Errata

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

Manual Part Number: **05326-90030**

Revision Date: **June 1972**

About this Manual

HP References in this Manual

Support for Your Product

Agilent Technologies

5326A/B

TIMER/COUNTER/DVM

H/P Part No.05326-90030

OPERATING AND SERVICE MANUAL

SERIAL PREFIX:

5326A — 1044A
5326B — 1124A

This manual applies to HP Model 5326A having serial prefix 1044A and HP Model 5326B having serial prefix 1124A.

NEW INSTRUMENTS

For serial prefixes below 1044A for the 5326A and 1124A for the 5326B, refer to Section VII of this manual.

NEWER INSTRUMENTS

For instruments with serial prefixes above 1044A for the 5326A and 1124A for the 5326B, a separate manual is needed. For 5326A's with 1116A and above; order "5326A/5327A Timer/Counter" manual. For 5326B with 1128A and above, order "5326B/5327B Timer/Counter/DVM" manual.

5301 STEVENS CREEK BLVD., SANTA CLARA, CALIF. 95050

PRINTED: JUN 1972

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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 facility.

WARRANTY AND ASSISTANCE

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

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

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

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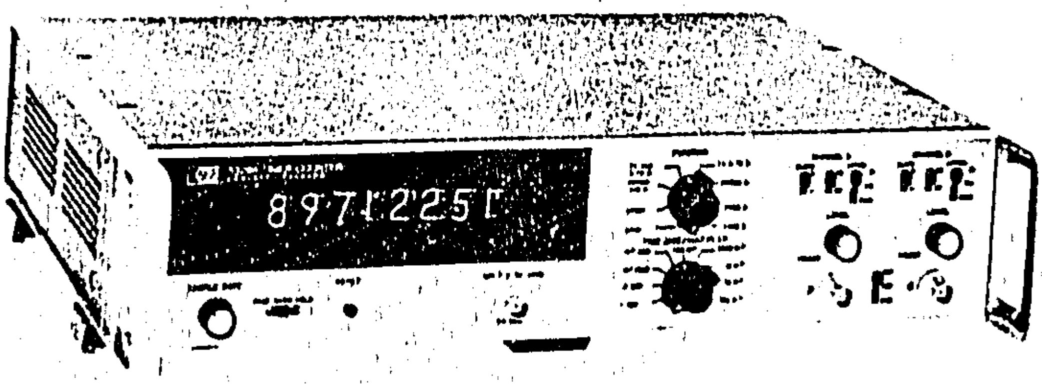
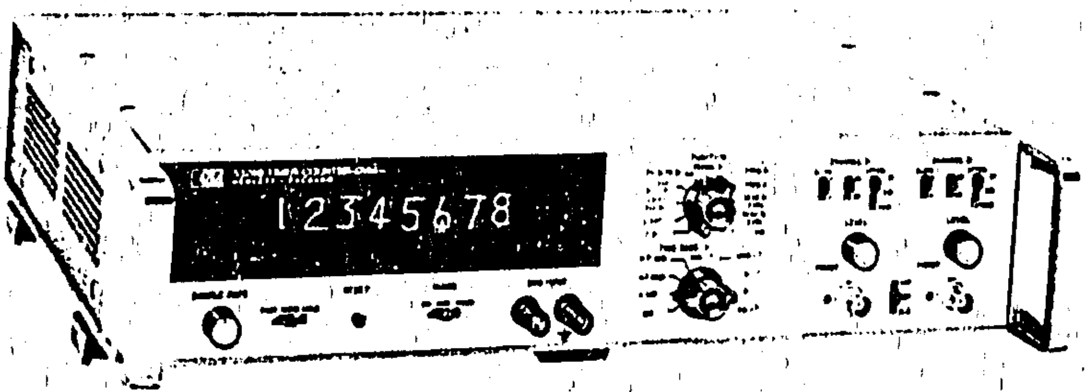
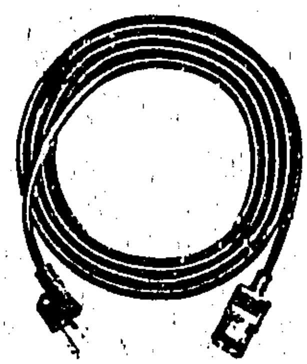
Figure 1-1. Models 5326A/B and Power Cord



MODEL 5326A



MODEL 5326B



POWER CORD

SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The Hewlett-Packard Models 5326A/B Timer Counters measure frequency, ratio, period, period average, time interval, and time interval average. The 5326B Timer-Counter-DVM also measures dc voltages up to 1000 volts and provides a direct readout of the voltage and polarity of the trigger level controls. Both models feature a 7-digit display, 1 MΩ and 50Ω inputs, display storage and blanking for insignificant digits in the display. Decimal point and unit readouts are displayed automatically with each operating section. Two independent input channels are provided to facilitate time interval measurements. Each input channel has an attenuator, trigger slope control, level control, ac-dc coupling, and an oscilloscope marker output.

1-3. Electrical and mechanical specifications are listed in Table 1-3.

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 (0000A00000). 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. The 5326A/B models 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 1 nanosecond. When used with microwave tests systems, group delay, phase, and level measurements can be performed.

1-7. OPTIONS. Either model can be ordered with the following options: Option 001, 8-digit display; Option 002, remote programming; and Option 003, digital recorder output.

1-8. EQUIPMENT SUPPLIED AND AVAILABLE ACCESSORIES

1-9. Table 1-1 lists equipment supplied and Table 1-2 lists available accessories.

Table 1-1. Equipment Supplied

Description	HP Part No.
Detachable Power Cord, 7½ feet (231 cm) long	8120-1348
Rack Mount Kit	05326-60029*

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

Table 1-2. Accessories Available

Description	HP Part No.
Digital Recorders	5050B, 5055A
Interconnect Cable, Digital Recorder, 6 feet (183 cm)	562A-16C
50-ohm BNC to BNC Coaxial Cable, 4 feet (122 cm)	10503-6001
Circuit Board Extender, 15-pin (2 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: 0-50 MHz
ac coupled: 20 Hz - 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

Range:
dc coupled, 0 - 50 MHz.

Sensitivity:
50 mV rms sine wave to 30 MHz; 100 mV to 50 MHz. 10 ns minimum pulse width.

Impedance: 50Ω nominal

Maximum Input: ±5 V.

Trigger Level: 0 volts

Location:
5326A Front Panel.
5326B Rear Panel.

CAUTION

Do not exceed voltage specification or damage will occur.

START (Totalizing and Scaling)

Range: 0 - 10 MHz

Factor: 1 - 10^8 selectable in decade steps

Output: Rear panel TIME BASE BNC

Display:
Channel A input divided by scaling factor

FREQUENCY

Range:
0 - 50 MHz

Input:
Channel A; Channel C (switchable). Channel A provides triggered frequency measurement.

Gate Times: 0.1 μs to 10 s in decade steps

Accuracy:
±1 count ± time base accuracy.

Display:
kHz, MHz with positioned decimal point.

TIME INTERVAL

Range: 0.1 μs to 10^8 seconds

Input:
Channels A and B; can be common or separate

Frequency Counted:
10 MHz to 0.1 Hz in decade steps

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

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

TIME INTERVAL AVERAGE

Range: 0.15 ns to 10 s

Intervals Averaged:
1 - 10^8 selectable in decade steps

Table 1-3. Specifications (Continued)

Input:
Channels A and B; can be common or separate

Frequency Counted: 10 MHz

Minimum Time Stop to Start: 150 ns

Accuracy: ± time base accuracy ± 2 ns

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

Display: ns, μs with positioned decimal point

PERIOD

Range: 0 - 10 MHz

Input: Channel A

Frequency Counted:
10 MHz to 0.1 Hz in decade steps

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

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

PERIOD AVERAGE

Range: 0 - 10 MHz

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

Input: Channel A

Frequency Counted: 10 MHz

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

Display: ns, μs, with positioned decimal point

RATIO

Display:
F_A/F_{ext} or F_C/F_{ext} times MULTIPLIER (M).
M = 1 to 10^8, selectable in decade steps

Range:
F_A (Channel A or Channel C) 0 - 50 MHz
F_{ext} (External Oscillator Input) 100 Hz to 10 MHz

Mode:
Operating mode will be either FREQUENCY A or FREQUENCY C

Accuracy:
± 1 count of F_A ± trigger error of F_{ext}

INTEGRATING DIGITAL VOLTMETER (5326B ONLY)

Technique: Voltage-to-frequency conversion

Voltage Ranges: Manual selection

Range	Resolution	Input Impedance
(Vdc)	(1 sec integration time)	
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):

Range	Stability	Linearity	Zero Offset	Counter
	(% of Reading)	(% of Range)	(% of Range)	
10 V	±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

*For any waveshape, trigger error is less than

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

**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 1-1. Specifications (Continued)

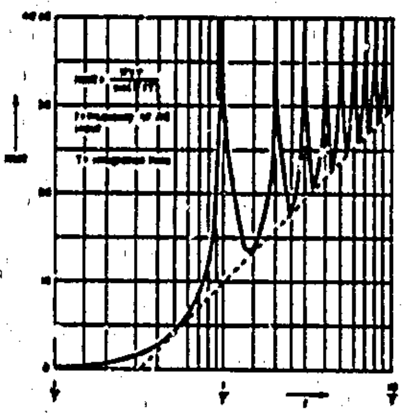
Operating Temperature:
10°C to 40°C, <80% RH

Measurement Time:

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

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

AC Noise Rejection:
Infinite for multiples of (measurement time)$^{-1}$. See graph for Normal Mode Rejection below.



TIME BASE

Crystal Frequency: 10 MHz

Stability:

Aging Rate: <3 parts in 10^7/mo.
Temperature: <±2.5 parts in 10^6, 0° to 50°C.
Line Voltage: <±1 part in 10^7 for 10% line variation.
Short-term Fluctuation: Typically <5 parts in 10^9, 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 - 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 is CHANNEL A frequency 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 position: 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

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, 7½ ft. Rack Mount Kit.

DIMENSIONS

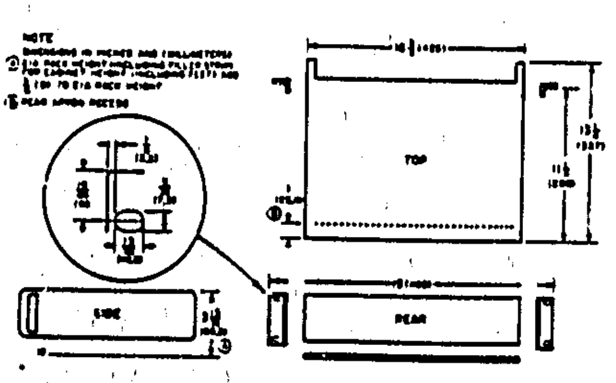


Table 1-3. Specifications (Continued)

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, 10532-60001

HP Cable 562A-16C, 6 ft. (183 cm) to connect 5326A/B Series with Option 003 to HP 5050B or 5055A Digital Recorder.

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 57-40300-375. (36-pin blue ribbon).

Mating connector: HP 1251-0084; Amphenol 57-30360-375

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 than 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

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, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken knobs, etc.). If the instrument is damaged or fails to self-check (Self-Check 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.

2-15. Front Panel Controls

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

a. FUNCTION

b. TIME BASE/MULTIPLIER

c. DVM RANGE (5326B)

d. CHECK function

e. SLOPE

f. SAMPLE RATE and HOLD

g. LEVEL controls

h. 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 but START or STOP.

b. Ground the EXT line at rear-panel REMOTE PROGRAM connector J10(17). This disables the front panel switches. 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	Pin 7	
READ A LEVEL	Pin 8	5326B
READ B LEVEL	Pin 9	5326B
DVM	Pin 10	5326B

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 on 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. BLANKING DEFEAT

2-37. This counter is 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).

2-38. On A9 with series number 944A, Rev. A, defeat the blanking feature by lifting pin 10 of A9U7 and A9U8 from the ground lead and tying pin 10 to +5 V, which is available at A9U7(12) and A9U8(12). Also lift the lead at pin 1 of A8U2 and connect pin 1 to ground (available at pin 7 of A8U2).

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 . 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 G light is on (in START), indicating counting is taking place.

3-7. Frequency Modes

3-8. Two frequency measurement modes are available: Frequency A and Frequency C. In the Frequency A mode, the input signal connects to the CHANNEL A input and can be conditioned with the LEVEL, SLOPE, and ATTENUATOR controls. The TIME BASE/MULTIPLIER selects the gate time and therefore the desired resolution. Input impedance is 1 Megohm shunted by less than 25 pF. Frequency range is 0 to 50 MHz. Sensivity is 0.1 V rms sine wave or 0.3 V p-p pulse.

3-9. In the Frequency C mode, the input signal (0-50 MHz) connects to the INPUT C jack. The jack is located on the front panel of the 5326A and on the rear panel of the 5326B. The input impedance is 50 ohm nominal. Maximum input amplitude is ±5 volts peak. Trigger level is zero volts.

3-10. Period Modes

3-11. 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.

3-12. During single period measurements, the TIME BASE/MULTIPLIER switch scales the time base frequency and determines the resolution of the measurement.

3-13. 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.

3-14. Time Interval Modes

3-15. 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.

3-16. 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.

3-17. 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 4-27 and Figures 4-10 and 4-11.

3-18. Digital Voltmeter Measurements

3-19. 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 on 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.

3-20. 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.

3-21. Ratio

3-22. 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 CHANNEL A or INPUT 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 =

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

3-23. 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.

3-24. MARKER OUTPUTS

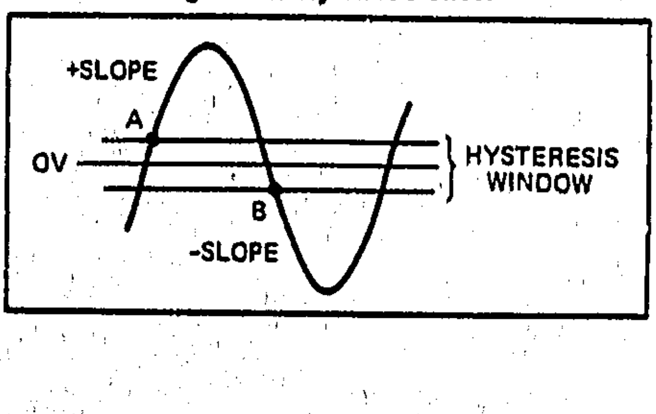
3-25. Two marker output jacks are mounted on the counter's rear panel. These outputs provide a negative-going 2 μs pulse (approx.) at DTL levels each time the input signal passes through the trigger point of Channel A or B. The pulses may be used to trigger other circuits or may be applied to the Z axis of an HP 180 Oscilloscope. When using the pulses to intensity modulate an oscilloscope, note that the actual trigger point is the left-most portion of the intensified segment. 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.

3-26. HYSTERESIS

3-27. 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.

3-28. 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.

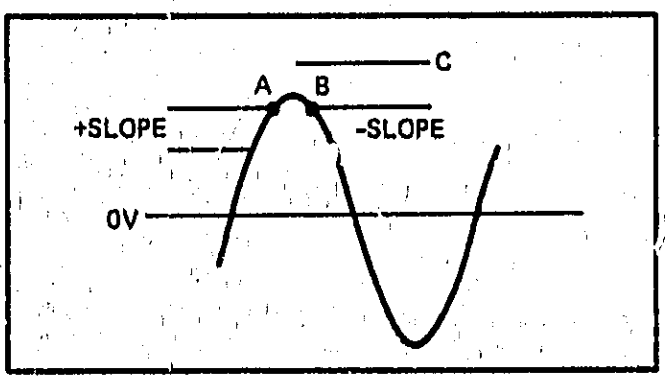
Figure 3-1. Hysteresis Offset



3-29. Time Interval Compensation

3-30. 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). In this example, 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 3-2. Hysteresis Compensation



3-31. ACCURACY

3-32. 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.

3-33. 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

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

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).

3-34. An example of frequency error calculation is as follows:

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

gate length = .1 sec ($1 \text{ X } 10^{-1}$)

E = 3 parts in 10^7 per month times 2 months (e. g.) = 6 parts in 10^7

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

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

or 3.9 parts in 10^6

3-35. 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:

$$A = 100\left(\pm \frac{f_2}{nf_1} \pm \frac{e}{n} \pm E\right)$$

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

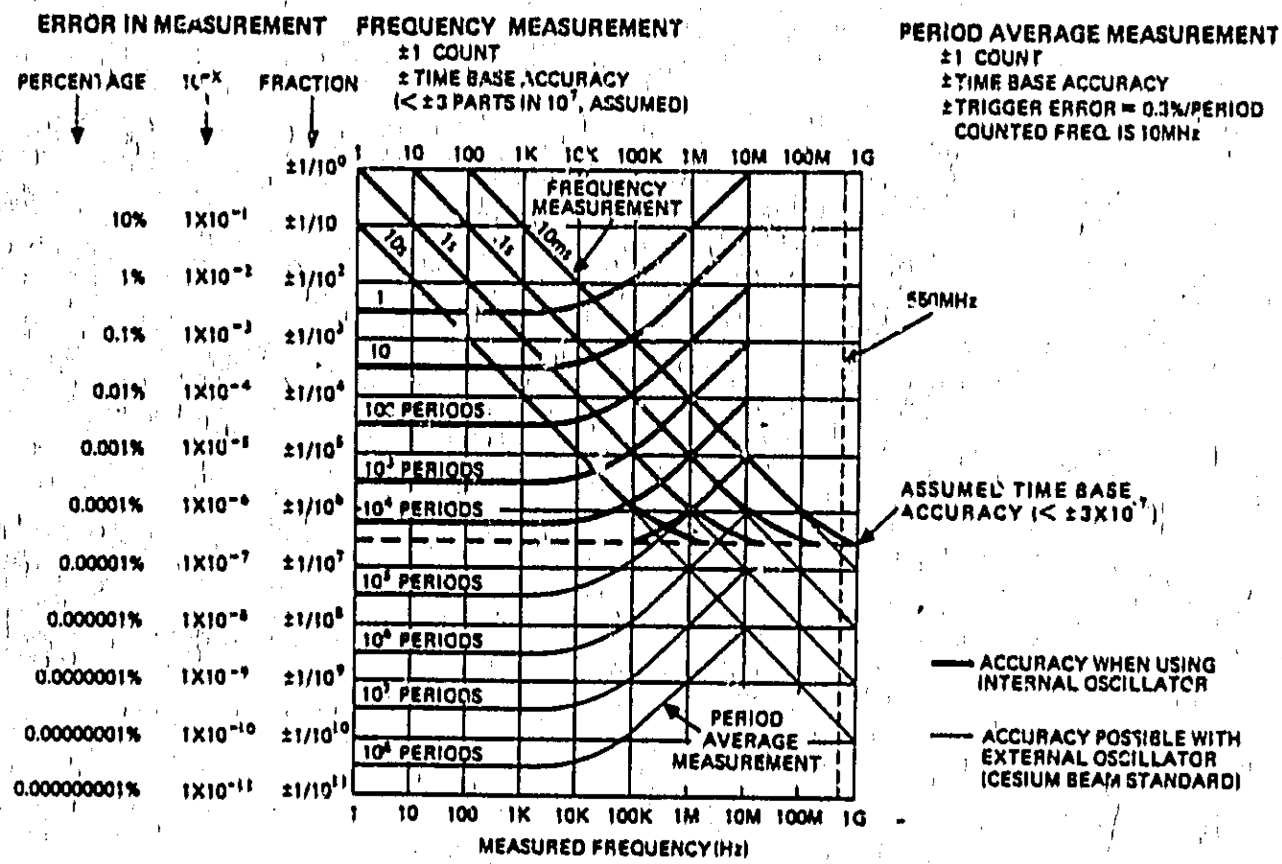
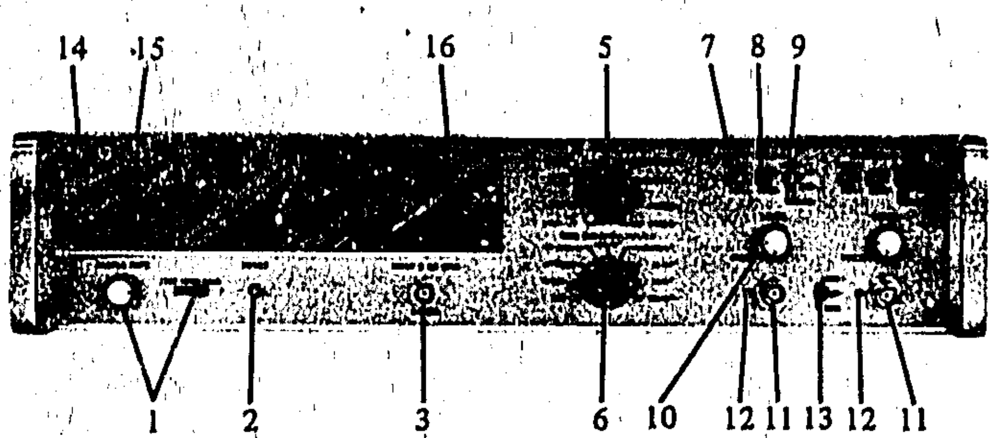
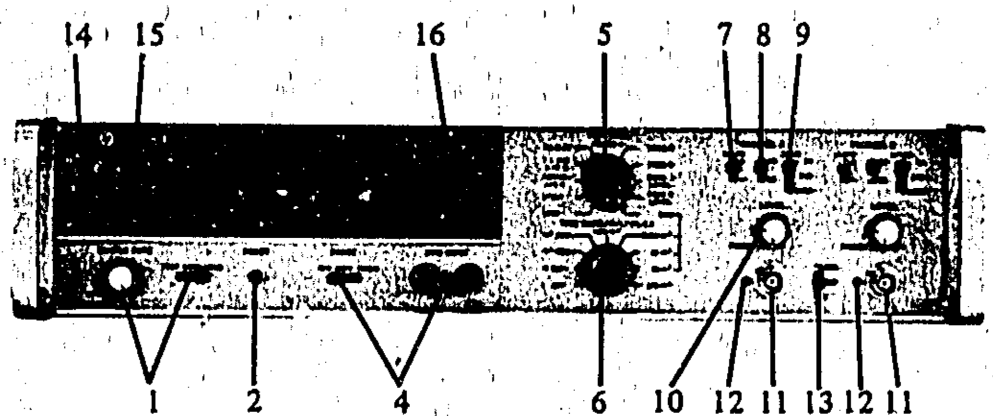


Figure 3-4. Front Panel Controls and Indicators





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. INPUT C (5326A). 50-ohm input for 0 to 50 MHz frequency C measurements. Has dc coupling and sensitivity of 50 mV rms sine wave (150 mV p-p pulse). Maximum input is ±5 volts referenced to ground (DO NOT EXCEED). Trigger level is zero volts.

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

5. 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.

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

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 15 ns to 10 sec; 10 MHz maximum repetition rate. There must be a 150 ns deadtime between intervals.

d. T.I. A to B - Set counter to measure time interval A to B. Channel A starts measurement and Channel B stops the measurement. Use TIME BASE/MULTIPLIER selector to set counted frequency. T.I. input range is 0.1 μs to 10^9 sec. There must be a 150 ns deadtime between intervals.

e. PERIOD A - Set counter to measure single period of frequency applied to CHANNEL A input. Use TIME BASE/MULTIPLIER to set desired 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/MULTIPLIER to set gate time and resolution. Frequency input range is 0 to 50 MHz.

g. FREQ C - Similar to FREQ A except sets counter to measure frequency applied to FREQ C input jack. 50-ohm input impedance. 5 volt peak maximum input. Frequency range is 0 to 50 MHz.

h. READ A LEVEL (5326B) - Sets counter to measure trigger voltage of LEVEL A control. Trigger level = DVM readout times ATTENUATOR setting.

i. READ B LEVEL (5326B) - Same as READ A LEVEL for LEVEL B control.

j. DVM (5326B) - Sets counter to measure dc voltage applied to DVM INPUT jack. Use TIME BASE/MULTIPLIER to select integration time and resolution.

6. 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.

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

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

9. 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.

10. 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.

11. 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.

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

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

13. 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.

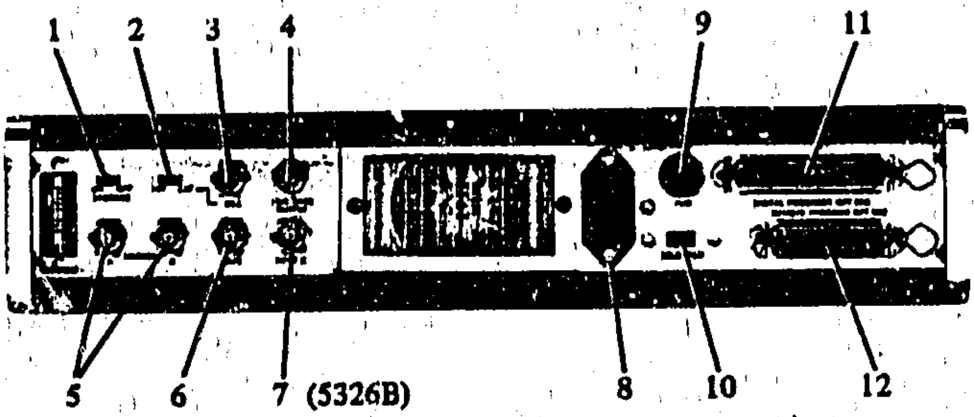
b. COM-SEP - Connects A and B inputs in parallel when set to COM position. When applying two separate inputs, set switch to SEP. When set to COM, input impedance is 500 kΩ shunted with less than 50 pF.

14. G (Gate) Annunciator light. Lights when counter maingate is open. For short duration gate times, the annunciator circuits include a 50 ms one-shot MV to allow a visible flash to the G light.

15. OF (Over Flow) Annunciator light. Lights when accumulated count exceeds counter capacity.

16. * (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. Provide 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 500Ω 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 50 mV rms sine wave. Trigger level is zero volts. Maximum input is ±5 volts referenced to ground (DO NOT EXCEED).

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.

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 switch 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 G 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 G 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.

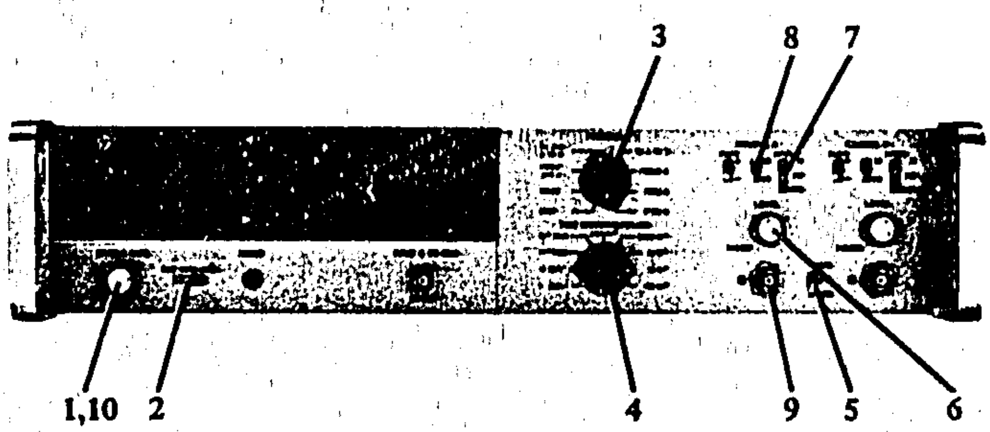
Frequency A Self Check

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

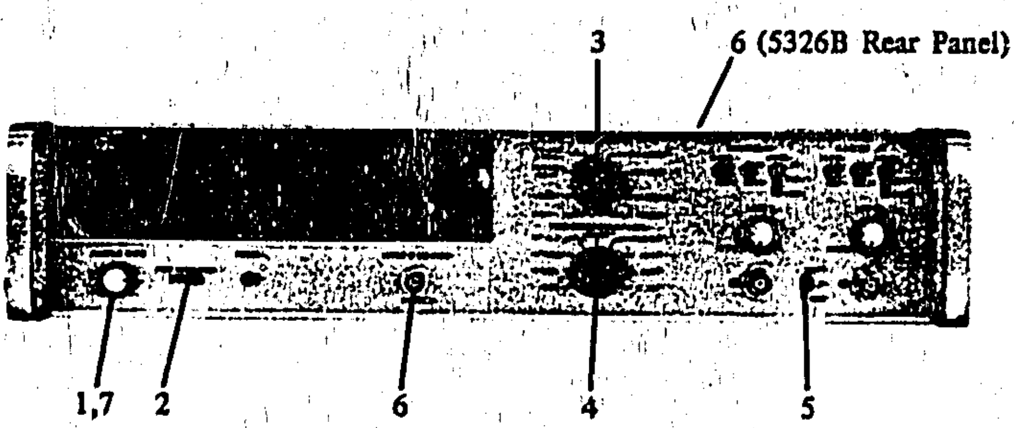


1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to FREQ A.
4. Set TIME BASE switch for desired gate time.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.
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

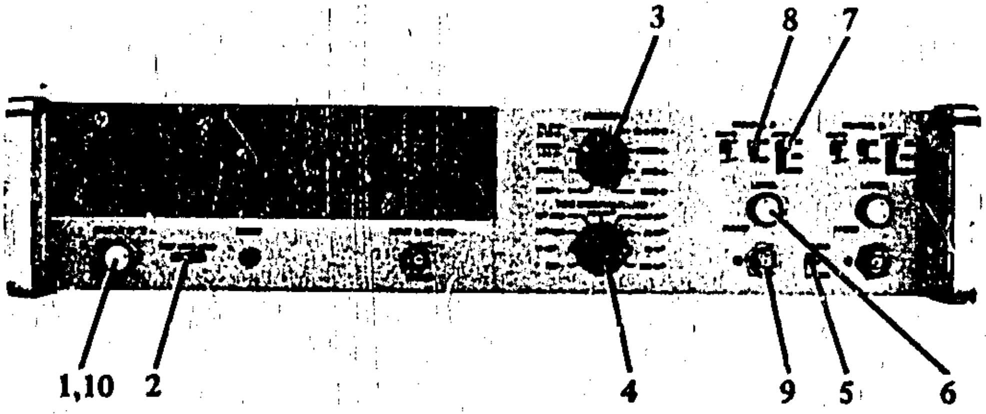
When the input signal is removed from CHANNEL A or the signal level is insufficient to trigger Channel A, the gate light (G) will not cycle. This is normal for this counter and does not indicate a malfunction.

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/MULTIPLIER switch for desired resolution.
5. Set CHK-SEP-COM switch to SEP.
6. Connect input signal (0 to 50 MHz, ±5 volts peak maximum) to INPUT C connector. Input impedance is 50-ohms nominal.
7. Adjust SAMPLE RATE control for convenient measurement interval.

Figure 3-8. Period Measurements



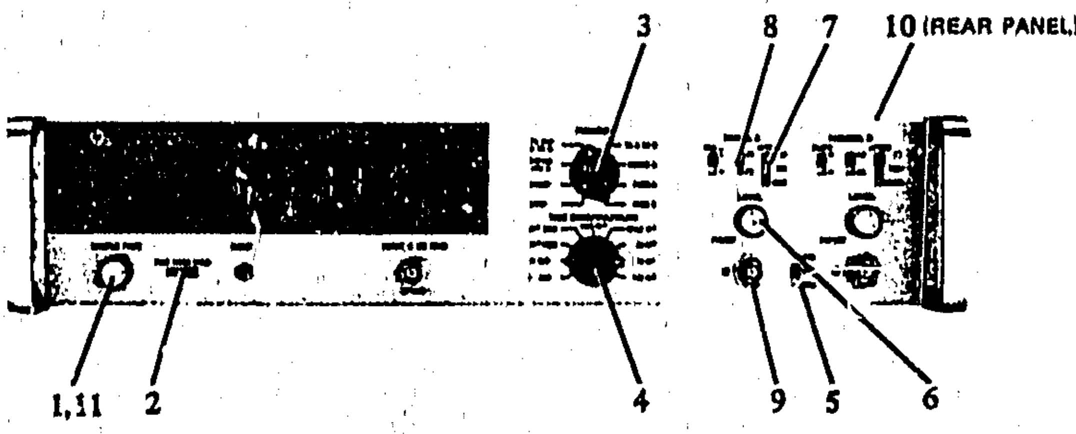
Period

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

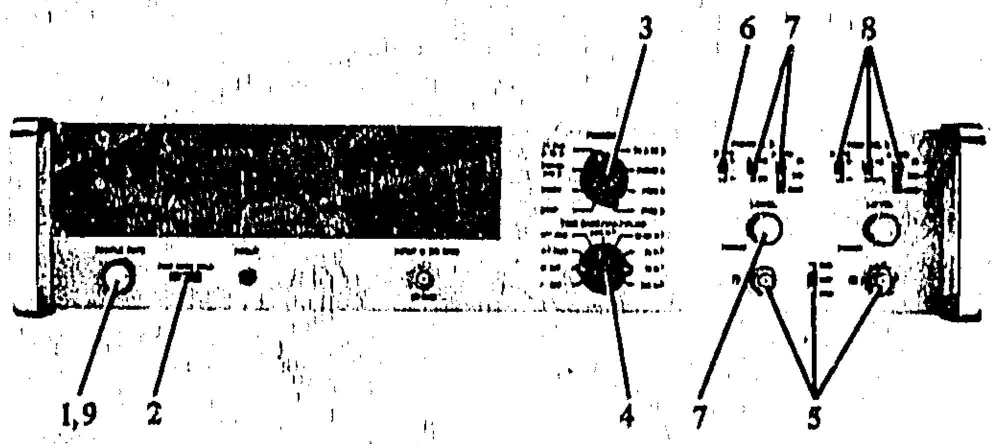
1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to PERIOD AVG A.
4. Set MULTIPLIER switch to number of periods to be averaged.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET 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.
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 $= \frac{F_A \text{ or } F_C}{F_{ext}} = \frac{\text{DISPLAY}}{\text{MULTIPLIER}}$. 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).

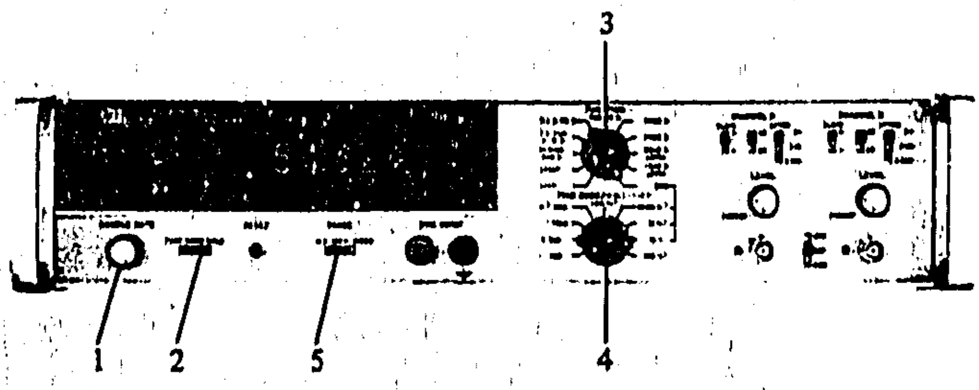
Time Interval Average

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 x $\frac{M}{N}$ (M and N integers).

Figure 3-11. Digital Voltmeter and Read A Level, Read B Level Measurements (5326B only)



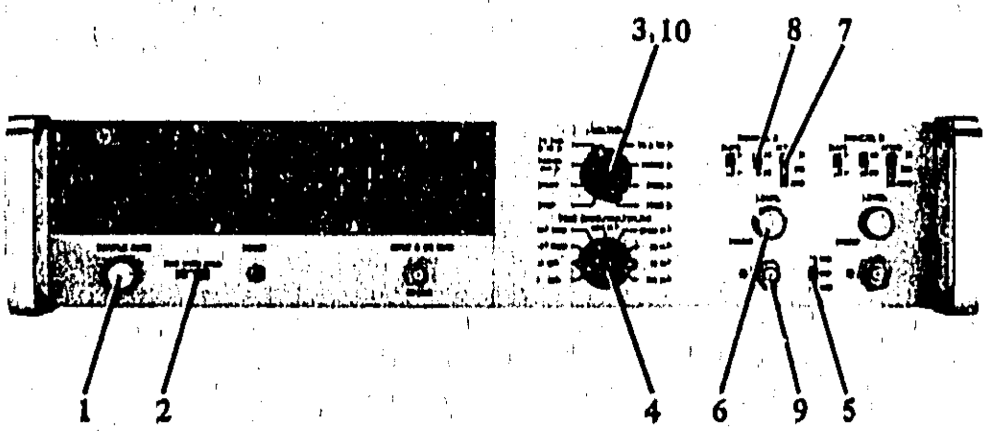
DVM

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 1000 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

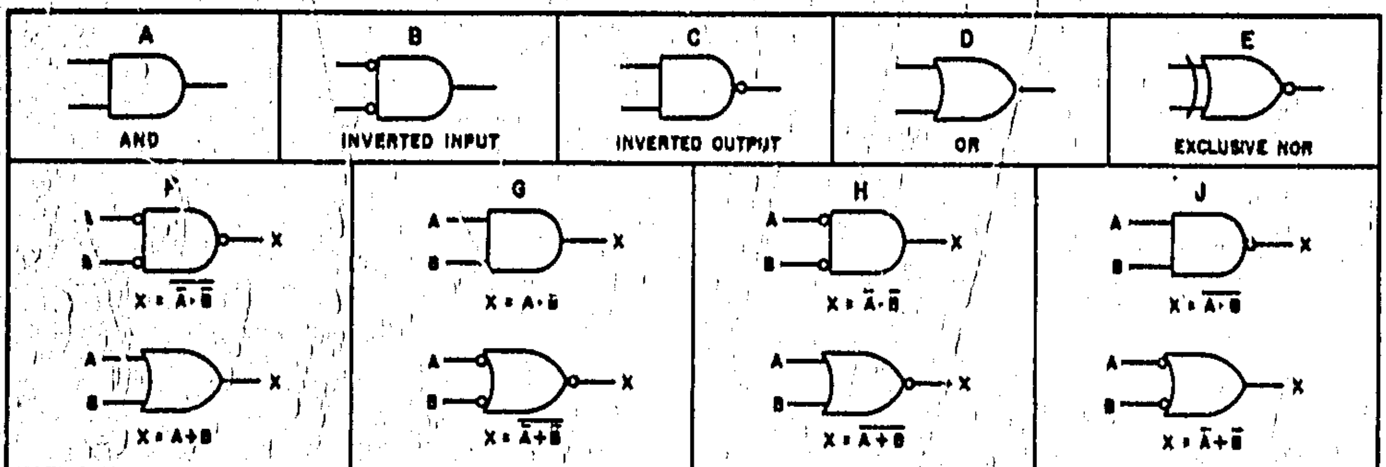
4-4. Two states exist in the binary system, 1 and 0. In positive logic, the 1 state is more positive than the 0 state. High (H) and low (L) are used to represent the 1 and 0 levels. *HIGH ALWAYS REPRESENTS THE MORE POSITIVE LEVEL, WHETHER IT BE POSITIVE OR NEGATIVE LOGIC.*

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 $\overline{Q}$ 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, $\overline{Q}$ goes low and Q goes high; when a low is applied to reset input, Q goes low and $\overline{Q}$ goes high. Set or reset can override all other inputs at any time.

Figure 4-2. JK Flip-Flop

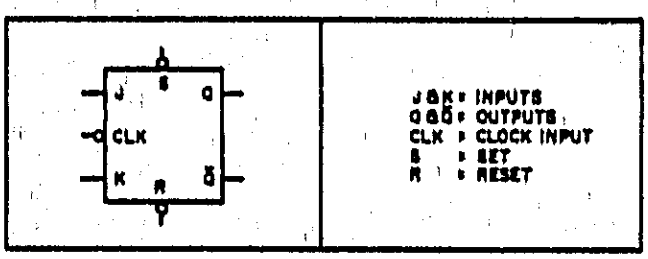


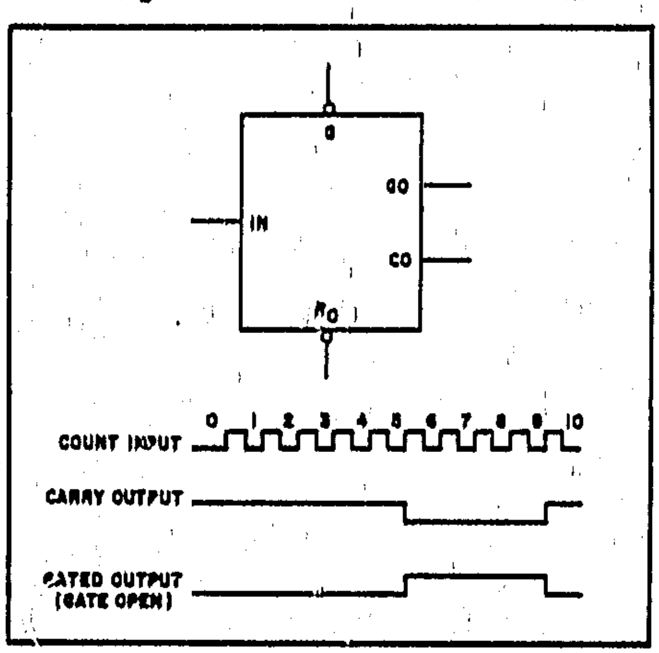
Table 4-1. Truth Table

t_n		$t_n + 1$		t_n = Before clock pulse
J	K	Q	$\overline{Q}$	$t_n + 1$ = After clock pulse
L	L	Q_n	$\overline{Q}_n$	If J = L and K = L, then Q and $\overline{Q}$ 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 $\overline{Q}$ will be L after the clock pulse.
L	H	L	H	If J = L and K = H, then Q will be L and $\overline{Q}$ will be H after a clock pulse.
H	H	$\overline{Q}_n$	Q_n	If J = H and K = H before the clock pulse, then after the clock pulse Q and $\overline{Q}$ 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.

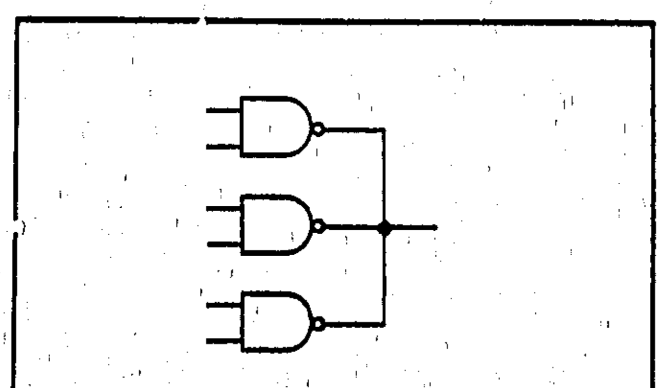
Figure 4-3. Time-Base Decade 1820-0412



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 1820-0327



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

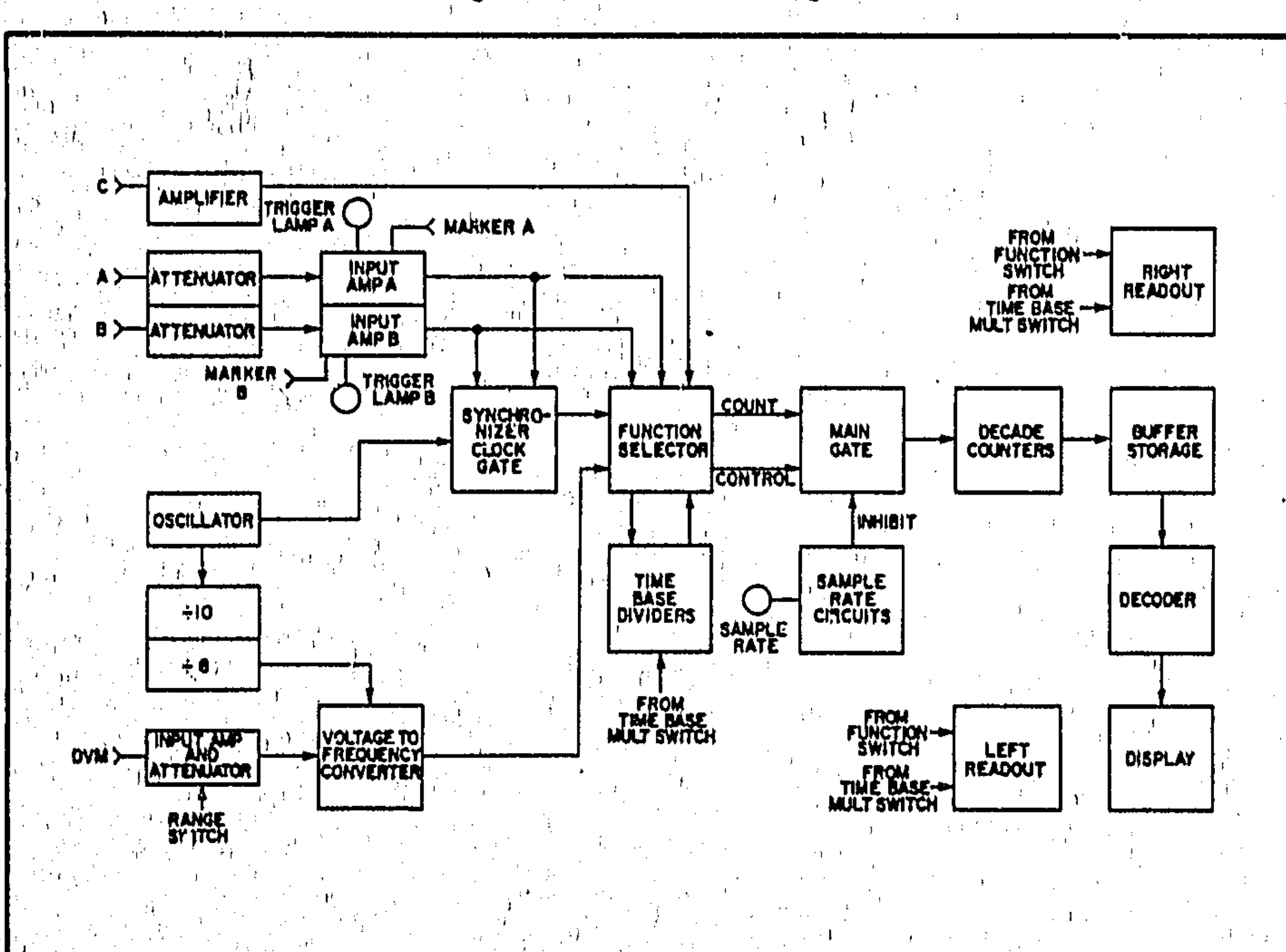
4-17. OVERALL COUNTER OPERATION

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.

