLAY BUS LINE	A	1	0	0	0	0	0	0	0	1
	B	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0

3. ISOLATE FAILURE TO THE COUNTER OR STORAGE LATCH ASSOCIATED WITH THE ERRONEOUS BCD CHARACTER AS LISTED IN TABLE A OF FIGURE 5-3.
4. IF DISPLAY BUS DATA IS CORRECT, REPLACE A2U1.

Figure 5-2. Counter Function Troubleshooting Flowchart



OSCILLOSCOPE DISPLAY

TABLE A

Active Display Digit	A2 DS1 (MSD)	A2 DS2	A2 DS3	A2 DS4	A2 DS5	A2 DS6	A2 DS7	A2 DS8	A2 DS9 (LSD)
Scan Signal	S5	S4	S3	S2	S1	S0	S9	S7	S6
Counter and Storage Latch Components	A1 U18	A1 U18	A1 U18	A1 U18	A1 U18	A1 U18	A1 U17, U21	A1 U4, U7 U15, U16	A1 U1, U4 U7, U12

PROCEDURE

- a. Remove counter front panel to gain access to display bus A,B,C, and D lines.
- b. Set up oscilloscope to trigger on the negative slope of the B channel input.
- c. Connect scan signal of interest to oscilloscope B channel (see Table A).
- d. Set up oscilloscope sweep time vernier so that the scan signal takes up the full width of the oscilloscope display. This width is the "data interval".
- e. With the oscilloscope channel A probe, check lines A,B,C, and D lines for correct BCD data (weight: A=1, B=2, C=4, D=8). Valid data occurs only during the "data interval" established in step (d). For example if a 5 should be displayed at DS2, then the S4 signal should trigger the oscilloscope and be displayed on channel B. Display Bus lines A,B,C, and D should show respective high, low, high and low TTL levels (BCD 5).

Figure 5-3. Multiplexed Display Bus Monitoring

SECTION VI REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. The major replaceable parts of the 5383A Counter are presented in these tables:

- Table 6-1. Main Board Assembly A1 Parts List
- Table 6-2. Display Board Assembly A2 Parts List
- Table 6-3. Miscellaneous Parts List
- Table 6-4. Manufacturers Code List

6-3. In addition, the following notation is provided to indicate whether the part is used in the standard counter, the Option 001 counter, or in both counters.

Notation	Meaning
No asterisk	Part is used in both the standard and Option 001 counter.
Single asterisk (*)	Part is used in the standard counter only.
Double asterisk (**)	Part is used in the Option 001 counter only.

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order to your local Hewlett-Packard Sales and Service Office (see lists at the back of this manual 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 DESIGNATIONS

A	= assembly	E	= miscellaneous electrical part	P	= electrical connector (movable portion); plug	U	= integrated circuit; microcircuit
AT	= attenuator; isolator; termination	F	= fuse	Q	= transistor; SCR; triode thyristor	V	= electron tube
B	= fan; motor	FI.	= filter	R	= resistor	VR	= voltage regulator; breakdown diode
BT	= battery	H	= hardware	RT	= thermistor	W	= cable; transmission path; wire
C	= capacitor	HY	= circulator	S	= switch	X	= socket
CP	= coupler	J	= electrical connector (stationary portion); jack	T	= transformer	Y	= crystal unit—piezo-electric
CR	= diode; diode thyristor; varactor	K	= relay	TB	= terminal board	Z	= tuned cavity; tuned circuit
DC	= directional coupler	L	= coil; inductor	TC	= thermocouple		
DL	= delay line	M	= meter	TP	= test point		
DS	= annunciator; signaling device (audible or visual); lamp; LED	MP	= miscellaneous mechanical part				

ABBREVIATIONS

A	= ampere	avg	= average	CHAN	= channel	dc	= direct current
ac	= alternating current	AWG	= American wire gauge	cm	= centimeter	deg	= degree (temperature interval or difference)
ACCESS	= accessory	BAL.	= balance	CMO	= cabinet mount only	...°	= degree (plane angle)
ADJ	= adjustment	RCD	= binary coded decimal	COAX	= coaxial	°C	= degree Celsius (centigrade)
A/D	= analog-to-digital	RD	= board	COEF	= coefficient	°F	= degree Fahrenheit
AF	= audio frequency	BE CU	= beryllium copper	COM	= common	°K	= degree Kelvin
APC	= automatic frequency control	BFO	= beat frequency oscillator	COMP	= composition	DEPC	= deposited carbon
AGC	= automatic gain control	BH	= binder head	COMPL.	= complete	DET	= detector
AL	= aluminum	BKDN	= breakdown	CONN	= connector	diam	= diameter
AIC	= automatic level control	BP	= bandpass	CP	= cadmium plate	DIA	= diameter (used in parts list)
AM	= amplitude modulation	BPF	= bandpass filter	CRT	= cathode-ray tube	DIFF	= differential
AMPL.	= amplifier	BRS	= brass	CTL.	= complementary transistor logic	AMPL.	= differential amplifier
APC	= automatic phase control	BWO	= backward-wave oscillator	CW	= continuous wave	div	= division
ASSY	= assembly	CAL.	= calibrate	cw	= clockwise	DPDT	= double-pole, double-throw
AUX	= auxiliary	CB	= counter-clockwise	cm	= centimeter	DR	= drive
		CER	= ceramic	D/A	= digital-to-analog		
				dB	= decibel		
				dBm	= decibel referred to 1 mW		

ABBREVIATIONS

DSB	= double sideband	MFR	= manufacturer	PIV	= peak inverse voltage	TFT	= thin-film transistor
DTL	= diode transistor logic	mg	= milligram	pk	= peak	TGL	= toggle
DVM	= digital voltmeter	MHz	= megahertz	PL	= phase lock	THD	= thread
ECL	= emitter coupled logic	mH	= millihenry	PL.O	= phase lock oscillator	THRU	= through
EMF	= electromotive force	mho	= mho	PM	= phase modulation	TI	= titanium
EDP	= electronic data processing	MIN	= minimum	PNP	= positive-negative-positive	TOI	= tolerance
ELECT	= electrolytic	min	= minute (time)	P/O	= part of	TRIM	= trimmer
ENCAP	= encapsulated	MINAT	= minute (plane angle)	POLY	= polystyrene	TSTR	= transistor
EXT	= external	mm	= millimeter	PORC	= porcelain	TTI	= transistor-transistor logic
F	= farad	MOD	= modulator	POS	= positive; position(s) (used in parts list)	TV	= television
FET	= field-effect transistor	MOM	= momentary	POT	= potentiometer	TVI	= television interference
F/F	= flip-flop	MOS	= metal-oxide semiconductor	PP	= peak-to-peak (used in parts list)	TWT	= traveling wave tube
FH	= flat head	ms	= millisecond	PPM	= pulse-position modulation	U	= micro (10 ⁻⁶) (used in parts list)
FIL. H	= fillister head	MTG	= mounting	PREAMPL.	= preamplifier	UF	= microfarad (used in parts list)
FM	= frequency modulation	MTR	= meter (indicating device)	PRF	= pulse-repetition frequency	UHF	= ultrahigh frequency
FP	= front panel	mV	= millivolt	PRR	= pulse repetition rate	UNREG	= unregulated
FREQ	= frequency	mVac	= millivolt, ac	ps	= picosecond	V	= volt
FXD	= fixed	mVdc	= millivolt, dc	PT	= point	VA	= voltampere
g	= gram	mVpk	= millivolt, peak	PTM	= pulse-time modulation	Vac	= volts, ac
GE	= germanium	mV p-p	= millivolt, peak-to-peak	PWM	= pulse-width modulation	VAR	= variable
GHz	= gigahertz	mVrms	= millivolt, rms	PWV	= peak working voltage	VCO	= voltage-controlled oscillator
GL	= glass	mW	= milliwatt	RC	= resistance	Vdc	= volts, dc
GND	= grounded	MUX	= multiplex	RECT	= rectifier	VDCW	= volts, dc, working (used in parts list)
H	= henry	MY	= mylar	REF	= reference	V(F)	= volts, filtered
h	= hour	μA	= microampere	REG	= regulated	VFO	= variable-frequency oscillator
HET	= heterodyne	μF	= microfarad	REPL.	= replaceable	VHF	= very-high frequency
HEX	= hexagonal	μH	= microhenry	RF	= radio frequency	Vpk	= volts, peak
HD	= head	μmho	= micromho	RFI	= radio frequency interference	Vp-p	= volts, peak-to-peak
HDW	= hardware	μs	= microsecond	RH	= round head; right hand	Vrms	= volts, rms
HF	= high frequency	μV	= microvolt	RIC	= resistance-inductance-capacitance	VSWR	= voltage standing wave ratio
HG	= mercury	μVac	= microvolt, ac	RMO	= rack mount only	VTO	= voltage-tuned oscillator
HI	= high	μVdc	= microvolt, dc	rms	= root-mean-square	VTVM	= vacuum-tube voltmeter
HP	= Hewlett-Packard	μVpk	= microvolt, peak	RND	= round	V(X)	= volts, switched
HPF	= high pass filter	μVp-p	= microvolt, peak-to-peak	ROM	= read-only memory	W	= watt
HR	= hour (used in parts list)	μVrms	= microvolt, rms	R&P	= rack and panel	W	= with
HV	= high voltage	μW	= microwatt	RWV	= reverse working voltage	WIV	= working inverse voltage
Hz	= Hertz	nA	= nanoampere	S	= scattering parameter	WW	= wirewound
IC	= integrated circuit	NC	= no connection	s	= second (time)	W/O	= without
ID	= inside diameter	N/C	= normally closed	S-B	= slow-blow (fuse) (used in parts list)	YIG	= yttrium-iron-garnet
IF	= intermediate frequency	NE	= neon	SCR	= silicon controlled rectifier; screw	Zo	= characteristic impedance
IMPG	= impregnated	NEG	= negative	SE	= selenium		
in	= inch	nF	= nanofarad	SECT	= sections		
INCD	= incandescent	nI PL	= nickel plate	SEMICON	= semiconductor		
INCL.	= include(s)	N/O	= normally open	SHF	= superhigh frequency		
INP	= input	NOM	= nominal	SI	= silicon		
INS	= insulation	NORM	= normal	SIL	= silver		
INT	= internal	NPN	= negative-positive-negative	SI.	= slide		
kg	= kilogram	NPO	= negative-positive zero (zero temperature coefficient)	SNR	= signal-to-noise ratio		
kHz	= kilohertz	NRFR	= not recommended for field replacement	SPDT	= single-pole, double-throw		
kΩ	= kilohm	NSR	= not separately replaceable	SPG	= spring		
kV	= kilovolt	ns	= nanosecond	SR	= split ring		
lb	= pound	nW	= nanowatt	SPST	= single-pole, single-throw		
LC	= inductance-capacitance	OBD	= order by description	SSB	= single sideband		
LED	= light-emitting diode	OD	= outside diameter	SST	= stainless steel		
LF	= low frequency	OH	= oval head	STL	= steel		
LG	= long	OP AMPL.	= operational amplifier	SQ	= square		
LH	= left hand	OPT	= option	SWR	= standing-wave ratio		
LJM	= limit	OSC	= oscillator	SYNC	= synchronize		
LJN	= linear taper (used in parts list)	OX	= oxide	T	= timed (slow-blow fuse)		
lin	= linear	oz	= ounce	TA	= tantalum		
LK	= lock washer	Ω	= ohm	TC	= temperature compensating		
WASH	= lock washer	P	= peak (used in parts list)	TD	= time delay		
LO	= low; local oscillator	PAM	= pulse-amplitude modulation	TERM	= terminal		
LOG	= logarithmic taper (used in parts list)	PC	= printed circuit				
log	= logarithmic	PCM	= pulse-code modulation; pulse-count modulation				
LPF	= low pass filter	PDM	= pulse-duration modulation				
LV	= low voltage	pF	= picofarad				
m	= meter (distance)	PH BRZ	= phosphor bronze				
mA	= milliampere	PHI.	= Phillips				
MAX	= maximum	PIN	= positive-intrinsic-negative				
MO	= megohm						
MEG	= meg (10 ⁶) (used in parts list)						
MET FILM	= metal film						
MET OX	= metal oxide						
MF	= medium frequency; microfarad (used in parts list)						

