Errata

Title & Document Type: **5353A Channel C Plug-In Operating and Service Manual**

Manual Part Number: **05353-90002**

Revision Date: **May 1974**

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HP References in this Manual

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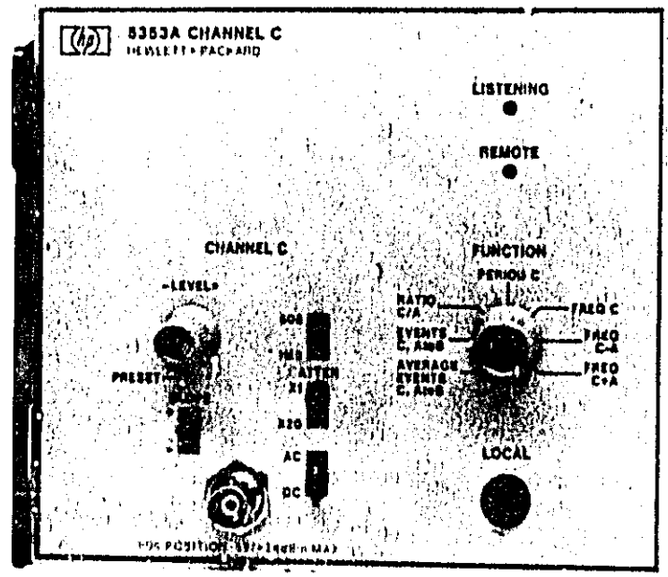
OPERATING AND SERVICE MANUAL

CHANNEL C PLUG-IN

5353A



HEWLETT hp PACKARD

HP 5353A

SAFETY

This is an International Electrotechnical Commission Safety Class I instrument. This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring apparatus," and has been supplied in safe condition. To ensure safe operation and to keep the instrument safe, the information, cautions, and warnings in this manual must be heeded.

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facilities, or to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. Hewlett-Packard will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

OPERATING AND SERVICE MANUAL

CHANNEL C PLUG-IN

5353A

SERIAL PREFIX: 1416A

This manual applies directly to Hewlett-Packard Model 5353A Channel C Plug-Ins with Serial Prefix 1416A.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 1416A, a "Manual Change" sheet is included with this manual.

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MICROFICHE PART NO. 05353-90003

PRINTED IN U.S.A.

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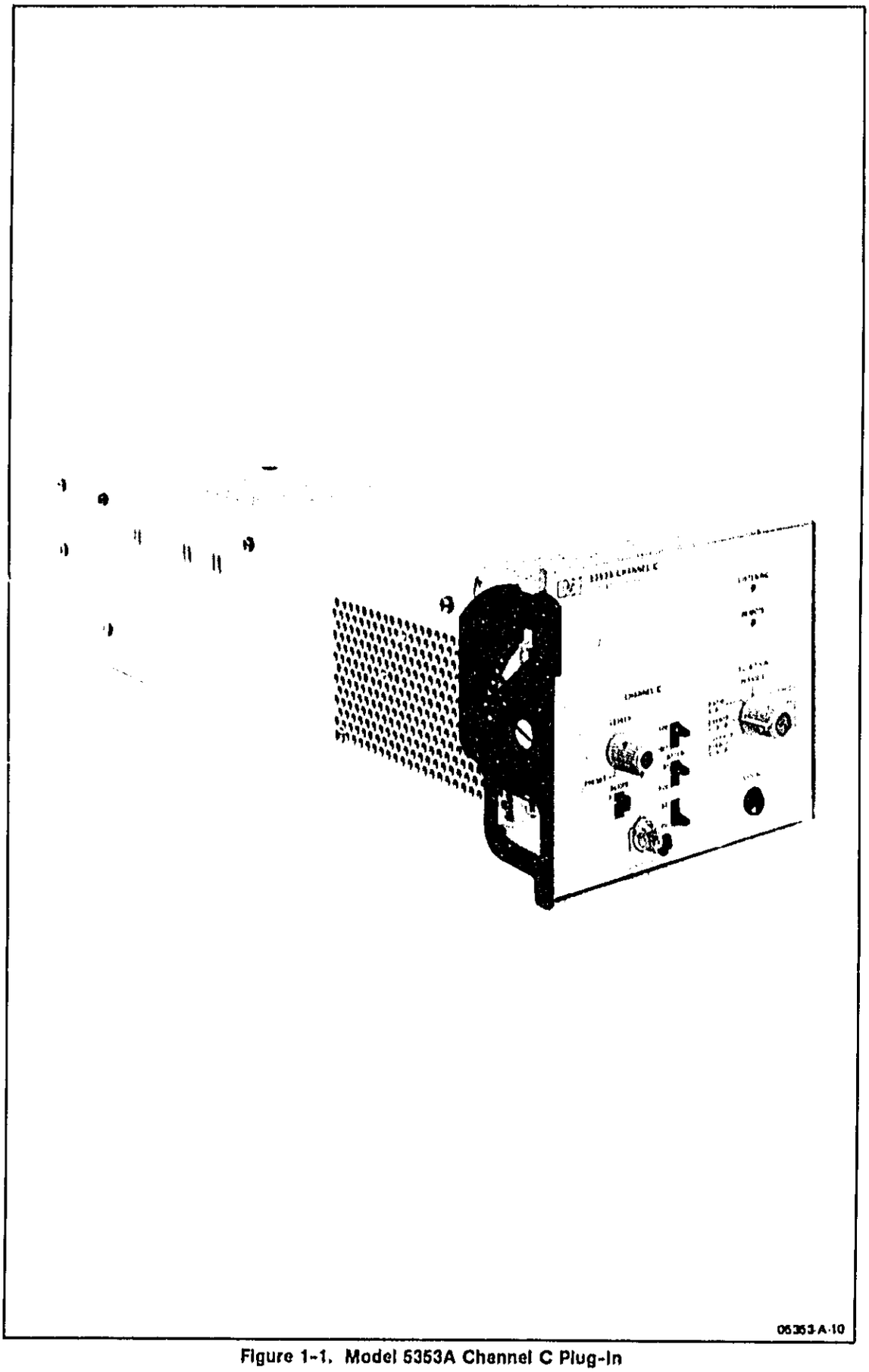


Figure 1-1. Model 5353A Channel C Plug-In

SECTION I

GENERAL INFORMATION

1-1. SCOPE OF MANUAL

1-2. This manual contains information required to install, operate, and maintain the Hewlett-Packard Model 5353A Channel C Plug-In. This section kovers instrument identification, a description, and specifications.

1-3. MANUAL MICROFICHE

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

1-5. DESCRIPTION

1-6. The Hewlett-Packard Model 5353A Channel C Plug-In is used with the 5345A Electronic Counter to provide a third input channel. In addition to making frequency, period, and ratio measurements similar to the 5345A, the plug-in provides additional functions of frequency C-A, frequency C+A, events C from A to B, and average events C from A to B. The added channel and functions expand the capability of 5345 to make measurements of time coded signals over defined time intervals, multiplex capabilities, and dual channel sum and di ference measurements.

1-8. OPTIONS

1-9. Option 011 is available for the 5353A and allows remote programming of the FUNCTION selector via the HP Interface Bus. See Section II for programming information and Section VII for field installation of Option 011.

1-10. INSTRUMENT IDENTIFICATION

1-11. Hewlett-Packard instruments have a 2-section, 10-character serial number (0000A00000), which is located on the rear ; anel. The 4-digit serial prfix identifies instrument changes. If the serial prefix of your instrument differs from that listed on the title page of this manual, there are differences between this m.:nual and your instrument. Instruments having lower serial prefixes than that listed on the title page are documented in Section VII, and higher serial prefixes are covered with manual change sheets included with the manual. If the change sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed on the inside rear cover of this manual.

Table 1-1. Specifications

RANGE: DC coupled 0 to 500 MHz
AC coupled 1 MΩ 200 Hz to 500 MHz
50Ω 4 MHz to 500 MHz

IMPEDANCE: 1 MΩ shunted by <30 pf or 50Ω nominal; Switch Selectable

SENSITIVITY: X1 10 mV rms sine wave, 30 mV peak-to-peak pulse
X20 200 mV rms sine wave, 600 mV peak-to-peak pulse

DYNAMIC RANGE: 30 dB

50Ω X1	10 mV to 350 mV rms
	30 mV to 1.0V peak-to-peak
X20	0.2V to 7.0V rms
	±7 Vdc max 0.6V to 14V peak-to-peak
1MΩ X1	10 mV to 350 mV rms
	30 mV to 1.0V peak-to-peak
X20	0.2V to 7.0V rms
	±10 Vdc max 0.6V to 20V peak-to-peak

TRIGGER LEVEL: Continuously adjustable over ±0.5 Vdc multiplied by attenuntor setting. Control is non-linear with more settability around zero volts.

DRIFT: ±10 mV dc max, 0°C to 55°C

PRESET: Centers trigger level about 0 Vdc at 25°C

OUTPUT: CHAN C trigger voltage (X ATTEN) is accurate to within ±15 mV (X ATTEN) of actual trigger point. Rear panel BNC connector.

SLOPE: Independent selection of positive or negative slope.

DAMAGE LEVEL: Damage may occur beyond specified level. For larger inputs, voltage divider probes 10020A for 50Ω and 10004B for 1 MΩ are recommended.

50Ω X1	±7 Vdc
	7V rms below 5 MHz
	3.5V rms (+24 dBm) above 5 MHz
X20	±7 Vdc 7V rms (+30 dBm)
1MΩ X1	±350 Vdc
	250V rms to 20 kHz
	3.5V rms above 5 MHz
X20	±350 Vdc
	250V rms to 20 kHz
	70V rms above 5 MHz

MODES OF OPERATION: Frequency C+A; Frequency C-A; Period C; Frequency C; Ratio C/A; Average Events C, A to B, Events C, A to B.

Events Accuracy: plus or minus one count worst case.

MINIMUM TIME BETWEEN TRIGGER POINTS: A to B, 10 nsec; B to A 10 nsec in Average Events C, A to B; B to A 100 nsec in Events C, A to B.

OPTION 011: Digital Input Full compatibility with HP Interface (ASCII) Bus. Provides for digital control over all functions excluding amplifier.

GATE OUTPUT: When the 5353A is installed in the 5345A, the 5345A GATE OUTPUT (rear panel) is >0.5 volt into 50Ω.

INSTALLATION

SECTION II

INSTALLATION AND REMOTE PROGRAMMING

2-1. INTRODUCTION

2-2. This section provides instructions for unpacking, inspection, preparation for use, storage, and shipment.

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, inspect the plug-in for visible damage (scratches, dents, etc.). If the plug-in is damaged, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately (offices are listed at the back of this manual). Keep the shipping carton and packing material for the carrier's inspection. The HP Sales and Service Office will arrange for repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. The 5353A does not require external ac power. All necessary power is supplied by the 5345A when the 5353A is plugged in.

2-8. Operating Environment

2-9. Maximum and minimum allowable operating temperatures are listed in Table 1-1. If these limits are exceeded at the installation site, auxiliary cooling or heating should be used to keep environment within limits.

2-10. Installation

2-11. To install the 5353A, proceed as follows:

a. On 5345A, set POWER switch to STANDBY.

b. Extend the locking handle on the left side of the 5353A to the horizontal position.

c. Slide the 5353A into the 5345A.

d. Push locking handle toward the instrument until it is parallel with the front panel.

2-12. Operational Check

2-13. To determine if the instrument is operating properly, refer to the in-cabinet performance check in Section V. Contact the nearest HP Sales and Service Office (see manual back cover) for information relative to warranty claims.

2-14. PACKAGING FOR RESHIPMENT

2-15. Original Packaging

2-16. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard Sales and Service Offices listed at the rear of this manual.

2-17. If the instrument is being returned to Hewlett-Packard for service, attach a tag indicating the type of service required, return address, model number, and full serial number. Mark the container FRAGILE to assure careful handling.

2-18. In any correspondence refer to the instrument by model number and full serial number.

2-19. Other Packaging Methods

2-20. If it becomes necessary to reship an instrument, good commercial packing should be used. Contract packaging companies in many cities can provide dependable custom packaging on short notice. The following general instructions should be followed when repackaging with commercially available materials.

a. If shipping to a Hewlett-Packard Service Office or Center, attach a tag indicating the type of service required, return address, model number, and full serial number.

b. Wrap the instrument in heavy paper or plastic.

c. Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.

d. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

e. Seal the shipping container securely.

f. Mark the shipping container FRAGILE to assure careful handling.

2-21. STORAGE

2-22. If the instrument is to be stored for an extended period of time, it should be enclosed in a clean, sealed container.

2-23. REMOTE PROGRAMMING (OPTION 011)

2-24. Option 011 adds remote programming capability to the 5353A and is fully compatible with the HP Interface Bus. For detailed explanations of the Interface Bus, refer to the 5345A Operating and Service manual.

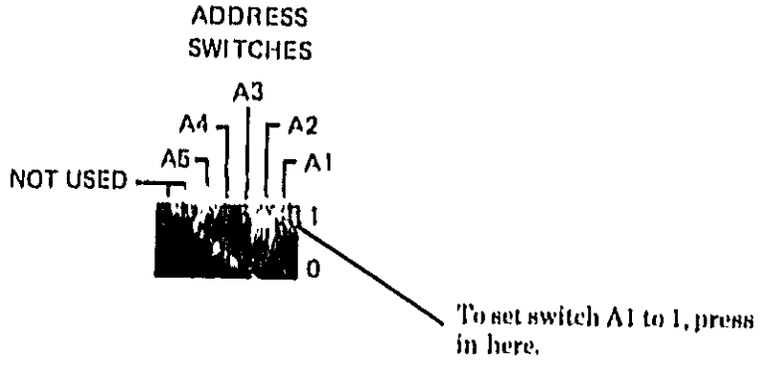
2-25. Both the 5345A and the 5353A are separately addressable. The 5353A can only be addressed to accept program information from the bus, hence it can function only as a listener. The front panel FUNCTION switch, reset function, and local lockout function can be remotely controlled. Except for the LEVEL control, the controls associated with the amplifier input are not programmable (PRESET, SLOPE, 50Ω-1MΩ, ATTEN and AC-DC controls). The level function can be remotely controlled by setting the LEVEL control to preset and connecting ±5 volts to the rear panel CHAN C TRIGGER LEVEL BNC. The ±5 volts corresponds to a ±0.5 volts level.

2-26. Connection to the Bus

2-27. The digital input connector (labeled DIGITAL BUS 1.0 LOAD) is located on the 5353A rear panel. Interconnecting cables and load considerations are covered in the 5345A Operating and Service manual.

2-28. Setting the 5353A Address

2-29. The 5353A has five address switches mounted on Bus Interface assembly A3. A cutout in the top cover allows the switches to be set without removing the cover. A decal is also included on the 5353A top cover to identify switch numbers and 1 and 0 settings.



2-30. Listen address codes that can be used are listed in the 5345A manual. An example of setting a listen address of 3 is as follows:

ASCII Bits	b_5	b_4	b_3	b_2	b_1
Switch No.	A_5	A_4	A_3	A_2	A_1
Code (3)	1	0	0	1	1

2-31. 5353A Remote Program Codes

2-32. Table 2-1 lists program codes for the 5353A. The codes corresponding to the front panel FUNCTION switch will configure the 5353A the same as a manual selection on the front panel FUNCTION switch. The reset command resets the 5345A and must be used when changing function codes. The local lockout command disables the LOCAL pushbutton on the 5353A so that local control can only be assumed by a bus command or by turning the 5345A power switch momentarily to STANDBY and back to ON.

2-33. Preliminary Set-up Procedures (Remote Operation)

2-34. The following procedures are used to prepare the 5353A for remote operation.

a. Refer to 5345A Operating and Service Manual and manually or remotely set the 5345A to plug-in function.

b. At 5353A top cover, set ADDRESS SWITCHES (see paragraph 2-28) for desired 5353A listen address.

2-35. Programming Procedures

a. Program the bus controller to send the REMOTE ENABLE command (set REN low). When using an HP 9820/9830 calculator this is done automatically.

b. Program the controller to send the listen address that corresponds to switch setting of 2-34b above. The REMOTE and LISTENING lights should illuminate.

NOTE

At this point if it is desired to disable the LOCAL pushbutton, send the LOCAL LOCKOUT command (ASCII DC1). After receipt of DC1, the 5353A cannot be returned to local control except by command from the bus. This can also be accomplished by setting the 5345A power switch momentarily to STANDBY and back to ON. To return to LOCAL, set REN high.

Table 2-1. 5353A Program Codes

PROGRAM CODE	ASCII CHARACTER		DI07	DI06	DI05	DI04	DI03	DI02	DI01	OCTAL
FREQ C/A	F5	F=	1	0	0	0	1	1	0	1 0 6
		5=	0	1	1	0	1	0	1	0 6 5
FREQ C-A	F3	F=	1	0	0	0	1	1	0	1 0 6
		3=	0	1	1	0	0	1	1	0 6 3
PERIOD C	F0	F=	1	0	0	0	1	1	0	1 0 6
		0=	0	1	1	0	0	0	0	0 6 0
FREQ C	F1	F=	1	0	0	0	1	1	0	1 0 6
		1=	0	1	1	0	0	0	1	0 6 1
RATIO C/A	F4	F=	1	0	0	0	1	1	0	1 0 6
		4=	0	1	1	0	1	0	0	0 6 4
EVENTS AVE	F6	F=	1	0	0	0	1	1	0	1 0 6
		6=	0	1	1	0	1	1	0	0 6 6
EVENTS MIN	F2	F=	1	0	0	0	1	1	0	1 0 6
		2=	0	1	1	0	0	1	0	0 6 2
RESET	R		1	0	1	0	0	1	0	1 2 2
LOCAL LOCKOUT	DC1		0	0	1	0	0	0	1	0 2 1

c. Send the desired FUNCTION program code. See Table 2-1. These codes determine the measurement mode, i.e., Freq C, Period C, etc.

d. Program the controller to send the RESET program code (ASCII R). This resets the 5345A. Reset must be sent after a 5353A function code is changed or programmed.

e. If the 5345A is in the plug-in mode, the 5345/5353 combination will display the measured function of Channel C. The 5353A does not output on the bus, but a 5353A measurement may be outputted by the 5345A. See 5345A Operating and Service Manual.

5353A

PROGRAMMING SUMMARY SHEET

Possible Listen Addresses: Any ASCII code of the form $A_6A_4A_3A_2A_1$ where A5 -- A1 can be any combination of 1's and 0's other than 1111. A5 -- A1 are set by address switches accessible through the top cover of the 5353A.

Specifications: Bus load is 1.0 representing the normal allowable standard load for one instrument on the bus.

PROGRAMMING CODES

Program Code	ASCII Character
FREQ C/A	F5
FREQ C-A	F3
PERIOD C	F0
FREQ C	F1
RATIO C/A	F4
AVERAGE EVENTS C, A to B	F6
EVENTS C, A to B	F2
RESET	R
LOCAL LOCKOUT	DC1

DIGITAL BUS SUMMARY

Digital Bus Connector Pin Number	Line Name	Use
1-4, 13-15	DI01-7	Carries characters to 5353A for processing as bus commands or program codes.
16	DI08	Not monitored or driven, terminated by resistive network.
6	DAV	These three lines make up the "handshake" system on the HP Interface Bus. DAV is monitored; RFD and DAC are driven by 5353A to control rate of data transferred on DIO lines.
7	RFD	
8	DAC	
9	BCL	Unconditionally clears 5353A as a listener, 5353A will remain in remote.
11	MRE	Indicates to 5353A whether data on DIO lines are bus commands or program codes. Low = command mode and High = program codes.
17	REN	Low in conjunction with listen address and MRE low sets 5353A in remote operation.
5	EOI	Not monitored or driven, terminated by resistive network.
10	SRQ	Not monitored or driven, terminated by resistive network.
12	Shield	Not connected.
18-24	Grounds	Connected to chassis ground.

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section contains a general description of the operating modes, the functions of the controls and indicators, and setup procedures for making basic measurements.

3-3. OPERATING MODES

3-4. The following paragraphs describe the operating modes for frequency, period, ratio, events C from A to B, and the sum and difference frequency measurements.

3-5. Frequency C Mode

3-6. Channel C accepts input frequencies from 50μHz to 500 MHz (when dc coupled) with a minimum level of 10 mV rms sine wave. Channel C frequency measurements are identical with the 5345A frequency/frequency average measurements. The 5345A FUNCTION switch must be set or programmed to PLUG-IN to make a C Channel measurement.

3-7. Period C Mode

3-8. Period C measurements are the same as the period/period average measurement for the 5345A.

3-9. Ratio C/A Mode

3-10. Ratio measurements between the frequency at Channel C (5353A) and the frequency at Channel A (5345A) can be made. Both channels accept frequencies in the 50 μHz to 500 MHz range when dc coupling is used. If the higher frequency is connected to Channel C, the ratio will be greater than one. The measurement result for a ratio is a dimensionless number. Refer to the 5345A Operating and Service Manual for details of measurement time when making ratio measurements.

3-11. Frequency C+A Mode

3-12. This mode of operation measures the frequency at Channel A (5345A) and the frequency at Channel C and displays the sum. The time between the frequency measurements of "A" and "C" is approximately 3 milliseconds. During this mode, the SAMPLE RATE control on the 5345A is only functional between the pairs of measurements. During the individual measurements of "C" and "A", the gate time is controlled by the 5345A in the same manner as a 5345A frequency measurement.

3-13. Frequency C-A Mode

3-14. Frequency C-A measurements are similar to the sum measurements described above except that the 5345A displays the difference between the frequency input at Channel C (5353A) and Channel A (5345A). If A is larger than C a minus value will be displayed.

3-15. Events C, A to B Mode

3-16. This mode of operation totalizes the events occurring in Channel C over the time interval between Channel A and Channel B. Figure 3-1 illustrates a typical measurement. The C Channel of the 5353A counts 7 pulses of a digital signal over a gate period determined by the "A" and "B" inputs of the 5345A. The time interval from A to B can be generated by two separate signals, a pulse width, or a single period. In this mode, the GATE TIME selector on the 5345A is disabled and the DISPLAY POSITION functions in the same manner as a 5345A measurement.