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^{-7} 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 10^8, 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 8-24 for timing diagrams and a technical description.

4-30. DVM Mode (5326B)

4-31. The DVM input connects to voltmeter Input Amplifier A12 (Figure 4-12), 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

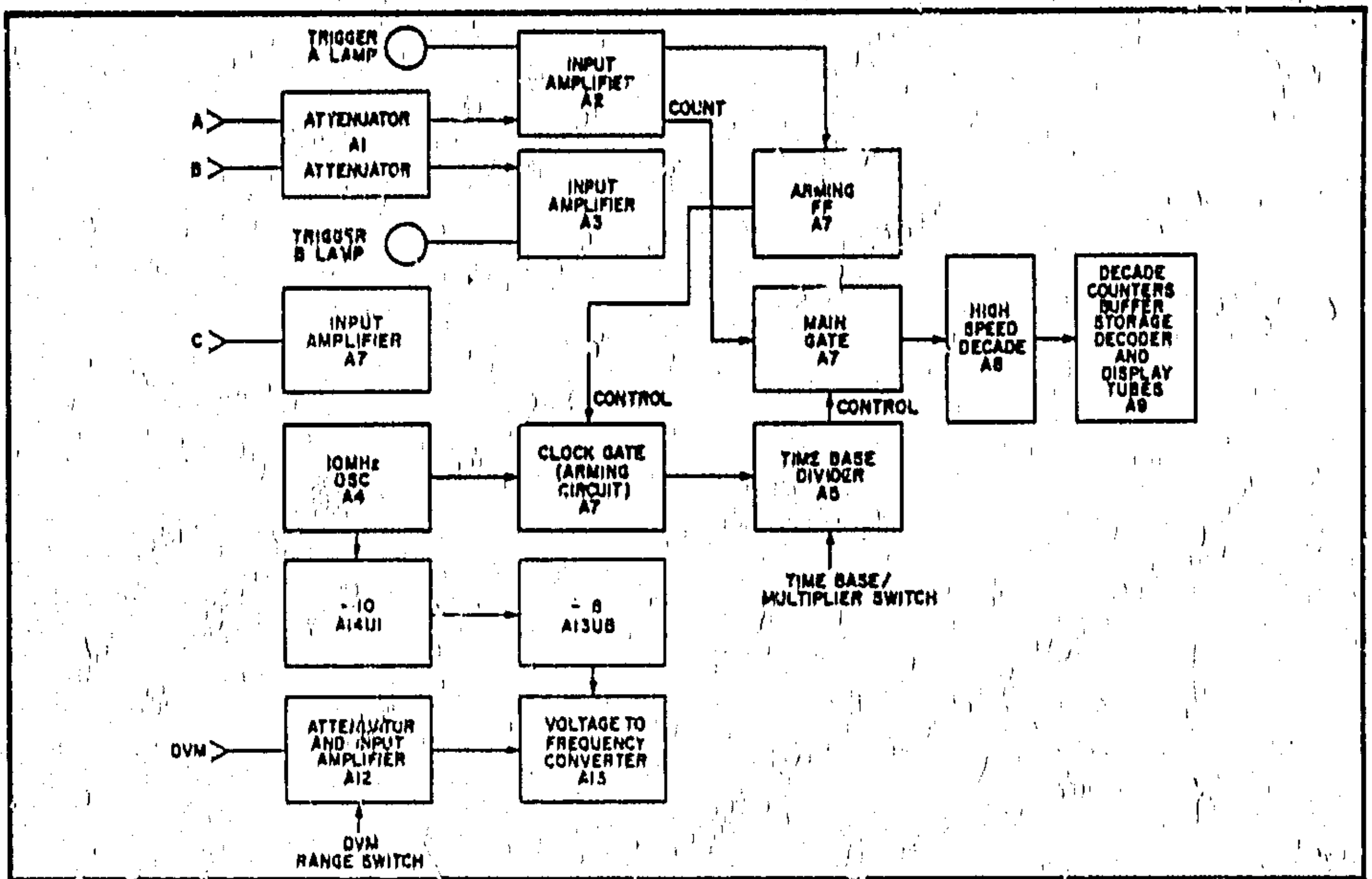


Figure 4-7. Frequency C Mode Flow Diagram

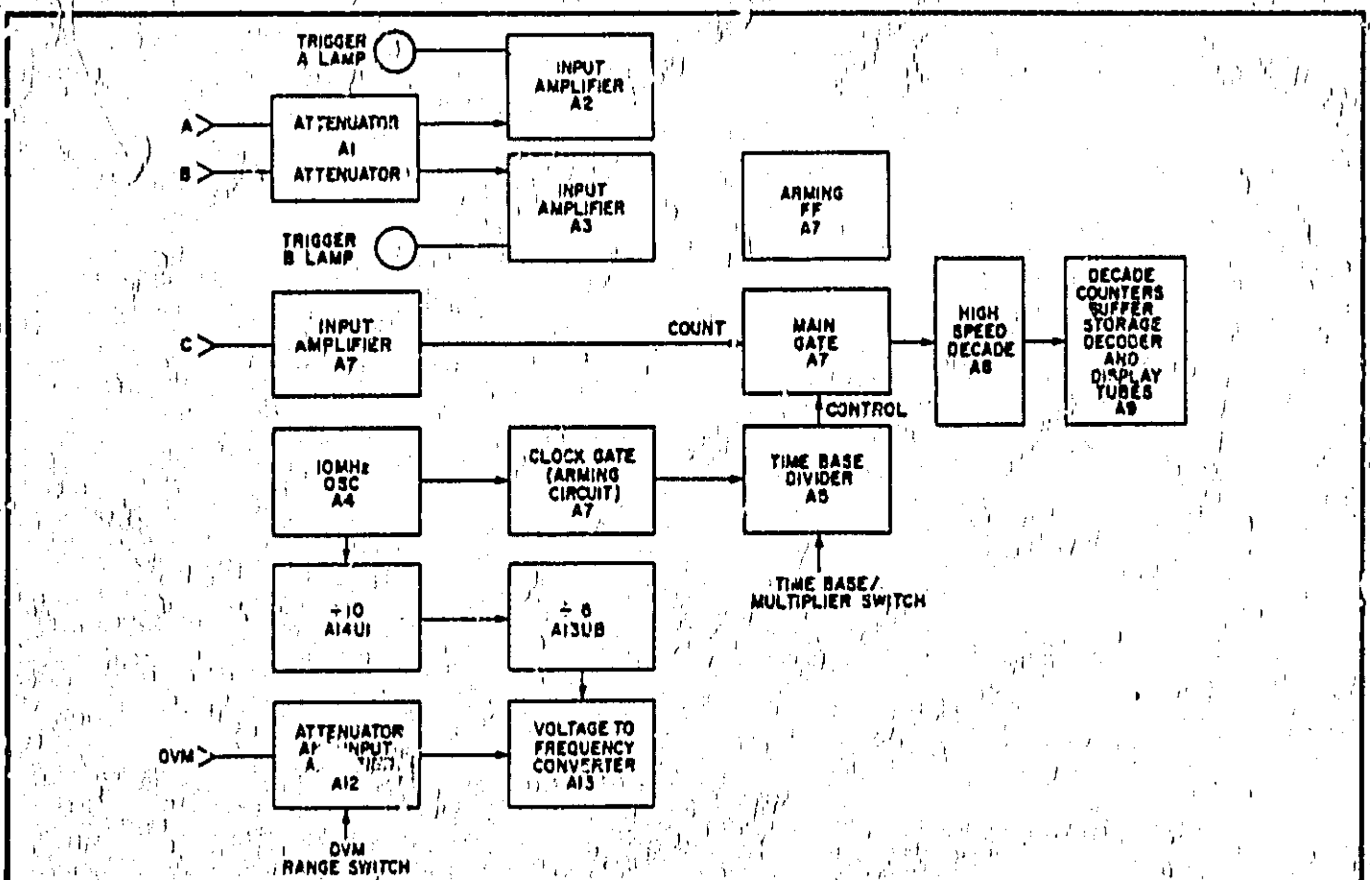


Figure 4-8. Period Mode Flow Diagram

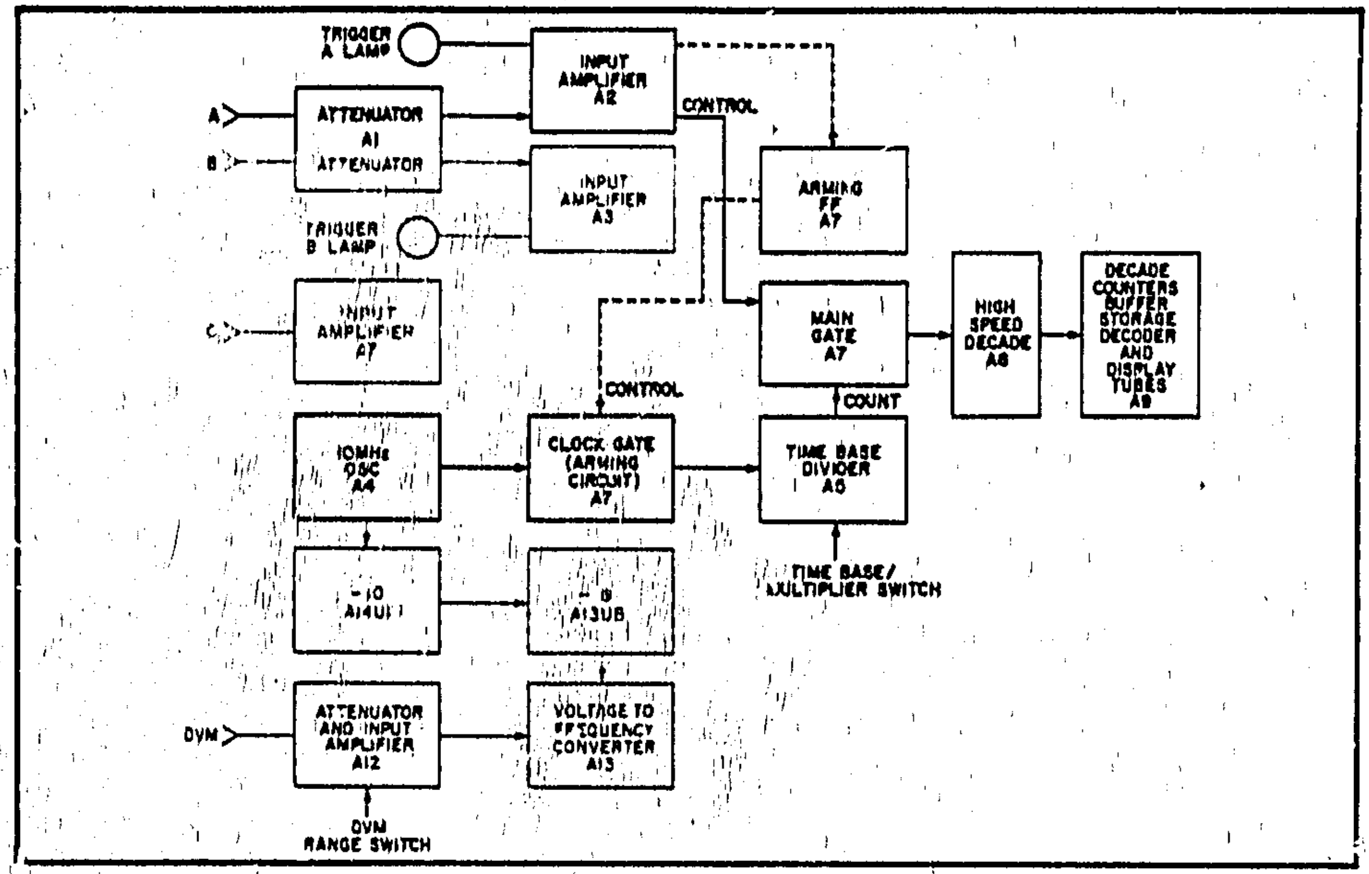


Figure 4-9. Period Average Mode Flow Diagram

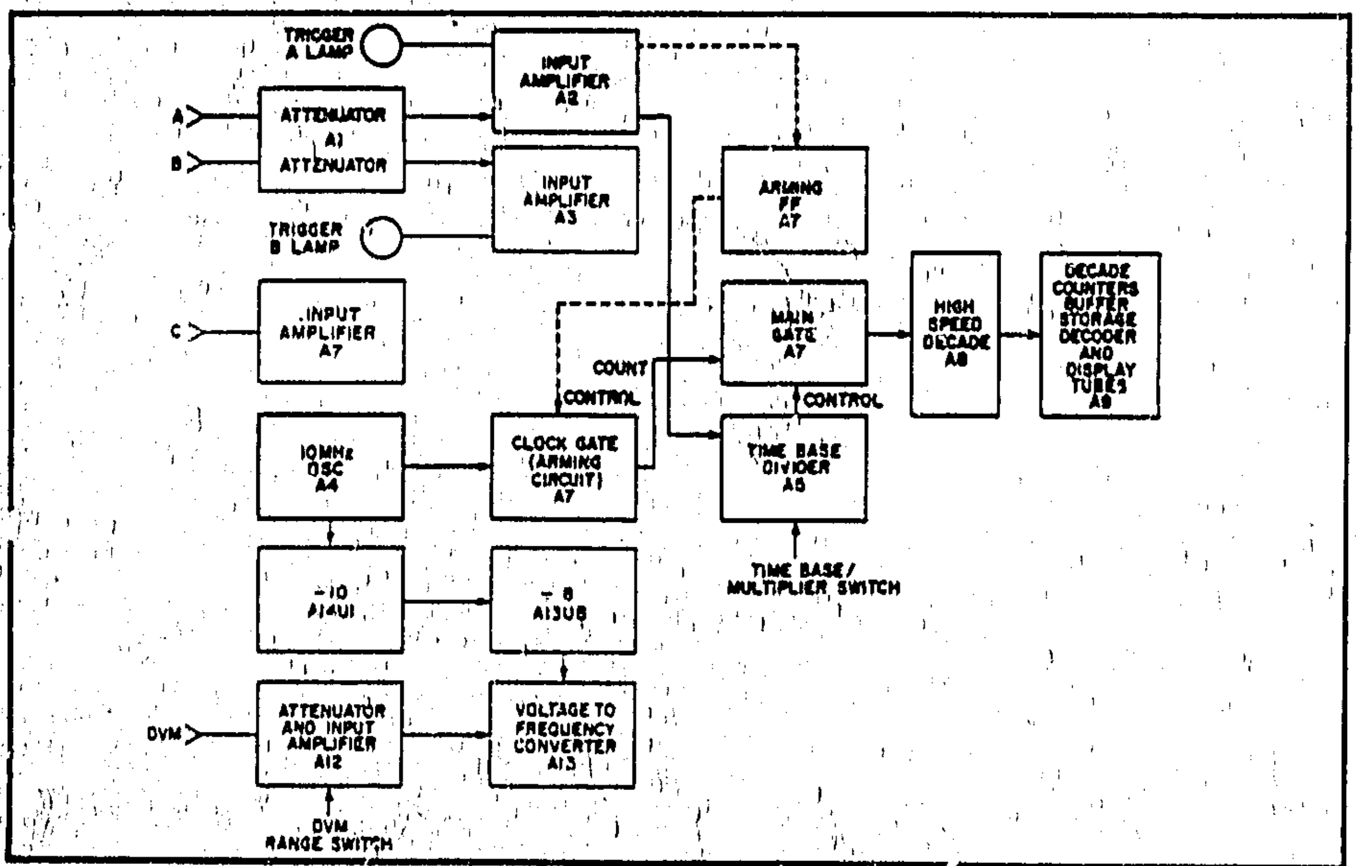


Figure 4-10. Time Interval Mode Flow Diagram

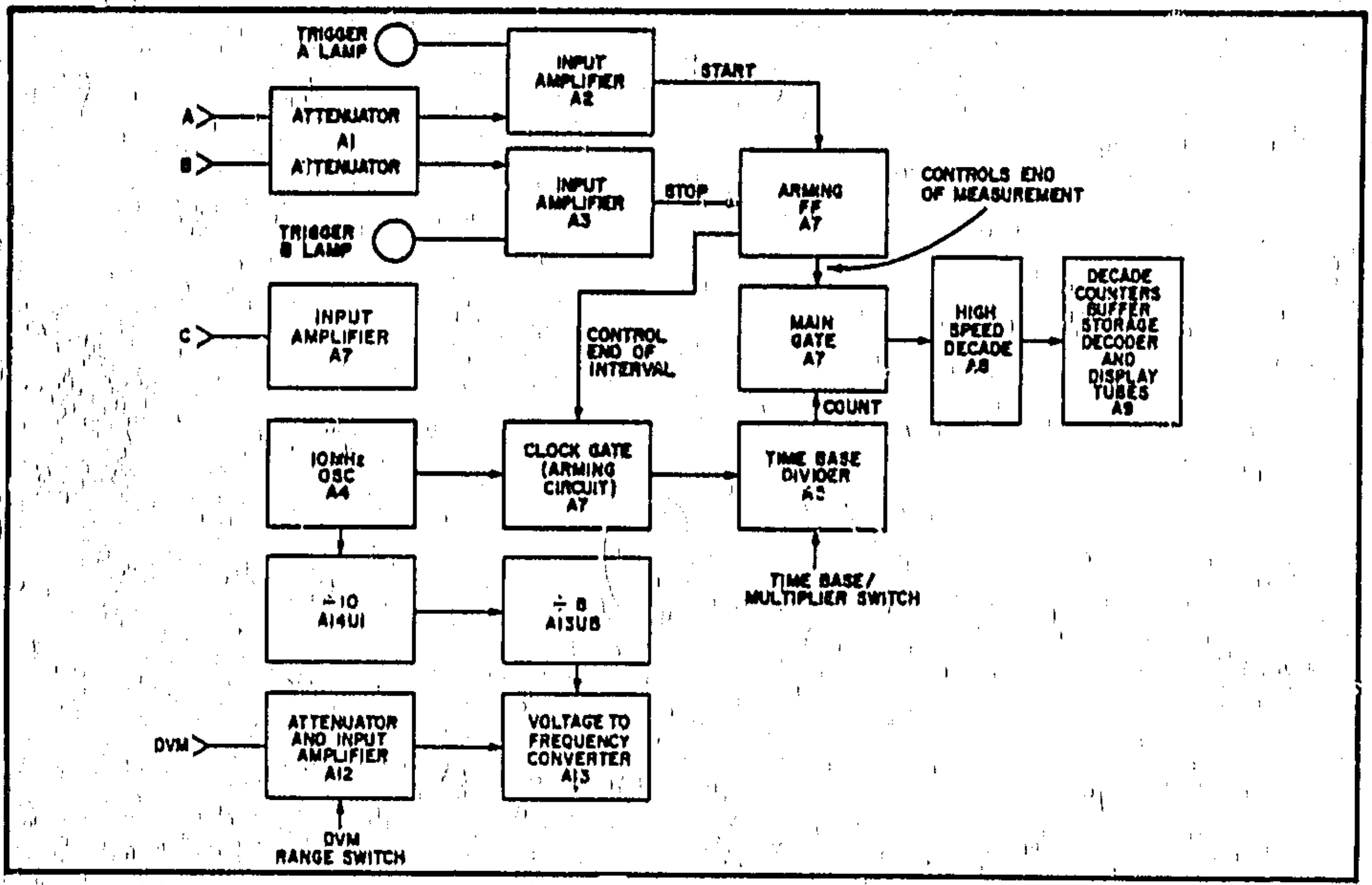


Figure 4-11. Time Interval Average Mode Flow Diagram

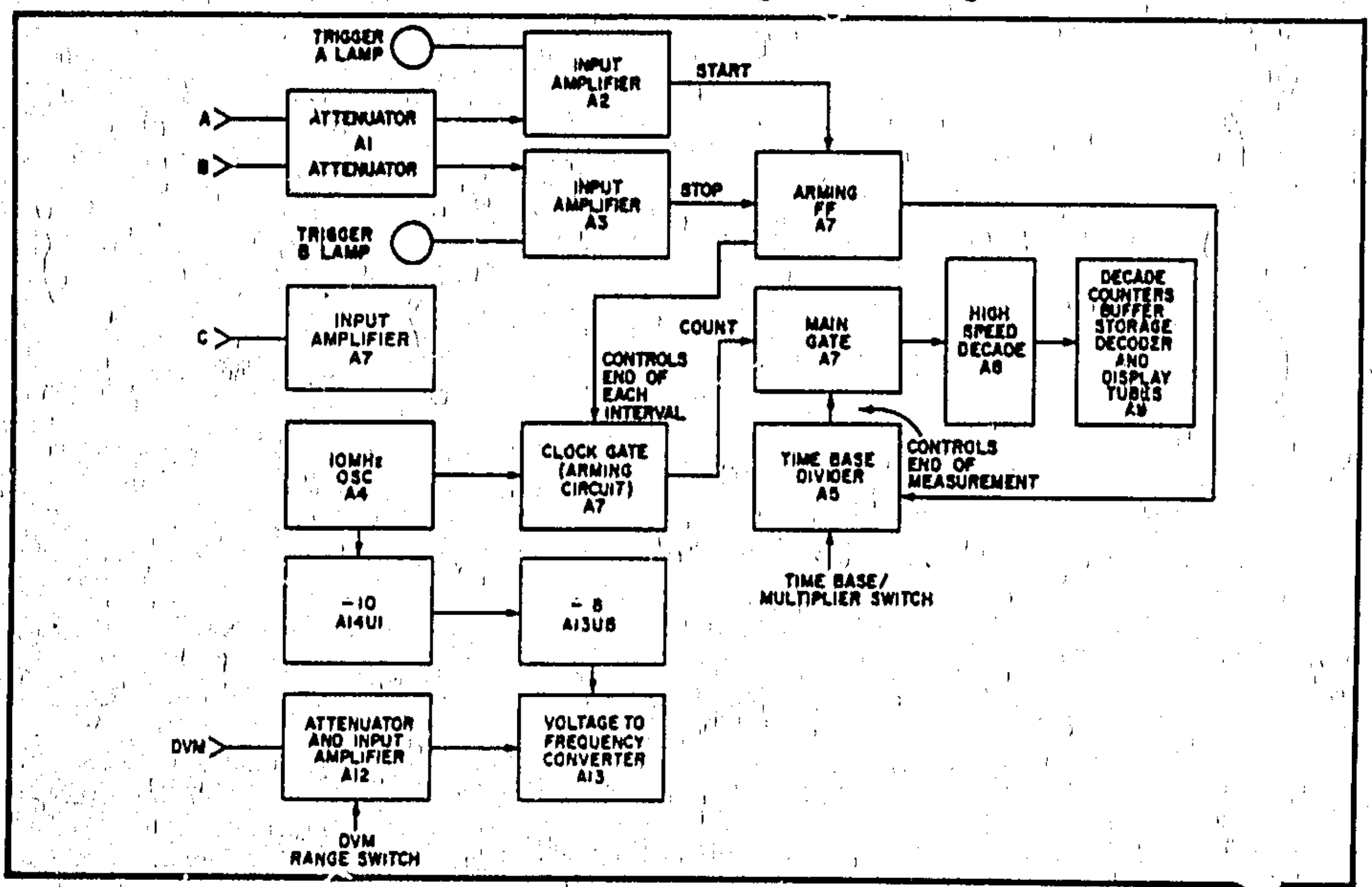


Figure 4-12. DVM Mode Flow Diagram

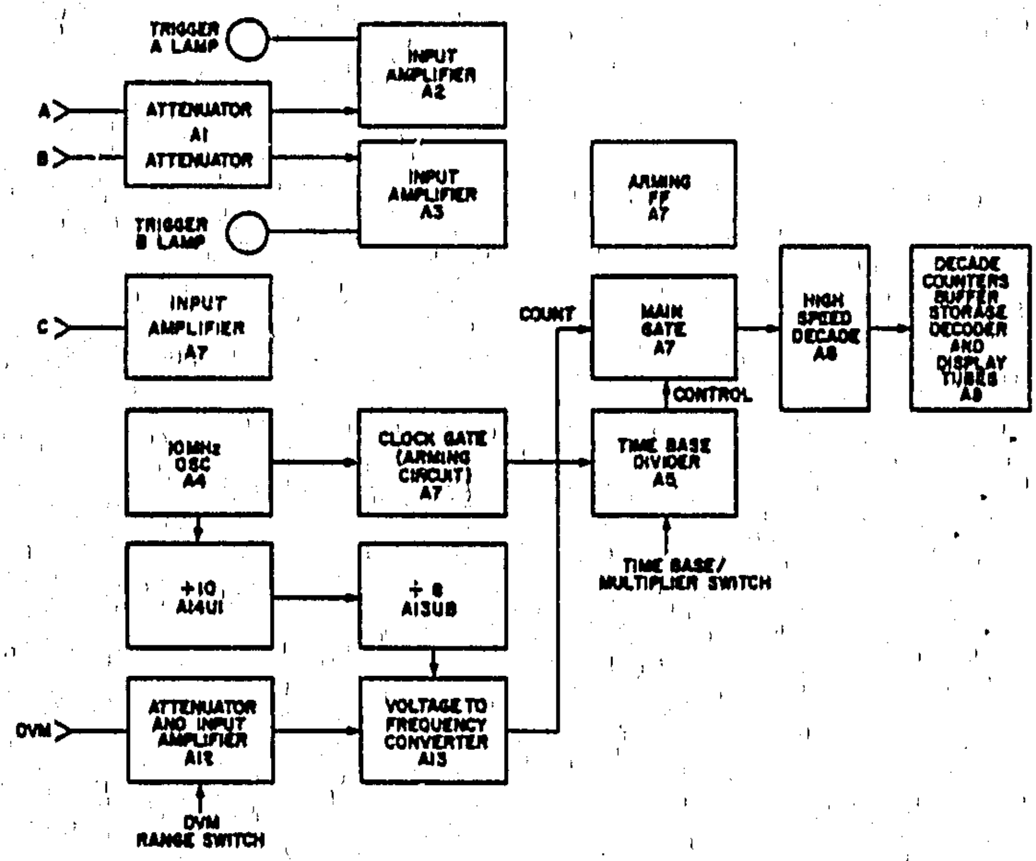
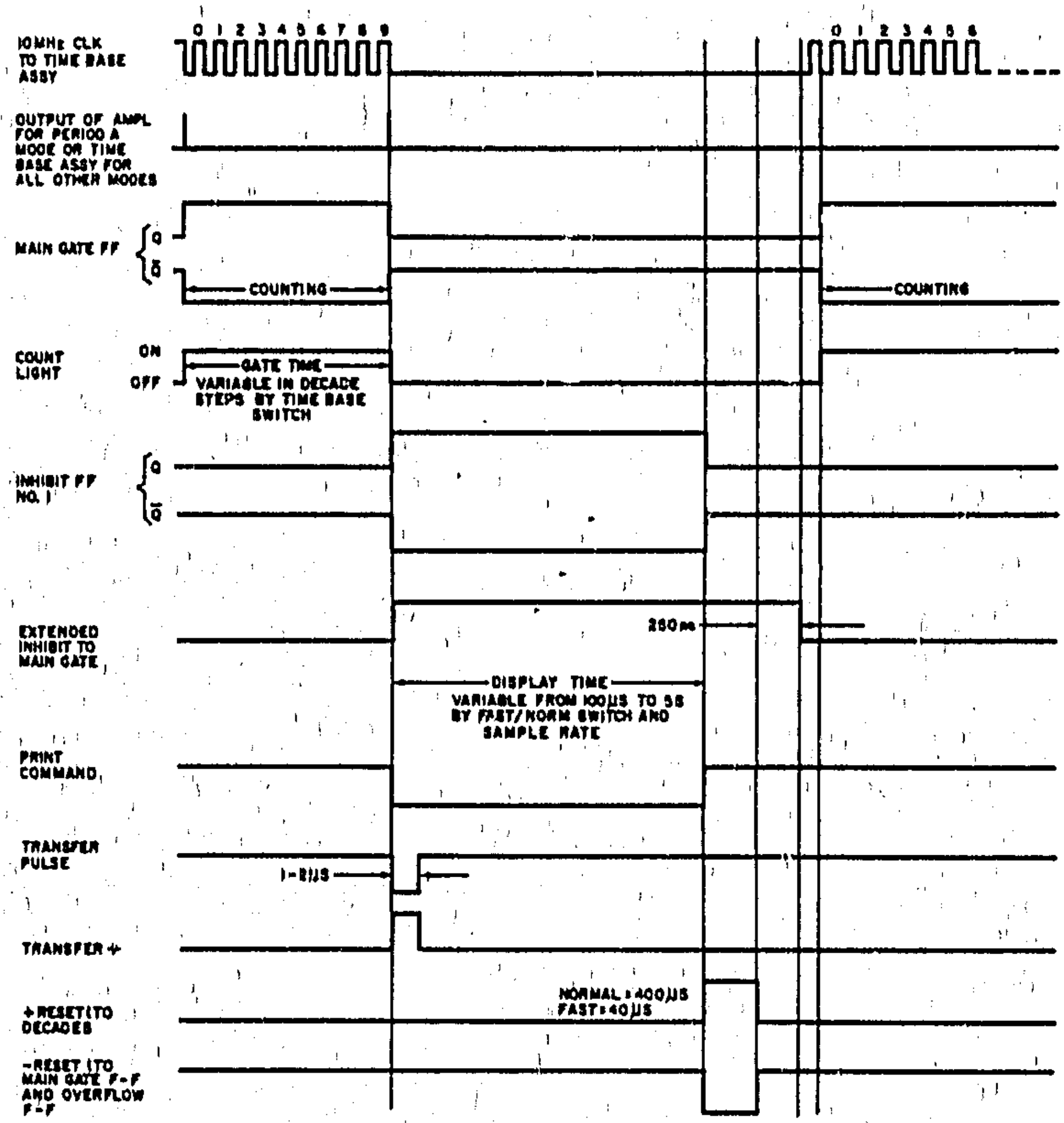


Figure 4-13. 5326A/B Timing Diagram



SECTION V

MAINTENANCE

5-1. INTRODUCTION

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

Table 5-1. Assembly Identification

Assy	Name	HP Part No.	
		5326A	5326B
A1	Attenuator	05326-60003	05326-60003
A2	Input Amplifier	05326-60004	05326-60004
A3	Input Amplifier	05326-60004	05326-60004
A4	Oscillator	05326-60002	05326-60002
A5	Time Base Control	05326-60005	05326-60005
A6	Sample Rate	05326-60013	05326-60013
A7A	Function Control	05326-60007	05326-60007
A7B	Function Control	05326-60024	05326-60024
A8	Display Support	05326-60009	05326-60009
A9	Display	05326-60008	05326-60008
A9	Display (Option 001)	05326-60025	05326-60025
A10	Right Readout	05326-60011	05326-60023
A11	Left Readout	05326-60010	05326-60022
A12	Voltmeter Input Amplifier	Not Used	05326-60016
A13	Voltmeter V-F Converter	Not Used	05326-60017
A14	DVM Logic	Not Used	05326-60015
A15	Regulator	05327-60020	05326-60001
A16	Interconnect	05326-60014	05326-60026

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.

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 5-4, and test card can be used to verify proper operation of all circuits in 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 5-4), 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 which 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.

Table 5-2. Recommended Test Equipment

Instrument Type	Required Characteristics	Recommended Type
Frequency Standard	1 MHz Output	HP 107AR
Oscilloscope	50 MHz Bandwidth	HP 180A
Vertical Plug-In	50 mV/cm Sensitivity	HP 1801A
Time Base Plug-In	50 MHz Bandwidth	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
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 200 Vac	HP 400F
RF Voltmeter	1 mV to 3 V	HP 3406A

5-14. ASSEMBLY LOCATION

5-15. Top internal, front and rear panel view of the Counter are shown in Section VIII. These show the location of the assemblies, connectors, and chassis parts.

5-16. REPAIR

5-17. Printed Circuit Component Replacement

5-18. 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. The following replacement procedure is recommended:

a. Remove defective component.

b. Melt solder in component-lead holes. Use clean dry soldering iron to remove excess solder. Clean holes with a wooden toothpick or splinter. Do not use metal tool for cleaning as this may damage through-hole plating.

c. Bend leads of replacement component to the correct shape and insert into component-lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of the board, but do not apply excess pressure with soldering iron.

d. Through-hole plating breaks are indicated by separation of the round conductor pad from either side of the board. To repair breaks, press conductor pad against board and solder replacement component lead to conductor pad on both sides of board.

5-19. Replacing Integrated Circuits

5-20. Following are two recommended methods of replacing integrated circuits:

a. SOLDER GOBBLER. This is the best method. Solder is removed from the board by a hollow tip soldering iron connected to a vacuum source. This IC is removed intact, so it may be reinstalled if found to be operative.

b. CLIP OUT. This method should be used as a last resort only. Clip the leads as close to the case as possible. With a soldering iron and longnose pliers, carefully remove the wires from each hole. Clean holes as described in Paragraph 5-18b.

5-21. ADJUSTMENTS

5-22. The adjustments in Table 5-5 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 5-4 (In-Cabinet Performance Checks).

5-23. TROUBLESHOOTING

5-24. The following paragraphs give overall troubleshooting procedures to isolate trouble to a particular pc assembly.

5-25. TROUBLE AT TURN ON. If the Counter does not operate when power is applied, (no display, no decimal point, and no measurement unit*) make the following checks:

a. Line voltage switch must be set to correct voltage (115 V 230 V as appropriate).

b. Power cord plugged into Counter and ac power outlet.

c. Line fuse good.

d. AC power on at outlet.

*At least the right zero digit should be on regardless of front panel control setting if power is ON.

5-26. COUNTER QUICK CIRCUIT CHECKS: Make the following quick checks if the Counter does not operate.

a. Remove the top and bottom covers. Set the Counter controls as follows:

FUNCTION	FREQ A
TIME BASE	.1 µs
SAMPLE RATE set	Counterclockwise but ON
FAST/NORM/HOLD	FAST
CHANNEL A and B ATTEN	X1
AC-DC	AC
LEVEL	PRESET
CHECK-SEP-COM	CHECK
STORAGE	ON
INT-EXT OSC	INT

b. Connect Counter power cord to correct ac outlet.

c. Continue with the quick checks that follow to locate which assembly a trouble is in.

5-27. POWER SUPPLY QUICK CHECKS.

a. Turn SAMPLE RATE knob clockwise.

b. Measure +175 Vdc at pin 1 of A15. If this voltage is not correct, refer to A15-A16 schematic diagram.

c. Measure +5 Vdc at the collector (metal tab) of Q1 and -5 V at the collector of Q2. If this voltage is not correct, refer to the A15-A16 schematic diagram.

d. Measure +16.5 Vdc at F1 on A15, -16.5 Vdc at F2 on A15. These pins are the large projections on the foil side of A15. If these voltages are not correct, refer to A15-A16 schematic diagram.

5-28. A4 OSCILLATOR QUICK CHECKS. Check the output of the oscillator at the rear panel OSC connector with an oscilloscope. If the 10 MHz signal is not present, refer to A4 schematic diagram and troubleshooting procedure.

5-29. A7 FUNCTION CONTROL QUICK CHECKS

a. With oscilloscope, check pin T of A7A for 10 MHz signal.

b. Check pin 7 for 10 MHz signal. If the 10 MHz signal is at pin T, but is not at pin 7, refer to A7 Function Control schematic diagrams. If the signal is not at pin T, check the oscillator signal flow through gates U3A and U3B on A5.

5-30. A5 TIME BASE QUICK CHECKS.

a. Change FUNCTION to START.

b. With oscilloscope, check for 10 MHz at TIME BASE OUT BNC.

c. Set TIME BASE/MULTIPLIER switch to 10^8. Using HP 10028A Logic Probe check for low every 10 seconds at the TIME BASE OUT BNC.

d. If the signal is absent at either of the above two steps, check for 10 MHz at pin 14 of A5 using oscilloscope. If present there but absent in steps c or d, refer to A5 schematic and troubleshooting. If absent at pin 14, refer to A7 schematic.

5-31. Decimal Point and Annunciator Troubleshooting

5-32. To troubleshoot these circuits, compare readout with Table 5-6 and check the logic levels of the gates and drivers on A8, A10, A11, and A14 for the DVM decimal points, as per the Boolean equations on the schematics.

5-33. A7 Troubleshooting

5-34. Table 5-3 lists ECL logic levels present at the interconnect jack of A7A and A7B (H >-0.85 V, L <-1.50 V). If trouble exists in the Function Control assembly A7, check the logic levels for the various functions as given in Table 5-3. Any discrepancy found indicates trouble on A7B. If logic levels are correct, install A7B in the service position and check the signal flow in A7A as per the Boolean equations shown on the schematic.

Table 5-3. A7 Logic Levels

Pin No.	STOP	START	PER AVG	T.I. AVG	T.I.	PER	FREQ A	FREQ C	READ A, B DVM
B15									
B14									
B13									
B12									
B11	L	L	H	H	L	L	L	L	L
B10	*	*	*	*	*	*	*	*	*
B9	L	L	L	L	L	L	H	H	H
B8	H	L	H	H	L	H	H	H	H
B7									
B6									
B5									
B4									
B3									
B2	**	**	**	**	**	**	**	**	**
B1									
A15									
A14	H	H	H	L	H	H	H	H	H
A13	H	H	L	L	H	H	H	H	H
A12	H	H	H	H	H	H	H	H	L
A11									
A10									
A9	H	H	H	H	L	L	L	L	L
A8	L	L	L	L	H	H	L	L	L
A7	H	H	H	H	H	H	L	H	H
A6	L	L	L	H	H	H	H	H	H
A5	H	H	H	H	H	H	H	L	H
A4	L	H	L	L	H	L	L	L	L
A3	H	H	H	H	L	L	H	H	H
A2	H	H	H	L	L	H	H	H	H
A1	L	L	L	L	L	L	L	H	H

* H for CHECK, L otherwise
** L for CHECK, H otherwise

NOTE
Levels are measured at interconnect jack of A7A and A7B.

Table 5-4. 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 $<\pm 2.5$ parts in 10^{7}.

Table 5-4. 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

<u>CHANNEL A</u>

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. Steps k through n are for 5326B models only. 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.

o. Disconnect test Oscillator from CHANNEL A input and connect it to INPUT C jack.

p. Set HP Signal Generator output for 50 MHz at 100 mV rms. Set FUNCTION selector to FREQ C and TIME BASE/MULTIPLIER to .1 s.

q. Check that Counter display 50000.00 kHz ± 1 count ± time base error.

Table 5-4. In-Cabinet Performance Check (Continued)

r. Set Audio Oscillator to 2 Hz at 50 mV rms. Check that Counter displays 2 Hz ± 1 count ± time base error. 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)	DC
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, gate 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.

f. Check that counter displays repetition rate and gate 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 5-4. 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)	DC
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, gate light (G) 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% points. 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 5-4. 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 10^3. Display should be ratio of two input frequencies X 10^3 (approximately 10^6). 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 ccw

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 rotate SAMPLE RATE fully clockwise. Verify that the time between flashes of the gate (G) 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 5-4. In-Cabinet Performance Check (Continued)

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/MULTIPLIER	0.1 s
RANGE	10 V

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 100 V. 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 1000 V. 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 10 V. 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 Meg 1/4W 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 100 V. Counter display should be 9.09 V ± 22 counts.

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

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

Table 5-4. In-Cabinet Performance Check (Continued)

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 >2.4 V to <0.4 V) immediately after the G lamp goes out.

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

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

e. Verify proper output by connecting a 5055A printer to 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 5-5. 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 Fuse F1 and adjust A15R10 for +16.5 volts.

   d. Connect VTVM to A15 Fuse F2 and adjust A15R13 for -16.5 volts.

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 50-ohm 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 A	X1
AC-DC A	DC
LEVEL A	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 symetrical 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. V TO F CONVERTER AND ATTENUATOR A12, A13 (5326B ONLY)

   a. Set Counter controls as follows:

SAMPLE RATE control	slightly clockwise out of OFF
RANGE	10V
FUNCTION	DVM
TIME BASE	1sec

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

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

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

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

   f. Reverse polarity of the DC Standard.

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

   h. Set Counter RANGE switch to 100V.

   i. Set DC Standard for +100 Volt output.

   j. On Voltmeter Input Amplifier Assembly, adjust A12R21 ("100V" 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 volts ±2 counts and -100.000 volts ±2 counts.

Table 5-6. Adjustments (Continued)

l. Set Counter Range switch to 1000V.

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 (1000v pot) for +990.00 ±2 counts on display.

4. OSCILLATOR A4

NOTE

This adjustment must be made with the top and bottom covers in place.

a. Connect 1 MHz Frequency Standard to INPUT 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. 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 instruments without Option 001 the Counter display will overflow; however all digits are valid.

