Errata

Title & Document Type: **5330A/B Preset Counters Operating and Service Manual**

Manual Part Number: **05330-90011**

Revision Date: **July 1973**

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OPERATING AND SERVICE MANUAL

PRESET COUNTERS
5330A/B

HEWLETT hp PACKARD

HP 5330A/B

PRESET COUNTERS

5330A/B

SERIAL PREFIX: 1224A

This manual applies directly to Hewlett-Packard Models 5330A/B Preset Counters with serial prefix number 1224A.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 1224A, a "Manual Change" sheet is included with this manual. For serial prefixes below 1224A, refer to Section VII, Manual Changes.

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HEWLETT hp PACKARD

MANUAL CONTENT

This manual provides operating and service information for Hewlett-Packard 5330A/B Preset Counters. Information is arranged in eight sections as follows:

Section I, GENERAL INFORMATION, contains an overall instrument description, specifications, equipment supplied, available accessories, options, and instrument applications.

Section II, INSTALLATION, covers unpacking, inspection, rack installation, power and cooling requirements, connections for remote programming, and printer operation.

Section III, OPERATION, explains how to operate the 5330A/B including display interpretation for all modes of operation.

Section IV, THEORY OF OPERATION, describes the overall theory of operation. Integrated circuit operation and special circuit operation are included in this section.

Section V, MAINTENANCE, provides maintenance procedures, assembly designations, recommended test equipment, in-cabinet performance checks (incoming inspection), adjustments (calibration procedures), and removal and replacement instructions.

Section VI, REPLACEMENT PARTS, lists replacement parts by reference designator, including options, lists total quantity of each part used, and manufacturer's code and part number.

Section VII, OPTIONS AND MANUAL CHANGES, covers options available and provides information to make this manual applicable for older instruments.

Section VIII, CIRCUIT DIAGRAMS AND SERVICE INFORMATION, contains schematic diagrams and component locators for all assemblies, operation of each assembly including waveforms and voltages. Adjustment and troubleshooting information are included in this section.

ADDITIONAL MANUALS

To order additional operating and service manuals, contact your nearest Hewlett-Packard Sales and Service Office. Give complete model, name, and 8-digit serial number. The serial number place is on the rear panel (see Section I for serial number system). This manual's HP part number is the last item listed in Table 6-1. Comments on this manual are welcome at any Sales and Service Office.

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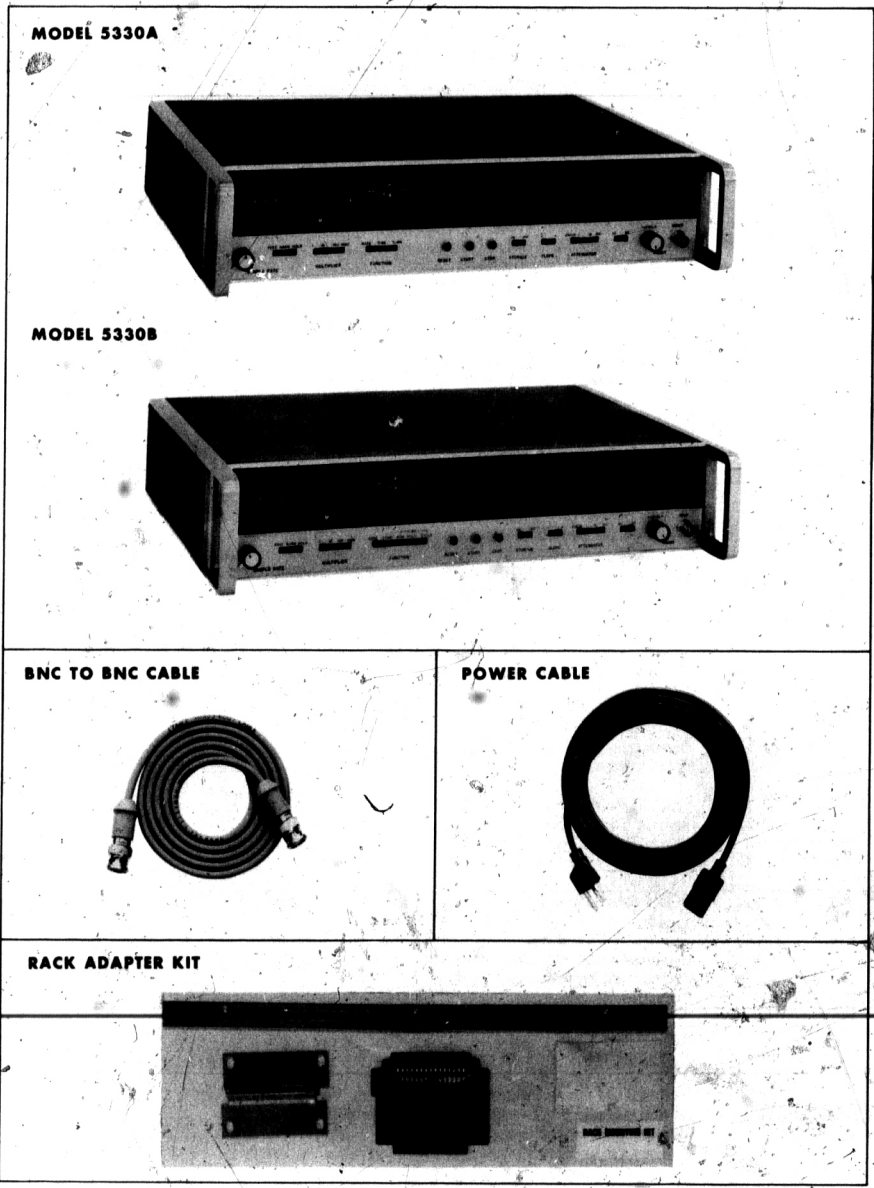


SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The Hewlett-Packard Models 5330A/B Preset Counters measure rate and normalized rate, frequency, ratio and normalized ratio, time, period average, time for N events, time interval, and frequency division. Both models have preset time bases, 5-digit readout, local or remote function selection, BCD printer outputs, trigger level, and slope controls. The 5330B model also has dual limit detection. Either model can be ordered with optional preset-offset or remote programming for the preset time base, limit switches, and preset-offset switch. Several variations of the two models are available on special order including 6- or 7-digit readout, 6-digit single or dual limits, single limit control, deletion of preset time base, and 8-decade multiplier. Electrical and mechanical specifications are listed in Table 1-3.

1-3. INSTRUMENT IDENTIFICATION

1-4. Hewlett-Packard uses a two-section serial number mounted on the rear panel. Earlier instruments use an eight-digit serial number (000-00000). The first three digits are a serial prefix number; the last five digits refer to the specific instrument. Later instruments use a nine-digit serial number (0000A00000). The first four digits are the serial prefix and the last five digits refer to the specific instrument. If the serial prefix on your instrument does not appear on the title page of this manual, there may be differences between the manual and your instrument. If there are differences, they will be described in a change sheet 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.

1-5. APPLICATIONS

1-6. The Preset Counters are designed for use in automatic control systems, physical measurements in laboratories, and many types of digital measurements required in engineering and industry. The counters are particularly adaptable to automatic control systems and industrial counting tasks such as speed controls, fuel control, heat measurement, pressure measurements, displacement control, batching by number, batching by weight, weight control, length cutting, limit signal warning, running inventory count, and precise timing of processes. The remote programming allows the counters to be set for several types of measurements as required by the control system. The 5330B model can also be used as a precision pulse generator or delay generator.

1-7. OPTIONS

1-8. The Preset Counters are available with the following options:

Option 001, preset-offset.

Option 002, remote control of preset time base switches.

Option 003, remote control of preset-offset switches.

Option 004, remote control of limit switches.

1-9. EQUIPMENT SUPPLIED AND AVAILABLE ACCESSORIES

1-10. Table 1-1 lists equipment supplied and Table 1-2 lists accessories available.

Table 1-1. Equipment Supplied

DESCRIPTION	HP PART NO.
Detachable power cord, 7-1/2 feet (231 cm) long, NEMA plug	8120-1348
Rack Mounting Kit	05330-60040*
Circuit Board Extender	05245-6022
50-ohm BNC to BNC coaxial cable, 4 feet (122 cm) long	10503A

*See sublist of kit parts in Table 6-1.

Table 1-2. Accessories Available

DESCRIPTION	HP PART NO.
Digital Recorder	5050B
Recorder Interconnect cable, 6 feet (183 cm)	10513A
Generator Tachometers	508A, B, C, D

Table 1-3. Specifications

FUNCTIONS

Range:* dc coupled, 0 to 10 MHz.
ac coupled, 10 Hz to 10 MHz.

Impedance: 1 MΩ shunted by 30 pF.

Sensitivity:
0.1 V rms sine wave.
0.3 V p-p pulse, 50 ns minimum pulse width.
10 mV rms sine wave, available on special order.

Maximum Input:

120 V rms	X1 range
250 V rms	X10 range
500 V rms	X100 range

Overload Protection: 1.5 V rms x ATTENUATOR settings.

Trigger Level: PRESET to trigger at 0 V or adjustable.

±3 V	X1 range
±30 V	X10 range
±300 V	X100 range

Slope: Independent selection of positive or negative slope.

RATE (FREQUENCY):

Range: 0 to 10 MHz for frequency measurements. 0 to 2 MHz for frequency limit detection.

Gate Times:
M = 1:1 μs to 0.1 s in 1 μs steps.
M = 10:10 μs to 1 s in 10 μs steps.
M = 100:100 μs to 10 s in 100 μs steps.
M = 1000:1 ms to 100 s in 1 ms steps.

Display: (Events/sec) x 10^{-6} x MN.

Accuracy: ±1 count ± time base accuracy.

TIME (PERIOD):

Range: 0 to 2 MHz.

Periods Averaged: 1 to 10^5 selected by "N" switch.

Time Units: 1 μs, 10 μs, 100 μs, or 1 ms (selected by "M" switch).

Display: (N x PERIOD) ÷ (M x 1 μs).

Accuracy: ±1 count, ± time base error, ± trigger error.

*On special order, reduced bandwidths are available for use in electrically noisy environments.

RATIO (RATE MODE):

Range: F1–0 to 10 MHz, into input amplifier; F2–1 kHz to 1 MHz. Apply to FREQ. STD. connector (BNC type) on rear panel and switch to EXT.

Sensitivity: F1 same as input amplifier. F2, 1 volt rms sine wave into 1 kΩ.

Display: (F1 x MN)/F2.

Accuracy: ±1 count of F1, ± trigger error of F2.

RATIO (TIME MODE):

Range: F1–0 to 10 MHz into input amplifier; F2–1 kHz to 1 MHz to FREQ STD connector.

Sensitivity: F1 same as input amplifier. F2, 1 volt rms sine wave into 1 kΩ.

Display: F2 N/F1M.

Accuracy: ±1 count of F2/M, ± trigger error of F1/N.

TIME INTERVAL (USE F/MN MODE AND CHECK):

Range: 10 μs to 10^8 s.

Time Increments (Check Mode): 1 μs to 100 s (1 μs x MN).

Start: Controlled by "START" pushbutton or remote line.

Stop: Controlled by "STOP" pushbutton or remote line.

Display: Total (MN x 1 μs) time increments.

Accuracy: ±1 count ± time base error.

F/MN MODE:

Range: 0 to 10 MHz (0 to 2 MHz if M = 1).

N Switch: 1 to 100,000 selected by "N" digits.

Multiplier: 1, 10, 100, or 1000 selected by "M".

Start: Closure of front panel switch or remote line.

Stop: Closure of front panel switch or remote line.

Display: Total counts ÷ (M x N).

Accuracy: Absolute.

Output: 0.4 to 2.4 V pulse, 200 ns width (pin 32, J 12 on rear panel).

Table 1-3. Specifications (Continued)

LIMIT SWITCH FUNCTIONS (MODEL 5330B)

GENERAL:

Limits: 2 sets (L1 and L2, 5 digits each). *

Range: 0 to 2 MHz.

RATE:

One Limit (other limit at 0): Output according to whether counted rate is above or below limit for each gate cycle with storage on.

Two Limits: Separate outputs according to whether counted rate is below, between, or above limits for each gate cycle with storage on.

MANUAL F/MN:

One Limit (other limit at 0): Output changes at coincidence with limit and continues count.

Two Limits: Separate outputs change at coincidence with limits and continues count.

HOLD F/MN:

Same as in MANUAL except count stops at coincidence with the larger limit.

CYCLE F/MN:

Generates separate outputs at coincidence with limit numbers. Automatically resets at larger limit and repeats cycle.

Recycle Time: 1 μs (1 MHz rate, max.).

CONTROL LINE OUTPUTS:

Source Impedance: >4.6 V at 2.5 kΩ, <0.5 V at -10 mA.

Control Lines	Nominal Voltage LO	IN	HI
Count less than low limit	0 V	+5 V	+5 V
Count equals low limit	+5 V	0 V	+5 V
Count between low and high limits	+5 V	0 V	+5 V
Count equals high limit	+5 V	+5 V	0 V
Count greater than high limit	+5 V	+5 V	0 V

Storage (Rate and Time Modes)

ON: Control and overflow lines "latch", i.e., store, and change only if future measurement results in different limit conditions.

OFF: Control and overflow lines return to "pre-lower limit" values upon reset.

* Other choices on special order.

TIME BASE

CRYSTAL FREQUENCY: 1 MHz.

STABILITY:

Aging Rate: Less than 5 parts in 10^7/mo.

Temperature: < ±3 parts in 10^5 (0° to 65°C). < ±5 parts in 10^6 (10° to 40°C).

Line Voltage: < ±1 part in 10^6 for ±10% line voltage variation.

OUTPUT: (for external use)

Frequency: 1 MHz.

Voltage: 3 V p-p open circuit.

Impedance: 100 Ω source.

EXTERNAL INPUT:

Sensitivity: 1 V rms into 1 kΩ (10 V rms maximum).

Range: 1 kHz to 1 MHz.

GENERAL

N SWITCH: 1 to 100,000 selected by "N" digits.

MULTIPLIER: 1, 10, 100, or 1000 selected by "M". "M".

DISPLAY: 5-digit long-life neon digital tubes (6-digit and 7-digit available).

DISPLAY STORAGE: Holds reading between samples. Front panel switch overrides storage.

OVERFLOW: Front panel light indicates count is larger than can be fully displayed.

SAMPLE RATE: FAST position: Continuously variable from less than 100 μs to approx. 12 ms. NORM position: Continuously variable from less than 12 ms to 5 s. HOLD position: Display can be held indefinitely.

RESET: Manual by pushbutton or remote.

GATE OUTPUT: Level change at gate closure from 0.4 to 2.4 V min.

DIGITAL OUTPUT:

Code: 4-line 1-2-4-8 BCD, "1" state positive.

"0" State: < 0.5 at -10 mA.

"1" State: >4.6 V open circuit. 2.5 kΩ source impedance, nominal.

Reference Levels: Ground and +5 V; negligible impedance.

Print Command: Neg. pulse, 5 V to 0 V, 35 μs to 45 μs wide. Occurs at end of gate time.

Hold-off Requirements: > +2.4 V required to prevent data transfer to buffer storage when instrument's cycle time is less than external equipment to interrogate BCD outputs.

Table 1-3. Specifications (Continued)

OPERATING TEMPERATURE RANGE: 0°C to 50°C

REMOTE OPERATION: Single line overrides front panel switches; REM'T light is on. Single line for each switch position; 4-line/digit for thumbwheel switches (1-2-4-8 BCD).

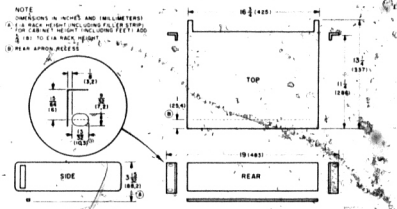
REMOTE LINE REQUIREMENTS: Compatible with DTL and TTL integrated circuits as well as saturated NPN transitor switches and contact closures. A high or off level is an open circuit or a voltage from 2.4 V to 5 V. A low or on level is a ground or a voltage from 0 to 0.4 V at -15 mA. Amplifier trigger level can be set by placing LEVEL control in PRESET and applying an external ±3 V input. Trigger level range equals ±3 V X ATTENUATOR setting.

CONNECTORS: BNC inputs. Remote Function HP 1251-0085 (Cinch or Amphenol female 57-40360. Matching mate for Remote Function connector is HP 1251-0084 (male Amphenol 57-30360).

POWER REQUIREMENTS: 115 or 230 V ±10% 50 to 400 Hz, 35 W (approx.).

WEIGHT: Net, 12 lb. (5, 5 kg). Shipping, 17 lb. (7, 8 kg).

DIMENSIONS:



ACCESSORIES FURNISHED:
HP 10503A 50Ω BNC to BNC cable, 4 ft (120 cm).
Detachable power cord, 7-1/2 ft. (230 cm).
Rack mount kit with 15-pin PC extender board.

ACCESSORIES AVAILABLE:
HP cable 10513A (6 ft, 183 cm) to connect to HP 5050B or 5055A Digital Recorder.

OPTION 001: Presettable Offset Counting (Preset-Reset). Counter resets to number dialed into 5-decade digits switches. Thus, counting starts from that number rather than 0.

OPTION 002: Remote N switch connector. †

OPTION 003: Remote R switch connector. †

OPTION 004: (5330B only): Remote L1 and L2 switch connectors. †

SPECIALS: Models 5330A and 5330B are designed for flexibility in providing modifications to suit particular requirements. These include:

a. 6 or 7 digits of readout for both models.

b. 6-digit preset for Option 001 with 6- or 7-digit readout for both models.

c. Single 5-digit preset limit control for Model 5330B.

d. 6-digit single or dual preset limits for Model 5330B.

e. Delete the preset time base from either model.

f. Add standard decade divider time base to any model.

g. Extend M divider to 8 decades.

† Mates with HP 1251-0293 (Male Amphenol 57-30240).

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information on unpacking, inspection, repacking, storage, remote programming installation, and digital recorder installation.

2-3. UNPACKING INSPECTION

2-4. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken knobs, etc.). If the instrument is damaged or fails to self-check (Self-Check Procedure, Figure 3-4), notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately (offices are listed at the back of this manual). Retain the shipping carton and the padding material for the carrier's inspection. The sales and service office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. STORAGE AND SHIPMENT

2-6. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard Sales and Service Office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here are two recommended packaging methods:

a. RUBBERIZED HAIR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument securely in strong corrugated container (350 lb./sq. inch bursting test) with 2-inch rubberized hair pads placed along all surfaces of the instrument. Insert fillers between pads and container to ensure a snug fit.

b. EXCELSIOR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument in strong corrugated container (350 lb./sq. inch bursting test) with a layer of excelsior about 6 inches thick packed firmly against all surfaces of the instrument.

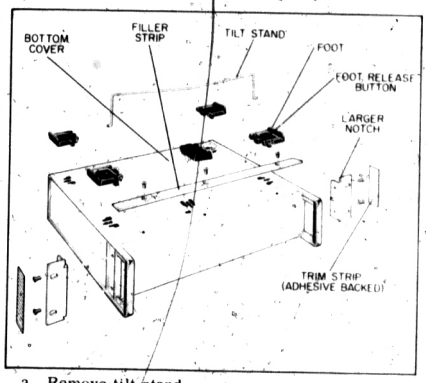
2-7. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

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

2-8. RACK INSTALLATION

2-9. The counter is ready for bench operation as shipped from the factory. Additional parts necessary for rack mounting are packaged with the instrument. To convert to rack installation, refer to Figure 2-1 and proceed as follows:

Figure 2-1. Rack Mounting



a. Remove tilt stand.

b. Remove feet (press the foot-release button, slide foot toward center of instrument, and lift off).

c. Remove adhesive-backed trim strips at front end of sides.

d. Attach filler strip along bottom edge of front panel using two screws on outer edges of filler strip. Omit the center screw.

e. Attach flanges to front end of sides (larger corner-notch toward bottom of instrument). Instrument is now ready to mount in standard rack.

CAUTION

Ambient temperature in rack during operation should not exceed a maximum of 122°F (50°C). Be sure instrument position in rack permits adequate air circulation and that nearby equipment does not discharge hot air directly on the instrument.

2-10. POWER CONNECTION

2-11. LINE VOLTAGE. The Counter may be operated from either 115 or 230 volt (±10%) power lines. A slide switch on the rear panel permits quick conversion for operation from either voltage. Insert a narrow-blade screwdriver in the switch slot and slide the switch to the right for 230 volt operation ("230" marking exposed) or to the left for 115 volt operation ("115" marking exposed). The Counter is supplied with 115 volt fuse; be sure to replace this fuse for 230 volt operation. See Table 2-1.

Table 2-1. 115/230 Volt Conversion

CONVERSION	115 VOLT	230 VOLT
Slide Switch	Left (115)	Right (230)
AC Line Fuse	1/2 Ampere Slow-Blow (HP 2110-0202)	1/4 Ampere Slow-Blow (HP 2110-0201)

CAUTION

Before plugging instrument to AC power line be sure slide switch is properly positioned.

2-12. POWER CABLE. The Counter is equipped with a detachable 3-wire power cable. Proceed as follows for installation.

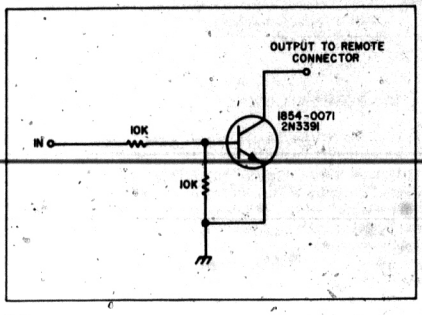
a. Connect flat plug (3-socket connector) to AC line jack at rear of instrument.

b. Connect plug (2 blade with round grounding pin) to 3-wire (grounded) power outlet. Exposed portions of instrument are grounded through the round pin on the plug for safety; when only 2-blade outlet is available, use connector adapter (HP Part No, 1251-0048), then connect short wire from side of adapter to ground.

2-13. REMOTE PROGRAMMING

2-14. The counters have provision for remote programming for use in automatic manufacturing systems such as mixing, batching, and packaging. Figure 8-19 shows the remote connector (J12) rear view and pin functions. Remote switching can be made with mechanical switches, saturated NPN transistors (Figure 2-2), or DTL-TTL integrated circuits. For most installations, unshielded wire is satisfactory for the remote program cable. If a particular line is to be pulsed, shielded cable is recommended.

Figure 2-2. Typical Saturated NPN Switching Circuit



2-15. REMOTE PROGRAMMING REQUIREMENTS

2-16. When operating in the remote mode, the following functions must be selected otherwise the counter will be inoperative.

a. Remote select.

b. Function select (select 1 mode with or without check).

c. Attenuator select (1 of 3 lines or check).

d. Trigger slope (select 1 of 2 lines).

e. Multiplier (select 1 of 4 lines).

2-17. If no selection is made for sample rate, sample rate is fast; if no selection is made for storage, storage is on; and if no selection is made for AC-DC, AC is selected.

2-18. A single line enables remote operation and overrides all front panel switches except the PWR and RESET switches. (All potentiometers are still operative during remote.) The trigger level can be set with the front panel LEVEL control or supplied remotely to J12-26. Remote trigger levels can be programmed by setting the front LEVEL control to PRESET and applying a variable ±3 volts to J12-26. The trigger level is ±3 volts X the ATTENUATOR switch setting. Provision is made to remotely select slow, fast, or hold sample rate ranges; however, the sample rate must be adjusted with the front panel potentiometer. The HI, IN, and LO output lines (J12-29, 31, and 12) can be used to drive devices requiring 10 mA or less. For higher current requirements, the circuit shown in Figure 2-3 can be used. Table 2-2 lists the remote program functions.

Figure 2-3. Typical Output Driver Circuit

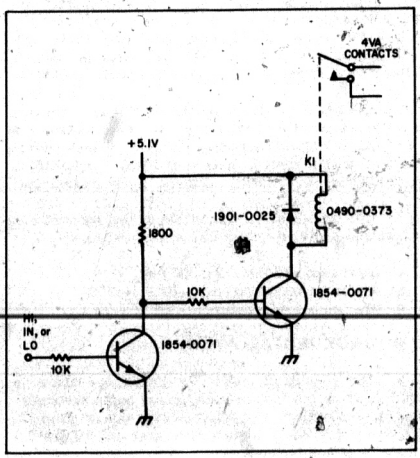


Table 2-2. Remote Control Operation (see Figure 8-19 for schematic diagram of Remote Connector J12)

REMOTE CONTROL LINE	CONTROL LEVEL*	FUNCTION
Remote Select J12-10	H	All front panel controls are operative.
	L	Disables front panel controls except POWER, SAMPLE RATE, RESET, and LEVEL.
5330A Mode Select (select 1 with or without check)	H	No selection.
Rate Mode J12-16	L	Selects rate mode.
Time Mode J12-34	L	Selects time mode.
F/MN Mode J12-4	L	Selects F/MN mode.
Check Mode J12-9	L	Selects check mode.
5330B Mode Select (select 1 of 5 combinations with or without check)	H	No selection.
Rate Mode J12-16	L	Selects rate mode.
Time Mode J12-34	L	Selects time mode.
F/MN Man Mode J12-4	L	Selects F/MN manual mode.
F/MN Hold Mode J12-4 & 3	L	Selects F/MN hold mode.
F/MN Cycle Mode J12-4 & 11	L	Selects F/MN cycle mode.
Check Mode J12-9	L	Selects check mode.
Attenuator Select (select 1 of 3 lines or check)	H	No selection.
X1 J12-27	L	Selects X1 input attenuation.
X10 J12-6	L	Selects X10 input attenuation.
X100 J12-7	L	Selects X100 input attenuation.
Trigger Level Control J12-26 (Set 5330 front panel LEVEL control to PRESET)	0 volts	Selects preset trigger level.
	+3V to -3V Variable	Adjusts trigger level to ±3V times attenuator setting.
AC-DC Select J12-8	H	Switches coupling capacitor in signal path. (AC)
	L	Bypasses coupling capacitor. (DC)
Trigger Slope (select 1 of 2 lines or check)	H	No operation.
Positive Slope J12-24	L	Selects + slope operation.
Negative Slope J12-25	L	Selects - slope operation.
Multiplier (select 1 of 4 lines)	H	No selection.
X1 J12-2	L	Selects X1 M function.
X10 J12-18	L	Selects X10 M function.
X100 J12-17	L	Selects X100 M function.
X1000 J1-2-15	L	Selects X1000 M function.
Sample Rate (2 lines) (Rate/Time Modes)	H	Selects fast sample rate.
Sample Hold J12-1	L	Selects sample hold.
Sample Normal J12-20	L	Selects normal sample rate.
Storage (Rate/Time Modes) J12-23	L	No storage operation.
	H	Selects storage operation.

*A high or off level is an open circuit or a voltage from 2.4 V to 5 V. A low or on level is a ground or a voltage from 0 to 0.4 V at 5 mA.

Table 2-2. Remote Control Operation (Continued)

REMOTE CONTROL LINE	CONTROL LEVEL*	FUNCTION
Start J12-21	H	No count.
	L	Count continuously.
Stop J12-22	H	Count if started.
	L	Stops count.
Reset J12-28 (front panel control also operative)	H	No reset.
	L	Resets counter to zero.
Main Gate Control Output J12-30	H	Indicates main gate closure.
	L	Indicates that main gate is open.
Overflow Output J12-13	H	Indicates not overflowed.
	L	Indicates overflow.
Limit Detection Outputs		
"LO" Output J12-12	L	Indicates that count is less than low limit.
"IN" Output J12-31	L	Indicates that count is equal to or greater than low limit but less than high limit.
"HI" Output J12-29	L	Indicates that count is equal to or greater than high limit.
+N Output J12-32	Positive pulse ≈175 nsec (2.4 V min)	Indicates when N value is reached.
+5.1 Volt Output J12-33	-	Available for NPN switching transistors.
Ground J12-35	-	For remote control equipment.

*A high or off level is an open circuit or a voltage from 2.4 V to 5 V. A low or on level is a ground or a voltage from 0 to 0.4 V at 5 mA.

2-19. DIGITAL RECORDER INSTALLATION

2-20. The counter supplies positive-true 8421 BCD outputs to drive an external digital recorder. Use HP cable 10513A to drive an HP 5050B recorder. Parts for this cable are listed in Table 2-3. Normally, the counter's STORAGE switch is set to ON and the SAMPLE RATE control is used to set the interval between recorder printouts. If the sample rate exceeds the printer rate, the printer supplies a holdoff to inhibit the counter main gate. If the STORAGE switch is set to OFF, the sample rate must be long enough so that the recorder can print before the counter resets to zero. For high-speed data acquisition, the storage switch should be set to ON and the sample rate adjusted to minimum.

Table 2-3. 10513A Digital Recorder Cable

DESCRIPTION	HP PART NO.	
36-pin connector	1251-0334	5080-5364
Cover	10513-4001	including
Key-polarizing	1251-1115	hardware
50-pin connector	1251-0086	

2-21. For standard 5330A/B instruments, the two optional BCD outputs (J8 pins 15 through 18 and S through V) are floating and the 5060B should be programmed to eliminate the undesired printouts. (Refer to 5050B Operating and Service Manual.) Table 2-4 lists the printer output connector and functions. Also see Figure 8-19 for digital recorder connector schematic.

Table 2-4. Digital Recorder Output

OUTPUT	BCD WEIGHT			
	8 (D)	4 (C)	2 (B)	1 (A)
Units (10^0)	J8-5	J8-8	J8-7	J8-6
Tens (10^1)	J8-E	J8-J	J8-H	J8-F
Hundreds (10^2)	J8-P	J8-M	J8-N	J8-R
Thousands (10^3)	J8-K	J8-10	J8-9	J8-L
Ten Thousands (10^4)	J8-12	J8-14	J8-13	J8-11
Print Command (+5 V to 0 V pulse, 15 to 20 μsec wide)	J8-D			
Hold OFF (+5 V) from Printer	J8-B			
Ground	J8-1			
+5.1 V	J8-3			

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. The 5330A/B Counters measure frequency, rate, normalized rate, ratio, normalized ratio, period, period average, time, time for N events, time interval, and frequency division. Both models have preset time bases to allow for normalized measurements and the 5330B has dual limit detection capability. In addition, either model can be ordered with a preset-offset option. Both models come equipped with a remote input connector to remote program all front-panel switches except the POWER and RESET switches. Options are available to remote program the preset time base, dual limit switches, and preset-offset switch.

3-3. OPERATING MODES

3-4. There are three basic modes of operation for the 5330A; rate, time, and F/MN. The 5330B can also be operated in two additional modes; F/MN hold and F/MN cycle. For both models the basic modes can be combined with check mode operation.

3-5. Rate Mode

3-6. The counter measures frequencies to 10 MHz. Direct readouts of rates such as gallons/min, revolutions/sec, miles/hour, etc., can be obtained by normalizing with the time base. The rate mode is similar to the frequency measurement mode of a conventional electronic counter except for the preset time base. The gate length selection is (10^{-6} sec, x M)N. N is the setting of the N switch and can be set from 1 to 100,000. When the N switch is set to 00000, N = 100,000. M is the MULTIPLIER switch, and can be set to X1, X10, X100, or X1000.

3-7. An example of normalized rate operation is a tachometer generator providing 100 pulses per revolution and a direct readout in rpm is desired. The preset time base setting MN is equal to:

$$\frac{\text{time in Seconds} \times 10^6}{\text{events per unit}} = \frac{60 \times 10^6}{100} = 0.6 \times 10^6$$

To set this value of MN on the counter, set MULTIPLIER to 1000 and the N switch to 600 or any equivalent combination.

3-8. Frequency measurements are made in the rate mode by setting MN to 1 or any decade multiple up to 10^8. Input frequency = Readout/10^{-6} MN. When MN = 10^6, the gate length is 1 second and a direct readout in Hz is displayed. Dividing MN by tens reduces resolution, because counter's gate time is reduced, but higher frequencies can be displayed. When MN = 10^4, a frequency of 9.9999 MHz can be read.

3-9. Ratio measurements are similar to rate measurements except an external signal replaces the counter time base. Ratio or normalized ratio measurements can be made. To measure the ratio of two frequencies, connect F_1 (0 to 10 MHz) to the INPUT jack and F_2 (1 kHz to 1 MHz) to EXT FREQ jack. MN is selected as in the rate mode and the readout is interpreted as:

$$\text{Ratio} = \frac{\text{Readout}}{\text{MN}}$$

3-10. For the 5330B model, limit detection can be used with the rate mode, but the input frequency range is reduced to 0 to 2 MHz. The desired limit values are entered on the L1 and L2 switches, the high limit can be entered on either L1 or L2. When the displayed count is below the lower limit, the LO annunciator will light and the control line outputs will indicate this condition as shown in Figure 3-1. When the displayed count is equal to or greater than the lower limit but less than the higher limit, the IN annunciator will light and the control line outputs will assume the states shown in Figure 3-1. At the high limit coincidence or above, the HI annunciator lights and the control line outputs switch accordingly. Two modes of limit detection are provided -- latched and unlatched. When the STORAGE switch is ON, the control and overflow output lines will latch and change only when a new measurement results in a different set of limit conditions. During the latched mode, the output lines are not affected when the counter resets. With the STORAGE switch OFF during the rate mode, the control and overflow lines return to "pre-lower limit" values each time the counter resets.

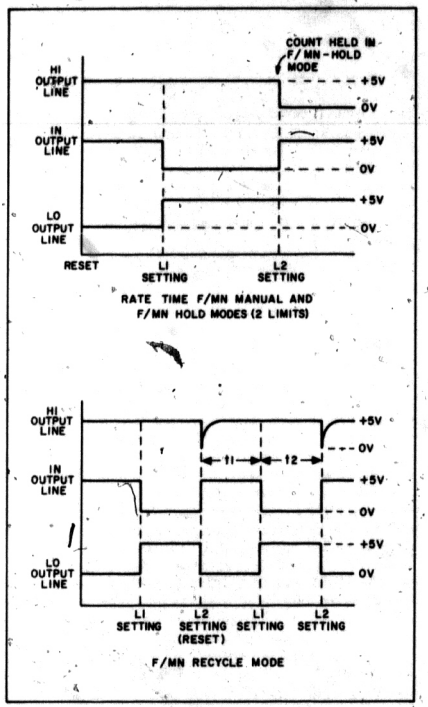
3-11. Time Mode

3-12. This mode measures period, period average, and time for N events to occur. The input frequency (0 to 2 MHz) is divided by N and the counter time base frequency is divided by M. To make single period measurements, the N switch is set to 1 and the M switch selects time increments to be counted; X1 = 1 μsec, X10 = 10 μsec, X100 = 100 μsec, and X1000 = 1 millisecond. When N = 1 the counter will display single period measurements, period = READOUT x 1 μsec x M.

3-13. To reduce inaccuracies due to ±1 count, period average measurements can be made by setting the N switch to the number of periods to be averaged, range is 10^0 to 10^5. The display is interpreted as period = Readout x 1 μsec x M/N.

3-14. Time for N events to occur can be measured by setting N to the desired number of events. N can be any number between 1 and 100,000. The value of M is selected as in period measurements. The display is interpreted as time for N events = Readout x 1 μsec x M.

Figure 3-1. 5330B Control Line Outputs



3-15. Ratio measurements can be made in the time mode by connecting an external signal to replace the internal time base. Ratio = $\frac{\text{Readout} \times M}{N}$ see Figure 3-9. For 5330B models, limit detection for the time mode is the same as the rate mode, refer to paragraph 3-10 and Figure 3-1.

3-16. F/MN Mode

3-17. This mode allows division of the input frequency before counting. Maximum input frequency is 10 MHz when M > 1 and 2 MHz when M = 1. For 5330A models, measurements are controlled with either the START-STOP switches or corresponding remote control lines. When the STOP switch is pressed, the count stops and the display is held for the sample rate period, then resets to zero. If the FAST-NORM-HOLD switch is in HOLD, the display is held indefinitely. Table 3-1 shows maximum input frequencies for the F/MN modes. For 5330B models, three F/MN operating modes can be selected as follows:

Table 3-1. F/MN Mode Input Frequencies

Multiplier Switch	N Switch	Maximum Freq Input	
		F/MN Cycle	F/MN MAN or HOLD
= 1	= 1	1 MHz	2 MHz
= 1	>1	2 MHz	2 MHz
>1	>1	10 MHz	10 MHz

a. F/MN-HOLD. Division factor is set on M and N switches. Measurement is started with the START switch or corresponding remote line. When count reaches higher limit setting, counter will stop counting and hold for the sample rate period, then reset to zero. If the FAST-NORM-HOLD switch is in HOLD, the count is held indefinitely. Counter supplies separate control outputs at L1 and L2 coincidence. See Figure 3-1 for control line output waveforms.

b. F/MN-MANUAL. Similar to above except that counter continues to count after coincidence. To stop the count, the STOP switch or corresponding remote line is used. When the count is stopped, the display is held for the sample rate period, then resets to zero. If the FAST-NORM-HOLD switch is in HOLD, the count is held indefinitely. See Figure 3-1 for control line outputs. For time interval operation, the CHECK F/MN MANUAL mode is used. Time increments from 1 μsec to 100 sec (1 μsec x MN) can be selected. The START or STOP switches or the corresponding remote control lines can be used to control the measurement interval.

c. F/MN-CYCLE. Similar to hold mode except that counter automatically resets to zero at high limit, then repeats the cycle. See Figure 3-1 for control line outputs.

3-18. Limit detection for the 5330B F/MN modes is similar to that described in paragraph 3-10 except the storage feature is disabled. Using limit detection in the CHECK - F/MN CYCLE mode allows the counter to function as a pulse generator or repetitive delay generator. In this mode, the counter counts the divided time base frequency and the limit switches are used to set pulse width and repetition rate. Output waveforms are shown in Figure 3-1. Operation in the CHECK-F/MN HOLD mode allows the counter to function as a delay generator.

3-19. CONTROLS AND INDICATORS

3-20. Figures 3-2 and 3-3 describe front and rear panel controls.

3-21. OPERATING PROCEDURES

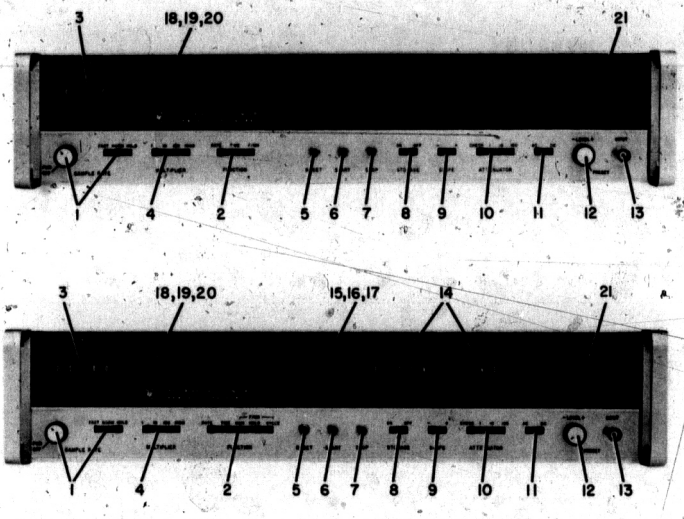
3-22. Figures 3-4 through 3-15 describe operating procedures.

3-23. OPTION 001 OPERATION

3-24. Option 001 consists of an R switch to preset-reset the counter display to any number between 00000 to 99999. When the counter resets, the display presets to the R switch value and counting starts from that value. To enter a positive offset value, set the R switch to the desired value. For a negative offset, enter the complement of the desired offset value.

3-25. For 5330B models, if the R switch value is greater than an L switch value, the L switch value is increased by 100,000. Effectively, this places a 1 in front of the L switch value, i.e., if the L switch is 00143 then the setting is 100143. For F/MN HOLD or RECYCLE modes, the counter will overflow, then count to the higher L switch value before holding or recycling.

Figure 3-2. Front Panel Controls and Indicators



1. SAMPLE RATE control. Applies primary power. Works in conjunction with FAST-NORM-HOLD switch to control interval between measurements.

   a. FAST - Selects sample rate range from 100 μsec. to 12 msec.

   b. NORM - Selects sample rate range from 12 msec. to 5 sec.

   c. HOLD - Holds display indefinitely.

2. FUNCTION selector.

   a. RATE - Sets counter for frequency and rate measurements.

   b. TIME - Sets counter for period, period average, and time for N events measurements.

   c. F/MN (5330A) - Set counter to divide input frequency by settings on N and MULTIPLIER switches. Counting interval is controlled with START and STOP switches.

   d. F/MN MAN (5330B) - Same as c above. Count continues until STOP switch is pressed.

   e. F/MN HOLD (5330B) - Similar to c except that count is stopped when display reaches higher setting on L1 and L2 switches.

   f. F/MN CYCLE (5330B) - Similar to c above except that counter resets to zero when count reaches higher setting on L1 and L2 switches, then repeats cycle.

3. N Switch. Sets value of N function from 00001 to 100, 000. When switch is set to 00000, N = 100, 000.

   a. RATE - N and MULTIPLIER switches divide time base frequency to set main gate time.

   b. TIME - N switch divides input frequency to set main gate time.

   c. F/MN - N and M switches divide input frequency prior to counting.

4. MULTIPLIER (M) Switch. Decade multiplier selector from X1 to X1000.

   a. RATE - M and N switches divide time base frequency to set main gate time.

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

b. TIME - M switch divides oscillator frequency prior to counting.

c. F/MN - M and N switches divide input frequency prior to counting.

5. RESET Switch. Resets display and internal count to zero.

6. START Switch. Used in F/MN mode to initiate count.

7. STOP Switch. Used in F/MN mode to stop count.

8. STORAGE Switch. For rate and time modes, provides display storage when ON and continuous display when OFF. Storage is disabled during F/MN modes.

9. SLOPE Switch. Permits triggering on positive or negative slope of input signal.

10. ATTENUATOR Switch. Selects attenuation for INPUT signal. Maximum input; 120 V rms on X1 range, 250 V rms on X10 range, 500 V rms on X100 range. Used in conjunction with LEVEL control to determine input triggering point. In CHECK position, connects internal 1 MHz as input signal.

11. AC-DC. Selects direct or capacitor coupling for input signal. Minimum input frequency on AC setting is 10 Hz.

12. LEVEL Control. Used in conjunction with ATTENUATOR switch to determine level at which triggering occurs. With X1 attenuator setting, level is variable ±3 volt; on X10, ±30 volts; and X100, ±300 volts.

