Errata

Title & Document Type: 5383A Frequency Counter Operating and Service Manual

Manual Part Number: 05383-90005

Revision Date: September 1976

HP References in this Manual

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

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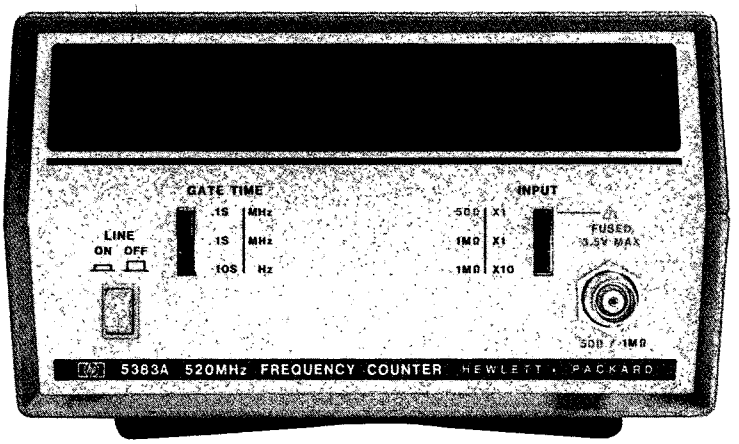
Agilent Technologies

OPERATING AND SERVICE MANUAL

FREQUENCY COUNTER

5383A



HEWLETT PACKARD

HP 5383A

FREQUENCY COUNTER

5383A

OPERATING AND SERVICE MANUAL

SERIAL PREFIX: 1628A

This manual applies directly to HP Model 5383A Frequency Counters having serial number prefix 1628A.

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.

OLDER INSTRUMENTS

For serial prefixes below the serial prefix shown above, refer to Section VII for manual backdating instructions.

MANUAL PART NUMBER 05383-90005
Microfiche Part Number 05383-90006

Printed: SEP 1976

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".

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.

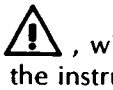
SERVICE

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.

⚠ ATTENTION ⚠

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 520 MHz. Nine display digits provide a resolution of one Hz per second for inputs up to 520 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.

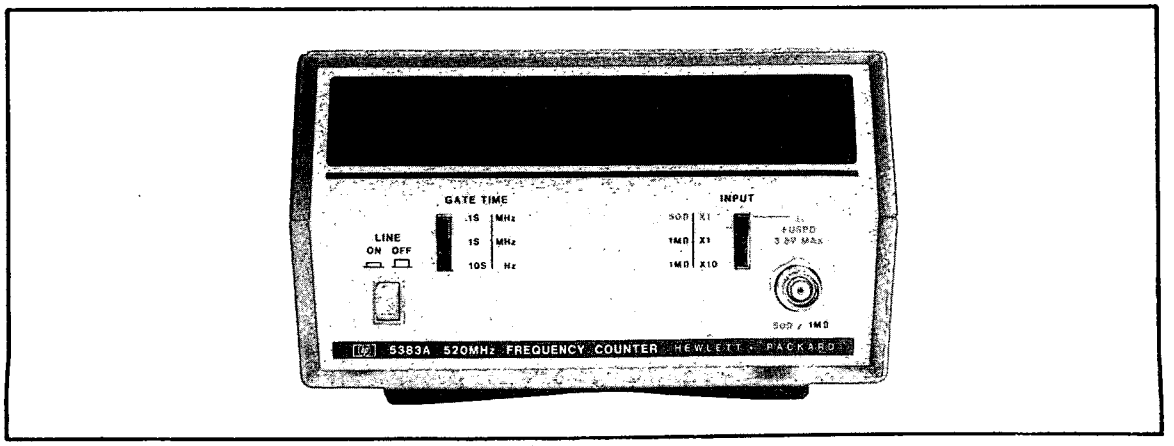


Figure 1-1. Model 5383A Frequency Counter

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 25 mV Output	HP 651B	P,T
Signal Generator	10 MHz to 520 MHz 25 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 520 MHz
DISPLAY: Nine-segment LED digits
DISPLAY TEST: RESET function (activated with GATE TIME switch) illuminates all segments of all digits.
INPUT IMPEDANCE: Three selections:
50Ω X1 (nominal) — fuse protected
1MΩ X1 (<40 pF shunt)
1MΩ X10 (<40 pF shunt, attenuation factor of 10)
ATTENUATION: X10 in 1MΩ
SENSITIVITY:

INPUT Switch Position	Frequency Range	Sensitivity (RMS)
50Ω X1	20 Hz to 520 MHz	25 mV
1MΩ X1	20 Hz to 10 MHz	25 mV
	10 Hz to 50 MHz	50 mV

MAXIMUM INPUT:

INPUT Switch Position	Range	Maximum Input
50Ω X1 (Fuse protected)	DC to 520 MHz	3.5V rms (+24 dBm)
1MΩ X1	DC to 40 MHz	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 520 MHz	200V dc + 5V rms (ac)
1MΩ X10	DC 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 520 MHz	200V dc + 5V rms (ac)

ACCURACY: ±1 Count ± Time Base Accuracy
GATE TIME: Manually selected .1 second, 1 second, 10 seconds
RESOLUTION: (Direct Count)

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

OVERFLOW: LED indicator lamp shows display overflow.
RESET: Manual reset occurs when GATE TIME switch is between three normal positions.

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

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

Table 1-2. Specifications (Continued)

STANDARD

TIME BASE DATA:

Time Base: 10 MHz (Xtal Oscillator)
<3 ppm per month due to aging
±2.5 ppm due to temperature variations between 0°C and 40°C
±0.5 ppm due to ±10% line (power) variation
Time Base Output: Frequency: 10 MHz Time Base
Voltage: 200 mV peak-to-peak into 50Ω
Control: Active when the INT/EXT switch is in INT position.
External Frequency Standard Input (rear panel): 10 MHz
Rear Panel Input: Sensitivity: 250 mV rms
Impedance: >500Ω
Maximum Input: 10V rms
Control: Internal/External rear-panel switch at EXT.
Ratio: Rear Panel Input, 100 kHz to 10 MHz

OPERATING TEMPERATURE: 0°C to 40°C
POWER REQUIREMENTS: 100, 120, 220, and 240V rms +5 -10%; 48 Hz to 440 Hz; 30VA max.
WEIGHT: Net: 2.2 kg (4.75 lbs). Shipping: 2.7 kg (6 lbs).
DIMENSIONS: 89 mm H x 160 mm W x 248 mm D (3.5 in H x 625 in W x 9.75 in D).

OPTION 001 TEMPERATURE COMPENSATED XTAL OSCILLATOR

Does not provide rear panel input capability.

TIME BASE DATA:
Frequency: 10 MHz TCXO
Stability: <0.1 ppm per month due to aging
±1 ppm due to temperature variations between 0°C and 40°C
±0.1 ppm due to 10% line (power) variation
Rear Panel Input: Not available with Option 001.

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°F (+75°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, 0.500 ampere, slow-blow fuse for 100-volt or 120-volt operation. Use a Listed, 0.150 ampere, slow-blow 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.

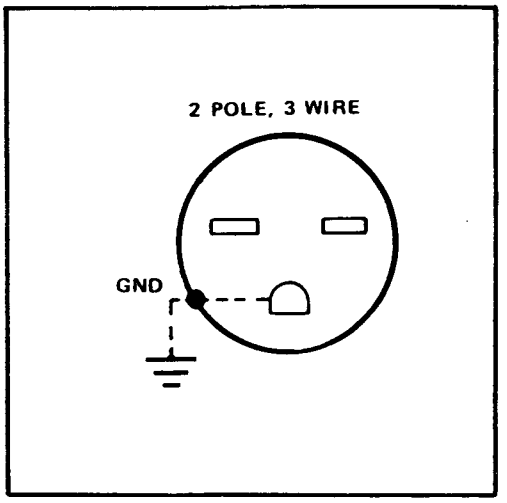


Figure 2-1. Power Cord Connector for 240-Volt Operation

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.

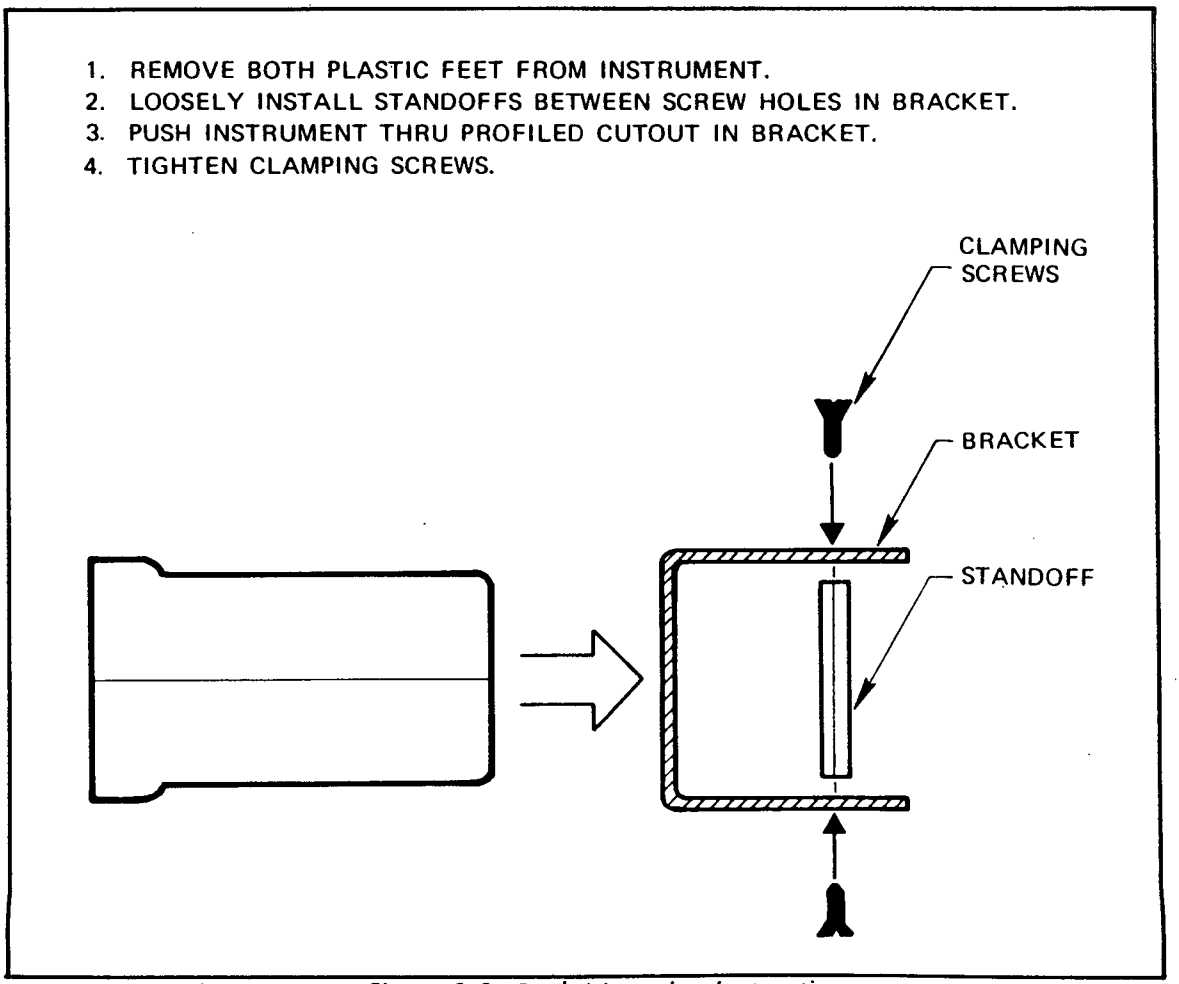
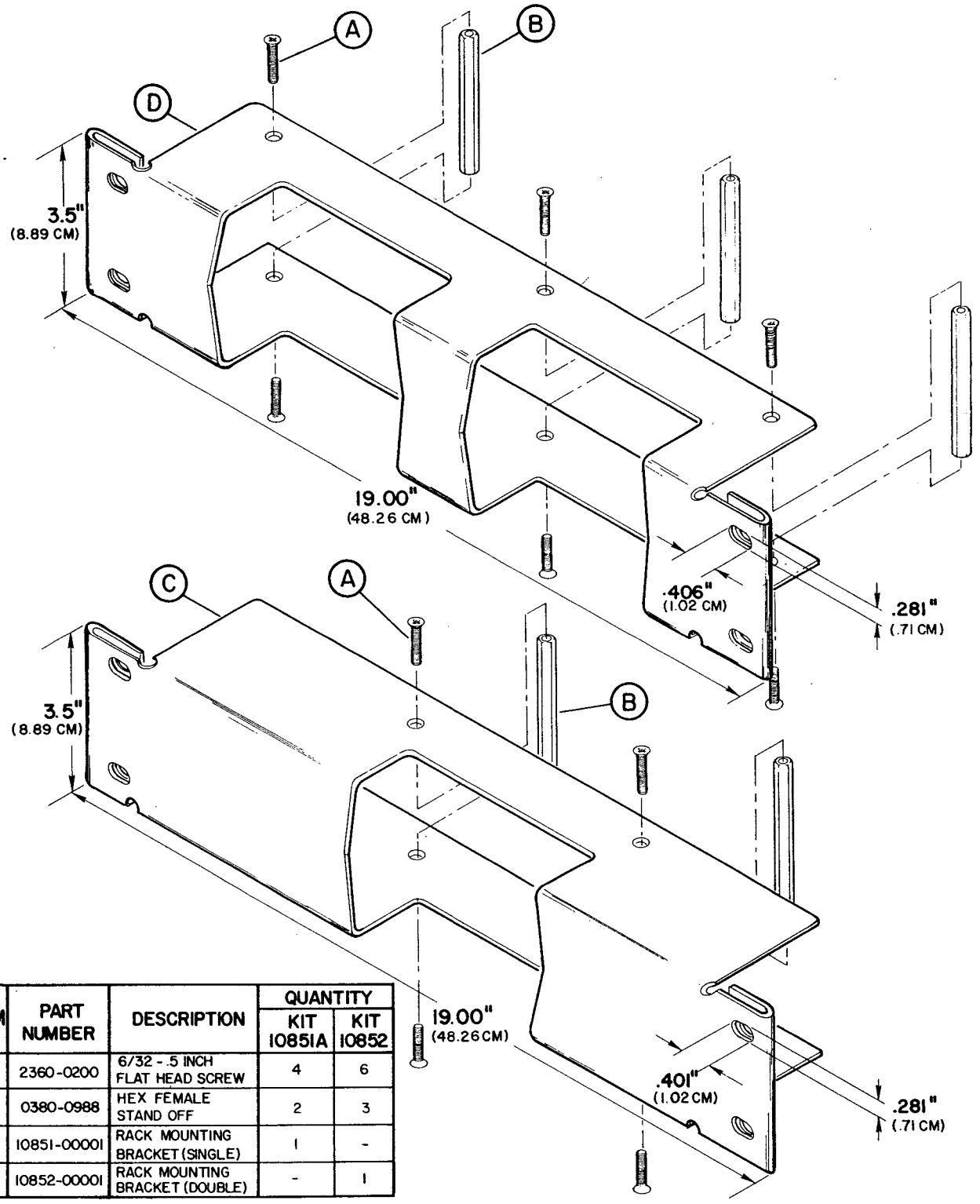


Figure 2-2. Rack Mounting Instructions



ITEM	PART NUMBER	DESCRIPTION	QUANTITY	
			KIT 10851A	KIT 10852
Ⓐ	2360-0200	6/32 - .5 INCH FLAT HEAD SCREW	4	6
Ⓑ	0380-0988	HEX FEMALE STAND OFF	2	3
Ⓒ	10851-00001	RACK MOUNTING BRACKET (SINGLE)	1	-
Ⓓ	10852-00001	RACK MOUNTING BRACKET (DOUBLE)	-	1

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
1. Signal Generators, or circuits with output: a. Frequency range from 10 MHz to 520 MHz b. Level less than 3.5V (rms) or +24 dBm c. Impedance of 50Ω	Via Coaxial cable or 50 ohm oscilloscope probe system (e.g., HP 10020A or equivalent)	50Ω X1
2. Signal Generators, or circuits with output: a. Frequency range from 10 MHz to 520 MHz b. Level exceeding 3.5V (rms) or more than +24 dBm c. Impedance of 50Ω	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 probles	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

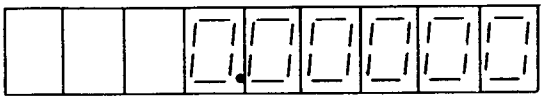
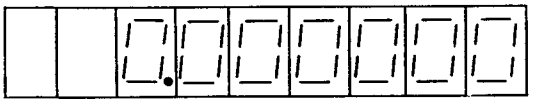
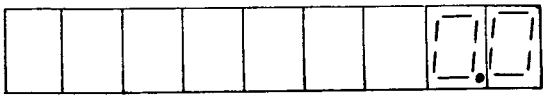
a. Equipment cable plugged in?

b. Proper line voltage selected on rear panel? (Refer to Paragraph 2-8.)

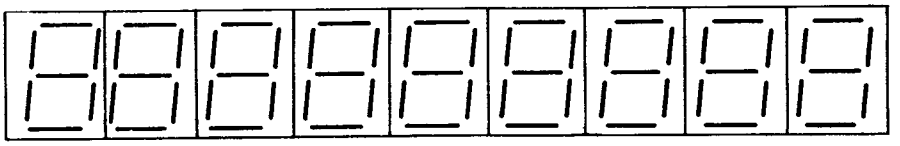
c. Rear panel fuse blown? Replace blow fuse with a Listed, ½ Amp slow-blow 125-volt fuse (HP Part Number 2110-0008) for 100-120 volt operation or a Listed, ¼ Amp (HP Part Number 2110-0201) slow-blow 250-volt fuse for 220-240 volt operation.