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

Function Switch	Multiplier Switch	n	μ	m	s	*	k	M	Hz	V	10^5	Decimal 10^4	10^3	10^2	10^1	10^0
Period	1		x		x											x
AVG A	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	1		x		x											x
A to B	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											
T.I.	1		x		x											x
A to D	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	1		x		x											x
A	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. D.P. and Annunciator Troubleshooting (Continued)

Function Switch	Multiplier Switch	n	μ	m	s	•	k	M	Hz	V	10^5	10^4	Decimal 10^3	10^2	10^1	10^0
Freq. A	1					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	1					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			
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															
	10^5									x					10v	100v
	10^6									x				10v	100v	1000v
	10^7									x			10v	100v	1000v	
	10^8															

PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 5326A/B
Timer Counter-DVM
Serial No. _____ - __________

Test Performed by ____________________

Date ____________________

Description	Check
1. TIME BASE STABILITY AND OUTPUT	
Aging Rate: < 3 parts in 10^7/month	
Line Voltage: < 1 part in 10^7 for 10% line variation	______
Temperature: $<\pm 2.5$ parts in 10^6, 0 to 50 C	______
Output: 10 MHz, > 2.4 volts p-p	______
	______
2. DISPLAY, DECIMAL POINTS, AND DIVIDERS	
As per self check procedures, Table 3-3	______
3. FREQUENCY RESPONSE AND SENSITIVITY	
Frequency Range: 0 to 50 MHz	
Sensitivity: 0.1V rms sine wave	______
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 (5326B): +3.0 to -3.0V DVM readout	______
Read B Level (5326B): +3.0 to -3.0V DVM readout	______
Frequency C Input: 0 to 50 MHz, 50 mV rms	______
	______
4. PULSE OPERATION	
CHANNEL A	
Sensitivity: .3 volts p-p	______
Pulse width: 15 nsec	______
CHANNEL C	
Sensitivity: 150 mV p-p	______
Pulse width: 10 ns minimum	______
5. PERIOD AND PERIOD AVERAGE	
Frequency Range: 0 to 10 MHz	______
6. TIME INTERVAL AND TIME INTERVAL AVERAGE	
Time Interval Range: 0.1 s to 10^9 sec	______
Time Interval Avg Range: 15 ns to 10	______
7. TOTALIZE	
Range: 0 to 10 MHz	
Output: rear panel TIME BASE BNC	______
Factor: $1\text{-}10^8$ in decade steps	______
	______
8. RATIO	
Range Channel A: 0 to 50 MHz	
Range External Input: 100 Hz to 10 MHz	______
	______

PERFORMANCE CHECK TEST CARD

Description	Check
9. GATE OUTPUT AND SAMPLE RATE	
Output: >2.4V p-p	______
Gate Open: low output	______
Gate Closed: high output	______
10. DIGITAL VOLTMETER	
10 volt range	______
100 volt range	______
1000 volt range	______
12.490 V check	______
10 V impedance check	______
100 V impedance check	______
11. DIGITAL RECORDER	
Code: 4-line 1248 BCD "1" state high	______
Print Command: +5V to 0V	______
Inhibit Input: +5V	______

OPERATING AND SERVICE MANUAL

50 MHz TIMER COUNTER DVM

5326A/B

HEWLETT hp PACKARD

HP 5326A/B

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 facility.

WARRANTY AND ASSISTANCE

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

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

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

5326A/B

TIMER/COUNTER/DVM

OPERATING AND SERVICE MANUAL

SERIAL PREFIX:

5326A — 1044A
5326B — 1124A

This manual applies to HP Model 5326A having serial prefix 1044A and HP Model 5326B having serial prefix 1124A.

NEW INSTRUMENTS

For serial prefixes below 1044A for the 5326A and 1124A for the 5326B, refer to Section VII of this manual.

NEWER INSTRUMENTS

For instruments with serial prefixes above 1044A for the 5326A and 1124A for the 5326B, a separate manual is needed. For 5326A's with 1116A and above, order "5326A/5327A Timer/Counter" manual. For 5326B with 1128A and above, order "5326B/5327B Timer/Counter/DVM" manual.

5301 STEVENS CREEK BLVD., SANTA CLARA, CALIF. 95050

PRINTED: JUN 1972

This Manual Printed on 100% Recycled Paper.

HEWLETT hp PACKARD

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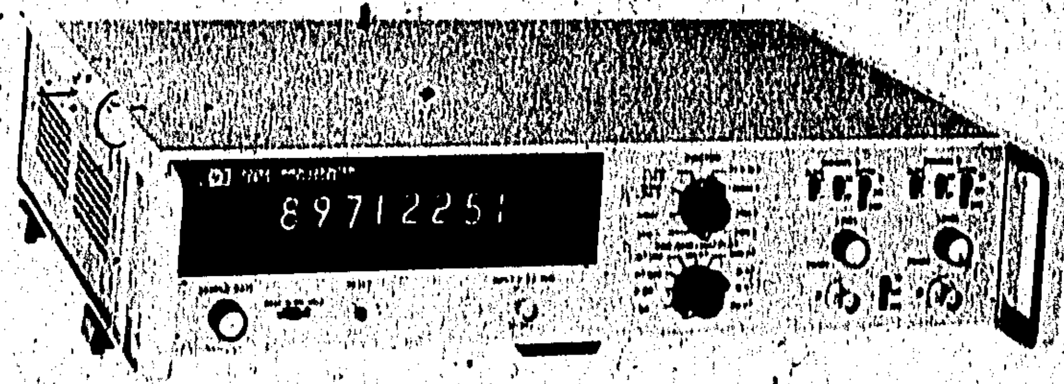
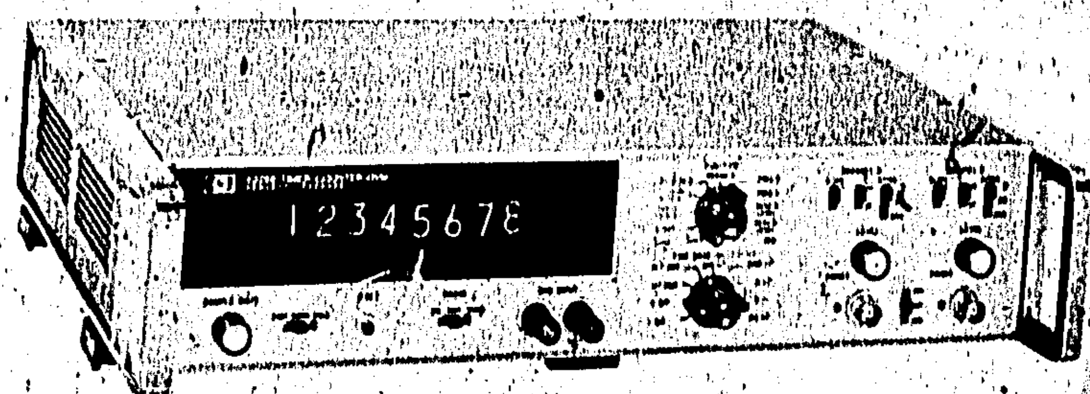
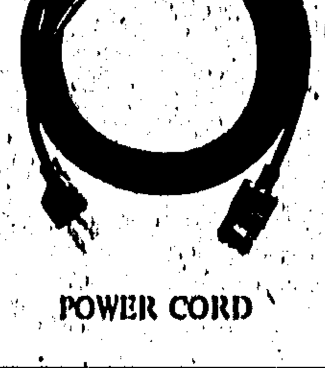
Figure 1-1. Models 5326A/B and Power Cord



MODEL 5326A



MODEL 5326B



POWER CORD

SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The Hewlett-Packard Models 5326A/B Timer Counters measure frequency, ratio, period, period average, time interval, and time interval average. The 5326B Timer-Counter-DVM also measures dc voltages up to 1000 volts and provides a direct readout of the voltage and polarity of the trigger level controls. Both models feature a 7-digit display, 1 MΩ and 50Ω inputs, display storage, and blanking for insignificant digits in the display. Decimal point and unit readouts are displayed automatically with each operating section. Two independent input channels are provided to facilitate time interval measurements. Each input channel has an attenuator, trigger slope control, level control, ac-dc coupling, and an oscilloscope marker output.

1-3. Electrical and mechanical specifications are listed in Table 1-3.

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 (0000A00000). 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. The 5326A/B models 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 1 nanosecond. When used with microwave tests systems, group delay, phase, and level measurements can be performed.

1-7. OPTIONS. Either model can be ordered with the following options: Option 001, 8-digit display; Option 002, remote programming; and Option 003, digital recorder output.

1-8. EQUIPMENT SUPPLIED AND AVAILABLE ACCESSORIES

1-9. Table 1-1 lists equipment supplied and Table 1-2 lists available accessories.

Table 1-1. Equipment Supplied

Description	HP Part No.
Detachable Power Cord, 7½ feet (231 cm) long	8120-1348
Rack Mount Kit	05326-60020*

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

Table 1-2. Accessories Available

Description	HP Part No.
Digital Recorders	5050B, 5055A
Interconnect Cable, Digital Recorder, 6 feet (183 cm)	562A-16C
50-ohm BNC to BNC Coaxial Cable, 4 feet (122 cm)	10503-6001
Circuit Board Extender, 15-pin (2 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: 0-50 MHz
ac coupled: 20 Hz - 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.
15 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 <10 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

Range:
dc coupled, 0 - 50 MHz.

Sensitivity:
50 mV rms sine wave to 30 MHz; 100 mV to 50 MHz. 10 ns minimum pulse width.

Impedance: 50Ω nominal

Maximum Input: ±5 V.

Trigger Level: 0 volts

Location:
5326A Front Panel.
5326B Rear Panel.

CAUTION

Do not exceed voltage specification or damage will occur.

START (Totalizing and Scaling)

Range: 0 - 10 MHz

Factor: 1 - 10^8 selectable in decade steps

Output: Rear panel TIME BASE BNC

Display:
Channel A input divided by scaling factor.

FREQUENCY

Range:
0 - 50 MHz

Input:
Channel A; Channel C (switchable).
Channel A provides triggered frequency measurement.

Gate Times: 0.1 μs to 10 s in decade steps

Accuracy:
±1 count ± time base accuracy.

Display:
kHz, MHz with positioned decimal point.

TIME INTERVAL

Range: 0.1 μs to 10^8 seconds

Input:
Channels A and B; can be common or separate

Frequency Counted:
10 MHz to 0.1 Hz in decade steps

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

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

TIME INTERVAL AVERAGE

Range: 0.15 ns to 10 s

Intervals Averaged:
1 - 10^8 selectable in decade steps

Table 1-3. Specifications (Continued)

Input:
Channels A and B; can be common or separate

Frequency Counted: 10 MHz

Minimum Time Stop to Start: 150 ns

Accuracy: ± time base accuracy ± 2 ns

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

Display: ns, μs with positioned decimal point

PERIOD

Range: 0 - 10 MHz

Input: Channel A

Frequency Counted:
10 MHz to 0.1 Hz in decade steps

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

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

PERIOD AVERAGE

Range: 0 - 10 MHz

Periods Averaged: 1 - 10⁸ selectable in decade steps.

Input: Channel A

Frequency Counted: 10 MHz

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

Display: ns, μs, with positioned decimal point

RATIO

Display:
F_A/F_{ext} or F_C/F_{ext} times MULTIPLIER (M).
M = 1 to 10^8, selectable in decade steps

Range:
F_A (Channel A or Channel C) 0 - 50 MHz
F_{ext} (External Oscillator Input) 100 Hz to 10 MHz

Mode:
Operating mode will be either FREQUENCY A or FREQUENCY C

Accuracy:
± 1 count of F_A ± trigger error of F_{ext}*

INTEGRATING DIGITAL VOLTMETER (5326B ONLY)

Technique: Voltage-to-frequency conversion

Voltage Ranges: Manual selection

Range	Resolution	Input Impedance
(Vdc)	(1 sec inte-gration time)	
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):

Range	Stability	Linearity	Zero Offset	Counter
	(% of Reading)	(% of Range)	(% of Range)	
10 V	±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

*For any waveshape, trigger error is less than

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

**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)

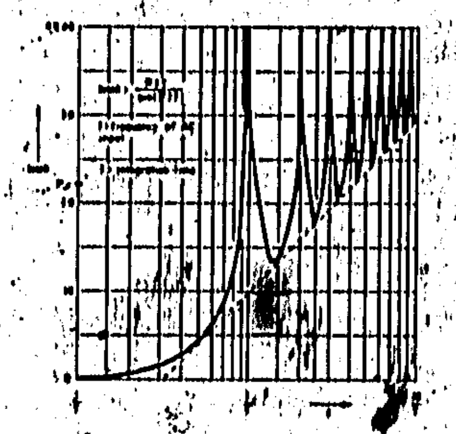
Operating Temperature:
10°C to 40°C, <80% RH

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 (measurement time)$^{-1}$. See graph for Normal Mode Rejection below.



TIME BASE

Crystal Frequency: 10 MHz

Stability:

Aging Rate: <3 parts in 10^7/mo.
Temperature: <±2.5 parts in 10^6, 0° to 50°C.
Line Voltage: <±1 part in 10^7 for 10% line variation.
Short-term Fluctuation: Typically <5 parts in 10^9, 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 - 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 is CHANNEL A frequency 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 position: 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

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, 7½ ft. Rack Mount Kit.

DIMENSIONS

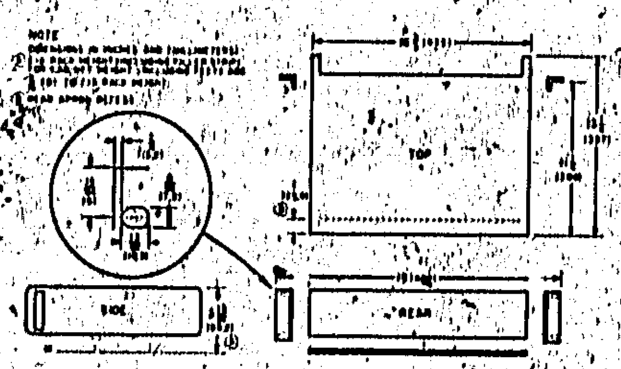


Table 1-2. Specifications (Continued)

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, 10532-60001

HP Cable 562A-16C, 6 ft. (183 cm) to connect 5326A/B Series with Option 003 to HP 5050B or 5055A Digital Recorder.

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

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 than 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

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, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken knobs, etc.). If the instrument is damaged or fails to self-check (Self-Check 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 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.

2-15. Front Panel Controls

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

a. FUNCTION
b. TIME BASE/MULTIPLIER
c. DVM RANGE (5326B)
d. CHECK function
e. SLOPE
f. SAMPLE RATE and HOLD
g. LEVEL controls
h. 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 but START or STOP.

b. Ground the EXT line at rear-panel REMOTE PROGRAM connector J10(17). This disables the front panel switches. 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	Pin 7	
READ A LEVEL	Pin 8	5326B
READ B LEVEL	Pin 9	5326B
DVM	Pin 10	5326B

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. BLANKING DEFEAT

2-37. This counter is 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).

2-38. On A9 with series number 944A, Rev. A, defeat the blanking feature by lifting pin 10 of A9U7 and A9U8 from the ground lead and tying pin 10 to +5 V, which is available at A9U7(12) and A9U8(12). Also lift the lead at pin 1 of A8U2 and connect pin 1 to ground (available at pin 7 of A8U2).

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 G light is on (in START), indicating counting is taking place.

3-7. Frequency Modes

3-8. Two frequency measurement modes are available: Frequency A and Frequency C. In the Frequency A mode, the input signal connects to the CHANNEL A input and can be conditioned with the LEVEL, SLOPE, and ATTENUATOR controls. The TIME BASE/MULTIPLIER selects the gate time and therefore the desired resolution. Input impedance is 1 Megohm shunted by less than 25 pF. Frequency range is 0 to 50 MHz. Sensivity is 0.1 V rms sine wave or 0.3 V p-p pulse.

3-9. In the Frequency C mode, the input signal (0-50 MHz) connects to the INPUT C jack. The jack is located on the front panel of the 5326A and on the rear panel of the 5326B. The input impedance is 50 ohm nominal. Maximum input amplitude is 5 volts peak. Trigger level is zero volts.

3-10. Period Modes

3-11. 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.

3-12. During single period measurements, the TIME BASE/MULTIPLIER switch scales the time base frequency and determines the resolution of the measurement.

3-13. 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.

3-14. Time Interval Modes

3-15. 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.

3-16. 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.

3-17. 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 4-27 and Figures 4-10 and 4-11.

3-18. Digital Voltmeter Measurements

3-19. 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 on 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.

3-20. 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.

3-21. Ratio

3-22. 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 CHANNEL A or INPUT C jack, is used as the comparator signal. The MULTIPLIER switch controls the resolution of the display. For a ratio of frequencies, the Ratio $= \dfrac{F_A}{F_{ext}} = \dfrac{\text{DISPLAYED NUMBER}}{\text{MULTIPLIER SETTING}}$. For a ratio of periods (P), the Ratio =

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

3-23. 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.

3-24. MARKER OUTPUTS

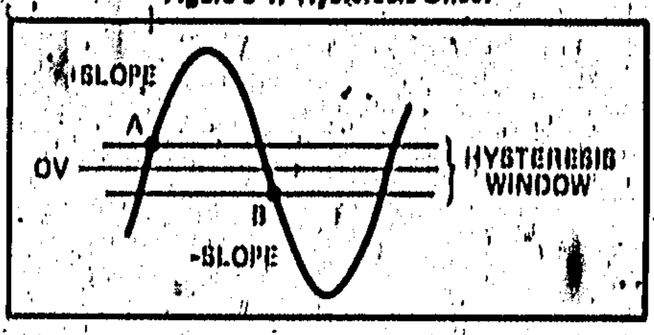
3-25. Two marker output jacks are mounted on the counter's rear panel. These outputs provide a negative-going 2 µs pulse (approx.) at DTL levels each time the input signal passes through the trigger point of Channel A or B. The pulses may be used to trigger other circuits or may be applied to the Z axis of an HP 180 Oscilloscope. When using the pulses to intensity modulate an oscilloscope, note that the actual trigger point is the left-most portion of the intensified segment. 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.

3-26. HYSTERESIS

3-27. 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.

3-28. 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.

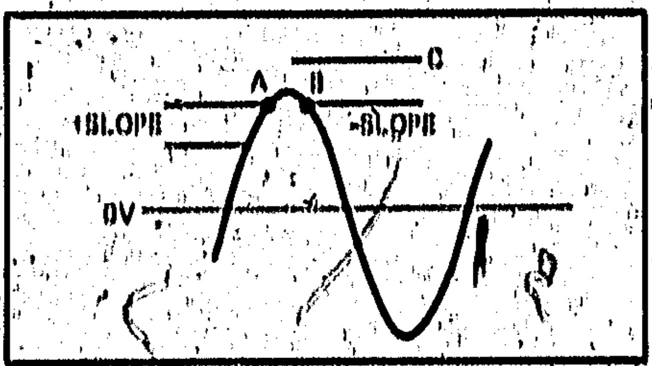
Figure 3-1. Hysteresis Offset



3-29. Time Interval Compensation

3-30. 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). In this example, 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 3-2. Hysteresis Compensation



3-31. ACCURACY

3-32. 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.

3-33. 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

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

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 offset at standardization, and line voltage effects).

3-34. An example of frequency error calculation is as follows:

$$f_1 = 5 \text{ MHz } (5 \text{ X } 10^6 \text{ Hz})$$

gate length = .1 sec (1 X 10^{-1})

E = 3 parts in 10^7 per month times 2 months (e.g.) = 6 parts in 10^7

$$\text{error} = \pm\frac{1}{(5 \text{ X } 10^6)(1 \text{ X } 10^{-1})} \pm \frac{6}{10^7}$$

$$= \pm 2.0 \text{ X } 10^{-6} + 6 \text{ X } 10^{-7} = 2.6 \text{ X } 10^{-6}$$

or 2.6 parts in 10^6.

3-35. 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:

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

A = Accuracy in percent

f_1 = Time base frequency counted

f_x = Frequency of input signal (Hz)

n = Number of periods averaged

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

E = time-base accuracy (monthly drift rate of individual time base times the number of months since calibration, absolute value of offset 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 3-5. Measurement Accuracy

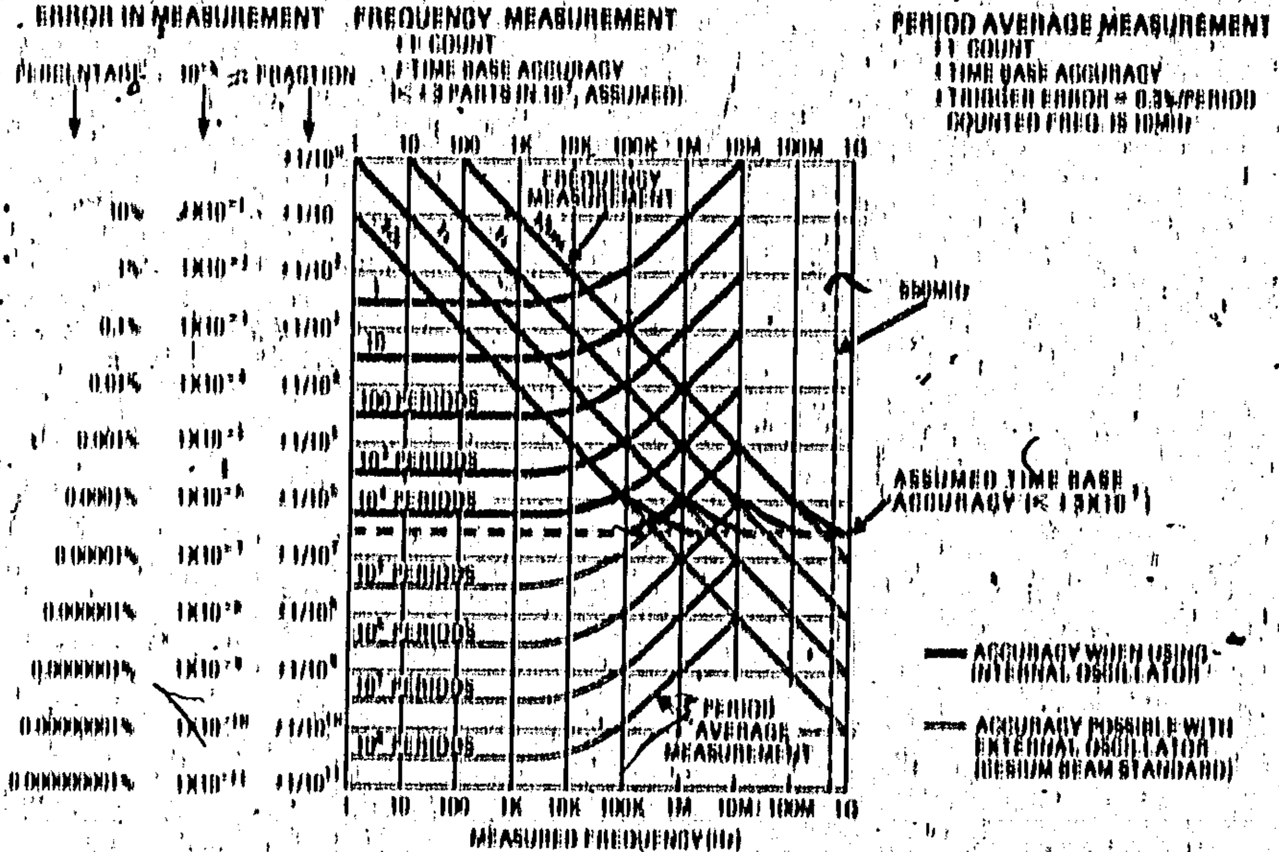
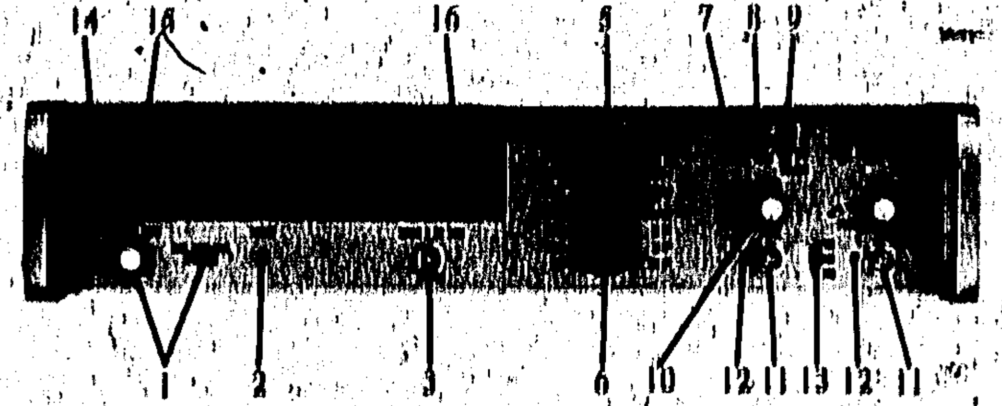
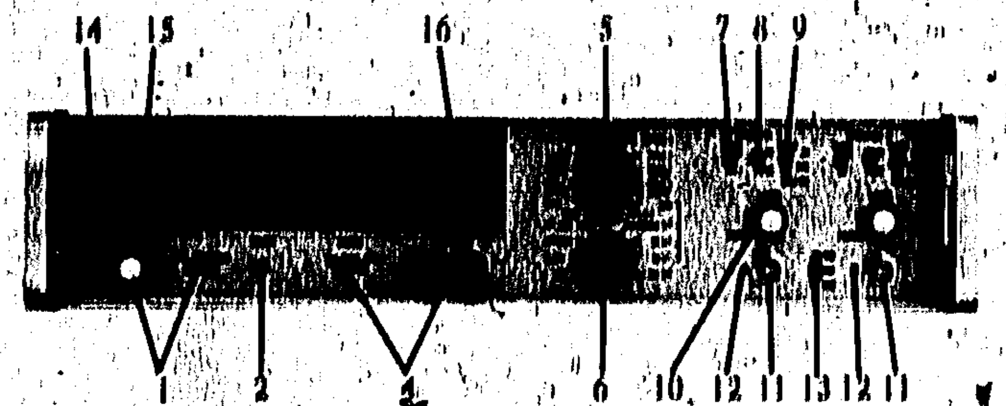


Figure 3-4. Front Panel Controls and Indicators

5326A



5326B



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. INPUT C (5326A). 50-ohm input for 0 to 50 MHz frequency C measurements. Has dc coupling and sensitivity of 50 mV rms sine wave (150 mV p-p pulse). Maximum input is ±5 volts referenced to ground (DO NOT EXCEED). Trigger level is zero volts.

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

5. 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 sealed 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.

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

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 15 ns to 10 sec; 10 MHz maximum repetition rate. There must be a 150 ns deadtime between intervals.

d. T.I. A to B - Set counter to measure time interval A to B. Channel A starts measurement and Channel B stops the measurement. Use TIME BASE/MULTIPLIER selector to set counted frequency. T.I. input range is 0.1 μs to 10^8 sec. There must be a 150 ns deadtime between intervals.

e. PERIOD A - Set counter to measure single period of frequency applied to CHANNEL A input. Use TIME BASE/MULTIPLIER to set desired 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/MULTIPLIER to set gate time and resolution. Frequency input range is 0 to 50 MHz.

g. FREQ C - Similar to FREQ A except sets counter to measure frequency applied to FREQ C input jack. 50-ohm input impedance. 5 volt peak maximum input. Frequency range is 0 to 50 MHz.

h. READ A LEVEL (5326B) - Sets counter to measure trigger voltage of LEVEL A control. Trigger level = DVM readout times ATTENUATOR setting.

i. READ B LEVEL (5326B) - Same as READ A LEVEL for LEVEL B control.

j. DVM (5326B) - Sets counter to measure dc voltage applied to DVM INPUT jack. Use TIME BASE/MULTIPLIER to select integration time and resolution.

6. 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.

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

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

9. 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.

10. 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.

11. 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.

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

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

13. 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.

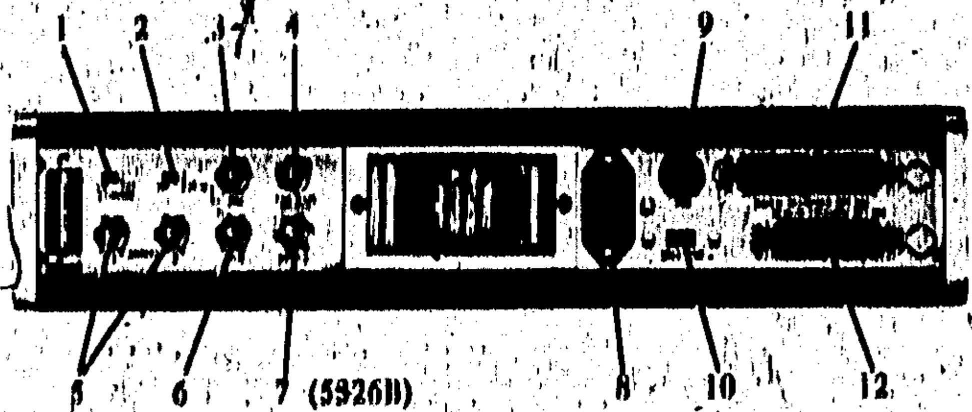
b. COM-SEP - Connects A and B inputs in parallel when set to COM position. When applying two separate inputs, set switch to SEP. When set to COM, input impedance is 500 kΩ shunted with less than 50 pF.

14. G (Gate) Annunciator light. Lights when counter maingate is open. For short duration gate times, the annunciator circuits include a 50 ms one-shot MV to allow a visible flash to the G light.

15. OF (Over Flow) Annunciator light. Lights when accumulated count exceeds counter capacity.

16. * (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. Provide 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 50 mV rms sine wave. Trigger level is zero volts. Maximum input is ±5 volts referenced to ground (DO NOT EXCEED).

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.

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 switch 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 G 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 G 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	s

*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 0.00 V ±1 count.

15. Rotate CHANNEL A LEVEL control clockwise and check that display varies from at least -8.0 to +8.0 V.

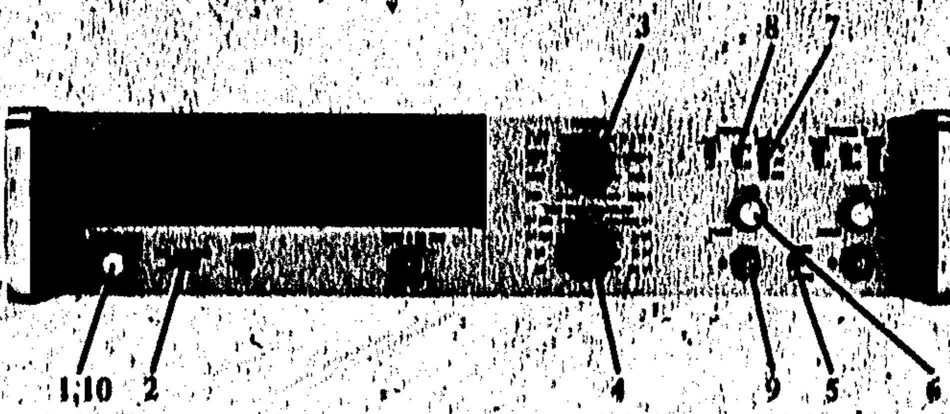
16. Repeat steps 14 and 15 for READ B LEVEL.

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.

DVM Self-Check (with DVM Input Shorted)

TIME BASE/ MULTIPLIER	10 V RANGE	100 V RANGE	1000 V RANGE
10 ms	.00 V ±1 count	.0 V ±1 count	0 V ±1 count
.1 s	.000 V ±1 count	.00 V ±1 count	.0 V ±1 count
1 s	.0000 V ±1 count	.000 V ±10 counts	.00 V ±10 counts

Figure 3-6. Frequency A Measurements

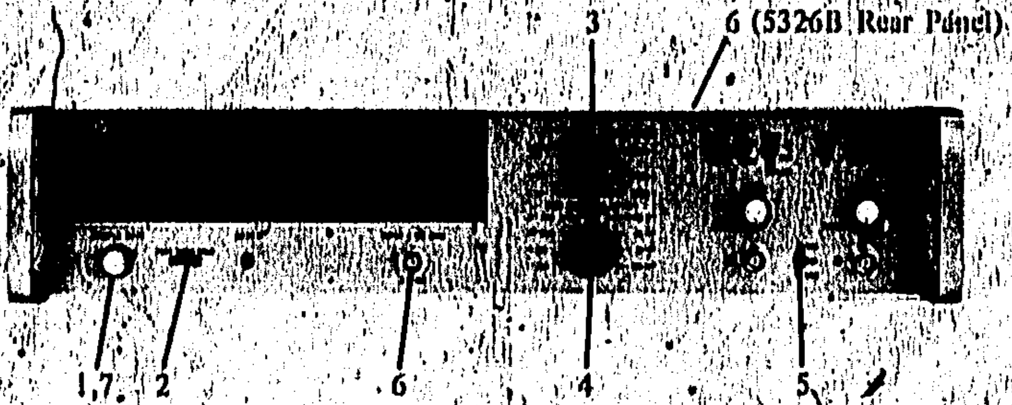


1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to FREQ A.
4. Set TIME BASE switch for desired gate time.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.
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

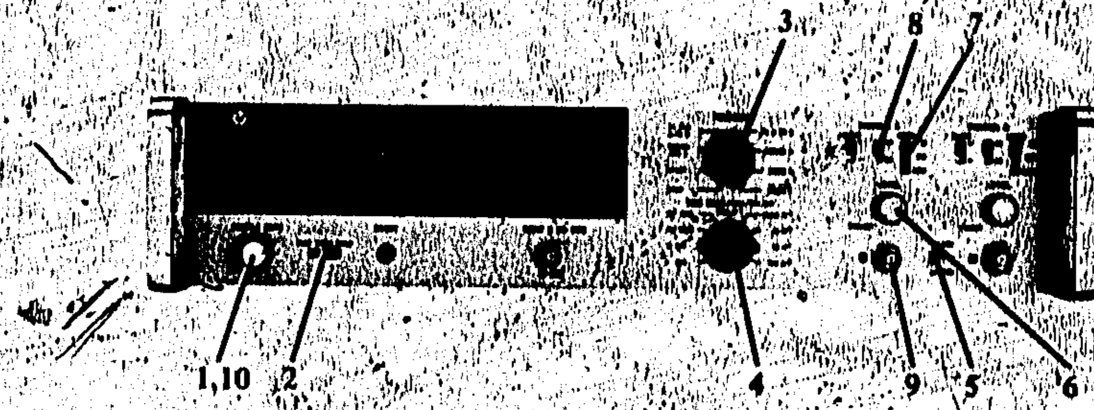
When the input signal is removed from CHANNEL A or the signal level is insufficient to trigger Channel A, the gate light (G) will not cycle. This is normal for this counter and does not indicate a malfunction.

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/MULTIPLIER switch for desired resolution.
5. Set CHK-SEP-COM switch to SEP.
6. Connect input signal (0 to 50 MHz, ±5 volts peak maximum) to INPUT C connector. Input impedance is 50-ohms nominal.
7. Adjust SAMPLE RATE control for convenient measurement interval.

Figure 3-8. Period Measurements



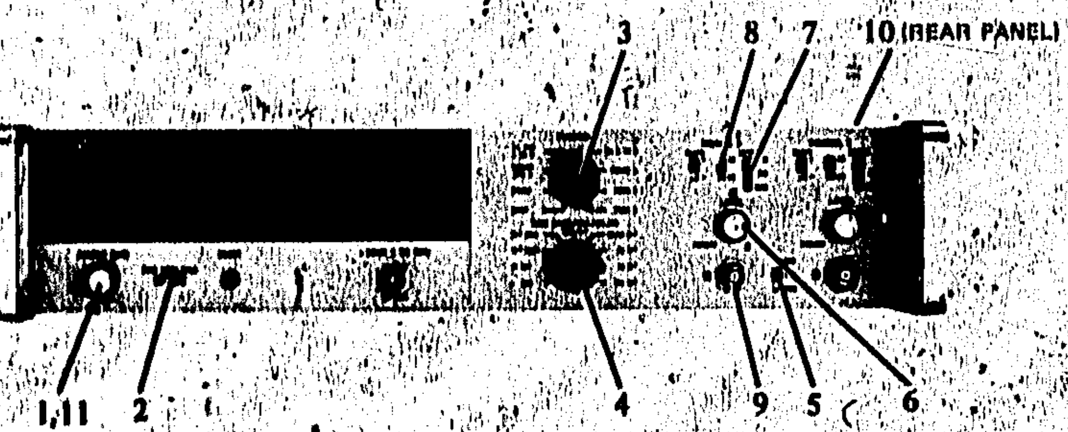
Period

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

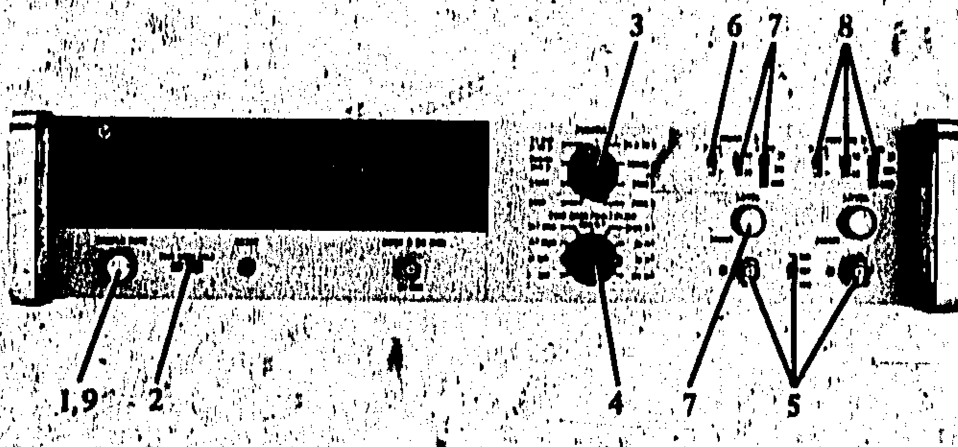
1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to PERIOD AVG A.
4. Set MULTIPLIER switch to number of periods to be averaged.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET 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.
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 $= \frac{F_A \text{ or } F_C}{F_{ext}} = \frac{\text{DISPLAY}}{\text{MULTIPLIER}}$. 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 (5328B only)

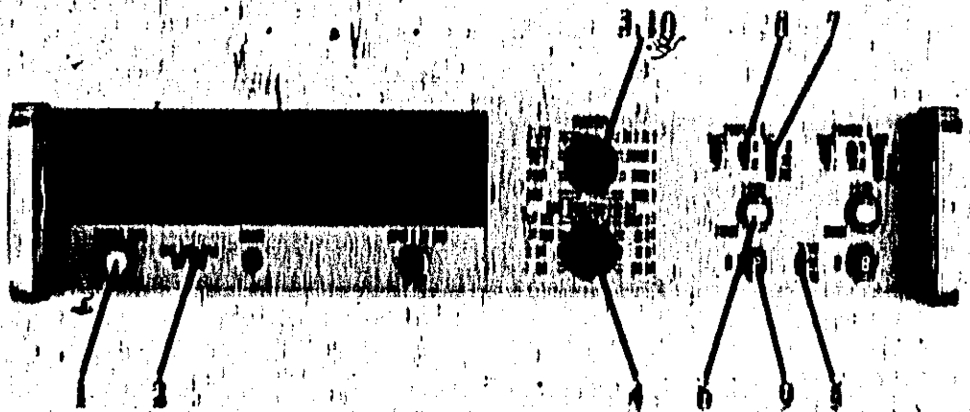
DVM

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

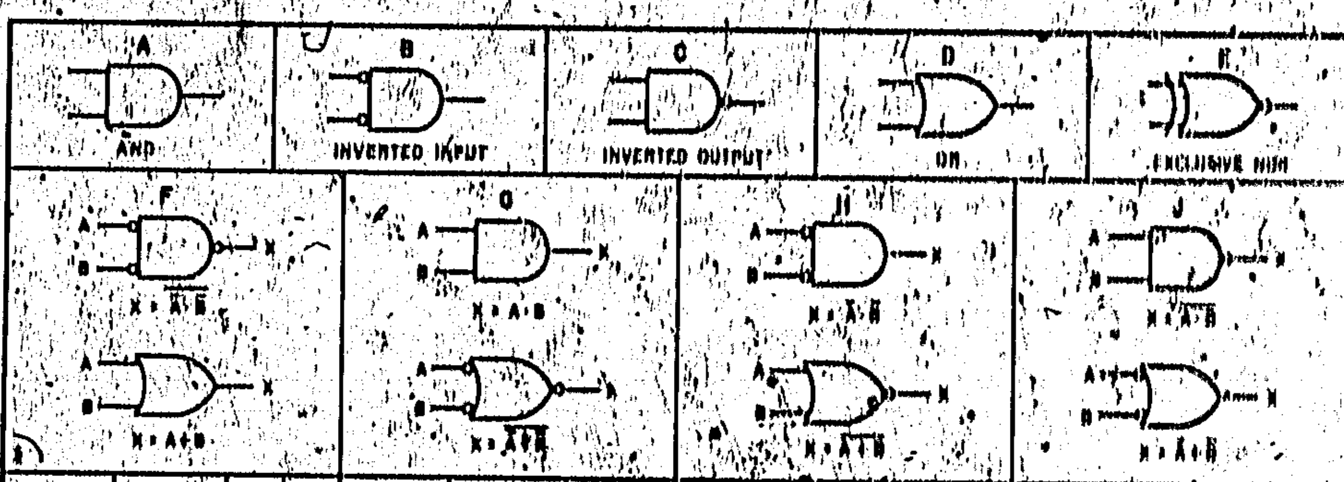
4-4. Two states exist in the binary system, 1 and 0. In positive logic, the 1 state is more positive than the 0 state. High (H) and low (L) are used to represent the 1 and 0 levels. *HIGH ALWAYS REPRESENTS THE MORE POSITIVE LEVEL, WHETHER IT BE POSITIVE OR NEGATIVE LOGIC.*

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

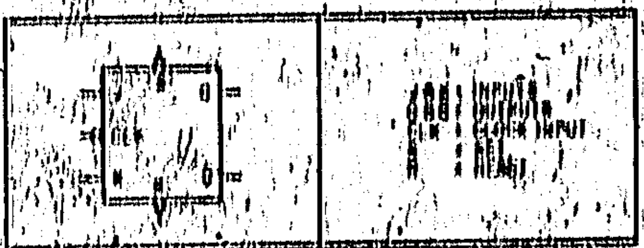


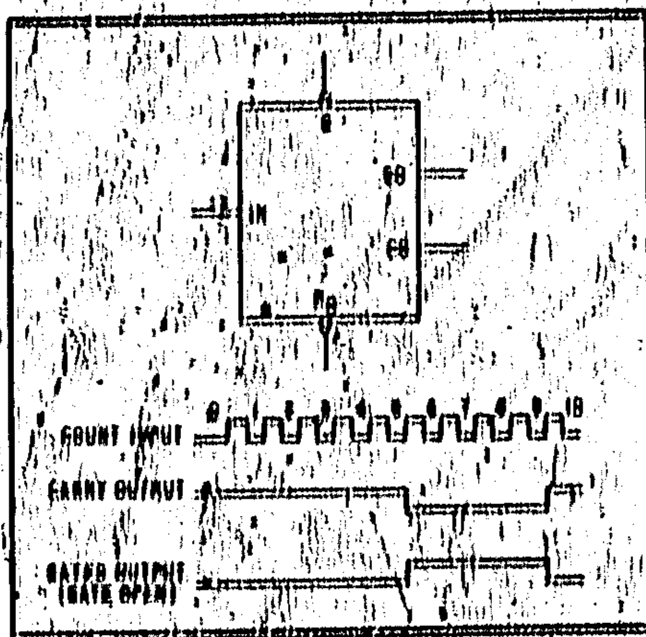
Table 4-1. Truth Table

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.