13. INPUT Jack. Input signal connector, 0 to 10 MHz or 0 to 2 MHz depending on mode selection.

14. L1 and L2 Switches (5330B). Sets value of L1 and L2 functions from 00000 to 99999. Sets upper and lower limit values. Lower limit can be set on either switch.

15. L0 Annunciator Light (5330B). Lights when displayed count is less than the lower limit value set on L1 or L2.

16. IN Annunciator Light (5330B). Lights when displayed count is $\geq$ L1 but $<$ L2 value.

17. HI Annunciator Light (5330B). Lights when displayed count is equal to or greater than the higher limit set on L1 or L2.

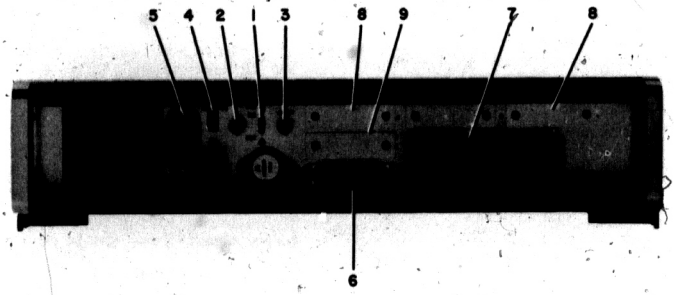
18. OVERFLOW Light. Lights when display count exceeds counter capacity.

19. GATE Light. Lights when counter main gate is open.

20. REM'T Light. Lights when counter is in remote.

21. R Switch. (Option 001) sets preset-reset value from 00000 to 99999. Counter will reset to value entered on R switch and commence count from this value.

Figure 3-3. Rear Panel Control and Connectors



1. FREQ STD INT-EXT Switch. In INT position, selects normal counter operation using internal time base. In EXT position, permits use of external 1 kHz to 1 MHz signal connection to adjacent BNC connector.

2. FREQ STD BNC Jack. With EXT-INT switch set to INT, provides 1 MHz output. With EXT-INT switch set to EXT, provides input connection for external signal from 1 kHz to 1 MHz, 1 V to 10 V rms.

NOTE

If an external signal is connected to the STD jack when the STD-INT-EXT switch is in INT, erratic operations can occur if the external signal level is approximately 4 volts or greater.

3. INPUT Jack. Wired in parallel with front panel INPUT jack.

4. SELECTOR 115-230 Volt Switch. Insert narrow blade screwdriver and slide to desired position.

5. AC LINE Connector. NEMA type with offset pin connected to chassis.

6. REMOTE Connector. 36-pin connector to remotely control counter modes and functions (see Table 2-2).

7. DIGITAL RECORDER Connector. 36-pin printed circuit connector for digital recorder interconnection (see Table 2-4).

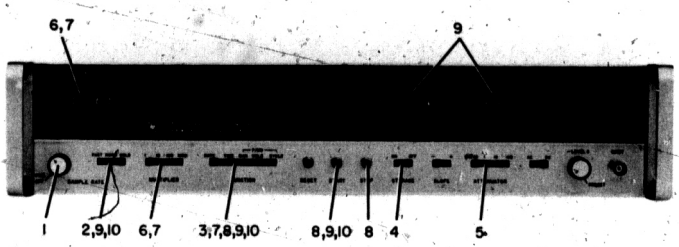
8. L1 and L2 remote connectors (Option 004). 24-pin connectors to remotely control L1 and L2 functions.

9. ÷ N remote connector (Option 002). 24-pin connector to remotely control preset time base function.

10. R remote connector (Option 003). 24-pin connector to remotely control preset-offset function.

Figure 3-4. Self Check

SELF CHECK

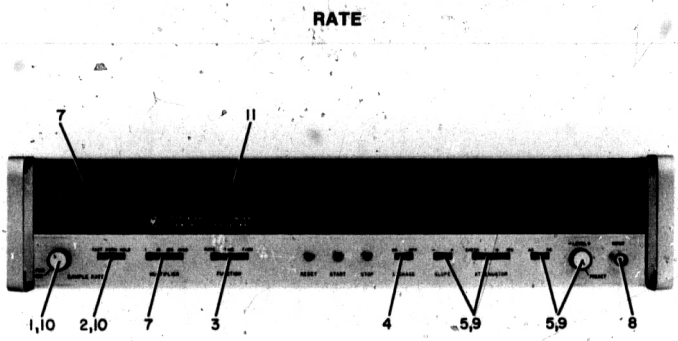


1. Turn SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST-NORM-HOLD switch to NORM.
3. Set FUNCTION switch to RATE.
4. Set STORAGE switch to ON.
5. Set ATTENUATOR switch to CHECK.
6. Set MULTIPLIER switch and N switch as follows and check for proper display:

MULTIPLIER SWITCH	N SWITCH	DISPLAY
X1	00000	00000 O' Flo
X1	11111	11111
X1	22222	22222
X1	33333	33333
X1	44444	44444
X1	55555	55555
X1	66666	66666
X1	77777	77777
X1	88888	88888
X1	99999	99999
X10	00010	00100
X100	00010	01000
X1000	00010	10000

7. Set FUNCTION switch to TIME, N switch to 11111, and MULTIPLIER to X1, check that display is 11111.
8. Set FUNCTION switch to F/MN MAN and press START switch, check that counter totalizes. Press STOP switch, check that totalizing stops and display is held for the sample rate period, then resets to zero.
9. For 5330B models, set FUNCTION switch to F/MN HOLD, set FAST-NORM-HOLD to HOLD, L1 switch to 00111, and L2 switch to 00222. Press reset, press START switch and check that display totalizes to 00222 then holds.
10. Set FAST-NORM-HOLD to NORM, set FUNCTION switch to F/MN CYCLE. Press START switch and check that display totalizes to 00222 then resets to 00000, then repeats cycle.

Figure 3-5. Rate Measurements (5330A/B Models)



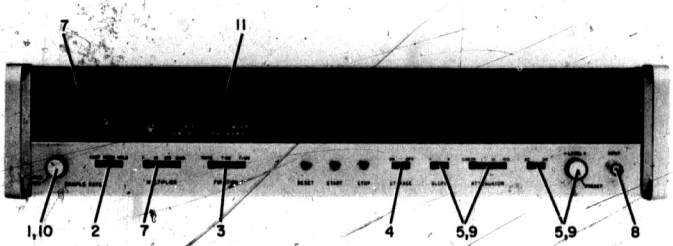
1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FAST-NORM-HOLD switch to NORM.
3. Set FUNCTION switch to RATE.
4. Set STORAGE switch to ON.
5. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match input signal characteristics (see Figure 3-2).
6. Using the following formula, determine values of MULTIPLIER (M) and N switch (N) settings (see paragraph 3-7 for example).

$$MN = \frac{(\text{time in sec})\ 10^{-6}}{\text{events per unit}}$$

7. Set MULTIPLIER switch and N switch combination to equal the value determined in Step 6. Any equivalent combination of MN may be used, e.g., if MN = 6000, N = 6 and M = 1000 or N = 60 and M = 100, etc.
8. Connect 0 to 10 MHz signal to INPUT connector.
9. Adjust ATTENUATOR and LEVEL controls for stable count.
10. Adjust SAMPLE RATE control and FAST-NORM switch for desired sample interval.
11. Display is readout of rate as set in Steps 6 and 7.
12. For 5330B models, rate limit detection may be set on L1 and L2 switches as given in Figure 3-10. Frequency input is limited to 2 MHz.

Figure 3-6. Frequency Measurements (5330A/B Models)

FREQUENCY



1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FAST-NORM-HOLD switch to NORM.
3. Set FUNCTION selector to RATE.
4. Set STORAGE switch to ON.
5. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match input signal characteristics (see Figure 3-2).
6. Determine desired gate length and values of M and N as follows: (Value of N should be a decade multiple, i.e., 1, 10, 100, 1000, etc.).
7. Set MULTIPLIER and N switches to desired gate length.
8. Connect 0 to 10 MHz signal to INPUT connector.
9. Adjust ATTENUATOR and LEVEL controls for stable display.
10. Adjust SAMPLE RATE control and FAST-NORM switch for desired sample interval.
11. To interpret display: $\text{Freq (Hz)} = \frac{\text{READOUT}}{10^{-6}\ \text{MN}}$
12. For 5330B models, frequency limit detection may be set on L1 and L2 switches as given in Figure 3-10. Frequency input is limited to 2 MHz.

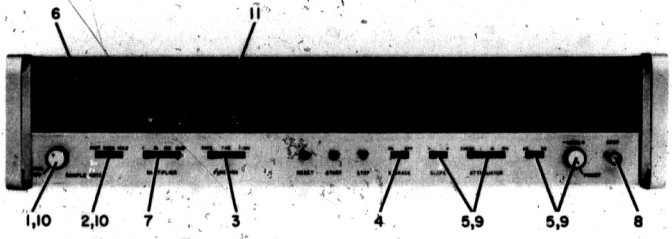
GATE LENGTH SELECTIONS

MULTIPLIER SETTING	RANGE	N* INCREMENTS	GATE LENGTH
X1	1 μsec to 0.1 sec.	1 μsec	1 μsec · N
X10	10 μsec to 1 sec.	10 μsec	10 μsec · N
X100	100 μsec to 10 sec.	100 μsec	100 μsec · N
X1000	1 msec to 100 sec.	1 msec	1 msec · N

*When N switch is set to 00000; N = 100,000.

Figure 3-7. Time for N Events (5330A/B Models)

TIME FOR N EVENTS



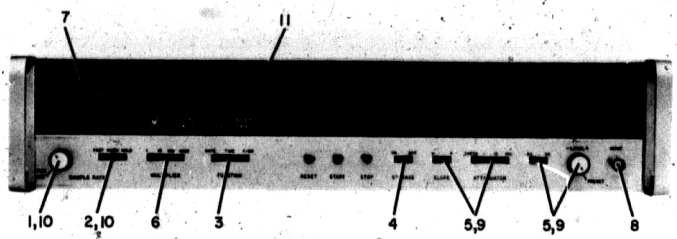
1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FAST-NORM-HOLD switch to NORM.
3. Set FUNCTION switch to TIME.
4. Set STORAGE switch to ON.
5. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match input signal characteristics (see Figure 3-2).
6. Set N switch to equal the number of events to be counted.
7. Select MULTIPLIER setting as follows:

Desired Display Units	MULTIPLIER
Microseconds	X1
Tens of microseconds	X10
Hundreds of microseconds	X100
Milliseconds	X1000

8. Connect 0 to 2 MHz signal to INPUT connector.
9. Adjust ATTENUATOR and LEVEL controls for stable count.
10. Adjust SAMPLE RATE and FAST-NORM switch for desired sample interval.
11. The time for N events to occur is equal to the counter display times the units selected in Step 7, i. e., DISPLAY x 10^{-6} sec x M = time for N events.
12. For 5330B models, time limit detection can be set with L1 and L2 switches, see Figure 3-10.

Figure 3-8. Period Measurements (5330A/B Models)

PERIOD



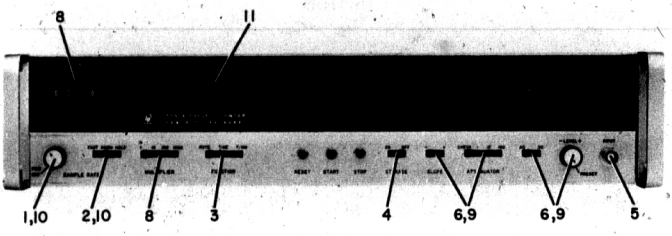
1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FAST-NORM-HOLD switch to NORM.
3. Set FUNCTION switch to TIME.
4. Set STORAGE switch to ON.
5. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match input signal characteristics (see Figure 3-2).
6. Set MULTIPLIER switch to desired display units as follows:

Desired Display Limits	MULTIPLIER
Microseconds	X1
Tens of microseconds	X10
Hundreds of microseconds	X100
Milliseconds	X1000

7. For single period measurements, set N to 1. For period average measurements, set N to desired periods to be averaged. (1 to 10^5 periods in increments of 1 can be selected.)
8. Connect 0 to 2 MHz signal to INPUT connector.
9. Adjust ATTENUATOR and LEVEL controls for stable count.
10. Adjust SAMPLE RATE control and FAST-NORM switch for desired sample interval.
11. For single period measurements, period = DISPLAY in units selected in Step 6, i.e., period = READOUT x 10^{-6} x M. For period average measurements, period = $\frac{\text{READOUT} \times 10^{-6} \times \text{M}}{\text{N}}$.
12. For 5330B models, limit detection can be set with L1 and L2 switches as given in Figure 3-10.

Figure 3-9. Ratio Measurements (5330A/B Models)

RATIO



NOTE

Ratio measurements can be made in either the rate or time modes. In rate, F_2 is divided by MN. In time, F_2 is divided by M and F_1 is divided by N.

RATE MODE:

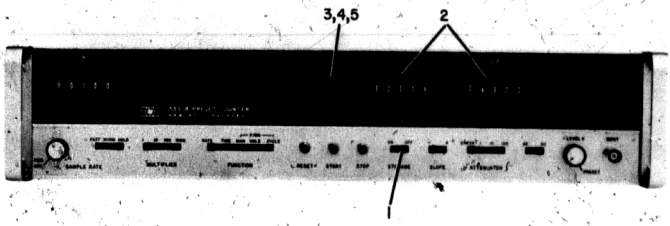
1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FAST-NORM-HOLD switch to NORM.
3. Set FUNCTION switch to RATE.
4. Set STORAGE switch to ON.
5. Connect higher of two input signals (F_1 = 0 to 10 MHz, >100 mV rms) to INPUT connector.
6. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match signal connected to INPUT connector (see Figure 3-2).
7. Connect lower of two input signals (F_2 = 1 kHz to 1 MHz, at 1 to 10 volt rms) to FREQ STD connector on rear panel. Set FREQ STD switch to EXT.
8. Set MULTIPLIER and N switches to desired combination to divide F_2.
9. Adjust ATTENUATOR and LEVEL controls for stable count.
10. Adjust SAMPLE RATE control and FAST-NORM switch for desired sample interval.
11. To interpret display, ratio = $\frac{\text{READOUT}}{MN}$
12. For 5330B models, limit detection can be set with L1 and L2 switches as given in Figure 3-10.

TIME MODE:

1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FAST-NORM-HOLD switch to NORM.
3. Set FUNCTION switch to TIME.
4. Set STORAGE switch to ON.
5. Connect lower of two input signals ($\frac{F_1}{N}$ where F_1 = 0 to 10 MHz, >100 mV rms) to INPUT connector.
6. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match signal connected to INPUT connector (see Figure 3-2).
7. Connect higher of two input signals ($\frac{F_2}{M}$ where F_2 = 1 kHz to 1 MHz at 1 to 10 V rms) to FREQ STD connector on rear panel. Set FREQ STD switch to EXT.
8. Set MULTIPLIER switch to desired value to divide F_2. Set N switch to desired value to divide F_1.
9. Adjust ATTENUATOR and LEVEL controls for stable count.
10. Adjust SAMPLE RATE control and FAST-NORM switch for desired sample interval.
11. To interpret display, Readout = $\frac{F_2 N}{F_1 M}$ or Ratio = $\frac{\text{Readout } M}{N}$

Figure 3-10. Limit Detection-5330B Models (Rate and Time Modes)

LIMIT DETECTION

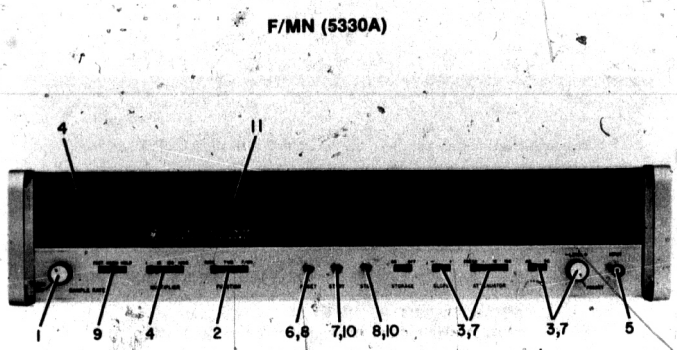


LATCHED LIMIT DETECTION. In this mode the outputs of the control lines and overflow lines will store, i.e., change only when a measurement results in different limit or overflow conditions.

1. Set STORAGE switch to ON.
2. Set upper and lower limit value on L1 and L2. High limit can be either L1 and L2.
3. When display is below lower limit, the L0 annunciator will light.
4. When display is equal to or greater than the lower limit, but less than the higher limit, the IN annunciator will light.
5. When display is equal to or greater than the higher limit, the HI annunciator will light.
6. L0, IN, and HI output control lines are available at rear panel remote connector to control external equipment.

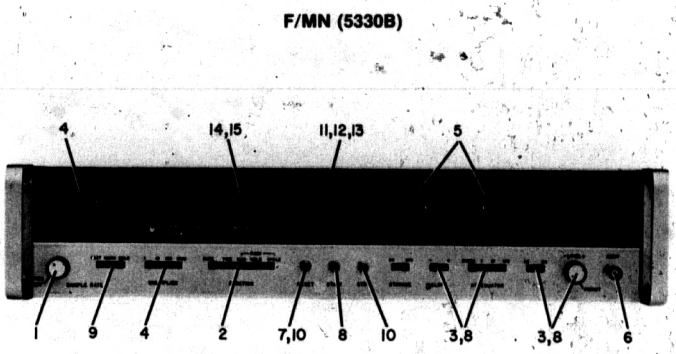
UNLATCHED LIMIT DETECTION. When the STORAGE switch is OFF, the outputs of the control lines and overflow lines will not store and the lines will reset to values indicating limit conditions when counter resets.

Figure 3-11. F/MN Mode (5330A Models)



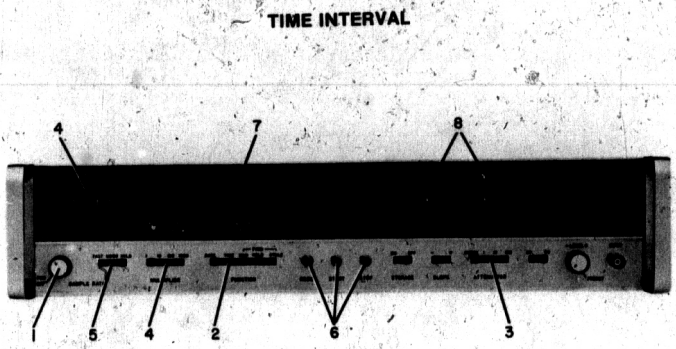
1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FUNCTION switch to F/MN position.
3. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match input signal characteristics (see Figure 3-2).
4. Set MULTIPLIER and N switches to desired combination to divide the input frequency. If MULTIPLIER = 1, input frequency range is 0-2 MHz. For M > 1, range is 0-10 MHz.
5. Connect input signal to INPUT connector.
6. Press RESET button.
7. Press START button and adjust ATTENUATOR and LEVEL controls for stable continuous counting cycle.
8. Press STOP button, then RESET button. Counter is now ready to totalize F/MN for period between START and STOP switch closures or between remote start and stop switch closures from external equipment.
9. If desired to hold display indefinitely, set FAST-NORM-HOLD switch to HOLD. When set to FAST or NORM, the display is held for the sample period, then resets to zero.
10. When desired to initiate measurement, press START button. When desired time interval has elapsed, press STOP button.
11. Counter display = $\frac{\text{Fin} \times t_1}{MN}$ where t_1 = time interval between START and STOP closures.

Figure 3-12. F/MN Modes (5330B Models)



1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FUNCTION switch as follows:
   a. F/MN - HOLD. Counter will supply separate control outputs when count is coincident with L1 and L2 settings. Count will stop when higher limit is reached.
   b. F/MN - MAN. Similar to hold mode except that counter continues count after high coincidence.
   c. F/MN - CYCLE. Similar to hold mode except that counter automatically resets to zero at higher limit, then repeats counting cycle.
3. Set SLOPE, ATTENUATOR, AC-DC, and LEVEL controls to match input signal characteristics (see Figure 3-2).
4. Set MULTIPLIER and N switches to desired combination to divide the input frequency. If MULTIPLIER = 1, input frequency range is 0-2 MHz. For M > 1, range is 0-10 MHz.
5. To establish limits on displayed count, set upper and lower limit values on L1 and L2. High limit can be set on either L1 or L2.
6. Connect input signal to INPUT connector.
7. Press RESET button.
8. Press START button and adjust ATTENUATOR and LEVEL controls for stable continuous counting.
9. If desired to hold display after stop, set FAST-NORM-HOLD to HOLD. If set to NORM or FAST, the display will hold for the sample rate period, then reset to zero.
10. Press STOP button, the RESET button. Counter is now set up to totalize F/MN for period between START and STOP switch closures or from remote equipment switches.
11. When display is below lower limit, the LO annunciator will light.
12. When display is equal to or greater than the lower limit, but less than the higher limit, the IN annunciator will light.
13. When display is equal to or greater than the higher limit, the HI annunciator will light.
14. For F/MN manual mode, counter display = $\frac{Fin \times t_1}{MN}$, where t_1 is time interval between START and STOP closures.
15. When higher L number has been reached, F/MN HOLD display is the delay in MN μsec from START command until higher number is reached.

Figure 3-13. Time Interval Measurements (5330A/B Models)



1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FUNCTION switch to F/MN - MAN position.
3. Set ATTENUATOR switch to CHECK.
4. Determine setting of MULTIPLIER switch (M) and N switch for desired display units as follows:
5. If desired to hold display after stop, set FAST-NORM-HOLD to HOLD. When set to FAST or NORM, the display is held for the sample period, then resets to zero.
6. Press RESET button. Counter is now set up to totalize selected display units for period between START and STOP switch closures or from remote equipment switches.
7. Time Interval = 10^{-6} sec x M x N x READOUT.
8. For the 5330B counter, limits may be set on L1 and L2 switches to determine if measured interval is within tolerances.

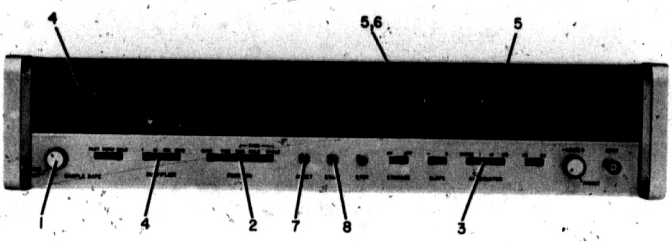
DISPLAY UNIT SELECTIONS

MULTIPLIER SETTING	RANGE	N* INCREMENTS	DISPLAY UNITS
X1	1 μsec to 0.1 sec.	1 μsec	1 μsec · N
X10	10 μsec to 1 sec.	10 μsec	10 μsec · N
X100	100 μsec to 10 sec.	100 μsec	100 μsec · N
X1000	1 millisec to 10 sec.	1 msec	1 msec · N

*When N switch is set to 00000; N = 100,000.

Figure 3-14. Delay Generator Operation (5330B Models)

DELAY GENERATOR

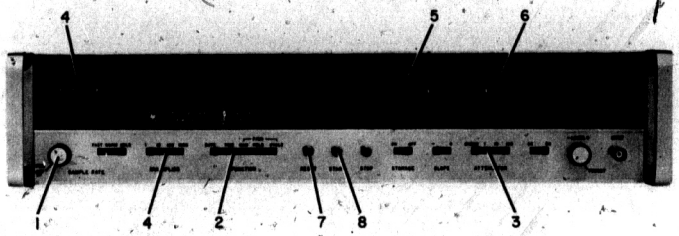


1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FUNCTION switch to F/MN-HOLD.
3. Set ATTENUATOR to CHECK.
4. Set MULTIPLIER (M) and N switches to select desired resolution. Time = 10^{-6} sec x M x N. Range is 1 μsec to 100 seconds.
5. For single time delay output, set L1 switch to 00000 and set L2 switch as follows:

$$L2 = \frac{\text{Desired Time Delay}}{\text{Time set in Step 4}}$$

6. If dual time delay operation is desired, set L1 to second time delay.
7. Press RESET button. Counter is now set up to generate time delays set on L1 and L2 switches referenced to START switch closure or remote start line control.
8. Press START switch. Time delays are available at HI, IN, and LO output lines, see Figure 3-1.

Figure 3-15. Pulse Generator Operation (5330B Models)



1. Rotate SAMPLE RATE control slightly clockwise from PWR OFF position.
2. Set FUNCTION switch to F/MN-RECYCLE.
3. Set ATTENUATOR to CHECK.
4. Set MULTIPLIER (M) and N switches to select desired resolution. Time = 10^{-6} sec x M x N.
5. Set L1 switch for t_1 in Figure 3-1.

$$L1 = \frac{t_1}{\text{Time set in Step 4}}$$

6. Set L2 switch for t_2 in Figure 3-1.

$$L2 = \frac{t_2}{\text{Time set in Step 4}}$$

7. Press RESET button. Counter is now set up to generate pulse trains as set by L1 and L2 switches.
8. Press START switch. Pulse outputs are available at HI, IN, and LO output lines, see Figure 3-1. The counter can be set to generate symmetrical or asymmetrical waveform outputs by appropriate L1 and L2 switch settings.

THEORY

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section describes the overall operation of the counter and the individual logic elements. Section VIII describes assembly operation and troubleshooting.

4-3. LOGIC SYMBOLS

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

4-5. GATES. Figure 4-2(A) represents a basic AND gate. The AND gate output is HIGH if all inputs are HIGH. An AND gate may have two or more inputs. Figure 4-2(B) represents a basic OR gate. The OR gate output is HIGH if one or more of its inputs is HIGH. An OR gate may have two or more inputs.

4-6. INVERSION. AND and OR gates are shown in Figure 4-2(A, B). A circle on the output of a logic symbol indicates a LOW when activated as shown in Figure 4-2(C and D). Thus, a circle indicates inversion. An AND gate with an inverted output is called a NAND gate; an OR gate with an inverted output is called a NOR gate. A unity-gain amplifier with an inverted output is called an inverter, Figure 4-2(F). The exclusive NOR gate, Figure 4-2(E) will provide a low output when either input is high, but not both inputs high. When both inputs are high or both are low, the gate output is high.

Figure 4-2. Gate Symbols

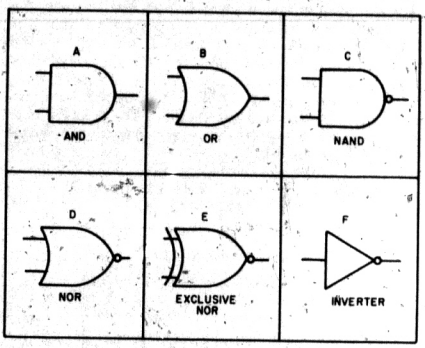
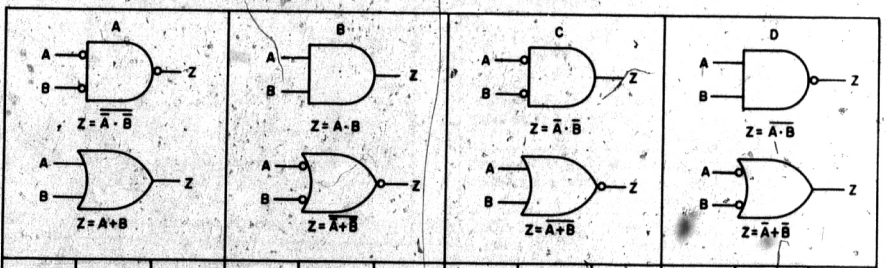


Figure 4-1. Logic Comparison Diagrams



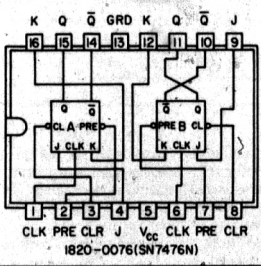
A	B	Z	A	B	Z	A	B	Z	A	B	Z
L	L	L	L	L	L	L	L	H	L	L	H
L	H	H	L	H	L	L	H	L	L	H	H
H	L	H	H	L	L	H	L	L	H	L	H
H	H	H	H	H	H	H	H	L	H	H	L

4-7. INTEGRATED CIRCUIT OPERATION

4-8. Dual J-K Master Slave Flip-Flop

4-9. The IC package for this FF is shown in Figure 4-3. When both inputs (J and K) are low the clock pulses have no effect. When J is high and K is low, the negative clock transition will set the FF so that Q is high and $\overline{Q}$ is low. When K is high and J is low, the negative clock transition will reset the FF so that Q is low and $\overline{Q}$ is high. If both J and K are high, the FF will change states (toggle) with each negative clock transition. A low R input will override all other functions and reset the FF. A low S input will override all other functions and set the FF. The Q and $\overline{Q}$ outputs are always opposite in level. Figure 4-3 shows the J-K FF truth table.

Figure 4-3. Dual J-K Master Slave FF (1820-0076)

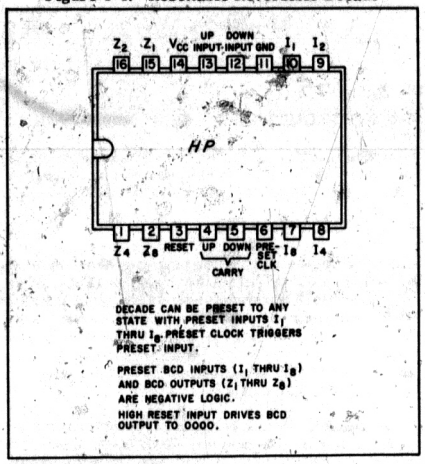


t_n		t_{n+1}		t_n = Before clock pulse t_{n+1} = After clock pulse
J	K	Q	$\overline{Q}$	
L	L	Q_n	$\overline{Q}_n$	If J = L and K = L, the Q and $\overline{Q}$ will not change from what they were before clock pulse.
H	L	H	L	If J = H and K = L, the Q will be high and $\overline{Q}$ will be low after clock pulse.
L	H	L	H	If J = L and K = H, then Q will be low and $\overline{Q}$ will be high after clock pulse.
H	H	$\overline{Q}_n$	Q_n	If J = H and K = H before clock pulse, then after clock pulse Q and $\overline{Q}$ will change states.

4-10. Preset Reversible Decade

4-11. IC package for this decade is shown in Figure 4-4. The unit can be used as an up-counter or down-counter. The circuit has negative logic preset BCD inputs and outputs. The up-count and down-count inputs operate on the positive transition of the input signal. To reset or preset the decade, a high level is required and the up- or down-count input should be inhibited.

Figure 4-4. Resettable Reversible Decade



4-12. Dual Decade

4-13. The IC package for this decade is shown in Figure 4-5. The unit has a gated output which is controlled by the gate control line. When the gate control is low, the gated output is enabled. Waveforms for the decade are shown in Figure 4-6. The reset 0 and reset 9 require a high input to reset the decade.

Figure 4-5. Dual Decade

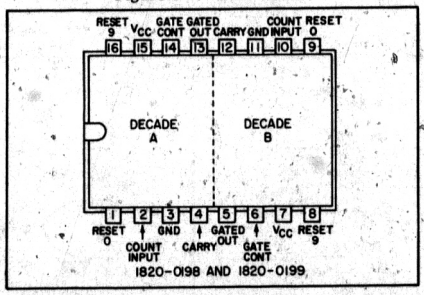
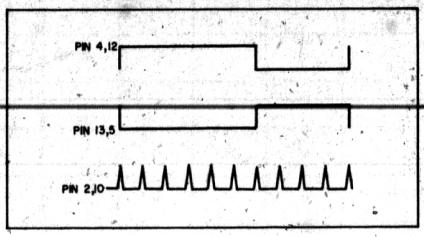


Figure 4-6. Dual Decade Waveforms



4-14. Four-Bit Buffer Storage

4-15. The IC package for this circuit is shown in Figure 4-7. As used in the 5330A/B instruments, the inputs are -8421 BCD and G2 is held high. With G2 high, the Z_A, Z_B, Z_C, and Z_D outputs are enabled. When G1 goes high, the input circuits are inhibited, so that the buffer will store the last BCD inputs and provide the stored information to inverted outputs at Z_A, Z_B, Z_C, and Z_D and non-inverted outputs at Z_A, Z_B, Z_C, and Z_D. When G1 goes low, the inputs are gated to the outputs. Figure 4-7 shows the buffer truth table.

4-16. Decoder Driver

4-17. The IC package for this circuit is shown in Figure 4-8. As used in the 5330A/B instruments, the decoders receive -8421 BCD inputs from the buffer storage units. The decoder converts the BCD to decimal information and provides a low output to illuminate the corresponding digit on the display tube. A truth table is shown in Figure 4-8.

4-18. Six-Bit Comparator

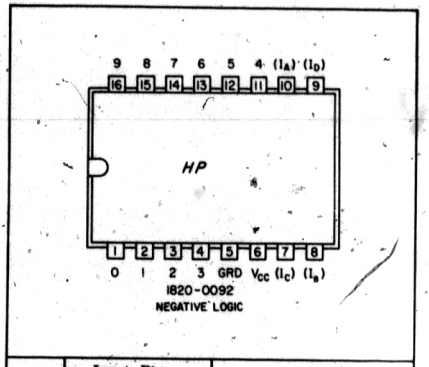
4-19. The IC package for this circuit is shown in Figure 4-9. The exclusive NOR gates provide low outputs when either input is high but not both inputs. As used in the 5330B, when both inputs to a NOR gate are high or both are low, a high NOR gate output is fed to the six input AND gate. When all AND gate inputs are high, a high Z output occurs to signify that coincidence has occurred between all six pairs of inputs.

4-20. OVERALL COUNTER OPERATION

4-21. Rate Mode

4-22. Figure 4-10 shows the rate mode block diagram. This mode is similar to the frequency mode of a conventional counter except that the gate length can be set to values other than decade multiples. The main gate

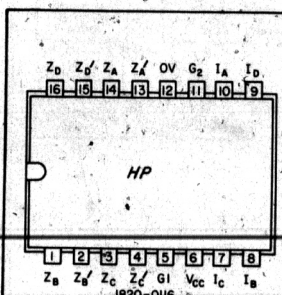
Figure 4-8. Decoder Driver



Digit	Input Pin Number D (9)	C (7)	B (8)	A (10)	Output Pin that is Low (all others HIGH)
Blank	L	L	L	L	All output pins are high
0	H	H	H	H	(1)
1	H	H	H	L	(2)
2	H	H	L	H	(3)
3	H	H	L	L	(4)
4	H	L	H	H	(11)
5	H	L	H	L	(12)
6	H	L	L	H	(13)
7	H	L	L	L	(14)
8	L	H	H	H	(15)
9	L	H	H	L	(16)

H = High (> +2.1 V) L = Low (< +0.4 V) H = High (> +55 V) L = Low (< +3 V)

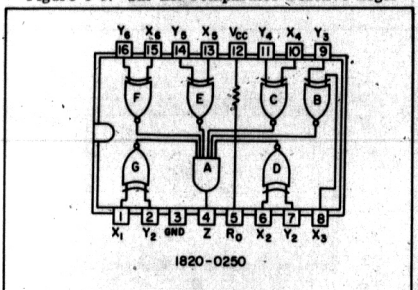
Figure 4-7. Four-Bit Buffer Storage



Digit	Input Pin Number D (9)	C (7)	B (8)	A (10)	Output Pin Number (to decoder) D (16)	C (3)	B (1)	A (14)	Output Pin Number (to J8) D (15)	C (4)	B (2)	A (13)
0	H	H	H	H	H	H	H	H	L	L	L	L
1	H	H	H	L	H	H	H	L	L	L	L	H
2	H	H	L	H	H	H	L	H	L	L	H	L
3	H	H	L	L	H	H	L	L	L	L	H	H
4	H	L	H	H	H	L	H	H	L	H	L	L
5	H	L	H	L	H	L	H	L	L	H	L	H
6	H	L	L	H	H	L	L	H	L	H	H	L
7	H	L	L	L	H	L	L	L	L	H	H	H
8	L	H	H	H	L	H	H	H	H	L	L	L
9	L	H	H	L	L	H	H	L	H	L	L	H

H = High (> +3.0 V) L = Low (< +0.5 V) H = High (> +2.1 V) L = Low (< +0.4 V) H = High (> 4.6 V) L = Low (< +0.4 V)

Figure 4-9. Six-Bit Comparator Positive Logic



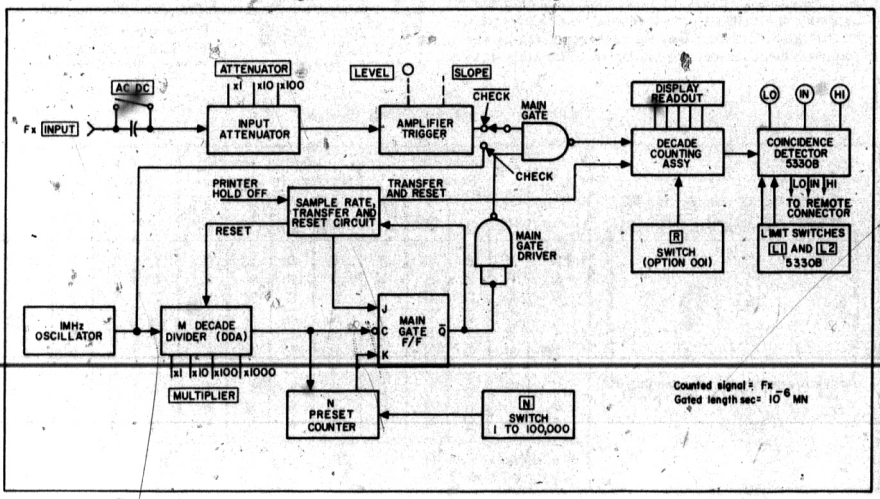
opens for a period equal to 1 μsec · M · N and the input signal Fx is counted by the decade counting assembly. The 1 MHz time base generates precision 1 μsec pulses which can be multiplied by 1, 10, 100, or 1000 in the M decade divider circuits. When the function selector is in rate, the 1 μsec · M pulses connect to the main gate FF and to the N preset down counter. The negative transition of the first 1 μsec · M pulse will set the main gate F/F so that $\overline{Q}$ goes low to open the main gate. The down counter is preset to the N switch value and will down-count to 00001. When 00001 is reached, the K input to the main gate FF is enabled. The next clock pulse input to the main gate FF will reset the FF so that $\overline{Q}$ goes high and closes the main gate. Since the N switch can be set to any number between 1 and 100,000, the gate length can be set for time intervals other than decade multiples. For example, if N = 06243, and M = 10, then the gate length is 62.43 milliseconds.

4-23. The input signal feeds through the input attenuator to the amplifier trigger. Either AC or DC coupling can be selected and up to X100 attenuation. The amplifier/trigger determines the triggering level and conditions the input signal into fast rise-narrow pulses. When the function selector is in rate, the amplifier/trigger output pulses are counted for the gate length interval. For option 001 instruments, the R switch will preset the decades to the R switch value so that counting starts from an offset.

4-24. For 5330B instruments, limit switches and coincidence detectors are installed. When the DCA count is lower than the lowest value set on the L1 and L2 switches, the L0 light illuminates and a low level is supplied to a rear panel connector. When the count is equal to or greater than the lowest L switch value but less than the higher L switch value, the IN light illuminates with a corresponding low level output to the rear panel. When the count is equal to or greater than the high L switch value, the HI light illuminates with a corresponding remote output.

4-25. The sample rate circuits control the interval between display readouts. When the main gate closes, the sample rate circuits provide a delay as determined by the front panel SAMPLE RATE controls. When the sample rate period has elapsed, a reset pulse is generated to reset the counter circuits to zero. The J input on the main gate F/F is held low until the sample rate

Figure 4-10. Rate Mode Block Diagram

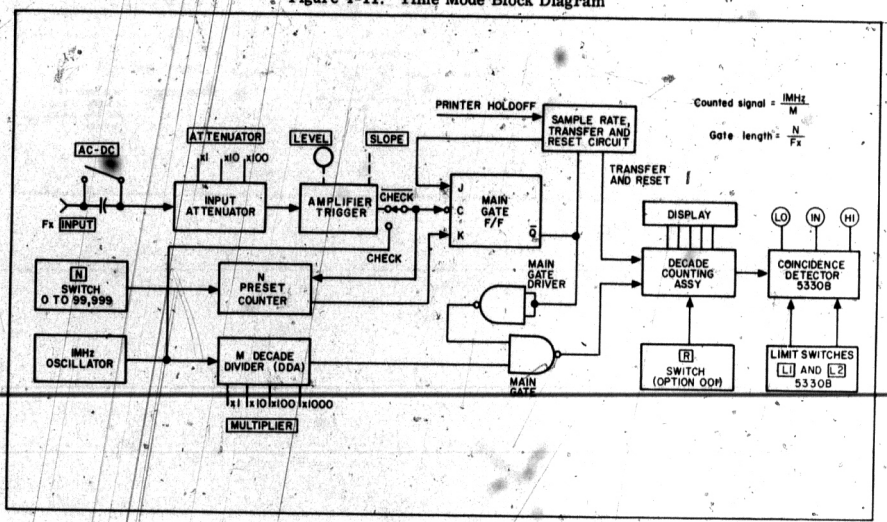


period is over, and the reset pulse has occurred, and no printer holdoff is present. Thus, the main gate cannot open until these three conditions are met. When $\overline{J}$ goes high, the next clock pulse sets the F/F so that $\overline{Q}$ goes low and opens the main gate. The transfer circuits are enabled during storage-on operation. At the end of gate time, a negative transfer pulse is generated to transfer BCD data to the display tubes and digital recorder output jack. During storage-off operation, the transfer line is held low so that data is continuously transferred to the display and the digital recorder output.

4-26. Time Mode

4-27. Figure 4-11 shows the time mode block diagram. The main gate is open for an interval equal to $\frac{N}{Fx}$ and the multiplied time base pulses are counted by the DCA. The M decade dividers provide 1 μsec, 10 μsec, 100 μsec, or 1 millisec outputs for counting. The time mode is similar to the period and period average mode of a conventional counter except that the preset time base allows period multiplies other than in decades. For example, if N is set to 04444 and Fx = 1 MHz, then the main gate will open for 4.444 milliseconds. This is useful for measuring time for N events to occur. The operation of the coincidence detectors, sample rate, reset, N down counter, and input circuits are the same as discussed in the rate mode.