NOTE

All abbreviations in the parts list will be in upper case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10 ¹²
G	giga	10 ⁹
M	mega	10 ⁶
k	kilo	10 ³
da	deka	10
d	deci	10 ⁻¹
c	centi	10 ⁻²
m	milli	10 ⁻³
μ	micro	10 ⁻⁶
n	nano	10 ⁻⁹
p	pico	10 ⁻¹²
f	femto	10 ⁻¹⁵
a	atto	10 ⁻¹⁸

Table 6-1. A1 Main Board Assembly Parts List

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05383-60001	1	MAIN BOARD ASSY (STANDARD INSTRUMENT)	28480	05383-60001
A1	05383-60003	1	MAIN BOARD ASSY (OPTION 001 ONLY)	28480	05383-60003
A1C1*	0121-0059	1	CAPACITOR; VAR; TRMR; CER; 2/8PF	73899	DV11PR8A
A1C2*	0160-2265	1	CAPACITOR-FXD 22PF $\pm 5\%$ 500WVDC CER 0+	28480	0160-2265
A1C3	0160-0161	1	CAPACITOR-FXD .01UF $\pm 10\%$ 200WVDC POLYE	56289	292P10392
A1C4	0160-3878	21	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C5	0180-0428	4	CAPACITOR-FXD; 68UF $\pm 20\%$ 6VDC TA-SOLID	28480	0180-0428
A1C6*	0160-2055	4	CAPACITOR-FXD .01UF $\pm 80-20\%$ 100WVDC CER	28480	0160-2055
A1C7*	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C8	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C9	0160-3879	2	CAPACITOR-FXD .01UF $\pm 20\%$ 100WVDC CER	28480	0160-3879
A1C10	0180-0058	1	CAPACITOR-FXD; 50UF $\pm 75-10\%$ 25VDC AL	56289	30D506G025CC2
A1C11	0160-2055	3	CAPACITOR-FXD .01UF $\pm 80-20\%$ 100WVDC CER	28480	0160-2055
A1C12	0180-0480	2	CAPACITOR-FXD; 4500 UF $\pm 75-10\%$ 25VDC AL	56289	360X452G025AA2A
A1C13	0180-0480	1	CAPACITOR-FXD; 4500 UF $\pm 75-10\%$ 25VDC AL	56289	360X452G025AA2A
A1C14*	0160-2055	1	CAPACITOR-FXD .01UF $\pm 80-20\%$ 100WVDC CER	28480	0160-2055
A1C15*	0160-2055	1	CAPACITOR-FXD .01 UF $\pm 20\%$ 100WVDC CER	28480	0160-2055
A1C16	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C17	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C18	0180-0428	1	CAPACITOR-FXD; 68UF $\pm 20\%$ 6VDC TA-SOLID	28480	0180-0428
A1C19	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C20	0160-3879	1	CAPACITOR-FXD .01UF $\pm 20\%$ 100WVDC CER	28480	0160-3879
A1C21	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C22	0180-1701	7	CAPACITOR-FXD; 6.8UF $\pm 20\%$ 6VDC TA-SOLID	56289	150D685X0006A2
A1C23	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C24	0180-1701	1	CAPACITOR-FXD; 6.8UF $\pm 20\%$ 6VDC TA-SOLID	56289	150D685X0006A2
A1C25	0180-0428	1	CAPACITOR-FXD; 68UF $\pm 20\%$ 6VDC TA-SOLID	28480	0180-0428
A1C26	0180-1701	1	CAPACITOR-FXD; 6.8UF $\pm 20\%$ 6VDC TA-SOLID	56289	150D685X0006A2
A1C27	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C28	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C29	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C30	0160-0128	2	CAPACITOR-FXD 2.2UF $\pm 20\%$ 25WVDC CER	28480	0160-0128
A1C31	0180-1701	1	CAPACITOR-FXD; 6.8UF $\pm 20\%$ 6VDC TA-SOLID	56289	150D685X0006A2
A1C32	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C33	0160-3875	1	CAPACITOR-FXD 22PF $\pm 5\%$ 200WVDC CER 0+	28480	0160-3875
A1C34	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C35	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C36	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C37	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C38	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C39	0160-0128	1	CAPACITOR-FXD 2.2UF $\pm 20\%$ 25WVDC CER	28480	0160-0128
A1C40	0160-3454	3	CAPACITOR-FXD 220PF $\pm 10\%$ 1000WVDC CER	28480	0160-3454
A1C41	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C42	0160-3454	1	CAPACITOR-FXD 220PF $\pm 10\%$ 1000WVDC CER	28480	0160-3454
A1C43	0160-3454	1	CAPACITOR-FXD 220PF $\pm 10\%$ 1000WVDC CER	28480	0160-3454
A1C44	0180-0428	1	CAPACITOR-FXD; 68UF $\pm 20\%$ 6VDC TA-SOLID	28480	0180-0428
A1C45	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C46	0180-1701	1	CAPACITOR-FXD; 6.8UF $\pm 20\%$ 6VDC TA-SOLID	56289	150D685X0006A2
A1C47	0160-3878	1	CAPACITOR-FXD 1000PF $\pm 20\%$ 100WVDC CER	28480	0160-3878
A1C48	0180-1701	1	CAPACITOR-FXD; 6.8UF $\pm 20\%$ 6VDC TA-SOLID	56289	150D685X0006A2
A1C49	0180-1701	1	CAPACITOR-FXD; 6.8UF $\pm 20\%$ 6VDC TA-SOLID	56289	150D685X0006A2
A1C50**	0160-2055	1	CAPACITOR-FXD .01UF $\pm 80-20\%$ 100WVDC CER	28480	0160-2055
A1C51	0160-3043	1	CAPACITOR-FXD 5000PF/5000PF $\pm 20\%$	28480	0160-3043
A1CR1*	1901-0040	8	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR2*	1901-0040	1	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR3	1901-0028	1	DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A1CR4	1906-0028	1	DIODE-MULT FULL WAVE BRIDGE RECTIFIER	04713	MDA922-3
A1CR5	1902-0040	1	DIODE-ZNR 14V 5% DC-7 PD=.4W TC=+.056%	07263	FZ 1201
A1CR6	1901-0040	1	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR7	1901-0040	1	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR8	1901-0535	4	DIODE-SCHOTTKY	28480	1901-0535
A1CR9	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A1CR10	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A1CR11	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A1CR12	1901-0050	2	DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A1CR13	1901-0050	1	DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A1CR14	1901-0040	1	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR15	1901-0040	1	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040

*Standard Counter Only
**Option 001 Counter Only

See introduction to this section for ordering information

Table 6-1. A1 Main Board Assembly Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1CR16*	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1F1	2110-0436	1	FUSE .1A 125V	28480	2110-0436
A1F2	2110-0018	1	FUSE .25A 125V SLC-BLD	75915	313-250
A1F2	2110-0318	1	FUSE .125A 250V SLC-BLD	71400	MDL 1/R
A1J1	1251-2357	1	CONNECTOR; AC PWR; HP-9 MALE FLANGE	28480	1251-2357
A1J2	1250-0083	1	CONNECTOR-RF 8NC FEM SGL MOLE FR	24931	28JR-130-1
A1L1	9140-0210	1	COIL; FXD; MOLDED RF CHOKE; 100UH 5% COIL; FXD; NCM-MOLDED RF CHOKE; .75UH	24226	15/103
A1L2	9100-1788	3	COIL; FXD; NCM-MOLDED RF CHOKE; .75UH	02114	VK200-20/48
A1L3	9100-1788	1	COIL; FXD; NCM-MOLDED RF CHOKE; .75UH	02114	VK200-20/48
A1L4	9100-1788	1	COIL; FXD; NCM-MOLDED RF CHOKE; .75UH	02114	VK200-20/48
A1L5	9100-2269	2	COIL; FXD; MOLDED RF CHOKE; 27UH 10%	24226	10/272
A1L6	9100-2269		COIL; FXD; MOLDED RF CHOKE; 27UH 10%	24226	10/272
A1L7	9170-0029	1	CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A1Q1	1853-0015	3	TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A1Q2	1853-0015	1	TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A1Q3	1853-0015	1	TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A1Q4	1854-0092	4	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q5	1854-0092	1	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q6	1854-0215	3	TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS 3611
A1Q7	1854-0215	1	TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS 3611
A1Q8	1853-0036	3	TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A1Q9	1853-0036	1	TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A1Q10	1854-0092	1	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q11	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q12	1854-0546	2	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A1Q13	1854-0546	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A1Q14	1854-0071	4	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q15	1854-0071	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q16	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS 3611
A1Q17	1855-0081	2	TRANSISTOR; J-FET N-CHAN, D-MODE SI	01295	2N5245
A1Q18	1855-0081	1	TRANSISTOR; J-FET N-CHAN, D-MODE SI	01295	2N5245
A1Q19	1854-0071	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q20	1853-0036	1	TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A1Q21	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q22**	1853-0015		TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A1R1*	0757-0893	1	RESISTOR 51 OHM 2% .125W F TUBULAR	24546	C4-1/R-T0-51R0-G
A1R1*	1251-3205	4	SOCKET, MINIATURE	28480	1251-3205
A1R2*	0683-2025	4	RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R3*	0683-2025	1	RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R4*	0683-2025	1	RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R5*	0683-2715	1	RESISTOR 270 OHM 5% .25W CC TUBULAR	01121	CB2715
A1R6*	0683-2015	3	RESISTOR 200 OHM 5% .25W CC TUBULAR	01121	CB2015
A1R7	0683-4315	1	RESISTOR 430 OHM 5% .25W CC TUBULAR	01121	CB4315
A1R8*	1810-0020	1	NETWORK-RES 8-PIN SIP .125-PIN-SPCG	28480	1810-0020
A1R9*	0683-2715	1	RESISTOR 270 OHM 5% .25W CC TUBULAR	01121	CB2715
A1R10*	0683-5115		RESISTOR 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A1R11*	0683-5605	2	RESISTOR 56 OHM 5% .25W CC TUBULAR	01121	CB5605
A1R12	1810-0030	1	NETWORK-RES 8-PIN SIP .125-PIN-SPCG	28480	1810-0030
A1R13	0683-1515	1	RESISTOR 150 OHM 5% .25W CC TUBULAR	01121	CB1515
A1R14	0683-2015	1	RESISTOR 200 OHM 5% .25W CC TUBULAR	01121	CB2015
A1R15	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R16*	0683-5115		RESISTOR 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A1R17	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R18	0683-1825	1	RESISTOR 1.8K 5% .25W CC TUBULAR	01121	CB1825
A1R19	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R20	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R21	0698-4132	2	RESISTOR 62 OHM 5% .125W CC TUBULAR	01121	8B6205
A1R22	0698-5176	10	RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	8B5115
A1R23	0698-5176	1	RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	8B5115
A1R24	0698-5176	1	RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	8B5115
A1R25	0698-6244	2	RESISTOR 3.3K 5% .125W CC TUBULAR	01121	8B3325
A1R26	0698-5174	3	RESISTOR 200 OHM 5% .125W CC TUBULAR	01121	8B2015
A1R27	0683-1035	1	RESISTOR 10K 5% .25W CC TUBULAR	01121	CB1035
A1R28	0688-6244		RESISTOR 3.3K 5% .125W CC TUBULAR	01121	8B3325
A1R29	0683-3025	1	RESISTOR 3K 5% .25W CC TUBULAR	01121	CB3025
A1R30	0698-5180	1	RESISTOR 2K 5% .125W CC TUBULAR	01121	8B2025
A1R31	0698-6294	3	RESISTOR 47K 5% .125W CC TUBULAR	01121	8B4735
A1R32	2100-1986	1	RESISTOR; VAR; TRMR; 1KOHM 10% C	30983	ET50W102
A1R33	0698-6244		RESISTOR 3.3K 5% .125W CC TUBULAR	01121	8B3325
A1R34	0698-6294		RESISTOR 47K 5% .125W CC TUBULAR	01121	8B4735
A1R35	0698-5174		RESISTOR 200 OHM 5% .125W CC TUBULAR	01121	8B2015
A1R36	0698-5179	1	RESISTOR 1.8K 5% .125W CC TUBULAR	01121	8B1825
A1R37	0698-5174		RESISTOR 200 OHM 5% .125W CC TUBULAR	01121	8B2015
A1R38	0698-4132		RESISTOR 62 OHM 5% .125W CC TUBULAR	01121	8B6205
A1R39	0698-3374	1	RESISTOR 20 OHM 5% .125W CC TUBULAR	01121	8B2005

