Errata

Title & Document Type: **5326B/27B Timer Counter DVM Operating and Service Manual**

Manual Part Number: **05326-90043**

Revision Date: **February 1975**

About this Manual

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

HP References in this Manual

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

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Agilent Technologies

OPERATING AND SERVICE MANUAL

TIMER COUNTER DVM

5326B/5327B

HEWLETT hp PACKARD

HP 5326B/5327B

CERTIFICATION

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

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5326B/5327B

TIMER/COUNTER/DVM

OPERATING AND SERVICE MANUAL

SERIAL PREFIX:

5326B-1428A
5327B-1428A

This manual applies to Model 5326B having serial prefix 1428A and HP Model 5327B having serial prefix 1428A.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 1428A, a "Manual Supplement" sheet is included with this manual. For serial prefixes below 1428A, refer to Section VII of this manual.

NOTE

For 5326B's with serial prefixes earlier than 1128A, a separate manual is required. Order "Model 5326A/B 50 MHz Timer/Counter/DVM Operating and Service Manual." See NOTE above Table 7-1 on page 7-3.

Printed: FEB 1975

MANUAL PART NO. 05326-90003
MICROFICHE PART NO. 05326-90044

PRINTED IN U.S.A.

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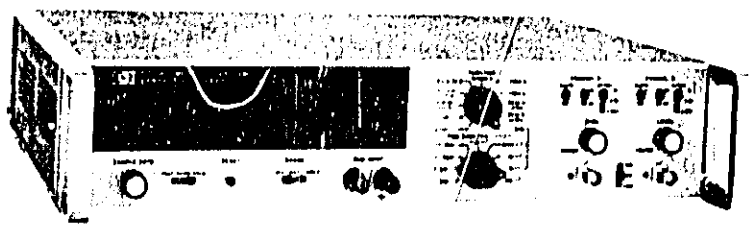
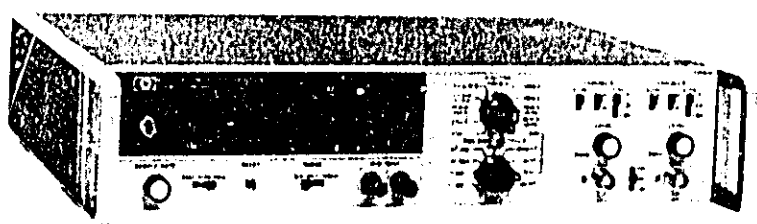
Figure 1-1. HP Model 5326B/5327B Timer/Counter/DVM



MODEL 5326B



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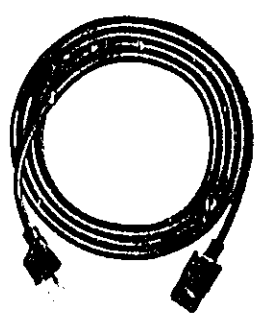


POWER CORD

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The Hewlett-Packard Model 5326B/5327B are frequency counters that have a variety of functions. The basic difference between the two models is the addition of the prescaler assembly in the 5327B. This assembly increases the upper frequency limit from 50 MHz to 500 MHz. The 5326B uses a high-sensitivity, 50-ohm input amplifier in place of the prescaler.

1-3. The instrument measures frequency, period, period average, time interval, time interval average, and ratio. The DVM (digital voltmeter) portion of the instrument measures dc voltages up to 1000 volts and provides a direct readout of the voltage and polarity of the counter's trigger levels. The model features a 7-digit display (8 digits optional), 1M ohm and 50-ohm inputs, display storage, and blanking for insignificant digits in the display. Decimal point and unit readouts are displayed automatically with each operating selection. Two independent input channels are provided for time interval measurements. Each input channel has an attenuator, trigger slope selector, level control, ac-dc coupling, and an oscilloscope marker output. Table 1-3 lists the electrical and mechanical specifications.

1-4. IDENTIFICATION

1-5. Hewlett-Packard uses a two-section serial number mounted on the rear panel. Earlier instruments use an 8-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 9-digit serial number (0000A00070). The first four digits are the serial prefix and the last five digits refer to the specific instrument. If the serial prefix of your instrument differs from that listed on the title page of this manual, there are differences between this manual and your instrument. Lower serial prefixes are documented in Section VII, and higher serial prefixes are covered with manual change sheets included with the manual. If the change sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed on the inside rear cover of this manual.

1-6. APPLICATIONS

1-7. The 5326B/5327B Counters are particularly adaptable to timing measurements such as pulse width, pulse repetition frequency, and propagation delay. The time interval average mode measures time interval on repetitive signals with resolution better than one nanosecond. When used with micro wave test systems, group delay, phase, and level measurements can be performed.

1-8. OPTIONS

1-9. The instrument can be ordered with the following options: Option 001, 8-digit display; Option 002, remote programming; Option 003, digital recorder outputs; Option 004, remote programming for all signal input conditions; Option 010, temperature compensated oscillator; Option 011, HP 10544A oven oscillator.

Table 1-1. Equipment Supplied

Description	HP Part No.
Detachable Power Cord, 7½ ft. (231 cm) long)	8120-1378
Rack Mounting Kit	05326-60046

Table 1-2. Accessories Available

Description	HP Part No.
Digital Recorders	5050B, 5055A
Interconnect Cable, Digital Recorder, 6 ft (183 cm)	562A-16C
50-ohm BNC to BNC Coaxial Cable, 4 ft (122 cm)	10503-6001
Circuit Board Extender, 15-pin (two required)	5060-0049
Input Amplifier Circuit Board Extender	10532-60001
Circuit Board Extender, 18-pin	5060-2041
Extender Board Kit; includes two 5060-0049, and one each 5060-2041, and 10532-60001	10532A

Table 1-3. Specifications

INPUT CHANNELS A AND B

Range: dc coupled: 0 to 50 MHz
ac coupled: 20 Hz to 50 MHz

Sensitivity: 0.1 V rms sine wave
0.3 V p-p pulse
8 ns minimum pulse width
Sensitivity can be decreased by 10 or 100 times, using the ATTENUATOR switch.

Impedance: 1 MΩ shunted by less than 25 pF.

Dynamic Input Voltage Range:
0.1 to 3 V rms ac times attenuator setting.
±5 Vdc times attenuator setting.

Trigger Level: PRESET to center triggering about 0 V or variable over the range of −3 V to +3 V times attenuator setting. Trigger threshold band <1.0 mV, referred to input at maximum frequency.

Overload Protection: 250 V rms on all attenuator settings, except 25 V rms on X1 above 50 kHz.

Slope: Independent selection of positive or negative slope.

Channel Inputs: Common or separate lines.

Marker Outputs: Rear panel BNC's DTL pulse, low for approximately 2 μs after trigger point for A and B channels.

INPUT CHANNEL C

5327B

Range: direct: 0 to 50 MHz, dc coupled
prescaled: 0 to 550 MHz, dc coupled.

Sensitivity: direct: 15 mV rms.
prescaled: 25 mV rms.

Impedance: 50Ω nominal.

Maximum Input: 3.5 volts rms; 5 volts peak.

Trigger Level: 0 volts.

5326B

Range: 0 to 50 MHz, dc coupled.

Sensitivity: 5 mV rms.

Impedance: 50Ω nominal.

Maximum Input: 5 volts rms; 7.5 volts peak.

Trigger Level: 0 volts.

CAUTION
Do not exceed voltage specification or damage will occur.

START (Totalizing and Scaling)

Range: 0 to 10 MHz.

Factor: 1 to 10^8 selectable in decade steps.

Output: Rear panel TIME BASE BNC.

Display: Channel A input divided by scaling factor.

FREQUENCY

Range: 0 to 50 MHz (5326B).
0 to 550 MHz (5327B).

Input: Channel A; Channel C for direct and for prescaled (switchable). Channel A provides triggered frequency measurement.

Gate Times: 0.1 μs to 10 s in decade steps.

Accuracy: ±1 count displayed* ± time base accuracy

Display: kHz, MHz, or GHz with positioned decimal point.

TIME INTERVAL

Range: 0.1 μs to 10^8 seconds.

Input: Channel A and B; can be common or separate.

Frequency Counted: 10 MHz to 0.1 Hz selectable in decade steps

Accuracy: ±1 count ± time base accuracy ± trigger error.**

Display: μs, ms, seconds, or 10's of seconds with positioned decimal point.

*When prescaled by 10, ±1 count displayed is ±10 counts of the input signal.

**For any waveshape, trigger error is less than

$$\pm \frac{0.0025}{\text{Signal Slope (V/μs)}} \ \mu s.$$

Table 1-3. Specifications (Continued)

TIME INTERVAL AVERAGE

Range: 0.15 ns to 10 seconds.

Intervals Averaged: 1 to 10^8 selectable in decade steps.

Input: START - Channel A; STOP - Channel B can be separate or common.

Frequency Counted: 10 MHz.

Accuracy: ± time base accuracy ±2 ns

$$\pm\frac{(\text{trigger error}^{**} \times 100\ \text{ns})}{\sqrt{\text{intervals averaged}}}$$

Dead Time: Minimum time between STOP (Channel B trigger) and START (Channel A trigger): 150 ns.

Display: ns, µs with positioned decimal point.

Read A; Read B Display: (Model 5326B and 5327B only). Trigger level of Channel A or B, displayed to hundredths of a volt. Effective trigger level is display times attenuator setting.

PERIOD

Range: 0 to 10 MHz.

Input: Channel A.

Frequency Counted: 10 MHz to 0.1 Hz selectable in decade steps.

Accuracy: ±1 count ± time base accuracy ± trigger error.***

Display: µs, ms, seconds, 10's of seconds with positioned decimal point.

PERIOD AVERAGE

Range: 0 to 10 MHz.

Periods Averaged: 1 to 10^8 selectable in decade steps.

Input: Channel A.

Frequency Counted: 10 MHz.

Accuracy: ± time base accuracy ±1 count displayed* ± trigger error***

Display: ns, µs, with positioned decimal point

RATIO

Display: (Any input Function) F_{ext} times MULTIPLIER (M)
M = 1 to 10^8 (10 to 10^8 when prescaling) selectable in decade steps.

Range: Input Function: see appropriate function section. F_{ext} (external Oscillator Input) 100 Hz to 10 MHz.

Model: Any input function.

Accuracy: Accuracy of selected input function ± trigger error of F_{ext}.

INTEGRATING DIGITAL VOLTMETER

Technique: Voltage-to-frequency conversion

Voltage Ranges: Manual selection.

Range (Vdc)	Resolution (1 sec integration time)	Input Impedance
10	100 µV	10 MΩ
100	1 mV	10 MΩ
1000	10 mV	10 MΩ

Input: Single ended.

Polarity: Automatic polarity detection.

Overrange: 25% overrange on 10 V and 100 V ranges with full accuracy.

Overload Protection: 1100 Vdc all ranges.

Accuracy: After 10 minutes warm-up (within 90-day calibration period), time base set to 1 sec

Range	Stability (% of Reading)	Linearity (% of Range)	Zero Offset (% of Range)	Counter
10V	±0.04%	±0.01%	±0.01%	±1 count
100 V	±0.04%	±0.01%	±0.01%	±1 count
1000 V	±0.08%	±0.01%	±0.01%	±1 count

***Trigger error is less than ±0.3% of one period - periods averaged for signals with 40 dB or better signal-to-noise ratio and 100 mV rms amplitude.

Table 1-3. Specifications (Continued)

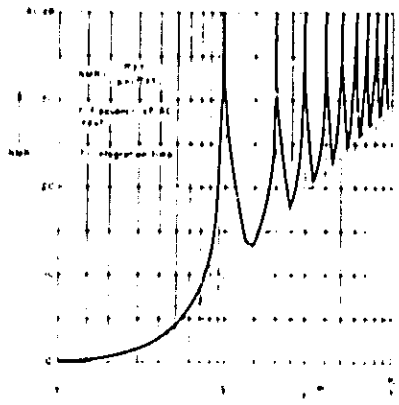
Operating Temperature: 10° C to 40° C, <80% RH.

Measurement Time:

1 msec	2 digits	Decimal points automatically displayed
10 msec	3 digits	
100 msec	4 digits	
1 sec	5 digits	
10 sec	6 digits	

Response: <100 μs for full accuracy with a step function input.

AC Noise Rejection: Infinite for multiples of (meas-time)⁻¹. See graph for Normal Mode Rejection below.



TIME BASE

Crystal Frequency: 10 MHz.

Stability: Aging Rate: <3 parts in 10⁷ mo.
Temperature: <±2.5 parts in 10⁶, 0° to 50° C.
Line Voltage: <1 part in 10⁷ for 10% line variation

Short-term Fluctuation: Typically <5 parts in 10⁸ rms (typical) one-second average (at constant temperature).

Oscillator Output: 10 MHz, TTL type output levels, 50Ω series impedance at rear panel BNC.

External Input: 100 Hz to 10 MHz; 1 V rms into 1kΩ.

Time Base Output: Negative pulses, +3 V to 0 V (open circuit), typically 100 ns wide. In START, output frequency is INPUT A divided by TIME BASE/MULTIPLIER switch setting. Available at rear panel BNC.

Gate Output: TTL level pulses; low while gate open, high while gate closed. Available at rear panel BNC.

GENERAL

Display: 7 digits (8 optional).

Blanking: Suppresses display of unwanted zeros left of the most significant digit.

Display Storage: Holds reading between samples. Rear panel switch overrides storage.

Sample Rate: FAST position: Continuously variable from less than 100 μs to approximately 20 ms. NORM positon: Continuously variable from less than 20 ms to approximately 5 seconds. HOLD position: Display can be held indefinitely

Overflow: Neon indicates when display range is exceeded.

Operating Temperature: 0° to 50° C (see DVM Temperature Range).

Power Requirements: 115 or 230 volts ±10%, 50 to 60 Hz, 70 watts maximum.

Weight: Net, 16 lb. (7,4 kg). Shipping, 18 lb. 16 oz. (8,7 kg).

Accessories Furnished: Power Cord, 7 ft. Rack Mount Kit.

DIMENSIONS

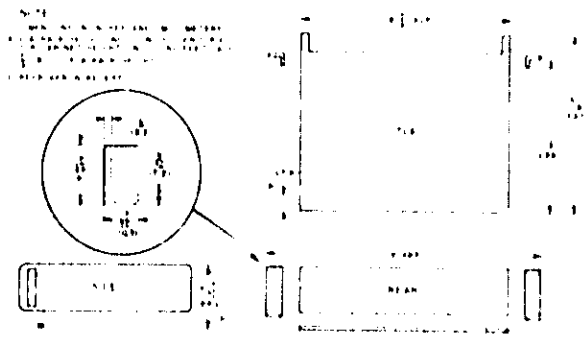


Table 1-3. Specifications (Continued)

ACCESSORIES AVAILABLE

HP 10503A, 50Ω BNC Cable, 4 ft (122 cm).

HP 10532A, Extender Board Kit containing 2 ea. 15-pin extender 5060-0049, 1 ea. 18-pin extender 5060-2041, and 1 ea. Amplifier Extender, 10532-60061.

HP 10542A, Remote Programming Interface enables interfacing between the 5326/5327 Series counter with Option 004 and 40-bit Output Register. Includes two (2) 7-bit Digital-to Analog Converters for level controls and decoding for time base and function selector.

HP Cable 5062A-1607, 6 ft (183 cm) to connect 5326/5327 Series with Option 003 to HP 5050B or 5055A Digital Recorder.

OPTIONS

Option 001: 8-digit display.

Option 002: Remote Programming.

Controls:
All front panel controls are single line programmable except:
SEP-COM (separate-common) switch; the check function is programmable.
FAST NORM Mode.
Input Attenuators.
AC/DC Input Signal Coupling

Control Signal:
Single line control using either contact closure to ground or DTL drive on all lines except trigger levels which are analog programmed (±3 Vdc).

Connector:
Rear panel connector: HP 1251-0085; Amphenol 57-40360-375, (36-pin blue ribbon.)

Mating connector: HP 1251-0084; Amphenol 57-30360-375 (not supplied).

Option 003: Digital output (for numerals and polarity only.

Code:
4-line 1-2-4-8 BCD, "1" state high, "0" state +0.25 V at -1 mA; "1" state: +5 V open circuit, 2.5 kΩ source impedance nominal.

Print Command:
+5 V to 0 V, dc coupled; occurs at end of gate.

Storage:
Buffer storage is provided so BCD output is constant while next measurement is being made

Inhibit Input:
Inhibits gate when instrument's cycle time is less then the time required for external equipment to interrogate BCD outputs. Positive inhibit +5 Vdc

Connector:
Rear panel connector: HP 1251-0087, Amphenol 57-40500-375 (50-pin blue ribbon). Mating connector: HP 1251-0086; Amphenol 57-30500-375 (not supplied).

Option 004: Remote Programming including all signal input conditions.

Controls:
All front panel controls are programmable except FAST NORM Mode.

Control Signal:
Single line control using either contact closure to ground or DTL drive on all lines except trigger levels which are analog programmable (±3 Vdc).

Connector:
Rear panel connector: HP 1251-0087; Amphenol 57-40500-375 (50-pin blue ribbon). Mating Connector: HP 1251-0086; Amphenol 57-30500-375 (not supplied)

Option 010 Temperature Compensated Oscillator:
Aging Rate: $<1 \times 10^{-}$ /month.
Temperature Stability (0° to 50 °C): $<5 \times 10^{-}$.
Short Term Fluctuation (1 sec avg) $<1 \times 10^{-}$ rms (typical).
Warm-Up: room temp crystal.
Line Voltage (10% change): $<5 \times 10^{-}$.

Option 011 HP 10544A Oven Oscillator:
Aging Rate: $<5 \times 10^{-}$/day.
Temperature Stability (0° to 50 °C): $<5 \times 10^{-}$.
Short Term Fluctuation (1 sec avg): $<1 \times 10^{-}$ rms.
Warm-Up: $<5 \times 10^{-}$ in 15 min.
Line Voltage (10%change): $<5 \times 10^{-}$.

SECTION II

INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information for unpacking, inspection, repacking, storage, and installation. The instructions for remote programming are also given in this section.

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, as 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 Procedures, Table 3-1), notify the carrier and nearest Hewlett-Packard Sales and Service Office immediately (offices are listed at the back of this manual). Retain the shipping carton and 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. in. 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 in-instrument with protective wrapping paper. Pack instrument in strong corrugated container (350 lb/sq. in. bursting test) with a layer of excelsior about six 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, proceed as follows:

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 104°F (40°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 with frequencies from 50 to 60 Hz. 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 a 115 volt fuse; be sure to change this fuse for 230 volt operation, see Table 2-1.

CAUTION

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

Table 2-1. 115/230 Volt Conversion

Line Voltage Conversion	115 Volt	230 Volt
Slide Switch	Left (115)	Right (230)
AC Line Fuse	1.50 Ampere (Slow-Blow) (HP 2110-0304)	0.8 Ampere (Slow-Blow) (HP 2110-0020)

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

a. Connect 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, OPTION 002

2-14. The following paragraphs describe remote programming requirements for the counter with Option 002. See Paragraph 2-36 for Option 004 programming.

2-15. Front Panel Controls

2-16. The following front-panel controls are programmable:

a. FUNCTION

b. TIME BASE MULTIPLIER

c. DVM RANGE

d. CHECK function

e. SLOPE

f. SAMPLE RATE and HOLD

g. LEVEL controls

h. Input Selector (5327B only)

i. RESET

2-17. The following front-panel controls are NOT programmable:

a. AC/DC

b. SEP-COM

c. FAST NORM

d. ATTEN

2-18. The trigger level controls may be remotely programmed or the front-panel LEVEL controls may be used. It is possible to program the LEVEL controls without programming the remainder of the front-panel controls. When remote programming is used, the LEVEL controls must be set to PRESET. Display time may be remotely programmed and/or the front-panel controls may be used.

2-19. Remote Programming Requirements

2-20. All lines may be controlled by TTL or DTL signals or contact closure to ground when the unit is being remotely programmed; except the trigger levels which are programmed by an analog level (if programmed) and the display time line (Hold), J10 pin 35, which should NOT be pulled up to +5 V by less than 200Ω while programming.

2-21. When the unit is NOT being programmed (Ext line high), all the lines should be left open or pulled up to +5 V by not less than 5kΩ, except the trigger levels, which should be open circuited.

2-22. Remote Programming Procedure

2-23. In order to remotely program the counter, the following must be done:

a. Set FUNCTION switch to any function by START or STOP.

b. Ground the EXT line at rear-panel REMOTE PROGRAM connector J10(17). Ground is available at J10(36).

c. Select the desired function.

d. Select the desired time base.

e. Select the desired voltmeter range, if using DVM.

f. Select the slope (+ or −) for CHANNEL A and B. This is accomplished by grounding the Slope line for (−) and leaving it open for (+). Slope A line is J10(28). Slope B line is J10(29).

g. Select the trigger level for input signal.

h. Adjust the display time.

i. Manual reset is available by grounding (≤.7 V) pin 34. Check is available by grounding pin 14.

2-24. Function Selection Programming

2-25. To program the desired function, ground (<.7 V) the proper line at J10 as follows:

STOP	Pin 32
START	Pins 1 and 32
PERIOD AVERAGE	Pin 2
T.I. AVG.	Pin 3
T.I. A to B	Pin 4
PERIOD	Pin 5
FREQ. A	Pin 6
FREQ. C DIRECT	Pin 7
FREQ. C PRESCALE	Pins 7 and 18
READ A LEVEL	Pin 8
READ B LEVEL	Pin 9
DVM	Pin 10

2-26. Programming READ A or READ B automatically selects a 10 ms time base and a 10 V DVM range. If a program line for time base must be used, select 10 ms only (pin 24). When switching between START and STOP, do not remove the ground from pin 32.

2-27. Time Base Selection Programming

2-28. To program the Time Base, ground (<.7 V) the proper line at J10 as follows:

.1 μs/1	Pin 19
1 μs/10	Pin 20
10 μs/10^2	Pin 21
.1 ms/10^3	Pin 22
1 ms/10^4	Pin 23
10 ms/10^5	Pin 24
.1 s/10^6	Pin 25
1 s/10^7	Pin 26
10 s/10^8	Pin 27

2-29. Voltmeter Programming

2-30. When using the DVM mode, the time base should be programmed to 10 ms, .1 s, or 1 s. To program the voltmeter range, ground (<.7 V) the proper line at J10 as follows:

10 V	Pin 11
100 V	Pin 12
1000 V	Pin 13

2-31. Trigger Level Programming

2-32. To program the trigger level, the LEVEL controls must be set to PRESET. Select the trigger level by placing a dc voltage between -3.0 and +3.0 volts on the level input line (Level A = J10 pin 30, Level B = J10 pin 31). This voltage, times the attenuator setting, is the trigger level. Preset is programmed by leaving the pin open or contact closure to ground. Grounding is preferable if noise exists on the remote programming line.

2-33. The front-panel LEVEL controls may be used manually if programming of the trigger levels is undesirable. Also, note the AC/DC and ATTEN switches on the front-panel must be set manually, as they are NOT programmable.

2-34. Sample Rate Adjustment

2-35. Adjusting the display time can be accomplished in several ways:

a. Manually adjust the display time by using the front-panel SAMPLE RATE controls.

b. Set the SAMPLE RATE control cw and the FAST/NORM/HOLD switch to NORM and connect a 1 megohm pot in series with a 1.5k ohm resistor from +5 V to pin 35. This will give a display time range of about 10 ms to 5 sec. If a shorter time is desired, set the FAST/NORM/HOLD switch to FAST, which gives a range of about 50 μs to 10 ms.

c. Set the SAMPLE RATE control cw in FAST and hold the Hold line (pin 35) to ground for the desired display time. The display will continue for about 100 μs after the ground is released.

2-36. REMOTE PROGRAMMING, OPTION 004

2-37. The following paragraphs describe remote programming requirements for the counter with Option 004.

2-38. Front Panel Controls

2-39. All front-panel controls are programmable, except the FAST/NORM/HOLD switch. The trigger level controls may be remotely programmed, or the front-panel LEVEL controls may be used. It is possible to program the front-panel LEVEL controls without programming the remainder of the front-panel controls. When remote programming the trigger levels, the LEVEL controls must be set to PRESET. The display time may be remotely programmed and/or the front-panel controls may be used.

2-40. Remote Programming Requirements

2-41. All lines may be controlled by TTL or DTL signals or contact closure to ground when the unit is being remotely programmed: except the trigger levels

which are programmed by an analog level (if programmed) and the display time line (Hold), J10 pin 16, which should NOT be pulled up to +5 V by less than 200Ω while programming.

2-42. When the unit is NOT being programmed (EXT line high), all the lines should be left open or pulled up to +5 V by not less than 5kΩ, except the trigger levels, which should be open circuited.

2-43. Remote Programming Procedure

2-44. In order to remotely program the counter, the following must be done:

a. Set FUNCTION switch to any position but START or STOP.

b. Ground the EXT line at rear-panel REMOTE PROGRAM connector J10634). Ground is available at J10(1, 2, 15).

c. Select the desired function.

d. Select the desired time base.

e. Select the voltmeter range, if using DVM.

f. Select the signal conditioning.

g. Select the trigger level for input signal.

h. Adjust the display time.

i. Manual reset is available by ground (<.7 V) pin 17. Check is available by grounding pin 37.

2-45. Function Selection Programming

2-46. To program the desired function, ground (<.7 V) the proper line at J10 as follows:

STOP	Pin 19
START	Pins 46, 19
PERIOD AVG A	Pin 47
T.I. AVG.	Pin 45
T.I. A to B	Pin 44
PERIOD	Pin 43
FREQ. A	Pin 42
FREQ. C DIRECT	Pin 41
FREQ. C PRESCALE (5327B only)	Pin 33
READ A LEVEL	Pin 48
READ B LEVEL	Pin 49
DVM	Pin 50

2-47. Programming READ A or READ B automatically selects a 10 ms time base and a 10 V DVM range. If a program line for time base must be used, select 10 ms only (pin 24). When switching between START and STOP, do not remove the ground from pin 19.

2-48. Time Base Selection Programming

2-49. To program the time base, ground (<.7 V) the proper line at J10 as follows:

.1 μs/1	Pin 28
1 μs/10	Pin 29
10 μs/10^2	Pin 27
.1 ms/10^3	Pin 26
1 ms/10^4	Pin 25
10 ms/10^5	Pin 24
.1 s/10^6	Pin 30
1 s/10^7	Pin 31
10 s/10^8	Pin 32

2-50. Voltmeter Programming

2-51. When using the DVM mode, the time base should be programmed to 10 ms, .1 s, or 1 s. To program the voltmeter range, ground (<.7 V) the proper line at J10 as follows:

10 V	Pin 40
100 V	Pin 39
1000 V	Pin 38

2-52. Signal Conditioning Programming

2-53. Program the input conditions by grounding the proper line as follows:

CONDITION	LINE J10	INPUT
AC/DC A	11	AC=H DC=L
SLOPE A	23	+ = H - = L
ATTENUATOR A	13, 14	13 - H, 14 - H = X1 13 - L, 14 - H = X10 13 - H, 14 - L = X100
AC/DC B	7	AC = H DC = L
SLOPE B	22	+ = H - = L
ATTENUATOR B	9, 10	9 - H, 10 - H = X1 9 - L, 10 - H = X10 9 - H, 10 - L = X100
SEP/COM	6	COM = L, SEP = H
CHECK	37	CHK = L

2-54. Trigger Level Programming

2-55. To program the trigger level, the LEVEL controls must be set to PRESET. Select the trigger level by placing a dc voltage between -3.0 and +3.0 volts on the level input line (Level A - J10 pin 21, Level B J10 pin 20). This voltage, time the attenuator setting, is the trigger level. Preset is programmed by leaving the pin open or contact closure to ground. Grounding is preferable if noise exists on the remote programming line.

2-56. The front-panel LEVEL controls may be used manually if programming of the trigger levels is undesirable.

2-57. Sample Rate Adjustment

2-58. Adjusting the display time can be accomplished in several ways:

a. Manually adjust the display time by using the front-panel SAMPLE RATE controls.

b. Set the SAMPLE RATE control cw and the FAST NORM HOLD switch to NORM and connect a 1 megohm pot in series with a 1.5k ohm resistor from +5 V to pin 16. This will give a display time range of about 10 ms to 5 sec. If a shorter time is desired, set the FAST NORM HOLD switch to FAST, which gives a range of about 50 μs to 10 ms.

c. Set the SAMPLE RATE control cw in FAST and hold the Hold line (pin 16) to ground for the desired display time. The display will continue for about 100 μs after the ground is released.

2-59. Sample Rate Disable-Computer Inhibit

2-60. The sample rate disable line is used only with the start command to initiate a totalizing measurement. The sample rate disable command disables auto reset and enables continuous plus and minus transfer commands.

2-61. The computer inhibit command (when Low) inhibits the main gate from opening. This command may be sent from a computer to prevent the counter from making any further measurements. It may also be used as an external sample rate signal, since the command would determine the time between measurements. Auto reset and print command signals are not disabled by computer inhibit.

NOTE

DO NOT ground or otherwise program any of the remote programming lines if the unit is not being operated remotely (EXT line HIGH - not programmed remotely). The line should be left open or, at worst, be pulled up to +5 V by a source impedance of not less than 5 kΩ.

2-62. BLANKING DEFEAT

2-63. This counter id designed to blank insignificant zeros (zeros to left of data). When blanking occurs, the digital recorder output for the blanked columns is BCD 15 (HHHH). To use this instrument with a digital-analog converter, it is necessary to defeat the blanking feature by repositioning the two jumpers on the A9 Display board. Move the jumpers to position 2, as shown in A9 Component Locator (Section VIII). This connects pin 10 of A9U7 and A9U8 to +5 V. Also, lift the pin 1 lead of A8U2 and connect pin 1 to ground (available at U2 pin 7).

SECTION III

OPERATION

3-1. INTRODUCTION

3-2. Section III contains the operating information required to obtain the most effective performance from the instrument. This includes a general description of the operating modes, the function of all controls and indicators, a self-check procedure, and setup procedures for making basic measurements.

3-3. OPERATING MODES

3-4. The following paragraphs describe the operating modes of totalize, frequency, period, time interval, ratio, and DVM.

3-5. Totalize Mode

3-6. START and STOP positions on the FUNCTION selector allow manual opening and closing of the counter's main gate. When the switch is in the START position, the counter does not measure frequency, but instead, counts the number of times the signal passes through the trigger point. The input signal, connected to the front-panel CHANNEL A jack, is divided by the MULTIPLIER switch setting prior to counting. For example, when the MULTIPLIER switch is set to the 1 position, every pulse is counted. When the switch is set to 10^3, the counter registers every thousandth pulse. When the FUNCTION switch is set to STOP, the counter stops totalizing and holds the displayed count until the RESET switch is pressed or the MULTIPLIER switch setting is changed. If the FUNCTION switch is again set to START before a reset is generated, the count continues to totalize from the previously displayed value. With the FUNCTION switch set to START, the scaled input signal is available at the rear-panel TIME BASE OUTPUT jack. The unit indicators and decimal points are blanked during the totalize mode. The C light is on (in START), indicating counting is taking place.

3-7. Frequency Modes

3-8. Three frequency modes are available in the 5327B: Frequency A, Frequency C prescaled, and Frequency C direct. (The prescale operation is not included in the 5326B.) In the Frequency A mode, the input signal connects to the high impedance CHANNEL A input jack and can be conditioned with the LEVEL, SLOPE, and ATTEN controls. In the Frequency C modes, the input signal is connected to the INPUT C jack (50 ohm), located on the rear panel. The signal is not conditioned by any front-panel controls but may be counted either directly (50 MHz) or by prescaling (550 MHz), depending on the setting of the Input Selector switch. The INPUT C of the 5326B model counts the signal directly.

3-9. Period Modes

3-10. The period and period average modes allow single period measurements or multiple period averages to be made with input frequencies into CHANNEL A of up to 10 MHz. These modes are useful for making low frequency measurements where maximum resolution is desired.

3-11. For single period measurements, the MULTIPLIER switch scales the time base frequency and selects the placement of the decimal point and determines the resolution of the measurement.

3-12. The period average mode is used for increased resolution and reduced inaccuracies. For example, if 10^2 period averaging is selected, the counter will display the average of 100 periods with the proper decimal point. In this example, trigger error is 100 times less than in a single period measurement.

3-13. Time Interval Modes

3-14. Two modes of time interval measurements can be selected: time interval and time interval average. The time interval modes measure the time between points on a single waveform or between separate input signals; thus, pulse width and phase differences can be measured. Separate slope and level controls allow variable triggering levels on either the + or - slope. Marker A and B outputs are available at the rear panel to intensity-modulate an HP 180A oscilloscope. The markers indicate the trigger point of the counter's input circuits and provide a visual means of adjusting the trigger points to measure the time interval between any two points and are useful to about 100 kHz.

3-15. In time interval measurements, Channel A opens the main gate and Channel B closes the main gate. While the main gate is open, the internal oscillator, divided by the setting of the MULTIPLIER switch, is totalized by the counter and readout on the display. The less the division factor, the more pulses of the internal oscillator there are to count and, therefore, the better the resolution and accuracy.

3-16. With time interval average, the main gate is open for the number of time intervals selected by the MULTIPLIER switch. The internal oscillator pulses (not divided) are totalized only during the individual time intervals. Once Channel B triggers, there must

be a time lapse of 150 ns before Channel A can trigger. Averaging of time intervals results in increased resolutions and reduced inaccuracies. For a further explanation of theory, refer to Paragraph 4-45 and Figure 4-9.

3-17. Digital Voltmeter Measurements

3-18. Three modes of voltmeter measurements can be selected: READ A LEVEL, READ B LEVEL, and DVM. In the READ A and B modes, the digital voltmeter indicates the trigger level of the input amplifiers. The trigger level is equal to the DVM reading times the attenuator setting. In the DVM mode, dc levels up to 1000 V can be applied. Three ranges are provided: 10 V, 100 V, and 1000 V. The 10 V and 100 V ranges have 25% over-ranging with full accuracy. Maximum input voltage any any range is 1100 V. Resolution of the DVM with a 1-second integration time is 100 μV on the 10 V range, 1 mV on the 100 V range, and 10 mV on the 1000 V range. Since there is no over-range indicator, ranges should be changed whenever a 12.5 V readout is obtained on the 10 V range or 125 V readout on the 100 V range.

3-19. The READ A LEVEL and READ B LEVEL modes automatically select a 10 ms time base and a 10 V range. In the DVM mode, the counter displays the proper decimal point and annunciator when the time base is 10 ms, .1 s, or 1 s. A longer integration time does not result in increased accuracy.

3-20. Ratio

3-21. The counter may be used to measure the ratio of two signals in either the frequency or period mode. By setting the rear-panel OSC INT-EXT switch to EXT, the counter will accept an external signal (F_{ext}) for use as the internal oscillator. This frequency should be 100 Hz to 10 MHz at 1 V rms minimum to 5 V peak maximum. A second signal (F_A), applied to either INPUT A or C jack, is used as the comparator signal. The MULTIPLIER switch controls the resolution of the display. For a ratio of frequencies, the Ratio = $\frac{F_A}{F_{ext}} = \frac{\text{DISPLAYED NUMBER}}{\text{MULTIPLIER SETTING}}$. For a ratio of periods (P), the Ratio =

$$\frac{P_A}{P_{ext}} = \frac{F_{ext}}{F_A} = \frac{\text{DISPLAYED NUMBER}}{\text{MULTIPLIER SETTING}}$$

3-22. Disregard the units and decimal point; also, ignore any zeros to the left of the most significant digit. It makes no difference which signal is higher in frequency, as long as the two frequencies are within the specifications of their respective channels.

3-23. MARKER OUTPUTS

3-24. Two marker output jacks are mounted on the counter's rear panel. These outputs provide a negative-going 2 μs pulse (approx.) at DTL levels each time the input signal passes through the trigger point of Channel A or B. The pulses may be used to trigger other circuits or may be applied to the Z axis of an HP 180 Oscilloscope. When using the pulses to intensity modulate an oscilloscope, note that the actual trigger point is the leading edge of the pulse. The marker's pulse width determines the upper frequency limit of the input signal. The pulses overlap on the oscilloscope trace when the period of the signal is less than the pulse width.

3-25. HYSTERESIS

3-26. Each input channel has a small amount of hysteresis (about 100 mV). If the SLOPE switch is set to "+," the trigger pulse occurs at the top of the hysteresis "window." If the SLOPE switch is set to "-," the pulse occurs on the bottom line of the window. In other words, the signal must pass through the entire hysteresis window before a trigger pulse is generated.

3-27. When measuring frequency or period, the counter positions the hysteresis band around zero (see Figure 3-1). This assumes a waveform with no dc component and the counter's LEVEL control is in the PRESET position. The input amplifier then yields maximum input sensitivity for both positions of the SLOPE switch. The offset introduces no measurement error, since the trigger point is repetitive from cycle to cycle. The trigger point is point A for + slope and point B for - slope.

3-28. Time Interval Compensation

3-29. In the time interval modes and READ A/READ B modes only, both input amplifiers have an automatic compensation network that keeps the trigger level at the same potential when switching from positive to negative slope (see Figure 3-2). The window shifts upward to accomplish this. There is the possibility, therefore, that if Point A is near the top of the signal, switching to negative slope will place a portion of the window outside the signal (C). In such case, there would be no triggering. When switching from time interval to frequency, or vice versa, the trigger point shifts by half the hysteresis band.

Figure 3-1. Hysteresis Offset

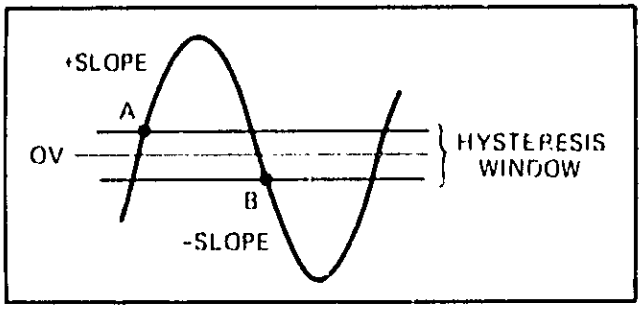
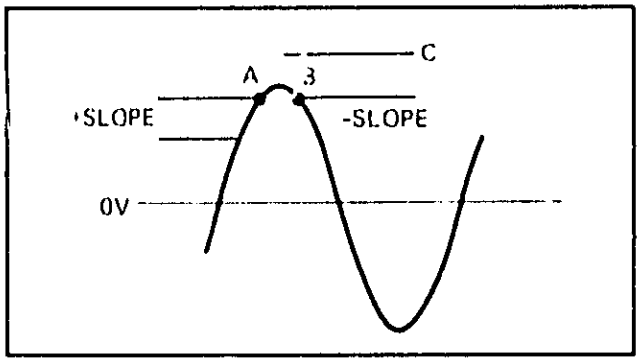


Figure 3-2. Hysteresis Compensation



3-30. ACCURACY

3-31. FREQUENCY MEASUREMENTS. The basic counter accuracy is determined by two factors. One factor is the aging rate of the 10 MHz crystal standard in the time base (less than 3 parts in 10^7 per month). A second factor is the inherent error of ± 1 count of the display's least significant digit, which is present in all electronic counters. This error is due to phasing between the timing pulse that operates the electronic gate and the pulses that pass through the gate to the counting assembly. The chart in Figure 3-3 shows the error possible for frequency and period measurements.

3-32. The formula for determining the actual frequency is given as follows:

$$\text{error} = \pm \left(\frac{1}{f_1 \times \text{gate length (sec)}} \right) \pm E$$

The expression

$$\frac{1}{f_1 \times \text{gate length (sec)}}$$

equals the ± 1 count ambiguity, where f_1 equals measured frequency (Hz) and gate length equals the selected gate time in seconds. E equals the time base accuracy (monthly drift rate of the individual time base times the number of months since calibration, frequency change due to ambient temperature change, absolute off-set at standardization, and line voltage effects).

3-33 An example of frequency error calculation is as follows:

$$f_1 = 3\ \text{MHz}\ (3 \times 10^6\ \text{Hz})$$

gate length = .1 sec (1×10^{-1})

E = 3 parts in 10^7 per month times 2 months
= 6 parts in 10^7

$$\text{error} = \frac{1}{(3 \times 10^6)(1 \times 10^{-1})} \pm \frac{6}{10^7}$$

$$= 3.3 \times 10^{-6} \pm 6 \times 10^{-7} = 3.9 \times 10^{-6}$$

or 3.9 parts in 10^6

3-34. PERIOD MEASUREMENTS. There are three factors contributing to the accuracy of period measurements:

a. The aging rate of the 10 MHz crystal standard.

b. The ± 1 count ambiguity.

c. The trigger error for one period.
Assuming a signal-to-noise ratio of 40 dB, the trigger error is less than 0.3% at rate sensitivity. A general formula for finding the percentage error to be expected under various conditions is as follows:

$$A = 100 \left(\pm \frac{f_2}{n f_1} \pm \frac{e}{n} \pm E \right)$$

A = Accuracy in percent

f_1 = Time base frequency counted

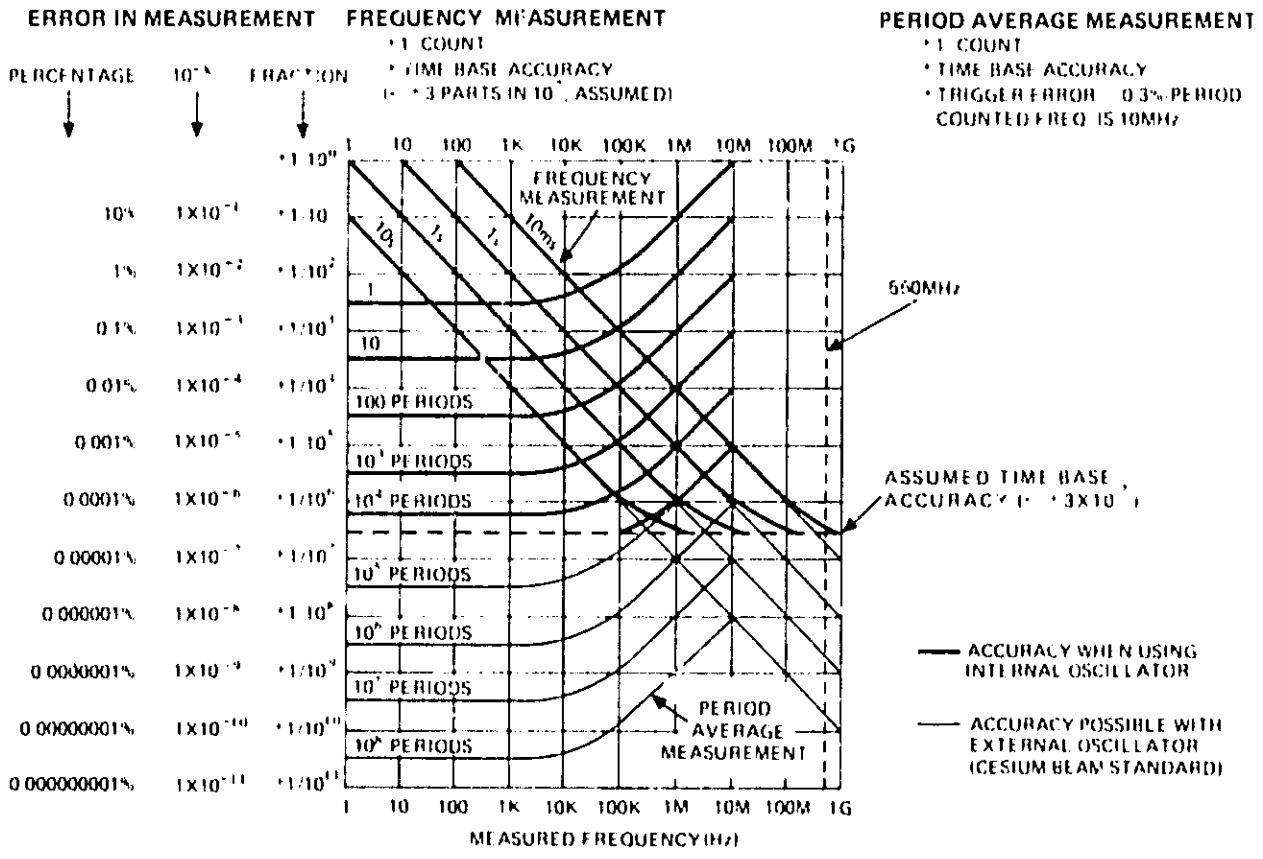
f_2 = Frequency of input signal (Hz)

n = Number of periods averaged

e = 3×10^{-3} (trigger error for one period, 40 dB S/N at rated sensitivity.)

E = time base accuracy (monthy drift rate of individual time base times the number of months since calibration, absolute value of off-set at standardization, frequency change due to ambient temperature change, and line voltage effects). A plot of the above formula is shown in Figure 3-3.

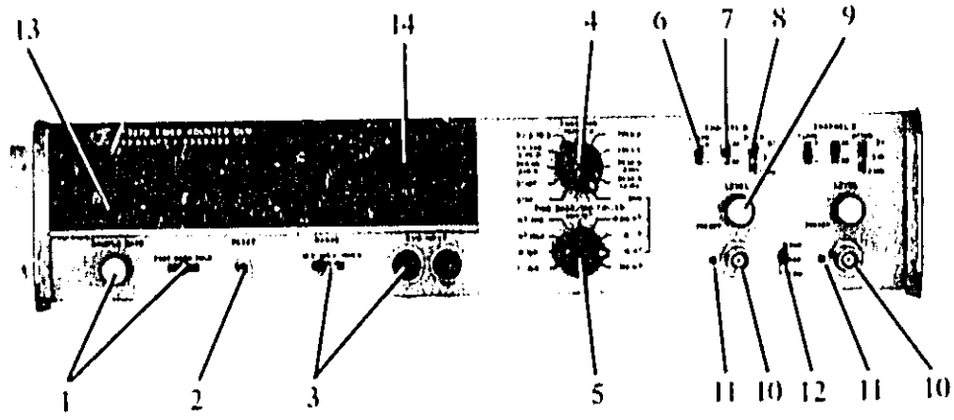
Figure 3-3. Measurement Accuracy



NOTE

FOR 560MHZ INPUT (÷ 10) USE LINE TO RIGHT OF ACTUAL GATE LENGTH TO DETERMINE ACCURACY OF MEASUREMENT, SINCE • 1 COUNT ERROR REPRESENTS • 10 COUNTS OF INPUT SIGNAL WHEN PRESCALING BY 10

Figure 3-4. 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 - Varies display time from <100 µs to >20 ms. STORAGE switch (rear panel) must be ON to use this mode.

   b. NORM - Varies display time from < 20 ms to >5 seconds.

   c. HOLD - Holds display indefinitely.

2. RESET Switch. Resets display and internal count to zero and starts new measurement.

3. RANGE - DVM INPUT. Input jack and range switch for dc integrating digital voltmeter. Maximum input level is 1100 volts.

4. FUNCTION selector. Selects mode of operation. Blue lettering matches corresponding blue lettering on TIME BASE/MULTIPLIER switch.

   a. STOP, START - Used for totalize mode to manually open and close counter's main gate and to turn scaled output on and off. Frequency input range is 0 to 10 MHz.

   b. PERIOD AVG A - Sets counter to measure period of signal applied to CHANNEL A input. Use MULTIPLIER switch to select number of periods to be averaged. Input frequency range is 0 to 10 MHz.

   c. T.I. AVG A to B - Sets counter to measure average time interval, A to B. Channel A starts interval and Channel B stops the interval. Use MULTIPLIER selector to set number of time intervals to be averaged. Time interval input range is 150 ps to 10 sec; there must be a 150 ns deadtime between intervals.

   d. T.I. A to B - Sets counter to measure time interval A to B. Channel A starts measurement and Channel B stops the measurement. T.I. input range is 0.1 µs to 10^7 sec. The internal time base frequency is divided by the setting of the MUTLIPLIER switch and totalized for subsequent display. The more cycles of the oscillator frequency that are counter during A to B time, the better the resolution. There must be 150 ns deadtime between Channel B and Channel A trigger points.

   e. PERIOD A - Sets counter to measure a single period of the signal applied to CHANNEL A input. Use MUTLIPLIER switch to set counted internal oscillator frequency and therefore the desire resolution. Frequency input range is 0 to 10 MHz.

   f. FREQ A - Sets counter to measure frequency applied to CHANNEL A input. Use TIME BASE switch to set gate time and resolution. Frequency input range is 0 to 50 MHz.

Figure 3-4. Front Panel Controls and Indicators (Continued)

g. FREQ C - Similar to FREQ A, except sets counter to measure frequency applied to INPUT C jack. 50-ohm input impedance, 3.5 V rms 5 V peak maximum input. Frequency range is 0 to 550 MHz prescaled or 0 to 50 kHz direct. The the 5326B, the frequency range is 0 to 50 MHz. See INPUT C.

h. READ A LEVEL - Sets counter to measure trigger voltage of LEVEL A control. Trigger level = DVM readout times ATTEN setting. See TIME BASE/MULTIPLIER switch.

i. READ B LEVEL - Same as READ A LEVEL for LEVEL B control.

j. DVM - Sets counter to measure dc voltage applied to DVM INPUT jack. Use TIME BASE/MULTIPLIER switch to select integration time and resolution.

5. TIME BASE/MULTIPLIER switch. The function of the switch changes with each mode of operation:

a. TOTALIZE - Determines scaling factor for input signal prior to counting.

b. PERIOD AVG A - Selects number of periods to be averaged.

c. T.I. AVG A to B - Selects number of time intervals to be averaged.

d. T.I. A to B - Selects scaling factor for internal oscillator signal.

e. PERIOD A - Selects scaling factor for internal oscillator signal.

f. FREQ A and FREQ C - Sets gate time.

g. READ A LEVEL and READ B LEVEL Not operative. 10 ms integration time is automatically selected.

h. DVM - Selects DVM integrating time. Decimal point and measurement units are displayed for 10 ms, .1 s, and 1 s settings only.

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

7. AC-DC switch. Selects direct or capacitor coupling for input signal. Minimum input frequency on AC setting is 20 Hz.

8. ATTEN switch. Selects attenuation for input signal. Used in conjunction with LEVEL control to set input triggering point. Maximum input: 250 V rms on all ranges except 25 V rms on X1 range above 50 kHz. Recommended input is 0.1 V rms to 2 V rms times ATTEN setting.

9. LEVEL control. Used in conjunction with ATTEN switch to determine voltage at which triggering occurs. With X1 attenuator setting, level is variable ±3 V; on X10, ±30 V; and X100, ±300 V.

10. Input jacks. Input jacks to Channels A and B. Input impedance is 1 MΩ shunted by less than 25 pF. By using a 10 to 1 divider probe, input impedance can be increased to 10 MΩ.

11. Trigger lamps adjacent to input jacks indicate when amplifier triggering occurs.

12. CHK-SEP-COM-switch. (Check-separate-common)

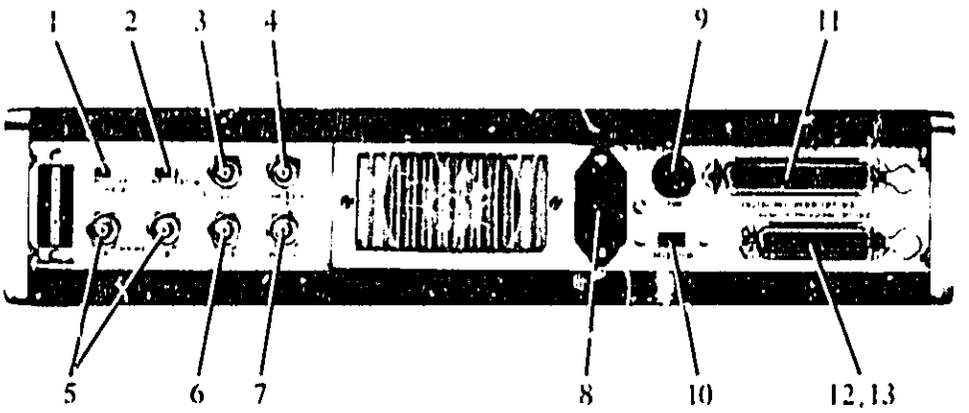
a. CHK - Connects internal 10 MHz time base to Channels A and B circuitry to check that unit is functioning. No indication in T.I. or T.I. Avg; ignore displayed digits in period average.

b. COM-SEP - Connects A and B inputs in parallel when set to COM position. When applying two separate inputs, set switch to SEP. When set to COM, input impedance is 500 kΩ shunted with less than 50 pF.

13. C (count) light. Lights when counter's main gate is open. For short-duration gate times, the annunciator circuits include a 50 ms one-shot MV to allow a visible flash of the C light.

14. * (asterisk). Indicates that proper units are not displayed with combination of function time base selection. To interpret display, add a zero to the right of least significant digit displayed on the counter.

Figure 3-5. Rear Panel Controls and Connectors



1. STORAGE switch. When set to ON, provides display storage while new measurement is being made. In OFF position, allows continuous display of counting process.

2. OSC INT-EXT switch. In INT position, selects normal counter operation using internal time base. In EXT position, permits use of external time base.

3. OSC jack. With INT-EXT switch set to INT, provides 10 MHz, >3 V p-p output (no load), 50Ω series impedance. With INT-EXT switch set to EXT, allows external time base input of 100 Hz to 10 MHz at 1 V rms (5 V peak maximum).

4. TIME BASE OUTPUT jack. Provides negative going > +3 V to 0 V pulses (open circuit), >50 ns wide. In START, frequency output is Channel A input frequency divided by MULTIPLIER setting.

5. MARKER A and B jacks. Provides marker outputs to intensity modulate HP 180 Oscilloscopes. Markers begin coincident with channel trigger points.

6. GATE jack. Provides >2.4 V output (open circuit) for external use. Has 50Ω series resistance. Output is low when counter main gate is open and high when gate is closed.

7. INPUT C (5326B). 50-ohm input for 0 to 50 MHz frequency measurements. Has dc coupling and sensitivity of 5 mV rms sine wave. Trigger level is zero volts. Maximum input is ±5 volts referenced to ground (DO NOT EXCEED).

   INPUT C (5327B). 50-ohm input for 0 to 550 MHz frequency measurements. Has dc coupling (selector switch in PRESCALE position) and sensitivity of 25 mV rms sine wave. Maximum input is 3.5 volts referenced to ground (DO NOT EXCEED). Trigger level is zero volts. The input is dc coupled with the INPUT C switch in DIRECT position. The frequency range is 0 to 50 MHz with a sensitivity of 15 mV.

8. AC LINE. IEC type with offset pin connected to chassis.

9. AC LINE FUSE. 1.50 A at 115 V, 800 mA at 230 V.

10. 115/230 volt switch. Insert narrow screwdriver and slide switch to show desired voltage.

11. DIGITAL RECORDER connector (Option 003 only). 50-pin connector for digital recorder interconnection.

12. REMOTE PROGRAM connector (Option 002 only). 36-pin connector to allow remote control of counter modes and functions.

13. REMOTE PROGRAM connector (Option 004 only). 50-pin connector to allow remote control of counter modes and functions.

Table 3-1. Self-Check

1. Set SAMPLE RATE control slightly clockwise out of OFF.

2. Set FAST/NORM/HOLD switch to NORM.

3. Set FUNCTION switch to STOP.

4. Set MULTIPLIER selector to 1.

5. Set CHK-SEP-COM witch to CHK.

6. Press RESET and check that counter's right hand column displays a 0 and all other digits are blanked.

7. Set FUNCTION switch to START and check that counter totalizes and C light is on. Check that OF light goes on as display overflows. Set TIME BASE/MULTIPLIER to each position and check that counter totalizes in each position.

8. Set FUNCTION switch to STOP. Check that C light goes out and display is held.

9. Set FUNCTION to PERIOD AVG A. Set MULTIPLIER as shown in table below and check for proper display.

Period Average Self-Check

MULTIPLIER	DISPLAY	ANNUNCIATOR
1	.1	μs
10	.10	μs
10^2	.100	μs
10^3	100.0	ns
10^4	100.00	ns
10^5	100.000	ns
10^6	100.0000	ns
10^7 Standard	00.00000	ns OF
10^7 Option 001	100.00000	ns
10^8 Standard	0.000000	ns OF
10^8 Option 001	00.000000	ns OF

NOTE

Digits noted are for reference, actual display may differ by several counts.

10. Set FUNCTION to T.I. AVG A to B. Set MULTIPLIER as shown in table below and check for proper display.

Time Interval Average Self Check

MULTIPLIER	DISPLAY	ANNUNCIATOR
1	.0	μs
10	.00	μs
10^2	.000	μs
10^3	.0	ns
10^4	.00	ns
10^5	.000	ns
10^6	.0000	ns
10^7	.00000	ns
10^8	.000000	ns

11. Set FUNCTION to T. I. A to B. Rotate MULTIPLIER switch as shown in the following table (Step 12) and check for proper display.

12. Set FUNCTION to PERIOD A. Set MULTIPLIER switch as shown in the following table and check for proper display.

Time Interval and Period Self-Check

MULTIPLIER	DISPLAY	ANNUNCIATOR
1*	.1 ± 1 count	μs
10	0	μs
10^2	.00	ms
10^3	.0	ms
10^4	0	ms
10^5	.00	s
10^6	.0	s
10^7	0	s
10^8	0	*

*NOTE: For Time Interval Self-Check, display is .0 μs for MULTIPLIER setting of 1.

13. Set FUNCTION to FREQ A. Set TIME BASE switch as shown in table below and check for proper display.

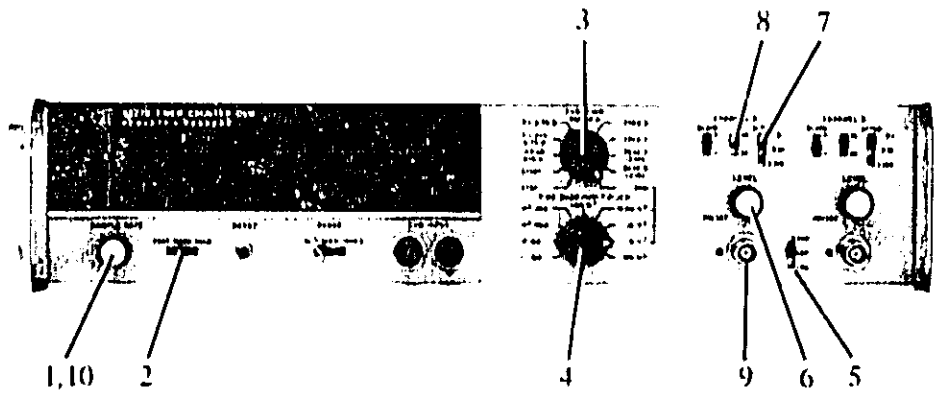
Frequency A Self Check

TIME BASE	DISPLAY		ANNUNCIATOR
.1 μs	.01	±1 count	GHz
1 μs	10	±1 count	MHz
10 μs	10.0	±1 count	MHz
.1 ms	10.00	±1 count	MHz
1 ms	10.000	±1 count	MHz
10 ms	10000.0	±1 count	kHz
.1 s	10000.00	±1 count	kHz
1 s	0000.000	±1 count	kHz OF
	10000.000	±1 count	kHz (Option 001)
10 s	000.0000	±1 count	kHz OF
	0000 0000	±1 count	kHz OF (Opt. 001)

Table 3-1. Self-Check (Continued)

14. Set FUNCTION to READ A LEVEL. Rotate CHANNEL A LEVEL to PRESET. Display should read +.00 V ±1 count.	DVM Self-Check (with DVM Input Shorted) TIME BASE/ MULTIPLIER 10 ms .1s 1s
15. Rotate CHANNEL A LEVEL control clockwise and check that display varies from at least -3.0 to +3.0 V.	10 V RANGE .00 V ±1 count .000 V ±1 count .0000 V±1 count
16. Repeat steps 14 and 15 for READ B LEVEL.	100 V RANGE .0 V ±1 count .00 V ±1 count .000 V ±10 counts
17. Set FUNCTION to DVM. Set TIME BASE and RANGE switch as shown in Table below and check for proper readout. Short DVM input terminals.	1000 V RANGE 0 V ±1 count .0 V ±1 count .00V ±10 counts

Figure 3-6. Frequency A Measurements

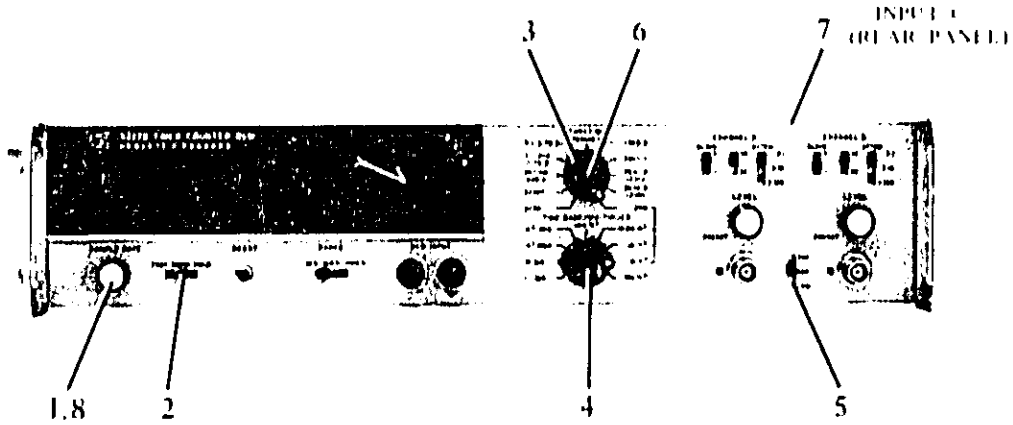


1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to FREQ A.
4. Set TIME BASE switch for desired gate time.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.
7. Set ATTEN switch to match input signal amplitude.
8. Set AC-DC switch to AC or DC.
9. Connect input signal (0 to 50 MHz) to CHANNEL A input jack.
10. Adjust SAMPLE RATE control for convenient measurement interval.

NOTE

When the input signal is removed from CHANNEL A or the signal level is insufficient to trigger Channel A, the count light (C) will not cycle. This is normal for this counter and does not indicate a malfunction.

Figure 3-7. Frequency C Measurements



1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST NORM/HOLD switch to NORM.
3. Set FUNCTION switch to FREQ C.
4. Set TIME BASE switch for desired resolution.
5. Set CHK-SEP-COM switch to SEP.
6. Set Input Selector switch to DIRECT.
7. Connect input signal (0 to 50 MHz, 45 V peak maximum, 15 mV rms minimum) to INPUT C connector (rear panel). Input impedance is 50Ω nominal.
8. Adjust SAMPLE RATE control for convenient measurement interval.

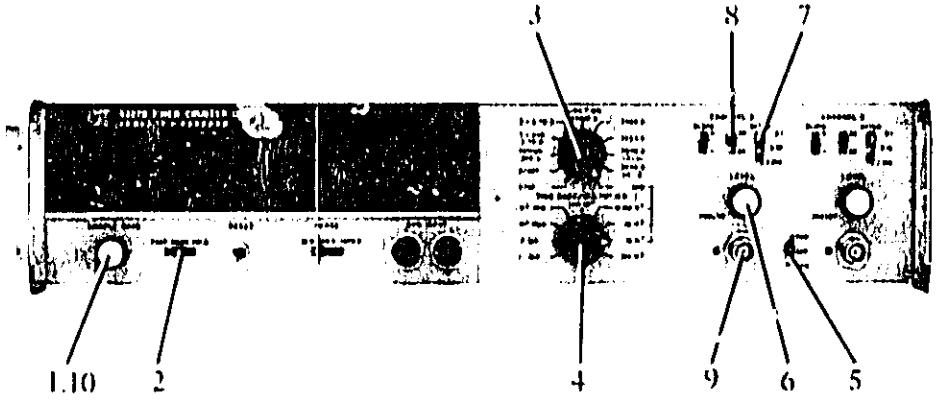
NOTE

For frequencies from 0 to 550 MHz with minimum levels of 25 mV rms, connect signal to INPUT C jack and place input selector switch in PRESCALE position.

CAUTION

Damage will occur if Input C voltage specifications are exceeded.

Figure 3-8. Period Measurements



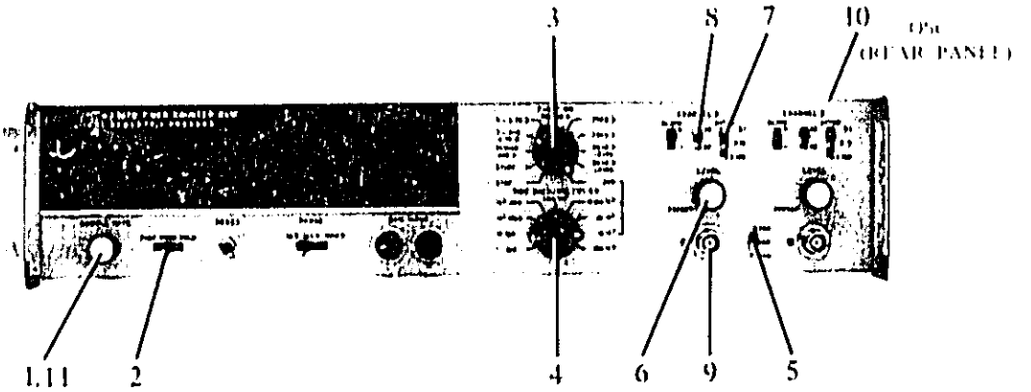
Period

1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to PERIOD A.
4. Set MULTIPLIER switch for desired resolution.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.
7. Set ATTEN switch to match input signal's amplitude.
8. Set AC-DC switch to AC or DC.
9. Connect input signal (0 to 10 MHz) to CHANNEL A input jack.
10. Adjust SAMPLE RATE control for a convenient interval between measurements.

Period Average

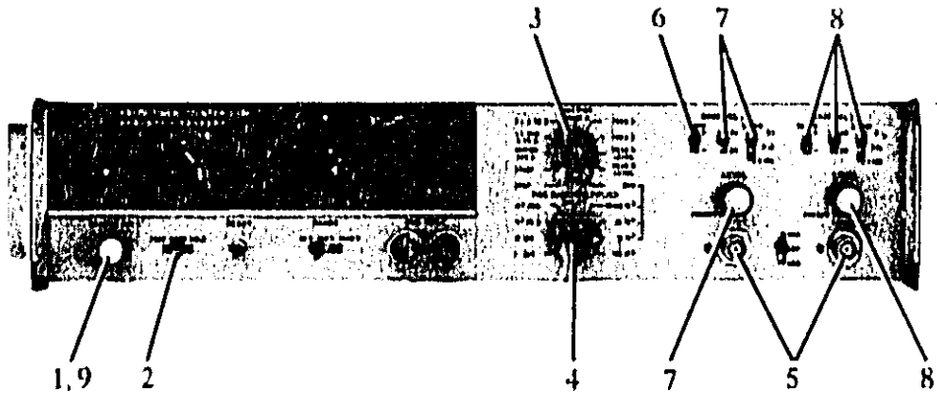
1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to PERIOD AVG A.
4. Set MULTIPLIER switch to number of periods to be averaged.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.
7. Set ATTEN switch to match input signal amplitude.
8. Set AC-DC switch to AC or DC.
9. Connect input signal (0 to 10 MHz) to CHANNEL A input jack.
10. Adjust SAMPLE RATE control for convenient measurement interval.

Figure 3-9. Ratio Measurements



1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to FREQ A or FREQ C, direct or prescaled.
4. Set MUTLIPLIER switch to desired dividing factor for F_{ext}.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.
7. Set ATTEN switch to match input amplitude.
8. Set AC-DC switch to AC or DC.
9. Connect F_A (0 to 50 MHz) to CHANNEL A input jack or F_C to INPUT C.
10. Set OSC INT-EXT switch to EXT. Connect F_{ext} to OSC jack. F_{ext} can be 100 Hz to 10 MHz 1 V rms (min) to 5 V peak maximum.
11. Adjust SAMPLE RATE control for convenient measurement interval.
12. Ratio = $\frac{F_A \text{ or } F_C}{F_{ext}} \cdot \frac{\text{DISPLAY}}{\text{MULTIPLIER}}$. Disregard units and decimal point.

Figure 3-10. Time Interval Measurements



Single Time Interval

1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to T.I. A to B.
4. Set MUTLIPLIER switch for desired resolution.
5. If start-stop signals are from a common source, connect signal to CHANNEL A input and set CHK-SEP-COM switch to COM. If start-stop signals are from separate sources, connect start signal to CHANNEL A input and stop signal to CHANNEL B input and CHK-SEP-COM switch to SEP.
6. Set CHANNEL A SLOPE switch to + for triggering on positive slope of signal or to - for triggering on negative slope of signal.
7. Set CHANNEL A LEVEL and ATTEN switches to start measurement at desired voltage level. Select AC or DC coupling. For frequencies below 100 kHz, use MARKER A OUTPUT jack on rear panel to display starting point on an oscilloscope.
8. Set CHANNEL B, AC-DC, LEVEL, SLOPE, and ATTEN controls to stop measurement at desired level. For frequencies below 100 kHz, use MARKER B OUTPUT to display stopping point on oscilloscope.
9. Adjust SAMPLE RATE control for convenient measurement interval.

NOTE

There must be at least 150 ns between the STOP pulse (Channel B trigger) and the next START pulse (Channel A trigger).

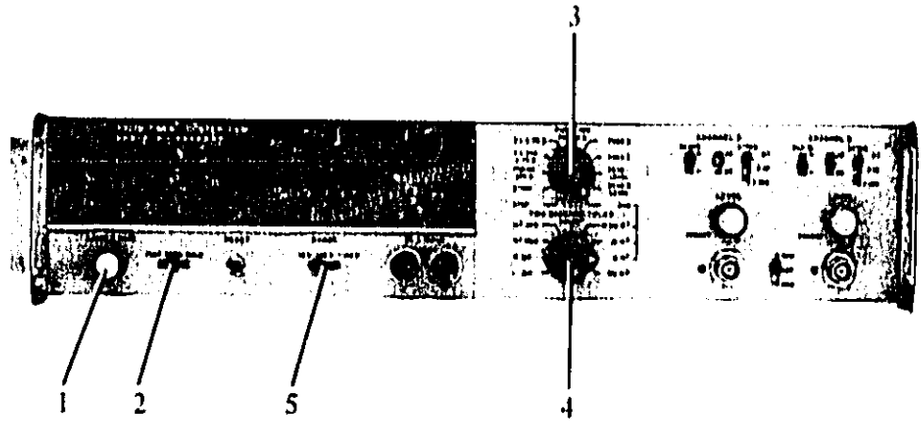
Time Interval Average

1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch T.I. AVG A.
4. Set MULTIPLIER switch to number of time intervals to be averaged.
5. If start-stop signals are from a common source, connect signal to CHANNEL A input and set CHK-SEP-COM switch to COM. If start-stop signals are from separate sources, connect start signal to CHANNEL A input and stop signal to CHANNEL B input and CHK-SEP-COM switch to SEP.
6. Set CHANNEL A SLOPE switch to + for triggering on positive slope of signal or to - for triggering on negative slope of signal.
7. Set CHANNEL A, LEVEL, and ATTEN to start the measurement at desired voltage level. Select AC or DC coupling. For frequencies below 100 kHz, use MARKER A OUTPUT jack on rear panel to display starting point on oscilloscope.
8. Set CHANNEL B, AC-DC, LEVEL, SLOPE, and ATTEN to stop the measurement at desired level. For frequencies below 100 kHz, use MARKER B OUTPUT to display stopping point on oscilloscope.
9. Adjust SAMPLE RATE control for convenient measurement interval.

NOTE

STOP to START delay must be >150 ns and input range should not be 10 MHz $\times \frac{M}{N}$ (M and N integers).

Figure 3-11. Digital Voltmeter and Read A Level, Read B Level Measurements



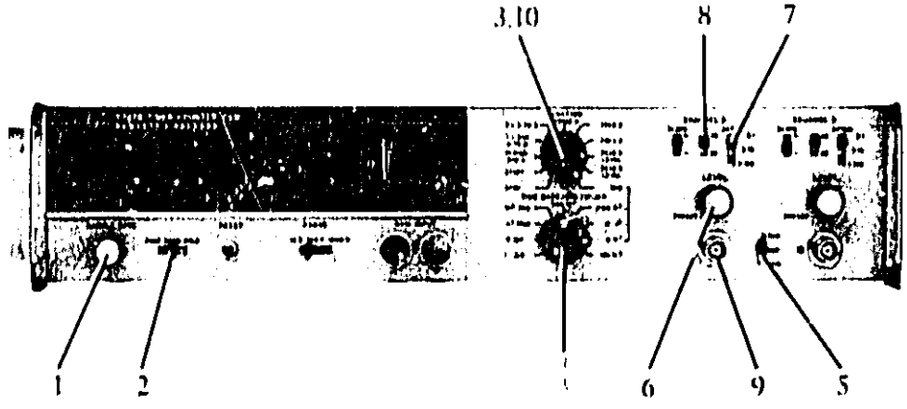
DVM

1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to DVM.
4. Set TIME BASE to 10 ms, .1 s, or 1 s. (1 s setting gives maximum resolution.)
5. Set RANGE switch to match input voltage. Do not exceed 1100 V peak input.
6. If DVM display is 12.5 V on the 10 V scale or 125 V on the 100 V scale, over-ranging has occurred and the next highest range setting should be used.

Read A and Read B Levels

1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to READ A LEVEL or READ B LEVEL.
4. TIME BASE is automatically selected for 10 ms integration time.
5. Trigger level is equal to DVM reading X ATTEN setting. To set trigger level, adjust LEVEL control until DVM indicates desired level.

Figure 3-12. Totalize Measurements



1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to STOP.
4. Set MULTIPLIER switch to input signal scaling factor.
5. Set CHK-SEP-COM switch to SEP.
6. Set LEVEL control to desired trigger level or to PRESET for triggering at zero volts.
7. Set ATTEN switch to match input signal's amplitude.
8. Set AC-DC switch to AC or DC.
9. Connect input signal (0 to 10 MHz) to CHANNEL A input jack.
10. Set FUNCTION switch to START.