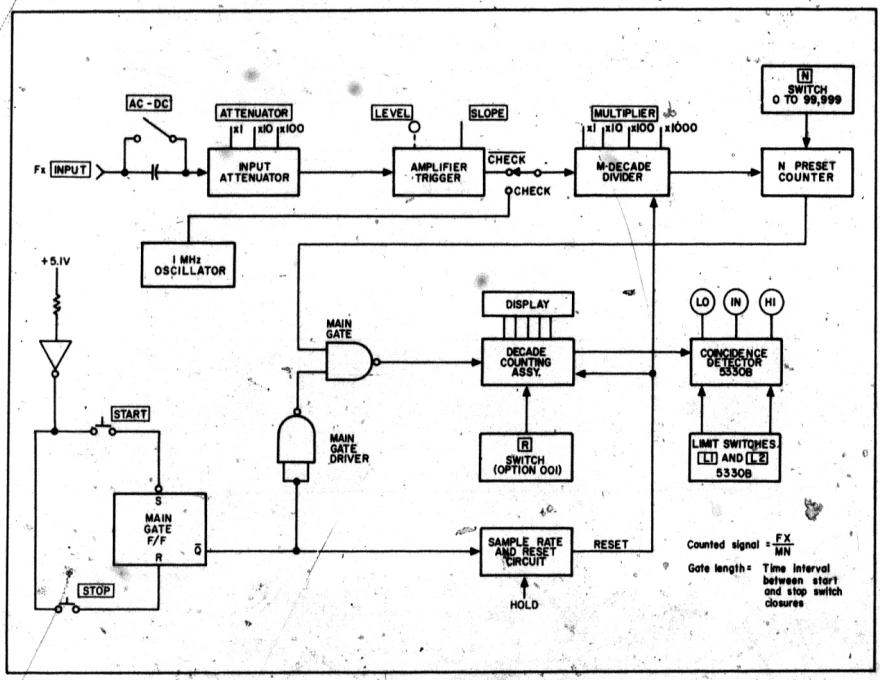
Figure 4-11. Time Mode Block Diagram



4-28. F/MN Manual Mode

4-29. Figure 4-12 shows the block diagram for the F/MN manual mode. This mode is similar to the totalize mode of a conventional counter except that Fx can be divided by MN. The main gate is controlled either manually with the STOP, START switches or remotely with external equipment. When the STOP switch is pressed, the sample rate circuits activate and allow the DCA count to be held for the sample rate period. When the sample rate period has elapsed, a reset pulse is generated to reset the counter. If the sample rate controls are set to hold, the display is held until the reset switch is pressed. During the F/MN modes, the storage feature is disabled.

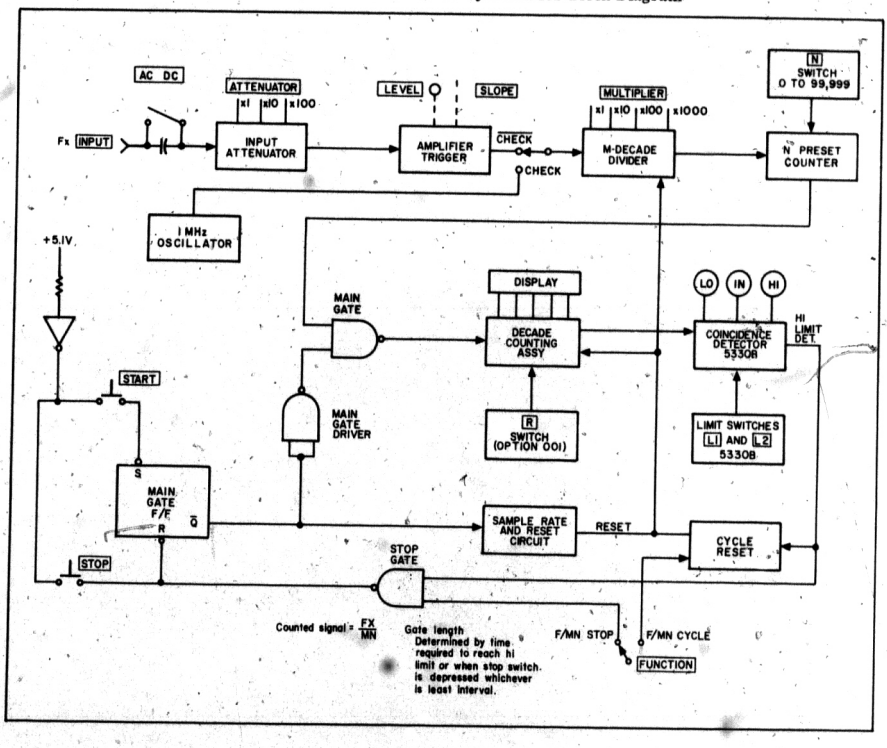
Figure 4-12. F/MN Manual Mode, Block Diagram



4-30. F/MN Hold and F/MN Recycle Modes

4-31. Figure 4-13 shows the block diagram for the F/MN hold and F/MN recycle modes. These modes are for 5330B counters only. The F/MN hold mode is similar to the F/MN manual mode except that the main gate closes when the HI limit value is reached. When the HI limit is reached, the display is held for the duration of the sample rate period, then resets to zero. If the SAMPLE RATE is set to HOLD, the HI count is held until a reset pulse is generated with the RESET switch or remotely from external equipment. During the F/MN recycle mode, the counter counts until the HI limit value is reached, then the reset circuits reset the counter to zero and the counting cycle repeats. Recycle time is less than 1 μsecs. The main gate remains open during the recycling until the stop switch or reset switch is pressed.

Figure 4-13. F/MN Hold and F/MN Cycle Modes Block Diagram



MAINTENANCE

SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. This section gives maintenance and service information. Included are tables of recommended test equipment, disassembly and repair procedures, troubleshooting, adjustments, and an in-cabinet performance check to verify proper operation of the counter.

5-3. ASSEMBLY DESIGNATIONS

5-4. Table 5-1 lists the designations, name, and HP part number of assemblies used in the instruments.

5-5. TEST EQUIPMENT

5-6. Table 5-2 lists test equipment recommended for maintaining and checking the counter performance. Test equipment having equivalent characteristics may be substituted for the equipment listed.

5-7. ASSEMBLY CONNECTION IDENTIFICATION

5-8. Throughout this manual, connections to printed circuit assemblies are referred to in abbreviated form. For example, connection to A4 pin 10 is A4(10).

5-9. IN-CABINET PERFORMANCE CHECK

5-10. GENERAL. The performance check is given in Table 5-3 and the test results and tolerances are listed on the performance check test card. The performance checks can 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.

c. As part of a procedure to locate defective circuits.

d. After repairs or adjustments, and before returning instrument to regular service.

e. As a permanent record of instrument maintenance performed. The test record pages are perforated and may be removed.

5-11. VARIABLE LINE VOLTAGE. During the performance tests (Table 5-3) the counter should be connected to a variable voltage source so the line voltage may be varied ± 10% from nominal 115 or 230 Vac.

5-12. INSTRUMENT COVERS REMOVAL

5-13. To remove top or bottom cover, remove the four screws which secure the cover. Slide cover toward rear of instrument and lift off. To replace cover, reverse procedure.

WARNING

115/230 VAC AND +175 VDC SUPPLY WIRES ARE EXPOSED WHEN EITHER TOP OR BOTTOM COVERS ARE REMOVED. USE EXTREME CAUTION DURING TROUBLESHOOTING, ADJUSTMENT, OR REPAIR. AVOID DAMAGE TO INSTRUMENT BY REMOVING POWER WHEN REMOVING OR REPLACING COVERS, ASSEMBLIES, OR COMPONENTS.

5-14. ASSEMBLY LOCATION

5-15. Top and bottom internal views of the counter are shown in Figure 8-2 and 8-3. The front and rear panel views are shown in Figures 3-2 and 3-3.

5-16. REMOVAL OF PRINTED CIRCUIT BOARDS

5-17. DISPLAY TUBE REPLACEMENT

a. Remove display tube shield by loosening the two pozi-drive retaining screws.

b. Adjust pin spacer flush with the tube pins.

c. Align knobs on bottom of spacer with the dimples on the socket.

d. Press downward on tube taking care not to bend pins.

5-18. A3 INTERCONNECT BOARD

a. Remove plug-in boards A4 through A8.

b. At top of counter on A14, remove the four #4 screws that secure A14 to J7.

c. At top of counter on A2, remove the three #4 screws that secure A2 to J6.

d. At top of counter near power transformer, remove transformer push-fit terminals (blue, gray, brown, and black wires) from pins on A3.

e. On bottom of counter, remove the five screws that secure A3 to the chassis.

Table 5-1. Assembly Identification

Assembly	Name	5330A	5330B
A1	Display Assembly	05330-60008	05330-60007
A2	Counter Assembly	05330-60011	05330-60023
A3	Interconnect Assembly	05330-60004	05330-60004
A4	Amplifier/Trigger	05267-60002	05267-60002
A5	Gate Control Assembly	05330-60006	05330-60006
A6	1 MHz Time Base	05330-60002	05330-60002
A7	+175 V and +5.1 V Power Supply	05323-60022	05323-60022
A8	±12 V Power Supply	05325-60005	05325-60005
A9	Switch Assembly	05330-60012	05330-60012
A10	N Switch Interconnect Assembly	05330-60005	05330-60005
A11	L1 Switch Interconnect Assembly	Not Used	05330-60025
A12	L2 Switch Interconnect Assembly	Not Used	05330-60025
A13	R Switch Interconnect Assembly (Option 001 Only)	05330-60025	05330-60025
A14	Remote Interconnect Assembly	05330-60024	05330-60024
S8	N Switch	3100-3209	3100-3209
S9	L1 Switch	Not Used	3100-3209
S10	L2 Switch	Not Used	3100-3209
S11	Reset Switch (Option 001)	05330-60001	05330-60001

f. Tilt A3 away from chassis and gently remove A3P1 from A9J1.

g. To replace A3, locate (do not tighten) the three #4 screws at J6 and the four #4 screws at J7. Then reverse removal procedures. Tighten the chassis screws first, then the seven #4 screws.

5-19. DISPLAY BOARD A1.

a. Remove the four #4 screws and the two #6 screws that secure A1 to A2.

b. Slide A1 toward rear of chassis and lift A1 to clear front panel. Slide forward and up to remove A1.

5-20. COUNTER BOARD A2.

a. Remove A1.

b. At top of counter at rear of A2, remove the three #4 screws that secure A2 to J6.

c. At bottom of counter at front of A2, remove the 12 screws that secure A10, A11, and A12 to A2. Remove A10, 11, and 12.

d. At bottom of counter near INPUT jack, unsolder the two wires connected to A2.

d. At top of counter, remove 10 screws that secure A2 to the chassis. Remove A2.

f. To replace A2, locate but not tighten the three screws that secure A2 to J6. Then reverse procedure. Tighten chassis screws first, then tighten the three #4 screws.

5-21. SWITCH BOARD A9.

a. Remove either side frame from chassis.

b. At bottom of counter, unsolder wires from INPUT jack. Unsolder wires from ON-OFF POWER switch.

c. At side frame, remove the three screws that secure the front panel main frame.

d. Tilt front panel away from chassis and remove A9J1 from A3P1.

[redacted] the six retaining nuts that secure A9 to the [redacted]el. Remove retaining nuts from RESET, START, and STOP switches.

f. A9 can now be tilted away from the front panel for servicing. To remove A9, unsolder the five wires from A9 and remove board.

g. To reassemble A9, reverse procedures.

5-22. PRINTED CIRCUIT COMPONENT REPLACEMENT

5-23. Component lead-holes in the circuit boards have plated through walls to ensure good electrical contact between conductors on opposite sides of the board. To prevent damage to this plating and the replacement component, apply heat sparingly, and work carefully.

Table 5-2. Recommended Test Equipment

Instrument Type	Required Characteristics	Recommended Type
Oscilloscope Vertical plug-in Time Base plug-in	50 MHz Bandwidth 50 mV/cm Sensitivity 50 MHz Bandwidth, 50 nsec/cm	HP 180A HP 1801A HP 1820A
Test Oscillator (2 Required)	10 Hz to 10 MHz 100 mV and 1 volt rms	HP 651B
Pulse Generator	10 MHz duty cycle, 50 nanosec pulse width 0.3 V p-p amplitude	HP 222
Digital Recorder	Print rate: 20 lines/sec. Data input: +8421 BCD parallel entry, accepts 1 = > +4.75 V 0 = < +0.4 V. Accepts negative going +5 to 0 V, 15 to 20 μsec transfer pulse.	HP 5050B
Frequency Standard	1 MHz output stability, ±1 part in 10^8/mo	HP 107AR
VTVM	DC voltage range: +175 V. Accuracy: ±2% AC voltage range: 100 mV to 8 V rms. Accuracy: ±3%. Frequency response: to 10 MHz	HP 410C
Variable line Transformer	103 to 127 volts rms and 206 to 254 volts rms	Superior Electric Power Stat 3PF 116 (115V); 3PF 216 (230V)
36-Pin Connector	Wired to test remote programming	HP 1251-0084 (Amphenol 57-30360)

5-24. ADJUSTMENTS

5-25. The adjustments in Table 5-4 are in the order they should be performed, but should not be done unless:

a. A trouble has been repaired which would affect these values.

b. The instrument does not meet all specifications while performing the checks in Table 5-3 (In-Cabinet Performance Checks).

5-26. TROUBLESHOOTING

5-27. Troubleshooting Aids

5-28. The following features of the Counters are useful for troubleshooting:

a. Logic probe jack A14J17 provides power for an HP 10525A logic probe.

b. All IC's are installed in plug-in sockets. Identical IC's can be interchanged to isolate trouble.

c. On PC boards, the Δ symbol on the component side denotes direction of IC installation. The Δ is nearest the hp symbol or cutout on the IC.

d. On PC boards, the Δ symbol on the circuit side denotes pin 1 of the IC.

e. On all PC boards, the etched number adjacent to the IC's denote the IC reference designator.

f. On A3 interconnect assembly, all plugs, jacks, sockets, and pin numbers are etched on the circuit side.

g. An IC test clip (HP 1400-0734) simplifies test connection to IC pins.

h. A PC board extender (05345-6022) is supplied to allow access to PC components for testing.

i. The N, L1, L2, and R switches can be easily removed from the front panel and interchanged to isolate trouble.

j. The CHECK mode can be used for counter checkout of all circuits except A4 and part of A2 (input attenuator and amp/trigger).

5-29. Troubleshooting Procedures

5-30. Figures 8-5 through 8-7 provide servicing block diagrams for each of the basic modes of operation. When trouble has been narrowed down to a particular PC board, refer to the applicable schematic in Section VIII for troubleshooting to the stage level.

Table 5-3. In-Cabinet Performance Check

FREQUENCY RANGE AND SENSITIVITY

FREQ RANGE:
Rate: 0 to 10 MHz
Time: 0 to 2 MHz
F/MN: 0 to 10 MHz (M >1); 0 to 2 MHz (M=1)
Limit Detection (5330B only): 0 to 2 MHz.

SENSITIVITY:
Sine Wave Input: 100 millivolts rms
Pulse Input: 300 millivolts p-p, 50 nanosecond pulse width

a. Set Counter controls as follows:

SAMPLE RATE	Clockwise out of OFF
FAST-NORM-HOLD	NORM
N SWITCH	1000
MULTIPLIER	X1
FUNCTION	RATE
STORAGE	ON
ATTENUATOR	X1
AC-DC	AC
LEVEL	PRESET
SLOPE	+

b. Connect test oscillator output to Counter INPUT using 50-ohm feed through termination and T-connector at Counter INPUT. Monitor Counter input signal with VTVM at T-connector.

c. Adjust test oscillator for 10 MHz output at 0.1 V rms. Check that Counter displays test oscillator frequency. Change AC-DC switch to DC and repeat check.

d. Vary test oscillator frequency from 10 MHz to 10 Hz. Maintain input level at 0.1 V rms. Check for proper Counter display over the frequency range. Record on test card.

e. Set Counter controls as follows:

FUNCTION	TIME
N SWITCH	00000
MULTIPLIER	X1

f. Adjust test oscillator for 2 MHz output at 0.1 V rms. Check that Counter indicates period of test oscillator output. Record on test card.

g. Set Counter controls as follows:

FUNCTION	F/MN MAN
N SWITCH	00100
MULTIPLIER	1

h. Adjust test oscillator for 2 MHz output at 0.1 V rms. Press START switch. Check for totalizing readout on Counter display. Record on test card.

i. Adjust test oscillator for 10 MHz output at 0.1 V rms. Set Counter MULTIPLIER to 10 and press START switch. Check for totalizing readout on Counter display. Record on test card.

j. Steps j through m are for 5330B models only. Set L1 switch to 19980, L2 switch to 20000, MULTIPLIER to 1, N switch to 10000, and FUNCTION switch to RATE.

k. Adjust test oscillator for 2 MHz at 0.1 V rms. Fine tune oscillator frequency until Counter display is 20000 or greater, HI indicator should light.

Table 5-3. In-Cabinet Performance Check (Continued)

FREQUENCY RANGE AND SENSITIVITY (Continued)

l. Fine tune oscillator frequency until Counter display is between 19980 and 20000, IN indicator should light.

m. Fine tune oscillator frequency until Counter display is below 19980, LO indicator should light. Record 2 MHz limit detection on test card.

n. Connect pulse generator to counter INPUT using 50-ohm feed through and T-connector. Use oscilloscope to monitor counter input.

o. Set Counter FUNCTION to RATE, N switch to 1000, MULTIPLIER to 1, AC-DC to DC.

p. Adjust pulse generator for 10 MHz rep rate, with 50 nanosecond pulses at 0.3 V p-p. Check that Counter indicates pulse generator frequency. Record on test card.

TRIGGER LEVEL

RANGE:
±3 V on X1 attenuator range; 0 V trigger in PRESET. Selectable + or - slope triggering.

NOTE

The check requires removal of the Counter bottom cover. To verify proper trigger operation, the marker output of A4 is used to intensity modulate an oscilloscope that is monitoring the counter input signal waveform. An alternate check can be made without cover removal by connecting a DC VTVM to REMOTE connector J12-26. Vary the LEVEL control fully CW and CCW and check that VTVM indicates approximately +3 to -3 volts.

a. Set Counter controls as follows:

SAMPLE RATE	CW out of OFF
FAST-NORM-HOLD	NORM
N SWITCH	1000
MULTIPLIER	X1
FUNCTION	RATE
STORAGE	ON
ATTENUATOR	X1
AC-DC	AC
LEVEL	PRESET
SLOPE	+

b. Connect test oscillator to Counter INPUT using 50-ohm feed through and T-connector. Use oscilloscope to monitor counter input.

c. Connect oscilloscope Z-axis to XA4(11).

d. Adjust test oscillator output for 10 kHz at 8 V p-p.

e. On oscilloscope, check that marker pulse is at 0 volt point on the positive slope of waveform.

f. Set Counter slope switch to - and check that marker pulse is at 0 volt point on the negative slope of waveform. Record on test card.

g. Vary LEVEL control fully CW and CCW (not in PRESET) and check that marker is adjustable from the +3 V to - 3 V points on waveform. Record on test card.

Table 5-3. In-Cabinet Performance Check (Continued)

RATIO

RANGE:
F_1 0 to 10 MHz, sensitivity (same as FREQ RANGE).
F_2 1 kHz to 1 MHz, sensitivity (1 volt rms sine wave).

a. Set Counter controls as follows:

FUNCTION	RATE
STORAGE	ON
FREQ STD switch (rear panel)	EXT
MULTIPLIER	X1
N SWITCH	00001
FAST-NORM-HOLD	NORM
SAMPLE RATE	clockwise out of PWR OFF position.

b. Connect test oscillator output to Counter INPUT. Adjust oscillator for 10 MHz at 0.1 V rms.

c. Connect second test oscillator output to Counter FREQ STD jack on rear panel. Adjust oscillator for 1 kHz output at 1 volt rms.

d. Check that Counter displays ratio of two oscillator frequencies (approximately 10000).

e. Repeat test using FREQ STD inputs of 100 kHz and 1 MHz. Check for Counter displays of approximately 100 and 10. Record on test card.

DIGITAL RECORDER CHECK

BCD Output: 4-line +8421.
Print Command: Negative pulse +5 V to 0 V (nominal), 35 usec to 45 usec.
Hold-Off Requirements: > +2.4 volts.

a. Connect 5050B recorder to Counter DIGITAL RECORDER OUTPUT jack.

b. Set Counter controls as follows:

SAMPLE RATE	Clockwise out of OFF
FAST-NORM-HOLD	NORM
MULTIPLIER	X1
FUNCTION	RATE
STORAGE	ON
N SWITCH	00000
ATTENUATOR	CHECK

c. Load paper in Digital Recorder and press OPER switch.

d. Adjust Counter SAMPLE RATE for convenient printout time. Check that printout is 00000.

e. Set Counter N switch to 11111, 22222, etc., and check for proper recorder printout. Record on test card.

f. Disconnect digital recorder cable from Counter.

g. Using 10:1 probe, connect oscilloscope vertical input to Counter Digital Recorder connector J8(D).

h. Set Counter N switch to 10, MULTIPLIER to X1, SAMPLE RATE to FAST.

Table 5-3. In-Cabinet Performance Check (Continued)

DIGITAL RECORDER CHECK (Continued)

i. Check that oscilloscope indicates a negative going 35 to 45 usec print command pulse, +5 V to 0 V nominal. Record on test card.

j. To check printer holdoff, connect jumper from J8(3) to J8(B). Press RESET switch. Check that main gate is inhibited (gate light out) and counter does not count.

REMOTE PROGRAMMING

REMOTE Line Requirements
High or OFF: Open circuit or voltage from +2.4 V to +5 V.
Low or ON: Ground or voltage from 0 to +0.4 V at -15 mA maximum.
Main Gate Pulse Out: +2.4 V to 0.4 V minimum.
SAMPLE RATE TIME: FAST 100 μsec to 12 msec, NORM 12 msec to 5 sec.

NOTE

This test programs the counter for remote operation in RATE-CHECK mode, sample-normal, storage off, and X1 multiplier.

a. Using an HP 1251-0084 connector (Amphenol 57-30360), make remote programming plug as follows: connect jumper wires from pin 2 to 20, 20 to 23, 23 to 9, 9 to 10, 10 to 16, and 16 to 35. Attach 1-inch wire to pin 30.

b. On Counter, set N switch to 11111 and SAMPLE RATE for convenient display time. Check that REM'T light is ON and counter display is 11111. Record proper operation on test card.

c. To check other remote functions, make remote connector as in step a using Table 2-2 to determine programmed lines.

d. Connect oscilloscope vertical input to 1-inch wire on remote program plug J12(30).

e. Set N switch to 00010 and check that oscilloscope indicates main gate pulses at least +2.4 V to 0.4 V amplitude. Pulse width should be 10 usec wide. Record on test card.

f. On Counter, vary SAMPLE RATE control and check that intervals between main gate pulses varies between 12 milliseconds and 5 seconds. Record on test card.

g. Disconnect jumper from J12(20) to set SAMPLE RATE to FAST. Check that SAMPLE RATE control varies intervals between main gate pulses from 100 usec to 12 ms. Record on test card.

5330B F/MN CHECK

F/MN HOLD: Count stops at HI coincidence with the larger limit.
F/MN CYCLE: Automatically resets at larger limit and repeats cycle. Recycle time less than 1 usec.

F/MN HOLD

a. Set Counter controls as follows:

SAMPLE RATE	Mid-range out of OFF
FAST-NORM-HOLD	NORM
N SWITCH	00001
MULTIPLIER	X1
FUNCTION	F/MN HOLD
ATTENUATOR	CHECK
L1 Switch	00001
L2 Switch	00001

Table 5-3. In-Cabinet Performance Check (Continued)

5330B F/MN CHECK (Continued)

b. Press RESET switch, then press START switch and check that counter cycles and stops count at 00001. Count should hold for sample rate period, then reset to zero.

c. Repeat step b with FAST-NORM-HOLD in HOLD position. Check that count is held at 00001 until RESET switch is pressed.

d. Repeat step b with L1 set to 11111, 22222, etc., check for proper readout.

e. Repeat step d for L2 switch.

F/MN CYCLE

a. Connect 5325B TIME BASE OUTPUT to 5330 INPUT.

b. Using low capacity shielded cable (8120-0026), connect HI output (REMOTE connector J12-29) to 5325B INPUT A.

c. Using low capacity shielded cable, connect IN output (REMOTE connector J12-31) to 5325B INPUT B.

d. Set 5330 controls as follows:

FUNCTION	F/MN RECYCLE
LEVEL	PRESET
ATTENUATOR	X1
SLOPE	-
AC-DC	AC
L2	99000
L1	00001

e. Set 5325B controls as follows:

FUNCTION	T. I. A to B
SAMPLE RATE	Fully CCW (not OFF)
FAST-NORM-HOLD	NORM
TIME BASE	10 μs
COM-SEP	SEP
ATTENUATOR A and B	X10
AC-DC A and B	DC
SLOPE A and B	-
LEVEL	+.5
STORAGE	ON
INT-EXT	INT

f. Press RESET switch on both counters, then press 5330 START switch. Check that 5330 counts to higher of L switch numbers, then resets, then repeats cycle. Check that 5325B reads the same as the lower L switch setting.

g. Repeat test with L1 set to 00002, 00004, 00006, and 80000.

h. Set 5325B FUNCTION switch PERIOD A. Set 5330 L1 switch to 00001.

i. Press RESET switch on both counters, then press 5330 START switch. Check that 5325B displays same number as set on high L switch setting.

i. Repeat test with L2 set to 00002, 00004, 00006, and 80000.

Table 5-3. In-Cabinet Performance Check (Continued)

TIME BASE

FREQUENCY: 1 MHz

STABILITY:

Aging Rate: Less than 5 parts in 10^7/mo

Temperature: $<\pm 3$ parts in 10^5 (0° to 65°C)
$<\pm 5$ parts in 10^6 (10° to 40°C)

Line Voltage: $<\pm 1$ part in 10^6 for $\pm 10\%$ line voltage variation

Output: 1 MHz at 3 V p-p open circuit.

a. Connect 1 MHz frequency standard to oscilloscope trigger input.

b. Connect Counter FREQ STD jack to Oscilloscope Vertical input. Set counter FREQ STD switch to INT.

c. Set oscilloscope to external trigger and sweep time to .1 μsec/cm.

d. At right side panel of counter, use insulated tuning tool to adjust A6C5 for minimum oscilloscope drift. Horizontal drift of scope pattern in cm/sec is difference between frequency standard and counter time base frequency in parts in 10^7.

e. Record frequency difference. For long term stability check, repeat test daily for about one month.

f. Vary line voltage ±10% and record frequency difference.

g. Vary temperature from 0° to 65°C and record frequency difference.

h. Vary temperature from 10° to 40°C and record frequency difference.

i. Measure and record oscilloscope peak-to-peak vertical amplitude. Should be 3 V minimum.

Table 5-4. Adjustments

1. AMPLIFIER/TRIGGER A4

With 10 MHz applied to counter input, A4R10 is adjusted for maximum sensitivity. An HP 651B test oscillator is required. Proceed as follows:

a. Set counter controls as follows:

SAMPLE RATE	Slightly CW out of PWR OFF
FAST-NORM-HOLD	NORM
MULTIPLIER	10
FUNCTION	RATE
STORAGE	ON
SLOPE	+
ATTENUATOR	X1
AC-DC	DC
LEVEL	PRESET
N SWITCH	1000

b. Connect 10 MHz at 0.1 V rms to INPUT connector.

c. Adjust input level until display is unstable. Adjust A4R10 for stable display.

d. Repeat b and c until A4R10 is adjusted for maximum sensitivity.

2. 1 MHz TIME BASE A6

This adjustment consists of displaying the 1 MHz oscillator output on the vertical axis of an oscilloscope. A frequency standard is used to trigger the horizontal input. A6C5 is adjusted for minimum drift on the scope display. An HP 107AR frequency standard and an HP 180 oscilloscope with 1801A and 1820A plug-ins are required.

a. At counter rear panel, set FREQ STD to INT and connect FREQ STD output to oscilloscope vertical input.

b. Connect 1 MHz frequency standard to oscilloscope trigger input.

c. Set oscilloscope controls for external trigger and adjust A6C5 for minimum drift of display.

PERFORMANCE CHECK TEST CARD

Hewlett-Packard Models 5330A/B
Preset Counters

Serial No. ____ - _____

Test Performed by _____

Date _____

Description	Check
FREQUENCY RANGE	
Rate Mode: 0 to 10 MHz	_____ 10 Hz to 10 MHz
Time Mode: 0 to 2 MHz	_____ 2 MHz
F/MN Mode (M=1): 0 to 2 MHz	_____ 2 MHz
F/MN Mode (M>1): 0 to 10 MHz	_____ 10 MHz
Limit Detection (5330B only): 0 to 2 MHz	_____ 2 MHz
SENSITIVITY	
Sine Wave Input: 100 mV rms	_____ 100 mV rms
Pulse Input: 300 mV p-p, 50 nanosec pulse width	_____ 300 mV rms
TRIGGER LEVEL	
±3 V on X1 attenuator setting	_____ ±3 V
0 V PRESET, + and - slope	_____ 0 V + and - slope
RATIO	
F_1 0 to 10 MHz	_____ 10 MHz
F_2 1 kHz to 1 MHz	_____ 1 kHz, 100 kHz, 1 MHz
DIGITAL RECORDER	
BCD Output: 4-line +8421	_____ BCD printouts
Print Command: Negative +5 V to 0 V, 35 μsec to 45 μsec nominal	_____ +5 V to 0 V, 35 to 45 μsec
Hold-Off: > +2.4 V	_____ > +2.4 V
REMOTE PROGRAMMING	
High or OFF: Open circuit or voltage from +2.4 V to +5 V at 0.4 mA	_____ Proper Operation
Low or ON: Ground or voltage from 0 to 0.4 V at 5 mA	_____ Proper Operation
Main Gate Pulse Out: +0.4 to 2.4 V minimum	_____ +0.4 V to +2.4 V minimum
Sample Rate	
FAST: 100 μsec to 12 msec	_____ 100 μsec to 12 msec
NORM: 12 msec to 5 sec	_____ 12 msec to 5 sec
5330B F/MN CHECK	
F/MN Hold: Count stops at HI coincidence with the larger limit	_____ Hold
F/MN Cycle: Automatically resets at larger limit and repeats cycle. Recycle time less than 1 μsec	_____ Recycle less than 1 μsec

PERFORMANCE CHECK TEST CARD

Description	Check
TIME BASE	
Stability	
Aging Rate: less than 5 parts in 10^7/mo	_____ < 5 parts in 10^7/month
Temperature: < ± 3 parts in 10^5 (0° to 65°C)	_____ < ± 3 parts in 10^5
Line Voltage: < ± 1 parts in 10^6 for ± 10% line voltage variation	_____ < ± 1 part in 10^6 for 10% for ± 10% line voltage variation

PARTS LIST

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designators and indicates the description and HP Part Number of each part, together with any applicable notes. The table includes the following information.

a. Description of part (see abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-2.

c. Manufacturer's part number.

d. Total quantity used in the instrument (TQ column).

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

6-4. ORDERING INFORMATION

6-5. 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 numbers.

6-6. To obtain a part that is not listed, include:

a. Instrument model number.
b. Instrument serial number.
c. Description of the part.
d. Function and location of the part.

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

A . . . . . ampere
ac . . . . alternating current
ACCESS . . . . . accessory
ADJ . . . . . adjustment
A/D . . . . analog-to-digital
AF . . . . . audio frequency
AFC . . . . . automatic frequency control
AGC . . . . automatic gain control
AL . . . . . aluminum
ALC . . . . automatic level control
AM . . . amplitude modulation
AMPL . . . . . amplifier
APC . . . . automatic phase control
ASSY . . . . . assembly
AUX . . . . . auxiliary
avg . . . . . average
AWG . . . . American wire gauge
BAL . . . . . balance
BCD . . . . . binary coded decimal
BD . . . . . board
BE CU . . . . . beryllium copper
BFO . . . . beat frequency oscillator
BH . . . . . binder head
BKDN . . . . . breakdown
BP . . . . . bandpass
BPF . . . . . bandpass filter
BRS . . . . . brass
BWO . . . . . backward-wave oscillator
CAL . . . . . calibrate
ccw . . . counter-clockwise
CER . . . . . ceramic
CHAN . . . . . channel
cm . . . . . centimeter
CMO . . . cabinet mount only
COAX . . . . . coaxial
COEF . . . . . coefficient
COM . . . . . common
COMP . . . . . composition
COMPL . . . . . complete
CONN . . . . . connector
CP . . . . . cadmium plate
CRT . . . cathode-ray tube
CTL . . . . complementary transistor logic
CW . . . . continuous wave
cw . . . . . clockwise
cm . . . . . centimeter
D/A . . . . digital-to-analog
dB . . . . . decibel
dBm . . . . decibel referred to 1 mW
dc . . . . . direct current
deg . . . degree (temperature interval or difference)
. . . . . degree (plane angle)
°C . . . . . degree Celsius (centigrade)
°F . . . . . degree Fahrenheit
°K . . . . . degree Kelvin
DEPC . . deposited carbon
DET . . . . . detector
diam . . . . . diameter
DIA . . . diameter (used in parts list)
DIFF AMPL . . differential amplifier
div . . . . . division
DPDT . . . . . double-pole, double-throw
DR . . . . . drive
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 HZ . . . . fillister head
FM . . frequency modulation
FP . . . . . front panel
FREQ . . . . . frequency
FXD . . . . . fixed
g . . . . . gram
GE . . . . . germanium
GHz . . . . . gigahertz
GL . . . . . glass
GRD . . . . . ground(ed)
H . . . . . henry
h . . . . . hour
HET . . . . . heterodyne
HEX . . . . . hexagonal
HD . . . . . head
HDW . . . . . hardware
HF . . . . . high frequency
HG . . . . . mercury
HI . . . . . high
HP . . . . Hewlett-Packard
HPF . . . . high pass filter
HR . . . . . hour (used in parts list)
HV . . . . . high voltage
Hz . . . . . Hertz
IC . . . . integrated circuit
ID . . . . . inside diameter
IF . . . . . intermediate frequency
IMPG . . . . impregnated
in . . . . . inch
INCD . . . . incandescent
INCL . . . . . include(s)
INP . . . . . input
INS . . . . . insulation
INT . . . . . internal
kg . . . . . kilogram
kHz . . . . . kilohertz
kΩ . . . . . kilohm
kV . . . . . kilovolt
lb . . . . . pound
LC . . . . . inductance-capacitance
LED . . light-emitting diode
LF . . . . . low frequency
LG . . . . . long
LH . . . . . left hand
LIM . . . . . limit
LIN . . . linear taper (used in parts list)
lin . . . . . linear
LK WASH . . . lock washer
LO . . . low; local oscillator
LOG . . . logrithmic taper (used in parts list)
log . . . . . logrithm(ic)
LPF . . . . low pass filter
LV . . . . . low voltage
m . . . . . meter (distance)
mA . . . . . milliampere
MAX . . . . . maximum
MΩ . . . . . megohm
MEG . . . meg (10^6) (used in parts list)
MET FLM . . . metal film
MET OX . . metallic oxide
MF . . . medium frequency; microfarad (used in parts list)
MFR . . . . manufacturer
mg . . . . . milligram
MHz . . . . . megahertz
mH . . . . . millihenry
mho . . . . . mho
MIN . . . . . minimum
min . . . . minute (time)
. . . . . minute (plane angle)
MINAT . . . . . minature
mm . . . . . millimeter

NOTE

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

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
mVp-p . . . millivolt, peak-to-peak
mVrms . . . . millivolt, rms
mW . . . . . milliwatt
MUX . . . . . multiplex
MY . . . . . mylar
μA . . . . . microampere
μF . . . . . microfarad
μH . . . . . microhenry
μmho . . . . micromho
μs . . . . . microsecond
μV . . . . . microvolt
μVac . . . . . microvolt, ac
μVdc . . . . microvolt, dc
μVpk . . . microvolt, peak
μVp-p . . . microvolt, peak-to-peak
μVrms . . . . microvolt, rms
μW . . . . . microwatt
nA . . . . . nanoampere
NC . . . . . no connection
N/C . . . . normally closed
NE . . . . . neon
NEG . . . . . negative
nF . . . . . nanofarad
NI PL . . . . nickel plate
N/O . . . . normally open
NOM . . . . . nominal
NORM . . . . . normal
NPN . . . negative-positive-negative
NPO . . . . negative-positive zero (zero temperature coefficient)
NRFR . . not recommended for field replacement
NSR . . . . not separately replaceable
ns . . . . . nanosecond
nW . . . . . nanowatt
OBD . . . order by description
OD . . . . . outside diameter
OH . . . . . oval head
OP AMPL . . . operational amplifier
OPT . . . . . option
OSC . . . . . oscillator
OX . . . . . oxide
oz . . . . . ounce
Ω . . . . . ohm
P . . . . peak (used in parts list)
PAM . . . . pulse-amplitude modulation
PC . . . . . printed circuit
PCM . . pulse-code modulation; pulse-count modulation
PDM . . . . pulse-duration modulation
pF . . . . . picofarad
PH BRZ . . phosphor bronze
PHL . . . . . 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; position(s) (used in parts list)
POSN . . . . . position
POT . . . . . potentiometer
p-p . . . . . peak-to-peak
PP . . . peak-to-peak (used in parts list)
PPM . . . . pulse-position modulation
PREAMPL . . . preamplifier
PRF . . . . pulse-repetition frequency
PRR . . . . pulse repetition rate
ps . . . . . picosecond
PT . . . . . point
PTM . . . . . pulse-time modulation
PWM . . . . . pulse-width modulation
PWV . . . . . peak working voltage
RC . . . . . resistance-capacitance
RECT . . . . . rectifier
REF . . . . . reference
REG . . . . . regulated
REPL . . . . . replaceable
RF . . . . radio frequency
RFI . . . . radio frequency interference
RH . . . . round head; right hand
RLC . . . . . resistance-inductance-capacitance
RMO . . . rack mount only
rms . . . . root-mean-square
RND . . . . . round
ROM . . . read-only memory
R&P . . . . rack and panel
RWV . . . . reverse working voltage
S . . . scattering parameter
s . . . . . second (time)
. . . " . . . second (plane angle)
S-B . . . . slow-blow (fuse) (used in parts list)
SCR . . . silicon controlled rectifier; screw
SE . . . . . selenium
SECT . . . . . sections
SEMICON . . . . semiconductor
SHF . . . . superhigh frequency
SI . . . . . silicon
SIL . . . . . silver
SL . . . . . slide
SNR . . signal-to-noise ratio
SPDT . . . . single-pole, double-throw
SPG . . . . . spring
SR . . . . . split ring
SPST . . . . single-pole, single-throw
SSB . . . . single sideband
SST . . . . stainless steel
STL . . . . . steel
SQ . . . . . square
SWR . . standing-wave ratio
SYNC . . . . synchronize
T . . . timed (slow-blow fuse)
TA . . . . . tantalum
TC . . . . . temperature compensating
TD . . . . . time delay
TERM . . . . . terminal
TFT . . . thin-film transistor
TGL . . . . . toggle
THD . . . . . thread
THRU . . . . . through
TI . . . . . titanium
TOL . . . . . tolerance
TRIM . . . . . trimmer
TSTR . . . . . transistor
TTL . . transistor-transistor logic
TV . . . . . television
TVI . . television interference
TWT . . traveling wave tube
U . . . . micro (10^{-6}) (used in parts list)
UF . . . microfarad (used in parts list)
UHF . . ultrahigh frequency
UNREG . . . . unregulated
V . . . . . volt
VA . . . . . voltampere
Vac . . . . . volts, ac
VAR . . . . . variable
VCO . . . voltage-controlled oscillator
Vdc . . . . . volts, dc
VDCW . . volts, dc, working (used in parts list)
V(F) . . . . . volts, filtered
VFO . . . variable-frequency oscillator
VHF . . . . very-high frequency
Vpk . . . . . volts, peak
Vp-p . . volts, peak-to-peak
Vrms . . . . . volts, rms
VSWR . . . voltage standing wave ratio
VTO . . . . voltage-tuned oscillator
VTVM . . . vacuum-tube voltmeter
V(X) . . . . volts, switched
W . . . . . watt
W/ . . . . . with
W/V . . . working inverse voltage
WW . . . . . wirewound
W/O . . . . . without
YIG . . . yttrium-iron-garnet
Z_o . . . characteristic impedance

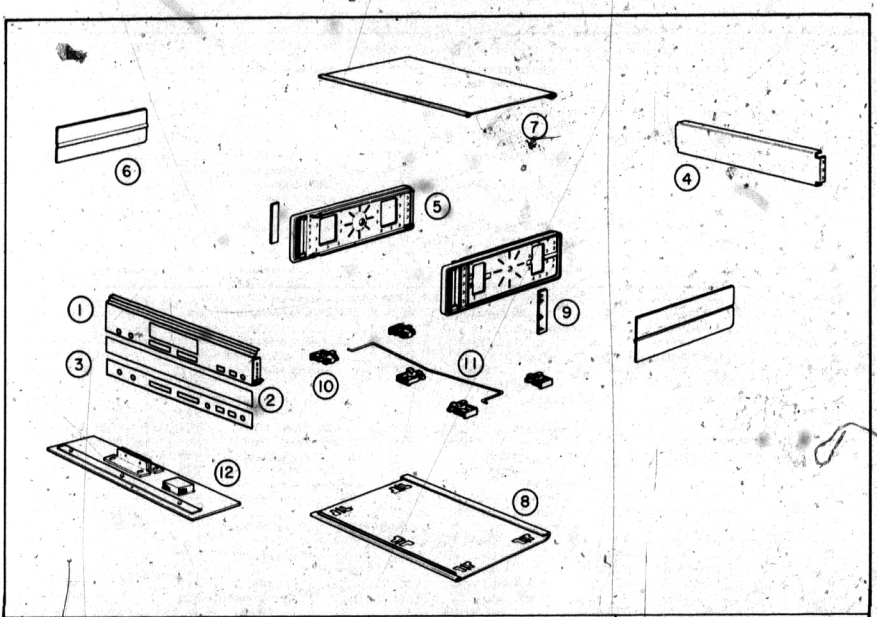
NOTE

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

MULTIPLIERS

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

Figure 6-1. Cabinet Parts



Item	Description	Standard
1	Front Panel	05330-00003
	Top Panel Trim (001) (5330A only)	05330-00009
2	Top Panel Trim (5330A only)	05330-00008
	Top Panel Trim (5330B only)	05330-00028
	Top Panel Trim (002) (5330B only)	05330-00029
3	Bottom Panel Trim (5330A only)	05330-00002
	Bottom Panel Trim (5330B only)	05330-00001
4	Rear Panel	05330-00031
5	Side Frame	5060-0729
6	Side Cover	5000-8591
7	Top Cover	05330-00032
8	Bottom Cover	05330-00033
9	Trim Strip	5000-0050
10	Foot Assembly	5060-0767
11	Tilt Stand	1490-0030
12	Rack Mount Kit	05330-60040