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:

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

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 50Ω X1 or 1MΩ 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 .1 amp 125-volt 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 50Ω X1!

c. Does this problem occur only when the INPUT switch is in the 1MΩ 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.

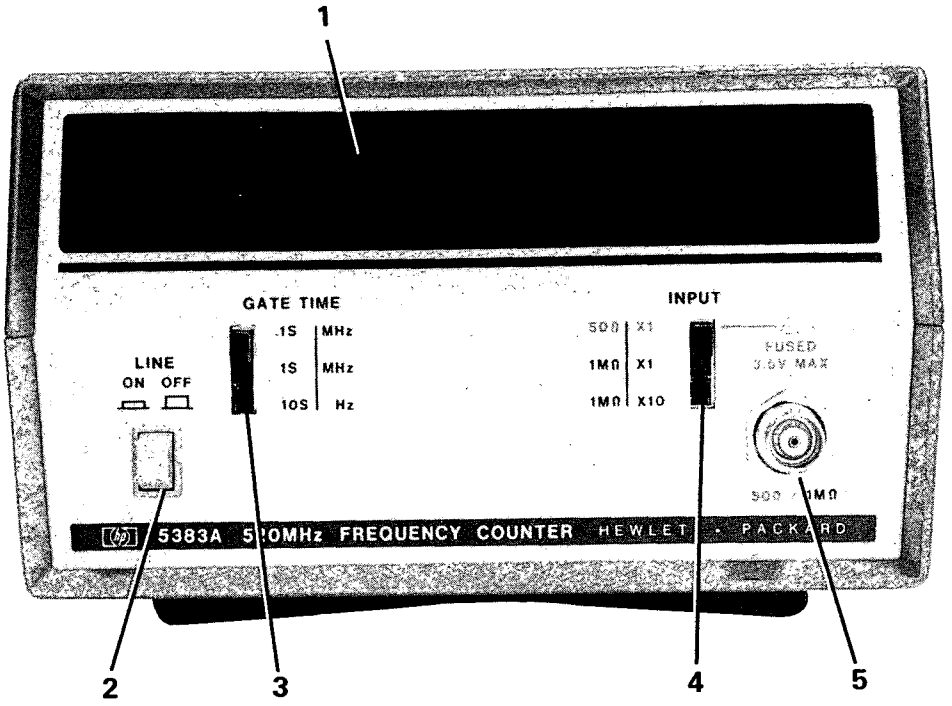
b. Set the front panel INPUT switch to the 50Ω X1 position.

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 1MΩ X1, or X10 INPUT paths, use a 50Ω 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 surpresses 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:

   50Ω 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).

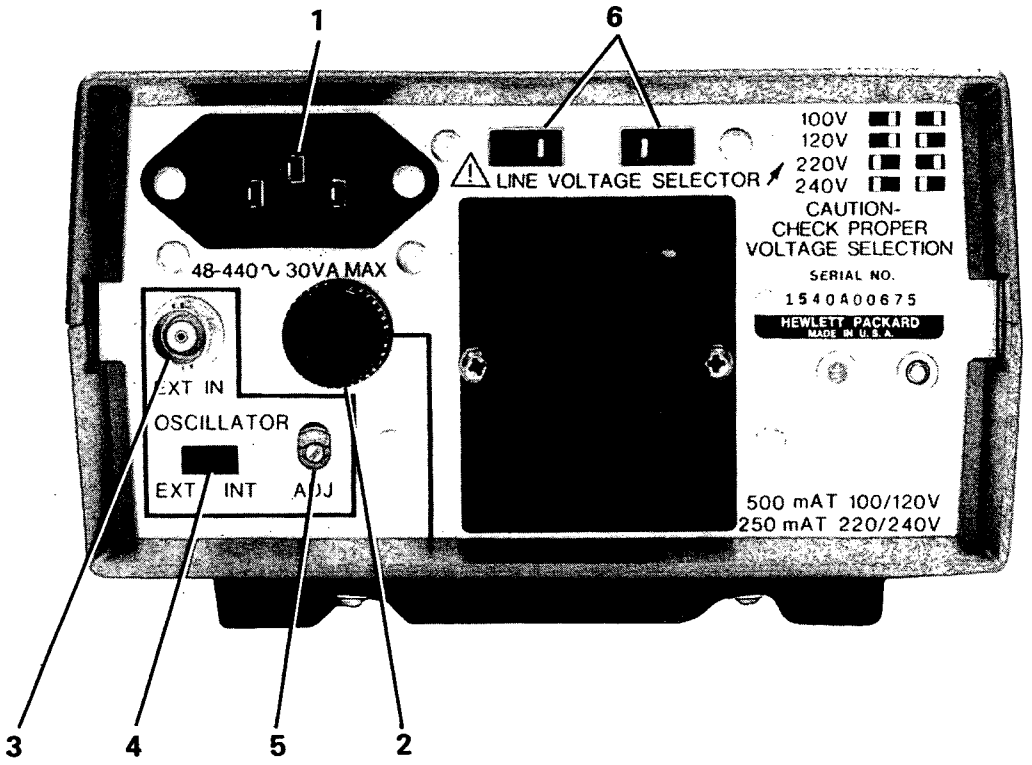
   1MΩ X1 Shunt capacity: less than 40 pf.

   1MΩ 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, 0.500 ampere, slow-blow fuse is required for 100-volt or 120-volt operation; a Listed, 0.250 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

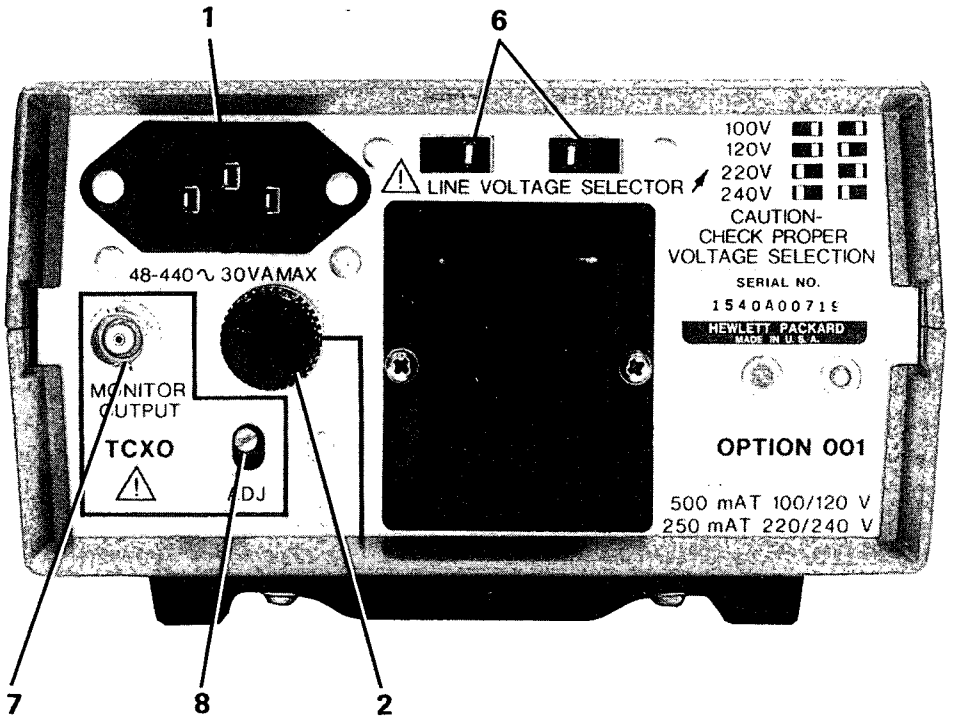
a. The monitor output is designed to drive a 50Ω load.

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 3-2a. 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) for Option 001.

8. **TCXO ADJ control:** Same as 5, above. Refer to Paragraph 5-13, in Section V for information on Option 011 time base adjustment.

Figure 3-2b. 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 1MΩ X1, X10 path, or the the 50Ω path. Q14 and Q15 biases these signal paths, allowing the Balanced Input Amplifier to accept either the 50Ω or the 1MΩ signal (refer to the schematic for detailed biasing information and corresponding signal path selection). A2S2 can also select a 1MΩ X10 attenuator consisting of a 1:10 voltage divider network.

The 50Ω 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 1MΩ 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.

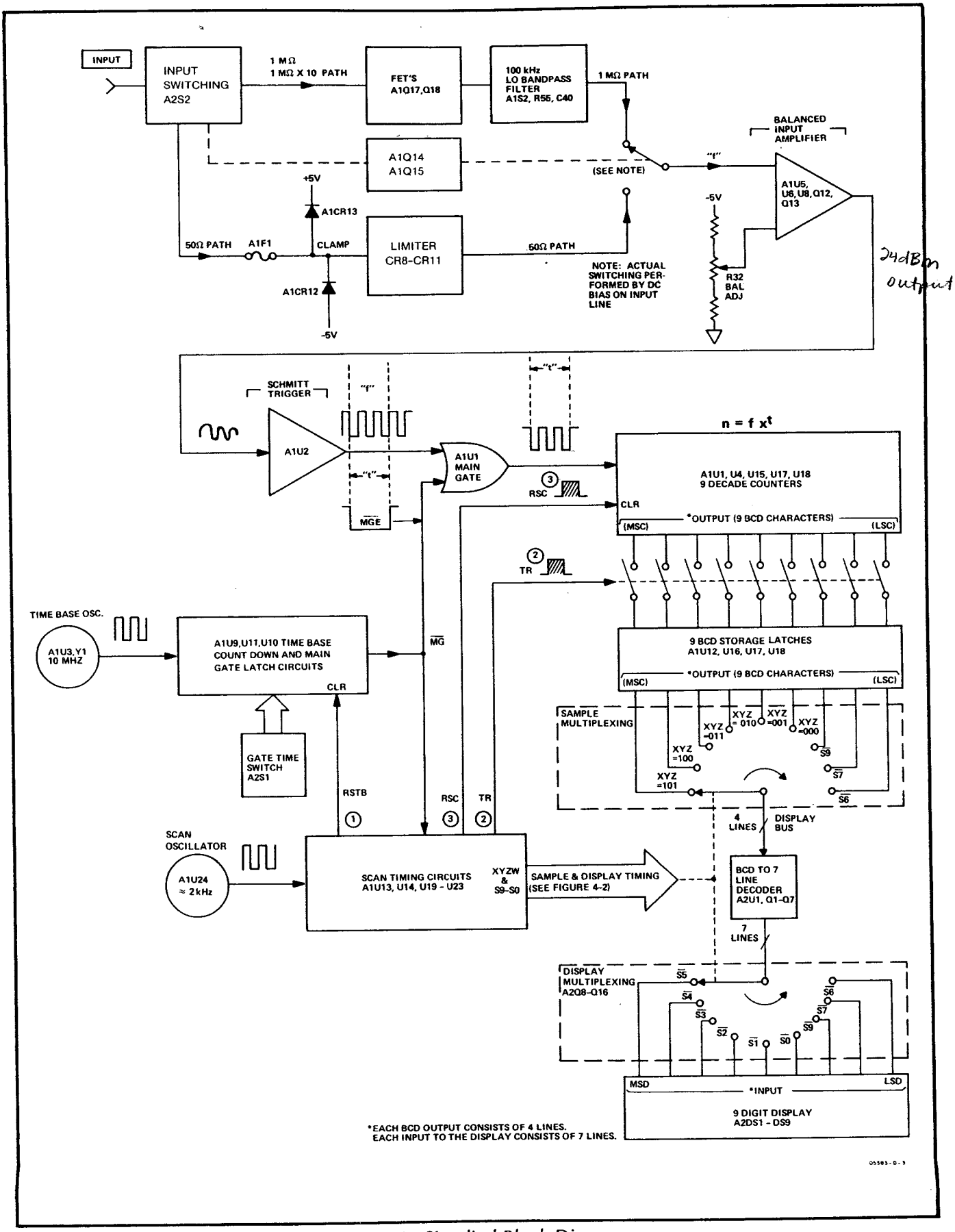


Figure 4-1. Simplied Block Diagram

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	Y	0	0	1	1	0	0	S9		S7	S6
Control Signal	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.

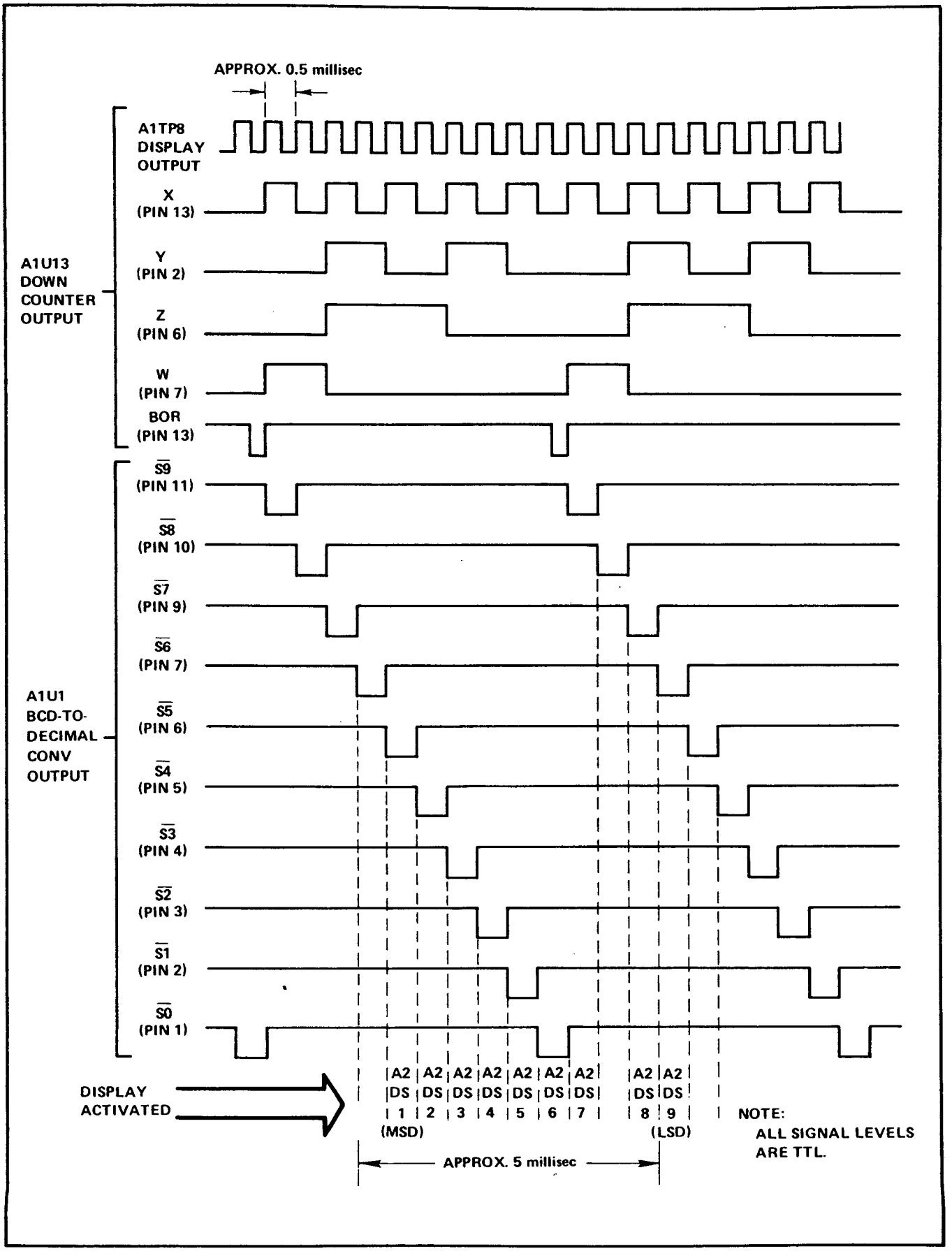
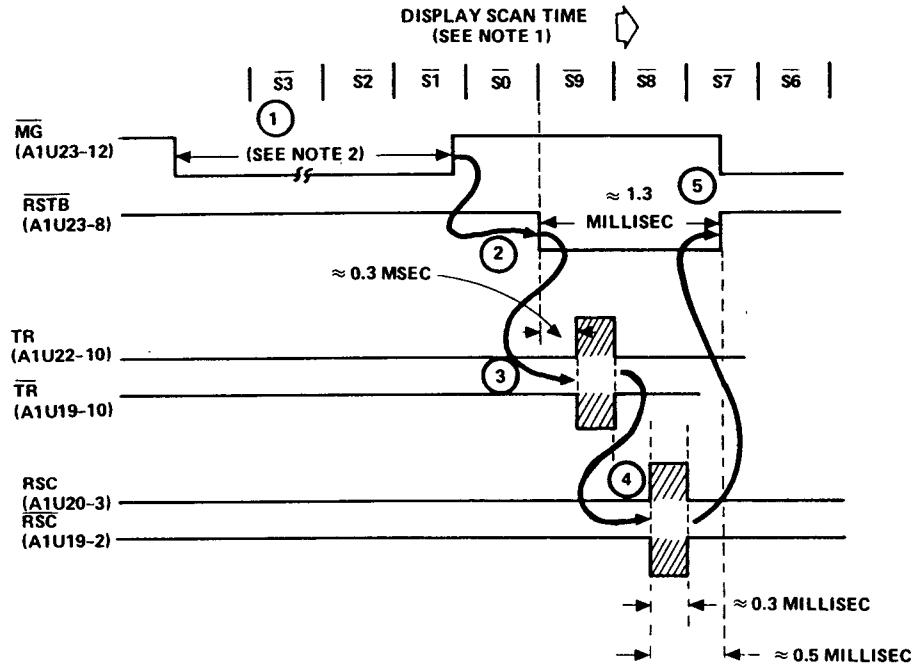


Figure 4–2. Scan Timing Waveforms



NOTES

1. $\overline{MGE}$ is an EECL 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 MG (or 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.