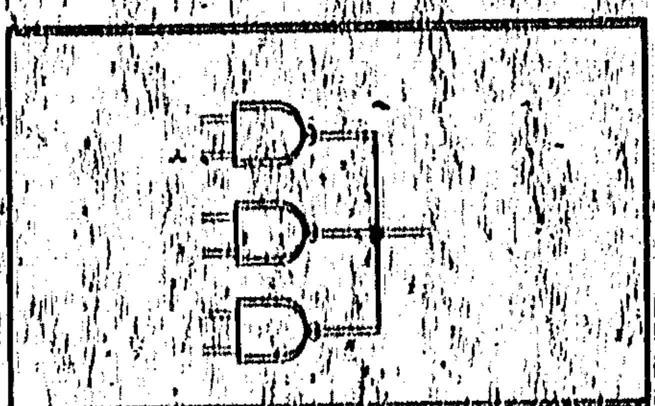
Figure 4-3. Time-Base Decade 1820-0418



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 1820-0327



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	V_H (Min)	V_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

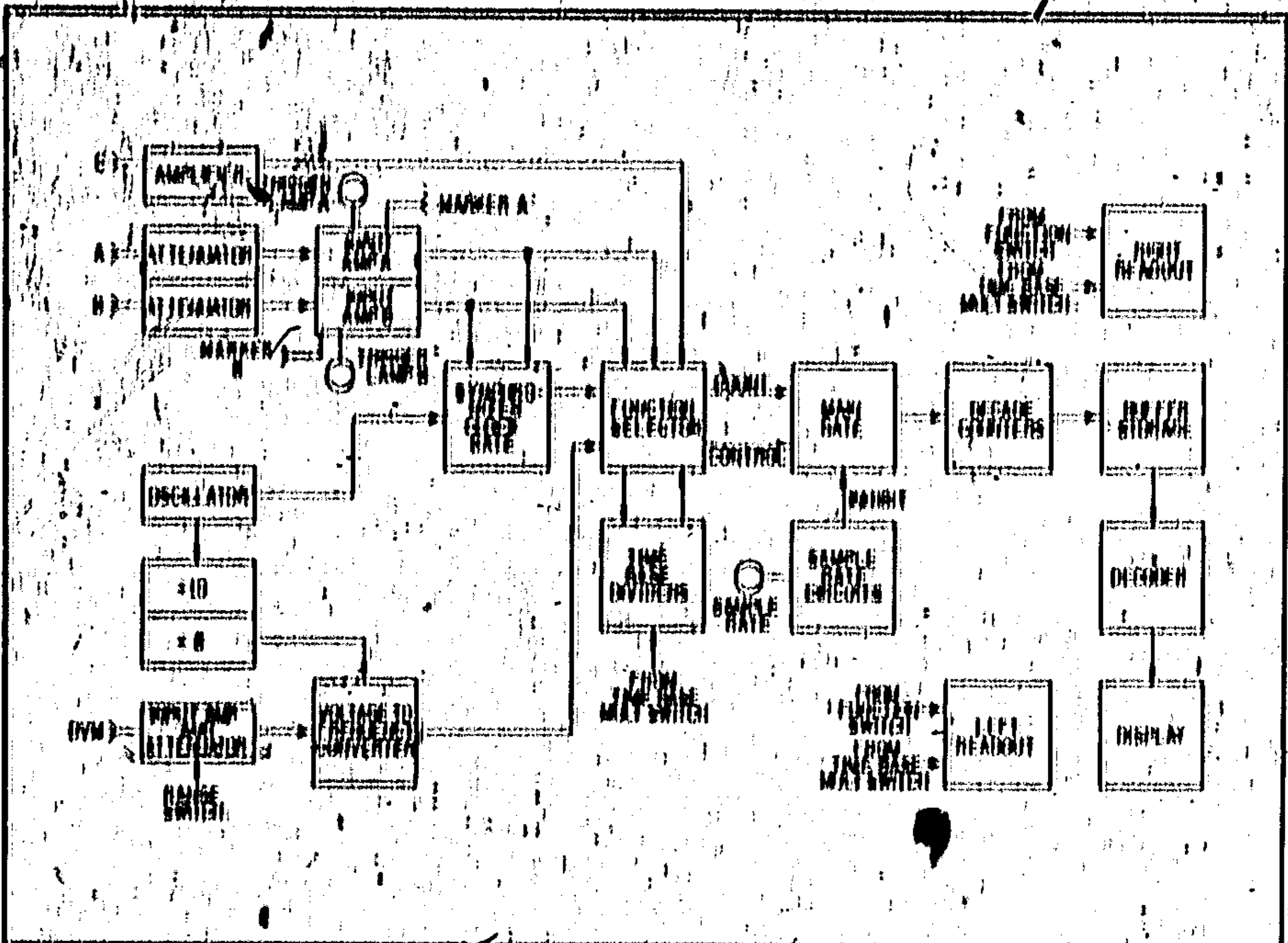
4-17. OVERALL COUNTER OPERATION

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.

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 cycles 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^{-7} 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 10^8, 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 8-24 for timing diagrams and a technical description.

4-30. DVM Mode (5328B)

4-31. The DVM input connects to voltmeter Input Amplifier A19 (Figure 4-12), which provides attenuation for the range selection. The output of A19 connects to Voltage-to-Frequency Converter A18. 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

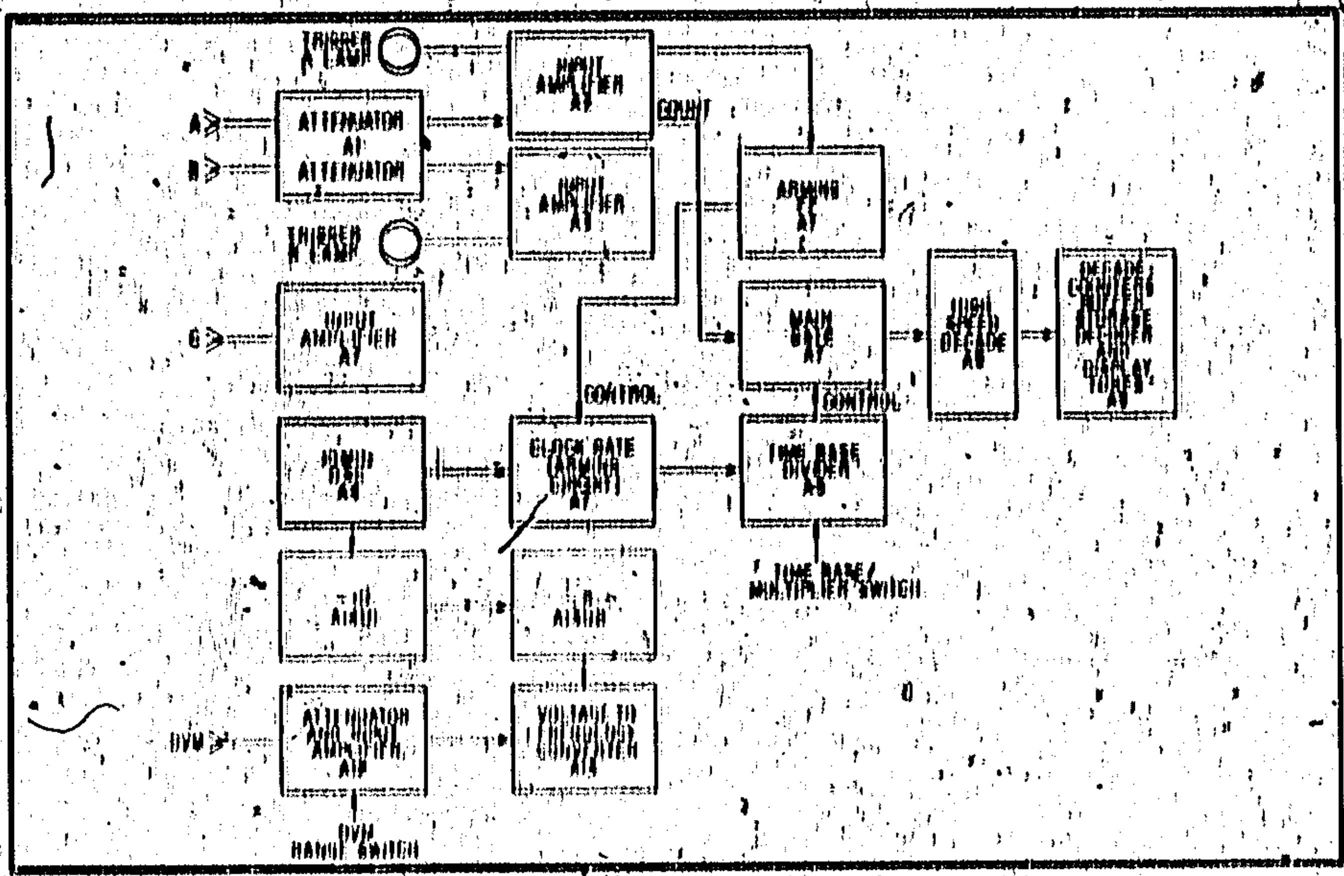


Figure 4-7. Frequency C Mode Flow Diagram

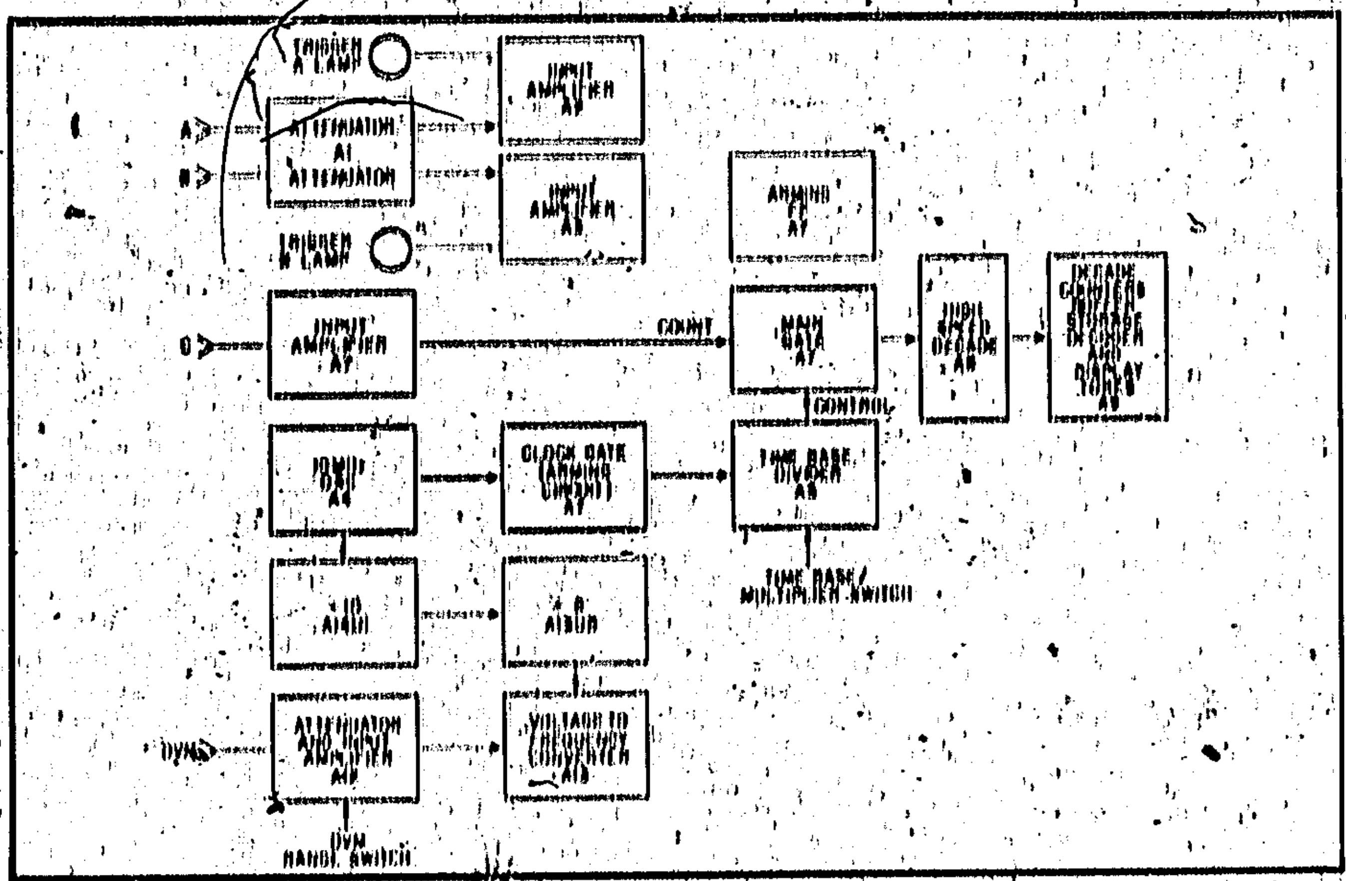


Figure 4-8. Period Mode Flow Diagram

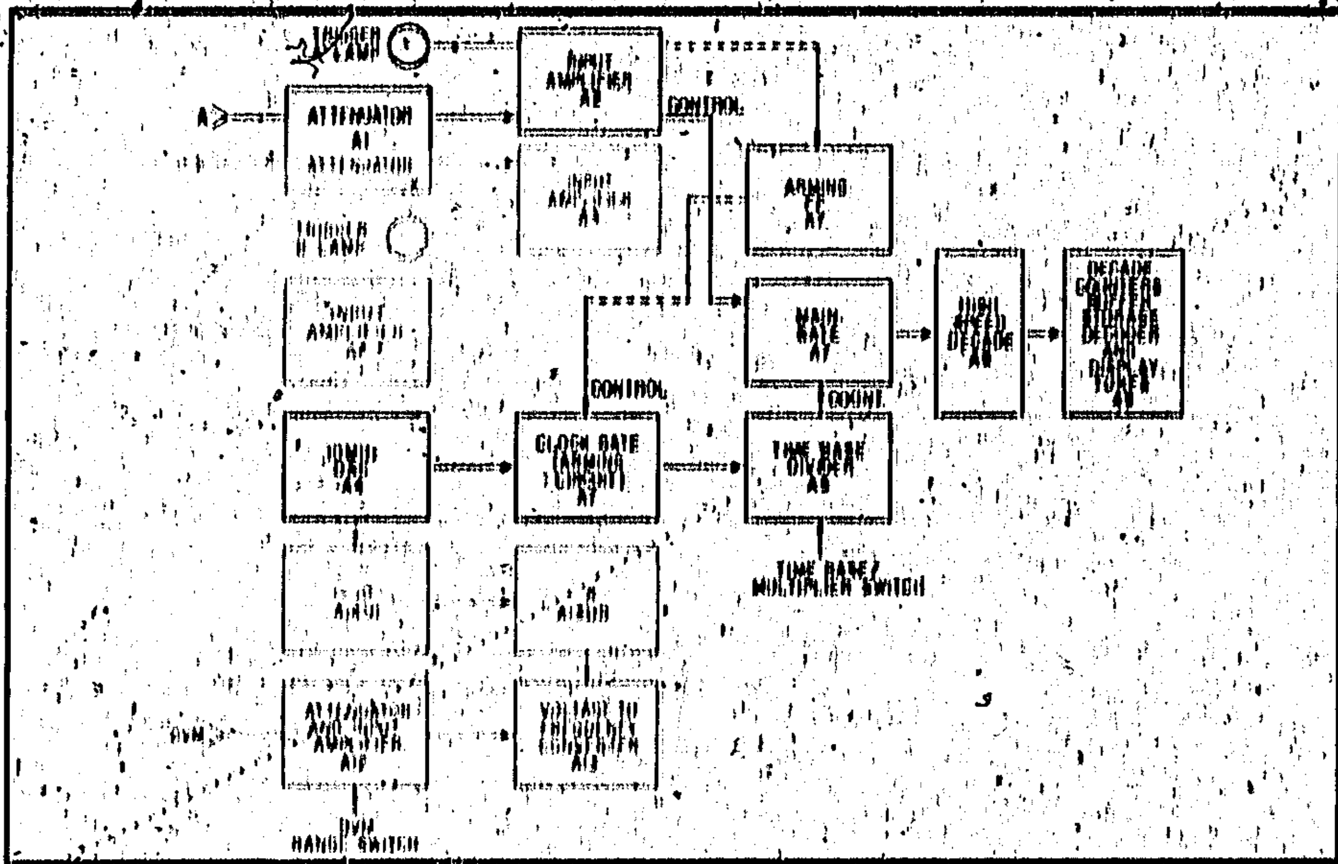


Figure 4-9. Period Average Mode Flow Diagram

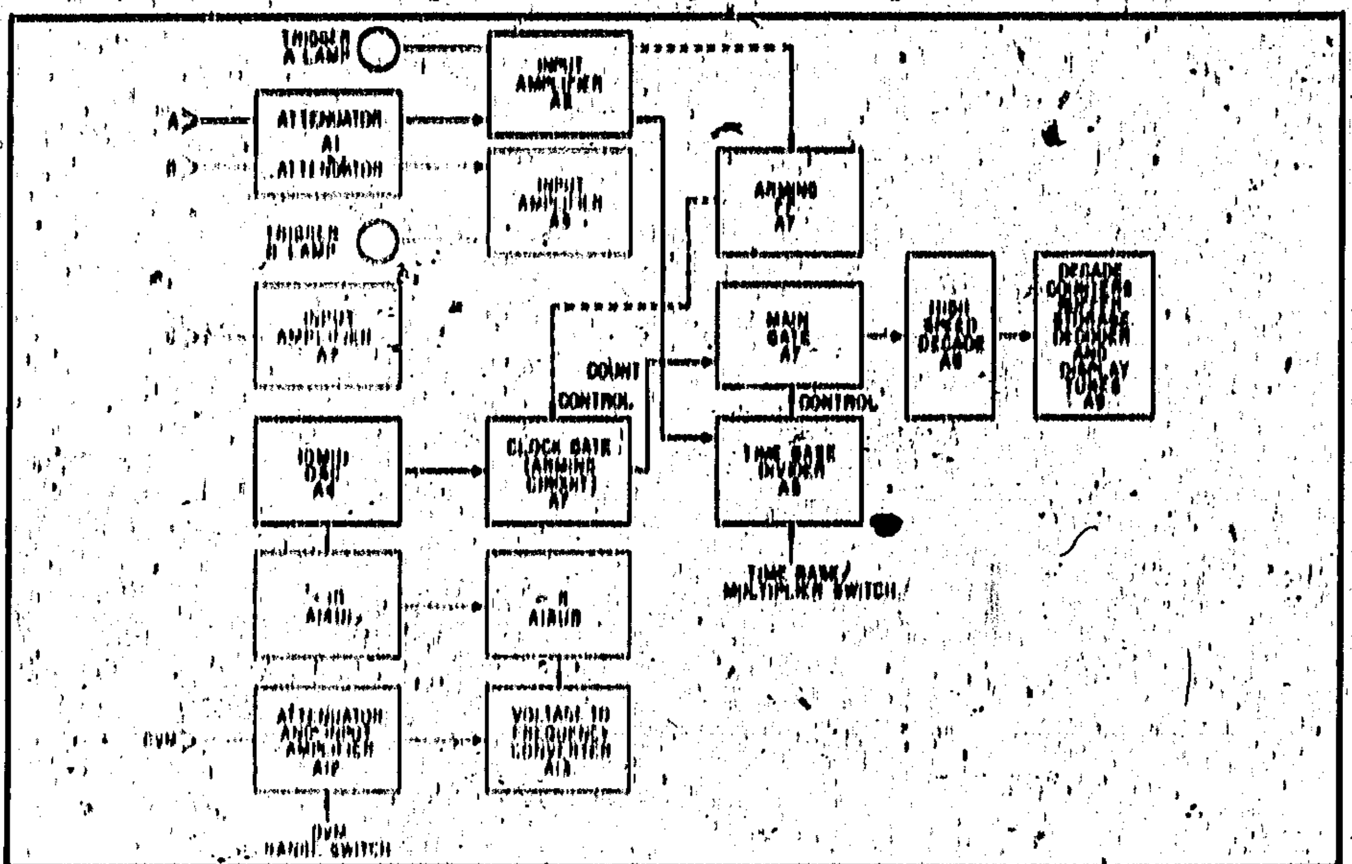


Figure 4-10. Time Interval Mode Flow Diagram

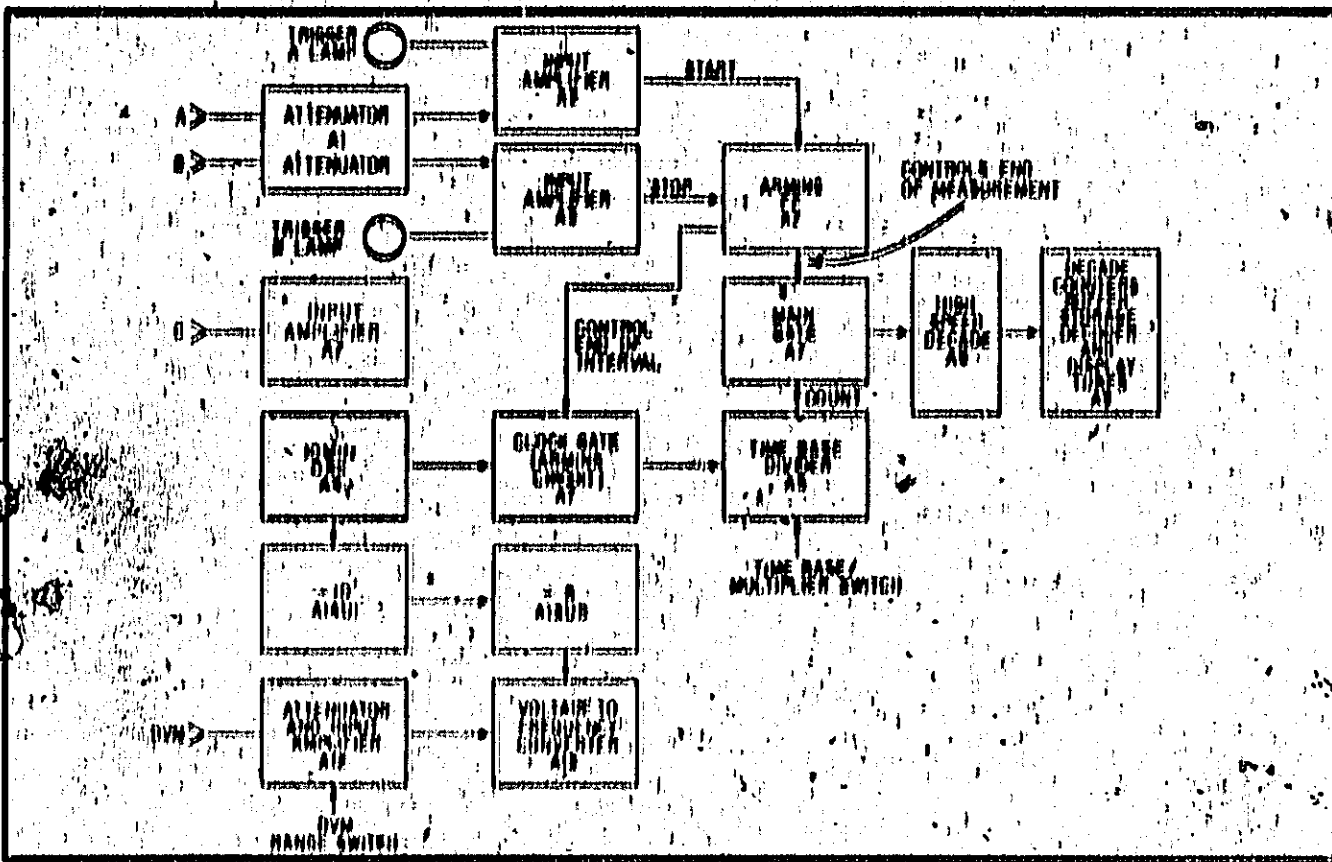


Figure 4-11. Time Interval Average Mode Flow Diagram

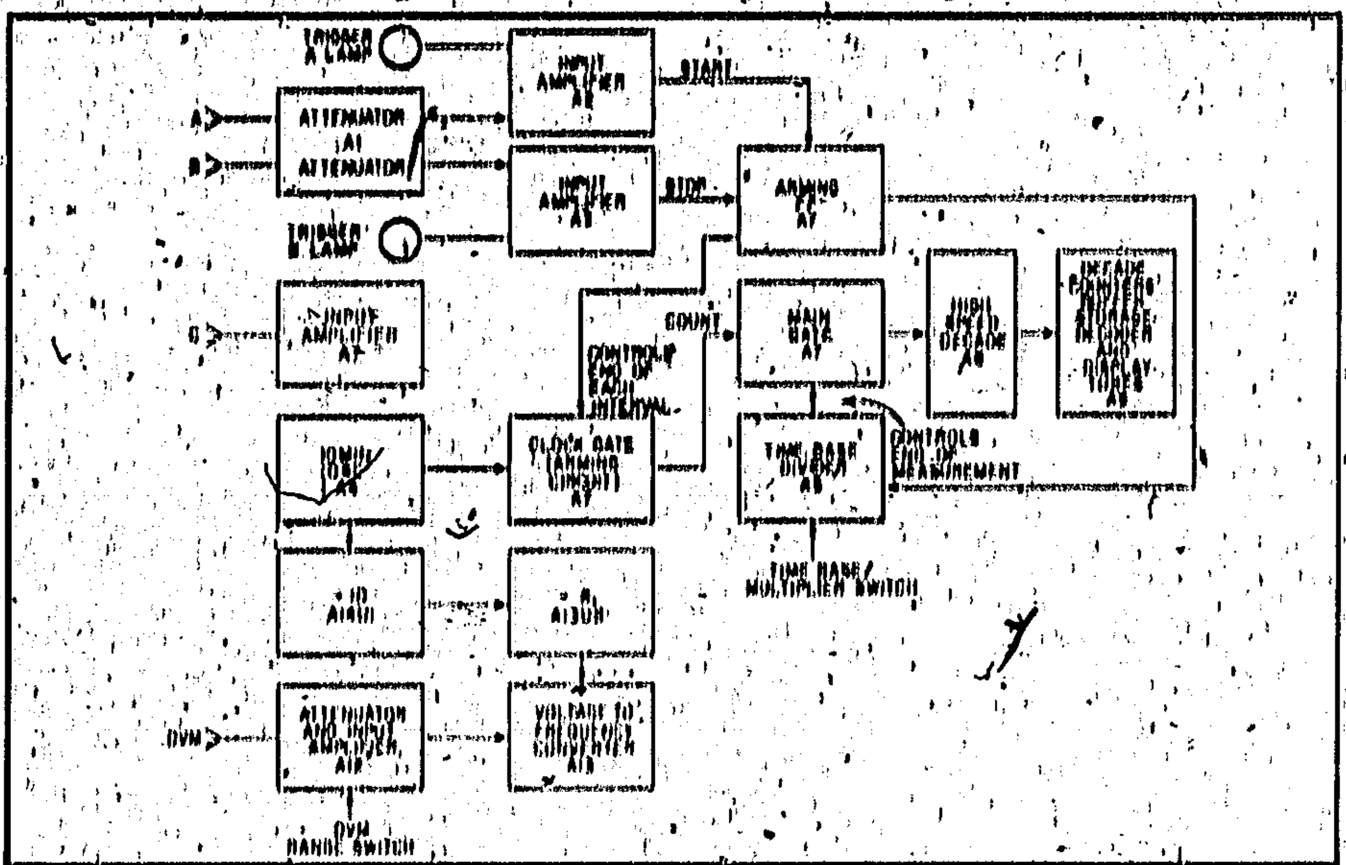


Figure 4-12. DVM Mode Flow Diagram

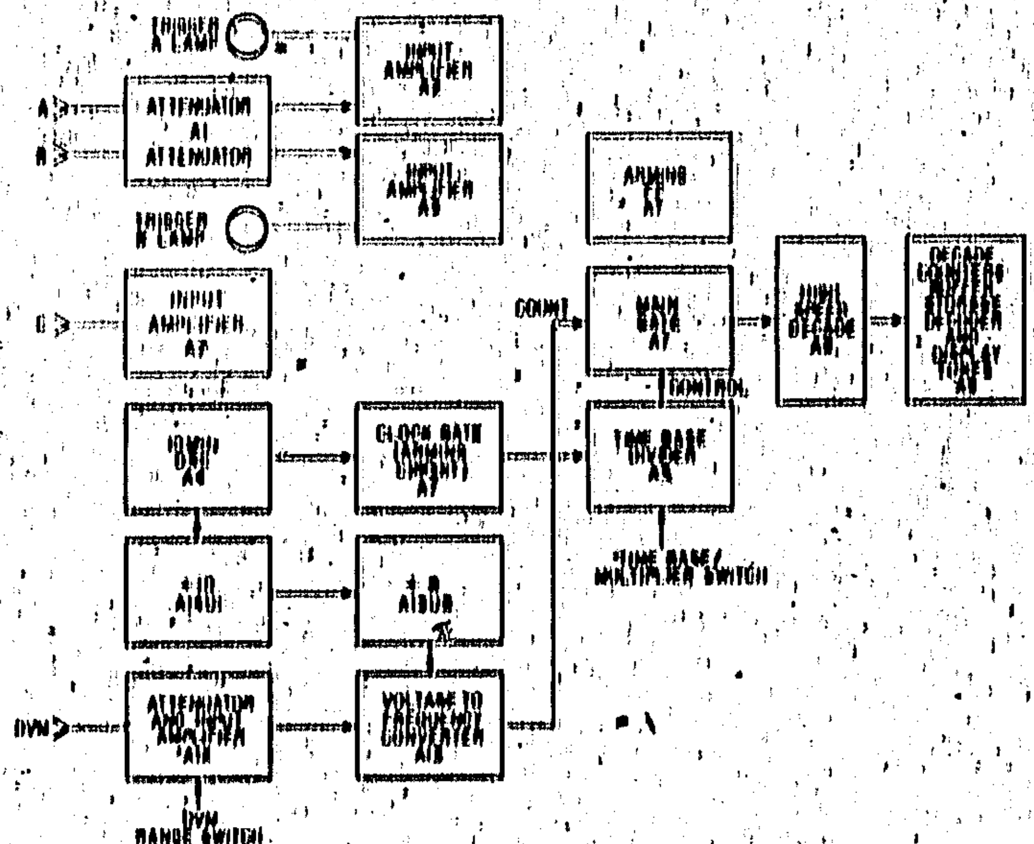
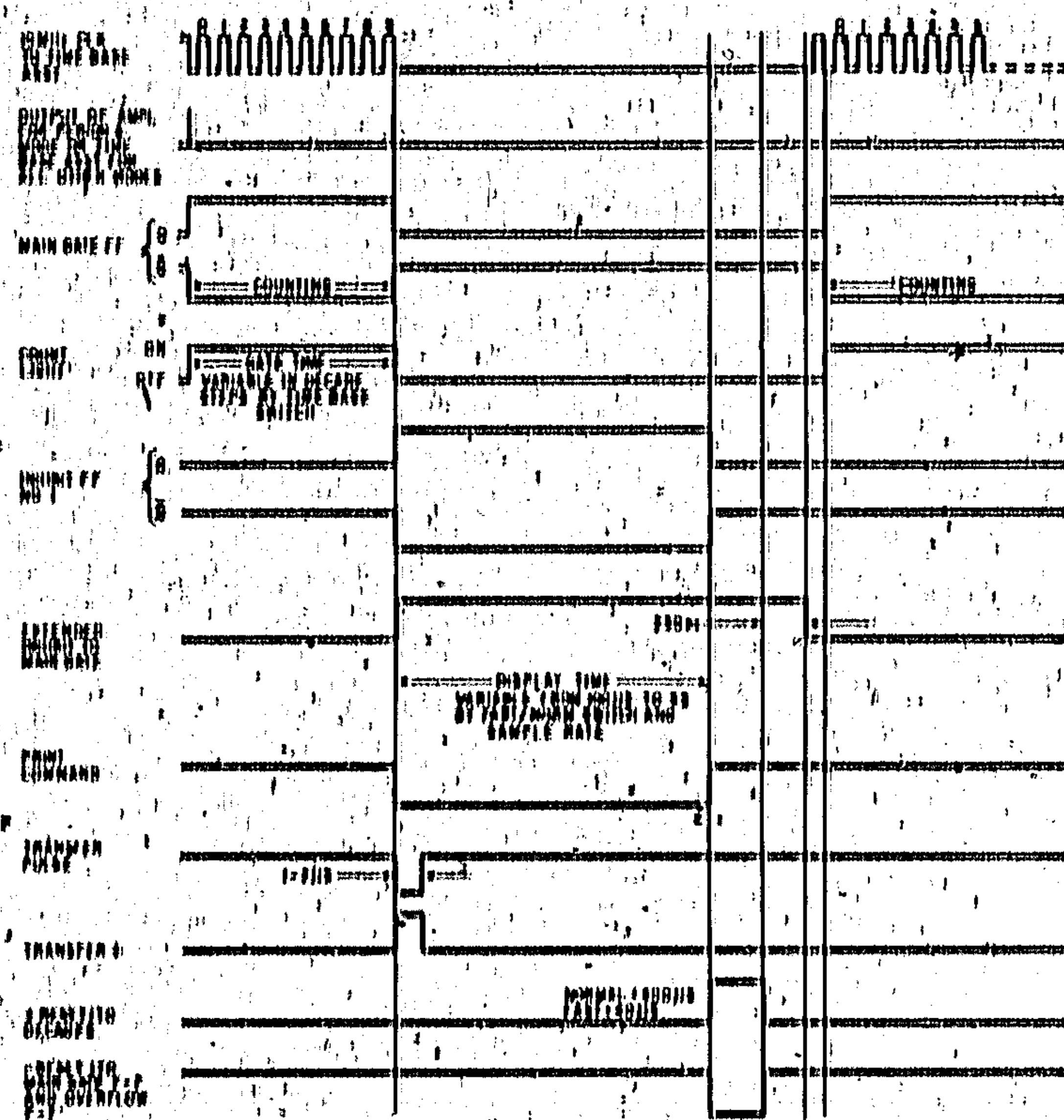


Figure 4-13. 5020A/B Timing Diagram



SECTION V

MAINTENANCE

5-1. INTRODUCTION

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

Table 5-1. Assembly Identification

Assy	Name	HP Part No.	
		5326A	5326B
A1	Attenuator	05326-60003	05326-60003
A2	Input Amplifier	05326-60004	05326-60004
A3	Input Amplifier	05326-60004	05326-60004
A4	Oscillator	05326-60002	05326-60002
A5	Time Base Control	05326-60005	05326-60005
A6	Sample Rate	05326-60013	05326-60013
A7A	Function Control	05326-60007	05326-60007
A7B	Function Control	05326-60024	05326-60024
A8	Display Support	05326-60009	05326-60009
A9	Display	05326-60008	05326-60008
A9	Display (Option 001)	05326-60025	05326-60025
A10	Right Readout	05326-60011	05326-60023
A11	Left Readout	05326-60010	05326-60022
A12	Voltmeter Input Amplifier	Not Used	05326-60016
A13	Voltmeter V-F Converter	Not Used	05326-60017
A14	DVM Logic	Not Used	05326-60015
A15	Regulator	05327-60020	05326-60001
A16	Interconnect	05326-60014	05326-60026

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.

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 A8, pin 10 is A8(10).

5-9. IN-CABINET PERFORMANCE CHECK

5-10. GENERAL. The performance check, Table 5-4, and test card can be used to verify proper operation of all circuits in 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 5-4), 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 which 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.

Table 5-2. Recommended Test Equipment

Instrument Type	Required Characteristics	Recommended Type
Frequency Standard	1 MHz Output	HP 107AR
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	5 Hz to 100 kHz at 100 mV rms	HP 202C
HF Signal Generator	50 kHz to 50 MHz at 3 V rms	HP 606B
Pulse Generator	10 MHz repetition rate, 5 ns pulse width, 0.5 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 SPF116 (115V), SPF216 (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 15 to 0 V print command	HP 5055A
DC Voltmeter	0 to 500 Vdc, 1 % accuracy	HP 412A
AC VTVM	0 to 300 Vac	HP 400F
RF Voltmeter	1 mV to 3 V	HP 3406A

5-14. ASSEMBLY LOCATION

5-15. Top internal, front and rear panel view of the Counter are shown in Section VIII. These show the location of the assemblies, connectors, and chassis parts.

5-16. REPAIR

5-17. Printed Circuit Component Replacement

5-18. Component lead holes in the circuit boards have plated-through walls to insure 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. The following replacement procedure is recommended:

a. Remove defective component.

b. Melt solder in component-lead holes. Use clean dry soldering iron to remove excess solder. Clean holes with a wooden toothpick or splinter. Do not use metal tool for cleaning as this may damage through-hole plating.

c. Bend leads of replacement component to the correct shape and insert into component-lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of the board, but do not apply excess pressure with soldering iron.

d. Through-hole plating breaks are indicated by separation of the round conductor pad from either side of the board. To repair breaks, press conductor pad against board and solder replacement component lead to conductor pad on both sides of board.

5-19. Replacing Integrated Circuits

5-20. Following are two recommended methods of replacing integrated circuits:

a. SOLDER GOBBLER. This is the best method. Solder is removed from the board by a hollow tip soldering iron connected to a vacuum source. This IC is removed intact, so it may be reinstalled if found to be operative.

b. CLIP OUT. This method should be used as a last resort only. Clip the leads as close to the case as possible. With a soldering iron and longnose pliers, carefully remove the wires from each hole. Clean holes as described in Paragraph 5-18b.

5-21. ADJUSTMENTS

5-22. The adjustments in Table 5-5 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 5-4 (In Cabinet Performance Checks).

5-23. TROUBLESHOOTING

5-24. The following paragraphs give overall troubleshooting procedures to isolate trouble to a particular pc assembly.

5-25. TROUBLE AT TURN ON. If the Counter does not operate when power is applied, (no display, no decimal point, and no measurement units*) make the following checks:

a. Line voltage switch must be set to correct voltage (115 V 230 V as appropriate).

b. Power cord plugged into Counter and ac power outlet.

c. Line fuse good.

d. AC power on at outlet.

*At least the right zero digit should be on regardless of front panel control setting if power is ON.

5-26. COUNTER QUICK CIRCUIT CHECKS. Make the following quick checks if the Counter does not operate.

a. Remove the top and bottom covers. Set the Counter controls as follows:

FUNCTION	FREQ A
TIME BASE	1 µs
SAMPLE RATE	Counterclockwise but ON
FAST/NORM/HOLD	FAST
CHANNEL A and B ATTEN	X1
AC-DC	AC
LEVEL	PRESET
CHECK-SEP-COM	CHECK
STORAGE	ON
INT-EXT OSC	INT

b. Connect Counter power cord to correct ac outlet.

c. Continue with the quick checks that follow to locate which assembly a trouble is in.

5-27. POWER SUPPLY QUICK CHECKS.

a. Turn SAMPLE RATE knob clockwise.

b. Measure +175 Vdc at pin 1 of A15. If this voltage is not correct, refer to A15-A16 schematic diagram.

c. Measure +5 Vdc at the collector (metal tab) of Q1 and -5 V at the collector of Q2. If this voltage is not correct, refer to the A15-A16 schematic diagram.

d. Measure +16.5 Vdc at P1 on A15, -16.5 Vdc at P2 on A15. These pins are the large projections on the foil side of A15. If these voltages are not correct, refer to A15-A16 schematic diagram.

5-28. A4 OSCILLATOR QUICK CHECKS. Check the output of the oscillator at the rear panel OSC connector with an oscilloscope. If the 10 MHz signal is not present, refer to A4 schematic diagram and troubleshooting procedure.

5-29. A7 FUNCTION CONTROL QUICK CHECKS.

a. With oscilloscope, check pin T of A7A for 10 MHz signal.

b. Check pin 7 for 10 MHz signal. If the 10 MHz signal is at pin T, but is not at pin 7, refer to A7 Function Control schematic diagrams. If the signal is not at pin T, check the oscillator signal flow through gates U3A and U3B on A5.

5-30. A5 TIME BASE QUICK CHECKS.

a. Change FUNCTION to START.

b. With oscilloscope, check for 10 MHz at TIME BASE OUT BNC.

c. Set TIME BASE/MULTIPLIER switch to 10⁹. Using HP 10525A Logic Probe check for low every 10 seconds at the TIME BASE OUT BNC.

d. If the signal is absent at either of the above two steps, check for 10 MHz at pin 14 of A5 using oscilloscope. If present there but absent in steps c or d, refer to A5 schematic and troubleshooting. If absent at pin 14, refer to A7 schematic.

5-31. Decimal Point and Annunciator Troubleshooting

5-32. To troubleshoot these circuits, compare readout with Table 5-6 and check the logic levels of the gates and drivers on A8, A10, A11, and A14 for the DVM decimal points, as per the Boolean equations on the schematics.

5-33. A7 Troubleshooting

5-34. Table 5-8 lists ECL logic levels present at the interconnect jack of A7A and A7B ($H \geq -0.85$ V, $L \leq -1.50$ V). If trouble exists in the Function Control assembly A7, check the logic levels for the various functions as given in Table 5-8. Any discrepancy found indicates trouble on A7B. If logic levels are correct, install A7B in the service position and check the signal flow in A7A as per the Boolean equations shown on the schematic.

Table 5-3. A7 Logic Levels

Pin No.	STOP	START	PER AVG	T.I. AVG	T.I.	PER	FREQ A	FREQ C	READ A, B DVM
B15									
B14									
B13									
B12									
B11	L	L	H	H	L	L	L	L	L
B10	*	*	*	*	*	*	*	*	*
B9	L	L	L	L	L	L	H	H	H
B8	H	L	H	H	L	H	H	H	H
B7									
B6									
B5									
B4									
B3									
B2	**	**	**	**	**	**	**	**	**
B1									
A15									
A14	H	H	H	L	H	H	H	H	H
A13	H	H	L	L	H	H	H	H	H
A12	H	H	H	H	H	H	H	H	L
A11									
A10									
A9	H	H	H	H	L	L	L	L	L
A8	L	L	L	L	H	H	L	L	L
A7	H	H	H	H	H	H	L	H	H
A6	L	L	L	H	H	H	H	H	H
A5	H	H	H	H	H	H	H	L	H
A4	L	H	L	L	H	L	L	L	L
A3	H	H	H	H	L	L	H	H	H
A2	H	H	H	L	L	H	H	H	H
A1	L	L	L	L	L	L	L	H	H

* H for CHECK, L otherwise
** L for CHECK, H otherwise

NOTE
Levels are measured at interconnect jack of A7A and A7B.

Table 5-4. 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 $< \pm 2.5$ parts in 10^6.

Table 5-4. 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 > 0.4 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 5-1. Record on test card.

3. FREQUENCY RESPONSE AND SENSITIVITY

<u>CHANNEL A</u>

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. Steps k through n are for 5326B models only. 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.

o. Disconnect test Oscillator from CHANNEL A input and connect it to INPUT C jack.

p. Set HP Signal Generator output for 50 MHz at 100 mV rms. Set FUNCTION selector to FREQ C and TIME BASE/MULTIPLIER to .1 s.

q. Check that Counter display 50000.00 kHz ± 1 count ± time base error.

Table 5-4. In-Cabinet Performance Check (Continued)

r. Set Audio Oscillator to 9 Hz at 50 mV rms. Check that Counter displays 9 Hz ± 1 count ± time base error. 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)	DC
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 0.5 volts peak-to-peak indication on oscilloscope.

d. Check that counter displays the repetition rate, gate 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.

f. Check that counter displays repetition rate and gate 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 4a, 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 5-4. 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)	DC
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

$$\pm 1\ \text{ns} \pm \frac{\text{trigger error} \pm 100\ \text{ns}^{**}}{\sqrt{\text{number of intervals averaged}}}$$

7. TOTALIZE

a. Set counter controls as follows:

FUNCTION	START
MULTIPLIER	1
CHK-SEP-COM	CHK

b. Check that display totalizes, gate light (G) 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% points. 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 5-4. In-Cabinet Performance Check (Continued)

8. RATIO

a. Set counter controls as follows:

FUNCTION	FREQ A
MULTIPLIER	10^0
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 10^3. Display should be ratio of two input frequencies X 10^3 (approximately 10^6). 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 ccw

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 rotate SAMPLE RATE fully clockwise. Verify that the time between flashes of the gate (G) 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 8-4. In-Cabinet Performance Check (Continued)

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/MULTIPLIER .... 0.1 s
RANGE .... 10 V

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 100 V. 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 1000 V. 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 10 V. Counter display should be 19.500 ± 1 count.

i. Set Voltage Standard for 19.400 volt output. Counter display should be 19.400 ± 7 counts.

j. Connect a 1 Meg 1/4W 1% resistor in series with the red DVM INPUT jack.

k. Set Voltage Standard for 10 volts output. Counter display should be 9.990 ± 17 counts.

l. Set RANGE switch to 100 V. Counter display should be 9.99 V ± 22 counts.

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

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

Table 5-4. In-Cabinet Performance Check (Continued)

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(46). Observe oscilloscope display a print command (drop from +2.4 V to +0.4 V) immediately after the G lamp goes out.

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

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

e. Verify proper output by connecting a 5055A printer to 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 5-5. 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 Fuse F1 and adjust A15R10 for +16.5 volts.

d. Connect VTVM to A15 Fuse F2 and adjust A15R13 for -16.5 volts.

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 50-ohm 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 A	X1
AC-DC A	DC
LEVEL A	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 symetrical 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. V TO F CONVERTER AND ATTENUATOR A12, A13 (5326B ONLY)

a. Set Counter controls as follows:

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

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

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

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

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

f. Reverse polarity of the DC Standard.

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

h. Set Counter RANGE switch to 100V.

i. Set DC Standard for +100 Volt output.

j. On Voltmeter Input Amplifier Assembly, adjust A12R21 ("100V" 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 volts ±2 counts and -100.000 volts ±2 counts.

Table 5-5. Adjustments (Continued)

l. Set Counter Range switch to 1000V.

CAUTION

DO NOT REVERSE POLARITY OF VOLTAGE STANDARD WHEN 900 VOLTS IS APPLIED. DAMAGE TO THE VOLTAGE STANDARD MAY OCCUR.

m. Set DC Standard for +900 volts output.

n. On A12, adjust R24 (1000v pot) for +900.00 ±2 counts on display.