NOTE

A scaled output of the input signal is available at the rear-panel TIME BASE OUTPUT BNC. The division is determined by the MULTIPLIER switch setting.

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section discusses the general operating principles of the instrument. Assembly description is covered in more detail in Section VIII, opposite each schematic diagram. Logic fundamentals are explained in Paragraphs 4-3 through 4-16.

4-3. LOGIC SYMBOLS

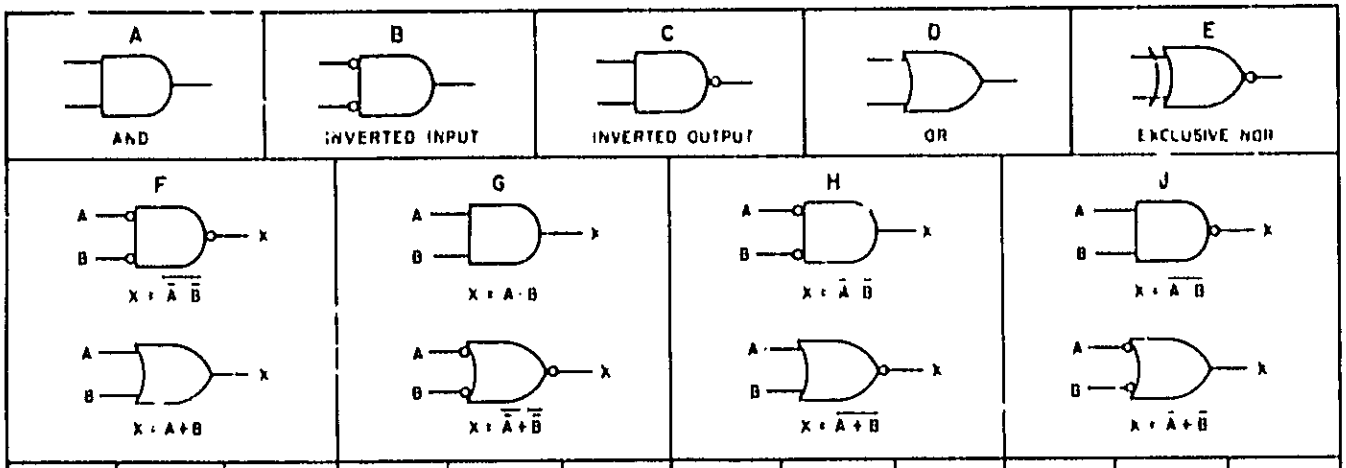
4-4. Two states exist in the binary system, 1 and 0. In positive logic, the 1 state is more positive than the 0 state. High (H) and low (L) are used to represent the 1 and 0 levels. *HIGH ALWAYS REPRESENTS THE MORE POSITIVE LEVEL, WHETHER IT BE POSITIVE OR NEGATIVE LOGIC.*

4-5. A circle at the input line of a logic symbol indicates that a low activates the function. Figure 4-1B shows that a low at both inputs produces a high output. A circle at the output line of a logic symbol indicates a low when activated, as shown in Figure 4-1C.

4-6. Gating and Logic

4-7. Figure 4-1A represents a basic AND gate. The output is high if all inputs are high. An AND gate may have two or more inputs. Figure 4-1D 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. An OR gate with a circle on the output is called a NOR gate. An AND gate with a circle on the output is called a NAND gate. An EXCLUSIVE NOR (Figure 4-1E) has two inputs; and the output will be low if one, but not both, of the inputs is high. The output will be high if the inputs are both low or both high.

Figure 4-1. Gate Symbols and Logic Comparisons



A	B	X	A	B	X	A	B	X	A	B	X
H	H	H	H	H	H	H	H	L	H	H	L
H	L	H	H	L	L	H	L	L	H	L	H
L	H	H	L	H	L	L	H	L	L	H	H
L	L	L	L	L	L	L	L	H	L	L	H

4-8. INTEGRATED CIRCUIT OPERATION

4-9. JK Master-Slave Flip-Flop

4-10. The JK master-slave flip-flop is basically a bistable multivibrator. With simultaneous high inputs to J and K, before the clock pulse, Q and $\bar{Q}$ will change states after the clock pulse. Refer to Figure 4-2 and Table 4-1. This circuit triggers on the trailing edge (negative transition) of the clock pulse. The set (S) and reset (R) inputs operate as follows: when a low is applied to set input, $\bar{Q}$ goes low and Q goes high; when a low is applied to reset input, Q goes low and $\bar{Q}$ goes high. Set or reset can override all other inputs at any time.

Figure 4-2. JK Flip-Flop

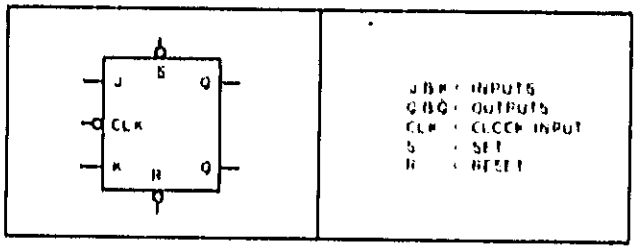


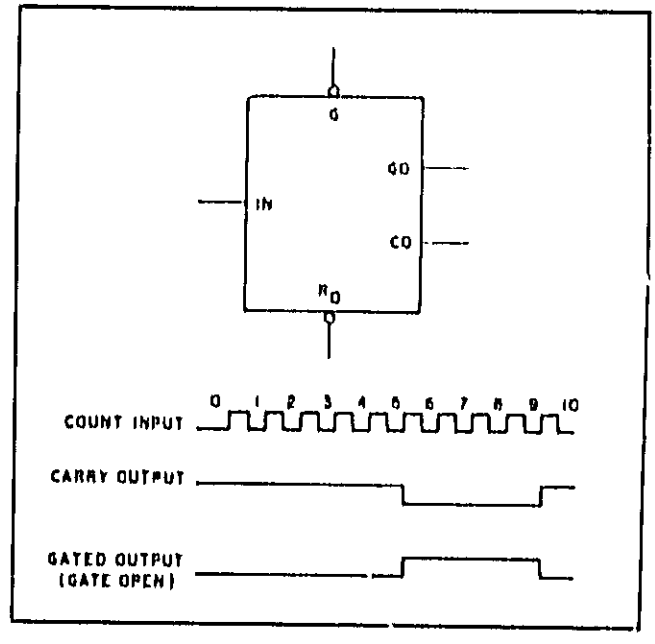
Table 4-1. Truth Table

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

4-11. Time-Base Decade

4-12. In the reset state, Carry Output (CO) (see Figure 4-3) is high and, if the Gate input (G) is low, Gated Output (GO) is low. Ten pulses on the Gate input produce a negative transition at the Gated Output. If the G input is high, GO is open-circuited regardless of the count. The Carry Output gives a positive transition after 10 pulses.

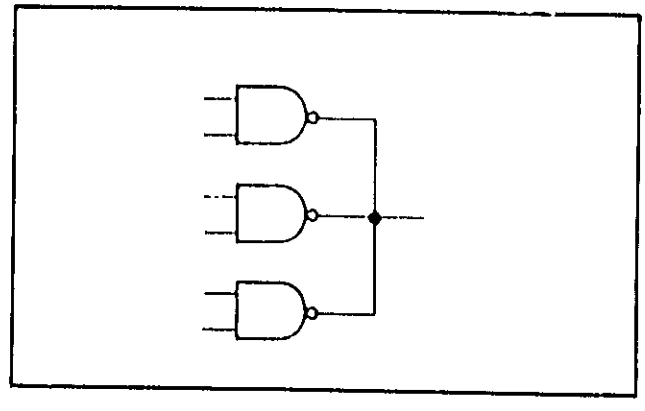
Figure 4-3. Time-Base Decade 1620-0412



4-13. Open-Collector Gate

4-14. The output of an open-collector gate can be paralleled with gates of the same type to perform a wire-OR function, as shown in Figure 4-4. When the outputs are tied to the same line, any one of the gates can pull the line low without damaging itself.

Figure 4-4. Open-Collector Gate 1620-0327



4-15. Logic Levels

4-16. This counter uses three types of logic: TTL (transistor-transistor logic), ECL (emitter-coupled logic), and DTL (diode-transistor logic). See Table 4-2 for specific logic levels.

Table 4-2. Logic Levels

Type	H (Min)	L (Max)	Trigger	Supply
ECL	-.7 V	-1.4 V	-1.2 V	-5.0 V
TTL	2.4 V	0.4 V	1.5 V	5.0 V
DTL	2.6 V	0.4 V	1.5 V	5.0 V

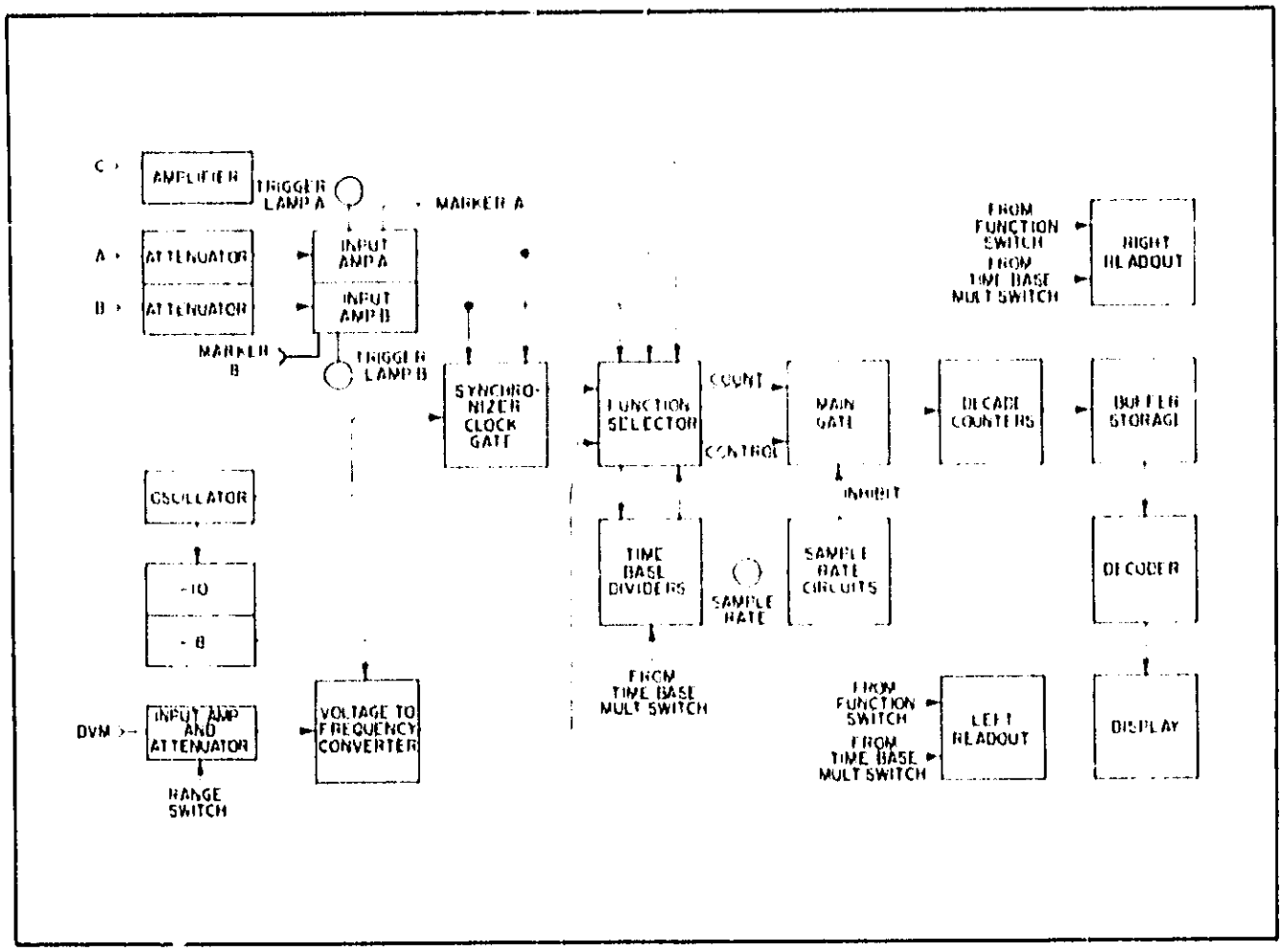
4-17. OVERALL COUNTER OPERATION

4-18. The signal connected to CHANNEL A is conditioned by the front-panel switches of the Attenuator Assembly (Figure 4-5). These switches set the operating conditions for trigger level, coupling, and the required slope. The Input Amplifier converts the signal into narrow pulses for more efficient usage throughout the counter. In the 5327B, INPUT C provides an alternate path through the Prescaler Assembly, which divides the signal by 10 or passes it directly to the Function Control Assembly. The path taken is determined by the setting of the front-panel Input Selector switch.

4-19. The Function Control accepts both the input signal and the 10 MHz internal oscillator pulses and routes them in accordance with the mode of operation being used. One of these signals is sent to the Time Base Assembly, which divides the signal as determined by the front panel TIME BASE MULTIPLIER switch. The first and last pulse of the divided signal controls the length of time the main gate is open. During this time, the other signal is sent directly to the main gate for totalizing in the decade counters and is subsequently displayed. The synchronizer prevents the main gate from opening until an input signal is present.

4-20. The sample rate circuits control the interval between measurements. When the main gate closes, these circuits provide a delay, as controlled by the

Figure 4-5. Functional Block Diagram



front panel SAMPLE RATE controls. When the sample rate period has elapsed, a reset pulse is generated to reset the counter and start a new measurement.

4-21. The signal to be counted, either the internal oscillator or input signal, passes through the main gate to the decade counters. The buffer storage registers store the BCD count before it is translated into a decimal equivalent and displayed on the front panel. Also displayed on the front panel are the units of measurement and the decimal point. The left and right readout assemblies contain the unit indicators and the logic necessary to position the decimal point.

4-22. Frequency Modes

4-23 Frequency is defined as the number of periodic events per unit of time. The counter, therefore, measures an unknown signal (COUNT) for a known length of time (Figures 4-6 and 4-7). The 10 MHz internal oscillator provides the known time and controls the opening of the main gate. The Time Base Assembly divides the oscillator frequency by powers of 10 to open the main gate from 10 seconds to 10 seconds. The longer the gate is open, the more pulses of the unknown frequency are counted and, therefore, the better the resolution and accuracy.

4-24. Period Modes

4-25. In the Period Mode, the main gate is open for the period of the input signal (Figure 4-8). The Time Base dividers scale the 10 MHz oscillator signal by powers of 10 from 1 to 10^5, as determined by the MULTIPLIER switch. This oscillator signal (COUNT) is counted during the gate time (period) by the decade counters and is subsequently displayed.

4-26. In the Period Average Mode, the MULTIPLIER switch selects the number of periods to be averaged (Figure 4-9). The Time Base dividers count the number of periods selected with the switch and holds the main gate open until this count is complete. The Decade Counter totalizes the oscillator pulses while the main gate is open.

4-27. Time Interval Modes

4-28. In the Time Interval Mode (Figure 4-10), Channel A signal controls the start of the measurement, while Channel B signal stops the measurement. The two signals control the state of the arming flip-flop, which, in turn, enables the Clock Gate to pass oscillator pulses to the Time Base Divider. The oscillator signal is scaled, congruent with the setting of the MULTIPLIER switch, before it is passed through the main gate to the counting assemblies.

4-29. For the Time Interval Average measurements (Figure 4-11), the setting of the MULTIPLIER switch determines the number of intervals that are averaged. The oscillator signal is counted directly for the duration of each, individual time interval that is being averaged. Once the Time Base Divider totalizes the number of selected intervals, the main gate closes and the measurement is displayed. See Page 8-27 for timing diagrams and a technical description.

4-30. DVM Mode

4-31. The DVM input connects to voltmeter Input Amplifier A12 (Figure 4-1 , which provides attenuation for the range selection. The output of A12 connects to Voltage-to-Frequency Converter A13. The V-to-F converter supplies a pulse-train output, whose frequency is proportional to the magnitude of the input signal. This output feeds through the main gate for subsequent counting by the decade counters. In the DVM mode, the front-panel TIME BASE switch selects the integrating time. When reading the triggering level of A or B channel, the 10 V range and 10 ms integration time are automatically selected.

Figure 4-6. Frequency A Mode Flow Diagram

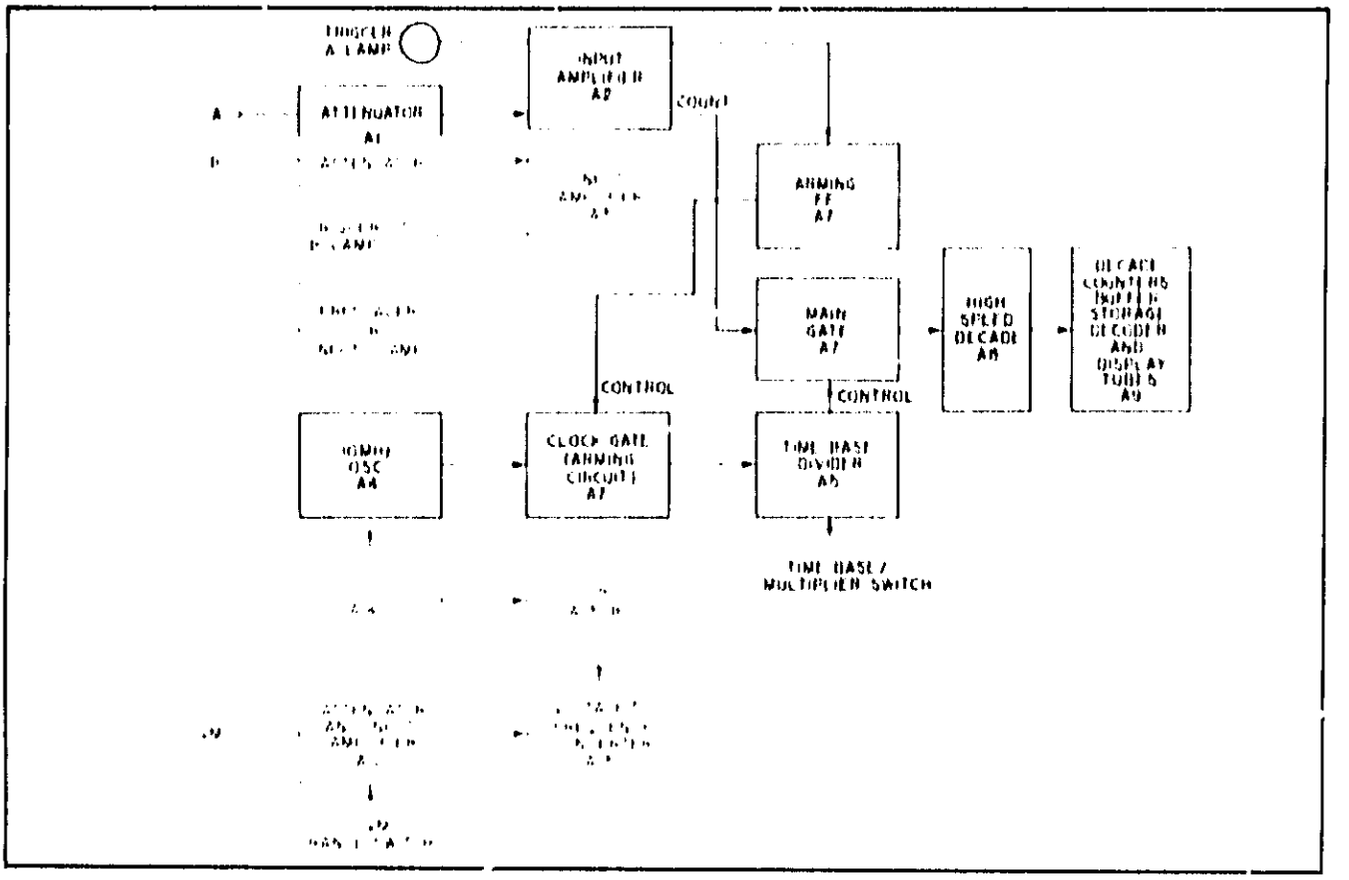


Figure 4-7. Frequency C Mode Flow Diagram

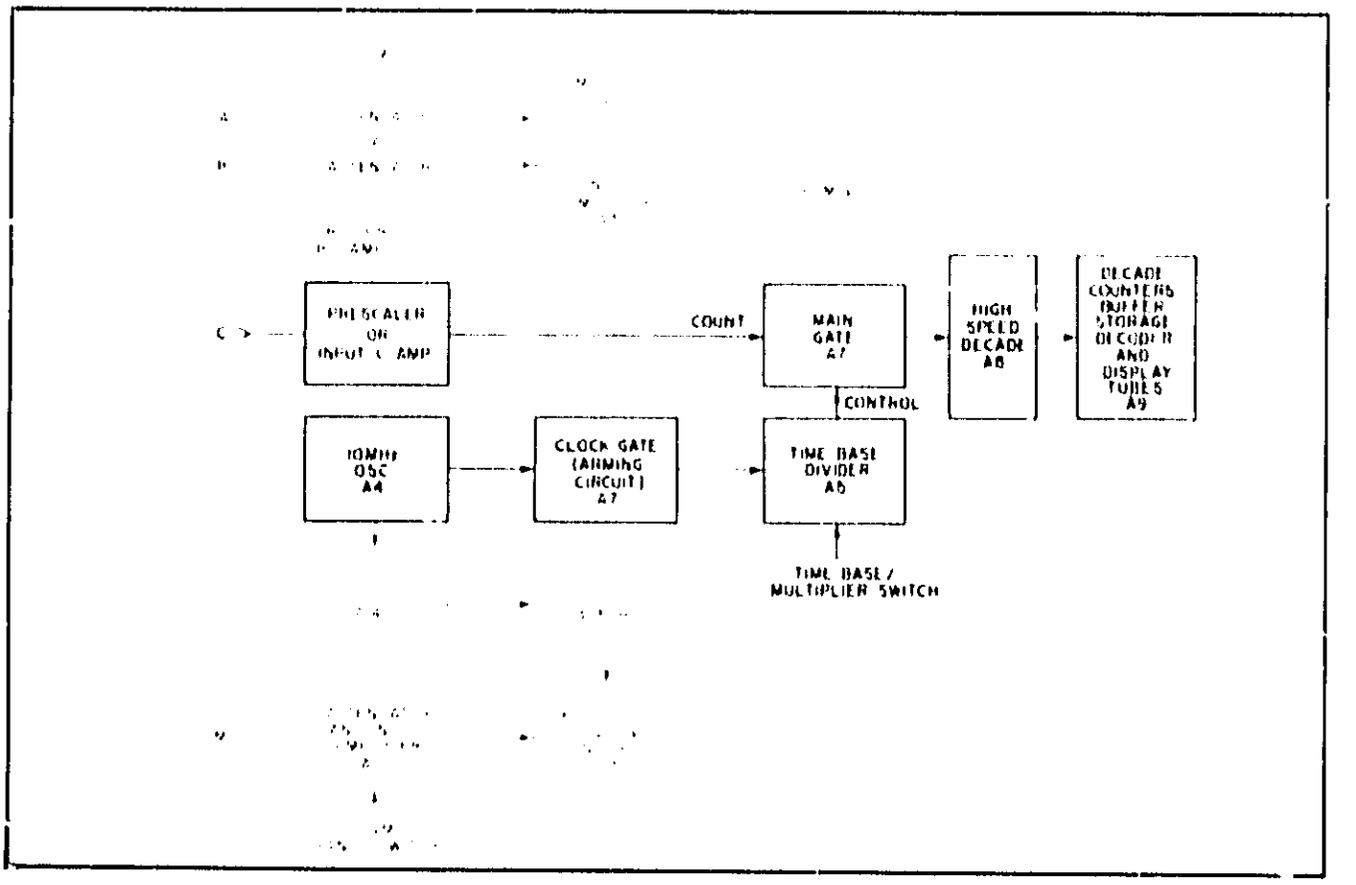


Figure 4-8. Period Mode Flow Diagram

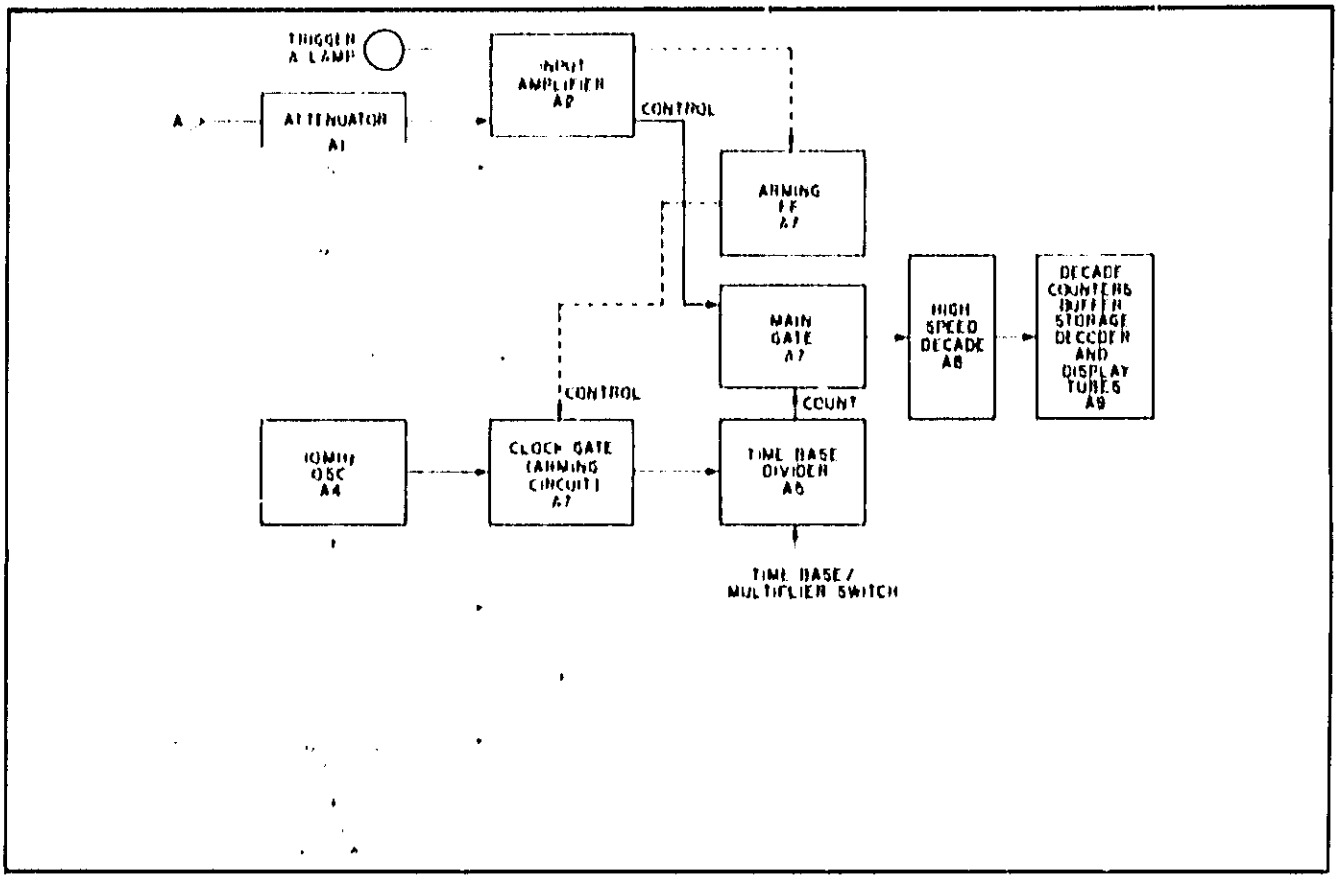


Figure 4-9. Period Average Mode Flow Diagram

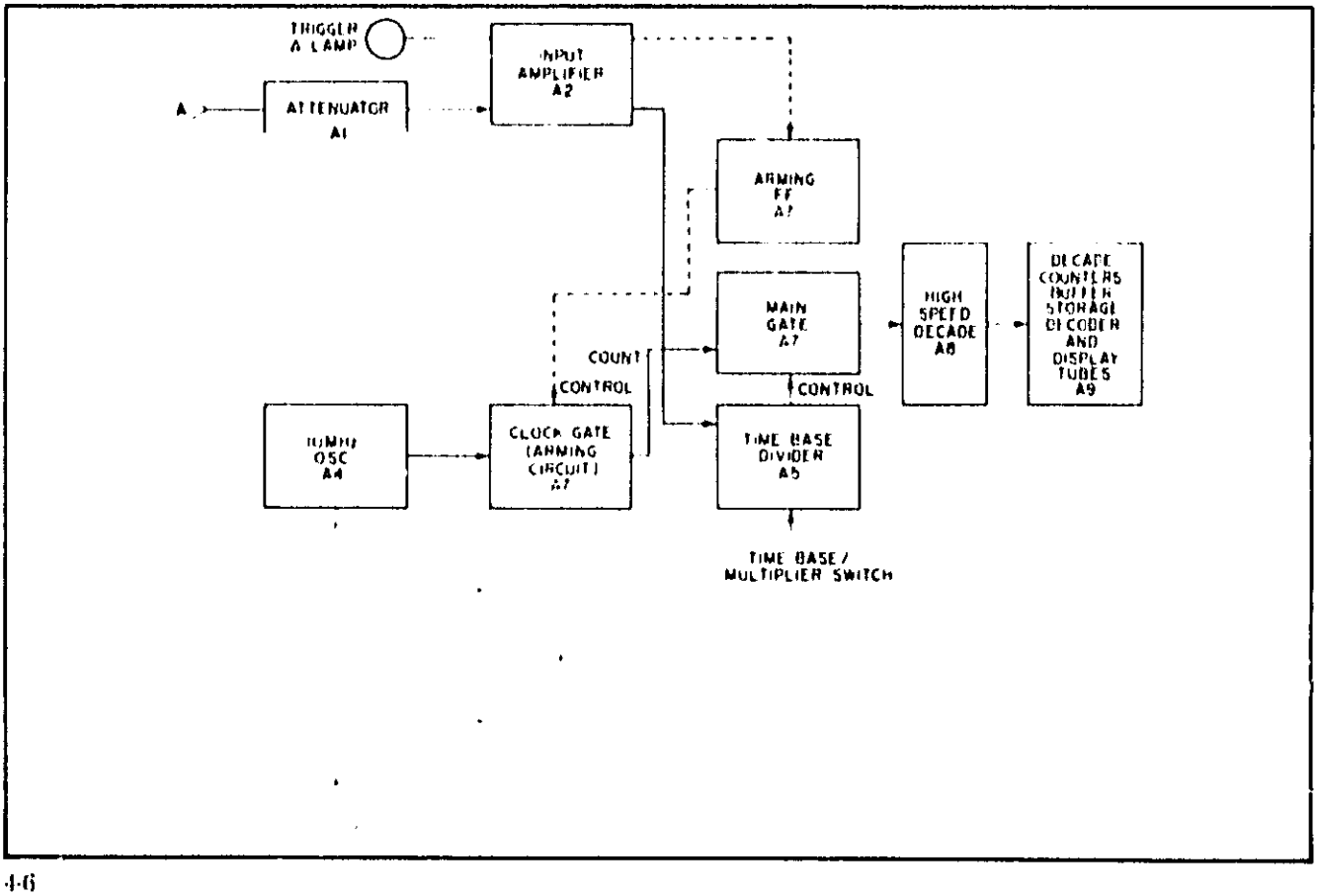


Figure 4-10. Time Interval Mode Flow Diagram

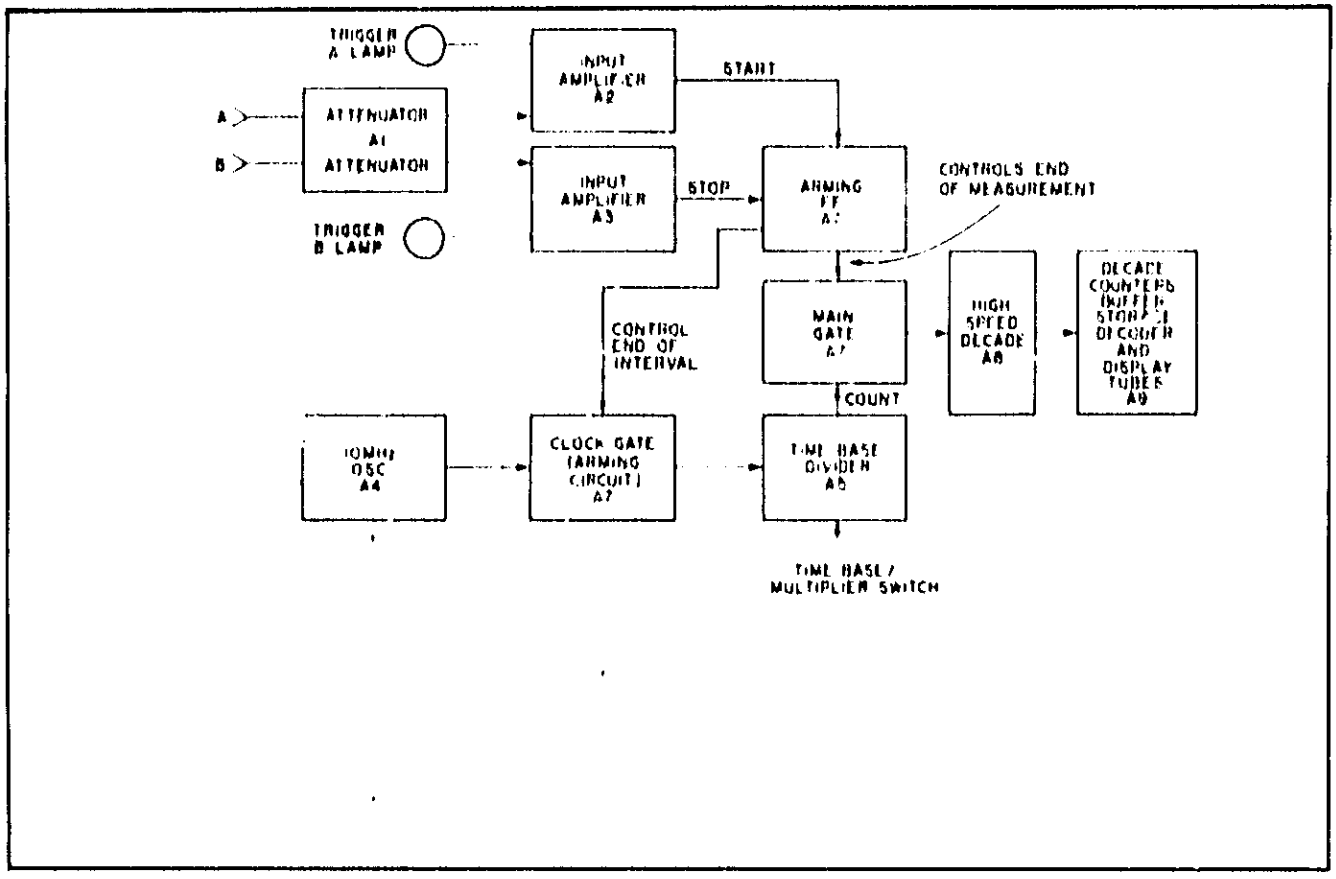


Figure 4-11. Time Interval Average Mode Flow Diagram

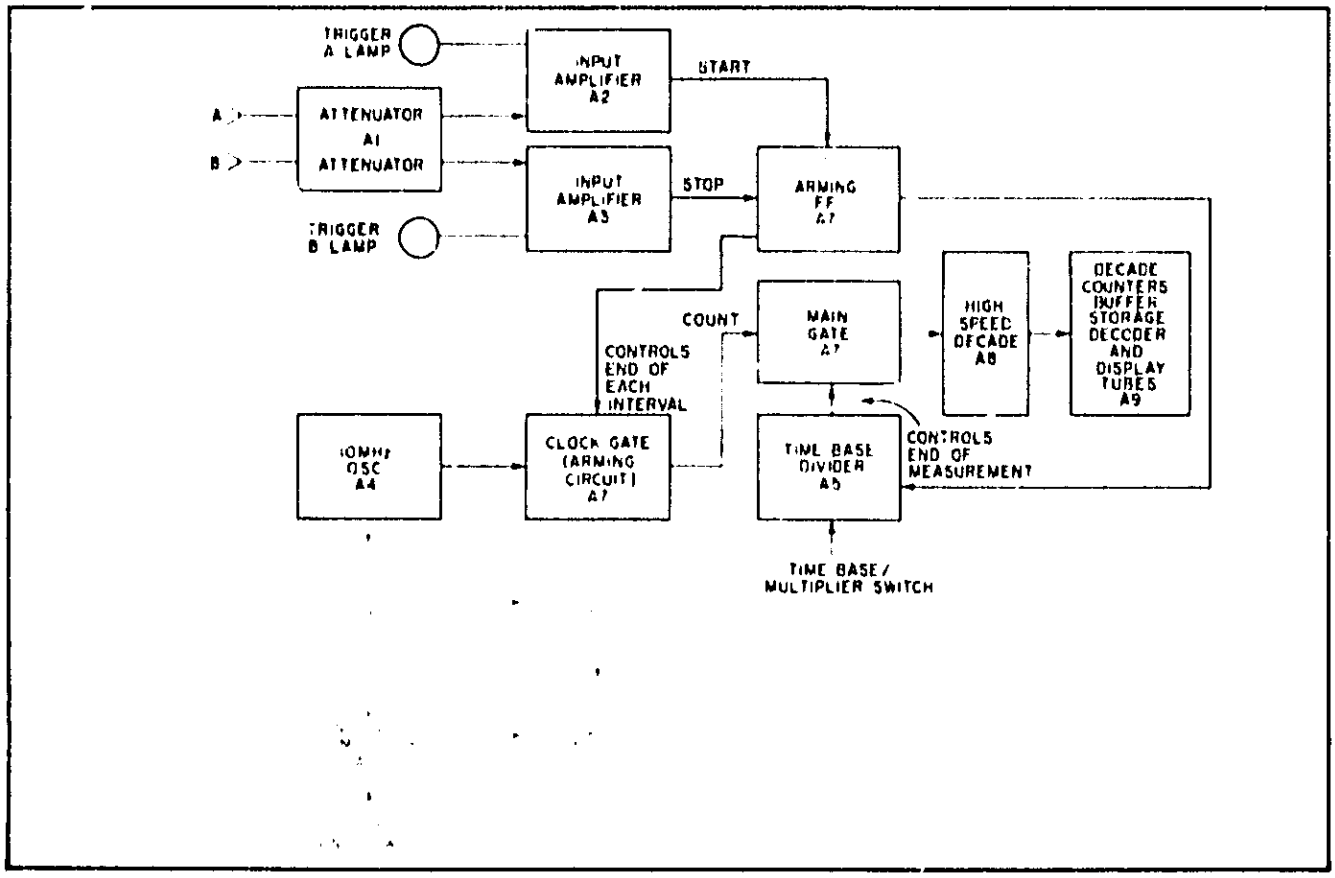


Figure 4-12. DVM Mode Flow Diagram

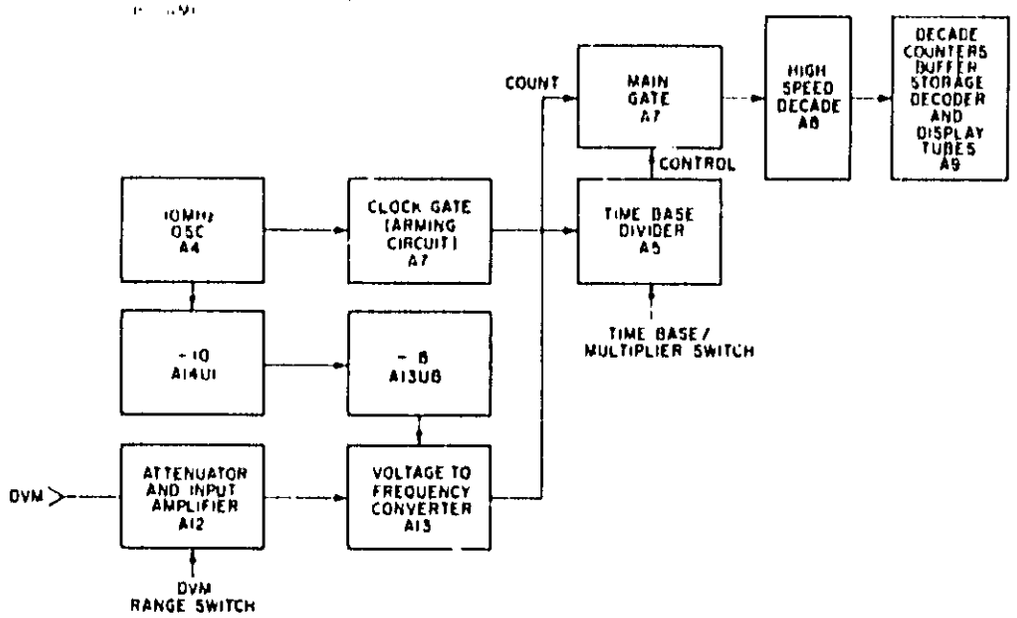
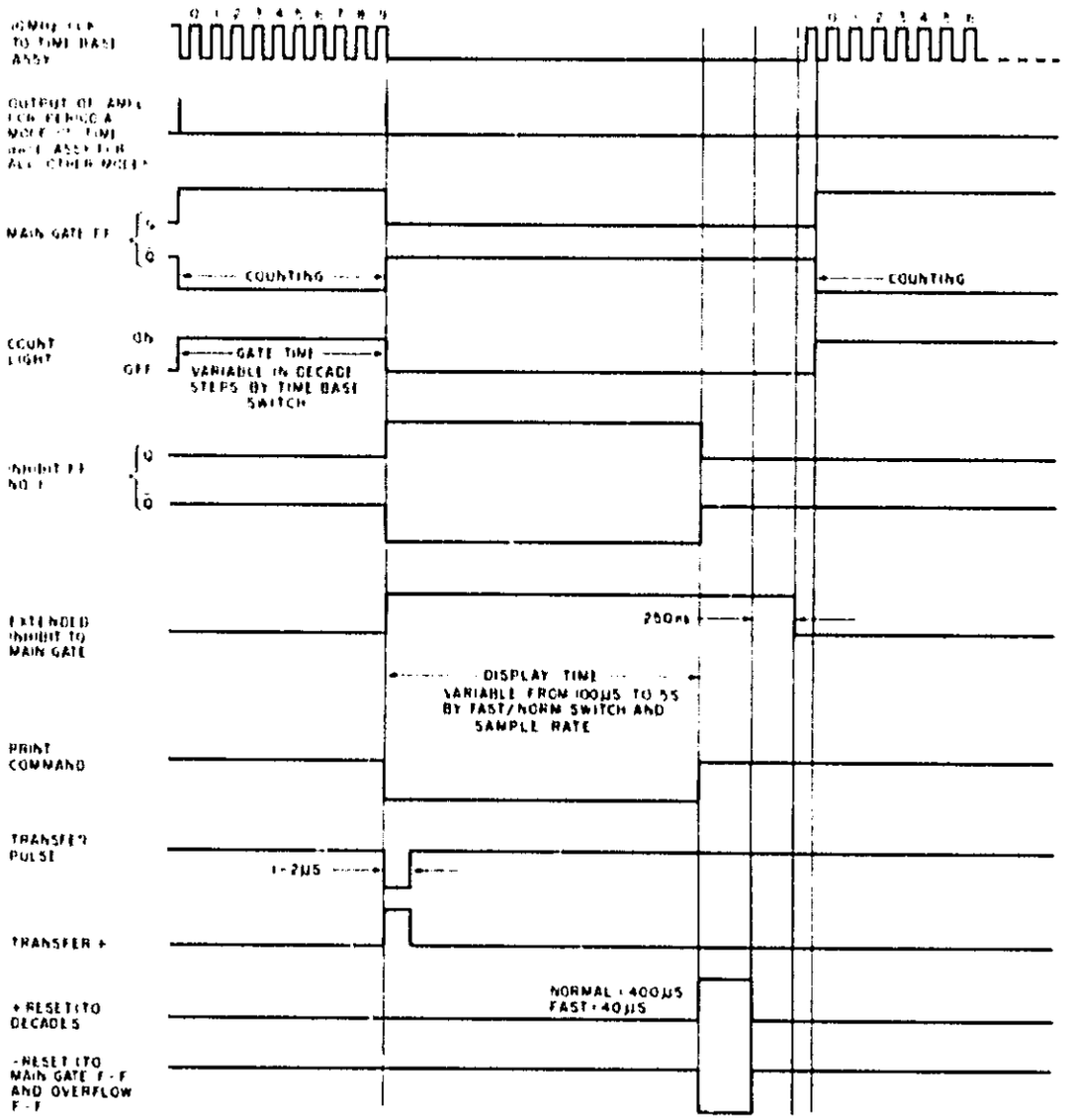


Figure 4-13. Instrument Timing Diagram



SECTION V

MAINTENANCE

5-1. INTRODUCTION

5-2. This section gives maintenance and service information. Included is a table of assemblies, recommended test equipment, in-cabinet performance checks, which may be used to verify proper counter operation, and adjustments.

5-3. ASSEMBLY DESIGNATIONS

5-4. Table 5-1 lists the designations, name, and Hewlett-Packard part number of assemblies used in this instrument.

5-5. TEST EQUIPMENT

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

Table 5-1. Assembly Identification

Assembly	Description	HP Part No.
A1	Attenuator	05326-60047
A1	Attenuator (Option 004)	05327-60034
A2	Input Amplifier	05326-60004
A3	Input Amplifier	05326-60004
A4	Oscillator	05326-60002
A4	TCXO (Option 010)	05327-60036
A4	Oven Oscillator (Opt. 011)	10544-60011
A5	Time Base Control	05326-60005
A6	Sample Rate	05326-60013
A7	Function Control	05327-60031
A8	Display Support	05326-60009
A9	Display	05326-60008
A9	Display (Option 001)	05326-60025
A10	Right Readout	05327-60008
A11	Left Readout	05327-60007
A12	Voltmeter Input Amplifier	05326-60016
A13	Voltmeter V-F Converter	05326-60017
A14	DVM Logic	05326-60015
A15	Regulator	05327-60020
A16	Interconnect	05327-60027
A17	Input C Amp (5326B)	05326-60031
A18	Prescaler (5327B)	05327-60033

5-7. ASSEMBLY CONNECTION IDENTIFICATION

5-8. Throughout the manual, connections to printed circuit assemblies are referred to in abbreviated form. For example, connection to A3, pin 10 is A3(10).

5-9. IN-CABINET PERFORMANCE CHECK

5-10. GENERAL. The performance check (Table 5-3) and test card can be used to verify proper operation of all circuits of the counter and may also be used:

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 any repairs or adjustments and before returning instrument to regular service.

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

5-11. VARIABLE LINE VOLTAGE. During the test (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 COVER REMOVAL.

5-13. To remove top or bottom cover, remove the four screws that secure cover to instrument. 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 COVER IS REMOVED. USE EXTREME CAUTION DURING TROUBLESHOOTING, ADJUSTMENT, OR REPAIR. AVOID DAMAGE TO INSTRUMENT BY REMOVING POWER BEFORE REMOVING OR REPLACING COVERS, ASSEMBLIES, OR COMPONENTS.

5-14. REPAIR

5-15. Printed Circuit Component Replacement

5-16. 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 the plating and the replacement component, apply heat sparingly, and work carefully.

5-17. Replacing Integrated Circuits

5-18. Following are two recommended methods of replacing integrated circuits.

a. SOLDER GOBBLER. This is the best method. Solder is removed from board by a soldering iron with a hollow tip connected to a vacuum source.

b. CLIP-OUT. This method should be used as a last resort only. Clip the leads as close to the base as possible. With a soldering iron and long nose pliers, carefully remove the wires from each hole. Then clean the holes.

5-19. ADJUSTMENTS

5-20. 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 check in Table 5-3 (In-Cabinet Performance Checks).

Table 5-2. Recommended Test Equipment

Instrument Type	Required Characteristics	Recommended Type
Frequency Standard	1 MHz Output	HP 10,AR
Oscilloscope Vertical Plug-In Time Base Plug-In	50 MHz Bandwidth 50 mV/cm Sensitivity 50 MHz Bandwidth	HP 180A HP 1801A HP 1820A
Test Oscillator (two required)	10 Hz to 10 MHz at 5 volts peak-to-peak	HP 651B
Audio Oscillator	2 Hz to 100 kHz at 100 mV rms	HP 202C
HF Signal Generator	50 kHz to 50 MHz at 3 V rms	HP 606B
VHF Signal Generator	10 MHz to 480 MHz	HP 608F
Frequency Doubler	240 - 550 MHz	HP 10575A
Pulse Generator	10 MHz repetition rate, 8 ns pulse width, 0.3 volts peak-to-peak output	HP 216A
Electronic Counter	0.1 Hz to 10 MHz Frequency Measurements	HP 5245L
Variable Line Transformer	103 to 127 V rms and 206 to 254 V rms	Electronic Power Stat 3PF116 (115V); 3PF216 (230V)
Voltage Standard	10 to 1000 volts, 0.01% accuracy	HP 741B
Digital Recorder	Print Rate: 10 lines/sec. Data Input: +8421 BCD parallel entry, accepts 1 = +5 V, 0 = +0.25 V. Accepts negative going +5 to 0 V print command	HP 5055A
DC Voltmeter	0 to 200 Vdc, 1% accuracy	HP 412A
AC VTVM	0 to 250 Vac	HP 400F
RF Voltmeter	1 mV to 3 V	HP 3406A

Table 5-3. In-Cabinet Performance Check

1. TIME BASE STABILITY AND OUTPUT

a. Set counter controls as follows:

SAMPLE RATE	Mid position
FAST/NORM/HOLD	NORM
FUNCTION	FREQ A
TIME BASE/MULTIPLIER	10s
SLOPE A	+
AC/DC	DC
ATTEN	X1
CHK-SEP-COM	SEP
LEVEL	PRESET
STORAGE	ON
OSC	INT

NOTE

Allow one-hour warm-up before proceeding to step b.

b. Connect 1 MHz frequency standard to CHANNEL A input.

c. A counter display of 000.0000 (1000.0000 Option 001) indicates that counter time base frequency is exactly 10 MHz. The offset between counter time base and 1 MHz frequency standard can be determined by subtracting 10 MHz from the indicated oscillator frequency.

COUNTER DISPLAY	A4 OSCILLATOR FREQUENCY
999.9950 kHz	10 000 050 Hz
999.9960	10 000 040
999.9970	10 000 030
999.9980	10 000 020
999.9990	10 000 010
1 000.0000	10 000 000
1 000.0010	9 999 990
1 000.0020	9 999 980
1 000.0030	9 999 970
1 000.0040	9 999 960
1 000.0050	9 999 950

d. Record frequency offset on test card. For long-term stability, operate the counter continuously for at least one month. Measure frequency offset at one-month intervals.

e. To calibrate the counter time base to the frequency standard, perform time-base adjustment in Table 5-4.

NOTE

Temperature must be held constant or compensation for temperature difference must be made whenever a frequency difference is recorded. Unless a record of the temperature and date of last calibration is available, the frequency offset should not be considered drift or aging rate of the 10 MHz crystal.

f. To check time base stability vs. line voltage variations, connect variable transformer to counter power cord. Vary line voltage ±10% and record frequency difference on test card, it should be ≤ 1 part in 10^7.

g. To check time base stability vs. temperature, vary counter operating temperature between 0 and 50°C. Record frequency difference on test card: it should be ± 2.5 parts in 10^6.

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

h. Connect oscilloscope vertical input to OSC jack on counter rear panel. Use 10:1 probe at OSC jack

i. Oscilloscope should display 10 MHz nominal at > 2.4 volts peak-to-peak amplitude. Record on test card.

2. DISPLAY, DECIMAL POINTS, AND DIVIDERS

Proper operation is verified in the Self-Check procedures in Table 3-1. Record on test card.

3. FREQUENCY RESPONSE AND SENSITIVITY

CHANNEL A

a. Set counter controls as in 1a., except TIME BASE to 1s and AC/DC switch to AC

b. Connect a BNC T connector to CHANNEL A jack. Connect sine wave test oscillator output to T connector. Connect oscilloscope's vertical input to T connector to monitor input signal amplitude, use a 50-ohm feedthrough at oscilloscope BNC.

c. Adjust test oscillator from 20 Hz to 50 MHz, maintaining 100 mVrms input amplitude. Counter should properly display all frequencies in this range. Record on test card.

d. Set audio oscillator frequency to 2 Hz. Counter should not count. Switch AC/DC switch to DC. Counter should count input signal.

e. Connect a BNC T connector to Z axis input of oscilloscope. Connect counter MARKER A and B outputs to T connector.

f. Adjust test oscillator output for 1000 Hz at 8 volts peak-to-peak indication.

g. Set CHANNEL A LEVEL to PRESET and check that oscilloscope marker is at 0 volts.

h. Set CHANNEL A SLOPE to +. Vary CHANNEL A LEVEL control and check that marker is variable over at least -3.0 to +3.0 volts on the positive slope of waveform.

i. Set CHANNEL A SLOPE to -. Vary CHANNEL A LEVEL control and check that marker dot is variable over at least -3.0 to +3.0 volts on the negative slope of waveform. Record on test card.

j. Set CHK-SEP-COM switch on COM and repeat marker test for CHANNEL B. Record on test card.

k. Set FUNCTION selector to READ A LEVEL. Set LEVEL A to PRESET. Display should be .00 V ±1 count.

l. Rotate LEVEL A control clockwise just out of PRESET. Readout should be negative display of 3.00 volts or greater. Gate light should flash.

m. Rotate LEVEL A control clockwise and check that readout decreases, crosses zero (polarity sign changes) and displays +3.00 volts or greater in the full clockwise position. Record on test card.

n. Set FUNCTION selector to READ B LEVEL and repeat step K through M for Channel B. Record on test card.

INPUT C (for 5327B, perform all steps; for 5326B perform steps a and f thru h).

a. Disconnect oscilloscope and input to CHANNEL A. Remove 50Ω feedthrough and connect cable to INPUT C jack

b. Set FUNCTION selector to FREQ C, TIME BASE to 1s, and input selector to PRESCALE.

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

c. Use the set of frequency generators (Table 5-2) necessary to cover the input frequency from 0 to 550 MHz, while maintaining 25 mV rms input levels. Adjust TIME BASE switch as necessary for best display.

d. Check for stable count within stability of oscillator. Record on test card.

e. For 5327B, set input selector switch to DIRECT.

f. Set FUNCTION selector to FREQ C and TIME BASE to 1s.

g. Use the set of frequency generators necessary to cover the input frequency from 0 to 50 MHz, while maintaining 15 mV rms input level for the 5327B or 5 mV rms for the 5326B. Adjust TIME BASE switch as necessary for best display.

h. Check for stable count within stability of oscillator. Record on test card.

4. PULSE OPERATION

a. Set counter controls as follows:

FUNCTION	FREQ A
TIME BASE	1 s
SLOPE A	+
AC/DC (A)	AC
ATTEN (A)	X1
LEVEL (A)	PRESET
CHK-SEP-COM	SEP
STORAGE	ON
OSC	INT

b. Connect BNC T connector to oscilloscope vertical input. Connect pulse generator to T. Connect CHANNEL A input to T connector, using 50Ω feedthrough at the counter input.

c. Adjust pulse generator output for 10 MHz repetition rate, 15 ns pulse width at 0.3 volts peak-to-peak indication on oscilloscope.

d. Check that counter displays the repetition rate, count light flashes, and trigger A lamp is on. Record on test card.

e. Remove input connection from CHANNEL A input jack. Remove 50Ω feedthrough and connect cable to INPUT C jack. Set FUNCTION selector to FREQ C. Set input selector switch to DIRECT.

f. Check that counter displays repetition rate and count lamp flashes. Record on test card.

g. Repeat above check for 10 kHz.

5. PERIOD AND PERIOD AVERAGE

a. Set counter controls as in step 1a. with FUNCTION to PERIOD A and MULTIPLIER to 10^3 or as needed. Set audio oscillator to 2 Hz at 100 mVrms.

b. Connect oscillator to CHANNEL A input, using BNC T. Connect oscilloscope to T, using 50Ω feedthrough at oscilloscope BNC.

c. Vary audio and test oscillator frequency from 2 Hz to 10 MHz, maintaining 100 mVrms input amplitude. Vary MULTIPLIER as needed to maintain meaningful display with change of frequency. Counter should properly display the period of the frequencies in this range within accuracy spec of the instrument. Record on test card.

d. Set FUNCTION switch to PERIOD AVG A and repeat step c. Record on test card.

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

6. TIME INTERVAL AND TIME INTERVAL AVERAGE

a. Set counter controls as follows:

SAMPLE RATE	Mid-position
FAST/NORM/HOLD	NORM
FUNCTION	T. I. A to B
MULTIPLIER	1
SLOPE A	+
SLOPE B	-
AC/DC (A and B)	AC
ATTEN (A and B)	X1
LEVEL (A and B)	PRESET
CHK-SEP-COM	COM

b. Connect test oscillator to CHANNEL A input. Set oscillator for 1 MHz output at 300 mVrms. Observe display of .5 μs ±1 count ± trigger error. Record on test card.

c. Set FUNCTION to T. I. AVG and MULTIPLIER to 10^4. Set signal source to < 2 MHz.* Counter should display one half the period of the input signal

$$\pm 2 \text{ ns} \pm \frac{\text{trigger error} \pm 100 \text{ ns}^{**}}{\sqrt{\text{number of intervals averaged}}}$$

7. TOTALIZE

a. Set counter controls as follows:

FUNCTION	START
MULTIPLIER	1
CHK-SEP-COM	CHK

b. Check that display totalizes, count light (C) is on and trigger A and B lamps light. Record on test card.

c. Using 10:1 divider probe, connect oscilloscope vertical input to TIME BASE OUTPUT jack on counter rear panel.

d. Check that oscilloscope indicates 10 MHz negative going pulses at least 3 volts peak-to-peak, typically > 30 nsec at 50% point). Set MULTIPLIER switch to 10 and observe 1 MHz output pulses, typically 100 nsec.

e. Disconnect oscilloscope from TIME BASE OUTPUT jack and connect TIME BASE OUTPUT to 5245L Electronic Counter input. Set 5245L for frequency measurements.

f. Set MULTIPLIER as follows, and check for proper counter display. Record on test card.

MULTIPLIER	5245 DISPLAY
1	10 MHz
10	1 MHz
10^2	100 kHz
10^3	10 kHz
10^4	1 kHz
10^5	100 Hz
10^6	10 Hz
10^7	1 Hz
10^8	.1 Hz

*2 MHz must NOT be exact or display will be ambiguous.
**±1 count.

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

8. RATIO

a. Set counter controls as follows:

FUNCTION	FREQ A
MULTIPLIER	10^4
SLOPE A	+
AC/DC	AC
ATTEN	X1
CHK-SEP-COM	SEP
LEVEL A	PRESET
OSC (rear panel)	EXT

b. Connect test oscillator to OSC jack, using BNC T. Connect oscilloscope to T connector, using 50Ω feedthrough at oscilloscope BNC. Set oscillator output for 10 MHz at 1 Vrms.

c. Connect BNC T connector to counter's CHANNEL A jack. Connect second test oscillator to T connector. Connect second channel of dual channel oscilloscope vertical input to T connector, using 50Ω feedthrough at oscilloscope BNC. Set variable oscillator for 100 kHz at 100 mVrms display on oscilloscope.

d. Check that counter displays 100. Disregard units and decimal point. Record on test card.

e. Repeat test using 100 Hz into OSC jack and 100 kHz into CHANNEL A. Set MULTIPLIER to 10^4. Display should be ratio of two input frequencies X 10^4 (approximately 10^9). Disregard decimal point and units. Record on test card.

9. GATE OUTPUT AND SAMPLE RATE

a. Disconnect setup.

b. Set counter controls as follows:

FUNCTION	FREQ A
TIME-BASE	1 ms
CHK-SEP-COM	CHK
FAST/NORM/HOLD	FAST
SAMPLE RATE	max cew

c. Using 10:1 divider probe, connect oscilloscope vertical input to GATE output and observe positive pulses ≥ 2.4V with a pulse width of < 100 μs. Record on test card.

d. Slowly rotate SAMPLE RATE clockwise and observe that the pulse width increases.

e. Set the TIME BASE switch to 10 ms and rotate the SAMPLE RATE fully clockwise. Observe that the pulse width is > 20 ms. Record on test card.

f. Set FAST/NORM/HOLD to NORM and turn SAMPLE RATE fully counterclockwise, just out of OFF. Observe the positive pulse width is < 20 ms. Record on test card.

g. Slowly rotate the SAMPLE RATE clockwise, observing an increase in the pulse width.

h. Set TIME BASE to 1s and rotate SAMPLE RATE fully clockwise. Verify that the time between flashes of the count (C) lamp is greater than 5 seconds. Record on test card.

i. Set FUNCTION to START and check that gate output is TTL Low (< 0.4V).

j. Set FUNCTION to STOP and verify that gate output is TTL High (> 2.4V).

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

10. DIGITAL VOLTMETER

a. Set counter controls as follows and allow for 10-minute warmup (with covers on).

SAMPLE RATE	Mid-position
FAST/NORM/HOLD	NORM
FUNCTION	DVM
TIME BASE	1s
RANGE	10V

b. Set voltage standard for +10.000 volt output. Connect voltage standard to DVM input jack.

c. Check that counter display is +10.000 volts ±7 counts.

d. Reverse voltage standard polarity and check for counter display of -10.000 volts ±7 counts.

e. Set counter RANGE switch to 100V. Set voltage standard for +100.00 volts output. Check that counter display of +100.00 volts ±7 counts.

f. Reverse voltage standard polarity and check for counter display of -100.00 volts ±7 counts.

g. Set counter RANGE switch to 1000V. Set voltage standard for +990.0 volts output. Counter display should be +990.0 ±11 counts.

CAUTION

DO NOT REVERSE VOLTAGE STANDARD POLARITY. DAMAGE TO THE STANDARD MAY OCCUR.

h. Set counter RANGE switch to 10V. Counter display should be 12.500 ±1 count.

i. Set voltage standard for 12.490 volt output. Counter display should be 12.490 ±7 counts.

j. Connect a 1 MΩ, ¼W, 1% resistor in series with the red DVM INPUT jack.

k. Set voltage standard for 10 volts output. Counter display should be 9.090 ±17 counts.

l. Set RANGE switch to 100V. Counter display should be 9.09V ±22 counts.

m. Short DVM input terminals. Set RANGE switch as follows and check for proper readout.

RANGE SWITCH	READOUT
10V	000 ±2 counts
100V	.00 ±2 counts
1000V	.0 ±2 counts

11. DIGITAL RECORDER (Option 003)

a. Set counter controls as follows:

FUNCTION	FREQ A
TIME BASE	1 s
COM-SEP-CHK	CHK
FAST NORM HOLD	NORM
SAMPLE RATE	Mid-position

b. Connect oscilloscope to J9(48). Observe oscilloscope display a print command (drop from >2.4V to <0.4V) immediately after the C lamp goes out.

c. Connect jumper from J9(25) to J9(22).

d. Check that counter's main gate is inhibited. C light does not flash, and no print command pulses are generated.

e. Verify proper output by connecting a 5055A printer on J9. Printed output should agree with counter display. Logic probe or voltmeter may be used to verify that output logic levels agree with instrument display. Record on test card.

Table 5-4. Adjustments

1. POWER SUPPLY A15

a. Connect counter line cord to variable power transformer. Monitor output voltage with AC VTVM. Adjust transformer for 117 volt indication on VTVM.

b. Turn counter SAMPLE RATE control clockwise out of OFF.

c. Connect VTVM to A15 Pin 7 and adjust A15R10 for +16.5 V.

d. Connect VTVM to A15 Pin 6 and adjust A15R13 for -16.5 V.

2. SENSITIVITY AND OFFSET A2, A3

a. Connect a BNC T connector to CHANNEL A input jack.

b. Connect test oscillator output to T connector.

c. Connect oscilloscope vertical input to T connector, using 50Ω feedthrough at oscilloscope input BNC.

d. Connect counter MARKER A output to oscilloscope Z-axis input.

e. Adjust test oscillator for 1 kHz output at 100 mV rms.

f. Set counter controls as follows:

FUNCTION	FREQ A
CHK-SEP-COM	SEP
ATTEN	X1
AC-DC	DC
LEVEL	PRESET

g. Set SLOPE A switch to - and + positions and observe marker position on oscilloscope waveform.

h. On Input Amplifier board A2, adjust A2R2 SENS pot until + and - marker positions have a symmetrical offset about the zero volt axis for + and - slope switch positions.

i. Adjust test oscillator for 1 kHz output at 200 mV rms.

j. Set counter FUNCTION switch to T.I. A to B

k. On Input Amplifier, adjust A2R24 TRIG LEVEL pot until markers are at 0 volts for both + and - SLOPE switch positions.

l. Repeat procedure for CHANNEL B input (Amplifier Board A3).

3. OPTION 004 ATTENUATOR A1

Set:

TIME BASE	0.1 sec.
AC/DC	DC
SEP/COM	SEP
ATTEN A-B	X10

a. Using an HP 412A or equivalent, measure voltage at CHANNEL A jack.

b. Adjust R56 for < ±1 mV reading.

c. Measure voltage at CHANNEL B jack.

d. Adjust R9 for < ±1 mV reading.

e. Set A and B attenuators to X100 position.

f. Measure voltage at CHANNEL B jack.

g. Adjust R32 for < ±1 mV reading.

h. Measure voltage at CHANNEL A jack.

i. Adjust R33 for < ±1 mV reading.

4. OSCILLATOR A4

a. Connect 1 MHz frequency standard to CHANNEL A jack.

b. Set counter controls as follows:

CHK-SEP-COM	SEP
FUNCTION	FREQ A
TIME BASE	10s
SAMPLE RATE	slightly clockwise out of OFF

c. Remove top cover.

d. Using insulated tuning tool, adjust A4C3 until display indicates all zeros with cover on. (Wait 10 seconds between adjustments for counter to make measurement.)

NOTE

For standard instruments without Option 001, the counter display will overflow; however, all digits are valid.

5. PRESCALER ADJUSTMENTS A18 (5327B)

a. Set counter controls as follows:

FUNCTION	FREQ C
TIME BASE	0.1s
Input Selector	PRESCALE

Table 5-4. Adjustments (Continued)

b. With no input signal applied, adjust R3 offset pot for 0 V on U2 pin 4.

c. Adjust R10 bias pot for 0.65 ±.05 V on U2 pin 3.

d. Adjust R27 bias pot for 0.9 ±.05 V on U3 pin 3.

e. Check that the previously adjusted voltage on U2 pin 3 is correct. If voltage has shifted, adjust R10 for proper reading and recheck U3 pin 3.

f. Set HP VHF Signal Generator and doubler for 550 MHz at 1 V rms. Measure the output with an HP 3406A RF Voltmeter using a 50Ω termination at the probe. Connect signal source to INPUT C of counter.

g. Reduce output level until counter's display becomes unstable. Adjust R3 for a stable display. Repeat this procedure until unable to obtain a stable reading. Increase signal level until display just becomes stable.

h. Disconnect input and connect to voltmeter; reading should be 25 mV or less. Check other frequencies within the band.

i. Set input selector switch to DIRECT.

j. Change input signal to 50 MHz at 15 mV. Counter should display 50 MHz.

6. V-to-F CONVERTER AND ATTENUATOR A12, A13

a. Set counter controls as follows:

SAMPLE RATE .... slightly clockwise out of OFF
RANGE ..... 10 V
FUNCTION ..... DVM
TIME BASE 1s

b. Connect a jumper lead across the DVM INPUT terminals.

c. On Voltmeter Input Amplifier Assembly, adjust A12R31 ("ZERO" pot) for ±.0000 V ±1 count display.

d. Disconnect jumper and connect DC Standard to DVM INPUT terminals. Set DC Standard for ±10 V output.

e. On V-to-F Converter Assembly, adjust A13R16 ("+" pot) for +10.0000 V ±2 counts.

f. Reverse polarity of the DC standard.

g. Adjust A13R15 ("-" pot) for -10.0000 V ±2 counts.

h. Set counter RANGE switch to 100 V.

i. Set DC Standard for +100 volt output.

j. On Voltmeter Input Amplifier Assembly, adjust A12R21 ("100 V" pot) for +100.000 volts ±2 counts on display.

k. Reverse polarity of DC Standard and check that display is -100.000 volts ±2 counts. If not, adjust A12R21 and repeat steps i., j., and k., until A12R21 setting gives display of +100.000 V ±2 counts and -100.000 V ±2 counts.

l. Set counter RANGE switch to 1000 V.

CAUTION

Do not reverse polarity of voltage standard when 990 volts is applied. Damage to the voltage standard may occur.

m. Set DC Standard for +990 volts output.

n. On A12, adjust R24 (1000 V pot) for +990.00 ±2 counts on display.

7. INPUT C AMPLIFIER A17 (5326B)

a. Set counter controls as follows:

FUNCTION ..... FREQ C
TIME BASE 0.1s

b. Set HP 606B HF Signal Generator (or equivalent) for 50 MHz at 500 mV rms. Measure the output signal of 606B with an HP 411A RF Millivoltmeter, using a 50Ω termination. Connect signal source to INPUT C of counter.

c. Reduce output level until counter's display becomes unstable. Adjust R11 for a stable display. Repeat this procedure until unable to obtain a stable reading. Increase the signal level until display just becomes stable.

d. Disconnect input and connect to voltmeter, reading should be less than 5 mV. Check other frequencies within the band.