*Standard Counter Only

**Option 001 Counter Only

See introduction to this section for ordering information

Table 6-1. A1 Main Board Assembly Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R40	0698-6242	4	RESISTOR 1.2K 5% .125W CC TUBULAR	01121	881225
A1R41	0698-7080	2	RESISTOR 27 OHM 5% .125W CC TUBULAR	01121	882705
A1R42	0698-3378	2	RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	885105
A1R43	0698-3378		RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	885105
A1R44	0698-7080		RESISTOR 27 OHM 5% .125W CC TUBULAR	01121	882705
A1R45	0698-8354	2	RESISTOR 270 OHM 5% .125W CC TUBULAR	01121	882715
A1R46	0698-6241		RESISTOR 750 OHM 5% .125W CC TUBULAR	01121	881225
A1R47	0698-5176		RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	885115
A1R48	0698-7102		RESISTOR 5.1K OHM 5% .125W CC TUBULAR	01121	885125
A1R49	1810-0055	2	NETWORK-RES 9-PIN SIP .15-PIN-SPCG	28480	1810-0055
A1R50	0683-2015		RESISTOR 200 OHM 5% .25W CC TUBULAR	01121	CB2015
A1R51	0698-6242		RESISTOR 1.2K 5% .125W CC TUBULAR	01121	881225
A1R52	0698-5177	1	RESISTOR 820 OHM 5% .125W CC TUBULAR	01121	888215
A1R53	0698-6294		RESISTOR 47K 5% .125W CC TUBULAR	01121	884735
A1R54	0698-5183	2	RESISTOR 4.3K 5% .125W CC TUBULAR	01121	884325
A1R55	0698-5426	1	RESISTOR 10K 10% .125W CC TUBULAR	01121	881031
A1R56	0683-2745	1	RESISTOR 270K 5% .25W CC TUBULAR	01121	CB2745
A1R57	0698-5176		RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	885115
A1R58	0698-5176		RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	885115
A1R59	0698-6283	1	RESISTOR 10 OHM 5% .125W CC TUBULAR	01121	881005
A1R60	0698-6242		RESISTOR 1.2K 5% .125W CC TUBULAR	01121	881225
A1R61	0698-5176		RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	885115
A1R62	0675-1021	2	RESISTOR 1K 10% .125W CC TUBULAR	01121	881021
A1R63	0698-5176		RESISTOR 510 OHM 5% .125W CC TUBULAR	01121	885115
A1R64	0675-1021		RESISTOR 1K 10% .125W CC TUBULAR	01121	881021
A1R65	0683-5605		RESISTOR 56 OHM 5% .25W CC TUBULAR	01121	CB5605
A1R66	0698-6242		RESISTOR 1.2K 5% .125W CC TUBULAR	01121	881225
A1R67	0698-5183		RESISTOR 4.3K 5% .125W CC TUBULAR	01121	884325
A1R68	1810-0055		NETWORK-RES 9-PIN SIP .15-PIN-SPCG	28480	1810-0055
A1R69*	0683-1515	1	RESISTOR 150 OHM 5% .25W CC TUBULAR	01121	CB1515
A1R70*	0683-1025	5	RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R71*	0683-5115		RESISTOR 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A1S1*	3101-1618	1	SWITCH-SL DPDT -NS SUBMIN .5A 125VAC/DC	28480	3101-1618
A1S2	3101-1341	1	SWITCH: SL; SPDT NS; .5A 125VAC/DC	79727	G-111-0004
A1S3	3101-0680	1	SWITCH-PB DPDT ALTAG 4A 250VAC	28480	3101-0680
A1S4	3101-1609	1	SWITCH-SL 2-DPDT-NS 3A 125VAC	82389	11E-1036
A1T1	9100-3039	1	TRANSFORMER, POWER	28480	9100-3039
A1U1	1820-0736	1	IC DGTL COUNTER	28480	1820-0736
A1U2	1820-0982	3	IC LIN AMPLIFIER	28480	1820-0982
A1U3*	1820-1224	1	IC DGTL MC10216P RECEIVER	04713	MC10216P
A1U4	1820-1019	1	IC DGTL COUNTER	28480	1820-1019
A1U5	1826-0139	1	IC LIN MC 1458P1 AMPLIFIER	04713	MC1458P1
A1U6	1820-0982		IC LIN AMPLIFIER	28480	1820-0982
A1U7	1820-1052	1	IC DGTL MC10125L TRANSLATOR (LOGIC)	04713	MC10125L
A1U8	1820-0982		IC LIN AMPLIFIER	28480	1820-0982
A1U9	1820-1251	1	IC DGTL SN74LS196 N COUNTER	01295	SN74LS196N
A1U10	1820-0817	1	IC DGTL MC10131L FLIP-FLOP	04713	MC10131P
A1U11	1820-0633	1	IC:M.O.S. TIME BASE	28480	1820-0633
A1U12	1820-1166	2	IC DGTL DM85L 51N FLIP-FLOP	27014	DM85L51N
A1U13	1820-0911	1	IC DGTL SN74L 192 N COUNTER	01295	SN74L192N
A1U14	1820-0214	1	IC DGTL SN74 42 N DECODER	01295	SN7442N
A1U15	1820-1155	1	IC DGTL N82590A COUNTER	18324	N82590A
A1U16	1820-1166		IC DGTL DM85L 51N FLIP-FLOP	27014	DM85L51N
A1U17	1820-1143	1	IC DGTL CM85 52N COUNTER	27014	CM8552N
A1U18	1820-0634	1	IC DGTL COUNTER	28480	1820-0634
A1U19	1820-0174	1	IC DGTL SN74 04 N INVERTER	01295	SN7404N
A1U20	1820-0054	1	IC DGTL SN74 00 N GATE	01295	SN7407N
A1U21	1820-0661	1	IC DGTL SN74 32 N GATE	01295	SN7432N
A1U22	1820-0328	1	IC DGTL SN74 02 N GATE	01295	SN7402N
A1U23	1820-0077	1	IC DGTL SN74 74 N FLIP-FLOP	01295	SN7474N
A1U24	1820-0537	1	IC DGTL SN74 13 N SCHMITT TRIGGER	01295	SN7413N
A1U25*	0960-0394	1	CRYSTAL OSCILLATOR	28480	0960-0394
A1U26	1826-0122	1	IC LIN REGULATOR	07263	7805UC
A1U27	1826-0215	1	IC LIN MC 7905.2CP REGULATOR	04713	MC7905.2CP
A1Y1*	0410-0405	1	CRYSTAL:QUARTZ 10 MHZ	28480	0410-0405