4. OSCILLATOR A4

NOTE

This adjustment must be made with the top and bottom covers in place.

a. Connect 1 MHz Frequency Standard to INPUT 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. 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 instruments without Option 001 the Counter display will overflow; however all digits are valid.

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

Function Switch	Multiplier Switch	p	μ	m	s	*	k	M	Hz	V	10^5	Decimal				
												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. D.P. and Annunciator Troubleshooting (Continued)

Function Switch	Multiplier Switch	n	μ	m	s	*	k	M	Hz	V	10^5	10^4	Decimal 10^3	10^2	10^1	10^0
Freq. A	1					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	1					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			
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															
	10^5									x					10v	100v
	10^6									x				10v	100v	1000v
	10^7									x			10v	100v	1000v	
	10^8															

PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 5326A/B
Timer Counter-DVM
Serial No. ______ - ______

Test Performed by ______

Date ______

Description	Check
1. TIME BASE STABILITY AND OUTPUT	
Aging Rate: < 3 parts in 10^7/month	______
Line Voltage: < 1 part in 10^7 for 10% line variation	______
Temperature: <±2.5 parts in 10^6, 0 to 50 C	______
Output: 10 MHz, > 2.4 volts p-p	______
2. DISPLAY, DECIMAL POINTS, AND DIVIDERS	
As per self check procedures, Table 3-3	______
3. FREQUENCY RESPONSE AND SENSITIVITY	
Frequency Range: 0 to 50 MHz	______
Sensitivity: 0.1V rms sine wave	______
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 (5326B): +3.0 to -3.0V DVM readout	______
Read B Level (5326B): +3.0 to -3.0V DVM readout	______
Frequency C Input: 0 to 50 MHz, 50 mV rms	______
4. PULSE OPERATION	
CHANNEL A	
Sensitivity: .3 volts p-p	______
Pulse width: 15 nsec	______
CHANNEL C	
Sensitivity: 150 mV p-p	______
Pulse width: 10 ns minimum	______
5. PERIOD AND PERIOD AVERAGE	
Frequency Range: 0 to 10 MHz	______
6. TIME INTERVAL AND TIME INTERVAL AVERAGE	
Time Interval Range: 0.1 s to 10^9 sec	______
Time Interval Avg Range: 15 ns to 10	______
7. TOTALIZE	
Range: 0 to 10 MHz	______
Output: rear panel TIME BASE BNC	______
Factor: 1-10^8 in decade steps	______
8. RATIO	
Range Channel A: 0 to 50 MHz	______
Range External Input: 100 Hz to 10 MHz	______

PERFORMANCE CHECK TEST CARD

Description	Check
9. GATE OUTPUT AND SAMPLE RATE	
Output: >2.4V p-p	______
Gate Open: low output	______
Gate Closed: high output	______
10. DIGITAL VOLTMETER	
10 volt range	______
100 volt range	______
1000 volt range	______
12.490 V check	______
10 V impedance check	______
100 V impedance check	______
11. DIGITAL RECORDER	
Code: 4-line 1248 BCD "1" state high	______
Print Command: +5V to 0V	______
Inhibit Input: +5V	______

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

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

a. Description of part (see abbreviations below).

b. Typical manufacturer of the part in a five-digit code.

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 or 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 bulb, photocell, etc.
BT	= battery	IC	= integrated circuit	Q	= transistor		
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, network
E	= misc electronic part	MK	= microphone	TP	= test point		

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	HR	= hour(s)				
BE CU	= beryllium copper	HZ	= hertz	NPN	= negative-positive-negative	S-B	= slow-blow
BH	= binder head					SCR	= screw
BP	= bandpass	IF	= intermediate freq	NRFR	= not recommended for field replacement	SE	= selenium
BRS	= brass	IMPG	= impregnated			SECT	= section(s)
BWO	= backward wave oscillator	INCD	= incandescent	NSR	= not separately replaceable	SEMICON	= semiconductor
		INCL	= include(s)			SI	= silicon
CCW	= counter-clockwise	INS	= insulation(ed)			SIL	= silver
CER	= ceramic	INT	= internal	OBD	= order by description	SL	= slide
CMO	= cabinet mount only			OH	= oval head	SPG	= spring
COEF	= coefficient	K	= kilo = 1000	OX	= oxide	SPL	= special
COM	= common	LH	= left hand	P	= peak	SST	= stainless steel
COMP	= composition	LIN	= linear taper	PC	= printed circuit	SR	= split ring
COMPL	= complete	LK WASH	= lock washer	PF	= picofarads = 10^{-12} farads	STL	= steel
CONN	= connector	LOG	= logarithmic taper			TA	= tantalum
CP	= cadmium plate	LPF	= low pass filter	PH BRZ	= phosphor bronze	TD	= time delay
CRT	= cathode-ray tube			PHL	= Phillips	TGL	= toggle
CW	= clockwise	M	= milli = 10^{-3}	PIV	= peak inverse voltage	THD	= thread
		MEG	= meg = 10^{6}	PNP	= positive-negative-positive	TI	= titanium
DEPC	= deposited carbon	MET FLM	= metal film			TOL	= tolerance
DR	= drive	MET OX	= metallic oxide	P/O	= part of	TRIM	= trimmer
ELECT	= electrolytic	MFR	= manufacturer	POLY	= polystyrene	TWT	= traveling wave tube
ENCAP	= encapsulated	MHZ	= mega hertz	PORC	= porcelain		
EXT	= external	MINAT	= miniature	POS	= position(s)	U	= micro = 10^{-6}
F	= farads	MOM	= momentary	POT	= potentiometer	VAR	= variable
FH	= flat head	MOS	= metal oxide substrate	PP	= peak-to-peak	VDCW	= dc working volts
FIL H	= fillister head	MTG	= mounting	PT	= point		
FXD	= fixed	MY	= "mylar"	PWV	= peak working voltage	W/	= with
						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	= ground(ed)	NI PL	= nickel plate			W/O	= without

01194-14

Table 6-1. Reference Designation Index

Reference Designation	⊕ Part No.	Description #	Note
A1	05326-60003	ATTENUATOR ASSY (5326A/B)	
	05326-26003	BOARD:BLANK PC	
A1C1	0160-2244	C:FXD CER 3.0 0.25 PF 500VDCW	
A1C2	0160-0939	C: FXD MICA 430 PF 5% 300 VDCW	
A1C3	0160-0378	C:FXD MICA 27PF 5%	
A1C4	0160-0161	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C5	0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	
A1C6	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C7	0160-2197	C:FXD MICA 10 PF 5%	
A1C8	0160-2146	C:FXD CER 0.02 UF +80-20% 100VDCW	
A1C9	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C10	0160-2244	C:FXD CER 3.0 0.25 PF 500VDCW	
A1C11	0160-0939	C: FXD MICA 430 PF 5% 300 VDCW	
A1C12	0160-0378	C:FXD MICA 27PF 5%	
A1C13	0160-0161	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C14	0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	
A1C15	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C16	0160-2197	C:FXD MICA 10 PF 5%	
A1C17	0160-2146	C:FXD CER 0.02 UF +80-20% 100VDCW	
A1CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A1CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A1CR3	1901-0376	DIODE:SILICON 35V	
A1CR4	1901-0376	DIODE:SILICON 35V	
A1CR5		NOT ASSIGNED	
A1CR6	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1CR7	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1CR8		NOT ASSIGNED	
A1CR9	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A1CR10	1901-0376	DIODE:SILICON 35V	
A1CR11	1901-0376	DIODE:SILICON 35V	
A1CR12		NOT ASSIGNED	
A1CR13	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1CR14	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1DS1	2140-0047	LAMP:NEON GLOW 0.8MA	
A1DS2	2140-0047	LAMP:NEON GLOW 0.8MA	
A1J1	1251-0472	CONNECTOR:PC 12 CONTACTS	
A1J2	1251-0472	CONNECTOR:PC 12 CONTACTS	
A1J3	1250-1163	CONNECTOR:RF BNC INPUT	
A1J4	1250-1163	CONNECTOR:RF BNC INPUT	
A1Q1	1855-0334	Q:FET DUAL N-CHAN	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A1Q2	1855-0334	Q:FET DUAL N-CHAN	
A1R1	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A1R2	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A1R3	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A1R4	0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	
A1R5	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R6	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R7	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R8	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A1R9	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R10	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R11	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A1R12	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R13	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R14	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R15	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R16	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A1R17	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A1R18	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A1R19	0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	
A1R20	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R21	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R22	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R23	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A1R24	2100-2905	R:VAR CERMET 10K OHM 10% LIN	
A1R25	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R26	2100-2905	R:VAR CERMET 10K OHM 10% LIN	
A1R27	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R28	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A1R29	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R30	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R31	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1R32	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1R33	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1R34	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1S1	3101-1313	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	
A1S2	3101-1279	SWITCH:SLIDE DP 3 POSITIONS	
A1S3	3101-1279	SWITCH:SLIDE DP 3 POSITIONS	
A1S4	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	
A1S5	3101-1278	SWITCH:SLIDE DPDT	
A1S6	3101-1278	SWITCH:SLIDE DPDT	
A1S7	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	
A1S8		NSR PART OF R24	
A1S9		NSR PART OF R26	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A2	05326-60004	INPUT AMPLIFIER ASSY(5326A/B)	
A2C1	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2C2	0180-0127	C:FXD CER 1.0 UF 20% 25VDCW	
A2C3	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2C4	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A2C5	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A2C6	0160-0153	C:FXD MY 0.001 UF 10% 200VDCW	
A2C7	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A2C8	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A2C9	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2C10	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2CR1	1902-0049	DIODE:BREAKDOWN 6.19V 5%	
A2CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A2CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A2CR4	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A2CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A2L1	9140-0144	COIL:FXD RF 4.7 UH	
A2L2	9100-2255	COIL/CHOKE 0.47 UH 10%	
A2L3	9140-0144	COIL:FXD RF 4.7 UH	
A2L4	9140-0144	COIL:FXD RF 4.7 UH	
A2L5	9100-2255	COIL/CHOKE 0.47 UH 10%	
A2L6	9140-0144	COIL:FXD RF 4.7 UH	
A2L7	9140-0144	COIL:FXD RF 4.7 UH	
A2L8	9140-0142	COIL:FXD RF 2.2 UH	
A2L9	9140-0144	COIL:FXD RF 4.7 UH	
A2L10	9140-0144	COIL:FXD RF 4.7 UH	
A2Q1	1854-0092	Q:SI NPN	
A2Q2	1853-0015	Q:SI PNP	
A2Q3	1853-0015	Q:SI PNP	
A2Q4	1854-0345	Q:SI NPN	
A2Q5	1854-0345	Q:SI NPN	
A2Q6	1853-0015	Q:SI PNP	
A2Q7	1853-0015	Q:SI PNP	
A2Q8	1854-0092	Q:SI NPN	
A2Q9	1853-0015	Q:SI PNP	
A2Q10	1853-0015	Q:SI PNP	
A2Q11	1853-0015	Q:SI PNP	
A2Q12	1853-0015	Q:SI PNP	
A2Q13	1853-0015	Q:SI PNP	
A2Q14	1854-0092	Q:SI NPN	
A2Q15	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A2Q16	1854-0092	Q:SI NPN	
A2Q17	1854-0092	Q:SI NPN	
A2Q18	1854-0368	Q:SI NPN	
A2Q19	1854-0092	Q:SI NPN	
A2Q20	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊛ Part No.	Description #	Note
A2R1	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A2R2	2100-2520	R:VAR CERMET 50 OHM 20% TYPE V 1/2W	
A2R3	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A2R4	0683-2405	R:FXD COMP 24 OHM 5% 1/4W	
A2R5	0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	
A2R6	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R8	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R9	0698-3113	R:FXD COMP 100 OHM 5% 1/8W	
A2R10	0698-3381	R:FXD COMP 150 OHM 5% 1/8W	
A2R11	0698-5175	R:FXD COMP 360 OHM 5% 1/8W	
A2R12	0698-3379	R:FXD COMP 68 OHM 5% 1/8W	
A2R13	0698-3375	R:FXD COMP 33 OHM 5% 1/8W	
A2R14	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A2R15	0698-5180	R:FXD COMP 2K OHM 5% 1/8W	
A2R16	0698-5175	R:FXD COMP 360 OHM 5% 1/8W	
A2R17	0698-3381	R:FXD COMP 150 OHM 5% 1/8W	
A2R18	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R19	0698-3113	R:FXD COMP 100 OHM 5% 1/8W	
A2R20	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R21	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A2R22	0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	
A2R23	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A2R24	2100-2521	R:VAR FLM 2000 OHM 10% LIN 1/2W	
A2R25	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A2R26	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R27	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R28	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A2R29	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A2R30	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A2R31	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A2R32	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A2R33	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A2R34	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A2R35	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A2R36	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R37	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A2R38	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R39	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A2R40	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A2R41	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A2R42	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R43	0683-3035	R:FXD COMP 30K OHM 5% 1/4W	
A2R44	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A2R45	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A2R46	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A2R47	0683-1065	R:FXD COMP 10M OHM 5% 1/4W	
A2R48	0683-2055	R:FXD COMP 2 MEGOHM 5% 1/4W	
A2R49, 50	0683-2715	R:FXD COMP 270 OHM 5% 1/4W	
A2U1	1820-0238	INTEGRATED CIRCUIT:DTL 2 INPUT NOR GATE	
A2U2	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A3		SAME AS A2:USE PREFIX A3	
A4	05326-60002	OSCILLATOR ASSY (5326A/B)	
	05326-20002	BOARD:BLANK PC	
A4C1	0160-0161	C:FXD MYLAR .01 µf 10%	
A4C2	0180-0197	C:FXD TANT 2.2 UF 10% 20VDCW	
A4C3	0121-0059	C:VAR CER 2-8 PF	
A4C4	0160-2264	C:FXD CER 20 PF 5% 500VDCW	
A4C5	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A4L1	9100-2276	COIL:FXD 100 UH 10%	
A4Q1	1850-0158	Q:GE PNP 2N2635	
A4R1	0698-4037	R:FXD MET FLM 46.4 OHM 1% 1/8W	
A4R2	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A4R3	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A4R4	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A4U1	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A4Y1	0410-0405	CRYSTAL:QUARTZ 10 MHZ	
A5	05326-60005	TIME BASE CONTROL ASSY (5326A/B)	
	05326-20005	BOARD:BLANK PC	
A5C1	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A5C2	0160-0127	C:FXD CER 1.0UF 20% 25 VDCW	
A5C3	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A5C4	0160-2150	C:FXD MICA 33 PF 5%	
A5C5	0160-2204	C:FXD MICA 100PF 5%	
A5CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A5Q1	1854-0092	Q:SI NPN	
A5Q2	1854-0092	Q:SI NPN	
A5Q3	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q4	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q5	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q6	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5R1	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A5R2	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A5R3	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A5R4	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R5	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A5R6	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R8	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R9	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R10	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A5R11	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A5R12	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R13	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R14	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R15	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R16	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R17	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R18	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A5R19	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A5R20	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A5R21	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A5U1	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U2	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U3	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U4	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U5	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A5U6	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U7	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U8	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U9	1820-0413	INTEGRATED CIRCUIT	
A5U10	1820-0174	INTEGRATED CIRCUIT:TTL HEX INVERTER	
A6	05326-60013	SAMPLE RATE ASSY (5326A/B)	
	05326-20013	BOARD:BLANK PC	
A6C1	0160-2201	C:FXD MICA 51 PF 5%	
A6C2	0160-0134	C:FXD MICA 220 PF 5%	
A6C3	0180-0228	C:FXD ELECT 22 UF 10% 15VDCW	
A6C4	0160-0166	C:FXD MY 0.068 UF 10% 200VDCW	
A6C5	0140-0193	C:FXD MICA 82 PF 5%	
A6C6	0160-0153	C:FXD MY 0.001 UF 10% 200VDCW	
A6C7	0160-2199	C:FXD MICA 30 PF 5%	
A6C8	0160-0153	C:FXD MY 0.001 UF 10% 200VDCW	
A6C9	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A6C10	0160-0161	C:FXD MICA .01 µF 2% 300VDCW	
A6C11	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A6C12	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A6CR1	1901-0040	DIODE: SILICON 30MA 30WV	
A6CR2	1901-0040	DIODE: SILICON 30MA 30WV	
A6CR3	1910-0016	DIODE: GERMANIUM 100MA/0.85V 60PIV	
A6CR4	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A6CR5	1901-0040	DIODE:SILICON 30MA 30WV	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A6CR6		NOT ASSIGNED	
A6CR7	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR8	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR9	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A6CR10	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR11	1901-0040	DIODE:SILICON 30MA 30WV	
A6Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q2	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q3	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q4	1854-0009	Q:SI NPN	
A6Q5	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q6	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q7	1854-0215	Q:SI NPN	
A6Q8	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q9	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q10	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q11	1854-0009	Q:SI NPN	
A6Q12	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q13	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6R1	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A6R2	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R3	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R4	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R5	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R6	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R7	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R8	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R9	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A6R10	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R11	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R12	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R13	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R14	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R15	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R16	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R17	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R18	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R19	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R20	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R21	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R22	0683-3915	R:FXD COMP 390 OHM 5% 1/4W	
A6R23	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R24	0683-6215	R:FXD COMP 620 OHM 5% 1/4W	
A6R25	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R26	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A6R27	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A6R28	0683-9115	R:FXD COMP 910 OHM 5% 1/4W	
A6R29	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R30	0683-2415	R:FXD COMP 240 OHM 5% 1/4W	
A6R31	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R32	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R33	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R34	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R35	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R36	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R37	0683-2045	R:FXD COMP 200K OHM 5% 1/4W	
A6R38	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R39	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R40	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R41	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R42	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A6R43	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
A6U1	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A6U2	1820-0272	INTEGRATED CIRCUIT:DIGITAL	
A6U3	1820-0068	IC:TTL TRIPLE 3-INPUT POS NAND GATE	
A6U4	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A6U5	1820-0328	IC:TTL QUAD 2-INPUT NOR GATE	
A6U6	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7A	05326-60007	FUNCTION SELECTOR ASSY (5326A/B)	
	05326-20007	BOARD:BLANK PC FOR 5326A INSTRUMENT ONLY	
A7C1	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A7C2	0160-0336	C:FXD MICA 100 PF 1%	
A7C3	0160-2930	C:FXD CER 0.01 UF +80 -20% 100 VDCW	
A7C4	0140-0145	C:FXD 22 PF 5% 500VDCW	
A7C5	0160-2205	C:FXD 120 PF	
A7CR1	1901-0651	DIODE:SILICON 3-JUNCTION STABISTOR	
A7CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A7J1	5060-0111	CONNECTOR	
A7L1	9140-0158	COIL:FXD RF 1 UH 10%	
A7Q1	1854-0009	Q:SI NPN	
A7Q2	1854-0009	Q:SI NPN	
A7Q3	1854-0009	Q:SI NPN	
A7R1	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R2	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R3	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A7R4	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R5	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R6	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A7R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7R8	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A7R9	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7R10	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A7R11	0683-8205	R:FXD COMP 82 OHM 5% 1/4W	
A7R12	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7R13	0683-2015	R:FXD COMP 200 OHM 5% 1/4W	
A7R14	0683-2015	R:FXD COMP 200 OHM 5% 1/4W	
A7R15	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A7R16	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A7R17	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A7R18	0683-7515	R:FXD COMP 750 OHM 5% 1/4W	
A7R19	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A7R20	0683-1025	R: FXD COMP 1000 OHM 5% 1/4W	
A7R21	0683-3005	R:FXD COMP 30 OHM 5% 1/4W	
A7R22	0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	
A7R23	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7U1	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7U2	1820-0440	INTEGRATED CIRCUIT	
A7U3	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A7U4	1821-0001	TRANSISTOR ARRAY:SI NPN	
A7U5	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A7U6	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7U7	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A7U8	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7U9	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7U10	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A7U11	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A7U12	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7B	05326-60024	FUNCTION SELECTOR ASSY (5326A/B)	
	05326-20024	BOARD:BLANK PC FOR 5326B INSTRUMENT ONLY	
A7 R1	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R2	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R3	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R4	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R5	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R6	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R7	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R8	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R9	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R10	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R11	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R12	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R13	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R14	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R15	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R16	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R17	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R18	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R19	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R20	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A7 R21	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R22	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R23	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R24	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R25	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R26	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R27	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 U1	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A7 U2	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U3	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U4	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U5	1820-0174	INTEGRATED CIRCUIT:TTL HEX INVERTER	
A7 U6	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U7	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A8	05326-60009	DISPLAY SUPPORT ASSY (5326A/B)	
	05326-20009	BOARD:BLANK PC	
A8C1	0160-2055	C:FXD CER 0.01 UF +80-10% 100VDCW	
A8C2	0160-2199	C: FXD MICA 30 PF 5% 300VDCW	
A8CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A8CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A8CR3	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A8CR4	1901-0040	DIODE: SILICON 30MA 30WV	
A8P1	1251-2035	CONN:PC 30(2X15) CONTACTS	
A8Q1	1854-0092	Q:SI NPN	
A8Q2	1854-0092	Q:SI NPN	
A8Q3	1854-0365	Q:SI NPN	
A8Q4	1854-0365	Q:SI NPN	
A8Q5	1854-0365	Q:SI NPN	
A8Q6	1854-0365	Q:SI NPN	
A8Q7	1854-0365	Q:SI NPN	
A8Q8	1854-0365	Q:SI NPN	
A8Q9	1854-0092	Q:SI NPN	
A8Q10	1854-0092	Q:SI NPN	
A8Q11	1854-0092	Q: SI NPN	
A8R1	0683-1125	R:FXD COMP 1100 OHM 5% 1/4W	
A8R2	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R3	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R4	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A8R5	0683-1255	R:FXD COMP 1.2MEGOHM 5% 1/4W	
A8R6	0683-1255	R:FXD COMP 1.2MEGOHM 5% 1/4W	
A8R7	0683-1255	R:FXD COMP 1.2MEGOHM 5% 1/4W	
A8R8	0683-1255	R:FXD COMP 1.2MEGOHM 5% 1/4W	
A8R9	0683-1255	R:FXD COMP 1.2MEGOHM 5% 1/4W	
A8R10	0683-1255	R:FXD COMP 1.2MEGOHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A8R11	0683-2425	R:FXD COMP 2400 OHM 5% 1/4W	
A8R12	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A8R13	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A8R14	0683-2715	R:FXD COMP 270 OHM 5% 1/4W	
A8R15	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R16	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A8R17	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R18	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A8R19	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R20	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R21	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A8R22	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A8R23	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R24	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A8R25	0683-1535	R: FXD COMP 15K OHM 5% 1/4W	
A8R26	0683-2225	R: FXD COMP 2.2K OHM 5% 1/4W	
A8U1	1820-0094	IC: DTL QUAD 2-INPUT NAND NOR GATE	
A8U2	1820-0107	IC:DTL HEX INVERTER RL:6K	
A8U3	1820-0143	INTEGRATED CIRCUIT:DIGITAL	
A8U4	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A8U5	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A8U6	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A9	05326-60008	DISPLAY ASSY (5326A/B)	
	05326-20001	BOARD:BLANK PC FOR OPT 001 DELETE 60008 ADD 60025	
A9DS1	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS2	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS3	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS4	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS5	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS6	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS7	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9R1	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R2	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R4	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R5	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R6	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R7	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R8	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R9	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R10	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A9U1	1820-0275	INTEGRATED CIRCUIT:DIGITAL	
A9U2	1820-0119	INTEGRATED CIRCUIT	
A9U3	1820-0119	INTEGRATED CIRCUIT	
A9U4	1820-0119	INTEGRATED CIRCUIT	
A9U5	1820-0119	INTEGRATED CIRCUIT	
A9U6	1820-0119	INTEGRATED CIRCUIT	
A9U7	1820-0119	INTEGRATED CIRCUIT	
A9U8	-------	NOT ASSIGNED	
A9U9	1820-0116	INTEGRATED CIRCUIT	
A9U10	1820-0116	INTEGRATED CIRCUIT	
A9U11	1820-0116	INTEGRATED CIRCUIT	
A9U12	1820-0116	INTEGRATED CIRCUIT	
A9U13	1820-0116	INTEGRATED CIRCUIT	
A9U14	1820-0116	INTEGRATED CIRCUIT	
A9U15	1820-0116	INTEGRATED CIRCUIT	
A9U16		NOT ASSIGNED	
A9U17	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U18	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U19	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U20	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U21	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U22	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U23	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A10	05326-60011	RIGHT READOUT ASSY (5326A ONLY)	
	05326-20011	BOARD:BLANK PC	
	05330-40002	BLOCK:ANNUNCIATOR FOR 5326A ONLY	
A10C1	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A10CR1	1902-3234	DIODE BREAKDOWN:19.6V 5%	
A10DS1	2140-0313	LAMP:NEON GLOW	
A10DS2	2140-0313	LAMP:NEON GLOW	
A10DS3	2140-0313	LAMP:NEON GLOW	
A10DS4	2140-0313	LAMP:NEON GLOW	
A10DS5	2140-0313	LAMP:NEON GLOW	
A10DS6	2140-0313	LAMP:NEON GLOW	
A10DS7	2140-0313	LAMP:NEON GLOW	
A10DS8	2140-0313	LAMP:NEON GLOW	
A10Q1	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A10Q2	1854-0365	Q:SI NPN	
A10Q3	1854-0365	Q:SI NPN	
A10Q4	1854-0365	Q:SI NPN	
A10Q5	1854-0365	Q:SI NPN	
A10Q6	1854-0365	Q:SI NPN	
A10Q7	1854-0365	Q:SI NPN	
A10Q8	1854-0365	Q:SI NPN	
A10Q9	1854-0365	Q:SI NPN	
A10R1	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A10R2	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A10R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A10R4	0683-2045	R:FXD COMP 200K OHMS 5% 1/4W	
A10R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R7	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R8	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R9	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R10	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R11	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R12	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R13	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R14	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R15		NOT ASSIGNED	
A10R16		NOT ASSIGNED	
A10R17	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R18	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R19	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10U1	1820-0274	INTEGRATED CIRCUIT:DIGITAL	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A10U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U3	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U6	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U8	1820-0273	INTEGRATED CIRCUIT:DIGITAL	
A10	05326-60023	RIGHT READOUT ASSY (5326B ONLY)	
	05326-20023	BOARD:BLANK PC	
	05330-40002	BLOCK:ANNUNCIATOR FOR 5326B ONLY	
A10 C1	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A10 CR1	1902-3234	DIODE BREAKDOWN:19.6V 5%	
A10 DS1	2140-0313	LAMP:NEON GLOW	
A10 DS2	2140-0313	LAMP:NEON GLOW	
A10 DS3	2140-0313	LAMP:NEON GLOW	
A10 DS4	2140-0313	LAMP:NEON GLOW	
A10 DS5	2140-0313	LAMP:NEON GLOW	
A10 DS6	2140-0313	LAMP:NEON GLOW	
A10 DS7	2140-0313	LAMP:NEON GLOW	
A10 DS8	2140-0313	LAMP:NEON GLOW	
A10 DS9	2140-0313	LAMP:NEON GLOW	
A10 Q1	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A10 Q2	1854-0365	Q:SI NPN	
A10 Q3	1854-0365	Q:SI NPN	
A10 Q4	1854-0365	Q:SI NPN	
A10 Q5	1854-0365	Q:SI NPN	
A10 Q6	1854-0365	Q:SI NPN	
A10 Q7	1854-0365	Q:SI NPN	
A10 Q8	1854-0365	Q:SI NPN	
A10 Q9	1854-0365	Q:SI NPN	
A10 Q10	1854-0365	Q:SI NPN	
A10 R1	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A10 R2	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A10 R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A10 R4	0683-2045	R:FXD COMP 200K OHMS 5% 1/4W	
A10 R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R7	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R8	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R9	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 R10	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A10 R11	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R12	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R13	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R14	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R15	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A10 R16	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R17	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 R18	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 R19	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 U1	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U3	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U6	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U8	1820-0273	INTEGRATED CIRCUIT:DIGITAL	
A11	05326-60010	LEFT READOUT ASSY (5326A ONLY)	
	05326-20010	BOARD:BLANK PC FOR 5326A ONLY	
	05330-40002	BLOCK:ANNUNCIATOR	
	05326-80002	INDICATOR:MASK	
	05326-80009	INDICATOR:MASK	
A11C1	0160-2200	C:FXD MICA 43 PF 5%	
A11C2	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A11C3	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11CR1	1902-3234	DIODE BREAKDOWN:19.6V 5%	
A11DS1	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11DS2	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11DS3	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A11Q2	1854-0365	Q:SI NPN	
A11Q3	1854-0365	Q:SI NPN	
A11Q4	1854-0365	Q:SI NPN	
A11Q5	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A11R1	0683-2045	R:FXD COMP 200K OHM 5% 1/4W	
A11R2	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A11R3	0683-2035	R:FXD COMP 20K OHM 5% 1/4W	
A11R4	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A11R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11R7	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11R8	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11R9	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11R10	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11R11	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11R12	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11R13	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11U1	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U3	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A11U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U6	1820-0327	IC:TTL QUAD 2-INPUT NAND GATE	
A11U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U8	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11	05326-60022	LEFT READOUT ASSY (5326B ONLY)	
	05326-20022	BOARD:BLANK PC FOR 5326B ONLY	
	05330-40002	BLOCK:ANNUNCIATOR	
	05326-80002	INDICATOR:MASK	
	05326-80004	INDICATOR:MASK	
A11 C1	0160-2200	C:FXD MICA 43 PF 5%	
A11 C2	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A11 C3	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11 CR1	1902-3234	DIODE:SILICON 19.6V 5%	
A11 CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A11 CR3	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A11 DS1	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS2	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS3	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS4	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS5	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A11 Q2	1854-0365	Q:SI NPN	
A11 Q3	1854-0365	Q:SI NPN	
A11 Q4	1854-0365	Q:SI NPN	
A11 Q5	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A11 Q6	1854-0365	Q:SI NPN	
A11 Q7	1854-0365	Q:SI NPN	
A11 R1	0683-2045	R:FXD COMP 200K OHM 5% 1/4W	
A11 R2	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A11 R3	0683-2035	R:FXD COMP 20K OHM 5% 1/4W	
A11 R4	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R7	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11 R8	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11 R9	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 R10	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 R11	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R12	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R13	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R14	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R15	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R16	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R17	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 R18	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 U1	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U3	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A11 U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U6	1820-0327	IC:TTL QUAD 2-INPUT NAND GATE	
A11 U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U8	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A12	05326-60016	VOLTMETER INPUT AMPLIFIER ASSY (5326B ONLY)	
	05326-20016	BOARD:BLANK PC FOR 5326B ONLY	
A12C1	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12C2	0160-2307	C:FXD MICA 47 PF 5%	
A12C3	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12C4	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12CR1		NOT ASSIGNED	
A12CR2	1901-0376	DIODE:SILICON 35V	
A12CR3	1901-0376	DIODE:SILICON 35V	
A12CR4	1902-3081	DIODE BREAKDOWN:4.64V 2%	
A12CR5	1902-0049	DIODE:BREAKDOWN 6.19V 5%	
A12CR6	1901-0040	DIODE:SILICON 30MA 30WV	
A12K1	0490-0853	RELAY:1 OHM 1500 VDC	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A12K2		NOT ASSIGNED	
A12K3	0490-0764	RELAY:REED 0.1 AMP	
A12K4	0490-0764	RELAY:REED 0.1 AMP	
A12K5	0490-0764	RELAY:REED 0.1 AMP	
A12K6	0490-0764	RELAY:REED 0.1 AMP	
A12Q1	1850-0099	Q:GE PNP 2N964	
A12Q2		NOT ASSIGNED	
A12Q3	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q4	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q5	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q6	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q7	1855-0049	Q:SI DUAL N-CHAN	
A12Q8	1854-0087	Q:SI NPN(SIMILAR TO 2N3417)	
A12Q9	1854-0087	Q:SI NPN(SIMILAR TO 2N3417)	
A12Q10	1853-0036	Q:SI PNP	
A12R1		NOT ASSIGNED	
A12R2		NOT ASSIGNED	
A12R3	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R4	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R5	0683-3045	R:FXD COMP 300K OHM 5% 1/4W	
A12R6	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R7	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R8	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R9	0683-3045	R:FXD COMP 300K OHM 5% 1/4W	
A12R10	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R11	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R12	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R13	0683-3045	R:FXD COMP 300K OHM 5% 1/4W	
A12R14	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R15	0698-7535	R:FXD FLM 98.5K OHM 0.5% 1/8W	
A12R16	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R17	0757-0466	R:FXD MET FLM 110K OHM 1% 1/8W	
A12R18	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R19	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R20	0698-3152	R:FXD MET FLM 3.48K 1% 1/8W	
A12R21	2100-2503	R:VAR CERMET 20K OHM 10% TYPE P	
A12R22	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R23	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R24	2100-2503	R:VAR CERMET 20K OHM 10% TYPE P	
A12R25	0683-8245	R:FXD COMP 820K OHM 5% 1/4W	
A12R26	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A12R27	0683-3925	R:FXD COMP 390Ω OHM 5% 1/4W	
A12R28	0683-1645	R:FXD COMP 160K OHM 5% 1/4W	
A12R29	0698-3442	R:FXD MET FLM 237 OHM 1% 1/8W	
A12R30	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A12R31	2100-2931	R:VAR CERMET 500 OHM 10% TYPE P 3/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A12R32	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A12R33	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A12R34	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A12U1	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	
A13	05326-60017	VOLTMETER V-F CONVERTER ASSY (5326B ONLY)	
	05326-20017	BOARD:BLANK PC FOR 5326B ONLY	
A13C1	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C2	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C3	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C4	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C5	0160-2150	C:FXD MICA 33 PF 5% 300VDCW	
A13C6	0160-2150	C:FXD MICA 33 PF 5% 300VDCW	
A13C7	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A13C8	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A13C9	0160-2150	C:FXD MICA 33 PF 5% 300VDCW	
A13C10	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A13C11	0160-2150	C:FXD MICA 33 PF 5%	
A13C13	0160-2249	C:FXD CER 4.7 PF ±.25 PF 500 VDCW	
A13CR1	1902-0680	DIODE:TC REF. JEDEC TYPE	
A13CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR4	1902-0680	DIODE:TC REF. JEDEC TYPE	
A13CR5	1901-0179	DIODE:SILICON 15WV	
A13CR6	1901-0179	DIODE:SILICON 15WV	
A13CR7	1901-0535	DIODE:SILICON HOT CARRIER	
A13CR8	1901-0179	DIODE:SILICON 15WV	
A13CR9	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR10	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR11	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR12	1901-0179	DIODE:SILICON 15WV	
A13CR13	1901-0179	DIODE:SILICON 15WV	
A13Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A13Q2	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A13Q3	1855-0056	Q:FET	
A13Q4	1855-0081	Q:FET	
A13Q5	1854-0009	Q:SI NPN	
A13Q6	1854-0092	Q:SI NPN	
A13Q7	1854-0092	Q:SI NPN	
A13Q8	1854-0092	Q:SI NPN	
A13Q9	1854-0092	Q:SI NPN	
A13Q10	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A13R1	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A13R2	0757-0421	R:FXD MET FLM 825 OHM 1% 1/8W	
A13R3	0757-0421	R:FXD MET FLM 825 OHM 1% 1/8W	
A13R4	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A13R5	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R6	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R7	0698-3160	R:FXD MET FLM 31.6K 1% 1/8W	
A13R8	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A13R9	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A13R10	0698-3160	R:FXD MET FLM 31.6K 1% 1/8W	
A13R11	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R12	0757-0384	R:FXD FLM 20 OHM 1% 1/8W	
A13R13	0757-0384	R:FXD FLM 20 OHM 1% 1/8W	
A13R14	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R15	2100-2705	R:VAR CERMET 1K OHM 10% TYPE P 3/4W	
A13R16	2100-2705	R:VAR CERMET 1K OHM 10% TYPE P 3/4W	
A13R17	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R18	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A13R19		NOT ASSIGNED	
A13R20		NOT ASSIGNED	
A13R21	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R22		NOT ASSIGNED	
A13R23		NOT ASSIGNED	
A13R24	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R25		NOT ASSIGNED	
A13R26		NOT ASSIGNED	
A13R27	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R28	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A13R29	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A13R30	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A13R31	0683-3915	R:FXD COMP 390 OHM 5% 1/4W	
A13R32	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A13R33	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A13R34	0683-5615	R:FXD COMP 560 OHM 5% 1/4W	
A13R35	0683-3615	R:FXD COMP 360 OHM 5% 1/4W	
A13R36	0683-3615	R:FXD COMP 360 OHM 5% 1/4W	
A13R37	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R38	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A13R39	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A13R40	0683-3915	R:FXD COMP 390 OHM 5% 1/4W	
A13R41	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A13U1	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL	
A13U2	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL	
A13U3	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL	
A13U4	1820-0212	INTEGRATED CIRCUIT:ECL LINE RECEIVER	
A13U5	1820-0213	INTEGRATED CIRCUIT:ECL R-S FLIP-FLOP	
A13U6	1820-0276	INTEGRATED CIRCUIT:DIGITAL	
A13U7	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A13U8	1820-0209	INTEGRATED CIRCUIT:DIGITAL	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A14	5326-60015	VOLTMETER DISPLAY CONTROL ASSY (5326B ONLY)	
	05326-20015	BOARD:BLANK PC FOR 5326B ONLY	
A14CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR3	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR4	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR5	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR6	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR7	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14R1	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14R2	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14R3	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A14R4	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A14R5	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14R6	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14U1	1820-0413	INTEGRATED CIRCUIT:DECADE DIVIDER	
A14U2	1820-0094	IC:DTL QUAD 2-INPUT NAND NOR GATE	
A14U3	1820-0094	IC:DTL QUAD 2-INPUT NAND NOR GATE	
A14U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A14U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A14U6	1820-0273	INTEGRATED CIRCUIT:DIGITAL	
A14U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
		NOTE FOR 5326B's WITH SERIAL PREFIX 1124A AND ABOVE, USE PARTS LIST PROVIDED ON PAGE 6-46. A15 PART NUMBER IS 05327-60020.	
A15	05326-60001	REGULATOR ASSY (5326A/B)	
	05326-20001	BOARD:BLANK PC	
A15C1	0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	
A15C2	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C3	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C4	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C5	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C6, 7	0160-0876	C:FXD CER 0.001 UF 20% 75VDCW	
A15CR1	1902-3002	DIODE BREAKDOWN:2.37V 5%	
A15CR2	1902-0551	DIODE BREAKDOWN:6.19V 5%	
A15CR3	1902-0551	DIODE BREAKDOWN:6.19V 5%	
A15CR4	1902-3002	DIODE BREAKDOWN:2.37V 5%	
A15CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A15CR6	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR7	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR8	1901-0040	DIODE:SILICON 30MA 30WV	
A15CR9	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR10	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR11	1902-3394	DIODE BREAKDOWN:75 V 2%	
A15CR12	1902-3429	DIODE BREAKDOWN:100 V 2%	
A15F1	2110-0331	FUSE:0.3A	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Ⓗ Part No.	Description #	Note
A15F2	2110-0331	FUSE:0.3A	
A15Q1	1854-0039	Q:SI NPN	
A15Q2	1853-0012	Q:SI PNP	
A15Q3	1854-0039	Q:SI NPN	
A15Q4	1853-0012	Q:SI PNP	
A15Q5	1854-0232	Q:SI NPN(SELECTED FROM 2N3440)	
A15Q6	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A15Q7	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A15Q8	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A15Q9	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A15Q10	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A15R1	0683-2035	R:FXD COMP 20K OHM 5% 1/4W	
A15R2	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A15R3	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A15R4	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A15R5	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A15R6	0683-1505	R:FXD COMP 15 OHM 5% 1/4W	
A15R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A15R8	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A15R9	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A15R10	2100-2093	R:VAR COMP 200 OHM 30% LIN 1/8W	
A15R11	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A15R12	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A15R13	2100-2093	R:VAR COMP 200 OHM 30% LIN 1/8W	
A15R14	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A16	05326-60014	INTERCONNECT ASSY (5326A ONLY)	
	05326-20014	BOARD:BLANK PC FOR 5326A ONLY	
A16C1	0180-2352	C:FXD ELECT 6000 UF +75-10% 15VDCW	
A16C2	0180-2296	C:FXD ELECT 4000 UF +75-10%	
A16C3	0180-1962	C:FXD ELECT 15 UF +50-20% 250VDCW	
A16C4	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16C5	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A16CR4	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16CR5	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16CR6	1901-0029	DIODE:SILICON 600 PIV	
A16CR7	1901-0029	DIODE:SILICON 600 PIV	
A16CR8	1901-0029	DIODE:SILICON 600 PIV	
A16CR9	1901-0029	DIODE:SILICON 600 PIV	
A16CR10	1901-0415	DIODE:SILICON 50 PIV 3A	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A16CR11	1901-0415	DIODE:SILICON 50 PIV 3A	
A16CR12	1901-0415	DIODE:SILICON 50 PIV 3A	
A16CR13	1901-0415	DIODE:SILICON 50 PIV 3A	
A16R1	0812-0021	R:FXD WW 0.47 OHM 5% 3W	
A16R2	0811-1732	R:FXD WW 1 OHM 5% 3W	
A16R3	0686-2045	R:FXD COMP 200K OHM 5% .5W	
A16XA2	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA3	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA4	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA5	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA6	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16XA7	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16XA8	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA9	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA10	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16XA11	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16	05326-60026	INTERCONNECT ASSY (5326B ONLY)	
	05326-20014	BOARD:BLANK PC FOR 5326B ONLY	
A16 C1	0180-2352	C:FXD ELECT 6000 UF +75-10% 15VDCW	
A16 C2	0180-2396	C:FXD ELECT 4000 UF +75-10% 15 VDCW	
A16 C3	0180-1962	C:FXD ELECT 15 UF +50-20% 250VDCW	
A16 C4	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16 C5	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16 CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16 CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16 CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A16 CR4	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16 CR5	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16 CR6	1901-0029	DIODE:SILICON 600 PIV	
A16 CR7	1901-0029	DIODE:SILICON 600 PIV	
A16 CR8	1901-0029	DIODE:SILICON 600 PIV	
A16 CR9	1901-0029	DIODE:SILICON 600 PIV	
A16 CR10	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 CR11	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 CR12	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 CR13	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 R1	0812-0021	R:FXD WW 0.47 OHM 5% 3W	
A16 R2	0811-1732	R:FXD WW 1 OHM 5% 3W	
A16 R3	0686-2045	R:FXD COMP 200K OHM 5% .5W	
A16 XA2	1251-1886	CONNECTOR:PC 30 CONTACTS	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A16 XA3	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA4	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA5	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA6	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA7	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA8	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA9	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA10	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA11	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA12	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA13	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA14	1251-1886	CONNECTOR:PC 30 CONTACTS	
		CHASSIS PARTS	
B1	3140-0030	MOTOR:SHADED POLE	
B1	3150-0039	FILTER:AIR	
B1	3160-0035	FAN:IMPELLER AXIAL 2-1/4 DIAM	
C1	0160-3043	C:FXD CER 2 X 0.005 UF 20% 250VAC	
F1	2110-0304	FUSE:CARTRIDGE 1.50 AMP SLOW BLOW (115V OPER)	
F1	2110-0336	FUSE:CARTRIDGE 0.8 AMP SLOW BLOW (230V OPER)	
F1	1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	
J1	1510-0039	BINDING POST:15A 1000V	
J1		FOR 5326B ONLY	
J1	1510-0040	BINDING POST:15 A 1000V	
J1		FOR 5326B ONLY	
J2	1250-1253	CONNECTOR:BNC	
J3	1250-1253	CONNECTOR:BNC	
J4	1250-1253	CONNECTOR:BNC	
J5	1250-1253	CONNECTOR:BNC	
J6	1250-1253	CONNECTOR:BNC	
J7	1250-1253	CONNECTOR:BNC (5326B)	
J7	1250-0118	CONNECTOR:(5326A)	
J8	1251-2357	CONNECTOR:AC POWER 3 MALE CONTACTS	
J9		LISTED IN OPTION 003	
J10		LISTED IN OPTION 002 ONLY	
J11	1250-0212	CONNECTOR:RF BNC	
	3050-0499	WASHER:SHOULDER (2)	
	5040-0170	SUPPORT BOARD	
Q1	1853-0233	Q:SI PNP	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
Q2	1854-0420	Q:SI NPN	
Q2	05327-20004	HEAT SINK (Q1 & Q2)	
R1	2100-2961	R:VAR COMP 1 MEGOHM 10% 10 CLOG 1/4W	
S1		PART OF R1	
S2	3101-1327	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	
S3	3101-1216	SWITCH:PUSHBUTTON SPST	
S4	3101-1327	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	
S4		FOR 5326B ONLY	
S4	5040-0702	INSULATOR:CONNECTOR	
S4		FOR 5326B ONLY	
S5	05326-60018	SWITCH ASSY:TIME BASE(WIRED)	
S5	3100-2902	SWITCH:ROTARY	
S6	05326-60019	SWITCH ASSY:FUNCTION	
S6		FOR 5326A ONLY	
S6	3100-2901	SWITCH:ROTARY	
S6	05326-60020	SWITCH ASSY:FUNCTION	
S6		FOR 5326B ONLY	
S6	3100-2903	SWITCH:ROTARY	
S7	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC (P/O 05326-20028)	
S8	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC (P/O 05326-20028)	
S9	3101-1234	SWITCH:SLIDE DPDT	
T1	9100-2888	TRANSFORMER:POWER	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
		OTHER CABINET PARTS	
	0460-0114	TAPE:POLYURETHANE 1-1/4 IN WIDE (TOP COVER)	
	1490-0030	STAND:TILT	
	5000-0050	TRIM:SIDES	
	5060-0729	FRAME ASSY:3 X 11 (SIDE)	
	5060-0767	FOOT ASSY:FM	
	05326-00001	PANEL:FRONT	
	05326-00004	PANEL:REAR	
	05326-00008	INSULATOR (FOR BOTTOM COVER)	
	05326-00011	PLATE:CONNECTOR, LONG (J9 COVER)	
	05326-00012	PLATE:CONNECTOR, SHORT (J10 COVER)	
	05326-20012	WINDOW (5326A)	
	05326-20006	WINDOW (5326B)	
	7120-1254	TRADEMARK (HP LOGO)	
		PAINTED CABINET PARTS	
	05325-00009	COVER:BOTTOM	
	05326-00006	RIGHT FRONT PANEL TRIM	
	05326-00003	LEFT FRONT PANEL TRIM (5326A)	
	05326-60007	LEFT FRONT PANEL TRIM (5326B)	
	05326-00021	SIDE COVER	
	05326-00022	TOP COVER	
	05326-60029	KIT:RACK MOUNT	
		CONSISTING OF:	
	2370-0012	SCREW:SST FLAT HD PHL DR 6-32 x 1/4	
	2510-0047	SCREW:PAN HD POZI DR 8-32 x 0.438" LG	
	5020-0706	BRACKET:LEFT	
	5020-0707	BRACKET:RIGHT	
	05326-40002	STRIP:FILLER GRAY	
		INTERNAL AND OTHER PARTS	
	0370-0104	KNOB:BLK BAR (TIME BASE)	
	0370-0104	KNOB:BLK BAR (FUNCTION)	
	01821-67401	KNOB (LEVEL)	
	00180-67403	KNOB (SAMPLE RATE)	
	5040-0170	GUIDE:PLUG-IN PC BD (BOARD SUPPORT)	
	5060-0109	CONNECTOR:15 CONTACTS	
	05326-00010	SHIELD:NIXIE	
	05326-00018	CHASSIS	
	05326-20028	BOARD: BLANK (REAR PANEL INTERCONNECT)	
	05326-60032	CABLE ASSY:POWER	
	8120-1348	CORD:LINE	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A9	05326-60025	DISPLAY ASSY (OPTION 001 ONLY)	
	05326-20008	BOARD:BLANK PC OPTION 001 ONLY	
A9DS1	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS2	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS3	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS4	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS5	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS6	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS7	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS8	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9R1	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R2	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R4	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R5	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R6	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R7	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R8	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R9	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R10	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A9R11	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9U1	1820-0275	INTEGRATED CIRCUIT:DIGITAL	
A9U2	1820-0119	INTEGRATED CIRCUIT	
A9U3	1820-0119	INTEGRATED CIRCUIT	
A9U4	1820-0119	INTEGRATED CIRCUIT	
A9U5	1820-0119	INTEGRATED CIRCUIT	
A9U6	1820-0119	INTEGRATED CIRCUIT	
A9U7	1820-0119	INTEGRATED CIRCUIT	
A9U8	1820-0119	INTEGRATED CIRCUIT	
A9U9	1820-0116	INTEGRATED CIRCUIT	
A9U10	1820-0116	INTEGRATED CIRCUIT	
A9U11	1820-0116	INTEGRATED CIRCUIT	
A9U12	1820-0116	INTEGRATED CIRCUIT	
A9U13	1820-0116	INTEGRATED CIRCUIT	
A9U14	1820-0116	INTEGRATED CIRCUIT	
A9U15	1820-0116	INTEGRATED CIRCUIT	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A9U16	1820-0116	INTEGRATED CIRCUIT	
A9U17	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U18	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U19	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U20	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U21	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U22	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U23	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U24	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
P1		5326A/B OPT 002 REMOTE PROGRAMMING	
P1		DELETE P1A 5060-0109	
P1		ADD REMOTE CABLE ASSY 05326-60006	
J10	1251-0085	CONNECTOR:FEMALE 36-PIN MINAT	
P1A, B, C	5060-0113	CONNECTOR:45 CONTACT	
P2		5326A/B OPT 003 DIGITAL RECORDER	
P2		ADD PRINTER CABLE ASSY 05326-60012	
P2		1251-0087 IS J9 ON SCHEMATIC	
J9	1251-0087	CONNECTOR:FEMALE 50-PIN MINAT	
P1, 2	1251-2262	CONN:PC 20 (2 x 10) CONTACTS	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
0121-0059	C:VAR CER 2-8 NPO	72982	538-011-COPO-89R	1	1
0140-0159	C:FXD MICA 300 PF 2% 300VDCW	28480	0140-0150	1	1
0140-0193	C:FXD MICA 82 PF 5%	28480	0140-0193	1	1
0160-0134	C:FXD MICA 220 PF 5% 500VDCW	91418	TA	1	1
0160-0153	C:FXD MY 0.0[illegible] UF 10% 200VDCW	56289	192P10292-PTS	4	4
0160-0161	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS	3	3
0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	56289	192P33392-PTS	1	1
0160-0156	C:FXD MY 0.0068 UF 10% 200VDCW	56289	192P68392-PTS	1	1
0160-0336	C:FXD MICA 100 PF 1%	28480	0160-0336	1	
0160-0378	C:FXD MICA 27PF 5%	72136	RDM15E270J5S	2	2
0160-0975	C:FXD CER 0.001 UF 20% 75VDCW			2	2
0160-0939	C:FXD MICA 430 PF 5% 300 VDCW	28480	0160-0939	2	2
0160-2055	C:FXD CER .01 UF +80-20% 100VDCW	28480	0160-2055	10	10
0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B	2	2
0160-2146	C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA	2	2
0160-2150	C:FXD MICA 33 PF 5%	28480	0160-2150	1	2
0160-2197	C:FXD MICA 10 PF 5%	72136	RDM15C100J3C	2	2
0160-2199	C:FXD MICA 30 PF 5%	28480	0160-2199	1	1
0160-2200	C:FXD MICA 43 PF 5%	72136	RDM15E430J3C	1	1
0160-2201	C:FXD MICA 51 PF 5%	72136	RDM15E510J3C	1	1
0160-2204	C:FXD MICA 100PF 5%	72136	RDM15F101J3C	1	1
0160-2205	C:FXD MICA 120 PF 5% 300VDCW	28480	0160-2205	1	1
0160-2244	C:FXD CER 3.0 0.25 PF 500VDCW	28480	0160-2244	2	2
0160-2264	C:FXD CER 20 PF 5% 500VDCW	28480	0160-2264	1	1
0160-2307	C:FXD MICA 47 PF 5%	28480	0160-2307		1
0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA		
0160-3043	C:FXD CER 2 X 0.005 UF 20% 250VAC	56289	29C147A-CDH	1	1
0170-0024	C:FXD MY 0.022UF 20% 200VDCW	56289	192P22302	1	1
0170-0055	C:FXD MY 0.1UF 20% 200VDCW	56289	192P10402	4	6
0180-0187	C:FXD ELECT 2.2 UF +100-10% 25VDCW	28480	0180-0187	9	9
0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS	6	10
0180-0228	C:FXD ELECT 22 UF 10% 15VDCW	28480	0180-0228	1	1
0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS	3	3
0180-1962	C:FXD ELECT 15 UF +50-20% 250VDCW	56289	39D156F250EJ4-DSB	1	1
0180-2296	C:FXD ELECT 4000 UF +75-10% 15VDCW	56289	39D167-DSB	1	1
0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	56289	39D170-DSB	2	2
0180-2352	C:FXD ELECT 6000 UF -10+75% 15VDCW	28480	0180-2352	1	1
0340-0162	INSULATOR:TRANSISTOR	28480	0340-0162	2	2
0370-0104	KNOB:BLK BAR W/ARROW 1/4" SHAFT	28480	0370-0104	1	1
0410-0161	COMPONENT:OVEN	82647	45TI-2	1	1
0410-0175	CRYSTAL:QUARTZ 10 MHZ	28480	0410-0175	1	1
0490-0764	RELAY:REED 0.1 AMP	28480	0490-0764		4
0490-0853	RELAY:1 OHM 1500 VDC	28480	0490-0853		1
0683-1005	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005	5	5
0683-1015	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015	20	19
0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025	30	31
0683-1035	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035	19	45
0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045	6	6
0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055	10	10
0683-1065	R:FXD COMP 10M OHM 5% 1/4W	01121	CB 1065	2	2
0683-1125	R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125	1	1
0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225	1	1
0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	01121	CB 1325	2	2
0683-1505	R:FXD COMP 15 OHM 5% 1/4W	01121	CB 1505	1	1
0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525	10	10
0683-1645	R:FXD COMP 160K OHM 5% 1/4W	01121	CB 1645		1
0683-2015	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015	2	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