Table 5-5. D.P. and Annunciator Troubleshooting

Function Switch	Multiplier Switch	n	μ	m	s	•	Decimal					
							10^{5}	10^{4}	10^{3}	10^{2}	10^{1}	10^{0}
Period AVG A	1		x		x							x
	10		x		x						x	
	10^{2}		x		x					x		
	10^{3}	x			x							x
	10^{4}	x			x						x	
	10^{5}	x			x					x		
	10^{6}	x			x				x			
	10^{7}	x			x			x				
	10^{8}	x			x		x					
T.I. AVG A to B	1		x		x							x
	10		x		x						x	
	10^{2}		x		x					x		
	10^{3}	x			x							x
	10^{4}	x			x						x	
	10^{5}	x			x					x		
	10^{6}	x			x				x			
	10^{7}	x			x			x				
	10^{8}	x			x		x					
T.I. A to B	1		x		x							x
	10		x		x							
	10^{2}			x	x						x	
	10^{3}			x	x							x
	10^{4}			x	x							
	10^{5}				x						x	
	10^{6}				x							x
	10^{7}				x							
	10^{8}					x						
Period A	1		x		x							x
	10		x		x							
	10^{2}			x	x						x	
	10^{3}			x	x							x
	10^{4}			x	x							
	10^{5}				x						x	
	10^{6}				x							x
	10^{7}				x							
	10^{8}					x						

Table 5-6. Frequency, D.P., and Annunciator Troubleshooting

Function Switch	Multiplier Switch	G	k	M	Hz	Decimal					
						10^5	10^4	10^3	10^2	10^1	10^0
Freq. A	1	x			x					x	
	10			x	x						
	10^2			x	x						x
	10^3			x	x					x	
	10^4			x	x				x		
	10^5		x		x						x
	10^6		x		x					x	
	10^7		x		x				x		
	10^8		x		x			x			
Freq. C DIRECT	1	x			x					x	
	10			x	x						
	10^2			x	x						x
	10^3			x	x					x	
	10^4			x	x				x		
	10^5		x		x						x
	10^6		x		x					x	
	10^7		x		x				x		
	10^8		x		x			x			
Freq. C PRESCALE	1	x			x						x
	10	x			x					x	
	10^2			x	x						x
	10^3			x	x					x	
	10^4			x	x				x		
	10^5		x		x						x
	10^6		x		x					x	
	10^7		x		x				x		
	10^8		x		x			x			

Table 5-7. DVM, D.P., and Annunciator Troubleshooting

Function Switch	Multiplier Switch	G	k	M	Hz	V	Decimal					
							10^5	10^4	10^3	10^2	10^1	10^0
Read A Level	1					x						x
	10					x						x
	10^2					x						x
	10^3					x						x
	10^4					x						x
	10^5					x						x
	10^6					x						x
	10^7					x						x
	10^8					x						x
DVM	1											
	10											
	10^2											
	10^3											
	10^4											
	10					x					10v	100v
	10^2					x				10v	100v	1000v
	10^3					x			10v	100v	1000v	
	10^4											

PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 5326B/5327B Timer/Counter/DVM
Serial No. _____ Test Performed by _____
Date _____

DESCRIPTION	CHECK
1. TIME BASE STABILITY AND OUTPUT	
Aging Rate: < 3 parts in 10^7 per month	
Line Voltage: < 1 part in 10^7 for 10% line variation	
Temperature: ≤ 2.5 parts in 10^6, 0-50°C	
Output: 10 MHz, > 2.4 volts peak-to-peak	
2. DISPLAY, DECIMAL POINTS, AND DIVIDERS	
As per self-check procedures, Table 3-1	
3. FREQUENCY RESPONSE AND SENSITIVITY	
Frequency A Range: 0 to 50 MHz	
Frequency C Range: 0 to 550 MHz (prescaled)	
0 to 50 MHz (direct)	
Sensitivity, Frequency A: 100 mV rms	
Sensitivity, Frequency C (5326B): 5 mV rms	
Sensitivity, Frequency C (5327B Direct): 15 mV rms	
Sensitivity, Frequency C (5327B Prescaled): 25 mV rms	
Channel A Preset: 0 volts	
Channel A Level: +3.0 to -3.0 volts	
Channel B Preset: 0 volts	
Channel B Level: +3.0 to -3.0 volts	
Read A Level: +3 V to -3V	
Read B Level: +3 V to -3 V	
4. PULSE OPERATION	
CHANNEL A: Sensitivity: 0.3 volts peak-to-peak	
Pulse Width: 15 ns	
INPUT C: Sensitivity: 0.3 volts peak-to-peak	
Pulse Width: 15 ns	
5. PERIOD AND PERIOD OPERATION	
Frequency Range: 0 to 10 MHz at 100 mV	
6. TIME INTERVAL AND TIME INTERVAL AVERAGE	
Time Interval: 0.5 μs at 300 mV	
Time Interval Average: 1/2 period of input signal	
7. TOTALIZE	
Range: 0 to 10 MHz	
Output: Rear panel TIME BASE BNC	
Factor: 1 to 10^8 in decade steps	

PERFORMANCE CHECK TEST CARD

8. RATIO

Range Channel A: 3 to 50 MHz
Range External Input: 100 Hz to 10 MHz

9. GATE OUTPUT AND SAMPLE RATE: Output: Step e
Step e
Step f
Step h

10. DIGITAL VOLTMETER:
10 volt range
100 volt range
1000 volt range
12.400 volt check
10 volt impedance check
100 volt impedance check

11. DIGITAL RECORDER

Print Command: +5V to 0V
Output: Corresponds to input data

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alphanumerical 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 DESIGNATORS

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

ABBREVIATIONS

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

01194-14

Figure 6-1. Panel Designations

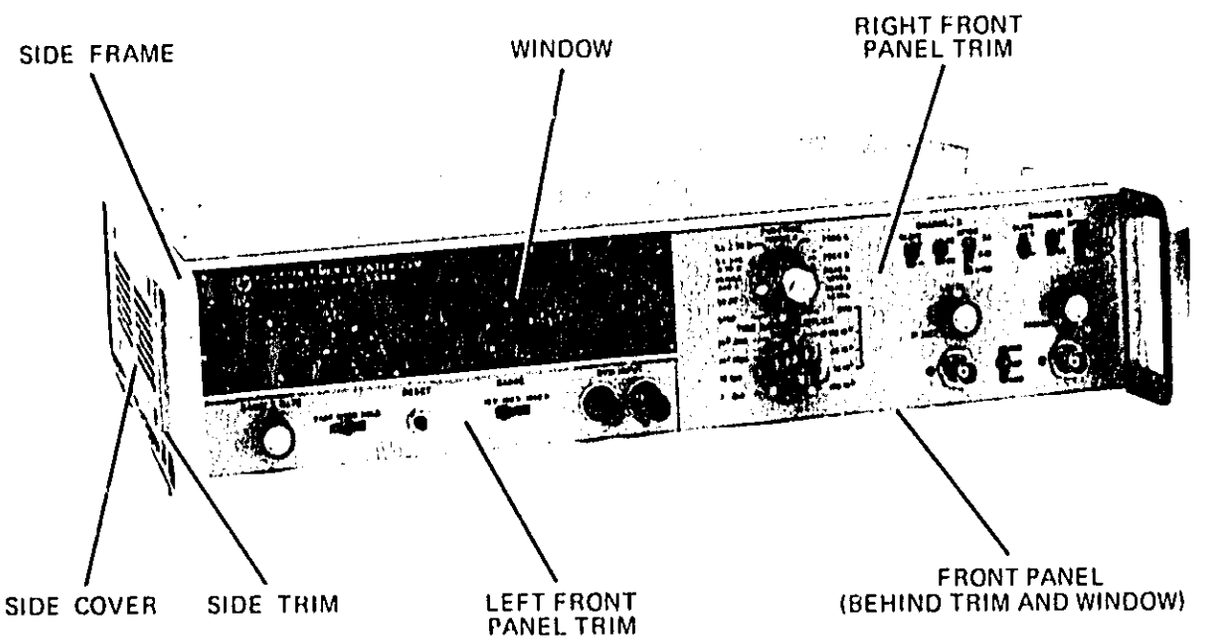


Table 6-1. Replaceable Parts, Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05326-60047	1	ATTENUATOR ASSY (SERIES 1224A) (LOADED ON 05326-60047 BLANK BOARD) NOTE 1 A1R24 & A1R26 ARE NOT INCLUDED WHEN A1 IS ORDERED(ORDER A1R24 & R26 SEPARATELY	28480	05326-60047
A1C1	0160-2244	2	CAPACITOR-FXD CER 3.0PF+-0.25 PF 500VDCW	28480	0160-2244
A1C2	0160-0939	2	CAPACITOR-FXD MICA 430 PF 5% 300 VDCW	28480	0160-0939
A1C3	0160-0378	2	CAPACITOR-FXD MICA 27PF 5%	72136	RDM15E270J5S
A1C4	0160-0161	4	CAPACITOR-FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PT5
A1C5	0160-2140	2	CAPACITOR-FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A1C6	0160-2930	19	CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A1C7	0160-2197	2	CAPACITOR-FXD MICA 10 PF 5%	72136	RDM15E100J3C
A1C8	0160-2146	2	CAPACITOR-FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A1C9	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A1C10	0160-2244		CAPACITOR-FXD CER 3.0PF+-0.25 PF 500VDCW	28480	0160-2244
A1C11	0160-0939		CAPACITOR-FXD MICA 430 PF 5% 300 VDCW	28480	0160-0939
A1C12	0160-0378		CAPACITOR-FXD MICA 27PF 5%	72136	RDM15E270J5S
A1C13	0160-0161		CAPACITOR-FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PT5
A1C14	0160-2140		CAPACITOR-FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A1C15	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A1C16	0160-2197		CAPACITOR-FXD MICA 10 PF 5%	72136	RDM15C100J3C
A1C17	0160-2146		CAPACITOR-FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A1CR1	1910-0016	24	DIODE-GE 60 MIV	28480	1910-0016
A1CR2	1910-0016		DIODE-GE 60 MIV	28480	1910-0016
A1CR3	1901-0376	6	DIODE-SILICON 35V	28480	1901-0376
A1CR4	1901-0376		DIODE-SILICON 35V	28480	1901-0376
A1CR6	1902-0041	4	DIODE-BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR7	1902-0041		DIODE-BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR9	1910-0016		DIODE-GE 60 MIV	28480	1910-0016
A1CR10	1901-0376		DIODE-SILICON 35V	28480	1901-0376
A1CR11	1901-0376		DIODE-SILICON 35V	28480	1901-0376
A1CR13	1902-0041		DIODE-BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR14	1902-0041		DIODE-BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1DS1	2140-0047	2	LAMP-NEON GLOW 0.8 MILLIAMPS	08806	A1C
A1DS2	2140-0047		LAMP-NEON GLOW 0.8 MILLIAMPS	08806	A1C
A1J1	1251-0472	2	CONNECTOR-RPC 12 CONTACTS	71785	252-06-30-300
A1J2	1251-0472		CONNECTOR-RPC 12 CONTACTS	71785	252-06-30-300
A1J3	1250-1163	2	CONNECTOR-RF BNC INPUT	28480	1250-1163
A1J4	1250-1163		CONNECTOR-RF BNC INPUT	28480	1250-1163
A1Q1	1855-0334	2	TSTR-FET DUAL N-CHANNEL	17856	DN377
A1Q2	1855-0334		TSTR-FET DUAL N-CHANNEL	17856	DN377
A1R1	0683-2235	4	RES-FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A1R2	0683-9145	4	RES-FXD COMP 910K OHM 5% 1/4W	01121	CB 9145
A1R3	0683-1015	21	RES-FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A1R4	0757 0947	2	RES-FXD COMP 9100 OHM 2% 1/4W	28480	0757 0947
A1R5	0757 0973	4	RES-FXD COMP 110K OHM 2% 1/4W	28480	0757 0973
A1R6	0683 1058	4	RES-FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R7	0757 0973		RES-FXD COMP 110K OHM 2% 1/4W	28480	0757 0973
A1R8	0683-2215	8	RES-FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A1R9	0683-4715	8	RES-FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R10	0683-1055		RES-FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R11	0683-3325	19	RES-FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A1R12	0683-4715		RES-FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R13	0683-4715		RES-FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R14	0683-2225	24	RES-FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A1R15	0683-2225		RES-FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A1R16	0683-2235		RES-FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A1R17	0683-9145		RES-FXD COMP 910K OHM 5% 1/4W	01121	CB 9145
A1R18	0683-1015		RES-FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A1R19	0757 0947		RES-FXD COMP 9100 OHM 2% 1/4W	28480	0757 0947
A1R20	0757 0973		RES-FXD COMP 110K OHM 2% 1/4W	28480	0757 0973
A1R21	0683 1058		RES-FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R22	0757 0973		RES-FXD COMP 110K OHM 2% 1/4W	28480	0757 0973
A1R23	0683-2215		RES-FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A1R24	2100-3228	2	RES-VAR COMP 10K OHM 20% LIN 1/2W (SEE NOTE 1 ABOVE)	28480	2100-3228
A1R25	0683-1055		RES-FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R26	2100-3228		RES-VAR COMP 10K OHM 20% LIN 1/2W (SEE NOTE 1 ABOVE)	28480	2100-3228
A1R27	0683-4715		RES-FXD COMP 470 OHM 5% 1/4W	01121	CB 4715

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R28	0683-1365		RESD COMP 330 OHM 5% 1/4W	01121	CB 3315
A1R29	0683-2225		RESD COMP 2.2M OHM 5% 1/4W	01121	CB 2255
A1R30	0683-2225		RESD COMP 2.2M OHM 5% 1/4W	01121	CB 2255
A1R31	0683-1005	6	RESD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1R32	0683-1005		RESD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1R33	0683-1005		RESD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1R34	0683-1005		RESD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1S1	3101-1566	1	SWITCH-SLIDE DPDT POSITION	28480	3101-1566
A1S2	3101-1566	2	SWITCH-SLIDE DPDT POSITIONS	28480	55-53
A1S3	3101-1566		SWITCH-SLIDE DPDT POSITIONS	28480	55-53
A1S4	3101-1566	5	SWITCH-SLIDE DPDT MINIATURE	28480	55-51-1
A1S5	3101-1566	2	SWITCH-SLIDE DPDT	28480	3101-1566
A1S6	3101-1566		SWITCH-SLIDE DPDT	28480	3101-1566
A1S7	3101-1566		SWITCH-SLIDE DPDT MINIATURE	28480	55-51-1
A1U8			PART OF A26		
A1U9			PART OF A26		
A2	05326-60004	1	INPUT AMPLIFIER ASSY (SERIES 972) LOADED ON 05326-20004 BLANK BOARD)	28480	05326-60004
A2C1	0180-2910		CERD CER 0.01 UF +80-20% 100VDCW	91418	FA
A2C2	0180-2910		CERD CER 0.01 UF +80-20% 100VDCW	91418	FA
A2C3	0180-2910		CERD CER 0.01 UF +80-20% 100VDCW	91418	FA
A2C4	0180-0197	1	CERD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A2C5	0180-0197		CERD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A2C6	0160-0153	4	CERD MY 0.001 UF 10% 200VDCW	56289	15%F10G%2-PTS
A2C7	0170-0055	6	CERD MY 0.1UF 20% 200VDCW	56289	15%P10G%2
A2C8	0170-0055		CERD MY 0.1UF 20% 200VDCW	56289	15%P10G%2
A2C9	0160-2910		CERD CER 0.01 UF +80-20% 100VDCW	91418	FA
A2C10	0160-2910		CERD CER 0.01 UF +80-20% 100VDCW	91418	FA
A2CR1	1902-0049	3	DIODE-BREAKDOWN 6.19V 5%	04713	SZ10939-137
A2CR2	1910-0016		DIODE-GE 60 MIV	28480	1910-0016
A2CR3	1901 0040	28	DIODE SILICON 50 MA 30 WV	07263	FD6/D6
A2CR4	1910 0016		DIODE GE 60 MIV	28480	1910-0016
A2CR5	1901 0040		DIODE SILICON 50 MA 30 WV	07263	FD6/D6
A2L1	9140 0144		COIL FXD RF 4.7 UH	28480	28480
A2L2	9100 2255	4	COIL CHOKE 0.47 UH 10%	28480	9100-2255
A2L3	9140 0144		COIL FXD RF 4.7 UH	28480	9140-0144
A2L4	9140-0144		COILFXDRF 4.7 UH	28480	9140-0144
A2L5	9100-2255		COILCHOKE 0.47 UH 10%	28480	9100-2255
A2L6	9140-0144		COILFXDRF 4.7 UH	28480	9140-0144
A2L7	9140-0144		COILFXDRF 4.7 UH	28480	9140-0144
A2L8	9140-0142	4	COILFXDRF 2.20 UH 10%	84411	CF-4536-68
A2L9	9140-0144		COILFXDRF 4.7 UH	28480	9140-0144
A2L10	9140-0144		COILFXDRF 4.7 UH	28480	9140-0144
A2Q1	1854-0052	25	TSTRSTR NPN	80131	2N3563
A2Q2	1853-0015	20	TSTRSTR PNP	80131	2N3645
A2Q3	1853-0015		TSTRSTR PNP	80131	2N3645
A2Q4	1854-0345	6	TSTRSTR NPN	80131	2N5179
A2Q5	1854-0345		TSTRSTR NPN	80131	2N5179
A2Q6	1853-0015		TSTRSTR PNP	80131	2N3640
A2Q7	1853-0015		TSTRSTR PNP	80131	2N3640
A2Q8	1854-0052		TSTRSTR NPN	80131	2N3563
A2Q9	1853-0015		TSTRSTR PNP	80131	2N3640
A2Q10	1853-0015		TSTRSTR PNP	80131	2N3640
A2Q11	1853-0015		TSTRSTR PNP	80131	2N3640
A2Q12	1853-0015		TSTRSTR PNP	80131	2N3640
A2Q13	1853-0015		TSTRSTR PNP	80131	2N3640
A2Q14	1854-0052		TSTRSTR NPN	80131	2N3563
A2Q15	1854-0071	23	TSTRSTR NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2Q16	1854-0052		TSTRSTR NPN	80131	2N3563
A2Q17	1854-0052		TSTRSTR NPN	80131	2N3563
A2Q18	1854-0345	6	TSTRSTR NPN	80131	2N5179
A2Q19	1854-0052		TSTRSTR NPN	80131	2N3563
A2Q20	1854-0071		TSTRSTR NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0683-6815	1	RESD COMP 68K OHM 5% 1/4W	01121	CB 6835
A2R2	2100-2520	1	RESVAR CERMET 50 OHM 20% TYPE X 1/2W	28480	2100-2520
A2R3	0683-2215		RESD COMP 220 OHM 5% 1/4W	01121	CB 2215
A2R4	0683-2405	2	RESD COMP 24 OHM 5% 1/4W	01121	CB 2405
A2R5	0683-3625	5	RESD COMP 3600 OHM 5% 1/4W	01121	CB 3625
A2R6	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R7	0683-3025	7	RESD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A2R8	0683-1025	10	RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R5	0698-3113	1	RESISTOR CARBON 100 OHM 5% 1/4W	28480	0698-3113
A2R10	0698-3381	1	RESISTOR COMP 150 OHM 5% 1/4W	28480	0698-3381
A2R11	0698-5175	1	RESISTOR COMP 300 OHM 5% 1/4W	28480	0698-5175
A2R12	0698-3375	1	RESISTOR COMP 68 OHM 5% 1/4W	28480	0698-3375
A2R13	0698-3375	2	RESISTOR COMP 33 OHM 5% 1/4W	28480	0698-3375
A2R14	0683-1525	11	RESISTOR COMP 1500 OHM 5% 1/4W	01121	CB 1525
A2R15	0698-5180	1	RESISTOR COMP 20 OHM 5% 1/4W	28480	0698-5180
A2R16	0698-5175		RESISTOR COMP 300 OHM 5% 1/4W	28480	0698-5175
A2R17	0698-3381		RESISTOR COMP 150 OHM 5% 1/4W	28480	0698-3381
A2R18	0683-1025		RESISTOR COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R19	0698-3113		RESISTOR CARBON 100 OHM 5% 1/4W	28480	0698-3113
A2R20	0683-1015		RESISTOR COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R21	0683-1025		RESISTOR COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R22	0683-3625		RESISTOR COMP 3.6K OHM 5% 1/4W	01121	CB 3625
A2R23	0683-2225		RESISTOR COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A2R24	2100-2521	1	RESVAR FILM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A2R25	0683-2225		RESISTOR COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A2R26	0683-1015		RESISTOR COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R27	0683-1015		RESISTOR COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R28	0683-6815	4	RESISTOR COMP 680 OHM 5% 1/4W	01121	CB 6815
A2R29	0683-6815		RESISTOR COMP 680 OHM 5% 1/4W	01121	CB 6815
A2R30	0683-4725	1	RESISTOR COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2R31	0683-1035	12	RESISTOR COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R32	0683-3315	6	RESISTOR COMP 330 OHM 5% 1/4W	01121	CB 3315
A2R33	0683-1035		RESISTOR COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R34	0683-3315		RESISTOR COMP 330 OHM 5% 1/4W	01121	CB 3315
A2R35	0683-1035		RESISTOR COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R36	0683-1015		RESISTOR COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R37	0683-2235		RESISTOR COMP 22K OHM 5% 1/4W	01121	CB 2235
A2R38	0683-1025		RESISTOR COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R39	0683-2215		RESISTOR COMP 220 OHM 5% 1/4W	01121	CB 2215
A2R40	0683-2225		RESISTOR COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A2R41	0683-1525		RESISTOR COMP 1500 OHM 5% 1/4W	01121	CB 1525
A2R42	0683-1025		RESISTOR COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R43	0683-3035	2	RESISTOR COMP 30K OHM 5% 1/4W	01121	CB 3035
A2R44	0683-1015	7	RESISTOR COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R45	0683-3315		RESISTOR COMP 330 OHM 5% 1/4W	01121	CB 3315
A2R46	0683-1025		RESISTOR COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R47	0683-1065	2	RESISTOR COMP 10M OHM 5% 1/4W	01121	CB 1065
A2R48	0683-2055	2	RESISTOR COMP 2 MEGOHM 5% 1/4W	01121	CB 2055
A2R49	0683-2715	5	RESISTOR COMP 270 OHM 5% 1/4W	01121	CB 2715
A2R50	0683-2715		RESISTOR COMP 270 OHM 5% 1/4W	01121	CB 2715
A2U1	1820-0238	4	INTEGRATED CIRCUIT:DTL J INPUT NOR GATE	04713	MC 830P
A2U2	1820-0142	3	INTEGRATED CIRCUIT:DUAL J-K/MSR	04713	MC1004P
A3			SAME AS A2 USE PREFIX A3		
A4	0532/6-60002	1	OSCILLATOR ASSY (SERIES 1032) (LOADED ON 0632A 20002 BLANK BOARD)	28480	0532/6-60002
A4C1	0160-0161		CAPACITOR-FXD 0.01 UF 10% 200VDCW	56289	192P10392-ET5
A4C2	0180-0197		CAPACITOR-FXD 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A4C3	0121-0059	1	CAPACITOR-VAR 2-8 PF 300VDCW	28480	0121-0059
A4C4	0160-2264	1	CAPACITOR-FXD 20 PF 5% 300VDCW	72982	9C1-000-C0G0-200J
A4C5	0160-2930		CAPACITOR-FXD 0.01 UF +80-20% 100VDCW	56289	TA
A4C6	0160-2276	1	CAPACITOR-FXD 100 PF 10%	28480	0160-2276
A4Q1	1854-0338	1	TRANSISTOR PNP	80131	2N6439
A4R1	0698-4037	1	RESISTOR MET FLM 464 OHM 1% 1/8W	28480	0698-4037
A4R2	0683-1025		RESISTOR COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R3	0683-1015		RESISTOR COMP 100 OHM 5% 1/4W	01121	CB 1015
A4R4	0683-3015		RESISTOR COMP 300 OHM 5% 1/4W	01121	CB 3015
A4U1	1820-0142		INTEGRATED CIRCUIT:DUAL J-K/MSR	04713	MC1004P
A4Y1	0410-0405	1	CRYSTAL:QUARTZ 10 MHZ	28480	0410-0405
A5	0532/6-60005	1	TIME BASE CONTROL ASSY (SERIES 1032) (LOADED ON 0632A-20005 BLANK BOARD)	28480	0532/6-60005
A5C1	0180-0197		CAPACITOR-FXD 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5C2	0160-0127	1	CERAM CER 1.0 UF 20% 25VDCW	[illegible]	[illegible]
A5C3	0180-0291	2	CERAM ELECT 1.0 UF 10% 35VDCW	[illegible]	[illegible]
A5C4	0160-2190	5	CERAM MICA 33 PF 5%	[illegible]	[illegible]
A5C5	0160-2204	2	CERAM MICA 100PF 5%	[illegible]	[illegible]
A5CR1	1901-0040		DIODE-SILICON 50 MA 30 MV	[illegible]	[illegible]
A5Q1	1854-0092		TSTR-SI NPN	[illegible]	[illegible]
A5Q2	1854-0092		TSTR-SI NPN	[illegible]	[illegible]
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	1854-0071		TSTR-SI NPN-SELECTED FROM 2N3704	28480	1854-0071
A5R1	0683-1035		RESD COMP 10K OHM 5% 1/4W	C1121	CB 1035
A5R2	0683-1035		RESD COMP 10K OHM 5% 1/4W	C1121	CB 1035
A5R3	0683-5105	4	RESD COMP 51 OHM 5% 1/4W	C1121	CB 5105
A5R4	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R5	0683-4715		RESD COMP 470 OHM 5% 1/4W	01121	CB 4715
A5R6	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R7	0683-1225	2	RESD COMP 1200 OHM 5% 1/4W FACTORY SELECTED VALUE.	C1121	CB 1225
A5R8	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R9	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R10	0683-2215		RESD COMP 220 OHM 5% 1/4W	01121	CB 2215
A5R11	0683-6835		RESD COMP 68K OHM 5% 1/4W	01121	CB 6835
A5R12	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R13	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R14	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R15	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R16	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R17	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R18	0683-2225		RESD COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A5R19	0683-2225		RESD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A5R20	0683-5105		RESD COMP 51 OHM 5% 1/4W	01121	CB 5105
A5R21	0683-5105		RESD COMP 51 OHM 5% 1/4W	01121	CB 5105
A5U1	1820-0412	7	INTEGRATED CIRCUIT-DECADE DIVIDER	28480	1820-0412
A5U2	1820-0412		INTEGRATED CIRCUIT-DECADE DIVIDER	28480	1820-0412
A5U3	1820-0412		INTEGRATED CIRCUIT-DECADE DIVIDER	28480	1820-0412
A5U4	1820-0412		INTEGRATED CIRCUIT-DECADE DIVIDER	28480	1820-0412
A5U5	1820-0054	4	ECTTL QUAD 2-INPUT NAND GATE	01295	SN7400N
A5U6	1820-0412		INTEGRATED CIRCUIT-DECADE DIVIDER	28480	1820-0412
A5U7	1820-0412		INTEGRATED CIRCUIT-DECADE DIVIDER	28480	1820-0412
A5U8	1820-0412		INTEGRATED CIRCUIT-DECADE DIVIDER	28480	1820-0412
A5U9	1820-0413	2	ECTTL DECADE DIVIDER 125 MHZ MIN.	28480	1820-0413
A5U10	1820-0174	1	ECTTL HEX INVERTER	01295	SN7404N
A6	05326-60013	1	SAMPLE RATE ASSY (SERIES 1226A) (LOADED ON 05326-60013 BLANK BOARD)	28480	05326-60013
A6C1	0160-2201	1	CERAM MICA 51 PF 5%	[illegible]	[illegible]
A6C2	0160-0134	1	CERAM MICA 2400PF 5% 100VDCW	[illegible]	[illegible]
A6C3	0180-0228	3	CERAM ELECT 22 UF 10% 15VDCW	[illegible]	[illegible]
A6C4	0160-0166	1	CERAM MY 0.022 UF 10% 100VDCW	[illegible]	[illegible]
A6C5	0160-0153	1	CERAM MICA 82 PF 5%	28480	0160-0153
A6C6	0160-0153		CERAM MY 0.001 UF 10% 200VDCW	[illegible]	[illegible]
A6C7	0160-2199	2	CERAM MICA 3 PF +5% 500VDCW FACTORY SELECTED PART	28480	0160-2199
A6C8	0160-0153		CERAM MY 0.001 UF 10% 200VDCW	[illegible]	[illegible]
A6C9	0180-0291		CERAM ELECT 1.0 UF 10% 35VDCW	[illegible]	[illegible]
A6C10	0160-0161		CERAM MY 0.01 UF 10% 200VDCW	[illegible]	[illegible]
A6C11	0180-0114	6	CERAM ELECT +50 UF +100-10% 25VDCW	28480	0180-0114
A6C12	0180-0114		CERAM ELECT +50 UF +100-10% 25VDCW	28480	0180-0114
A6CR1	1901-0040		DIODE-SILICON 50 MA 30 MV	07263	FD6100A
A6CR2	1901-0040		DIODE-SILICON 50 MA 30 MV	07263	FD6100A
A6CR3	1910-0016		DIODE-SW 60 MIV	28480	1910-0016
A6CR4	1910-0016		DIODE-SW 60 MIV	28480	1910-0016
A6CR5	1901-0040		DIODE-SILICON 50 MA 30 MV	07263	FD6100A
A6CR7	1901-0040		DIODE-SILICON 50 MA 30 MV	07263	FD6100A
A6CR8	1901-0040		DIODE-SILICON 50 MA 30 MV	07263	FD6100A
A6CR9	1910-0016		DIODE-SW 60 MIV	28480	1910-0016
A6CR10	1901-0040		DIODE-SILICON 50 MA 30 MV	07263	FD6100A
A6CR11	1901-0040		DIODE-SILICON 50 MA 30 MV	07263	FD6100A
A6Q1	1854-0071		TSTR-SI NPN-SELECTED FROM 2N3704	28480	1854-0071
A6Q2	1854-0071		TSTR-SI NPN-SELECTED FROM 2N3704	28480	1854-0071

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6U1	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6U4	1854-0305	7	TSTR/SI NPN	04713	SPS35
A6U5	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6U6	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6U7	1854-0215	1	TSTR/SI NPN	80131	2N3904
A6U8	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6U9	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6U10	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6U11	1854-0305		TSTR/SI NPN	04713	SPS35
A6U12	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6U13	1854-0071		TSTR/SI NPN/SELECTED FROM 1853/1854	28480	1854-0071
A6R1	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R2	0683-1525		RESD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R3	0683-1215	11	RESD COMP 120 OHM 5% 1/4W	01121	CB 1215
A6R4	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R5	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R6	0683-5125		RESD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R7	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R8	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R9	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R10	0683-2005	4	RESD COMP 2C00 OHM 5% 1/4W	01121	CB 2025
A6R11	0683-2735	5	RESD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R12	0683-5125		RESD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R13	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R14	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R15	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R16	0683-5125		RESD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R17	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R18	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R19	0683-5115	8	RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A6R20	0683-2735		RESD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R21	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R22	0683-5115	3	RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A6R23	0683-2025		RESD COMP 2C00 OHM 5% 1/4W	01121	CB 2025
A6R24	0683-6215	3	RESD COMP 620 OHM 5% 1/4W	01121	CB 6215
A6R25	0683-1525		RESD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R26	0683-2025		RESD COMP 2C00 OHM 5% 1/4W	01121	CB 2025
A6R27	0683-3025		RESD COMP 3C00 OHM 5% 1/4W	01121	CB 3025
A6R28	0683-5115	1	RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A6R29	0683-1525		RESD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R30	0683-2415	4	RESD COMP 240 OHM 5% 1/4W	01121	CB 2415
A6R31	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R32	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R33	0683-2735		RESD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R34	0683-2735		RESD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R35	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R36	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R37	0683-2065	1	RESD COMP 206R OHM 5% 1/4W	01121	CB 2065
A6R38	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R39	0683-1035		RESD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R40	0683-4735	2	RESD COMP 47K OHM 5% 1/4W	01121	CB 4735
A6R41	0683-1525		RESD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R42	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R43	0683-4735		RESD COMP 47K OHM 5% 1/4W	01121	CB 4735
A6R44	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6U1	1820-0054		IC TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A6U2	1820-0772	1	IC DECL TYPE D FF	04713	MC1022P
A6U3	1820-0074	1	IC TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6U4	1820-0054		IC TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A6U5	1820-0328	1	IC TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A6U6	1820-0147	5	IC DECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
A7	05327-60031	1	BOARD ASSY:FUNCTION CONTROL (SERIES 1812A) (LOADED ON 05327 20004 BLANK BOARD)	28480	05327-60031
A7C1	0160 2306	1	C FXD MICA 27 PF 5%	28480	0160 2306
A7C2	0150 0042	1	C FXD TI 4.7 PF 5% 500VDCW	28480	TYPE GA
A7C3	0160 2150	1	C FXD MICA 33 PF 5% 300VDCW FACTORY SELECTED PART	28480	0160 2150
A7CR1	1901-0535	2	DIODE:HYBRID HOT CARRIER	28480	1901-0535
A7R1	0683-1125	4	RESD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R2	0683-1825	6	RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A7R3	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A7R4	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R7	0683-9125	5	RESD COMP 9100 OHM 5% 1/4W	01121	CB 9125
A7R8	0683-2225		RESD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A7R9	0683-1125		RESD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R10	0683-2225		RESD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A7R11	0683-1125		RESD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R12	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A7R13	0683-3325		RESD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A7R14	0683-1525		RESD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A7R15	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A7R16	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A7R17	0683-5115		RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A7R18	0683-3015		RESD COMP 300 OHM 5% 1/4W	01121	CB 3015
A7R19	0683-3015		RESD COMP 300 OHM 5% 1/4W	01121	CB 3015
A7R20	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A7R21	0683-1125		RESD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R22	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A7R23	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A7R24	0683-4715		RESD COMP 470 OHM 5% 1/4W	01121	CB 4715
A7R25	0683-1515	1	RESD COMP 150 OHM 5% 1/4W	01121	CB 1515
A7R26	0683-2415		RESD COMP 240 OHM 5% 1/4W	01121	CB 2415
A7R27	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A7R28	0683-5115		RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A7R29	0683-5115		RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A7R30	0683-7515	1	RESD COMP 750 OHM 5% 1/4W	01121	CB 7515
A7U1	1820-0102	5	INTEGRATED CIRCUIT D-K FLIP FLOP	04713	MC1013P
A7U2	1820-0499	5	ICTEC	28480	1820-0485
A7U3	1820-0147		ICTEC TRIPLE 3-INPT NOR GATE	04713	MC1027P
A7U4	1820-0102		INTEGRATED CIRCUIT D-K FLIP FLOP	04713	MC1013P
A7U5	1820-0440	1	ICTEC DUAL MS FF	04713	MC1013P
A7U6	1820-0147		ICTEC TRIPLE 3-INPT NOR GATE	04713	MC1027P
A7U7	1820-0499		ICTEC	28480	1820-0485
A7U8	1820-0434	2	ICTEC QUAD LINE RECEIVER	04713	MC1024P
A7U9	1820-0485		ICTEC	28480	1820-0485
A7U10	1820-0203	1	IC ECL QUAD EXCL OR GATE	04713	MC 10398P
A7U11	1820-0145		IC DIGITAL QUAD 2 INPT NOR GATE	28480	1820-0145
A7U12	1820-0485		ICTEC	28480	1820-0485
A7U13	1820-0257	1	ICTEC DUAL 3-4 INPT OR/NOR GATE	04713	MC1024P
A7U14	1820-0809	1	ICTEC QUAD LINE RECEIVER	04713	MC10115P
A7U15	1820-0808	1	IC ECL DUAL 3 INPT 3 OUT NOR GATE	04713	MC10111P
A7XU35	1200-0474		SOCKET IC 14 PIN	28480	1200-0474
A8	08326-60009	1	DISPLAY SUPPORT ASSY (SERIES 999) (LOADED ON 08326-20009 BLANK BOARD)	28480	08326-60009
A8C1	0160-2910		CERM CER 0.01 UF +80-20% 100VDCM	91418	TA
A8C2	0160-2199		CERAM MICA 10 PF 5% 100VDCM	28480	0160-2155
A8CR1	1901-0040		DIODE-SWITCHING 50 MA 30 NV	07263	FDG10RR
A8CR2	1910-0016		DIODE-GE 60 NIV	28480	1910-0016
A8CR3	1910-0016		DIODE-GE 60 NIV	28480	1910-0016
A8CR4	1901-0040		DIODE-SWITCHING 50 MA 30 NV	07263	FDG10RR
A8J1	1251-7035	1	CONNECTOR-PC EDGE 12 X 151 30 CONTACT	71785	252-15-30-100
A8Q1	1854-0092		TSTR-SI NPN	80131	2N3563
A8Q2	1854-0092		TSTR-SI NPN	80131	2N3563
A8Q3	1854-0365		TSTR-SI NPN	80131	2N4410
A8Q4	1854-0365		TSTR-SI NPN	80131	2N4410
A8Q5	1854-0365		TSTR-SI NPN	80131	2N4410
A8Q6	1854-0365		TSTR-SI NPN	80131	2N4410
A8Q7	1854-0365		TSTR-SI NPN	80131	2N4410
A8Q8	1854-0365		TSTR-SI NPN	80131	2N4410
A8Q9	1854-0092		TSTR-SI NPN	80131	2N3563
A8Q10	1854-0092		TSTR-SI NPN	80131	2N3563
A8Q11	1854-0092		TSTR-SI NPN	80131	2N3563
A8R1	0683-1125		RESD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A8R2	0683-1045	7	RESD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A8R3	0683-1045		RESD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A8R4	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A8R5	0683-1255	6	RESD COMP 1.2 MEGOHM 5% 1/4W	01121	CB 1255
A8R6	0683-1255		RESD COMP 1.2 MEGOHM 5% 1/4W	01121	CB 1255
A8R7	0683-1255		RESD COMP 1.2 MEGOHM 5% 1/4W	01121	CB 1255
A8R8	0683-1255		RESD COMP 1.2 MEGOHM 5% 1/4W	01121	CB 1255
A8R9	0683-1255		RESD COMP 1.2 MEGOHM 5% 1/4W	01121	CB 1255

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R10	0683-1255		RESD COMP 1.2 MEGOHM 5% 1/4W	C1121	CB 1255
A8R11	0683-2425	1	RESD COMP 2400 OHM 5% 1/4W	C1121	CB 2425
A8R12	0683-1015		RESD COMP 100 OHM 5% 1/4W	C1121	CB 1015
A8R13	0683-1025		RESD COMP 1000 OHM 5% 1/4W	C1121	CB 1025
A8R14	0683-2715		RESD COMP 270 OHM 5% 1/4W	C1121	CB 2715
A8R15	0683-4725		RESD COMP 4700 OHM 5% 1/4W	C1121	CB 4725
A8R16	0683-1025		RESD COMP 1000 OHM 5% 1/4W	C1121	CB 1025
A8R17	0683-4725		RESD COMP 4700 OHM 5% 1/4W	C1121	CB 4725
A8R18	0683-5115		RESD COMP 510 OHM 5% 1/4W	C1121	CB 5115
A8R19	0683-1045		RESD COMP 100K OHMS 5% 1/4W	C1121	CB 1045
A8R20	0683-1045		RESD COMP 100K OHMS 5% 1/4W	C1121	CB 1045
A8R21	0683-2725	4	RESD COMP 2700 OHM 5% 1/4W	C1121	CB 2725
A8R22	0683-5115		RESD COMP 510 OHM 5% 1/4W	C1121	CB 5115
A8R23	0683-1045		RESD COMP 100K OHMS 5% 1/4W	C1121	CB 1045
A8R24	0683-2725		RESD COMP 2700 OHM 5% 1/4W	C1121	CB 2725
A8R25	0683-1535	1	RESD COMP 15K OHM 5% 1/4W	C1121	CB 1535
A8R26	0683-2225		RESD COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A8U1	1820-0094	3	IC:DTL QUAD 2-INPUT GATE	C4713	SFC6503PA
A8U2	1820-0307	1	IC:DTL HEX INVERTER	C4713	MC836P
A8U3	1820-0143	1	INTEGRATED CIRCUIT:TAC COUPLED JK F/F	C4713	MC10270
A8U4	1820-0102		INTEGRATED CIRCUIT:J-K FLIP FLOP	C4713	MC1013P
A8U5	1820-0102		INTEGRATED CIRCUIT:J-K FLIP FLOP	C4713	MC1013P
A8U6	1820-0102		INTEGRATED CIRCUIT:J-K FLIP FLOP	C4713	MC1013P
A9	05326-60008 OR 05326-60025 OR	1	DISPLAY ASSY (SERIES 1312A) (LOADED ON 05326-20008 BLANK BOARD)	28480	05326-60008 05326-60025
A9DS1	1970-0042	7	TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A9DS1	1200-0405	8	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS2	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A9DS2	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS3	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A9DS3	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS4	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A9DS4	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS5	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A9DS5	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS6	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A9DS6	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS7	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A9DS7	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS8	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9R1	0683-1025		RESD COMP 1000 OHM 2% 1/4W	C1121	CB 1025
A9R2	0698-8431	8	RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R3	0683-1025		RESD COMP 1000 OHM 5% 1/4W	C1121	CB 1025
A9R4	0698-8431		RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R5	0698-8431		RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R6	0698-8431		RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R7	0698-8431		RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R8	0698-8431		RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R9	0698-8431		RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R10	0683-1005		RESD COMP 10 OHM 5% 1/4W	C1121	CB 1005
A9R11	0698-8431		RESD COMP 7500 OHM 2% 1/4W	28480	0698-8431
A9R12	0683-1005		RESD COMP 10 OHM 5% 1/4W	C1121	CB 1005
A9U1	1820-0275	1	IC:ECL TO TTL QUAD 2-INPT OR TRANS.	C4713	MC10350P
A9U2	1820-0119	6	IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U3	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U4	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U5	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U6	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U7	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U9	1820-0116	7	IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U10	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U11	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U12	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U13	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116

See introduction to this section for ordering information

ΔFOR THIS INSTRUMENT, 1820-0232's ARE DIRECTLY INTERCHANGEABLE WITH 1820-0119's WHEN USED FOR U3 THRU U7

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9U14	1820-0116		IC:74-PET PUFF STORE GATED CUTS	28480	1820-0116
A9U15	1820-0116		IC:74-PET PUFF STORE GATED CUTS	28480	1820-0116
A9U17	1820-0729	1	IC:DECODER-DIVIDER	28480	1820-0729
A9U18	1820-0092	4	INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U19	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U20	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U21	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U22	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U23	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U24	1200-0477	1	SOCKET:IC	28480	1200-0477
A9U25,26	1200-0477		SOCKET:IC	28480	1200-0477
A9U27,28	1200-0477		SOCKET:IC	28480	1200-0477
A10	05327-60008	1	MIGHT READOUT ASSY (SERIES [10]6A, REV. B) (LOADED ON 05327-20008 BLANK BOARD)	28480	05327-60008
	05326-00009	2	BRACKET:READOUT	28480	05326-00009
	05326-00008	1	INDICATOR:MASK (U,h,S,)	28480	05326-00008
	05326-00009	1	INDICATOR:MASK (V,M,HZ)	28480	05326-00009
	05326-00010	1	INDICATOR:MASK (*,K,G)	28480	05326-00010
	05330-40002	2	BLOCK:ANNUNCIATOR	28480	05330-40002
A10CR1	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FD6106
A10CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FD6106
A10DS1	2140-0313	14	LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS2	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS3	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS4	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS5	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS6	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS7	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS8	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10DS9	2140-0313		LAMP:NEON GLOW FROSTED 1.5 MILLIAMPS	08806	C2A-B
A10Q1	1854-0009		TSTR:SI NPN	80131	2N709
A10Q2	1854-0009		TSTR:SI NPN	80131	2N709
A10Q3	1854-0009		TSTR:SI NPN	80131	2N709
A10Q4	1854-0474	16	TSTR:SI NPN	28480	1854-0474
A10Q5	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q6	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q7	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q8	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q9	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q10	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q11	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q12	1854-0474		TSTR:SI NPN	28480	1854-0474
A10Q13	1854-0474		TSTR:SI NPN	28480	1854-0474
A10R1	0683-5125		RESD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A10R2	0683-5125		RESD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A10R3	0683-5125		RESD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A10R4	0683-3025		RESD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A10R5	0683-2025		RESD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A10R6	0683-2025		RESD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A10R7	0683-3025		RESD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A10R8	0683-5135	6	RESD COMP 51K OHM 5% 1/4W	01121	CB 5135
A10R9	0683-5135		RESD COMP 51K OHM 5% 1/4W	01121	CB 5135
A10U1	1820-0274	12	IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U2	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U3	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U4	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U5	1820-0310	1	IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC69108R
A10U6	1820-0273	4	IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A10U7	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
	0610-0207		STANDOFF PRESS IN	28480	0610-0207
A11	05327-60007	1	LEFT READOUT ASSY (SERIES [10]6A, REV. A) (LOADED ON 05327-20007 BLANK BOARD)	28480	05327-60007

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	05326-00009		BRACKET-PC BOARD	28480	05326-00009
	05326-60002	1	INDICATOR-MASK	28480	05326-60002
	05326-60011	1	INDICATOR-MASK (EXT, C, OFF)	28480	05326-60011
	05330-40002		PLUG-TRANSDUCER	28480	05330-40002
A11C1	0160-2200	1	FIXED MICA 47 PF 5%	72136	DM15E470J0H
A11DS1	2140-0313		LAMP-NEON GLOW FROSTED 1.9 MILLIAMPS	08807	C2A-B
A11DS2	2140-0313		LAMP-NEON GLOW FROSTED 1.9 MILLIAMPS	08807	C2A-B
A11DS3	2140-0313		LAMP-NEON GLOW FROSTED 1.9 MILLIAMPS	08807	C2A-B
A11DS4	2140-0313		LAMP-NEON GLOW FROSTED 1.9 MILLIAMPS	08807	C2A-B
A11DS5	2140-0313		LAMP-NEON GLOW FROSTED 1.9 MILLIAMPS	08807	C2A-B
A11Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A11Q2	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q3	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q4	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q5	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q6	1854-0474		TSTR:SI NPN	28480	1854-0474
A11R1	0683-2035	1	RESIS-COMP 20K OHM 5% 1/4W	01121	CB 2035
A11R2	0683-1035		RESIS-COMP 10K OHM 5% 1/4W	01121	CB 1035
A11R3	0683-5125		RESIS-COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R4	0683-5135		RESIS-COMP 51K OHM 5% 1/4W	01121	CB 5135
A11R5	0683-2025		RESIS-COMP 2000 OHM 5% 1/4W	01121	CB 2025
A11R6	0683-5135		RESIS-COMP 51K OHM 5% 1/4W	01121	CB 5135
A11R7	0683-5125		RESIS-COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R8	0683-5135		RESIS-COMP 51K OHM 5% 1/4W	01121	CB 5135
A11R9	0683-5125		RESIS-COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R10	0683-1525		RESIS-COMP 1500 OHM 5% 1/4W	01121	CB 1525
A11R11	0683-1025		RESIS-COMP 1000 OHM 5% 1/4W	01121	CB 1025
A11R12	0683-5125		RESIS-COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R13	0683-5135		RESIS-COMP 51K OHM 5% 1/4W	01121	CB 5135
A11U1	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A11U2	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U3	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U4	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U5	1820-0327	1	IC:TTL QUAD 2-INPT NAND GATE	04713	SN7401N
A11U6	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U7	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A11U8	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
	0610 0207		STANDOFF PRESS IN	28480	0610 0207
A12	05326-60016	1	VOLTMETER INPUT AMPLIFIER ASSY (SERIES 1048A) (LOADED ON 05326-20016 BLANK BOARD)	28480	05326-60016
A12C1	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	1A
A12C2	0160-2307	1	CAPACITOR-FXD MICA 47 PF 5%	28480	0160-2307
A12C3	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	1A
A12C4	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	1A
A12CR2	1901-0376		DIODE-SILICON 35V	28480	1901-0376
A12CR3	1901-0376		DIODE-SILICON 35V	28480	1901-0376
A12CR4	1902-3083	1	DIODE-BREAKDOWN 6.49V 2%	28480	1902-3083
A12CR5	1902-0049		DIODE-BREAKDOWN 6.19V 5%	04713	SZ10939-122
A12CR6	1901-0040		DIODE-SILICON 50 MA 30 NV	07263	FD6100E
A12K1	0490-0853	1	RELAY-REED OHM 1500 VDC	28480	0490-0853
A12K2			NOT ASSIGNED		
A12K3	0490-0764	4	RELAY-REED 0.1 AMP	28480	0490-0764
A12K4	0490-0764		RELAY-REED 0.1 AMP	28480	0490-0764
A12K5	0490-0764		RELAY-REED 0.1 AMP	28480	0490-0764
A12K6	0490-0764		RELAY-REED 0.1 AMP	28480	0490-0764
A12Q1	1850-0099	1	TSTR:SI PNP	80131	2N964
A12Q2			NOT ASSIGNED		
A12Q3	1853-0020	7	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q4	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q5	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q7	1855-0049	1	TSTR:SI FET N-CHANNEL DUAL	28480	1855-0049
A12Q8	1854-0087	2	TSTR:SI NPN	80131	2N3417
A12Q9	1854-0087		TSTR:SI NPN	80131	2N3417
A12Q10	1853-0036	1	TSTR:SI PNP	80131	2N3906
A12R3	0698-7618	14	RESIS-FLM 866K OHM 1.0% 1/4W	28480	0698-7618
A12R4	0698-7618		RESIS-FLM 866K OHM 1.0% 1/4W	28480	0698-7618
A12R5	0686-3045	1	RESIS-COMP 300K OHM 5% 1/2W	01121	EB 3045
A12R6	0698-7618		RESIS-FLM 866K OHM 1.0% 1/4W	28480	0698-7618

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12R7	0698-7616		RESISTOR 464K OHM 1.0% 1/4W	28480	0698-7616
A12R8	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R9	0686-1045		RESISTOR COMP 100K OHM 5% 1/2W	01121	EB 1045
A12R10	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R11	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R12	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R13	0686-1045		RESISTOR COMP 100K OHM 5% 1/2W	01121	EB 1045
A12R14	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R15	0698-7535	1	RESISTOR 56.9K OHM 0.1% 1/8W	28480	0698-7535
A12R16	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R17	0757-0466	1	RESISTOR MET FLM 100K OHM 1% 1/8W	28480	0757-0466
A12R18	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R19	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R20	0698-3152	1	RESISTOR MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A12R21	2100-2503	2	RESVAR CERMET 20K OHM 10% TYPE P	28480	2100-2503
A12R22	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R23	0698-7618		RESISTOR 499K OHM 1.0% 1/4W	28480	0698-7618
A12R24	2100-2503		RESVAR CERMET 20K OHM 10% TYPE P	28480	2100-2503
A12R25	0683-2245	1	RESISTOR COMP 2.2M OHM 5% 1/4W	01121	CB 2245
A12R26	0683-9145		RESISTOR COMP 910K OHM 5% 1/4W	01121	CB 9145
A12R27	0683-1925		RESISTOR COMP 19GO OHM 5% 1/4W	01121	CB 1925
A12R28	0686-1645	1	RESISTOR COMP 160K OHM 5% 1/2W	01121	EB 1645
A12R29	0698-3442	1	RESISTOR MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A12R30	0698-3136	2	RESISTOR MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A12R31	2100-2501	1	RESVAR CERMET 500 OHM 10% TYPE P 1/4W	28480	2100-2501
A12R32	0698-3136		RESISTOR MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A12R33	0683-1035		RESISTOR COMP 10K OHM 5% 1/4W	01121	CB 1035
A12R34	0683-9145		RESISTOR COMP 910K OHM 5% 1/4W	01121	CB 9145
A12U1	1820-0221	4	INTEGRATED CIRCUIT(OPERATIONAL AMPL.	28480	1820-0221
A13	05326-60017	1	VOLTMETER V-F CONVERTER ASSY (SERVES 1C12A) (LOADED ON 05326-60017 BLANK BOARD)	28480	05326-60017
A13C1	0180-0197		CAPACITOR 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A13C2	0180-0197		CAPACITOR 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A13C3	0180-0197		CAPACITOR 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A13C4	0180-0197		CAPACITOR 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A13C5	0160-2150		CAPACITOR MICA 33 PF 5%	28480	0160-2150
A13C6	0160-2150		CAPACITOR MICA 33 PF 5%	28480	0160-2150
A13C7	0160-2636		CAPACITOR CER 0.01 UF +80-20% 100VDCW	56289	TA
A13C8	C170-0055		CAPACITOR 0.10UF 20% 200VDCW	56289	192P10402
A13C9	0160-2150		CAPACITOR MICA 33 PF 5%	28480	0160-2150
A13C10	0170-0055		CAPACITOR 0.10UF 20% 200VDCW	56289	192P10402
A13C11	0160-2150		CAPACITOR MICA 33 PF 5%	28480	0160-2150
A13C13	0160-2264	1	CAPACITOR CER 5.7 PF 500VDCW	72982	301-000-C0J-5R7-D
A13CR1	1902-0660	2	DIODE-ZENER REF. 200UC TYPE	04713	1N827
A13CR2	1901-0040		DIODE-SWITCHING 50 MA 30 NV	07263	FDH1C44
A13CR3	1901-0040		DIODE-SWITCHING 50 MA 30 NV	07263	FDH1C44
A13CR4	1902-0660		DIODE-ZENER REF. JEDEC TYPE	04713	1N827
A13CR5	1901-0179	5	DIODE-SWITCHING 15NV	28480	1901-0179
A13CR6	1901-0179		DIODE-SWITCHING 15NV	28480	1901-0179
A13CR7	1901-0535		DIODE-SCHOTTKY HOT CARRIER	28480	1901-0535
A13CR8	1901-0179		DIODE-SWITCHING 15NV	28480	1901-0179
A13CR9	1901-0040		DIODE-SWITCHING 50 MA 30 NV	07263	FDH1C44
A13CR10	1901-0040		DIODE-SWITCHING 50 MA 30 NV	07263	FDH1C44
A13CR11	1901-0040		DIODE-SWITCHING 50 MA 30 NV	07263	FDH1C44
A13CR12	1901-0179		DIODE-SWITCHING 15NV	28480	1901-0179
A13CR13	1901-0179		DIODE-SWITCHING 15NV	28480	1901-0179
A13Q1	1854-0071		TRANSIS NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13Q2	1853-0020		TRANSIS PNP(SELECTED FROM 2N3702)	28480	1853-0020
A13Q3	1855-0056	1	TRANSIS FET	80131	2N5196
A13Q4	1855-0081	1	TRANSIS FET	80131	2N5246
A13Q5	1854-0009		TRANSIS NPN	80131	2N709
A13Q6	1854-0092		TRANSIS NPN	80131	2N3565
A13Q7	1854-0092		TRANSIS NPN	80131	2N3565
A13Q8	1854-0092		TRANSIS NPN	80131	2N3565
A13Q9	1854-0092		TRANSIS NPN	80131	2N3565
A13Q10	1854-0071		TRANSIS NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13R1	0683-1525		RESISTOR COMP 1500 OHM 5% 1/4W	01121	CB 1525
A13R2	C757-0421	2	RESISTOR MET FLM 8.5 OHM 1% 1/8W	28480	0757-0421

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13R3	0757-0421		RESIS MET FLM 100 OHM 1% 1/8W	24546	0757-0421
A13R4	0698-3155		RESIS COMP 1.00K OHM 5% 1/4W	C1121	CB 1025
A13R5	0698-3227		RESIS COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A13R6	0698-3227		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A13R7	0698-3160	1	RESIS MET FLM 31.6K OHM 1% 1/8W	24546	0757-0160
			FACTORY SELECTED PART		
A13R8	0757-0458	2	RESIS MET FLM 75 OHM 1% 1/8W	24546	C757-0458
A13R9	C757-0199		RESIS MET FLM 75 OHM 1% 1/8W	24546	C757-0199
A13R10	0698-3160		RESIS MET FLM 31.6K OHM 1% 1/8W	24546	C698-3160
			FACTORY SELECTED PART		
A13R11	0698-7610	5	RESIS FLM 1.78K OHM 0.1% 1/8W	24546	C698-7610
A13R12	C757-0184	1	RESIS FLM 40 OHM 1% 1/8W	24546	C757-0184
A13R13	C757-0396		RESIS FLM 40 OHM 1% 1/8W	24546	C757-0396
A13R14	0698-7610		RESIS FLM 1.78K OHM 0.1% 1/8W	24546	C698-7610
A13R15	2100-2705	1	RESVAR CERMET 1K OHM 10% TYPE P 1/2W	24546	2100-2705
A13R16	2100-2705		RESVAR CERMET 1K OHM 10% TYPE P 1/2W	24546	2100-2705
A13R17	0698-7610		RESIS FLM 1.78K OHM 0.1% 1/8W	24546	C698-7610
A13R18	0683-3325		RESIS COMP 3300 OHM 5% 1/4W	C1121	CB 3325
A13R19	0698-7610		RESIS FLM 1.78K OHM 0.1% 1/8W	24546	C698-7610
A13R20	0683-2225		RESIS COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A13R21	0683-2225		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A13R22	0683-4715		RESIS COMP 470 OHM 5% 1/4W	C1121	CB 4715
A13R23	0683-3325		RESIS COMP 3300 OHM 5% 1/4W	C1121	CB 3325
A13R24	0683-1025		RESIS COMP 1000 OHM 5% 1/4W	01121	CB 1025
A13R25	C683-3915		RESIS COMP 390 OHM 5% 1/4W	C1121	CB 3915
A13R26	0683-6815		RESIS COMP 680 OHM 5% 1/4W	01121	CB 6815
A13R27	0683-1025		RESIS COMP 1000 OHM 5% 1/4W	01121	CB 1025
A13R28	0683-3615	2	RESIS COMP 360 OHM 5% 1/4W	01121	CB 3615
A13R29	0683-3615		RESIS COMP 360 OHM 5% 1/4W	C1121	CB 3615
A13R30	0683-3615		RESIS COMP 360 OHM 5% 1/4W	C1121	CB 3615
A13R31	0683-2225		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A13R32	0683-1025		RESIS COMP 1000 OHM 5% 1/4W	C1121	CB 1025
A13R33	C683-4725		RESIS COMP 4700 OHM 5% 1/4W	C1121	CB 4725
A13R34	0683-3915		RESIS COMP 390 OHM 5% 1/4W	C1121	CB 3915
A13R35	0683-3325		RESIS COMP 3300 OHM 5% 1/4W	01121	CB 3325
A13R36	0683-3325		RESIS COMP 3300 OHM 5% 1/4W	01121	CB 3325
A13R37	0683-2225		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A13R38	0683-1025		RESIS COMP 1000 OHM 5% 1/4W	C1121	CB 1025
A13R39	C683-4725		RESIS COMP 4700 OHM 5% 1/4W	C1121	CB 4725
A13R40	0683-3915		RESIS COMP 390 OHM 5% 1/4W	C1121	CB 3915
A13R41	0683-3325		RESIS COMP 3300 OHM 5% 1/4W	01121	CB 3325
A13U1	1820-0223		INTEGRATED CIRCUIT OPERATIONAL AMPL.	24546	1820-0223
A13U2	1820-0223		INTEGRATED CIRCUIT OPERATIONAL AMPL.	24546	1820-0223
A13U3	1820-0223		INTEGRATED CIRCUIT OPERATIONAL AMPL.	24546	1820-0223
A13U4	1820-0412		SCHOTT QUAD LINE RECEIVER	04713	MC1039
A13U5	1820-0413	1	SCHOTT QUAD R-S FF	04713	MC1093F
A13U6	1820-0276	1	INTEGRATED CIRCUIT DIGITAL	04713	MC 1039F
A13U7	1820-0145		SCHOTTKY QUAD 2-INPUT NOR GATE	24546	1820-0145
A13U8	1820-0209	1	INTEGRATED CIRCUIT DIGITAL	24546	1820-0209
A14	05326-60011	1	VOLTMETER DISPLAY CONTROL ASSY	28480	05326-60011
			INCLUDES: (####)		
			ASSEMBLY A (5326-60015 REAR P ASSY		
A14CR1	1910-0016		DIODE 50 PIV	24546	1910-0016
A14CR2	1910-0016		DIODE 50 PIV	24546	1910-0016
A14CR3	1910-0016		DIODE 50 PIV	24546	1910-0016
A14CR4	1910-0016		DIODE 50 PIV	24546	1910-0016
A14CR5	1910-0016		DIODE 50 PIV	24546	1910-0016
A14CR6	1910-0016		DIODE 50 PIV	24546	1910-0016
A14CR7	1910-0016		DIODE 50 PIV	24546	1910-0016
A14R1	0683-2225		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A14R2	0683-2225		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A14R3	0698-3435		RESIS COMP 10K OHM 5% 1/4W	C1121	CB 1035
A14R4	C698-3435		RESIS COMP 100K OHM 5% 1/4W	C1121	CB 1045
A14R5	0683-2225		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A14R6	C683-2225		RESIS COMP 2.2K OHM 5% 1/4W	C1121	CB 2225
A14U1	1820-0413		SCHTTL OCTACT GIVEUEP 1.25 MHZ MIN.	24546	1820-0413
A14U2	1820-0056		SCHOTT QUAD 2-INPUT GATE	04713	SL83010B
A14U3	1820-0056		SCHOTT QUAD 2-INPUT GATE	04713	SL83010B
A14U4	1820-0274		SCHOTT QUAD J-K FLIP-FLOP GATE	24546	1820-0274
A14U5	1820-0274		SCHOTT QUAD J-K FLIP-FLOP GATE	24546	1820-0274
A14U6	1820-0213		SCHOTT QUAD 2-INPUT AND GATE	24546	1820-0213
A14U7	1820-0274		SCHOTT QUAD J-K FLIP-FLOP GATE	24546	1820-0274

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16	05327-60020	1	BOARD ASSY POWER SUPPLY (SERIES 1426A) (LEADED ON 05326-60020 BLANK BOARD)	28480	05327-60020
	0510-0207		NUT,CAPTIVE 4-40 X 0.188 LG	28480	0510-0207
	2200-0145	3	SCREW,PAN HD POZI DR 4-40 X 0.438	00000	OPD
	5040-0409	1	SPACER,SHIELD	28480	5040-0409
A15C1	0160-0163	1	CAPAC MY 0.033 UF 10% 200VDCW	56289	192P33392-PF5
A15C2	0180-0114		CAPAC ELECT 4.0 UF +100-10% 25VDCW	28480	0180-0114
A15C3	0180-0114		CAPAC ELECT 4.0 UF +100-10% 25VDCW	28480	0180-0114
A15C4	0180-0114		CAPAC ELECT 4.0 UF +100-10% 25VDCW	28480	0180-0114
A15C5	0180-0114		CAPAC ELECT 4.0 UF +100-10% 25VDCW	28480	0180-0114
A15C6	0160-3878	28	CAPAC CER 1000 PF 20% 100VDCW	60031	CW205X7R102M
A15C7	0160-3878		CAPAC CER 1000 PF 20% 100VDCW	60031	CW205X7R102M
A15C8	0160-3277	2	CAPAC CER 0.01 UF 20% 50VDCW	56733	6504BX103M
A15C9	0160-3277		CAPAC CER 0.01 UF 20% 50VDCW	56733	6504BX103M
A15CR1	1902-3002	2	DIODE BREAKDOWN 2.37V 5%	28480	1902-3002
A15CR2	1902-0551	2	DIODE BREAKDOWN 6.19V 5%	28480	1902-0551
A15CR3	1902-0551		DIODE BREAKDOWN 6.19V 5%	28480	1902-0551
A15CR4	1902-3002		DIODE BREAKDOWN 2.37V 5%	28480	1902-3002
A15CR5	1901-0040		DIODE,SILICON 50 MA 30 NV	07263	FDG1088
A15CR6	1902-3094	4	DIODE BREAKDOWN 5.11V 2%	28480	1902-3094
A15CR7	1902-3094		DIODE BREAKDOWN 5.11V 2%	28480	1902-3094
A15CR8	1901-0040		DIODE,SILICON 50 MA 30 NV	07263	FDG1088
A15CR9	1902-3094		DIODE BREAKDOWN 5.11V 2%	28480	1902-3094
A15CR10	1902-3094		DIODE BREAKDOWN 5.11V 2%	28480	1902-3094
A15CR11	1902-3354	1	DIODE BREAKDOWN 75 V 2%	28480	1902-3354
A15CR12	1902-3429	1	DIODE BREAKDOWN 100 V 2%	28480	1902-3429
A15CR13	1901-0033	2	DIODE,SILICON 100MA 180NV	07263	FD3165
A15CR14	1901-0033		DIODE,SILICON 100MA 180NV	07263	FD3165
A15CR15	1901-0044	4	DIODE,SILICON 20MA/1V	28480	1901-0044
A15CR16	1901-0044		DIODE,SILICON 20MA/1V	28480	1901-0044
A15CR17	1901-0044		DIODE,SILICON 20MA/1V	28480	1901-0044
A15CR18	1901-0044		DIODE,SILICON 20MA/1V	28480	1901-0044
A15F1	2110-0487	1	FUSE,1/20 AMP	28480	2110-0487
A15Q1	1854-0300	1	TSTR,SI NPN	28480	1854-0300
A15Q1	1205-0018	2	HEAT SINK,SEMICONDUCTOR	05820	203-CB
A15Q2	1853-0073	1	TSTR,SI PNP	28480	1853-0073
A15Q2	1205-0018		HEAT SINK,SEMICONDUCTOR	05820	203-CB
A15Q3	1854-0039	1	TSTR,SI NPN	80131	2N3053
A15Q3	1205-0033	2	HEAT SINK,SEMICONDUCTOR	05820	207-CB
A15Q4	1853-0012	1	TSTR,SI PNP	80131	2N2904A
A15Q4	1205-0033		HEAT SINK,SEMICONDUCTOR	05820	207-CB
A15Q5	1854-0232	1	TSTR,SI NPN,SELECTED FROM 2N3440	28480	1854-0232
A15Q5	1205-0061	1	HEAT SINK,SEMICONDUCTOR	05820	209-CB
A15Q6	1853-0020		TSTR,SI PNP,SELECTED FROM 2N3702	28480	1853-0020
A15Q7	1854-0071		TSTR,SI NPN,SELECTED FROM 2N3704	28480	1854-0071
A15Q8	1854-0474		TSTR,SI NPN	28480	1854-0474
A15Q9	1854-0071		TSTR,SI NPN,SELECTED FROM 2N3704	28480	1854-0071
A15Q10	1853-0020		TSTR,SI PNP,SELECTED FROM 2N3702	28480	1853-0020
A15R1	0683-2735		RESD COMP 27K OHM 5% 1/4W	01121	CB 2735
A15R2	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A15R3	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A15R4	0683-3925		RESD COMP 3900 OHM 5% 1/4W	01121	CB 3925
A15R5	0683-3925		RESD COMP 3900 OHM 5% 1/4W	01121	CB 3925
A15R6	0698-8476	1	RESD COMP 82 OHM 5% 1/2W	01121	EB 8205
A15R7	0683-6815		RESD COMP 680 OHM 5% 1/4W	01121	CB 6815
A15R8	0683-6815		RESD COMP 680 OHM 5% 1/4W	01121	CB 6815
A15R9	0683-1325	2	RESD COMP 1300 OHM 5% 1/4W	01121	CB 1325
A15R10	2100-2093	2	RESVAR COMP 200 OHM 30% LIN 1/8W	28480	2100-2093
A15R11	0683-6815		RESD COMP 680 OHM 5% 1/4W	01121	CB 6815
A15R12	0683-6815		RESD COMP 680 OHM 5% 1/4W	01121	CB 6815
A15R13	2100-2093		RESVAR COMP 200 OHM 30% LIN 1/8W	28480	2100-2093
A15R14	0683-1325		RESD COMP 1300 OHM 5% 1/4W	01121	CB 1325
A15R15	0683-2765	4	RESD COMP 2.7 OHM 5% 1/4W	01121	CB 2765
A15R16	0683-2765		RESD COMP 2.7 OHM 5% 1/4W	01121	CB 2765
A15R17	0683-2765		RESD COMP 2.7 OHM 5% 1/4W	01121	CB 2765
A15R18	0683-2765		RESD COMP 2.7 OHM 5% 1/4W	01121	CB 2765
A15XF1	1251-3206	2	SOCKET, MINIATURE SINGLE	00779	2-331272-7

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16	05327-60027	1	BOARD ASSY CONNECTOR (SERIES 1224A) (LOADED ON 05327-60027 BLANK BOARD)	28480	05327-60027
A16C1	C [illegible]	1	CERAMIC FIXED 4000 PF +75-10% 150VDCW	28480	0160-2182
A16C2	C [illegible]	1	CERAMIC FIXED 4000 PF +75-10% 150VDCW	[illegible]	150D167-050P5E3
A16C3	C [illegible]	1	CERAMIC AL ELECT 15 UF +50-10% 250VDCW	[illegible]	150D156X5250J3-CSR
A16C4	C [illegible]	1	CERAMIC AL ELECT 1500 UF +75-10% 10VDCW	56289	150D153
A16C5	C [illegible]	1	CERAMIC AL ELECT 1500 UF +75-10% 10VDCW	56289	150D153
A16C6	C [illegible]		CERAMIC MICA 1000PF 5%	[illegible]	RDM15E102J3K
A16CR1	1910-0016		DIODE GEGE 60 PIV	28480	1910-0016
A16CR2	1910-0016		DIODE GEGE 60 PIV	28480	1910-0016
A16CR3	1910-0016		DIODE GEGE 60 PIV	28480	1910-0016
A16CR4	1901-0518	2	DIODE SILICON 0.75A 400PIV	04713	SR1554-5
A16CR5	1901-0028		DIODE SILICON 0.75A 400PIV	04713	SR1554-5
A16CR6	1901-0029	4	DIODE SILICON 600 PIV	28480	1901-0029
A16CR7	1901-0029		DIODE SILICON 600 PIV	28480	1901-0029
A16CR8	1901-0029		DIODE SILICON 600 PIV	28480	1901-0029
A16CR9	1901-0029		DIODE SILICON 600 PIV	28480	1901-0029
A16CR10	1901-0415	4	DIODE SILICON 50 PIV 3A	28480	1901-0415
A16CR11	1901-0415		DIODE SILICON 50 PIV 3A	28480	1901-0415
A16CR12	1901-0415		DIODE SILICON 50 PIV 3A	28480	1901-0415
A16CR13	1901-0415		DIODE SILICON 50 PIV 3A	28480	1901-0415
A16CR14	1910-0016		DIODE GEGE 60 PIV	28480	1910-0016
A16CR15	1910-0016		DIODE GEGE 60 PIV	28480	1910-0016
A16CR16	1901-0460	2	DIODE SILICON 4-JUNCTION STABISTOR	03508	SD521
A16CR17	1901-0460		DIODE SILICON 4-JUNCTION STABISTOR	03508	SD521
A16CR18	1910-0034	1	DIODE GERMANIUM 20V	28480	1910-0034
A16G1	1854-0069		TRANSISTOR NPN	80131	2N709
A16R1	0812-0021	2	RESISTOR WW 0.47 OHM 5% 3W	28480	0812-0021
A16R2	0812-0021		RESISTOR WW 0.47 OHM 5% 3W	28480	0812-0021
A16R3	0686-2065	1	RESISTOR COMP 2000K OHM 5% 1/4W	01121	EB 2065
A16R4	0683-0825	1	RESISTOR COMP 8.2 OHM 5% 1/4W	01121	CB 8265
A16R5	0683-1025		RESISTOR COMP 1000 OHM 5% 1/4W	01121	CB 1025
A16R6	0698-3135		RESISTOR COMP 130 OHM 5% 1/4W	01121	CB 5135
A16R7	0698-3153	2	RESISTOR MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A16R8	0757-0439	1	RESISTOR MET FLM 6.66K OHM 1% 1/8W	28480	0757-0439
A16U1	1826-0156	1	IC LINEAR VOLTAGE REGULATOR (INPUT)	28480	1820-0156
A16XA1			NOT ASSIGNED		
A16XA2	1251-1886	11	CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA3	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA4	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA5	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA6	1251-2134	4	CONNECTOR (2310) 36 CONTACTS	71785	252-18-30-340
A16XA7	1251-2134		CONNECTOR (2310) 36 CONTACTS	71785	252-18-30-340
A16XA8	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA9	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA10	1251-2134		CONNECTOR (2310) 36 CONTACTS	71785	252-18-30-340
A16XA11	1251-2134		CONNECTOR (2310) 36 CONTACTS	71785	252-18-30-340
A16XA12	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA13	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA14	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA15	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A16XA16			NOT ASSIGNED		
A16XA17			NOT ASSIGNED		
A16XA18	1251-1886		CONNECTOR 30-CONTACT (2315)	71785	252-15-30-340
A17	05326-60031	1	BOARD ASSY (INPUT C AMPLIFIER (SERIES 1312A) 5326B ONLY (LOADED ON 05326-20031 BLANK BOARD)	28480	05326-60031
A17C1	0180-0197		CERAMIC ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A17C2	0180-0197		CERAMIC ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A17C3	0160-2049	4	CERAMIC CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A17C4	0160-2049		CERAMIC CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A17C5	0160-3878		CERAMIC CER 1000 PF 20% 100VDCW	80031	CW205X7R102M
A17C6	0180-0106	2	CERAMIC ELECT 60 UF 20% 6VDCW	28480	0180-0106
A17C7	0160-3878		CERAMIC CER 1000 PF 20% 100VDCW	80031	CW205X7R102M
A17C8	0180-0106		CERAMIC ELECT 60 UF 20% 6VDCW	28480	0180-0106
A17C9	0150-0055	2	CERAMIC TI DIOXIDE 10 PF 5% 500VDCW	78488	TYPE GA
A17C10	0160-3878		CERAMIC CER 1000 PF 20% 100VDCW	80031	CW205X7R102M
A17C11	0150-0045	1	CERAMIC TI 8.2 PF 5% 500VDCW	78488	TYPE GA
A17C12	0150-0055		CERAMIC TI DIOXIDE 10 PF 5% 500VDCW	78488	TYPE GA
A17C13	0160-3878		CERAMIC CER 1000 PF 20% 100VDCW	80031	CW205X7R102M
A17CR1	1901-0047	2	DIODE JUNCTION SILICON 20PIV	28480	1901-0047
A17CR2	1901-0047		DIODE JUNCTION SILICON 20PIV	28480	1901-0047
A17CR3	1902-0009	1	DIODE TUNNEL GERMANIUM 1N3712	01930	1N3712 SPEC