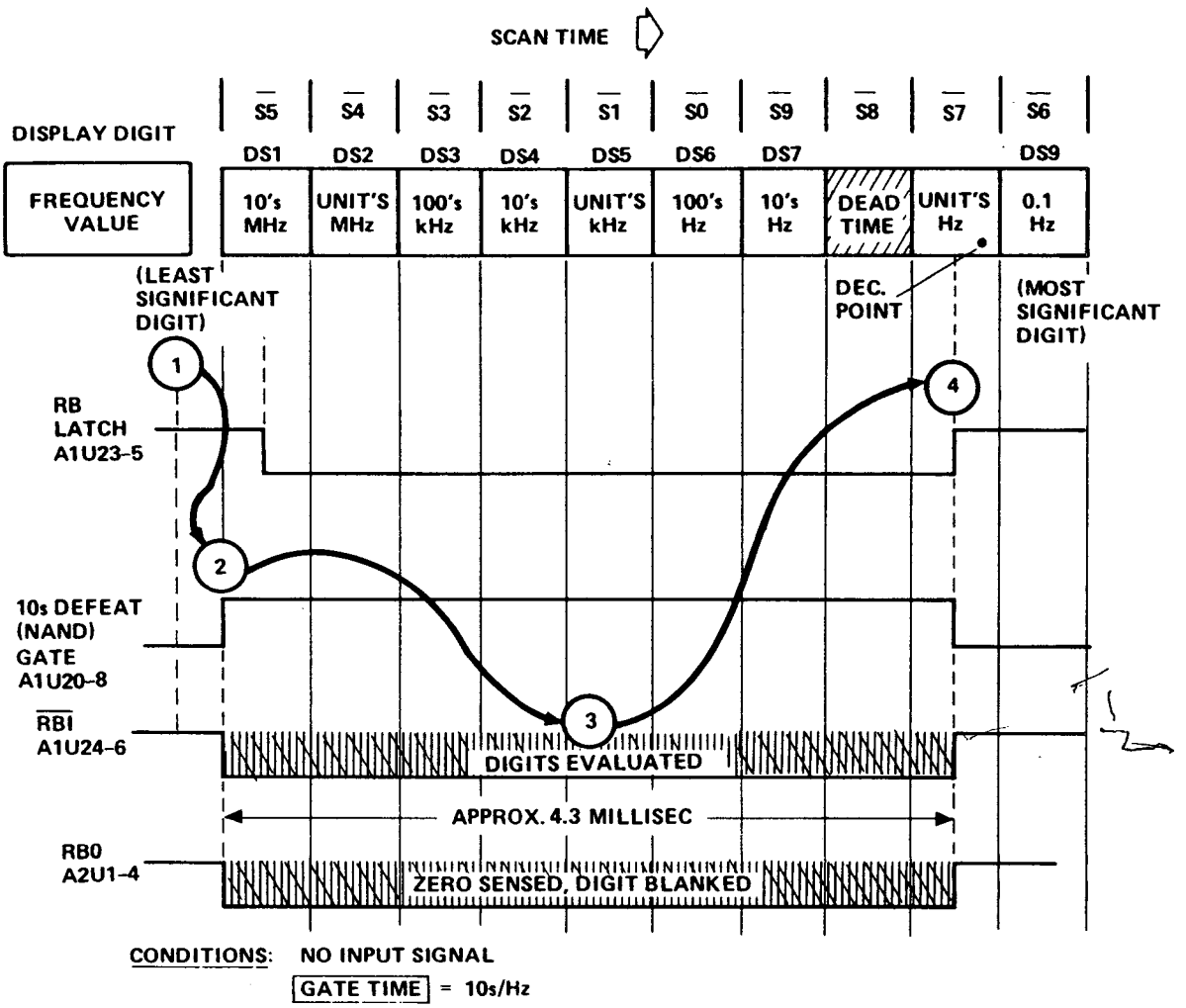
(2) After the $\overline{MG}$ signal terminates, the RSTB latch is set at the beginning of scan time $\overline{S9}$. This initiates the update sequence. A $\overline{RSTB}$ signal holds $\overline{MGE}$ off (i.e., high) until the completion of the update sequence (approximately 0.5 milliseconds later).

(3) During scan time $\overline{S9}$, 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 TR and $\overline{TR}$ pulses end, the latches are again isolated from the frequency counters.

(4) During scan time $\overline{S8}$ RSC and $\overline{RSC}$ pulses reset the frequency counters to zero.

(5) During scan time $\overline{S7}$, the 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

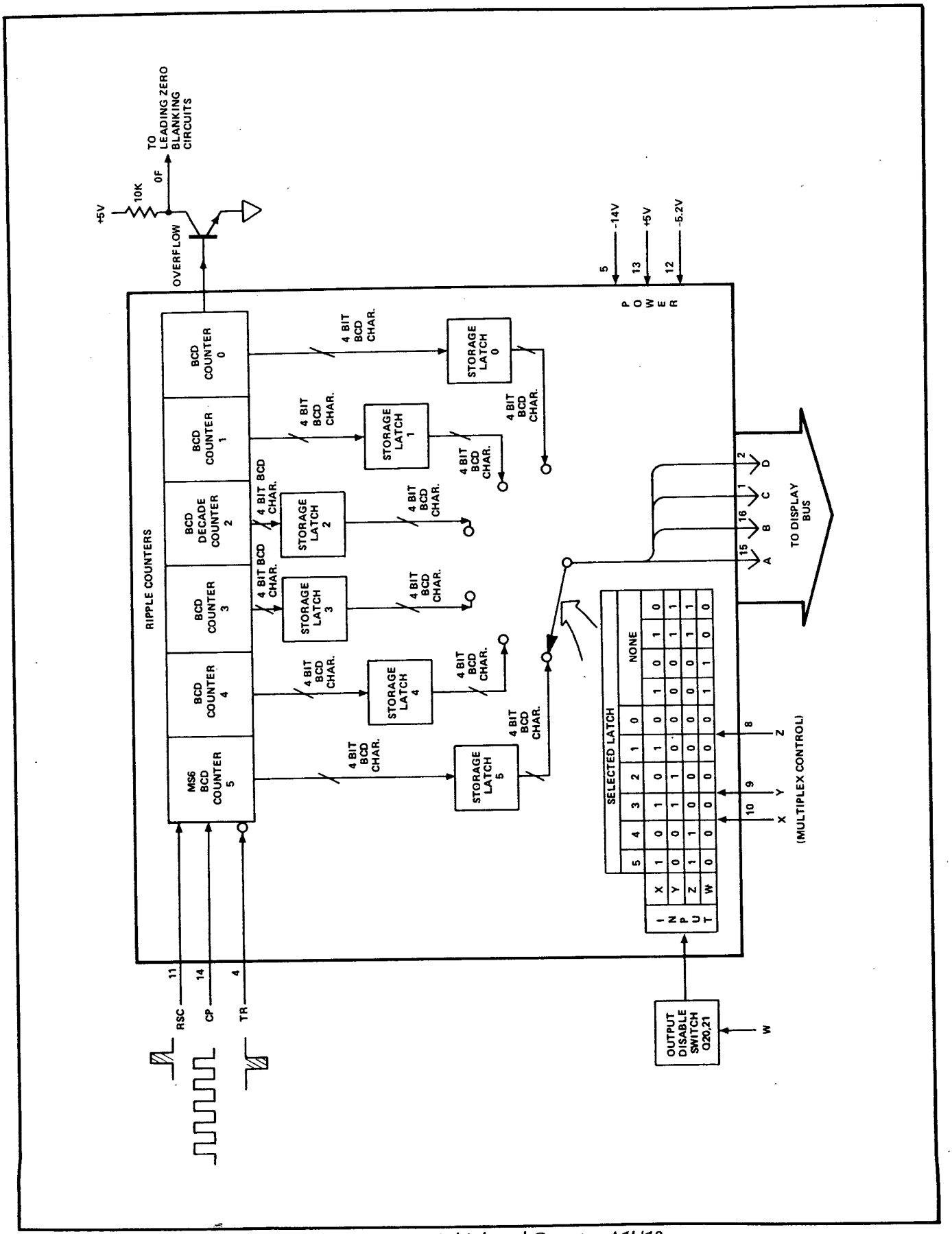


Figure 4-5. Hex Multiplexed Counter A1U18

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.

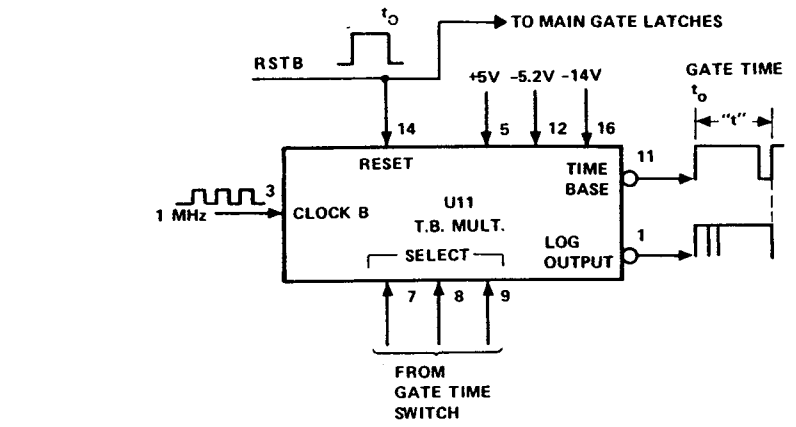
d. The BCD characters in the storage latches are sequentially addressed and transferred, one character at a time, to the display bus according to the XYZ multiplexing control signal. A binary XYZ input of six (110) and seven (111) are not recognized by the counter. These inputs result in the isolation of the counter output from the display bus. A high "W" signal also isolates the counter during scan times $\overline{S8}$ and $\overline{S9}$ to avoid interaction on the display bus between its output and the output of Counter/Storage Latch A1U15.

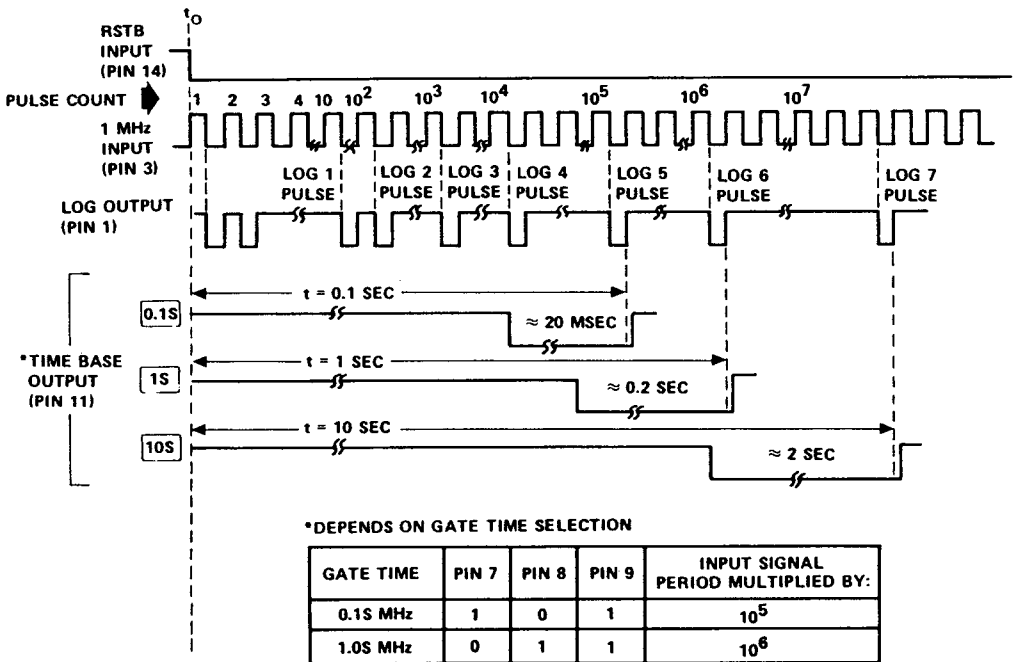
e. The Hex Multiplexed Counter generates a high OF (overflow) signal when all six BCD counters reach a terminal nine count. This output is inverted by Q19 to provide the $\overline{OF}$ which:

   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)





*DEPENDS ON GATE TIME SELECTION

GATE TIME	PIN 7	PIN 8	PIN 9	INPUT SIGNAL PERIOD MULTIPLIED BY:
0.1S MHz	1	0	1	10^5
1.0S MHz	0	1	1	10^6
10S MHz	1	1	1	10^7

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 ($\overline{MGE}$) 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 $\overline{MGE}$) 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

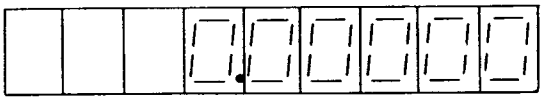
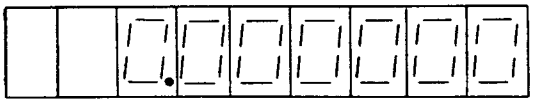
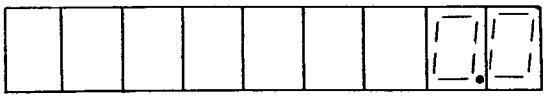
5-4. Use the performance check in Table 5-1 to verify proper operation of counter. This check should be used when improper operation or nonconformance to specifications is suspected.

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 50ΩFeedthru 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	520 MHz	25 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.			

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.

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

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.

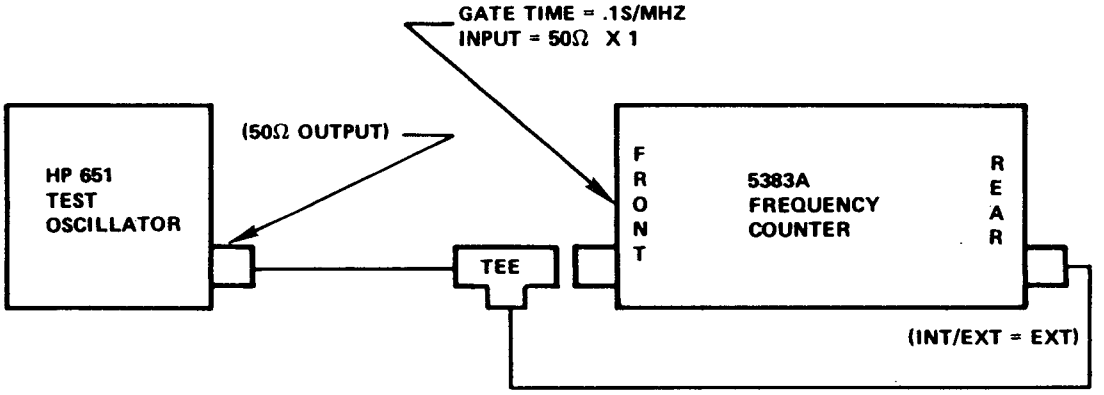


Figure A

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 ±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 50Ω 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 ±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
520 MHz	25 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)	_____	_____

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
520 MHz	25 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:

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.

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 50Ω/1MΩ input connector of the counter. Set the counter INPUT switch to 50Ω X1.

d. Set the Test Oscillator for a 1 MHz output at a 25 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. Connect Scope probe to A1TP1 and adjust A1R72 for a 50% duty cycle. Set as close as possible. 45/55 to 55/45 is acceptable.

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 010 (10544A Crystal Oscillator)
HP 11048C or equivalent 50Ω Feedthru connector
OR
HP 5345A Electronic Counter

* Note: If Symmetric waveform (50/50 duty cycle) cannot be achieved, R33 may require changing. Values between 1.5 kΩ and 4.7 kΩ are acceptable.

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:

TEST COUNTER	DISPLAY
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:

TEST COUNTER	DISPLAY (example)
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 50Ω Feedthru connector is also required.

1. Connect the coaxial cable to INPUT A through the 50Ω Feedthru connecto (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 (10^6).

HP 5345A ELECTRONIC COUNTER

1. Connect coaxial cable to front panel CHANNEL A input connector.
2. Set CHANNEL A input impedance to 50Ω.
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 5-17.c., 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.