ⓗ Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025	16	10
0683-2035	R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035	2	2
0683-2045	R:FXD COMP 200K OHM 5% 1/4W	01121	CB 2045	2	2
0683-2055	R:FXD COMP 2 MEGOHM 5% 1/4W	01121	CB 2055	2	2
0683-2215	R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215	7	7
0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225	17	22
0683-2235	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235	4	4
0683-2405	R:FXD COMP 24 OHM 5% 1/4W	01121	CB 2405	2	2
0683-2415	R:FXD COMP 240 OHM 5% 1/4W	01121	CB 2415	1	1
0683-2425	R:FXD COMP 2400 OHM 5% 1/4W	01121	CB 2425	1	1
0683-2715	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715	1	1
0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725	2	2
0683-2735	R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735	5	5
0683-3015	R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015	5	5
0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025	5	5
0683-3035	R:FXD COMP 30K OHM 5% 1/4W	01121	CB 3035	2	2
0683-3005	R:FXD COMP 30 OHM 5% 1/4W	01121	CB 3005	1	1
0683-3045	R:FXD COMP 300K OHM 5% 1/4W	01121	CB 3045		3
0683-3315	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315	11	8
0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325	12	15
0683-3615	R:FXD COMP 360 OHM 5% 1/4W	01121	CB 3615		2
0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	01121	CB 3625	4	4
0683-3915	R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915	1	5
0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925	3	4
0683-3935	R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935	8	9
0683-4715	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715	5	6
0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725	4	5
0683-5105	R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105	3	4
0683-5115	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115	2	2
0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125	6	15
0683-5525	R:FXD COMP 5500 OHM 5% 1/4W	01121	CB 5525	1	1
0683-5615	R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615		1
0683-6215	R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215	1	1
0683-6225	R:FXD COMP 6200 OHM 5% 1/4W	01121	CB 6225	1	1
0683-6815	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815	6	7
0683-6835	R:FXD COMP 68K OHM 5% 1/4W	01121	CB 6835	3	3
0683-7515	R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515	1	
0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	01121	CB 7525	7	7
0683-8205	R:FXD COMP 82 OHM 5% 1/4W	01121	CB 8205	1	1
0683-8245	R:FXD COMP 820K OHM 5% 1/4W	01121	CB 8245		1
0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	01121	CB 9125	2	2
0683-9145	R:FXD COMP 910K OHM 5% 1/4W	01121	CB 9145	2	4
0686-2045	R:FXD COMP 200K OHM 5% .5W	01121	EB 2045	1	1
0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	14674	C4		2
0698-3152	R:FXD MET FLM 3.48K 1% 1/8W	14674	C4		1
0698-3160	R:FXD MET FLM 31.6K 1% 1/8W	14674	C4		2
0698-3375	R:FXD COMP 33 OHM 5% 1/8W	28480	0698-3375	2	2
0698-3379	R:FXD COMP 68 OHM 5% 1/8W	28480	0698-3379	2	2
0698-3381	R:FXD COMP 150 OHM 5% 1/8W	28480	0698-3381	4	4
0698-3442	R:FXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442		1
0698-3576	R:FXD COMP 110K OHM 5% 1/4W	28480	0698-3576	4	4
0698-4037	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037	1	1
0698-5175	R:FXD COMP 360 OHM 5% 1/8W	28480	0698-5175	4	4
0698-5180	R:FXD COMP 2K OHM 5% 1/8W	28480	0698-5180	2	2
0698-7535	R:FXD FLM 98.5K OHM 0.5% 1/8W	28480	0698-7535		1
0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	28480	0698-7610		4
0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618		14

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
0757-0384	R:FXD FLM 20 OHM 1% 1/8W	28480	0757-0384		2
0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398		2
0757-0421	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421		2
0757-0466	R:FXD MET FLM 110K OHM 1% 1/8W	28480	0757-0466		1
0811-1732	R:FXD WW 1 OHM 5% 3W	28480	0811-1732	1	1
0812-0021	R:FXD WW 0.47 OHM 5% 3W	28480	0812-0021	1	1
1200-0405	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207	7	7
1250-0083	CONNECTOR:BNC	28480	1250-0083	6	6
1250-0212	CONNECTOR:JACK CHASSIS BNC	95712	30409-1	1	1
1250-1163	CONNECTOR:RF BNC INPUT	28480	1250-1163	2	2
1251-0085	CONNECTOR:FEMALE 36-PIN MINAT	28480	1251-0085		
1251-0087	CONNECTOR:FEMALE 50-PIN MINAT	28480	1251-0087		
1251-0472	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300	2	2
1251-1886	CONNECTOR:PC 30 CONTACTS	28480	1251-1886	6	9
1251-2034	CONN:PC 20(2X10) CONTACTS	76530	65-716C		
1251-2035	CONN:PC 30(2X15) CONTACTS	76530	65-7160	1	1
1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	71785	252-18-30-340	4	4
1251-2357	CONNECTOR:AC POWER 3 MALE CONTACTS	82389	EAC-301	1	1
1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	79515	342014	1	1
1490-0030	STAND:TILT	28480	1490-0030	1	1
1510-0039	BINDING POST:15A 1000V	58474	DF 218C		1
1510-0040	BINDING POST:15 A 1000V	58474	DF 21 MAROON		1
1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	01295	SN4342	4	5
1820-0068	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N	1	1
1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	28480	1820-0092	7	7
1820-0094	IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994459X	1	3
1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	04713	MC1013P	4	3
1820-0119	INTEGRATED CIRCUIT	28480	1820-0119	14	14
1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	04713	MC1004P	4	4
1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	04713	MC1010P	3	1
1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	04713	SC 7011PK	4	1
1820-0174	INTEGRATED CIRCUIT:TTL HEX INVERTER	01295	SN6199	1	2
1820-0201	INTEGRATED CIRCUIT:OPERATIONAL AMPL	04713	MC1439G		3
1820-0209	INTEGRATED CIRCUIT:DIGITAL	28480	1820-0209		1
1820-0212	INTEGRATED CIRCUIT:ECL LINE RECEIVER	04713	SC7014PK		1
1820-0213	INTEGRATED CIRCUIT:ECL R-S FLIP-FLOP	04713	SC7015PK		1
1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223		1
1820-0238	INTEGRATED CIRCUIT:DTL 2 INPUT NOR GATE	04713	MC 1810P	2	2
1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	04713	MC1035P	2	4
1820-0272	INTEGRATED CIRCUIT:DIGITAL	04713	SC 7022PK	2	2
1820-0273	INTEGRATED CIRCUIT:DIGITAL	04713	MC 1806P	1	2
1820-0274	INTEGRATED CIRCUIT:DIGITAL	04713	MC 1808P	13	16
1820-0275	INTEGRATED CIRCUIT:DIGITAL	04713	SC 7023PK	1	1
1820-0276	INTEGRATED CIRCUIT:DIGITAL	04713	MC 1033P		1
1820-0307	IC:DTL HEX INVERTER RL:6K	07263	U6A993659X	1	1
1820-0327	IC:TTL QUAD 2-INPUT NAND GATE	01295	SN4466	1	1
1820-0328	IC:TTL QUAD 2-INPUT NOR GATE	18324	N7402N	1	1
1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412	7	7
1820-0413	INTEGRATED CIRCUIT	28480	1820-0413	1	2
1820-0440	INTEGRATED CIRCUIT	04713	MC 1016P	1	
1821-0001	TRANSISTOR ARRAY:SI NPN	02735	CA3046	1	
1850-0099	Q:GE PNP 2N964	80131	2N964		1
1850-0158	Q:GE PNP 2N2635	01295	2N2635	1	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

⊕ Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
1853-0012	Q:SI PNP	04713	2N2904A	2	2
1853-0015	Q:SI PNP	04713	MPS3640-5	20	20
1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020	4	9
1853-0036	Q:SI PNP	04713	SPS 3612		1
1853-0233	Q:SI PNP	01295	TIP 32	1	1
1854-0009	Q:SI NPN	04713	2N709	5	3
1854-0039	Q:SI NPN	04713	2N3053	2	2
1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071	22	24
1854-0087	Q:SI NPN(SIMILAR TO 2N3417)	28480	1854-0087		2
1854-0092	Q:SI NPN	07263	2N3563	18	22
1854-0215	Q:SI NPN	04713	SPS3611	1	1
1854-0232	Q:SI NPN(SELECTED FROM 2N3440)	28480	1854-0232	1	1
1854-0345	Q:SI NPN	02735	2N5179	4	4
1854-0365	Q:SI NPN	04713	SPS 3321	17	20
1854-0420	Q:SI NPN	01295	TIP 31	1	1
1855-004 /	Q:SI DUAL N-CHAN	28480	1855-0049		1
1855-0056	Q:FET	07263	2N4342		1
1855-0081	Q:FET	01295	2N5245		1
1855-0334	Q:FET DUAL N-CHAN	17856	DN377	2	2
1901-0029	DIODE:SILICON 600 PIV	28480	1901-0029	4	4
1901-0040	DIODE:SILICON 30MA 30WV	07263	FDG1088	16	21
1901-0045	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7	2	2
1901-0179	DIODE:SILICON 15WV	28480	1901-0179		5
1901-0376	DIODE:SILICON 35V	28480	1901-0376	4	6
1901-0535	DIODE:HOT CARRIER	28480	1901-0535		1
1901-0415	DIODE:SILICON 50 PIV 3A	28480	1901-0415	4	4
1901-0651	DIODE:SILICON 3-JUNCTION STABISTOR	28480	1901-0651	2	2
1902-0041	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98	4	4
1902-0049	DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122	2	3
1902-0551	DIODE BREAKDOWN:6.19V 5%	28480	1902-0551	2	2
1902-0680	DIODE:TC REF. JEDEC TYPE	04713	1N827		2
1902-3002	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002	2	2
1902-3083	DIODE BREAKDOWN:4.64V 2%	28480	1902-3083		1
1902-3094	DIODE BREAKDOWN:5.11V 2%	28480	1902-3094	4	4
1902-3301	DIODE BREAKDOWN:34.8V 5%	28480	1902-3301	2	1
1902-3345	DIODE:SILICON 31.1V	28480	1902-3345		1
1902-3394	DIODE BREAKDOWN:75 V 2%	28480	1902-3394	1	1
1902-3429	DIODE BREAKDOWN:100 V 2%	28480	1902-3429	1	1
1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361	15	24
1970-0042	TUBE:NUMERICAL INDICATOR	83594	B-5750-S	7	7
2100-2093	R:VAR COMP 200 OHM 30% LIN 1/8W	28480	2100-2093	2	2
2100-2503	R:VAR CERMET 20K OHM 10% TYPE P	28480	2100-2503		2
2100-2520	R:VAR CERMET 50 OHM 20% TYPE V 1/2W	28480	2100-2520	2	2
2100-2521	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521	2	2
2100-2705	R:VAR CERMET 1K OHM 10% TYPE P 3/4W	28480	2100-2705		2
2100-2905	R:VAR CERMET 10K OHM 10% LIN	28480	2100-2905	2	2
2100-2931	R:VAR CERMET 500 OHM 10% TYPE P 3/4W	28480	2100-2931		1
2100-2961	R:VAR COMP 1 MEGOHM 10% 10 CLOG 1/4W	28480	2100-2961	1	1
2110-0020	FUSE:CARTRIDGE 0.8 AMP SLOW BLOW	75915	313,800S	1	1
2110-0331	FUSE:0.3A	71400	GMW 3/10	2	2
2100-0304	FUSE:SLO BLO 1.50 AMP	71400	MDX-1-1/2A	1	1
2140-0047	LAMP:NEON GLOW 0.8MA	24455	A1C	2	2
2140-0313	LAMP:NEON GLOW	24455	C2A-8	11	14
3100-2901	SWITCH:ROTARY	28480	3100-2901	1	
3100-2902	SWITCH:ROTARY	28480	3100-2902	1	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

⊕ Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
3100-2903	SWITCH:ROTARY	28480	3100-2903		1
3101-0199	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	79727	G126-0012	2	2
3101-1216	SWITCH:PUSHBUTTON SPST	82389	85-1034	1	1
3101-1234	SWITCH:SLIDE DPDT	82389	11A-1242	1	1
3101-1278	SWITCH:SLIDE DPDT	79727	G-126-0007	2	2
3101-1279	SWITCH:SLIDE DP 3 POSITIONS	79727	G-128-5-0016	2	2
3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	79727	G126-0020	2	2
3101-1313	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	79727	G128S-0004	1	1
3101-1327	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	79727	G128S-0006	1	2
3140-0030	MOTOR:SHADED POLE	28480	3140-0030	1	1
3150-0039	FILTER:AIR	28480	3150-0039	1	1
3160-0035	FAN:IMPELLER AXIAL 2-1/4 DIAM	0467C	2 1/4 RHF 125 S	1	1
5000-0050	TRIM:SIDES	28480	5000-0050	1	1
5000-0729	COVER:SIDE FM	28480	5000-0729	1	1
5040-0702	INSULATOR:CONNECTOR	28480	5040-0702		1
5060-0109	CONNECTOR:15 CONTACTS	28480	5060-0109	1	1
5060-0111	CONNECTOR	28480	5060-0111	1	
5060-0113	CONNECTOR:45 CONTACT	28480	5060-0113		
5060-0729	FRAME ASSY:3 X 11(SIDE)	28480	5060-0729	1	1
5060-0767	FOOT ASSY:FM	28480	5060-0767	5	5
8120-1348	CABLE ASSY:POWER, DETACHABLE	70903	KHS-7041	1	1
9100-2276	COIL:FXD 100 UH 10%				1
9100-2255	COIL/CHOKE 0.47 UH 10%	28480	9100-2255	4	4
9100-2888	TRANSFORMER:POWER	28480	9100-2888	1	1
9140-0142	COIL:FXD RF 2.2 UH	28480	9140-0142	2	2
9140-0144	COIL:FXD RF 4.7 UH	28480	9140-0144	14	14
9140-0158	COIL:FXD RF 1 UH 10%	99800	1025-20	1	
00180-67403	KNOB ASSY	28480	00180-67403	1	1
01821-67401	KNOB ASSY	28480	01821-67401	1	1
05325-00008	COVER:TOP	28480	05325-00008	1	1
05325-00009	COVER:BOTTOM	28480	05325-00009	1	1
05326-00001	PANEL:FRONT	28480	05326-00001	1	1
05326-00003	PANEL:FRONT TRIM	28480	05326-00003	1	
05326-00005	CHASSIS	28480	05326-00005	1	1
05326-00006	PANEL:FRONT EXTRACTOR	28480	05326-00006		1
05326-00007	PANEL:FRONT TRIM	28480	05326-00007		1
05326-00008	INSULATOR	28480	05326-00008	1	1
05326-00009	BRACKET:READOUT	28480	05326-00009	5	5
05326-00010	SHIELD:NIXIE	28480	05326-00010	1	1
05326-00011	PLATE:CONNECTOR,LONG	28480	05326-00011	1	1
05326-00012	PLATE:CONNECTOR,SHORT	28480	05326-00012	1	1
05326-00013	SPACER:BNC	28480	05326-00013	1	
05326-20001	BOARD:BLANK PC	28480	05326-20001	1	1
05326-20002	BOARD:BLANK PC	28480	05326-20002	1	1
05326-20003	BOARD:BLANK PC	28480	05326-20003	1	1
05326-20005	BOARD:BLANK PC	28480	05326-20005	1	1
05326-20006	WINDOW	28480	05326-20006		1
05326-20007	BOARD:BLANK PC	28480	05326-20007	1	
05326-20008	BOARD:BLANK PC	28480	05326-20008	1	1
05326-20009	BOARD:BLANK PC	28480	05326-20009	1	1
05326-20010	BOARD:BLANK PC	28480	05326-20010	1	
05326-20011	BOARD:BLANK PC	28480	05326-20011	1	1
05326-20012	WINDOW	28480	05326-20012	1	
05326-20013	BOARD:BLANK PC	28480	05326-20013	1	1
05326-20014	BOARD:BLANK PC	28480	05326-20014	1	1
05326-20015	BOARD:BLANK PC	28480	05326-20015		1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

⊕ Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
05326-20016	BOARD:BLANK PC	28480	05326-20016		1
05326-20017	BOARD:BLANK PC	28480	05326-20017		1
05326-20022	BOARD:BLANK PC	28480	05326-20022		1
05326-20024	BOARD:BLANK PC	28480	05326-20024		1
05326-60001	REGULATOR ASSY	28480	05326-60001	1	1
05326-60002	OSCILLATOR ASSY	28480	05326-60002	1	1
05326-60003	ATTENUATOR ASSY	28480	05326-60003	1	1
05326-60004	INPUT AMPLIFIER ASSY	28480	05326-60004	2	2
05326-60005	TIME BASE CONTROL ASSY	28480	05326-60005	1	1
05326-60007	FUNCTION SELECTOR ASSY	28480	05326-60007	1	
05326-60008	DISPLAY ASSY	28480	05326-60008	1	1
05326-60009	DISPLAY SUPPORT ASSY	28480	05326-60009	1	1
05326-60010	LEFT READOUT ASSY	28480	05326-60010	1	
05326-60011	RIGHT READOUT ASSY	28480	05326-60011	1	
05326-60013	SAMPLE RATE ASSY	28480	05326-60013	1	1
05326-60014	INTERCONNECT ASSY	28480	05326-60014	1	
05326-60015	VOLTMETER DISPLAY CONTROL ASSY	28480	05326-60015		1
05326-60016	VOLTMETER INPUT AMPLIFIER ASSY	28480	05326-60016		1
05326-60017	VOLTMETER V-F CONVERTER ASSY	28480	05326-60017		1
05326-60018	SWITCH ASSY:TIME BASE(WIRED)	28480	05326-60018	1	1
05326-60019	SWITCH ASSY:FUNCTION	28480	05326-60019	1	
05326-60020	SWITCH ASSY:FUNCTION	28480	05326-60020		1
05326-60021	CABLE ASSY:VOLTMETER	28480	05326-60021	1	1
05326-60022	LEFT READOUT ASSY	28480	05326-60022		1
05326-60023	RIGHT READOUT ASSY	28480	05326-60023		1
326-60024	FUNCTION SELECTOR ASSY	28480	05326-60024		1
05326-60026	INTERCONNECT ASSY	28480	05326-60026		1
05326-60027	CABLE ASSY:INPUT C	28480	05326-60027	1	1
05326-80002	INDICATOR:MASK	28480	05326-80002	1	1
05326-80004	INDICATOR:MASK	28480	05326-80004		1
05326-80006	WINDOW:FILM	28480	05326-80006	1	1
05326-80009	INDICATOR:MASK	28480	05326-80009	1	
05330-40002	BLOCK:ANNUNCIATOR	28480	05330-40002	5	5
5212A-128	BRACKET:FAN	28480	5212A-128	1	1
5212A-478	SPACER:FILTER	28480	5212A-478	1	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

⊕ Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
0683-1005	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005		
0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025		
0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	01121	CB 7525		
1200-0405	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207		
1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	28480	1820-0092		
1820-0117	INTEGRATED CIRCUIT	28480	1820-0117		
1820-0119	INTEGRATED CIRCUIT	28480	1820-0119		
1820-0275	INTEGRATED CIRCUIT:DIGITAL	04713	SC 7023PK		
1970-0042	TUBE:NUMERICAL INDICATOR	83594	B-5750-S		
05326-20008	BOARD:BLANK PC	28480	05326-20008		
05326-60025	DISPLAY ASSY	28480	05326-60025		

See introduction to this section for ordering information

Table 6-3. Manufacturers Code List

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00287	Cemco Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Microtron Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc.	Cherry Hill, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00809	Croven Ltd.	Whitby, Ontario Canada
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
00929	Microlab Inc.	Livingston, N.J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01536	Small Parts Inc.	Los Angeles, Calif.
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp.	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
02875	Hudson Tool & Die Co.	Newark, N.J.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Calif.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div., Finderne Plant	Somerville, N.J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lambertville, N.J.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04217	Essex Wire	Los Angeles, Calif.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.
04673	Dakota Engr. Inc.	Culver City, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05245	Components Corp.	Chicago, Ill.
05277	Westinghouse Electric Corp., Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05397	Union Carbide Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind. Inc.	Canoga Park, Calif.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Calif.
05615	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Ariz. Div.	Phoenix, Ariz.
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
06980	Varian Assoc. Eimac Div.	San Carlos, Calif.
07088	Kelvin Electric Co.	Van Nuys, Calif.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07256	Silicon Transistor Corp.	Carle Place, N.Y.
07261	Avnet Corp.	Culver City, Calif.
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Birtcher Corp., The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Calif.
07700	Technical Wire Products Inc.	Cranford, N.J.
07829	Bodine Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.
07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N.J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08289	Blinn, Delbert Co.	Pomona, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Calif.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div of C.B.S. Inc.	Lowell, Mass.
08806	General Electric Co. Miniat. Lamp Dept.	Cleveland, Ohio
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09922	Burndy Corp.	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12040	National Semiconductor	Danbury, Conn.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elmar Filter Corp.	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N.J.
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13019	Airco Supply Co., Inc.	Witchita, Kansas
13103	Thermolloy	Dallas, Texas
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dubilier Electric Corp.	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Calif.
14960	Williams Mfg. Co.	San Jose, Calif.
15106	The Sphere Co., Inc.	Little Falls, N.J.
15203	Webster Electronics Co.	New York, N.Y.
15287	Scionics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15558	Micron Electronics	Garden City, Long Island, N.Y.
15566	Amprobe Inst. Corp.	Lynbrook, N.Y.
15631	Cabletronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mt. View, Calif.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Omni-Spectra Inc.	Farmington, Mich.
16352	Computer Diode Corp.	Lodi, N.J.
16585	Boots Aircraft Nut Corp.	Pasadena, Calif.
16688	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Calif.
17474	Tranex Company	Mountain View, Calif.
17554	Components Inc.	Biddeford, Me.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Calif.
17856	Siliconix Inc.	Sunnyvale, Calif.

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From: FSC. Handbook Supplements

Table 6-3. Manufacturers Code List (Continued)

Code No.	Manufacturer	Address
17870	McGraw-Edison Co.	Manchester, N.H.
18042	Power Design Pacific Inc.	Palo Alto, Calif.
18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
18324	Signetics Corp.	Sunnyvale, Calif.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18612	Vishay Instruments Inc.	Malvern, Pa.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19589	Concoa	Baldwin Park, Calif.
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N.Y.
21335	Fafnir Bearing Co., The	New Britain, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23042	Texscan Corp.	Indianapolis, Ind.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G.E. Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
24796	Pareko Inc.	San Juan Capistrano, Calif.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobet File Co. of America, Inc.	Carlstadt, N.J.
26851	Compac Hollister Co.	Hollister, Calif.
26992	Hamilton Watch Co.	Lancaster, Pa.
27251	Specialties Mfg. Co., Inc.	Stratford, Conn.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
30817	Instrument Specialties Co., Inc.	Little Falls, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W.H. & Hill, Ltd.	Toronto Ontario, Canada
37942	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	Sanborn Company	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N.J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Inc. Weston-Newark	Newark, N.J.
66295	Wittek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionic Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N.Y.
71707	Coto Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasbey, N.J.
72699	General Instrument Corp., Cap. Div.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N.J.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Elect. Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.
73734	Federal Screw Products Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
73957	Groov-Pin Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littelfuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	General Instrument Corp., Micamold Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So. Braintree, Mass.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78424	Speciality Leather Prod. Co.	Newark, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
[illegible]	Prestole Corp.	Toledo, Ohio
80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association. Any brand tube meeting EIA Standards	Washington, DC.
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio

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Table 6-3. Manufacturers Code List (Continued)

Code No.	Manufacturer	Address
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Calif.
80583	Hammarlund Co., Inc.	Mars Hill, N.C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80813	Dimco Gray Co.	Dayton, Ohio
81030	International Instruments Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	. . . .
81483	International Rectifier Corp.	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Paramus, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83014	Hartwell Corp.	Los Angeles, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Calif.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Rosan Inc.	Newport Beach, Calif.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisade's Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A. J. Glesener Co., Inc.	San Francisco, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A. B. Boyd Co.	San Francisco, Calif.
85474	R. M. Bracamonte & Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Calif.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	San Francisco, Calif.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	G. E. Distributing Corp.	Schenectady, N.Y.
89665	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90763	United Carr Fastener Corp.	Chicago, Ill.
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect., Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91886	Malco Mfg. Co., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co. Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury Long Island, N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93632	Waters Mfg. Co.	Culver City, Calif.
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94142	Phelps Dodge	Yonkers, N.Y.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.	Dania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Siemon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West Inc.	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96306	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
96508	Xcelite Inc.	Orchard Park, N.Y.
96733	San Fernando Elect. Mfg. Co.	San Fernando, Calif.
96881	Thomson Ind. Inc.	Long Is., N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Tronics, Inc.	Jamaica, N.Y.
98159	Rubber Tech, Inc.	Gardena, Calif.
98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98376	Zero Mfg. Co.	Burbank, Calif.
98410	Etc Inc.	Cleveland, Ohio
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Branson Corp.	Whippany, N.J.
99934	Renbrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

Code No.	Manufacturer	Address
0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AB	ETA	England
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	A "N" D Mfg. Co.	San Jose, Calif.
000QQ	Cooltron	Oakland, Calif.
000WW	California Eastern Lab.	Burlingame, Calif.
000YY	S. K. Smith Co.	Los Angeles, Calif.

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Revised October 1969

From: FSC. Handbook Supplements

SECTION VII

OPTIONS AND MANUAL CHANGES

7-1. OPTIONS

7-2. Options 001 through 003 are available for both the 5326A and 5326B models.

7-3. Option 001, 8-Digit Display

7-4. Option 001 consists of Display Assembly 05326-60025 in place of 05326-60008. The schematic diagram for A9 shows both assemblies. The parts list in Section VI lists parts for both assemblies.

7-5. Option 002, Remote Programming

7-6. Option 002 consists of Remote Connector Assembly 05326-60006. This assembly consists of a wiring harness, a 36-pin connector 1251-0085, and a 45-pin connector 5060-0113. Programming instructions are given in Section II. A schematic diagram is included in Section VIII.

7-7. Option 003, Digital Recorder Output

7-8. Option 003 consists of Digital Recorder Cable Assembly 05326-60012 for the +8421 output TTL compatible. This assembly comprises a wiring harness, a 50-pin connector 1251-0087, and two 1251-2034. A schematic diagram is included in Section VIII.

7-9. FIELD INSTALLATION OF OPTIONS IN MODEL 5326A/B

7-10. Installation of Option 001, 8-Digit Display

Parts required to install this option are:

1820-0119 Decade Counter U-3
1820-0116 Buffer Storage U-16
1820-0092 Decoder Driver U-24
0683-7525 7.5K ohm ¼-watt resistor R11
1200-0405 Display tube socket
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 and display support boards A9 and A8 from the Model 5326A/B by pulling up on display support board A8. Separate A8 and A9.

d. Install parts on A9 as shown in component locator photo on Page 8-31 and solder in place.

e. Resistor R10 carries the overflow information from the decades and can be placed in one of two locations. Move R10 to the location shown in component locator photo. In this location R10 connects to pin 8 of U8. See A9 schematic on Page 8-31, Figure 8-15.

f. Perform steps 1-7 of the Self-Check on Page 3-9, Table 3-1. Especially note that the OF (overflow) lamp lights when the left-most digit changes from 9 to 0.

7-11. Installation of Option 002, Remote Programming

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 ⅝-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 nuts holding rear panel BNC's. For instruments without this board, see note following step m.

c. Remove two screws holding P1A, 1½-inch long black pressure connector, to 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 rear-panel interconnect board from the instrument and separate it from P1A by removing two screws.

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

g. Assemble rear-panel interconnect board and the new 5-inch long pressure connector P1 with the three 6-32 x ⅝-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, Page 8-10, Figure 8-4.

CAUTION

SCREWS LONGER THAN ¼-INCH WILL DAMAGE P1.

i. Gently reinstall rear panel. Install BNC lock nuts finger tight.

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.

NOTE

Below serial number 00130 on the 5326A and 00120 on the 5326B, the rear panel switches and BNC's were interconnected with hand wiring and no rear-panel interconnect board was installed, as shown in the picture on Page 8-11. Installation procedure for these instruments is similar except that the Remote Programming cable must be modified by: 1) removing the black wire from terminal A10 and attach to chassis ground at J4. See Page 8-49 for terminal identification; 2) remove the blue wire from terminal B8 and attach to terminal A10. The wires from the old pressure connector A1A must be unsoldered and attached to the corresponding pins of the new pressure connector.

7-12. Installation of Option 003, Digital Recorder Output

Order digital recorder cable assembly HP Part No. 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 then remove display support board A3 and display board A9 by pulling up on A8.

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

d. Slide the connectors on the A9 board, as shown in the photograph on Page 8-11. The connector with the long wires attaches to P1(J1) and is positioned so pin 1 is towards the front of the instrument. The other connector attaches to P2(J2), and pin 1 is towards the rear of the instrument.

e. Position the cable so it passes between A8 and A11, completely clearing A8. Note that this differs from Figure 8-4, Page 8-11. Reinstall A8 and A9.

f. Route the cable around T1 as in the photograph.

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

7-13. MANUAL CHANGES

7-14. This manual applies directly to Models 5326A having serial prefix 1044A and 5326B having serial prefix 1124A (refer to paragraph 1-4).

7-15. Newer Instruments

7-16. For instruments with serial prefixes above 1044A for the 5326A and 1124A for the 5326B, a separate manual is needed. For 5326A's with 1116A and above, order "5326A/5327A Timer/Counter" manual. For 5326B's with 1128A and above, order "5326B/5327B Timer/Counter/DVM" manual.

7-17. Older Instrument

7-18. To adapt this manual to instruments having a serial prefix prior to 1044A for the 5326A or 1124A for the 5326B, perform the backdating that applies to your instrument's serial prefix, as listed in the table below.

5326A With Serial Prefix	Perform Change
944	1, 2, 3, 4, 5
960	2, 3, 4, 5
972	3, 4, 5
1032	4, 5
1036	5

5326B With Serial Prefix -	Perform Change -
944	1, 2, 3, 4, 5, 6, 7
960	2, 3, 4, 5, 6, 7
972	3, 4, 5, 6, 7
1032	4, 5, 6, 7
1036	5, 6, 7
1048	7

BACKDATING MANUAL CHANGES

CHANGE 1

Page 6-25, Table 6-1:
Change part number of J2 through J6 to 1250-0083.
Change J7 to 1250-0083 for both 5326A and 5326B.

Page 6-26, Table 6-1:
Change part number of S7 and S8 to 3101-0139.
Delete indication that J2 through J7 and S7 and S8 are part of PC board 05326-20028.

CHANGE 2

Page 6-6, Table 6-1:
Delete A2R49, 50.
Change A5C2 to 0160-3060 C:FXD CER 0.1 UF 25VDCW.

Page 6-7, Table 6-1:
Change A5R7 to 0683-1035 10K ohms.

Page 6-14, Table 6-1:
Change A10CR1 to 1902-3301 34.8 V.

Page 6-15, Table 6-1:
Change A10CR1 to 1902-3301 34.8 V.

Page 6-17, Table 6-1:
Change A11CR1 to 1902-3301 34.8 V.

Page 8-17, Figure 8-8:
Delete A2R49, R50 from schematic.
Change REFERENCE DESIGNATION table to R1-48.
Delete SERIES 972 at top of schematic.

Page 8-21, Figure 8-10:
Change A5C2 to 0.1 UF.
Change A5R7 to 10K.

Page 8-33, Figure 8-16:
Change A10CR1 in schematic to 34.8 V.
Change all +155 V points to +140 V.
Change CR1 in TABLE to 1902-3301.
Delete SERIES 972 at top of schematic.

Page 8-35, Figure 8-17:
Change A11CR1 in schematic to 34.8 V.
Change all +155 V point to +140 V.
Change CR1 in TABLE to 1902-3345.
Delete SERIES 972 at top of schematic.

Page 8-37, Figure 8-18:
Change A11CR1 in schematic to 34.8 V.
Change all +155 V points to +140 V.
Change CR1 in TABLE to 1902-3345.
Delete SERIES 972 at top of schematic.

CHANGE 3

Page 6-6, Table 6-1:
Change A4C2 to 0180-0114 C:FXD ELECT 4.0 UF +100-10% 25VDCW.
Change A4C3 to 0120-0174 C:VAR CER 3-10 PF.
Delete A4C5 and A4L1.

Page 6-20 and 6-21, Table 6-1:
Change A13C5, C6, and C9 to 0150-0023 C:FXD CER 2000 PF 20% 1000VDCW.
Add A13C12 0160-2249 C:FXD CER 4.7 PF ±0.25 PF 500VDCW.
Delete A13C13 0160-2249 C:FXD CER 4.7 PF ±0.25 PF 500VDCW.
Add A13R19, R20 0683-3915 R:FXD COMP 390 OHM 5% ¼W.
Add A13R22, R23, R26 0683-1035 R:FXD COMP 10K OHM 5% ¼W.
Add A13R25 0683-1025 R:FXD COMP 1000 OHM 5% ¼W.
Change A13U1, U2, U3 to 1820-0201.

Page 6-22, Table 6-1:
Delete A15C6, C7 .001 μF 0160-0975.

Page 6-27, Table 6-2:
Change Chassis part number to 05326-60005.

Page 8-19, Figure 8-9:
Replace A4 OSCILLATOR ASSY schematic and reference designation table with Figure 7-2.
Replace A4 parts locator photo with Figure 7-1.

CHANGE 3 (Cont'd)

Page 8-31, Figure 8-15:
Delete SERIES 1032A at top of schematic.
Change U7 and U8 to show pin 10 of both IC's connected directly to ground.

Page 8-43, Figure 8-20:
Replace A13 VOLTMTER VOLTAGE to FREQUENCY CONVERTER ASSY schematic with Figure 7-4.
Replace A13 component locator photo with Figure 7-3.

Page 8-47, Figure 8-22:
Delete A15C6, C7 from schematic
Change reference designation table to C1-5.
Delete SERIES 1032A REV B from top of schematic.