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1J1	1250-0836	2	CONNECTOR-RF SUB-MINIATURE	98291	50-651-0000
A1L1	9100-2255	1	COIL CHOKE 1.60 UH 10%	55680	1025-24
A1L2	9100 2260		COIL CHOKE RF 1.80 UH 10%	82142	09-4436-3K
A1L3	9140-0142		COIL/FERRO RF 2.20 UH 10%	82142	09-4436-4K
A1L4	9100-2256	1	COIL/FERROX 0.56 UH 10%	13015	01-4426-3K
A1Q1	1853-0035		TSTR:SI PNP	80131	2N3640
A1Q2	1853-0035		TSTR:SI PNP	80131	2N3640
A1Q3	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q4	1854-0345		TSTR:SI NPN	80131	2N5179
A1R1	0760-0012	1	RESD MET OX 51 OHM 2% 1W	28480	0760-0012
A1R2	0758-0093	1	RESD MET OX 56 OHM 5% 1/4W	28480	0758-0093
A1R3	0683-1045		RESD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A1R4	0683-7515		RESD COMP 750 OHM 5% 1/4W	01121	CB 7515
A1R5	0683-1515		RESD COMP 150 OHM 5% 1/4W	01121	CB 1515
A1R6	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A1R7	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A1R8	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A1R9	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A1R10	0683-2215		RESD COMP 220 OHM 5% 1/4W	01121	CB 2215
A1R11	2100-2633	2	RVAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A1R12	0683-2015	3	RESD COMP 200 OHM 5% 1/4W	01121	CB 2015
A1R13	0683-2015		RESD COMP 200 OHM 5% 1/4W	01121	CB 2015
A1R14	0683-1515		RESD COMP 150 OHM 5% 1/4W	01121	CB 1515
A1R15	0683-5105		RESD COMP 51 OHM 5% 1/4W	01121	CB 5105
A1R16	0683-7515		RESD COMP 750 OHM 5% 1/4W	01121	CB 7515
A1R17	0683-1045		RESD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A1R18	0683-1225		RESD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1R19	0683-3625		RESD COMP 3600 OHM 5% 1/4W	01121	CB 3625
A1R21	0698-3153		RESD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R22	0757-0284	1	RESD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A1R23	0757-0280	1	RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R24	0683-4715		RESD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R25	0683-5615		RESD COMP 560 OHM 5% 1/4W	01121	CB 5615
A1R26	0757-0416	1	RESD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A1U1	1858-0004	1	TSTR ARRAY:SI NPN DUAL DIFF. AMPL.	28480	1858-0004
A1U2	1820-0147		ECIECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
	05326-00031	1	SHIELD:DIECAST	28480	05326-00031
A1A	05327-60033	1	BOARD ASSY:HIGH SENSITIVITY PRESCALER	28480	05327-60033
			(SERIES 1484A) ORDERED ON 05327-21033 BLANK BOARD)		
A1C1	0180-0228		CPRD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C2	0160-2049		CPRD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A1C3	0160-3879	6	CPRD CER 0.01 UF 20% 100VDCW	72982	8121-8112-X7R-103M
A1C4	0160-2049		CPRD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A1C5	0180-0228		CPRD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C6	0160-3879		CPRD CER 0.01 UF 20% 100VDCW	72982	8121-8112-X7R-103M
A1C7	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C8	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C9	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C10	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C11	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C12	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C13	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C14	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C15	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C16	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C17	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C18	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C19	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C20	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C21	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C22	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C23	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C24	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C25	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C26	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C27	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1C28	0160-3879		CPRD CER 0.01 UF 20% 100VDCW	72982	8121-8112-X7R-103M
A1C29	0160-3878		CPRD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A1CR1	1901-0050	2	DIODE:SI .00 MA AT 1V	07263	FDA 6308
A1CR2	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18CR3	1901-0040		DIODE-SILICON 50 MA 30 WV	07263	FD6108
A18CR4	1901-0040		DIODE-SILICON 50 MA 30 WV	07263	FD6108
A18CR5	1901-0040		DIODE-SILICON 50 MA 30 WV	07263	FD6108
A18CR6	1901-0040		DIODE-SILICON 50 MA 30 WV	07263	FD6108
A18F1	2110-0436	2	FUSE 1/10 AMP 125V	28480	2110-0436
A18F2	2110-0436		FUSE 1/10 AMP 125V	28480	2110-0436
A18J1	1250-0816		CONNECTOR-RF SUB-MINIATURE	98291	50-053-0000
A18L1	9100-1788	2	COIL-RF CHOKE	02114	VK200-10/4B
A18L2	9100-1788		COIL-RF CHOKE	02114	VK200-10/4B
A18Q1	1854-0345		TRANSISTOR NPN	80131	2N5179
A18Q2	1854-0092		TRANSISTOR NPN	80131	2N3563
A18R1	0683-1025		RESISTOR 1000 OHM 5% 1/4W	01121	CB 1025
A18R2	0698-5996	2	RESISTOR 560 OHM 5% 1/8W	28480	0698-5996
A18R3	2100-2633		RESISTOR-TRMR 1K OHM 10% LIN 1/2W	28480	2100-2633
A18R4	0683-3925		RESISTOR 39000 OHM 5% 1/4W	01121	CB 3925
A18R5	0698-3378	5	RESISTOR 51 OHM 5% 1/8W	28480	0698-3378
A18R6	0698-3378		RESISTOR 51 OHM 5% 1/8W	28480	0698-3378
A18R7	0698-3111	5	RESISTOR 30 OHM 5% 1/8W	28480	0698-3111
A18R8	0683-1025		RESISTOR 1000 OHM 5% 1/4W	01121	CB 1025
A18R9	0683-2015		RESISTOR 200 OHM 5% 1/4W FACTORY SELECTED VALUE	01121	CB 2015
A18R10	2100-2413	2	RESISTOR-TRMR 200 OHM 10% LIN 1/2W	28480	2100-2413
A18R11	0698-6283	2	RESISTOR 10 OHM 5% 1/8W	01121	BB 1005
A18R12	0683-1505	2	RESISTOR 15 OHM 5% 1/4W	01121	CB 1505
A18R13	0698-3374	4	RESISTOR 20 OHM 5% 1/8W	28480	0698-3374
A18R14			NOT ASSIGNED		
A18R15	0698-5180		RESISTOR 2R OHM 5% 1/8W	28480	0698-5180
A18R16	0698-3378		RESISTOR 51 OHM 5% 1/8W	28480	0698-3378
A18R17	0698-3374		RESISTOR 20 OHM 5% 1/8W	28480	0698-3374
A18R18	0683-4315	5	RESISTOR 430 OHM 5% 1/4W	01121	CB 4315
A18R19	0698-5180		RESISTOR 2R OHM 5% 1/8W	28480	0698-5180
A18R20	0698-3111		RESISTOR 30 OHM 5% 1/8W	28480	0698-3111
A18R21	0698-5996		RESISTOR 560 OHM 5% 1/8W	28480	0698-5996
A18R22	0698-4131	4	RESISTOR 56 OHM 5% 1/8W	28480	0698-4131
A18R23	0698-4131		RESISTOR 56 OHM 5% 1/8W	28480	0698-4131
A18R24	0698-3111		RESISTOR 30 OHM 5% 1/8W	28480	0698-3111
A18R25	0683-1025		RESISTOR 1000 OHM 5% 1/4W	01121	CB 1025
A18R26	0683-1015		RESISTOR 100 OHM 5% 1/4W FACTORY SELECTED VALUE	01121	CB 1015
A18R27	2100-2413		RESISTOR-TRMR 200 OHM 10% LIN 1/2W	28480	2100-2413
A18R28	0698-6283		RESISTOR 10 OHM 5% 1/8W	01121	BB 1005
A18R29	0698-5177	2	RESISTOR 820 OHM 5% 1/8W	28480	0698-5177
A18R30	0698-5177		RESISTOR 820 OHM 5% 1/8W	28480	0698-5177
A18R31	0683-1505		RESISTOR 15 OHM 5% 1/4W	01121	CB 1505
A18R32			NOT ASSIGNED		
A18R33	0698-3374		RESISTOR 20 OHM 5% 1/8W	28480	0698-3374
A18R34	0698-8073	1	RESISTOR 1.6K OHM 5% 1/8W	01121	BB 1625
A18R35	0698-3378		RESISTOR 51 OHM 5% 1/8W	28480	0698-3378
A18R36	0698-3111		RESISTOR 30 OHM 5% 1/8W	28480	0698-3111
A18R37	0698-3378		RESISTOR 51 OHM 5% 1/8W	28480	0698-3378
A18R38	0698-3374		RESISTOR 20 OHM 5% 1/8W	28480	0698-3374
A18R39	0683-4315		RESISTOR 430 OHM 5% 1/4W	01121	CB 4315
A18R40	0698-4131		RESISTOR 56 OHM 5% 1/8W	28480	0698-4131
A18R41	0698-5563	1	RESISTOR 180 OHM 5% 1/8W	28480	0698-5563
A18R42	0698-4131		RESISTOR 56 OHM 5% 1/8W	28480	0698-4131
A18R43	0698-3111		RESISTOR 30 OHM 5% 1/8W	28480	0698-3111
A18R44	0698-3113		RESISTOR 100 OHM 5% 1/8W	28480	0698-3113
A18R45			NOT ASSIGNED		
A18R46	0683-1025		RESISTOR 1000 OHM 5% 1/4W	01121	CB 1025
A18R47	0683-3905	1	RESISTOR 39 OHM 5% 1/4W	01121	CB 3905
A18R48	0683-8215	1	RESISTOR 820 OHM 5% 1/4W	01121	CB 8215
A18R49	0683-1025		RESISTOR 1000 OHM 5% 1/4W	01121	CB 1025
A18R50	0683-4315		RESISTOR 430 OHM 5% 1/4W	01121	CB 4315
A18R51	0683-4315		RESISTOR 430 OHM 5% 1/4W	01121	CB 4315
A18R52	0683-4315		RESISTOR 430 OHM 5% 1/4W	01121	CB 4315
A18R53			NOT ASSIGNED		
A18U1	5088-7602	1	IC-LIMITER	28480	5088-7602
A18U2	1826-0084	1	IC-LINEAR	28480	1826-0084
A18U2 OR	1826 0085	1	IC LINEAR	28480	1826 0085
A18U3	1826 0161	1	IC LINEAR	28480	1826 0161
A18U4 OR	1820 0736	1	IC DIGITAL	28480	1820 0736
A18U4	1820 0668	1	IC DUAL BINARY	28480	1820 0668
A18U5	1820 0714	1	IC DIGITAL QUINARY DIVIDER	28480	1820 0714
A18U6	1820 0489		IC ECL	28480	1820 0489
A18U7	1821 0001	2	TRANSISTOR ARRAY SI NPN	02735	CA3046
A18U8	1821 0001		TRANSISTOR ARRAY SI NPN	02735	CA3046

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1805	1820-0802	1	[illegible]	04713	MC1031P1
			CHASSIS PARTS		
M1	3150-0035	1	FILTER,FAN	28480	3150-0035
M1	3140-0030	1	MOTOR,SHADED POLE	28480	3140-0030
B1	3160-0035	1	FAN,IMPELLER AXIAL 2-1/4 DIAM	04713	2 1/4 RMF 1,5 *
H1	5212A-1L6	1	BRACKET,FAN	28480	5212A-1L6
C1	0160-1063	1	CAPACITOR-FXD 2 UF 0.00% UP +0% 250VAC	56289	250D247A-C1UU
F1	2110-0030	1	FUSE,3.0A 250V SLOW-BLOW	75915	313.030CT
F1	2110-0304	1	FUSE,CARTRIDGE 1.5 AMP 250V SLOW-BLOW	71400	MDX-1-1/4A
F1	1400-0084	1	FUSEHOLDER,EXTRACTOR POST TYPE	75915	342014
J1	1510-0075	1	BINDING POST ASSY,BLACK	28480	1510-0075
J1	1510-0074	1	BINDING POST ASSY,SAFETY RED INSULATOR	28480	1510-0074
J2	1250-1293	5	CONNECTOR,BNC MOUNT JACK	24931	28JR154-1
J3	1250-1293		CONNECTOR,BNC MOUNT JACK	24931	28JR154-1
J4	1250-1293		CONNECTOR,BNC MOUNT JACK	24931	28JR154-1
J5	1250-1293		CONNECTOR,BNC MOUNT JACK	24931	28JR154-1
J6	1250-1293		CONNECTOR,BNC MOUNT JACK	24931	28JR154-1
J8	1251-2317	1	SOCKET,3-PIN MALE POWER RECEPTACLE	00779	1-41-101
J11	1250-0212	1	CONNECTOR,JACK CHASSIS BNC	55339	31069-1
P1	5060-0109	2	CONNECTOR,25 CONTACTS	28480	5060-0109
Q1	1853-0211	1	TRANSI PNP	04713	TIP 32
Q1	0532?-20024	2	HEAT SINK FOR Q1 AND Q2	28480	0[illegible]-20024
Q2	1854-0220	1	TRANSI NPN	28480	1854-0220
Q2	05327-20024		HEAT SINK FOR Q1 AND Q2	28480	05327-20024
R1	2100-3561	1	RVAR,COMP 1 MEGOHM TOT TO CLOG 12TM	28480	2100-3561
R1	0811?0-67401	2	PAIR ASSY	28480	0811?0-67401
S1			PART OF A1		
S2	3101-1555	2	SWITCH,SLIDE DPST 6.5A 125V AC/DC (FAST-NORM-HOLD)	28480	3101-1555
S3	3101-1216	1	SWITCH,PUSHBUTTON DPST (PRESET)	62705	55-1016
S4	3101-1555		SWITCH,SLIDE DPST 6.5A 125V AC/DC (RANGE)	28480	3101-1555
S5	05326-60018	1	SWITCH ASSY,TIME BASE(WIRED)	28480	05326-60018
S6	05326-60070	1	SWITCH ASSY,FUNCTION (WIRED) 6326B	28480	05326-60070
S6	05327-60017	1	SWITCH ASSY,FUNCTION (WIRED) 6327B	28480	05327-60017
S7	3101-1556		SWITCH,SLIDE DPDT MINIATURE (LOCK-INTERLOCK)	28480	3101-1556
S8	3101-1556		SWITCH,SLIDE DPDT MINIATURE (STORAGE)	28480	3101-1556
S9	3101-1216	1	SWITCH,SLIDE DPDT (SELECTOR 115V,60V)	62705	55-1016
T1	9100-3020	1	TRANSFORMER,POWER	28480	9100-3020
			OTHER CABINET PARTS		
	0460-0114	12	FOOT,CYLINDRICAL POLYURETHANE 0.625 IN HIGH	04713	SC5A0111-2
	1490-0010	1	STAND,TILT	28480	1490-0010
	5000-0010	2	TRIM,SIDE	28480	5000-0010
	5060-0329	2	FRAME ASSY,REAR SIDE	28480	5060-0329
	5060-0367	1	SEAL ASSY,FAN	28480	5040-0367
	05326-00001	1	PANEL,FRONT	28480	05327-00001
	05326-00012	1	PANEL,REAR	28480	05327-00012
	05326-00008	1	INSULATOR	28480	05326-00008
	05326-00011	1	FOOT,FOLDABLE (BOTTOM COVER)	28480	05326-00011
	06327-20016		WINDOW,6322B		
	05326-20006	1	WINDOW,6326B	28480	05327-20006
	7120-1256	1	TRADEMARK,HP LOGO	28480	7120-1256
			PAINTED CABINET PARTS		
	05327-00004	1	COVER,BOTTOM(OPT A5E)	28480	05327-00004
	05326-00033	1	OUTER COVER	28480	05330-00033
	05327-00006	1	PANEL,FRONT PANEL TRIM(OPT A05 X06	28480	05327-00006
	05327-00007	1	PANEL,RIGHT FRONT TRIM(6322B)STANDARD	28480	05327-00007
	05326-00026	1	PANEL,RIGHT FRONT TRIM(6326B)STANDARD	28480	05326-00026
	05326-00025	1	PANEL,LEFT FRONT TRIM(STANDARD)	28480	05326-00025
	05326-00007	1	PANEL,LEFT FRONT PANEL TRIM(6326B) OPT A05 X06	28480	05327-00007
	05326-00024	1	SIDE COVER,STANDARD COLOR	28480	05326-00024
	05326-00031	2	SIDE COVER,OPT X06	28480	05326-00031
	05326-00022	1	TOP COVER,OPT A5E	28480	05326-00022

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	05326-00030	1	TOP COVER STANDARD COVER	28480	05326-00030
	05326-00025	2	FEET BACK MOUNT (OPT 907)	28480	0403-0025
	05327-00025		FEET BACK MOUNT (OPT 907)	28480	0403-0025
	0403-0026	1	FEET BACK MOUNT STANDARD CONSISTING OF	28480	0403-0026
	2170-0012	1	SCREW-SET FLAT HD PNT SL 6-32 X 1/4	28480	2170-0012
	2510-0047	4	SCREW-PAN HD POZI DR 8-32 X 0.438" LG	00000	OBD
	5020-0706	1	BRACKET-LEFT	28480	5020-0706
*	5020-0707	1	BRACKET-RIGHT	28480	5020-0707
	05326-40002	1	STRIP-FILLER GRAY	28480	05326-40002
			INTERNAL AND OTHER PARTS		
	0370-0104	2	KNOB BLK BAR W/ARROW 1/4" SHAFT (FUNCTION FUNCTION 5326B)	28480	0370-0104
	0340-0734	2	INSULATOR BINDING POST RED	28480	0340-0734
	0340-0733	2	INSULATOR BINDING POST BLACK	28480	0340-0733
	0340-0766		INSULATOR TRANSISTOR	28480	0340-0766
	0370-0104		KNOB BLK BAR W/ARROW 1/4" SHAFT (FIVE BASE)	28480	0370-0104
	0370-0163	1	KNOB BAR BLK 0.600" DIA (FUNCTION 5327B)	28480	0370-0163
	1200-0087		BUSHING TRANSISTOR	28480	1200-0087
	01821-67401	2	KNOB TRIGGER LEVEL	28480	01821-67401
	05326-20046	1	BOARD-REAR (REAR PANEL CONNECTOR)	28480	05326-20046
	05326-60032	1	CABLE ASSY-POWER	28480	05326-60032
	05326-60021	1	CABLE ASSY-VOLTMETER	28480	05326-60021
	05326-00019	2	SCALE-DVM JACKS, WHEEL	28480	05326-00019
	05326-00018	1	CHASSIS	28480	05326-00018
	05326-00010	1	SHIELD-INNER	28480	05326-00010
	05327-60011	1	CABLE ASSY-PRESCALER	28480	05327-60011
	05326-00033	1	ADAPTER-CONNECTOR	28480	05326-00033
	5040-0345	4	INSULATOR DVM JACKS JADE GRAY	28480	5040-0345
	8120-1378	1	CABLE ASSY-AC POWER CORD	70903	8120-1378
	5060-0109		CONNECTOR-EYELET CONTACTS	28480	5060-0109
	5040-0170	5	GUIDE-PLUG-IN PC BOARD	28480	5040-0170

See introduction to this section for ordering information

Table 6-2. Replaceable Parts, Options

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9	[illegible]		[illegible]		
		17	DISPLAY ASSY	28480	05326-60063
A9DS1	1970-0042	8	OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS1	1200-0405	8	SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9DS2	1970-0042		OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS2	1200-0405		SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9DS3	1970-0042		OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS3	1200-0405		SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9DS4	1970-0042		OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS4	1200-0405		SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9DS5	1970-0042		OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS5	1200-0405		SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9DS6	1970-0042		OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS6	1200-0405		SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9DS7	1970-0042		OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS7	1200-0405		SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9DS8	1970-0042		OPTOELECTRONICAL INDICATOR	[illegible]	[illegible]
A9DS8	1200-0405		SOCKET-STRIP FOR 7200 SERIES	[illegible]	[illegible]
A9R1	0698-7027	1	RESISTOR 4.64K OHM 1% .125W	28480	[illegible]
A9R2	0698-8831	8	RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R3	0698-7027		RESISTOR 4.64K OHM 1% .125W	28480	[illegible]
A9R4	0698-8831		RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R5	0698-8831		RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R6	0698-8831		RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R7	0698-8831		RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R8	0698-8831		RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R9	0698-8831		RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R10	0683-1005	1	RESISTOR 10 OHM 5% .25W	01121	CB 1005
A9R11	0698-8831		RESISTOR 7.50 OHM 1% .125W	28480	[illegible]
A9R12	0683-1005		RESISTOR 10 OHM 5% .25W	01121	CB 1005
A9U1	1820-0279	1	DECODER-DRIVER	04713	MC1413P
A9U2	1820-0119	7	COUNTER-DECADE	28480	1820-0119
A9U3	1820-0119		COUNTER-DECADE	28480	1820-0119
A9U4	1820-0119		COUNTER-DECADE	28480	1820-0119
A9U5	1820-0119		COUNTER-DECADE	28480	1820-0119
A9U6	1820-0119		COUNTER-DECADE	28480	1820-0119
A9U7	1820-0119		COUNTER-DECADE	28480	1820-0119
A9U8	1820-0119		COUNTER-DECADE	28480	1820-0119
A9U9	1820-0116	8	SHIFT REGISTER-8-BIT	28480	1820-0116
A9U10	1820-0116		SHIFT REGISTER-8-BIT	28480	1820-0116
A9U11	1820-0116		SHIFT REGISTER-8-BIT	28480	1820-0116
A9U12	1820-0116		SHIFT REGISTER-8-BIT	28480	1820-0116
A9U13	1820-0116		SHIFT REGISTER-8-BIT	28480	1820-0116
A9U14	1820-0116		SHIFT REGISTER-8-BIT	28480	1820-0116
A9U15	1820-0116		SHIFT REGISTER-8-BIT	28480	1820-0116
A9U16	1820-0116		SHIFT REGISTER-8-BIT	28480	1820-0116
A9U17	1820-0729	1	DECODER-DRIVER	28480	1820-0729
A9U18	1820-0042	7	INTEGRATED CIRCUIT-DECADE-DIVIDER	28480	1820-0042
A9U19	1820-0042		INTEGRATED CIRCUIT-DECADE-DIVIDER	28480	1820-0042
A9U20	1820-0042		INTEGRATED CIRCUIT-DECADE-DIVIDER	28480	1820-0042
A9U21	1820-0042		INTEGRATED CIRCUIT-DECADE-DIVIDER	28480	1820-0042
A9U22	1820-0042		INTEGRATED CIRCUIT-DECADE-DIVIDER	28480	1820-0042
A9U23	1820-0042		INTEGRATED CIRCUIT-DECADE-DIVIDER	28480	1820-0042
A9U24	1820-0042		INTEGRATED CIRCUIT-DECADE-DIVIDER	28480	1820-0042
A9U25	1200-0477	1	SOCKET-IC	28480	1200-0477
A9U26	1200-0477		SOCKET-IC	28480	1200-0477
A9U27	1200-0477		SOCKET-IC	28480	1200-0477

See introduction to this section for ordering information

*FOR THIS INSTRUMENT 1820-0252 ARE DIRECTLY INTERCHANGEABLE WITH THE 1820-0119

Table 6-2. Replaceable Parts, Options (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 002 REMOTE PROGRAMMING DELETE 5060-0302 16 CONTACT CONNECTOR AND ADD 05327-60011 CABLE ASSY		
	05327-60011		CABLE ASSY PROGRAMMING	28480	05327-60011
J10	1251-0086	1	CONNECTOR FEMALE 36 PIN MINAT	28480	1251-0086
A2P1	5060-0311		CONNECTOR 40 CONTACT	28480	5060-0311
A2P2	1200-0063		[illegible]	28480	1200-0063
			OPTION 003 DIGITAL OUTPUT ADD 05327-60012 CABLE ASSY		
J9	1251-0087	1	CONNECTOR FEMALE 50 PIN MINAT	28480	1251-0087
A1P1	1251-2262	2	CONNECTOR PC 2 X 10 20 CONTACTS	[illegible]	251-10-30-400
A1P2	1251-2262		CONNECTOR PC 2 X 10 20 CONTACTS	[illegible]	251-10-30-400
	05327-60034	1	OPTION 004 BOARD ASSY REMOTE ATTENUATOR SERIES 1224A LOADED ON 05327-20034 BLANK BOARD	28480	05327-60034
A1C1	0150-0031	2	CFXD TI 2 PF 5% 500VDCW	78488	TYPE GA
A1C2	0150-0031		CFXD TI 2 PF 5% 500VDCW	78488	TYPE GA
A1C3	0140-0221	2	CFXD MICA 220 PF 1%	28480	0140-0221
A1C4	0140-0221		CFXD MICA 220 PF 1%	28480	0140-0221
A1C5	0170-0207	2	CFXD MYLAR 0.010UF 5% 200VDCW	28480	0170-0207
A1C6	0170-0207		CFXD MYLAR 0.010UF 5% 200VDCW	28480	0170-0207
A1C7	0140-0199	3	CFXD MICA 470 PF 1%	72136	[illegible]
A1C8	0140-0199		CFXD MICA 470 PF 1%	72136	[illegible]
A1C9	0160-2055	2	CFXD CER 0.01 UF +80-20% 100VDCW	[illegible]	[illegible]
A1C10	0160-3028	2	CFXD CER 100PF 10% [illegible]VDCW	[illegible]	[illegible]
A1C11	0160-2055		CFXD CER 0.01 UF +80-20% 100VDCW	[illegible]	[illegible]
A1C12	0160-3028		CFXD CER 100PF 10% [illegible]VDCW	[illegible]	[illegible]
A1C13	0140-0199		CFXD MICA 470 PF 1%	28480	0140-0199
A1C14	0140-0199		CFXD MICA 470 PF 1%	28480	0140-0199
A1CR1	1910-0016	8	DIODE:GE 60 WIV	28480	1910-0016
A1CR2	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1CR3	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1CR4	1902-0025	1	DIODE:BREAKDOWN [illegible] 5% 400 MW	28480	1902-0025
A1CR5	1902-0057	1	DIODE BREAKDOWN [illegible] ASSY	28480	1902-0057
A1CR6	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1CR7	1906-0024	6	DIODE ASSY:[illegible]	28480	1906-0024
A1CR8	1906-0024		DIODE ASSY:[illegible]	28480	1906-0024
A1CR9	1906-0025	4	DIODE ASSY:[illegible]	28480	1906-0025
A1CR10	1906-0025		DIODE ASSY:[illegible]	28480	1906-0025
A1CR11	1901-0040	10	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR12	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR13	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR14	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR15	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1CR16	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR17	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR18	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1CR19	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR20	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR21	1906-0025		DIODE ASSY:[illegible]	28480	1906-0025
A1CR22	1906-0025		DIODE ASSY:[illegible]	28480	1906-0025
A1CR23	1906-0024		DIODE ASSY:[illegible]	28480	1906-0024
A1CR24	1906-0024		DIODE ASSY:[illegible]	28480	1906-0024
A1CR25	1901-0376	4	DIODE:SILICON [illegible]	28480	1901-0376
A1CR26	1901-0376		DIODE:SILICON [illegible]	28480	1901-0376
A1CR27	1901-0376		DIODE:SILICON [illegible]	28480	1901-0376
A1CR28	1901-0376		DIODE:SILICON [illegible]	28480	1901-0376
A1CR29	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1CR30	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1CR31	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A1CR32	1902-0041	4	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR33	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR34	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR35	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR36	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A1DS1	1450-0567	2	LAMP:INCAN GRAIN OF WHEAT [illegible] MILLIAMPS	[illegible]	A1E
A1DS2	1450-0567		LAMP:INCAN GRAIN OF WHEAT [illegible] MILLIAMPS	[illegible]	A1E
A1J1	1251-0472	2	CONNECTOR:PC 12 CONTACTS	[illegible]	[illegible]

See introduction to this section for ordering information

Table 6-2. Replaceable Parts, Options (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A7	1251-0672		CONNECTOR-PC 5 CONTACTS	71785	151-05-10-100
A1J1	1251-1103	*	CONNECTOR-PC PNL INPUT	28480	1251-1103
A1J6	1251-1103		CONNECTOR-PC PNL INPUT	28480	1251-1103
A1K1	0490-0399	1	RELAY-REED ASSY 5,000 OHM 12VDC	28480	0490-0399
A1K2	0490-0359		RELAY-REED ASSY 1,000 OHM 12VDC	28480	0490-0359
A1K3	0490-0359		RELAY-REED ASSY 1,000 OHM 12VDC	28480	0490-0359
A1K4	0490-0359		RELAY-REED ASSY 1,000 OHM 12VDC	28480	0490-0359
A1K5	0490-0359		RELAY-REED ASSY 1,000 OHM 12VDC	28480	0490-0359
A1K6	1854-0039	1	TRANSI NPN	04713	SPS8404
A1R1	1853-0001	1	TRANSI PNP(SELECTED FROM 2N3906)	28480	1853-0001
A1R2	1854-0215	6	TRANSI NPN	04713	SPS8404
A1R4	1854-0215		TRANSI NPN	04713	SPS8404
A1R5	1853-0016	4	TRANSI PNP	80131	2N3906
A1R7	1853-0016		TRANSI PNP	80131	2N3906
A1R8	1854-0215		TRANSI NPN	04713	SPS8404
A1R9	1854-0215		TRANSI NPN	04713	SPS8404
A1R10	1853-0016		TRANSI PNP	04713	SPS8404
A1R11	1853-0016		TRANSI PNP	04713	SPS8404
A1R12	1854-0215		TRANSI NPN	04713	SPS8404
A1R13	1854-0215		TRANSI NPN	04713	SPS8404
A1R14	1855-0334	*	TRANSI FET TUNE N-CHANNEL	17856	SST27
A1R15	1855-0334		TRANSI FET TUNE N-CHANNEL	17856	SST27
A1R1	0698-6373	2	RESD 6.04K OHM .5% .125W F TC=0+-100	28480	0698-6373
A1R2	0698-6373		RESD 6.04K OHM .5% .125W F TC=0+-100	28480	0698-6373
A1R3	0698-5565	6	RESD 1.43K OHM .1% .125W F TC=0+-100	28480	0698-5565
A1R4	0698-5565		RESD 1.43K OHM .1% .125W F TC=0+-100	28480	0698-5565
A1R5	0698-3515	1	RESD 10.0K OHM .1% .125W F TC=0+-100	01121	EB 1003
A1R6	0698-3515	1	RESD 10.0K OHM .1% .125W F TC=0+-100	01121	EB 1003
A1R7	0698-3161	6	RESD 100 OHM .1% .125W F TC=0+-100	28480	0698-3161
A1R8	0698-3161		RESD 100 OHM .1% .125W F TC=0+-100	28480	0698-3161
A1R9	2100-2633	2	RETRIM CERMET 1K OHM 10% 1.1W T=0.5	28480	2100-2633
A1R10	0698-5103	2	RESD 9.31K OHM .5% .125W F TC=0+-100	28480	0698-5103
A1R11	0698-5103		RESD 9.31K OHM .5% .125W F TC=0+-100	28480	0698-5103
A1R12	0698-7969	2	RESD 100K OHM .5% .125W F TC=0+-100	28480	0698-7969
A1R13	0698-7968	2	RESD 90.9K OHM .5% .125W F TC=0+-100	01121	DB 9092
A1R14	0698-7968		RESD 90.9K OHM .5% .125W F TC=0+-100	01121	DB 9092
A1R15	0698-7967		RESD 100K OHM .5% .125W F TC=0+-100	01121	DB 1003
A1R16	0757-0447	2	RESD MFI FILM 121K OHM 1% .125W F TC=0+-100	28480	0757-0447
A1R17	0757-0447		RESD MFI FILM 121K OHM 1% .125W F TC=0+-100	28480	0757-0447
A1R18	0698-3161		RESD 100 OHM .1% .125W F TC=0+-100	28480	0698-3161
A1R19	0683-3015	4	RESD 300 OHM 5% .25W C TC=0+-100	01121	CB 3015
A1R20	0698-3161		RESD 100 OHM .1% .125W F TC=0+-100	28480	0698-3161
A1R21	0683-3015		RESD 300 OHM 5% .25W C TC=0+-100	01121	CB 3015
A1R22	0698-5569	1	RESD 14.3K OHM .1% .125W F TC=0+-100	28480	0698-5569
A1R23	0698-6344	4	RESD 1.47K OHM .5% .125W F TC=0+-100	01121	CB 1471
A1R24	0698-5569		RESD 14.3K OHM .1% .125W F TC=0+-100	28480	0698-5569
A1R25	0698-6344		RESD 1.47K OHM .5% .125W F TC=0+-100	01121	CB 1471
A1R26	0683-1515	2	RESD 150 OHM 5% .25W C TC=0+-100	01121	CB 1515
A1R27	0683-1515		RESD 150 OHM 5% .25W C TC=0+-100	01121	CB 1515
A1R28	0698-6381	2	RESD 11K OHM .5% .125W F TC=0+-100	28480	0698-6381
A1R29	0698-6381		RESD 11K OHM .5% .125W F TC=0+-100	28480	0698-6381
A1R30	0698-7057	4	RESD 1 MEGOHM .5% .125W F TC=0+-100	01121	DB 1004
A1R31	0698-7057		RESD 1 MEGOHM .5% .125W F TC=0+-100	01121	DB 1004
A1R32	2100-2574	2	RETRIM CERMET 500 OHM 10% 1.1W T=0.5	28480	2100-2574
A1R33	2100-2574		RETRIM CERMET 500 OHM 10% 1.1W T=0.5	28480	2100-2574
A1R34	0698-7964	2	RESD 60.4K OHM .5% .125W F TC=0+-100	01121	DB 6042
A1R35	0698-7964		RESD 60.4K OHM .5% .125W F TC=0+-100	01121	DB 6042
A1R36	0698-3161		RESD 100 OHM .1% .125W F TC=0+-100	28480	0698-3161
A1R37	0698-3161		RESD 100 OHM .1% .125W F TC=0+-100	28480	0698-3161
A1R38	0698-7176	5	RESD 200 OHM .1% .125W F TC=0+-100	28480	0698-7176
A1R39	0698-5176		RESD 200 OHM .1% .125W F TC=0+-100	28480	0698-5176
A1R40	0698-6388	1	RESD 976 OHM .5% .125W F TC=0+-100	28480	0698-6388
A1R41	0698-6388		RESD 976 OHM .5% .125W F TC=0+-100	28480	0698-6388
A1R42	0698-7057		RESD 1 MEGOHM .5% .125W F TC=0+-100	01121	DB 1004
A1R43	0698-7057		RESD 1 MEGOHM .5% .125W F TC=0+-100	01121	DB 1004
A1R44	0698-6344		RESD 1.47K OHM .5% .125W F TC=0+-100	01121	CB 1471
A1R45	0698-6344		RESD 1.47K OHM .5% .125W F TC=0+-100	01121	CB 1471
A1R46	0698-5561	2	RESD 6.49K OHM .1% .125W F TC=0+-100	28480	0698-5561
A1R47	0698-5561		RESD 6.49K OHM .1% .125W F TC=0+-100	28480	0698-5561
A1R48	0698-5176		RESD 200 OHM .1% .125W F TC=0+-100	28480	0698-5176
A1R49	2100-2228	1	RETRIM CERMET 10K OHM 20% 1.1W T=0.5	28480	2100-2228
A1R50	0698-5176		RESD 200 OHM .1% .125W F TC=0+-100	28480	0698-5176
A1R51	2100-2228		RETRIM CERMET 10K OHM 20% 1.1W T=0.5	28480	2100-2228
A1R52	0698-5565		RESD 14.3K OHM .1% .125W F TC=0+-100	28480	0698-5565

Continued on next page

See introduction to this section for ordering information

Table 6-2. Replaceable Parts, Options (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
[illegible]	0698-5565		[illegible] CARBON [illegible] COM [illegible] 1/8W	28480	0698-5565
[illegible]	0698-[illegible]		[illegible] CARBON [illegible] COM [illegible] 1/8W	28480	0698-[illegible]
[illegible]	0698-[illegible]		[illegible] CARBON [illegible] COM [illegible] 1/8W	28480	0698-[illegible]
[illegible]	2100-[illegible]		[illegible] COMP [illegible]	28480	2100-[illegible]
[illegible]	3101-1558	1	SWITCH:SLIDE [illegible] POSITION	28480	3101-1558
[illegible]	3101-1558		SWITCH:SLIDE [illegible] POSITION	28480	3101-1558
[illegible]	3101-1558		SWITCH:SLIDE [illegible] POSITION	28480	3101-1556
[illegible]	3101-1556	[illegible]	SWITCH:SLIDE DPDT MINIATURE	76854	55-51-1
[illegible]	3101-1556		SWITCH:SLIDE DPDT MINIATURE	76854	55-51-1
[illegible]			PART OF [illegible]		
[illegible]			PART OF [illegible]		
[illegible]	3101-155[illegible]		SWITCH:SLIDE DPDT MINIATURE	76854	55-51-1
[illegible]	3101-155[illegible]		SWITCH:SLIDE DPDT MINIATURE	76854	55-51-1
[illegible]	1820-0[illegible]	1	IC:TTL QUAD 2-INPUT OR GATE	28480	1820-0[illegible]
[illegible]	1820-0[illegible]	[illegible]	IC:DIGITAL QUAD 2-INPUT NAND GATE	28480	1820-0287
[illegible]	1820-0[illegible]	1	IC:TTL [illegible] LEVEL TRANSLATOR [illegible]	04713	[illegible]
[illegible]	1820-0287		IC:DIGITAL QUAD 2-INPUT NAND GATE	28480	1820-0287
[illegible]	1251-0087		CONNECTOR:PC EDGE 10-PIN [illegible]	28480	1251-0087
[illegible]	05327-60019	1	CABLE ASSY	28480	05327-60019
[illegible]	1200-0[illegible]	1	SOCKET:IC	28480	1200-0[illegible]
			OPTION 010 (NOT FIELD REPAIRABLE)		
A8	05327-60026	1	TEMPERATURE CONTROLLED OSCILLATOR	28480	05327-60026
A8			OPTION 011 (NOT FIELD REPAIRABLE)		
A8	10544-60011	1	OVEN CONTROLLED OSCILLATOR FOR REPLACEMENT OR REPAIR, ORDER REBUILT ASSY 10544-60511	28480	10544-60011

See introduction to this section for ordering information

Table 6-3. Manufacturers Code List

Mfr. No.	Manufacturer Name	Address	Zip Code
00000	No M/F Description for this Mfg Number		
00000	U.S.A. Common	Any Supplier of U.S.A.	
00770	AMP Inc.	Harrisburg, Pa.	77105
01121	Allen Bradley Co.	Milwaukee, Wis.	53204
01295	Texas Instruments Inc. Semi. Comp. Div.	Dallas, Tex.	75231
02114	Ferroxcube Corp.	Saugerties, N.Y.	12477
02735	RCA Solid State & Receiving Tube Div.	Somerville, N.J.	08876
03508	G.E. Co. Semiconductor Prod. Dept.	Syracuse, N.Y.	13201
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Ariz.	85008
04870	P M Motor Co.	Westchester, Ill.	60156
05820	Wakefield Engineering Inc.	Wakefield, Mass.	01880
07263	Fairchild Camera & Inst. Corp. Semicon. Div.	Mountain View, Calif.	94040
09806	G.E. Co. Minature Lamp Dept.	Cleveland, Ohio	44112
12040	National Semiconductor Corp.	Danbury, Conn.	06810
12954	Gulton Ind. Inc. Data System Div.	Albuquerque, N.M.	87108
13919	Airco Supply Co. Inc.	Witchita, Kans.	67213
14655	Cornell Dublier Elect. Div. Federal Pacific Elect. Co.	Newark, N.J.	07105
17856	Siliconix Inc.	Sunnyvale, Calif.	94086
24931	Specialty Connector Co. Inc.	Indianapolis, Ind.	46227
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	Bussman Mfg. Div. McGraw-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	Littlefuse Inc.	Des Plaines, Ill.	60016
76530	Cinch Monadnock Mfls Div. TRW Inc.	City of Industry, Calif.	91746
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
82142	Airco Speer Elect. Comp.	Du Bois, Pa.	15801
82389	Switchcraft Inc.	Chicago, Ill.	60630
83594	Burroughs Corp. Elect. Comp. Div.	Plainsfield, N.J.	07061
85471	Boyd A.B. Co.	San Francisco, Calif.	94103
91418	Radio Materials Co.	Chicago, Ill.	60646
95712	Bendix Corp. The Microwave Device Div.	Franklin, Ind.	46131
96733	San Fernando Elect. Mfg. Co.	San Fernando, Calif.	91341
98291	Sealectro Corp.	Mamaroneck, N.Y.	10544
99800	Delevan Electronics Corp.	E. Aurora, N.Y.	14052

SECTION VII

OPTIONS AND MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information necessary to adapt this manual to older instruments. Also included are installation procedures for available options. Refer to Section II for remote programming requirements.

7-3. OPTIONS

7-4. Options 001 through 004, 010 and 011 are available for the 5326B and 5327B Models. The purpose of each option is described in the following paragraphs.

7-5. Option 001, 8-Digit Display

7-6. Option 001 is the addition of an eighth digit to the display assembly. This addition becomes the most significant digit and extends the counter's resolution at higher frequencies. The digit is always blanked if the reading is "0". Option 001 consists of A9 Display Assembly 05326-60025 in place of 05326-60008.

7-7. Option 002, Remote Programming

7-8. Option 002 allows the counter to be computer controlled from a 36-pin connector on the counter's rear panel. Programming instructions are given in Section II. A schematic diagram is included in Section VIII.

7-9. Option 003, Digital Recorder Output

7-10. The data displayed on the counter's front panel can be permanently recorder by connecting a printer to the counter vin Option 003. The necessary signals are coupled from A9 Display Assembly to an HP 5055A or 5050B Digital Recorder through J9 on the counter's rear panel (also, see Table 1-1 for specifications and Section VIII for pin references).

7-11. Option 004, Extended Remote Programming

7-12. This option is similar to Option 002 except it includes the remote programming of the AC/DC, SEP-COM-CHK, FAST/NORM, and ATTEN switches. Remote programming of the attenuator board is achieved by connecting the DTL input lines in parallel with the front panel switches (connected at cable points 1 through 8). When the counter is being externally controlled, the A COM line goes high. This high turns off diodes CR6, 18, 2, 3, 15, 30, 31, and 1, and disables the front panel switches.

7-13. Option 010 Temperature Compensated Oscillator

7-14. Option 010 consists of a Temperature Compensated Oscillator (TCXO) (05327-60036) in place of Oscillator Assembly A4 (05326-60002)). This option is available for 5326B instruments with Serial Prefix 1240A and above and 5327B instruments with prefix 1224A and above. The TCXO is not field repairable.

7-15. Option 011 Oven Oscillator

7-16. Option 011 consists of an HP Oven Oscillator (10544-60011) in place of Oscillator Assembly A4 (05326-60002). This option is available for 5326B instruments with Serial Prefix 1240A and above and 5327B instruments with prefix 1224A and above. The oven oscillator is not field repairable, for replacement or repair, order rebuilt assembly 10544-60511.

7-17. FIELD INSTALLATION OF OPTIONS

7-18. Installation of Option 001, 8th Digit

7-19. Parts required to install this option are:

1820-0119 Decade Counter U8
1820-0116 Buffer Storage U16
1820-0092 Decoder Driver U24
1970-0042 Display Tube DS8

a. Remove right and left readout boards, A10 and A11.

b. Remove two screws holding display tube shield and remove shield.

c. Remove display board A9 and display support board A8 from the counter by pulling up on the display support board A8. Separate A8 from A9.

d. Install parts on A9 as shown in the component location photo on Figure 8-12 of this manual, and plug in place.

e. Clip out resistor R10. Install blanking jumper as per schematic and Paragraph 2-62.

f. Perform Self-Check in Table 3-1. Especially note that the OF (overflow) lamp lights when the leftmost digit changes from 9 to 0.

7-20. Installation of Option 002, Remote Programming

7-21. To install remote programming capability in units not so equipped, order remote cable assembly HP Part No. 05327-60013, two 4-40 x ¼-inch machine screws, and one 6-32 x ⅜-inch machine screw with hex nut.

a. Remove the plate covering the lower opening in the rear panel for Option 002.

b. The rear-panel interconnect board containing the wiring for the rear-panel BNC's and switches must be removed. To accomplish this, remove the nuts holding the rear-panel BNC's.

c. Remove two screws holding P1A, and 1 ½-inch-long, black, pressure connecter to the motherboard A16.

d. Remove side covers and six screws holding rear panel. Loosen one side frame. Pull rear panel away from the instrument.

e. Remove the rear-panel interconnect board from the instrument and separate it from P1A by removing two screws.

f. Feed the pressure connector through the hole in rear-panel and mount rear-panel connector J10, with screws removed earlier. Position J10 with pin 1 near the side frame.

g. Assemble the rear-panel interconnect board and the new 5-inch-long pressure connector P1 with three 6-32 x ⅜-inch screws and hex nuts. Be certain that proper contact is made between interconnect board and P1.

h. Attach P1 to the motherboard using four 4-40 x ¼-inch screws. Do not tighten screws. Route cable as shown in the top internal photo of instrument, Figure 8-4.

CAUTION

SCREWS LONGER THAN ¼-INCH WILL DAMAGE P1.

i. Gently reinstall rear panel. Install BNC lock nuts so that the board is still moveable.

j. Observe the alignment of the connector in the motherboard. Tighten the four screws holding P1 to the motherboard, making sure to maintain proper contact.

k. Check contact alignment of P1 with motherboard and with the rear-panel interconnect board. If necessary, loosen the screws in P1 and shift slightly to obtain proper terminal contact.

l. Tighten BNC lock nuts and reassemble instrument.

m. Run a complete performance check on the unit to verify that remote programming is working properly.

7-22. Installation of Option 003, Digital Recorder Output

7-23. Order digital recorder cable assembly HP Part Number 05326-60012.

a. Remove the plate covering the upper opening in the rear panel.

b. Remove right and left readout boards A10 and A11. Remove two screws holding the display tube shield and remove shield. Remove display support board A8 and the display board A9 by pulling up on A8.

c. Feed the two connectors of the recorder cable through the rear panel and mount J9 on the rear panel, using the screws previously removed. Position J9 so pin 1 is near the side frame.

d. Slide the connectors on the A9 Board. The connector with the long wires attaches to J1 and is positioned so that pin 1 is toward the front of the instrument. The other connector attaches to J2, and pin 1 is toward the rear of the instrument.

e. Position the P1 cable so it passes between A8 and A11, completely clearing A8. Reinstall A8 and A9.

f. Route the cable around T1 and in front of A8 assembly.

g. Reassemble unit and run a proof-of-performance check of the digital output to verify that the option is installed properly.

7-24. Installation of Option 004, Extended Remote Programming

7-25. Field installation of Option 004 is not available.

7-26. Installation of Option 010 and 011, Oscillator Assemblies

7-27. Remove the standard oscillator A4 and insert the option into the XA4 connector. The Option 011 assembly must be mounted to the interconnect board with two 6 x 32, ½-inch screws. Place the fiber washers on the underside of the board.

7-28. MANUAL CHANGES

7-29. This manual applies directly to Models 5326B and 5327B that have serial prefixes 1428A (see Paragraph 1-4).

7-30. NEWER INSTRUMENTS

7-31. As changes are made, newer instruments may have serial prefixes that are not listed in this manual. The manual for these instruments are supplied with a manual change sheet, containing the required information. If this sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office for information.

7-32. Older Instruments

7-33. To adapt this manual to instruments having a serial prefix prior to 1428A, perform the backdating that applies to your instrument serial prefix as listed in Table 7-1 below.

NOTE

For 5326B's with serial prefixes earlier than 1128A, a separate manual is required. Order "Model 5326A/B 50 MHz Timer/Counter/DVM Operating and Service Manual," HP Part Number 05326-90030.

Table 7-1. Manual Backdating Changes

5326B	5327B	Change
1312A	1312A	12
1240A	1248A	1,12
.....	1224A	1,2,12
1224A	.....	1,3,5,12
.....	1220A	1,2,3,4,12
1208A	.....	1,3,4,5,12
.....	1140A	1,2,3,4,5,12
.....	1132A	1,2,3,4,5,6,8,12
1140A	.....	1,3,4,5,8,12
1136A	.....	1,3,4,5,8,9,12
1128A	.....	1,3,4,5,7,8,9,10,12
See	1116A	1,2,3,4,5,6,8,9,10,12
Above	1104A	1,2,3,4,5,6,8,9,10,11,12

CHANGE 1

Page 6-9, Table 6-1:
Change A9R2, R4-9 and R11 to "0683-7525"
Change board series number to 1224A.

Page 6-14, Table 6-1:
Change A15R1 to "0683-2035, R:FXD COMP 20K OHM 5% ¼W 01121 CB 2035."

Change A15R6 to "0686-1505 R:FXD COMP 15 OHM 5% ½ W 01121 EB 1505."

Delete "A15F1 2110-460 FUSE: 1 32 AMP."

Delete "A15XF1 1400-0110 FUSE HOLDER."

Page 8-45, Figure 8-18:
Change A15 R1 to "20K."
Change A15 R6 to "15 OHM."
Delete F1. Q8 emitter connects directly to XA15 (1,A).
Change board series number to 1224A.

CHANGE 2

Page 1-2, Table 1-3:
Under INPUT CHANNEL C RANGE: change to "1 kHz - 50 MHz, ac coupled." Change sensitivity to direct "5 mV rms pre-scaled 100 mV rms."

Page 6-16, Table 6-1:
Replace parts listing for A18 (05327-60033) with Table 7-2 (parts list for 05327-60009) and Table 7-3 (parts list for 05327-60029). Instruments with series prefix 1224 and below could have either the 05327-60009 or 05327-60029 boards installed.

Page 8-48, Figure 8-20:
Replace A18 schematic diagram with Figure 7-1 (05327-60009) and Figure 7-2 (05327-60029). Instruments with serial prefix 1224 and below could have either board installed. Replace A18 component locator with Figure 7-3 (05327-60009) and Figure 7-4 (05327-60029).

Page 6-18, Table 6-1:
Add "A19 05327-60032 Protection Board."
Add "A19 05327-20032 Blank Board."
Add "A19C1,2 0180-0228 C:FXD TANT 22 UF 10% 15 V."
Add "A19CR1,2 1901-0050 DIODE: SILICON."
Add "A19F1 2110-0436 FUSE: 0.1 AMP."
Add A19J1 1250-1408 CONNECTOR:RF SUBMINIATURE.
Add A19J1 1250-1835 CONNECTOR:RF SUBMINIATURE.
Add A19XF1A/B 1251-3205 SOCKET: MINIATURE (2).

CHANGE 3

Page 1-1, Paragraph 1-9:
Pages 7-1 and 7-2, Paragraphs 7-13 through 7-15, 7-26, and 7-27: Delete reference to Options 010 and 011 oscillators. Options 010 and 011 were available for 5326B instruments with Serial Prefix 1240A and above and for 5327B with Serial Prefix 1224A and above.

Page 6-6, Table 6-1:
Delete A6R44. Change board series to 1132A.

Page 8-21, Figure 8-9:
On schematic, delete A6R44. A6C10 connects directly to A6Q2).

Page 6-9, Table 6-1:
Change A9 series number to 1224A.
Delete A9R11, A9R12, A9XDS8, A9XU8, 16 and 24.

Page 8-33, Figure 8-12:
Change Note 3 to read R10 is wired to B for Option 001.

Page 6-15, Table 6-1:
Delete A16C9, A16CR18, A16Q5, A16R4, A16R5, A16R6, A16R7, A16R8, and A16U1.

Page 8-57, Figure 8-24:
Delete schematic diagram and component locator.

Page 6-7, Table 6-1:
Delete parts list for A7 (05327-60031) and replace with Table 7-4 (parts list for A7, 05327-60004).

Page 8-29, Figure 8-10:
Replace A7 schematic with Figure 7-5 (schematic for A7 05327-60004). Replace component locator with Figure 7-6.

CHANGE 4

Page 6-3, Table 6-1:
Change A1 part number to 05326-60003.
Change A1R24 and R26 to 2100-2905.

Page 6-19, Table 6-1:
Change 05326-00032 Rear Panel to 05326-00004.
Add 05326-00012 Plate:Connector, Short (J10 Cover).
Add 05326-20028 Board:Blank (Rear Panel Interconnect).
Delete 05326-00033 Adapter:Connector.
Delete 05326-20046 Board, Rear Panel Connector.

CHANGE 5

Page 6-18, Table 6-1:
Delete A19 and all A19 listed parts.

Pages 7-7 and 7-8, Figures 7-1 and 7-2:
Delete A19 protection board from Schematic diagrams.

Page 1-2, Table 1-3:
Under INPUT CHANNEL C Maximum Input, change to "5 Volts rms; 7.5 volts peak."

CHANGE 6

Some instruments with serial prefix 1208 and below have standard colors of light gray panels with blue textured cabinet. For replacement, order Option X95 parts listed in Section VI.

CHANGE 7

Pages 6-15 and 6-16, Table 6-1:
Change A17CR3 to "1912-0007."
Change A17Q4 to "1854-0092."
Change "A17R21 to 0683-3625 R:FXD COMP 3600 OHM 5% 1W 01121 CB 3625."
Change A17R22 to "0683-1515 R:FXD COMP 150 OHM 5% 1W 01121 CB 1515."
Change A17R23 to "0683-1025 R:FXD 1000 OHM 5% 1W 01121 CB 1025."
Change A17R26 to "0683-5615 R:FXD COMP 560 OHM 5% 1W 01121 CB 5615."
Delete "05326-00031 SHIELD: NOISE."
Change board series to "1128A."
Page 8-47, Figure 8-19:
Change A17R21 to "3600 OHMS."
Change A17R26 to "560 OHMS."
Change A17CR3 to "1912-0007."
Change A17Q4 to "1854-0092."
Change board series to "1128."

CHANGE 8

Page 6-14, Table 6-1:
Delete A15C8 and description.
Change board series to "1132A."

Page 8-45, Figure 8-18:
Delete A15C8.

CHANGE 9

Page 6-18, Table 6-1:
Change T1 part number to 9100-2888.

Page 6-14, Table 6-1:
Change A15CR15-18 to "1901-0040."
Change A15R17, 18 to "0683-0395 R:FXD 3.9 OHM 5% 1W 01121 CB 3965."
Change Board series numbers to "1040A."

Page 8-45, Figure 8-18:
Change A15R17, 18 to 3.9 OHM.
Change A15CR15-18 to "1901-0040."
Change Board series to "1040A."

Page 7-11, Table 7-4:
Change A7C2 to "0160-0333 C:FXD MICA 15 PF 5% 500 VDCW 00853 RDM15C150DE3C."
Change A7 Board Series to 1040A.

Page 8-20, Figure 8-10:
Change A7C2 to 15 PF.

Page 6-7, Table 6-1:
Change A6R19 to "0683-2025 R: FXD COMP 2000 OHM 5% ¼W 01121 CB 2025."
Change A6 Board Series Number to 1036A.

CHANGE 10

Page 6-14, Table 6-1:
Change part number of A16 Board Assembly Connector to read 05327-60006, Series Number 1104A. Change 05327-20027 blank board to 05327-20006.

Page 8-45, Figure 8-18, A16 schematic:
Change A16 part number from 05327-60027 to 05327-60006.

CHANGE 11

Table 6-1:
Change part numbers to read:

COVER-SIDE 3x11	5000-0729, 2 ea.
COVER-TOP	05326-00008, 1 ea.
INSULATOR (Q1&Q2)	0340-0162, 1 ea.

NOTE

If replacement of any of the above parts is required, replace with new parts listed in Table 6-1.

CHANGE 12

Page 6-14, Table 6-1:
Change A15F1 from 2110-0487 (1/20 A) to 2110-0460 (1/32 A).
Change A15R6 from 0698-5479 (8.2 OHM) to 0686-1305 (13 OHM); MFR PART NO. EB 8265 to EB 1305.
Change A15XF1 from 1251-3205 Qty 2 to 1400-0110 Qty 1; Change description from SOCKET, MINIATURE: SINGLE to BODY: FUSEHOLDER; Change MFR CODE from 00779 to 71400; Change MFR PART NO. from 2-331272-7 to "P/O HWA FUSEHOLDER."
Change A15 board series from 1428A to 1312A.

Page 8-45, Figure 8-18, A15 Schematic Diagram:
Change A15F1 value from 1/20A to 1/32A.
Change A15R6 value from 8.2 ohm to 13 ohm.
Change board series from 1428A to 1312A.

Table 7-2. A18 (05327-60009) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18	05327-60009	1	PNEUMATIC ASSY (SERIES 1040A) (LOADED ON 05327-20009 MAIN BOARD)	28480	05327-60009
A18C1	1050-0067 0180-0197	2	WASHER:FLAT, BAPHOLE) C:FXD ELECT 2.2 UF 10% 20VDCW	00000 56289	OMO 1.5D225X9020A2-DYS
A18C2 A18C3 A18C4 A18C5 A18C7	0160-0575 0180-0106 0160-0575 0180-0106 0160-0575		C:FXD CER 0.001 UF 20% 75VDCW C:FXD ELECT 10 UF 20% 6VDCW C:FXD CER 0.001 UF 20% 75VDCW C:FXD ELECT 10 UF 20% 6VDCW C:FXD CER 0.001 UF 20% 75VDCW	12954 28480 12954 28480 12954	SCM-.001-5P 0180-0106 SCM-.001-5P 0180-0106 SCM-.001-5P
A18C8 A18C9 A18C10 A18C11 A18C12	0160-0225 0160-0575 0160-0575 0180-0197 0180-0197	2	C:FXD MICA 100 PF 1% C:FXD CER 0.001 UF 20% 75VDCW C:FXD CER 0.001 UF 20% 75VDCW C:FXD ELECT 2.2 UF 10% 20VDCW C:FXD ELECT 2.2 UF 10% 20VDCW	28480 12954 12954 56289 56289	0160-0225 SCM-.001-5P SCM-.001-5P 1.5D225X9020A2-DYS 1.5D225X9020A2-DYS
A18C13 A18C14 A18CR1 A18CR2 A18CR3	0160-2049 0160-2049 1902-3002 1902-0007 1902-3048	4 2	C:FXD CER FEED-THRU 5000 PF +80-20% C:FXD CER FEED-THRU 5000 PF +80-20% DIODE BREAKDOWN:2.37V 5% DIODE:TUNNEL EIA TYPE 1N3716 DIODE BREAKDOWN:SILICON 5.48V 5%	28480 28480 28480 03508 28480	0160-2049 0160-2049 1902-3002 1N3716 SPEC 1902-3048
A18J1 A18L1 A18Q1 A18Q2 A18Q3	1250-0836 9100-2251 1853-0015 1854-0092 1854-0092	2	CONNECTOR:RF SUB-MINIATURE COIL:FXD RF 0.22 UH 10% TSTR:SI PNP TSTR:SI NPN TSTR:SI NPN	98291 28480 80131 80131 80131	50-053-0000 9100-2251 2N5640 2N3563 2N3563
A18R1 A18R2 A18R3 A18R4 A18R5	2100-2633 2100-2521 0683-5105 0683-5105 0683-1065		RVAR:CERMET 1K OHM 10% LIN 1/2W RVAR:FLM 2000 OHM 10% LIN 1/2W RESD:COMP 51 OHM 5% 1/4W RESD:COMP 51 OHM 5% 1/4W RESD:COMP 100K OHMS 5% 1/4W	28480 28480 01121 01121 01121	2100-2633 2100-2521 CB 5105 CB 5105 CB 1065
A18R6 A18R7 A18R8 A18R9 A18R10	0683-1025 0698-3378 0683-1815 0683-1825 0683-2215		RESD:COMP 1000 OHM 5% 1/4W RESD:CARBON 91 OHM 5% 1/8W RESD:COMP 180 OHM 5% 1/4W RESD:COMP 1800 OHM 5% 1/4W RESD:COMP 220 OHM 5% 1/4W	01121 28480 01121 01121 01121	CB 1025 0698-3378 CB 1815 CB 1825 CB 2215
A18R11 A18R12 A18R13 A18R14 A18R15	0683-1825 0683-1825 0683-1825 0683-2015 0683-2015		RESD:COMP 1800 OHM 5% 1/4W RESD:COMP 1800 OHM 5% 1/4W RESD:COMP 1800 OHM 5% 1/4W RESD:COMP 200 OHM 5% 1/4W RESD:COMP 200 OHM 5% 1/4W	01121 01121 01121 01121 01121	CB 1825 CB 1825 CB 1825 CB 2015 CB 2015
A18R16 A18R17 A18R18 A18R19 A18R20	0683-1025 0683-1515 0683-6315 0683-3315 0683-8205	2 2	RESD:COMP 1000 OHM 5% 1/4W RESD:COMP 150 OHM 5% 1/4W RESD:COMP 630 OHM 5% 1/4W RESD:COMP 330 OHM 5% 1/4W RESD:COMP 82 OHM 5% 1/4W	01121 01121 01121 01121 01121	CB 1025 CB 1515 CB 6315 CB 3315 CB 8205
A18R21 A18R22 A18R23 A18R24 A18U1	0683-1015 0683-2025 0683-3315 0683-2405 5088-7002		RESD:COMP 100 OHM 5% 1/4W RESD:COMP 2000 OHM 5% 1/4W RESD:COMP 330 OHM 5% 1/4W RESD:COMP 24 OHM 5% 1/4W IC:LIMITER	01121 01121 01121 01121 28480	CB 1015 CB 2025 CB 3315 CB 2405 5088-7002
A18U2 A18U3 A18U4 A18U5 A18U6	5088-7001 1820-0716 1820-0716 1820-0489 1820-0147	1	IC:AMP AND TRIG IC:DIGITAL IC:DIGITAL QUINARY DEVIDER IC:MISC IC:MSC TRIPLE 3-INPT NOR GATE	28480 28480 28480 28480 04713	5088-7001 1820-0716 1820-0716 1820-0489 MC10078
A18U7 A18W2	1854-0004 1251-1556	45	TSTR ARRAY:SI NPN DUAL DIFF. AMPL. CONNECTOR:SINGLE CONTACT	28480 00779	1854-0004 2-330808-5

See introduction to this section for ordering information

Table 7-3. A18 (05327-60029) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18	[illegible]	1	BOARD ASSY PRESCALER SERIES 5326A (ADDITION OF 2ND PLANK BOARD)	[illegible]	[illegible]
A18C1	0180-0197		FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C2	0160-0571		FXD CER 0.001 UF 20% 25VDCW	12954	SSM-.001-98
A18C3	0180-0106		FXD ELECT 68 UF 20% 6VDCW	28480	0180-0106
A18C4	0160-0975		FXD CER 0.001 UF 20% 25VDCW	12954	SSM-.001-98
A18C5	0180-0106		FXD ELECT 68 UF 20% 6VDCW	28480	0180-0106
A18C6	0160-0575		FXD CER 0.001 UF 20% 25VDCW	12954	SSM-.001-98
A18C7	0160-0975		FXD CER 0.001 UF 20% 25VDCW	12954	SSM-.001-98
A18C8	0140-0225	1	FXD MICA 300 PF 1%	28480	0140-0225
A18C9	0160-0975		FXD CER 0.001 UF 20% 25VDCW	12954	SSM-.001-98
A18C10	0160-0975		FXD CER 0.001 UF 20% 25VDCW	12954	SSM-.001-98
A18C11	0180-0197		FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C12	0180-0197		FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C13	0160-2049		FXD CER [illegible] 5000 PF [illegible]	28480	0160-2049
A18C14	0160-2049		FXD CER 5000-THRU 5000 PF [illegible]	28480	0160-2049
A18CR1	1902-3032		DI CARBOMAT2.37V 5%	28480	1902-3032
A18CR2	1912-0057		DI [illegible] TEA TYPE 1N5715	03508	1N5715 SPEC
A18CR3	1902-3048	1	DIODE BREAKDOWN=5.11 COEF 3.48V 5%	28480	1902-3048
A18J1	1250-08[illegible]		CONNECTOR-RF SUB-MINIATURE	98291	50-051-0000
A18J2	[illegible]		CONNECTION	[illegible]	[illegible]
A18L1	9100-2251	1	EQUIPMENT RF 0.22 UH 10%	28480	9100-2251
A18Q1	1853-0015		TSTR=SI PNP	80131	2N3640
A18Q2	1854-0345		TSTR=SI NPN	80131	2N5179
A18Q3	1854-0092		TSTR=SI NPN	80131	2N3563
A18R1	2100-2633		RSVAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A18R2	2100-2521		RSVAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A18R3	0683-5105		RESD COMP 51 OHM 5% 1/4W	01121	CB 5105
A18R4	0683-5105		RESD COMP 51 OHM 5% 1/4W	01121	CB 5105
A18R5	0683-1045		RESD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A18R6	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R7	0698-3378	1	RESD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R8	0683-1815	1	RESD COMP 180 OHM 5% 1/4W	01121	CB 1815
A18R9	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R10	0683-2215		RESD COMP 220 OHM 5% 1/4W	01121	CB 2215
A18R11	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R12	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R13	0683-1825		RESD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R14	0683-2015		RESD COMP 200 OHM 5% 1/4W	01121	CB 2015
A18R15	0683-2015		RESD COMP 200 OHM 5% 1/4W	01121	CB 2015
A18R16	0683-1025		RESD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R17	0683-1515		RESD COMP 150 OHM 5% 1/4W	01121	CB 1515
A18R18	0683-4315	1	RESD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R19	0683-5115		RESD COMP 510 OHM 5% 1/4W	01121	CB 5115
A18R20	0683-8205	1	RESD COMP 82 OHM 5% 1/4W	01121	CB 8205
A18R21	0683-1015		RESD COMP 100 OHM 5% 1/4W	01121	CB 1015
A18R22	0683-2025		RESD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A18R23	0683-3315		RESD COMP 330 OHM 5% 1/4W	01121	CB 3315
A18R24	0683-2405		RESD COMP 24 OHM 5% 1/4W	01121	CB 2405
A18R25	0698-3374	1	RESD CARBON 20 OHM 5% 1/8W	28480	0698-3374
A18R26	0683-3615		RESD COMP 360 OHM 5% 1/4W	01121	CB 3615
A18R27	0683-2715		RESD COMP 270 OHM 5% 1/4W	01121	CB 2715
A18R28	2100-2670	1	RSVAR CERMET 20 OHM 10% LIN 1/2W	28480	2100-2670
A18U1	5088-7002	1	IC=LIMITER	28480	5088-7002
A18U2	5088-7001	1	IC=AMP AND FREQ	28480	5088-7001
A18U3	1820-0736	1	IC=DIGITAL	28480	1820-0736
A18U4	1820-0784	1	IC=BINARY-QUINARY	28480	1820-0784
A18U5	1820-0489		IC=ECL	28480	1820-0489
A18U6	1820-0147		IC=ECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
A18U7	1858-0004		TSTR ARRAY=SI NPN DUAL DIFF. AMPL.	28480	1858-0004
A18U8	1820-0790	1	IC=DIGITAL	28480	1820-0790
A18XJ[illegible]	1251-1556	11	CONNECTOR=SINGLE CONTACT	00779	2-330808-8
A18XU4	1251-1556		CONNECTOR=SINGLE CONTACT	00779	2-330808-8
A18XU5	1205-0243	1	HEAT DISSIPATOR	28480	1205-0243
A18XU6	1205-0244	1	RETAINER	28480	1205-0244
A18U9	0520-0129	2	SCREW=PAN HD POZI DR 2-56 X 0.312" LG	00000	ORD
A18U9	0510-0001	2	NUT=HEX 2-56 X 0.188"	00000	ORD
	3050-0062	1	WASHER=FLAT, FIBER	00000	ORD
	3050-0079	2	WASHER=NYLON 0.187" OD	00000	ORD

See introduction to this section for ordering information

Figure 7-1. A18 Prescaler Board Assembly (5327B Only)

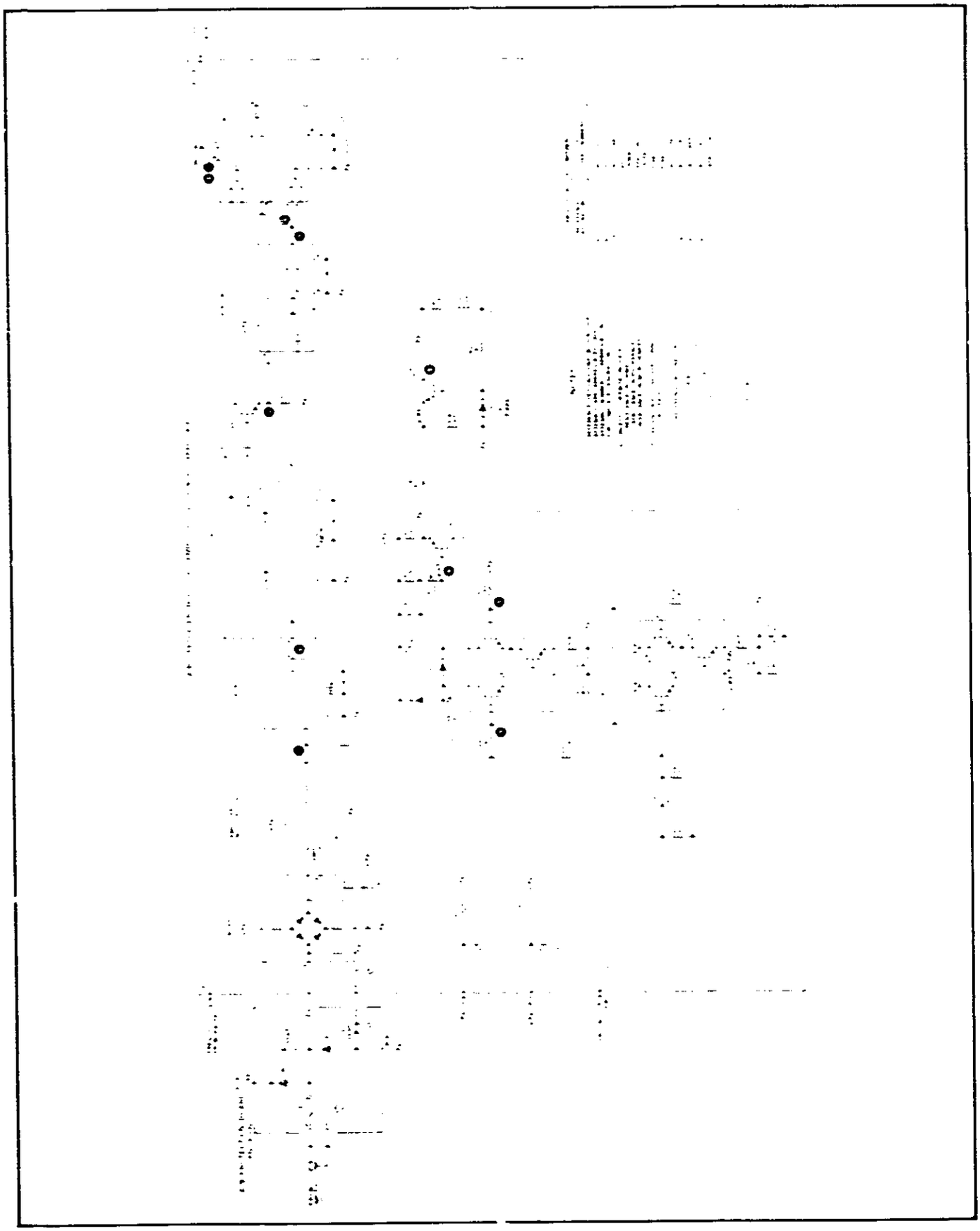


Figure 7-2. A18 Prescaler Board Assembly (5327B Only)

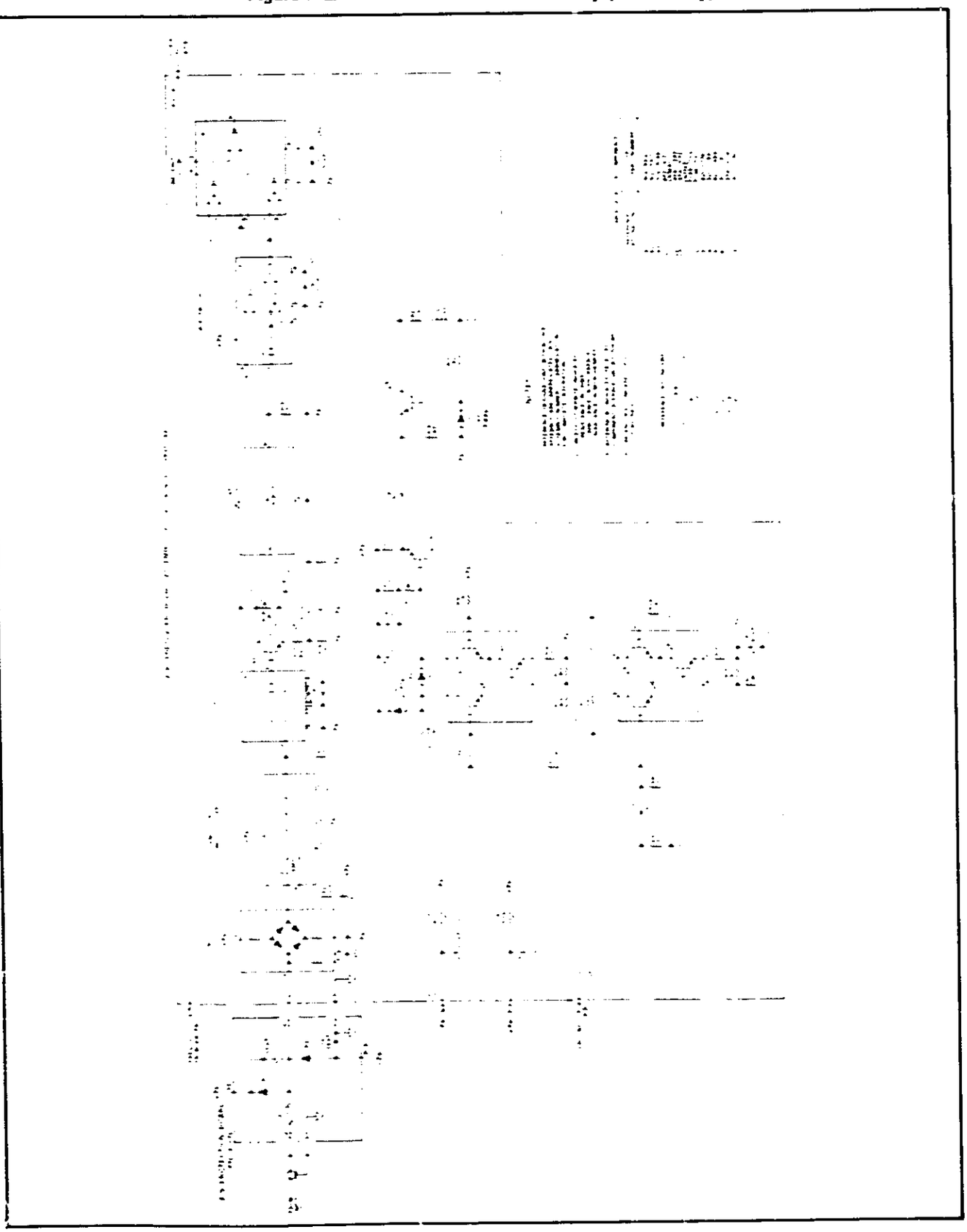


Figure 7-3. A16 (05327-60009) Component Locator

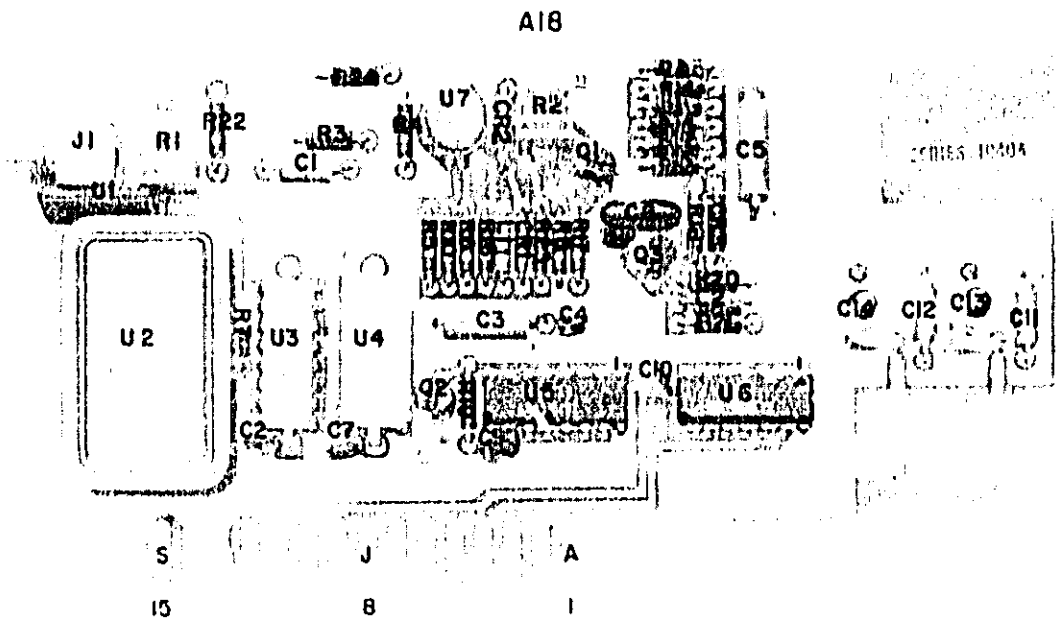


Figure 7-4. A18 (05327-60029) Component Locator

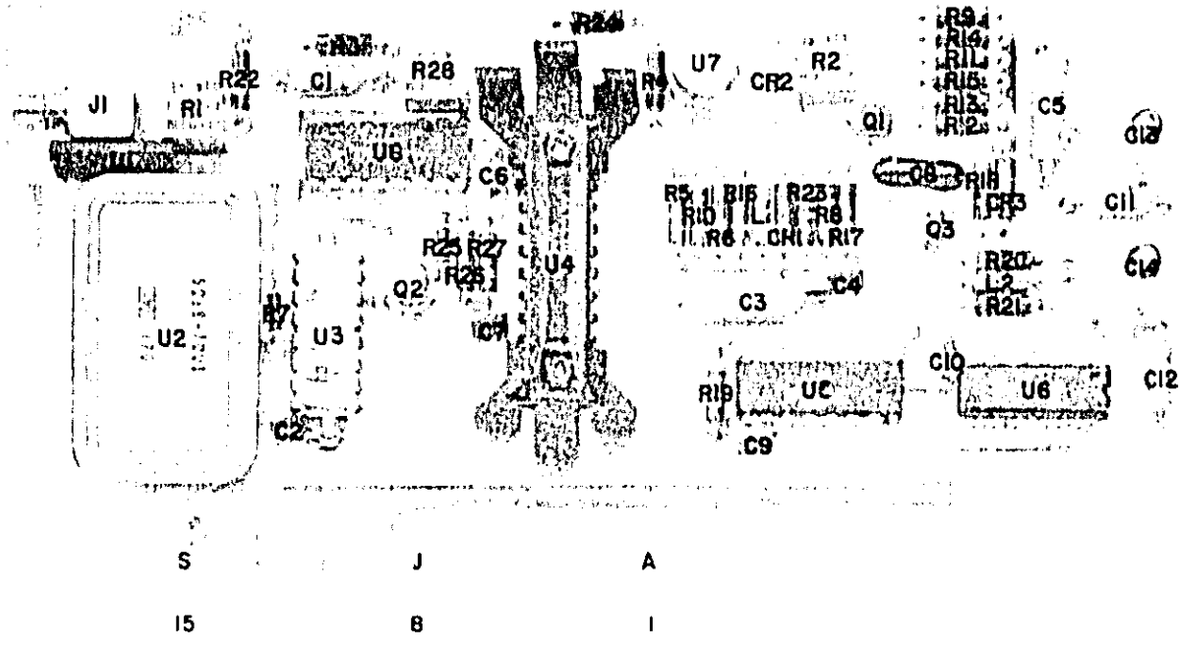


Table 7-4. A7 (05327-60004) Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	05327-60004	1	BOARD ASSY:FUNCTION CONTROL (SERIES 1040A; REV. C) (LOADED ON 05327-20004 BLANK BOARD)	28480	05327-60004
			NOT ASSIGNED		
A7C1				00853	RDM15C150D3C
A7C2	0160-0333	1	C:FXD MICA 15+/-0.5 PF 300VDCW	96733	B1048X102M
A7C3	0160-2327	5	C:FXD CER 1000 PF 20% 100VDCW		
A7C4	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B1048X102M
A7C5	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B1048X102M
A7C6	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B1048X102M
A7C7	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B1048X102M
A7Q1	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q3	1854-0009		TSTR:SI NPN	80131	2N709
A7Q4	1854-0009		TSTR:SI NPN	80131	2N709
A7Q5	1854-0009		TSTR:SI NPN	80131	2N709
A7R1	0683-1125	7	R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R2	0683-1825	10	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A7R3	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A7R4	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A7R5	0683-3925	4	R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925
A7R6	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A7R7	0683-1125		R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R8	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A7R9	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A7R10	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A7R11	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A7R12	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A7R13	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A7R14	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A7R15	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A7R16	0683-5115	4	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A7R17	0683-3015		R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015
A7R18	0683-3015		R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015
A7R19	0683-2015	5	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A7R20	0683-2725	3	R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725
A7R21	0683-7515	3	R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A7R22	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A7R23	0683-1125		R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R24	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A7R25	0683-1125		R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R26	0683-1125		R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R27	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A7R28	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A7R29	0683-1125		R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7U1	1820-0102	4	INTEGRATED CIRCUIT:D-K FLIP FLOP	04713	MC1013P
A7U2	1820-0489	5	IC:ECL	28480	1820-0489
A7U3	1320-0147		IC:ECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
A7U4	1820-0440	1	IC:ECL DUAL D/S F/F	04713	MC1013P
A7U5	1820-0147		IC:ECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
A7U6	1820-0489		IC:ECL	28480	1820-0489
A7U7	1820-0212	2	IC:ECL QUAD LINE RECEIVER	04713	MC1020P
A7U8	1820-0489		IC:ECL	28480	1820-0489
A7U9	1820-0145	2	IC:DIGITAL QUAD 2-INPT NOR GATE	28480	1820-0145
A7U10	1820-0489		IC:ECL	28480	1820-0489
A7U11	1820-0252	1	IC:ECL DUAL 3-4 INPT OR/NOR GATE	04713	MC1026P
A7U12	1820-0200	1	IC:ECL QUAD EXCL OR GATE	04713	MC 1030P