*Standard Counter Only
**Option 001 Counter Only

See introduction to this section for ordering information

Table 6-2. A2 Display Board Parts List

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2	0583-80002		DISPLAY BOARD ASSEMBLY	28480	0583-80002
A2C1	0180-0106	1	CAPACITOR-FXD; 60UF +-20% 6VDC TA-SOLID	56289	150D606X000682
A2C2	0160-4182	1	CAPACITOR-FXD .01UF +-20% 200WVDC CER	72982	8121-M200-X7R-103M
A2C3	0140-0209	1	CAPACITOR-FXD 5PF +.10% 500WVDC MICA	72136	DM15C050K0500WVICR
A2CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2D51	1990-0469 OR 1990-0470 OR 1990-0471 (Refer to Paragraph 6-6.)	9	DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D52			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D53			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D54			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D55			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D56	1990-0471 (Refer to Paragraph 6-6.)		DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D57			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D58			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D59			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2J1	1250-1163	1	CONNECTOR-RF BMC FEM SGL HOLE RR	28480	1250-1163
A2L1	9100-1620	1	COIL; FXD; MGLDED RF CHOKE; 15UH 10%	24226	15/152
A2Q1	1854-0246 1854-0246 1854-0246 1854-0246 1854-0246	7	TRANSISTOR NPN SI PD=350MW FT=250MHZ	04713	SPS 233
A2Q2			TRANSISTOR NPN SI PD=350MW FT=250MHZ	04713	SPS 233
A2Q3			TRANSISTOR NPN SI PD=350MW FT=250MHZ	04713	SPS 233
A2Q4			TRANSISTOR NPN SI PD=350MW FT=250MHZ	04713	SPS 233
A2Q5			TRANSISTOR NPN SI PD=350MW FT=250MHZ	04713	SPS 233
A2Q6	1854-0246 1854-0246 1853-0318 1853-0318 1853-0318	9	TRANSISTOR NPN SI PD=350MW FT=250MHZ	04713	SPS 233
A2Q7			TRANSISTOR NPN SI PD=350MW FT=250MHZ	04713	SPS 233
A2Q8			TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q9			TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q10			TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q11	1853-0318 1853-0318 1853-0318 1853-0318 1853-0318		TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q12			TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q13			TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q14			TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q15			TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2Q16	1853-0318		TRANSISTOR PNP SI CHIP PD=500MW	28480	1853-0318
A2R1	0683-2705 0683-2705 0683-2705 0683-2705 0683-2705	11	RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R2			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R3			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R4			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R5			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R6	0683-2705 0683-2705 0683-0395 0683-0395 0683-0395	9	RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R7			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R8			RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R9			RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R10			RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R11	0683-0395 0683-0395 0683-0395 0683-0395 0683-0395		RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R12			RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R13			RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R14			RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R15			RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R16	0683-0395 1810-0041 0683-2705 0683-2705 0683-2705	1	RESISTOR 3.9 OHM 5% .25W CC TUBULAR	01121	C83965
A2R17			NETWORK-RES SIP .15-PIN-SPCG	28480	1810-0041
A2R18			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R19			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R20			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R21	0683-4715 0683-4715 0683-4715 0683-4715 0683-4715	9	RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R22			RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R23			RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R24			RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R25			RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R26	0683-4715 0683-4715 0683-4715 0683-2705 0683-2725	1	RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R27			RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R28			RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R29			RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	C82705
A2R30			RESISTOR 2.7K 5% .25W CC TUBULAR	01121	C82725
A2R31	0683-4715 0698-8354 0698-7102 0698-7097 0698-7964	1	RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	C84715
A2R32			RESISTOR 270 OHM 5% .125W CC TUBULAR	01121	882715
A2R33			RESISTOR 5.1K 5% .125W CC TUBULAR	01121	885125
A2R34			RESISTOR 1M 5% .125W CC TUBULAR	01121	881055
A2R35			RESISTOR 100K 5% .125W CC TUBULAR	01121	881045
A2S1	3101-1598 3101-1598	2	SWITCH; SL; DP3T NS; 1A 125VAC	28480	3101-1598
A2S2			SWITCH; SL; DP3T NS; 1A 125VAC	28480	3101-1598
A2U1	1820-0914	1	IC DCTL DECODER	07263	93070C

See introduction to this section for ordering information

Table 6-3. Miscellaneous Parts List

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	0510-0076 1251-3768	1 32	.JUT-SHEETMETAL 6-32-THD .63-WD STL CONTACT-CONN U/W POST TYPE MALE DPSLDR	78553 28480	C8599-632-248 1251-3768
	0340-0765 0360-0353 0360-1610 0370-0914 0370-2486	1 2 2 1 1	MISCELLANEOUS PARTS INSULATOR; XSTR; .002 THK TERMINAL, SLDR LUG, 6 SCR, .144/.144 ID TERMINAL, SLDR LUG, 6 SCR, .136/.172 ID BEZEL; PUSHBUTTON KNOB, JADE GREY PUSHBUTTON(SOLID GRAY)	28480 79963 79963 28480 28480	0340-0765 176 608 0370-0914 0370-2486
	0510-0002 2950-0054 8120-1348 5040-7032 05301-20005	2 1 1 1 1	PRESS-IN NUT 6-32 .062-LG .062-HGT NUT-MEX-DBL CHAM 1/2-28-THD .125-THK CABLE; UNSHLD 3-CORD 18AWG FOOT, REAR STAND, TILT	28480 28480 28480 28480 28480	0510-0002 2950-0054 8120-1348 5040-7032 05301-20005
	05301-40001 05381-20003 05381-20004 05381-20005 05382-00002	1 1 1 4 1	FOOT COVER, TCP COVER, BOTTOM STANDOFF *PANEL, REAR	28480 28480 28480 28480 28480	05301-40001 05381-20003 05381-20004 05381-20005 05382-00002
	05382-00003 05383-00001 05383-60001 05383-60002 05383-60003	1 1 1 1 1	*PANEL, REAR PANEL, FRONT *BOARD ASSY, MAIN BOARD ASSY, DISPLAY *BOARD ASSY, MAIN	28480 28480 28480 28480 28480	05382-00003 05383-00001 05383-60001 05383-60002 05383-60003
	05383-90001	1	MANUAL	28480	05383-90001

See introduction to this section for ordering information

Table 6-4. Manufacturers Code List

Mfg. No.	Manufacturer Name	Address	Zip Code
01121	ALL BRADLEY CO	MILWAUKEE, WI	53212
01295	TEXAS INSTR INC SEMICOND CMPT DIV	DALLAS, TX	75231
02114	FERROXCUBE CORP	SAUGERTIES, NY	12477
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX, AZ	85008
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW, CA	94040
18324	SIGNETICS CORP	SUNNYVALE, CA	94086
24226	GOWANDA ELECTRONICS CORP	GOWANDA, NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD, PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS, IN	46227
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA, CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO, CA	94304
30983	MEPCO/ELECTRA CORP	SAN DIEGO, CA	92121
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS, MA	01247
71400	BUSSMAN MFG DIV OF MCGRAW-EDISON CO	ST LOUIS, MO	63017
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE, PA	16512
73899	J F D ELECTRONICS CORP	BROOKLYN, NY	11219
75915	LITTLEFUSE INC	DES PLAINES, IL	60016
78553	TINNERMAN PRODUCTS INC	CLEVELAND, OH	44129
79727	C-W INDUSTRIES	WARMINSTER, PA	18974
79963	ZIERICK MFG CO	MT KISCO, NY	10549
82389	SWITCHCRAFT INC	CHICAGO, IL	60630

6-6. LED Display Digit Ordering Information

6-7. The 5380 series frequency counter uses three types of LED display digit. These LED's differ according to light intensity. Table 6-5 lists the three LED intensities together with the original and new part numbers. The original part numbers denote the intensity level of the LED with the suffix C, D, or E; while the new part numbers are different for each intensity level.

Table 6-5. LED Display Digit Part Numbers

LED LIGHT INTENSITY	ORIGINAL PART NUMBERS	CORRECT REPLACEMENT PART NUMBERS
C Light Intensity	5082-7731 C or 1990-0452 C	1990-0469
D Light Intensity	5082-7731 D or 1990-0452 D	1990-0470
E Light Intensity	5082-7731 E or 1990-0452 E	1990-0471

NOTE

When replacing an LED, check the part number to determine the correct intensity level for its replacement. Order the new LED using the correct replacement part number listed in Table 6-5.

SECTION VII

MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information regarding manual changes for instrument serial prefixes other than that listed on the title page.

7-3. MANUAL CHANGES

7-4. This manual applies directly to Model 5383A's with serial prefix 1508A and 1516A. See Paragraph 1-8 (in Section I) for the method of serial number identification.

7-5. Newer Instruments

7-6. As changes are made, newer instruments may have serial prefixes that are not listed in this manual. The manual for these instruments are supplied with a manual change sheet which contains the required updating information. If this sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed at the back of this manual.

SECTION VIII

SCHEMATIC DIAGRAMS

8-1. INTRODUCTION

8-2. This section contains component location and schematic diagrams. Included on the schematic diagrams are key waveforms for the convenience of the troubleshooter. These waveforms show nominal values that are present when the 5383A Counter is set up in the following manner:

- a. Loop-around test configuration (the rear panel OSCILLATOR output connector is connected to the front panel INPUT connector with a coaxial cable and a 50Ω feedthru connector (i.e., HP 11048C or equivalent).
- b. The INPUT switch is set to $1M\Omega \times 10$.

8-3. A list of active components is provided for quick identification of those parts which are more likely to fail. A complete listing of all replaceable parts is provided in Section VI.

Model 5383A
Schematic Diagrams

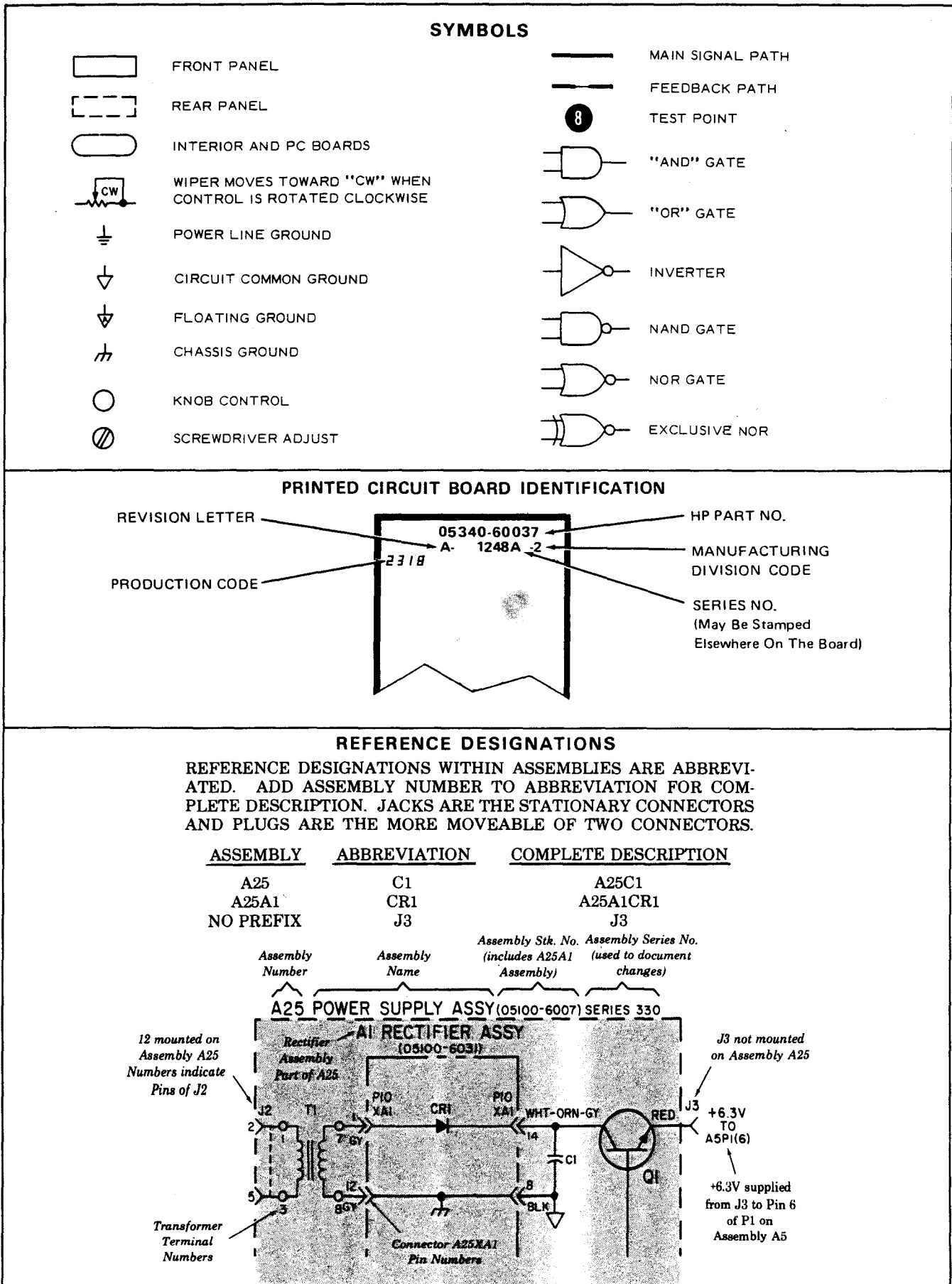
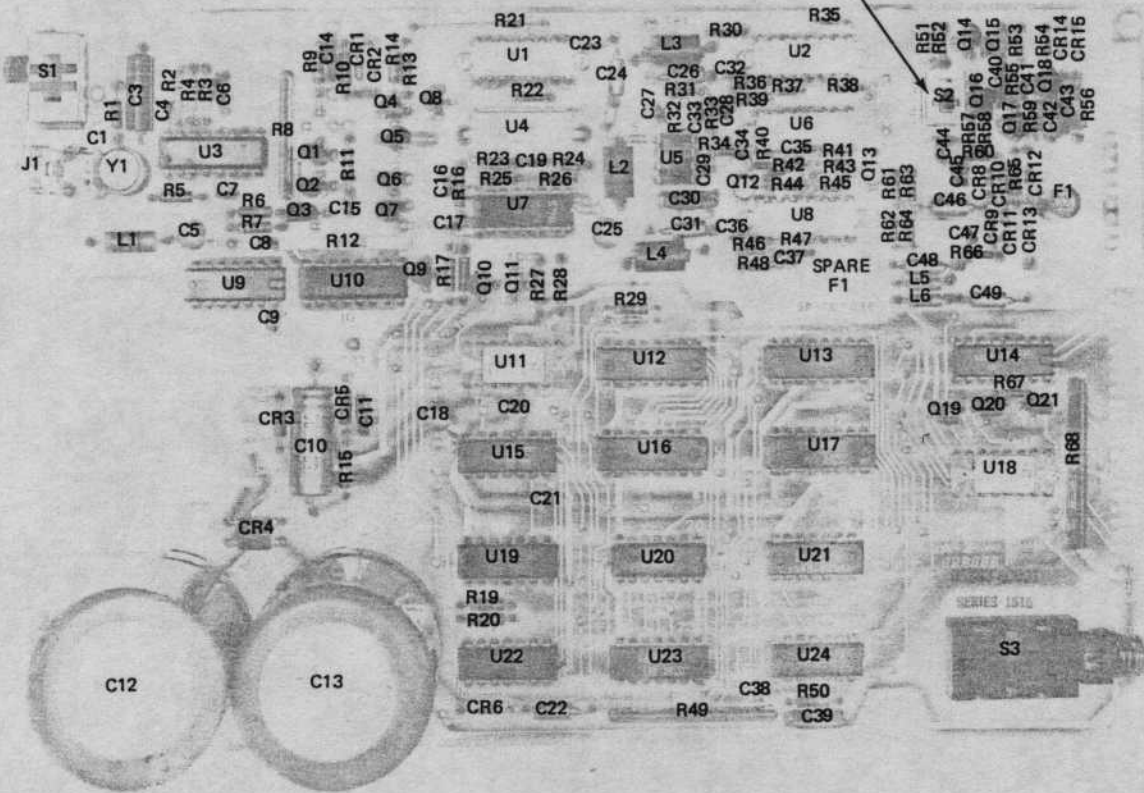