Figure 5–1
DISPLAY FUNCTION TROUBLESHOOTING FLOWCHART

(See Page 5–9)

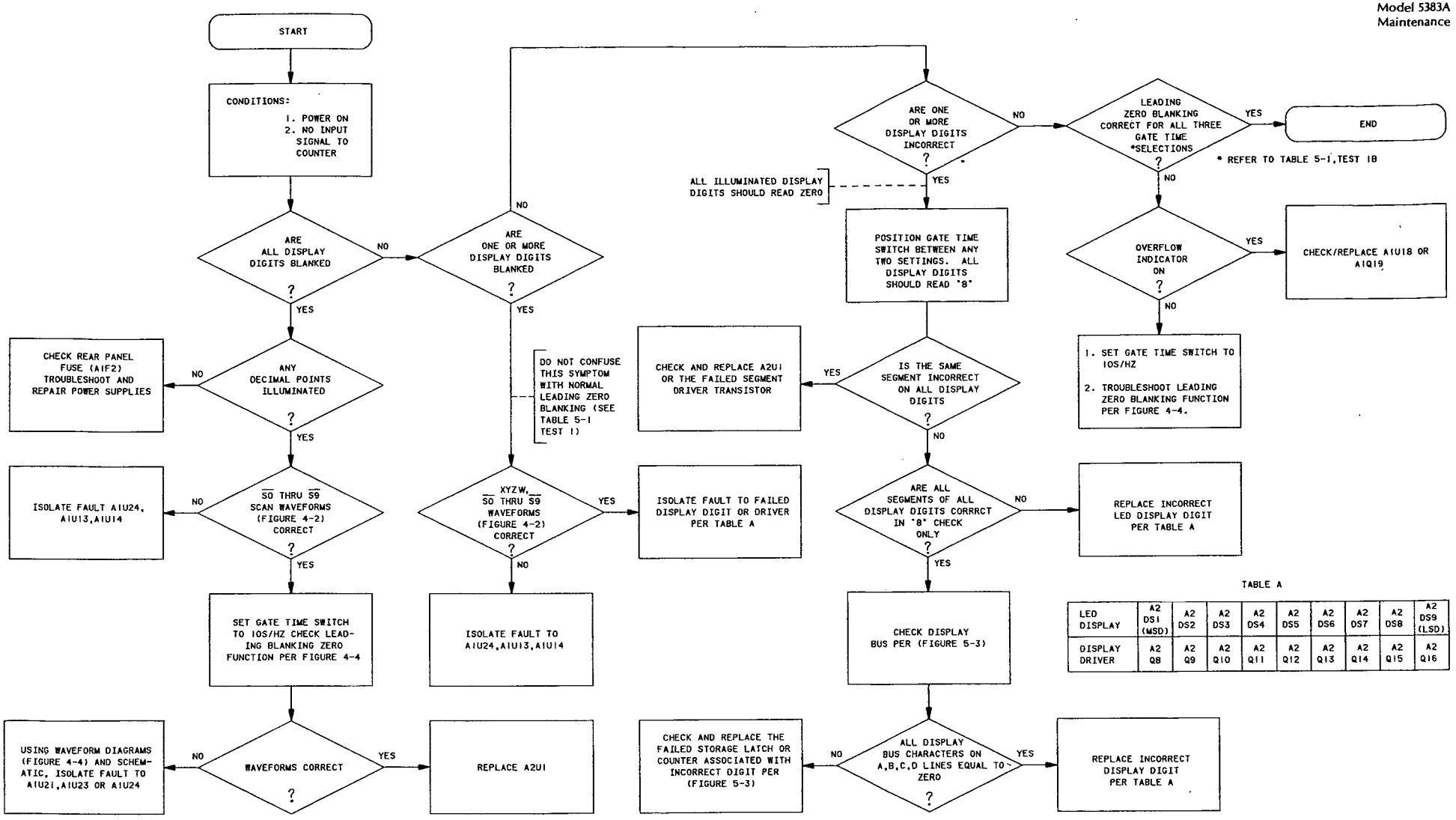


TABLE A

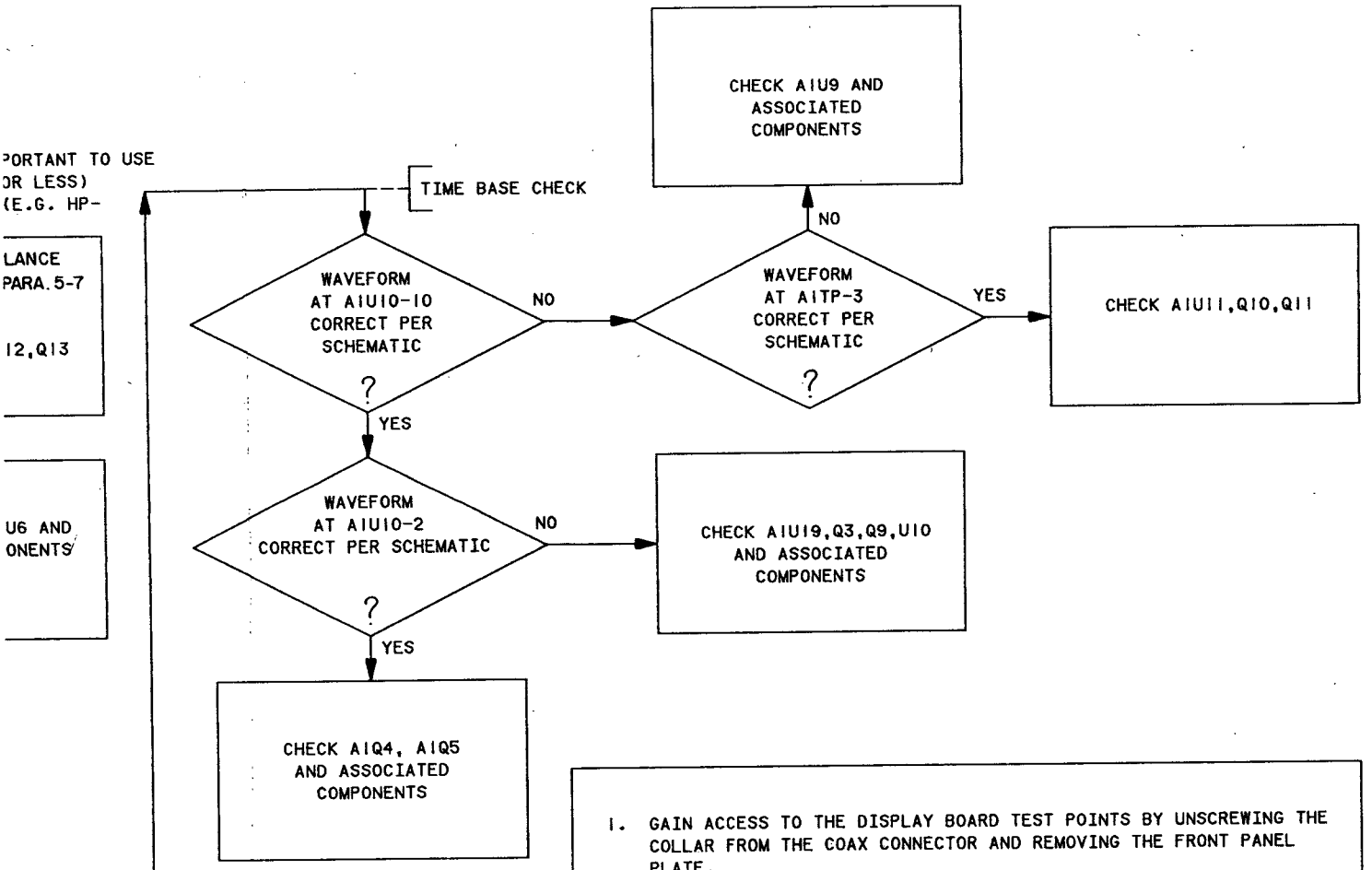
LED DISPLAY	A2 DS1 (MSD)	A2 DS2	A2 DS3	A2 DS4	A2 DS5	A2 DS6	A2 DS7	A2 DS8	A2 DS9 (LSD)
DISPLAY DRIVER	A2 Q8	A2 Q9	A2 Q10	A2 Q11	A2 Q12	A2 Q13	A2 Q14	A2 Q15	A2 Q16

05383-D-1

Figure 5-1. Display Function Troubleshooting Flowchart

Figure 5–2
COUNTER FUNCTION TROUBLESHOOTING FLOWCHART

(See Page 5–11)



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 →		S6	S7	S9	S0	S1	S2	S3	S4	S5
TIME		(LSC)								(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.

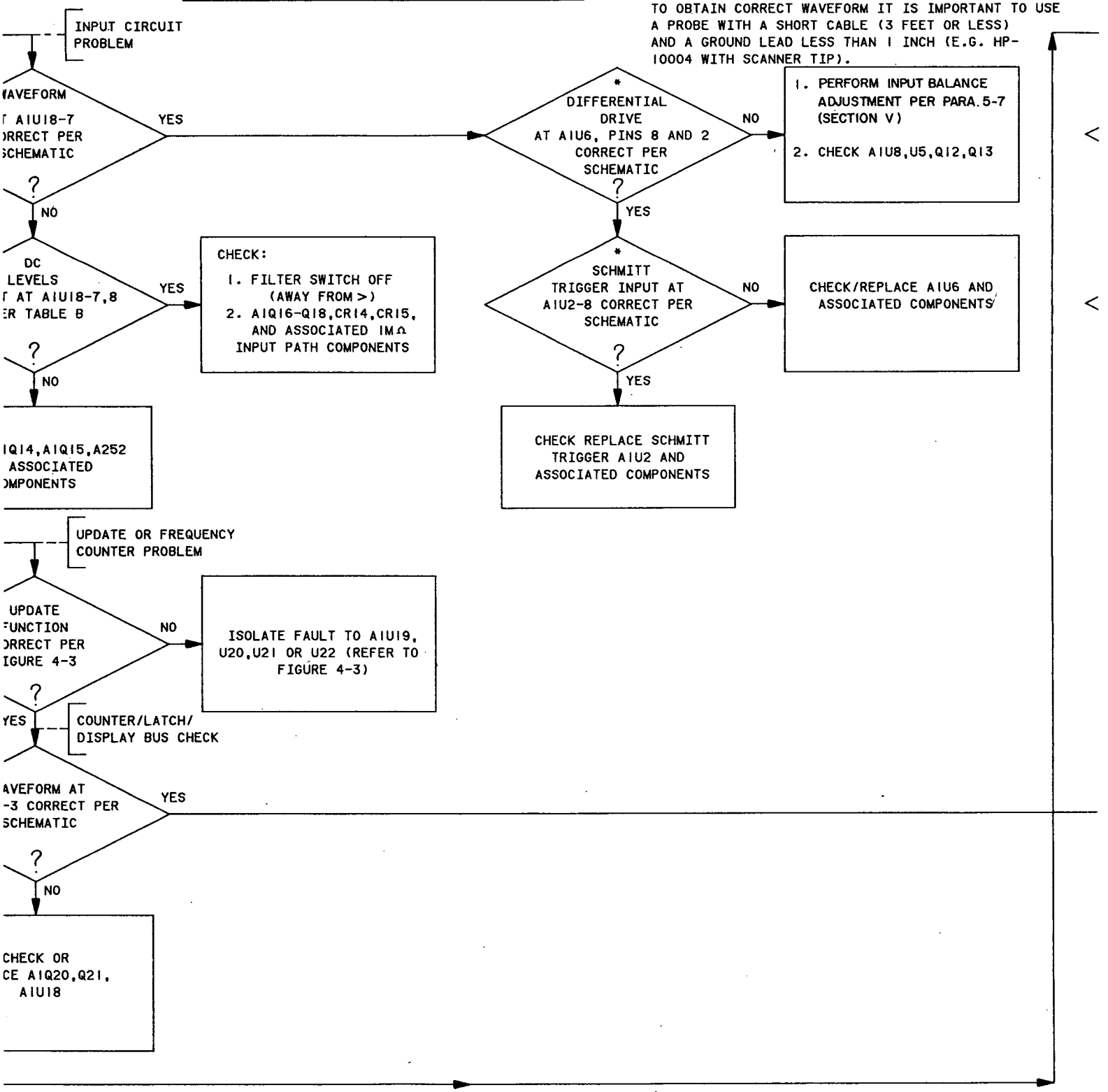
4. IF DISPLAY BUS DATA IS CORRECT, REPLACE A2U1.

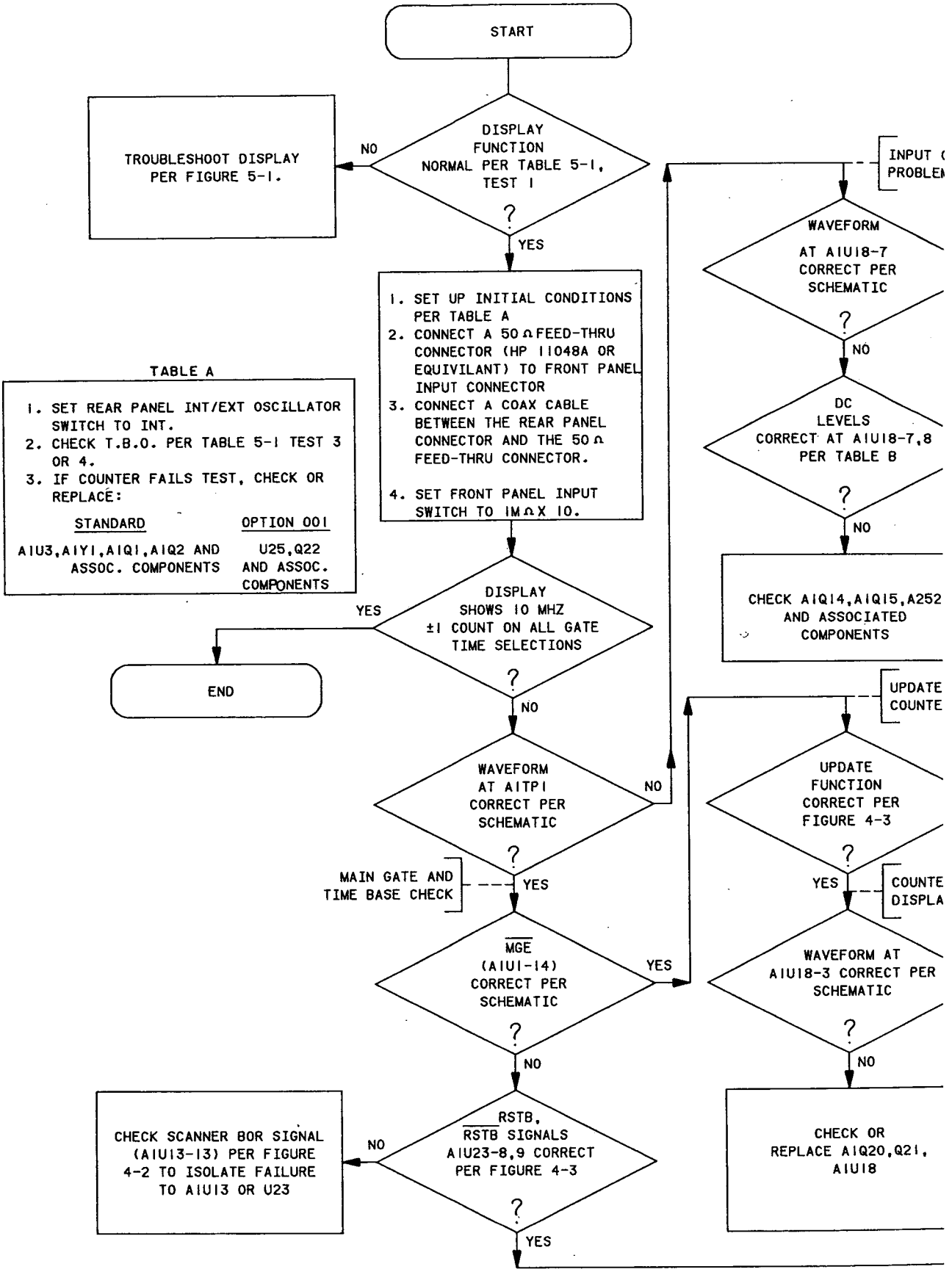
Figure 5-2. Counter Function Troubleshooting Flowchart

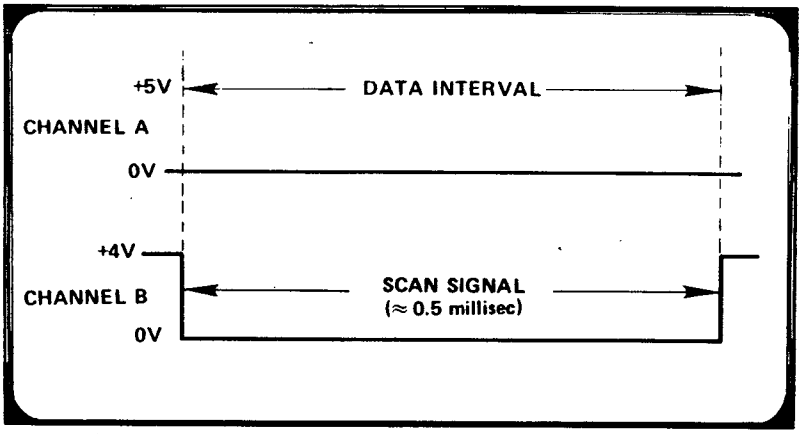
TABLE B

INPUT SW. POSITION	A1U8 PIN 7	A1U8 PIN 8	TOLERANCE
500Ω X 1	-2.0 V DC	-3.4 V DC	±0.2V
1MΩX 1 OR 1MΩX 10	-3.4 V DC	-2.0 V DC	

* NOTE:
TO OBTAIN CORRECT WAVEFORM IT IS IMPORTANT TO USE A PROBE WITH A SHORT CABLE (3 FEET OR LESS) AND A GROUND LEAD LESS THAN 1 INCH (E.G. HP-10004 WITH SCANNER TIP).




START
DISPLAY FUNCTION NORMAL PER TABLE 5-1, TEST 1
NO
TROUBLESHOOT DISPLAY PER FIGURE 5-1.
YES
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 1MΩX 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
A1U3,A1Y1,A1Q1,A1Q2 AND ASSOC. COMPONENTS
OPTION 001
U25,Q22 AND ASSOC. COMPONENTS
DISPLAY SHOWS 10 MHZ ±1 COUNT ON ALL GATE TIME SELECTIONS
YES
END
NO
WAVEFORM AT A1TP1 CORRECT PER SCHEMATIC
NO
MAIN GATE AND TIME BASE CHECK
YES
MGE (A1U1-14) CORRECT PER SCHEMATIC
YES
NO
RSTB, RSTB SIGNALS A1U23-8,9 CORRECT PER FIGURE 4-3
NO
CHECK SCANNER BOR SIGNAL (A1U13-13) PER FIGURE 4-2 TO ISOLATE FAILURE TO A1U13 OR U23
YES
INPUT (
PROBLEM
WAVEFORM AT A1U18-7 CORRECT PER SCHEMATIC
NO
DC LEVELS CORRECT AT A1U18-7,8 PER TABLE B
NO
CHECK A1Q14,A1Q15,A252 AND ASSOCIATED COMPONENTS
UPDATE COUNTE
UPDATE FUNCTION CORRECT PER FIGURE 4-3
YES
COUNTE DISPLA
WAVEFORM AT A1U18-3 CORRECT PER SCHEMATIC
NO
CHECK OR REPLACE A1Q20,Q21, A1U18



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).

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.

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 a factory selected value or is added or removed for the Option 001 TCXO time base oscillator.