See introduction to this section for ordering information

Figure 7-5. A7 Function Control Assembly

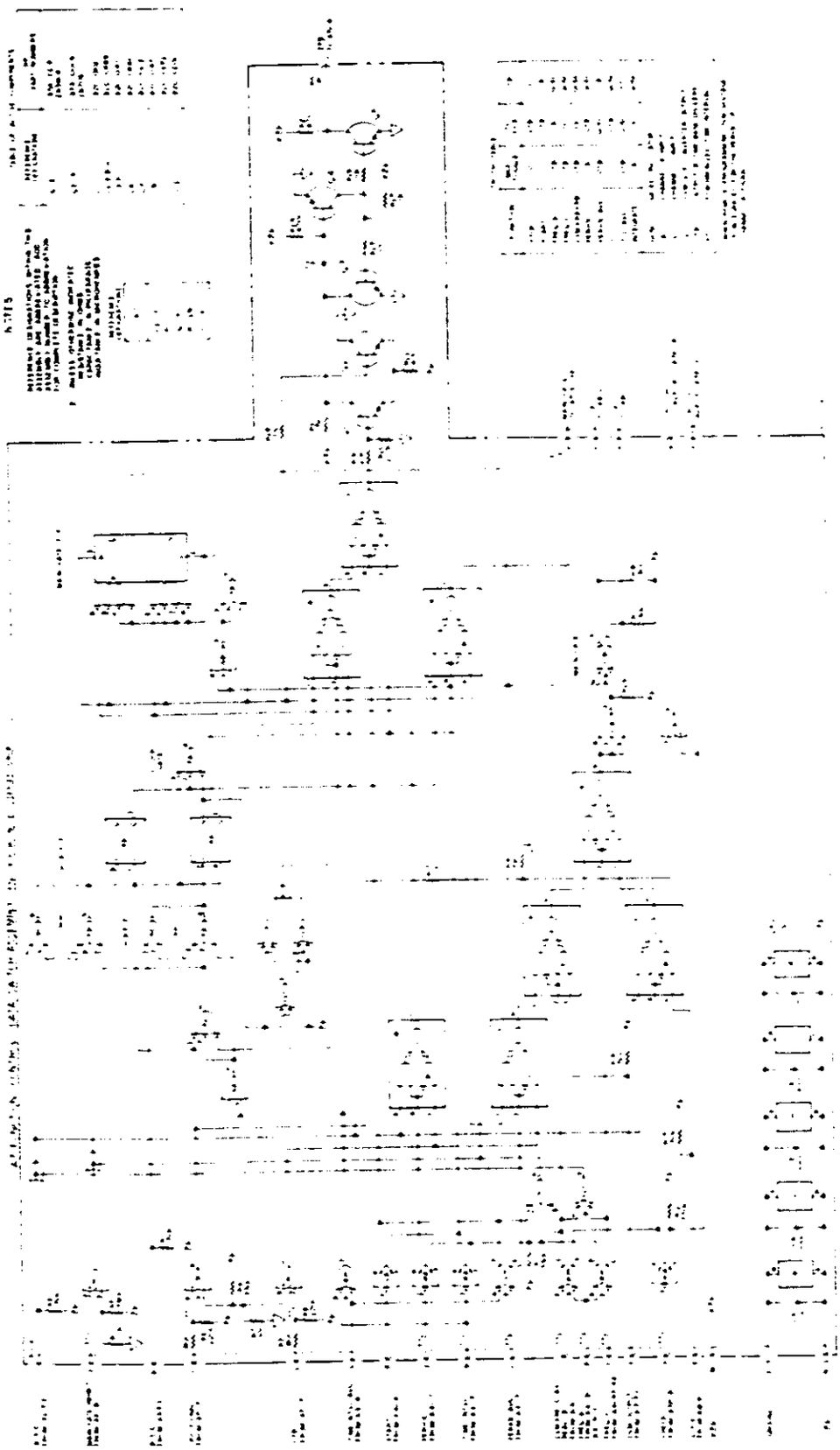
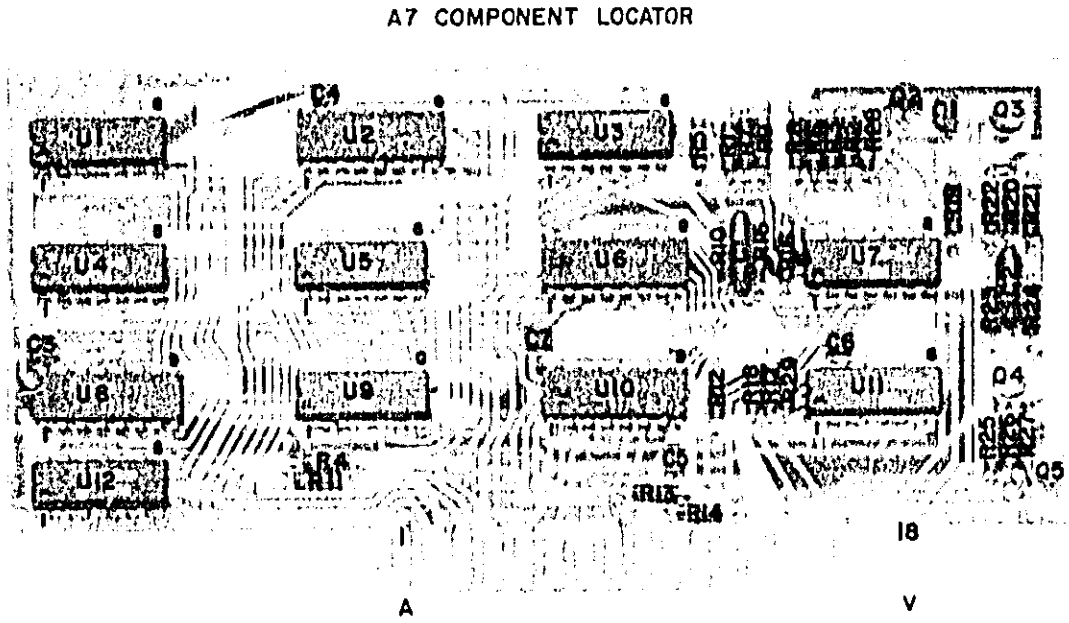


Figure 7-6. A7 (05327-60004) Component Locator



SECTION VIII

SCHEMATIC DIAGRAMS

8-1. GENERAL

8-2. This section contains the following:

a. Schematic diagram notes.

b. Schemati s.

c. Component locators.

d. IC outline drawings.

e. Waveforms.

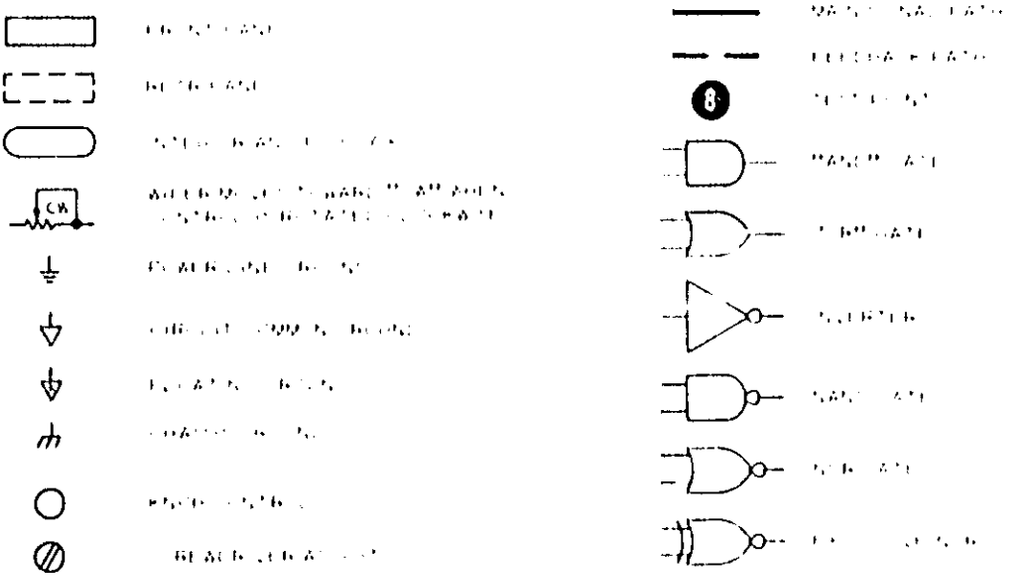
f. Simplified block diagrams.

g. Theory of operation.

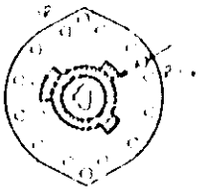
h. Troubleshooting.

Figure 8-1. Schematic Diagram Notes

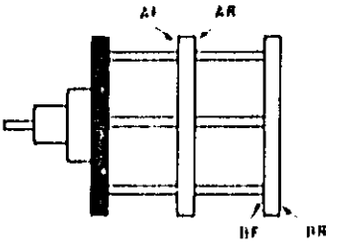
SYMBOLS



SWITCH DESIGNATIONS



A351		
B		
R		
A351BR(2-1 2)	(2-1 2)	



REFERENCE DESIGNATIONS

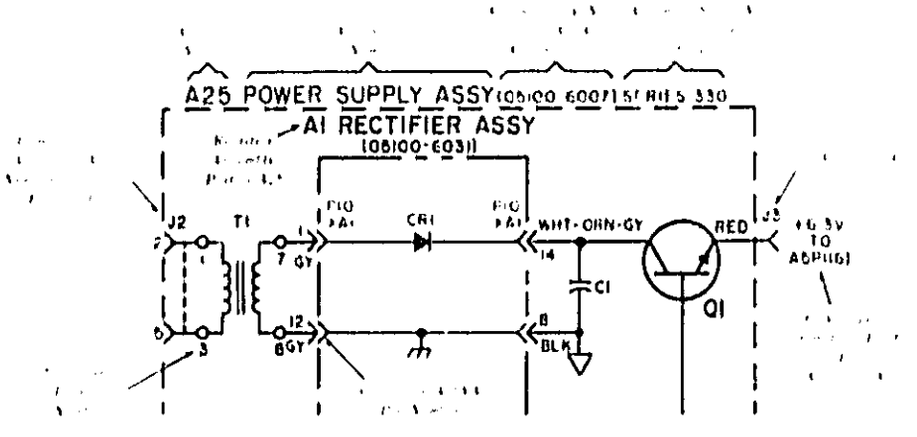
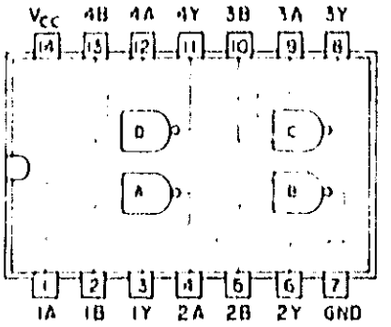


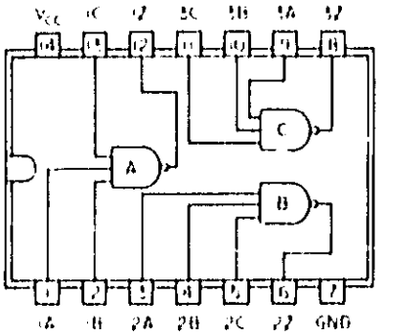
Figure 8-2. Integrated Circuit Diagrams

1820-0064



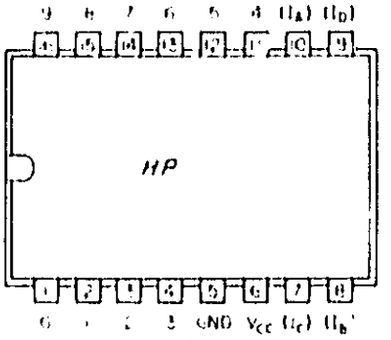
1820-0064(SN7400N)
QUADRUPLE 2-INPUT POSITIVE NAND GATE
NOTE POSITIVE LOGIC $Y = \overline{AB}$

1820-0068



1820-0068(MC846P)
TRIPLE 3-INPUT POSITIVE NAND GATE
POSITIVE LOGIC $Y = \overline{ABC}$

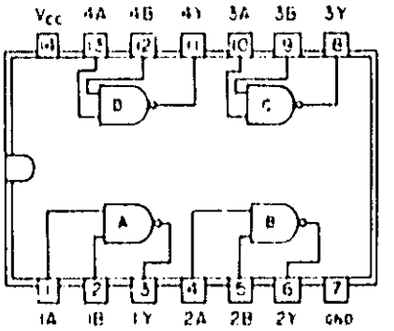
1820-0092



1820-0092
DRIVER
NEGATIVE LOGIC

$I_A(1)$	$I_B(2)$	$I_C(4)$	$I_D(8)$	OR OUTPUT
H	H	H	H	0
L	H	H	H	1
H	L	H	H	2
L	L	H	H	3
H	H	L	H	4
L	H	L	H	5
H	L	L	H	6
L	L	L	H	7
H	H	H	L	8
L	H	H	L	9
BCD 0-9				NON

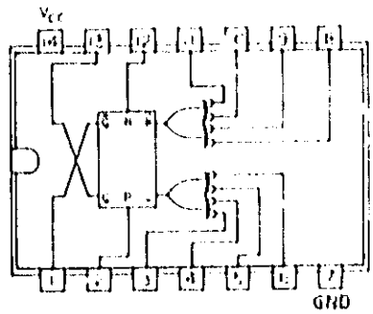
1820-0094



1820-0094(MC846P)
QUADRUPLE 2 INPUT POSITIVE NAND GATE
NOTE POSITIVE LOGIC $Y = \overline{AB}$

Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0102



1820-0102(MC-0048)
DUAL J-K FLIP-FLOP

R-S TRUTH TABLE

R	S	Q^{n+1}
0	0	Q^n
0	1	1
1	0	0
1	1	ND

ALL J-K INPUTS ARE STATIC

J_D - K_D TRUTH TABLE

J	K	Q^{n+1}
↓	↓	1
0	0	Q^n
0	1	0
1	0	1
1	1	$\overline{Q}^n$

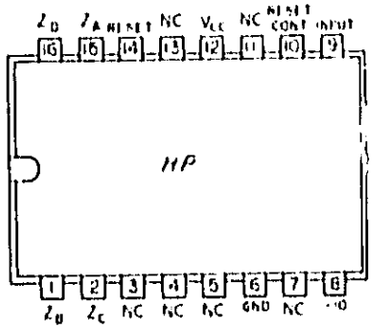
ALL OTHER J-K INPUTS AND THE R-S INPUTS ARE AT A "0" LEVEL

CLOCKED J-K TRUTH TABLE

J	K	C_D	Q^{n+1}
1	1	↓	$\overline{Q}^n$
↓	↓	0	Q^n
0	0	1	Q^n
0	1	1	1
1	0	1	0
1	1	1	$\overline{Q}^n$

ALL OTHER J-K INPUTS AND THE R-S INPUTS ARE AT A "0" LEVEL

1820-0117



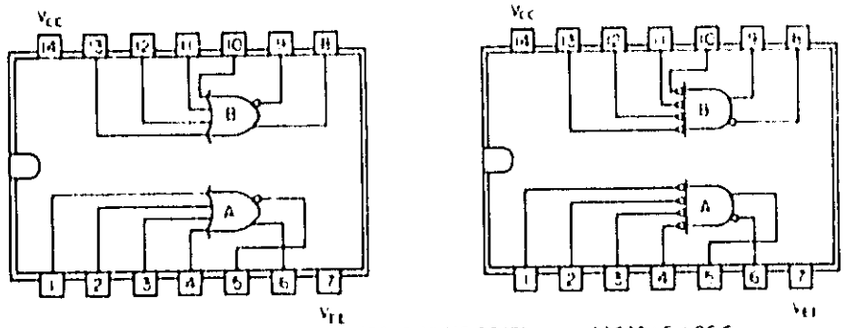
1820-0117,0119,0252
BLANKING DECADE COUNTER
NEGATIVE LOGIC 1= LOW
0= HIGH

TRUTH TABLE

INPUT PULSE	OUTPUT A	B	C	D
0	H	H	H	H
1	L	H	H	H
2	H	L	H	H
3	L	L	H	H
4	H	H	L	H
5	L	H	L	H
6	H	L	L	H
7	L	L	L	H
8	H	H	H	L
9	L	H	H	L
PULSE CONTINUES HIGH AFTER RESET PULSE	H	H	H	H
PULSE CONTINUES LOW AFTER RESET PULSE	L	L	L	L

POSITIVE PULSE APPLIED TO RESET WILL
A RESET A,B,C & D TO LOW IF RESET CONTROL IS LOW
B RESET A,B,C & D TO HIGH IF RESET CONTROL IS HIGH
C THE +10 OUTPUT WILL ALWAYS BE RESET TO HIGH STATE

1820-0142



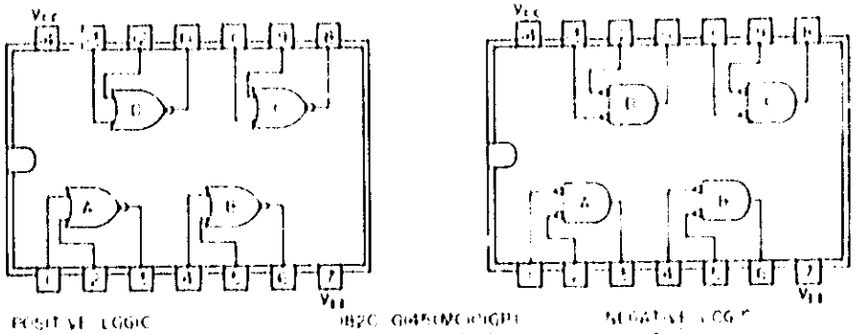
POSITIVE LOGIC
$5 = \overline{1+2+3+4}$
$6 = 1+2+3+4$

1820-0142(MC-0048)
ECL DUAL 4-INPUT 2-OR,2-NOR

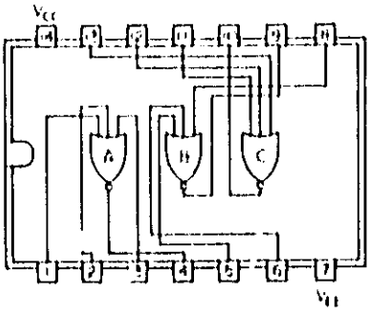
NEGATIVE LOGIC
$5 = \overline{1 \cdot 2 \cdot 3 \cdot 4}$
$6 = 1 \cdot 2 \cdot 3 \cdot 4$

Figure 8-2. Integrated Circuit Diagrams (Continued)

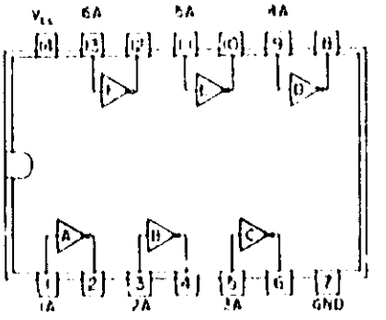
1820-0145



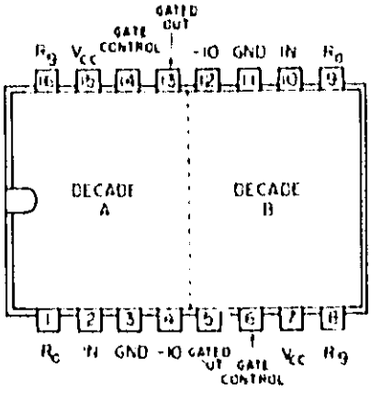
1820-0147

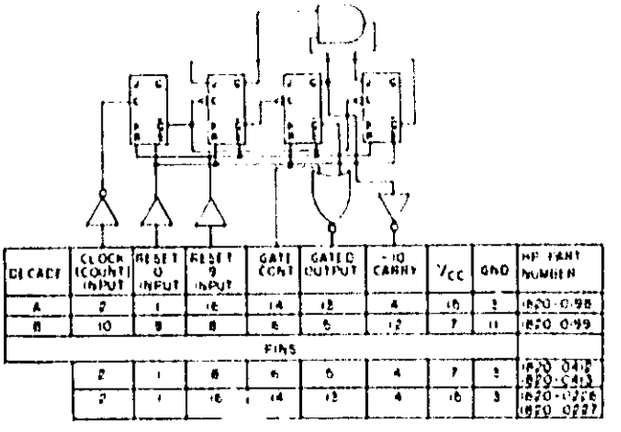


1820-0174



1820-0198 and 1820-0199

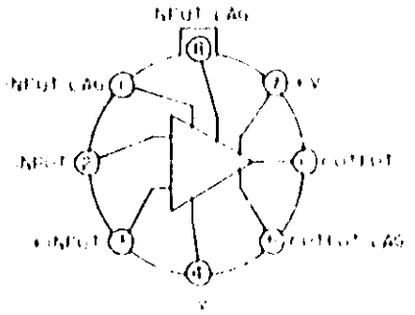




DECADE	CLOCK (COUNT) INPUT	RESET 0 INPUT	RESET 9 INPUT	GATE CONT	GATED OUTPUT	-10 CARRY	V_{CC}	GND	HP PART NUMBER
A	2	1	15	14	12	4	16	5	1820-0198
B	10	9	8	6	5	12	7	11	1820-0199
PINS									
	2	1	8	6	5	4	7	3	1820-0418 1820-0419
	2	1	15	14	13	4	16	3	1820-0226 1820-0227

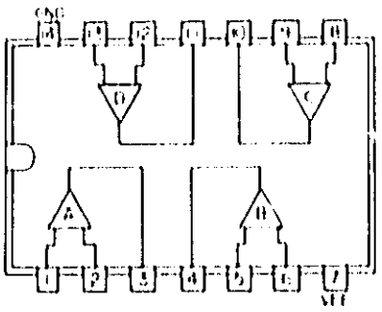
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0201



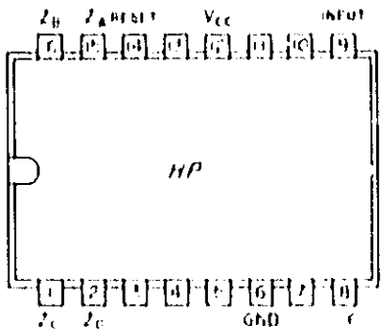
1820-0201 (MC1456)
OPERATIONAL AMPLIFIER

1820-0212



1820-0212
QUADRUPLE LINE RECEIVER

1820-0209



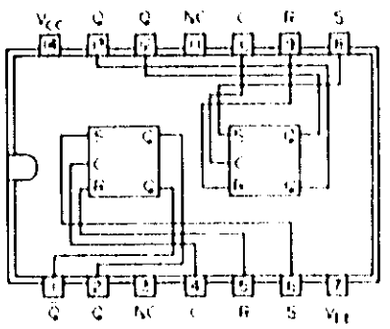
1820-0209
DIVIDE BY 16 COUNTER
NEGATIVE LOGIC: LOW
= HIGH

TRUTH TABLE

IN	A	B	C	D
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H
10	L	H	L	H
11	H	H	L	H
12	L	L	H	H
13	H	L	H	H
14	L	H	H	H
15	H	H	H	H

THE -16 OUTPUT WILL GO HIGH ON COUNT 8 AND LOW ON COUNT 16 OR RESET

1820-0213



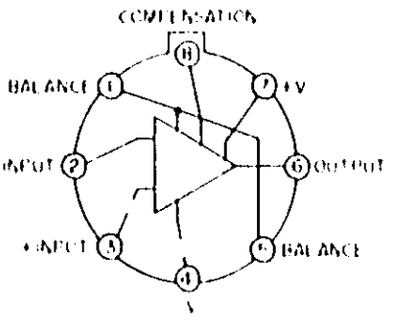
TRUTH TABLE

R	S	C	Q^{n+1}
0	1	↓	1
1	0	↓	0
0	0	↓	Q^n
1	1	↓	ND
↑	↑	0	Q^n

*EITHER STATE
NOT DEFINED

1820-0213 (MC1472)
DUAL RS FF

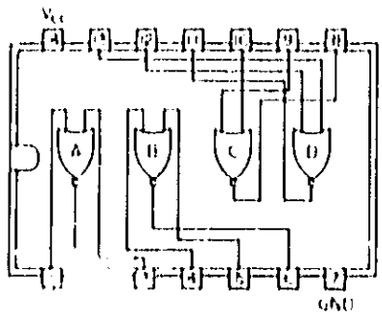
1820-0223



1820-0223 (LM301A)
OPERATIONAL AMPLIFIER

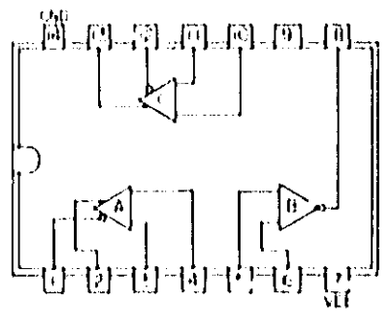
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0238



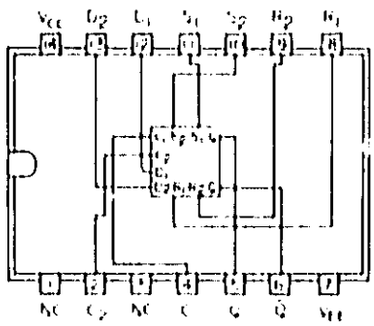
1820-0238 (MC1808P)
QUAD 2-INPUT NOR GATES

1820-0263



1820-0263
TRIPLE DIFFERENTIAL AMPLIFIER

1820-0272



1820-0272 (MC1822P)
TRIPLE D FLIP-FLOP

CLOCKED TRUTH TABLE

D	C	Q^{n+1}	$\bar{Q}^{n+1}$
PIN No. 2	PIN No. 3	5	6
1	0	Q^n	$\bar{Q}^n$
1	0	Q^n	$\bar{Q}^n$
0	↑	0	1
1	↑	1	0

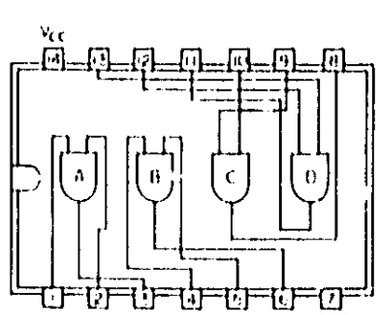
*A 1 OR CLOCK INPUT IS DEFINED FOR THIS FLIP-FLOP AS A CHANGE IN LEVEL FROM A LOW INPUT TO A HIGH INPUT

S-R Truth TABLE

R	S	Q^{n+1}	$\bar{Q}^{n+1}$
PIN No. 1	PIN No. 4	5	6
0	0	Q^n	$\bar{Q}^n$
0	1	1	0
1	0	0	1
1	1	N.D.	N.D.

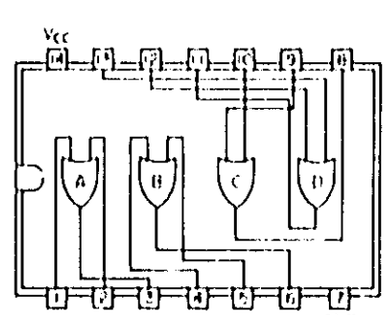
N.D. = NOT DEFINED

1820-0273



1820-0273 (MC1808P)
QUAD 2-INPUT AND GATES

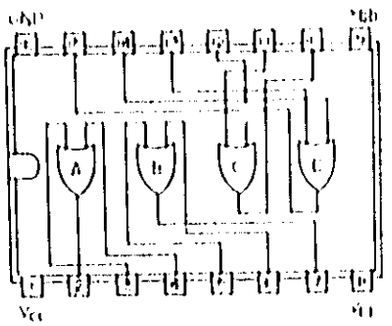
1820-0274



1820-0274 (MC1808P)
QUAD 2-INPUT OR GATES

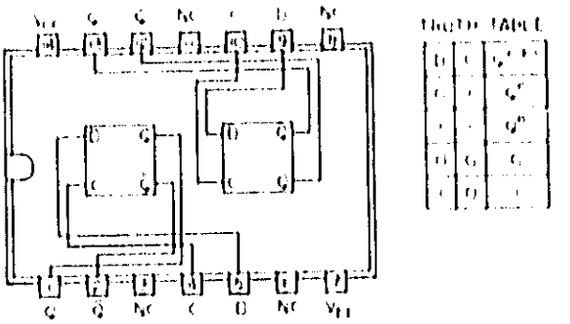
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0276



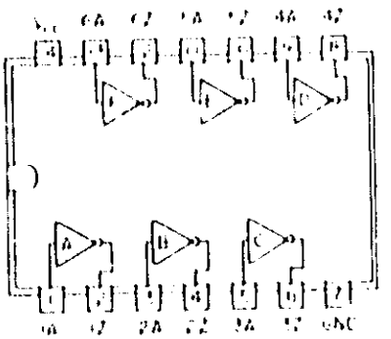
1820-0276 (MC1035P)
QUAD TRANSLATOR 2-INPUT OR GATE

1820-0276



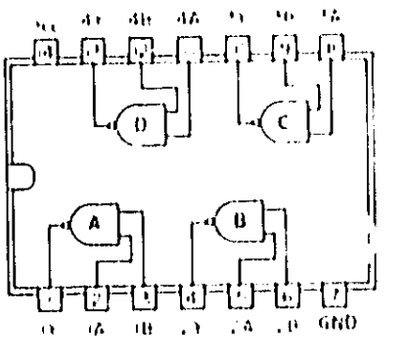
1820-0276 (MC1035P)
DUAL D/S FF

1820-0307



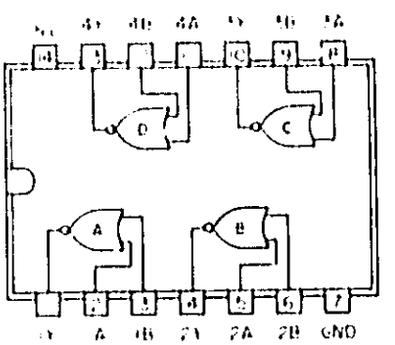
1820-0307 (SN7407N)
HEX BUFFER

1820-0327



1820-0327 (SN7426N)
QUAD 2-INPUT NAND WITH OPEN COLLECTOR
POSITIVE LOGIC Y = AB

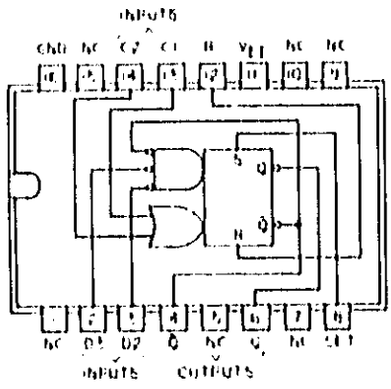
1820-0328



1820-0328 (SN7402N)
QUAD 2-INPUT NOR GATE
POSITIVE LOGIC Y = A+B

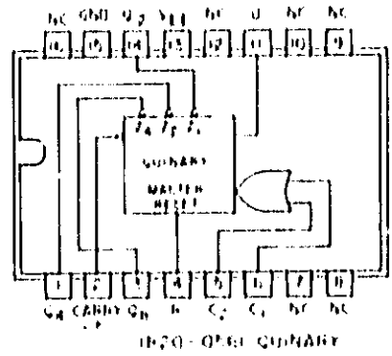
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0558



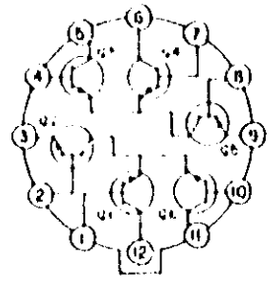
1820-0558
ECL HIGH SPEED D-BINARY

1820-0561



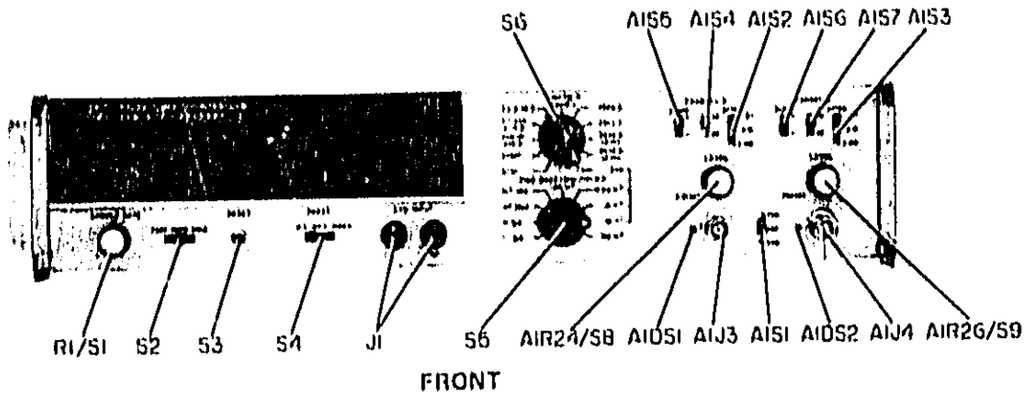
1820-0561 QUINARY

1858-0004



1858-0004
TRANSISTOR ARRAY
(BOTTOM VIEW)

Figure 8-3. Model 5327B Front and Rear Panels



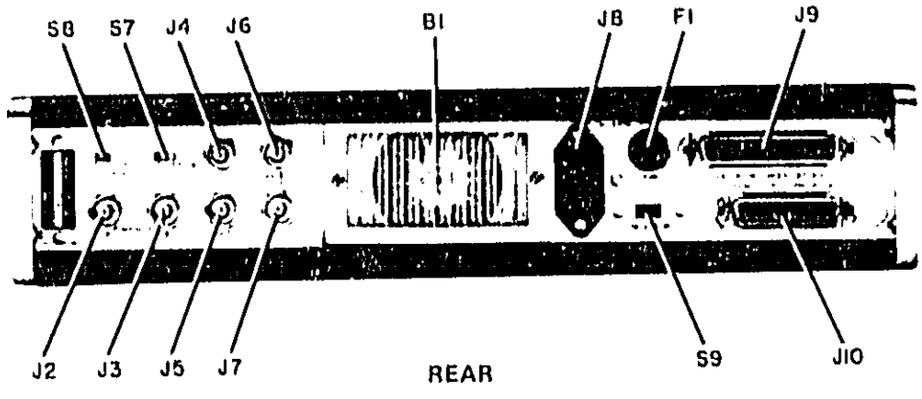
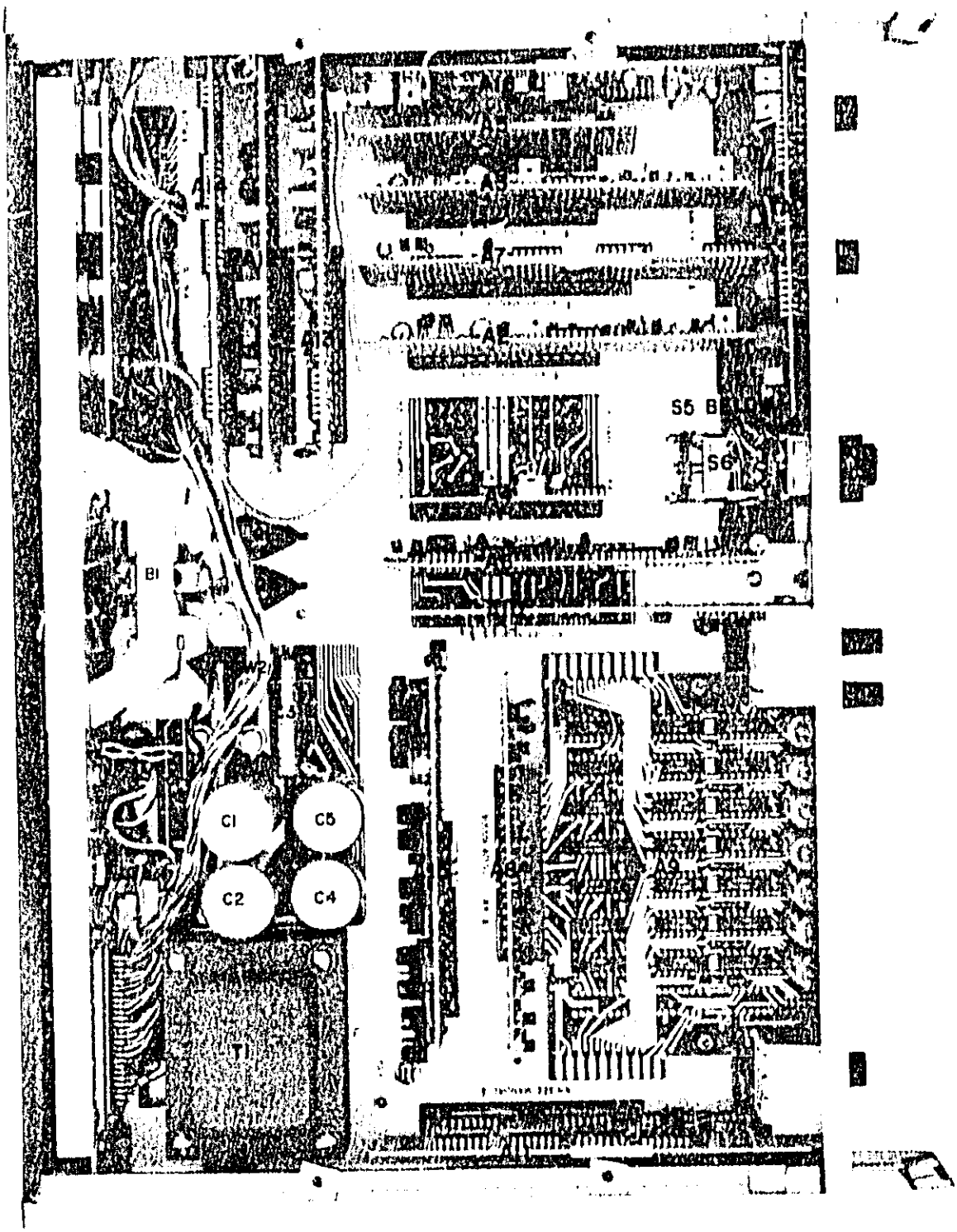


Figure 8-4. Model 5327B Top Internal View



A1 ATTENUATOR OPERATION

Attenuator Assembly A1 consists of two input attenuator channels. Since the channels are identical, only Channel A will be described. Channel A input signals are routed through J3 to the attenuator network. When ATTEN switch S2 is set to X1, the full input signal is fed to the gate of Q1A. With the ATTEN switch in X10, R2, R5, C1, and C3 serve as a 10:1 voltage divider. In the X100 position, the 100:1 divider consists of R2, R4, C1, and C2. R3 provides damping.

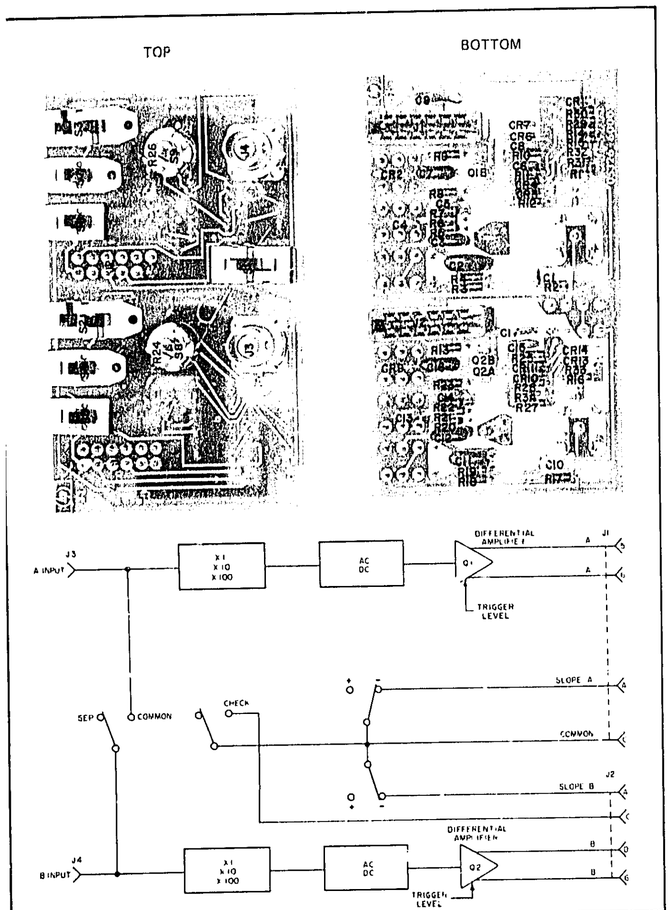
When AC DC switch S4 is set to AC, C4 is in series with the signal path. CR3 and CR4 limit the input amplitude to Q1A to approximately ±5.8 volts. R7 and R8 provide current limiting. C5 compensates Q1A input capacitance.

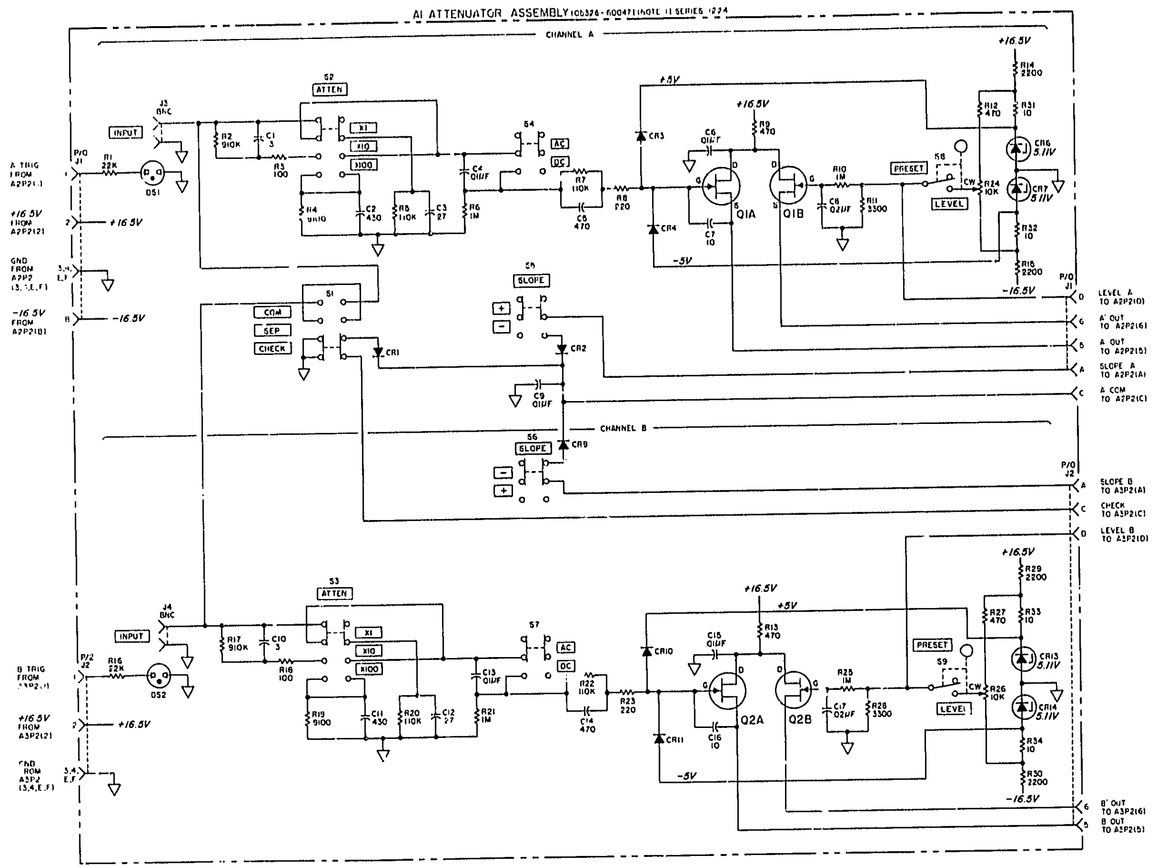
Q1A and Q1B form a differential amplifier connected as source followers. The outputs are fed to A2 via pins 5 and 6 of J1. LEVEL potentiometer R24 determines the trigger level on Q1B gate. The trigger level can be preset to zero volts or varied from -3 to +3 volts; or with the LEVEL control set to PRESET, an external trigger level can be applied at J10 to A1J1(D) for remote programming. Diodes CR6 and CR7 develop 5 volts for the input protection and level pots. R12 adds symmetry to the voltage range of R24. R11 lowers the impedance of Q1B gate circuit to limit stray charges and false triggering. R10 and C8 form a filter to prevent noise from triggering the differential amplifier.

When SLOPE switch S5 is set to -, a ground is supplied via CR2 to J1 pin A. This sets amplifier trigger A2 to trigger on the negative slope of the input signal. When remote programming is used, J1(C) is held high to disable the SLOPE switches and the CHK switch.

COM-SEP-CHK switch S1 connects inputs A and B in parallel when set to COM and grounds J2(C) via CR1 for the check mode.

A1 contains trigger lights DS1 and DS2 and current limiters R1 and R2. CR1, CR2, and CR9 eliminate interaction of the remote programming signals.





NOTES

1 REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

2 UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS.

REFERENCE DESIGNATIONS

A1
C1-17
CR1-4,6,7, 9-11,13,14
DS1,2
J1-4
Q1,2
R1-34
S1-9

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2,9	1910-0016
CR3,4,10,11	1901-0376
CR6,7,13,14	1902-0041
Q1,2	1855-0334

CE28-C-A

COMPLETE PARTS LIST FOR THE THIS ASSEMBLY IS LOCATED ON PAGE 6-3

Figure 8-5. A1 Attenuator Assembly

A2, A3 AMPLIFIER/TRIGGER OPERATION

Two input amplifier assemblies are provided: A2 for Channel A and A3 for Channel B. Since the assemblies are identical, only one will be described. The input signal and the trigger level are received from A1 via P2(5) and P2(6) respectively. Potentiometer R2 is adjusted to cancel out offset voltages due to imbalances in the circuit.

The differential amplifier (Q1 and Q8) serves to clip a small window out of the input signal waveform. The outputs of Q1 and Q8 drive another differential amplifier Q2 and Q6. Q2 and Q6 inject a current drive input to differential Schmitt trigger Q3, Q4, Q5, and Q7.

Q3 and Q7 are common base amplifiers, which present a low input impedance and high output impedance to Q4 and Q5. This arrangement allows for greater high-speed operation of Q4 and Q5. C2 and R15 reduce the hysteresis of the Schmitt trigger to give greater reliability at the high frequencies. Two out-of-phase signals from this circuit are routed to Q9 and Q10. The output levels shift from approximately +0.8 to +0.5 volts.

The SLOPE switch on A1 drives U1D(11) low for a +slope selection and U1A(3) low for a -slope selection. This allows either the in-phase signal or the out-of-phase signal to be switched to Q13 via Q10 and Q12 for +slope or via Q9 and Q11 for -slope.

The differentiator circuit consists of Q13 and feedback network L8 and R32. The circuit develops 10 ns pulses at the collector of Q13. CR3 and CR4 bias Q13 so that the collector circuit is compatible with ECL output driver U2B.

U2A(6) drives trigger-lamp driver Q16, Q17, Q18, Q19, and Q20. The circuit consists of RS FF Q16-Q17 and one-shot Q19-Q20. When U2A(6) is low, Q16 turns off and Q17 turns on. With Q17 on, Q18 cuts off to drive P1(1) high, which will light the trigger lamp DS1 on A1. As C8 charges, Q20 base goes positive. When Q20 base is approximately ground potential, the one-shot fires to turn off Q19 and Q17.

The marker circuit, Q15 and Q14, is a pulse stretcher that provides a low marker output at P1(12, N). When the input amplifier circuits trigger, U2B(8) provides a positive spike to Q14 base to drive Q14 collector below ground and allow CR5 to conduct. This makes the charge on C6 more positive. When U2B(8) returns to logical zero (approximately -1.6 V), Q14 is back biased and turns off, allowing Q15 to turn on to drive the marker output line low. After C6 has discharged through R36, Q14 turns on again, Q15 turns off, and the marker output line returns to the high state.

During the check mode, A1P1(C) is held high to disable U2B and enable U2A. With U2B disabled, the marker pulses are inhibited. With U2A enabled, the 10 MHz check signal at P1(4,D) connects to the amplifier output line P1(5,E).

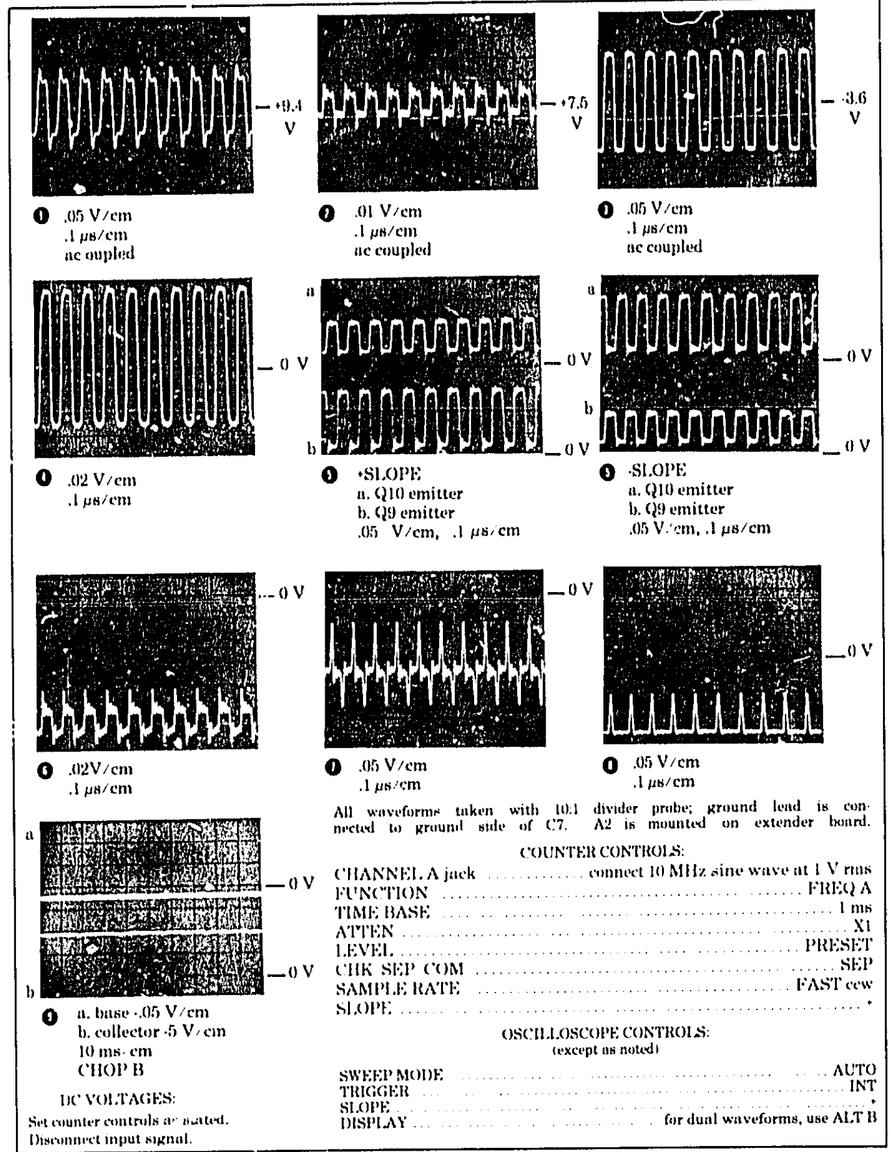
A2 TROUBLESHOOTING

When tracing the signal through the amplifier assembly, a good starting point is the collector of Q1, test point 4. With a sine wave input and the LEVEL control set to zero, this waveform should always resemble a square wave, due to the action of the Schmitt Trigger. A second check would be test point 6. If no signal is available there, check the slope gates of U1 and transistors Q9-Q12. Make use of the waveforms that are provided on this page. Once the problem is confined to a general area, use dc voltage checks to pinpoint the trouble.

Figure 8-5
A1 ATTENUATOR ASSEMBLY

(See Page 8-13)

Part of Figure 8-6. Input Amplifier Assembly



❶ .05 V/cm
.1 μs/cm
ac coupled

❷ .01 V/cm
.1 μs/cm
ac coupled

❶ .05 V/cm
.1 μs/cm
ac coupled

❶ .02 V/cm
.1 μs/cm

❸ +SLOPE
a. Q10 emitter
b. Q9 emitter
.05 V/cm, .1 μs/cm

❸ -SLOPE
a. Q10 emitter
b. Q9 emitter
.05 V/cm, .1 μs/cm

❶ .02V/cm
.1 μs/cm

❶ .05 V/cm
.1 μs/cm

❶ .05 V/cm
.1 μs/cm

❶ a. base -.05 V/cm
b. collector -5 V/cm
10 ms/cm
CHOP B

DC VOLTAGES:
Set counter controls as noted.
Disconnect input signal.

All waveforms taken with 10:1 divider probe; ground lead is connected to ground side of C7. A2 is mounted on extender board.

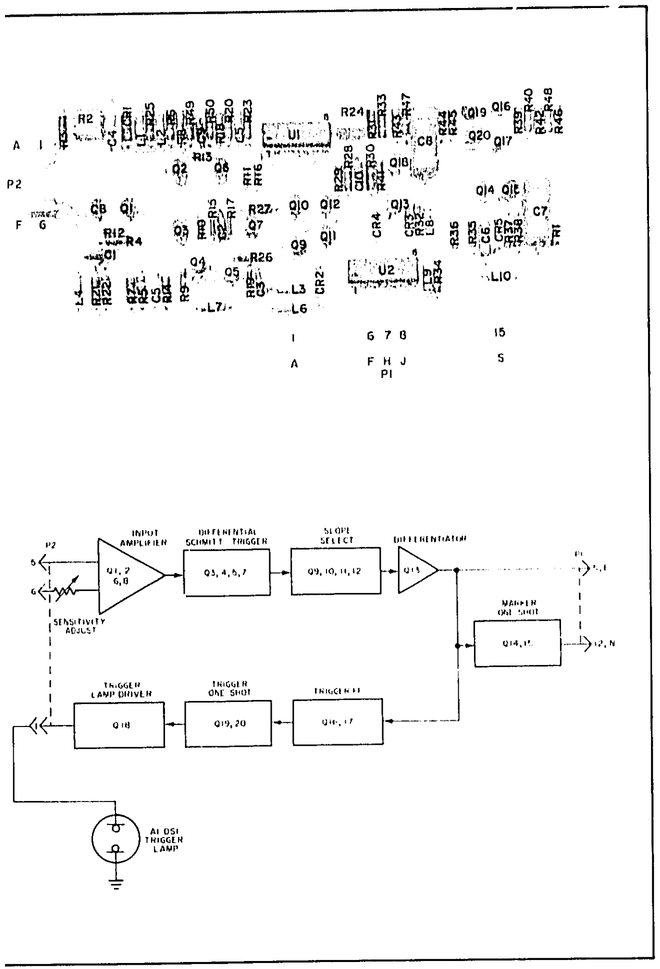
COUNTER CONTROLS:

CHANNEL A jack	connect 10 MHz sine wave at 1 V rms
FUNCTION	FREQ A
TIME BASE	1 ms
ATTEN	X1
LEVEL	PRESET
CHK SEP COM	SEP
SAMPLE RATE	FAST ccw
SLOPE	*

OSCILLOSCOPE CONTROLS:
(except as noted)

SWEEP MODE	AUTO
TRIGGER	INT
SLOPE	*
DISPLAY	for dual waveforms, use ALT B

MORE DATA UNDER FOLD



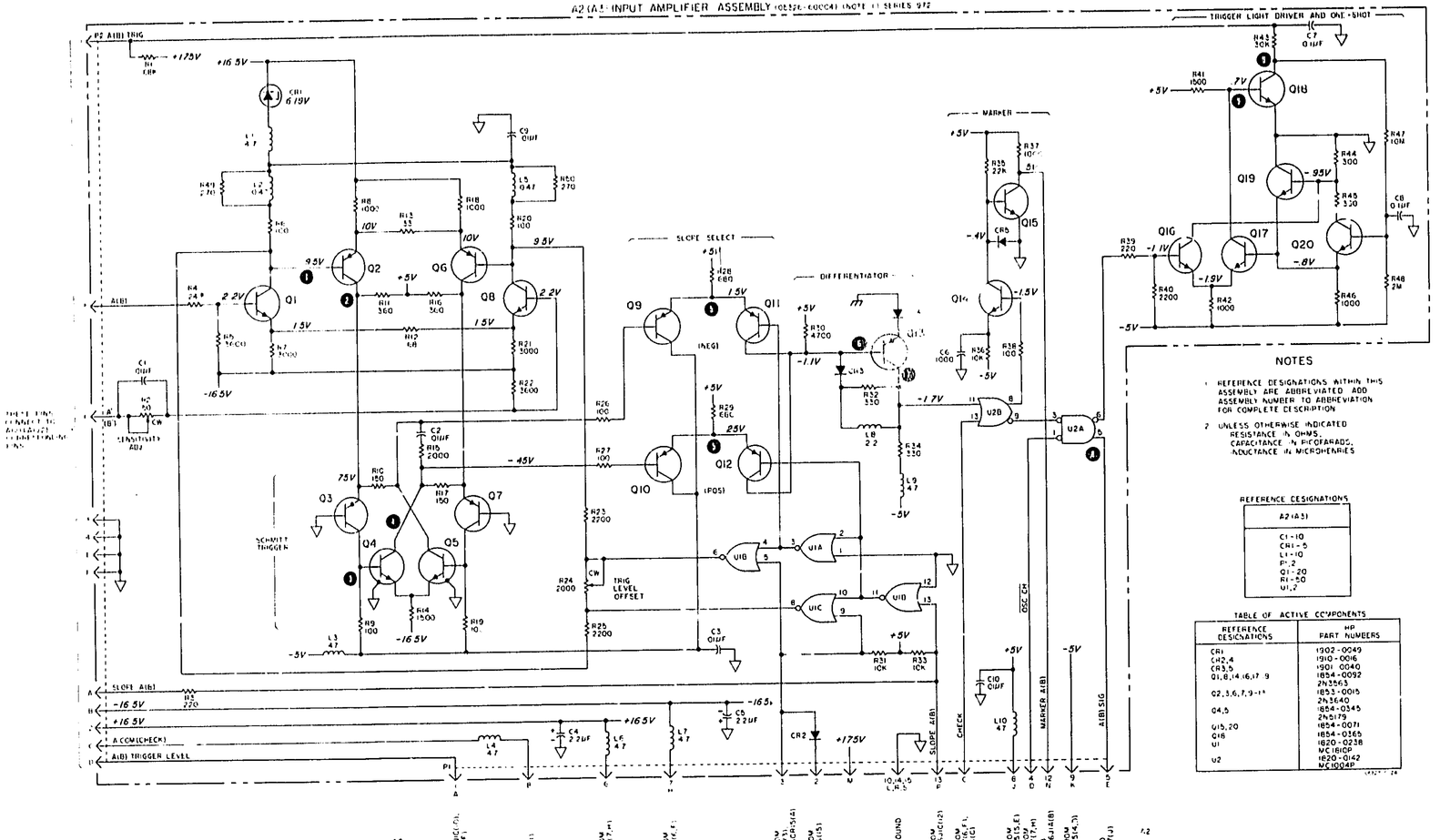
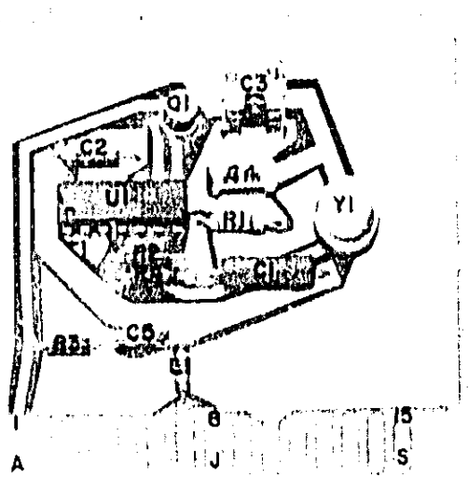


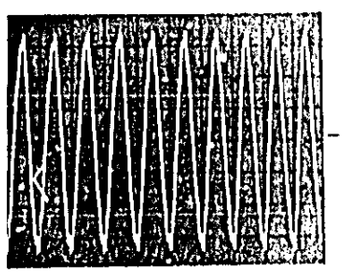
Figure 8-6. A2, A3 Amplifier/Trigger Assembly

A4 OSCILLATOR OPERATION

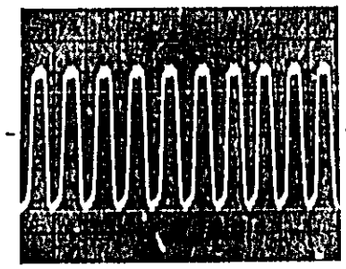
The 10 MHz oscillator assembly consists of oscillator U1A, buffer U1B, and level shifter Q1. U1A operates like an amplifier with positive feedback. The positive feedback path is from the noninverted output of U1A(6) through 10 MHz crystal Y1, trimmer capacitor C3, and C4 to U1A(4). Negative feedback is used to establish the input bias for U1A. The negative feedback path consists of R1 and R2. The inverted output of U1A(5) connects to buffer U1B(10). The buffer provides isolation between the oscillator and the output. The outputs of U1B(8) and (9) switch from approximately 3.5 to 4.25 volts. When one output is 3.5 volts, the other output is 4.25 volts. Level shifter Q1 converts the output of U1B to an approximate square wave of 0 to +4 volts.

Part of Figure 8-7. A4 Oscillator Assembly

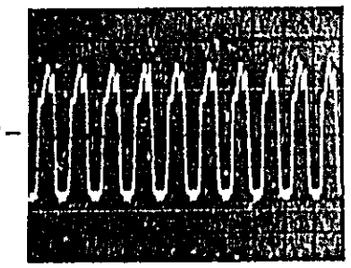




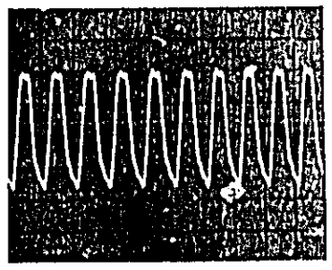
❶ .01 V/cm
.1 μs/cm
ac coupled



❷ .02 V/cm
.1 μs/cm
ac coupled



❸ .02 V/cm
.1 μs/cm
ac coupled



❹ .1 V/cm
.1 μs/cm

All waveforms taken through 10:1 divider probe. Divider probe's 8½" ground lead is connected to ground side of C5.

COUNTER CONTROLS:

INT-EXT (rear panel) ..... INT

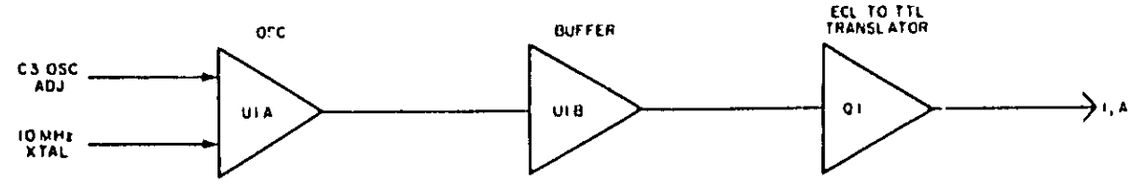
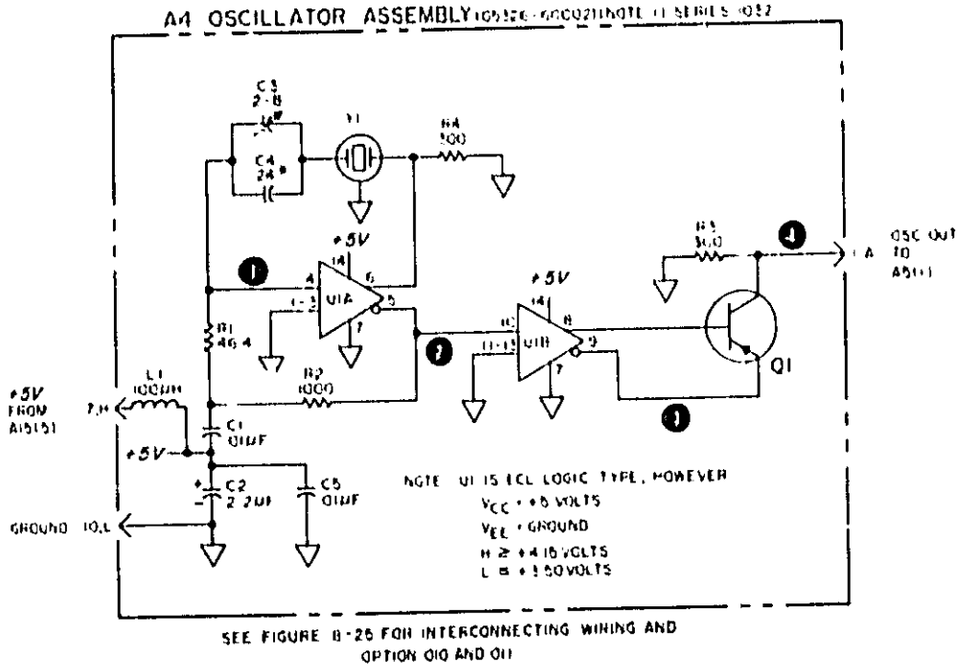


Figure 8-6
A2, A3 AMPLIFIER/TRIGGER ASSEMBLY

(See Page 8-15)



SEE FIGURE 8-26 FOR INTERCONNECTING WIRING AND OPTION 010 AND 011

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

REFERENCE DESIGNATIONS

A4
C1-5 L1 Q1 R1-4 U1 Y1

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
Q1	1850-0158 2N2635
U1	1820-0142
Y1	0410-0405

Figure 8-7. A4 Oscillator Assembly

Part of Figure 8-8. Time Base Control Assembly

A5 TIME BASE OPERATION

This assembly contains 8 decade dividers, which are controlled by TIME BASE switch S5. The input signal is 10 MHz for the frequency mode. For the totalize and period-average modes, the decade dividers receive INPUT A signals.

When a particular decade receives a gate-enable signal the corresponding gated output line is enabled. For example, if S5 is set to .1 second U1(6) is grounded. This gates the divided signal out on U1(5). The gated outputs are connected together on a common line to C5. C5 differentintes the high to low transitions into approximately 100 ns pulses at U5C(8). When S5 is set to .1 µs, the input signal bypasses the decade dividers and passes through U10D and U5D. The output of U5C feeds through U10C to A7 and also through U10E to the rear-panel TIME BASE OUTPUT jack J6.

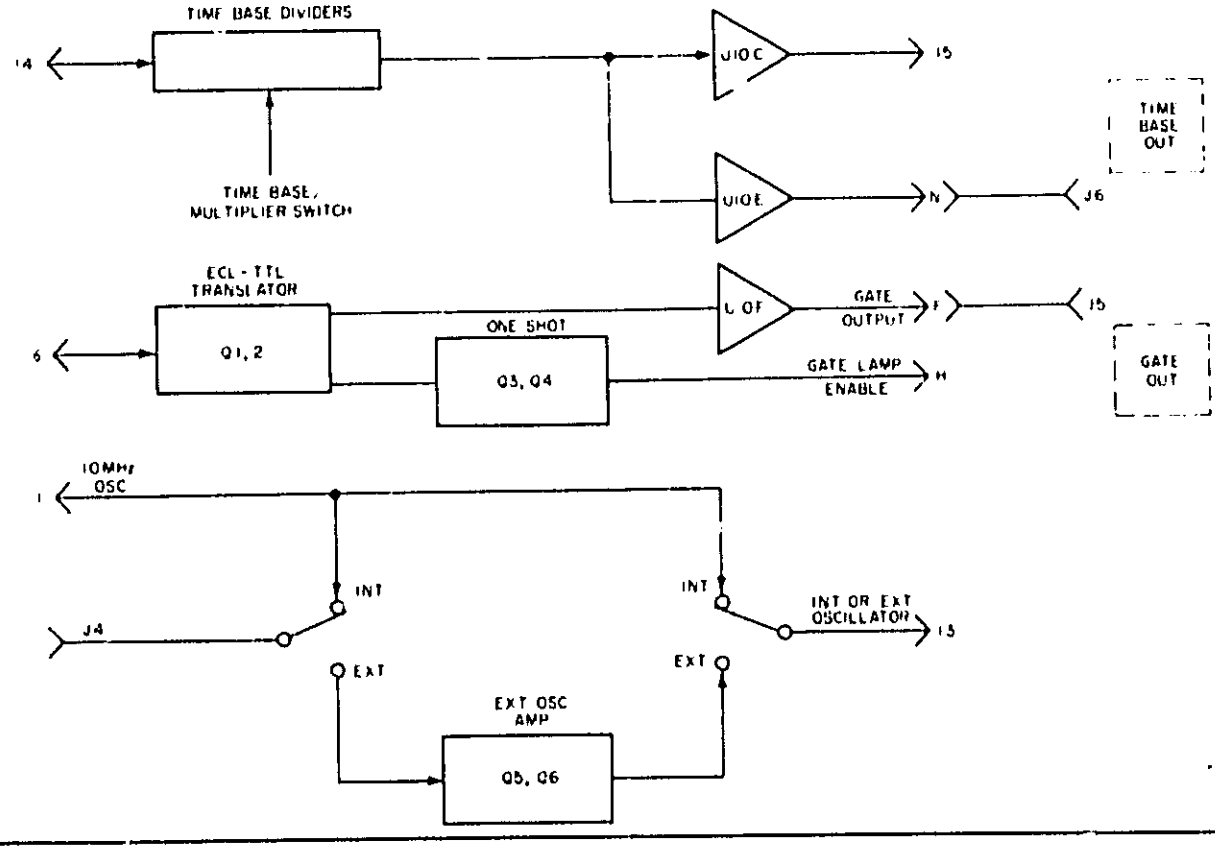
Q1 and Q2 orm an ECL to TTL translator. When the main gate opens (low is main-gate enable), Q2 turns on the start one-shot Q3/Q4. During short gate-length times, this holds the gate lamp enable line low for approximately 50 ms to extend the time the gate lamp is on. When Q1 collector goes high, a low is developed at U10F(12) and routed to the GATE OUT jack J5.