Figure 8-1. Schematic Diagram Notes

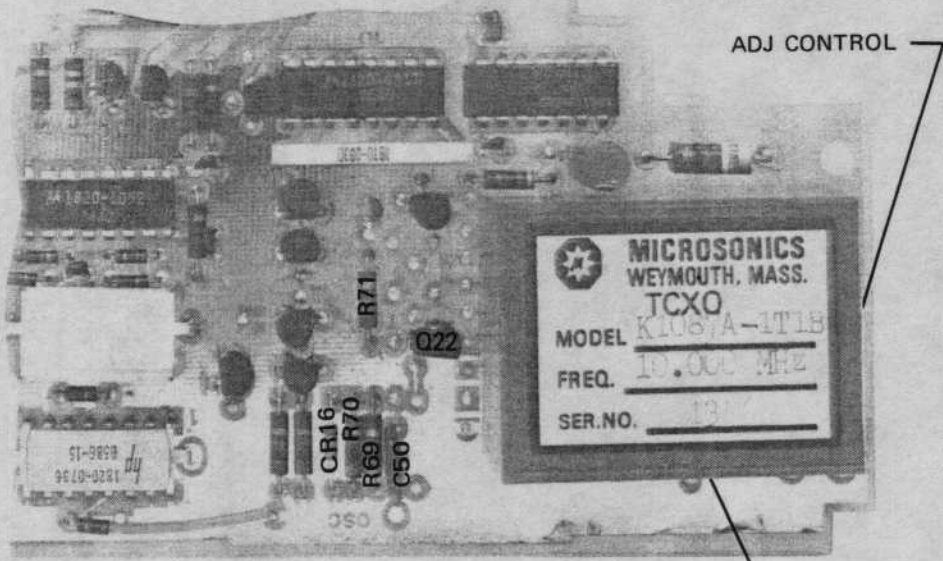
Table 8-1. Major Signal Definitions

Mnemonic	Description
A,B,C,D	Display Data Bus BCD lines (Weight: A=1, B=2, C=4, D=8).
\overline{MG}	TTL version of MGE; used to control RSTB Latch.
\overline{MGE}	Main gate control signal (EECL logic level); allows input to frequency counters (when Low).
\overline{MRS}	Counter reset and display digit test command (generated by RS signal).
\overline{OF}	Overflow; low TTL level indicates overflow of frequency counters.
\overline{RBI}	Ripple Blanking Input; low TTL level allows blanking of zeros in display; high TTL level inhibits zero blanking.
RBO	Ripple Blanking Output; low TTL level when zeros are blanked from display; high TTL level at all other times.
RS	High TTL level resets counter when GATE TIME switch position is changed. Provides display digit test when GATE TIME switch is held between positions.
\overline{RSC} \overline{RSC}	TTL signals that reset frequency counters.
\overline{RSTB} \overline{RSTB}	TTL signals that reset the variable Time Base counter and Main Gate Latches during the update sequence (see Figure 4-3).
$\overline{S0}$ THRU $\overline{S9}$	Eight continuously cycling display scan signals; each scan line activates one display digit.
\overline{TR} \overline{TR}	TTL signals that transfer frequency counter BCD data to the storage latches during the update sequence (see Figure 4-3).
W X Y Z	Used for output multiplexing of the Hex Multiplexed Decade Counter BCD characters. These signals also drive the Hu BCD-to-Decimal converter providing the Scan signals (S0 thru S9).
$\overline{.1s}$ $\overline{1s}$ $\overline{10s}$	Low TTL level that illuminate the LED display decimal points and control leading zero blanking.

100 kHz LO PASS FILTER SWITCH
(REFER TO FIG. 2-2 ITEM 6)



A1



ADJ CONTROL

MICROSONICS
WEYMOUTH, MASS.
TCXO
MODEL K1067A-1T1B
FREQ. 10.000 MHz
SER. NO. 1317

25° C FREQUENCY
OFFSET VALUE

A1 (OPTION 001)

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 FARADS;
INDUCTANCE IN HENRIES.
3. ASTERISK (*) INDICATES SELECTED COMPONENT.
4. WAVEFORMS SHOWN RESULT FROM SET-UP DESCRIBED IN PARA. 8-2.

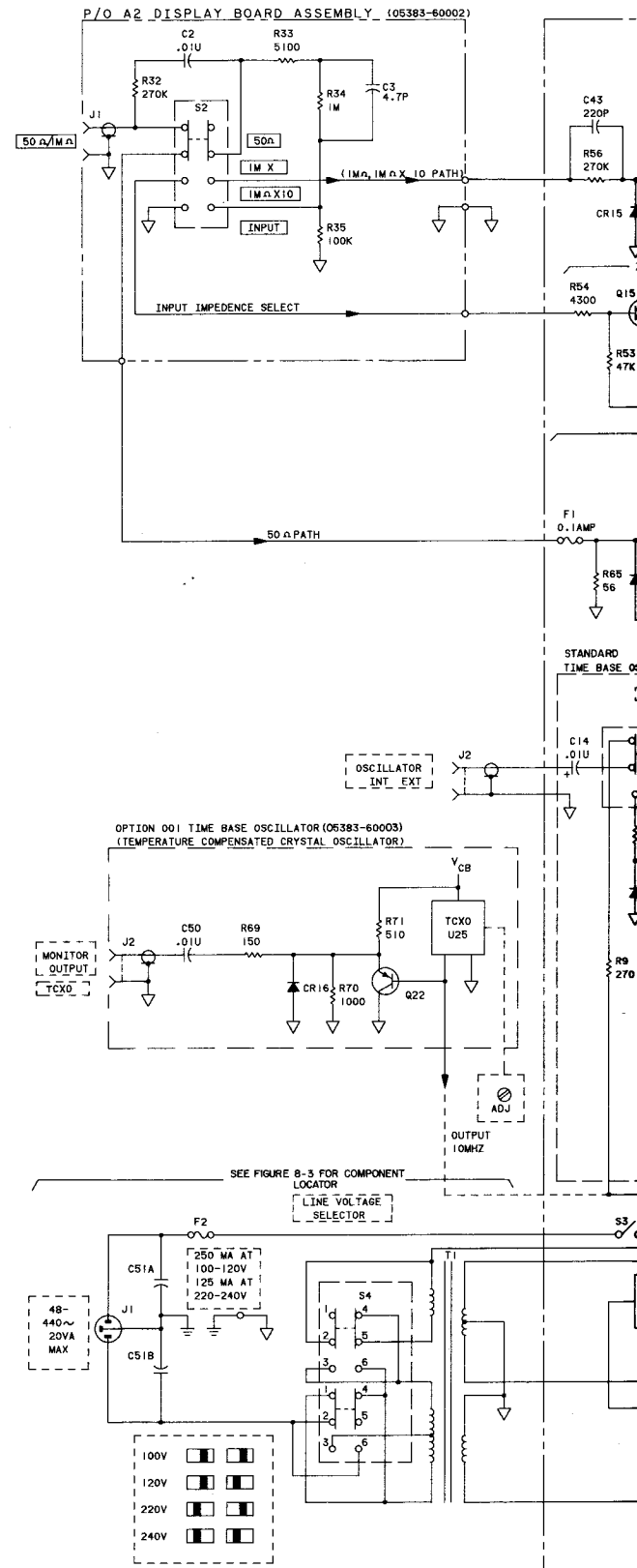
ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	PART NUMBERS
CR1,2,6,7,14,15,16	1901-0040
CR3	1901-0028 (SR1358-9)
CR4	1906-0028 (MDA922-3)
CR5	1902-0040 (FZ1201)
CR8-11, CR12, 13	1901-0535, 1901-0050
Q1-3, 22*	1853-0015 (2N3563)
Q4, 5, 10, 11	1854-0092 (2N3563)
Q6, 7, 16	1854-0215 (2N3904)
Q12, 13	1854-0546 (2N5179)
Q14, 15, 19, 21	1854-0071
Q17, 18	1855-0081 (2N5245)
U1	1820-0736
U2, 6, 8	1820-0982
U3	1820-1224 (ECL10216)
U4	1820-1019
U5	1826-0139 (LM1458N)
U7	1820-1052 (ECL10125)
U9	1820-1251 (74LS196)
U10	1820-0817 (ECL10131)
U11	1820-0633
U12, 16	1820-1166 (DM85L51)
U13	1820-0911 (74L192)
U14	1820-0214 (7442)
U15	1820-1155 (82S90)
U17	1820-1143 (8552)
U18	1820-0634
U19	1820-0174 (7404)
U20	1820-0054 (7400)
U21	1820-0661 (7432)
U22	1820-0328 (7402)
U23	1820-0077 (7474)
U24	1820-0537 (7413)
U25*	0960-0394
U26	1826-0122 (7805)
U27	1826-0215 (MC7905.2)