Notation	Meaning
Asterisk (*)	Part has factory selected value or may not be used in a particular instrument.
Triangle (Δ)	Part used in standard counter only; removed for Option 001.
Square (□)	Part added in Option 001 counter only; removed in standard counter.

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

ABBREVIATIONS

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

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. Main Board Assembly A1 Parts List

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05383-60001	1	MAIN BOARD ASSEMBLY (STANDARD) SERIES 1620	28480	05383-60001
	05383-60009		Series 2552 ($1200)		
A1	05383-60003	1	MAIN BOARD ASSEMBLY (OPTION 001) SERIES 1620	28480	05383-60003
	05383-60010		Series 2552 ($1300)		
A1C1▲ 3R	0121-0059	1	CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	00866	304324 2/8PF NPO
A1C2▲	0160-2265	1	CAPACITOR-FXD 22PF +-5% 500WVDC CER *FACTORY SELECTED PART	28480	0160-2265
A1C3▲	0160-0161	1	CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A1C4▲	0160-3878	20	CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C5	0180-0428	4	CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0428
A1C6▲ 3R	0160-2055	4	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A1C7▲	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C8	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C9	0160-3879	3	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1C10	0180-0058	1	CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A1C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A1C12	0180-0480	2	CAPACITOR-FXD 4500UF+75-10% 25VDC AL	56289	36DX452G025AA2A
A1C13	0180-0480		CAPACITOR-FXD 4500UF+75-10% 25VDC AL	56289	36DX452G025AA2A
A1C14▲ 3R	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A1C15▲	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1C16	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C17	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C18	0180-0428		CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0428
A1C19	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C20	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1C21	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C22	0160-1701	7	CAPACITOR-FXD 6.8UF+-20% 6VDC TA	56289	150D685X0006A2
A1C23	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C24	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA	56289	150D685X0006A2
A1C25	0180-0428		CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0428
A1C26	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA	56289	150D685X0006A2
A1C27	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C28	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C29	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C30	0160-0128	2	CAPACITOR-FXD 2.2UF +-20% 50WVDC CER	28480	0160-0128
A1C31	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA	56289	150D685X0006A2
A1C32	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C33	0160-3875	1	CAPACITOR-FXD 22PF +-5% 200WVDC CER	28480	0160-3875
A1C34	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C35	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C36	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C37	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C38	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C39	0160-0128		CAPACITOR-FXD 2.2UF +-20% 50WVDC CER	28480	0160-0128
A1C40	0160-3454	2	CAPACITOR-FXD 220PF +-10% 1000WVDC CER	28480	0160-3454
A1C41	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C42	0160-0182	1	CAPACITOR-FXD 47PF +-5% 300WVDC MICA	28480	0160-0182
A1C43	0160-3454		CAPACITOR-FXD 220PF +-10% 1000WVDC CER	28480	0160-3454
A1C44	0180-0428		CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0428
A1C45	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C46	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA	56289	150D685X0006A2
A1C47	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1C48	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA	56289	150D685X0006A2
A1C49	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA	56289	150D685X0006A2
A1C50■ A	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A1CR1▲ 3R	1901-0040	7	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR2▲	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR3	1901-0028	1	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR4	1906-0028	1	DIODE-FW BRDG 100V 1.8A	04713	MDA922-3
A1CR5	1902-0040	1	DIODE-ZNR 14V 5% DO-7 PD=.4W TC=+.056%	07263	FZ 1201
A1CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR8	1901-0535	4	DIODE-SCHOTTKY	28480	1901-0535
A1CR9	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR10	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR11	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR12	1901-0050	2	DIODE-SWITCHING 80V 200MA 2NS DO-7	28480	1901-0050
A1CR13	1901-0050		DIODE-SWITCHING 80V 200MA 2NS DO-7	28480	1901-0050
A1CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR16■ A	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

▲ Removed for Option 001
■ Added for Option 001

See introduction to this section for ordering information

Table 6-1. Main Board Assembly A1 Parts List Cont'd

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1F1	2110-0436	2	FUSE ,1A 125V FAST-BLO ,348X,25 UL	28480	2110-0436
A1F2	2110-0436		FUSE ,1A 125V FAST-BLO ,348X,25 UL (SPARE)	28480	2110-0436
A1L1	9140-0210	1	COIL-MLD 100UH 5% Q=50 ,155DX,375LG	24226	15/103
A1L2	9100-1788	3	COIL; FXD; NON-MOLDED RF CHOKE; ,75UH	02114	VK200-20/4B
A1L3	9100-1788		COIL; FXD; NON-MOLDED RF CHOKE; ,75UH	02114	VK200-20/4B
A1L4	9100-1788		COIL; FXD; NON-MOLDED RF CHOKE; ,75UH	02114	VK200-20/4B
A1L5	9100-2269	2	COIL-MLD 27UH 10% Q=45 ,095DX,25LG	24226	10/272
A1L6	9100-2269		COIL-MLD 27UH 10% Q=45 ,095DX,25LG	24226	10/272
A1L7	9170-0029	1	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A1Q1▲	1853-0015	4	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A1Q2▲	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A1Q3	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A1Q4	1854-0092	4	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q5	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A1Q6	1854-0215	3	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A1Q7	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A1Q8	1853-0036	3	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A1Q9	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A1Q10	1854-0092		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		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		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q16	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A1Q17	1855-0081	2	TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	01295	2N5245
A1Q18	1855-0081		TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	01295	2N5245
A1Q19	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q20	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A1Q21	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q22■	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A1R1▲	0757-0893	1	RESISTOR 51 2% ,125W F TC=0+-100	24546	C4-1/8-T0-51R0-G
A1R2▲	0683-2025	3	RESISTOR 2K 5% ,25W FC TC=-400/+700	01121	CB2025
A1R3▲	0683-2025		RESISTOR 2K 5% ,25W FC TC=-400/+700	01121	CB2025
A1R4▲	0683-2025		RESISTOR 2K 5% ,25W FC TC=-400/+700	01121	CB2025
A1R5▲	0683-2715	2	RESISTOR 270 5% ,25W FC TC=-400/+600	01121	CB2715
A1R6▲	0683-2015	3	RESISTOR 200 5% ,25W FC TC=-400/+600	01121	CB2015
A1R7	0683-4315	1	RESISTOR 430 5% ,25W FC TC=-400/+600	01121	CB4315
A1R8▲	1810-0020	1	NETWORK-RES 8-PIN-SIP ,125-PIN-SPCG	11236	750
A1R9▲	0683-2715		RESISTOR 270 5% ,25W FC TC=-400/+600	01121	CB2715
A1R10▲	0683-5115	3	RESISTOR 510 5% ,25W FC TC=-400/+600	01121	CB5115
A1R11▲	0683-5605	2	RESISTOR 56 5% ,25W FC TC=-400/+500	01121	CB5605
A1R12	1810-0030	1	NETWORK-RES 8-PIN-SIP ,125-PIN-SPCG	11236	750
A1R13	0683-1515	2	RESISTOR 150 5% ,25W FC TC=-400/+600	01121	CB1515
A1R14	0683-2015		RESISTOR 200 5% ,25W FC TC=-400/+600	01121	CB2015
A1R15	0683-1025	5	RESISTOR 1K 5% ,25W FC TC=-400/+600	01121	CB1025
A1R16	0683-5115		RESISTOR 510 5% ,25W FC TC=-400/+600	01121	CB5115
A1R17	0683-1025		RESISTOR 1K 5% ,25W FC TC=-400/+600	01121	CB1025
A1R18	0683-1825	1	RESISTOR 1,8K 5% ,25W FC TC=-400/+700	01121	CB1825
A1R19	0683-1025		RESISTOR 1K 5% ,25W FC TC=-400/+600	01121	CB1025
A1R20	0683-1025		RESISTOR 1K 5% ,25W FC TC=-400/+600	01121	CB1025
A1R21	0698-4123	2	RESISTOR 499 1% ,125W F TC=0+-100	24546	C4-1/8-T0-499R-F
A1R22	0698-5176	8	RESISTOR 510 5% ,125W CC TC=-330/+800	01121	BB5115
A1R23	0698-5176		RESISTOR 510 5% ,125W CC TC=-330/+800	01121	BB5115
A1R24	0698-5176		RESISTOR 510 5% ,125W CC TC=-330/+800	01121	BB5115
A1R25	0698-6244	2	RESISTOR 3,3K 5% ,125W CC TC=-350/+857	01121	BB3325
A1R26	0698-5174	3	RESISTOR 200 5% ,125W CC TC=-330/+800	01121	BB2015
A1R27	0683-1035	1	RESISTOR 10K 5% ,25W FC TC=-400/+700	01121	CB1035
A1R28	0683-3325	1	RESISTOR 3,3K 5% ,25W FC TC=-400/+700	01121	CB3325
A1R29	0683-3025	1	RESISTOR 3K 5% ,25W FC TC=-400/+700	01121	CB3025
A1R30	0698-5180	1	RESISTOR 2K 5% ,125W CC TC=-350/+857 *SELECTED VALUE; NOT IN ALL INSTRUMENTS	01121	BB2025
A1R31	0698-6294	3	RESISTOR 47K 5% ,125W CC TC=-466/+875	01121	BB4735
A1R32	2100-1986	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	62-206-1
A1R33	0698-6244		RESISTOR 3,3K 5% ,125W CC TC=-350/+857	01121	BB3325
A1R34	0698-6294		RESISTOR 47K 5% ,125W CC TC=-466/+875	01121	BB4735
A1R35	0698-5174		RESISTOR 200 5% ,125W CC TC=-330/+800	01121	BB2015
A1R36	0698-5179	1	RESISTOR 1,8K 5% ,125W CC TC=-350/+857	01121	BB1825
A1R37	0698-5174		RESISTOR 200 5% ,125W CC TC=-330/+800	01121	BB2015
A1R38	0698-4123		RESISTOR 499 1% ,125W F TC=0+-100	24546	C4-1/8-T0-499R-F
A1R39	0698-3374	1	RESISTOR 20 5% ,125W CC TC=-270/+540	01121	BB2005
A1R40	0698-6242	4	RESISTOR 1,2K 5% ,125W CC TC=-350/+857	01121	BB1225

▲ Removed for Option 001
■ Added for Option 001

See introduction to this section for ordering information

Table 6-1. Main Board Assembly A1 Parts List Cont'd

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R41	0698-7080	2	RESISTOR 27 5% .125W CC TC=-270/+540	01121	BB2705
A1R42	~~0698-3174~~	2	RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A1R43	~~0698-3174~~		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A1R44	0698-7080		RESISTOR 27 5% .125W CC TC=-270/+540	01121	BB2705
A1R45	0698-8354	1	RESISTOR 270 5% .125W CC TC=-330/+800	01121	BB2715
A1R46	0698-6241	1	RESISTOR 750 5% .125W CC TC=-330/+800	01121	BB7515
A1R47	0698-5176		RESISTOR 510 5% .125W CC TC=-330/+800	01121	BB5115
A1R48	0698-7102	1	RESISTOR 5.1K 5% .125W CC TC=-350/+857	01121	BB5125
A1R49	1810-0055	2	NETWORK=RES 9-PIN=SIP .15-PIN=SPCG	28480	1810-0055
A1R50	0683-2015		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A1R51	0698-6242		RESISTOR 1.2K 5% .125W CC TC=-350/+857	01121	BB1225
A1R52	0698-5177	1	RESISTOR 820 5% .125W CC TC=-330/+800	01121	BB8215
A1R53	0698-6294		RESISTOR 47K 5% .125W CC TC=-466/+875	01121	BB4735
A1R54	0698-5183	2	RESISTOR 4.3K 5% .125W CC TC=0+882	01121	BB4325
A1R55	0698-5486	1	RESISTOR 10K 10% .125W CC TC=-350/+857	01121	BB1031
A1R56	0683-2745	1	RESISTOR 270K 5% .25W FC TC=-800/+900	01121	CB2745
A1R57	0698-5176		RESISTOR 510 5% .125W CC TC=-330/+800	01121	BB5115
A1R58	0698-5176		RESISTOR 510 5% .125W CC TC=-330/+800	01121	BB5115
A1R59	0698-6283	1	RESISTOR 10 5% .125W CC TC=-120/+400	01121	BB1005
A1R60	0698-6242		RESISTOR 1.2K 5% .125W CC TC=-350/+857	01121	BB1225
A1R61	0698-5176		RESISTOR 510 5% .125W CC TC=-330/+800	01121	BB5115
A1R62	0675-1021	2	RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A1R63	0698-5176		RESISTOR 510 5% .125W CC TC=-330/+800	01121	BB5115
A1R64	0675-1021		RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A1R65	0683-5605		RESISTOR 56 5% .25W FC TC=-400/+500	01121	CB5605
A1R66	0698-6242		RESISTOR 1.2K 5% .125W CC TC=-350/+857	01121	BB1225
A1R67	0698-5183		RESISTOR 4.3K 5% .125W CC TC=0+882	01121	BB4325
A1R68	1810-0055		NETWORK=RES 9-PIN=SIP .15-PIN=SPCG	28480	1810-0055
A1R69■	0683-1515		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A1R70■	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R71■	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	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 SUBMIN .5A 125VAC/DC	95146	SLS-120-1
A1S3	3101-0680	1	SWITCH=PB DPDT ALTNG 4A 250VAC	28480	3101-0680
A1U1	~~1820-0736~~	1	IC=DIGITAL ECL DUAL D 8IN	28480	~~1820-0736~~ 1820-2642
A1U2	1820-0982	3	IC 5084-0164 DIFF AMPL	28480	1820-0982 see Son Note
A1U3▲	1820-1224	1	IC=DIGITAL MC10216P ECL TPL 2 LINE RCVR	04713	MC10216P 5383A-2
A1U4	~~1820-1019~~	1	IC=DIGITAL ECL 8I-QUINARY	28480	1820-1019
A1U5	1826-0139	1	IC MC 1458 OP AMP	04713	MC1458P1
A1U6	1820-0982		IC 5084-0164 DIFF AMPL	28480	1820-0982
A1U7	~~1820-1052~~	1	IC=DIGITAL MC10125L ECL/TTL QUAD 2	04713	MC10125L
A1U8	1820-0982		IC 5084-0164 DIFF AMPL	28480	1820-0982
A1U9	1820-1251	1	IC=DIGITAL SN74LS196N TTL LS DECD	01295	SN74LS196N
A1U10	1820-0817	1	IC=DIGITAL MC10131P ECL DUAL D-M/S	04713	MC10131P
A1U11	1820-0633	1	IC=DIGITAL	28480	1820-0633
A1U12	1820-1166	2	IC=DIGITAL DM85L51N TTL L QUAD	27014	DM85L51N
A1U13	1820-0911	1	IC=DIGITAL SN74L192N TTL L DECD	01295	SN74L192N
A1U14	1820-0491	1	IC=DIGITAL SN74145N TTL 4 BCD-TO-DEC	01295	SN74145N
A1U15	1820-1195	1	IC=DIGITAL N82S90A TTL S DECD	18324	N82S90A
A1U16	1820-1166		IC=DIGITAL DM85L51N TTL L QUAD	27014	DM85L51N
A1U17	1820-1143	1	IC=DIGITAL DM8552N TTL DECD SYNCHRO	27014	DM8552N
A1U18	1820-0634	1	IC=DIGITAL MOS DECD	28480	1820-0634
A1U19	1820-0174	1	IC=DIGITAL SN7404N TTL HEX 1	01295	SN7404N
A1U20	1820-0054	1	IC=DIGITAL SN7400N TTL QUAD 2 NAND	01295	SN7400N
A1U21	1820-0661	1	IC=DIGITAL SN7432N TTL QUAD 2 OR	01295	SN7432N
A1U22	1820-0328	1	IC=DIGITAL SN7402N TTL QUAD 2 NOR	01295	SN7402N
A1U23	1820-0077	1	IC=DIGITAL SN7474N TTL DUAL D-TYPE	01295	SN7474N
A1U24	1820-0537	1	IC=DIGITAL SN7413N TTL DUAL 4 NAND	01295	SN7413N
A1U25■	0960-0394	1	TCXO CRYSTAL OSCILLATOR	28480	0960-0394
A1XP1	1251-3205	4	CONNECTOR=SGL CONT SKT .022-DIA	28480	1251-3205
A1XP2	1251-3205		CONNECTOR=SGL CONT SKT .022-DIA	28480	1251-3205
A1Y1▲	0410-0405	1	CRYSTAL:QUARTZ 10 MHZ	28480	0410-0405
			A1 MISCELLANEOUS		
	0360-0393	1	TERMINAL=LUG=SLDR 6 SCR .144/.144 ID	79963	176