Table 6-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05330-60008	1	BOARD ASSY:DISPLAY (5330A ONLY)	28480	05330-60008
	05330-20007	2	BOARD:BLANK PC	28480	05330-20007
A1 C1	0160-2201	8	C:FXD MICA 51 PF 5%	72136	DDM15E510J1C
A1 C2	0160-0162	3	C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A1 C3	0160-0194	2	C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A1 CR1	1901-0040	5	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1 CR2	1910-0016	25	DIODE:GE 60 WIV	28480	1910-0016
A1 DS1 THRU A1 DS2			NOT ASSIGNED		
A1 DS4	2140-0313	9	LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	G2A-B
A1 DS5	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	G2A-B
A1 DS6	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	G2A-B
A1 DS7			NOT ASSIGNED		
A1 DS8	1970-0042	10	TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1 DS8	1200-0405	9	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 DS9	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 DS10	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1 DS10	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 DS11	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1 DS11	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 DS12	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1 DS12	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 IC1			NOT ASSIGNED		
A1 IC2	1820-0116	11	IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC3	1200-0473	52	SOCKET:IC 16-PIN	28480	1200-0473
	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC3	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC4	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC4	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC5	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC5	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC6	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC6	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC7			NOT ASSIGNED		
A1 IC8			NOT ASSIGNED		
A1 IC9	1820-0729	10	IC:DECODER-DIVIDER	28480	1820-0729
A1 IC9	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC10	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC10	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC11	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC11	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC12	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC12	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC13	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC13	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 Q1 THRU A1 Q3			NOT ASSIGNED		
A1 Q4	1854-0009	16	TSTR:SI NPN	80131	2N709
A1 Q5	1854-0022	9	TSTR:SI NPN	07263	S17843
A1 Q6	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q7	1854-0009		TSTR:SI NPN	80131	2N709
A1 Q8	1854-0071	18	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q9	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q10	1854-0009		TSTR:SI NPN	80131	2N709
A1 R1 THRU A1 R6			NOT ASSIGNED		
A1 R7	0683-4725	21	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A1 R8	0683-1225	7	R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1 R9	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1 R10	0683-1025	14	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1 R11	0686-8236	8	R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R12	0686-8236		R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R13	0683-2025	2	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A1 R14	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1 R15	0683-4735	2	R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735
A1 R16	0683-2725	4	R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725
A1 R17	0683-2745	2	R:FXD COMP 270K OHM 5% 1/4W	01121	CB 2745
A1 R18	0683-4325	2	R:FXD COMP 4300 OHM 5% 1/4W	01121	CB 4325
A1 R19	0683-1035	27	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A1 R20	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1 R21	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1 R22	0686-8235		R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R23			NOT ASSIGNED		
A1 R24	0683-6825	14	R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R25	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R26	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R27	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R28	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R29			NOT ASSIGNED		
A1 R30			NOT ASSIGNED		
A1 R31	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A1 R32	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
	05330-00006	2	SHIELD:NIXIE	28480	05330-00006
A1	05330-60007	1	BOARD ASSY:DISPLAY (5330B ONLY)	28480	05330-60007
	05330-20007		BOARD:BLANK PC	28480	05330-20007
A1 C1	0160-7201		C:FXD MICA 51 PF 5%	72136	RDM15E510JIC
A1 C2	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A1 C3	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A1 CR1	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FOG1088
A1 CR2	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1 DS1	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A1 DS2	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A1 DS3	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A1 DS4	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A1 DS5	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A1 DS6	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A1 DS7			NOT ASSIGNED		
A1 DS8	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1 DS9	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 DS10	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1 DS11	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 DS12	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1 DS13	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1 IC1			NOT ASSIGNED		
A1 IC2	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC2	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC3	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC3	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC4	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC4	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC5	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC5	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC6	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1 IC6	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC7			NOT ASSIGNED		
A1 IC8			NOT ASSIGNED		
A1 IC9	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC9	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC10	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC10	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC11	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC11	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC12	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC12	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 IC13	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A1 IC13	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A1 Q1	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q2	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q3	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q4	1854-0309		TSTR:SI NPN	80131	2N709
A1 Q5	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q6	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q7	1854-0309		TSTR:SI NPN	80131	2N709
A1 Q8	1854-0371		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q9	1854-0022		TSTR:SI NPN	07263	S17843
A1 Q10	1854-0309		TSTR:SI NPN	80131	2N709
A1 R1	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1 R2	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1 R3	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1 R4	0686-8235		R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R5	0686-8235		R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R6	0686-8235		R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R7	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A1 R8	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1 R9	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1 R10	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1 R11	0686-8235		R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R12	0686-8235		R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R13	0683-2025		R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A1 R14	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1 R15	0683-4735		R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735
A1 R16	0683-2725		R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725
A1 R17	0683-2745		R:FXD COMP 270K OHM 5% 1/4W	01121	CB 2745
A1 R18	0683-4325		R:FXD COMP 4300 OHM 5% 1/4W	01121	CB 4325
A1 R19	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A1 R20	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1 R21	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A1 R22	0686-8235	1	R:FXD COMP 82K OHM 5% 1/2W	01121	EB 8235
A1 R23			NOT ASSIGNED		
A1 R24	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R25	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R26	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R27	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R28	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1 R29			NOT ASSIGNED		
A1 R30			NOT ASSIGNED		
A1 R31	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A1 R32	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
	05330-00006		SHIELD:NIXIE	28480	05330-00006
	05330-00026	1	RETAINER:LEFT	28480	05330-00026
	05330-00027	1	RETAINER:RIGHT(SINGLE BRACKET)	28480	05330-00027
	05330-40002	1	BLOCK:ANNUNCIATOR	28480	05330-40002
	05330-80001	1	WINDOW:GATE	28480	05330-80001
	05330-80002	1	WINDOW:HI INDICATOR	28480	05330-80002
A2	05330-60011	1	BOARD ASSY:COUNTER (5330A ONLY)	28480	05330-60011
	05330-20011	2	BOARD:BLANK PC	28480	05330-20011
A2 C1	0160-2201		C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A2 C2	0140-0206	7	C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 C3	0140-0196	5	C:FXD MICA 150 PF 5%	72136	RDM15F151J3C
A2 C4	0140-0206		C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 C5	0140-0206	2	C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 C6	0140-0175	2	C:FXD MICA 39 PF 2% 300VDCW	28480	0140-0175
A2 C7	0160-0205	2	C:FXD MICA 10 PF 5%	28480	0160-0205
A2 C8	0160-2249	4	C:FXD CER 4.7 PF 500VDCW	72982	301-NPO-4.7 PF
A2 C9	0160-0362	2	C:FXD MICA 510PF 5%	28480	0160-0362
A2 C10	0160-2249		C:FXD CER 4.7 PF 500VDCW	72982	301-NPO-4.7 PF
A2 C11	0160-2265	2	C:FXD CER 22 PF 5% 500VDCW	72982	301-NPO-22PF
A2 C12	0160-0180	2	C:FXD MY 0.033 UF 5%	28480	0160-0180
A2 CR1	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A2 CR2	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A2 CR3	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A2 IC1	1820-0054	11	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2 IC1	1200-0474	70	SOCKET:IC 14-PIN	28480	1200-0474
A2 IC2	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2 IC2	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC3			NOT ASSIGNED		
A2 IC4	1820-0237	10	INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC4	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC5	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC5	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC6	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC6	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC7	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC7	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC8	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC8	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC9 THRU A2 IC90			NOT ASSIGNED		

See Introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2 IC21	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2 IC21	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC22	1820-0328	4	IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A2 IC22	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC23	1820-0070	2	IC:TTL 8-INPT POS NAND GATE	01295	SN7430N
A2 IC23	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC24	1820-0176	10	INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC24	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC25	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC25	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC26	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC26	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC27	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC27	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC28	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC28	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 J1	5060-0110	4	CONNECTOR:45 CONTACTS	28480	5060-0110
A2 J1	5060-0110		CONNECTOR:45 CONTACTS	28480	5060-0110
A2 J1	5060-0110		CONNECTOR:45 CONTACTS	28480	5060-0110
A2 K1	0490-0764	9	RELAY:REED 0.1 AMP	28480	0490-0764
A2 K2	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A2 K3	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A2 K4	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A2 Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2 Q2	1854-0009		TSTR:SI NPN	80131	2N709
A2 Q3	1854-0009		TSTR:SI NPN	80131	2N709
A2 Q4	1854-0009		TSTR:SI NPN	80131	2N709
A2 R1	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R2	0683-4715	7	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A2 R3	0683-1825	8	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A2 R4	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R5	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2 R6	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2 R7	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2 R8	0683-2235	3	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A2 R9	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A2 R10	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2 R11	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A2 R12	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2 R13	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A2 R14	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A2 R15	0683-3325	4	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A2 R16	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R17	0683-5115	5	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A2 R18	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2 R19	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A2 R20	0683-2715	5	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A2 R21	0683-2755	2	R:FXD COMP 2.7 MEGOHM 5% 1/4W	01121	CB 2755
A2 R22	0683-3035	4	R:FXD COMP 30K OHM 5% 1/4W	01121	CB 3035
A2 R23	0683-1855	2	R:FXD COMP 1.8 MEGOHM 5% 1/4W	01121	CB 1855
A2 R24	0683-2245	2	R:FXD COMP 220K OHM 5% 1/4W	01121	CB 2245
A2	05330-60023	1	BOARD ASSY:COUNTER (5330B ONLY)	28480	05330-60023
	05330-20011		BOARD:BLANK PC	28480	05330-20011
A2 C1	0160-2201		C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A2 C2	0140-0206		C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 C3	0140-0196		C:FXD MICA 150 PF 5%	72136	RDM15F151J3C
A2 C4	0140-0206		C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 C5	0140-0206		C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 C6	0140-0175		C:FXD MICA 39 PF 2% 300VDCW	28480	0140-0175
A2 C7	0160-0205		C:FXD MICA 10 PF 5%	28480	0160-0205
A2 C8	0160-2249		C:FXD CER 4.7 PF 500VDCW	72982	301-NP0-4.7 PF
A2 C9	0160-0362		C:FXD MICA 510PF 5%	28480	0160-0362
A2 C10	0160-2249		C:FXD CER 4.7 PF 500VDCW	72982	301-NP0-4.7 PF
A2 C11	0160-2265		C:FXD CER 22 PF 5% 500VDCW	72982	301-NP0-22PF
A2 C12	0160-0180		C:FXD MY 0.033 UF 5%	28480	0160-0180
A2 C13	0140-0196		C:FXD MICA 150 PF 5%	72136	RDM15F151J3C
A2 C14	0140-0196		C:FXD MICA 150 PF 5%	72136	RDM15F151J3C
A2 C15	0140-0206		C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 C16	0140-0206		C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V
A2 CR1	1910-0016		DIODE:GF 60 WIV	28480	1910-0016

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2 CR2	1910-0016		DIODE:GE 6O WIV	28480	1910-0016
A2 CR3	1910-0016		DIODE:GE 6O WIV	28480	1910-0016
A2 CR4	1910-0016		DIODE:GE 6O WIV	28480	1910-0016
A2 CR5	1910-0016		DIODE:GE 6O WIV	28480	1910-0016
A2 CR6	1910-0016		DIODE:GE 6O WIV	28480	1910-0016
A2 IC1	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2 IC1	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC2	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2 IC2	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC3			NOT ASSIGNED		
A2 IC4	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC4	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC5	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC5	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC6	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC6	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC7	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC7	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC8	1820-0237		INTEGRATED CIRCUIT:DECIMAL COUNTER 10MC	28480	1820-0237
A2 IC8	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC9			NOT ASSIGNED		
A2 IC10	1820-0250	8	INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC10	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC11	1820-0250		INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC11	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC12	1820-0250		INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC12	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC13	1820-0250		INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC13	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC14	1820-0250		INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC14	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC15	1820-0250		INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC15	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC16	1820-0250		INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC16	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC17	1820-0250		INTEGRATED CIRCUIT:TTL 6 BIT COMP	28480	1820-0250
A2 IC17	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC18	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A2 IC18	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC19	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2 IC19	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC20	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A2 IC20	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC21	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2 IC21	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC22	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A2 IC22	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC23	1820-0070		IC:TTL 8-INPT POS NAND GATE	01295	SN7430N
A2 IC23	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A2 IC24	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC24	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC25	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC25	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC26	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC26	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC27	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC27	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 IC28	1820-0176		INTEGRATED CIRCUIT:NEGATIVE LOGIC	28480	1820-0176
A2 IC28	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A2 J1	5060-0110		CONNECTOR:45 CONTACTS	28480	5060-0110
A2 K1	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A2 K2	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A2 K3	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A2 K4	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A2 Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2 Q2	1854-0009		TSTR:SI NPN	80131	2N709
A2 Q3	1854-0009		TSTR:SI NPN	80131	2N709
A2 Q4	1854-0009		TSTR:SI NPN	80131	2N709
A2 R1	0683-1035		RESXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R2	0683-4715		RESXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A2 R3	0683-1825		RESXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A2 R4	0683-1035		RESXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R5	0683-5125		RESXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A2 R6	0683-4725		RESXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2 R7	0683-4725		RESXD COMP 4700 OHM 5% 1/4W	01121	CB 4725

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2 R8			NOT ASSIGNED		
A2 R9	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A2 R10	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2 R11	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A2 R12	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2 R13	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A2 R14	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A2 R15	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A2 R16	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R17	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A2 R18	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2 R19	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A2 R20	0683-2715		R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A2 R21	0683-2755		R:FXD COMP 2.7 MEGOHM 5% 1/4W	01121	CB 2755
A2 R22	0683-3035		R:FXD COMP 30K OHM 5% 1/4W	01121	CB 3035
A2 R23	0683-1855		R:FXD COMP 1.8 MEGOHM 5% 1/4W	01121	CB 1855
A2 R24	0683-2245		R:FXD COMP 220K OHM 5% 1/4W	01121	CB 2245
A2 R25			NOT ASSIGNED		
A2 R26	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R27	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2 R28	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A3	05330-60004	1	BOARD ASSY:INTERCONNECT (5330A/B)	28480	05330-60004
	05330-20004	1	BOARD:BLANK PC	28480	05330-20004
A3J1 THRU A3J5			NOT ASSIGNED		
A3J6	5060-0111	2	CONNECTOR	28480	5060-0111
A3J7	5060-0110		CONNECTOR:46 CONTACT	28480	5060-0110
A3XA1 THRU A3XA3			NOT ASSIGNED		
A3XA4	1251-0213	3	CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3XA5	1251-1388	2	CONNECTOR:PC (2 X 15) 30 CONTACT	71785	252-15-30-008
A3XA6	1251-1388		CONNECTOR:PC (2 X 15) 30 CONTACT	71785	252-15-30-008
A3XA7	1251-0213		CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3XA8	1251-0213		CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A4	05267-60002	1	BOARD ASSY:AMPLIFIER/TRIGGER (5330A/B)	28480	05267-60002
	05267-20002	1	BOARD:BLANK PC (5330A/B)	28480	05267-20002
A4C1	0180-0210	10	C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A4C2	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A4C3 THRU A4C5			NOT ASSIGNED		
A4C6	0180-1743	1	C:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A4C7	0140-0192	2	C:FXD MICA 68 PF 5%	28480	0140-0192
A4C8	0140-0192		C:FXD MICA 68 PF 5%	28480	0140-0192
A4C9	0160-2255	2	C:FXD CER 8.2 PF 500VDCW	72982	301-000-COH0-829C
A4C10	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A4C11	0160-2255		C:FXD CER 8.2 PF 500VDCW	72982	301-000-COH0-829C
A4C12	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A4C13	0160-2257	2	C:FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A4C14	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A4C15	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A4C16	0160-2248	2	C:FXD CER 4.3 PF 500VDCW	28480	0160-2248
A4C17	0150-0093	1	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C18	0160-0333	1	C:FXD MICA 15+/-0.5 PF	00853	RDM15C15003C
A4C19	0160-2248		C:FXD CER 4.3 PF 500VDCW	28480	0160-2248
A4C20	0150-0050	1	C:FXD CER 1000 PF +80-20% 1000VDCW	56289	CD67B102E102ZS26-CDH
A4C21	0160-2199	1	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A4CR1	1902-3059	2	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A4CR2	1901-0040		DIODE:SILICON 50 MA 30 NV	07263	FDG1088
A4CR3	1901-0040		DIODE:SILICON	07263	FDG1088
A4CR4	1902-3059		DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A4CR5	1901-0040		DIODE:SILICON	07263	FDG1088
A4CR6	1901-0040		DIODE:SILICON	07263	FDG1088
A4CR7	1910-0022	2	DIODE:FDF SWIV	14483	G401

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4CR8	1910-0022		DIODE:GE 5NSV	14433	G401
A4CR9	1901-0022	1	DIODE:SILICON 0.56V AT 1 MA	28480	1901-0022
A4CR10	1901-0651	1	DIODE:SI 3-JUNCTION STABISTOR	28480	1901-0651
A4Q1	1855-0370	1	TSTR:SI DUAL	28480	1855-0370
A4Q2	1853-0015	2	TSTR:SI PNP	80131	2N5640
A4Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q4	1853-0015		TSTR:SI PNP	80131	2N3640
A4Q5	1854-0019	2	TSTR:SI NPN	28480	1854-0019
A4Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q7	1854-0019		TSTR:SI NPN	28480	1854-0019
A4Q8	1854-0009		TSTR:SI NPN	80131	2N709
A4Q9	1854-0009		TSTR:SI NPN	80131	2N709
A4Q10	1853-0036	1	TSTR:SI PNP	80131	2N3906
A4Q11	1854-0009		TSTR:SI NPN	80131	2N709
A4R1	0683-6815	4	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A4R2	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A4R3	0683-1045	3	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A4R4	0683-1065	1	R:FXD COMP 10M OHM 5% 1/4W	01121	CB 1065
A4R5	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A4R6	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A4R7	0683-1325	2	R:FXD COMP 1300 OHM 5% 1/4W	01121	CB 1325
A4R8	0683-4315	2	R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A4R9	0683-9105	2	R:FXD COMP 91 OHM 5% 1/4W	01121	CB 9105
A4R10	2100-1757	1	R:VAR WW 500 OHM 5% TYPE V 1W	28480	2100-1757
A4R11	0683-2015	1	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A4R12	0683-9105		R:FXD COMP 91 OHM 5% 1/4W	01121	CB 9105
A4R13	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A4R14	0683-1055	1	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A4R15	0683-5105	2	R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A4R16	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A4R17	0683-3315	2	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A4R18	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A4R19 THRU A4R20			NOT ASSIGNED		
A4R21	0683-2715		R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A4R22	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R23	0683-2725		R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725
A4R24	0683-1535	2	R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535
A4R25	0683-1235		R:FXD COMP 12K OHM 5% 1/4W	01121	CB 1235
A4R26	0683-1235		R:FXD COMP 12K OHM 5% 1/4W	01121	CB 1235
A4R27	0683-1535		R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535
A4R28	0683-2725		R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725
A4R29	0683-2715		R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A4R30	0683-6215	2	R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A4R31	0683-1625	2	R:FXD COMP 1600 OHM 5% 1/4W	01121	CB 1625
A4R32	0683-1625		R:FXD COMP 1600 OHM 5% 1/4W	01121	CB 1625
A4R33	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A4R34	0683-7525	2	R:FXD COMP 7500 OHM 5% 1/4W	01121	CB 7525
A4R35	0683-2035	4	R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035
A4R36	0683-8235	1	R:FXD COMP 82K OHM 5% 1/4W	01121	EB 8235
A4R37	0683-7525		R:FXD COMP 7500 OHM 5% 1/4W	01121	CB 7525
A4R38	0683-6215		R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A4R39	0683-1525	4	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A4R40	0683-2035		R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035
A4R41	0683-2715		R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A4R42	0683-1005	1	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A4R43	0683-2035		R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035
A4R44	0683-5105		R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A5	05330-60006	1	BOARD ASSY:GATE CONTROL (5330A/B)	28480	05330-60006
	05330-20006	1	BOARD:BLANK PC	28480	05330-20006
A5C1	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A5C2	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-MTS
A5C3	0160-2701		C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A5C4	0160-2701		C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A5C5	0180-0374	1	C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A5C6	0160-0207	4	C:FXD MYLAR 0.01UF 5% 200VDCW	28480	0160-0207
A5C7	0180-0195	1	C:FXD ELECT 0.33 UF 20% 35VDCW	56289	150D334X0035A2-DYS
A5C8	0160-2701		C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A5CR1	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5CR2	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5CR3	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5CR4	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5CR5	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5CR6	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5CR7	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FD6108A

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5CR8	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5CR9	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A5IC1	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC1	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A5IC2	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC2	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A5IC3	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC3	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A5IC4	1820-0068	2	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A5IC4	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A5IC5	1820-0307	3	IC:DTL HEX INVERTER	04713	MC836P
A5IC5	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A5IC6	1820-0076	1	IC:TTL DUAL J-K F/F W/PRESET CLOCK	01295	SN7476N
A5IC6	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A5IC7	1820-0068		IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A5IC7	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A5K1	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A5Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q6	1854-0005	1	TSTR:SI NPN	80131	2N708
A5R1	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R2	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R3	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R4	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R5	0683-2735	1	R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735
A5R6	0683-2235		R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A5R7	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R8	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R9	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R10	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R11			NOT ASSIGNED		
A5R12	0683-3615	1	R:FXD COMP 360 OHM 5% 1/4W	01121	CB 3615
A5R13	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R14	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A5R15	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A5R16	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A5R17	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A5R18	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R19	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A5R20	0683-5615	4	R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615
A5R21	0683-1115	1	R:FXD COMP 110 OHM 5% 1/4W	01121	CB 1115
A5R22	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A5R23	0683-5615		R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615
A5R24	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A5R25	0683-5615		R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615
A5R26	0683-2225	3	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A5R27	0683-5615		R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615
A6	05330-60002	1	BOARD ASSY:DECADE TIME BASE (5330A/B)	28480	05330-60002
	05330-20002	1	BOARD:BLANK PC	28480	05330-20002
A6C1	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A6C2	0160-0127	2	C:FXD CER 1.0 UF 20% 25VDCW	56289	SC13CS-CML
A6C3	0150-0121	1	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	SC50B1S-CML
A6C4	0140-0194	1	C:FXD MICA 110 PF 5%	72136	RDM15E111J3C
A6C5	0121-0180	1	C:VAR CER 15-60 PF	28480	0121-0180
A6C6	0140-0201	1	C:FXD MICA 12 PF 5%	28480	0140-0201
A6C7	0160-2218	1	C:FXD MICA 1000 PF 5%	28480	0160-2218
A6C8	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	SC13CS-CML
A6C9	0160-2143	1	C:FXD CER 2000 PF +80-20% 1000VDCW	91418	TYPE B
A6C10	0160-0168	1	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A6C11	0160-2203	1	C:FXD MICA 91 PF 5%	72136	RDM15E910J3C
A6C12	0140-0196	1	C:FXD MICA 150 PF 2%	28480	0140-0196
A6C13	0160-2306	1	C:FXD MICA 27 PF 5%	28480	0160-2306
A6C14	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15E910J1C
A6CR1	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A6CR2	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A6CR3	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A6CR4	1910-0016		DIODE:GE 60 MIV	28480	1910-0016

See Introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A61C1	1820-0413	2	IC:TTL DECADE DIVIDER 12.5 MHZ MIN.	28480	1820-0413
A61C1	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A61C2	1820-0413		IC:TTL DECADE DIVIDER 12.5 MHZ MIN.	28480	1820-0413
A61C2	1200-0474		SOCKET:IC 14-PIN	28480	1200-0474
A61C3	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A61C3	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A61C4	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A61C4	1200-0473		SOCKET:IC 16-PIN	28480	1200-0473
A6L1	9100-1661	1	COIL/CHOKE 2200 UH 5%	28480	9100-1661
A6Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q4	1854-0009		TSTR:SI NPN	80131	2N709
A6Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6R1	0683-1015	3	RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R2	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R3	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R4	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R5	0683-3035		RESD COMP 30K OHM 5% 1/4W	01121	CB 3035
A6R6	0683-2035		RESD COMP 20K OHM 5% 1/4W	01121	CB 2035
A6R7	0683-3025	2	RESD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A6R8	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R9	0683-3025		RESD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A6R10	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	GB 1825
A6R11	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R12	0683-2235		RESD COMP 22K OHM 5% 1/4W	01121	CB 2235
A6R13	0683-1045		RESD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A6R14	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R15	0683-5115		RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A6R16	0683-1525		RESD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R17	0683-6825	2	RESD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A6R18	0683-3925		RESD COMP 3900 OHM 5% 1/4W	01121	CB 3925
A6R19	0683-3925		RESD COMP 3900 OHM 5% 1/4W	01121	CB 3925
A6R20	0683-6825		RESD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A6R21	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A6R22	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R23	0683-6825		RESD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A6R24	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A6R25	0683-4715		RESD COMP 470 OHM 5% 1/4W	01121	CB 4715
A6Y1	0410-0142	1	CRYSTAL:QUARTZ 1.0 MHZ	28480	0410-0142
A7	05323-60022	1	POWER SUPPLY +5.1 & +175V (5330A/B)	28480	05323-60022
	05323-20022	1	BOARD:BLANK Ref.	28480	05323-20022
A7C1	0180-1962	1	C:FXD AL ELECT 15 UF +50-10% 250VDCW	56289	39D156F250EJ4-DS8
A7C2	0180-2154	1	C:FXD ELECT 1900 UF +75-10% 15VDCW	28480	0180-2154
A7C3	0180-0210	1	C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A7C4	0160-2276	1	C:FXD MICA 2200 PF 5% 300VDCW	28480	0160-2276
A7CR1	1901-0029	4	DIODE:SILICON 600 PIV	28480	1901-0029
A7CR2	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A7CR3	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A7CR4	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A7CR5	1901-0415	4	DIODE:SILICON 50 PIV 3A	28480	1901-0415
A7CR6	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A7CR7	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A7CR8	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A7CR9	1901-0040		DIODE:SILICON 50 MA 40 WV	07263	FDG1088
A7CR10	1902-3094	1	DIODE BREAKDOWN:5.11V 2%	28480	1902-3094
A7CR11	1902-3394	1	DIODE BREAKDOWN:175 V 2%	28480	1902-3394
A7CR12	1902-3429	1	DIODE BREAKDOWN:100 V 2%	28480	1902-3429
A7Q1	1853-0020	3	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q2	1854-0232	1	TSTR:SI NPN(SELECTED FROM 2N3440)	28480	1854-0232
A7Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7R1	0683-1045		RESD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A7R2	0683-7515	1	RESD COMP 750 OHM 5% 1/4W	01121	CB 7515
A7R3	0683-3035		RESD COMP 30K OHM 5% 1/4W	01121	CB 3035
A7R4	0683-1505	1	RESD COMP 15 OHM 5% 1/4W	01121	CB 1505

PARTS LIST CON'T

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8	05325-60005	1	POWER SUPPLY ASSY: +/-12 VOLT (5330A/B)	28480	05325-60005
	05325-20005	1	BOARD:BLANK PC	28480	05325-20005
ARC1	0180-2055	2			
ARC2	0180-2055				
ARC3	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
ARC4	0180-0160	1	C:FXD ELECT 22 UF 20% 35VDCW	28480	0180-0160
ARC5	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
ARCR1	1901-0049	8	DIODE:SILICON 50PIV	28480	1901-0049
ARCR2	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
ARCR3	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
ARCR4	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
ARCR5	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
ARCR6	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
ARCR7	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
ARCR8	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
ARCR9	1902-3114	2	DIODE BREAKDOWN:6.19V 2%	28480	1902-3114
ARCR10	1902-3114		DIODE BREAKDOWN:6.19V 2%	28480	1902-3114
AR01	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
AR02	1854-0300	2	TSTR:SI NPN	28480	1854-0300
AR02	05050-0034	2	HEAT SINK	28480	05050-0034
AR03	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3706)	28480	1854-0071
AR04	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
AR05	1854-0300		TSTR:SI NPN	28480	1854-0300
AR05 FOR Q5	05050-0034		HEAT SINK	28480	05050-0034
AR06	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3706)	28480	1854-0071
AR1	0683-1375		R:FXD COMP 1300 OHM 5% 1/4W	01121	CB 1375
AR2	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
AR3	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
AR4	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
AR5	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
AR6	0683-3935	1	R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935
AR7	0683-6235	1	R:FXD COMP 62K OHM 5% 1/4W	01121	CB 6235
AR8	0683-4335	2	R:FXD COMP 43K OHM 5% 1/4W	01121	CB 4335
AR9	0683-4335		R:FXD COMP 43K OHM 5% 1/4W	01121	CB 4335
AR10	0683-5635	1	R:FXD COMP 56K OHMS 5% 1/4W	01121	CB 5635
A9	05330-60012	1	BOARD ASSY:SWITCH (5330A/B)	28480	05330-60012
	05330-20012	1	BOARD:BLANK PC	28480	05330-20012
A9C1	0160-2055	2	C:FXD CER 0.[illegible] UF +80-20% 100VDCW	56289	C023F101F1032S22-CDH
A9C2	0160-2055		C:FXD CER 0.0[illegible] +80-20% 100VDCW	56289	C023F101F1032S22-CDH
A9C3	0160-3878	1	C:FXD CER 1000 PF 20% 100VDCW	A0031	CV2059X7R102M
A9CR1	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A9CR2	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A9IC1	1820-0907		IC:DTL HEX INVERTER	04713	MC836P
A9IC2	1820-0907		IC:DTL HEX INVERTER	04713	MC836P
A9J1	1251-2026	1	CONNECTOR:PC 36 CONTACT	71785	252-18-30-300
A9R1	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A9R2	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A9R3	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A9R4	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A9R5	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A9R6	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A9S1	1460-1174	7	SPRING:CONTROL SWITCH	28480	1460-1174
A9S1	5020-3440	7	SPRING:DETENT	28480	5020-3440
A9S1	5040-0280	7	SLIDE:1 ROW, 4 SLOTS	28480	5040-0280
A9S1	5040-0285	7	SWITCH:LEVER	28480	5040-0285
A9S2	1460-1174		SPRING:CONTROL SWITCH	28480	1460-1174
A9S2	5020-3440		SPRING:DETENT	28480	5020-3440
A9S2	5040-0280		SLIDE:1 ROW, 4 SLOTS	28480	5040-0280
A9S2	5040-0285		SWITCH:LEVER	28480	5040-0285
A9S3	1460-1174		SPRING:CONTROL SWITCH	28480	1460-1174
A9S3	5020-3440		SPRING:DETENT	28480	5020-3440
A9S3	5040-0280		SLIDE:1 ROW, 4 SLOTS	28480	5040-0280
A9S3	5040-0285		SWITCH:LEVER	28480	5040-0285
A9S4	1460-1174		SPRING:CONTROL SWITCH	28480	1460-1174
A9S4	5020-3440		SPRING:DETENT	28480	5020-3440
A9S4	5040-0280		SLIDE:1 ROW, 4 SLOTS	28480	5040-0280
A9S4	5040-0285		SWITCH:LEVER	28480	5040-0285
A9S5	1460-1174		SPRING:CONTROL SWITCH	28480	1460-1174
A9S5	5020-3440		SPRING:DETENT	28480	5020-3440

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9S5	5040-0280		SLIDE:1 ROW, 4 SLOTS	28480	5040-0280
A9S5	5040-0285		SWITCH:LEVER	28480	5040-0285
A9S6	1460-1174		SPRING:CONTROL SWITCH	28480	1460-1174
A9S6	5020-3440		SPRING:DETENT	28480	5020-3440
A9S6	5040-0280		SLIDE:1 ROW, 4 SLOTS	28480	5040-0280
A9S6	5040-0285		SWITCH:LEVER	28480	5040-0285
A9S7	1460-1174		SPRING:CONTROL SWITCH	28480	1460-1174
A9S7	5020-3440		SPRING:DETENT	28480	5020-3440
A9S7	5040-0280		SLIDE:1 ROW, 4 SLOTS	28480	5040-0280
A9S7	5040-0285		SWITCH:LEVER	28480	5040-0285
A9S8			NOT ASSIGNED		
A9S9	05330-80006	1	GUIDE:SWITCH SLIDE	28480	05330-80006
A9S9	05330-80007	1	GUIDE:SWITCH SLIDE	28480	05330-80007
A9S9	05330-80008	1	GUIDE:SWITCH SLIDE	28480	05330-80008
A10	05330-60005	1	BOARD ASSY:SWITCH INTERCONNECT (5330A/B)	28480	05330-60005
	05330-20005	1	BOARD:BLANK PC	28480	05330-20005
A10J1			NOT ASSIGNED		
A10J2	1251-2317	4	CONNECTOR:MULTI SWITCH	28480	1251-2317
A10J3	1251-2317		CONNECTOR:MULTI SWITCH	28480	1251-2317
A10J4	1251-2317		CONNECTOR:MULTI SWITCH	28480	1251-2317
A10J5	1251-2317		CONNECTOR:MULTI SWITCH	28480	1251-2317
A10P1	5060-0109	1	CONNECTOR:15 CONTACTS	28480	5060-0109
A11	05330-60025	3	BOARD ASSY:SWITCH INTERCONNECT (5330B ONLY) SAME AS 05330-60005 (A10) EXCEPT J1,2,3,4.(1251-2317)	28480	05330-60025
A12	05330-60025		BOARD ASSY:SWITCH INTERCONNECT (5330B ONLY) SAME AS 05330-60005 (A10) EXCEPT J1,2,3,4.(1251-2317)	28480	05330-60025
A13	05330-60025		BOARD ASSY:SWITCH INTERCONNECT (OPTION 001 SAME AS A12 ONLY)	28480	05330-60025
A14	05330-60024	1	BOARD ASSY:REMOTE INTERCONNECT (5330A/B)	28480	05330-60024
	05330-20024	1	BOARD:BLANK PC	28480	05330-20024
A14J1 THRU A14J16			NOT ASSIGNED		
A14J17	1250-1096	1	CONNECTOR:RF REAR MOUNTING	27251	28 JR159-1

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS FOR 5330A/B UNLESS OTHERWISE NOTED.		
C1	0160-3043	2	C:FXD CER 2 X 0.005 UF 20% 250VAC	56289	29C147A-CDH
F1	2110-0207	1	FUSE:0.50A 250V SLOW-BLOW (115V OPERATION)	75915	313.500S
F1	2110-0201	1	FUSE:0.25A,250V SLO-BLO (230V OPERATION)	71400	MDL-1/4
J1 THRU J8			NOT ASSIGNED		
J9	1250-0083	4	CONNECTOR:BNC	02660	31-221-1020
J10	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J11	1250-0118	2	CONNECTOR:BNC	24931	28JR 128-1
J12	1251-0085	2	CONNECTOR:FEMALE 36-PIN MINAT	28480	1251-0085
L1	9140-0115		COIL:FXD RF 22 UH 10%	99800	9140-0115
L2	9140-0115		COIL:FXD RF 22 UH 10%	99800	2150-32
Q1	1854-0063	2	TST:SI NPN	80131	2N3055
R1	2100-2856	2	R:VAR COMP 1 MEGOHM 10% 10CLOG 1/4W	28480	2100-2856
R2/S2	2100-2643	2	R:VAR COMP 50K OHM 20% LIN 1/2W W/SPST	28480	2100-2643
S1 (PWR)			(POWER) PART OF R1.		
S2 (PRESET)			(PRESET) PART OF R2.		
S3 (RESET)	3101-1216	3	SWITCH:PUSHBUTTON SPST (RESET)	82389	85-1034
S4 (START)	3101-1216		SWITCH:PUSHBUTTON SPST (START)	82389	85-1034
S5 (STOP)	3101-1216		SWITCH:PUSHBUTTON SPST (STOP)	82389	85-1034
S6 (115-230V)	3101-1234	1	SWITCH:SLIDE DPDT (115-230V)	82389	11A-1242
S7 (INT-EXT)	3101-1593	1	SWITCH:SLIDE DPDT MINIATURE (INT-EXT)	78488	SS-91-1
S8 (N)	3100-3209	4	SWITCH:THUMBWHEEL,5 MODULE ASSY (N)	28480	3100-3209
S9 (L1)	3100-3209		SWITCH:THUMBWHEEL,5 MODULE ASSY (L1)	28480	3100-3209
S10 (L2)	3100-3209		SWITCH:THUMBWHEEL,5 MODULE ASSY (L2)	28480	3100-3209
S11 (R)	3100-3209		SWITCH:THUMBWHEEL,5 MODULE ASSY (R) (OPTION 001 ONLY)	28480	3100-3209
T1	9100-2737	1	TRANSFORMER:POWER	28480	9100-2737
W1	8120-1378	1	CABLE ASSY:AC POWER CORD	70903	KH-7381
XW1	1251-2357	1	SOCKET:3-PIN MALE POWER RECEPTACLE	82389	EAC-301
XF1	1400-0084	2	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
			MISCELLANEOUS		
	05330-40001	1	WINDOW	28480	05330-40001
	05216-4008	1	GROUND:CONNECTOR	28480	05216-4008
	05330-00005	1	CHASSIS	28480	05330-00005
	00140-67402	3	KNOB ASSY:BLACK,FOCUS & HORIZ.	28480	00180-67402
	5040-0170	5	GUIDE:PLUG-IN PC BOARD	28480	5040-0170
	05330-40003	1	SOCKET:CONNECTOR	28480	05330-40003
	05330-60040	1	KIT:RACK MOUNTING CONSISTING OF:	28480	05330-60040
	2370-0012	2	SCREW:SST FLAT HD PHL DR 6-32 X 1/4	28480	2370-0012
	2510-0047	4	SCREW:PAN HD POZI DR 8-32 X 0.438" LG	00000	ORD
RACK	5020-0706	1	BRACKET:LEFT	28480	5020-0706
MOUNT	5020-0707	1	BRACKET:RIGHT	28480	5020-0707
KIT	05245-6022	1	ASSY:EXTENDER BOARD 15 PIN	28480	05245-6022
	05330-40005	1	STRIP:FILLER	28480	05330-40005
	05330-90007	1	LABEL	28480	05330-90007
	0380-0047	1	SPACER:POST TYPE 0.438" LG	76854	2457-428
	05326-00008	1	INSULATOR	28480	05326-00008
	05330-60035	1	CABLE:BNC INPUT	28480	05330-60035
	05330-60036	1	CABLE:POWER INPUT	28480	05330-60036
	10503-6001	1	CABLE ASSY:BNC-BNC	28480	10503-6001

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 001 5330A/B (R SWITCH) Delete Top Panel Trim 05330-00008 for 5330A and 05330-00028 for 5330B. Add Top Panel Trim 05330-00009 for 5330A and 05330-60029 for 5330B. Add R Switch S11 3100-3209. Add Switch Interconnect Assy A13 05330-60025 consisting of J1 through J5 1251-2317, PIA/B 15-Pin Connector 5060-0109, and 05330-20005 Blank Board. OPTION 002 5330A/B (REMOTE PROGRAMMABLE N SWITCH) Delete Blank Connector Cover 05330-00030. Delete Switch Interconnect Assy A10 05330-60005. Add Switch Interconnect Assy A10 05330-60026, consisting of J2 through J6 1251-2317, Blank Board 05330-20005, and Remote Cable Assy 05330-60034. The Remote Cable Assy consists of 24-Pin Connector J15 (on rear panel) 1251-0292 and two 15-Pin Connectors 5060-0115. For J15, use mating connector 1251-0293. OPTION 003 5330A/B (REMOTE PROGRAMMABLE R FUNCTION) Delete Blank Connector Cover 05330-00030. Add Remote Cable Assy 05330-60034. The Remote Cable Assy consists of 24-Pin Connector J13 (on rear panel) 1251-0292 and two 15-Pin Connectors 5060-0115. For J13 use mating connector 1251-0293. OPTION 004 5330B ONLY (REMOTE PROGRAMMABLE L1 AND L2 SWITCHES) Delete two Blank Connector Covers 05330-00030. Delete Switch Interconnect Assy A11 and A12 05330-60025. Add Switch Interconnect Assy A11 and A12 05330-60027, consisting of J1 through J5 1251-2317, Blank Board 05330-20005, and Remote Cable Assy 05330-60034. The Remote Cable Assy consists of 24-pin Connector J14 or J16 1251-0292 and two 15-Pin Connectors 5060-0115. For J14 or J16, use mating connector 1251-0293.		

Table 6-2. Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	U.S.A. COMMON	ANY SUPPLIER OF U.S.A.	
00853	SANGAMO ELECTRIC CO.PICKENS DIV.	PICKENS, S.C.	29671
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
08806	G.E. CO. MINIATURE LAMP DEPT.	CLEVELAND, OHIO	44112
12040	NATIONAL SEMICONDUCTOR CORP.	DANBURY, CONN.	06810
14433	ITT SEMICONDUCTOR DIV. ITT CORP.	W. PALM BEACH, FLA.	33401
24931	SPECIALTY CONNECTOR CO. INC.	INDIANAPOLIS, IND.	46227
27251	SPECIALITIES MFG. CO. INC.	BRIDGEPORT, CONN.	06601
28480	HEWLETT-PACKARD CO. CORPORATE HQ	YOUR NEAREST HP OFFICE	
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
70903	BELDEN CORP.	CHICAGO, ILL.	60644
71400	BUSSMANN MFG. DIV. MC GRAW-EDISON CO.	ST. LOUIS, MO.	63017
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
75915	LITTELFUSE INC.	DES PLAINES, ILL.	60016
76854	OAK MFG. CO. DIV. OAK ELECTRO/NETICS CORP.	CRYSTAL LAKE, ILL.	60014
78488	STACKPOLE CARBON CO.	ST. MARYS, PA.	15857
80031	MEPCO DIV. SESSIONS CLOCK CO.	MORRISTOWN, N.J.	07960
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
82389	SWITCHCRAFT INC.	CHICAGO, ILL.	60630
83594	BURROUGHS CORP. ELECT. COMP. DIV.	PLAINSFIELD, N.J.	07061
91418	RADIO MATERIALS CO.	CHICAGO, ILL.	60646
95354	METHODE MFG. CO.	ROLLING MEADOWS, ILL.	60008
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052

OPTIONS

AND

BACK DATING

MANUAL

CHANGES

SECTION VII

OPTIONS AND MANUAL CHANGES

7-1. OPTIONS

7-2. Options 001 through 003 are available for 5330A models and Options 001 through 004 can be installed on 5330B models.