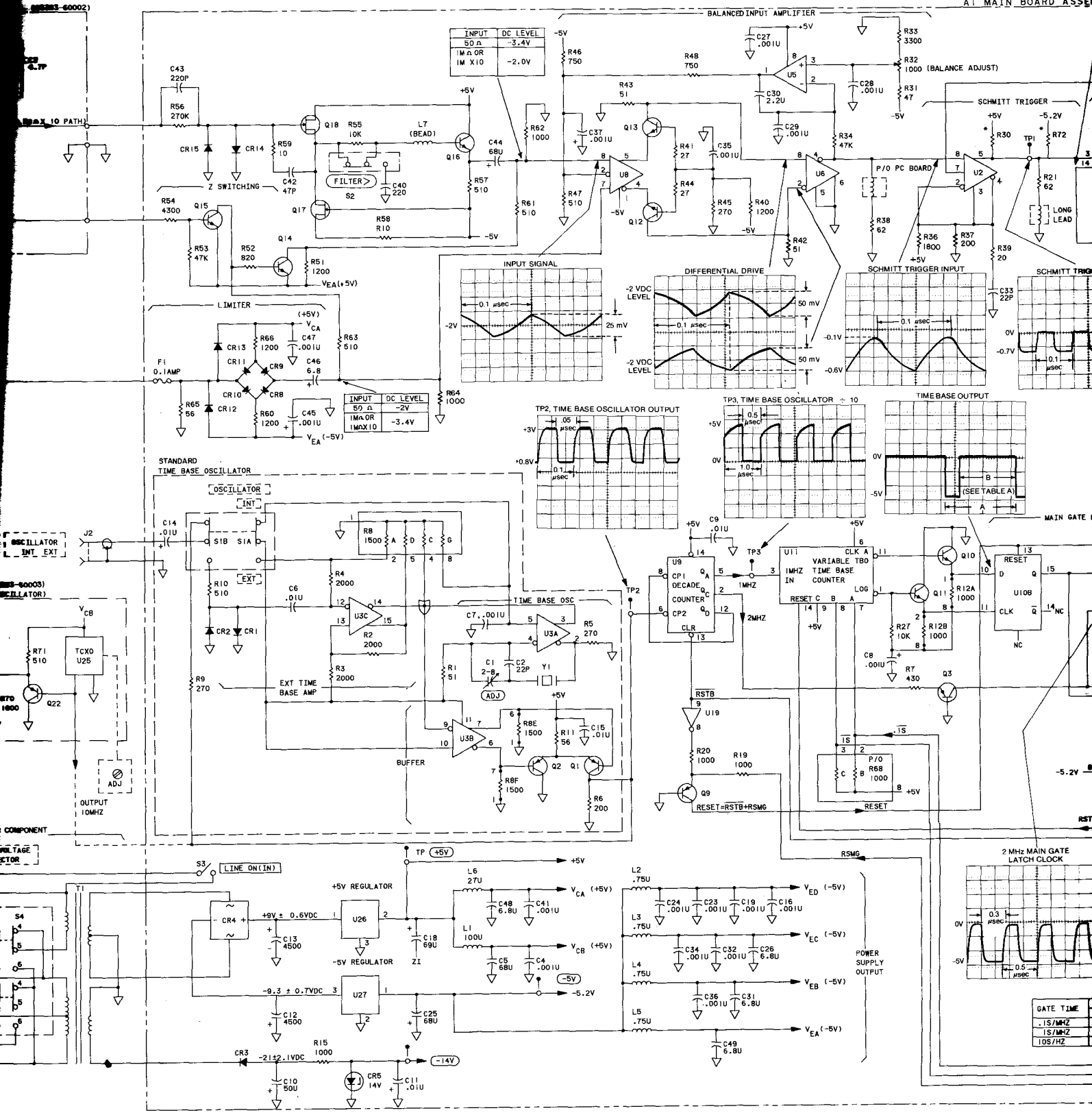
REFERENCE DESIGNATIONS

A1
C1-51
CR1-16
F1,2
J1,2
L1-7
Q1-22
R1-72
S1-4
T1
U1-25
Y1

PWR (PIN)	PWR RTN PIN
VED(11)	16
-5.2V(1)	9
VCB(16), (1)	8
VEB(13)	3,11,15
VEC(4)	
+5V(8)	
+5V(9)	16
VED(11)	7
+5V(14)	
-5.2V(8)	1, 16
-14V(16)	
-5.2V(4)	
+5V(9)	
+5V(16)	8
+5V(16)	8
+5V(16)	8
+5V(14)	7
+5V(14)	8
+5V(13),	
-5.2V(12),	
-14V(5)	
+5V(14)	7
+5V(14)	7
+5V(14)	7
+5V(14)	7
+5V(14)	7
See schem.	See schem.
See schem.	See schem.
See schem.	See schem.

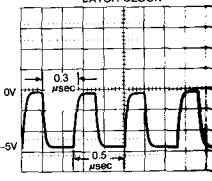
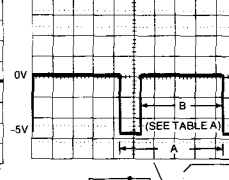
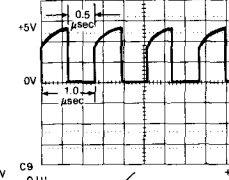
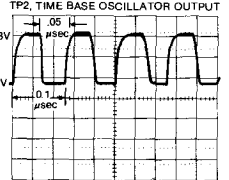
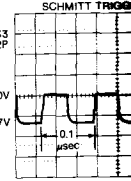
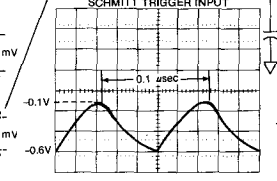
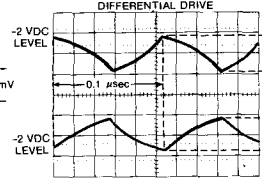
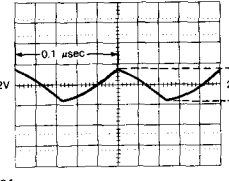


*OPTION 001 COUNTER ONLY



INPUT	DC LEVEL
50 Ω	-3.4V
1M Ω OR 1M X10	-2.0V

INPUT	DC LEVEL
50 Ω	-2V
1M Ω OR 1M X10	-3.4V



GATE TIME
1S/MHZ
1S/2MHZ
10S/2MHZ

AI MAIN BOARD ASSEMBLY (05383-6000) NOTE 1 SERIES (508A, 1516A)

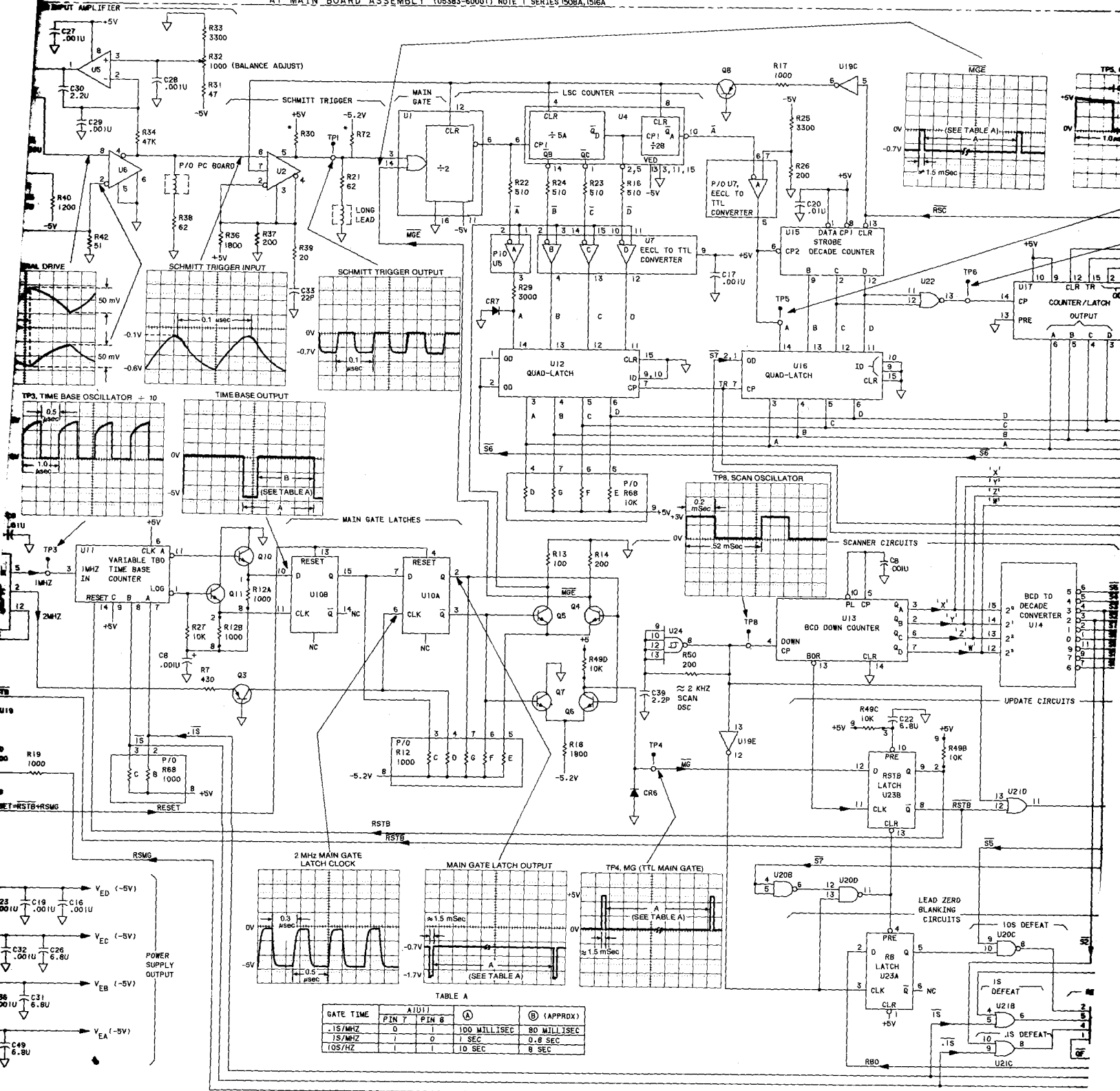


TABLE A

GATE TIME	AIU11	AIU11	(A)	(B) (APPROX)
	PIN 7	PIN 8		
.1S/MHZ	0	1	100 MILLISEC	80 MILLISEC
1S/MHZ	0	1	1 SEC	0.8 SEC
10S/HZ	1	1	10 SEC	8 SEC