▲ Removed for Option 001
■ Added for Option 001

Table 6-2. Display Board Assembly A2 Parts List

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2	05383-60002	1	DISPLAY BOARD ASSEMBLY	28480	05383-60002
A2C1	0180-0106	1	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X000682
A2C2	0160-4182	1	CAPACITOR-FXD .01UF +-20% 200WVDC CER	6F364	200-200-X7R-103M
A2C3	0140-0209	1	CAPACITOR-FXD 9PF +-10% 500WVDC MICA	72136	DM15C050K0500WV1CR
A2CR1	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2D81		9	DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D82	1990-0469		DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D83	OR		DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D84	1990-0470		DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D85	OR		DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D86	1990-0471		DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D87	(Refer to Paragraph 6-6.)		DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D88			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2D89			DISPLAY NUM SEG 1 CHAR .3 IN HIGH	28480	1990-0452
A2J1	1250-1163	1	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1163
A2L1	9100-1620	1	COIL-MLD 15UH 10% Q=65 .155DX.375LG	24226	15/152
A2Q1	1854-0492	7	TRANSISTOR NPN SI PD=350MW FT=250MHZ	28480	1854-0492
A2Q2	1854-0492		TRANSISTOR NPN SI PD=350MW FT=250MHZ	28480	1854-0492
A2Q3	1854-0492		TRANSISTOR NPN SI PD=350MW FT=250MHZ	28480	1854-0492
A2Q4	1854-0492		TRANSISTOR NPN SI PD=350MW FT=250MHZ	28480	1854-0492
A2Q5	1854-0492		TRANSISTOR NPN SI PD=350MW FT=250MHZ	28480	1854-0492
A2Q6	1854-0492		TRANSISTOR NPN SI PD=350MW FT=250MHZ	28480	1854-0492
A2Q7	1854-0492		TRANSISTOR NPN SI PD=350MW FT=250MHZ	28480	1854-0492
A2Q8	1853-0318	9	TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q9	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q10	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q11	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q12	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q13	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q14	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q15	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2Q16	1853-0318		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A2R1	0683-2705	11	RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R2	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R3	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R4	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R5	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R6	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R7	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R8	0683-0395	9	RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R9	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R10	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R11	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R12	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R13	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R14	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R15	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R16	0683-0395		RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB3905
A2R17	1810-0076	1	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0076
A2R18	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R19	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R20	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R21	0683-4715	9	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R22	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R23	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R24	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R25	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R26	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R27	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R28	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R29	0683-2705		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A2R30	0683-1825	1	RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A2R31	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A2R32	0698-8354	1	RESISTOR 270 5% .125W CC TC=-330/+800	01121	BB2715
A2R33	0698-7102	1	RESISTOR 5.1K 5% .125W CC TC=-350/+857	01121	BB5125
A2R34	0698-7097	1	RESISTOR 1M 5% .125W CC TC=-600/+1137	01121	BB1055
A2R35	0698-7964	1	RESISTOR 100K 5% .125W CC TC=-466/+875	01121	BB1045
A2S1	3101-1598	2	SWITCH-SL DP3T-NS MINTR 1A 125VAC PC	28480	3101-1598
A2S2	3101-1598		SWITCH-SL DP3T-NS MINTR 1A 125VAC PC	28480	3101-1598
A2U1	1820-0914	1	IC-DIGITAL 9307DC TTL 4 BCD-TO-7-SEG	07263	9307DC
			A2 MISCELLANEOUS		
	0510-0076	1	NUT-SHMET 6-32-THD .63-WD STL	78553	C8999-632-248
	1251-3768	32	CONTACT-CONN U/W POST TYPE MALE DPSLDR	28480	1251-3768

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
			CHASSIS MTD AND MISCELLANEOUS PARTS		
C51	0160-3043	1	CAPACITOR-FXD 5000PF/5000PF +-20%	28480	0160-3043
F2	2110-0008	1	FUSE .5A 125V SLO-BLO 1.25X.25 UL	75915	313.500
F2	2110-0201	1	FUSE .25A 250V SLO-BLO 1.25X.25 UL IEC	75915	313.250
J1	1251-2357	1	CONNECTOR-AC PWR HP-9 MALE FLG-MTG	28480	1251-2357
J2	1250-0083	1	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JR-130-1
S4	3101-1609	1	SWITCH-SL 2-DPDT-NS STD 1.5A 250VAC SLDR	82389	11E-1036
T1	9100-3039	1	TRANSFORMER, POWER	28480	9100-3039
U26	1826-0122	1	IC +5.0 VOLT RGLTR	07263	7805UC
U27	1826-0215	1	IC -5.2 VOLT RGLTR	04713	MC7905.2CP
W1	8120-1378	1	CABLE ASSEMBLY 18AWG 3-CNDCT GRY-JKT .253-OD	28480	8120-1378
XF2	2110-0464	1	FUSEHOLDER-EXTR POST 20A 300V UL/IEC	75915	345002-010
XF2	2110-0465	1	FUSEHOLD-CAP UL/IEC .25X1.25FUSE	28480	2110-0465
XF2	2950-0054	1	NUT-HEX-DBL-CHAM 1/2-28-THD .125-THK	28480	2950-0072
	0340-0765	1	INSULATOR-XSTR TO-220 .002-THK	28480	0340-0765
	0370-0914	1	BEZEL;PUSHBUTTON KNOB, JADE GREY	28480	0370-0914
	0370-2486	1	PUSHBUTTON(SOLID GRAY)	28480	0370-2486
	7101-0373	1	PANEL, FRONT	28480	7101-0373
	5040-7032	1	FOOT, REAR	28480	5040-7032
	05300-00006	2	CLIP-RFI	28480	05300-00006
	05301-20005	1	STAND, TILT	28480	05301-20005
	05301-40001	1	FOOT	28480	05301-40001
	05381-20003	1	COVER, TOP	28480	05381-20003
	05381-20004	1	COVER, BOTTOM	28480	05381-20004
	05381-20005	4	STANDOFF, A1 MOUNTING	28480	05381-20005
	05382-00002	1	PANEL, REAR (STANDARD INSTRUMENT)	28480	05382-00002
	05382-00003	1	PANEL, REAR (OPTION 001 INSTRUMENT)	28480	05382-00003

Table 6-4. Manufacturers Code List

Mfg. No.	Manufacturer Name	Address	Zip Code
0086S	STETTNER-TRUSH INC., CAZENOVIA, NY 13035		
01121	ALLEN-BRADLEY CO., MILWAUKEE, WI 53212		
01295	TEXAS INSTR INC SEMICOND CMPNT 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		
11236	CTS OF BERNE INC., BERNE, IN 46711		
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		
56289	SPRAGUE ELECTRIC CO., NORTH ADAMS, MA 01247		
6F364	CENTRE ENGINEERING INC., STATE COLLEGE, PA 16801		
72136	ELECTRO MOTIVE CORP SUB IEC, WILLIMANTIC, CT 06226		
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV., FULLERTON, CA 92634		
75915	LITTELFUSE INC., DES PLAINES, IL 60016		
78553	TINNERMAN PRODUCTS INC., CLEVELAND, OH 44129		
79963	ZIERICK MFG CO., MT. KISCO, NY 10549		
82389	SWITCHCRAFT INC., CHICAGO, IL 60630		
95146	ALCO ELECTRONIC PRODUCTS INC., LAWRENCE, MA 01843		

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.

6-6. LED Display Digit Ordering Information

6-7. The 5380 series frequency counter uses three types of LED display digits. 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 denot 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.

6-8. Replacement Hardware for Mounting U27 Regulator

6-9. Two methods have been used for mounting -5.2V regulator U27 on the rear panel. One method uses a single nylon screw which screws into a 6-32 threaded hole in the rear panel. The second method uses a stainless steel machine screw and a nylon shoulder washer. The screw fits a 4-40 threaded hole in the rear panel and the shoulder washer insulates the screw from the body of the regulator.

6-10. The 6-32 x ¼" nylon slotted head machine screw is available under HP Part Number 2360-0055. This screw will break if overtightened.

6-11. A number 4-40 x ¼" binding head Pozi-drive machine screw with lockwasher (HP Part Number 2200-0103) and flat washer (HP Part No. 3050-0124) is used in the second, more recent, mounting for U27. The flat washer prevents the lockwasher from damaging the nylon shoulder washer (HP Part Number 3050-0756).

6-12. Both mounting methods require the use of an insulator between the chassis and the body of U27. This insulator is listed in Table 6-3 under HP Part Number 0340-0765.

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 on inside front cover. 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.

7-7. Manual Backdating for Older Instruments

7-8. This manual, with the changes listed in Table 7-1, also applied to 5383A Counters with Serial Prefix 1508A or 1516A, Serial No. 1516A00275 and below, or Serial Prefixes of 1532A, 1540A, and 1620A.

7-9. To backdate this manual for any instrument with the serial numbers or serial prefixes listed above and in Table 7-1, make the changes shown in Table 7-1. Make the change in descending sequence starting with Change 3.

Table 7-1. Manual Changes

Serial Prefix or Serial Number	Changes
Serial Prefixes 1508A or 1516A	1,2,3
Serial No. 1516A00276 and above or Serial Prefix 1532A	2,3
Serial Prefix 1540A	3
Serial Prefix 1620A	4

CHANGE 1

Page 2-1, Paragraph 2-9, step b:

Change to the following: "Ensure that the correct fuse is installed. Use a Listed 0.250 ampere, slow-blow fuse for 100-volt or 120-volt operation. Use a Listed 0.125 ampere, slow-blow fuse for 220-volt or 240-volt operation. See NOTE at end of Change 1.

Page 3-3, Paragraph 3-10, Problem 1, Check c. and

Page 6-7, Table 6-3, Chassis Mounted and Miscellaneous Parts:

Change ½ Amp fuse F2 (HP Part No. 2110-0008) to ¼ Amp (HP Part No. 2110-0018) and the ¼ Amp fuse for F2 (HP Part No. 2110-0201) to ⅛ Amp (HP Part No. 2110-0318).

CHANGE 1 Cont'd

Page 3-7, Figure 3-2a; Page 3-8, Figure 3-2b; and Page 8-5, Figure 8-2, A1 Schematic Diagram:
Change VA rating (adjacent to power connector) from 30 to 20 VA.
Change fuse values of 500 and 250 MAT to 250 and 125 MAT, respectively.

NOTE

The recommended replacement fuse for F2 in any instrument is the 500 MAT 125V fuse (HP Part No. 2110-0008) for 100 or 120V operation; the 250 MAT 250V fuse (HP Part No. 2110-0201) for 220 or 240V operation.

CHANGE 2

Page 6-6, Table 6-2, A2 Display Board Replaceable Parts:
Change A2 series number to "(SERIES 1540)".
Change A2Q1 through A2Q7 from HP Part No. 1854-0492 to 1854-0246, "Mfr Code" to 04713, and "Mfr Part Number" to SPS233. See NOTE below.
Page 8-7, Figure 8-3: A2 Schematic Diagram table of "ACTIVE ELEMENTS":
Change "HP Part No." for "Q1-7" from 1854-0492 to 1854-0246 (SPS233).
Page 6-7, Table 6-3, Chassis Mounted and Miscellaneous Parts:
Change front panel from 7101-0373 to 05383-00001 in columns for "HP Part Number" and "Mfr Part Number". See NOTE below.
Page 1-1, Figure 1-1, Front Panel View:
Change name to read "500 MHz FREQUENCY COUNTER".
Change all front-panel views in the same manner.
Page 1-3, Table 1-2, Specifications:
Change "Frequency Range" maximum for 520 to 512 MHz.

NOTE

All 5383A Counters will meet the same specifications as those given in Table 1-2 for Series 1628A including the 520 MHz maximum frequency range.

The 7101-0373 panel can be used for replacement purposes in any series 1508A, 116A, or 1532A instrument. This panel shows 520 MHz in place of 500 MHz.

The HP Part No. 1854-0492 transistor is recommended for replacement of A2Q1 through A2Q7 in any series 1508A, 1516A, or 1532A instrument.

CHANGE 3

Pages 6-3 and 6-5, Table 6-1, 05383-60001/05383-60003 Replaceable Parts:
Change A1 series number to 1540.
Change A1U14 from 1820-0491 (SN74145N) to 1820-0214 (SN7442N) in "HP Part Number" and "Mfr Part Number" columns in Table 6-1. See NOTE below.
Page 6-6, Table 6-2, 05383-60002, Replaceable Parts:
Change A2 series number to 1540.
Change A2R7 from 1810-0076 (8 x 1800Ω) to 1810-0041 (8 x 1800Ω). See NOTE below.
Change A2R30 from 0683-1825 (1800Ω) to 0683-2725; (2700Ω) and change "Mfr Part Number" from "CB1825" to "CB2725".
Page 8-5, Figure 8-2, A1 Schematic Diagram:
Change series number at top of schematic to 1540.
Change A1U1 in table of ACTIVE ELEMENTS from 1820-0491 (74145) to 1820-0214 (7442).

CHANGE 3 Cont'd

Page 8-7, Figure 8-3, A2 Schematic Diagram:
Change series number, at top of schematic, to 1540.
Change A1R17 from 1800 to 2700 ohms per section.
Change A2R30 from 1800 to 2700 ohms.

NOTE

The SN74145N (HP Part No. 1820-0491) integral circuit is recommended for A1U14 replacement in all serial prefix 1508A, 1516A, 1532A, or 1540A instruments. If the SN74145N is used for A1U14, an 8 x 1800 ohm resistor pack (HP Part No. 1810-0076) is recommended for A2R7 and an 1800 ohm resistor (HP Part No. 0683-1825) is recommended for A2R30.

CHANGE 4

Page 1-3, Table 1-2:
Change SENSITIVITY specification as follows:

INPUT Switch Positon	Frequency Range	Sensitivity (RMS)
50Ω X1	20 Hz to 100 MHz	25 mV
	100 MHz to 520 MHz	50 mV

Page 5-2, Table A:
In first line of Table A, change output level at 520 MHz to 50 mV.
Page 5-4a, Performance Check Record Sheet:
In step 3, in first line of table, change output level for 520 MHz to 50 mV.

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).

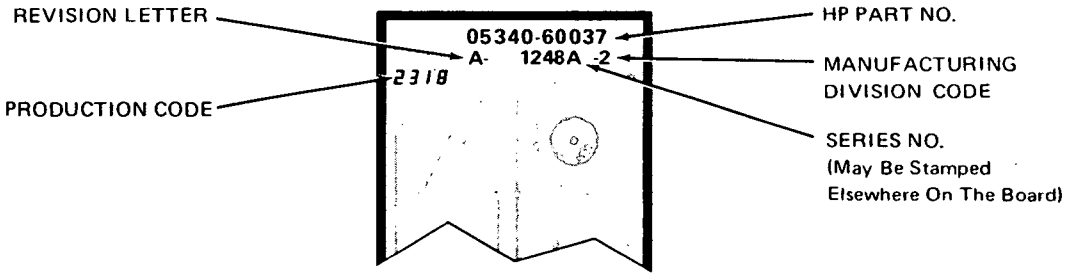
b. The INPUT switch is set to 1MΩ X10.

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.

SYMBOLS

- FRONT PANEL
- REAR PANEL
- INTERIOR AND PC BOARDS
- WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE
- POWER LINE GROUND
- CIRCUIT COMMON GROUND
- FLOATING GROUND
- CHASSIS GROUND
- KNOB CONTROL
- SCREWDRIVER ADJUST
- MAIN SIGNAL PATH
- FEEDBACK PATH
- TEST POINT
- "AND" GATE
- "OR" GATE
- INVERTER
- NAND GATE
- NOR GATE
- EXCLUSIVE NOR

PRINTED CIRCUIT BOARD IDENTIFICATION



REFERENCE DESIGNATIONS

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

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

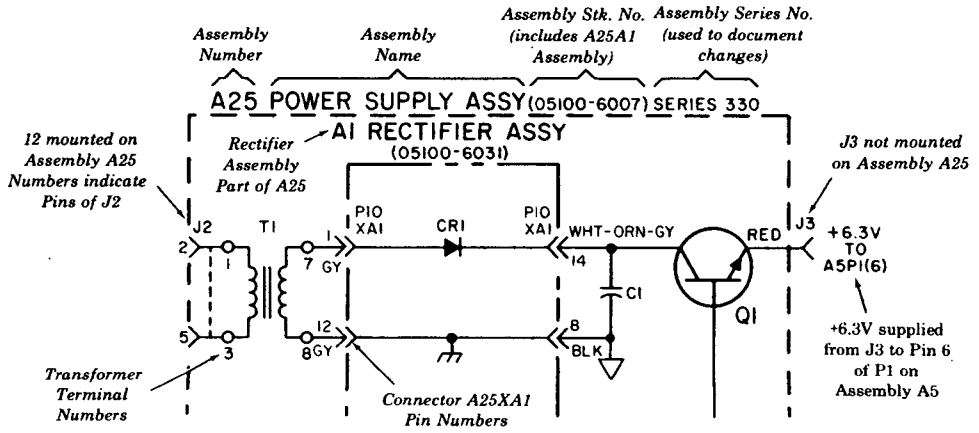
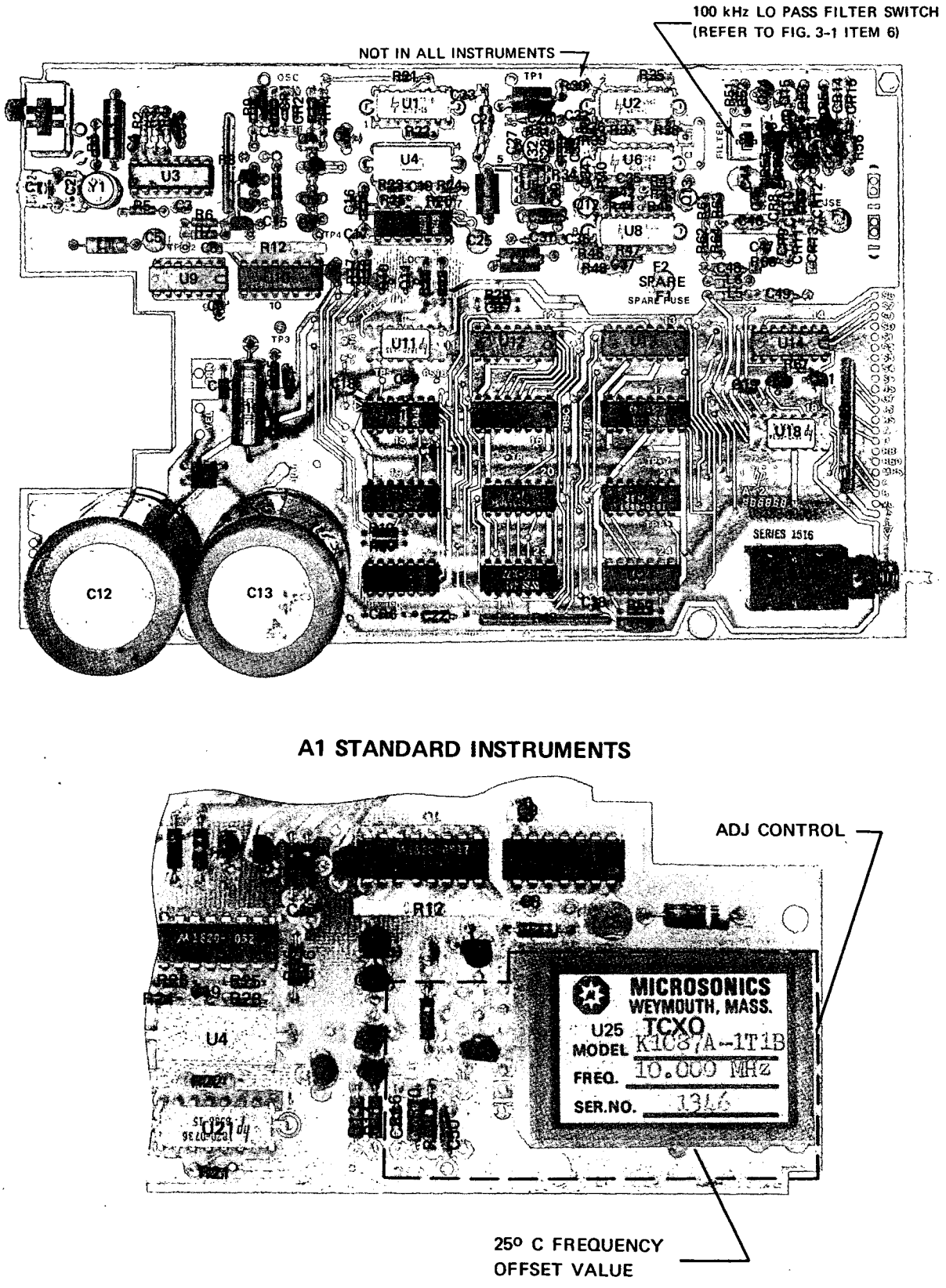


Figure 8-1. Schematic Diagram Notes

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.
RSC $\overline{RSC}$	TTL signals that reset frequency counters.
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 cyclying display scan signals; each scan line activates one display digit.
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.