7-3. Option 001: Preset —Offset (R Switch)

7-4. Option 001 consists of an additional 5-digit thumbwheel switch, interconnect board, and hardware. The R switch allows for offset counting with any number from 00000 to 99999. The counter will reset to the value entered on the R switch and commence count from that value. A schematic diagram of option 001 is shown in Figure 8-18 and Table 6-1 lists the additional parts.

7-5. Option 002: Remote Programmable N Switch

7-6. Option 002 consists of a rear panel 24-pin connector J15 and an interconnecting wire harness. This option allows remote programming of the N switch value from 00000 to 99999. When remote programming is used, the front panel N switch should be set to 00000. Table 7-1 lists the interconnections and Table 6-1 lists the parts.

7-7. Option 003: Remote Programmable R Switch

7-8. Option 003 consists of a rear panel 24-pin connector J13 and an interconnecting wire harness. This option allows remote programming of the R switch value from 00000 to 99999. When remote programming is used, the front panel R switch should be set to 00000. Table 7-2 lists the interconnections and Table 6-1 lists the parts.

7-9. Option 004: Remote Programmable L1 and L2 Switches

7-10. Option 004 consists of two rear panel 24-pin connectors J14(L2), J16(L1) and two interconnecting wiring harnesses. This option allows remote programming of the L1 and L2 switches from 00000 to 99999. When remote programming is used, the front panel L switches should be set to 00000. Table 7-2 lists the interconnections and Table 6-1 lists the parts.

Table 7-1. Option 002 Remote Programmable N Switch Wiring

Remote N Connector Pin No.	Wire Color Code	Destination A10P1 Pin No.	BCD Weight
J15 - 1	Brown	A6	Ground
2	Red	No Connection	
3	Orange	B14	$10^0 1$
4	Yellow	B12	$10^0 2$
5	Green	A2	$10^1 1$
6	Blue	A1	$10^1 2$
7	Violet	A9	$10^2 1$
8	Gray	A7	$10^2 2$
9	White	A15	$10^3 1$
10	White-Black	A14	$10^3 2$
11	White-Brown	B8	$10^4 1$
12	White-Red	B15	$10^4 2$
13	White-Orange	No Connection	- -
14	White-Yellow	No Connection	- -
15	White-Green	B1	$10^0 4$
16	White-Blue	B4	$10^0 8$
17	White-Violet	A4	$10^1 4$
18	White-Gray	A5	$10^1 8$
19	White-Black-Green	A11	$10^2 4$
20	White-Black-Blue	A12	$10^2 8$
21	White-Black-Brown	B9	$10^3 4$
22	White-Black-Red	B13	$10^3 8$
23	White-Black-Orange	B3	$10^4 4$
24	White-Black-Yellow	B2	$10^4 8$

Table 7-2. Options 003 and 004 Remote Programmable Wiring

Remote Connector Pin No. J13(R) J16(L1) J14(L2)	Wire Color Code	Destination A13(R) A11(L1) A12)L2)	BCD Weight
1	Brown	P1-A6	$10^0 1$
2	Red	A3	$10^0 2$
3	Orange	B14	$10^1 1$
4	Yellow	B12	$10^1 2$
5	Green	A2	$10^2 1$
6	Blue	A1	$10^2 2$
7	Violet	A9	$10^3 1$
8	Gray	A7	$10^3 2$
9	White	A15	$10^4 1$
10	White-Black	A14	$10^4 2$
11	White-Brown	B8	$10^5 1$*
12	White-Red	B15	$10^5 2$*
13	White-Orange	A13	$10^0 4$
14	White-Yellow	A10	$10^0 8$
15	White-Green	B1	$10^1 4$
16	White-Blue	B4	$10^1 8$
17	White-Violet	A4	$10^2 4$
18	White-Gray	A5	$10^2 8$
19	White-Black-Green	A11	$10^3 4$
20	White-Black-Blue	A12	$10^3 8$
21	White-Black-Brown	B9	$10^4 4$
22	White-Black-Red	B13	$10^4 8$
23	White-Black-Orange	B3	$10^5 4$*
24	White-Black-Yellow	B2	$10^5 8$*

*Special order only

7-11. MANUAL CHANGES

7-12. This manual applies directly to 5330A/B models with serial prefix 1224A.

7-13. Newer Instruments

7-14. As changes are made, newer instruments may have serial prefixes not listed in this manual. Manuals for these instruments will be supplied with an added "Manual Change" sheet. If the sheet is missing, contact your nearest Hewlett-Packard Sales office listed at the back of this manual.

7-15. Older Instruments

7-16. To adapt this manual to instruments with serial prefixes below 1224A, refer to Table 7-3 and make the specified changes to this manual.

Table 7-3. Manual Backdating

IF YOUR INSTRUMENT HAS SERIAL PREFIX	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL
1144A (5330B)	1
1140A (5330A)	1
984A (5330B)	1, 2
1108A (5330A)	1, 2
984A (5330A)	1, 2, 3
968 (5330A)	1, 2, 3, 4
948 (5330A, 5330B)	1, 2, 3, 4, 5
928 (5330A, 5330B)	1, 2, 3, 4, 5, 6

Change 1

Page 1-3, Table 1-3, Print Command Specification:

Change 35μs to 45μs to "15μs to 20μs".

Pages 6-5 and 6-6, Table 6-1, for both A1 assemblies (05330-60008 and 05330-60007):

Delete A1Q10 and description.

Add A1R30 0683-5115 R: FXD COMP 510 OHM 5% 1/4W.

Change part no. and value of A1R18 to 0683-2225 R: FXD COMP 2.2K OHM 5% 1/4W.

Delete A1R31 and description.

Delete A1R32 and description.

Page 8-13, Figure 8-8, A1 schematic:

Replace Figure 8-8 with Figure 7-2 (schematic for A1 series 984). Replace component locator with Figure 7-3.

Page 6-12, Table 6-1:

Delete A5CR9 and description.

Page 8-25, Figure 8-13, A5 schematic:

Delete A5CR9 and connection to IC7A(1).

Draw a connection with pin N to IC7A(12).

Change series number 948.

Change 2

This change established new colors for the cabinet parts. Instruments with series prefix 984 and below have blue textured cabinets. Replace descriptions to Figure 6-1 with Table 7-4.

Table 7-4. Cabinet Parts (Blue-Textured)

ITEM	DESCRIPTION	HP PART NUMBER	QTY
1	Front Panel	05330-00003	1
2	Top Panel Trim 001 (5530A only)	05330-00009	1
	Top Panel Trim (5330A only)	05330-00008	1
	Top Panel Trim (5330B only)	05330-00028	1
	Top Panel Trim 001 (5330B only)	05330-00029	1
3	Bottom Panel Trim (5330A only)	05330-00002	1
	Bottom Panel Trim (5330B only)	05330-00001	1
4	Rear Panel	05330-00004	1
5	Side Frame	5060-0729	2
6	Side Cover	5000-0729	2
7	Top Cover	05325-00008	1
8	Bottom Cover	05325-00009	1
9	Trim Strip	5000-0050	2
10	Foot Assembly	5060-0767	5
11	Tilt Stand	1490-0030	1
12	Rank Mount Kit	05330-60037	1

Page 6-16, Table 6-1, Rack Mount Kit Breakdown:

Change 05330-40005 to 05326-40002.

Change 3

Page 6-5 and 6-6 , Table 6-1, 05330-60007 and 05330-60008:

Change part numbers of A1IC9 thru A1IC13 to 1820-0092. Note that the preferred part is 1820-0729.

Page 8-13, Figure 8-8:

Change part numbers of A1IC9 thru A1IC13 to 1820-0092. Note that the preferred part is 1820-0729.

Change 4

This change affected the primary power circuits. Instruments with series prefix 968 (5330A) or 948 (5330B) and below do not have the IEC recommendations for primary power circuits.

Page 6-4 , Figure 6-1, Item 4:

Change part number of rear panel to 05330-00004.

Page 6-16, Table 6-1:

Change fuses to:

F1 2110-0008 Fuse: 0.50 Amp slow blow (115V operation).

F1 2110-0018 Fuse: 0.25 Amp slow blow (230V operation).

Page 6-16, Table 6-1:

Change S6 to 3101-0033 Switch: Slide DPDT.

Change W1 to 8120-0078 Cable Assy: Power Cord.

Change XW1 to 1251-0148 Connector: Power 3-Pin Male.

Page 6-16, Table 6-1:

Change part number 1251-2357 to 1251-0148.

Change part number 2110-0202 to 2110-0008.

Change part number 2110-0201 to 2110-0018.

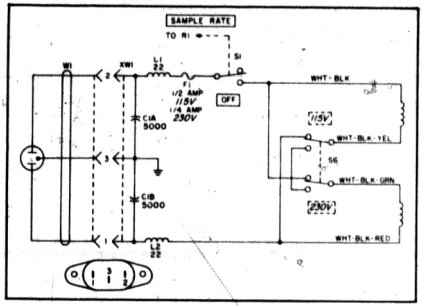
Change part number 3101-1234 to 3101-0033.

Change part number 8120-1348 to 8130-0078.

Page 8-29, Figure 8-14:

Change the primary power input circuits as shown in Figure 7-1.

Figure 7-1. Primary Power Circuits for Series 968 (5330A) and Series 948 (5330B) and Below



Change 5

Page 6-14, Table 6-1:

For assembly A9, indicate that 5330A models with serial prefix 948 have A9 boards with part number 05330-60003. This assembly is the same as 05330-60012 except for the deletion of CR2. For 5330B models with serial prefix 948, 05330-60012 boards were installed.

Page 8-31, Figure 8-16:

For 5330B models with serial prefix 948, change A9 part number to 05330-60003. Delete CR2.

Change 6

Replace Figure 8-13 component locator with Figure 7-4. Replace Figure 8-13 schematic diagram with Figure 7-5. Change parts list in Section VI as follows:

Change A5C2 to 0160-0165 C: FXD MY 0.056 UF 10% 200VDCW.

Change A5C5 to 0180-0229 C: FXD ELECT 33UF 10% 10VDCW.

Delete A5C8.

Add A5R11 0683-1035 R: FXD COMPT 10K OHM 5% 1/4W.

Change A5R20 to 0683-1035 R: FXD COMP 470 OHM 5% 1/4W.

Change A5R21 to 0683-1015 R: FXD COMP 100 OHM 5% 1/4W.

Change A5R23 to 0683-4725 R: FXD COMP 4700 OHM 5% 1/4W.

Delete A5R25 through A5R27.

Change A1R13 to 4700 OHMS and A1R15 to 22K OHMS.

Figure 7-2. Display Board A1, Series 984, Schematic Diagram

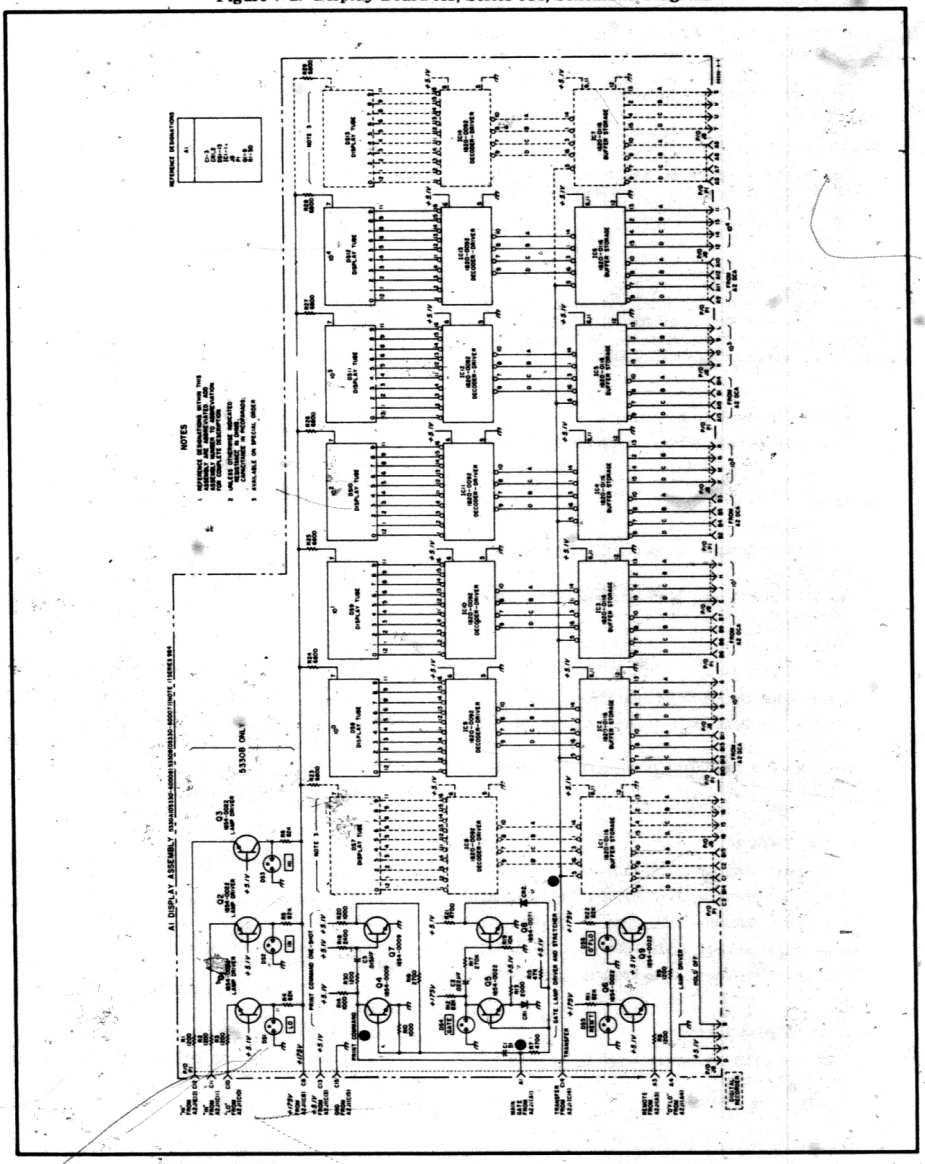


Figure 7-3. Display Board A1, Series 984, Component Locator

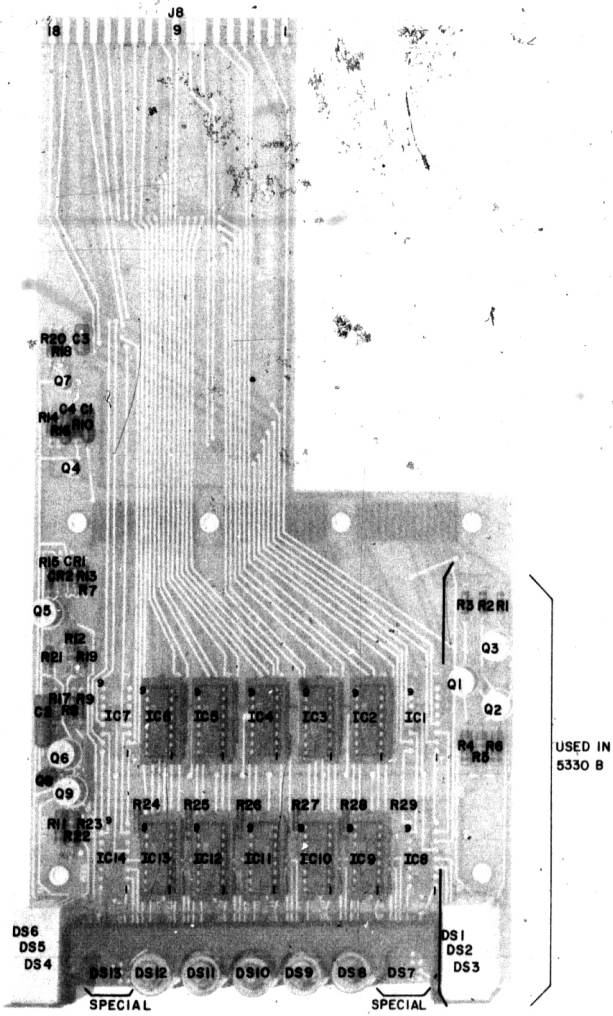


Figure 7-4. Gate Control Assembly A5, Series 928, Component Locator

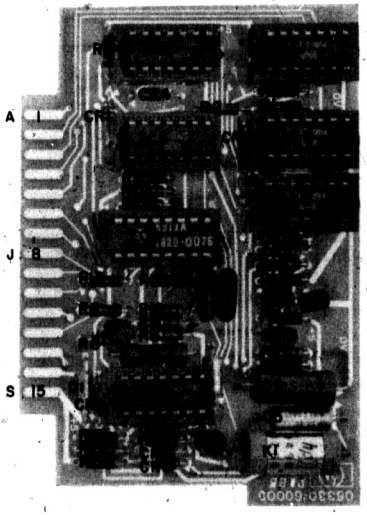
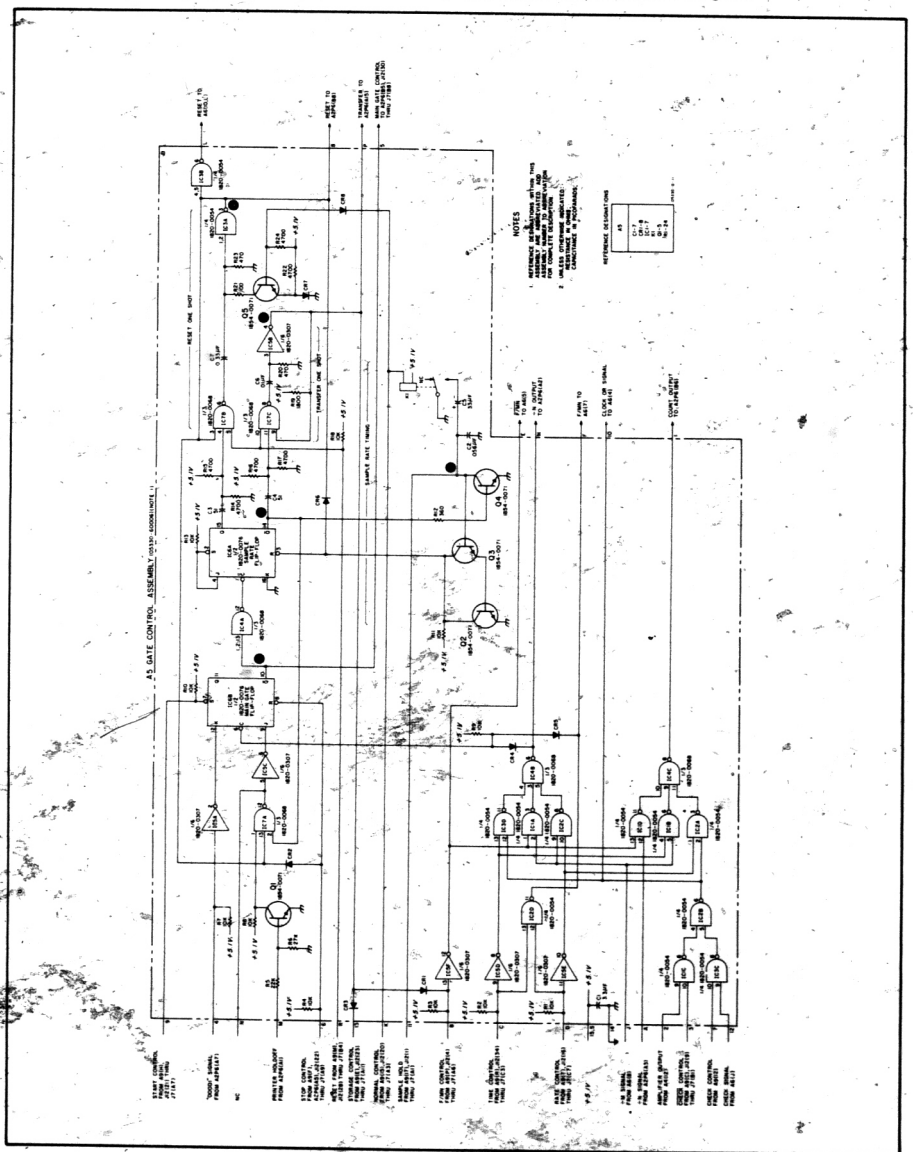


Figure 7-5. Gate Control Assembly A5, Series 928, Schematic Diagram



SCHEMATIC DIAGRAMS

SECTION VIII

CIRCUIT DIAGRAMS

8-1. This section contains the following:

a. Schematic diagram notes.

b. Servicing block diagrams including timing diagrams, Figures 8-5 through 8-7.

c. Schematic diagrams and component locators including theory of operation and troubleshooting procedures.

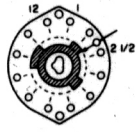
d. Shaded areas on schematic diagrams indicate circuit board assemblies. All components within the shaded area are mounted on that board.

Figure 8-1. Schematic Diagram Notes

SYMBOLS

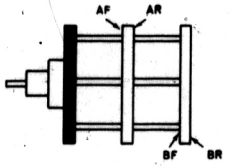
- FRONT PANEL
- REAR PANEL
- INTERIOR AND PC BOARDS
- WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE
- POWER LINE GROUND
- CIRCUIT COMMON GROUND
- FLOATING GROUND
- CHASSIS GROUND
- KNOB CONTROL
- SCREWDRIVER ADJUST
- MAIN SIGNAL PATH
- FEEDBACK PATH
- TEST POINT
- "AND" GATE
- "OR" GATE
-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

SWITCH DESIGNATIONS



A3S1BR(2-1/2)

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



REFERENCE DESIGNATIONS

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

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

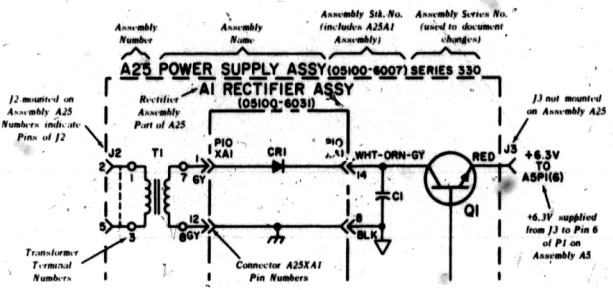


Figure 8-2. 5330A Top Interior View

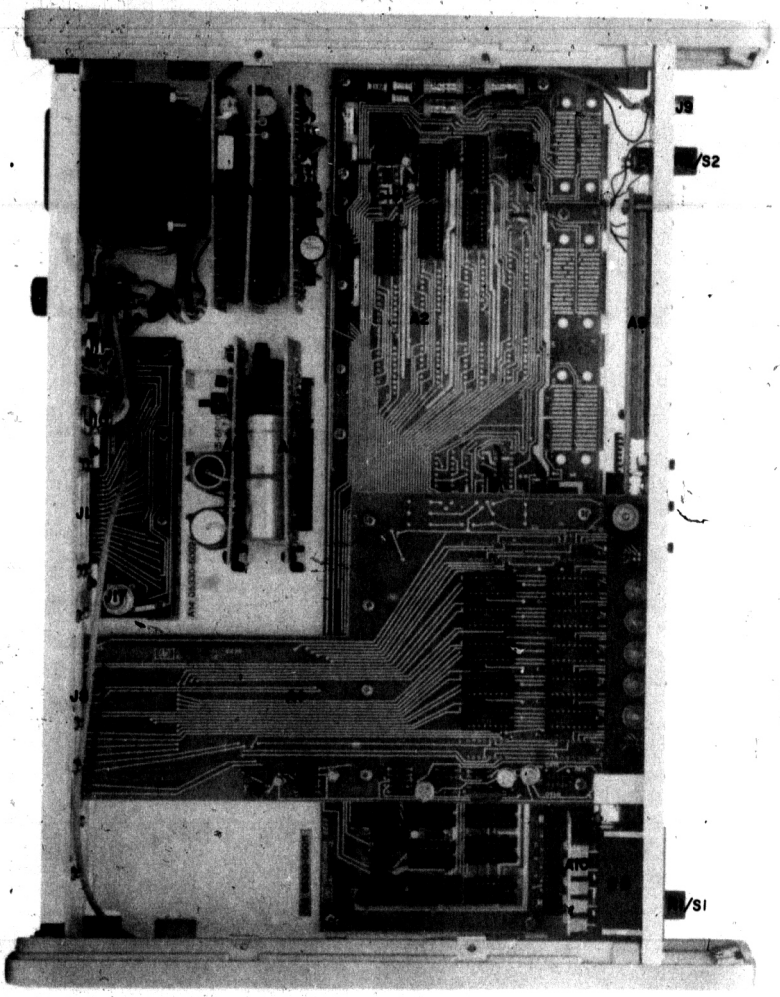


Figure 8-3. 5330A/B Bottom Interior View

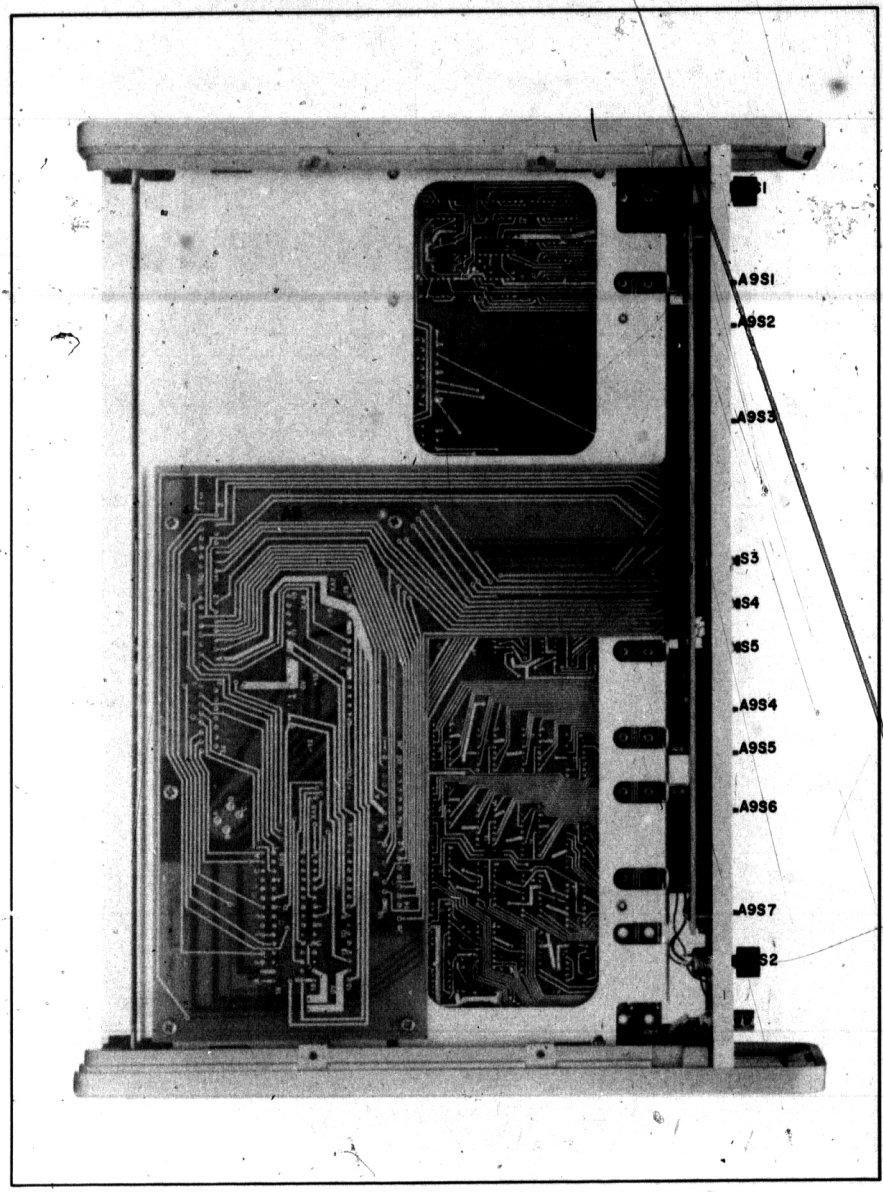
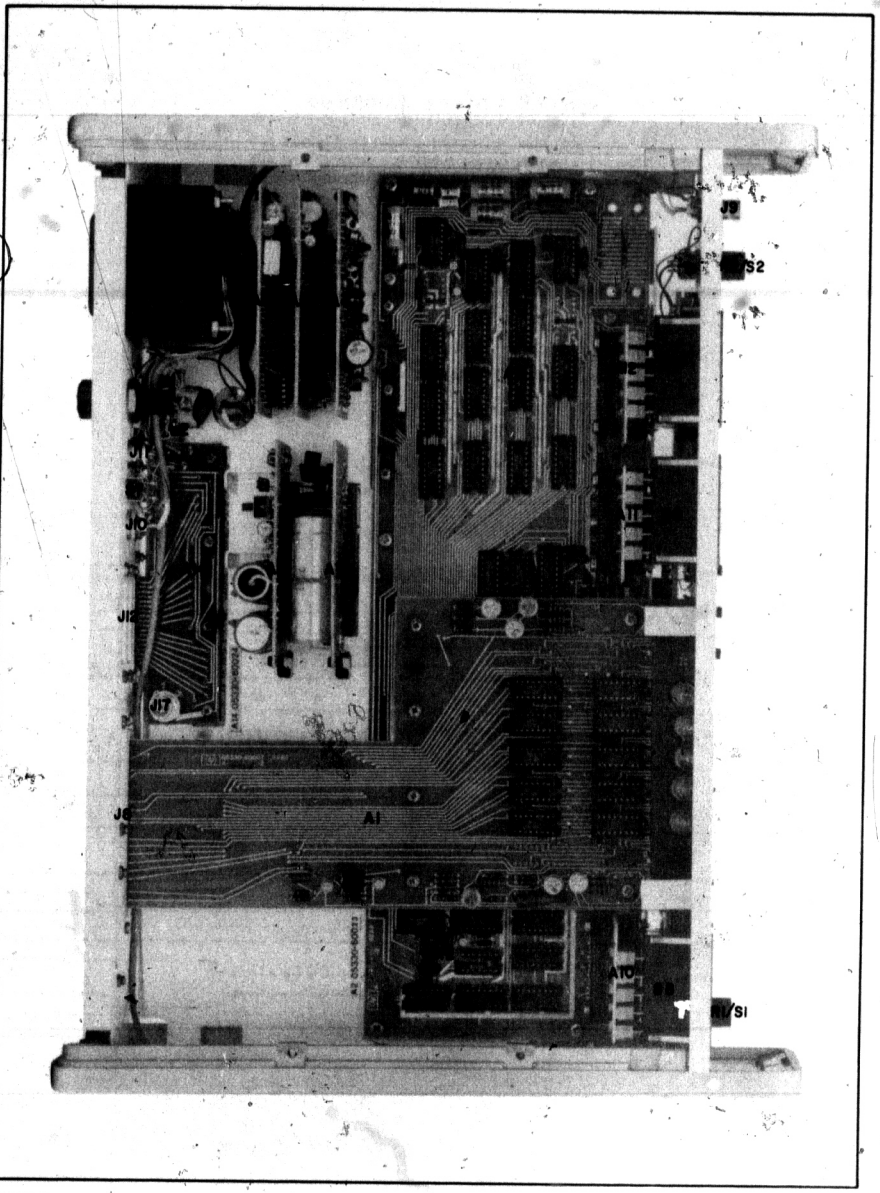


Figure 8-4. 5330B Top Interior View

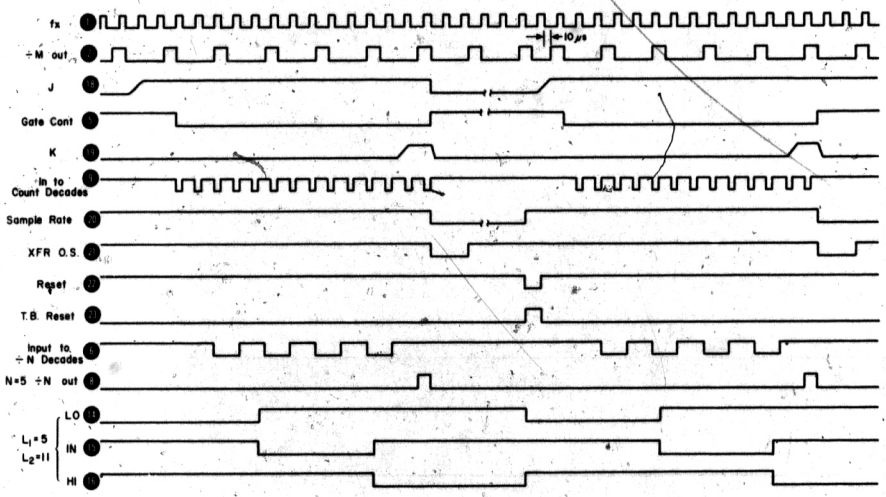


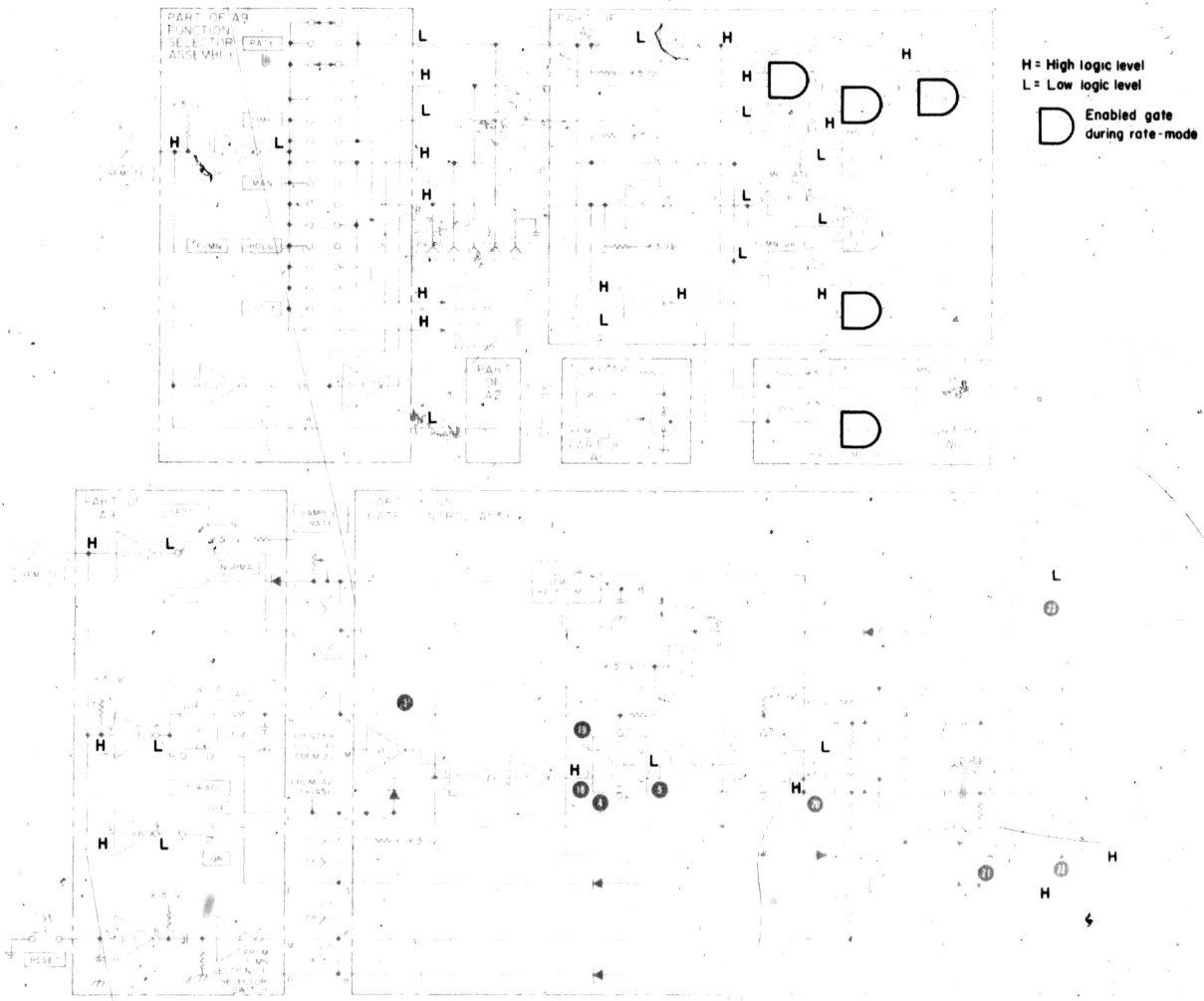
SERVICING BLOCK DIAGRAMS

The servicing block diagrams shown in Figures 8-5 through 8-7 include timing diagrams, signal flow, and logic levels. The servicing block diagrams can be used to isolate trouble to a particular PC assembly. When trouble is isolated to a particular board, refer to the applicable schematic diagram for additional troubleshooting information

RATE MODE TIMING DIAGRAMS

M=1 L1=2
N=5 L2=4




PART OF A9
FUNCTION
SELECTOR
ASSEMBLY
RATE
MAN
PART OF A2
H = High logic level
L = Low logic level
Enabled gate during rate-mode
H = High logic level L = Low logic level
Logic levels shown when main gate is open

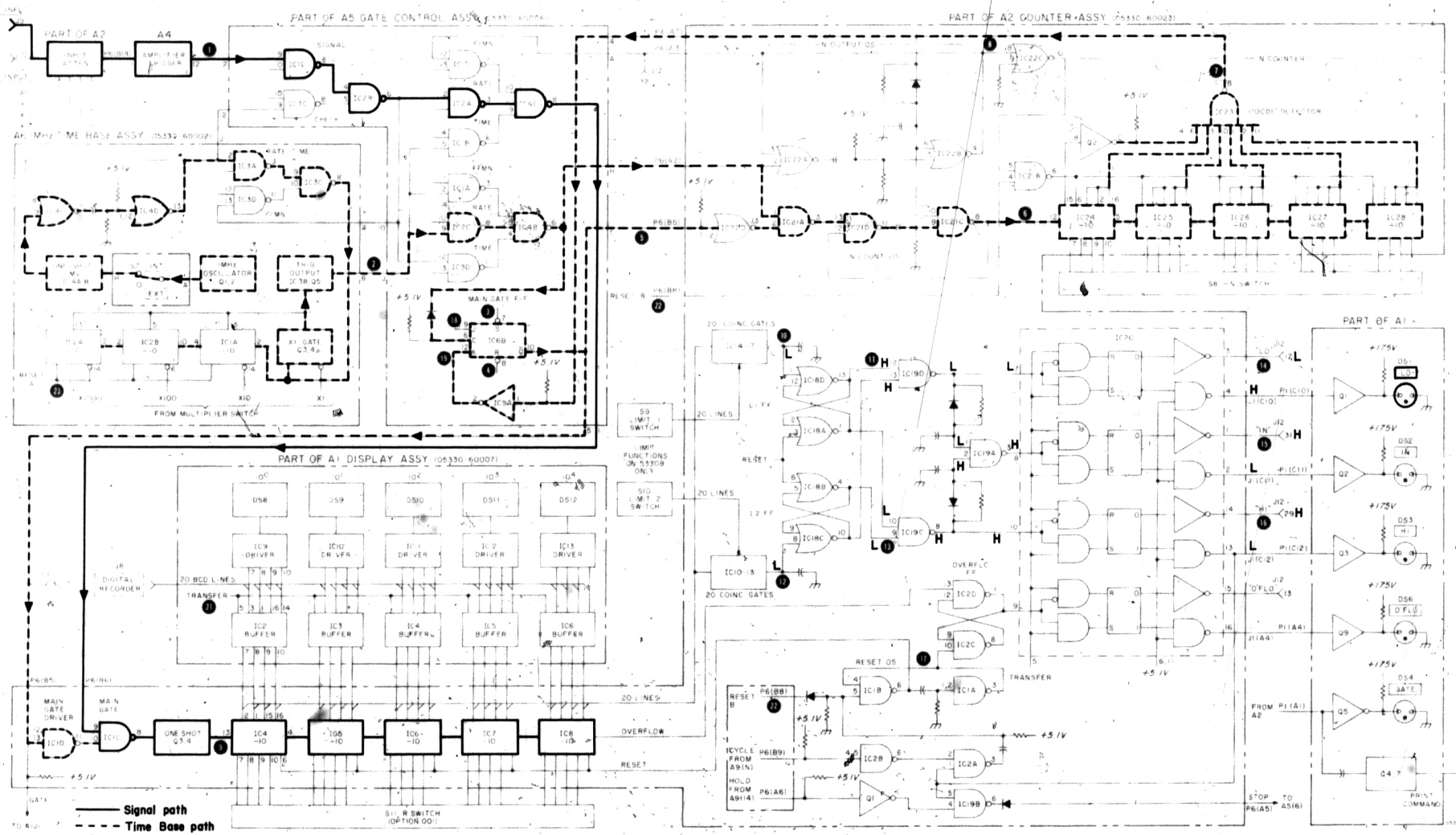
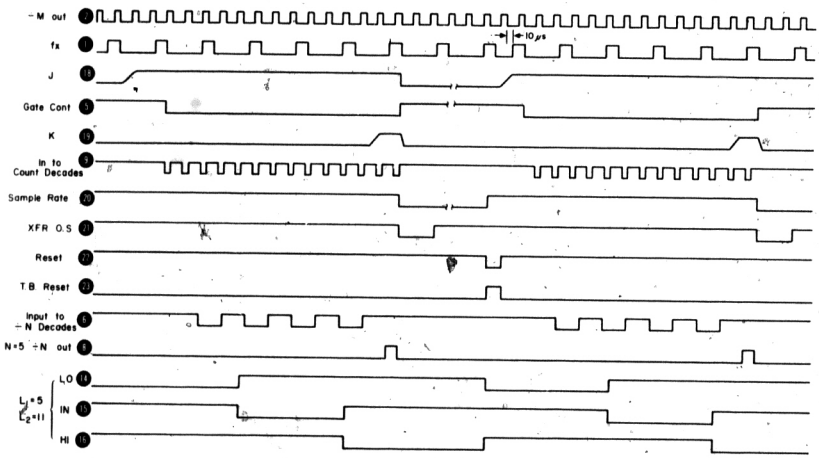