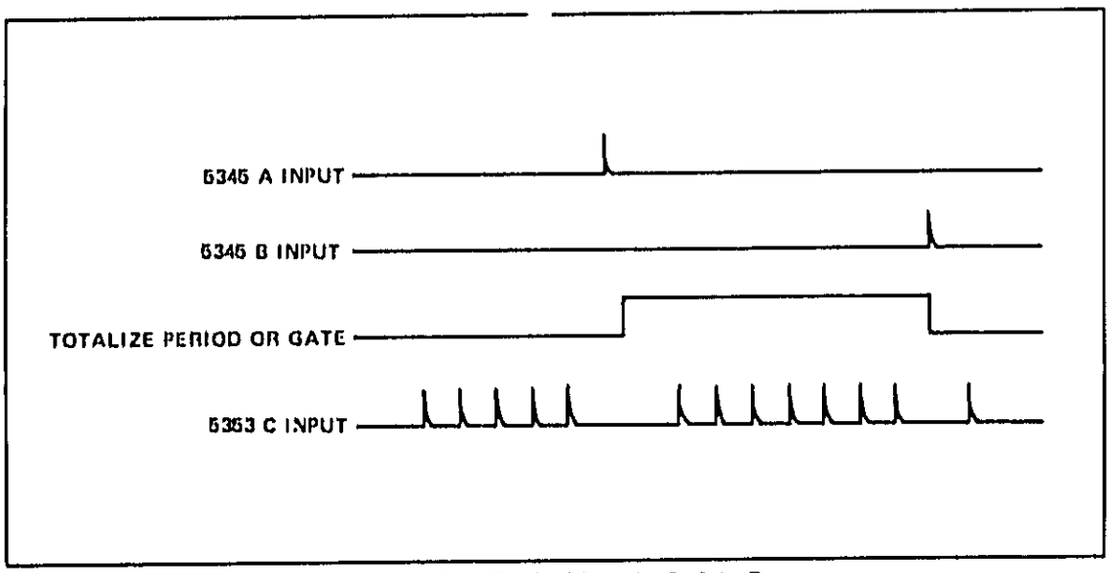


Figure 3-1. Typical Events C, A to B

3-17. Average Events C, A to B

3-18. In this mode, the measurement depends on the setting of the GATE TIME selector on the 5345A. When the GATE TIME is set to MIN, events C will be totalized over one window provided that the repetition rate of the A to B window is less than 20 MHz (otherwise averaging will occur, and at least one event is counted. When these requirements are met, an additional C event is required to complete the measurements. With the GATE TIME selector set to any position other than MIN, C events will be accumulated until the total C events equals or just exceeds a quantity of $\frac{\text{Gate Time Setting (sec)}}{2 \text{ nanoseconds}}$. If the accumulated C events equals the gate time requirements before an A to B window is complete, additional C events will be accumulated until the window closes. During the accumulation of C events, the counter keeps tally of the whole number of A to B windows required to have C events equal to or just exceed the gate time requirements $\frac{\text{Gate Time Setting (sec)}}{2 \text{ nanoseconds}}$. When these requirements are met, an additional C event is required to complete the measurement. The counter divides the C events by the number of A to B windows to give average events C from A to B. If it is necessary to know the approximate total time for a measurement, use the following formula:

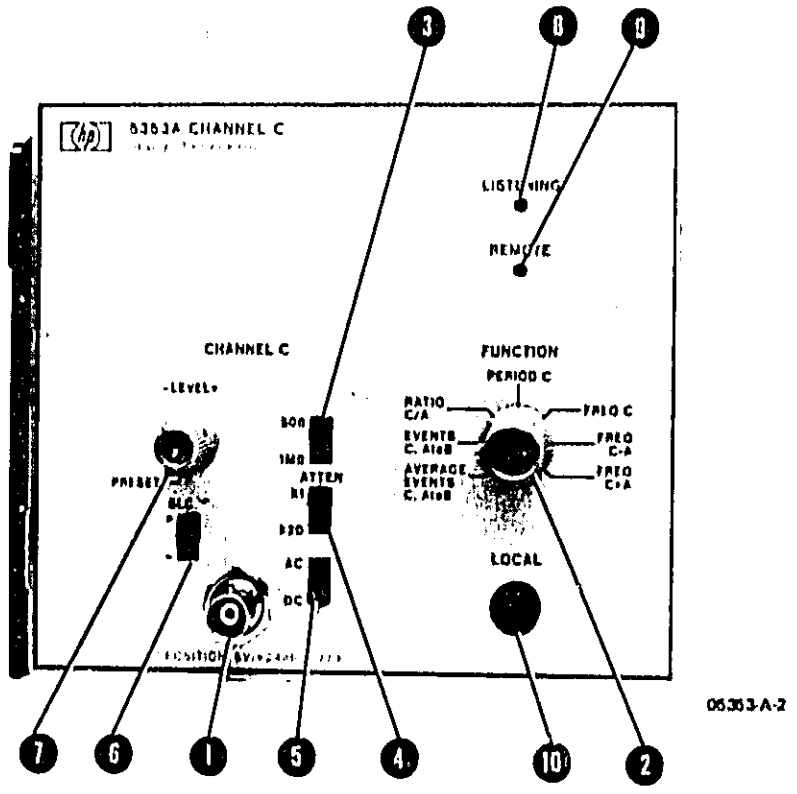
$$\frac{\text{(Gate Time) (500 MHz)}}{\text{(Ave. No. of Events C in a window) (No. of open A to B windows per sec)}} = \text{Measurement Time}$$

3-19. INPUT TRIGGERING

3-20. Input triggering for the 5353A is identical to the 5345A input circuits. For a full explanation of LEVEL and SLOPE controls and hysteresis, see 5345A Operating and Service Manual. A CHANNEL C TRIGGER LEVEL BNC is available on the 5353A rear panel to allow external setting of the LEVEL control. When using this feature, set front panel CHANNEL C LEVEL to PRESET. External levels can be set to ±5 volts dc which corresponds to ±0.5 volts trigger levels. Input resistance of CHAN C TRIGGER LEVEL is 2KΩ. The CHANNEL C TRIGGER LEVEL BNC can also be used as a monitoring point. When so used, the output level corresponds to the trigger point of channel C. The C channel LEVEL control varies this output ±0.5 volts dc.

3-21. CONTROLS AND INDICATORS

3-22. Figures 3-2 and 3-3 show and describe the front and rear panel features of the 5353A.



1. Input jack. Input for Channel C. Accepts inputs from 50 μHz to 500 MHz. See specifications in Table 1-1 for maximum allowable input levels.

2. FUNCTION selector. Selects mode of operation when not in REMOTE. See paragraph 3-3 for explanation of each operating mode.

3. Input Impedance Switch. Selects input impedance of 50Ω or 1 MΩ shunted by less than 30 pF.

4. ATTEN switch. Selects attenuation for input signal. Used in conjunction with LEVEL control to set trigger point. Input level is unaffected in X1 position. Signal amplitude is reduced by factor of 20 in X20 position.

5. Coupling switch. Selects direct or capacitor coupling for input signal.

6. SLOPE switch. Permits triggering on positive or negative slope of input signal.

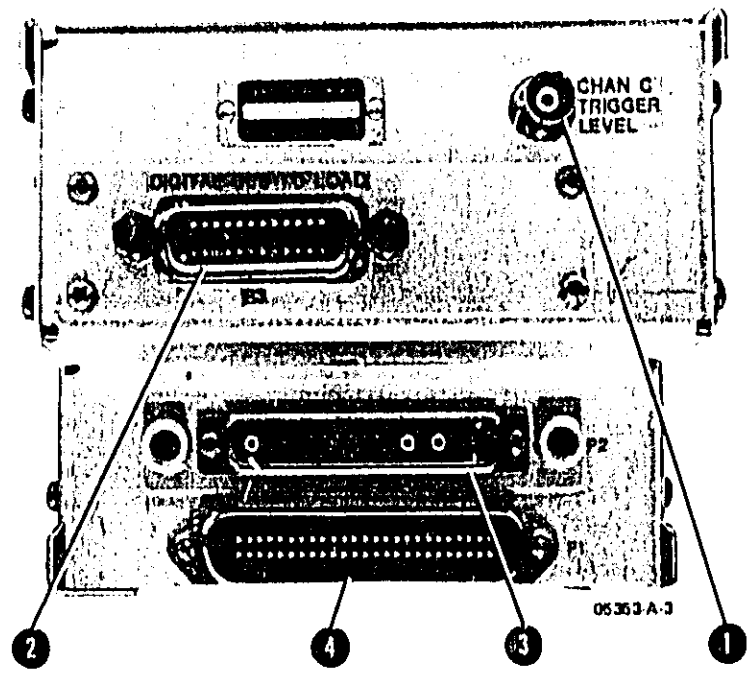
7. LEVEL control. Used in conjunction with ATTEN switch to select triggering voltage. With X1 attenuator setting, level is variable ±0.5 volts; on X20, ±10 volts.

8. LISTENING indicator. Operational only with instruments equipped with Option 011 (HP Interface Bus). When illuminated, indicates 5353A is addressed and monitoring the Interface Bus. See Section II for details of programming.

9. REMOTE indicator. Operational only with instruments equipped with Option 011 (HP Interface Bus). When illuminated, indicates that the 5353A is under remote control. See Section II for explanation of remote programming.

10. LOCAL switch. Operational only with instrnments equipped with Option 11 (HP Interface Bus). When pushed, sets 5353A to front panel co.trol provided tha he Local Lockout bus command has not been sent to the 5353A. See Section I. for explanation of Local Lockout.

Figure 3-2. 5353A Front Panel Controls and Indicators



1. CHAN C TRIGGER LEVEL. Can be used as an output or input jack.

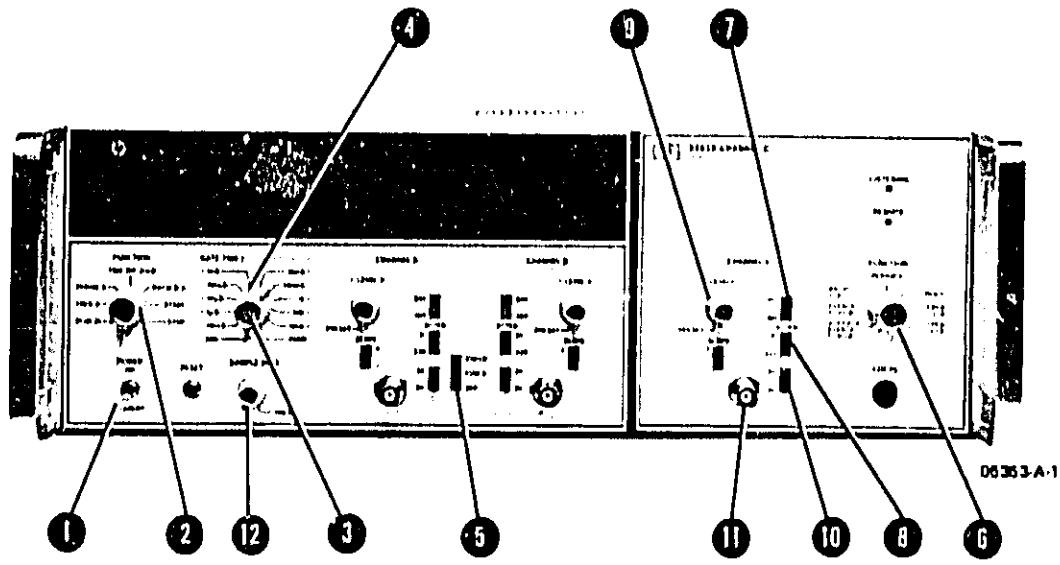
   a. When used as an output, the output level corresponds to the trigger point of Channel C. LEVEL control varies output ±0.5 Vdc.

   b. When used to remotely program the trigger level, this level can be ±5V which is approximately X10 the desired trigger level voltage. Set LEVEL to PRESET. Input resistance is 2KΩ.

2. DIGITAL BUS 1.0 LOAD. Functional only when equipped with Option 011. 24-pin connector used to convey programming instructions to the 5353A. The 1.0 load indicates the instrument load on the bus is a standard (1.0) load for one instrument.

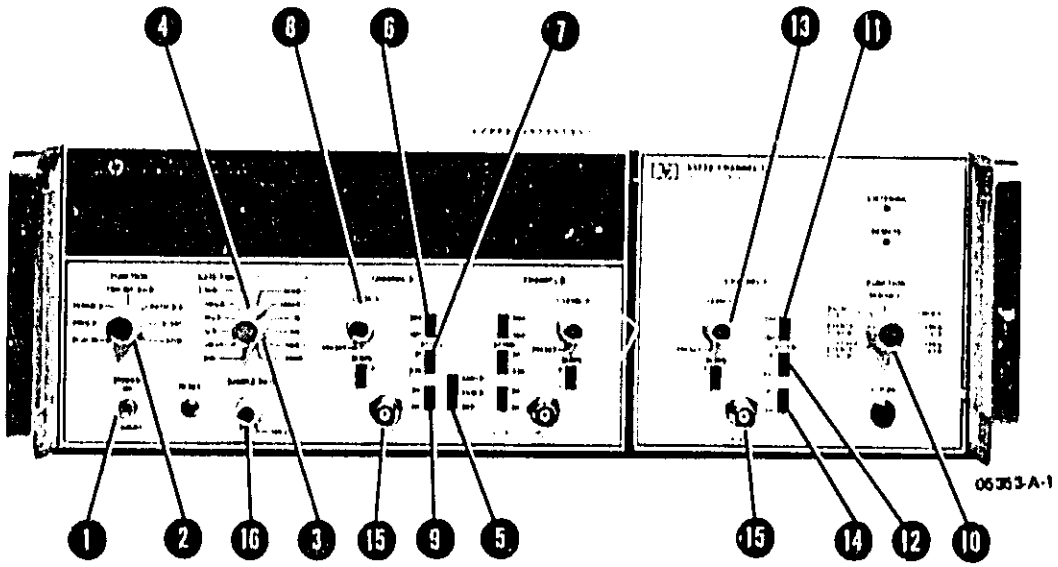
3,4. Connectors P1, P2. Provides interconnection with the 5345A.

Figure 3-3. 5353A Rear Panel Controls and Indicators



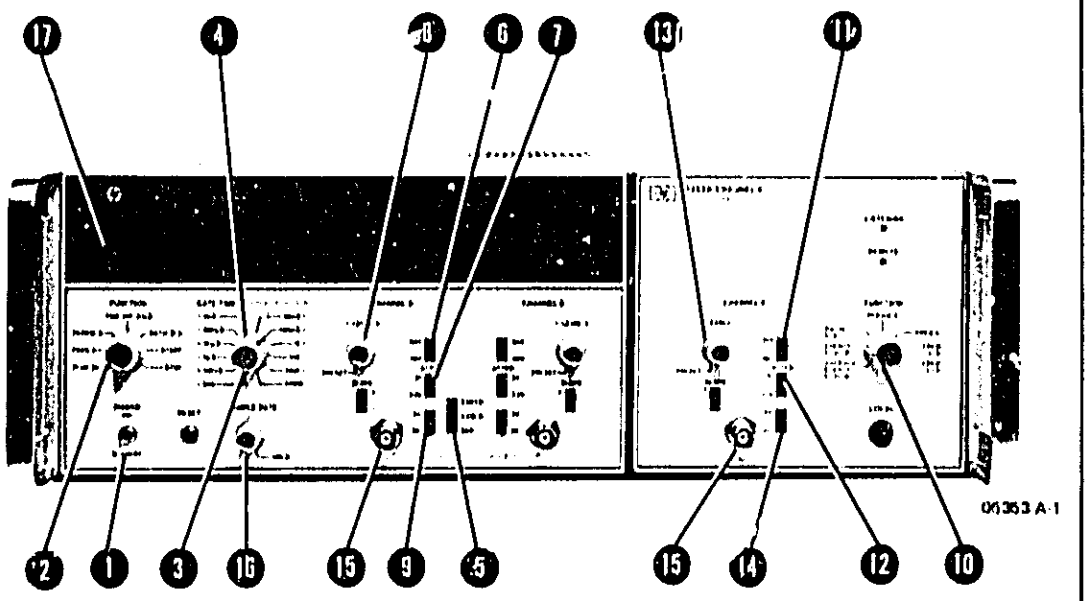
1. Set POWER switch to ON position.
2. Set FUNCTION switch to PLUG-IN.
3. Set DISPLAY POSITION selector to AUTO.
4. Set GATE TIME selector to give desired resolution.
5. Set Input Amplifier Control switch to COM A or SEP.
6. Set CHANNEL C FUNCTION switch to FREQ C or PERIOD C.
7. Set CHANNEL C Input Impedance switch to desired position.
8. Set CHANNEL C ATTEN switch to match input signal's amplitude; see Specifications in Table 1-1 for maximum input levels.
9. Set CHANNEL C LEVEL control to start measurement at desired voltage level. Use PRESET for sine waves.
10. Set CHANNEL C Coupling switch to AC or DC; see Specifications in Table 1-1 for details.
11. Connect input signal to CHANNEL C input jack.
12. Adjust SAMPLE RATE control for a convenient interval between measurements.

Figure 3-4. Frequency C or Period C Measurements



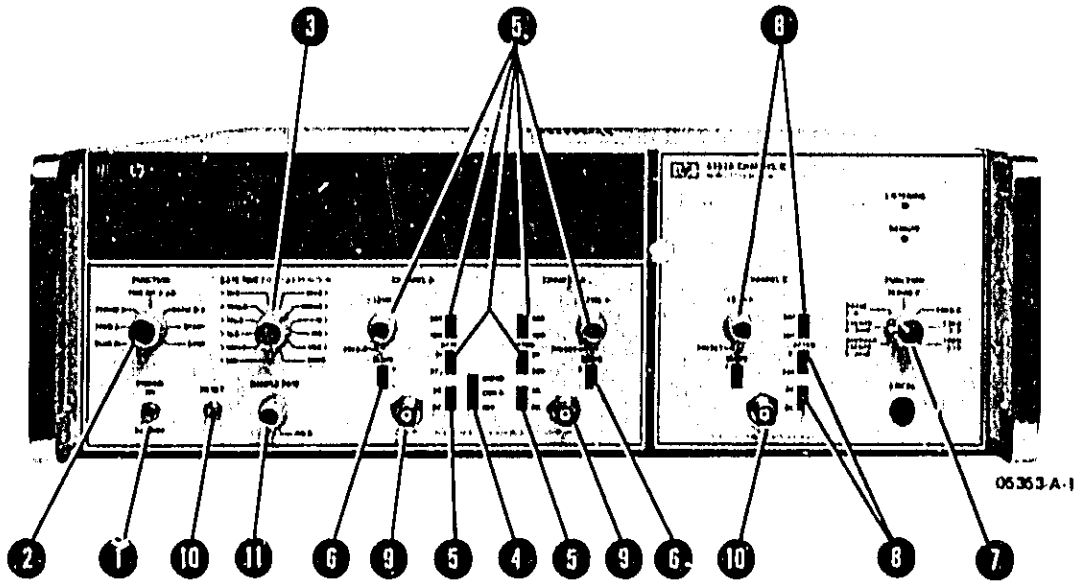
1. Set POWER switch to ON position.
2. Set FUNCTION switch to PLUG-IN.
3. Set DISPLAY POSITION selector to AUTO.
4. Set GATE TIME selector to desired resolution.
5. Set Input Amplifier Control switch to COM A or SEP.
6. Set CHANNEL A Input Impedance Switch to desired position.
7. Set CHANNEL A ATTEN switch to match input signal's amplitude. See 5345A specifications for maximum input levels.
8. Set CHANNEL A LEVEL control to desired trigger level or to PRESET for triggering on sine waves.
9. Set CHANNEL A Coupling switch to AC or DC as required by the input signal.
10. Set CHANNEL C FUNCTION switch to RATIO C/A.
11. Set CHANNEL C Input Impedance switch to desired position.
12. Set CHANNEL C ATTEN switch to match input signal's amplitude.
13. Set CHANNEL C LEVEL control for desired trigger level or to PRESET for sine waves.
14. Set CHANNEL C Coupling switch to AC or DC as required.
15. Connect input signals to CHANNEL A and CHANNEL C.
16. Adjust SAMPLE RATE control for a convenient interval between measurements.

Figure 3-5. Ratio C/A Measurements



1. Set POWER switch to ON position.
2. Set FUNCTION switch to PLUG-IN.
3. Set DISPLAY POSITION selector to AUTO.
4. Set GATE TIME selector to desired resolution.
5. Set Input Amplifier Control switch to COM A or SEP.
6. Set CHANNEL A Input Impedance switch to desired position.
7. Set CHANNEL A ATTEN switch to match input signal's amplitude. See 5345A specifications for maximum input levels.
8. Set CHANNEL A LEVEL control to desired trigger level or to PRESET for triggering on sine waves.
9. Set CHANNEL A Coupling switch to AC or DC as required by the input signal.
10. Set CHANNEL C FUNCTION switch to FREQ C+A or FREQ C-A.
11. Set CHANNEL C Input Impedance switch to desired position.
12. Set CHANNEL C ATTEN switch to match input signal's amplitude.
13. Set CHANNEL C LEVEL control for desired trigger level or to PRESET for sine waves.
14. Set CHANNEL C Coupling switch to AC or DC as required.
15. Connect input signals to CHANNEL A and C.
16. Adjust SAMPLE RATE control for a convenient interval between measurements.
17. For FREQ C-A measurements, a minus sign on the 5345A indicates that Channel C Frequency is less than channel A Frequency.

Figure 3-6. Frequency C+A or Frequency C-A Measurements



1. Set POWER to ON position.
2. Set FUNCTION switch to PLUG-IN.
3. Set DISPLAY POSITION selector to AUTO. (GATE TIME selector is inactive for this measurement.)
4. If desired to have the A to B window occur from one signal input, set Input Amplifier Control switch to COM A, otherwise set to SEP. In the SEP position, separate A and B input signals will be required.
5. Set CHANNEL A and B ATTEN, Impedance selectors, LEVEL and coupling switches to match input signals.
6. Set CHANNEL A and B SLOPE switches to trigger on desired + or - portions of the input signals.

NOTE

Triggering slopes are important for this measurement since the duration of the A to B window is determined by the + and - settings.

7. Set CHANNEL C FUNCTION switch to EVENTS C, A to B.
8. Set CHANNEL C ATTEN, LEVEL, Impedance selector and coupling switch to match input signal.
9. If the A to B window is from one input signal, connect input signal to CHANNEL A input jack, otherwise connect separate signals to CHANNEL A and CHANNEL B.
10. Connect events signal to CHANNEL C input jack. Push 5345A RESET.
11. Adjust SAMPLE RATE control for a convenient interval between measurements.

Figure 3-7. Events C, A to B Measurements

1. Set POWER switch to ON position.

2. Set FUNCTION selector to PLUG-IN.

3. Set DISPLAY position to AUTO.

4. Set GATE TIME selector to desired resolution. If a long GATE TIME selection is chosen, some measurements may take considerable time to complete, thus it is recommended to start with a fast gate time initially. See paragraph 3-17 for an explanation of measurement time in this mode.

5. If desired to have the A to B window occur from one signal input, set Input Amplifier Control switch to COM A, otherwise set to SEP. In the SEP position separate A and B input signals will be required.

6. Set CHANNEL A and B ATTEN, Impedance selectors, LEVEL and coupling switches to match input signals.

7. Set CHANNEL A and B SLOPE switches to trigger on desired + or - portions of the inpun signals.

NOTE

Triggering slopes are important for this measurement since the duration of the A to B window is determined by the + and - slope switch settings.

8. Set CHANNEL C FUNCTION switch to AVERAGE EVENTS C, A to B.

9. Set CHANNEL C ATTEN, LEVEL, Impedance selector and coupling switch to match the input signal.

(Continued on the following page)

Figure 3-8. Average Events C, A to B Measurements

10. If the A to B window is from one input signal, connect input signal to CHANNEL A input jack, otherwise connect separate signals to CHANNEL A and CHANNEL B.

11. Connect events signal to CHANNEL C input jack. Push 534A RESET.

12. Adjust SAMPLE RATE control for a convenient interval between measurements.

Figure 3-6. Average Events C, A to B Measurements (Cont'd)

THEORY

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section describes the overall theory of operation and the theory for each printed circuit assembly.

4-3. CVERALL THEORY OF OPERATION

4-4. Figure 4-1 shows the 5353A overall block diagram. The 5353A Channel C Plug-In consists of five board assemblies:

a. A1 Motherboard/Logic Circuitry

b. A2 Input Amplifier/Trigger

c. A3 Bus Interface (Option 011)

d. A4 Gate Assembly

e. A5 Interconnect Assembly (Option 011)

4-5. The Input Amplifier consists of two stages of amplification and a Schmitt trigger for conditioning of the input signal. The output of the Input Amplifier is sent to the Gate Assembly which routes the signal to the 5345A either through Channel A or C.

4-6. Motherboard A1 contains logic circuitry and provides mechanical support for the Gate Assembly and Bus Interface boards. The logic circuits perform control operations on the 5345A Electronic counter and 5353A Channel C plug-in. A function decoder and control circuit accepts either front panel function commands or remote commands from the Bus Interface board.

4-7. When in the Events C, A to B mode of operation, an $\overline{\text{ART C}}$ (Artificial C) pulse is generated in the logic circuitry after the stop pulse has been received by the mainframe. The reason for generating an artificial C is that no mainframe display occurs until after a C channel pulse has been received after the stop pulse.

4-8. When the 5353A is in the Freq C/A mode of operation, data is transferred between the 5345A and the plug-in. For storage of intermediate results, an auxiliary memory consisting of two RAMs is located in the A1 logic circuitry.

4-9. The Bus Interface board serves as an interface between the 5353A and the HP Interface Bus. When in the remote mode of operation, function codes, remote reset, and local lockout can be programmed.