Part of Figure 8-2. A1 Main Board Schematic Diagram (Standard and Option 001) and Part of A2 Display Board

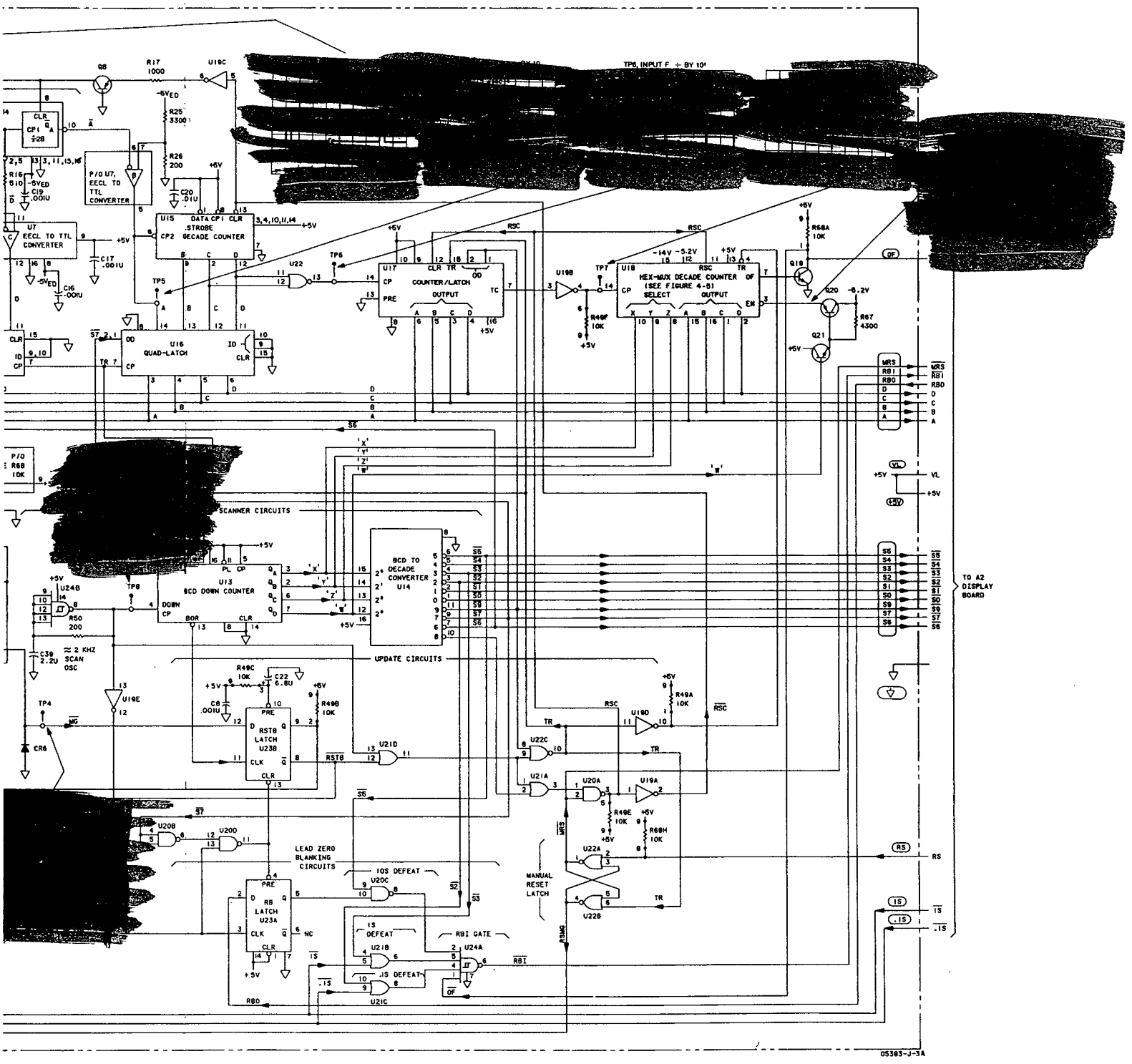
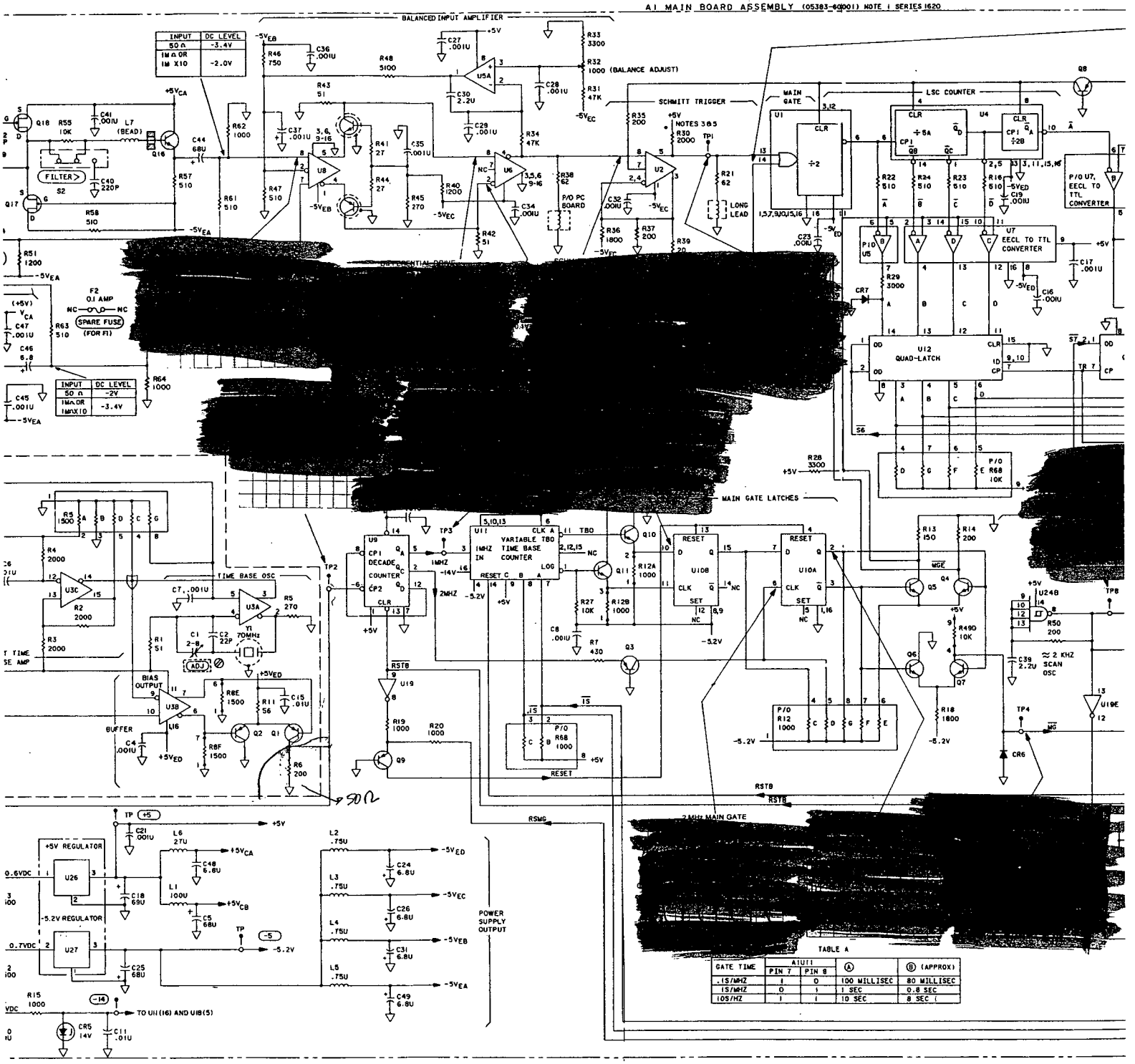


Figure 8–2. A1 Main Board Schematic Diagram (Standard and Option 001) and Part of A2 Display Board


A1 MAIN BOARD ASSEMBLY (05383-60001) NOTE 1 SERIES 1620
BALANCED INPUT AMPLIFIER
SCHMITT TRIGGER
MAIN GATE
LSC COUNTER
TIME BASE OSC
MAIN GATE LATCHES
U12 QUAD-LATCH
U7 EECL TO TTL CONVERTER
VARIABLE TBO TIME BASE COUNTER
DECADE COUNTER
BUFFER
+5V REGULATOR
-5.2V REGULATOR
POWER SUPPLY OUTPUT
TABLE A

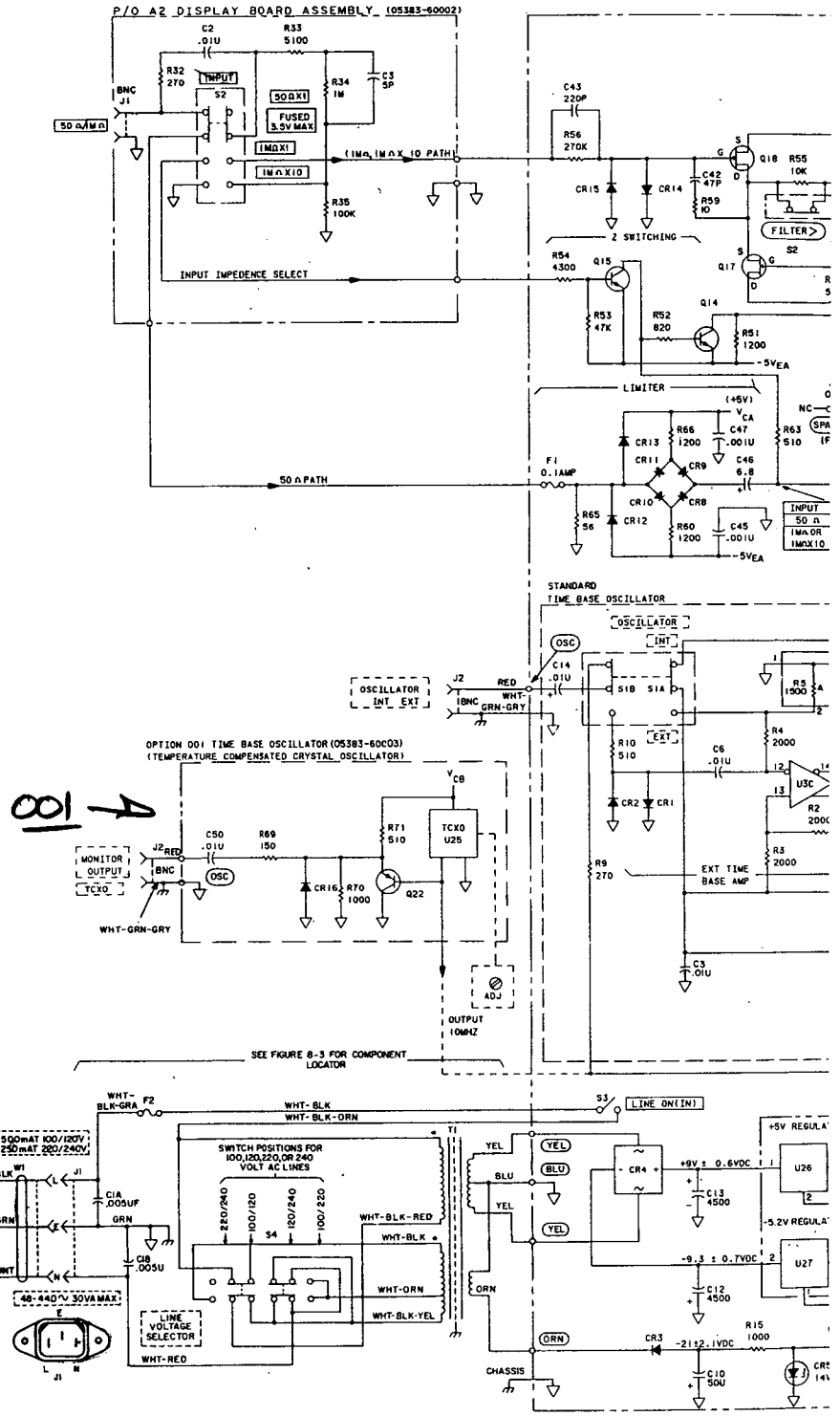
THIN THIS ASSEMBLY ARE ABBREVIATED.
BBREVIATION FOR COMPLETE DESCRIPTION.
):

TED COMPONENT.
ROM SET-UP DESCRIBED IN PARA. 8-2.
UMENTS.

REFERENCE DESIGNATIONS

A1	A2	CHASSIS
C1-50	C1-3	C51
CR1-16	CR1	F2
F1,2	DS1-9	J1,2
L1-7	J1	
Q1-22	L1	
R1-71	Q1-16	S4
S1-3	R1-35	T1
T1	S1,2	U26,27
U1-25	U1	W1
Y1		

MBERS	PWR (PIN)	PWR RTN PIN
040	VED(11)	16
R1358-9)	-5.2V(1)	9
IDA922-3)	VCB(16), (1)	8
FZ1201)	VEB(13)	3,11,15
901-0050	VEC(4) +5V(8)	
2N3563)	+5V(9)	16
2N3563)	VED(11) +5V(14)	7
2N3904)	-5.2V(8)	1, 16
2N5179)	-14V(16) -5.2V(4) +5V(9)	—
071	+5V(16)	8
2N5245)	+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
	+5V(14)	7
	See schem.	See schem.
	See schem.	See schem.
	See schem.	See schem.



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED.
2. 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.
5. A1R30 NOT USED IN ALL INSTRUMENTS.

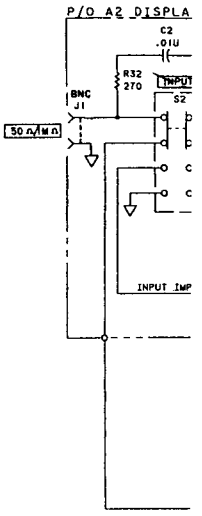
ACTIVE ELEMENTS

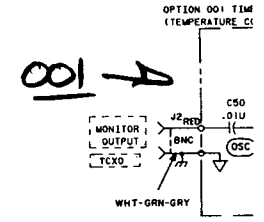
REFERENCE DESIGNATIONS	PART NUMBERS	PWR (PIN)	PWR RTN PIN
CR1▲,2▲,6,7,14,15,16	1901-0040		
CR3	1901-0028 (SR1358-9)		
CR4	1906-0028 (MDA922-3)		
CR5	1902-0040 (FZ1201)		
CR8-11, CR12, 13	1901-0535, 1901-0050		
Q1-3,22■	1853-0015 (2N3563)		
Q4, 5, 10, 11	1854-0092 (2N3563)		
Q6, 7, 16	1854-0215 (2N3904)		
Q12, 13	1854-0546 (2N5179)		
Q14, 15, 19, 21	1854-0071		
Q17, 18	1855-0081 (2N5245)		
U1	1820-0736	VED(11)	16
U2, 6, 8	1820-0982	-5.2V(1)	9
U3▲	1820-1224 (ECL10216)	VCB(16), (1)	8
U4	1820-1019	VEB(13)	3,11,15
U5	1826-0139 (LM1458N)	VEC(4) +5V(8)	
U7	1820-1052 (ECL10125)	+5V(9)	16
U9	1820-1251 (74LS196)	VED(11) +5V(14)	7
U10	1820-0817 (MC10131)	-5.2V(8)	1, 16
U11	1820-0633	-14V(16) -5.2V(4) +5V(9)	—
U12, 16	1820-1166 (DM85L51)	+5V(16)	8
U13	1820-0911 (74L192)	+5V(16)	8
U14	1820-0491 (74145)	+5V(16)	8
U15	1820-1155 (82S90)	+5V(14)	7
U17	1820-1143 (8552)	+5V(14)	8
U18	1820-0634	+5V(13), -5.2V(12), -14V(5)	
U19	1820-0174 (7404)	+5V(14)	7
U20	1820-0054 (7400)	+5V(14)	7
U21	1820-0661 (7432)	+5V(14)	7
U22	1820-0328 (7402)	+5V(14)	7
U23	1820-0077 (7474)	+5V(14)	7
U24	1820-0537 (7413)	+5V(14)	7
U25■	0960-0394	See schem.	See schem.
U26	1826-0122 (7805)	See schem.	See schem.
U27	1826-0215 (MC7905.2)	See schem.	See schem.