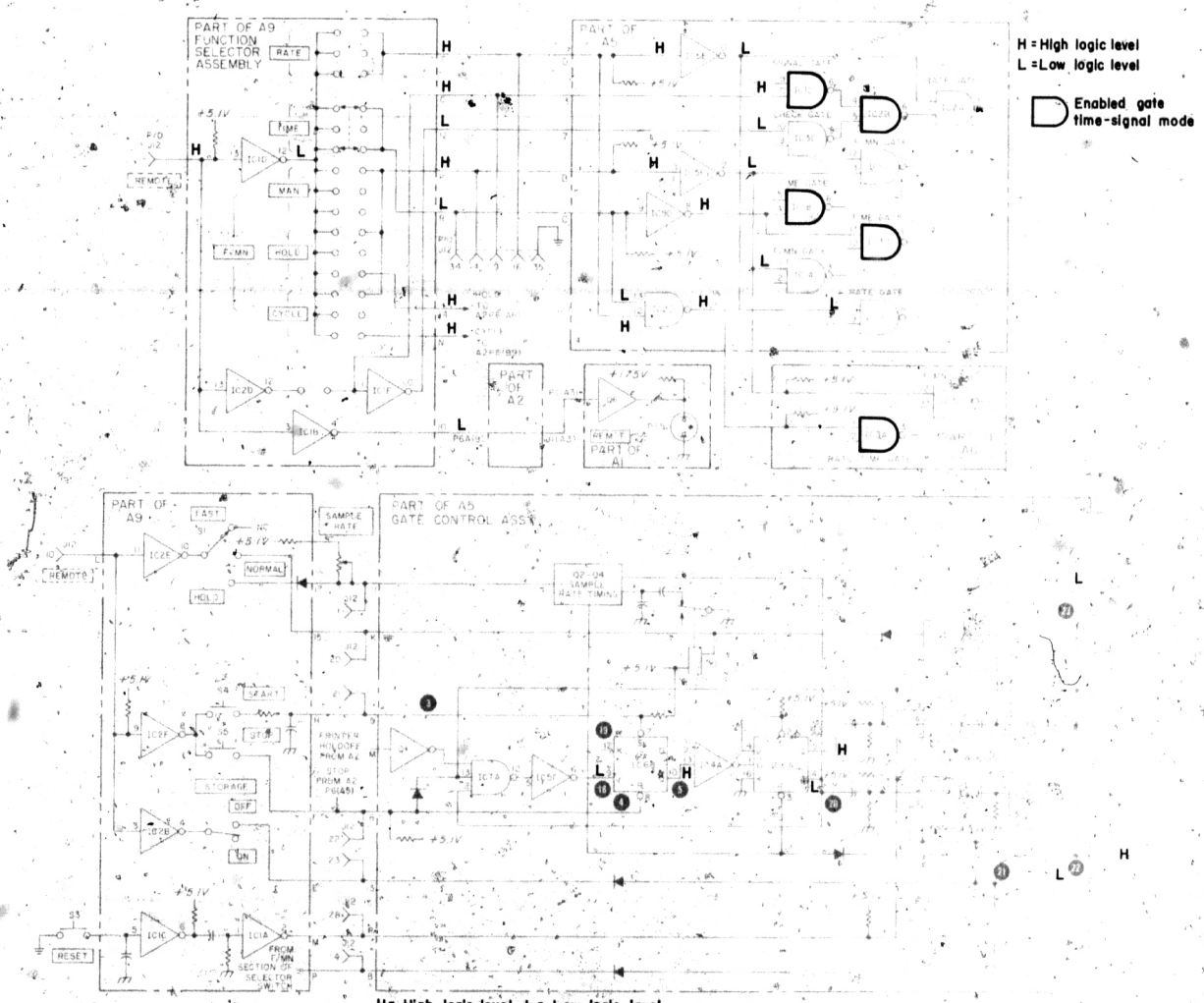
Figure 8-5. Rate Mode Servicing Block Diagram

TIME MODE TIMING DIAGRAMS

•M=1 L1=5

N=5 L2=11




PART OF A9 FUNCTION SELECTOR ASSEMBLY
RATE
TIME
MAN
F.MIN
HOLD
CYCLE
REMOTE
+5.1V
IC1D
IC2D
IC1F
IC1B
PART OF A2
PART OF A1
PART OF A5
H = High logic level
L = Low logic level
Enabled gate time-signal mode
PART OF A9
FAST
NORMAL
HOLD
SAMPLE RATE
IC2E
IC2F
IC2B
IC1C
IC1A
START
STOP
STORAGE
OFF
ON
RESET
FROM F.MIN SECTION OF SELECTOR SWITCH
PART OF A5 GATE CONTROL ASSY
02-04 SAMPLE RATE TIMING
FROM PRM A2 P6(A5)
H= High logic level L= Low logic level
Logic levels shown when main gate is closed and transfer pulse is generated

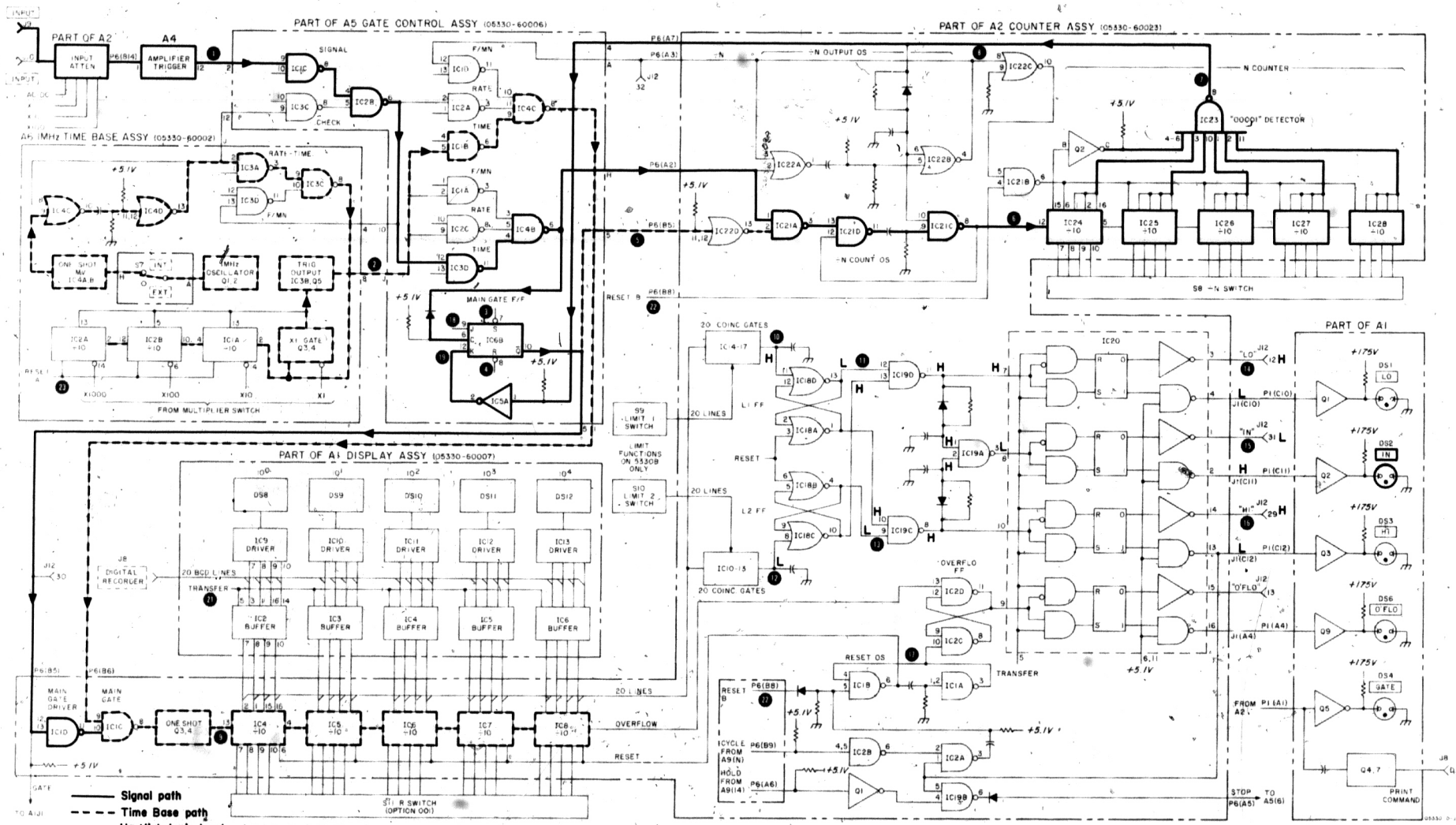
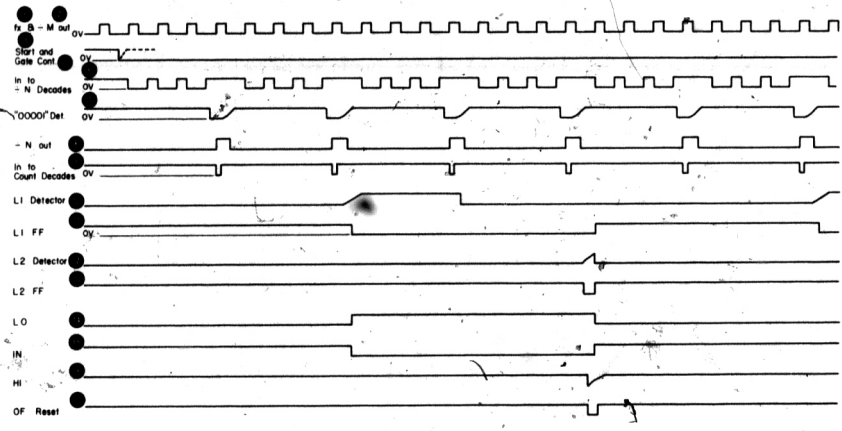


Figure 8-6. Time Mode Servicing Block Diagram

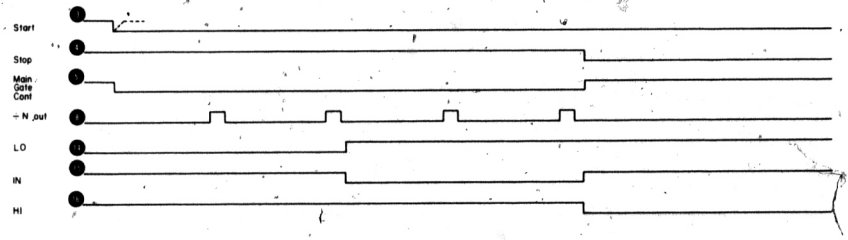
F/MN CYCLE MODE TIMING DIAGRAMS

M=1 L1=2

N=4 L2=4



F/MN HOLD TIMING DIAGRAM




PART OF A9 FUNCTION SELECTOR ASSEMBLY
RATE
TIME
MAN
F/MN
HOLD
REMOTE
+5.1V
PART OF A2
PART OF A5 GATE CONTROL ASSY
SAMPLE RATE
NORMAL
START
STOP
STORAGE
OFF
ON
RESET
H = High logic level
L = Low logic level
Enabled gate during F/MN-signal mode

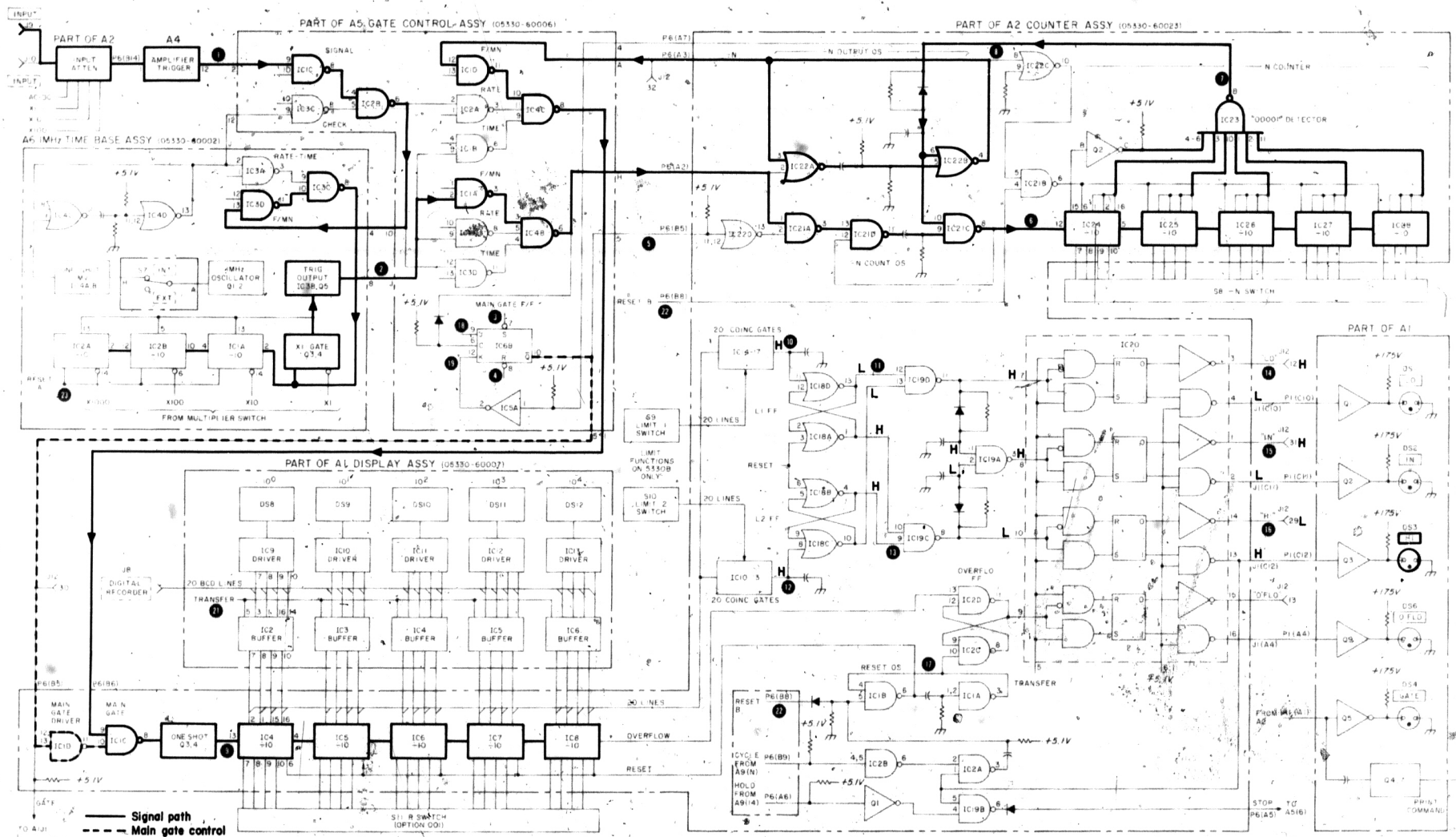


Figure 8-7. F/MN Mode Servicing Block Diagram

A1 OPERATION

BUFFER STORAGE UNITS

A1 receives -8421 BCD inputs at pins 7 through 10 of buffer storage units IC2 through IC6. Two modes of operation can be selected, storage-on and storage-off. In the storage-off mode, pin 5 of the buffers is held low and the BCD data is fed continuously to the decoders and to the digital recorder output connector J8. The decoders receive -8421 BCD and J8 receives +8421 BCD. In the storage-on mode, the BCD inputs are transferred to the two outputs only when the transfer pulse arrives. When pin 5 is high, both BCD outputs are held (stored) until the next transfer pulse arrives. The transfer pulse is a low 5.4 μsec pulse generated at the end of gate time or manual reset.

DECODERS

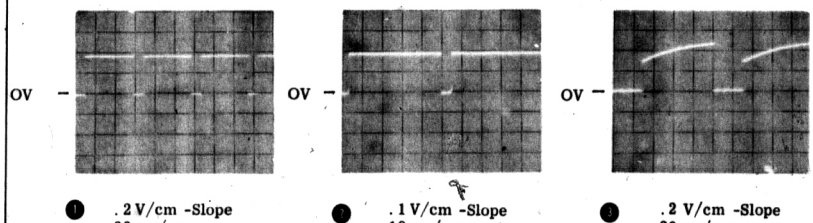
BCD, to decimal converters IC9 through IC13 receive -8421 BCD inputs from the buffer storage units and supply low outputs to the corresponding elements of the display tubes. A low ($\cong$ +2 V) to an element of a display tube will light the corresponding numeral. The remaining elements of the display tube will be high ($\cong$ 90 V) to extinguish the corresponding numerals.

ANNUNCIATORS

The LO, IN, HI, REM'T, and O'FLO drivers serve to light the neon annunciators when a high input is received at the emitter of the driver transistor. For example, when a high is received at A1PIC(10), Q1 cuts OFF and DS1 connects through an 82K resistor to +175 volts. The GATE annunciator circuit consists of Q5, Q8, and DS4. During slow main gate times, Q5 cuts off for the duration of the main gate opening. During fast gate times, Q8 holds Q5 off for a period determined by R17, R19, and C2. This extends the lamp on-time to allow a visible flash during fast gate times. The gate extension is effective down to about 10 μsec gate times. Below 10 μsec, the circuit may not light the neon lamp. The print command one-shot Q4 and Q7, operates on the positive transition of the main gate pulse. When the main gate closes, a +5 V to 0V, 35 to 45 μsec print command is generated for use by the digital recorder.

A1 TROUBLESHOOTING

To checkout and troubleshoot A1, set counter controls for CHECK-F/MN mode with N = 1000 and M = 1000. Press START switch and check that 10^0 display gives proper sequential 1-second counts. Change M to 100 to give a 1-second rate for the 10^1 display, then repeat for each display tube. When a faulty digit or column is evident, press the STOP switch and use a logic probe to locate the defective IC. Since the IC's are mounted in plug-in sockets, like IC's can be interchanged to confirm troubles. Waveforms for the transfer pulse, main gate pulse, and print command are shown to aid in troubleshooting.



❶ .2 V/cm -Slope
20 μs/cm

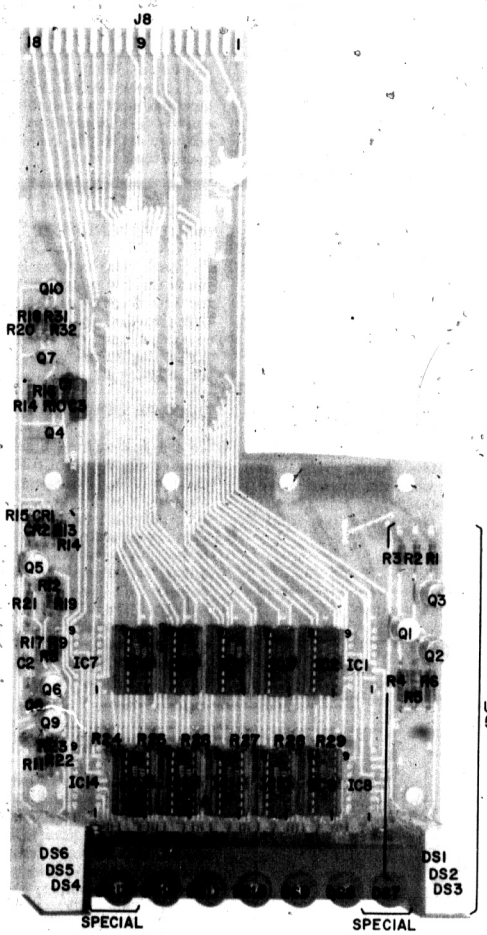
❷ .1 V/cm -Slope
10 μs/cm

❸ .2 V/cm -Slope
20 μs/cm

All waveforms dc coupled through 10:1 divider probe. Center line of graticule is zero volts. Triggering is internal ac.

Counter Controls:

SAMPLE RATE	FAST CCW
FUNCTION	RATE
N Switch	00010
MULTIPLIER	X1
STORAGE	ON


J8
18
9
1
Q10
R19 R31
R20 R32
Q7
R16
R14 R10 R13
Q4
R15 CR1
CR2 R13
R14
Q5
R22
R21 R19
R17 R9
C2 R8
IC7
IC1
Q6
C9
Q9
R24 R25 R26 R27 R28 R29
R11 R22
IC14
IC8
R3 R2 R1
Q3
Q1
Q2
R5 R6
R4
USED IN
5330B
DS6
DS5
DS4
DS1
DS2
DS3
SPECIAL
SPECIAL

02844-1

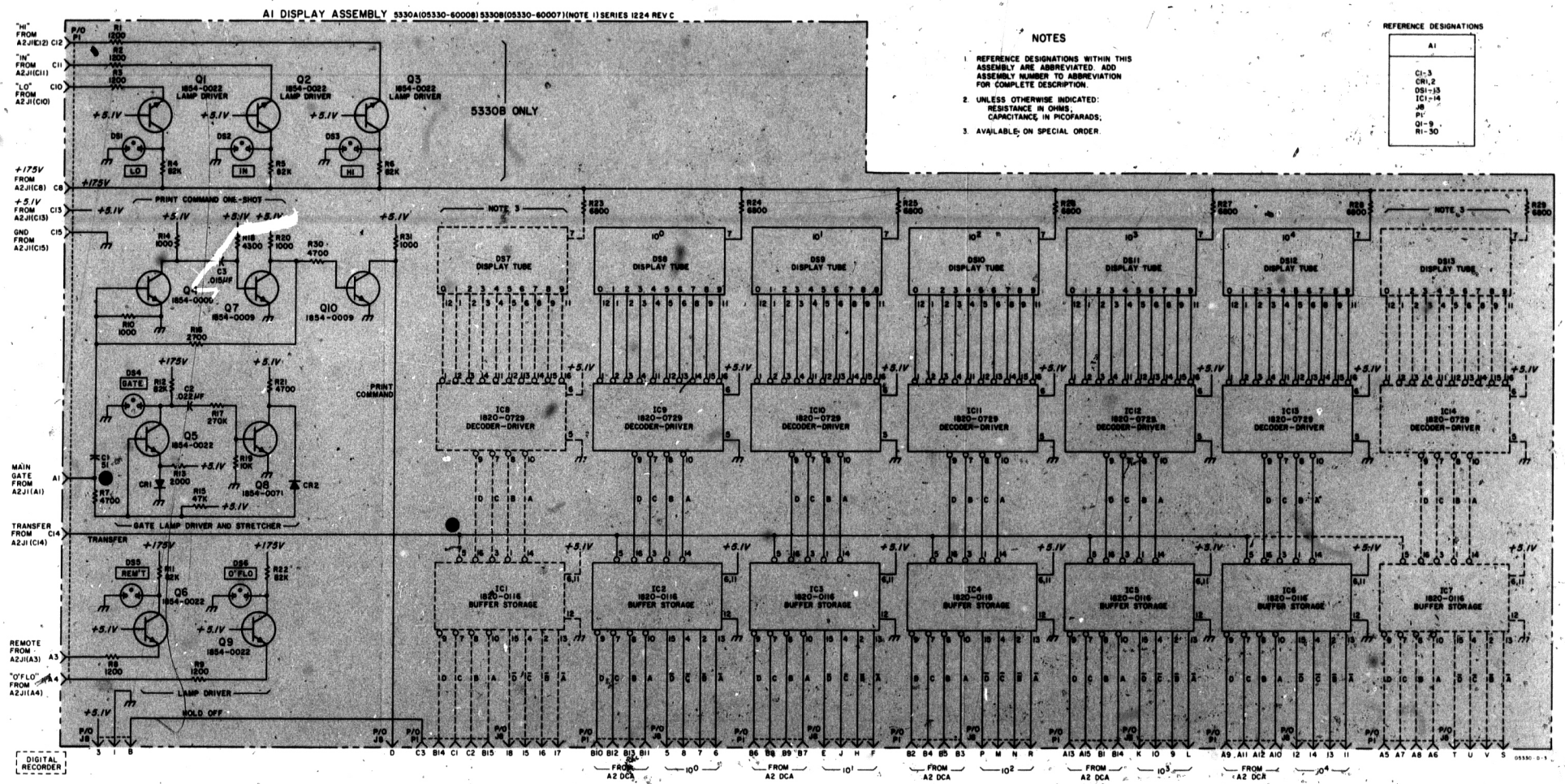


Figure 8-8. Display Board A1

A2 OPERATION

INPUT ATTENUATOR

Circuits associated with K1 through K4 receive input signals from the front or rear panel INPUT connectors. Control line inputs connect to P6B (7, 12, 11, and 10). As an example of operation, when the front panel ATTENUATOR is set to X10, K2 energizes to connect R23 and C10 in series with the input signal. The front panel AC-DC switch controls K4 which switches C12 in or out of the signal path.

DECADE COUNTERS

Input signals to be counted are received on P6B(6). When a main gate pulse at P6B(5) drives IC1C(10) high, the input signal drives one-shot MV Q3 and Q4. The one-shot provides negative-going pulses to decade IC4(13). The decades provide a divide-by-ten output at pin 4 to the following decade. Each decade also supplies a 4-line -8421 BCD output to A1 via J1A, B, and C. Table 8-1 shows the decade counter truth table. The reset pulse at pin 6 of the decades is a positive-going pulse supplied at the end of sample rate time. If the decades fill up (i.e., reach a count of 100,000) during the gate time, a low output pulse is supplied from IC8(4) to IC2D(13). When overflow occurs, IC2D(11) goes high to turn on the O'FLO lamp on A1. Q1 inverts the output of IC2D(11) to supply a low overflow output to remote output connector J12(13). For instruments with Option 001, preset inputs are received from the R switch at pins 7 through 10 of decades IC4 through 8. The R switch provides 4-line, -8421 BCD inputs to preset the decades when the preset pulse occurs. When the decades preset, they preset to the R switch setting and counting starts from that value.

Table 8-1. Preset Decade Counter Truth Table

Digit	Output Pin Number (To Decoder)			
	D (2)	C (1)	B (16)	A (15)
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L

H = HIGH (> +3 V)
L = LOW (< +0.5 V)

N PRESET DECADES AND 00001 DETECTOR

IC24 through IC28 form a preset down counter. Input signals are received at P6A(2) and connect through the N input one-shot to the preset down counter. The N input one-shot is enabled when a low main gate signal is received at P6B(5). N switch S8 supplies 4-line -8421 BCD inputs at pins 7 through 10 of preset decades IC24 through IC28. When a preset pulse is received at pin 6 of the decades, the decades preset to the N switch setting and down counting starts from that value. When the decade BCD outputs (pins 1, 2, 15, 16) reach 00001, IC23(8) goes low to disable the input one-shot and enable the output one-shot. The output one-shot provides a high output pulse to J12(32) and also drives the reset circuits IC22C and 21B to preset the decades.

A2 TROUBLESHOOTING

INPUT ATTENUATOR

To check relay control lines, use a logic probe and check for low control signal at P6B(7) for X1, P6B(12) for X10, P6B(11) for X100, and P6B(10) for DC. To check proper relay closures, connect ohmmeter across relay contacts (on component side of A2) and set ATTENUATOR switch to corresponding setting (X1 for K1, X10 for K2, etc.).

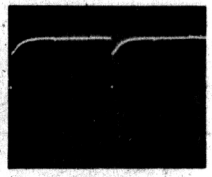
DECADE COUNTERS

To checkout and troubleshoot A2 counter circuits, set counter controls for CHECK-F/MN mode with N = 1000 and M = 1000. Press start switch and check that 10^0 display gives proper sequential counts. Change M to 100 to give a 1-second count rate for the 10^1 display, then repeat for each display tube. When a faulty digit or column is evident, press the STOP switch and use a logic probe and Table 8-1 to isolate trouble to the defective IC. Since the IC's are mounted in plug-in sockets, like IC's can be interchanged to confirm troubles. Waveforms for the decade outputs, reset pulse and main gate pulse are shown to aid in troubleshooting.

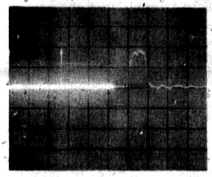
N PRESET DECADES AND 00001 DETECTOR

To checkout and troubleshoot these circuits, set counter controls for check F/MN mode with M = 1 and N = 100,000 (N switch to 00000). Using logic probe, check preset inputs to IC24 through IC28 to ensure that N switch and Switch Interconnect Board A10 are OK. Using logic probe, check pin 5 of IC24 through IC28 for pulse train output, then check IC23(8) for 10 Hz output. Check IC22(4) for 10 Hz output. When an improper output is evident, like IC's may be interchanged to confirm troubles.

1. .2 V/cm -Slope
   .2 μs/cm
   N = 00000

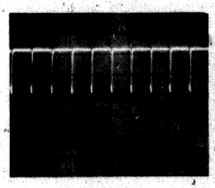


2. .2 V/cm -Slope
   10 μs/cm
   N = 00010

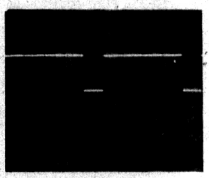


3. .2 V/cm +Slope
   20 μs/cm - Main
   .2 μs/cm - Delay
   N = 00010

4. .2 V/cm -Slope
   10 μsec/cm
   N = 00010



5. .2 V/cm -Slope
   1 μs/cm
   N = 00010

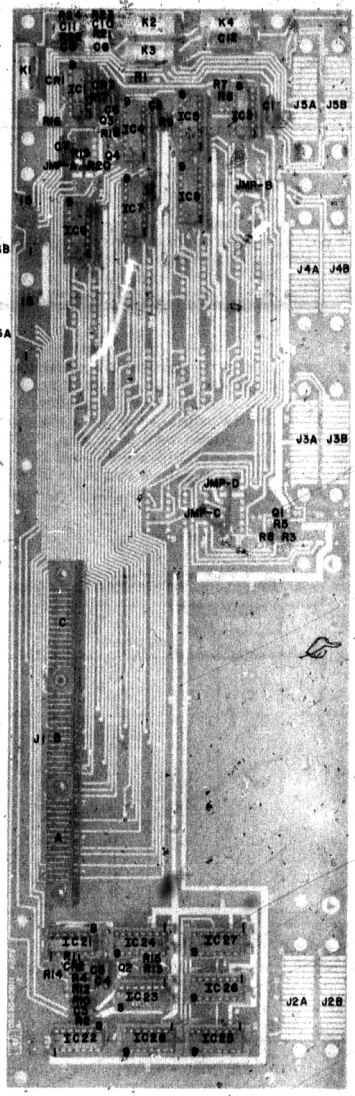


6. .2 V/cm +Slope
   10 μs/cm
   N = 00010

All waveforms dc coupled through 10:1 divider probe. Center line of graticule is zero volts. Triggering is internal ac.

Counter Controls:

SAMPLE RATE	FAST CCW
FUNCTION	RATE
ATTENUATOR	CHECK
N Switch	see waveforms
MULTIPLIER	X1
STORAGE	ON



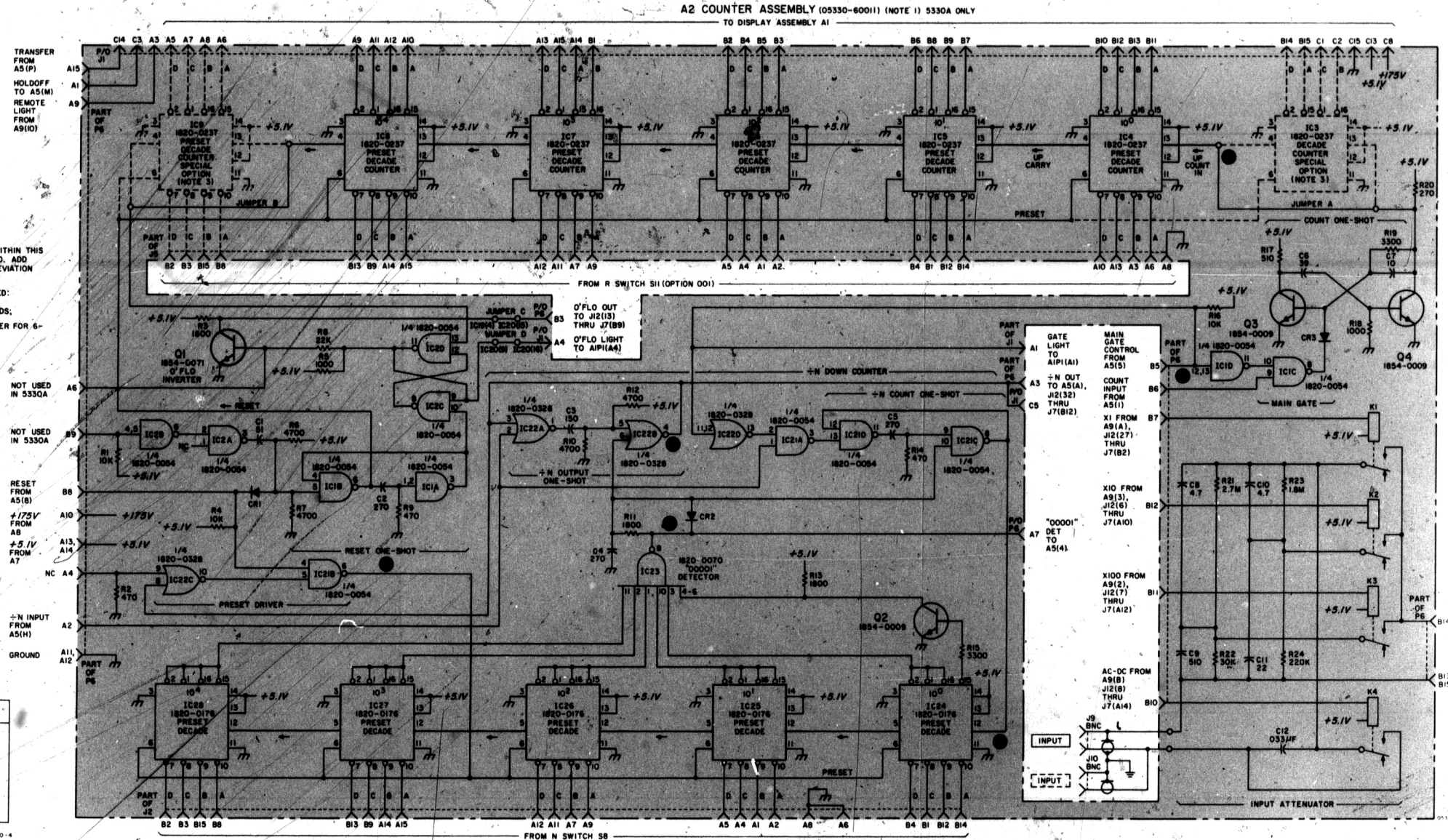


Figure 8-9. Counter Board A2 (5330A Only)

A2 OPERATION

INPUT ATTENUATOR

Circuit associated with K1 through K4 receive input signals from the front or rear panel INPUT connectors. Control line inputs connect to P6B(7, 12, 11, and 10). As an example of operation, when the front panel ATTENUATOR is set to X10, K2 energizes to connect R23 and C10 in series with the input signal. The front panel AC-DC switch controls K4 which switches C12 in or out of the signal path.

DECADE COUNTERS

Input signals to be counted are received on P6B(6). When a main gate pulse at P6B(5) drives IC1C(10) high, the input signal drives one-shot MV Q3 and Q4. The one-shot provides negative-going pulses to decade IC4(13). The decades provide a divide-by-ten output at pin 4 to the following decade. Each decade also supplies a 4-line -8421 BCD output to A1 via J1 A, B, and C. Table 8-2 shows the decade truth table. The reset pulse at pin 6 of the decades is a positive going pulse supplied at the end of sample rate time. If the decades fill up (i.e., reach a count of 100,000) during the gate time, a low output pulse is supplied from IC8(4) to IC2D(13). When overflow occurs, IC2D(11) goes high to drive IC20(9) high (see sheet 2). IC20 provides two overflow outputs, a high at pin 16 to light the O'FLO lamp on A1 and a low at pin 15 to supply a remote output at J12(13).

Table 8-2. Preset Decade Counter Truth Table

Digit	Output Pin Number (To Decoder)			
	D (2)	C (1)	B (16)	A (15)
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L

H = HIGH (> +3 V)
L = LOW (< +0.5 V)

For instruments with Option 001, preset inputs are received from the R switch at pins 7 through 10 of decades IC4 through IC8. The R switch provides 4-line, -8421 BCD inputs to preset the decades when the preset pulse occurs. When the decades preset, they preset to the R switch setting and counting starts from that value.

N PRESET DECADES AND 00001 DETECTOR

IC24 through IC28 form a preset down-counter. Input signals are received at P6A(2) and connect through the N input one-shot to the preset down-counter. The N input one-shot is enabled when a low main gate signal is received at P6B(5). N switch S8 supplies 4-line, -8421 BCD inputs to pins 7 through 10 of preset decades IC24 through IC28. When a preset pulse is received at pins 6 of the decades, the decades preset to the N switch setting and down-counting starts from that value. When the decade BCD outputs (pins 1, 2, 15, 16) reach 00001, IC23(8) goes low to disable the input one-shot and enable the output one-shot. The output one-shot supplies a high output pulse to J12(32) and also drives the reset circuits IC22C and IC21B to preset the decades.

A2 TROUBLESHOOTING

INPUT ATTENUATOR

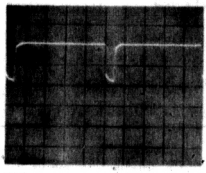
To check relay control lines, use a logic probe and check for low control signal at P6B(7) for X1, P6B(12) for X10, P6B(11) for X100, and P6B(10) for DC. To check proper relay closures, connect ohmmeter across relay contacts (on component side of A2) and set ATTENUATOR switch to corresponding setting (X1 for K1, X10 for K2, etc.).

DECADE COUNTERS

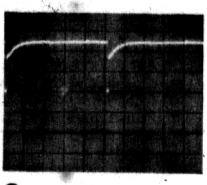
To checkout and troubleshoot A2 counter circuits, set counter controls for CHECK-F/MN mode with N = 1000 and M = 1000. Press start switch and check that 10^0 display gives proper sequential counts. Change M to 100 to give a 1-second count rate for the 10^1 display, then repeat for each display tube. When a faulty digit or column is evident, press the STOP switch and use a logic probe and Table 8-2 to isolate trouble to the defective IC. Since the IC's are mounted in plug-in sockets, like IC's can be interchanged to confirm troubles. Waveforms for the decade outputs, reset pulse, and main gate pulse are shown to aid in troubleshooting.

N PRESET DECADES AND 00001 DETECTOR

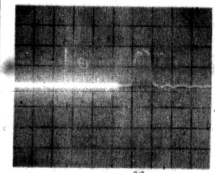
To checkout and troubleshoot these circuits, set counter controls for check F/MN mode with M = 1 and N = 100,000 (N switch to 00000). Using logic probe, check preset inputs to IC24 through IC28 to ensure that N switch and A10 are OK. Using logic probe, check pin 5 of IC24 through IC28 for pulse train output, then check IC23(8) for 10 Hz output. Check IC22B(4) for 10 Hz output. When an improper output is evident, like IC's may be interchanged to confirm troubles.



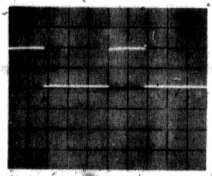
1 .2 V/cm -Slope
.2 μs/cm
N = 00000



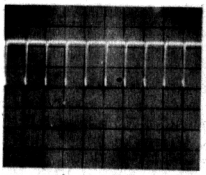
2 .2 V/cm -Slope
10 μs/cm
N = 00010



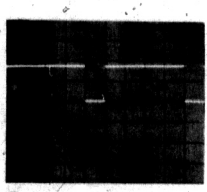
3 .2 V/cm +Slope
20 μs/cm - Main
.2 μs/cm - Delay
N = 00010



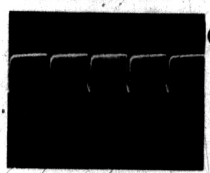
4 .2 V/cm -Slope
10 μsec/cm
N = 00010



5 .2 V/cm -Slope
1 μs/cm
N = 00010



6 .2 V/cm -Slope
10 μsec/cm
N = 00010

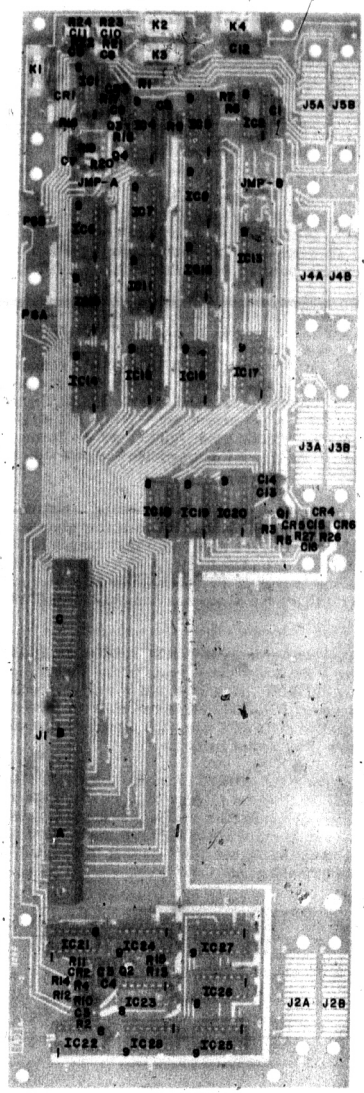


7 .2 V/cm - Slope
.5 μsec/cm
N = 00001
L2 = 00000
L1 = 00001
F/MN CYCLE
Press START

All waveforms dc coupled through 10:1 divider probe. Center line of graticule is zero volts. Triggering is internal ac.