4-10. A1 MOTHERBOARD ASSEMBLY

4-11. Motherboard A1 (Figure 8-5) provides mechanical support for Gate Assembly A4, Bus Interface Assembly A3 and routes power supply voltages throughout the instrument. The motherboard also includes digital circuitry to control the operation of the 5345A electronic counter and the plug-in.

4-12. The C channel plug-in performs seven separate functions as determined by the front panel FUNCTION selector switch. Multiplexer A1U25 selects either front panel function switch codes FSA, FSB, FSC or remote codes FRA, FRB, FRC from A3. PI REMOTE at XA($\overline{15}$) controls which set of data that U25 is to select. Circuitry in the plug-in decodes the function information and sends the mainframe PI FUN A, PI FUN B and PI FUN C. Table 4-1 lists the 5353A and 5345A function codes.

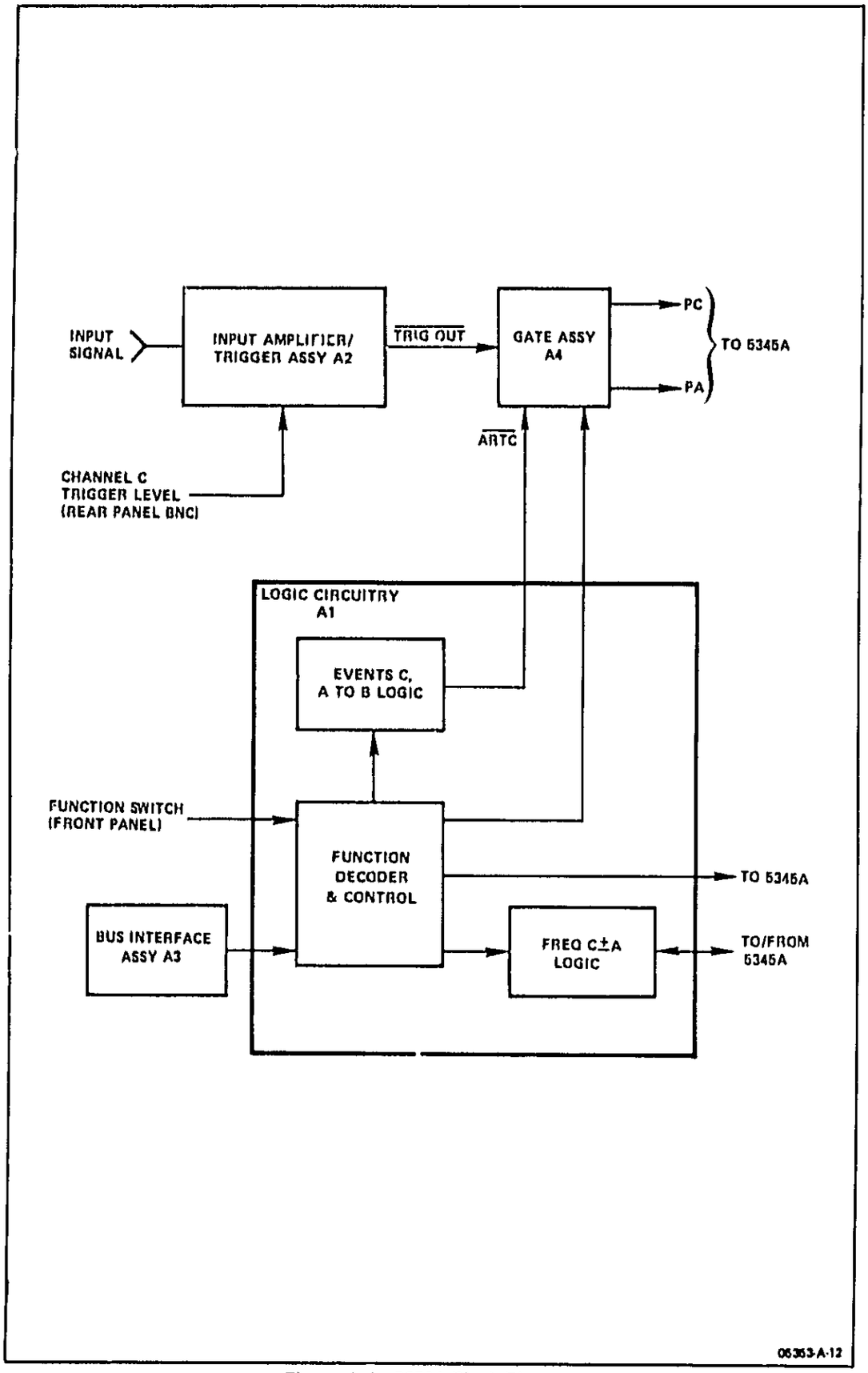


Figure 4-1. 5353A Block Diagram

Table 4-1. 5353A and 5345A Function Codes

FUNCTION	5353A			5345A		
	RFA FSA	RFB FSB	RFC FSC	PI FUN A	PI FUN B	PI FUN C
Period C	0	0	0	0	0	0
Freq C	1	0	0	1	0	0
Events C, A to B	0	1	0	0	1	1
Freq C-A	1	1	0	1	0	0
Ratio C/A	0	0	1	0	0	1
Freq C+A	1	0	1	1	0	0
Ave. Events C, A to B	0	1	1	0	1	1

4-13. Period C Operation

4-14. In this mode, the mainframe multiplies time counts by 2×10^9 and divides the result by events. $\overline{\text{SEL A•B}}$ at P1(18) controls gates in the mainframe which select either plug-in or mainframe information to be processed. When in Period C, the plug-in activates $\overline{\text{SEL A•B}}$.

4-15. Frequency C Operation

4-16. The frequency mode is similar to Period C except that arithmetic operations in the mainframe are inverted for frequency calculations.

4-17. Events C, A to B Operation

4-18. This mode of operation is used to measure C events during a single window A to B. Consequently, the plug-in forces the 5345A gate time to MIN and disables the front panel GATE TIME switch. Channel A of the mainframe is used for start pulses, channel B provides stop pulses, and the C channel plug-in receives the event pulses. While event pulses are being received, the plug-in routes them to the mainframe. After a stop pulse has been received, the plug-in generates one more C channel event pulse ($\overline{\text{ART C}}$) in order for the mainframe to display a result.

4-19. A1U10B and U19B convert the 5353A events C, A to B function code (010) into a mainframe events code of (011). $\overline{\text{SEL C}}$ at P1(33) is activated causing the 5345A to use the plug-in $\overline{\text{TRIG OUT}}$ signal at A4(6) as a clock instead of its own 500 MHz clock. $\overline{\text{SEL C}}$ also enables Gate Assembly A4 to route RF data via A4U1, J1(PC) to the mainframe.

4-20. Multiplexer U25 sends function code information to decoder U24. When in the events C, A to B mode, U24(3) goes low causing U7(6) to go low and U6(6,5) to go high. After the mainframe receives a stop pulse from Channel B, Event Gate P2(A3) goes low and U16(11) is clocked. U16(8) goes high, R21, C1 provides a 15 nsec delay between $\overline{\text{ART C}}$ (Artificial C) XA4(10) and SEL ART C XA4($\overline{10}$) which enables A4U1 to route $\overline{\text{ART C}}$ to the mainframe. The reason for generating an artificial C is that no mainframe display occurs until after a C channel pulse has been received after the stop pulse.

4-21. A1Q1 and Q2 serve as level converters/amplifiers for the event gate signal. The event gate is a 0 to 1V signal if the mainframe rear panel BNC labeled Gate Control Output is not terminated in 50Ω and 0 to 0.5V if terminated.

4-22. Before a measurement begins, the mainframe is armed. The first C channel pulse will disarm the counter, pulling ARMED P1(13) low. A1U16(2) monitors the arm line. If the arm line is

high after approximately 60 nsec from the time the event gate goes low, U16(6) goes low and puts the mainframe into its PI Data routine. The counter will be in a measurement situation and is forced out of the measurement loop. Figure 4-2 shows the timing diagram for the Events C, A to B.

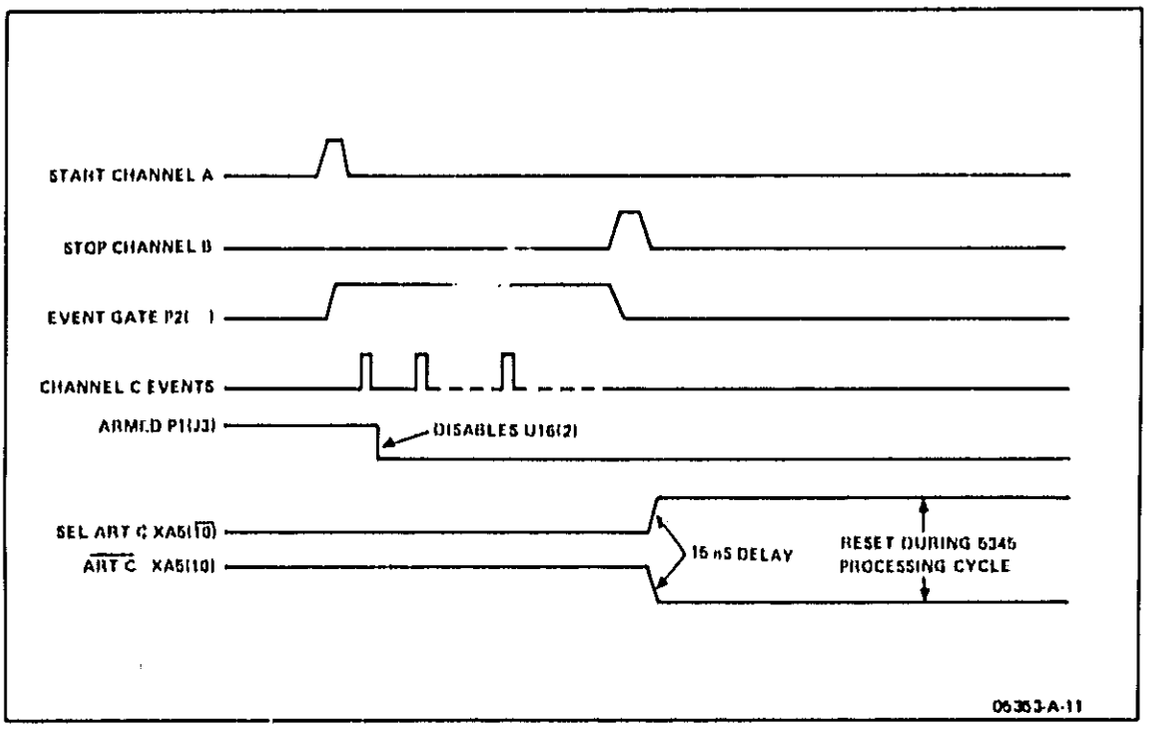


Figure 4-2. Events C, A to B Timing Diagram

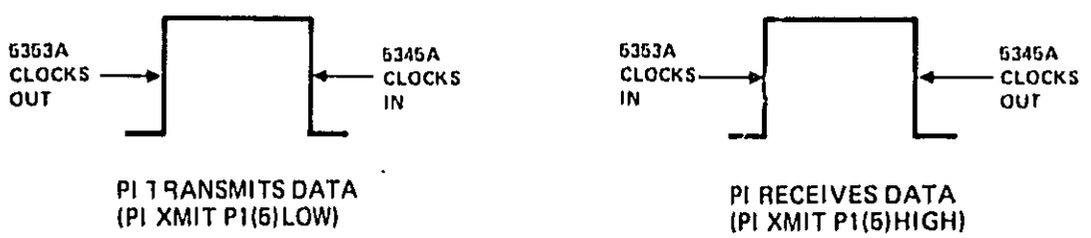
4-23. The outputs of U6 control $\overline{ME}$ (Memory Enable) of RAMs A1U3 and U2. Both RAMs are disabled in the events C, A to B mode to provide the mainframe with a PI data of zeroes via DRA, DRB, DRC, and DRD in the special case of a zero events. The zero events circuits consist of U16A, U15B, R12, R17, and C2. U16A monitors the signal at P1(13) ARMED. After Event Gate P2(A3) goes low, R12, R17, C2, and U15B provide a 60 nanosecond delay after which U16A is clocked. If the ARMED signal remains high, $\overline{\text{PI DATA}}$ P1(14) goes low forcing the mainframe into PI Data routine.

4-24. Frequency C-A Operation

4-25. In this mode of operation, two measurements are made. The first with plug-in information and the second with mainframe information. Results are then subtracted.

4-26. If $\overline{\text{SEL A•B}}$ at P1(18) is low, the plug-in is selected to make a measurement; and if high the mainframe is selected. The overall timing diagram for frequency C-A is shown in Figure 4-3.

4-27. Data exchange between mainframe and plug-ins is synchronized by PI Clock pulses generated in the 5345A. The mainframe clocks in/out data on the negative edge of each PI Clock pulse and the plug-ins clock in/out data on the positive edge of each PI Clock pulse.



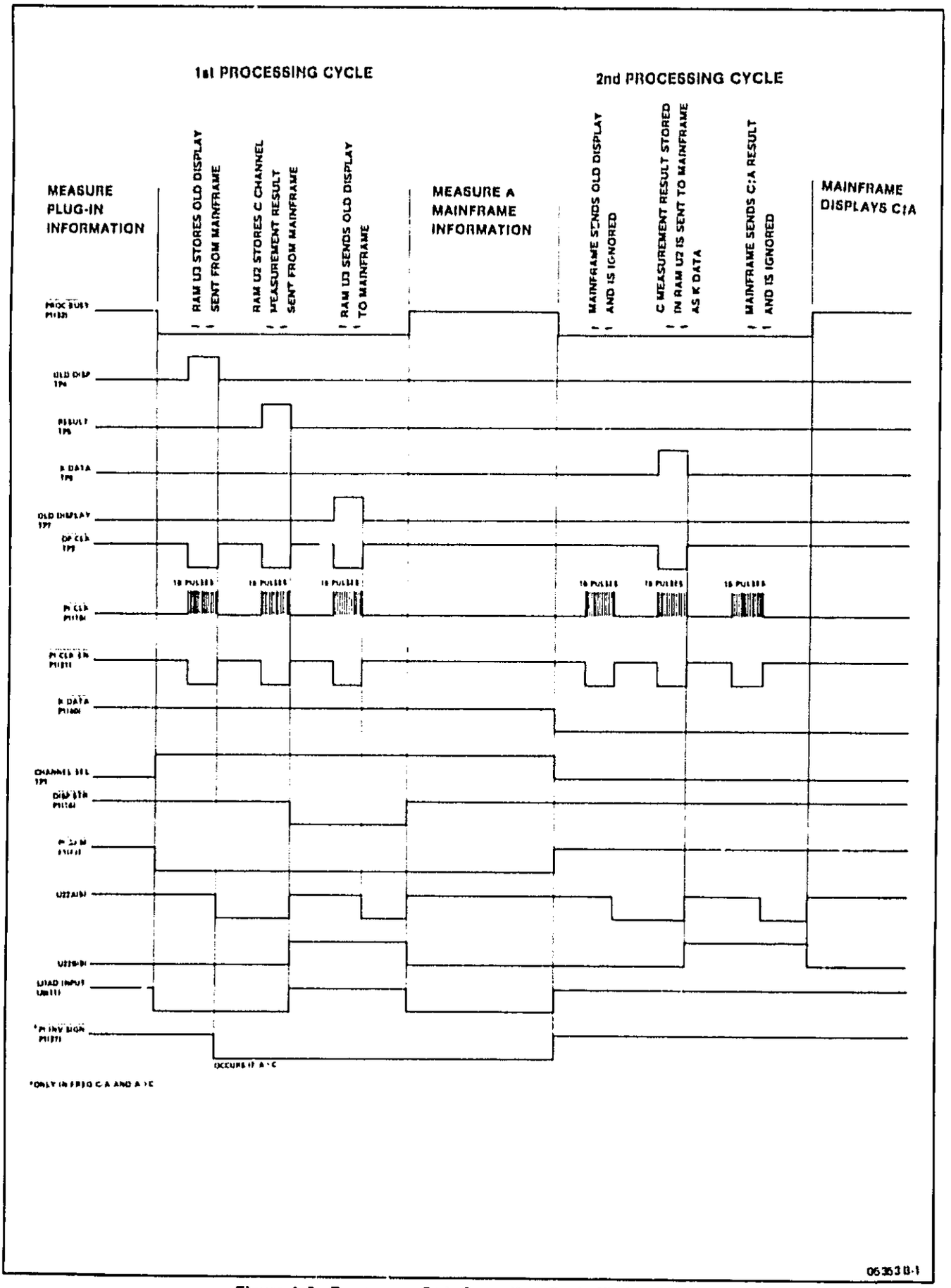


Figure 4-3. Frequency C:A Operating Cycle Timing Diagram

4-28. A1U4 is an asynchronous presettable binary counter. This counter is clocked on the leading edge of PI Clock pulses. Therefore, the initial address before the first PI Clock pulse must be the address preceding the RAM starting address of 0000. In the case of the 5353A this is 1111 (decimal 15).

4-29. When the plug-in is to transmit data then A, B, C, D are all high (Decimal 15) and the first byte clocked in by the mainframe will be that in memory location 0 of the plug-in RAMs (U2, U3). When the plug-in is to receive data then A, B, C, D are all low (Decimal 0) and the first digit shifted in will be in memory location zero. In both cases, the counter is preset to · set state and the 16 PI CLK pulses clock the RAMs through sixteen memory locations.

4-30. In the Freq C-A mode, $\overline{\text{SIGN}}$- at P1(19) and PI INV SIGN at P1(27) must both be active in order for the mainframe to display the correct sign if A is greater than C. When A is greater than C, $\overline{\text{SIGN}}$- goes low during the first and second processing cycle in order for the mainframe display to show the correct sign.

4-31. Ratio C/A Operation

4-32. In the ratio mode of operation, the front panel annunciators are inhibited and $\overline{\text{PI INH ANN}}$ is active. With $\overline{\text{PI INH ANN}}$ low, U20D(11) $\overline{\text{TRANS MULT}}$ goes low. $\overline{\text{TRANS MULT}}$ is used by the 5346 to display the correct ratio.

4-33. A peculiarity of the ratio C/A mode of operation is that the function code sent to the mainframe will change according to $\overline{\text{PROC BUSY}}$ P1(32). During its measurement cycle, the mainframe makes a period measurement and during the processing cycle it makes a ratio measurement. This prevents the mainframe from multiplying by 2×10^{-9}.

4-34. Average Events C, A to B Operation

4-35. The events average function is the same as events C, A to B except that the $\overline{\text{ART C}}$ line and the zero events circuitry are not used and the gate time is not set to MIN.

4-36. A2 INPUT AMPLIFIER

4-37. The input amplifier consists of two cascaded IC amplifiers followed by a Schmitt trigger. The amplifier has a gain of approximately 3.5. The Schmitt trigger shapes the lower frequencies into fast rise time square waves.

4-38. The input is routed from J1 through 50Ω microstrip to the AC-DC switch S5. Input impedances of 50Ω or 1MΩ can be selected by S3 and attenuations of X1 or X20 can be selected by S4. The signal is routed to input amplifier U2 by two paths depending upon the input frequency. Frequencies below 10 MHz including DC, feed through a FET impedance converter Q1A and Q1B. CR1 and CR2 serve as limiters for the FET input. Higher frequencies bypass Q1A and B thru C5.

4-39. U2 has differential inputs and outputs. The polarity of the inputs is controlled by the SLOPE switch. U3 is a buffer for the dc level input to differential amplifier U2. When R4 is set to PRESET, the reference level is at ground thru a 200Ω resistor R9. When out of PRESET, LEVEL potentiometer R4 determines the differential input to U2. OFFSET potentiometer R11 is used to correct dc offsets in the amplifier, buffer, and FET. U2 is biased with five current sources with BIAS 1 potentiometer R25 setting the proper bias.

4-40. U2 feeds U1 via 50Ω microstrip. DUTY CYCLE potentiometer R31 corrects for offsets at the input to U1. As with U2, U1 is biased with five current sources with BIAS 2 potentiometer R37 setting the proper bias.

4-41. Schmitt Trigger U1 is biased by a current source which also controls the amplitude of the output pulses. The output at J2 is EECL levels varying between approximately 0V and 0.75V.

4-42. A3 BUS INTERFACE (Part of Option 011)

4-43. The A3 board serves as the interface between the 5353A and the HP Interface Bus. The instrument can function only as a listener on the bus. Function codes, Reset and Local Lockout can be remotely programmed.

4-44. When A3TP1($\overline{\text{LET ENA}}$) is low it indicates a letter ASCII code has been received on DI01 through DI07.

4-45. A number ASCII code will cause A3TP2($\overline{\text{NUM ENA}}$) to go low. A3TP3 LET CLK is active (high) whenever a handshake takes place and a letter has been received. A3TP4 NUM CLK is analogous to A3TP3 LET CLK. A3U6B is a function code latch for storing the numeric portion of the function commands.

4-46. A4 GATE ASSEMBLY

4-47. The function of the gate assembly is to route the signal from A2 input amplifier into the mainframe. Buffer amplifier A4U3 receives the signal $\overline{\text{TRIG OUT}}$ and provides two complimentary outputs for Channel A gate U1 and Channel C gate U2. Each IC has an impedance matching network at its input consisting of a 51.1Ω series resistor and a 51Ω resistor with its lead serving as an inductor. Resistor R16 and potentiometer R19 change the dc average level at the input to U1 within a -100 mV to +100 mV range in order to adjust the symmetry of the output signal. A similar circuit is used at the input of U2.

4-48. $\overline{\text{ART C}}$ at XA4(10) and SEL ART C at XA4($\overline{10}$) are active only in the events C, A to B mode of operation. SEL ART C enables U1C to route the ART C pulse to the mainframe. $\overline{\text{SEL AB}}$ at XA4($\overline{8}$) enables A4U2 to route the signal to the 5345A whenever it is sent via Channel A. Table 4-2 shows when Channels A and B are active.

Table 4-2. Channel Activation Truth Table

Function	PA (Channel A)	PC (Channel C)
Period C	X	
Freq C	X	
Freq C+A	X	
Freq C-A	X	
Ratio C/A		X
Events C, A to B		X
Average Events C, A to B		X

MAINTENANCE

SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. This section contains maintenance and service information including a table of assemblies, recommended test equipment, an in-cabinet performance check, adjustments, and troubleshooting.

5-3. ASSEMBLY DESIGNATIONS

5-4. Table 5-1 lists the designations, nomenclature, and Hewlett-Packard part number of assemblies in the 5353A.

Table 5-1. Assembly Description

Reference Designation	Description	HP Part Number
A1	Motherboard	05353-60001
A2	Input Amplifier/Trigger	05353-60002
A3	Bus Interface (Option 011)	05353-60003
A4	Gate Assembly	05353-60004
A5	Interconnect Assembly (Option 011)	05353-60005

5-5. TEST EQUIPMENT

5-6. Table 5-2 lists recommended test equipment for maintaining the 5353A. Test equipment having equivalent characteristics may be substituted for the equipment listed.

Table 5-2. Recommended Test Equipment

Instrument Type		Required Characteristics	Recommended Type
5345A ASM Tester	Only one required, see para 5-10	State Machine Testing	HP K13-59992A
Logic State Analyzer		Logic Testing	HP 1601A
Oscilloscope		Four-Channel, 50 MHz, 20 mV Sensitivity	HP 180C with 1804A and 1821A Plug-Ins
Extender Cable for A2 Assembly		2 ft. Cable	HP P/N 8120-2652
Oscilloscope		DC — 1 GHz Bandwidth Sampling Scope	HP 180C with 1810A Plug-In
Oscilloscope		50 MHz Bandwidth	HP 180C with 1801A and 1820A Plug-Ins

Table 5-2. Recommended Test Equipment (Cont'd)

Instrument Type	Required Characteristics	Recommended Type
Oscilloscope, Active Probe	500 MHz	HP 1120A
Logic Probe	Logic State Testing	HP 10525T
Logic Clip		HP 10528A
Logic Pulser		HP 10526A
Logic Comparator	Logic State Testing	HP 10529A
Test Oscillator	10 Hz to 10 MHz	HP 651B
Signal Generator	10 MHz to 480 MHz	HP 608E
Frequency Doubler	240 MHz to 550 MHz	HP 10516A
DC Voltmeter	0-250 Vdc, 1%	HP 412A
RF Voltmeter	500 MHz	HP 411A
Measuring Tee		HP 11024A
Resistors	680Ω, 820Ω, 910Ω, 5%	
50 Ohm Feedthrough		
50 Ohm Load		HP 908A
50 Ohm Coax Cable	SMC to BNC	

5-7. IN-CABINET PERFORMANCE CHECK

5-8. The performance check, Table 5-3, and test card can be used to verify proper operation of the plug-in and may also be used as follows:

a. As part of an incoming inspection check of instrument specifications.

b. Periodically, for instruments used in systems where maximum reliability is important.