CHANGE 4

Page 6-9, Table 6-1:
Delete A7AC5 120 PF 0160-2205
Change A7AR6 to 1000 ohms 0683-1025

Page 6-7, Table 6-1:
Change A6C10 to 3000 PF 0140-0159

Page 8-25, Figure 8-12:
Delete A7AC5 from schematic
Change A7AR6 to 1000 ohms
Change SERIES number at top of schematic to 944A

Page 8-23, Figure 8-11:
Change A6C10 in schematic to 3000 PF

CHANGE 5

Page 6-24, Table 6-1:
Change A16C1 to 4000 μF, 0180-2296, 15 VDCW
Change A16C2 to 1900 μF, 0180-2295, 15 VDCW

Page 8-47, Figure 8-22:
Change A16C1 in schematic to 4000 μF
Change A16C2 to 1900 μF.
Change SERIES number at top of schematic to 944A.

CHANGE 6

Page 6-18 and 19, Table 6-1:
Add A12K2 Relay Hi Volt 0490-0853
Add A12R2 RF 100 K ohms 5% ¼W 0683-1045
Add A12R1 RF 4700 ohms 5% ¼W 0683-4725
Add A12Q2 Silicon NPN 1854-0071
Add A12CR1 Silicon 1901-0025.

Page 8-39, Figure 8-19:
Replace A12 component locator with Figure 7-5.
Replace A12 schematic with Figure 7-6 (board series 944A).

Page 1-2, Table 1-3:
In the first table under 'Integrating Digital Voltmeter," change the input impedance for the 10 V range to read ">1000 M Ω."

Page 5-11, Table 5-4, Step 10 k:
Change to read "Counter display should be 10.000 ±17 counts."

CHANGE 7

Page 8-45, Figure 8-21:
Delete A15 schematic, component locator, and parts list.

Use A15 schematic and component locator on page 8-47 and parts list Page 6-22, Table 6-1. A15 part number becomes 05326-60001 Series 1032A.

Page 6-26, Table 6-1 (For 5326B Only):
Delete: Heat Sink 05327-20024 1 ea.
Add: Q Insulator 0340-0162 2 ea.
Change part numbers to read:
Cov.-Side 3 x 11 5000-0729 2 ea.
Cov.-Top 05326-00008 1 ea.

NOTE

If reqplacement of any of the parts is required (Change 7 only), replace with new parts.

Figure 7-1. A4 Oscillator Component Locator

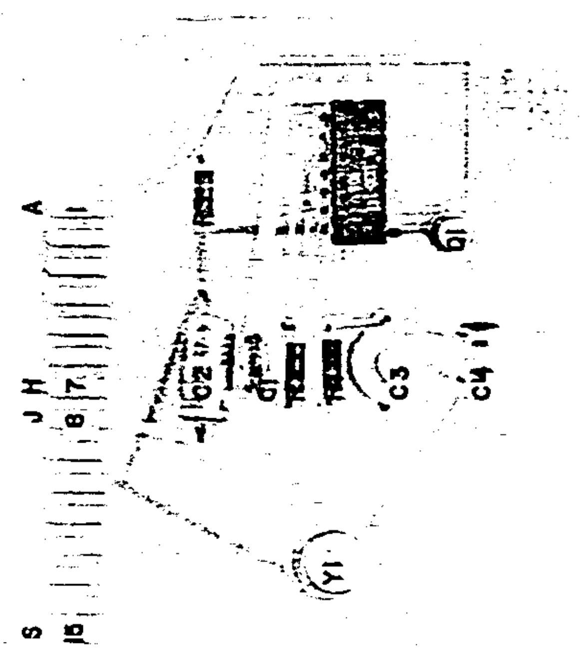
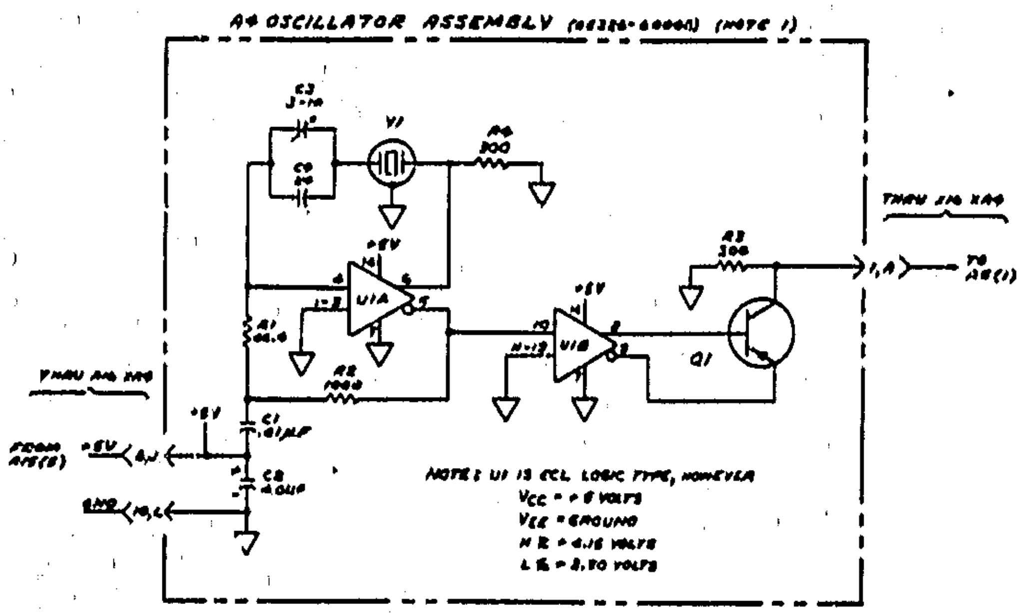


Figure 7-2. A4 Oscillator Schematic Diagram



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;

A4
C1-4
Q1
R1-4
U1
Y1

TABLE

REFERENCE DESIGNATIONS	HP PART NUMBERS
A4	
Q1	1820-0158 1N2636 1820-0142 MC1004P

Figure 7-3. A13 Voltmeter V-to-F Converter Component Locator

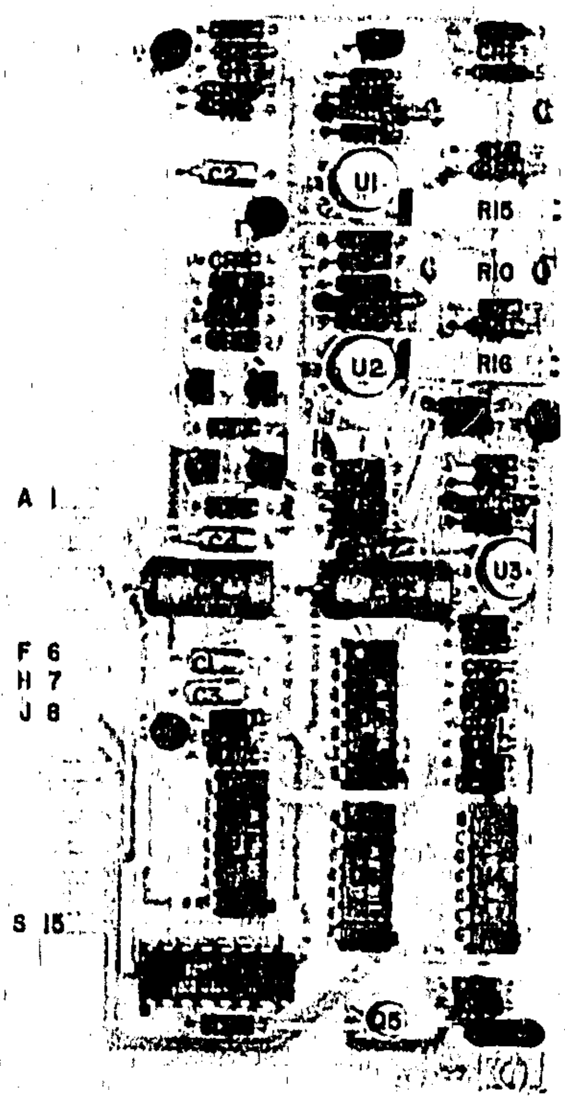


Figure 7-4. A13 Voltmeter V to F Converter Schematic Diagram

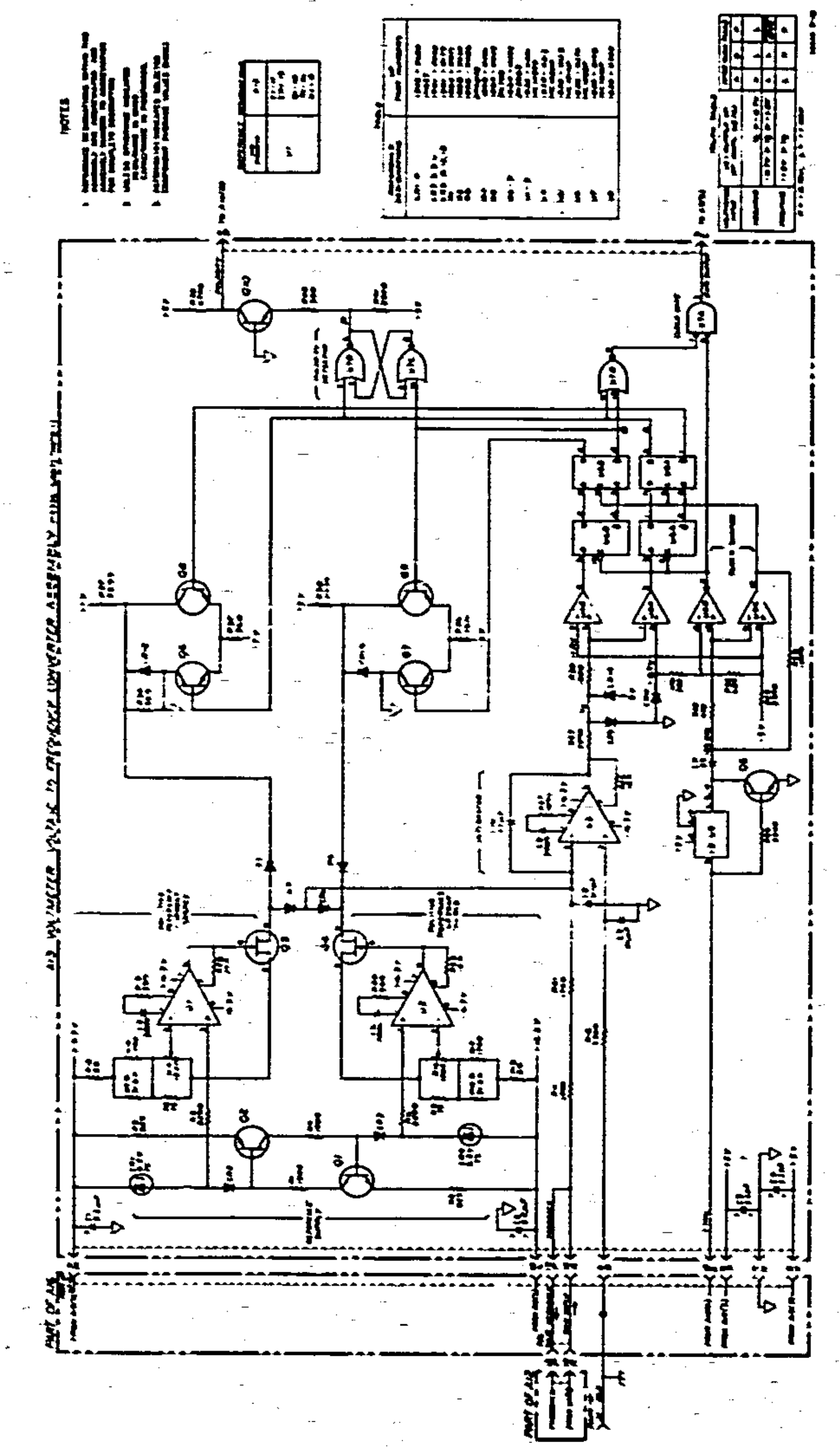
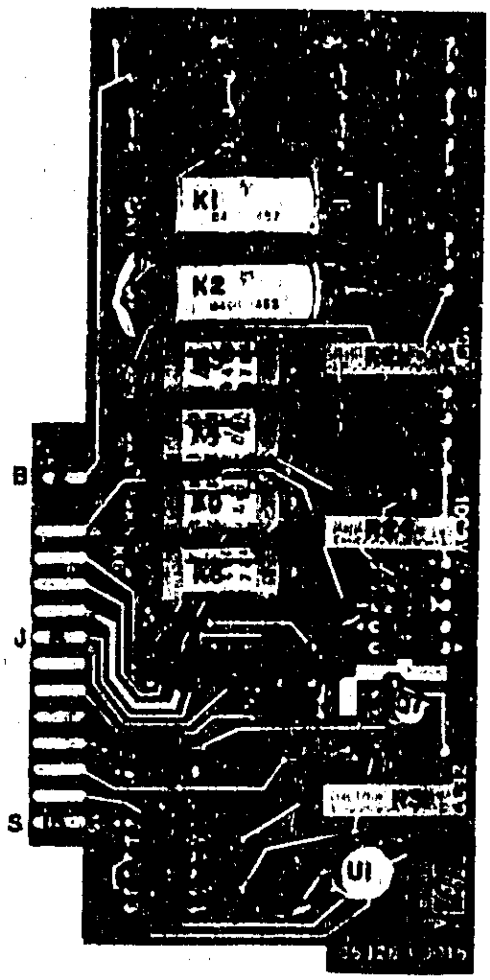
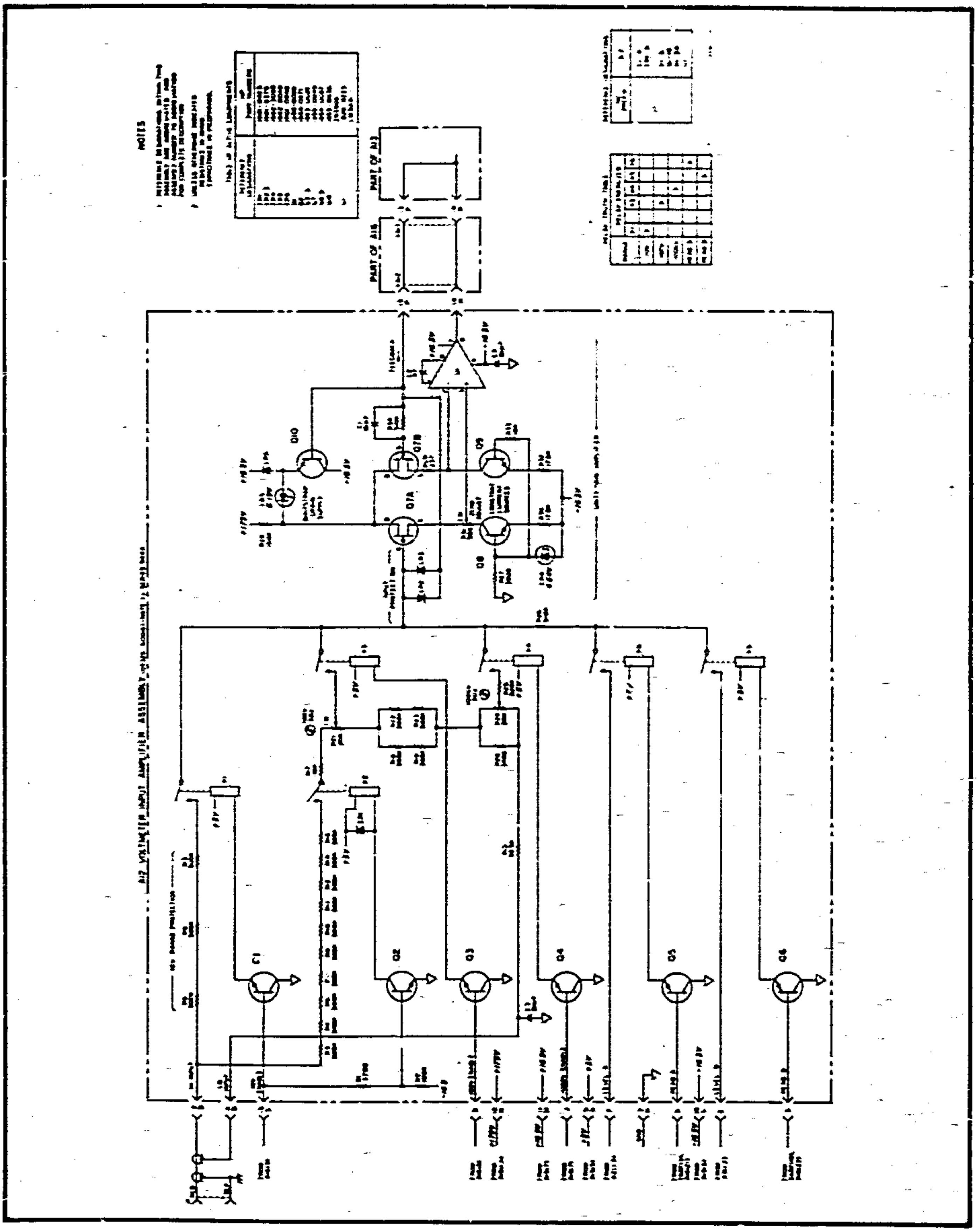


Figure 7-5. A12 Component Locator



107

Figure 7-6. A12 Voltmeter Input Amplifier Schematic Diagram



SECTION VIII

SCHEMATIC DIAGRAMS

This section contains the following:

a. Schematic diagram notes.

b. Component locators.

c. IC outline drawings.

d. Waveforms.

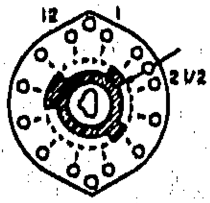
e. Simplified block diagrams.

Figure 8-1. Schematic Diagram Notes

SYMBOLS

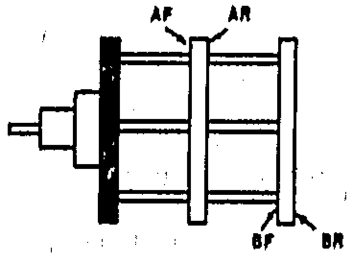
- FRONT PANEL
- REAR PANEL
- INTERIOR AND PC BOARDS
- WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE
- POWER LINE GROUND
- CIRCUIT COMMON GROUND
- FLOATING GROUND
- CHASSIS GROUND
- KNOB CONTROL
- SCREWDRIVER ADJUST
- MAIN SIGNAL PATH
- FEEDBACK PATH
- TEST POINT
- "AND" GATE
- "OR" GATE
-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

SWITCH DESIGNATIONS



A3S1BR(2-1/2)

A3S1	SWITCH S1 WITHIN ASSEMBLY A3
B	2ND WAFER FROM FRONT (A=1ST, ETC)
R	REAR OF WAFER (F=FRONT)
(2-1/2)	TERMINAL LOCATION (2½) (VIEWED FROM FRONT)



REFERENCE DESIGNATIONS

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

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

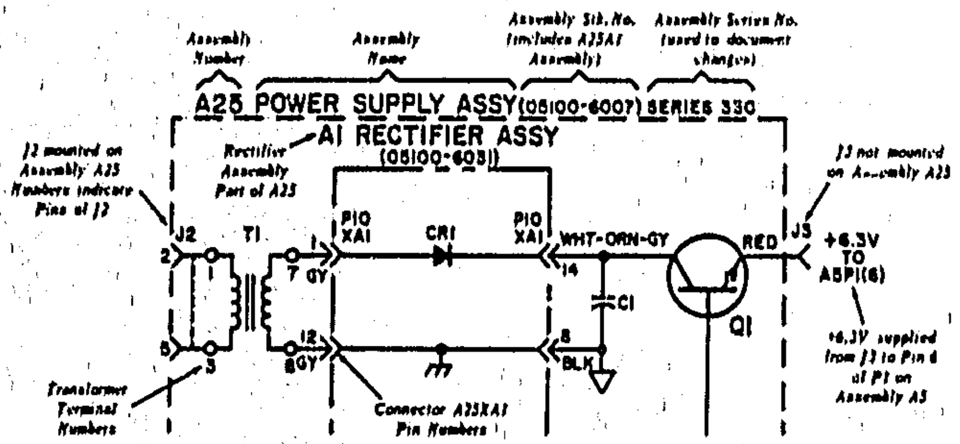
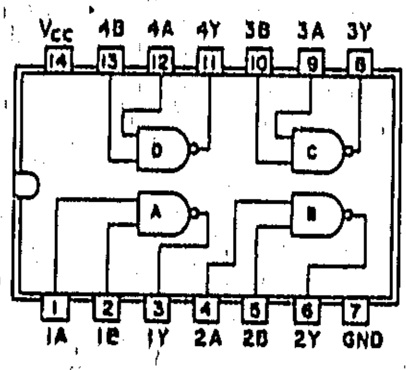


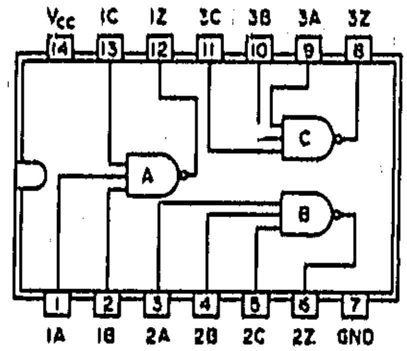
Figure 8-2. Integrated Circuit Diagrams

1820-0054



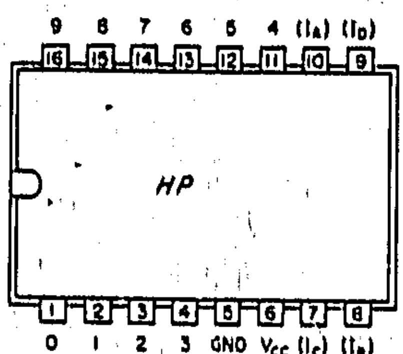
1820-0054(SN7400N)
QUADRUPLE 2-INPUT POSITIVE NAND GATE
NOTE: POSITIVE LOGIC $Y = \overline{AB}$

1820-0068



1820-0068(SN7410N)
TRIPLE 3-INPUT POSITIVE NAND GATE
POSITIVE LOGIC, $Y = \overline{ABC}$

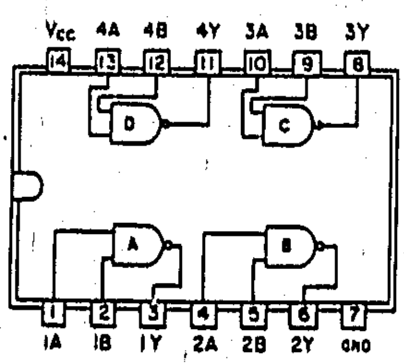
1820-0092



1820-0092
DRIVER
NEGATIVE LOGIC

$I_A(1)$	$I_B(2)$	$I_C(4)$	$I_D(8)$	"ON" 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 10-15				NONE

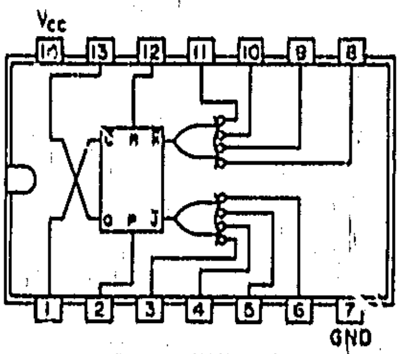
1820-0094



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(MC1013P)
85MHz J-K FLIP-FLOP

R-S TRUTH TABLE

R	S	Q^{n+1}
12	2	13
0	0	Q^n
0	1	1
1	0	0
1	1	ND

ALL $\overline{J} \cdot \overline{K}$ INPUTS ARE STATIC

$\overline{J}_D \cdot \overline{K}_D$ TRUTH TABLE

$\overline{J}_D$	$\overline{K}_D$	Q^{n+1}
•	•	13
0	0	Q^n
0	1	0
1	0	1
1	1	$\overline{Q}^n$

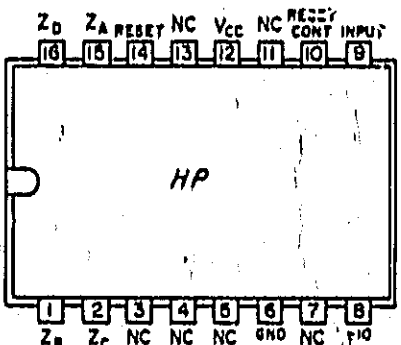
ALL OTHER $\overline{J} \cdot \overline{K}$ INPUTS AND THE R-S INPUTS ARE AT A "0" LEVEL

CLOCKED $\overline{J} \cdot \overline{K}$ TRUTH TABLE

$\overline{J}$	$\overline{K}$	C_D	Q^n
•	•	••	13
ϕ	ϕ	0	Q^n
0	0	1	$\overline{Q}^n$
0	1	1	1
1	0	1	0
1	1	1	Q^n

ALL OTHER $\overline{J} \cdot \overline{K}$ INPUTS AND THE R-S INPUTS ARE AT A "0" LEVEL

1820-0117



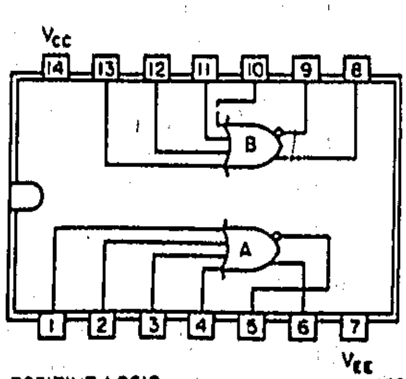
1820-0117,0119,0232
BLANKING DECADE COUNTER
NEGATIVE LOGIC 1 = LOW
0 = HIGH

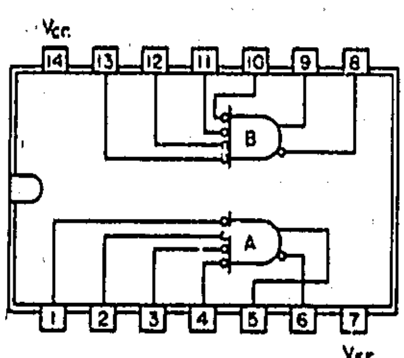
TRUTH TABLE

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
RESET CONTROL HIGH & RESET PULSE	H	H	H	H
RESET CONTROL LOW & 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





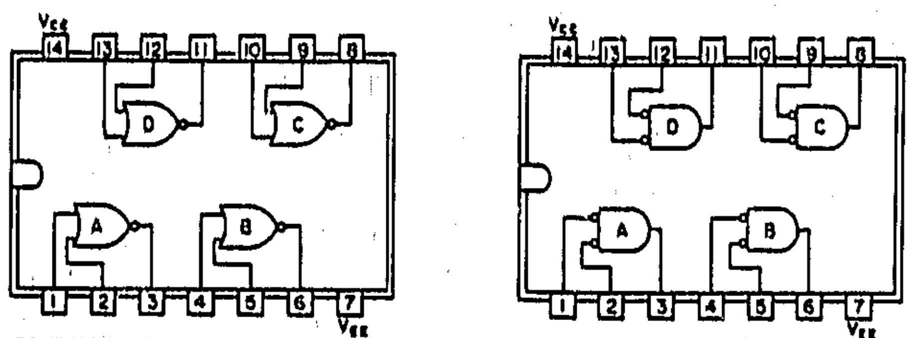
POSITIVE LOGIC:
$5 = \overline{1+2+3+4}$
$6 = 1+2+3+4$

1820-0142(MC1004P)
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

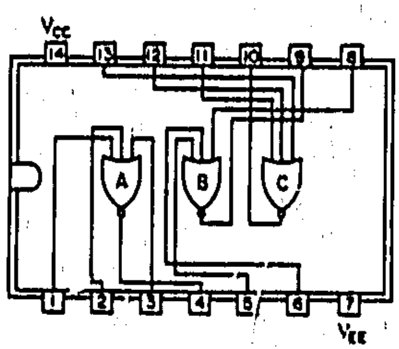


POSITIVE LOGIC:
$3 = \overline{1+2}$

1820-0145(MC1010P)
ECL QUAD 2-INP NOR

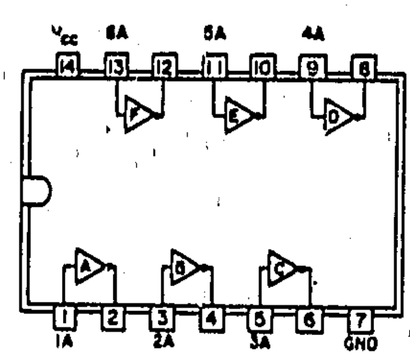
NEGATIVE LOGIC:
$3 = \overline{1 \cdot 2}$

1820-0147

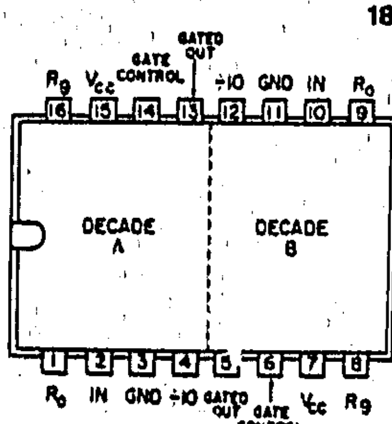


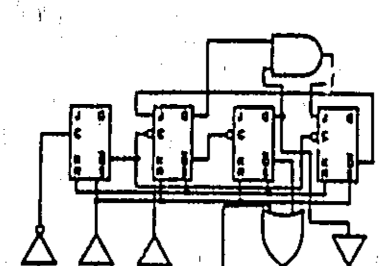
1820-0147 (MC1007P)
TRIPLE 3-INPUT GATES

1820-0174



1820-0198 and 1820-0199

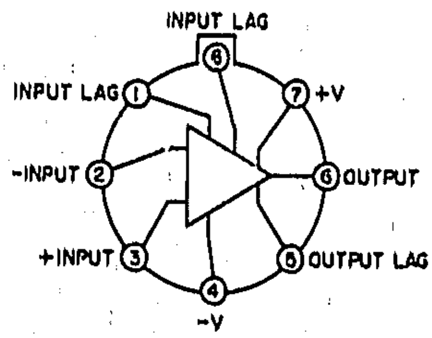




DECADE	CLOCK (COUNT) INPUT	RESET 0 INPUT	RESET 9 INPUT	GATE CONT	GATED OUTPUT	÷10 CARRY	VCC	GND	HP PART NUMBER
A	2	1	16	14	13	4	15	3	1820-0198
B	10	9	8	6	5	12	7	11	1820-0199
PINS									
	2	1	8	6	5	4	7	3	1820-0412 1820-0413
	2	1	16	14	13	4	15	3	1820-0226 1820-0227

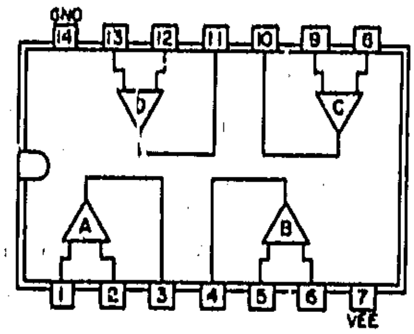
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0201



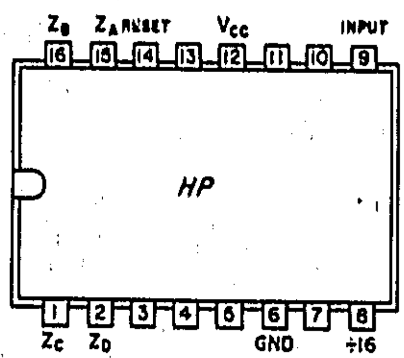
1820-0201 (MC1439G)
OPERATIONAL AMPLIFIER

1820-0212



1820-0212
QUADRUPLE LINE RECEIVER

1820-0209



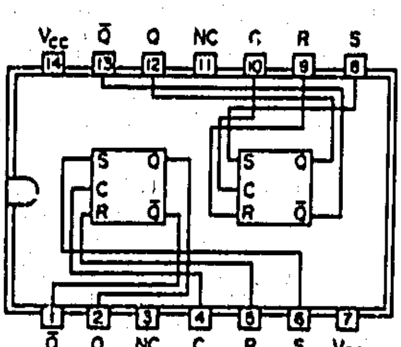
1820-0209
DIVIDE BY 16 COUNTER
NEGATIVE LOGIC 1=LOW
0=HIGH

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



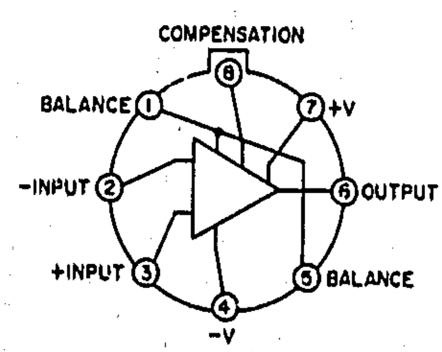
1820-0213 (MC1014P)
DUAL RS FF

TRUTH TABLE

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

*EITHER STATE
N.D.=NOT DEFINED

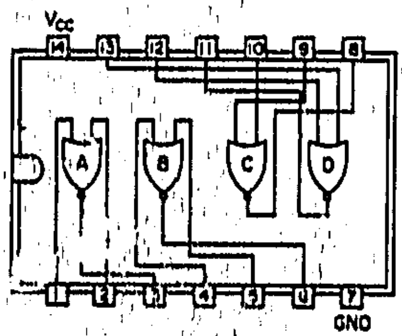
1820-0223



1820-0223 (LM 301A)
OPERATIONAL AMPLIFIER

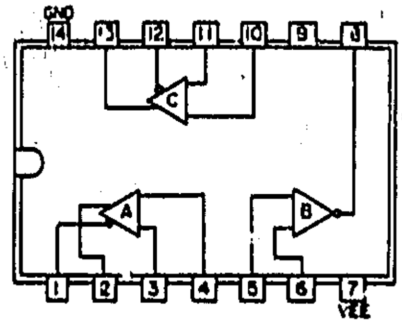
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0238



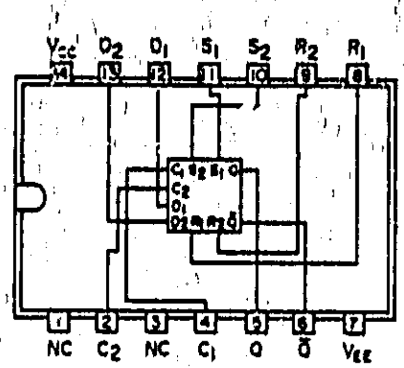
1820-0238 (MC1810P)
QUAD 2-INPUT NOR GATES

1820-0253



18..-0253
TRIPLE DIFFERENTIAL AMPLIFIER

1820-0272



1820-0272 (MC1022P)
TYPE "D" FLIP-FLOP

CLOCKED TRUTH TABLE

	D	C	Q^{n+1}	$\bar{Q}^{n+1}$
PIN No.	12 OR 13	2 OR 4	5	6
	0	0	Q^n	$\bar{Q}^n$
	1	0	Q^n	$\bar{Q}^n$
	0	1*	0	1
	1	1*	1	0

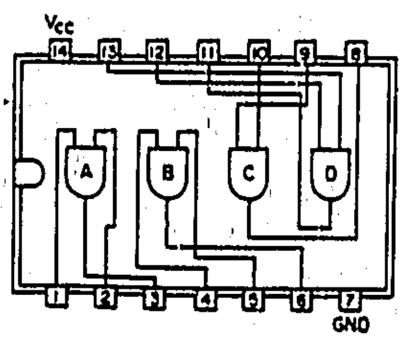
*A "1" OR CLOCK INPUT IS DEFINED FOR THIS FLIP-FLOP AS A CHANGE IN LEVEL FROM A LOW INPUT TO A HIGH INPUT.

R-S TRUTH TABLE

	R	S	Q^{n+1}	$\bar{Q}^{n+1}$
PIN No.	8 OR 9	10 OR 11	5	6
	0	0	Q^n	$\bar{Q}^n$
	0	1	1	0
	1	0	0	1
	1	1	N.D.	N.D.

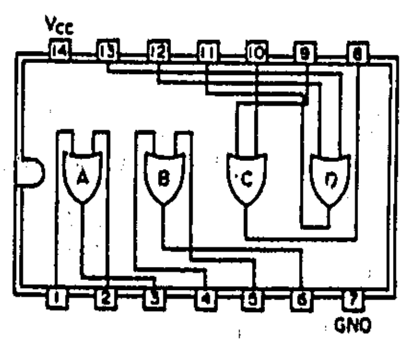
N.D. = NOT DEFINED

1820-0273



1820-0273 (MC1806P)
QUAD 2-INPUT AND GATES

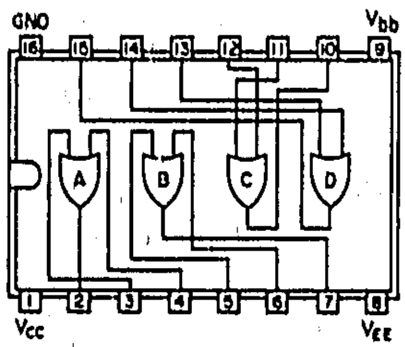
1820-0274



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

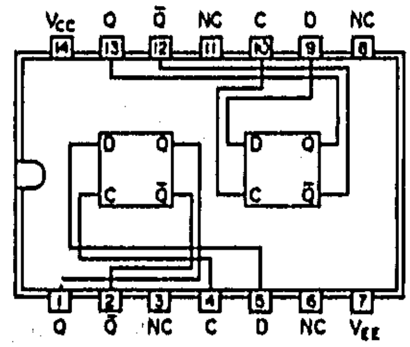
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0275



1820-0275 (MC 1039P)
QUAD TRANSLATOR 2-INPUT OR GATES

1820-0276

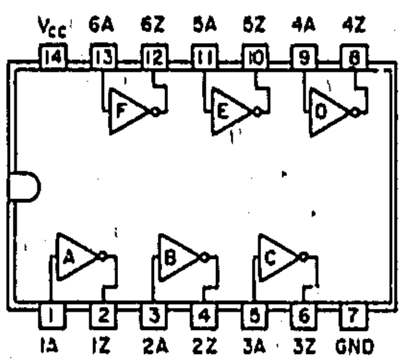


TRUTH TABLE

D	C	Q^{n+1}
0	1	Q^n
1	1	Q^n
0	0	0
1	0	1

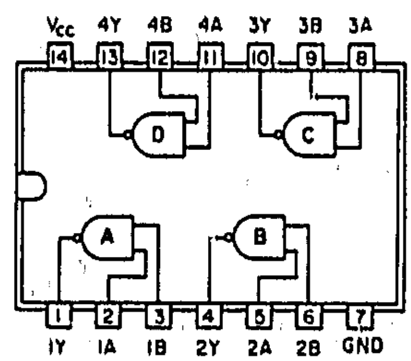
1820-0276 (MC 1033P)
DUAL RS FF

1820-0307



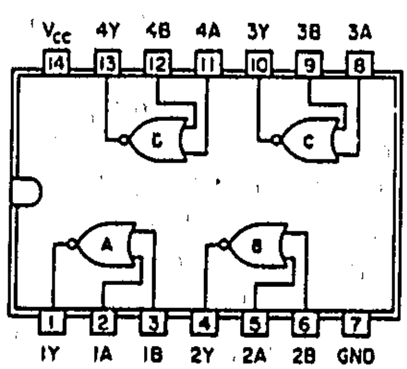
1820-0175, 0307 (MC1027D)
HEX INVERTER

1820-0327



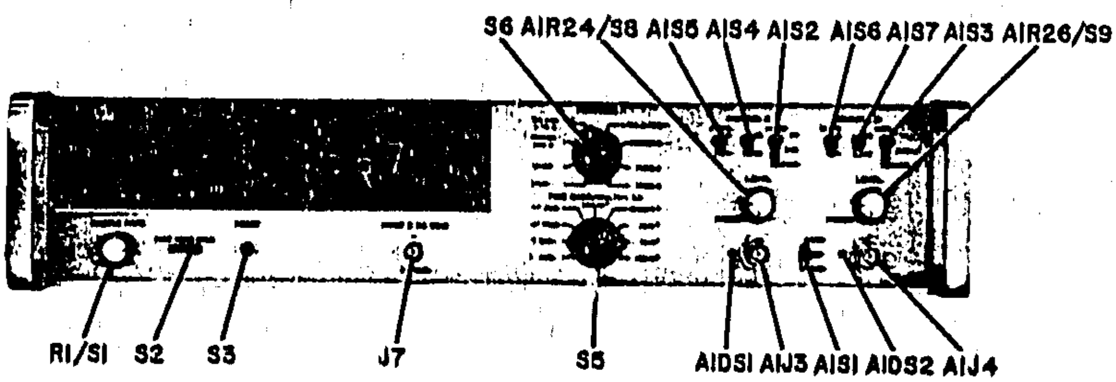
1820-0327 (SN7401N)
QUAD 2-INPUT NAND WITH OPEN COLLECTOR
POSITIVE LOGIC: $Y = \overline{AB}$

1820-0328

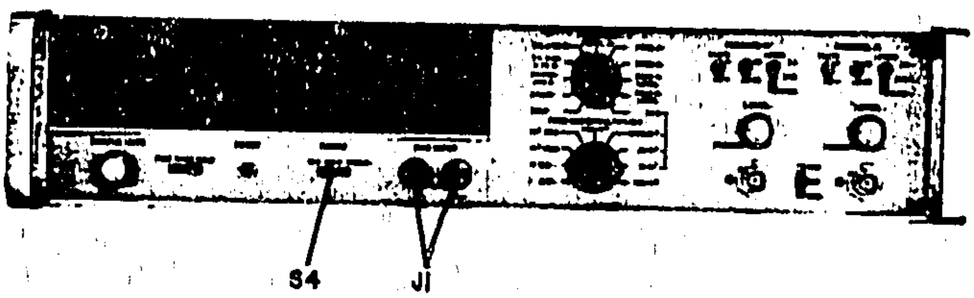


1820-0328 (SN7402N)
QUAD 2-INPUT NOR GATE
POSITIVE LOGIC: $Y = \overline{A+B}$

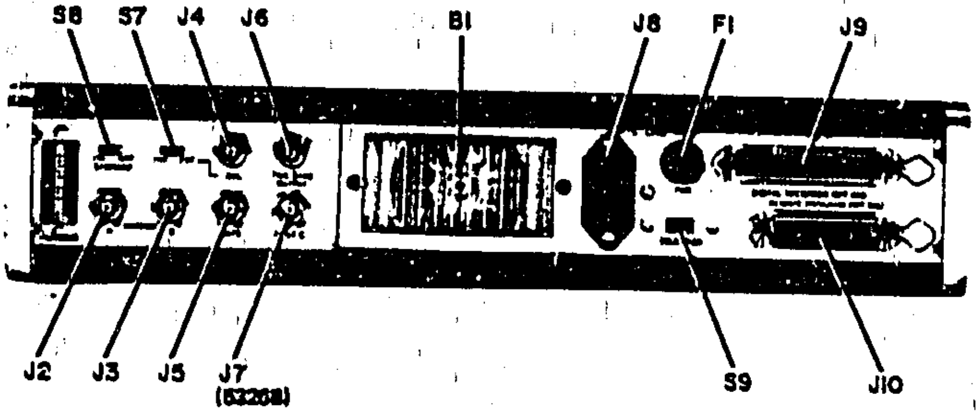
Figure 8-3. Front and Rear Panel Designations