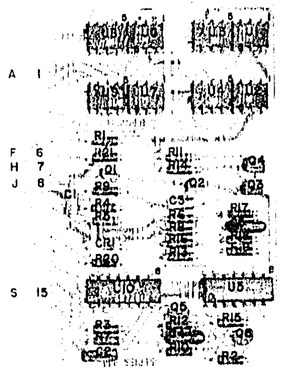
U5A and U5B select either the internal or external oscillator signal. When S7 is set to EXT, the internal oscillator signal is inhibited and the external oscillator signal passes through Schmitt trigger Q5 and Q6 to U5B and XA5(13).

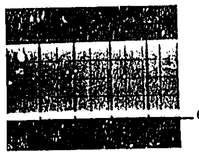
A5 TROUBLESHOOTING

When troubleshooting the Time Base Dividers, place the FUNCTION switch to START and CHK SEP COM to CHK. Step the TIME BASE switch through each position and note the counter's display. When the counter stops totalizing, check for a low on pin 6 of the selected decade. If the counter does not totalize for any position of the TIME BASE switch, the problem is in the circuitry of U10B, U10C, or U5C. Before the gated output is sent to the A7 Function Selector, it is differentiated by C5 and R18. The produces extremely sharp pulses, which are best observed when the gate time is 0.1 µs (TIME BASE switch).

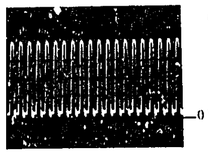
To check the operation of the Gate Lamp one-shot, check for waveform 5 and 6 with SAMPLE RATE switch to NORM. The Collector of Q3 should be Low for about 50 ms regardless of the gate time.



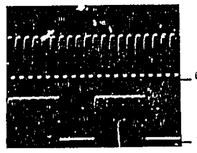




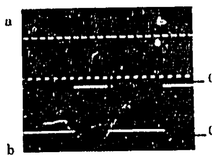
❶ .1 V/cm
.5 µs/cm



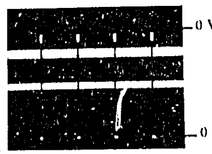
❷ .1 V/cm
.2 µs/cm



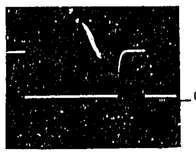
❸ a. U7(2) .2 V/cm
b. U7(4) .2 µs/cm



❹ a. U2(2) .2 V/cm
b. U2(5) .2 ms/cm



❺ a. Q1 base - .1 V/cm
b. Q1 collector - .2 V/cm
.5 ms/cm



❻ .2 V/cm
10 ms/cm
SAMPLE RATE - NORM
SWEEP MODE - NORM

COUNTER CONTROLS:
(except as noted)

Use settings of A2 Assembly

DC VOLTAGES:
Set counter controls as stated.
Disconnect input signal. Push RESET.

All waveforms taken with 10:1 divider probe; ground lead is connected to ground side of C1. A5 is mounted on extender board.

OSCILLOSCOPE CONTROLS:
(except as noted)

Use settings of A2 Assembly

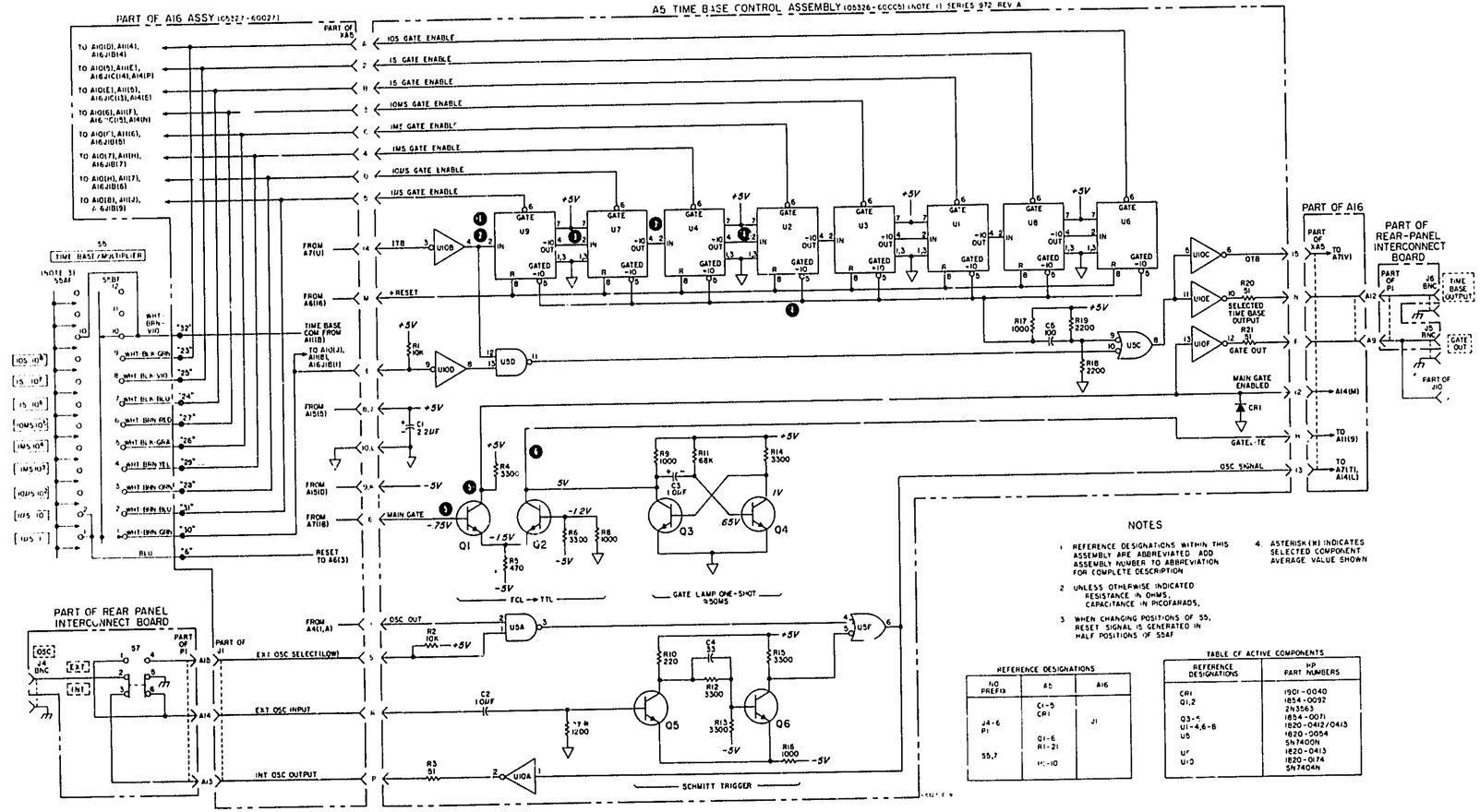


Figure 8-8. A5 Time Base Control Assembly

A6 SAMPLE RATE OPERATION

The sample-rate circuits determine interrogation rates for the input signal and provide several functions for the various operating modes. These functions include generating reset, transfer, print command, and main-gate inhibit signals. In addition, the circuits receive computer inhibit, printer inhibit, and manual reset signals. The circuits also serve to control storage and display-hold functions.

As an example of operation, assume the following operating conditions: STORAGE to ON, SAMPLE RATE to FAST, no printer inhibit, no computer inhibit, no manual reset, and main gate open. At the end of the gate time, Pin 17 goes high, which sets inhibit flip-flop U2. This sends a signal to U6C to generate a high inhibit at U6B(9). In addition, a low is generated at Q4 collector to trigger the sample rate one-shot if no printer inhibit is present at U5B(6). The display time starts at this point, and the high at U5C(10) generates a low at U1D(11). The resulting high on U1C(8) turns on Q6, giving a low at the collector, which is the print command. Also at this time, the low on U1B(6) activates U4C through differentiator C5 to generate the positive and negative transfer signals at pins T and K, respectively.

When the sample rate one-shot is set, U1B(6) goes low to turn off Q7, allowing the +5 V supply and R41 - R1 to charge C4 for the display time. C3 is also connected for the NORM position. R1 varies the display time by varying the time required to bring Q8 base to a sufficient plus value to trigger Schmitt Trigger Q8 through Q10. This gives a high at U1A(4). The reset will be delayed until there is no print inhibit. U1A(3) will go low, generating a high at U3B(6), which is fed out at A6(16). The negative reset at U3C(8) is fed out at pin 9 in addition to being used to reset the sample rate one-shot.

The positive reset is used on A6 after passing through level shifter CR7 and CR8. The positive reset turns on Q1 and applies an ECL high to clear U2 and also turns on Q2, which maintains inhibit approximately 200 ns after the end of the reset pulse. At this time, the inhibit goes low and the main-gate circuits are free to function.

Q11 circuitry is a reset one-shot that ensures a sufficiently long reset pulse. The reset pulse width is approximately 40 µs or 400 µs, as determined by the FAST NORM switch. For NORM sample rates. S2 switches C10 in parallel with C8. The sample rate disable line (pins 10, L) is low during START mode and maintains continuous transfer through CR3 and prohibits main-gate inhibit through U4B in addition to holding down Q8 base through CR2. This prevents the reset from being generated.

When STORAGE is OFF, U5A is activated to maintain transfer through CR4. The manual reset (pin 3) holds the reset one-shot in the ON state as long as the RESET button is depressed (reset low). It also maintains the transfer during the same time to clear the display. In addition, it turns on the main-gate inhibit, even if the main gate is open. The manual reset signal is low if the RESET button is depressed or if the TIME BASE or FUNCTION switch is between positions. (No reset is generated between start and stop positions.)

A6 TROUBLESHOOTING

Troubleshooting the Sample Rate board is best accomplished when the board is in a static state. The procedure given below examines each section separately when the circuit is in a working, but static, condition. Perform the tests in order listed. The schematic shows the circuit levels after RESET is pushed. These levels should be used as a reference.

NOTE

Do not use an input signal when performing the tests below.

MAIN GATE INHIBIT, PRINT COMMAND DRIVER, and SAMPLE RATE ONE-SHOT. Before troubleshooting, perform the procedure below.

FUNCTION switch	FREQ A
TIME BASE switch	1 s
SAMPLE RATE switch	HOLD
SLOPE switch	+
CHK SEP COM	SEP
STORAGE switch	ON
LEVEL control	full cw
Push RESET	
LEVEL	full ccw

(Note that trigger lamp fires)

The purpose of this procedure is to set these circuits to the point immediately after the main gate closes. Varying the LEVEL control triggers a pulse to open the main gate for 1-second, and pin 17 goes Low during the gate time. U2 sets when the gate closes (positive transition) and remains set with the SAMPLE RATE switch set to HOLD. Once U2 sets, check for a Low on U5C(8). This generates a High on U1C(8) and a Low on U1D(6). Check that U4C(8) pulses High and Q6 collector sets Low. The main gate inhibit line at U6B(9) should now be High. The collector of Q7 is not now affected.

SAMPLE RATE INHIBIT. The sample rate inhibit gates are controlled by the FUNCTION and STORAGE switches and by a print inhibit signal. With the controls set as above, check for the levels shown on the schematic.

SCHMITT TRIGGER. The Schmitt Trigger and Q7 should be checked by using an input signal. Set the counter controls as listed under the waveforms. In waveform five, the repetition rate of the pulses changes with gate time, but pulse width remains the same. Pulse width changes with the SAMPLE RATE controls, but not spacing.

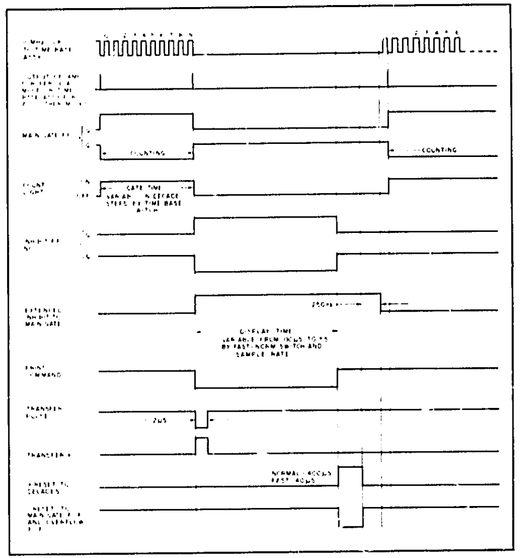


Figure 8-8
A5 TIME BASE CONTROL ASSEMBLY

(See Page 8-19)

Part of Figure 8-9. A6 Sample Rate Assembly

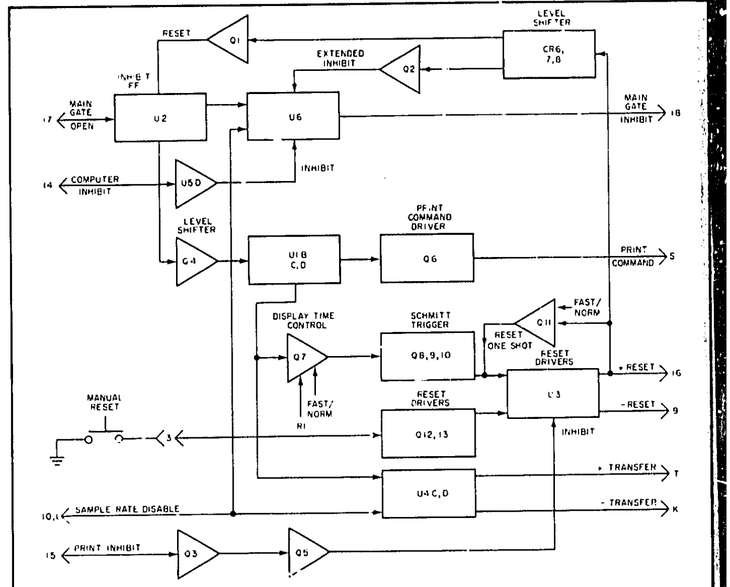


TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2,5,7,8,10,11 CR3,4,9	1901-0040 1910-0016
Q1-3,5,6,8-10,12,13	1854-0071
Q4,11	1854-0069 2N709
Q7	1854-0215 2N3904
U1,4	1820-0054 SN7400N
U2	1820-0272 MC1022P
U3	1820-0068 SN7410N
U5	1820-0328 SN74C2N
U6	1820-0147

REFERENCE DESIGNATIONS

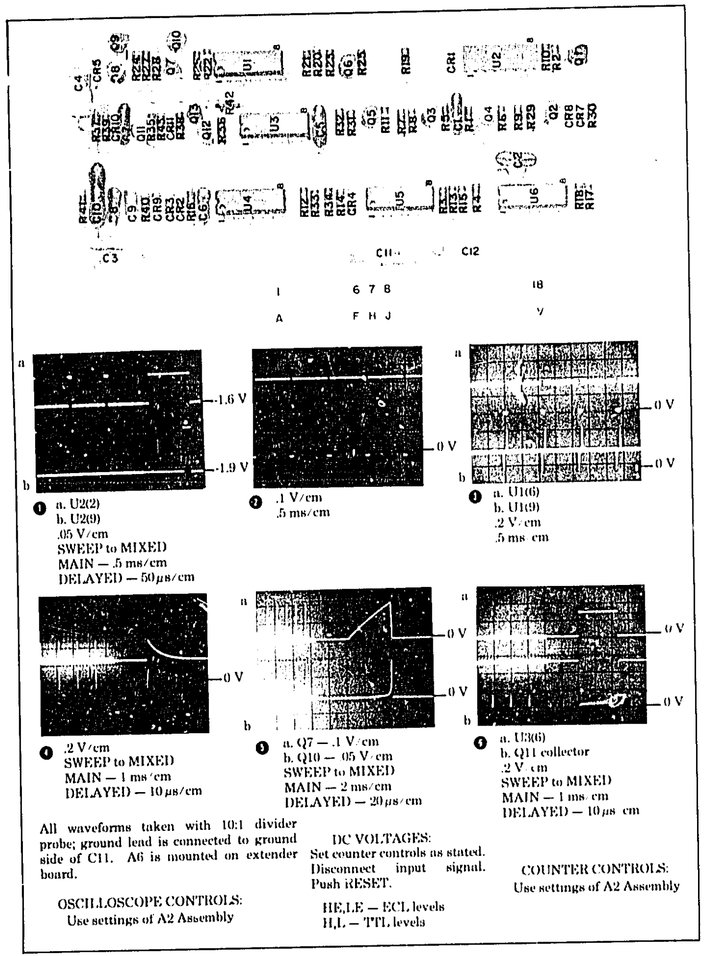
NO PREFIX	A6	A1G
	C1-12 CR1-5, 7-11	J1
R1	Q1-13 R1-44	
S2, 3, 5, 6, 8		
	U1-6	

DELETED CR6

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. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUE SHOWN

MORE DATA UNDER THIS FOLD



❶ a. U2(2)
b. U2(9)
.05 V/cm
SWEEP to MIXED
MAIN — .5 ms/cm
DELAYED — 50 μs/cm

❷ .1 V/cm
.5 ms/cm

❸ a. U1(6)
b. U1(9)
.2 V/cm
.5 ms/cm

❹ .2 V/cm
SWEEP to MIXED
MAIN — 1 ms/cm
DELAYED — 10 μs/cm

❺ a. Q7 — .1 V/cm
b. Q10 — .05 V/cm
SWEEP to MIXED
MAIN — 2 ms/cm
DELAYED — 20 μs/cm

❻ a. U3(6)
b. Q11 collector
.2 V/cm
SWEEP to MIXED
MAIN — 1 ms/cm
DELAYED — 10 μs/cm

All waveforms taken with 10:1 divider probe; ground lead is connected to ground side of C11. A6 is mounted on extender board.

OSCILLOSCOPE CONTROLS:
Use settings of A2 Assembly

DC VOLTAGES:
Set counter controls as stated. Disconnect input signal. Push RESET.

H,L,E — ECL levels
H,L — TTL levels

COUNTER CONTROLS:
Use settings of A2 Assembly

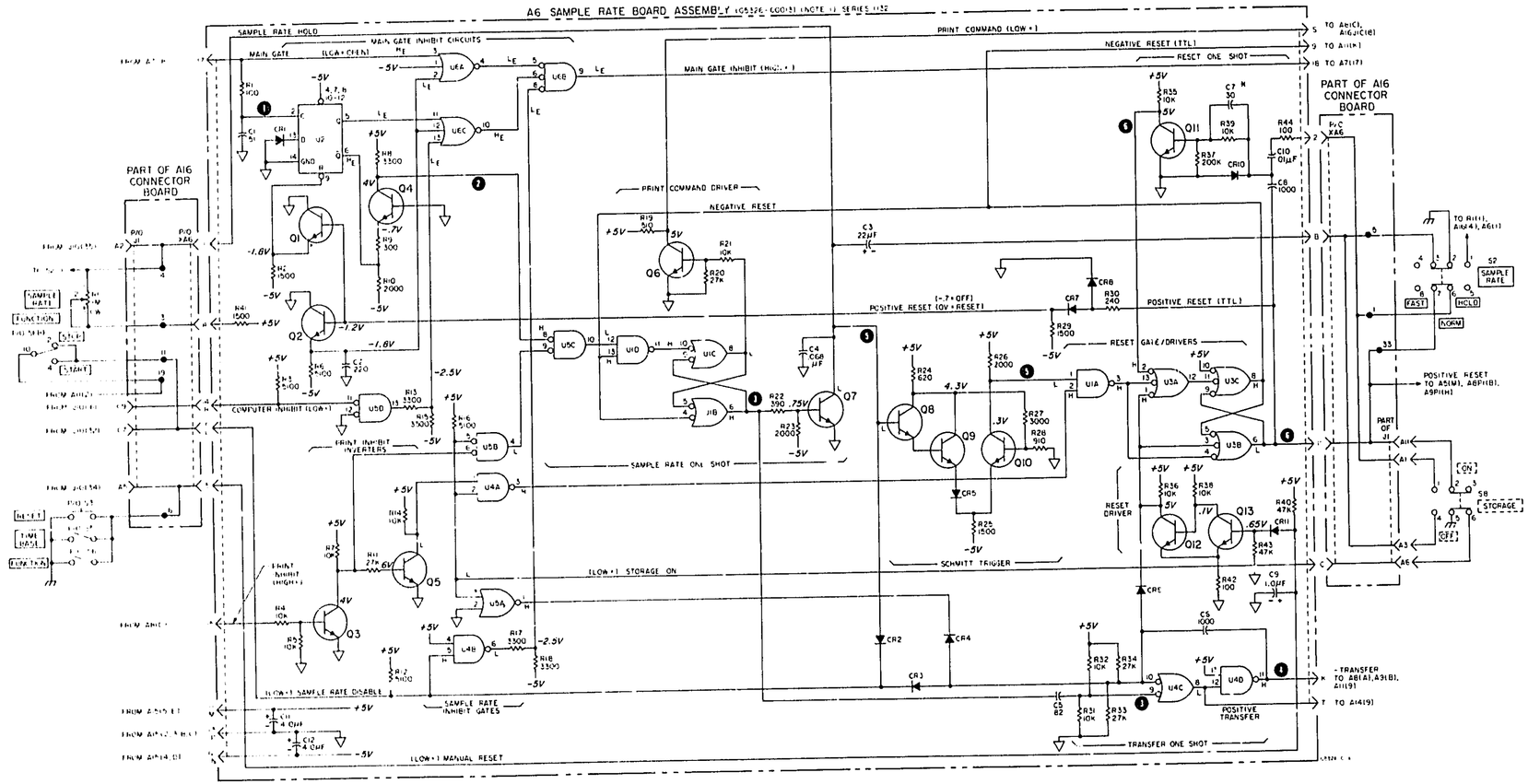


Figure 8-9. A6 Sample Rate Assembly

A7 FUNCTION CONTROL OPERATION

This assembly contains the gating, flip-flops, one-shots, and translators necessary to interconnect the oscillator, time base, and input channel signals to the time base and decade counting assemblies. Table 1 lists the functional interconnections for each function of the counter.

An example of the operation in the FREQ A mode will explain the typical circuit operation. This will be expanded to the other functions. Assuming the start of a new measurement, main gate inhibit (pin 17) has just gone low (at the end of the display time). Upon the arrival of the first subsequent channel A input, channel A flip-flop sets, making U5B(9) High. Upon the next leading edge of the oscillator signal (pin T, TTL levels; U8B(4) ECL levels), U6B sets and arms the oscillator gate U3A. The gated oscillator signal is then connected to the time base input one-shot U4, which generates 50 ns, negative-going pulses to the time base input (pin U).

The time base will return a pulse upon receipt of the 1st and Nth pulse delivered from pin U (N = multiplier setting on front panel). The 1st pulse arriving at pin V is translated from TTL to ECL by U8 and then goes on to toggle (set) main gate flip-flop U1. This opens the main gate (U13B), and the decade counting assembly counts the signal (in this case, input A — see Table I). Upon the arrival of the 2nd time base output pulse, U1 toggles closed, shutting main gate U13B and signaling A6 to start the display cycle (pin 18). A6 returns a High MINH (pin 17) and the main gate flip-flop U1, synchronizer U5, and ITB one-shot U4 are locked closed at the end of the display. MINH goes low and the cycle repeats.

In the period mode, the main gate F-F U1 is toggled by the input A signal so that it is set for exactly one period of A. The counted signal is the oscillator divided by the MULTIPLIER switch setting.

In period average, the input A signal goes to the time base, which generates a pulse on the 1st and Nth pulse. These pulses toggle the main gate, and the oscillator is counted during N periods of A.

In START, the main gate is held open and the input signal, which is scaled by the time base, is counted. The FREQ C operation is the same as FREQ A, except that the input synchronizer U5B is held on by U10. IC's U2, 3, 7, 8, 9, 10, and 12 are combination TTL, ECL translators and data switches. The function inputs (FREQ A, FREQ C, etc) are TTL low true and are pulled up by internal 10k-ohm pullups on the translators. U8(3) is the check signal to Amplifier A2 and A3. In normal it is low; while in check, it is high with negative 10 ns pulses at 10 MHz.

In time interval, the operation is similar to period, but U1 is set continuously. MGATE OUT (pin 18) is now controlled by the output of U5B. The following explanation describes how the synchronizer U5A and B works in a time interval mode.

Assuming a display cycle has just been completed, the flip-flops formed by U11 and U6 and U5 sections have been reset. Two conditions can occur.

First — if a channel A signal occurs before a B signal, the A signal will set the channel A flip-flop before the B sets the B flip-flop (see Timing Diagram). When the first leading edge of the oscillator occurs after the A F-F is set, U5B is set, opening the clock gate and instructing A6 that the measurement has started (pin 18). The oscillator signal goes to the time base and is divided, returns, and is set out through the main gate to A8 for subsequent display. When the B signal occurs, the leading edge of the next clock pulse sets U5A, closing the clock gate.

Table I. Functional Interconnections

FUNCTION	MGFF TOGGLE	TO DCA	ITB
STOP	0	OTB	0
START	1	OTB	IA
FREQ A	OTB	IA	GOSC
FREQ C	OTB	IC	GOSC
DVM•RA•RB	OTB	IV	GOSC
PERIOD	IA	OTB	GOSC
T.I.	1	OTB	GOSC
T.I. AVG.	OTB	GOSC	STI

DCA - Decade Counting Assembly
GOSC - Gated Oscillator
IA - Input A Signal
IC - Input C Signal
ITB - Input to Time Base
IV - DVM V-F Converter Output
OTB - Output of Time Base
STI - Synchronized Time Interval

The U5A $\bar{Q}$ low signal goes back to U6(11) and waits about 50 ns for the falling edge of the oscillator. At this point, U6(10) goes high, resetting the A and B flip-flops, putting lows at the D input of U5A and B. When the clock pulse again rises positive, U6(13) goes low (about the 10 ns after the clock edge) and U5A and B are closed to the "cleared" state.

Second — if a B signal occurs before an A, U5A would be set first, and no counting would occur. Also, it would take about 150 ns for U5A to complete the resetting described above; so if an A signal occurred during this time, it would be ignored. If the B-to-a delay is>150 ns, the A signal would start the interval as described above.

With time interval averaging, the input synchronizers work the same way, but the oscillator (not divided) is counted for the duration of each individual time interval that is being averaged. The first input A signal sets flip-flop U5B, which enables U3A to gate an oscillator pulse to the time base dividers. The dividers are now set to zero, from their previous reset-to-nine state. During this time, a channel B signal was received to complete the first time interval; but this first interval is not counted, since the main gate was closed. The time base output pulse enables the main gate to pass clock pulses for the duration of the time interval. After N intervals, the time base returns a pulse to close the main gate.

Part of Figure 8-10. A7 Function Control Assembly

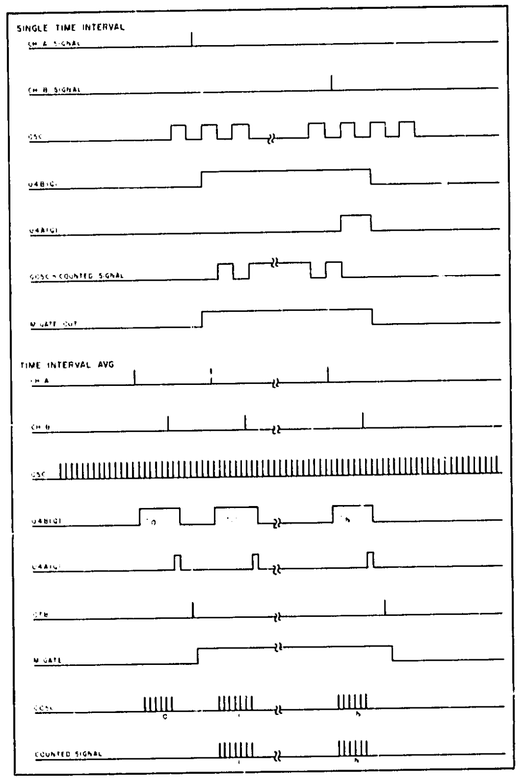
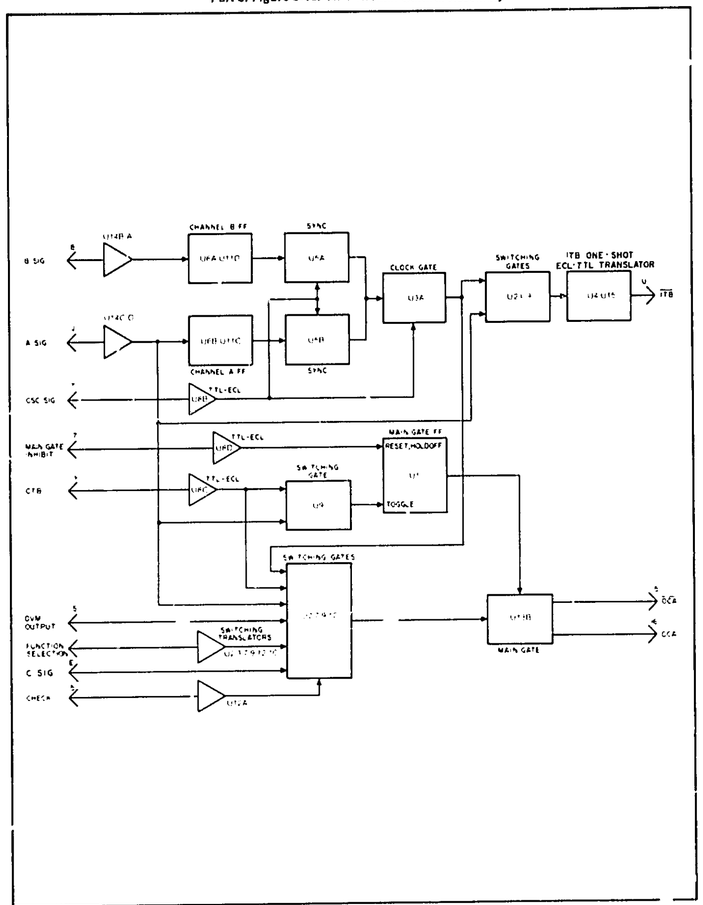


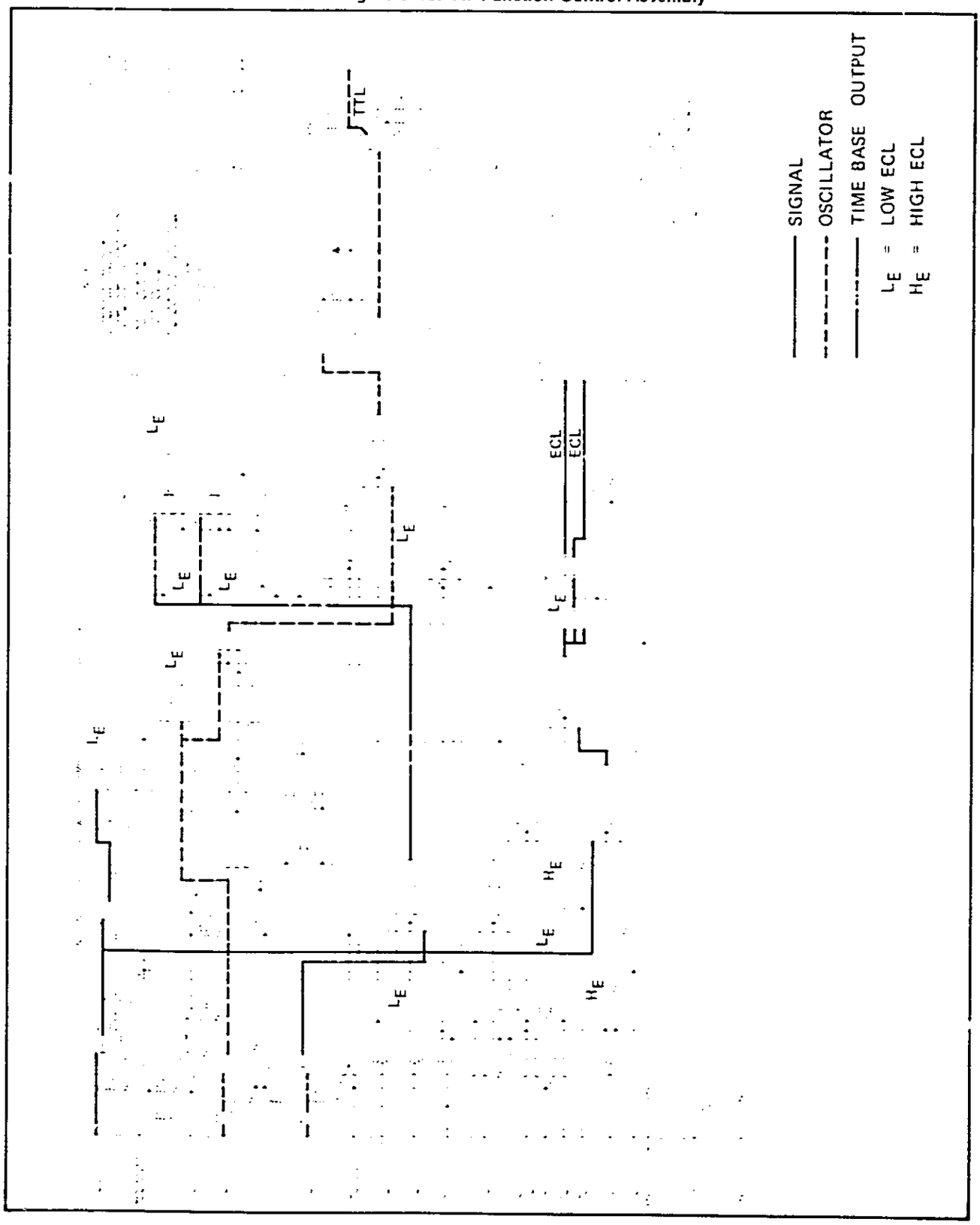
Figure 8-9
A6 SAMPLE RATE ASSEMBLY
(See Page 8-21)

Part of Figure 8-10. A7 Function Control Assembly

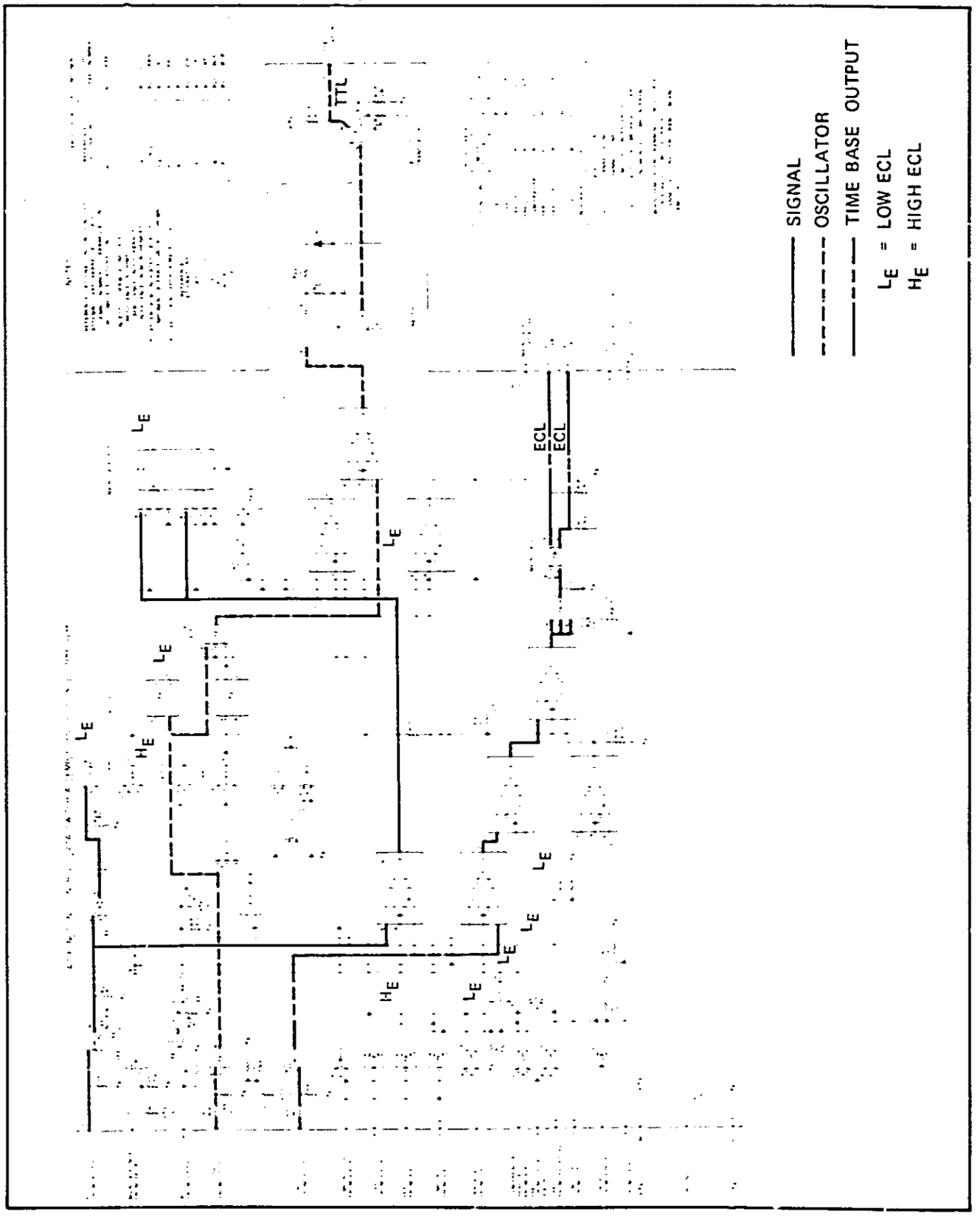


MORE DATA UNDER THIS FOLD

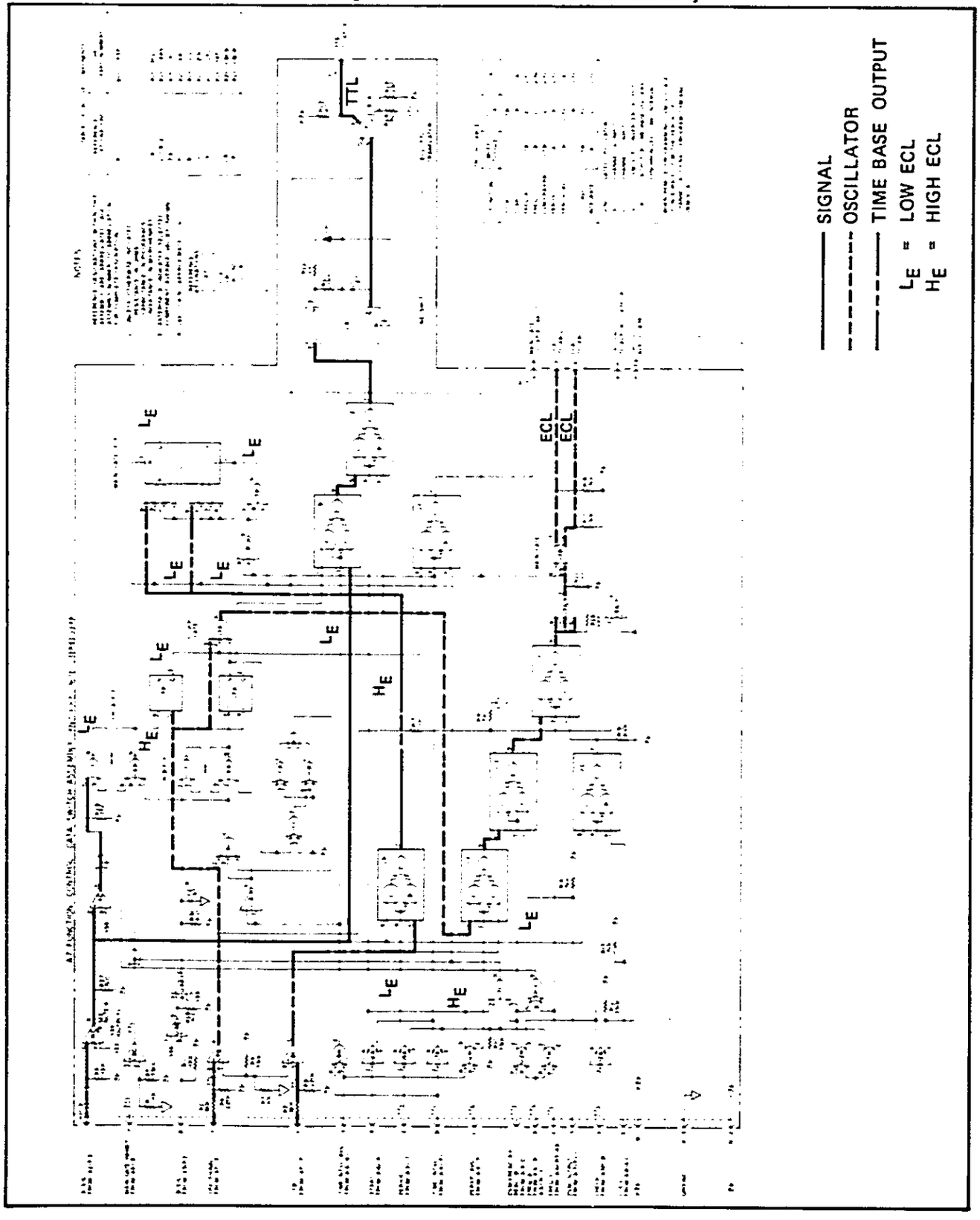
FREQ A Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly



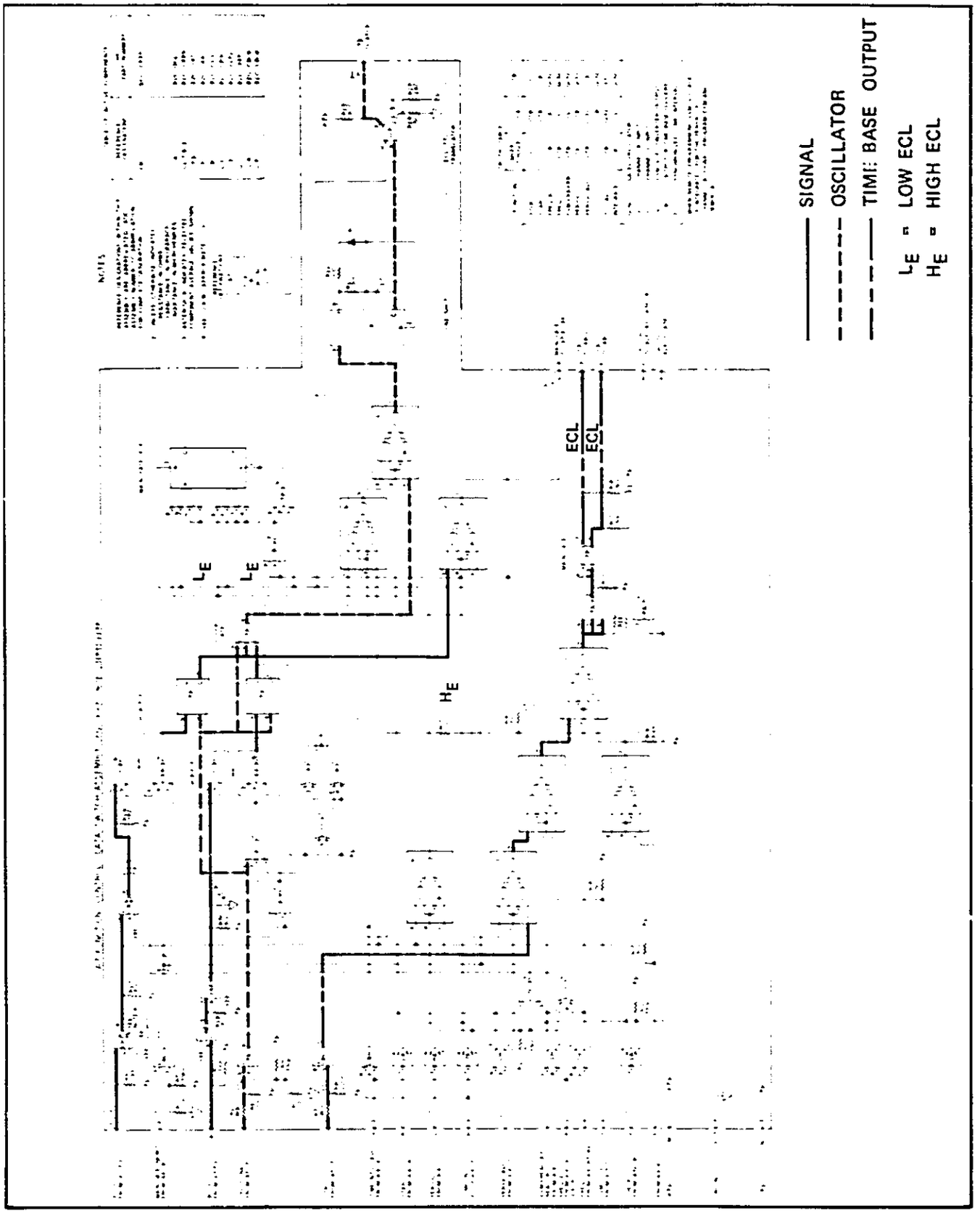
Period Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly



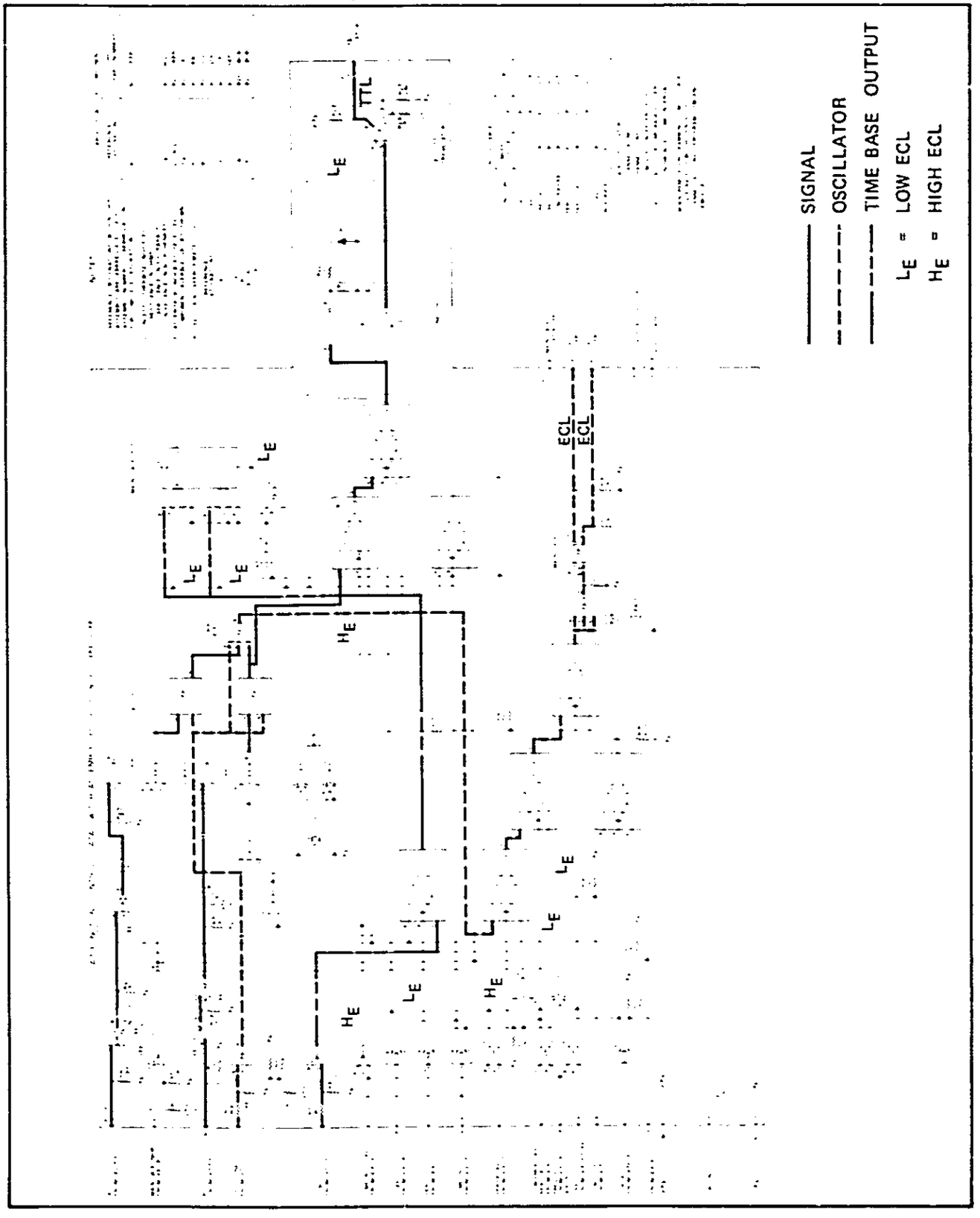
Period Average Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly



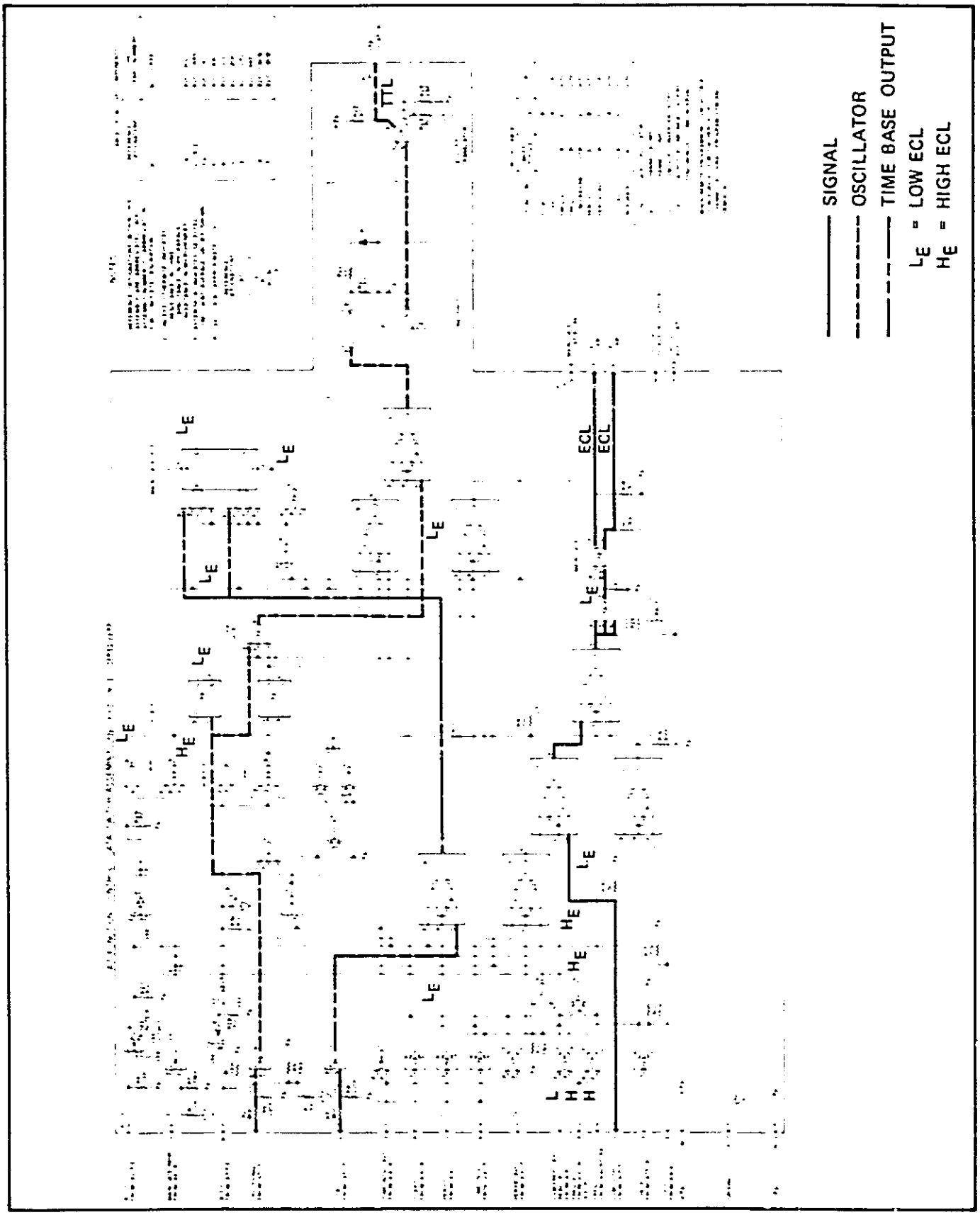
Time Interval Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly

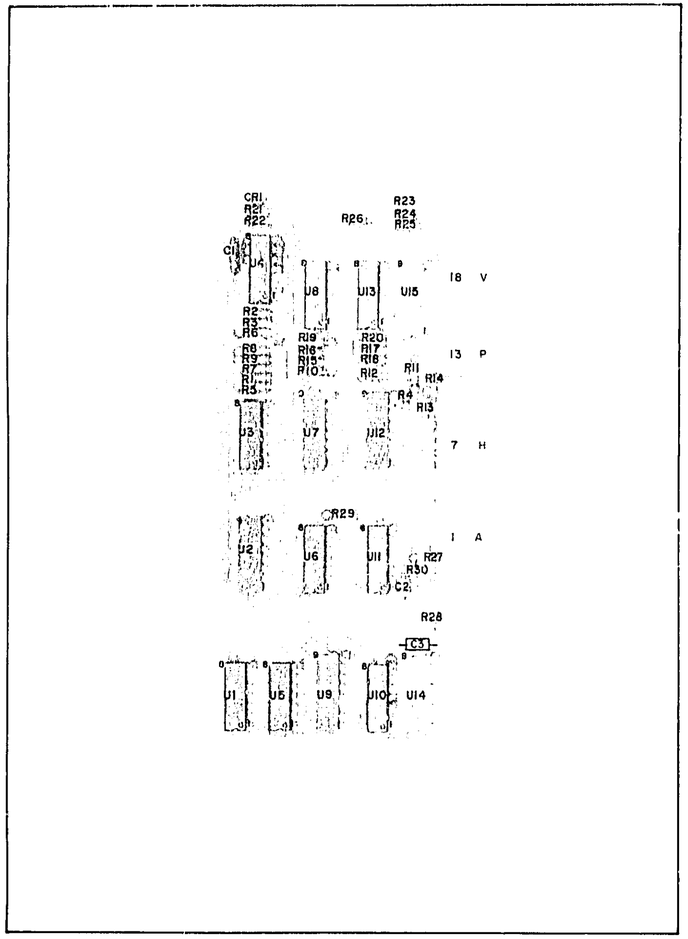


Time Interval Average Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly



DVM Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly





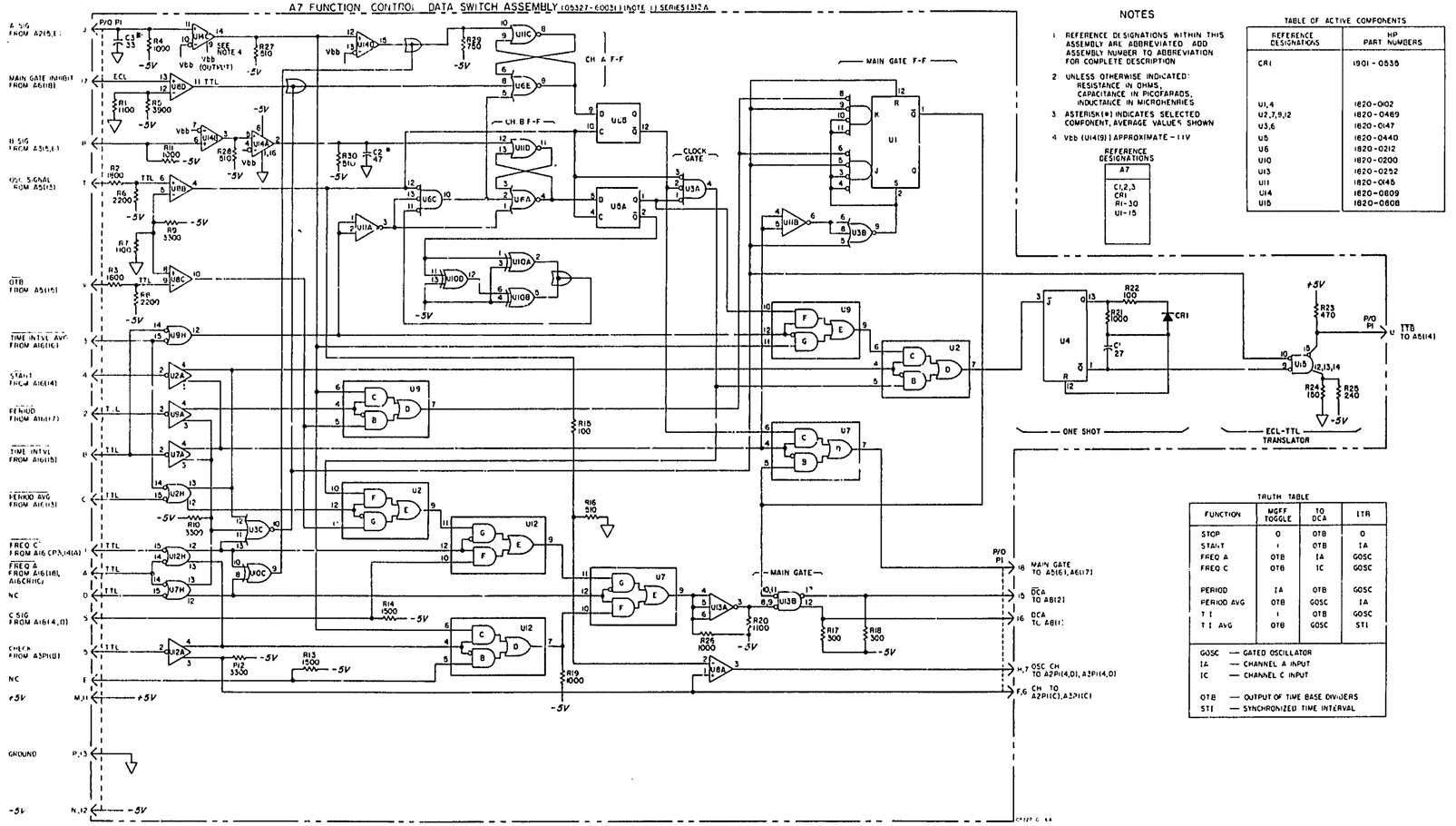


Figure 8-10. A7 Function Control Assembly

A8 DISPLAY SUPPORT OPERATION

The display support assembly A8 serves to interconnect the display assembly A9 with the interconnect assembly A16. In addition, A8 contains a high-speed decade counter, decimal point drivers, and blanking (logic) circuits.

The high-speed decade consists of four JK flip-flops U3 through U6. The line receiver, Q2 and Q9, serves to reduce noise levels on the signal from A7 prior to driving U3(6, 9). U3 divides by two and the combination of U4 through U6 divides by five. The decade supplies BCD outputs to A9 via J1(5, 4, 2, 3) for the 10^n display tube. The D output is also used as the carry output to the next decade counter on A9. Q1 translates the positive TTL reset signal to ECL levels to reset the high-speed decade to zero.

Decimal point drivers Q3 through Q8 work in conjunction with logic circuits on A11 to light the proper decimal points. R15 and R17 provide operating bias for Q3 through Q8. R19, R20, and R23 are current limiters. R2 and R4 provide 87.5 volts pre-bias for the OFF decimal points. R5 through R10 connect the off decimals to the pre-bias voltage to eliminate background glow.

As an example of operation, when a ground is received at P1(S) from A11, Q5 conducts. With Q5 on, decimal point enable line 3 (DP3) is pulled to ground to light the decimal point on A9DS4(10). Also with P1(S) low, U1D(11) is high to unblank A9 U4. When U1D(11) goes high, U1B(6) and U1A(3) are also high to unblank A9U3 and U2. This unblanks A9DS4, DS3, and DS2. DS5 and DS6 remain blanked. DS1 is never blanked, and DS7 and DS8 (Option 001) will always be blanked.

CR2 and CR3 are included for use with the digital recorder Option 003. When overflow occurs, P1(M) and J1(15) go low. CR2 and CR3 cause J1(14 and R) to also go low. When J1(15, 14, R) are low, the recorder will print a zero on the annunciator line. R21 and R24 are pull-up resistors.

A8 TROUBLESHOOTING

High Speed Decade

If a problem in the High-Speed Decade is not readily apparent when checking for the correct waveforms, a step-through method may be preferable. Set the counter as follows:

1. MULTIPLIER switch to 10^5.
2. CHK/SEP/COM switch to CHK.
3. FUNCTION switch to START.
4. Press RESET.

The High-Speed Decade has four output lines that are binary weighted DCBA. Release the RESET button and note the counter's display. A typical problem is as follows: The display counts 1...2...3...0...1...2...3...0. When the display reads "0," set the FUNCTION switch to STOP and check the C line for a Low (refer to the table below). Check the input lines of the IC, since their levels depend on the state of other IC's in the circuit (note U4 pin 3 and U6 pin 13). The levels given below are ECL.

	A	B	C	D
DISPLAY	U4(13)	U3(1)	U5(1)	U6(1)
1	L	H	H	H
2	H	L	H	H
3	L	L	H	H
4	H	H	L	H
5	L	H	L	H
6	H	L	L	H
7	L	L	L	H
8	H	H	H	L
9	L	H	H	L
10	H	H	H	H
11	REPEATS			

Decimal Point and Blanking

Before testing the decimal point and blanking circuitry, set the CHK/SEP/COM switch to SEP and disconnect the input signal.

DECIMAL POINT. To check the decimal point circuitry, set FUNCTION switch to PERIOD AVG and position the TIME BASE switch to pull the required D.P. line Low.

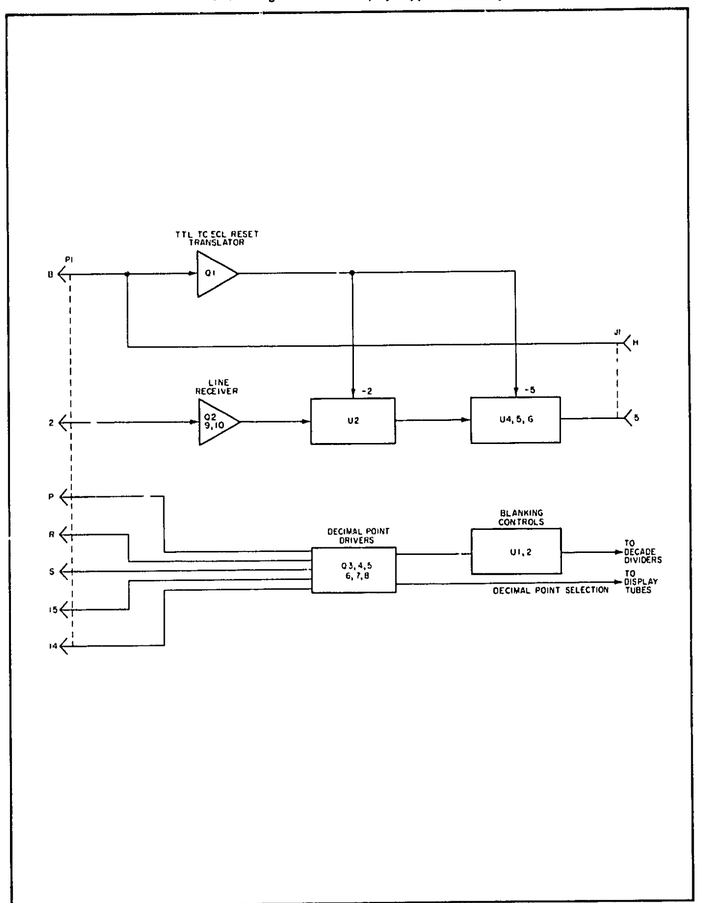
LINE	MULTIPLIER POSITION	DRIVER
D.P.0	1	Q8
D.P.1	10	Q7
D.P.2	10^4	Q6
D.P.3	10^3	Q5
D.P.4	10^2	Q4
D.P.5	10^1	Q3

BLANKING. To check the blanking circuitry, set the FUNCTION switch to PERIOD AVG and MULTIPLIER switch to 1. All digits, except the first one, should now be blanked. If another digit is lit, check that line at A8J1 for a High level, which indicates a problem on that line.

Figure 8-10
A7 FUNCTION CONTROL ASSEMBLY

(See Page 8-29)

Part of Figure 8-11. A8 Display Support Assembly



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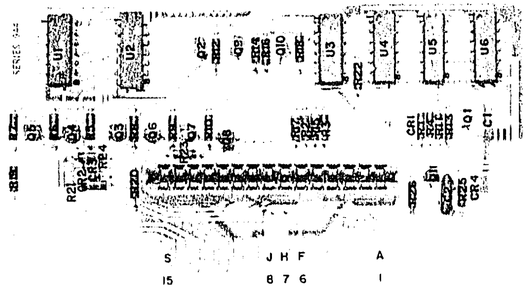
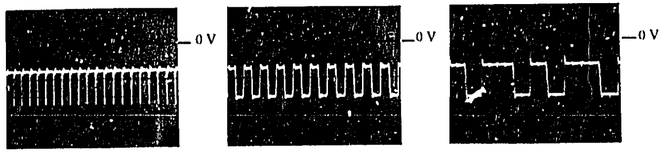
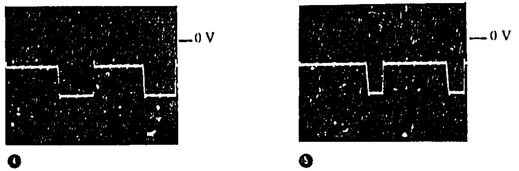






All waveforms taken with 10:1 divider probe; ground lead is connected to junction of R15, R3.

COUNTER CONTROLS:
Use settings of A2 Assembly

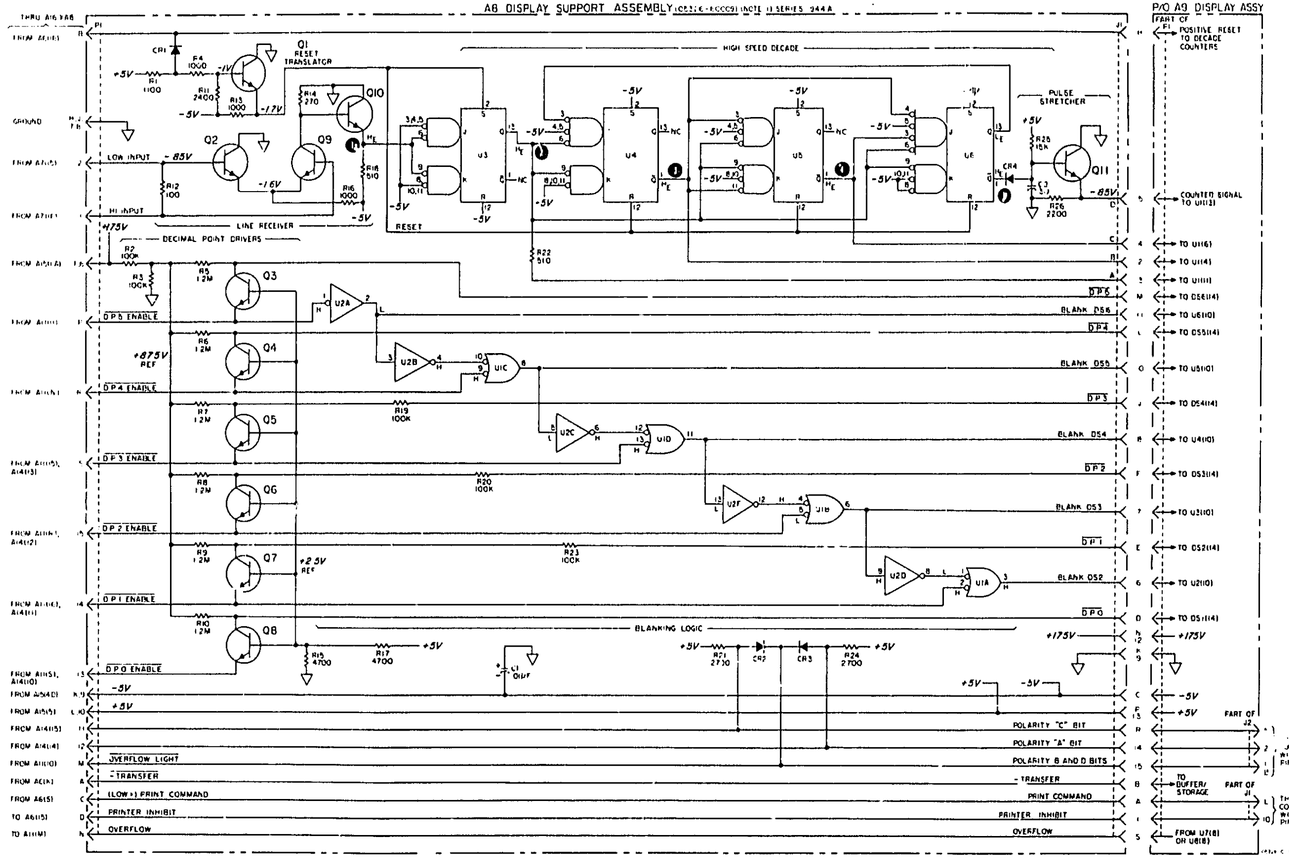
DC VOLTAGES:

Set counter controls as stated.
Disconnect input signal.
Push RESET.

HE,LE — ECL Levels
H,L — TTL Levels

OSCILLOSCOPE CONTROLS:

VOLTS/CM	.05 V/cm
TIME/CM	.2 μs/cm
SWEEP MODE	AUTO
TRIGGER	INT
SLOPE	+



NOTES

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

REFERENCE DESIGNATIONS

A6	A9
C1-2 CR1-4 J1 P1 Q1-11 R1-26 U1-6	J1-2 P1

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1-4	1901-0040
CR2,3	1910-0016
CR1,2,9-11	1854-0092
	2N3563
Q3-8	854-0365
	2N4440
U1	1820-0637
	MC846P
U2	1820-0307
	MC85F
U3	1820-0143
	MC-027
U4-6	1820-0162
	MC-012P

Figure 8-11. A8 Display Support Assembly

A9 DISPLAY ASSEMBLY OPERATION

Display assembly A9 contains decade counters U2 through U7, buffer storage units U9 through U15, BCD to decimal converters U17 through U23, and display tubes DS1 though DS7.

U1 translates the ECL data from A8 into TTL levels for use by circuits on A9. Each translator of U1 is noninverting. The D output at U1(15) is the counted signal divided by 10 and is used as the input to 10^1 decade U2.

Decade counters U2 through U7 count the number of input pulses while the main gate is open. Each decade provides a 8421 BCD output to the corresponding buffer storage unit. When pin 14 (reset) goes High, the decades reset to zero if pin 10 is High; the decades reset to 15 (blank) if pin 10 is Low. The ECL decade on A8 never blanks. U7 and U8 (Option 001) always blank. The last decade supplies an overflow output at pin 8 when the count exceeds the capacity.

Buffer storage units U9 through U15 receive the BCD outputs of the decades. When the counter operates in the storage-on mode, data is transferred when a low transfer pulse arrives at pin 5 of the buffers. When the transfer line is high, the buffers will store the data to allow a continuous display while a new measurement is being made. During storage-off or totalize mode, BCD data is continuously fed from the buffers to the decoders. The buffers also supply 8421 BCD outputs to A9 J1 and J2 for further distribution to J9 when Option 003 is included.

Decoder drivers U17 through U23 receive the 8421 BCD data and provide a decoded decimal output to light the corresponding numeral on the display tube. The terminal for an illuminated numeral will be approximately +2 volts whereas an extinguished numeral is typically +100 volts. The decimal point terminal (14) of the display tube is +5 volts when lit and about 87.5 volts when extinguished.

A9 TROUBLESHOOTING

The A9 Display Assembly may be set up for troubleshooting with either of two methods. A highly accurate oscillator may be used for a front-panel input signal. Any difference in count from the input signal is then immediately obvious on the display. Check for the proper signal division of the decade counter in previous column. As an alternate method, place the CHK SEP COM switch in CHK and the FUNCTION switch in START. Allow the count to totalize until the problem occurs; then, set the FUNCTION switch to STOP. Use the TIME BASE switch to adjust the rate of counting. When the problem appears, check the circuitry of that column.