Table 5-3. In-Cabinet Performance Check

1. CHANNEL C FREQUENCY AND SENSITIVITY CHECK

Specifications:

Range: 20 Hz to 500 MHz
Sensitivity: 10 mV rms

Equipment Required:

Signal Generators to cover 20 Hz to 500 MHz
Oscillosope: HP 180C with HP 1801A and HP 1820A with 50Ω feedthrough
RF Voltmeter: HP 411A with 11024A tee and 908A 50Ω load

Table 5-3. In-Cabinet Performance Check (Cont'd)

a. Set 5345A controls as follows:

FUNCTION	PLUG IN
GATE TIME	As required
DISPLAY POSITION	AUTO
SAMPLE RATE	Full ccw
Input Amplifier Control	COM A or SEP

b. Set 5363A controls as follows:

FUNCTION	FREQ C
LEVEL	PRESET
ATTEN	X1
Input Impedance	50Ω
Input Coupling	DC

c. Vary signal generator from 20 Hz to 500 MHz, maintaining 10 mV rms input amplitude (28.3V p-p). Use substitution method when measuring voltage. Counter should properly display all frequencies within this range. Record on test card.

2. CHANNEL C LEVEL AND ATTEN CONTROLS CHECK

Specifications:

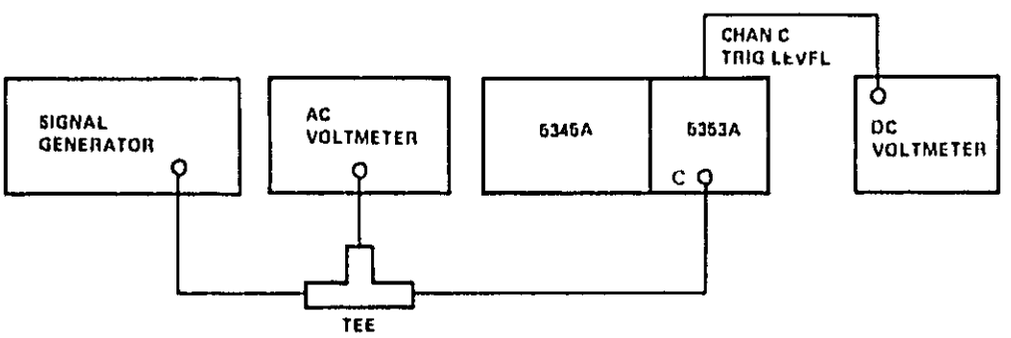
Level Range: ±0.5V
ATTEN (sensitivity): 200 mV rms in X20

Equipment:

Signal Generator: HP 651A
DC Voltmeter: HP 412A
AC Voltmeter: HP 410C

a. Set 5345A and 5363A controls as in step 1a and 1b with GATE TIME set to 100 ms.

b. Connect equipment as follows and set signal generator for 10 kHz at 1V rms output.



c. Vary CHANNEL C LEVEL control over entire range. Counter should not stop counting; dc voltmeter reading should vary from -0.5V to +0.5V with 0V at PRESET position. Record on test card.

d. On 5363A, set ATTEN switch to X20 and LEVEL control to PRESET.

e. Reduce amplitude of input signal to 0V.

f. Increase amplitude of input signal until counter displays a stable count of 10 kHz. AC voltmeter should read 200 mV or less. Record on test card.

Table 5-3. In-Cabinet Performance Check (Cont'd)

3. PERIOD C CHECK

   a. Set 5345A controls as follows:
      FUNCTION . . .. PLUG-IN
      GATE TIME ..... 100 ms
      SAMPLE RATE ..... ccw
      Input Amplifier Control ..... CHECK

   b. Disconnect input signal from CHANNEL C input BNC jack.

   c. Set 5353A FUNCTION selector to PERIOD C. 5345A should display 10.000000 nsec.

4. FREQ C+A CHECK

   a. Set 5345A controls as in step 3a. No input signal connected to Channel C input BNC jack.

   b. Set 5353A FUNCTION selector to FREQ C-A. 5345A should display all zeroes and Hz.

   c. Set 5353A FUNCTION selector to FREQ C+A. 5345A should display 200.00000 MHz.

5. RATIO C/A CHECK

   a. At 5345A rear panel, connect FREQ STD OUTPUT 10 MHz jack to CHANNEL C Input jack.

   b. Set 5345A controls as in step 3a with GATE TIME selector to 10 ms.

   c. Set 5353A FUNCTION selector to RATIO C/A. 5345A should display 100.0000 milli.

6. EVENTS C, A TO B CHECK

   a. Set 5345A controls as follows:
      FUNCTION ..... PLUG-IN
      LEVEL A and B ..... fully CW
      Input Amplifier Control ..... SEP
      DISPLAY POSITION ..... AUTO

   b. Set 5353A controls as follows:
      FUNCTION ..... EVENTS C, A to B
      LEVEL ..... fully CW

   c. On 5345A, press RESET and check that ARM light is on.

   d. On 5345A, rotate LEVEL A fully CCW (not to PRESET) and then back fully CW. Gate light should come on.

   e. Repeat step d for 5353A LEVEL control. GATE light should remain on.

   f. Repeat step d for 5345A LEVEL B control. GATE light should go OFF and 5345A displays "1". 5345A ARM light comes on.

   g. Repeat steps d, f and g; omitting step e. 5345A should display all zeroes.

PERFORMANCE CHECK TEST CARD

HEWLETT-PACKARD MODEL 5353A
CHANNEL C PLUG-IN

Test Performed by _____
Date ____ ____

Serial No. _____ - _____

	DESCRIPTION	CHECK
1.	CHANNEL C FREQUENCY AND SENSITIVITY	_____
2.	CHANNEL C LEVEL AND ATTEN CONTROLS	
	Channel C Level ±0.5V	_____
	Attenuator Sensitivity: 200 mV	_____
3.	PERIOD C	_____
4.	FREQ C÷A	_____
5.	RATIO C/A	_____
6.	EVENTS C, A to B	_____

TROUBLE-SHOOTING

5-9. TROUBLESHOOTING

5-10. For troubleshooting refer to the theory of operation, schematics and timing diagrams. The following procedures describe troubleshooting for the Frequency C+A modes. See Figure 4-3 for Frequency C+A Operating Cycle Timing Diagram. Three different methods can be used, as follows:

a. State Machine testing using an HP K13-59992A ASM Tester.

b. Logic state analysis using an HP 1601A Logic State Analyzer.

c. Oscilloscope testing using an HP 182C Oscilloscope with an 1804A Four Channel Vertical Amplifier and an 1821A Time Base Plug-In.

5-11. Troubleshooting with the ASM Tester

5-12. The following procedure troubleshoots the 5353A/5345A in the Frequency C+A mode using a K13-59992A ASM Tester.

a. Set controls on 5345A as follows:

FUNCTION ..... PLUG-IN
GATE TIME ..... 1 sec
DISPLAY POSITION ..... AUTO
Input Control ..... CHECK

b. Set controls on 5353A as follows:

FUNCTION ..... FREQ C+A

c. Connect ASM Tester to 5345A according to instructions in ASM Tester Technical Manual.

d. The test data for the ASM Tester is shown in Table 5-4.

5-13. Troubleshooting with the Logic State Analyzer

5-14. The following procedure troubleshoots the 5353A in the Frequency C+A modes using an HP 1601A Logic State Analyzer.

a. Remove 5345A and 5353A top covers.

b. Install 5353A into 5345A plug-in compartment.

c. On 5353A A1 Motherboard, connect 10230A clock probe to U9 pin 4 and ground to TP10.

d. Connect 10231A six bit data probes to 5353A motherboard A1 as follows:

Bit 8	A1TP4 (Old Disp 45)	1601A Trigger Signal
Bit 0	A1U2(4)	RAMS U2 and U3 Inputs
Bit 1	A1U2(6)	
Bit 2	A1U2(10)	
Bit 3	A1U2(12)	
Bit 4	A1U2(5)	RAMS U2 and U3 Outputs
Bit 5	A1U2(7)	
Bit 6	A1U2(9)	
Bit 7	A1U2(11)	
Grounds	A1TP10	Ground for both probes

Table 5-4. ASM Tester Procedure

ASM Tester Display	Program Address	Freq C+A Operating Cycle. Refer to Figure 4-3.
1. CONTENTS OF DR Data Bits 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 2 0 0 0 0 0 0 0 *0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0*	211	RAM U3 stores old display sent from mainframe.
2. INPUT TO DR Data Bits 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 C 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 Display will be the same for both Freq C+A	521 R Data Routine	C measurement result stored in RAM U2 is sent to mainframe as R Data during second processing cycle.
3. CONTENTS OF DR Data Bits 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 C+A 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 Ignored *0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 C-A *0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Ignored In both Freq C+A the display will alternate between two sets of data, the second of which will be ignored by the mainframe.	551	RAM U2 stores C Channel measurement result sent from mainframe during first processing cycle. Mainframe C+A result to RAM U2 and is ignored during second processing cycle.
4. INPUT TO DR Data Bits 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	560 Display Stored Routine	RAM U3 sends old display to mainframe during first processing cycle.

*Displays for the Freq C-A mode of operation are shown with an asterisk.

e. Set 5345A controls as follows:

FUNCTION ..... PLUG-IN
GATE TIME ..... MIN
DISPLAY POSITION ..... AUTO
Input Control ..... CHECK
SAMPLE RATE ..... Fully ccw

f. Set 5353A controls as follows:

FUNCTION ..... FREQ C+A

g. Set 1601A controls as follows:

TRIGGER WORD BIT 8 ..... HI
TRIGGER WORD BIT 0 THRU 7 ..... OFF
CLOCK .....
SAMPLE MODE ..... REPET
TRIGGER MODE ..... START DELAY
DISPLAY, LOGIC ..... POS
DISPLAY RATE ..... Midposition
COLUMN BLANKING .... Eliminate bits 11, 10, and 9
BYTE ..... BCD

NOTE

The 5345A should read 0.2 GHz throughout this procedure if the 5345A-5353A combination is operating properly.

h. Set 1601A DELAY SET switches to 00000. 1601A display should be as follows:

Bit	3	2	1	0	Clocks
	0	0	1	0	1
	1	1	1	1	2
	1	1	1	1	3
	1	1	1	1	4
	↓				↓
	1	1	1	1	16

RAM U3 stores old display sent from mainframe.

i. Set 1601A DELAY SET switches to 00016. 1601A display should be as follows:

Bit	3	2	1	0	Clocks
	0	0	0	1	1
	0	0	0	0	2
	0	0	0	0	3
	↓				↓
	0	0	0	0	16

RAM U2 stores C measurement result sent from mainframe.

j. Set 1601A DELAY SET switches to 00032. 1601A display should be as follows:

Bit 7	6	5	4	Clocks
0	0	0	0	1
1	1	0	1	2
0	0	0	0	3
↓				↓
0	0	0	0	16

RAM U3 sends only display to mainframe.

k. Set 1601A DELAY SET switches to 00048. 1601A display should be as follows:

Bit 3	2	1	0	Clocks
0	0	1	0	1
1	1	1	1	2
		↓		↓
1	1	1	1	16

Mainframe sends old display and is ignored.

l. Set 1601A DELAY SET switches to 00064. 1601A display should be as follows:

Bit 7	6	5	4	Clocks
1	1	1	1	1
1	1	1	0	2
1	1	1	1	3
		↓		↓
1	1	1	1	16

C measurement result stored in RAM U2 is sent to mainframe as K Data.

m. Set 1601A DELAY SET switches to 00080. 1601A display should be as follows:

Bit 3	2	1	0	Clocks
0	0	1	0	1
0	0	0	0	2
0	0	0	0	3
↓				↓
0	0	0	0	16

Mainframe sends C+A result and is ignored.

n. On 5363A, set FUNCTION selector to FREQ C-A. Set 1601A DELAY SET switches to 00080. 1601A display should be as follows:

Bit 3	2	1	0	Clocks
0	0	0	0	1
0	0	0	0	2
0	0	0	0	3
↓				↓
0	0	0	0	16

Mainframe sends C-A result and is ignored.

5-15. Troubleshooting with the Four-Channel Oscilloscope

5-16. The following procedure troubleshoots the 5363A in the Frequency C+A modes using an HP 182C Oscilloscope with an 1804A vertical amplifier and 1821A time base.

5-17. Set 5345A for Plug-In operation in the CHECK mode. See paragraph 5-14e.

5-18. Data transfer between the plug-in and mainframe at different points in the Freq C+A operating cycle can be observed by triggering on one of the 5363A built in test points. Refer to Figure 4-3 for the overall Freq C+A operating cycle timing diagram. The test points and their use are as follows:

a. TP4 OLD DISP 45

TP4 goes high in the first processing cycle. During its active state, plug-in RAM U3 stores old display data sent from mainframe.

b. TP5 RESULT

TP5 goes high in the first processing cycle. During its active state, plug-in RAM U2 stores C channel measurement result data sent from mainframe.

c. TP7 OLD DISP PI

TP7 goes high in the first processing cycle. During its active state, old display data stored in plug-in RAM U3 is sent to the mainframe.

d. TP6 K DATA

TP6 goes high in the second processing cycle. During its active state, C channel measurement data stored in RAM U2 is sent to the mainframe as K DATA.

5-19. ADJUSTMENTS

NOTE

Before performing any adjustments, allow 5-minute warmup for test equipment, 5345A, and 5363A.

5-20. A2 Input Amplifier Adjustments

a. Remove top cover on 5345A.

b. Remove top cover on 5363A and install 5363A into 5345A.

c. Set 5345A FUNCTION selector to PLUG-IN.

d. Set 5353A controls as follows:

SLOPE	- (minus)
ATTEN	X1
AC/DC	DC
50Ω/1MΩ	50Ω
LEVEL	PRESET

e. LEVEL CHECK

CAUTION

The heat sinks of the integrated circuits on A2 are at -5.2 volts dc. Take care not to short them to ground with test equipment leads while making adjustments.

1. Set 5345A POWER switch to STANDBY.
2. Connect oscilloscope vertical input to A2J2. Set oscilloscope for vertical sensitivity to 0.2V/div.
3. Set 5345A POWER switch to ON. Allow 5 minutes for warmup.
4. Rotate "LEVEL" control on 5353A front panel from full ccw (not in PRESET) to full cw position and back to full ccw. Check that oscilloscope trace shifts displays -750 mV dc to zero volts and back to -750 mV dc.
5. Set LEVEL control on 5353A to PRESET.

f. BIAS 1 ADJUSTMENT

1. Connect dc voltmeter to junction of A2R22 and A2R24.
2. Adjust A2R25 (BIAS 1) potentiometer for a -70 mV ±10 mV indication on dc voltmeter. See Figure 8-6 for location of adjustments.

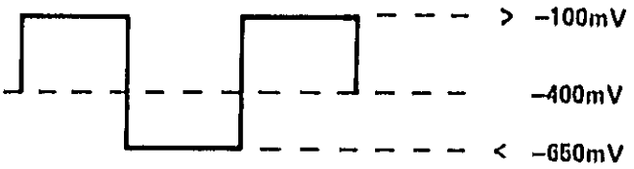
g. BIAS 2 ADJUSTMENT

1. Connect dc voltmeter to junction of A2R38 and U16).
2. Adjust A2R37(BIAS 2) potentiometer for a +30 mV ±10 mV indication on dc voltmeter.

h. OFFSET ADJUSTMENT

1. Connect 100 MHz, -7 dBm (100 mV rms) signal to input BNC on 5353A.
2. With oscilloscope connected to trigger output on A2J2. Check for trigger waveform on the oscilloscope. If no signal or a grossly unsymmetrical signal is observed, adjust A2R31 for a stable signal with approximately 50% duty cycle.
3. Adjust A2R11 (OFFSET) until oscilloscope display remains stationary when the 5353A front panel SLOPE switch is changed from + to -.
4. Reduce 100 MHz signal amplitude to -17 dBm and repeat step 3. Reduce 100 MHz signal amplitude to -30 dBm and repeat step 3. If the signal is lost at either level, adjust A2R31 (DUTY CYCLE) for a stable signal.

5. Adjust A2R31 (DUTY CYCLE) for a signal on the oscilloscope with a 50% duty cycle at a dc reference level of -400 mV. The most positive portion must not be below -100 mV and the most negative portion must be below -650 mV.



05353A-15

6. Slowly increase the signal generator frequency up to 500 MHz. Observe stable trigger waveform at all frequencies. Top of waveform must not fall below -150 mV level with minimum amplitude of 600 mV p-p.

i. A4 GATE ASSEMBLY ADJUSTMENT

NOTE

Perform this adjustment only when an active component (A4U1, 2, or 3) has been replaced.

1. If A4U3 is replaced, adjust A4R18 (A adjust) and A4R19 (C adjust).

2. If A4U2 is replaced, adjust A4R18 (A adjust).

3. If A4U1 is replaced, adjust A4R19 (C adjust).

j. A ADJUST AND C ADJUST PROCEDURE

1. In 5353A, remove A4. Unsolder A4R4 at the junction of R4, R5, and R8. Lift up resistor.

2. Insert an 820Ω 5% resistor from junction of A4R4 and A4R5 to -5.2V, see Figure 5-1 for placement and length of resistor leads. Reinstall A4.

3. Calibrate the sampling oscilloscope by connecting high frequency probe to oscilloscope and A9TP13 on the 5345A. Connect probe ground to TP RET on A9 in the 5345A. Set 5345A FUNCTION selector to FREQ A. These test points give a highly accurate 500 MHz signal. If necessary adjust time base vernier on oscilloscope.

4. Set 5345A FUNCTION switch to "PLUG-IN.

5. Set 5353A as follows:

FUNCTION ..... FREQ C for A adjust or
RATIO C/A for C adjust
Impedance Selector 50Ω
ATTEN X1
Coupling ..... DC
LEVEL ..... PRESET

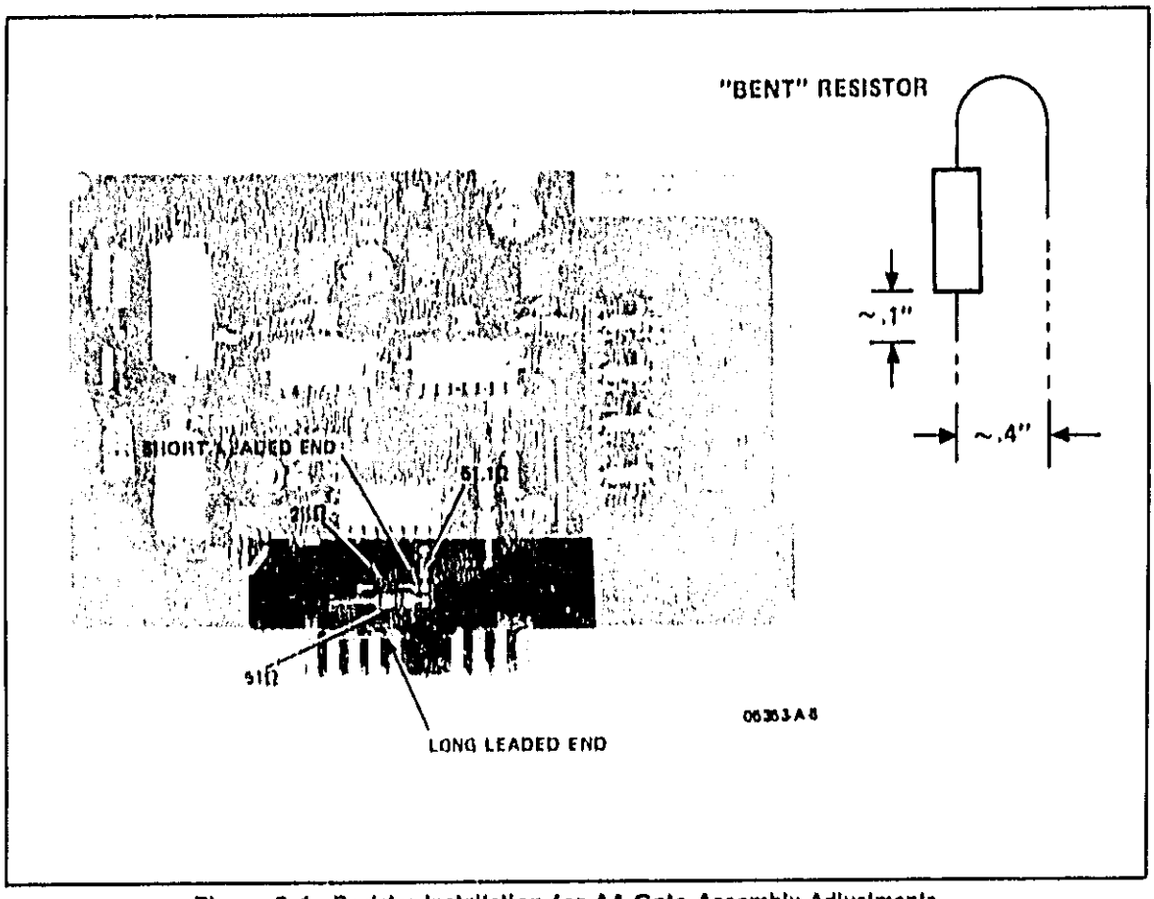


Figure 5-1. Resistor Installation for A4 Gate Assembly Adjustments

6. Adjust oscilloscope display so that ground is at the top graticule and the center graticule is at -0.4 Vdc. Connect oscilloscope cable to A4J2(PA) for A adjust, or to A4J1(PC) for the C adjust.

7. Set signal generator frequency to 530 MHz (channel A of the 5345A can be used to check the signal generator frequency).

8. Connect RF Voltmeter to signal generator output using a measurement Tee connector with a 50Ω load and adjust signal generator output to 265 mV rms.

9. In 5353A, disconnect flexible coax from A2J1. Connect 530 MHz into A4 via the flexible coax.

10. Adjust A4R18 (A ADJ) or A4R19 (C ADJ) for a 50% duty cycle as displayed on the oscilloscope. Display should be as shown in Figure 5-2.

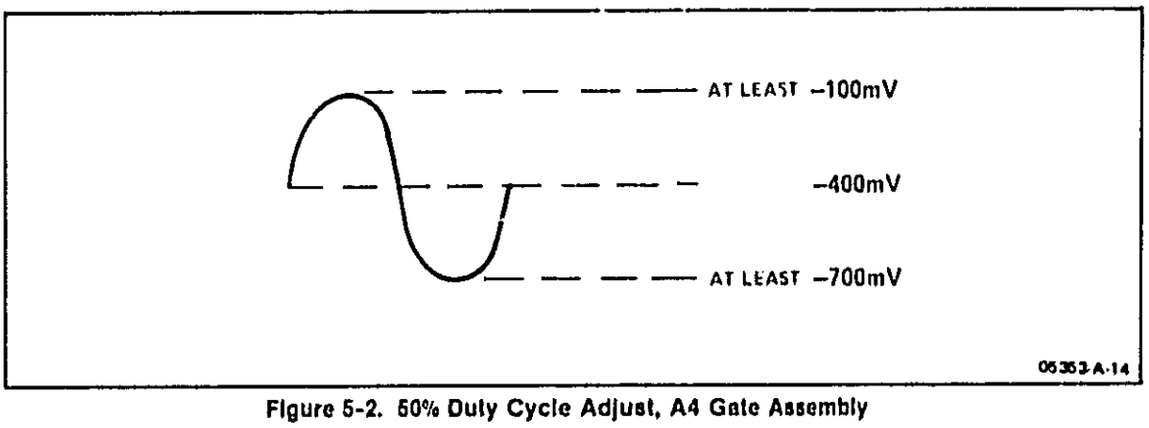


Figure 5-2. 50% Duty Cycle Adjust, A4 Gate Assembly

11. On 5345A, set POWER to STANDBY.

12. Remove printed-circuit board A4 from 5353A. Replace the 820 ohm resistor with a 910 ohm resistor. Be sure that the short lead of the resistor is inserted at the junction of R4, R5 and R8.