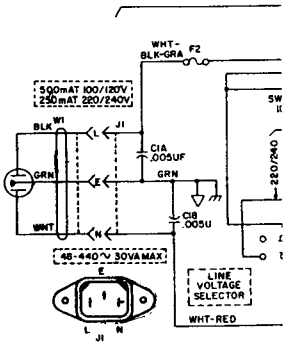
REFERENCE DESIGNATIONS

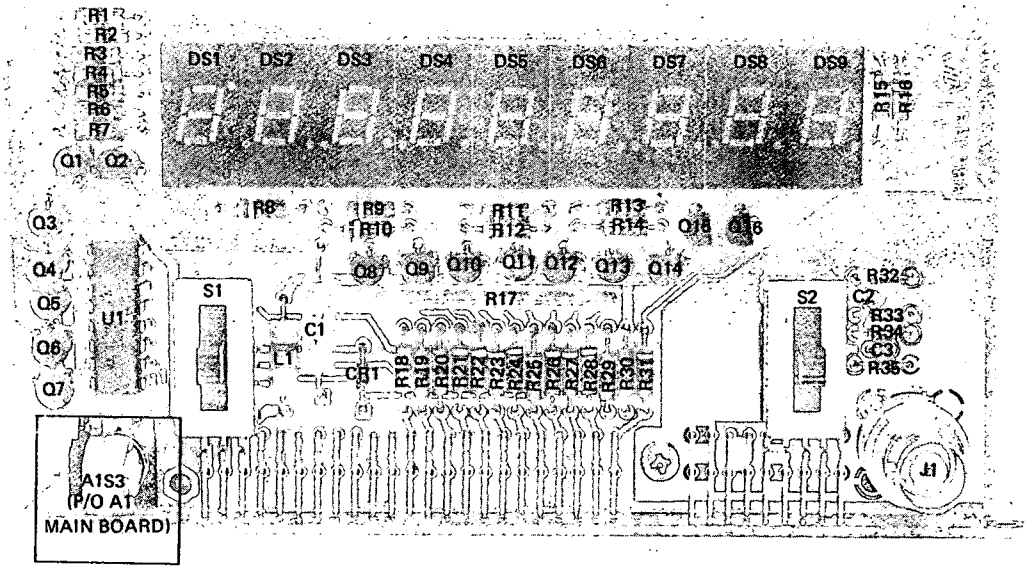
A1	A2	CHASSIS
C1-50	C1-3	C51
CR1-16	CR1	F2
F1,2	DS1-9	J1,2
L1-7	J1	
Q1-22	L1	
R1-71	Q1-16	S4
S1-3	R1-35	T1
T1	S1,2	U26,27
U1-25	U1	W1
Y1		

■ADDED FOR OPTION 001.
▲DELETED FOR OPTION 001.

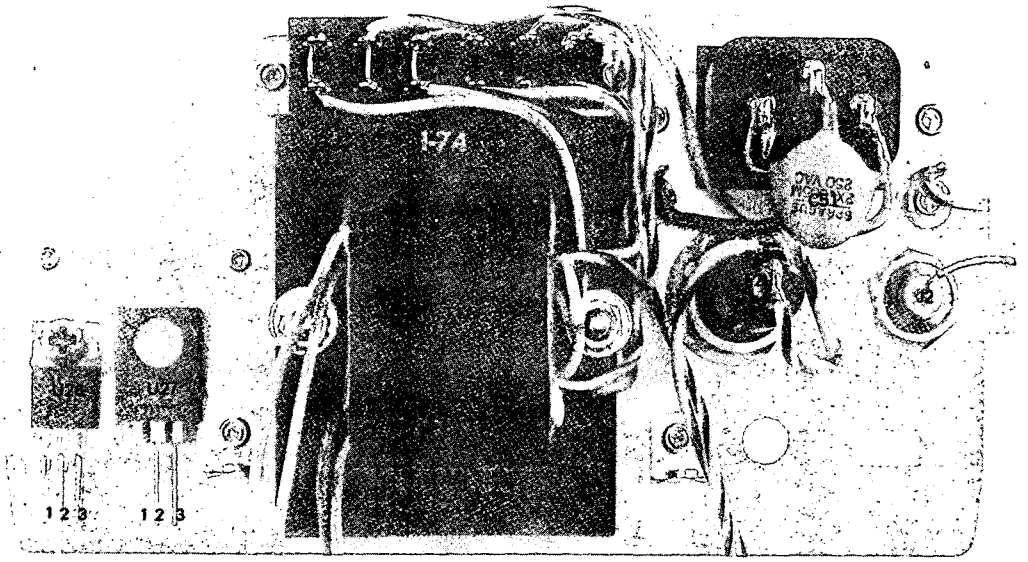








A2



REAR PANEL

Part of Figure 8-3. Part of A2 Display Board Schematic Diagram

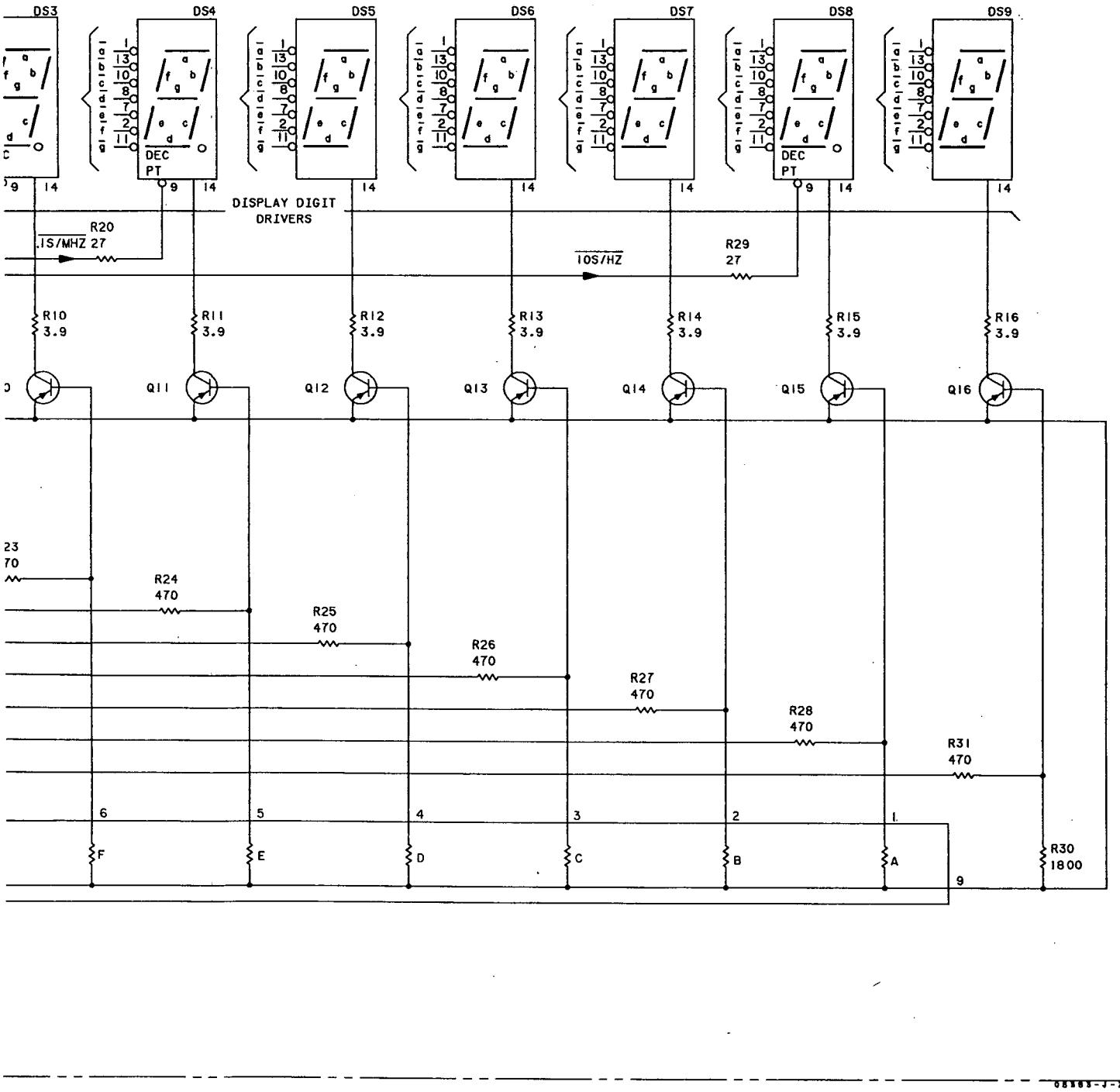
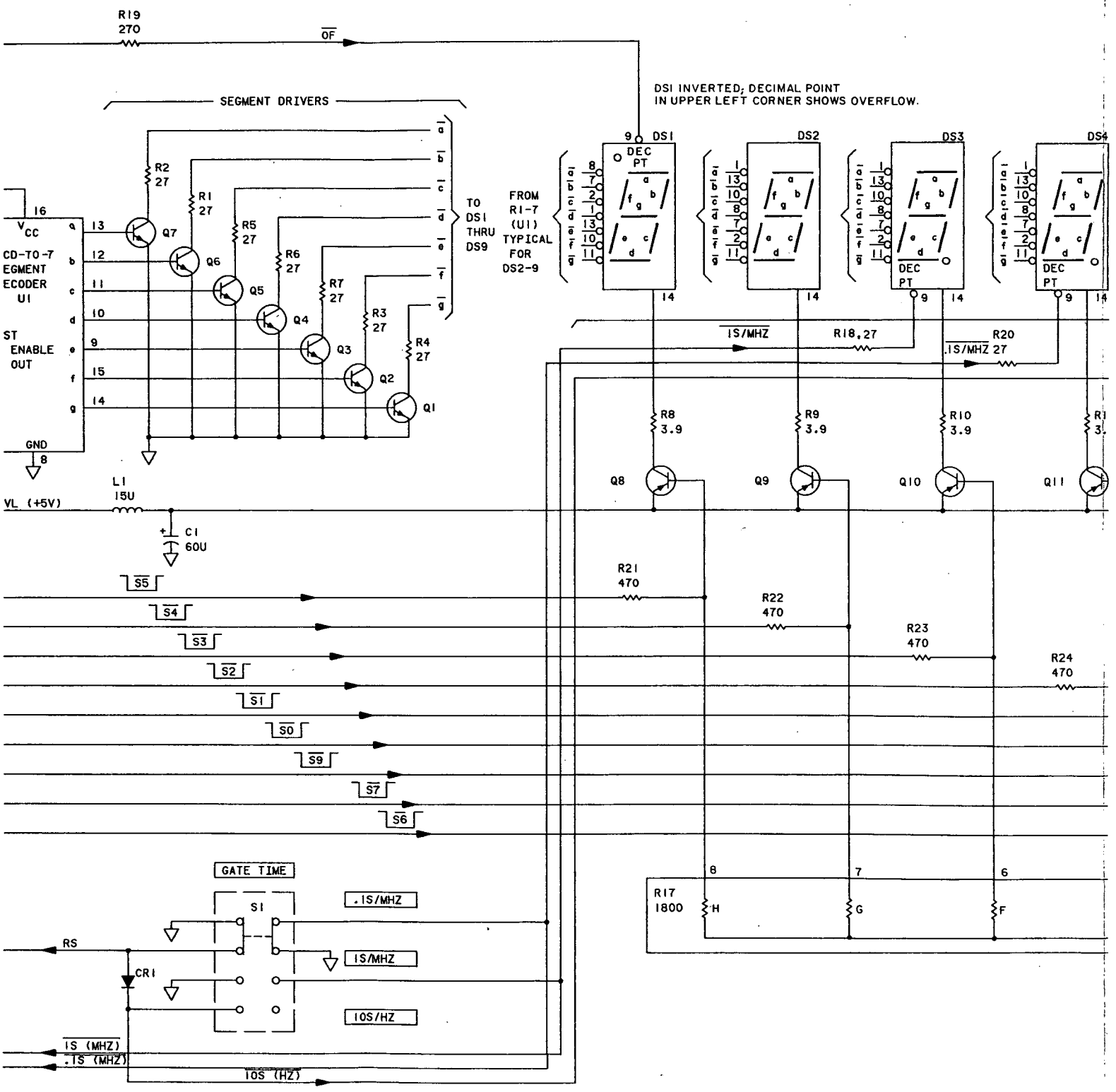


Figure 8-3. Part of A2 Display Board Schematic Diagram


R19
270
OF
SEGMENT DRIVERS
DSI INVERTED; DECIMAL POINT
IN UPPER LEFT CORNER SHOWS OVERFLOW.
DS1
DS2
DS3
DS4
DEC PT
R2 27
R1 27
R5 27
R6 27
R7 27
R3 27
R4 27
Q7
Q6
Q5
Q4
Q3
Q2
Q1
TO DS1 THRU DS9
FROM R1-7 (U1) TYPICAL FOR DS2-9
16
VCC
CD-TO-7 SEGMENT DECODER U1
ST ENABLE OUT
GND
8
VL (+5V)
L1 15U
C1 60U
1S/MHZ
R18,27
R20 .1S/MHZ 27
R8 3.9
R9 3.9
R10 3.9
Q8
Q9
Q10
Q11
R21 470
R22 470
R23 470
R24 470
S5
S4
S3
S2
S1
S0
S9
S7
S6
R17 1800
H
G
F
GATE TIME
S1
.1S/MHZ
1S/MHZ
10S/HZ
RS
CR1
1S (MHZ)
.1S (MHZ)
10S (HZ)

T DRIVE		DISPLAYED DIGIT VALUE
f	g	
0	1	0
1		1
1	0	2
1	0	3
0	0	4
0	0	5
0	0	6
1	1	7
0	0	8
0	0	9
0	0	8
er		
ox. 0 volts		

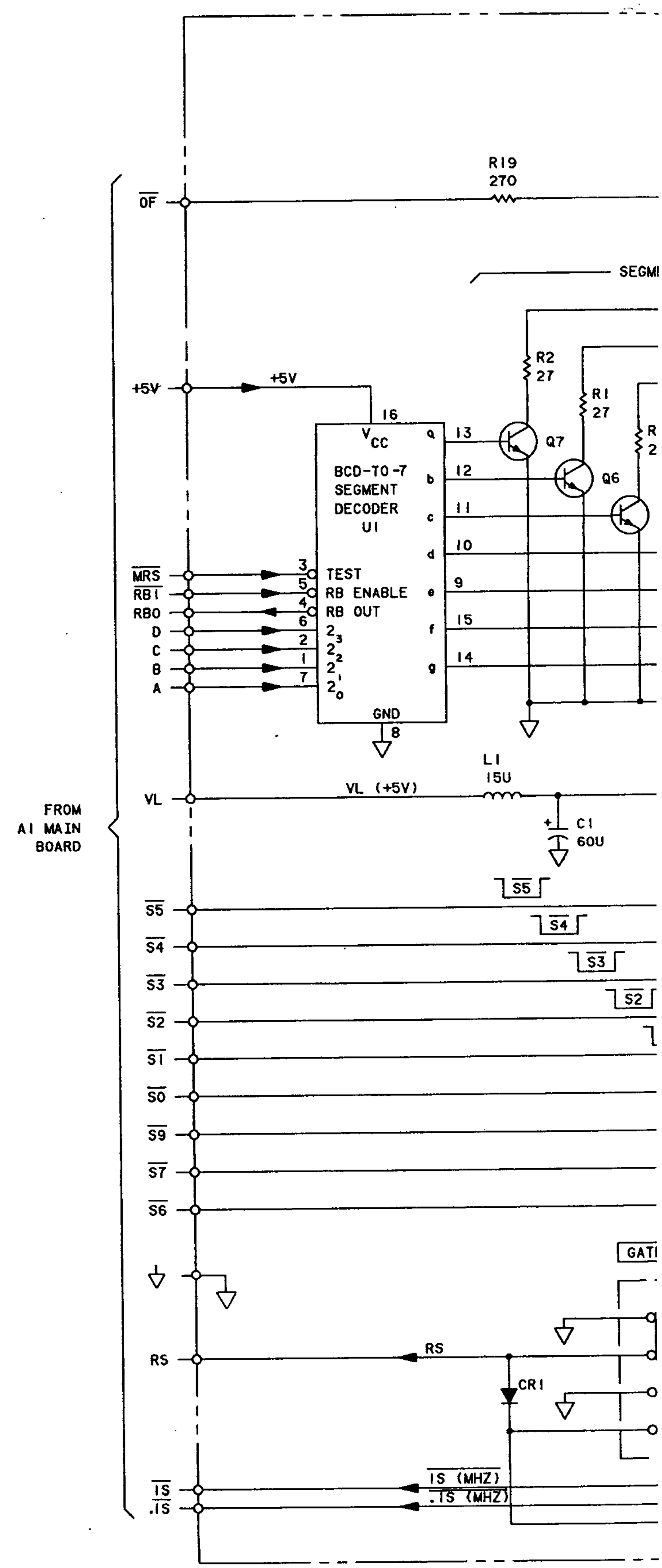
THIS ASSEMBLY ARE
MBER TO ABBREVIATION

MPONENT.

/R PIN
3

REFERENCE DESIGNATIONS

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



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	1901-0040		
DS1-9	1990-0452		
Q1-7	1854-0492		
Q8-11, 13-16	1853-0318		
U1	1820-0914 (9307)	VL (16)	8

REFERENCE DESIGNATIONS

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