Start by checking the Buffer Storage outputs (U9-U15) for the BCD code of the number that should be displayed, rather than what is displayed (see Table 1). Check that the Buffer-Storage code pulls the proper decimal line low on the BCD-to-Decimal Decoder.

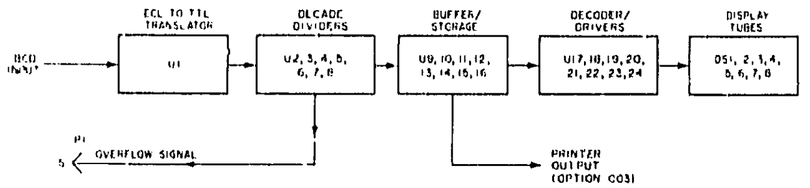
Table 1

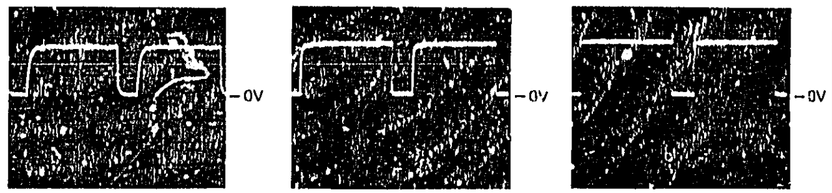
DISPLAYED DIGIT	BUFFER STORAGE BCD (TTL)			
	8	4	2	1
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L
Blank	L	L	L	L

Figure 8-11
A8 DISPLAY SUPPORT ASSEMBLY

(See Page 8-31)

Part of Figure 8-12. A9 Display Assembly (Option 001)

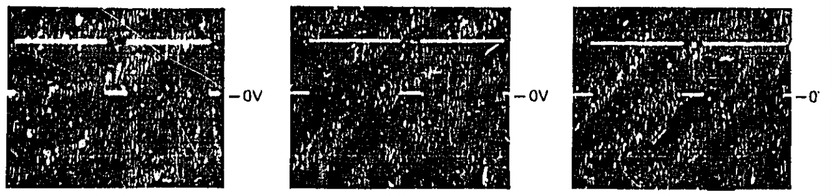




U1(15)
.2 V/cm
.2 μs/cm

U2(8)
.2 V/cm
2 μs/cm

U3(8)
.2 V/cm
20 μs/cm



U4(8)
.2 V/cm
.2 ms/cm

U5(8)
.2 V/cm
2 ms/cm

U6(8)
.2 V/cm
20 ms/cm

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

COUNTER CONTROLS:

FUNCTION ..... START
MULTIPLIER 1
CHK NORM ..... CHK

MORE DATA UNDER THIS FOLD

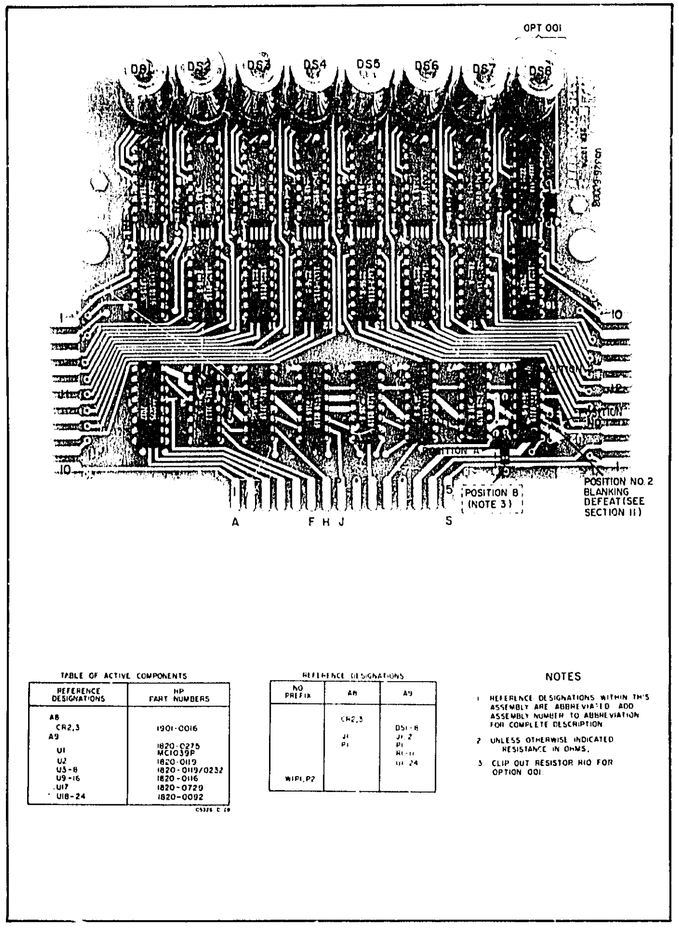


TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A8	
CR2,3	1901-0016
A9	
U1	1820-0235 MC10398P
U2	1820-0119
U3-8	1820-0119/0232
U9-16	1820-0116
U17	1820-0729
U18-24	1820-0092

REFERENCE DESIGNATIONS

NO PREFIX	A8	A9
	CR2,3	DS1-8
	J1	J1,2
	P1	P1
		R1-11
		U1-24
W1P1,P2		

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS.
3. CLIP OUT RESISTOR R10 FOR OPTION 001.

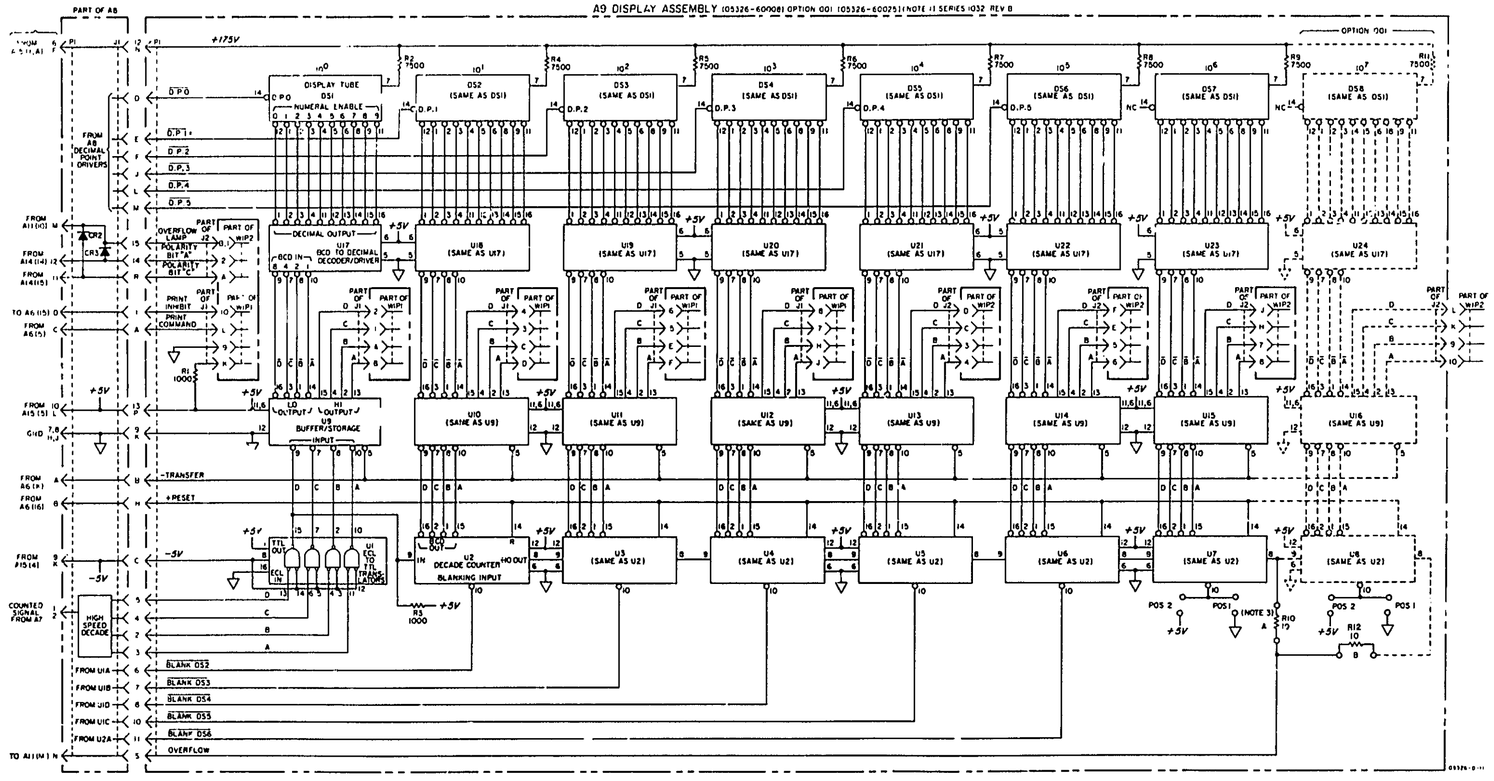


Figure 8-12. A9 Display Assembly Standard Instrument and Option 001

A10 RIGHT READOUT OPERATION

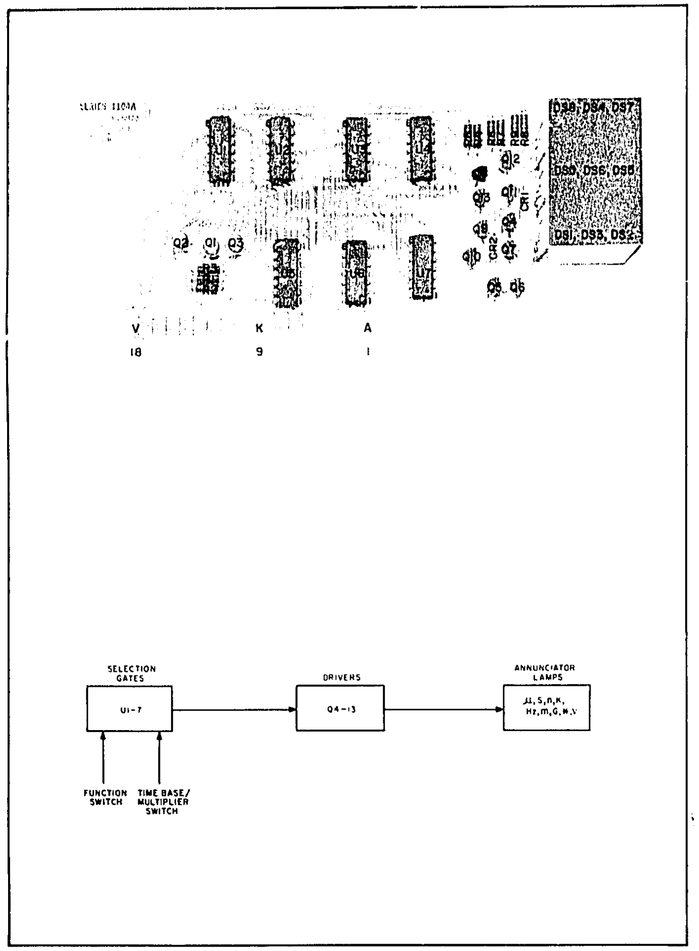
The right readout contains DTL logic to provide the proper measurement units for a given setting of the front-panel controls. A10 logic is negative true, and a low (<0.8 volts) to the emitter of any driver transistor will light the given neon. When a DTL high is applied on the emitters, the transistor is reverse biased to turn off the neon lamps. The voltage dividers provide a reference of 2 V (nominal) to the bases of the drivers, when no annunciators are on.

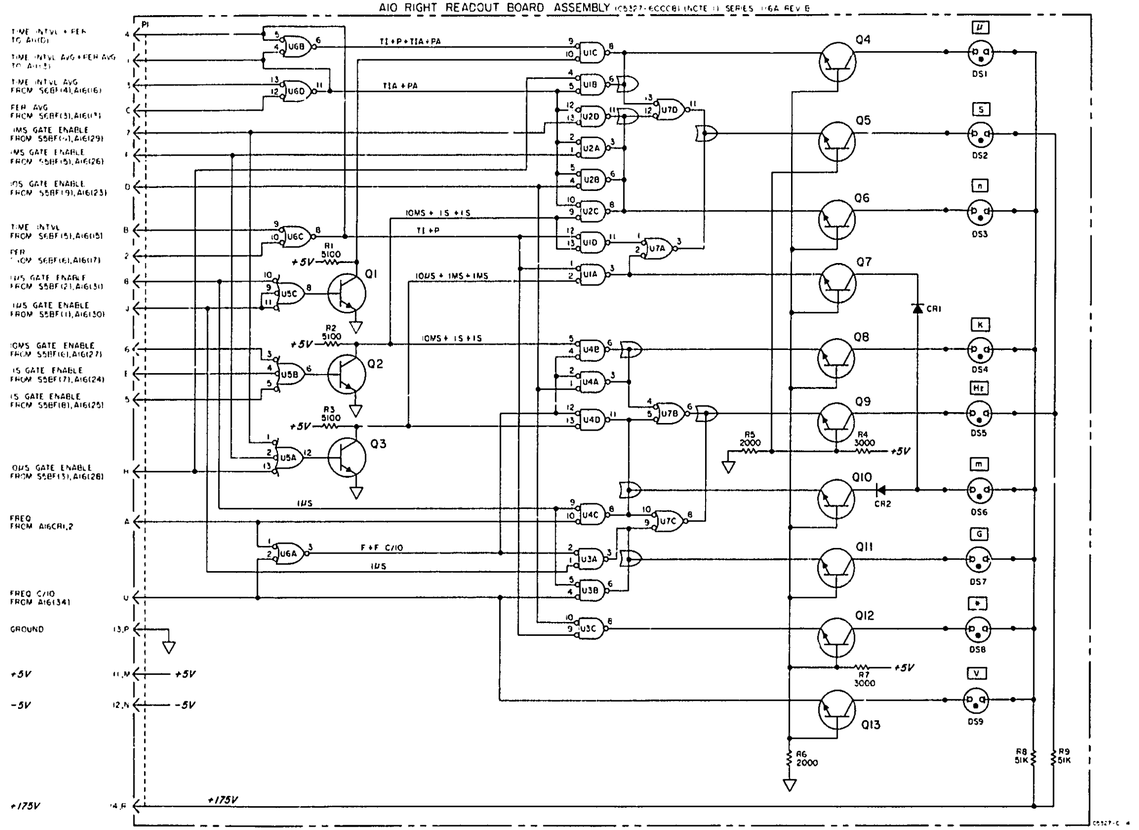
Selecting a function mode and time base pulls a pair of these lines low, activating a gate. This low on the gate output will forward bias the driver transistor to turn on the annunciator lamp. For example, selection of frequency and 1 ms makes the output of U4D(11) low, turning on Q9 to light DS5. Q10 also turns on, lighting DS6.

The asterisk (*) annunciator (DS8) is activated when the counter is in the time interval or period mode and the time base is 10s. An asterisk indicates the proper units are not displayed.

A10 TROUBLESHOOTING

Select the specific function mode and time base combination that is faulty. Check the gate that is common to the two lines. For instance, when using frequency and a 1 ms gate time, check U4D; when using .1 μs, U3A becomes the common gate. Refer to Table 5-5 for the proper annunciator lighting conditions.





NOTES

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

REFERENCE DESIGNATIONS

A10
CR1, 2 DS1-9 P1 Q1-13 R1-9 U1-7

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2	1901-0040
Q1-3	1854-0009 2N709
Q4-13	1854-0474 2N5551
U1-4	820-0274 MC1808
U5	1820-0310 MC862
U6,7	1820-0273

Figure 8-13. A10 Right Readout Assembly

A11 LEFT READOUT OPERATION

The left readout contains DTL logic to select the proper decimal point corresponding to the TIME BASE SETTING. It also contains the switch common drivers for the time base, function, and amplifier common lines (for remote programming), a storage circuit and lamp for the overflow signal, the gate light, and the EXT light.

The overflow signal from the ÷ 10 output on A9U7 (U8, Option 001) enters through pin M and is differentiated by C2 and R1. Q1 turns on momentarily to set flip-flop U1A&D. During the transfer pulse, the information at U1A&D is transferred to the overflow storage flip-flop U1B&C. The overflow condition drives U1C(8) low to turn Q2 on and light overflow lamp DS1. The next reset pulse clears flip-flop U1A&D; however, U1B&C are not reset until the transfer pulse arrives. With storage off, transfer is on continuously.

A low at pin L turns on Q3 to light the count lamp, DS2. Similarly, a low at pin A lights the EXT lamp and opens the common lines for the TIME BASE, FUNCTION, and SLOPE switches. This disables these controls to allow remote programming of the unit.

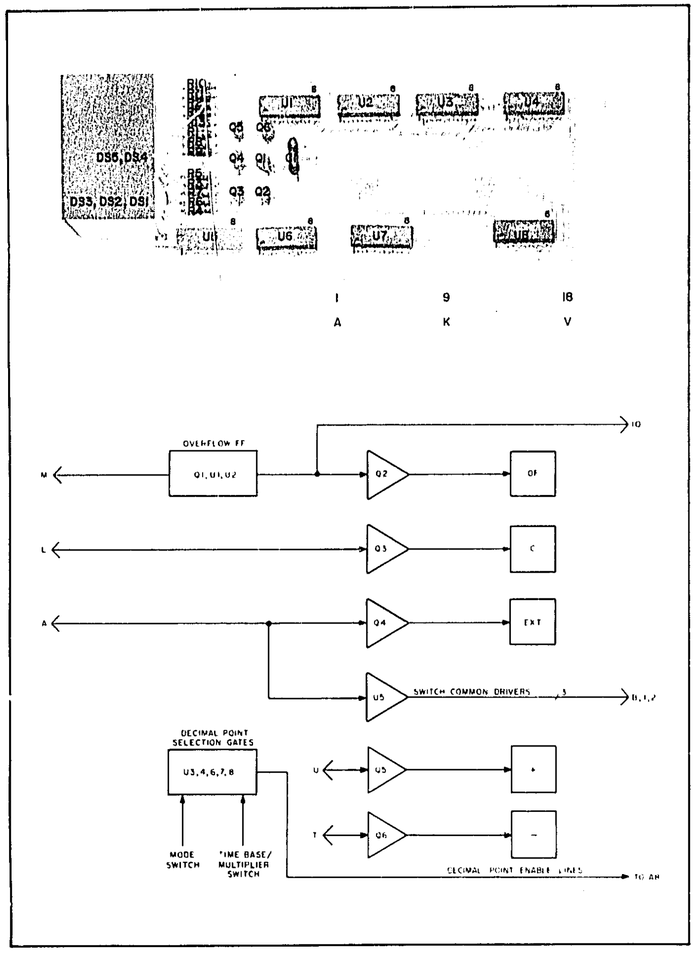
Decimal selection and resultant blanking are accomplished by the negative logic AND gates. For any pair of low inputs, a specific decimal point line is held low, lighting the decimal point. There are a number of combinations for each decimal; therefore, the output of each AND gate is paralleled to give a wired OR configuration (any output low = all low).

A11 TROUBLESHOOTING

Select the specific function mode and time base combination that is faulty. Check the gate that is common to the two lines. Refer to Table 5-5 for the proper annunciator lighting conditions.

To check the overflow circuits, set the FUNCTION switch to START and select a fast gate time. When the most significant digit on the counter's display changes from 9 to 0, both flip-flops in the overflow circuit should set. As an initial test, check U2 for a High on pin 13. The second flip-flop (U1B and U1C) should have a Low on pin 8 and a High on pin 6.

In any mode other than START, the -TRANSFER line pulses Low, rather than being held Low. If the OF light does not turn off at the end of the display time, check that the -RESET pulse clears flip-flop U1A&D.



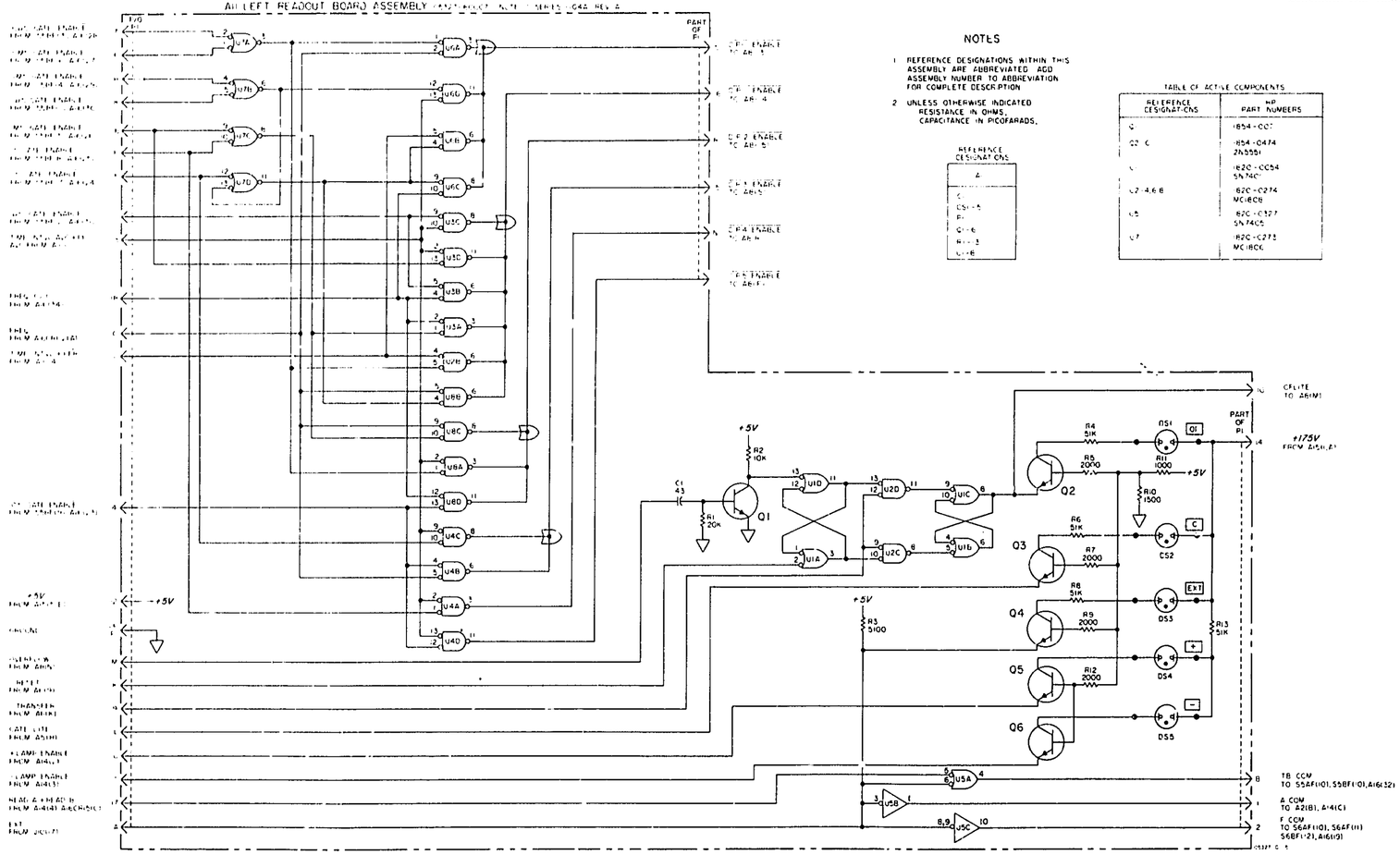


Figure 8-14. A11 Left Readout Assembly

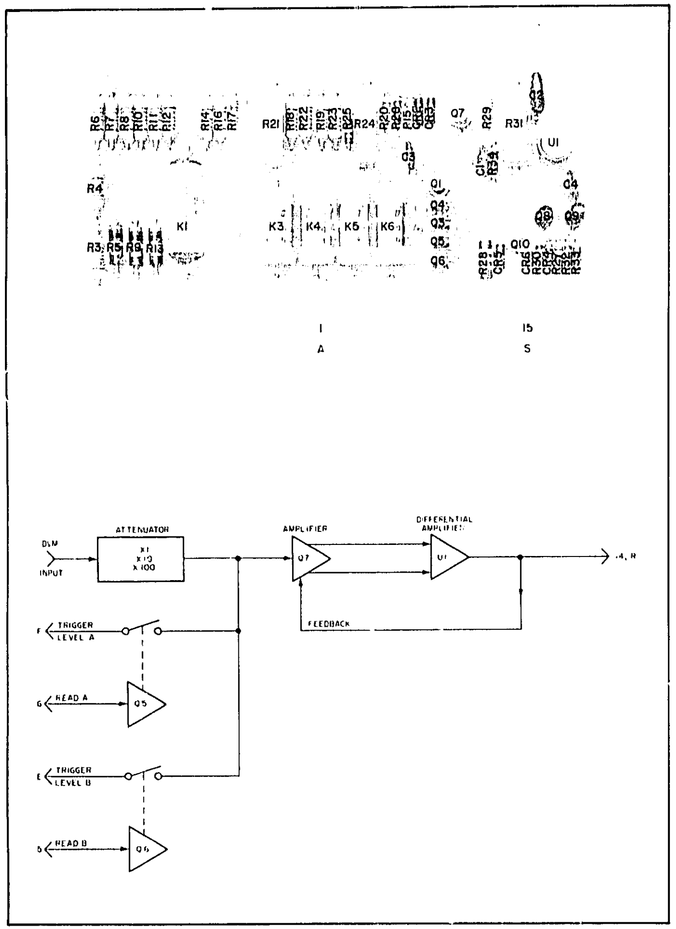
A12 VOLTMETER INPUT AMPLIFIER OPERATION

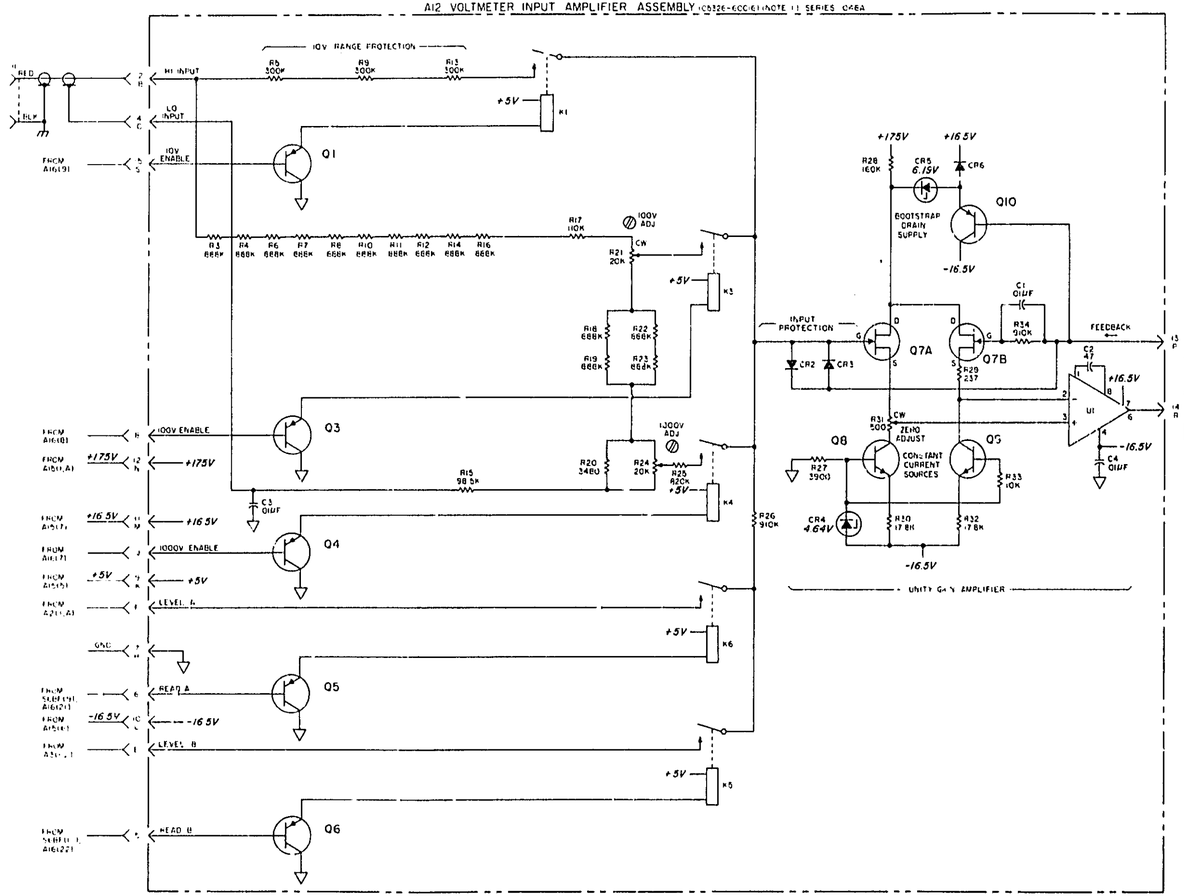
This board contains a unity-gain input amplifier that serves to buffer the voltage-to-frequency converter (A13) from the voltmeter input terminals. This provides a low impedance output to A13 while maintaining the high input impedance. The amplifier features high input impedance (typically 10 MΩ). Dynamic input voltage range is in excess of 12.5 V. Circuits are included to fully protect the stage from over voltage. To maintain the high input impedance, care should be taken not to damage the protective coating or the printed circuit board by heat or scratches.

The DC voltage input is fed into the board through pins B, 2, and goes through R5, R9, R13 for the 10 volt range or the R3-R24 resistor string for the other two ranges.

Selecting the 10 V position on S4 grounds the base of Q1 to energize K1 and apply the input signal directly to the gate of Q7A. Switching to 100 V grounds the base of Q3 to energize K3. The base of Q1 is pulled high (through a resistor on another board) to turn off Q1 and deenergize K1. The 1000 V position activates Q4 and K4, so that Q7A sees only the drop across R20-R24 and R15. During the "Read A Level" or "Read B Level" modes, Q5-K6 or Q6-K5 are activated to read the trigger level of Channel A or B.

The amplifier consists of a pair of matched FET's (Q7) and one operational amplifier (U1) in a feedback arrangement. Q8 and Q9 are constant current sources due to the constant voltage developed across CR4. The bootstrap circuit CR5 and Q10 develop a constant voltage between the gate and source of the FET's, to provide thermal stability. Q7A and Q7B are matched to ensure that a voltage difference between both gates will appear at the corresponding source terminals. Any voltage difference between the gates is amplified in U1 and fed back to Q7B until the voltage difference becomes zero. CR2 and CR3 provide overload protection for Q7A and B by conducting at voltage differences greater than 0.7 volts.





NOTES

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

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR2,3	1901-0376
CR4	1902-3083
CR5	1902-0049
CR6	1901-0040
Q1	1850-0099
Q3-6	1853-0020
Q7	1855-0049
Q8,9	1854-0087
Q10	1853-0036
	2N3906
U1	820-02..-
	LM301A

RELAY TRUTH TABLE

RANGE	RELAY ENERGIZED					
	K1	K3	K4	K5	K6
10V	X					
100V		X				
1000V			X			
READ A					X	
READ B				X		

REFERENCE DESIGNATIONS

NO PREFIX	A12
	C1-4
	CR2-6
	K1,3-6
	Q1,3-10
	R3-34
	U1

NOT USED: CR1, K2, Q2, R1, R2

5326E-C-E

Figure 8-15. A12 Voltmeter Input Amplifier Assembly

A13 VOLTAGE TO FREQUENCY CONVERTER OPERATION

This assembly converts the output from the unity gain amplifier on A12 to a control signal that opens the clock gate U7A. When the main gate A7U11B opens, the decade counters will count a signal whose frequency is proportional to the DVM input voltage. This is accomplished by establishing two reference voltages for U4A/B switching circuitry and integrating the input signal to generate a ramp function. The time required for the ramp function to go from one reference level to the other is proportional to the input voltage. A reference current is switched into the integrator via CR5 or CR6. This returns the integrator to its original reference level, where the cycle starts again. During the time the reference current is turned on to return the integrator to the original reference, clock pulses appear at the DVM output on Pin 3 of U7A.

This process continues during the integrating time selected by the time base switch. At the end of this time, the decade counters contain a count that indicates the input voltage on the DVM. Q1 and Q2 are constant current sources for CR1 and CR4. This developes extremely stable voltages across CR1 and CR4.

Q3 and Q4 are output transistors connected in feedback arrangement which keeps pins 2 of U1 and U2 at the same level as the voltage on the reference diode. This supplies constant currents through the resistive networks connected to U2(2) and U1(2). R15 and R16 adjust the magnitude of this current. R10 and R7 are factory selected according to the exact value of CR7 and CR1.

When the DVM input is negative, the negative reference current is switched through diode CR5 into the summing node of the integrator U3 pin 2. This operation is controlled by the digital part of the assembly. If pin 2 of U5A is high and pin 1 is low (A=1), diode CR7 is back biased to route Q3 current through CR5 into the summing node of the integrator. The summing node is at virtual ground.

In a similar way, the positive reference current switches through CR6 to the summing node of the integrator, when U5B pin 12 is low and pin B is high (B=1). This is used for a positive voltage at the DVM input.

U4 is a quad comparator with ECL output levels. U4A gives a high output if the output of U3(V2) is greater than -0.7 V and U4B pin 4 is low if V2 is less than -1.8 V. These threshold levels are set by CR11 and R29, 31, 32. U4C and D differentiate the clock input after it passes through the divide-by-8 circuit consisting of U8, Q5, and R24. U4D generates a negative going 100 ns pulse on each positive transition of the 125 kHz clock at the collector of Q5. U4C generates a positive going 100 ns pulse on each negative transition of the 125 kHz clock. Differentiating occurs through C11 and R33.

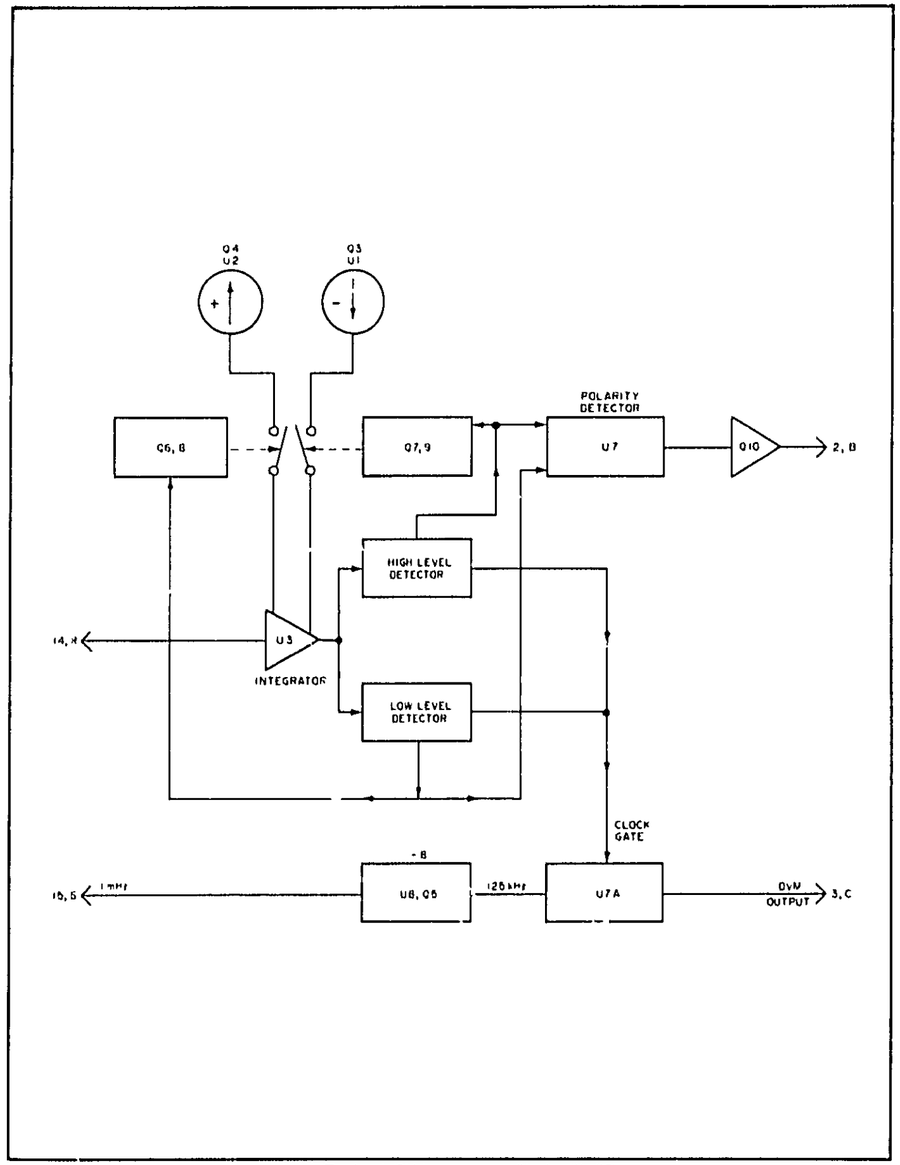
U6 and U5 are connected as two master-slave flip-flops. U6A is the master and U5A the slave. Data from U4A is stored and clocked for the negative reference current control, e.g., A will be high for a certain duty cycle, which is proportional to the applied negative voltage at input terminal 14, R.

U6B and U5B control the positive reference current in much the same way as U6A and U5A to evaluate input signals with a positive polarity. U7B and C detect polarity and Q10 translates the output of U7B to DTL levels. Q10 is conducting for negative polarity.

Figure 8-15
A13 VOLTMETER INPUT AMPLIFIER ASSEMBLY

(See Page 8-39)

Part of Figure 8-16. A13 Voltmeter V to F Converter Assembly



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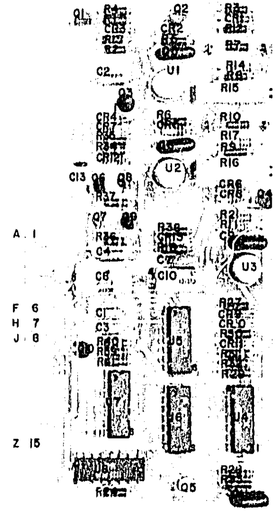
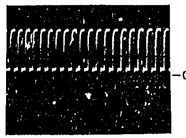
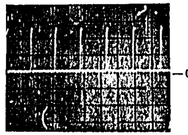
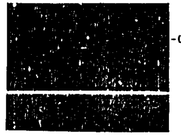




❶ U8(8)
.1 V/cm
2 μs/cm



❷ Q5 Collector
.2 V/cm
5 μs/cm



❸ U7(3)
.05 V/cm
10 μs/cm

All waveforms dc coupled through 10:1 divider probe. Divider probe ground connected to junction to C1 and C3. Triggering is internal ac. Zero volts in center line of graticule.

SAMPLE RATE ..... NORM CCW
FUNCTION ..... READ A
A LEVEL ..... for 2.10 V readout

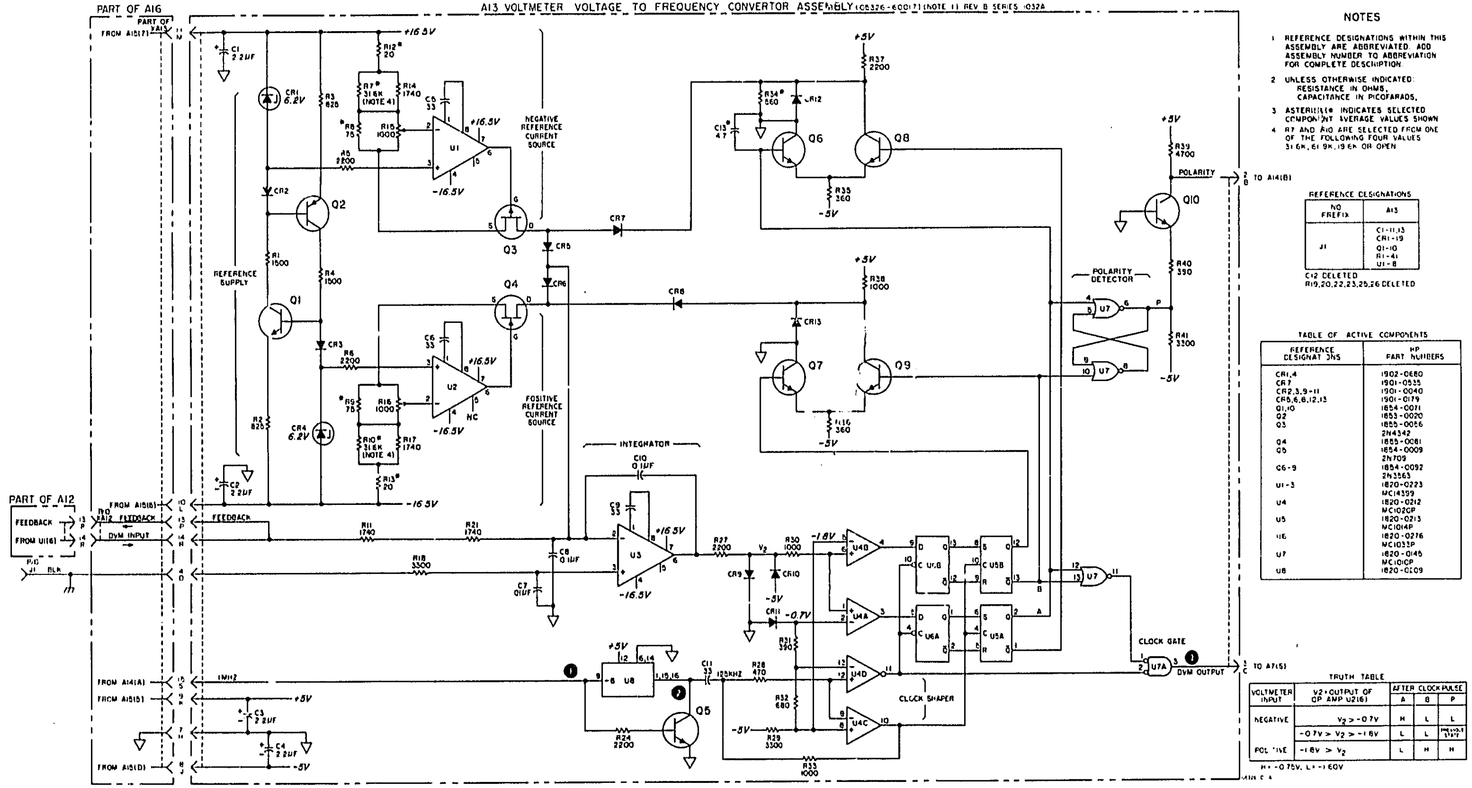


Figure 8-16. A13 Voltmeter V to F Converter Assembly

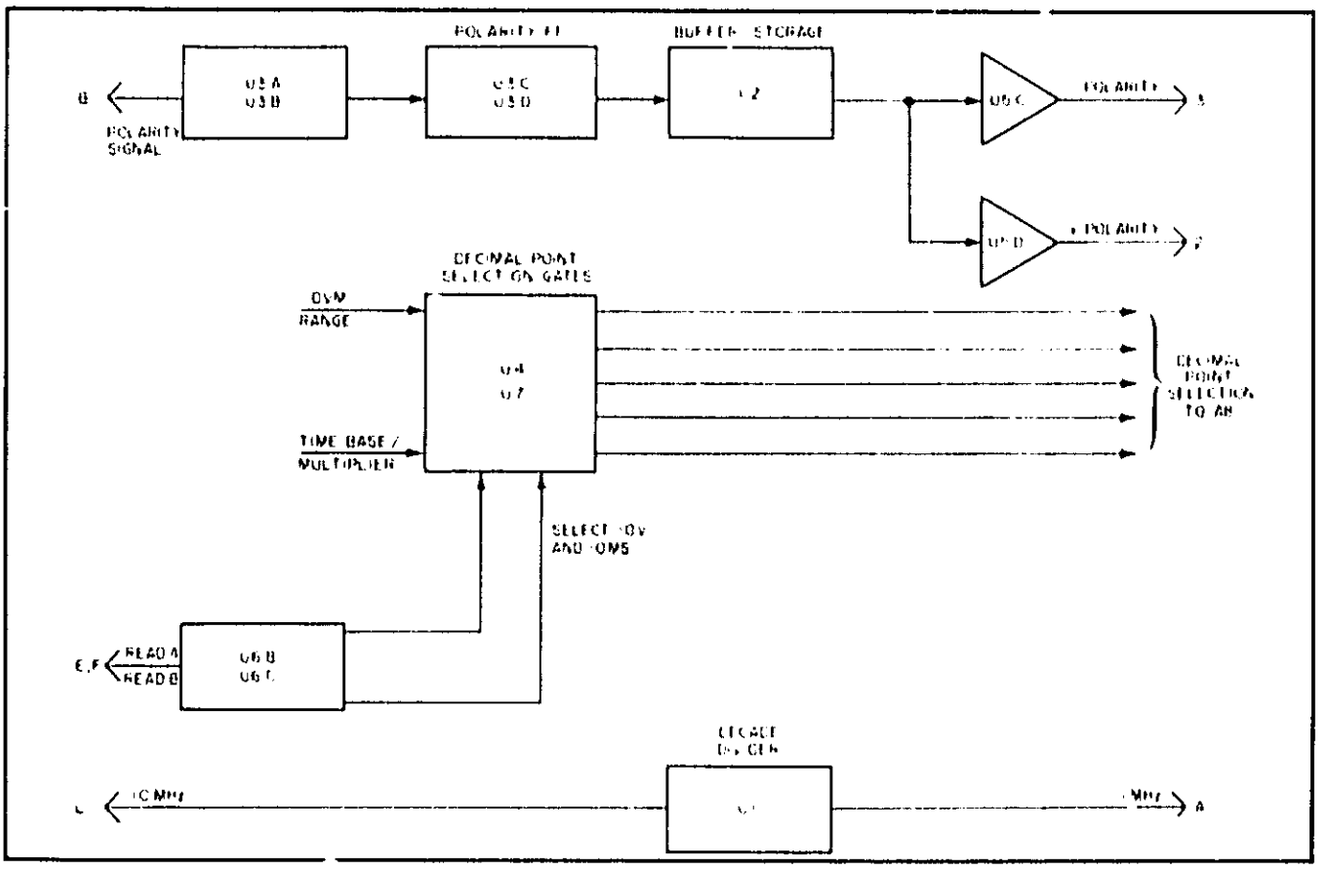
A14 VOLTMETER DISPLAY CONTROL OPERATION

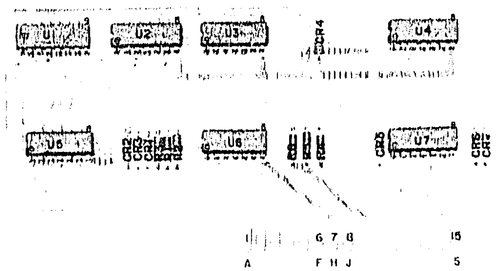
This board activates the "volts", "+", or "-" annunciators, provides the 1 MHz required by A13, and selects the decimal point for three settings of the time base switch.

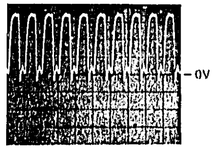
U3A and B gates the polarity information into the polarity flip-flop U3C, D (H=+ polarity). This information is transferred into buffer storage U2A and B by gates U2C and D when the "transfer data" line is enabled (low = enable).

Gates U6C and D activate either the + or - front panel lamp when the unit is in the DVM, READ A, or READ B mode. The volts annunciator is activated by U5B whenever the mode is DVM, READ A, or READ B and when the time base is 10 ms, 100 ms, or 1 sec. U5A removes the ground from the DVM range switch when not in the DVM mode. U6D sets the time base to 10 ns when the READ A or READ B mode is selected.

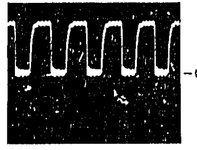
U4, U7, and U6C select the correct decimal point for the various combinations of time base and range switch settings. CR6, 7, 4, and 5 are installed to alleviate fan-out (IC loading) problems.







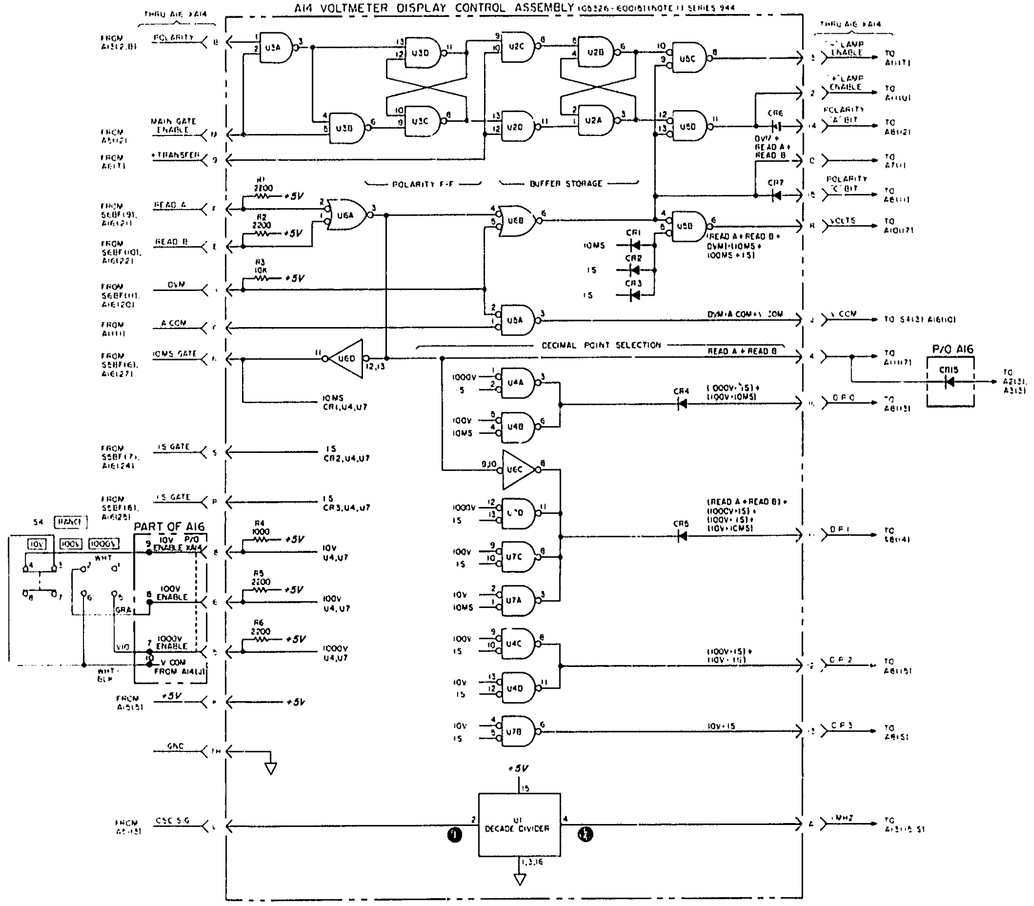
❶ A14 U1(2)
.1 V cm
.1 μs cm



❷ A14 U1(4)
.1 V cm
.5 μs cm

All waveforms dc coupled through 10:1 divider probe. Divider probe ground is connected to U2(7). Zero volt center line as indicated.

Counter Controls: INT-EXT (rear panel) . . . . . INT



NOTES

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2 UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS.

REFERENCE DESIGNATIONS

NC PREFIX	A14	A16
S4	CR1-7 R1-6 U1-7	CR15

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A14	
CR1-7	1910-0016
U1	1820-0413
U2,3	1820-0094 MC846P
U4,5,7	1820-0274
U6	1820-0273 MC1606P
A16	
CR15	1901-0040

(CONT'D)

Figure 8-17. A14 Voltmeter Display Control Assembly

A15-A16 POWER SUPPLY OPERATION

The power supply provides +175, +16.5 V and +5 V. Transformer T1 has a 115/220 primary and secondaries with open circuit voltages of 181 V at the red leads, 21 V at the orange, and 18.6 V between the green leads, with the winding center tapped to ground.

A15 CR6-9 comprise a full-wave bridge whose output is fed to filter C3 and bleeder R3. Q5 is a series pass regulator. A constant reference voltage is developed across CR11 and CR 12 through resistor R1. When the output voltage at XA15(1, A) decreases, Q5 increases conduction to increase the output voltage. Q8 is a current limiter that senses the voltage drop across R6. Output current above approximately 60 mA turns on Q8 and shunts base current from Q5, tending to turn Q5 off and limit the current. C1 adds oscillation stability to the regulator.

For the +16.5 V supplies, the orange leads of T1 connect to half wave rectifier CR4 and filter C4. Q1 is a series pass regulator and Q9 performs the same function as CR11&CR12 in the 175 V supply except that R10 provides a means to adjust the output. Assume that a Q1 base current is flowing through R2 and Q6. The resulting Q1 collector current establishes a voltage at the output, which is divided across R9, R10, and R11. If the voltage at the wiper of R10 is greater than that across CR9, Q9 will be turned on, shunting base current from Q1. This will tend to turn off Q1 and lower the regulated voltage. Thus, varying R10 establishes the largest output voltage that can exist before Q9 turns on to cut back Q1. Resistors R17, R18, and diodes CR15-18 provide current limit action at 180 mA similar to the +175 V supply.

Q6 is a preregulator that gives the circuit better line regulation and lower ripple than the Zener diodes of the 175 V supply. With CR1 as a reference, Q6 is a constant current circuit that maintains a Q1 base current independent of variations of the input (line voltage changes and ripple). R4 is needed to establish the current through CR1. The -16.5 V supply is complementary. The 5 V supplies are also complementary and only the + will be discussed.

The output from the T1 green leads is fed through full wave rectifier CR10 and CR11 into filter C1. It then passes through overload current limiter R1 and into the series pass regulator Q1, to the 5 V output at Q1C. Q3 is a driver for Q1 and has approximately 5.75 V on its base, developed across CR6 and CR5 by the current from the 16.5 V supply through R7. If the voltage at the emitter 5.1 V, Q3 is turned on providing base current to turn on Q1, raising the output voltage. Q3 turns off when its emitter gets above 5.1 V. C2 is the output filter to maintain a low output impedance at high frequencies.

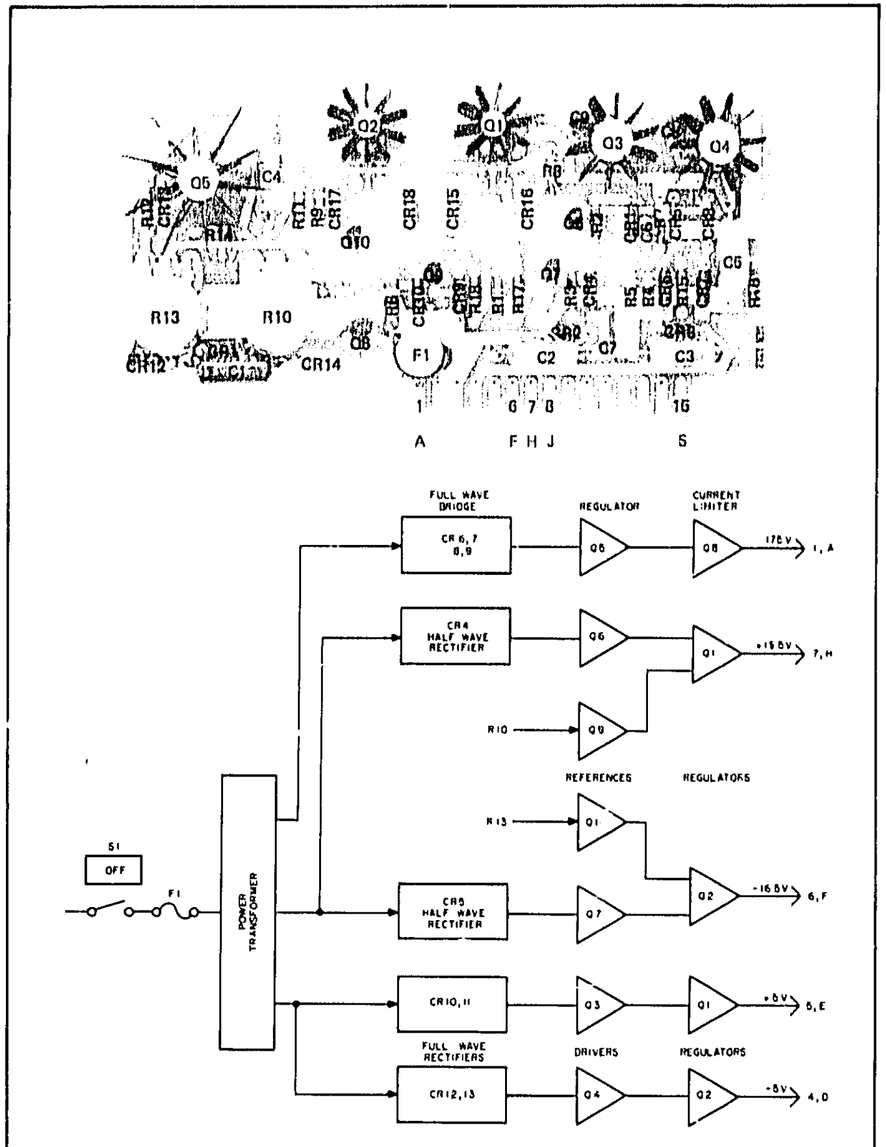
CR2 clamps the output at 6 V to provide protection for the IC's in case the 16.5 V or 175 V line should momentarily short to the 5 V line. CR5 provides thermal compensation for Q3.

Note that the 16.5 V supply is needed for operation of the 5 V supply. If the + or - 16.5 V supply fails, the corresponding 5 V supply will be inoperative.

Figure 8-17
A14 VOLTMETER DISPLAY CONTROL ASSEMBLY

(See Page 8-43)

Part of Figure 8-18. A15, A16 Regulator/Interconnect Board Assembly



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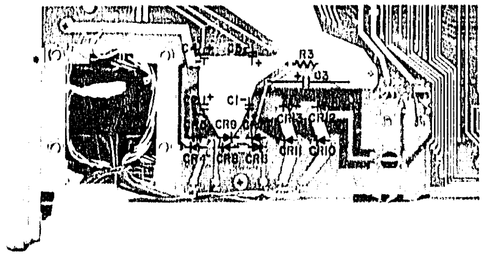
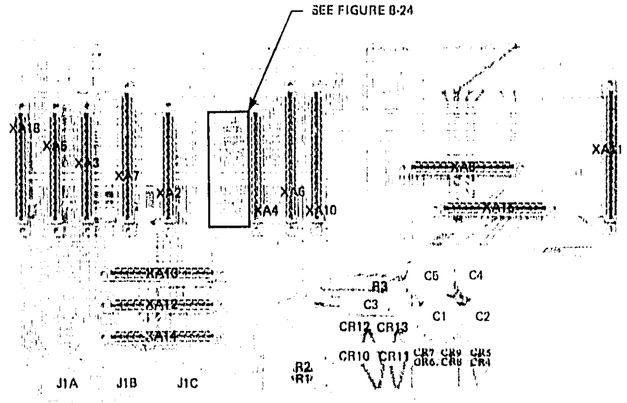
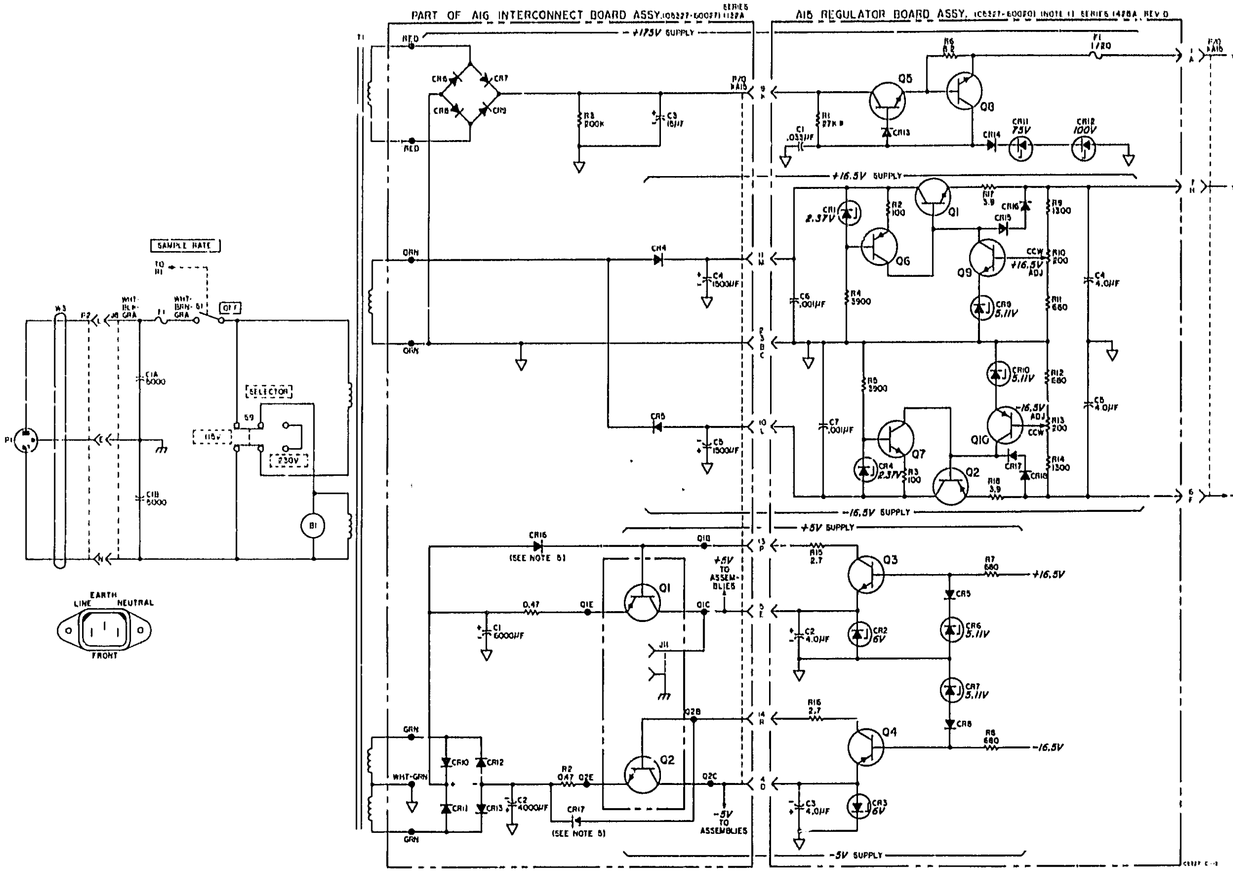






NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS, CAPACITANCE IN MICROFARADS.
3. A1B Q1-5 HAVE HEAT SINK.
4. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.
5. CR16 AND PAT NO. 3-JUNCTION SILICON DIODES.

REFERENCE DESIGNATIONS

NO PREFIX	A1B	A1G
B1		
C1	C1-7 CR1-18	C1-5 CR4-13, 16,17
F1	F1	
J8, J11		
P2		
Q1,2	Q1-10 R1-18	R1-3
S1,9		
T1		
W3		

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
NO PREFIX	
Q1	1853-0233
Q2	1854-0420
A1B	
CR1,4	1902-3002
CR2,3	1902-0551
CR5,8,15-18	1901-0040
CR6,7,9,10	1902-3084
CR11	1902-3354
CR12	1902-3429
CR13,14	1901-0033
Q1	1854-0300
Q2	1853-0073
Q3	1854-0039 2N3053
Q4	1853-0012 2N2904A
Q5	1854-0232
Q6,10	1853-0020
Q7,9	1854-0071
Q8	1854-0474
A1G	
CR4,5	1901-0046
CR6-9	1901-0029
CR10-13	1901-0415
CR16,17	1901-0460

Figure 8-18. A15, A16 Regulator/Interconnect Board Assembly

A17 INPUT C AMPLIFIER OPERATION

The input amplifier performs two functions: it provides a channel for increased sensitivity and it produces narrow pulses for efficient usage by other counter circuits. The amplifier is not controlled by any front-panel switches.

The input signal is dc coupled into a 50 ohm input impedance (R1) and is fed into the input amplifier, which is protected by R2, CR1, and CR2. Current source U1Q5 feeds the balanced differential amplifier U1Q3, Q4. The twin outputs are loaded by R10 and peaking coil L2. The signal flows to another amplifier circuit, whose outputs control the triggering of the tunnel diode, CR3. The diode is biased for maximum sensitivity with R11. When the diode fires, it produces fast rise and fall times on the input signal.

High-impedance emitter followers (Q1, Q2) ac couple the signal to the single-ended differential amplifier of Q3 and Q4. The short time constants of C9, R18, and C12, R23 differentiate the signal into narrow spikes of about 15 ns. The output circuit of C11, R22, and L4 approaches resonance at high frequencies for improved gain.

The signal is then fed to the one-shot multivibrator U2. The one-shot output goes High (U2, pin 4) when the input goes low. The output goes Low again after about 12 ns, when the level changes have propagated through the gates in a domino effect.

SENSITIVITY ADJUSTMENT

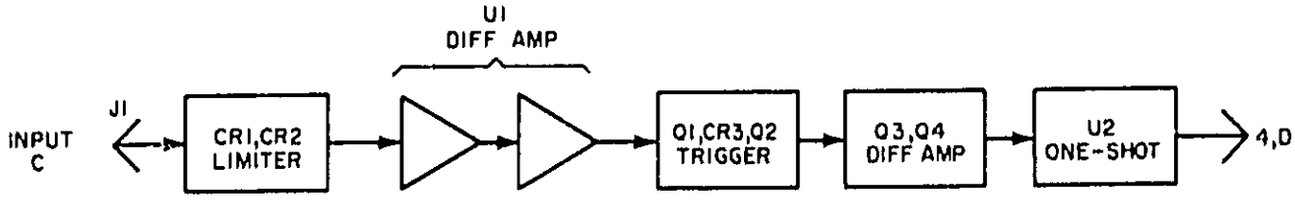
a. Set counter controls as follows:

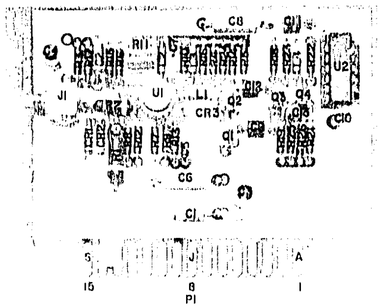
FUNCTION ..... FREQ C
TIME BASE ..... 0.1 S

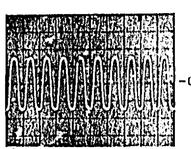
b. Set HP 606B HF Signal Generator (or equivalent) for 50 MHz at 500 mV rms. Measure the output signal of 606B with an HP 411A RF Millivoltmeter, using a 50Ω termination. Connect signal source to INPUT C of counter.

c. Reduce output level until counter's display becomes unstable. Adjust R11 for a stable display. Repeat this procedure until unable to obtain a stable reading. Increase the signal level until display just becomes stable.

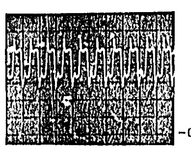
d. Disconnect input and connect to voltmeter, reading should be less than 5 mV. Check other frequencies within the band.



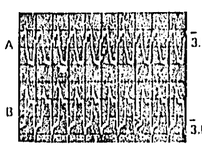




❶ .05 V/cm
.1 μs/cm

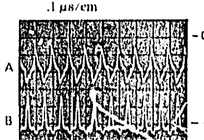


❷ .05 V/cm
.1 μs/cm



❹ a. Q1 (base)
b. Q2 (base)
.02 V/cm
.1 μs/cm
ALT B

DC VOLTAGES:
Set counter controls as stated.
Disconnect input signal



❸ a. Q4 b. U2(4)
.05 V/cm
.1 μs/cm
ALT B

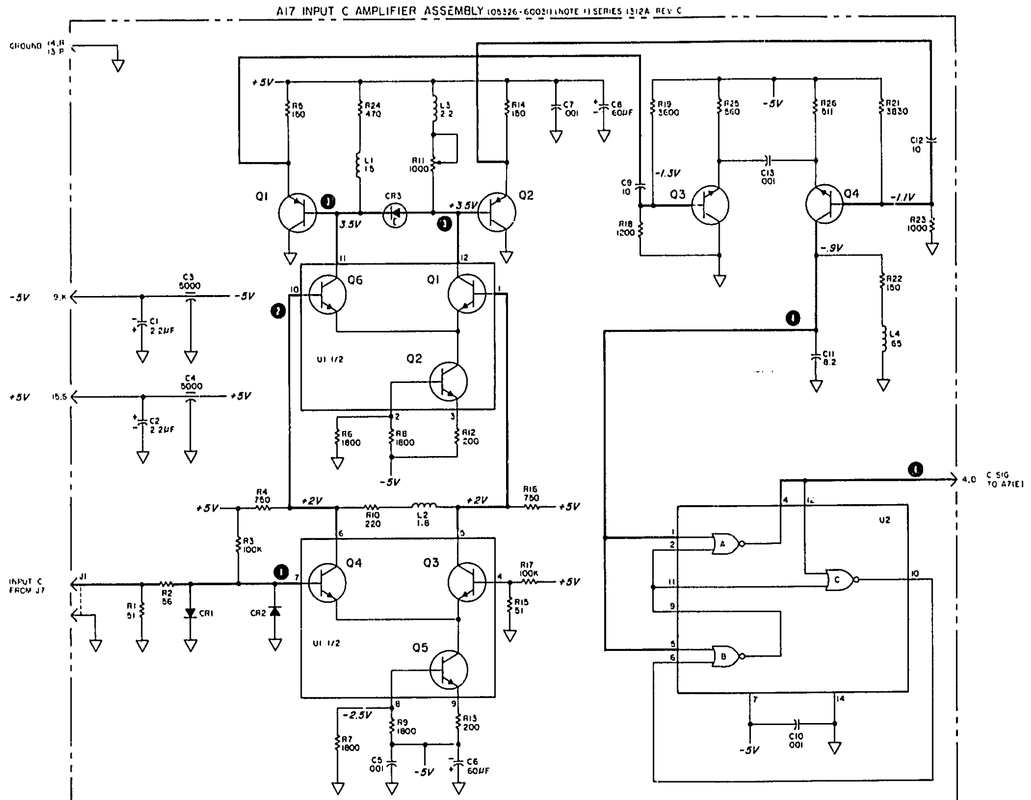
All waveforms taken with 10:1 divider probe; ground lead is connected to ground side of C6. A17 is mounted on extender board.

COUNTER CONTROLS:

INPUT C jack	connect 10 MHz sine wave at 1 V rms
FUNCTION	FREQ C
TIME BASE	1 ms
CHK SEP/COM	SEP

OSCILLOSCOPE CONTROLS:

SWEEP MODE	AUTO
TRIGGER	INT
SLOPE	+



NOTES

1 REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

2 UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS,
CAPACITANCE IN MICROFARADS,
INDUCTANCE IN MICROHENRIES.

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2	1901-0047
CR3	1912-0009
Q1,2	1853-0015
Q3	1854-0092
Q4	1854-0345
U1	1858-0004
U2	1820-0147

Figure 8-19. A17 Input C Amplifier Assembly (5326B Only)

A18 PRESCALER OPERATION

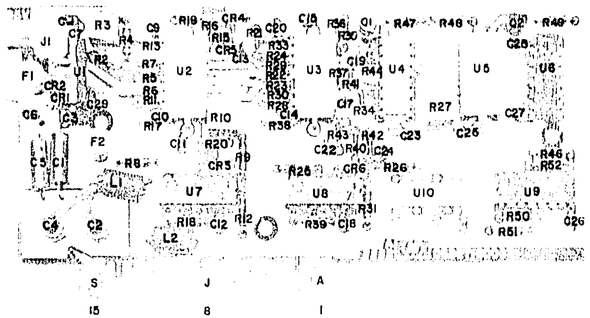
The prescaler board serves as a direct amplifier-trigger or as a divide-by-ten amplifier-trigger, with the function controlled by a front-panel input selector switch. With the switch in the PRESCALE position, the circuit performs as follows:

The signal is fed into the 50Ω input of J1. CR1, CR2, and U1 provide protection above 3.5 V rms or 5 V peak. There is about 2 dB loss through U1. The signal is passed to U2 amplifier, which is biased for sensitivity by R3. U3 amplifies the differential input and shapes the signal into a square wave. U4 and U5 combine to divide the signal by ten and Q2 translates the signal from EECL to ECL levels before presenting it to the data switch.

The direct signal, also from U3(13), bypasses the divider network and is sent to the data switch through the level translator Q1. The setting of the INPUT SELECTOR switch determines whether the data switch will accept the direct or prescaled signal. Pin 2 of U6 is High for direct and Low for prescaled. U9 shapes the positive, square-shaped pulses into narrow spikes before sending the signal to A7 Function board. U7, U8, and U10 (a production option) are constant-current sources for the amplifier circuits.

A18 TROUBLESHOOTING

Before troubleshooting the circuits, check the input protection fuse. If problem is in direct mode only, check Q1 and U6. If problem is in prescale mode only, check U4, U5, U6, and Q2. If a problem is found in the amplifiers (U2 and U3), remove the input signal and check the dc voltages supplied by the constant-current sources U7 and U8.