13. On 5345A, set POWER to ON. Observe 530 MHz signal on oscilloscope. Display should be as shown in Figure 5-3.

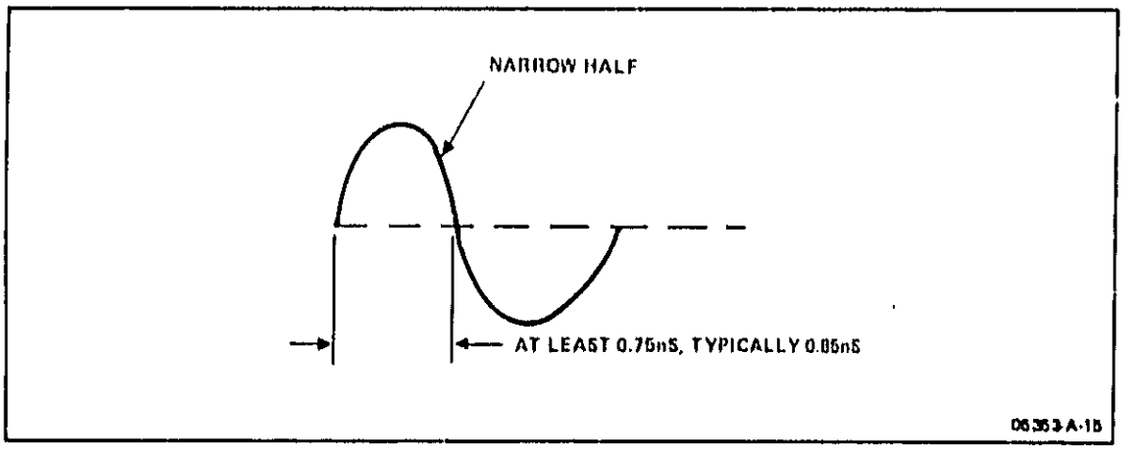


Figure 5-3. Waveform for Adjustments of A4

14. On 5345A, set POWER to STANDBY.

15. Remove A4 from 5353A. Replace the 910Ω resistor with a 680Ω resistor.

16. On 5345A, set POWER switch to ON. Observe 530 MHz signal on oscilloscope. Display should be as shown in Figure 5-4.

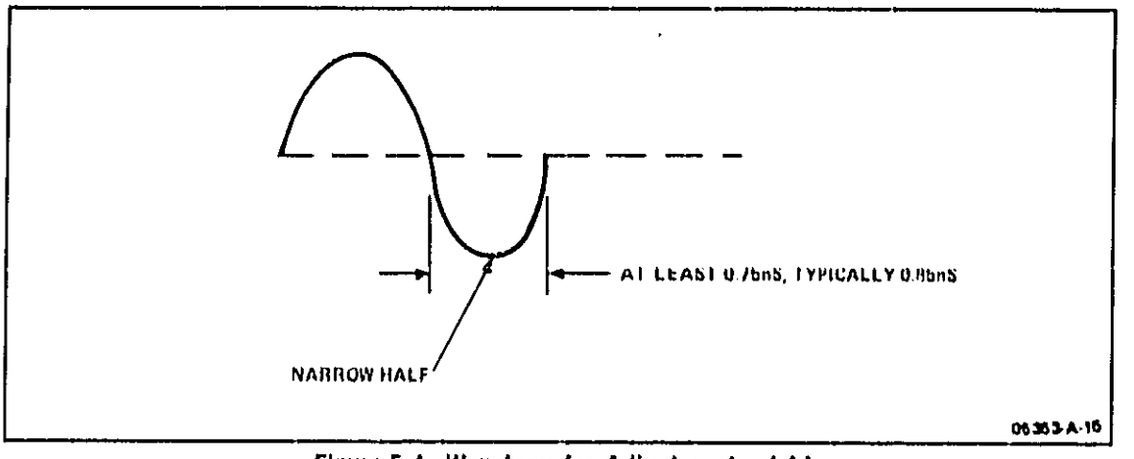


Figure 5-4. Waveform for Adjustments of A4

17. If the waveforms shown in Figures 5-3 and 5-4 cannot be obtained, the replacement IC should be replaced.

18a. If only one of the waveforms in steps 13 and 16 can be obtained with the replacement IC', insert the 680Ω or 910Ω resistor in A4 (choose resistor which results in pulse width narrower than 0.75 nsec) and adjust either A4R18(A ADJ) or A4R18(C' ADJ) for a pulse width of 0.75 nsec.

18b. Insert whichever resistor was not used in step 18a (680Ω or 910Ω) and make sure narrowest pulse width is at least 0.75 nsec. If this specifiention cannot be met, replacement IC' should be replaced.

19. Return A4 circuits to original configuration and insert 530 MHz at 0 mV rms and check that the 5345A-5353A combination is working properly.

PARTS LIST

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains a list of replaceable parts, information for ordering, and a list of abbreviations used in the parts lists.

6-3. REPLACEABLE PARTS LIST

6-4. Table 6-1 lists replaceable parts for the 5353A. Parts are listed in alpha-numerical order by reference designation starting with A1 and ending with chassis and miscellaneous parts. Table 6-2 contains a list of manufacturers and their codes. The replaceable parts lists include the following information:

a. Reference designator (when applicable).

b. HP part number.

c. Total quantity (QTY) used in the instrument. The quantity appears in the QTY column the first time that the part is listed.

d. Description of the part (see list of abbreviations).

e. Typical manufacturer of the part in a five-digit code (see list of manufacturers in Table 6-2).

f. Manufacturer's part number.

6-5. ORDERING INFORMATION

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

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

A	= ampere	avg	= average	CHAN	= channel	dc	= direct current
ac	= alternating current	AWG	= American wire gauge	cm	= centimeter	deg	= degree (temperature interval or difference)
ACCESS	= accessory	BAL	= balance	CMO	= cabinet mount only		
ADJ	= adjustment	BCD	= binary coded decimal	COAX	= coaxial		
A/D	= analog to digital			COEF	= coefficient		
AF	= audio frequency	BD	= board	COM	= common	°	= degree (plane angle)
AFC	= automatic frequency control	BE CU	= beryllium copper	COMP	= composition	°C	= degree Celsius (centigrade)
AGC	= automatic gain control	BFO	= beat frequency oscillator	COMPL	= complete	°F	= degree Fahrenheit
AL	= aluminum	BH	= binder head	CONN	= connector	°k	= degree kelvin
ALC	= automatic level control	BRDN	= breakdown	CP	= cadmium plate	DEPC	= deposited carbon
AM	= amplitude modulation	BP	= bandpass	CRT	= cathode ray tube	DET	= detector
AMPL	= amplifier	BPF	= bandpass filter	CTL	= complementary transistor logic	diam	= diameter
APC	= automatic phase control	BRS	= brass	CW	= continuous wave	DIA	= diameter used in parts list
ASSY	= assembly	BWO	= backward wave oscillator	cw	= clockwise	DIFF AMPL	= differential amplifier
AUX	= auxiliary	CAL	= calibrate	ccw	= counterclockwise	div	= division
		CER	= ceramic	D/A	= digital to analog	DPDT	= double pole, double throw
				dB	= decibel		
				dBm	= decibel referred to 1 mW	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	= grounded
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	= included
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	= local oscillator
LOG	= logar. basic taper (used in parts list)
log	= (logarithmic)
LPF	= low pass filter
LV	= low voltage
m	= meter (distance)
mA	= milliampere
MAX	= maximum
MΩ	= megohm
MEG	= meg (Ω) (used in parts list)
MET FLM	= metal film
MET OX	= metal oxide
MF	= mechanical frequency (manufacturer used in parts list)
MFR	= manufacturer
mg	= milligram
MHz	= megahertz
mH	= millihenrys
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	= microhenrys
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
OVH	= 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 intrinsic 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 (positions) (used in parts list)
POSN	= position
POT	= potentiometer
p-p	= peak to peak
PP	= peak to peak (used in parts list)
PPM	= pulse position modulator
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)
s	= second (plane angle)
SB	= 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)
VFD	= 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
VXO	= 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^{1}
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. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05353-60001	1	MOTHER BOARD ASSY	28480	05353-60001
A1C1	0160-3877	5	CAPACITOR-FXD 100PF +-5% 200VDCW CER	28480	0160-3877
A1C2	0140-0192	1	CAPACITOR-FXD 68PF +-5% 300VDCW MICA	72136	DM15E680J03000WVICR
A1C3	0160-3879	17	CAPACITOR-FXD .01UF +-20% 100VDCW CER	28480	0160-3879
A1C4	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDCW CER	28480	0160-3879
A1C5	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDCW CER	28480	0160-3879
A1C6	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDCW CER	28480	0160-3879
A1CR1	1901-0535	10	DIODE-SCHOTTKY	28480	1901-0535
A1CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR5	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR6	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1CR7	1901-0040	6	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1J4	1200-0433	1	SOCKET-ELEC EC 24-CONT	28480	1200-0433
A1J5	1200-0421	4	SOCKET-EC MEM 10 CONTACT	23880	CSA2400-168
A1P1	1251-0099	1	CONNECTOR, 50-CONT, PCB, MICRO RIBBON	71785	57-10500-375
A1Q1	1854-0094	2	TRANSISTOR NPN SI PD=200MW FT=350MHZ	28480	1854-0094
A1Q2	1854-0094		TRANSISTOR NPN SI PD=200MW FT=350MHZ	28480	1854-0094
A1R1	0683-5125	18	RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1R2	0683-5125		RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1R3	0683-5125		RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1R4	0683-5125		RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1R5	0683-5125		RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1R6	0683-1025	5	RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R7	0683-2025	5	RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R8	0683-2025		RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R9	0683-5105	1	RESISTOR 51 OHM 5% .25W CC TUBULAR	01121	CB5105
A1R10	0683-3915	2	RESISTOR 390 OHM 5% .25W CC TUBULAR	01121	CB3915
A1R11	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R12	0683-3915		RESISTOR 390 OHM 5% .25W CC TUBULAR	01121	CB3915
A1R13	0683-2015	3	RESISTOR 200 OHM 5% .25W CC TUBULAR	01121	CB2015
A1R14	0683-5125		RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1R15	0683-2015		RESISTOR 200 OHM 5% .25W CC TUBULAR	01121	CB2015
A1R16	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R17	0683-1215	4	RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A1R18	0683-2025		RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R19	0683-2025		RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R20	0683-5125		RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1R21	0683-2015		RESISTOR 200 OHM 5% .25W CC TUBULAR	01121	CB2015
A1R22	0683-2025		RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R23	0683 6126	5	RESISTOR 6.1K 6% 25W CC TUBULAR	28480	0683-6126
A1R24	0683 6126		RESISTOR 6.1K 6% 25W CC TUBULAR	28480	0683-6126
A1R25	0683 6126		RESISTOR 6.1K 6% 25W CC TUBULAR	28480	0683-6126
A1R26	0683 6126		RESISTOR 6.1K 6% 25W CC TUBULAR	28480	0683-512
A1R27	0683-1525	5	RESISTOR 1.5K 5% .25W CC TUBULAR	01121	CB1525
A1R28	0683-1525		RESISTOR 1.5K 5% .25W CC TUBULAR	01121	CB1525
A1R29	0683-1525		RESISTOR 1.5K 5% .25W CC TUBULAR	01121	CB1525
A1R30	0683-1525		RESISTOR 1.5K 5% .25W CC TUBULAR	01121	CB1525
A1R31	0683 6126		RESISTOR 6.1K 6% 25W CC TUBULAR	28480	0683-512
A1TP1	0360-1682	17	TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP2	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP3	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP4	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP5	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP6	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP7	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP8	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP9	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1TP10	0360-1682		TERMINAL SLDR STUDS .030 SHK DIA	28480	0360-1682
A1U1	1820-1255	1	IC-DGTL, HEX TRI STATE	28480	1820-1255
A1U2	1820-0828	2	IC-DGTL-EPROM	01295	SN74S89N
A1U3	1820-0828		IC-DGTL-EPROM	01295	SN74S89N
A1U4	1820-0233	1	IC-DGTL-COUNTER	01295	SN74193N
A1U5	1820-0761	2	IC-DGTL-D-FLIP-FLOP	01295	SN74107N
A1U6	1820-0854	4	IC-DGTL-GATE	01295	SN7400N
A1U7	1820-0511	4	IC-DGTL-GATE	01295	SN7408N
A1U8	1820-0738	2	IC-DGTL-D-FLIP-FLOP	01295	SN74174N
A1U9	1820-0809	1	IC-DGTL-GATE	01295	SN7420N
A1U10	1820-0806	1	IC-DGTL-GATE	01295	SN7410N

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1U11	1820-0174	3	IC DGTL INVERTER	01295	SN7404N
A1U12	1820-0077	4	IC DGTL FLIP-FLOP	01295	SN7474N
A1U13	1820-0054		IC DGTL GATE	01295	SN7400N
A1U14	1820-0661	2	IC DGTL GATE	01295	SN7432N
A1U15	1820-0681	1	IC DGTL GATE	01295	SN74S00N
A1U16	1820-0077		IC DGTL FLIP-FLOP	01295	SN7474N
A1U17	1820-1254	1	IC DGTL BUFFER	28480	1820-1254
A1U18	1820-0746		IC DGTL FLIP-FLOP	01295	SN74174N
A1U19	1820-0054		IC DGTL GATE	01295	SN7400N
A1U20	1820-0661		IC DGTL GATE	01295	SN7432N
A1U21	1820-0511		IC DGTL GATE	01295	SN7408N
A1U22	1820-0077		IC DGTL FLIP-FLOP	01295	SN7474N
A1U23	1820-0328	1	IC DGTL GATE	01295	SN7402N
A1U24	1820-0214	1	IC DGTL ENCODER/DECODER DRVR/DATA DISTR	01295	SN7442N
A1U25	1820-0616	1	IC DGTL MULTIPLEXER	07263	9322DC
A1XA1	1251-2026	1	CONNECTOR; PC EDGE; 18-CONT; DIP SOLDER	71785	252-18-30-300
A1XA4	1251-2016	1	CONNECTOR; PC EDGE; 10-CONT; DIP SOLDER	71785	252-10-30-300
A1XU2	1200-0423		SOCKET; IC DLP 16 CONTACT	23880	CSA2900-16B
A1XU3	1200-0423		SOCKET; IC DLP 16 CONTACT	23880	CSA2900-16B
A1XU4	1200-0423		SOCKET; IC DLP 16 CONTACT	23880	CSA2900-16B
A2	05353-60002	1	INPUT AMPLIFIER/TRIGGER ASSY	28480	05353-60002
A2C1	0160-0551	1	CAPACITOR-FXD .01UF+80-0% 400WVDC	28480	0160-0551
A2C2	0160-0550	1	CAPACITOR-FXD 10PF+-5% 500WVDC	28480	0160-0550
A2C3	NONE		STRAY WIRE CAPACITY		
A2C4	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A2C5	0160-4058	1	CAPACITOR-FXD 39PF+-5% 400WVDC	28480	0160-4058
A2C6	0160-3870		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3870
A2C7	0160-3870		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3870
A2C8	0160-3877		CAPACITOR-FXD 100PF+-20% 200WVDC	28480	0160-3877
A2C9	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A2C10	0160-3878	11	CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C11	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A2C12	0180-1701	5	CAPACITOR-FXD 6.8UF+-20% 6VDC TA-SOLID	56289	150D685X0006A2
A2C13	0160-4228	1	CAPACITOR, 1000 PF, FEED-THRU	28480	0160-4228
A2C14	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C15	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C16	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C17	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA-SOLID	56289	150D685X0006A2
A2C18	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C19	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A2C20	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C21	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C22	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C23	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA-SOLID	56289	150D685X0006A2
A2C24	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C25	0160-3877		CAPACITOR-FXD 100PF+-20% 200WVDC	28480	0160-3877
A2C26	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA-SOLID	56289	150D685X0006A2
A2C27	0160-4228		CAPACITOR, 1000 PF, FEED-THRU	28480	0160-4228
A2C28	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A2C29	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C30	0180-1701		CAPACITOR-FXD 6.8UF+-20% 6VDC TA-SOLID	56289	150D685X0006A2
A2C31	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A2C32	0160-3877		CAPACITOR-FXD 100PF+-20% 200WVDC	28480	0160-3877
A2C33	0180-1714	1	CAPACITOR-FXD 330UF+-10% 6VDC TA-SOLID	56289	150D337X9006S2
A2C34	0160-4228		CAPACITOR, 1000 PF, FEED-THRU	28480	0160-4228
A2C35	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A2C36	0160-3877		CAPACITOR-FXD 100PF+-20% 200WVDC	28480	0160-3877
A2C37	0180-1714		CAPACITOR-FXD 330UF+-10% 6VDC TA-SOLID	56289	150D337X9006S2
A2C38	0180-0157	2	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C39	0150-0072	1	CAPACITOR-FXD 200PF+-5% 1000WVDC	28480	0150-0072
A2C40	0180-0157		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2CR1	1901-0376	2	DIODE-GEN PRP 35V 50MA	28480	1901-0376
A2CR2	1901-0376		DIODE-GEN PRP 35V 50MA	28480	1901-0376
A2CR3	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2DS1	2140-0417	2	LAMP, BI PIN BASE	28480	2140-0417
A2DS2	2140-0417		LAMP, BI PIN BASE	28480	2140-0417
A2J1	1250-1163	1	CONNECTOR-COAX BNC 50 OHM FEMALE	28480	1250-1163
A2J2	1250-[illegible]	1	CONNECTOR-COAX SMC 50 OHM MALE	24931	17JR104-2
A2L1	9100-[illegible]	4	COIL; FXD; NON-MOLDED RF CHOKE; .75UH	02114	VK200-20/4B
A2L2	9100-[illegible]		COIL; FXD; NON-MOLDED RF CHOKE; .75UH	02114	VK200-20/4B
A2L3	9100-1788		COIL; FXD; NON-MOLDED RF CHOKE; .75UH	02114	VK200-20/4B
A2L4	9100-0565	2	COIL; FXD; MOLDED RF CHOKE; 22UH 10%	99800	2151-32
A2L5	9100-0565		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	99800	2150-32

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2Q1	1853-0050	1	TRANSISTOR 2 N-CHAN D-MODE SI	28480	1853-0050
A2Q2	1854-0215	2	TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS 3611
A2Q3			TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS 3611
A2R1	0757-0477	1	RESISTOR 845 OHM 1% .5W F TUBULAR	19701	MF7C1/2-10-4989-F
A2R2	0698-0083	1	RESISTOR 950K 5% .25W C CHIP	28480	0698-0083
A2R3	0698-0084	1	RESISTOR 50K 5% .25W C CHIP	28480	0698-8304
A2R4	2100-0557	1	RESISTOR-VAR 100K 20% CC SPST SM	28480	2100-0597
A2R5	0698-5629	1	RESISTOR 5.62K 5% .25W CC TUBULAR	01121	CB5625
A2R6	0698-8181	1	RESISTOR 50 OHM 5% .25W C CHIP	28480	0698-8181
A2R7	0698-5174	1	RESISTOR 200 OHM 5% .125W CC TUBULAR	01121	BB2C15
A2R8	0698-8329	1	RESISTOR 6.19K 5% .25W CC TUBULAR	01121	CB6325
A2R9	0757-0447	1	RESISTOR 200 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-201-F
A2R10	0698-1055	1	RESISTOR 1M 5% .25W CC TUBULAR	01121	CB1055
A2R11	2100-1736	1	RESISTOR-VARI TRMR 100OHM 10% C	73138	72PR100
A2R12	0698-2055	1	RESISTOR 2M 5% .25W CC TUBULAR	01121	CB2055
A2R13	0757-0620	2	RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A2R14	0698-8481	1	RESISTOR 750 OHM 5% .125W CC TUBULAR	01121	BB7515
A2R15	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A2R16	0698-7564	2	RESISTOR 100K 5% .125W CC TUBULAR	01121	BB1C45
A2R17	0683-1525		RESISTOR 1.5K 5% .25W CC TUBULAR	01121	CB1525
A2R18	0698-5178	7	RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A2R19	2257-0602	1	RESISTOR 162 OHM 1% .5W F TUBULAR	19701	MF7C-1/2-T0-162R-F
A2R20	0698-3151	5	RESISTOR 100 OHM 5% .125W CC TUBULAR	01121	BB1C15
A2R21	0757-0411	1	RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-G
A2R22	0698-3278		RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A2R23	0698-3113		RESISTOR 100 OHM 5% .125W CC TUBULAR	01121	BB1C15
A2R24	0683-8625		RESISTOR 1M 5% .25W CC TUBULAR	01121	CB1C25
A2R25	2100-1748	1	RESISTOR-VARI TRMR 500 OHM 10% C	73138	72PR500
A2R26	0683-1625		RESISTOR 1M 5% .25W CC TUBULAR	01121	CB1C25
A2R27	0683-1125	5	RESISTOR 1.1K 5% .25W CC TUBULAR	01121	CB1125
A2R28	0683-1125		RESISTOR 1.1K 5% .25W CC TUBULAR	01121	CB1125
A2R29	0683-5115	1	RESISTOR 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A2R30	0698-5178		RESISTOR 1.5K 5% .125W CC TUBULAR	01121	BB1525
A2R31	2100-2661	1	RESISTOR-VARI TRMR 200 OHM 10% C	73138	72PR200
A2R32	0698-5178		RESISTOR 1.5K 5% .125W CC TUBULAR	01121	BB1525
A2R33	0698-3278		RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A2R34	0698-3278		RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A2R35	2257-0621	1	RESISTOR 1.62K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1621-F
A2R36	0757-0420	1	RESISTOR 243 OHM 1% .25W F TUBULAR	24546	C4-1/4-T0-243R-F
A2R37	2100-1748	1	RESISTOR-VARI TRMR 100 OHM 10% C	73138	72PR101
A2R38	0757-0426	1	RESISTOR 681 OHM 1% .25W F TUBULAR	24546	C4-1/4-T0-681R-F
A2R39	0683-1125		RESISTOR 1.1K 5% .25W CC TUBULAR	01121	CB1125
A2R40	0683-1125		RESISTOR 1.1K 5% .25W CC TUBULAR	01121	CB1125
A2R41	0698-3278		RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A2R42	0683-4715	1	RESISTOR 470 OHM 5% .25W CC TUBULAR	01121	CB4715
A2R43	0698-3278		RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A2R44	0698-3181	1	RESISTOR 3.6K 5% .125W CC TUBULAR	01121	BB3625
A2R45	0698-3115	1	RESISTOR 10 OHM 5% .125W CC TUBULAR	01121	BB1005
A2R46	0698-3278		RESISTOR 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A2R47	0683-8215	1	RESISTOR 820 OHM 5% .25W CC TUBULAR	01121	CB8215
A2R48	0698-7564		RESISTOR 100K 5% .125W CC TUBULAR	01121	BB1C45
A2R49	0698-3113		RESISTOR 100 OHM 5% .125W CC TUBULAR	01121	BB1C15
A2R50	0698-3113		RESISTOR 100 OHM 5% .125W CC TUBULAR	01121	BB1C15
A2R51	0698-3113		RESISTOR 100 OHM 5% .125W CC TUBULAR	01121	BB1C15
A2S1	3101-1671	1	SWITCH PB 1-STA MECH SPDT	09353	PB121
	3101-1671	1	SWITCH PB ACCESS BUTTON CAP FOR	09353	A2527-2
A2S2	3101-1596	1	SWITCH SLD DPDT ASS 1A 125VAC	28480	3101-1596
A2S3	05345-40003	1	LEVER, SLIDE SWITCH	28480	05345-40003
	1251-2229	3	CONNECTOR-CONT SKT .031 DIA	00779	1-331677-3
	1460-0603	3	SPRING-HLCP .014-OD MLB	28480	1460-0603
	05345-40002	3	GUIDE, SWITCH	28480	05345-40002
A2S4	05345-40003		LEVER, SLIDE SWITCH	28480	05345-40003
	1251-2229		CONNECTOR-CONT SKT .031 DIA	00779	1-331677-3
	1460-0603		SPRING-HLCP .014-OD MLB	28480	1460-0603
	05345-40002		GUIDE, SWITCH	28480	05345-40002
A2S5	05345-40003		LEVER, SLIDE SWITCH	28480	05345-40003
	1251-2229		CONNECTOR-CONT SKT .031 DIA	00779	1-331677-3
	1460-0603		SPRING-HLCP .014-OD MLB	28480	1460-0603
	05345-40002		GUIDE, SWITCH	28480	05345-40002
A2S6	3100-3294	1	SWITCH SELECTOR	28480	3100-3294
A2TP1	0360-1682		TERMINAL SLDR STUD .070 SPH DIA	28480	0360-1682
A2TP2	0360-1682		TERMINAL SLDR STUD .070 SPH DIA	28480	0360-1682
A2U1	1826-0151	1	IC AMPLIFIER	28480	1826-0151
A2U2	1826-0088	1	IC DIGITAL	28480	1826-0088
A2U3	1906-0071	1	IC-LINEAR MISCELLANEOUS (LINEAR)	27014	LM311CH

See Introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2W1	8120-2039	1	CABLE, 16 CONDUCTOR	28480	8120-2039
A2XU1	1200-0475		CONNECTOR-CONT SKT .016 DIA	22526	75060-005
A3	05353-60003	1	LOOP INTERFACE ASSY	28480	05353-60003
A3C1	0180-0230	1	CAPACITOR-FXD 10UF+-20% 20VDC TA-SOLID	56289	150D106X9020B2
A3C2	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C3	0160-0156	3	CAPACITOR-FXD .0056UF+-10% 200WVDC	56289	292P56292
A3C4	0160-0156		CAPACITOR-FXD .0056UF+-10% 200WVDC	56289	292P56292
A3C5	0160-0156		CAPACITOR-FXD .0056UF+-10% 200WVDC	56289	292P56292
A3CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3R1	0683-1035	2	RESISTOR 10K 5% .25W CC TUBULAR	01121	CB1035
A3R2	0683-1035		RESISTOR 10K 5% .25W CC TUBULAR	01121	CB1035
A3R3	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A3R4	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A3R5	1810-0020	1	CIRCUITS P...., NON-REPAIRABLE IN	28480	1810-0020
A3R6	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A3R7	0683-5125		RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A3S1	3101-1826	1	SWITCH ASSY:ROCKER D.I.P. 1P1 SPST	00779	435166-1
A3S1	1200-0485	1	SOCKET:IC 14-PIN PC MOUNTING	28480	1200-0485
A3TP1	0360-1682		TERMINAL SLDR STUD .030 SHK DIA	28480	0360-1682
A3TP2	0360-1682		TERMINAL SLDR STUD .030 SHK DIA	28480	0360-1682
A3TP3	0360-1682		TERMINAL SLDR STUD .030 SHK DIA	28480	0360-1682
A3TP4	0360-1682		TERMINAL SLDR STUD .030 SHK DIA	28480	0360-1682
A3U1	1820-0781		IC:DGTL:FLIP-FLOP	01295	SN74107N
A3U2	1820-1047	1	IC:DGTL:DECODER/DEMODER DRVR/DATA DIST	27014	DM74LS42N
A3U3	1820-0504	1	IC:DGTL:COMPARATOR	07263	93L24DC
A3U4	1820-0174		IC:DGTL:INVERTER	01295	SN74C4N
A3U5	1820-0589	2	IC:DGTL:GATE	27014	DM74L30N
A3U6	1820-0077		IC:DGTL:FLIP-FLOP	01295	SN7474N
A3U7	1820-0876	1	IC:DGTL:LATCH	01295	SN74LS5N
A3U8	1820-0511		IC:DGTL:GATE	01295	SN7408N
A3U9	1820-0707	1	IC:DGTL:GATE	01295	SN74279N
A3U10	1820-0511		IC:DGTL:GATE	01295	SN7408N
A3U11	1820-0054		IC:DGTL:GATE	01295	SN74C00N
A3U12	1820-0174		IC:DGTL:INVERTER	01295	SN7404N
A3U13	1820-1056	1	IC:DGTL:SCHMITT TRIGGER	01295	SN74L132N
A3U14	1820-0583	1	IC:DGTL:GATE	27014	DM74L00N
A3U15	1820-0589		IC:DGTL:GATE	27014	DM74L30N
A3U16	1820-0580	1	IC:DGTL:INVERTER	27014	DM74L04N
A3U17	1820-0621	1	IC:DGTL:BUFFER/DRIVER/LINE DRIVER	01295	SN7438N
A3XU1	1200-0485		SOCKET:IC 14-PIN PC MOUNTING	28480	1200-0485
	5080-7043	2	PIN:P.C. BOARD EXTRACTOR	28480	5040-7043
	5040-7043	2	EXTRACTOR, P.C. BOARD	28480	5040-7043
A4	05353-60004	1	GATE ASSY	28480	05353-60004
A4C1	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A4C2	0160-3060	1	CAPACITOR-FXD .1UF+-20% 25WVDC	28480	0160-3060
A4C3	0180-1114		CAPACITOR-FXD 330UF+-10% 6VDC TA-SOLID	56289	150D337X9006S2
A4C4	0180-1702	1	CAPACITOR-FXD 180UF+-20% 6VDC TA-SOLID	56289	150D187X0006A2
A4C5	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A4C6	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A4C7	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A4CR1	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4J1	1250-0835		CONNECTOR-EDGE SPCE 50 CKM MALE	24931	3TJP1C4-2
A4J2	1250-0835		CONNECTOR-EDGE SPCE 50 CKM MALE	24931	3TJP1C4-2
A4L1	9100-1708		COIL: FXD MOLDED RF CHOKE, .75UH	02114	VK200-20/4B
A4L2	9100-1616	1	COIL: FXD MOLDED RF CHOKE 100UH 5%	24226	15/113
A4R1	0757-0925	4	RESISTOR 1.1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1101-G
A4R2	0757-0925		RESISTOR 1.1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1101-G
A4R3	0757-0925		RESISTOR 1.1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1101-G
A4R4	0757-0538	1	RESISTOR 2K 2% .125W F TUBULAR	24546	C4-1/8-T0-2001-G
A4R5	0757-0451	5	RESISTOR 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A4R6	0757-0925		RESISTOR 1.1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1101-G
A4R7	0757-0937	5	RESISTOR 3.6K 2% .125W F TUBULAR	24546	C4-1/8-T0-3601-G
A4R8	0698-7205	2	RESISTOR 51.1 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-51R1-G
A4R9	0757-0937		RESISTOR 3.6K 2% .125W F TUBULAR	24546	C4-1/8-T0-3601-G
A4R10	0757-0537		RESISTOR 1.8K 2% .125W F TUBULAR	24546	C4-1/8-T0-3601-G

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R11	0757-0537		RESISTOR 1.6K 2% .125W F TUBULAR	24546	C4-1/8-T0-1601-G
A4R12	0757-0693	1	RESISTOR 82 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-82R0-G
A4R13	0757-0493		RESISTOR 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A4R14	0757-0493		RESISTOR 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A4R15	0698-7405		RESISTOR 51.1 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-51R1-G
A4R16	0757-0477	2	RESISTOR 1.0K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A4R17	0757-0477		RESISTOR 1.0K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A4R18	2100-2216	2	RESISTOR: VARI TRMR 5K OHM TOP C	30983	ET50W502
A4R19	2100-2216		RESISTOR: VARI TRMR 5K OHM TOP C	30983	ET50W502
A4R20	0698-4037	2	RESISTOR 46.4 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-46R4-F
A4R21	0757-0493		RESISTOR 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A4R22	0698-4037		RESISTOR 46.4 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-46R4-F
A4R23	0757-0493		RESISTOR 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A4R24	0698-7405		RESISTOR 51.1 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-51R1-G
A4TP1	0360-0124	3	TERMINAL .040 .040	28480	0360-0124
A4TP2	0360-0124		TERMINAL .040 .040	28480	0360-0124
A4TP3	0360-0124		TERMINAL .040 .040	28480	0360-0124
A4U1	1820-0996	3	IC:DIGITAL/MULTIPLEXER	28480	1820-0996
A4U2	1820-0996		IC:DIGITAL/MULTIPLEXER	28480	1820-0996
A4U3	1820-0996		IC:DIGITAL/MULTIPLEXER	28480	1820-0996
	1200-0675	AR	CONNECTOR:LGHT SKT .081in DIA	22526	75060-005
	5060-9063		PINPAC, BOARD EXTRACTOR	28480	5060-9063
	5060-6863		EXTRACTOR, P.C. BOARD	28480	5060-6863
A5	05353-60005	1	INTERCONNECT ASSY	28480	05353-60005
A5CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
J5J1	1251-3283	1	CONNECTOR:24-CONTACT PINS MICRORIBBON	28480	1251-3283
A5RP1	1810-0116	2	RESISTIVE NETWORK	28480	1810-0116
A5RP2	1810-0116		RESISTIVE NETWORK	28480	1810-0116
A5W1	8120-0596	1	CABLE:UNSHLD 24-COND 28AWG	01121C	CA-L24P02-28T-0C-005
	1530-1070	2	FASTENER,.130" DIA 4-32 THREAD	00000	ORD
			CHASSIS PARTS		
C1	0150-0093	1	CAPACITOR-FXD .01UF 80%-20% 100VDC	28480	0150-0093
J1	1250-0083	1	CONNECTOR-COAXIAL BNC 50 OHM FEMALE	24931	28JR-130-1
FOR R4	0370-1005	1	KNOB:BASIC PTR .375 IND JGRS SET	28480	0370-1005
FOR S6	0370-1079	1	KNOB, BASIC, PTR, .5 IN, JGR, SET DELRI	28480	0370-1079
			MISCELLANEOUS PARTS		
	0590-0043	1	NUT:HEX 1/4-32 .375 W .312 HEIGHT PL	28480	0590-0043
	1410-0547	1	BUSHING-PANEL	28480	1410-0547
	1410-1135	1	BUSHING:PANEL 1/4-32 TFE BRASS	28480	1410-1135
	1460-1186	1	SPRING:WAVE 2.622-IN PLN	28480	1460-1186
	2950-0167	1	NUT:HEX 3/4-32 .375 W CD BRSE NI-STD	28480	2950-0167
	05353-40006	2	GUIDE, PC BOARD	28480	05353-40006
	05353-00001	1	PANEL, LEFT	28480	05353-00001
	05353-00002	1	PANEL, RIGHT	28480	05353-00002
	05353-00003	1	PANEL, REAR	28480	05353-00003
	05353-00004	1	PLATE, CONNECTOR HOLE OPTION CAL	28480	05353-00004
	05353-00005	1	COVER	28480	05353-00005
	05353-00006	1	PANEL, FRONT	28480	05353-00006
	05353-00007	1	PLATE, PATCH	28480	05353-00007
	05353-00010	1	PANEL, SUB-FRONT	28480	05353-00010
	05353-60020	1	CABLE ASSY, REAR PANEL	28480	05353-60020
	05353-60021	1	CABLE ASSY, INTERCONN	28480	05353-60021
	0403-0051	1	HANDLE, DRAWER LATCH	28480	0403-0051
	0363-0057	1	SCREW, LATCH	28480	0363-0057
	10550-00001	1	SPACER, CONNECTOR ALIGNMENT	28480	10550-00001

See introduction to this section for ordering information

Table 6-2. Manufacturers Code List

Mfr. No.	Manufacturer Name, Address, and Zip Code
00000	U.S.A. Common
00779	Amp Inc., Harrisburg, Pa. 17105
01121	Allen Bradley Co., Milwaukee, Wi. 53212
01210	Circuit Assembly Corp., Santa Ana, Ca. 92707
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
08353	C and K Components Inc., Watertown, Ma. 02172
16299	Corning Gl Wk Elec Cmpnt Div, Raleigh, N.C. 27604
19701	Mepco/Electra Corp., Mineral Wells, Tx. 76067
22526	Berg Electronic Inc., Cumberland, Pa. 17070
23880	Stanford Applied Engineering, Inc., Santa Clara, Ca. 95050
24226	Gowanda Electronics Corp., Gowanda, NY 14070
24546	Corning Glass Works, Bradford, Pa. 16701
24931	Specialty Connector Co., Inc., Indianapolis, In. 46227
27014	National Semiconductor Corp., Santa Clara, Ca. 95051
28480	Hewlett-Packard Co. Corporate HQ, Palo Alto, Ca. 94304
30983	Mepco/Electra Corp., San Diego, C... 92121
56289	Sprague Electric Co., North Adams, Ma. 01247
71785	TRW Elek Components Cneh Div., Elk Grove Village, Il. 60007
72136	Electro Motive Mfg Co. Inc., Willimantic, Ct. 06226
99800	Amer Pren Ind Inc Delevan Div., Aurora, NY 14052

BACK DATING MANUAL CHANGES

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION

7-2. This section contains information necessary to adapt this manual to newer instruments. Also included is information for available options. Refer to Section II for HP Interface bus information.

7-3. MANUAL CHANGES

7-4. This manual applies directly to Models 5353A with serial prefix 1416A. See paragraph 1-10 for 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. OPTIONS

7-8. Option 011 is available for the 5353A. Following is a description of the option.

7-9. HP Bus Interface, Option 011

7-10. Option 011 consists of Bus Interface Assembly A3 (05353-60003), Interconnect Assembly A5 (05353-60005) and a connector plate 05353-00004. Specifications are listed in Table 1-1. Programming information for this option is given in Section II. The schematic diagrams and component locators are located in Section VIII. See Section VI for the parts list. Theory of Operation is contained in Section IV.

7-11. FIELD INSTALLATION OF OPTIONS

7-12. Installation of Option 011, HP Bus Interface

7-13. The following parts are required:

1	A3 Bus Interface Assembly, HP Part No. 05353-60003	1 each
2	A5 Interconnect Assembly, HP Part No. 05353-60005	1 each
3	Connector Plate, HP Part No. 05352-00004	1 each
4	6-32 x 5/16" Pozidrive Screw, HP Part No. 2360-0115	4 each
5	6-32 x 3/8" Pozidrive Screw, HP Part No. 2360-0117	1 each
6	Stud, Threaded Hex 8-32: Connector Retainer Male/Female, HP Part No. 0380-1036	1 each

7-14. To install Option 011, refer to Figure 8-4 for instrument photos and Figures 8-7 for the schematics of Option 011. Proceed as follows:

a. On 5353A rear panel, remove blank connector plate. Install new connector plate to rear panel using four 6-32 x 5/16" pozidrive screws.

b. On back shelf of 5353A rear chassis, mount assembly A5 on standoff using 6-32 x 3/8" pozidrive screw. Components face toward the top of the instrument and the 24-pin connector protrudes through the new connector plate.

c. Connect A5 cable plug to J4 on Motherboard A1.

d. Secure 24-pin A5 connector to connector plate on rear panel using two 8-32 hex threaded studs.

e. Install assembly A3 into XA3 on Motherboard. This completes installation of Option 011. Refer to Section II for programming information and address setting.

SCHEMATIC DIAGRAMS

SECTION VIII

SCHEMATIC DIAGRAMS

8-1. SCHEMATIC DIAGRAMS

8-2. This section contains schematic diagrams, assembly and chassis part locators, and component locators. The schematics are presented in assembly number order A1 through A5. The component, chassis, and assembly locators show the location by reference designator.

8-3. SCHEMATIC DIAGRAM NOTES, ASSEMBLY NUMBERS, AND REFERENCE DESIGNATORS

8-4. Figure 8-1 shows the symbols used on the schematic diagrams. At the bottom of Figure 8-1, the system for reference designators, assemblies, and subassemblies is shown.

8-5. Reference Designations

8-6. Assemblies such as printed circuit boards are assigned numbers in sequence, A1, A2, etc. As shown in Figure 8-1, subassemblies within an assembly are given a subordinate A number. For example, rectifier subassembly A1 has the complete designator of A25A1. For individual components, the complete designator is determined by adding the assembly number and subassembly number if any. For example CR1 on the rectifier assembly is designated A25A1CR1.

8-8. Identification Markings on Printed-Circuit Boards

8-9. HP printed circuit boards (see Figure 8-1) have four identification numbers; an assembly part number, a series number, a revision letter, and a production code.

8-10. The assembly part number has 10 digits (such as 05340-60037) and is the primary identification. All assemblies with the same part number are interchangeable. When a production change is made on an assembly that makes it incompatible with previous assemblies, a change in part number is required. The series number (such as 1248A) is used to document minor electrical changes. As changes are made, the series number is incremented. When replacement boards are ordered, you may receive a replacement with a different series number. If there is a difference between the series number marked on the board and the schematic in this manual, a minor electrical difference exists. If the number on the printed-circuit board is lower than that on the schematic, refer to Section VII for back dating information. If it is higher, refer to the loose leaf manual change sheets for this manual. If the manual change sheets are missing, contact your local Hewlett-Packard Sales and Service Office. See the listing on the back cover of this manual.

8-11. Revision letters (A, B, etc.) denote changes in printed circuit layout. For example, if a capacitor type is changed (electrical value may remain the same) and requires different spacing for its leads, the printed circuit board layout is changed and the revision letter is incremented to the next letter. When a revision letter changes, the series number is also usually changed. The production code is the four digit, seven segment number used for production purposes.

8-12. ASSEMBLY LOCATIONS AND COMPONENT LOCATORS

8-13. Figures 8-2 through 8-4 show the front, rear, and top views of the 5340A. Component locators for each printed circuit assembly are located next to the schematics.

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

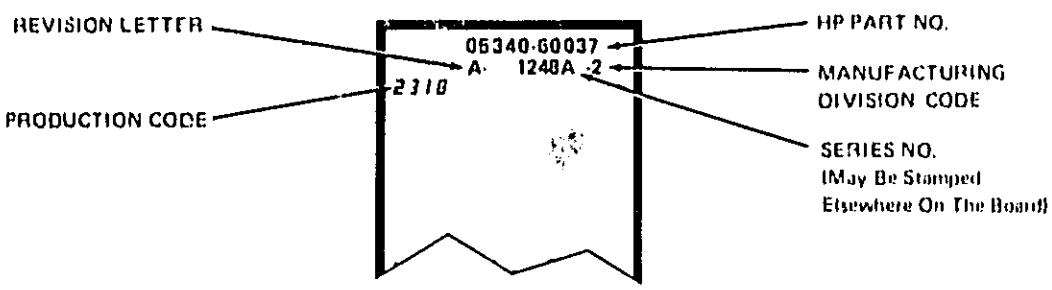
INVERTER

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

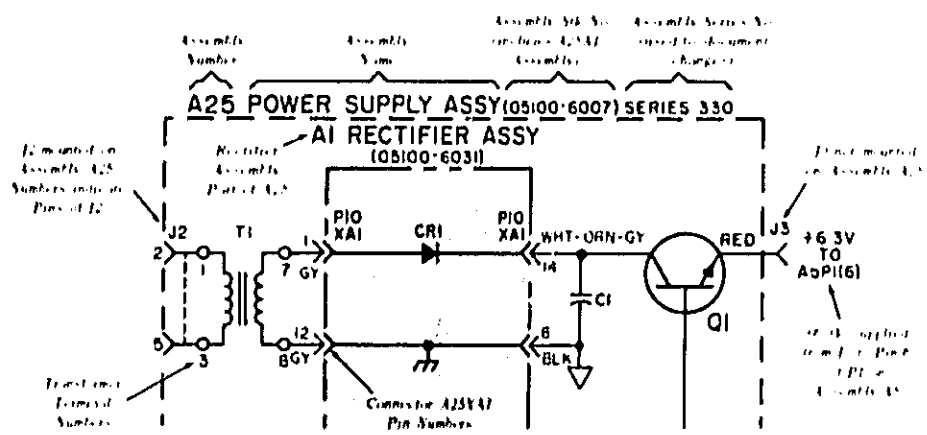


Figure 8-1. Schematic Diagram Notes

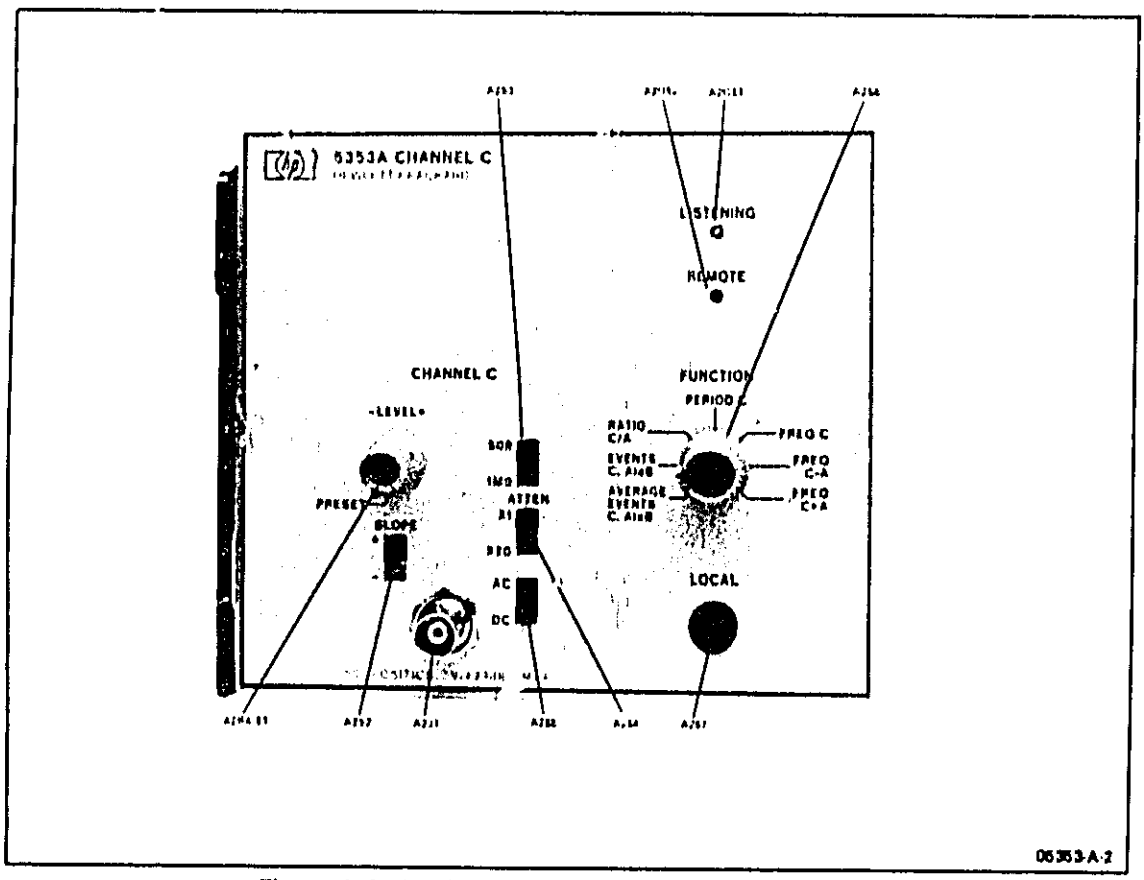


Figure 8-2. 5353A Front Panel Reference Designators

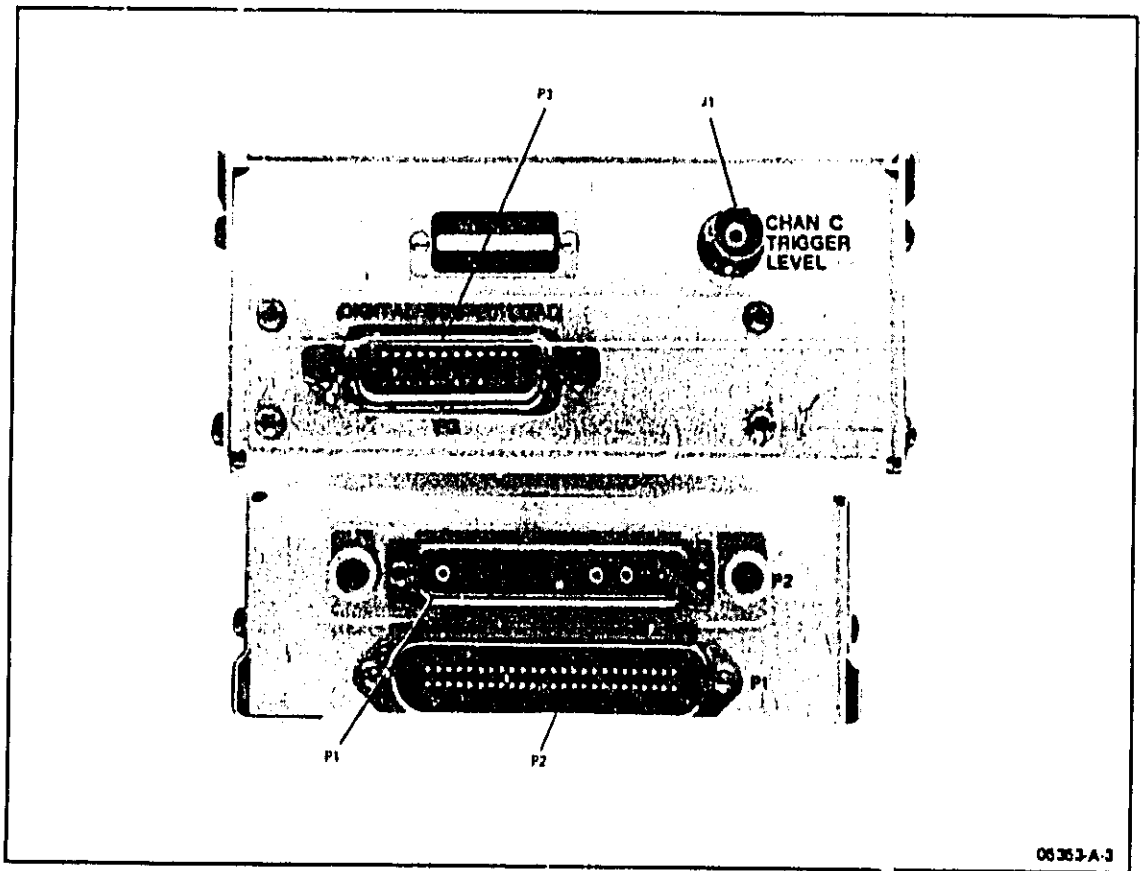


Figure 8-3. 5353A Rear Panel Reference Designators (with Option 01 Installed)