Model 5383A Schematic Diagram

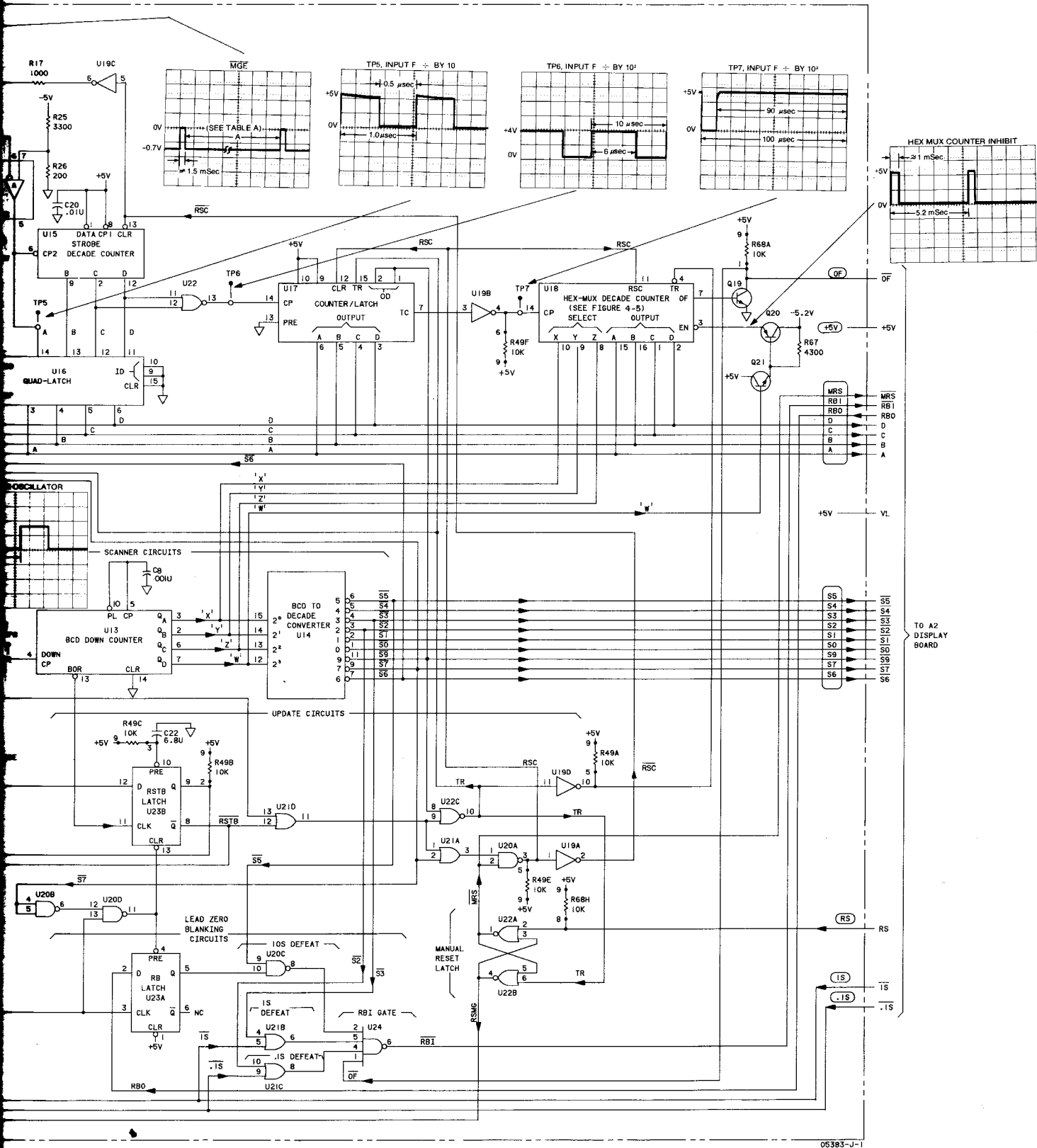
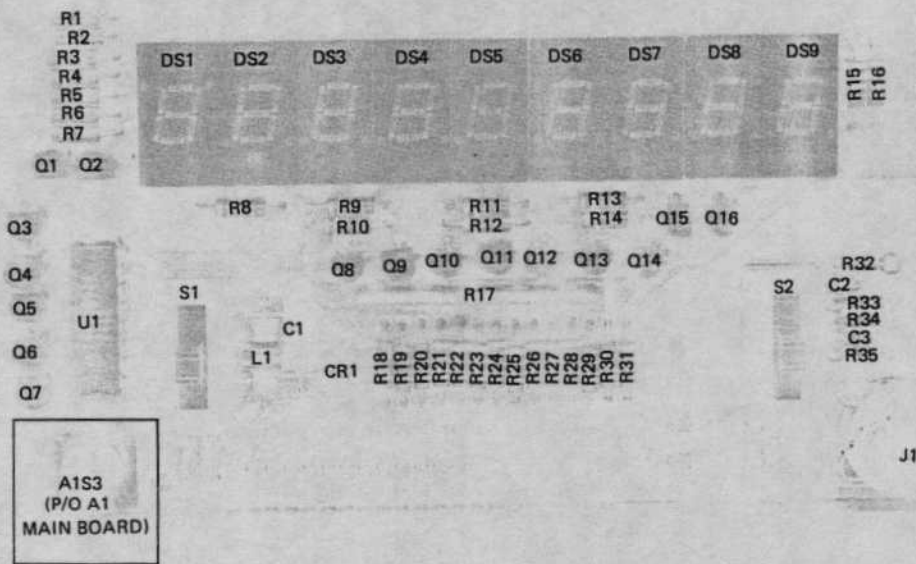
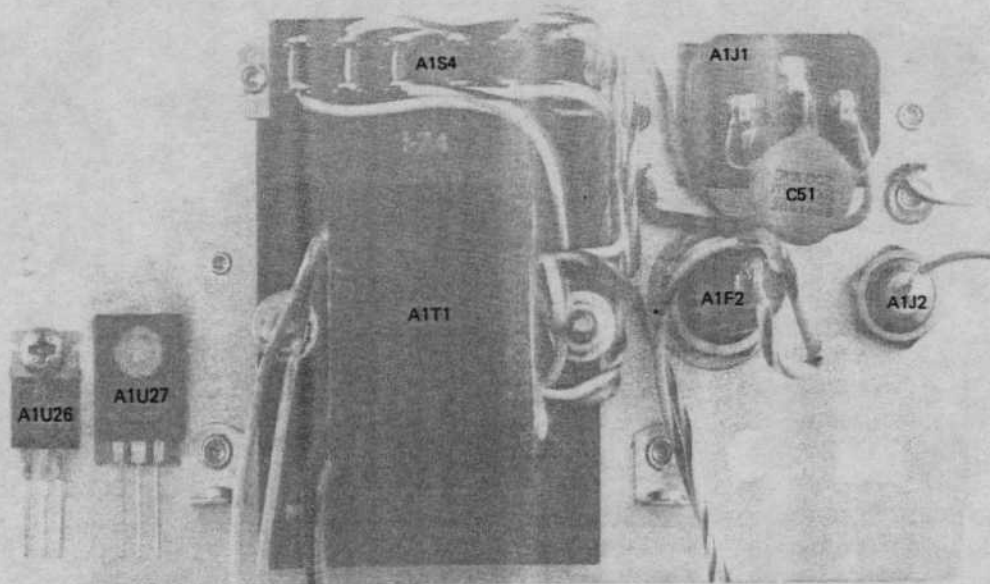


Figure 8-2. Main Board Schematic Diagram



A2



REAR PANEL

DISPLAY BUS BCD INPUT				TEST INPUT	DISPLAY DIGIT DRIVE							DISPLAYED DIGIT VALUE
A	B	C	D	MRS	a	b	c	d	e	f	g	
0	0	0	0	1	0	0	0	0	0	0	1	0
1	0	0	0	1	1	0	0	1	1	1		1
0	1	0	0	1	0	0	1	0	0	1	0	2
1	1	0	0	1	0	0	0	0	1	1	0	3
0	0	1	0	1	1	0	0	1	1	0	0	4
1	0	1	0	1	0	1	0	0	1	0	0	5
0	1	1	0	1	1	1	0	0	0	0	0	6
1	1	1	0	1	1	0	0	1	1	1	1	7
0	0	0	1	1	0	0	0	0	0	0	0	8
1	0	0	1	1	0	0	0	1	1	0	0	9
X	X	X	X	0	0	0	0	0	0	0	0	8
X = Does not matter												
1 = approx. +4V, 0 = approx. 0 volts												

NOTES

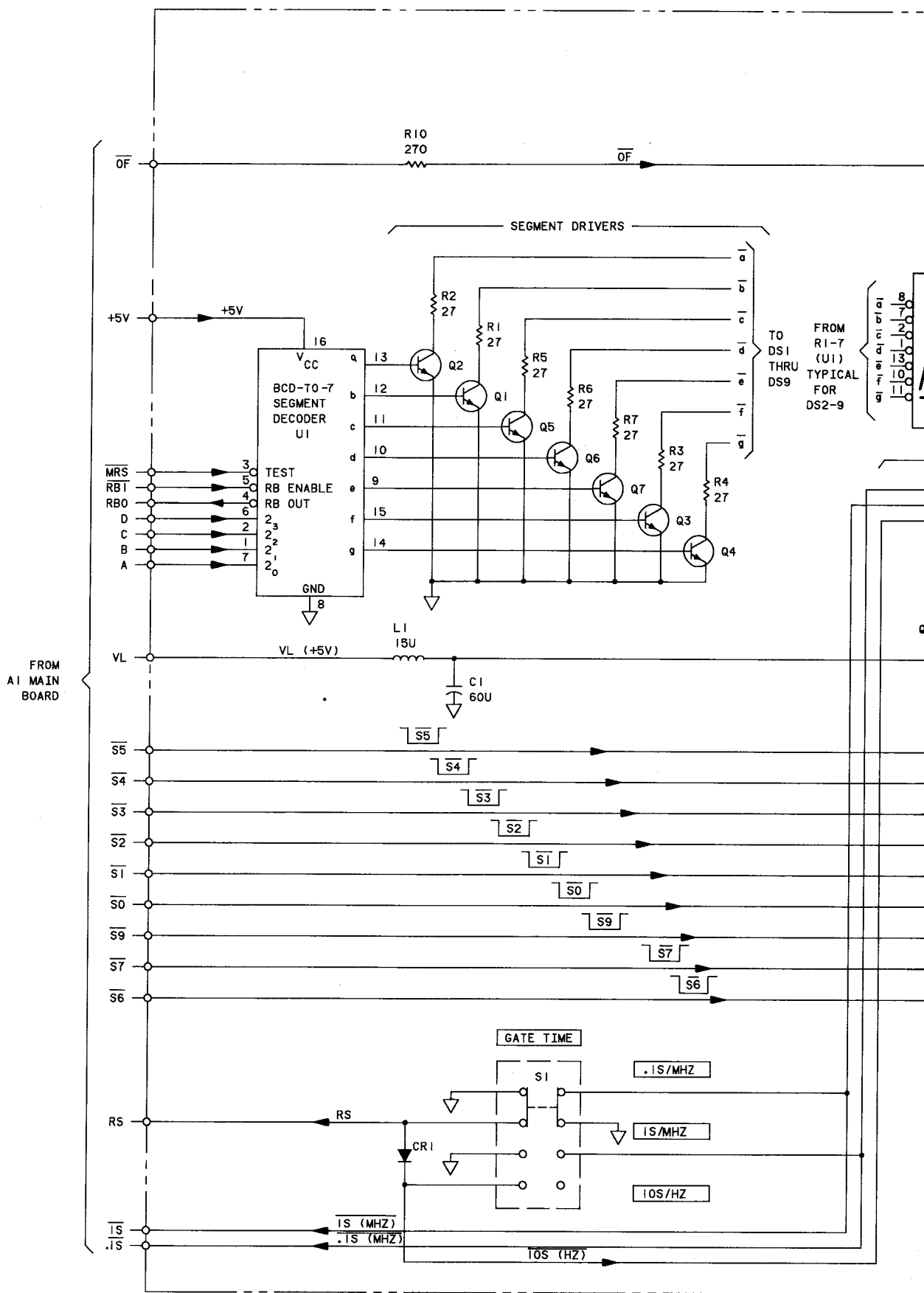
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS;
CAPACITANCE IN FARADS;
INDUCTANCE IN HENRIES.
3. ASTERISK (*) INDICATES SELECTED COMPONENT.