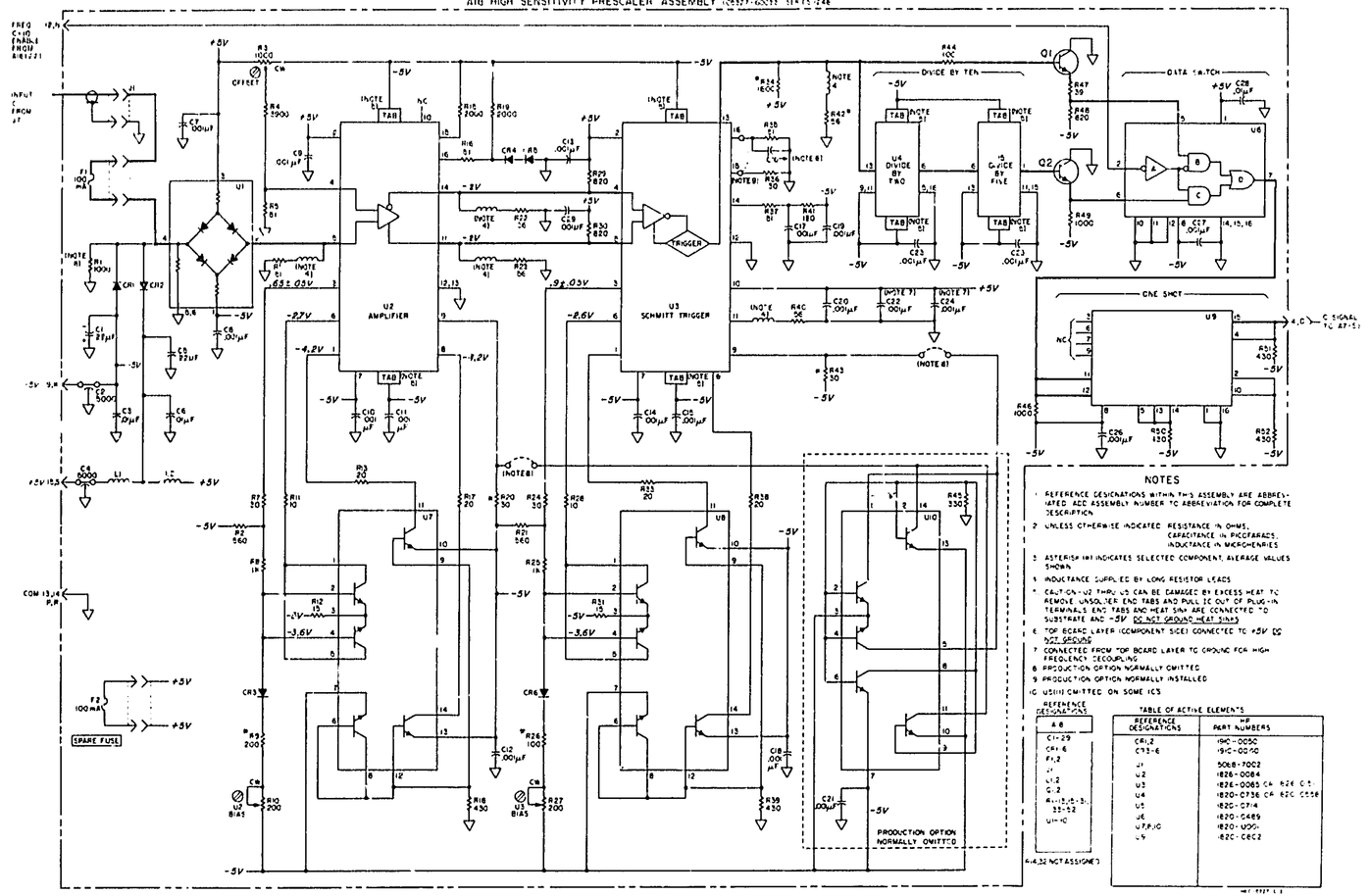


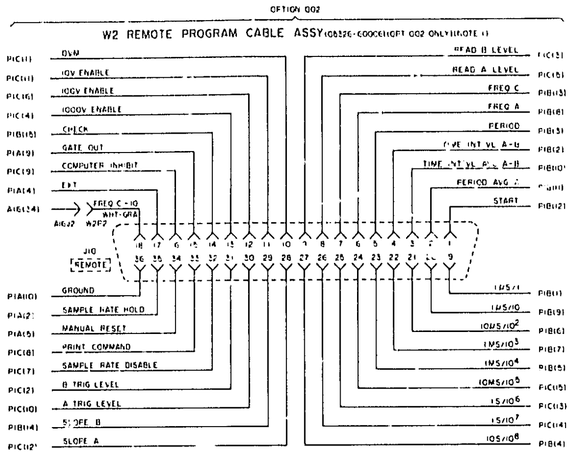
Figure 8-20. A18 Prescaler Board Assembly (5327B Only)

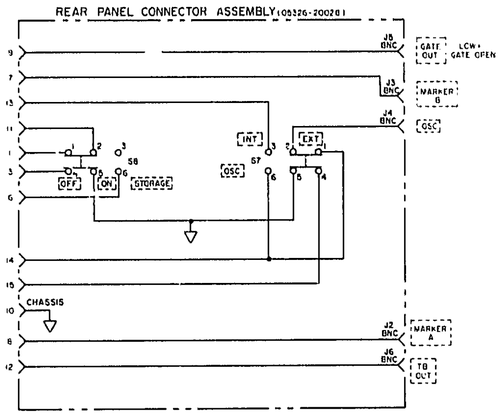
OPTION 002 REMOTE PROGRAMMING

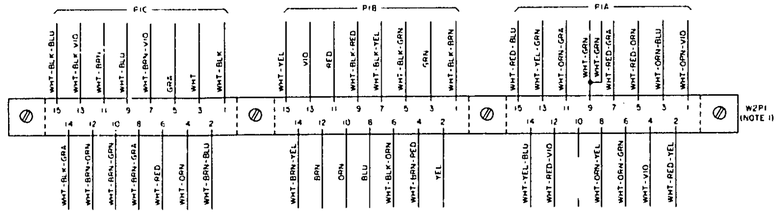
See Section II for programming information.

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Start	1	Brn	B12	A16(14)	L = Start Open = Stop
Period Avg A	2	Red	B11	A16(13)	L = Enable
Time Intvl Avg	3	Orn	B10	A16(16)	
Time Intvl	4	Yel	B2	A16(15)	
Period	5	Grn	B3	A16(17)	
Freq A	6	Blu	B8	A16(18)	
Freq C	7	Vio	B13	A16(12)	
Read A Level	8	Gra	C5	A16(21)	
Read B Level	9	Wht	C3	A16(22)	
DVM	10	Wht-Blk	C1	A16(20)	
10 V Enable	11	Wht-Brn	C11	A16(9)	
100 V Enable	12	Wht-Red	C6	A16(8)	
1000 V Enable	13	Wht-Orn	C4	A16(7)	L = Enable
Check	14	Wht-Yel	B15	XA3(B)	L = Check
Gate Out	15	Wht-Grn	A9	XA5(F)	H = Gate Closed L = Gate Open
Computer Inhibit	16	Wht-Blu	C9	XA6(14)	L = Inhibit
Ext	17	Wht-Vio	A4	XA11(A)	H = Int L = Ext
Freq C ÷ 10	18	Wht-Grn	(W2P2)	A16(34)	L = Enable
.1 μs/1	19	Wht-Blk-Brn	B1	A16(30)	
1 μs/10^1	20	Wht-Blk-Red	B9	A16(31)	
10 μs/10^2	21	Wht-Blk-Orn	B6	A16(28)	
.1 ms/10^3	22	Wht-Blk-Yel	B7	A16(29)	
1 ms/10^4	23	Wht-Blk-Grn	B5	A16(26)	
10 ms/10^5	24	Wht-Blk-Blu	C15	A16(27)	
.1 s/10^6	25	Wht-Blk-Vio	C13	A16(24)	
1 s/10^7	26	Wht-Blk-Gra	C14	A16(25)	
10 s/10^8	27	Wht-Blk-Red	B4	A16(23)	L = Enable
Slope A	28	Wht-Brn-Orn	C12	XA2(A,P)	L = Minus Open = Plus
Slope B	29	Wht-Brn-Yel	B14	XA3(B,P)	L = Minus Open = Plus

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
A Trig Level	30	Wht-Brn Grn	C10	XA2(1,A)	+3 V to -3 V
B Trig Level	31	Wht-Brn-Blu	C2	XA3(1,A)	+3 V to -3 V
Sample Rate Disable	32	Wht-Brn-Vio	C7	A16(11)	L = Disable
Print Command	33	Wht-Brn-Gra	C8	XA6(S)	L = Causes Print
Manual Reset	34	Wht-Red-Orn	A5	A16(6)	L = Reset
Sample Rate Hold	35	Wht-Red-Yel	A2	A16(4)	L = Maintain Display
Ground	36	Blk	A10	Ground	
Logic levels (Input) H > +2.0 V, L < +0.8 V (Output) H > +2.4 V, L < +0.4 V					







NOTES

1. IN STANDARD INSTRUMENT, ONLY W2P1A IS WIRED

Figure 8-21. Option 002, Remote Programming Cable Assembly and Rear Panel Connector Assembly

OPTION 003, DIGITAL RECORDER OUTPUT

Option 003 includes cable assembly W1 and rear panel connector J9. The counter (A9 Display Assembly) provides +8421 BCD and control line inputs and outputs for use with a printer or other data storage devices.

The annunciator lines (J9-17, 18, 42, and 43) supply overflow, plus, and minus outputs as follows:

FUNCTION	BCD
	8 4 2 1
Overflow	L L L L
+	H L H L
-	H L H H

When the print command line at J9(48) goes low, it indicates that the counter has completed a measurement and the data output may be interrogated. When the inhibit line is held High, the data output is maintained. The line must go high less than 30 µs after the print command goes low. The +5 V reference line (J9-25) has a 1K source impedance and is used for data level references. The 0 volt or ground reference connects to J9(24, 50).

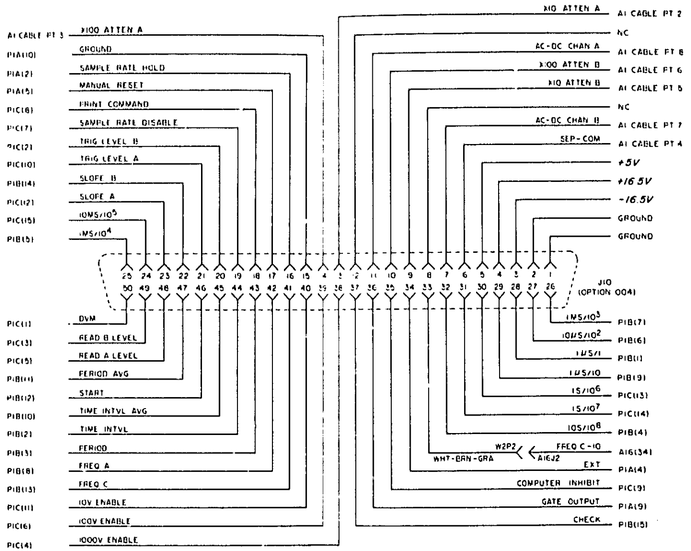
OPTION 004, EXTENDED REMOTE PROGRAMMING

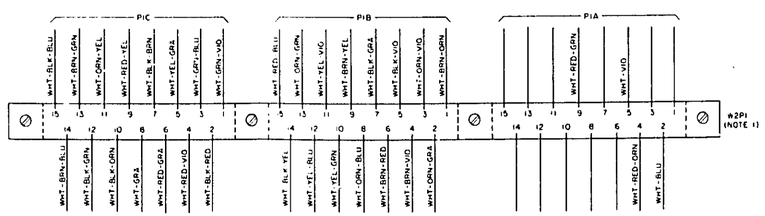
See Section II for remote programming information.

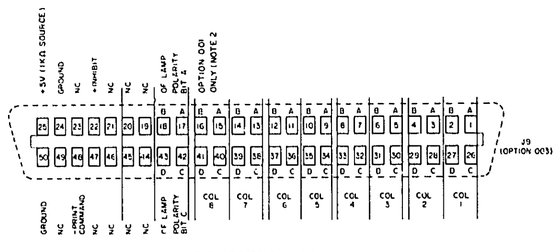
Option 004 Pin Connections

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Ground	1	Blk			
Ground	2	Blk			
-16.5 V Output	3	Orn			
+16.5 V Output	4	Yel			
+5 V Output	5	Grn			
Sep-Com	6	Blu		A1 Cable Point 4	
Ac-Dc Chan B	7	Vio		A1 Cable Point 7	
No connection	8	Gra			
X10 Atten B	9	Wht		A1 Cable Point 5	
X100 Atten B	10	Wht-Blk		A1 Cable Point 6	
Ac-Dc Chan A	11	Wht-Brn		A1 Cable Point 8	
No connection	12	Wht-Red			
X10 Atten A	13	Wht-Orn		A1 Cable Point 2	
X100 Atten A	14	Wht-Yel		A1 Cable Point 3	

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Ground	15	Blk	A10		
Sample Rate Hold	16	Wht-Blu	A2	A16(4)	L = Maintain Disable
Manual Reset	17	Wht-Vio	A5	A16(6)	L = Reset
Print Command	18	Wht-Gra	C8	XA6(S)	L = Causes Print
Sample Rate Disable	19	Wht-Blk-Brn	C7	A16(11)	L = Disable
Trig Level B	20	Wht-Blk-Red	C2	XA3(1, A)	+3 V to -3 V
Trig Level A	21	Wht-Blk-Orn	C10	XA2(1, A)	+3 V to -3 V
Slope B	22	Wht-Blk-Yel	B14	XA3(13, P)	L = Minus Open = Plus
Slope A	23	Wht-Blk-Grn	C12	XA2(13, P)	L = Minus Open = Plus
10 ms/10^5	24	Wht-Blk-Blu	C15	A16(27)	L = Enable
1 ms/10^4	25	Wht-Blk-Vio	B5	A16(26)	
.1 ms/10^3	26	Wht-Blk-Gra	B7	A16(29)	
10 µs/10^2	27	Wht-Brn-Red	B6	A16(28)	
.1 µs/1	28	Wht-Brn-Orn	B1	A16(30)	
1 µs/10	29	Wht-Brn-Yel	B9	A16(31)	
.1 s/10^6	30	Wht-Brn-Grn	C13	A16(24)	
1 s/10^7	31	Wht-Brn-Blu	C14	A16(25)	
10 s/10^8	32	Wht-Brn-Vio	B4	A16(23)	
Freq C ÷ 10	33	Wht-Brn-Gra	W2P2	A16(34)	L = Enable
Ext	34	Wht-Red-Orn	A4	XA11(A)	H = Int L = Ext
Computer Inhibit	35	Wht-Red-Yel	C9	XA6(4)	L = Inhibit
Gate Output	36	Wht-Red-Grn	A9	XA5(F)	H = Gate Closed L = Gate Open
Check	37	Wht-Red-Blu	B15	XA3(B)	L = Check
1000 V Enable	38	Wht-Red-Vio	C4	A16(7)	L = Enable
100 V Enable	39	Wht-Red-Gra	C6	A16(8)	
10 V Enable	40	Wht-Orn-Yel	C11	A16(9)	
Freq C	41	Wht-Orn-Grn	B13	A16(12)	
Freq A	42	Wht-Orn-Blu	B8	A16(18)	
Period	43	Wht-Orn-Vio	B3	A16(17)	
Time Intvl	44	Wht-Orn-Gra	B2	A16(15)	
Time Intvl Avg	45	Wht-Yel-Grn	B10	A16(16)	L = Enable
Start	46	Wht-Yel-Blu	B12	A16(14)	L = Start Open = Stop
Period Avg	47	Wht-Yel-Vio	B11	A16(13)	L = Enable
Read A Level	48	Wht-Yel-Gra	C5	A16(21)	L = Enable
Read B Level	49	Wht-Grn-Blu	C3	A16(22)	L = Enable
DVM	50	Wht-Grn-Vio	C1	A16(20)	L = Enable







BCD WEIGHTS: A=1, B=2, C=4, D=8
"1" STATE POSITIVE

NOTES

1. IN STANDARD INSTRUMENT, ONLY W2P1A IS WIRED.
2. OUTPUT FROM COLUMN B IS AVAILABLE ONLY WHEN OPTION 001 IS ADDED.

CR327-0-278

Figure 8-22. Option 004, Remote Programming Cable Assembly and J10 Option 003, Digital Recorder Cable Assembly

A1 OPTION 004 OPERATION

The remote programmable attenuator board attenuates the input signal and routes it to the amplifier boards. The signals from inputs A and B are routed through identical paths.

In the X1 position K2 is closed and the signal is routed directly to K4, which is open with ac coupling and closed with dc. R30 provides the 1 MΩ input impedance. R34, R38, and C7 compensate for high frequency roll-off and also limit the input current to Q1A. Diodes CR25 and CR27 limit the voltage at the input of Q13A to ±5.8 V. Q13A operates as a source follower with a high input impedance and a low output impedance to the amplifier boards. Q1B operates as a source follower, supplying the amplifiers with the dc trigger-level voltage generated either by R49, CR32, and CR33, or from an external analog input (J10). R46, 44, 42, and C13 filter the trigger-level voltage.

In the X1 position, K2 and K4 are closed providing a direct path for the input signal to the gate of Q13A. In the X10 position, K2 is open and diodes CR7 and CR9 are turned on, shorting R16 to ground. R12, R14, and R16 form the dc attenuator. The ac (high frequency) attenuator is formed by C1 and stray capacitance in the circuit.

In the X100 position, K2 is open, CR7 and CR9 are off, and CR21 and CR23 are turned on. C3 and R28 are thus connected to ground. R12, R14, and R28 form the dc portion of the attenuator, while C1, C3, and stray capacitance form the high frequency portion of the attenuator.

The circuitry to drive AC/DC relay K3, and SEP/COM relay K1 is provided by U3 A&C. U3's output is at HTL levels (+12 V, +1.5 V) and thus is sufficient to drive the relays directly. U3's input is at DTL levels and is compatible with remote programming levels. K2 is driven by Q7 and is open when CR7 and CR9 or CR21 and CR23 are on.

Diode pairs CR7 and CR9 are driven by emitter followers Q3 and Q6, which, in turn, are driven by HTL gates U2D AND U2C. U2's power supply, consisting of Q1 and Q2, is +8.9 V and -5.6 V rather than the usual +15 V and 0 V. This special bias moves the HTL input threshold to +1.9 V, rather than the normal +7.5 V. U2D can now be driven by DTL gate U1B. The output swing of U2D is +9 V to -4 V, providing the diode quad CR7 and CR9 with positive turn-on and turn-off signals. R9 is adjusted to minimize the offset voltage of the quad.

ADJUSTMENTS

Set:

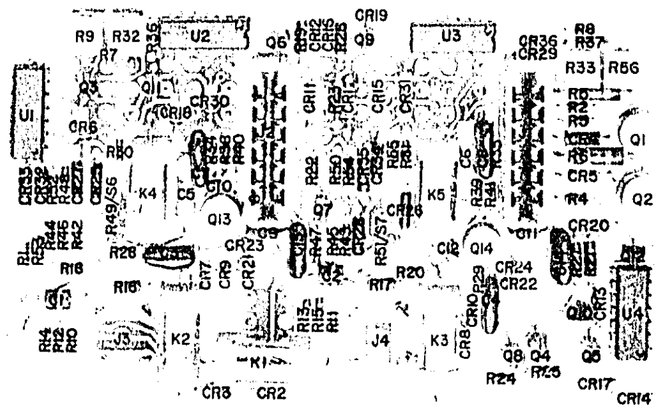
TIME BASE	0.1 sec.
AC/DC	DC
SEP/COM	SEP
ATTEN A/B	X10

1. Using an HP 412A or equivalent, measure voltage at CHANNEL A jack.
2. Adjust R56 for <±1 mV reading.
3. Measure voltage at CHANNEL B jack.
4. Adjust R9 for <±1 mV reading.
5. Set A and B attenuators to X100 position.
6. Measure voltage at CHANNEL B jack.
7. Adjust R32 for <±1 mV reading.
8. Measure voltage at CHANNEL A jack.
9. Adjust R33 for <±1 mV reading.

Figure 8-22
OPTION 004, REMOTE PROGRAMMING CABLE ASSEMBLY AND J10 OPTION 003, DIGITAL RECORDER CABLE ASSEMBLY

(See Page 8-53)

Part of Figure 8-23. Option 004 Programmable Attenuator Assembly



MORE DATA UNDER THIS FOLD

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.

REFERENCE DESIGNATIONS

A1 OPT 004
C1-14
CR1-36
DS1,2
J1-4
K1-5
Q1-14
R1-56
S1-9
U1-4

CABLE POINT	WIRE COLOR	DESTINATION
1	GRN	+5V
2	WHT-ORN	J101(3)
3	WHT-YEL	J101(4)
4	BLU	J101(6)
5	WHT	J101(9)
6	WHT-BLK	J101(10)
7	VIO	J101(1)
8	WHT-BRN	J101(11)

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1-3,6,15,18,30,31	1910-0016
CR4	1902-0025
CR5	1902-0057
CR7,8,23,24	1906-0024
CR9,10,21,22	1906-0025
CR11-14,16,17, 19,20,29,36	1901-0040
CR25-28	1901-0376
CR32-35	1902-3044
Q1	1854-0039
Q2	1853-0001
Q3,4,7,8,11,12	1854-0215
Q5,6,9,10	1853-0036
Q13,14	1855-0334
U1	1820-0274
U2,4	1820-0287
U3	1820-0625

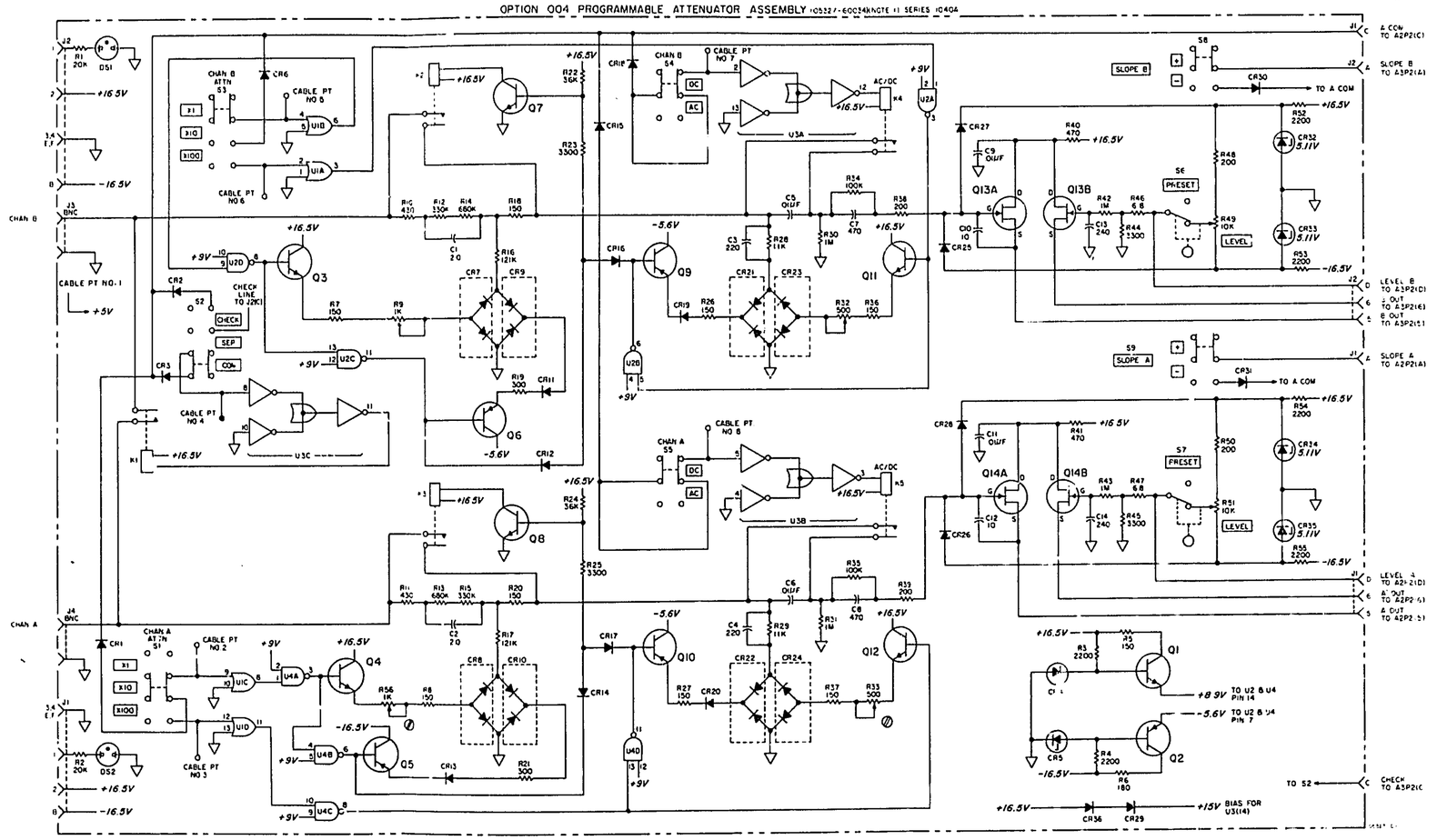
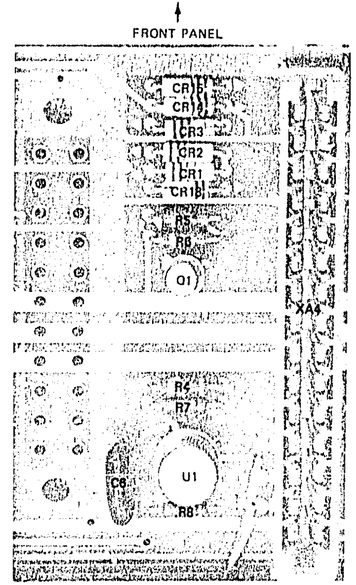


Figure 8-23. A1 Option 004 Programmable Attenuator Assembly



OPTIONS 010 AND 011 A16 INTERCONNECT CIRCUIT BOARD (PARTIAL DIAGRAM) 05327-60027 SERIES 1224A

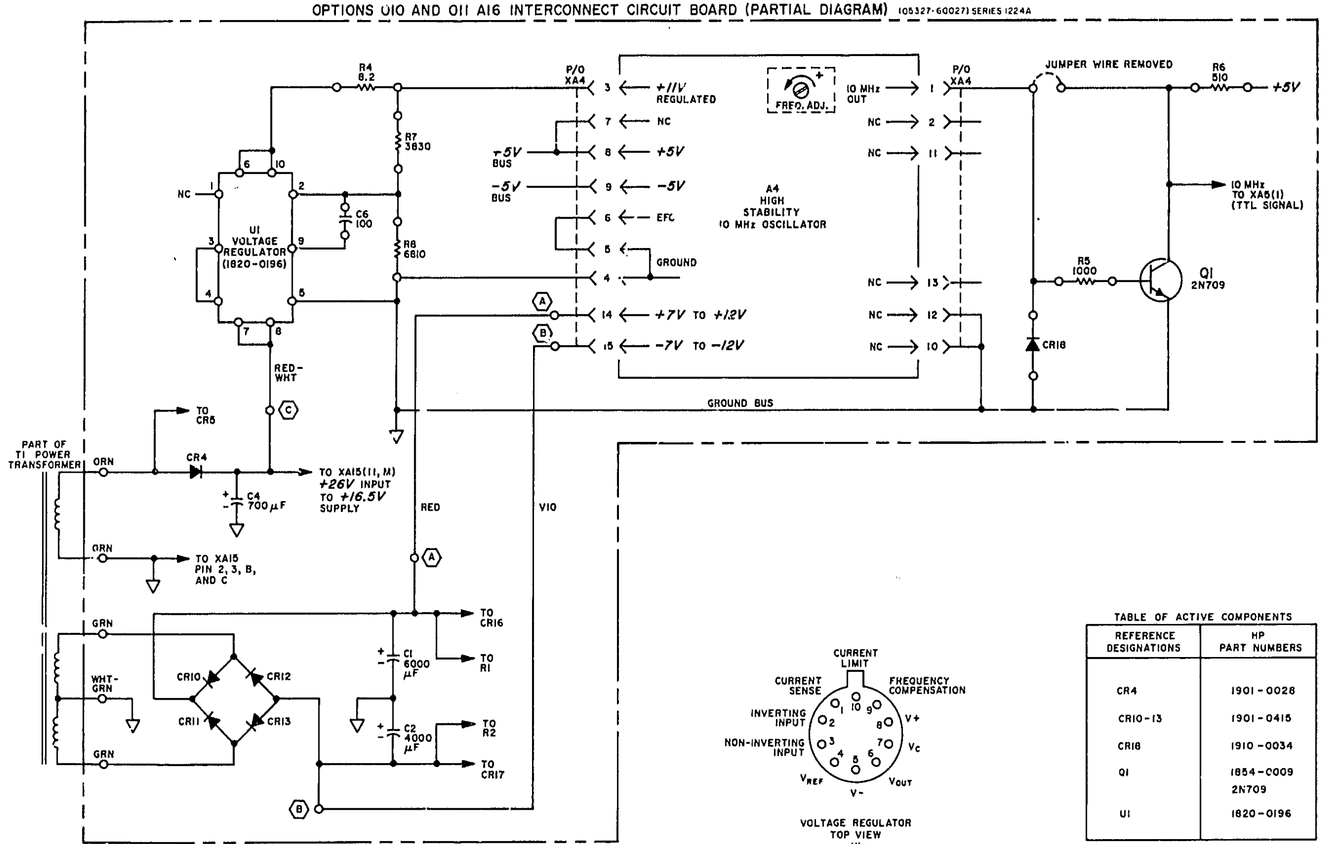


TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR4	1901-0028
CR10-13	1901-0415
CR16	1910-0034
Q1	1854-0009 2N709
U1	1820-0196

5326-8-11

Figure 8-24. Options 010, 011, and A16 Interconnect Circuit Board

Figure 8-25
5326B/5327B INTERCONNECT DIAGRAM

MANUAL CHANGES

MANUAL DESCRIPTION

INSTRUMENT:	5326B/5327B Timer-Counter-DVM Operating and Service Manual
SERIAL PREFIX:	5326B/5327B—1428A
DATE PRINTED:	FEB 1975
HP PART NO:	05326-90043
MICROFICHE NO:	05326-90044

CHANGE DATE: May 6, 1980

(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
1540A (5327B Only)	1	1620A03737 & Up (5326B) 1620A01351 & Up (5327B)	1,2,3,4,5,6
1544A (5327B Only)	1,2	1620A	1,2,3,4,5,6,7
1544A (5326B Only)	2	1844A	1,2,3,4,5,6,7,8
1604A (5327B Only)	1,2,3	1936A	1,2,3,4,5,6,7,8,9
1612A (5326B/27B)	1,2,3,4,	■ 2012A (5326B Only)	1 through 10
1620A (5326B/27B)	1,2,3,4,5	■ See Note 1 (5327B)	1 through 10

■ **NEW OR REVISED ITEM**

■ **NOTE 1** — Model 5327B Instruments with Serial Numbers 1844A01590, 1936A01594, 1936A01595, 1936A01599, 1936A01600, and 1936A01602 also incorporate CHANGE 10.

The following Service Notes are available from your local HP Sales and Service Office.

Service Note No.	Description
5326ABC/5327ABC-3	Input Attenuator Noise Solution
5326ABC/5327ABC-4	Extra Insulation for the + and -5 Vol. Regulators
5326ABC/5327ABC-5	Field Installation of Option 011
5326ABC/5327ABC-6	Field Instillation of Option 040 (Temperature Compensated Crystal Oscillator)
5326ABC/5327ABC-7	Added Protection for the +175 Volt Power Supply
5326ABC/5327ABC-8	Display Tube Driver Warning
5326ABC/5327ABC-9B	Added Protection to the +175 Volt Fuse

ERRATA

Page 1-3, Table 1-3, "INTEGRATING DIGITAL VOLTMETER" Accuracy:
Under Zero Offset (10V range) change ±10.01% to ±0.01%.

Page 5-10, Table 5-4, Steps 5C and d:
Change 0.65 ±.05V to 0.9 ±.05V at A18U2(3).
Change 0.90 ±.05V to 0.8 ±.05V at A18U3(3).

Page 6-13, Table 6-1, Replaceable Parts:
Change A13R8 and A13R9 from 0757-0398 (75 OHM) to 0757-0384; 20 OHM FACTORY SELECTED VALUE, MFR Part No. 0757-0384.

Page 6-15, Table 6-1, Replaceable Parts:
Change A16R7 from 0698-3153 (3830 OHM) to 0698-3155, 4630 ohms.

Page 1-5, Table 1-3, Specifications:
Change Option 011 Short-Term Fluctuation (1 s avg) to $<1 \times 10^{-10}$ rms.

3N—5295-5695-5700-5829-5840-5870-6413-6424-6602-6998-7004-7071/7983-8249/8296/9151/10=10437

HEWLETT PACKARD

ERRATA (Cont'd)

Page 6-17, Table 6-1:
Change A18R29, A18R30 from 0698-5177 (820 OHM) to 0698-5103, 430 OHM.
Add "FACTORY SELECTED VALUE" to description.

Page 6-19, Table 6-1:
Change 1200-0147 to 1200-0081 in "HP Part Number" and "Mfr Part Number" columns and "Qty" to 2.

Page 8-35, Figure 8-13, A10 Schematic:
Disconnect A10Q13 emitter from junction of A10P1(U), A10U6A(2), and A10U3B(4).
Add A10P1(17), mark "VOLTS FROM XA14(..)", and connect to A10Q13 emitter.

Change SERIES number of A16 circuit board to 1428A on various pages where portions of A16 appear in this manual. This includes the Table of Replaceable Parts.

Page 8-41, Figure 8-16, A13 Schematic:
Change A13R8 and A13R9 from 75 to 20 ohms.
Change heading in TRUTH TABLE to read "V2 = OUTPUT OF OP AMP U3(6)" in place of U2(6).

Page 8-44, A15 Component Locator:
Replace with attached Figure 1.

Page 7-2, Paragraph 7-21:
Add the following sentence, "An HP Part No. 05326-00033 adapter plate will also be required for mounting 36-pin remote programming connector J10.

Page 6-17, Table 6-1:
Add A18L3; 05303-80001, 1, COIL, FXD, RF PEAKING, 28480, 05303-80001.
Add "FACTORY SELECTED" to A18R34 and A18R42 "Description".
With these changes A18 assembly 05327-60033 is "SERIES 1428A".

Page 8-49, Figure 8-20, A18 schematic:
Add asterisk (*) adjacent to A18R22, A18R23, A18R29, A18R30, and A18R40.
In Table 6-1 for these resistors add "FACTORY SELECTED VALUE" to description.

Add A18L3 in series with A18U3(13) output line. Output circuit trace is cut and one end of A18L3 is connected to the junction of A18U3(13) and A18R34. The other end of A18L3 is connected to the junction of A18R44 and the coil from A18R42.

Change series number at top of A18 schematic diagram to "SERIES 1428A".

Change dc voltages at A18U2(3) from 0.65V to 0.9V and voltage at A18U3(3) from 0.9V to 0.8 volts.

Page 8-57, Figure 8-24, Schematic:
Change A16R7 from 3830 to 4630 ohms.
Change SERIES at top of schematic from 1224 to 1428.

Page v, List of Figures and Page 8-53, Figure 8-22:
Change caption to read "Option 004, J14 Remote Programming Cable Assembly and Option 003, J9 Digital Recorder Cable Connections".

Page 1-4, Table 1-3, Specifications:
Delete paragraph pertaining to "Short-Term Fluctuation" under "Time Base" heading.

Page 8-55, Figure 8-23, Option 004 Schematic:
Add the following NOTE:

NOTE

SERVICING THIS ASSEMBLY IS ACCOMPLISHED BY REMOVING THE BOARD FROM THE FRONT PANEL AND MATING IT TO THE AMPLIFIER BOARDS, WHICH HAVE BEEN ELEVATED USING TWO 15 PIN EXTENDER BOARDS (HP PART NO. 5060-0049). THIS ALLOWS ACCESS TO BOTH SIDES OF THE ASSEMBLY. RE-ATTACHING GREEN WIRE TO CABLE PT 1 IS NECESSARY TO ALLOW FRONT PANEL CONTROL.

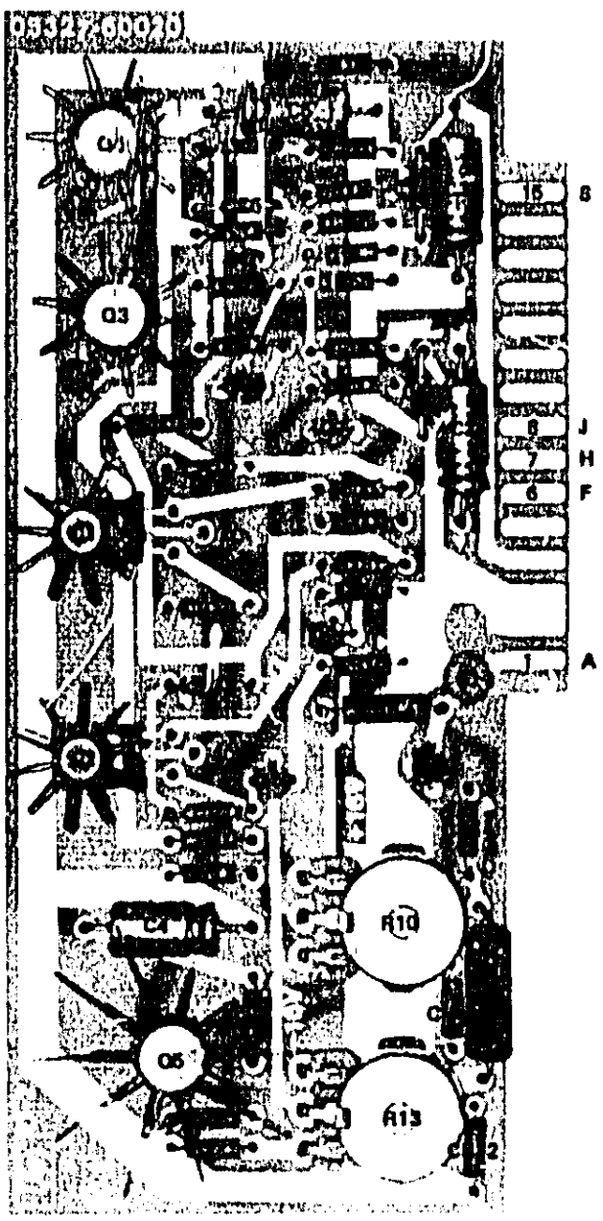


Figure 1. A15 Regulator Board Assembly
05327-60020 Series 1312A or
1428A Component Locator

ERRATA (Cont'd)

Page 5-5, 4. PULSE OPERATION:

In step a, set LEVEL (A) to "SLIGHTLY +" in place of PRESET.

Change step c to read "Adjust pulse generator for positive output for 10 MHz repetition rate, 15 ms pulse width for 0.3 volts peak-to-peak indication on oscilloscope."

Change step d to read "Adjust counter LEVEL A control until counter triggers and counts. Check that counter displays the repetition rate, count light flashes, and trigger A lamp is ON. Record on test card."

Page 6-18, Table 6-1, Replaceable CHASSIS PARTS:
Change Q1 from 1853-0233 to 1853-0356 in "HP" and "Mfr" part number columns.

Change Q2 from 1854-0420 to 1854-0625 in "HP" and "Mfr" part number columns.

NOTE – THE ABOVE TRANSISTORS FOR Q1 AND Q2 ARE RECOMMENDED FOR REPLACEMENT IN ALL INSTRUMENTS. THE HIGHER WATTAGE RATING OF THESE TRANSISTORS WILL IMPROVE INSTRUMENT RELIABILITY.

Page 8-45, Figure 8-18, TABLE OF ACTIVE ELEMENTS:
Change Q1 from 1853-0233 to 1853-0356 and Q2 from 1854-0420 to 1854-0625.

Page 6-15, Table 6-1, A16 (05327-60027) Replaceable Parts:
Change A16XA2 thru XA5, XA8, XA12 thru XA15, and XA18 from 1251-1886 to 1251-2035; Mfr Code to 28480; Mfr Part Number 1251-2035.

Change A16XA6, XA7, XA10, and XA11 from 1251-2134 to 1251-2026; Mfr Code 28480; Mfr Part Number 1251-2026.

Page 6-21, Table 6-2, Replacement Parts, Options:
Change A1C7 and C8 from HP Part Number 0140-0149 to 0160-3533; Mfr Code to 28480; Mfr Part Number to 0160-3533.

CHANGE 1 (1640A) (5327B ONLY)

Page 5-10, Table 5-4, Paragraph 5 Prescaler Adjustments:
Change paragraph 5-g to read as follows: "Reduce output level until counter's display becomes unstable. Alternately adjust A18R3 and A18R53 for a stable display. Repeat procedure until unable to obtain a stable display. Increase signal level until display just becomes stable and make any final adjustments of A18R3 and A18R53."

Page 6-16, Table 6-1, A18 Replaceable Parts (Series 1640):
Add A18C30; 0160-3879; CAPACITOR-FXD 0.01 μF 20% 100 VDCW CER; 28480; 0160-3879.

Change R18R22 and A18R23 from 0698-4131 (56 ohms) to 0698-3113; RESISTOR-FXD 30 OHM 5% .125W CC; 01121; BB3005.

Change A18R29 and A18R30 from 0698-5103 (430 ohms) to 0698-5177; RESISTOR-FXD 820 OHM 5% .125W CC; 01121; BB8215.

Change A18R34 from 0698-8073 (1600 ohms) to 0698-5178; RESISTOR-FXD 1500 OHMS 5% .125W CC; 01121; BB1525.

Add A18R53; 2100-2633; RESISTOR VAR 1000 OHMS 10% COMP SIDE ADJ; 30983; ET50X102.

Add A18R54 and A18R55; 0698-3374; RESISTOR-FXD 20 OHM 5% .125W CC; 01121; BB2005.

Add A18R56; 0698-6283; RESISTOR-FXD 10 OHMS 5%; .125W CC; 01121; BB1005.

CHANGE 1 (1540A) (5327B ONLY) (Cont'd)

Page 8-49, Figure 8-20, A18 Prescaler Assembly Schematic:
Add A18C30 (.01 μF) between common and the "+5V" end of A18R34.

Add A18R53 (1000 ohms) variable resistor between +5.2V and -5.2V. Connect junction of A18C30 and A18R34 to arm of A18R53 in place of "+5V" as shown on schematic diagram.

Change value of A18R34 from 1600 to 1500 ohms.

Change A18R22 and A18R23 from 56 to 30 ohms.

Change A18R29 and A18R30 from 430 to 820 ohms.

Add A18R54 (20 ohms) in series between A18U2 pin 11 and the junction of A18R23, A18R30, and A18U3 pin 5.

Add A18R55 (20 ohms) in series between A18U2 pin 14 and the junction of A18R22, A18R29, and A18U3 pin 4.

Add asterisk (*) adjacent to A18R54 and A18R55.

Add A18R56 (10 ohms) in series between A18U1 pin 2 and the junction of A18U2 pin 5 and A18R6.

Change "SERIES" number at top of schematic to "1540".

CHANGE 2 (1544A)

Page 1-5, Table 1-3, Specifications for OPTIONS:

Add to Option 001: 8-digit display. "Part of standard instrument; discontinued as an Option".

Add to Option 003: Digital Output (for numerals and polarity only). "Discontinued as an Option and included as part of the standard instrument."

Delete Option 010 Temperature Compensated Oscillator. This Option is discontinued and is no longer available.

Page 7-1, Options and Manual Changes:

Paragraph 7-14, delete second sentence.

Paragraph 7-18, Add – "Part of Standard Instrument; Discontinued as an Option."

Paragraph 7-22, Add – "Part of Standard Instrument; Discontinued as an Option."

Page 6-9, Table 6-1, A9 Replaceable Parts:
Replace A9 table for 05326-60008 with table for 05226-60025 A9 on page 6-20 of Table 6-2.

Page 6-21, Table 6-2:
Add parts for Option 003 as part of standard instrument.

The 5326B/5327B Timer-Counter-DVM is furnished less the RACK MOUNTING KIT described in this manual. If ordered at the same time as the instrument, the RACK MOUNTING KIT described in the manual is available as Option 908 at additional cost. If not ordered with an instrument, the RACK MOUNTING KIT is available under HP Part No. 05326-60046. Disregard any manual references stating the instrument is supplied with a rack mounting kit.

Page 6-18, Table 6-1, Chassis Replaceable Parts:
Change XF1 fuseholder from 1400-0084 to the following recommended replacement for all instruments. Add the following parts on Page 6-18 under CHASSIS PARTS:

XF1; 2110-0465; FUSEHOLDER BAYONET CAP; 75915; 345003-020
XF1; 2110-0470; FUSEHOLDER BODY UL/IEC; 75915; 345003-010
XF1; 2950-0054; NUT FUSEHOLDER MTG 1/2-28; 28480; 2950-0054

CHANGE 3 (1604A FOR 5327B)

Pages 6-16 and 6-17, Table 6-1, A18 (05327-60033) Replaceable Parts:
Change A18 from SERIES 1540 to SERIES 1604.
Add A18R57; 0698-3113; RESISTOR FXD 100 OHM 5% .125W CC; 01121; BB1015.

Page 8-49, Figure 8-20, A18 Schematic Diagram:
Change SERIES 1540 at top of schematic to SERIES 1604.
Add 100 ohm resistor R57 in series with +5V input to pin 10 of SCHMITT TRIGGER A18U3.

CHANGE 4 (1612A)

Page 6-12, Table 6-1, A13 (05326-60017) Replaceable Parts:
Change A13 to SERIES 1612 in "Description" column.
Change A13R8 and A13R9 from 0757-0384 (20Ω) to 0698-3435; R: FXD FLM 38.3 OHM 1% 1/8W; 28480; 0698-3435, Factory Selected Value.
Add A13R42; R: FXD COMP 100K OHM 5% 1/4W; 01121; CB1045.

NOTE: Some instruments with serial prefixes below 1612A have A13R42 added on circuit board assembly A13.

Page 8-41, Figure 8-16, A13 Schematic Diagram:
Change SERIES, at top of schematic, to 1612.
Change A13R8 and A13R9 from 20 to 38.3 ohms.
Add A13R42 resistor (100K) between the base of A13Q1 and the base of A13Q2.

CHANGE 5 (1620A)

Page 6-6, Table 6-1, A6 (05326-60013) Replacement Parts:
Change A6 series number to 1620.
Change A6C8 from 0160-0153 (.001 UF) to 0160-0299; CAPACITOR-FXD, 1800 PF 10% 200WVDC POLYE; 56289; 292P12292.
Add A6C13; 0180-1735; CAPACITOR-FXD .22 UF 10% 35WVDC TANT; 56289; 150D224X9035A2.

Page 8-21, Figure 8-9, A6 (05326-60013) Schematic Diagram:
Change series number, at top of diagram, from 1132 to 1620.
Change A6C8 from 1000 to 1800 pF.
Add A6C13 capacitor (.22 UF) between circuit board common and junction of A6R12, A6U4B(6), A6CR2 and A6CR3. The positive side of the capacitor goes to the SAMPLE RATE DISABLE line from connector pins 10L and the negative side to circuit board common. Add C13 in REFERENCE DESIGNATIONS table.

Pages 6-7 and 6-8, Table 6-1, A7 (05327-60031) Replacement Parts:
Change A7 series number from 1312A to 1620.
Change A7R15 from 0683-1015 (100Ω) to 0683-3915; RESISTOR; FXD, 390 OHM 5%, .25W CC; 01121; CB 3915.
Change A7R16 from 0683-5115 (510Ω) to 0683-1525; RESISTOR, FXD, 1500 OHM 5%, 25W CC; 01121; CB 5115.

Page 8-29, Figure 8-10, A7 (05327-60031) Schematic Diagram:
Change series number, at top of schematic, from 1312A to 1620.
Change A7R15 from 100 to 390 ohms.
Change A7R16 from 510 to 1500 ohms.

Pages 6-15 and 6-16, Table 6-1, A17 (05326-60031) Replacement Parts:
NOTE – This change will be found in some instruments with serial prefixes prior to 1620A.

Change A17 from series 1312A to series 1620.
Change A17R21 from 0698-3153 (3830Ω) to 0757-0933; RESISTOR, FXD, 2400 OHM 2% .125W F TUBULAR; 24546; C4-1/8-TO-2401-G. *FACTORY SELECTED VALUE.

Page 8-47, Figure 8-19, A17 (05326-60031) Schematic Diagram:
Change series number, at top of schematic, from "SERIES 1312A, REV. C" to "SERIES 1620".
Change A17R21 from 3830 to 2400 ohms.
Add asterisk (*) and "NOTE 3" adjacent to A17R21 in schematic.
Add following note to table of "NOTES":

3. RESISTOR A17R21 SELECTED TO SET DC LEVEL OF A17Q4 COLLECTOR BETWEEN -.80V and -.85V. MINIMUM VALUE FOR A17R21 IS 2000 OHMS.

CHANGE 6 (5326B Serial No. 1620A03736 or higher)
(5327B Serial No. 1620A01351 or higher)

NOTE – NOT ALL INSTRUMENTS WITH THE ABOVE SERIAL NUMBERS THAT HAVE OPTION 004 EXTENDED REMOTE PROGRAMMING WILL HAVE A SERIES 1620 CIRCUIT BOARD FOR A1.

Page 6-21, Table 6-2, Replaceable Parts for Option 004.
Change A1 (05327-60034) series number from 1224A to 1620.

Add capacitors A1C15, A1C16; 0160-3878; CAPACITORS-FXD 1000PF 20% 100VDC CER; 28480; 0160-3878.

Page 8-55, Figure 8-23, A1 (05327-60018) Schematic Diagram:
Change series number, at top of diagram, to 1620.

Add A1C15 and A1C16 capacitors (1000 pF) to A1 diagram. Connect both capacitors between the A COM line from A1J1(C) in upper right corner, and circuit board common.

Change capacitor listing from C1-14 to C1-16 in table of REFERENCE DESIGNATIONS.

CHANGE 7 (1620A) (5326B/5327B)

Page 6-18, Table 6-1, Chassis Replaceable Parts:
Add the following under CHASSIS PARTS:

XF1; 2110-0564; FUSEHOLDER BODY; 28480; 2110-0564.

XF1; 2110-0565; FUSEHOLDER CAP; 28480; 2110-0565.

XF1; 2110-0569; NUT FUSEHOLDER MTG, PLASTIC HEX; 28480; 2110-0569.

Delete 2110-0465, Fuseholder Cap; 2110-0470, Fuseholder Body; and 2950-0054, Fuseholder Mtg. Deleting these three parts negates part of Change 2.

Pages 6-11 and 6-12, Table 6-1, A12 (05326-60013) Replaceable Parts:
Change A12 series number from 1048A to 1820.

Delete A12Q1 transistor 1850-0099 and change description to NOT ASSIGNED.

Add A12Q11 and A12Q12; 1854-0071; TRANSISTOR-SI NPN; 28480; 1854-0071.

Add A12R35; 0683-1825; R: FXD 1.8KΩ 5% 1/4W; 01121; CB1825.

Add A12R36; 0683-3925; R: FXD 3.9KΩ 5% 1/4W; 01121; CB3925.

Add A12R37; 0683-1035; R: FXD 10KΩ 5% 1/4W; 01121; CB1035.

Page 8-39, Figure 8-15, A12 (05326-60016) Schematic Diagram:
Change series number at top of diagram from 1048A to 1820.

Delete transistor A12Q1.

Add A12Q11, A12Q12, and resistors A12R35 through A12R37 in place of A12Q1 as shown in the partial diagram in Figure 2.

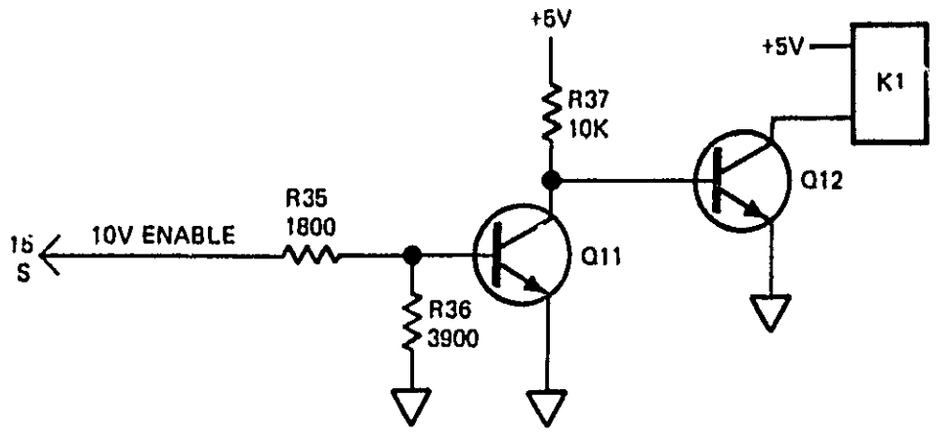


Figure 2. A12 Voltmeter Input Amplifier Assembly Changes

CHANGE 8 (1844A)

Page 8-5, Table 8-1, A4 OSCILLATOR ASSY REPLACEABLE PARTS:
Change A4 from 05326-60002 to 05326-60052; OSCILLATOR ASSY (SERIES 1844); 28480; 05326-60052.

Change A4 components to those given in attached Table 1.

Page 8-16, Part of Figure 8-7, Component Locator:
Change A4 component locator illustration to the new illustration given in attached Figure 3.

Page 8-17, Figure 8-7, A4 Schematic Diagram:
Change A4 schematic diagram to the new diagram in attached Figure 4.

Serial Prefix Numbers of 5326B/5327B Counters which have the 05326-60052 oscillators change to 1844A. The 05326-60052 Oscillator Assembly is the recommended replacement for A4 in all 5326B/5327B instruments.

Table 1. A4 Replaceable Parts — A4 Oscillator Assembly 05326-60052 (Series 1844)

REF. DESIG.	HP PART NO.	DESCRIPTION
A4C1	0121-0059	CAPACITOR-VAR 2-8 PF 350VDCW
A4C2	0160-2257	CAPACITOR-FXD CER 10PF 5% 500VDCW
A4C3	0160-3878	CAPACITOR-FXD CER 1000PF 20% 100VDCW
A4C4	0121-0061	CAPACITOR-VAR CER 5.5-18 PF 350VDCW
A4C5	0160-3879	CAPACITOR-FXD CER 0.01 UF 20% 100VDCW
A4C6	0180-0197	CAPACITOR-FXD TANT 2.2UF 10% 20VDCW
A4C7	0160-0161	CAPACITOR-FXD POLYE 0.01UF 10% 200VDCW
A4L1	9100-2276	COIL-MLD 100UH 10% Q=50
A4Q1	1853-0015	TRANSISTOR-SI PNP FT=500 MHz 200MW
A4Q2	1853-0015	TRANSISTOR-SI PNP FT=500 MHz 200MW
A4R1	0683-3015	RESISTOR-FXD FC 300Ω 5% .25W
A4R2	0683-1525	RESISTOR-FXD FC 1500Ω 5% .25W
A4R3	0683-2715	RESISTOR-FXD FC 270Ω 5% .25W
A4R4	0683-1525	RESISTOR-FXD FC 1500Ω 5% .25W
A4R5	0683-3905	RESISTOR-FXD FC 39 5% .25W
A4R6	0683-1525	RESISTOR-FXD FC 1500Ω 5% .25W
A4R7	0683-5105	RESISTOR-FXD FC 51Ω 5% .25W
A4U1	1820-1224	IC ECL TRIPLE 2-INPUT LINE RCVR MC 10216P
A4Y1	0140-0405	CRYSTAL 10 MHz

CHANGE 9 (1936A)

Page 6-3, Table 6-1, Replaceable Parts:
Change A1 (05326-60047) series number from 1224A to 1936.
Change A1S1 from 3101-1598 to 3101-2383; SWITCH-SL DP3T MINTR 0.5A 125VAC PC; 28480; 3101-2383.
Change A1S2 and S3 from 3101-1595 to 3101-2383; SWITCH-SL DP3T MINTR 0.5A 125VAC PC; 28480; 3101-2383.
Change A1S4 and S7 from 3101-1596 to 3101-2334; SWITCH-SL DPDT MINTR 0.5A 125VAC PC; 28480; 3101-2334.
Change A1S5 and S6 from 3101-1594 to 3101-2334; SWITCH-SL DPDT MINTR 0.5A 125VAC PC; 28480; 3101-2334.

Page 6-21, Table 6-2, Replaceable Parts (Option 004):
Change A1 (05327-60034) series number from 1620 to 1936.
Change A1S1 through S3 from 3101-1598 to 3101-2383; SWITCH-SL DP3T MINTR 0.5A 125VAC PC; 28480; 3101-2383.
Change A1S4, S5, S8, and S9 from 3101-1596 to 3101-2334; SWITCH-SL DPDT MINTR 0.5A 125VAC PC; 28480; 3101-2334.

Page 8-13, Figure 8-5, A1 (05326-60047) Schematic Diagram:
Change A1 series number from 1224 to 1936.

Page 8-55, Figure 8-23, A1 (05327-60034) Schematic Diagram:
Change A1 series number from 1620 to 1936.

NOTE — The above switches are recommended replacements in all 5326B and 5327B counters.

■ **CHANGE 10**

■ Page 1-3, and Page 3-4:
Under "PERIOD AVERAGE" add:
Measurement errors as large as one period may occur due to coherence between the measured signal and the time base. The error can be reduced by averaging over larger samples.

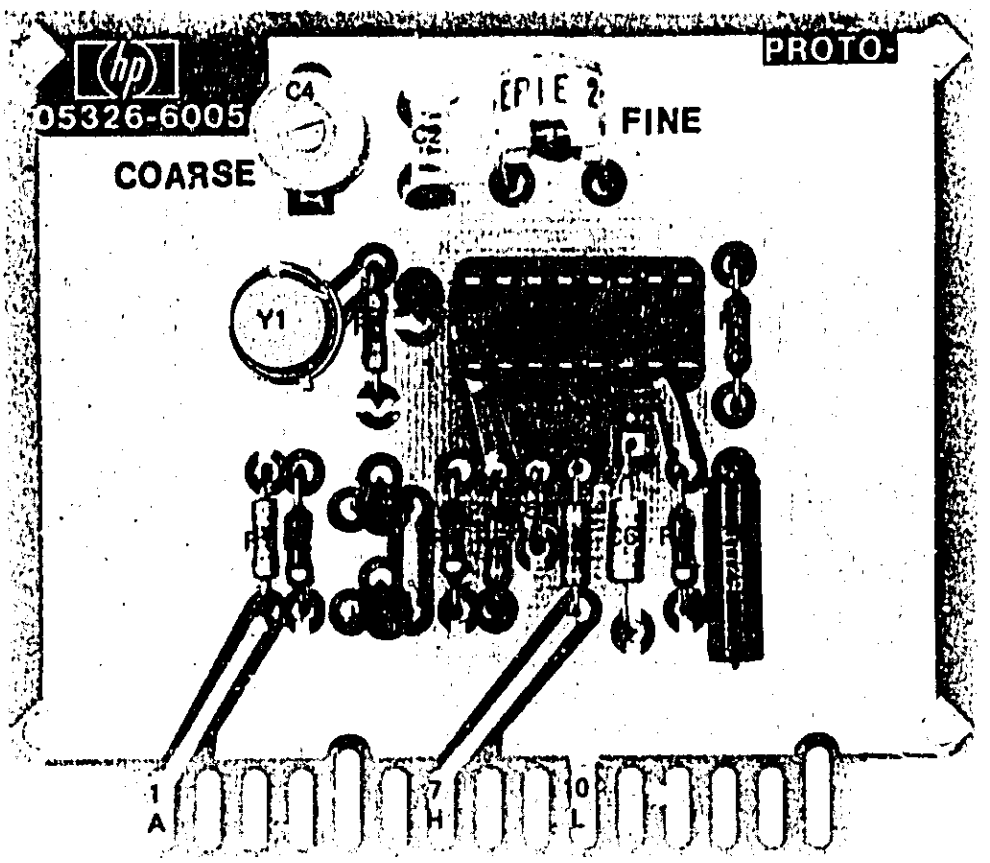
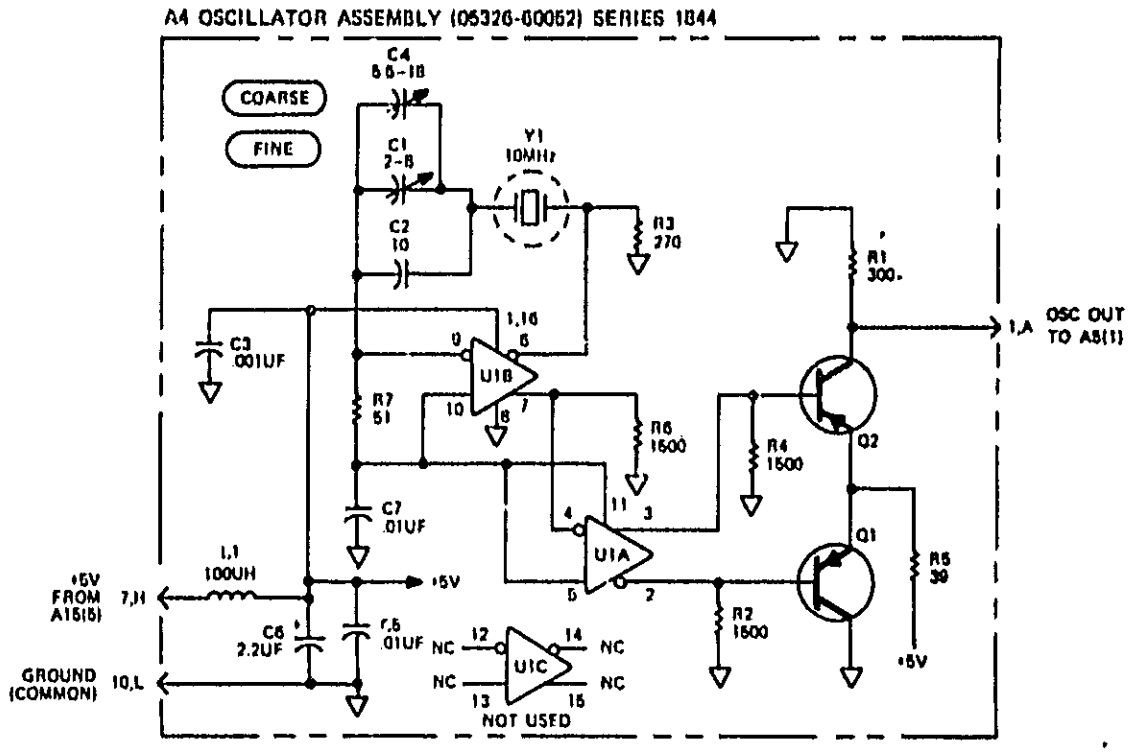


FIGURE 3. 05326-6005 10 MHz OSCILLATOR ASSY (SERIES 1844)



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

REFERENCE DESIGNATIONS

A4
C1-7
L1
Q1,Q2
R1-7
U1
Y1

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NO.
Q1, Q2	1853-0015 2N3640
U1	1820-0142 MC10216F
Y1	0410-0405

FIGURE 4. A4 (05326-60052) SCHEMATIC DIAGRAM

HP MANUAL CHANGES

MAKE ALL CORRECTIONS IN YOUR MANUAL ACCORDING TO ERRATA.

Check the following table for your instrument serial prefix and make any indicated changes to the manual:

*New or revised item.

MANUAL TITLE: 5326B/27B
MANUAL PRINTED: February, 1975
MANUAL PART NO: 05326-90043
CHANGE DATE: 14th December 1976

SERIAL PREFIX	MAKE CHANGE	SERIAL PREFIX	MAKE CHANGE	SERIAL PREFIX	MAKE CHANGE
1544U	1	1651U (27B)	1-3		
1645U(5327B	1-2				
only)					
1651U (27B)	1,3				

ERRATA

Page 6-19, Table 6-1
Add : To internal and other parts:- 05326-0031 Shield : Amplifier

Page 6-15 Table 6-1
Change : A17C5, 7, 10, 13 to part no. 0160-2327 C FXD 1000pF 100V

Page 6-6 Table 6-1
Change : A5C4 to part no. 0160-0179 C FXD 33pF 5%

Page 6-9 Table 6-1
Change : A5C5 to part no. 0160-3070 C FXD 100pF 5%

Page 6-9, Table 6-1
Change : A9R2, 4-9, 11 to part no. 0757-0440 R FXD 7.5K ohm 1% ½W

Page 6-6, Table 6-1
Change : A5U1-U4, U6-U8 to part no. 1820-0413 Int. Cct Divider

Page 6-18, Table 6-1
Change : 05326-00032 to 05326-60049 Panel Rear

The 5326B/27B is furnished less the RACK MOUNTING KIT described in the manual. If ordered at the same time as the instrument, the RACK MOUNTING KIT described in the manual is available as Option 908 at additional cost. If not ordered with an instrument, the RACK MOUNTING KIT is available under HP Part No. 05326-60046. Disregard any manual references stating the instrument is supplied with a rack mountimg kit.

Page 1-3, Table 1-3, "INTEGRATING DIGITAL VOLTMETER" Accuracy:
Under Zero Offset (10V Range) change ± 10.01% to ± 0.01%

Page 5-10, Table 5-4. Steps 5c and d:
Change : 0.65 ± .05V to 0.9 ± .05V at A18U2(3).
Change : 0.90 ± .05V to 0.8 ± .05V at A18U3(3).

Page 6-13, Table 6-1:
Change : A13R8 and A13R9 from 0757-0398 (75 OHM) to 0757-0384; 20 OHM FACTORY SELECTED VALUE.

Page 6-15, Table 6-1
Change : A16R7 from 0698-3153 (3830 OHM) to 0698-3155, 4630 OHMS.

Page 6-17, Table 6-1
Change : A18R29, A18R30 from 0698-5177 (820 OHM) to 0698-5103, 430 OHM.
Add : "FACTORY SELECTED VALUE" to description.

Page 6-19, Table 6-1
Change : 1200-0147 to 1200-0081 in "HP Part Number" and"Mfr Part Number" columns and"Qty". to 2.

Page 8-35, Figure 8-13, A10 Schematic:
Disconnect A10Q13 emitter from junction of A10P1(U), A10U6A(2), and A10U3B(4)
Add : A10P1(17), mark "VOLTS FROM XA14(R)", and connect to A10Q13 emitter.

Change SERIES number of A16 circuit board to 1428A on various pages where portions of A16 appear in this manual. This includes the Table of Replaceable Parts.

Page 8-41, Figure 8-16, A13 Schematic:
Change : A13R8 and A13R9 from 75 to 20 ohms.
Change : heading in TRUTH TABLE to read "V2 = OUTPUT OF OP AMP U3(6)" in place of U2(6).

Page 8-44, A15 Component Locator:
Replace with attached Figure 1.

Page 7-2, Paragraph 7-21:
Add the following sentence, "An HP Part No. 05326-00033 adapter plate will also be required for mounting 36-pin remote programming connectorJ10.

Page 6-17, Table 6-1
Add : A18L3; 05303-80001, 1 COIL, FXD, RF PEAKING, 28480, 05303-80001.
Add : "FACTORY SELECTED" to A18R34 add A18R42 "Description".
With these changes A18 assembly 05327-60033 is "SERIES 1428A"

Page 8-49, Figure 8-20, A18 schematic:
Add : asterisk(*) adjacent to A18R22, A18R23, A18R29, A18R30, and A18R40.
In Table 6-1 for these resistors add "FACTORY SELECTED VALUE" to description.

Add A18L3 in series with A18U3(13) output line. Output circuit trace is cut and one end of A18L3 is connected to the junction of A18U3(13) and A18R34. The other end of A18L3 is connected to the junction of A18R44 and the coil from A18R42.

Change series number at top of A18 schematic diagram to "SERIES 1428A"

Change dc voltages at A18U2(3) from 0.65V to 0.9V and voltage at A18U3(3) from 0.9V to 0.8 volts.

Page 8-57, Figure 8-24, Schematic:
Change : A16R7 from 3830 to 4630 ohms.
Change : SERIES at top of schematic from 1244 to 1428.

Page v, List of Figures and Page 8-53, Figure 8-22:
Change : caption to read "Option 004, J10 Remote Programming Cable Assembly and Option 003, J9 Digital Recorder Cable Connections".

Page 1-4, Table 1-3, Specifications:
Delete : paragraph pertaining to "Short-Term Fluctuation " under "Time Base" heading

Page 8-55, Figure 8-23, Option 004 Schematic:
Add : the following NOTE:

NOTE
SERVICING THIS ASSEMBLY IS ACCOMPLISHED BY REMOVING THE BOARD FROM THE FRONT PANEL AND MATING IT TO THE AMPLIFIER BOARDS, WHICH HAVE BEEN ELEVATED USING TWO 15 PIN EXTENDER BOARDS (HP PART NO. 5060-0049). THIS ALLOWS ACCESS TO BOTH SIDES OF THE ASSEMBLY. RE-ATTACHING GREEN WIRE TO CABLE PT 1 IS NECESSARY TO ALLOW FRONT PANEL CONTROL.

Page 5-6, 4. PULSE OPERATION:
In step a. set LEVEL (A) to "SLIGHTLY +" in place of PRESET
Change : step c to read "Adjust pulse generator for positive output for 10 MHz repetition rate, 15 ms pulse width for 0.3 volts peak-to-peak indication on oscilloscope"
Change : step d to read "Adjust counter LEVEL A control until counter triggers and counts. Check that counter displays the repetition rate, count light flashes, and trigger A lamp is ON. Record on test card".

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CHANGE 1

Page 1-5, Table 1-3, Specifications for OPTIONS
Add to Option 001: 8 digit display. "Part of standard instrument; discontinued as an Option."

Add to Option 003: Digital Output (for numerals and polarity only). "Discontinued as an Option and included as part of the standard instrument."

Page 1-5, Table 1-3, Specifications for OPTIONS
Delete Option 010 Temperature Compensated Oscillator. This Option is discontinued and is no longer available.

Page 7-1, Options and Manual Changes:
Paragraph 7-14, Delete second sentence
Paragraph 7-18, Add - "Part of Standard Instrument; Discontinued as an Option"
Paragraph 7-22, Add - "Part of Standard Instrument; Discontinued as an Option".

Page 6-9, Table 6-1, A9 Replaceable Parts:
Replace A9 Table for 05326-60008 with table for 05326-60025 A9 on Page 6-18 of Table 6-2.

Page 6-20, Table 6-2
Add parts for Option 003 as part of standard instrument.

CHANGE 2 (1645U) (5327B ONLY)

Page 5-10, Table 5-4, Paragraph 5 Prescaler Adjustments:
Change paragraph 5-g to read as follows: "Reduce output level until counter's display becomes unstable. Alternately adjust A18R3 and A18R53 for a stable display. Repeat procedure until unable to obtain a stable display. Increase signal level until display just becomes stable and make any final adjustments of A18R3 and A18R53."

Page 6-15, Table 6-1, A18 Replaceable Parts
Change A18R34 from 0698-8073 (1600 Ohms) to 0698-5178; RESISTOR-FXD 1500 OHMS 5% .125W CC
Add A18R53; 2100-2633: RESISTOR VAR 1000 OHMS 10% COMP SIDE ADJ
Add A18R54 and A18R55; 0698-3374; RESISTOR-FXD 20 OHM 5% .125W CC
Add A18R56; 0698-6283: RESISTOR-FXD 10 OHMS 5% .125W CC

Page 6-16, Table 6-1, A18 Replaceable Parts
Add A18C30; 0160-3879; CAPACITOR-FXD 0.01µF 20% 100 VDCW CER
Change R18R22 and A18R23 from 0698-4131 (56 ohms) to 0698-3111; RESISTOR-FXD 30 OHM 5% .125W CC
Change A18R29 and A18R30 from 0698-5103 (430 Ohms) to 0698-5177; RESISTOR-FXD 820 OHM 5% .125W CC

Page 6-16 and 6-17, Table 6-1, A18 (05327-60033) Replaceable Parts:
Add A 18R57; 0698-3113; RESISTOR FXD 100 OHM 5% .125W CC

Page 6-21, Table 6-2
Add A1C15; 0160-3878; C Fxd 0.001μF 100VDC.

Page 8-49, Figure 8-20, A18 Prescaler Assembly Schematic:
Add A18C30 (0.01μF) between common and the "+5V" end of A18R34.
Add A18R53 (1000 Ohms) variable resistor between +5.2V and -5.2V. Connect junction of A18C30 and A18R34 to arm of A18R53 in place of "+5V" as shown on schematic diagram.
Change value of A18R34 from 1600 to 1500 ohms.
Change A18R22 and A18R23 from 56 to 30 ohms.
Change A18R29 and A18R30 from 430 to 820 ohms.
Add A18R54 (20 ohms) in series between A1[illegible]2 pin 11 and the junction of A18R23, A18R30 and A18U3 pin 5.
Add A18R55 (20 ohms) in series between A18U2 pin 14 and the junction of A18R22, A18R29, and A18U3 pin 4.
Add asterisk (*) adjacent to A18R54 and A18R55.
Add A18R56 (10 ohms) in series between A18U1 pin 2 and the junction of A18U2 pin 5 and A18R6.
Change "SERIES" number at top of schematic to "1645U".
Add 100 ohm resistor R57 in series with +5V input to pin 10 of SCHMITT TRIGGER A18U3.

*** CHANGE 3

Page 6-6, Table 6-1
Change A6C8 to Part No. 0160-0299 C. FXD 0.0018μF 200V.
Add A6C13 Part No. 0180-1735 C. FXD .22μF 35V.

Page 6-8, Table 6-1
Change A7R15 to Part No. 0683-3915 R. FXD 390 ohms 5% .25WT.
Change A7R16 to Part No. 0683-1525 R. FXD 1.5Kohms 5% .25WT.

Page 6-15, Table 6-1
Change A16R7 to Part No. 0698-3155 R. FXD 4.63K ohms 1% .125W.

Page 6-16, Table 6-1
Change A17R21* to Part No. 0698-3150 R. FXD 2.37K ohms 1% (now select on test).

Page 8-21, Figure 8-9
Change C8 to 0.0018.
Add C13 (connected pin 5 of U4B to ground).

Page 8-29, Figure 8-10
Change R15 to 380.
Change R16 to 1500.

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Page 8-47, Figure 8-19
Change R21 to 2370 and asterisk to indicate select a Test.
Change Voltage at collector of Q4 to read 0.80V → 0.85V.

Page 8-57, Figure 8-24
Change R7 to 4630.