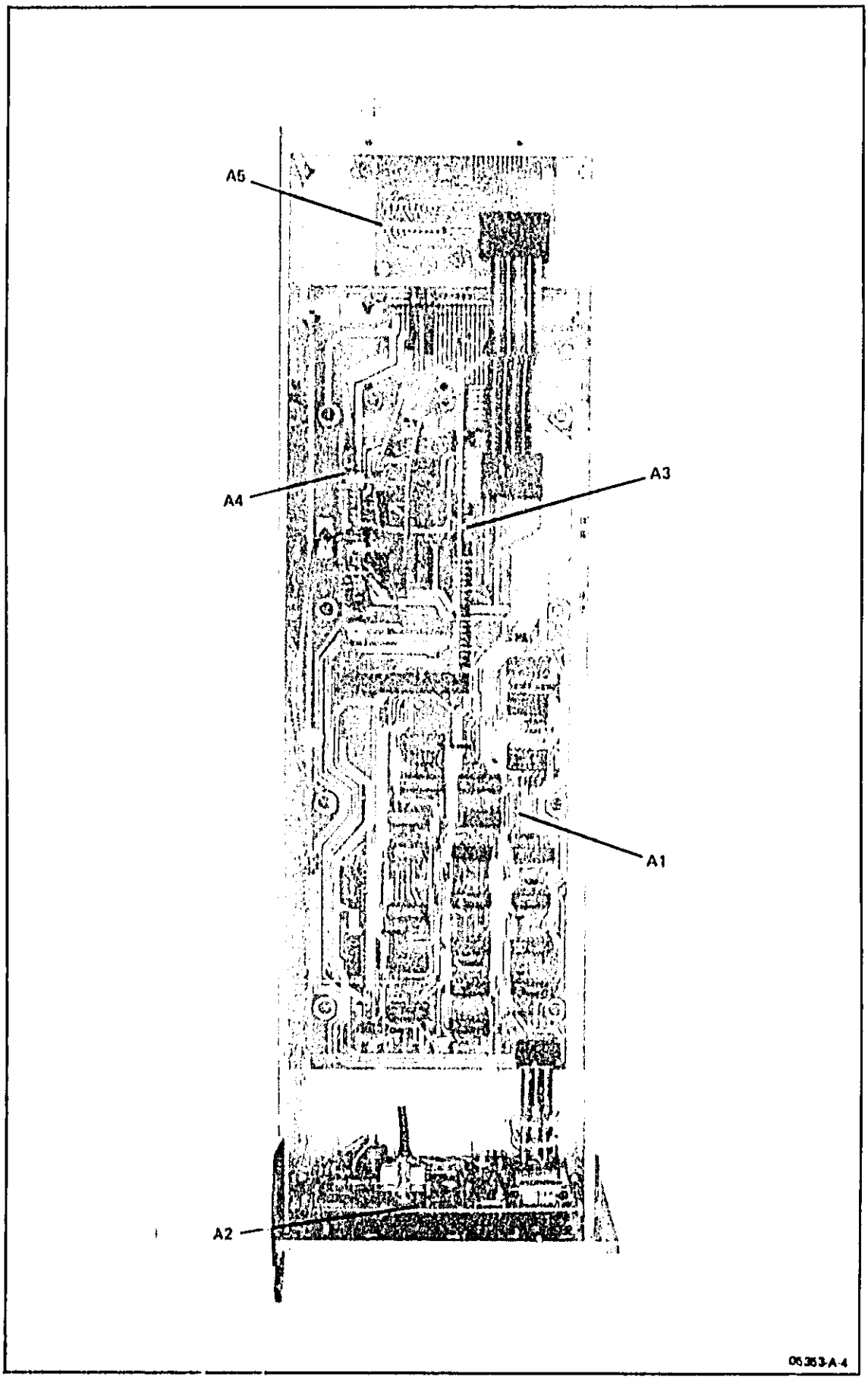
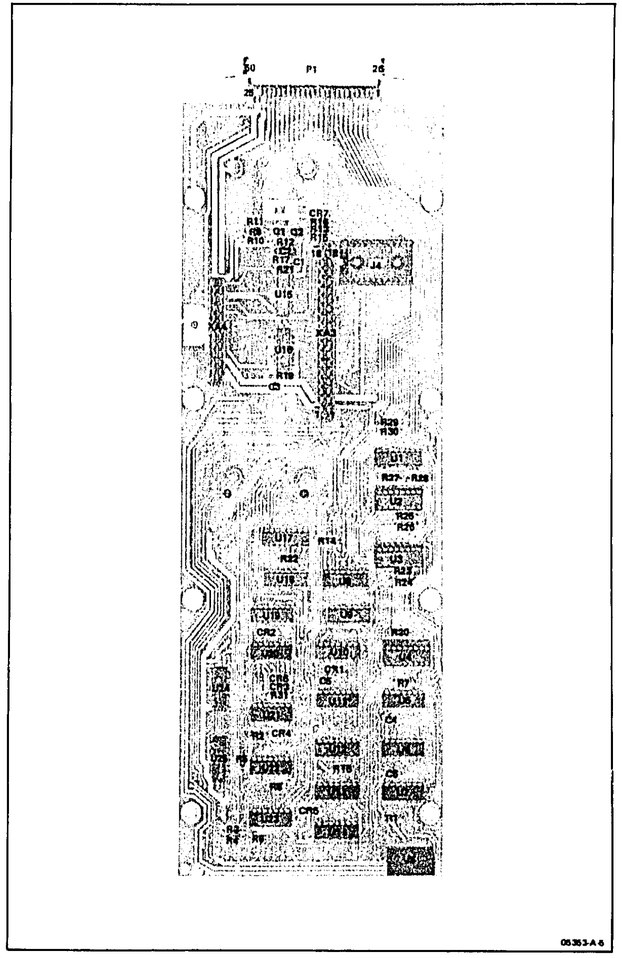


Figure 8-4. Top Internal View



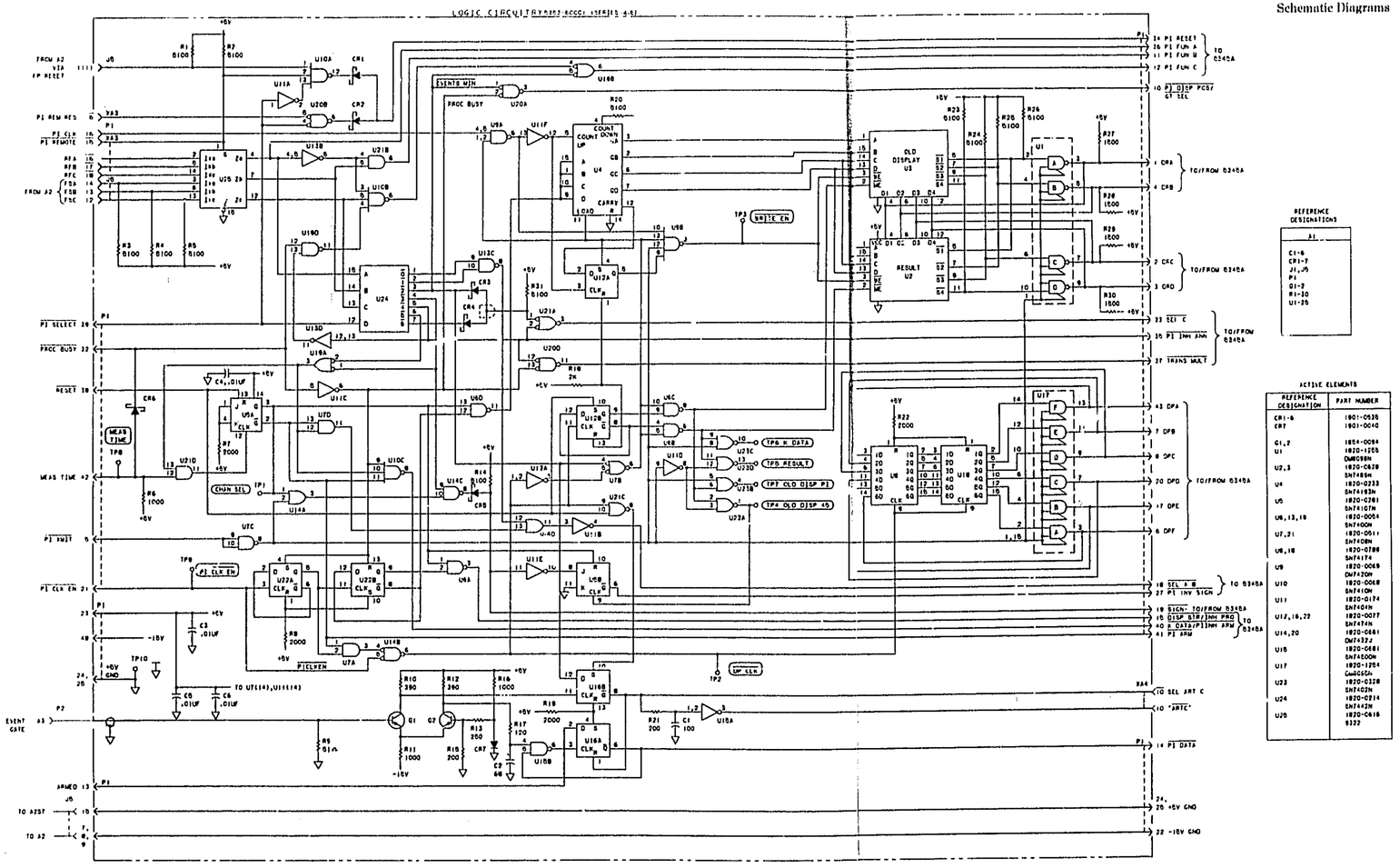
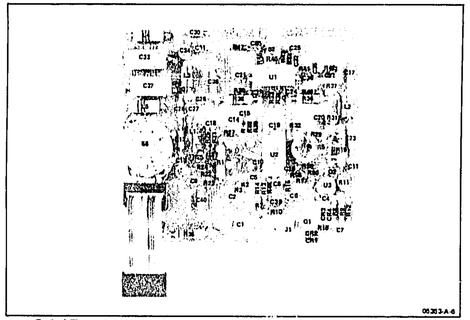
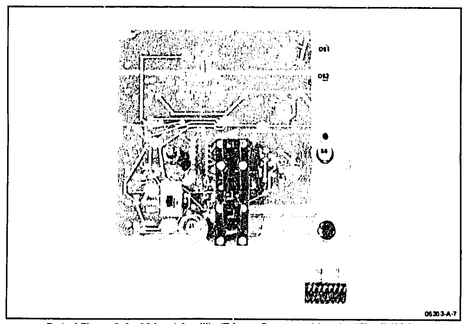


Figure 8-5
A1 MOTHERBOARD ASSEMBLY SCHEMATIC DIAGRAM



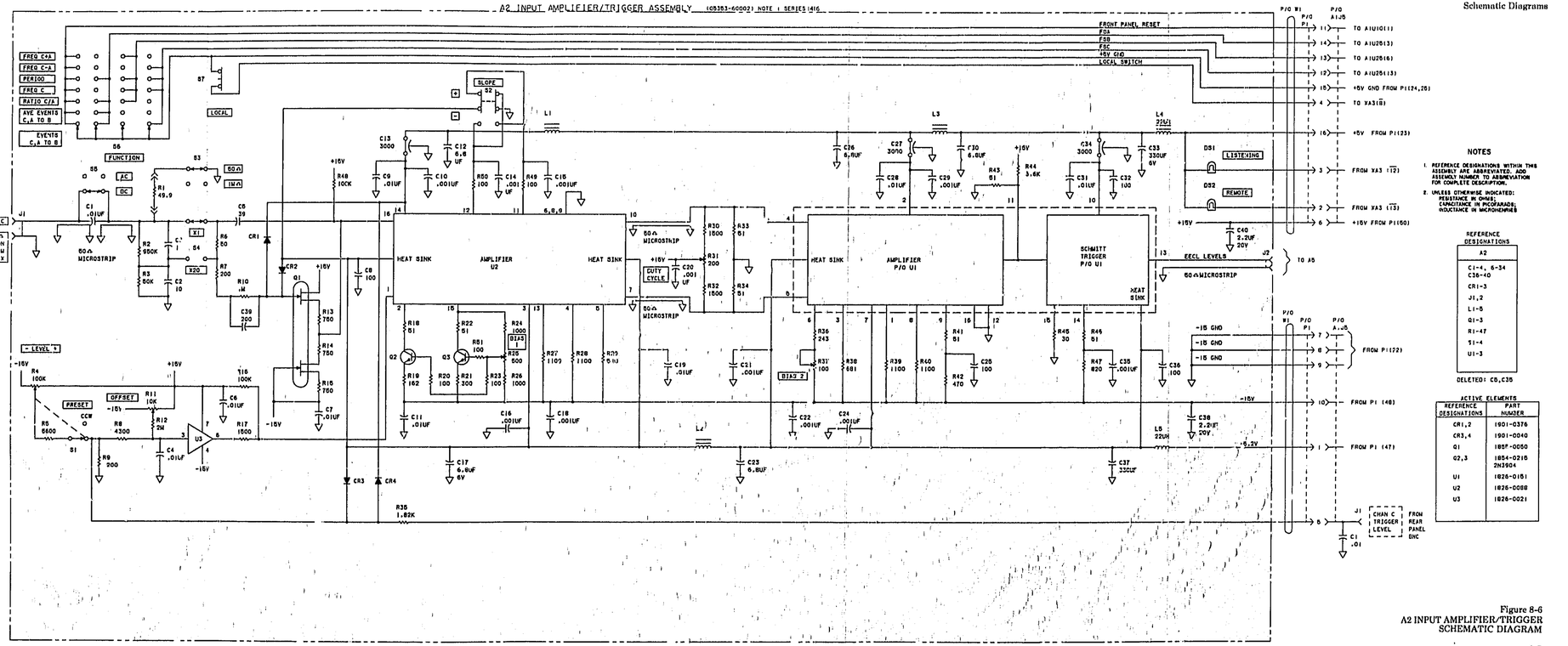
05353-A-6

Part of Figure 8-6. A2 Input Amplifier/Trigger Component Locator (Component Side)



05353-A-7

Part of Figure 8-6. A2 Input Amplifier/Trigger Component Locator (Circuit Side)



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 MICROFARADS; INDUCTANCE IN MICROHENRIES

REFERENCE DESIGNATIONS

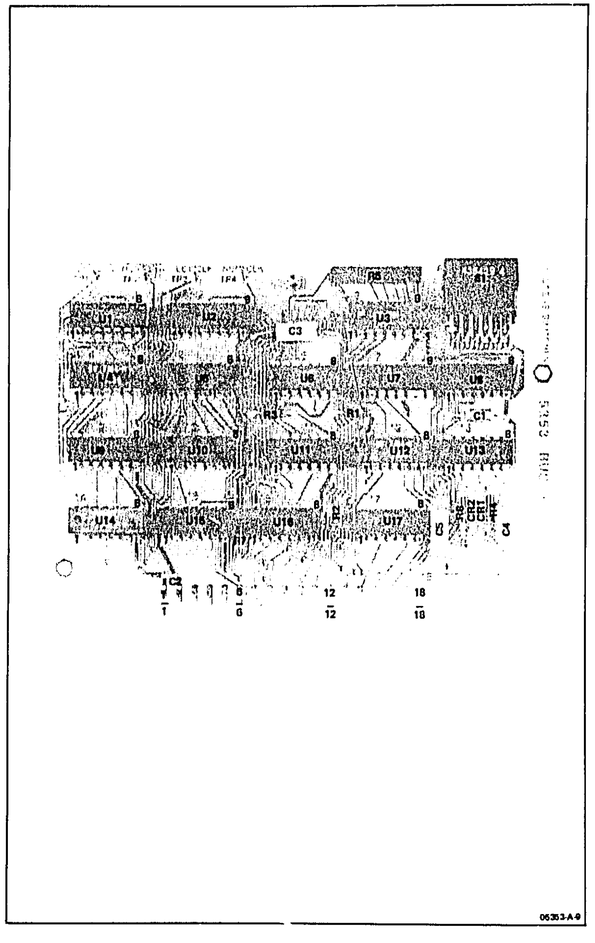
A2
C1-4, 6-34 C36-40 CR1-3 J1,2 L1-5 Q1-3 R1-47 S1-4 U1-3

DELETED: C5,C35

ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	PART NUMBER
CR1,2	1901-0376
CR3,4	1901-0040
Q1	1855-0050
Q2,3	1854-0215 2N3904
U1	1826-0151
U2	1826-0088
U3	1826-0021

Figure 8-6
A2 INPUT AMPLIFIER/TRIGGER
SCHEMATIC DIAGRAM



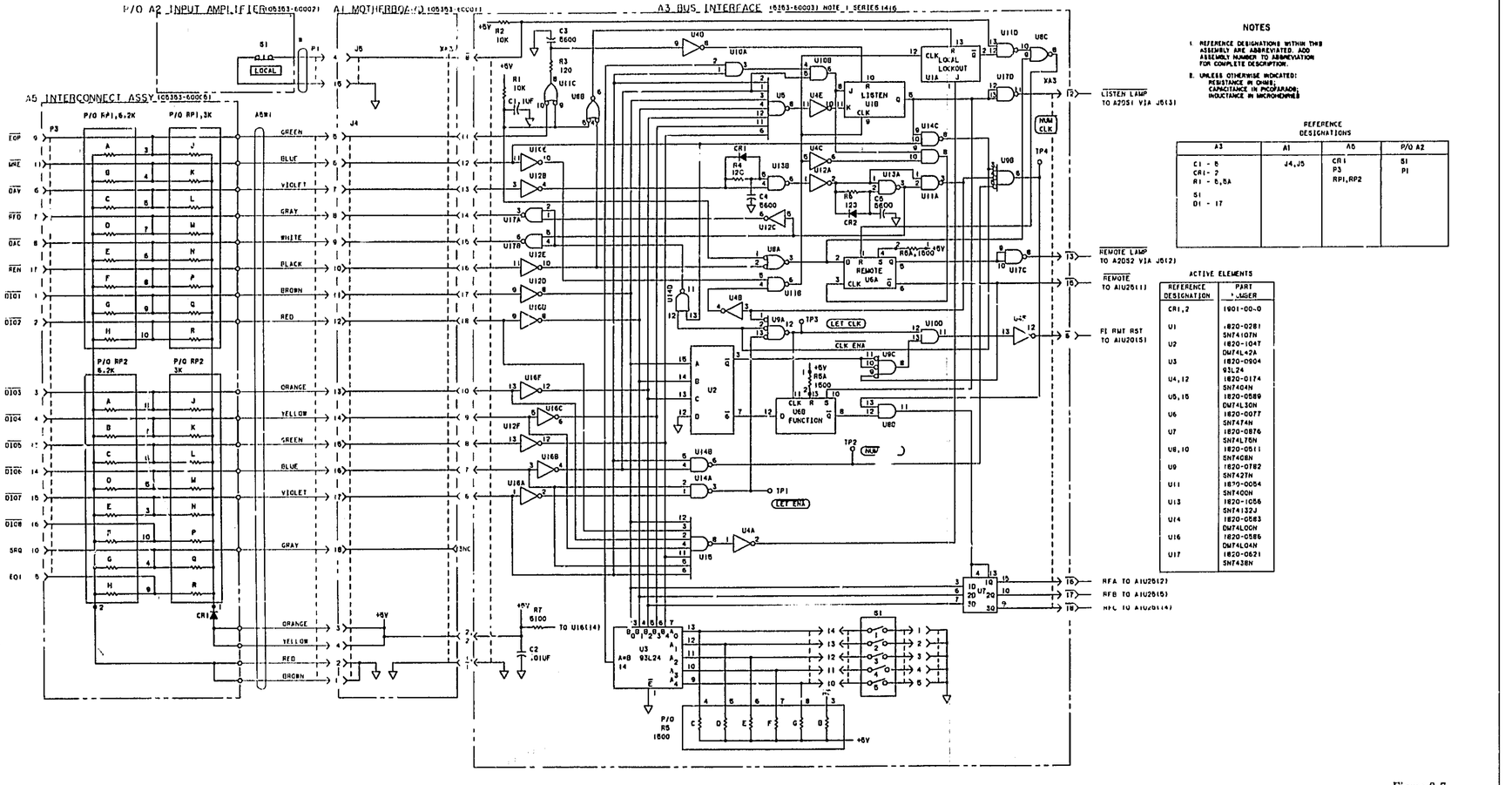
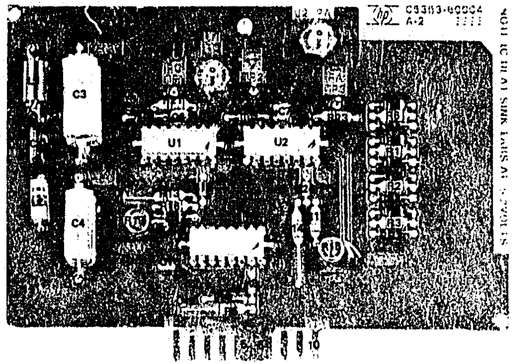