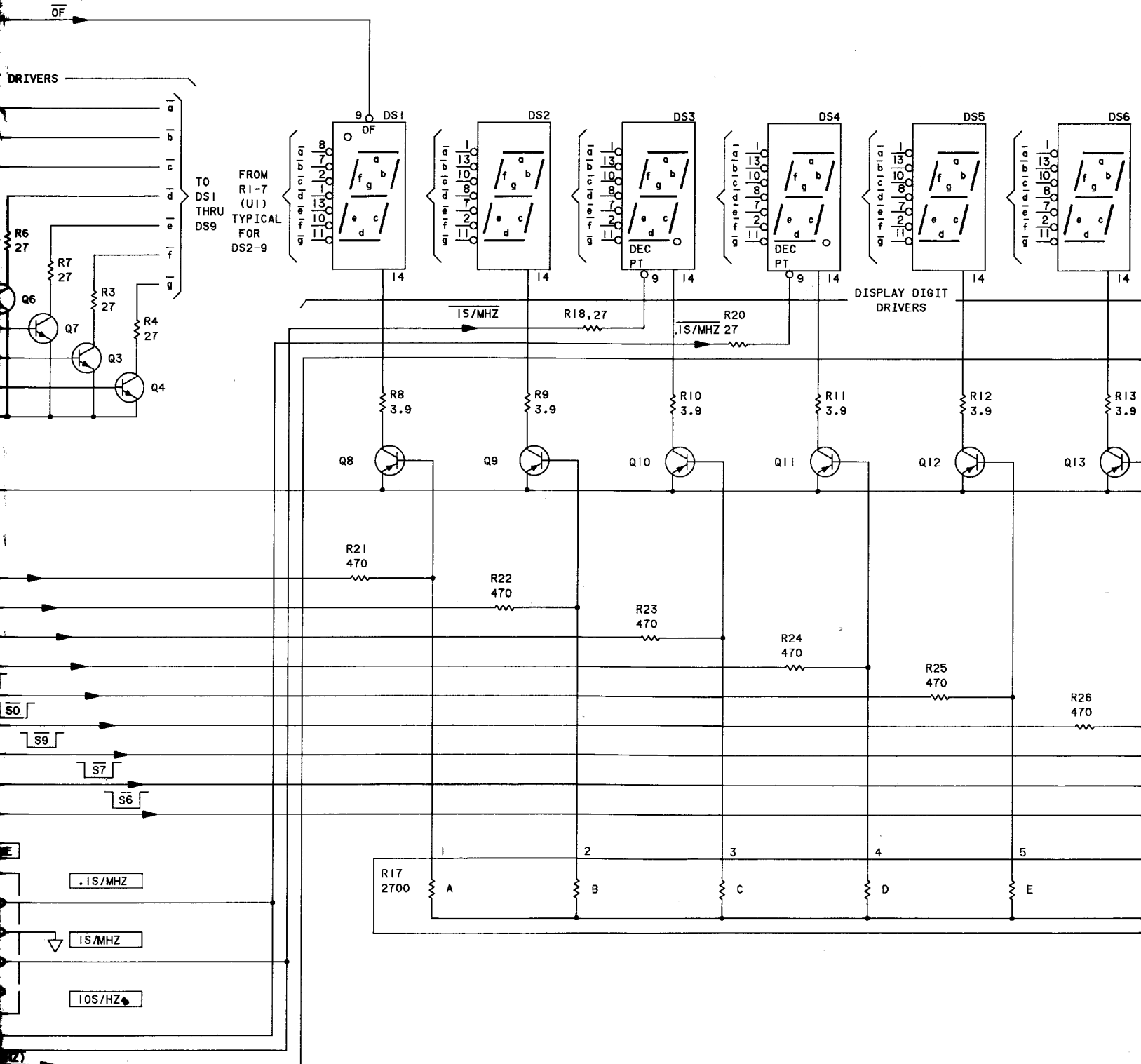
ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	HP PART NO.	PWR (PIN)	PWR RTN PIN
CR1 DS1-9 Q1-7	1901-0040 1990-0452 1854-0246 (SPS-233)		
Q8-11, 13-16 U1	1853-0318 1820-0914 (9307)	VL (16)	8

REFERENCE DESIGNATIONS

A2
C1-3 CR1 DS1-9 J1 L1 Q1-16 R1-35 S1, 2 U1





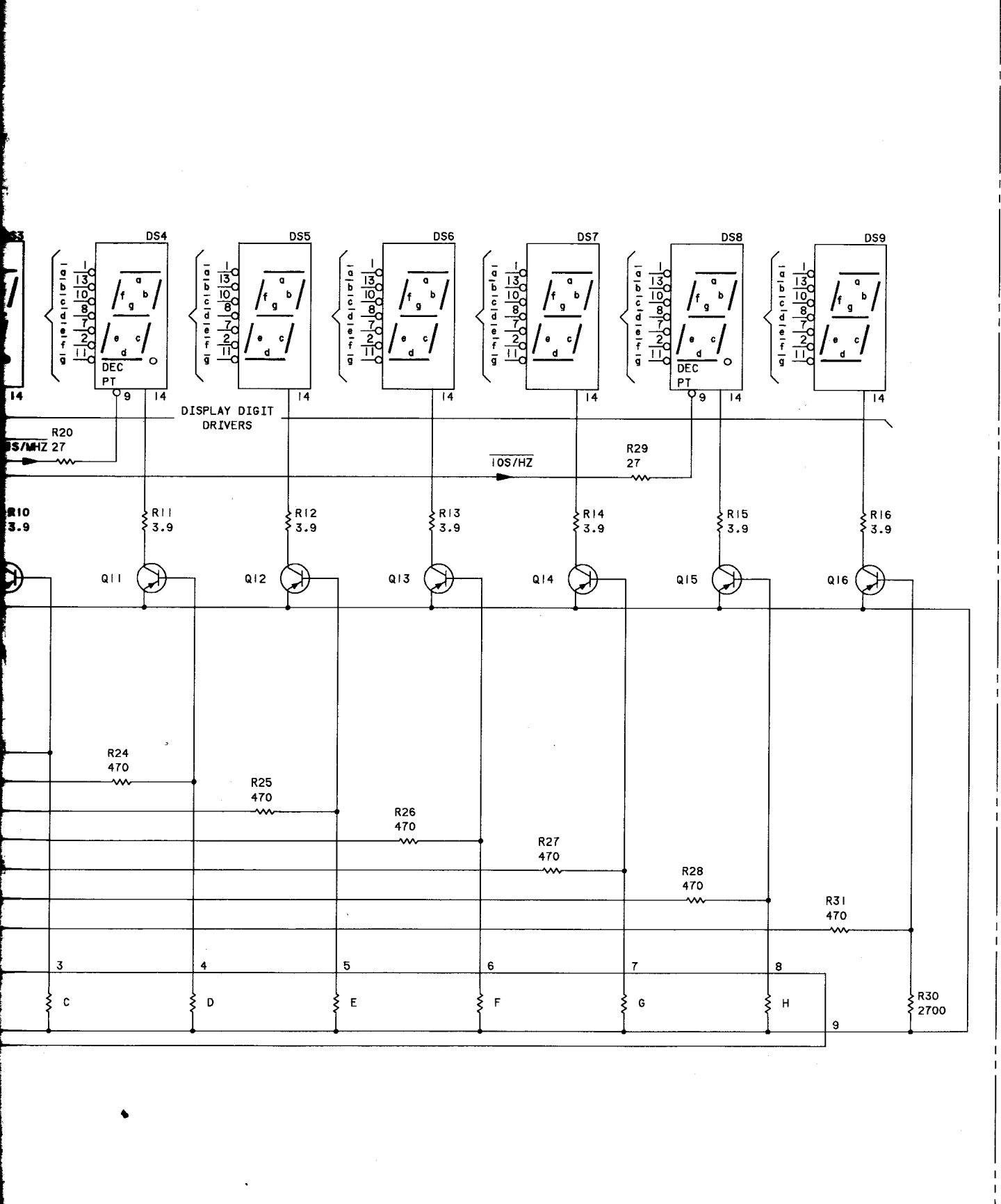


Figure 8-3. Display Board Schematic Diagram

WORLD WIDE SALES & SERVICE OFFICES

UNITED STATES

ALABAMA
8200 Whitesburg Dr., S.E.
P.O. Box 4207
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204
***Birmingham**
Medical Service only
Tel: (205) 879-2081

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2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 244-1361
TWX: 910-951-1331
2424 East Aragon Rd.
Tucson 85706
Tel: (602) 889-4661

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Fullerton 92631
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North Hollywood 91604
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Tel: (408) 249-7000
TWX: 910-338-0518
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Tel: (714) 446-6165
2220 Watt Ave.
Sacramento 95825
Tel: (916) 482-1463
TWX: 910-367-2092
9606 Aero Drive
P.O. Box 23333
San Diego 92123
Tel: (714) 279-3200
TWX: 910-335-2000

***Riverside**
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Tel: (916) 482-1463
TWX: 910-367-2092
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San Diego 92123
Tel: (714) 279-3200
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Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705
CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel: (319) 338-9466
Night: (319) 338-9467

FLORIDA
P.O. Box 24210
2806 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099
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Medical Service only
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6177 Lake Ellenor Dr.
Orlando 32809
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TWX: 910-850-0113
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Atlanta 30328
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TWX: 810-766-4890

HAWAII
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