Counter controls:

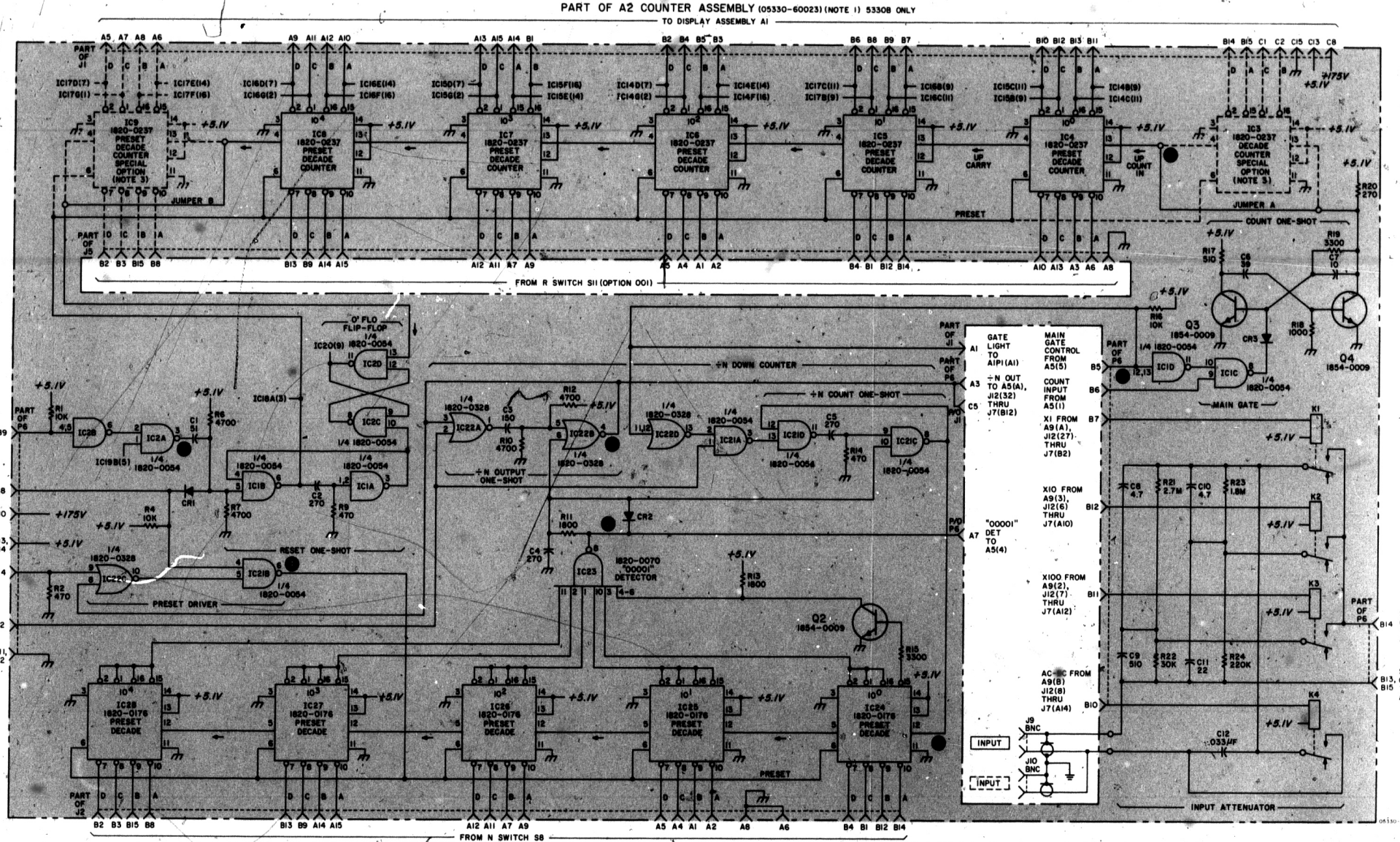
SAMPLE RATE	FAST CCW
FUNCTION	RATE (except 7)
ATTENUATOR	CHECK
N Switch	see waveforms
MULTIPLIER	X1
STORAGE	ON



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
3. AVAILABLE ON SPECIAL ORDER FOR 6- OR 7- DIGIT DISPLAY

PART OF A2 COUNTER ASSEMBLY (05330-60023) (NOTE 1) 5330B ONLY



REFERENCE DESIGNATIONS	
NO PREFIX	A2
J9,10	C1-16 CR1-6 IC1-28 J1,2,5 K1-4 P6 Q1-4 R1-7,9-24, 26,27

Figure 8-10. Counter Board A2 (5330B Only)
Sheet 1 of 2

A2 OPERATION

COINCIDENCE DETECTORS

These circuits receive -8421 BCD inputs from A2 decades and -8421 BCD from the L1 and L2 switches. When the decade count equals the L switch setting, the input pairs to each exclusive NOR gate will be either both high or both low resulting in a high NOR gate output. When all four of the six-input AND gates receive all high inputs, a high coincidence pulse output is supplied to latching FF IC18A and D or IC19B and C.

When the count is below L1 and L2, IC19D(12) and (13) are high which drives IC19D(11) and IC20(7) low. With transfer and IC20(7) low, IC20(3) is low and IC20(4) is high. This lights the LO annunciator light and provides a low output to the remote connector J12 on pin 12.

Assume that L1 switch setting is lower than L2 setting. When the count is equal to L1, IC18D(11) receives a high pulse to drive IC18D(13) low. Since IC18D and IC18A form a latching FF, IC18D(13) will remain low after the coincidence pulse returns to a low state. When IC18D(13) is low, IC19D(11) and IC20(7) go high to turn off the LO annunciator. With IC19A(3) and IC20(8) low, IC20(2) goes high to light the IN annunciator and IC20(1) goes low to provide a remote indication at J12(31).

When the count is equal to the L2 setting, a high coincidence pulse drives IC18C(10) to a low state so that IC19C(10) and (9) are both high. This causes IC19C(8) and IC20(10) to go low to give a high output at IC20(13) and a low output at IC20(14). The high output at IC20(13) lights the HI annunciator and drives IC19B(5) high.

When the counter is in the F/MN-HOLD mode, IC19B(4) is high. When the count reaches the high L switch setting, IC19B(5) goes high and a low stop pulse is developed at IC19B(6). The stop pulse connects to A5 to close the main gate when the decade count equals the high limit switch setting.

During the F/MN-RECYCLE mode, when IC20(13) goes high, IC2A(1) (sheet 1) goes high to drive the reset one-shot which in turn resets the decade counters. Thus, during the F/MN-RECYCLE mode, the decades count until the higher limit setting is reached, then resets to 0 and repeats the cycle.

A2 TROUBLESHOOTING

COINCIDENCE DETECTORS

Using the in-cabinet performance check, check that HI, IN, and LO annunciators indicate properly. If not, remove IC20 and check that HI, IN, and LO annunciators all light simultaneously. If not, check A1 circuits. If annunciators light, replace IC20 and use logic probe to check IC18, IC19, and IC20.

During the F/MN-HOLD mode, check that count stops on high limit set on L1 and L2 switches. If the count stops on the wrong value or doesn't stop at all, use the following L switch values to isolate trouble to the faulty IC.

Set L Switch to*	Change IC No. L2	L1
000703 / 000803	IC10	IC14
007004 / 008008	IC11	IC15
070030 / 080030	IC12	IC16
700040 / 800080	IC13	IC17

*Note: First (MSD) digit is for instruments with six-digit special L switches.

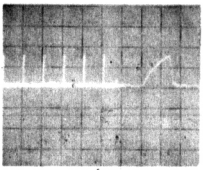
During the F/MN-HOLD mode, if the count does not stop on any setting, the output of IC10 through IC17 is probably shorted. First, isolate trouble to L1 or L2 circuits by setting L1 > L2 and check that IN light illuminates. If trouble is in L1, replace IC10, IC11, and IC12, one at a time and check for proper operation. If replacing IC10 through IC12 does not cure the trouble, change IC13. If trouble is in L2 circuits, check IC14 through IC17.

FOUR-LINE BUFFER STORAGE

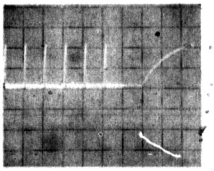
If coincidence circuits work properly but the annunciator or remote outputs are faulty, use Table 8-3 to isolate troubles to IC20, annunciator drivers on A1, or coincidence logic circuits IC18 and IC19.

Table 8-3. Four-Line Buffer Storage Truth Table

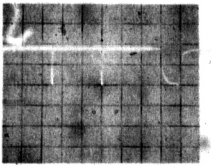
Display vs Limits	Input on IC20 Pin No.	High Output on IC20 Pin No.	Low Output on IC20 Pin No.	Remarks
Low	(7) Low	4	3	Pins 1, 8, 10, 14, 15 are high. Pins 2, 5, 9, 13, 16 are low
In	(8) Low	2	1	Pins 3, 7, 10, 14, 15 are high. Pins 4, 5, 9, 13, 16 are low
High (not overflowed)	(10) Low	13	14	Pins 1, 3, 7, 8, 15 are high. Pins 2, 4, 5, 9, 16 are low
Overflow	(9) High	16	15	



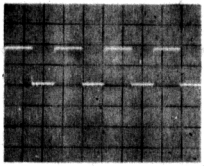
1. .2 V/cm -Slope
5 μs/cm - Main
.2 μs/cm - Delay



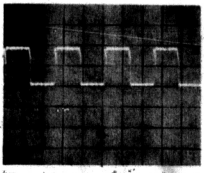
2. .2 V/cm -Slope
5 μs/cm - Main
.2 μs/cm - Delay



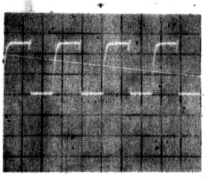
3. .2 V/cm -Slope
2 μs/cm - Main
.1 μs/cm - Delay



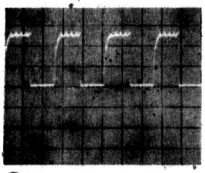
4. .2 V/cm +Slope
2 μs/cm



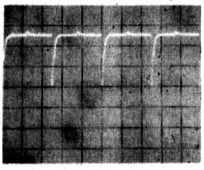
5. .2 V/cm +Slope
2 μs/cm



6. .2 V/cm +Slope
2 μs/cm



7. .2 V/cm +Slope
2 μs/cm

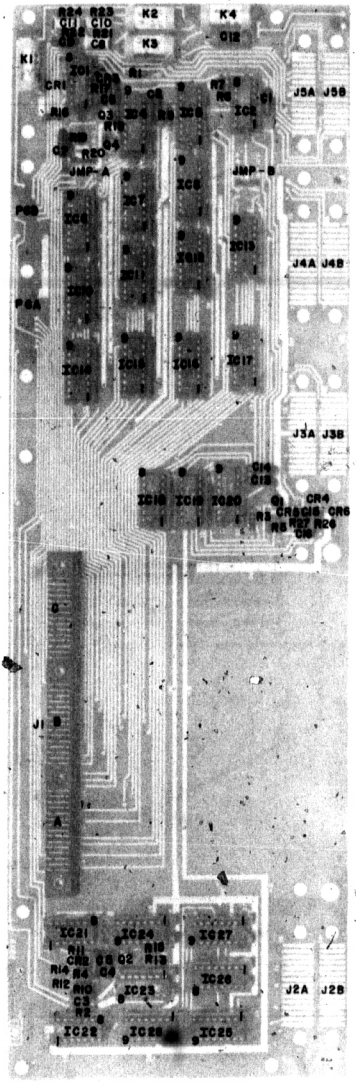


8. .2 V/cm +Slope
2 μs/cm

All waveforms dc coupled through 10:1 divider probe. Center line of graticule is zero volts. Triggering is interal ac.

Counter Controls:

SAMPLE RATE	FAST CCW
FUNCTION	F/MN CYCLE
INPUT	2 MHz at 100 mV rms
N Switch	00001
MULTIPLIER	X1
L1 Switch	00010
L2 Switch	00005



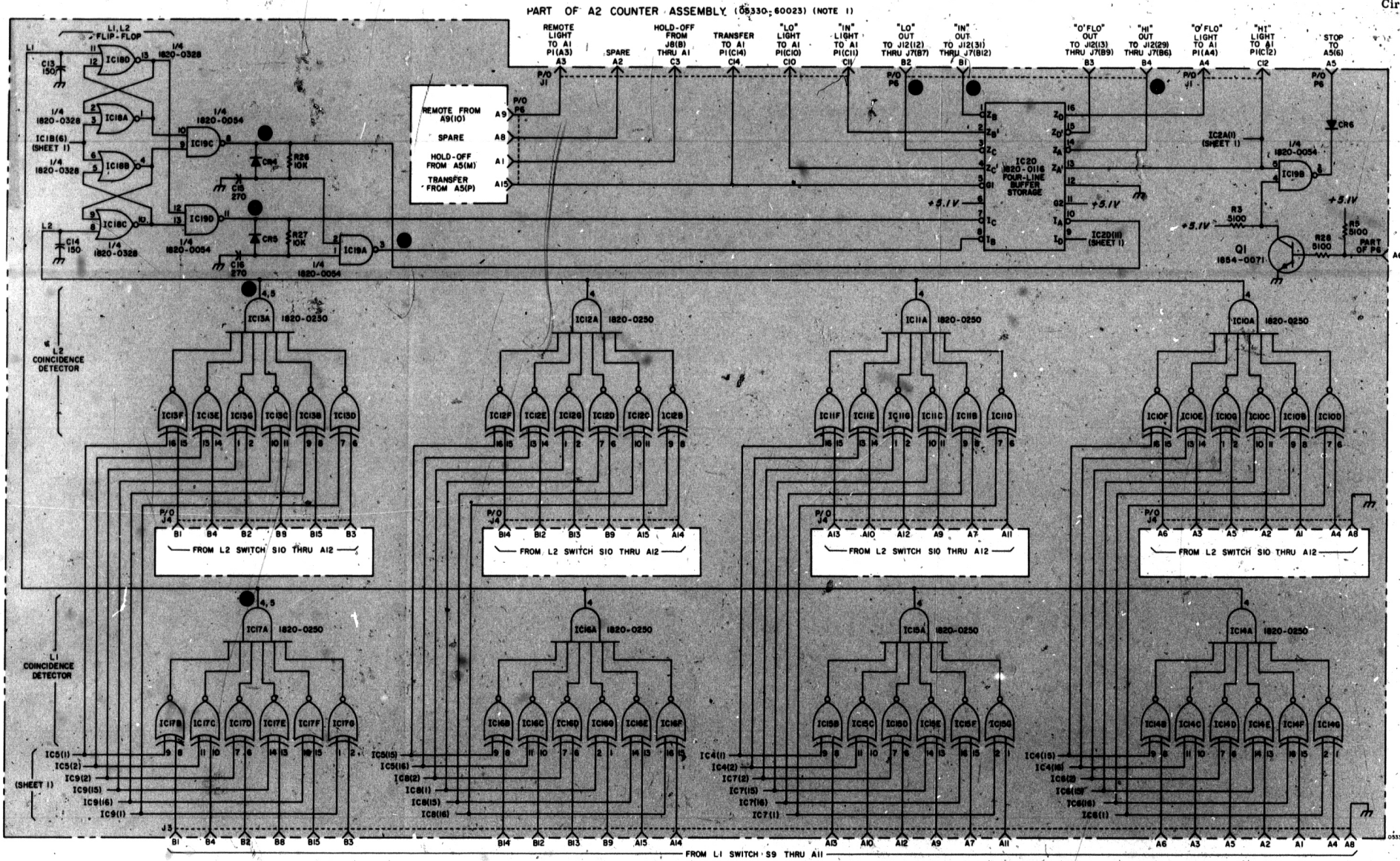


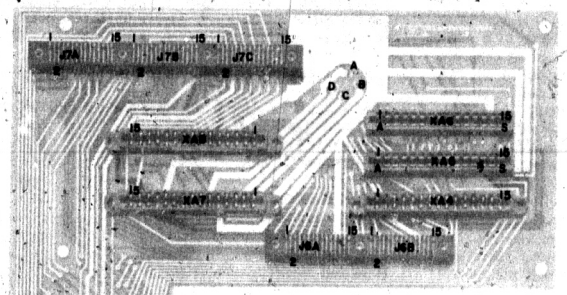
Figure 8-10. Counter Board A2 (5330B Only)
Sheet 2 of 2

A3, A14 OPERATION

A3 serves as the main interconnecting wiring board for the counter. The wiring diagram at the right is drawn to represent the physical layout of the PC board as viewed from the bottom of the instrument. The diagram gives immediate point-to-point wiring. For example, the X10 ATTEN control signal at A2P6B(12) comes from either A9(3) or J7A(10).

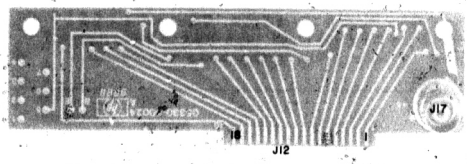
A3, A14 TROUBLESHOOTING

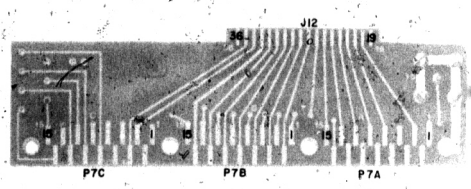
A3 interconnects to A14 via a 3-section pressure pin connector J7A, B, and C. The interconnect diagram can be used to check continuity from the bottom of A3 board to the remote connector J12. Likewise, continuity checks can be made from J6A and B to circuit points on A2.



A3 TOP VIEW

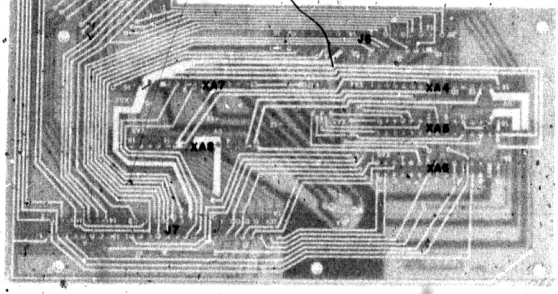
A14 TOP VIEW





A3 BOTTOM VIEW

A14 BOTTOM VIEW



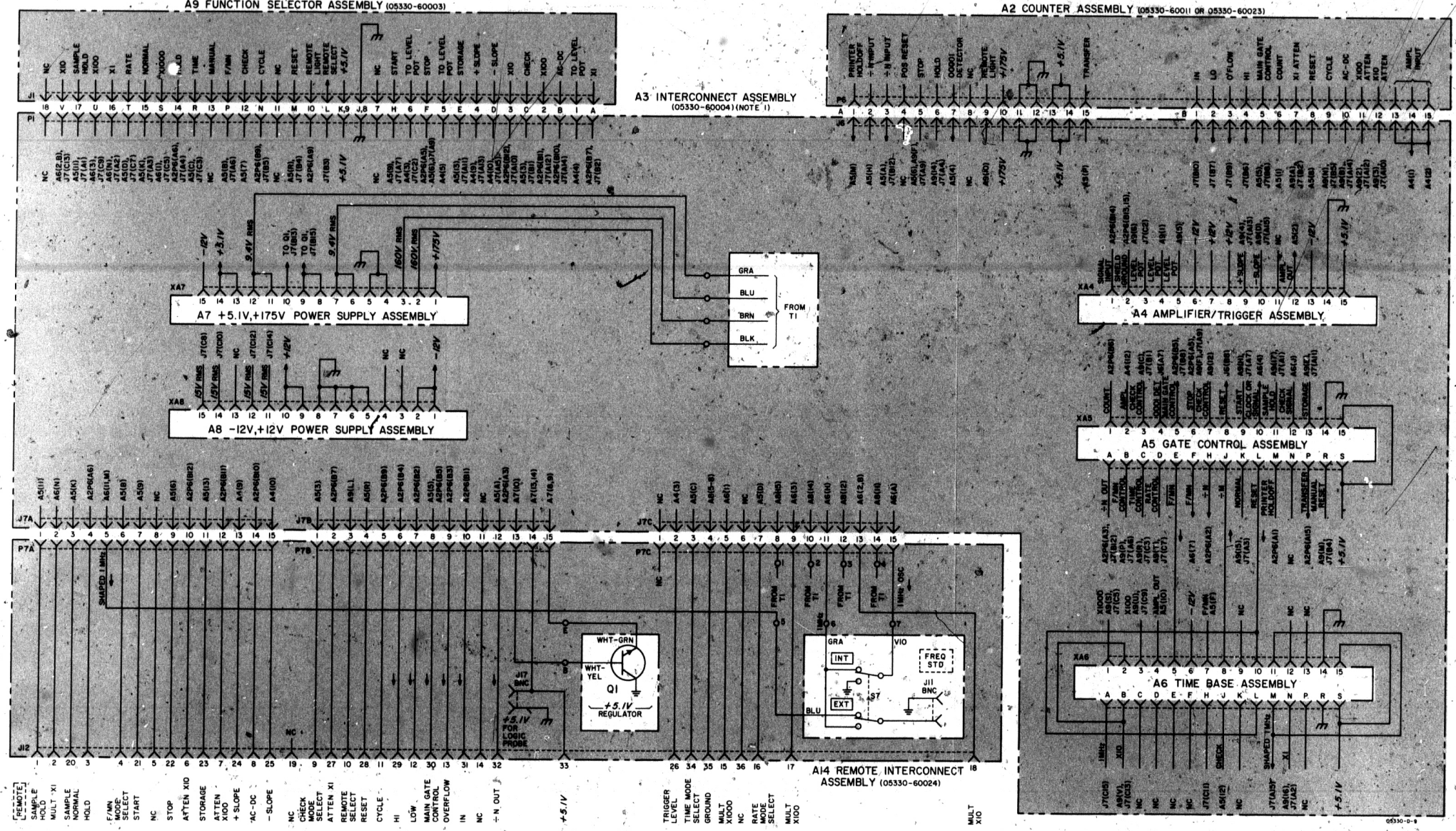


Figure 8-11. Interconnect Board A3
Remote Interconnect Board A14

A4 OPERATION

Amplifier/trigger A4 receives input signals from the attenuator circuits on A2 via J6A(14). Differential amplifier Q1A, Q1B, Q2, and Q4 connects to a constant current source, Q3. The level control supplies a variable ±3 volt reference to Q1B gate to set the crossover point between the differential amplifier output and the threshold of the trigger circuit. C13, R31, and CR5 differentiate the trigger circuit output for the - slope; and C14, R32, and CR6 for the +slope. When the SLOPE switch is set to +, +5 volts is applied to CR5 through R40 and R31 to inhibit Q7 output. The negative pulses applied to Q9 base will trigger the output one-shot to produce positive pulses for Q11. Q11 feeds output pulses to A5 for further routing. The output of Q10 is not used. During remote operation, the LEVEL control can be set to PRESET and an external +3 volt level can be used at J12(26) to remotely set the trigger level.

A4 TROUBLESHOOTING

Check ± 12 and +5.1 DC voltages. Check input signal at pin 1 for minimum 100 mV rms. Check waveforms to determine defective stage. Trouble can be further isolated by voltage and resistance measurements.

A4 ADJUSTMENT

With 10 MHz applied to counter input, A4R10 is adjusted for maximum sensitivity. An HP 651B test oscillator is required. Proceed as follows:

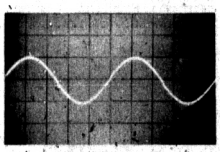
a. Set Counter controls as follows:

SAMPLE RATE	Slightly CW out of PWR OFF
FAST-NORM-HOLD	NORM
MUTLIPLIER	10
FUNCTION	RATE
STORAGE	ON
SLOPE	+
ATTENUATOR	X1
AC-DC	DC
LEVEL	PRESET
N Switch	1000

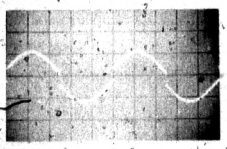
b. Connect 10 MHz at 0.1 V rms to INPUT connector.

c. Adjust input level unit display is unstable. Adjust A4R10 for stable display.

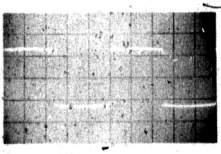
d. Repeat b and c until A4R10 is adjusted for maximum sensitivity.



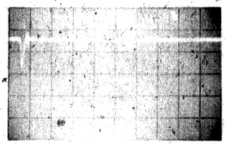
1. .05 V/cm +Slope
20 μs/cm



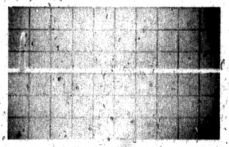
2. .05 V/cm +Slope
20 μs/cm



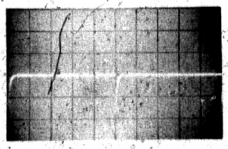
3. .1 V/cm +Slope
20 μs/cm



4. .05 V/cm -Slope
.2 μs/cm



5. .2 V/cm +Slope
.2 μs/cm

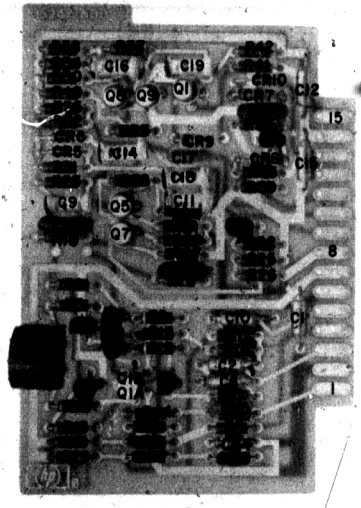


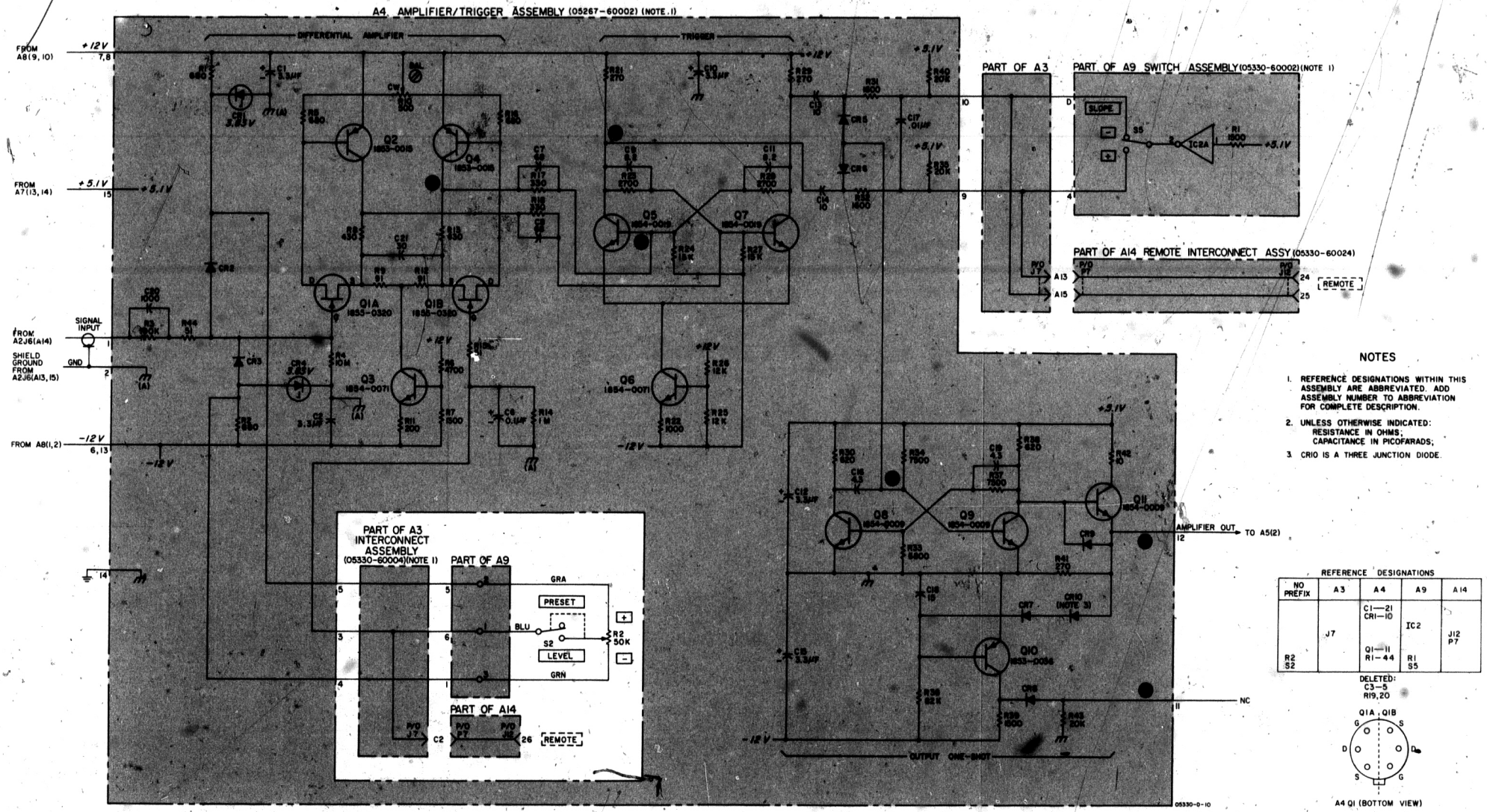
6. .5 V/cm -Slope
20 μs/cm

All waveforms dc coupled through 10:1 divider probe. Center line of graticule is zero volts. Triggering is internal ac.

Counter Controls:

ATTENUATOR	X1
AC-DC	AC
SLOPE	+
LEVEL	PRESET
INPUT	10 kHz at 100 mV rms


C16
C19
Q1
Q3
Q4
C12
J5
C14
C15
C11
Q5
Q7
J8
J1
Q17
J4



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS;
3. CR10 IS A THREE JUNCTION DIODE.

REFERENCE DESIGNATIONS

NO PREFIX	A3	A4	A9	A14
	J7	C1—21 CR1—10	IC2	J12 P7
R2 S2		Q1—11 R1—44	R1 S5	

DELETED:
C3-5
R19,20

A4 Q1 (BOTTOM VIEW)

Figure 8-12. Amplifier/Trigger A4

A5 OPERATION

GATE CIRCUITS

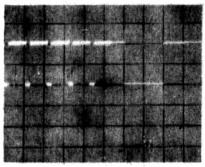
The gate circuits serve to route the signal input and time base signals to the proper points during the various mode of operation. The gates are controlled by selector switches on A9 or from the remote program connector J12. Figures 8-5 through 8-7 show the control lines and signal paths during the various modes.

MAIN GATE FF

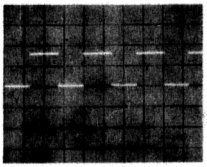
IC6B is controlled by the set, reset, J, K, and clock inputs. The set and reset inputs override all other inputs. When IC6B is set ($\overline{Q}$ is low), the main gate will be open. For main gate operation during the various modes, refer to Figures 8-5 through 8-7.

SAMPLE RATE, TRANSFER, AND RESET CIRCUITS

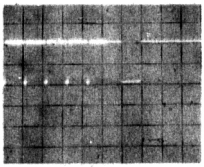
When the main gate closes, IC6A(1) goes low to set the sample rate FF (Q = high, $\overline{Q}$ = low). This will cause the transfer one-shot to supply a low transfer output pulse. When IC6A(14) goes low, Q4 turns off and C2 (or C2 and C5) charges through the sample rate potentiometer. After the delay set by the RC time constant, Q2 and Q3 conduct to drive IC3B(6) high. When IC3B(6) goes high, IC6A(3) goes low to reset the sample rate FF. Since IC6A(14) also connects to IC7A(2), the main gate FF is held in the reset state for at least the duration of the sample rate time. When IC6A resets, the reset OS provides a low reset output pulse at IC3A(3) and a high reset output pulse at the collector of Q6. The low reset pulse connects back to IC7A(13) to inhibit the J input of the main gate FF. When IC7A(2) is high (IC6A is reset), and IC7A(13) is high (reset pulse is over) and when no printer hold off is present at A5(M), then IC7A(12) goes low to drive IC6B(9) high. When the next clock pulse arrives, IC6B sets to open the main gate. Timing diagrams are shown in Figures 8-5 through 8-7. When the FAST-NORM-HOLD switch is set to FAST, Q5 is on and K1 is de-energized. Q5 acts to decrease the time constant of the reset OS during fast sample rate times.



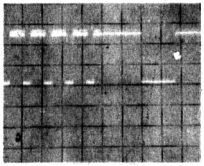
❶ .2 V/cm -Slope
50 μs/cm - Main
5 μs/cm - Delay



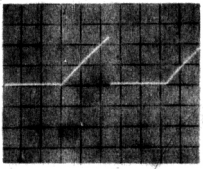
❷ .2 V/cm -Slope
20 μs/cm



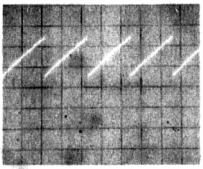
❸ .1 V/cm -Slope
50 μs/cm - Main
5 μs/cm - Delay



❹ .2 V/cm -Slope
50 μs/cm - Main
10 μs/cm - Delay



❺A .05 V/cm -Slope
10 μs/cm
FAST CCW
SAMPLE RATE

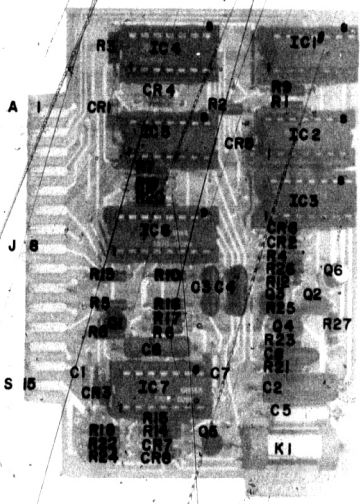


❺B .05 V/cm -Slope
5 ms/cm
NORM CCW
SAMPLE RATE

All waveforms dc coupled through 10:1 divider probe. Center line of graticule is zero volts. Triggering is internal ac.

Counter Controls:

SAMPLE RATE	FAST CCW (except TP 5B)
FUNCTION	RATE
ATTENUATOR	CHECK
N Switch	00010
MULTIPLIER	X1
STORAGE	ON


A
J
S
1
5
IC4
IC1
CR4
R2
R1
CR1
IC5
CR3
IC2
IC3
IC6
CR2
Q6
Q2
R25
Q4
R27
R23
R21
C1
C7
C2
C5
CR7
Q5
K1

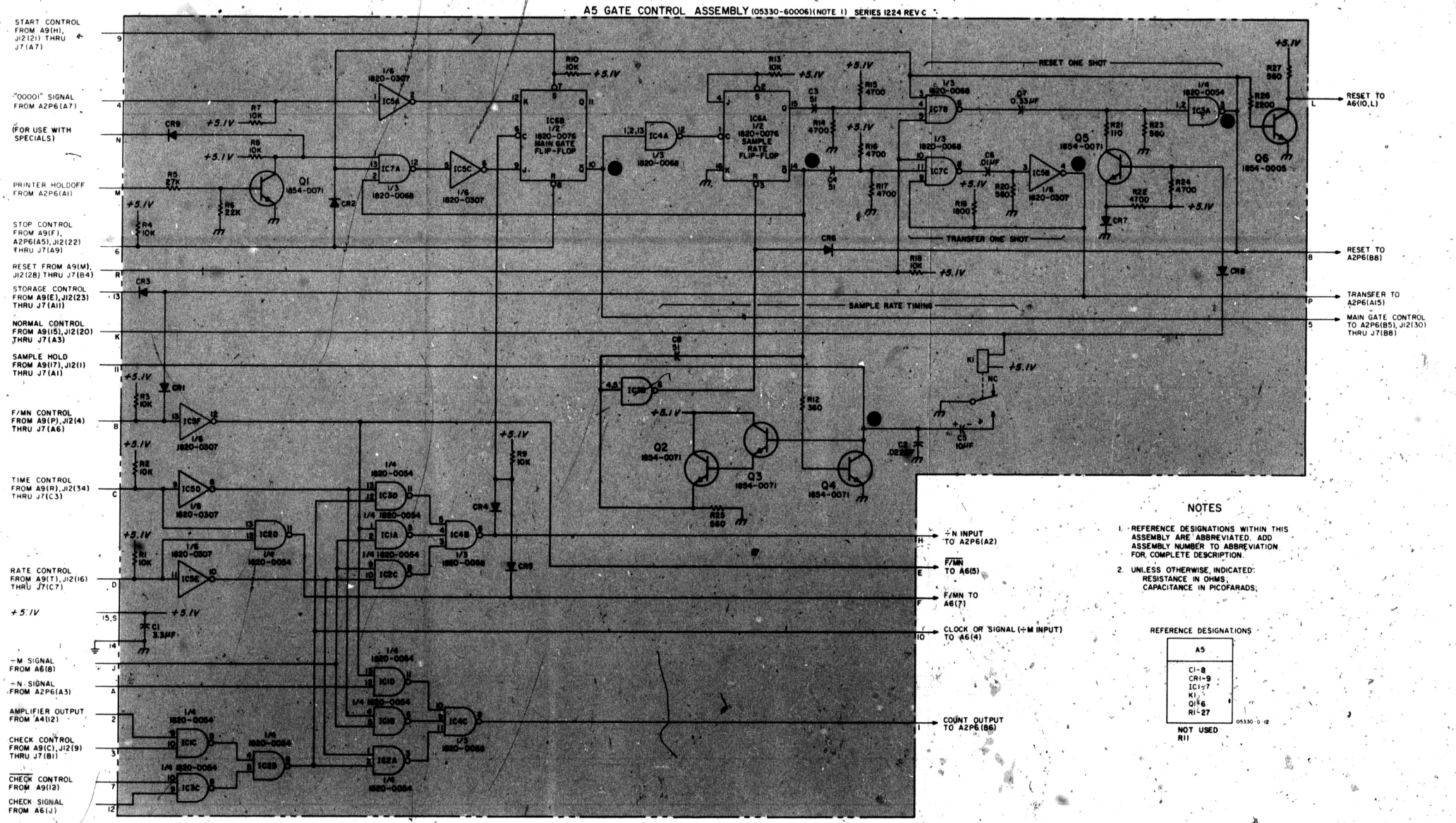


Figure 8-13. Gate Control A5

A6 OPERATION

1 MHz OSCILLATOR

The internal frequency standard is generated by 1 MHz crystal controlled oscillator Q1. When S7 is set to INT, the 1 MHz output feeds to shaper circuit IC4B and IC4A. IC4C(10) supplies 1 MHz pulses to FREQ STD output jack J11. The output of IC4D(13) provides an output to A5(12) for a check signal and also to IC3A(2). When the counter is not in the F/MN mode, IC3A(1) is high and IC3D(12) is low to route the 1 MHz through IC3C. Decades IC1 and IC2 are gated divide by 10 IC's that provide a ÷ 10 output at pin 13 when pin 14 is held low. The decade reset line requires a high reset pulse to reset the decades. When the X1 MULTIPLIER is selected, the 1 MHz goes through Q4 and IC3B to A6(8). When X10 MULTIPLIER is selected, the 1 MHz routes through IC1A where it is divided-by-ten to supply a 100 kHz output to IC3B. During F/MN mode, IC3A is disabled and IC3D is enabled to route the check or amplifier signal through the decade dividers.

A6 TROUBLESHOOTING

Either a logic probe or an oscilloscope can be used to isolate troubles to an individual IC or stage. Waveforms are shown for key checkpoints.

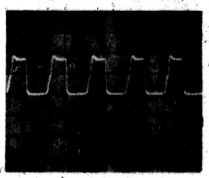
A6 ADJUSTMENT

This adjustment consists of displaying the 1 MHz oscillator output on the vertical output of an oscilloscope. A frequency standard is used to trigger the horizontal input. A6C5 is adjusted for minimum drift on the scope display. An HP 107AR frequency standard and an HP 180 oscilloscope with 1801A and 1820A plug-ins are required.

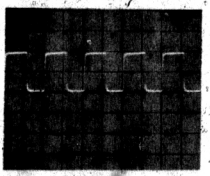
a. On counter rear panel, set FREQ STD to INT and connect FREQ STD output to oscilloscope vertical input.

c. Connect 1 MHz frequency standard to oscilloscope trigger input.

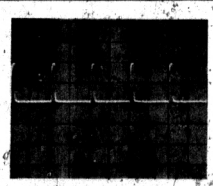
c. Set oscilloscope controls for 1 MHz display and adjust A6C5 for minimum drift of display.



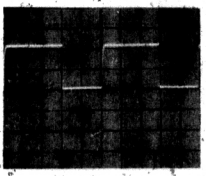
1 . 2 V/cm +Slope
. 5 μs/cm



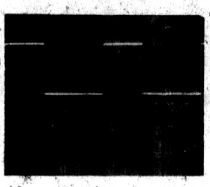
2 . 2 V/cm +Slope
. 5 μs/cm



3 . 2 V/cm +Slope
. 5 μs/cm



4 . 2 V/cm +Slope
2 μs/cm



5 . 2 V/cm
20 μs/cm
MULTIPLIER X100

6 . 2 V/cm
2 μs/cm
MUTLIPLIER X1

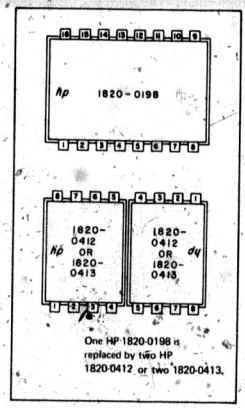
All waveforms dc coupled through 10:1 divider probe. Center line of graticule is zero volts. Triggering is internal ac.