Figure 8-7
A3 BUS INTERFACE ASSEMBLY, A5 INTERCONNECT ASSEMBLY (OPTION 011) SCHEMATIC DIAGRAM



05353-A-8

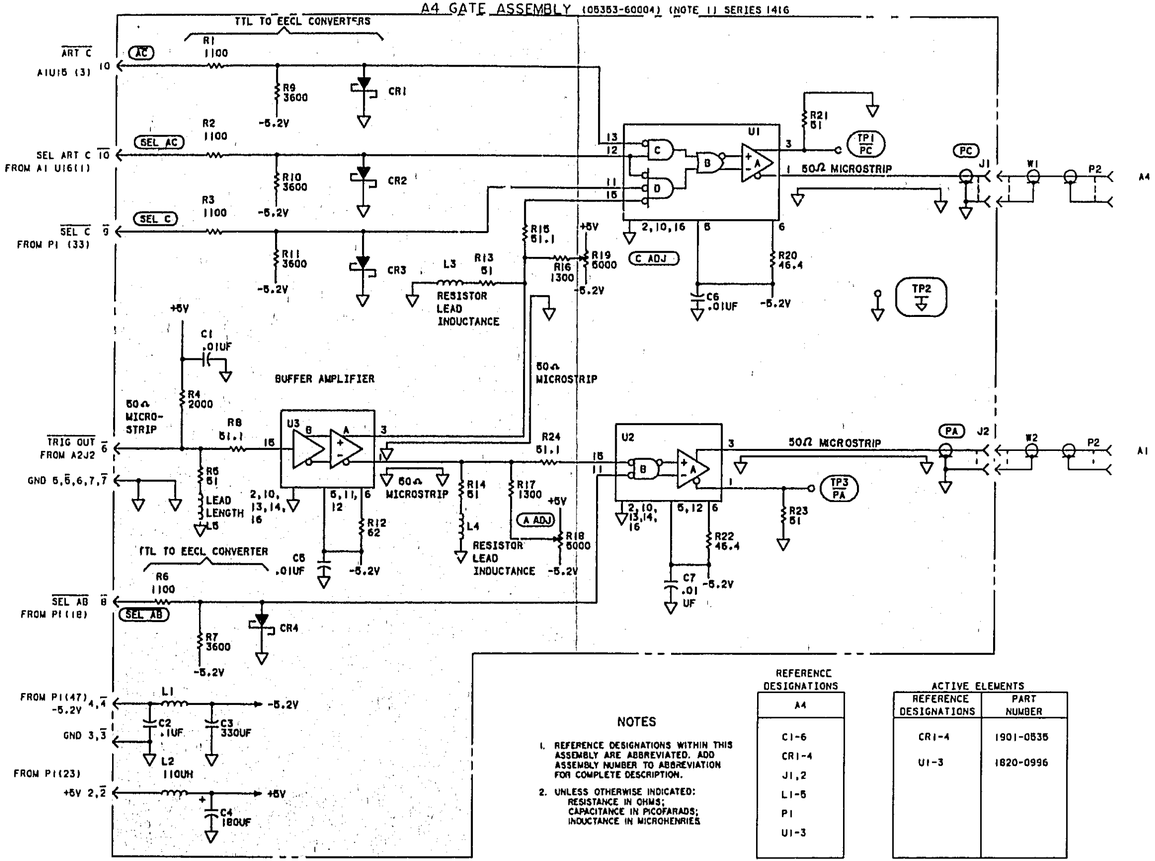


Figure 8-8
A4 GATE ASSEMBLY SCHEMATIC DIAGRAM

MANUAL CHANGES

HEWLETT PACKARD

MANUAL CHANGES

MANUAL DESCRIPTION

INSTRUMENT: Channel C Plug-In 5353A
Operating and Service Manual
SERIAL PREFIX: 1416A

DATE PRINTED: MAY 1974
HP PART NO: 05353-90002
MICROFICHE NO: 05353-90003

CHANGE DATE April 12, 1978

(This change supersedes all earlier dated changes)

- Make all changes listed as ERRATA.
- Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL	IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL
1424A	1	1720A	1,2,3,4,5,6
1444A	1,2	►1816A	1,2,3,4,5,6,7
1524A	1,2,3		
1624A	1,2,3,4		
1640A	1,2,3,4,5		

► NEW OR REVISED ITEM

ERRATA

Page 6-3, Table 6-1:
Add A1C7, A1C8 0160-0134 CAPACITOR: FXD 220 PF 300V.
Add A1R32 0698-3113 RESISTOR: FXD 100 OHM 1/8W.
Add A1R33 0683-8205 RESISTOR: FXD 82 OHM 1/4W.

Page 6-4 Table 6-1:
Add A2C41 0180-0210 CAPACITOR: FXD 3.3UF ±20% 15V TA.

Page 6-6, Table 6-1:
Add A3C6 0160-2055 CAPACITOR: FXD .01 UF CER +80-20% 100Vdcw.

Page 8-5, Figure 8-5:
Add A1C7 and A1C8, 220 pF each, A1R32 100 OHM, and A1R33 82 OHM as shown in Figure A.

Page 8-7, Figure 8-6 and Page 8-9, Figure 8-7, A2 Schematic Diagrams:
Add A2C41 3.3 UF as shown in Figure B.

Page 8-9, Figure 3-7, A3 schematic:
Add A3C6 .01 UF as shown in Figure C.

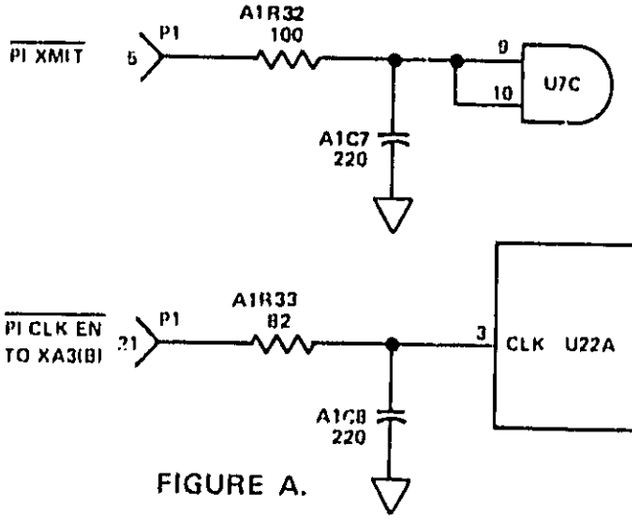


FIGURE A.

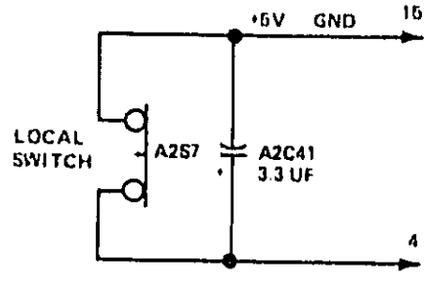


FIGURE B.

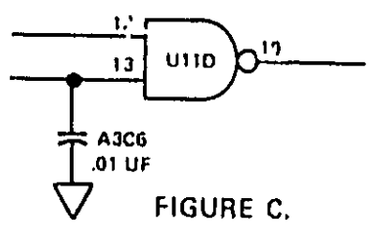


FIGURE C.

ERRATA (Cont'd)

Page 6-6, Table 6-1, A3 (05353-60003) Replaceable Parts:
Change A3S1 from 3101-1826 to 3101-2162; SWITCH ASSY: ROCKER D.I.P. (7) SPST; 00779; 3-435166-5.

Page 8-7, Figure 8-6, A2 Schematic Diagram:
Change 100Ω resistor in series with base of A2Q3 from R51 to R23.
Delete 100Ω resistor marked R23 (shown in series with R20) and connect R20 directly to the arm of "B1AS1" control R26.

CHANGE 1 (1424A)

Page 6-6, Table 6-1:
Add A3C7 0160-2930 CAPACITOR: FXD CER .01 UF +80 -20% 100V.

Page 8-9, Figure 8-7, A3 schematic:
Add A3C7 .01 UF; connected between U12E(10) and +5V.
Change board Series No. at top of schematic to 1424A.

CHANGE 2 (1444A)

Page 1-2, Table 1-1 Specifications:
Change 5353A (Channel C) specifications to the following:

5353A CHANNEL C PLUG-IN SPECIFICATIONS

Modes of Operation: Frequency C+A; Frequency C-A; Period C; Frequency C; Ratio C/A; Average Events C, A to B; Events C, A to B.

Range: DC Coupled 0 to 500 MHz
AC Coupled 1 MΩ 200 Hz to 500 MHz
50Ω 4 MHz to 500 MHz

Impedance: Switch selectable, 1MΩ shunted by less than 30 pf or 50Ω nominal

Sensitivity: (preset)
X1 20 mV rms sine wave, 60 mV p-p pulse
X20 400 mV rms sine wave, 1.2 V p-p pulse

Dynamic Range: (preset)
50Ω X1 20 mV to 400 mV rms sine wave
60 mV to 1.2 V p-p pulse
X20 400 mV to 7 V rms sine wave
1.2 V to 7 V p-p pulse
1 MΩ X1 20 mV to 400 mV rms sine wave
60 mV to 1.2 V p-p pulse
X20 400 mV to 8V rms sine wave
1.2 V to 24 V p-p pulse

Linear Operating Range: -2.0 V to +0.5 V dc

Trigger Level: Continuously adjustable over ±1.3 V dc. Adjustment is nonlinear with more settability around zero volts.

Minimum Time Between Trigger Points:
Average Events C to A: A to B 10 nsec, B to A 10 nsec
Events C to A: A to B 10 nsec, B to A 100 nsec

Preset: Centers trigger level about dc at 23°C

Drift: ±10 mV dc max., 0°C to 55°C

Output: Trigger voltage (XATTEN) is accurate to within ±15 mV (XATTEN) of actual trigger point hysteresis center. Rear BNC connector.

Slope: Selectable positive or negative

Maximum Input: Damage may occur beyond specified level. For larger inputs voltage divider probes 10020A (50Ω) or 10004B (1MΩ) are recommended.

50Ω X1 ±7 V dc
7 V rms below 5 MHz
3.5 V rms (+24 dBm) above 5 MHz
X20 ±7 V dc, 7 V rms (+30 dBm)
1MΩ X1 ±350 V dc
250 V rms to 20 kHz
3.5 V rms above 5 MHz
X20 ±350 V dc
250 V rms to 20 kHz
70 V rms above 5 MHz

CHANGE 2 (1444A) (Cont'd)

5353A CHANNEL C PLUG-IN SPECIFICATIONS (Cont'd)

Gate Ouput: 5345A GATE OUPUT changes to >0.5V with the 5353A installed.

Option 011: Digital Input. Fully compatible with HP-Interface Bus. Provides for digital control over all functions excluding amplifier.

Page 6-3, Table 6-1:
Change A1R32 from 1/8W resistor HP Part No. 0698-3113 to 1/4W Part No. 0683-1015.
Add A1R34; 0683-5125; RESISTOR 5.1K 5% CC TUBULAR; 01121; CB 5125.

Page 6-4, Table 6-1:
Delete A2C41 3.3 μF capacitor HP Part No. 0180-0210.

Page 8-6, Figure 8-6 and Page 8-9, Figure 8-7 Schematics:
Remove direct connection from A1J5(4) to A1XA3(8).
Add A1R34 (5100 OHMS) and connect A1U15C (8,9,10) as shown in Figure D.

Page 8-7, Figure 8-6 and Page 8-9, Figure 8-7 Schematics:
Delete A2C41 (3.3 μF in parallel with A2S7).
Show A2S7 wired for "normally open" connection as shown in Figure D.

Page 6-5, Table 6-1:
Change A2R5 from 0683-5625 (5600 OHMS) to 0683-2025; 2000 OHMS 5% .25W;
Mfr Part Number CB2025.

Page 8-7, Figure 8-6, A2 Schematic Diagram:
Add an asterisk (*) adjecent to reference designator for resistor A2R36.
Change A2R5 from 5600 to 2000 ohms.

With the above changes A1 and A2 circuit boards are both Series 1444A.

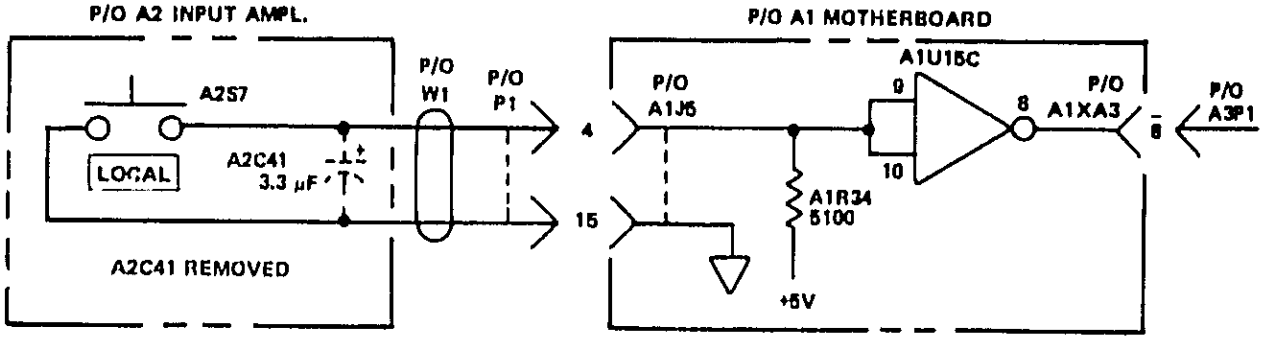


FIGURE D.

CHANGE 3 (1624A)

Page 6-4, Table 6-1, A2 Replaceable Parts:

Change A2 (05353-60002) "Description" from SERIES 1444A to SERIES 1624.

Change A2C5 from 0160-4058 (39 PF) to 0160-0552; 1; CAPACITOR-FXD 100 PF +-5% 400WVDC CER; 28480; 0160-0552.

Change A2Q1 from 1855-0050 to 1855-0225; TRANSISTOR FIELD EFFECT DUAL N CHANNEL S1; 28480; 1855-0225.

Change A2R11 from 2100-1738 to 2100-3216; 10K OHM 10% LINEAR 4-TURN TOP ADJ. TRMR CER; 28480; 2100-3216.

Change A2R12 from 0683-2055 (2 MEG.) to 0698-8623; RESISTOR-FXD 560K 5% 1/8W CC; 28480; 0698-8623.

Change A2R16, A2R48 from 0698-7964 (100K ohm) to 0698-8615; 75K OHM 1% .05W FILM; 28480; 0698-8615.

Change A2R31 from 2100-2061 (200 ohm) to 2100-1788; 500 OHM 10% TOP ADJ TRMR C; 84048; 170-501.

Change A2U1 from 1826-0151 to 1826-0290; AMPLIFIER/SCHMITT TRIGGER; 28480; 1826-0290.

Page 6-6, Table 6-1, A3 Replaceable Parts:

Add to A3 (05353-60003) Description "SERIES 1624".

Change A3C6 from 0160-2055 (.01 UF) and A3C7 from 0160-2930 (.01 UF) to 0160-3879; CAPACITOR-FXD .01 UF 20% 100WVDC CER; 28480; 0160-3879.

Page 6-8, Table 6-2, Manufacturer's Code List:

Add TRW IRC POTENTIOMETERS, 2801 72nd St. N, St. Petersburg, FL, 33733.

Page 8-7, Figure 8-6, A2 Schematic Diagram:

Change "SERIES 1444A" at top of diagram to "SERIES 1624".

Change A2C5 from 39 to 100 pF.

Change Q1 in "ACTIVE ELEMENTS" table from 1855-0050 to 1855-0225.

Change A2R12 from 2M to 560K ohms.

Change A2R16 and A2R48 from 100K to 75K ohms.

Change A2R31 from 200 to 500 ohms.

Change U1 in "ACTIVE ELEMENTS" table from 1826-0151 to 1826-0290.

CHANGE 4 (1624A)

Starting with Instrument Serial Prefix 1624A any instrument with HP-IB Option 011 will have metric threads in the mounting studs for the HP-IB connector.

The two mounting studs for the HP-IB connector are changed from 0380-1036 to 0380-0643. The 0380-0643 hex studs accommodate lock screws with ISO metric thread M3.5 x 0.6 or equivalent Optimum Metric Fastener System (OMFS) thread 3.5 P06.

Metric hardware supplied by HP for HP-IB connectors can be identified by the black finish. If metric tools are not available, a 9/32 inch hex socket will fit the 7 mm hex stud.

Conversion Kits for converting earlier instruments to use the metric lock screws are available through any HP Sales or Service Office.

CAUTION

THE THREADS OF THE METRIC HARDWARE WILL NOT FIT THE 6-32 UNC THREADS ON HARDWARE WITH A SILVER FINISH. THE THREADS WILL STRIP IF THE HARDWARE IS INTERMIXED.

A Serial Prefix 1624A instrument less Option 011 is electrically identical to an instrument with Serial Prefix 1624A.

CHANGE 5 · (1640A)

Page 6-5, Table 6-1, A2 (05353-60002) Replaceable Parts:

Change A2 from series 1524 to 1640.

Change A2R7 from 0698-6174 (200Ω) to 0683-5115; RESISTOR 510Ω 5% .25W FC TC=-400/+500; 01121; CB5115.

Change A2R12 from 0698-8623 (560K 1/8W) to 0685-5645; RESISTOR 560KΩ 5% .25W FC TC = -400/+500; 01121; CB5645.

Change A2R21 from 0757-0911 (300Ω) to 0683-1025; RESISTOR 1000Ω 5% .25W FC TC = 400/ +500; 01121; CB1025, FACTORY SELECTED VALUE.

Change A2R24 from 0683-1025 (1000Ω) to 0683-4715; RESISTOR 470Ω 5% .25W FC TC =-400/ +500; 01121; CB4715.

Change A2R26 from 0683-1025 (1000Ω) to 0683-2415; RESISTOR 240Ω 5% .25W FC TC =-40 / +500; 01121; CB2415.

Change A2R37 from 2100-1984 (100Ω) to 2100-2061; RESISTOR VAR 200Ω 10% C TOP-ADJ; 30983; ET50W201.

Add A2C41; 0160-3878; CAPACITOR 1000 pF 20% 100 VDC CER; 28480; 0160-3878.

Add A2R51; 0683-1015; RESISTOR 100Ω 5% .25W FC TC =-400/+500; 01121; CB1015.

Add A2R52* and A2R53*; 0683-5105; RESISTOR 51Ω 5% .25W FC TC = -400/+500; 01121; CB5105, FACTORY SELECTED VALUES.

Page 8-7, Figure 8-6, A2 (05353-60002) Schematic Diagram:

Change series number, at top of diagram, from 1524 to 1640.

Change A2R7 from 200 to 510 ohms.

Change A2R21 from 300 to 1000 ohms.

Change A2R24 from 1000 to 470 ohms.

Change A2R26 from 1000 to 240 ohms.

Change A2R37 from 100 to 200 ohms.

Add A2C41 (1000 pF) between circuit board common and the +15V end of resistor A2R44.

Add A2R51 (100 ohms) in series with the input to pin 10 of A2U1 amplifier. Connect one end of resistor to A2U1(10) and the other end to the junction of A2C31, C32, and C34.

Add A2R52 (51 ohms) between circuit board common and pin 10 of amplifier A2U2.

Add A2R53 (51 ohms) between circuit board common and pin 7 of amplifier A2U2.

Add an asterisk (*) adjacent to A2R21, A2R52, and A2R53.

CHANGE 6 (1720A)

Page 1-2, Table 1-1, Specifications:

Change specifications to agree with the following:

Sensitivity: (Preset) 50Ω and 1MΩ

X1 20 mV rms sine wave, 60 mV p-p pulse
X10 250 mV rms sine wave, 750 mV p-p pulse

Dynamic Range: (Preset)

50ΩX1	20 mV to 250 mV rms sine wave 60 mV to 750 mV p-p pulse
50ΩX10	250 mV to 2.0V rms sine wave 750 mV to 6.0V p-p pulse
1MΩX1	20 mV to 250 mV rms sine wave 60 mV to 750 mV p-p pulse
1MΩX10	250 mV to 2.0V rms sine wave 750 mV to 6.0V p-p pulse

CHANGE 6 (1720A) (Cont'd)

Page 1-2, Table 1-1, Specifications: (Cont'd)
Change specifications to agree with the following:

Trigger Level: Continuously adjustable over +0.5 V dc to -1.3 V dc multiplied by attenuator setting. Control is non-linear with more settability around zero volts.

Maximum Input: Damage may occur beyond specified level. For larger inputs, voltage divider probes 10020A for 50Ω and 10004B for 1MΩ are recommended.

50ΩX1	±7 Vdc 7V rms below 5 MHz 3.5V rms (+24 dBm) above 5 MHz
50ΩX10	±7 Vdc 7V rms (+30 dBm)
1MΩ X1	±350 Vdc 250V rms to 20 kHz 3.5V rms above 5 MHz
1MΩX10	±350 Vdc 250V rms to 20 kHz 70V rms above 5 MHz

Page 5-1, Table 5-1, Assembly Description:
Change A2 part number from 05353-60002 to 05353-60012.

Pages 5-2 and 5-3, Table 5-3, In-Cabinet Performance Check:
Change "Sensitivity" in step 1 "Specifications" from 10 to 20 mV rms.

Change "10 mV" and "28.3V p-p" in step 1c to "20 mV" and "56.6V p-p", respectively.

Change step 2 "Specifications" to "Level Range: +0.5V to -1.3V" and "ATTEN (sensitivity): 250 mV rms in X10".

Change "-0.5V" and "+0.5V" in step 2c. to "-1.3V" and "+0.5V", respectively.

Change "X20" in step 2d. to "X10".

Change "200 mV" in step 2f. to "250 mV".

Page 5-4a, Performance Check Test Card
Change step 2 CHANNEL C LEVEL AND ATTEN CONTROLS to
Channel C Level +0.5 V dc to -1.3 V dc . . . . . .
Attenuator Sensitivity: 250 mV . . . . . .

Page 6-4, Table 6-1, A2 Replaceable Parts:
Change A2 part number from 05353-60002 to 05353-60012 in HP and Mfr Part Number columns.

Change A2 series number from 1640 to 1720.

Change A2C2 from 0160-0550 (10 pF) to 0166-4631; CAPACITOR-FXD 2.2 pF +-.25 pF 50VDCW; 28480; 0166-4631.

Change A2R2 from 0698-8383 (950KΩ) to 0698-8881; RESISTOR-FXD 900K 5% .25W C TC=0+-150; 28480; 0698-8881.

Change A2R3 from 0698-8384 (50KΩ) to 0698-8880; RESISTOR-FXD 100K 5% .15W C TC=0+-150; 28480; 0698-8880.

Page 8-7, Figure 8-6, A2 Schematic Diagram:
Change A2 part number from 05353-60002 to 05353-60012.

Change A2 series number from 1640 to 1720.

Change "X20" position of ATTEN switch S4 to "X10".

Change A2C2 from 10 pF to 2.2 pF.

Change A2R2 from 950 to 900K.

Change A2R3 from 50K to 100K.

Page 6-7, Table 6-1, MISCELLANEOUS PARTS:
Change front panel part number from 05353-00006 to 05353-00008 in HP and Mfr Part Number columns.

►CHANGE 7 (1816A)

Page 6-4 and 6-5, Table 6-1, A2 (05363-60012) Replaceable Parts:
Change A2 from SERIES 1720 to 1816.

Add A2R54; 0698-3378; RESISTOR-FXD 51 5% .125W CC TC = -270/+540; 01121; BB5105.

Page 8-7, Figure 8-6, A2 (05363-60012) Schematic Diagram:
Change A2 series number (top of diagram) from 1720 to 1816.

Add 51 ohm resistor R54 in series between A2U2 pin 5 and resistor A2R29.