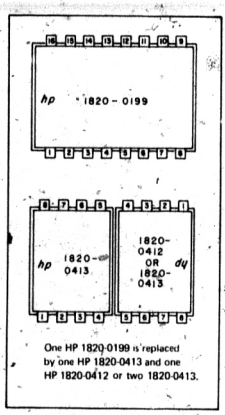
Counter Controls:

INT-EXT	INT
FUNCTION	RATE
INPUT	None
N Switch	00000

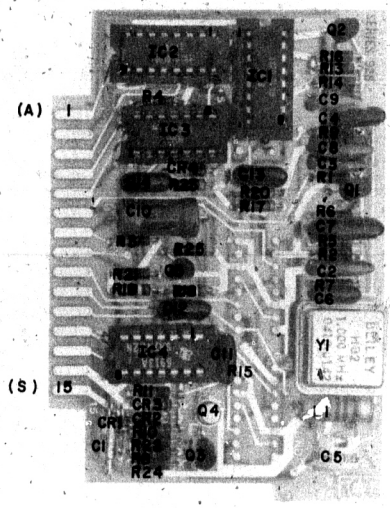
IC1 AND IC2 CONFIGURATIONS

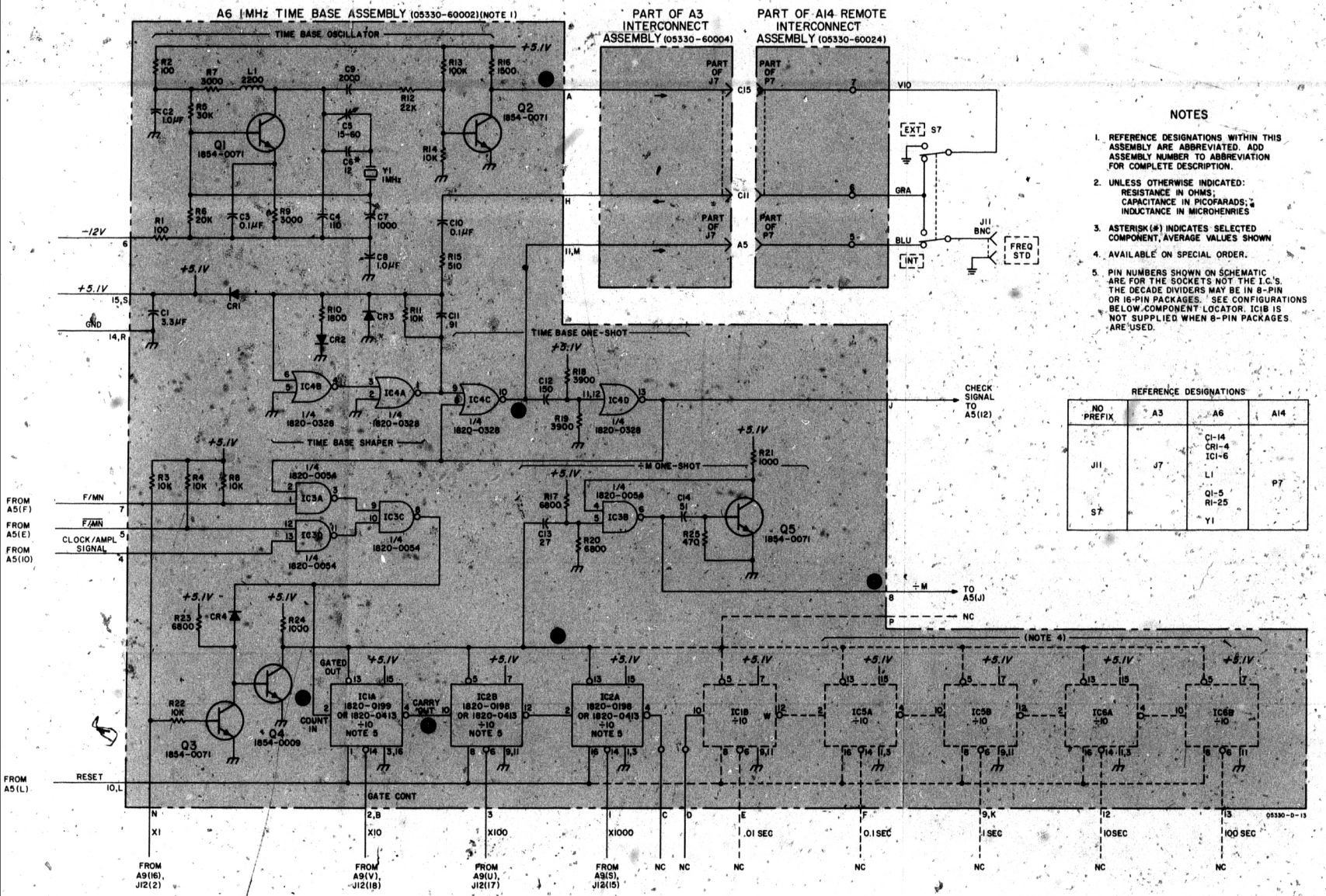
IC1 and IC2 may be 8-pin or 16-pin packages. Two 8-pin packages may replace or be replaced by one 16-pin unit as shown in the diagrams below.





HP Part No.	Decade	Clock (Count) Input	Reset 0 Input	Reset 9 Input	Gate Control	Gated Output	÷10 Carry	V_{CC}	Gnd
1820-0198 & 1820-0199	A	2	1	16	14	13	4	15	3
	B	10	9	8	6	5	12	7	11
1820-0412 & 1820-0413		2	1	8	6	5	4	7	3
				IC Pin Numbers					





NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. AVAILABLE ON SPECIAL ORDER.
5. PIN NUMBERS SHOWN ON SCHEMATIC ARE FOR THE SOCKETS NOT THE I.C.'S. THE DECADE DIVIDERS MAY BE IN 8-PIN OR 16-PIN PACKAGES. SEE CONFIGURATIONS BELOW. COMPONENT LOCATOR. IC1B IS NOT SUPPLIED WHEN 8-PIN PACKAGES ARE USED.

REFERENCE DESIGNATIONS

NO PREFIX	A3	A6	A14
J11	J7	C1-14 CR1-4 IC1-6 L1 Q1-5 R1-25 Y1	P7
S7			

A7 OPERATION

The +175 volt output is used for the digital display tubes and annunciator circuits on A1. The +5. 1 volts is used to power most of the circuits in the counter. The +5. 1 volt section receives operating bias from the -12 volt supply. Regulator Q1 is mounted on the rear of the counter chassis.

A7 TROUBLESHOOTING

WARNING

USE EXTREME CAUTION WHEN TROUBLESHOOTING THIS ASSEMBLY. +175 VOLTS IS PRESENT AT SEVERAL POINTS ON THE BOARD.

If the power supply is overloading, perform voltage and resistance measurements to isolate trouble to the power supply or to external circuits. If trouble is external to power supply, turn power OFF, then remove PC boards receiving the +5. 1 volts until overload is isolated to a particular PC board.

A8 OPERATION

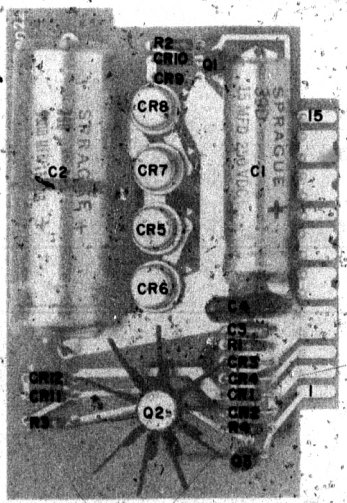
This assembly supplies ±12 volts. The -12 V output provides operating bias for the +12 volt regulator and vice versa. The -12 volt supply also provides operating bias for the +5. 1 volt regulator. If either the +12 V or -12 V regulator overloads, the interconnecting operating biases will cause both regulators to turn off to protect the supply. To restore power, either depress A8S1 or interrupt the 115 volt input power.

A8 TROUBLESHOOTING

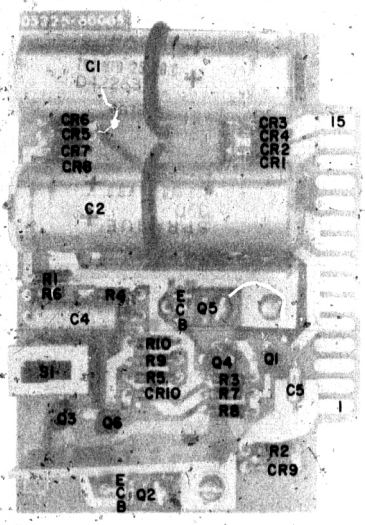
CAUTION

Do not short the heat sink plates on Q2 and Q5. The plates are at the collector potential.

If no output, press RESET switch A8S1. If still overloading, make voltage and resistance measurements to isolate trouble to power supply or to external circuits. If trouble is external to power supply, turn power OFF, then remove PC boards receiving that particular voltage until overload is isolated to a particular PC board.



A7 +5.1V and +175 POWER SUPPLY



A8 ±12V POWER SUPPLY

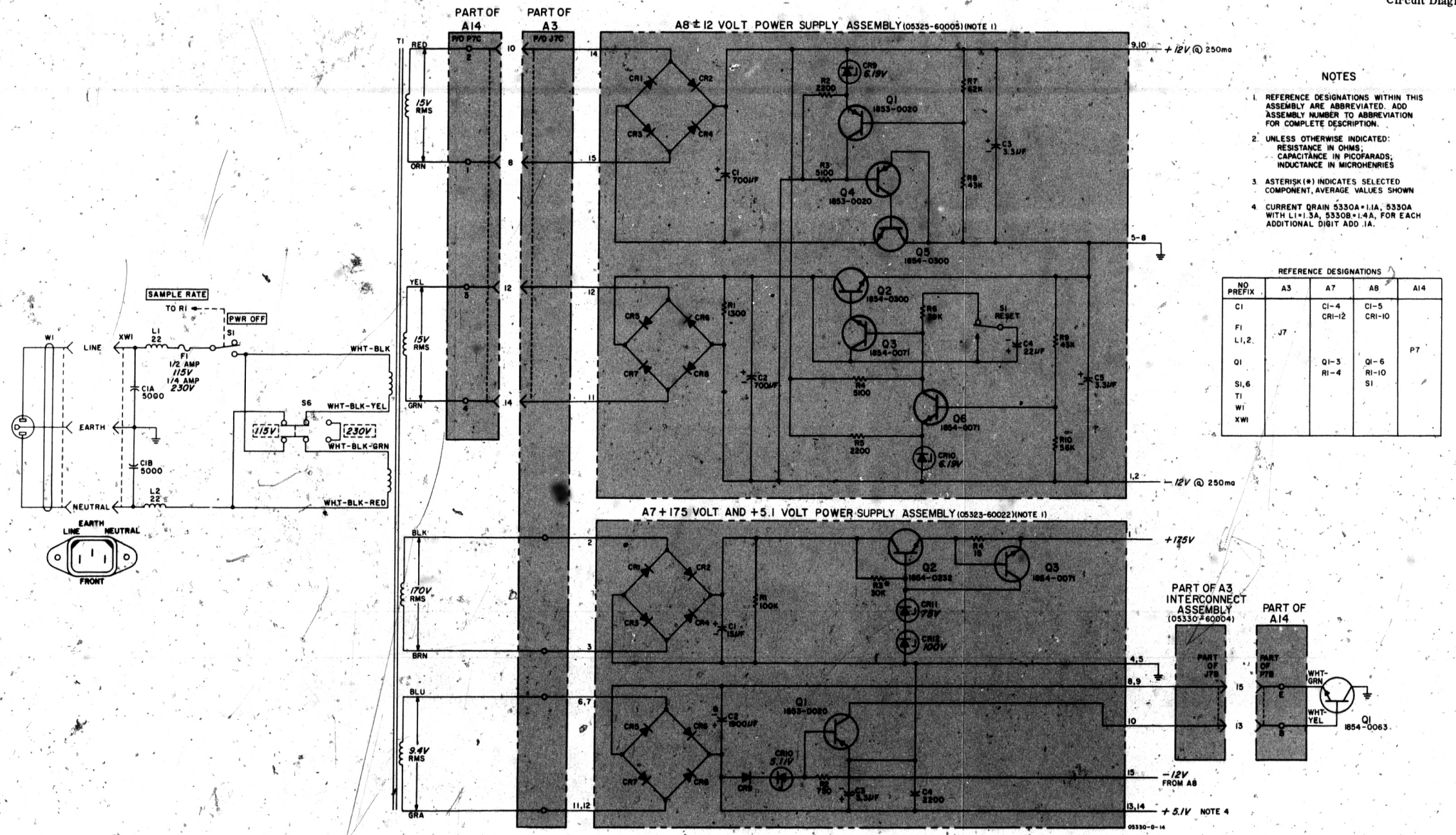
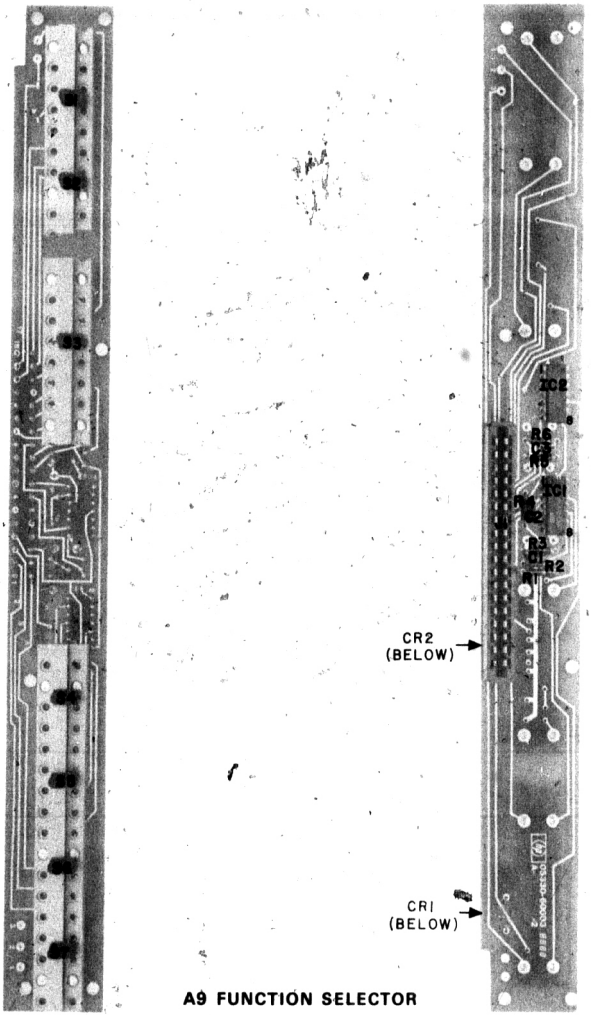


Figure 8-15. Power Supply Boards A7, A8

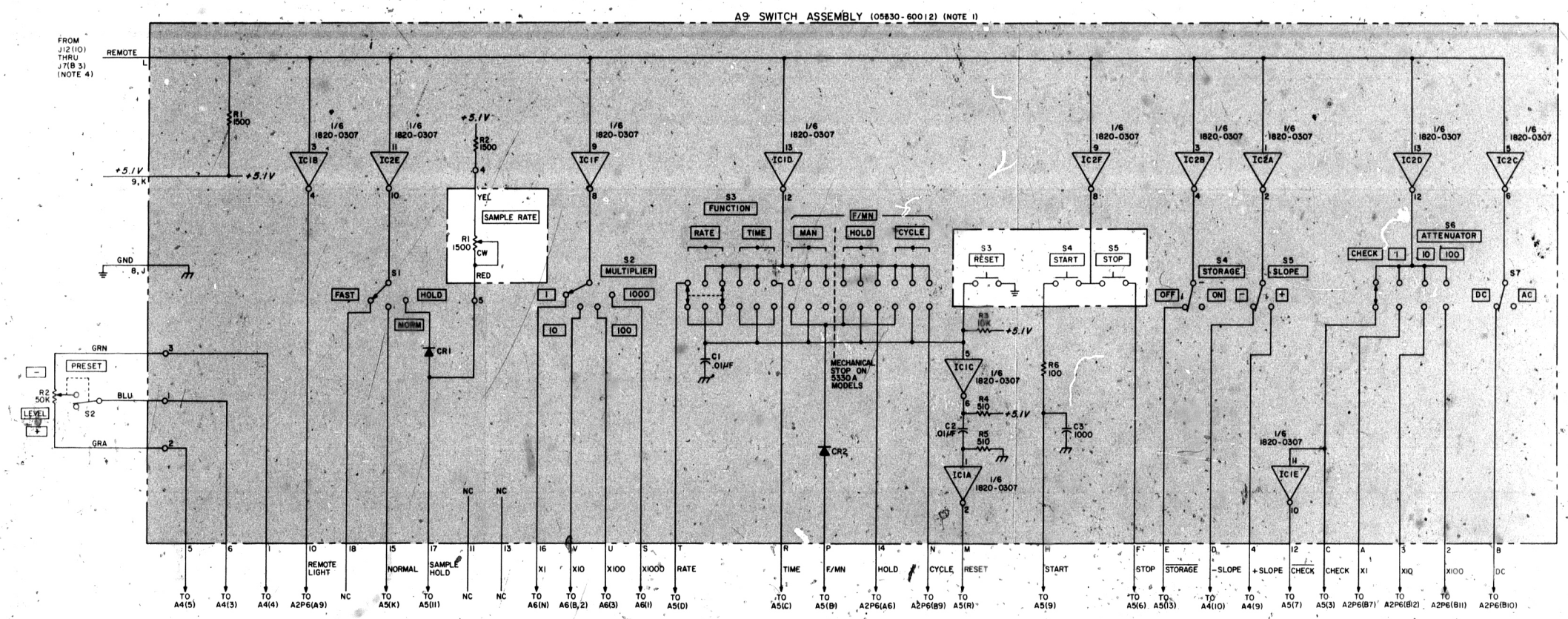
A9 OPERATION

When J12(10) is low, all front panel switches are inoperative except POWER and RESET. The potentiometers are still operative. When the counter is not in remote control operation, A9(L) is high so that all IC inputs are held high except IC1C, IC1E, and IC1A. As an example of operation, the MULTIPLIER switch routes the low output of IC1F(8) to one of four outputs to select the corresponding multiplier value. Notice that the RESET circuits are AC coupled, switch S3 will ground IC1C(5) when depressed. When the FUNCTION selector switch is in between detents, IC1C(5) is also low. When IC1C(5) goes low, a momentary reset pulse is generated to reset the counter. When the ATTENUATOR switch is in CHECK, IC1E(10) goes high to enable the check signal gate on A5.



A9 FUNCTION SELECTOR

02844-1



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS;
3. ⌐o DENOTES DETENT POSITION. 5330A MODELS SELECT RATE, TIME OR F/MN - MAN ONLY.
4. WHEN PIN L IS HIGH, FRONT PANEL CONTROLS ARE OPERATIVE. A LOW AT PIN L DISABLES ALL FRONT PANEL CONTROLS EXCEPT POWER, SAMPLE RATE, LEVEL AND RESET.

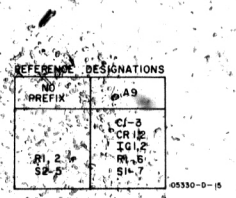


Figure 8-16. Switch Board A9

SCHEMATIC DIAGRAMS CON'T

S8 AND A10 OPERATION

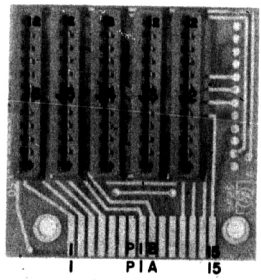
Thumbwheel switch S8 is a decimal to BCD converter. A ground is applied to S8(5) from A2J2A(8). As an example of operation, when the number 7 is dialed in on the switch, pins 1, 2, and 7 are grounded to represent a C, B, A output (4, 2, 1) to A2 decades. Table 8-4 shows the switch truth table. A10 serves to interconnect the switch outputs to A2.

S8 TROUBLESHOOTING

A quick way to check the N switch is to set the counter in the CHECK-RATE mode with N = 00000 and M = 1. Using a straight edge, rotate all switches to 11111, 22222, etc., and check that readout corresponds to switch setting. When a particular digit is faulty, use a logic probe and Table 8-4 to check each switch output.

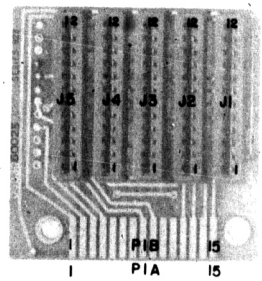
Table 8-4. S8 and S9 Truth Table

Decimal Number on Switch Dial	D Output (Pin 6)	C Output (Pin 7)	B Output (Pin 2)	A Output (Pin 1)
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L



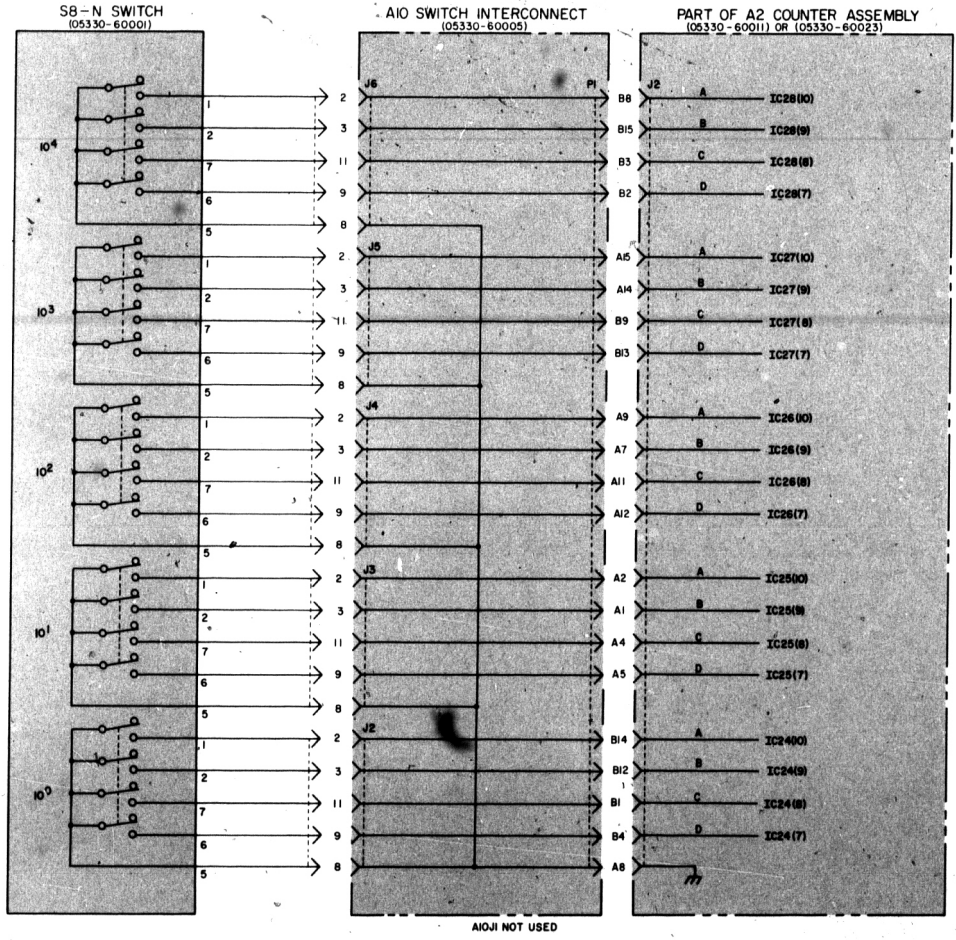
Note: P1A is on underside of board

A10 SWITCH INTERCONNECT ASSEMBLY



Note: P1A is on underside of board

A11 SWITCH INTERCONNECT ASSEMBLY


S8-N SWITCH
(05330-60001)
AIO SWITCH INTERCONNECT
(05330-60005)
PART OF A2 COUNTER ASSEMBLY
(05330-60011) OR (05330-60023)
10^4
10^3
10^2
10^1
10^0
J6
P1
J5
J4
J3
J2
J2
B8
B15
B3
B2
A15
A14
B9
B13
A9
A7
A11
A12
A2
A1
A4
A5
B14
B12
B1
B4
A8
A
B
C
D
IC28(10)
IC28(9)
IC28(8)
IC28(7)
IC27(10)
IC27(9)
IC27(8)
IC27(7)
IC26(10)
IC26(9)
IC26(8)
IC26(7)
IC25(10)
IC25(9)
IC25(8)
IC25(7)
IC24(10)
IC24(9)
IC24(8)
IC24(7)
A10J1 NOT USED

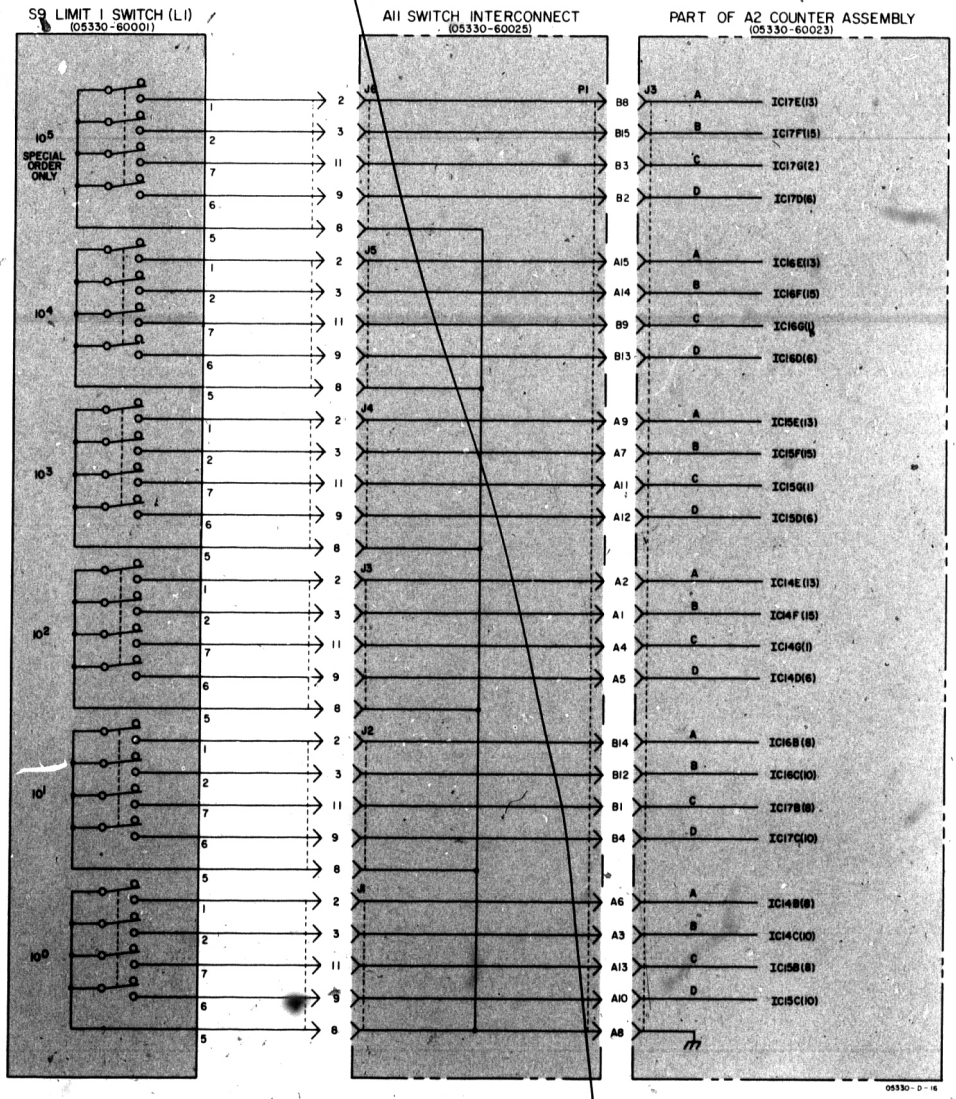


Figure 8-17. N Switch S8
Switch Interconnect A10
L1 Switch S9
Switch Interconnect A11

S10 AND A12 OPERATION

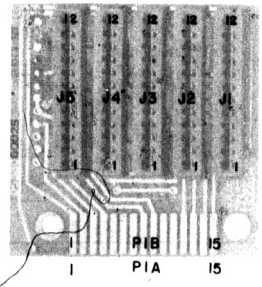
Thumbwheel switch S8 is a decimal to BCD converter. A ground is applied to S10(5) from A2J4A(8). As an example of operation, when the number 7 is dialed in on the switch, pins 1, 2, and 7 are grounded to represent C, B, A outputs (4, 2, 1) to A2 coincidence detector. A12 serves to interconnect the switch outputs.

S10 TROUBLESHOOTING

A quick way to check the L switches is to set the counter to the F/MN RECYCLE mode with M = 1, N = 00001, and both limit switches to 00000. Using a straight edge, rotate a limit switch to 11111 and press start switch, check that display corresponds to switch setting. Repeat for 22222, 33333, etc. When a particular digit is faulty, use a logic probe and Table 8-5 to check each switch output.

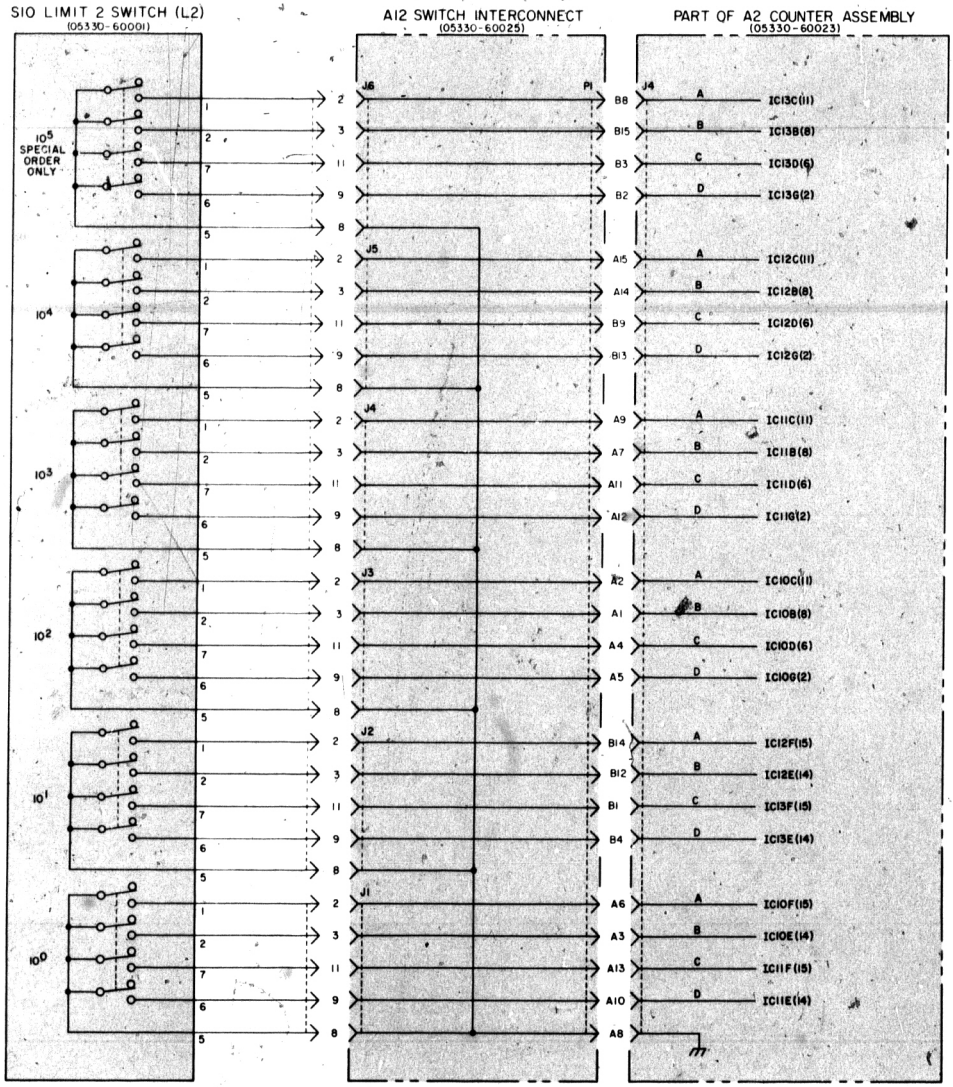
Table 8-5. S10 and S11 Truth Table

Decimal Number on Switch Dial	D Output (Pin 6)	C Output (Pin 7)	B Output (Pin 2)	A Output (Pin 1)
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L



Note: P1A is on underside of board

A12 SWITCH INTERCONNECT ASSEMBLY


SIO LIMIT 2 SWITCH (L2)
(05330-60001)
A12 SWITCH INTERCONNECT
(05330-60025)
PART OF A2 COUNTER ASSEMBLY
(05330-60023)
10^5 SPECIAL ORDER ONLY
10^4
10^3
10^2
10^1
10^0
J6
J5
J4
J3
J2
J1
P1
J4
B8
B15
B3
B2
A15
A14
B9
B13
A9
A7
A11
A12
A2
A1
A4
A5
B14
B12
B1
B4
A6
A3
A13
A10
A8
A
B
C
D
IC13C(11)
IC13B(8)
IC13D(6)
IC13G(2)
IC12C(11)
IC12B(8)
IC12D(6)
IC12G(2)
IC11C(11)
IC11B(8)
IC11D(6)
IC11G(2)
IC10C(11)
IC10B(8)
IC10D(6)
IC10G(2)
IC12F(15)
IC12E(14)
IC13F(15)
IC13E(14)
IC10F(15)
IC10E(14)
IC11F(15)
IC11E(14)

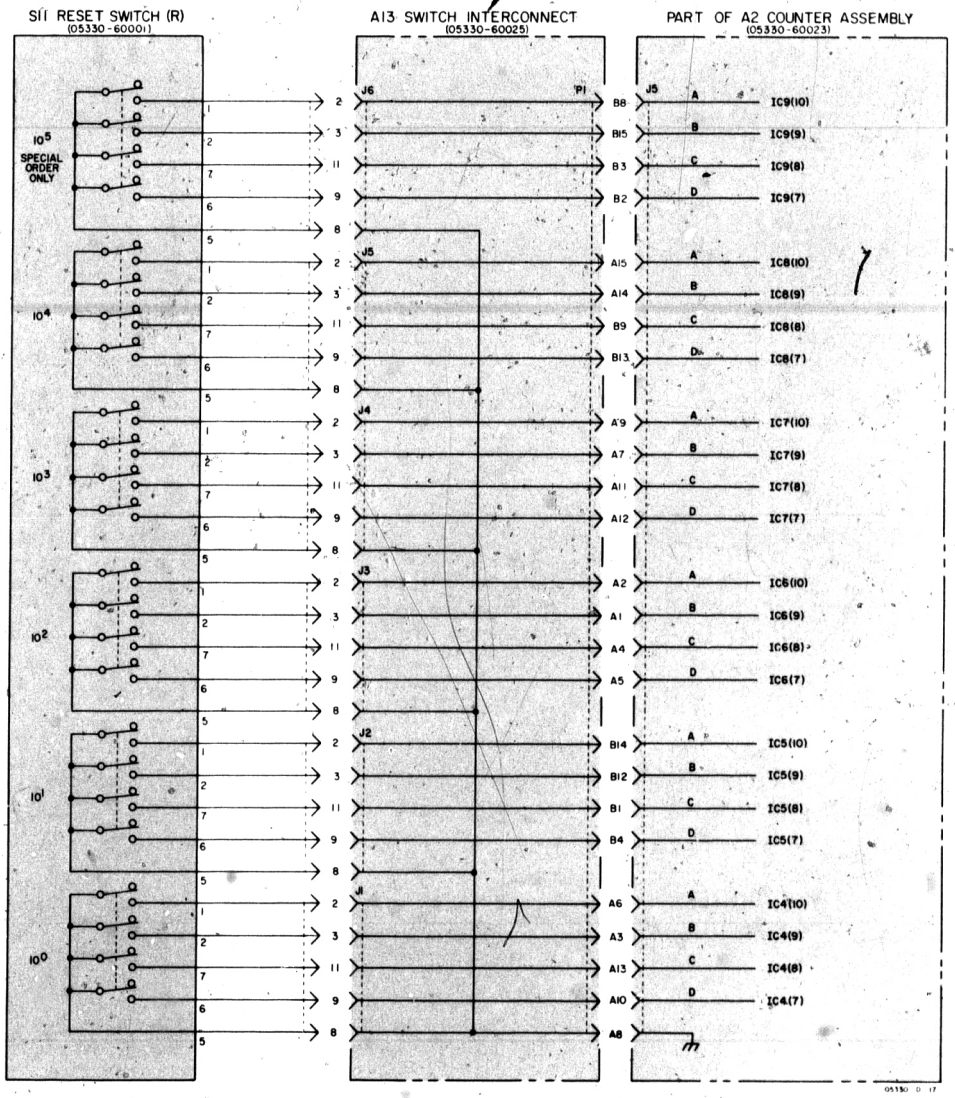
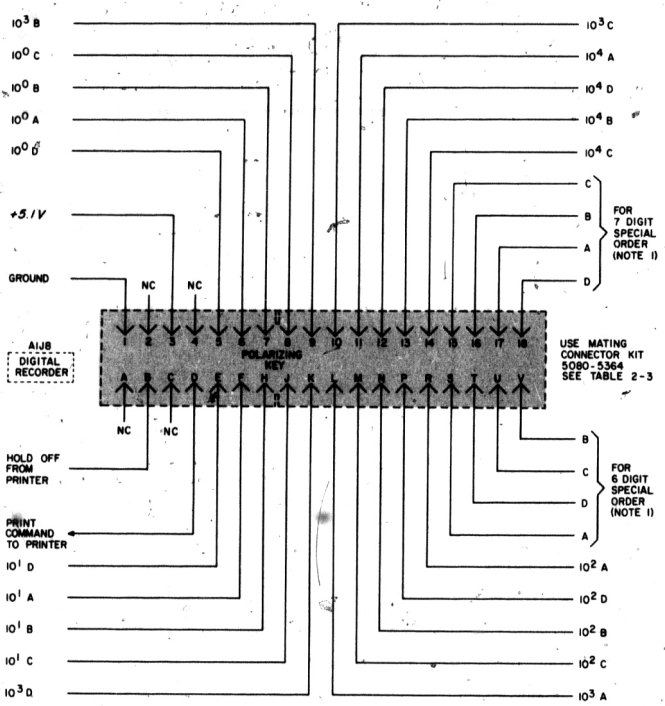


Figure 8-18. L2 Switch S10
Switch Interconnect A12
R Switch S11 (Option 001)
Switch Interconnect A13 (Option 001)


10^3 B
10^0 C
10^0 B
10^0 A
10^0 D
+5.1V
GROUND
NC
NC
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
POLARIZING KEY
A B C D E F H J K L M N P R S T U V
NC
NC
AIJ8 DIGITAL RECORDER
HOLD OFF FROM PRINTER
PRINT COMMAND TO PRINTER
10^1 D
10^1 A
10^1 B
10^1 C
10^3 D
10^3 C
10^4 A
10^4 D
10^4 B
10^4 C
C
B
A
D
FOR 7 DIGIT SPECIAL ORDER (NOTE 1)
USE MATING CONNECTOR KIT 5080-5364 SEE TABLE 2-3
B
C
D
A
FOR 6 DIGIT SPECIAL ORDER (NOTE 1)
10^2 A
10^2 D
10^2 B
10^2 C
10^3 A

NOTES

1. FOR STANDARD INSTRUMENTS THESE OUTPUTS ARE FLOATING: PROGRAM DIGITAL RECORDER TO SUPPRESS UNDESIRED PRINTOUTS.

SPECIALS

1. FOR SIX-DIGIT SPECIALS, PINS S, T, U, V OF A1J8 PROVIDE 10^5 BCD DATA (MOST SIGNIFICANT COUNTER DIGIT).
2. FOR SEVEN-DIGIT SPECIALS, THE BCD COLUMNS ARE:

A1J8 PIN NO.	
15 THRU 18	10^0
5 THRU 8	10^1
E THRU J	10^2
M THRU R	10^3
L, 9, 10, K	10^4
11 THRU 14	10^5
S THRU V	10^6

BCD WEIGHTS

A = 1
B = 2
C = 4
D = 8

FOR REMOTE OPERATION, THE FOLLOWING MUST BE SELECTED (SEE PARAGRAPH 2-15 AND TABLE 2-2).

A. REMOTE SELECT
B. FUNCTION (SELECT 1 MODE WITH OR WITHOUT CHECK).
C. ATTENUATOR OR CHECK (1 OF 3 LINES OR CHECK).
D. SLOPE (SELECT 1 OF 2 LINES).
E. MULTIPLIER (SELECT 1 OF 4 LINES).

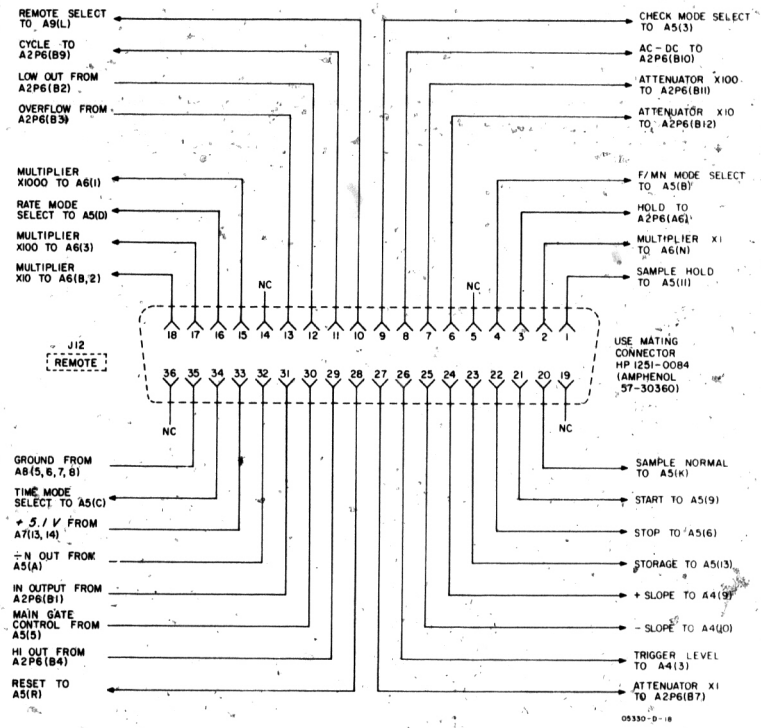


Figure 8-19. Digital Recorder Jack J8
Remote Function Jack J12

MANUAL CHANGES

HEWLETT hp PACKARD

MANUAL CHANGES

MANUAL DESCRIPTION

INSTRUMENT: 5330A/B Preset Counters

SERIAL PREFIX: 1224A

DATE PRINTED: JULY 1973

HP PART NO: 05330-90011

CHANGE DATE: October 11, 1973

(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

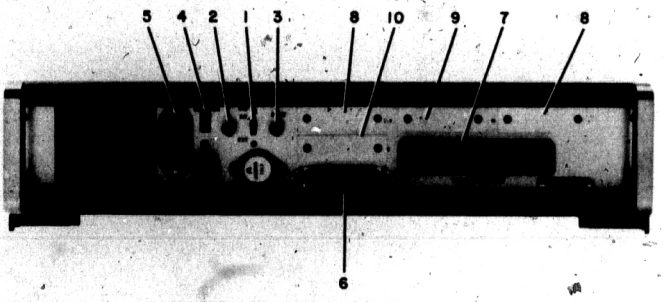
► NEW OR REVISED ITEM

ERRATA

Page 3-6, Figure 3-3:

Change photo call-out #9 to #10.

Add photo call-out #9 to connector between two #8 call-outs.



ERRATA (Cont'd)

►Page 8-17/19, Figure 8-10, A2 component locators:
Show A2R28 as being just right of A2R5 — see illustration:

►Page 8-19, Figure 8-10, A2 schematic:
Change A2R3 from 5100 to 1800 OHM.

►Page 8-33, Figure 8-17:
Change part numbers of S8 and S9 from 05330-60001 to 3100-3209.

►Page 8-35, Figure 8-18:
Change part numbers of S10 and S11 from 05330-60001 to 3100-3209.