MODEL 5326A



MODEL 5326B



REAR

Figure 8-4. 5326A Top Internal

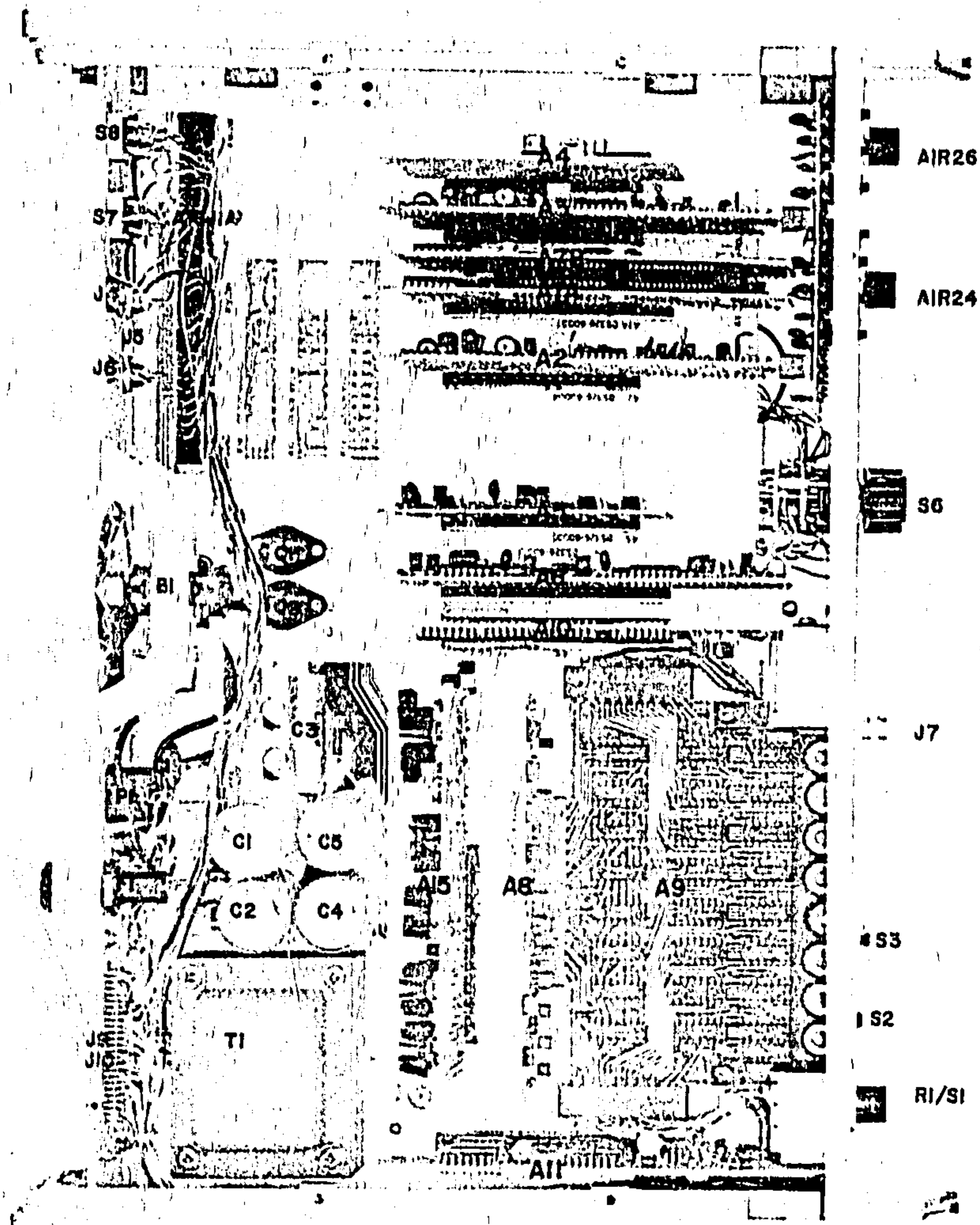


Figure 8-5. 5326B Top Internal

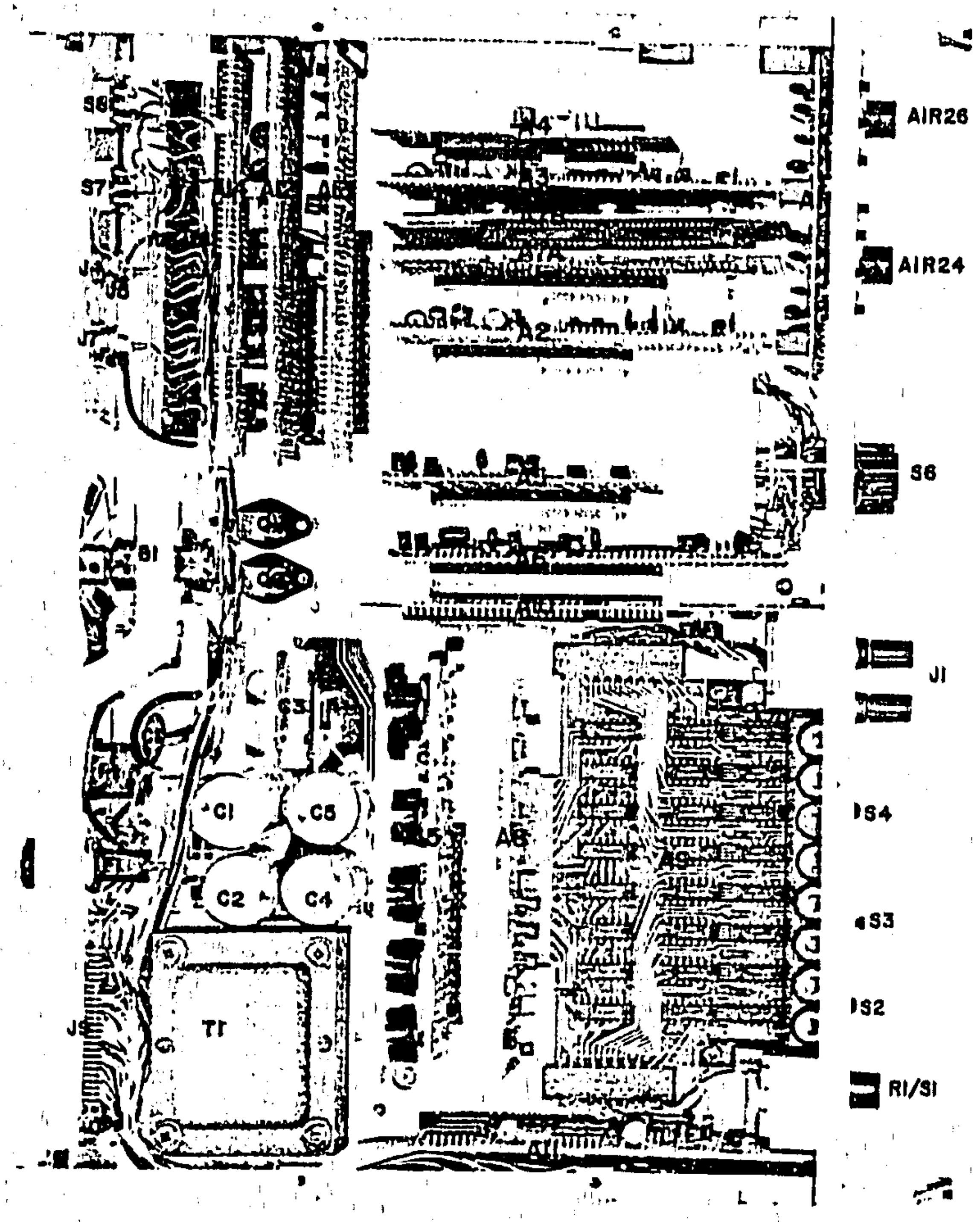
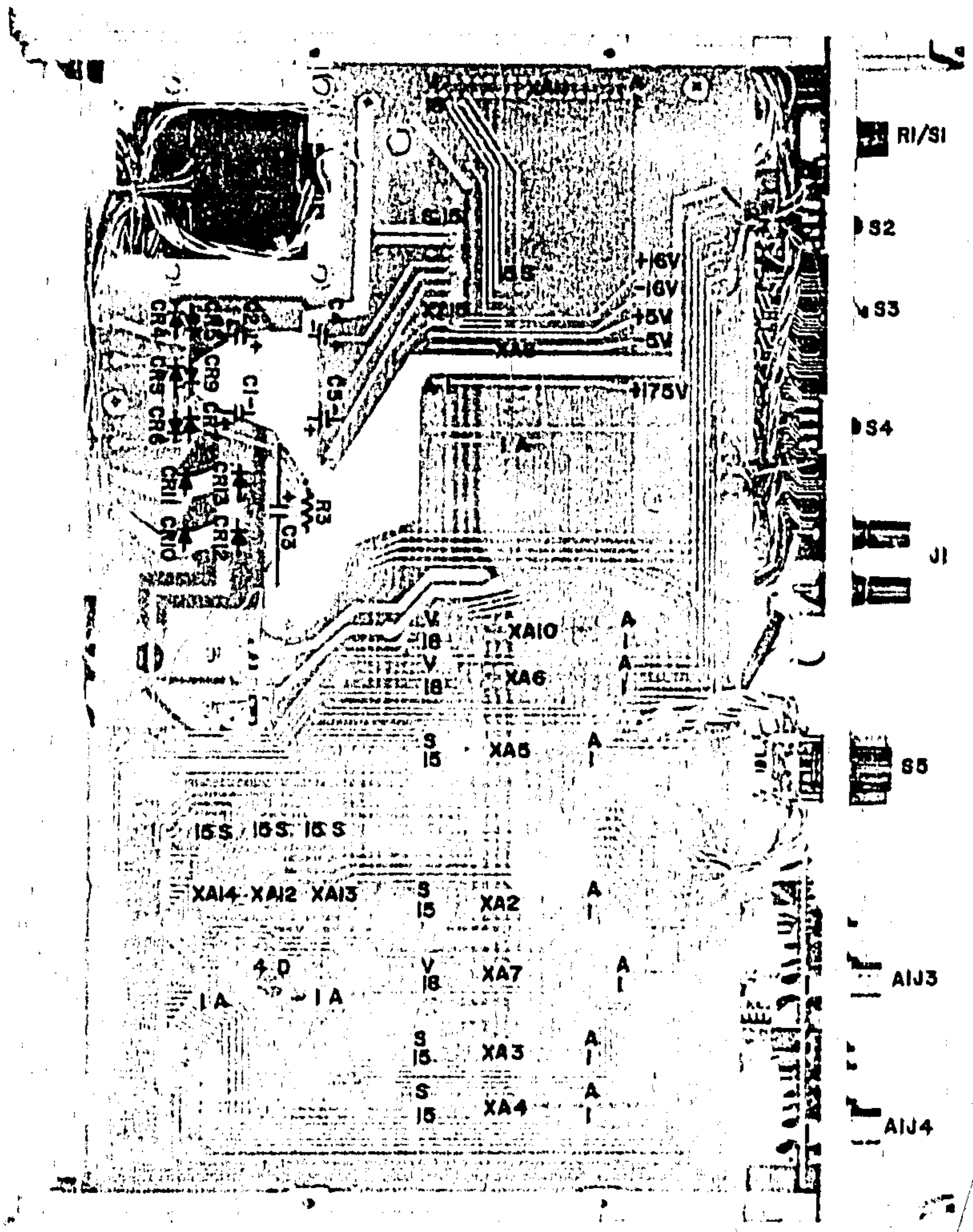


Figure 8-6. 5326A/B Bottom Internal



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.

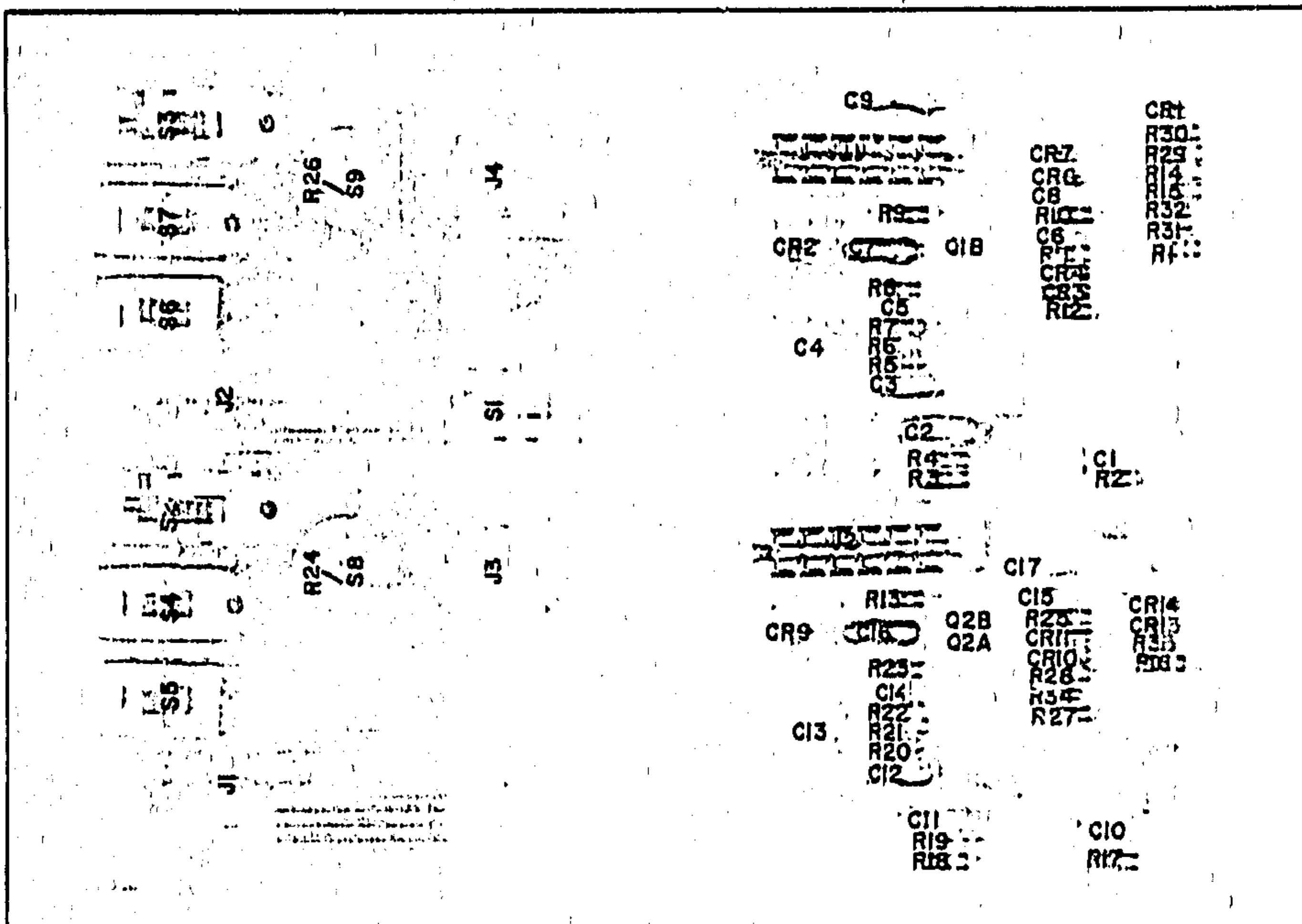
When AC/DC switch S4 is set to AC, C4 is in series with the signal path. CR3 and CR4 limit the input amplitude to Q1A to approximately ±5.8 volts. R7 and R8 provide current limiting. C5 compensates Q1A input capacitance.

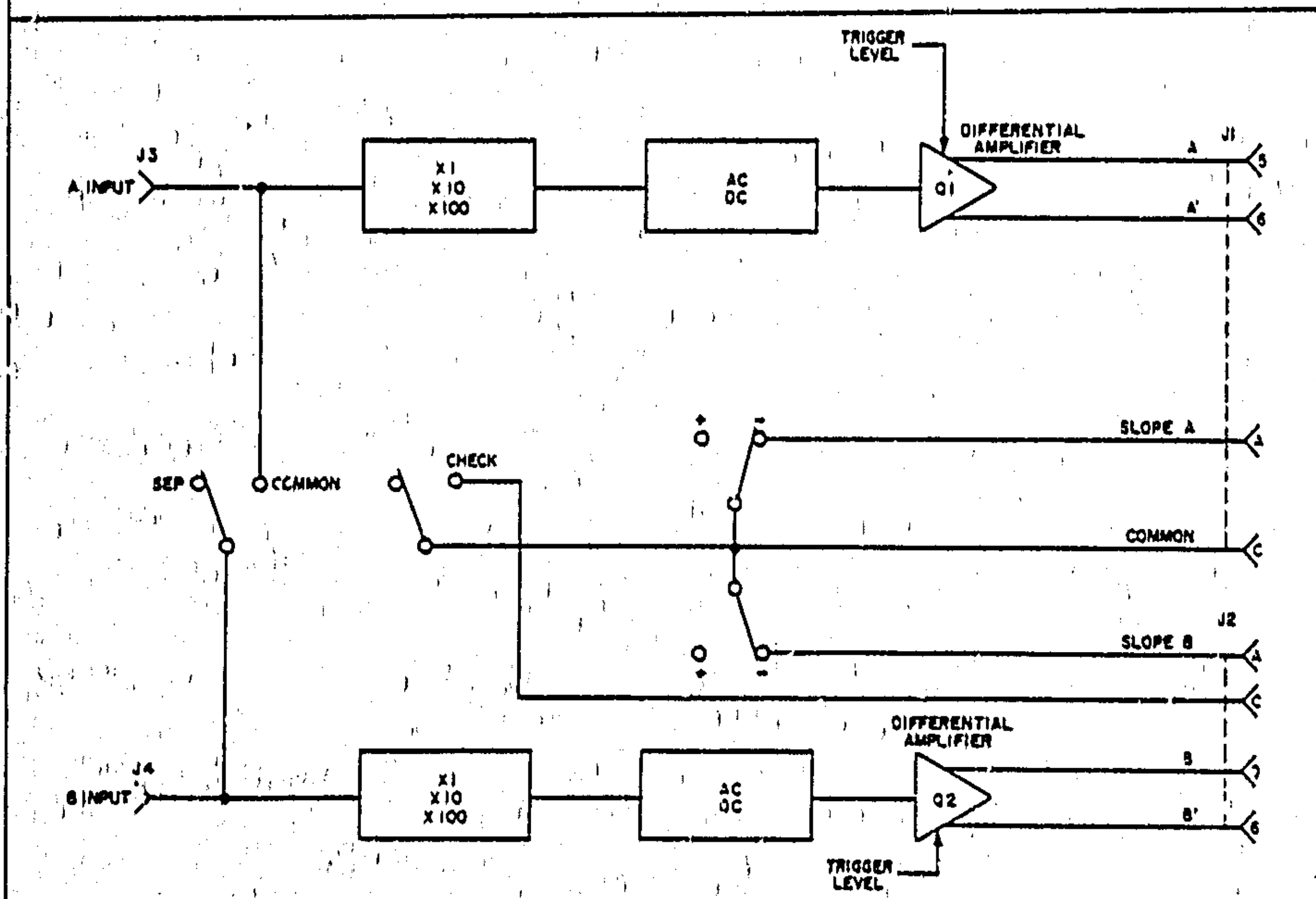
Q1A and Q1B form a differential amplifier connected as source followers. The outputs are fed to A2 via pins 5 and 6 of J1. LEVEL potentiometer R24 determines the trigger level on Q1B gate. The trigger level can be preset to zero volts or varied from -3 to +3 volts; or with the LEVEL control set to PRESET, 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.

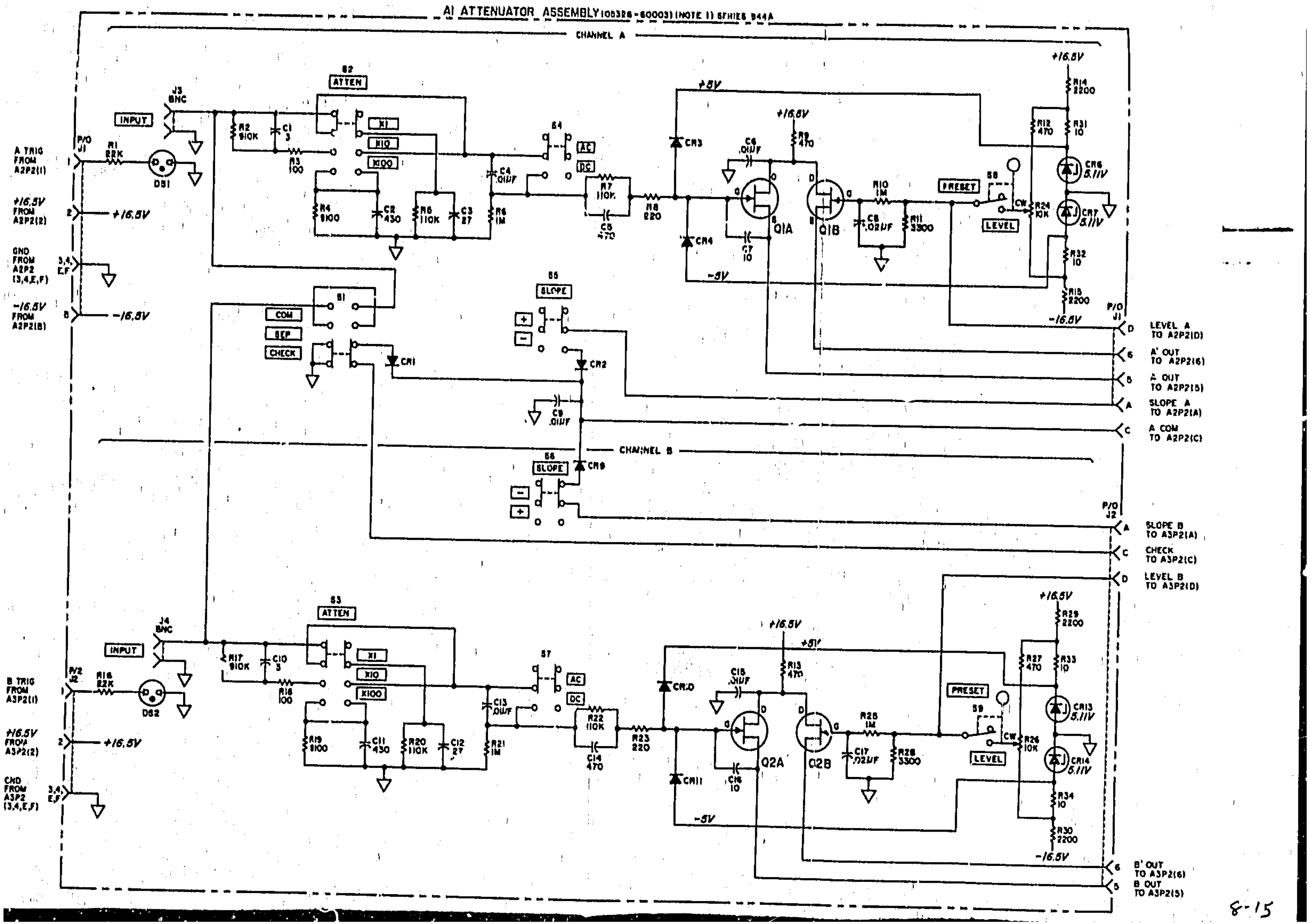
When SLOPE switch S5 is set to -, a ground is supplied via CR2 to J1 pin A. This sets amplifier trigger A2 to trigger on the negative slope of the input signal. When remote programming is used, J1(C) is held high to disable the SLOPE switches and the CHK switch.

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.


C9
CR1
R30
R29
R14
R16
R32
R31
CR7
CR6
C8
R10
C6
CR4
CR3
R12
R9
CR2
C7
Q1B
R8
C5
R7
R6
R5
C3
C4
C2
R4
R3
C1
R2
C17
C15
R13
Q2B
Q2A
CR9
C16
R25
CR14
CR13
R23
C14
R22
R21
R20
C12
C13
C11
R19
R18
C10
R17
R26
S9
J4
J2
S1
R24
S8
J3
J1


TRIGGER LEVEL
DIFFERENTIAL AMPLIFIER
J3
A INPUT
X1
X10
X100
AC
DC
Q1
A
A'
J1
SLOPE A
COMMON
SEP
CHECK
J2
SLOPE B
DIFFERENTIAL AMPLIFIER
J4
B INPUT
Q2
B
B'
TRIGGER LEVEL


A1 ATTENUATOR ASSEMBLY (05326-60003) (NOTE 1) SERIES 944A
CHANNEL A
CHANNEL B
A TRIG FROM A2P2(1)
+16.5V FROM A2P2(2)
GND FROM A2P2 (3,4,E,F)
-16.5V FROM A2P2(B)
B TRIG FROM A3P2(1)
+16.5V FROM A3P2(2)
GND FROM A3P2 (3,4,E,F)
INPUT
ATTEN
X1
X10
X100
AC
DC
COM
SEP
CHECK
SLOPE
PRESET
LEVEL
LEVEL A TO A2P2(D)
A' OUT TO A2P2(6)
A OUT TO A2P2(5)
SLOPE A TO A2P2(A)
A COM TO A2P2(C)
SLOPE B TO A3P2(A)
CHECK TO A3P2(C)
LEVEL B TO A3P2(D)
B' OUT TO A3P2(6)
B OUT TO A3P2(5)

A2 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(8) 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 R16 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 -0.5 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 L3 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).

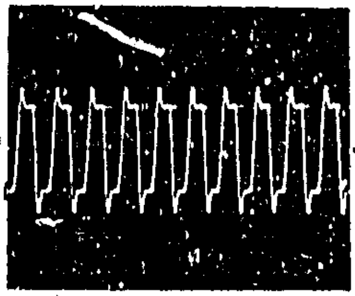
A2 TROUBLESHOOTING

When tracing the signal through the amplifier assembly, a good starting point is the collector of Q4, 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.

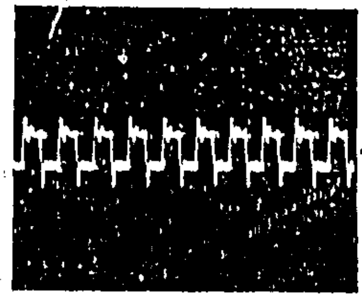
Figure 8-7
A1 ATTENUATOR ASSEMBLY

(See Page 8-15)

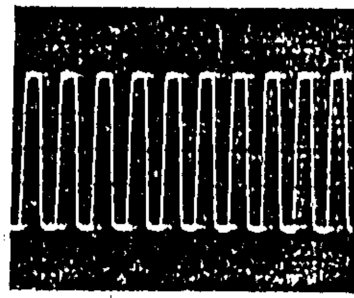
Part of Figure 8-8. Input Amplifier Assembly



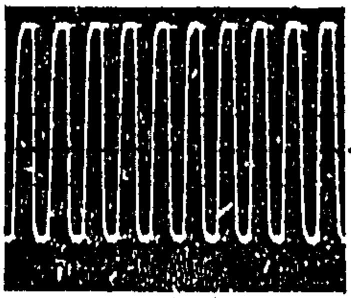
.05 V/cm
.1 μs/cm
ac coupled



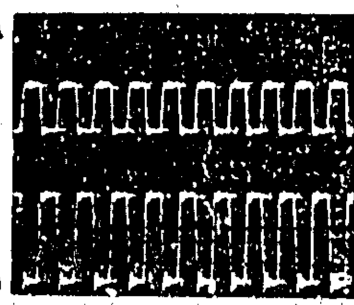
.01 V/cm
.1 μs/cm
ac coupled



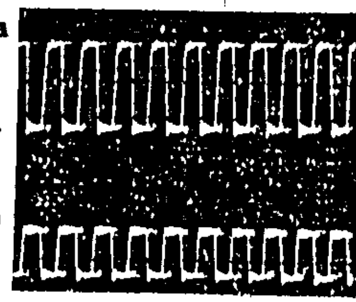
.05 V/cm
.1 μs/cm
ac coupled



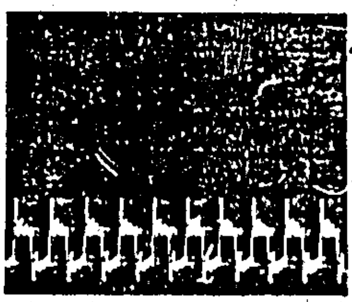
.02 V/cm
.1 μs/cm



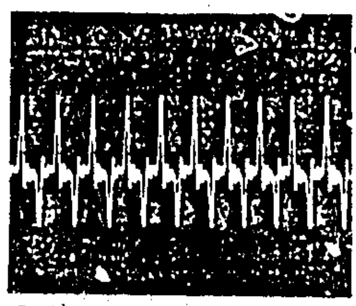
+SLOPE
a. Q10 emitter
b. Q9 emitter
.05 V/cm, .1 μs/cm



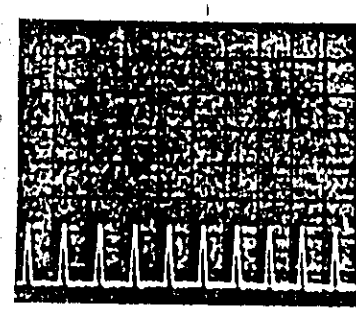
-SLOPE
a. Q10 emitter
b. Q9 emitter
.05 V/cm, .1 μs/cm



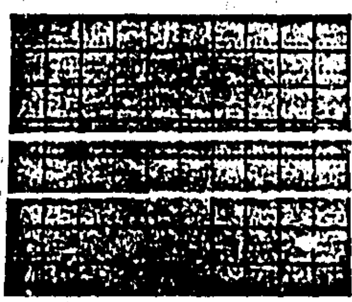
.02V/cm
.1 μs/cm



.05 V/cm
.1 μs/cm



.05 V/cm
.1 μs/cm



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

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 .... +

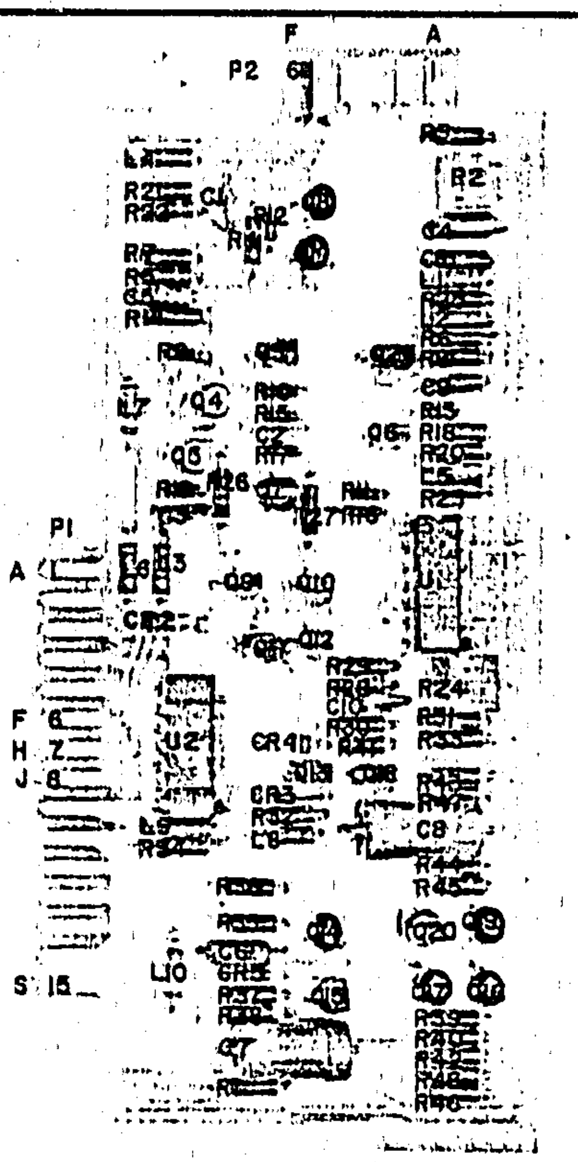
OSCILLOSCOPE CONTROLS:
(except as noted)

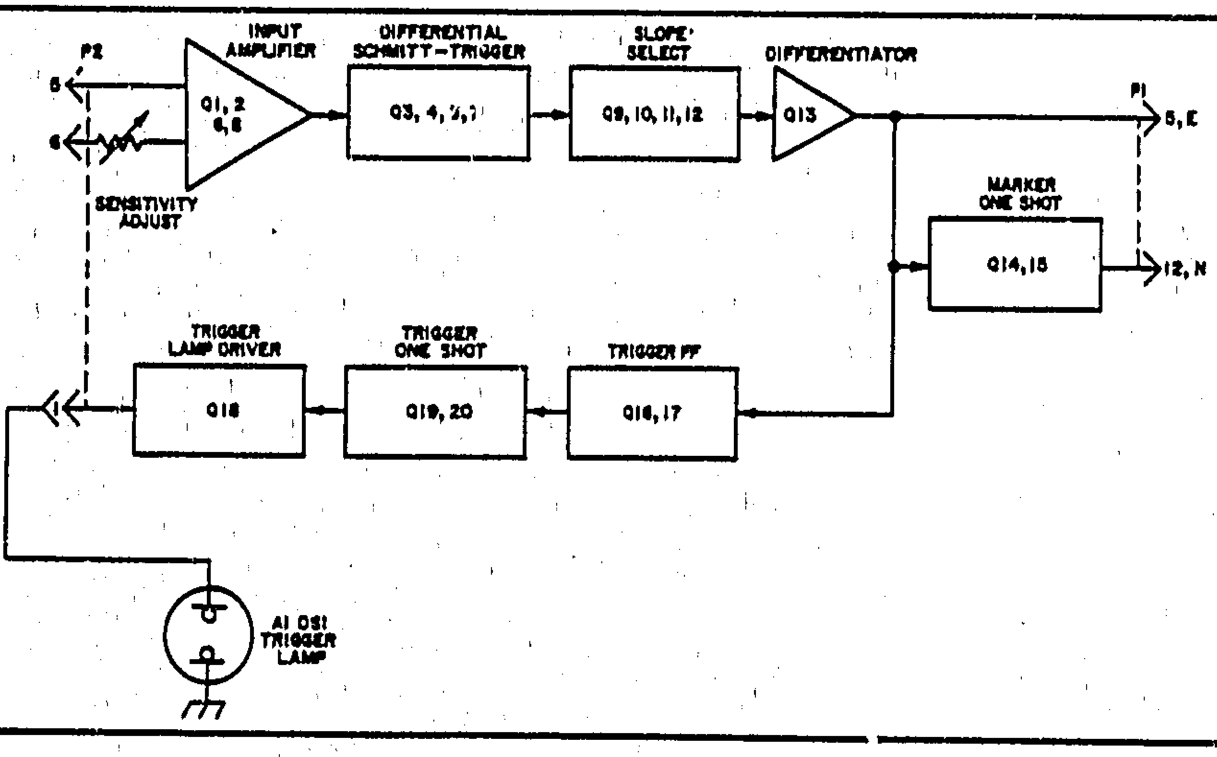
SWEEP MODE .... AUTO
TRIGGER .... INT
SLOPE .... +
DISPLAY .... for dual waveforms, use ALT B

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

8-12

MORE DATA UNDER FOLD





P2
5
6
INPUT AMPLIFIER
DIFFERENTIAL SCHMITT-TRIGGER
SLOPE SELECT
Q9, 10, 11, 12
DIFFERENTIATOR
Q13
P1
5, E
MARKER ONE SHOT
Q14, 15
12, N
SENSITIVITY ADJUST
TRIGGER LAMP DRIVER
Q18
TRIGGER ONE SHOT
Q19, 20
TRIGGER FF
Q16, 17
A1 DS1 TRIGGER LAMP

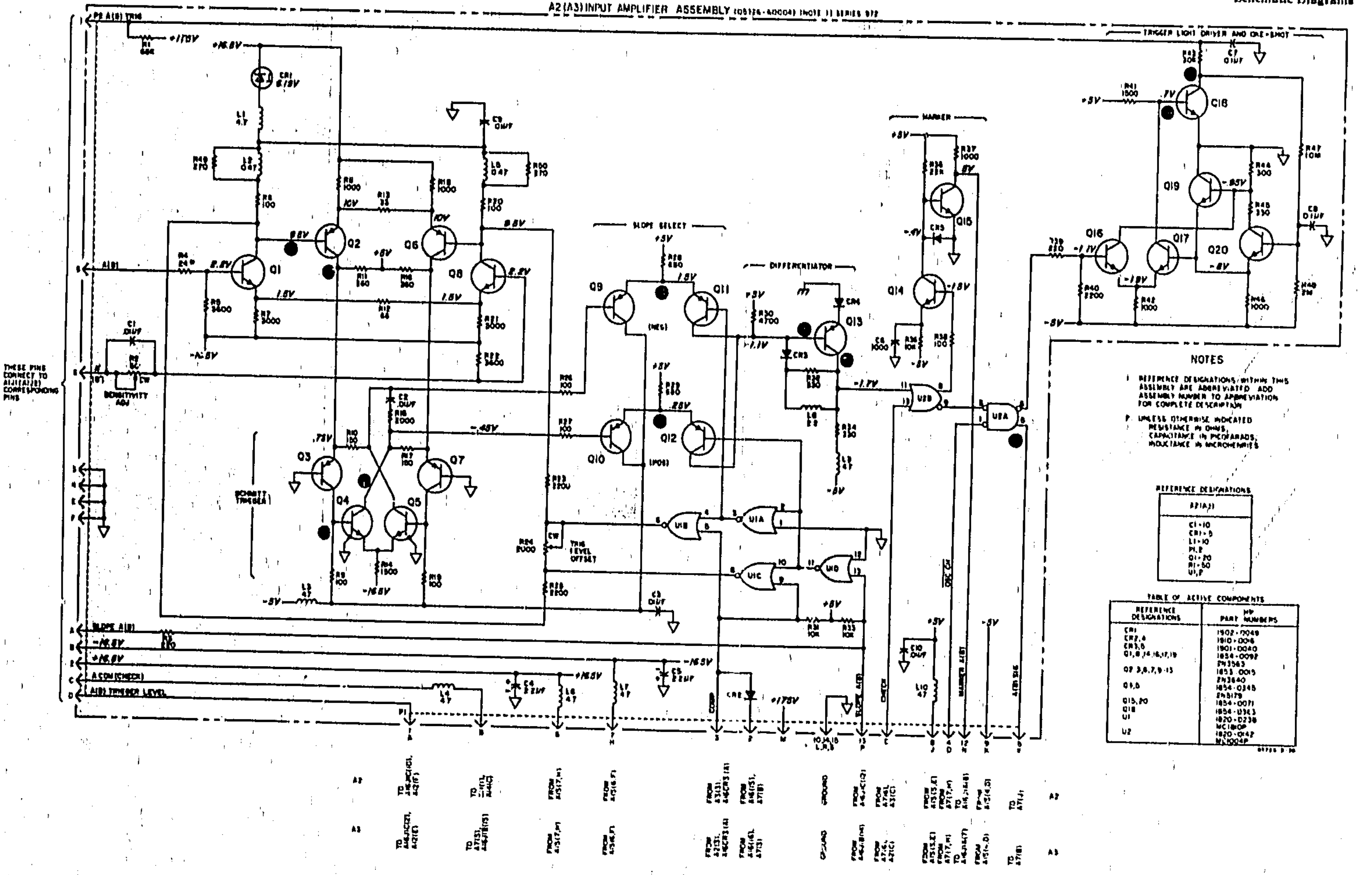


Figure 8-8. A2, A3 Input Amplifier Assembly

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.

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 U5C 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.

Apr 10

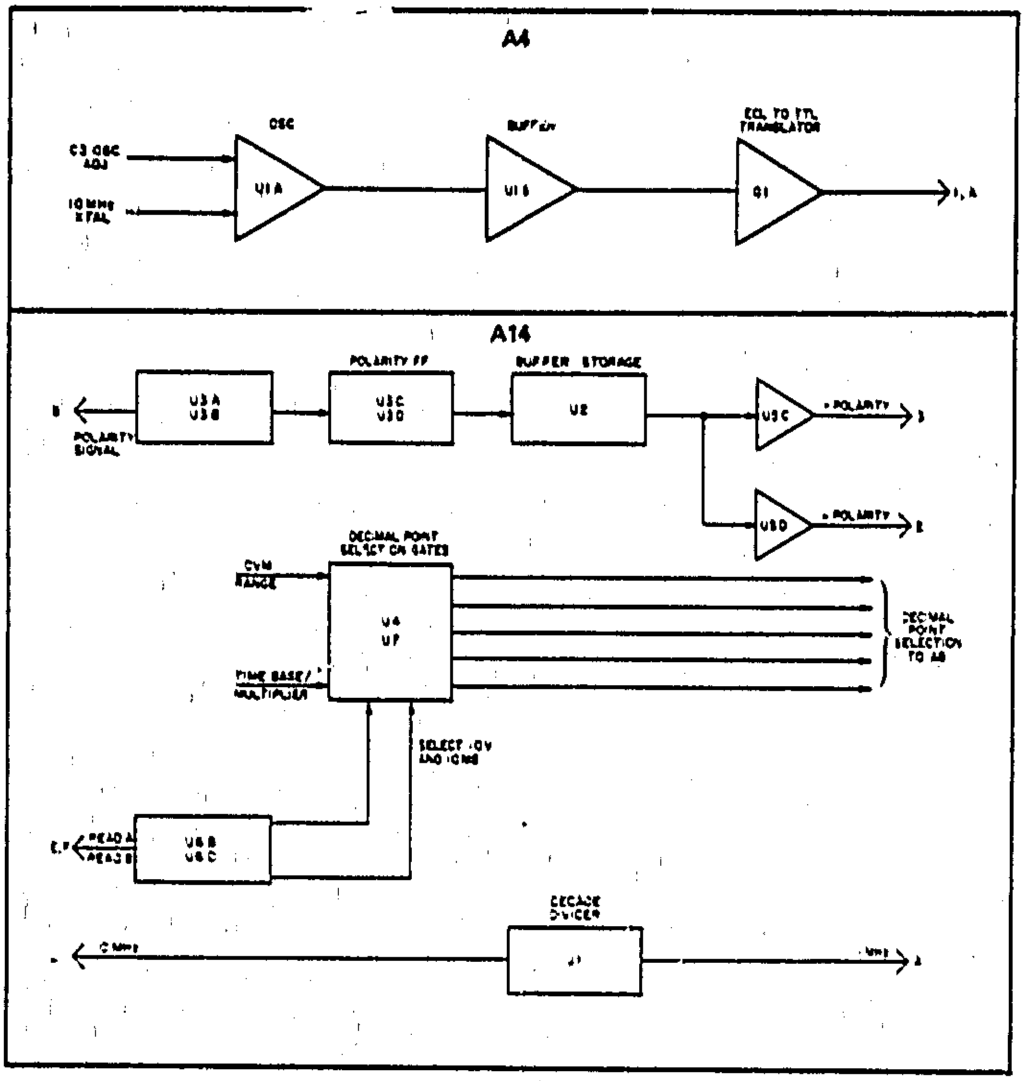
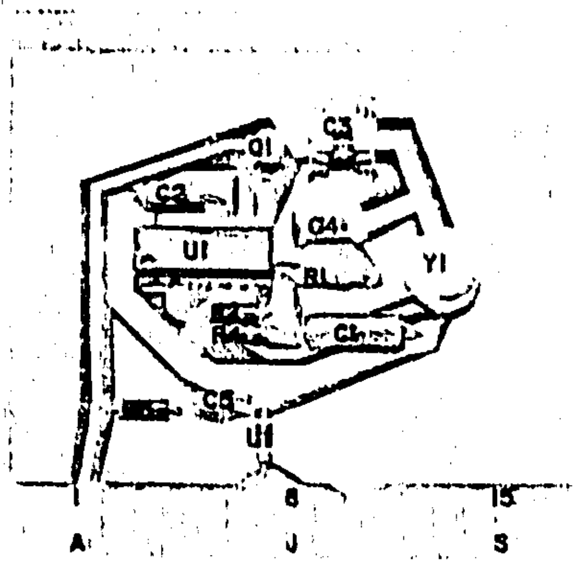
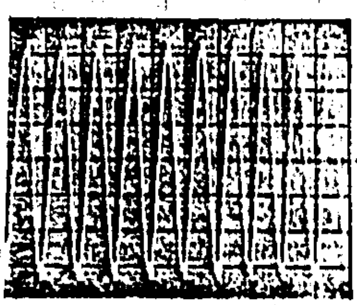


Figure 8-8
A2, A3 INPUT AMPLIFIER ASSEMBLY

(See Page 8-17)

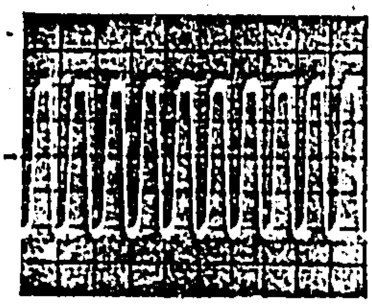
Part of Figure 8-9. A4 Oscillator Assembly





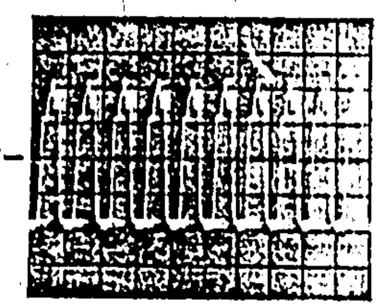
— +3.7 V —

.01 V/cm
.1 µs/cm
ac coupled

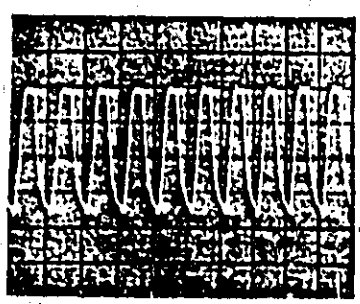


— +3.7V —

.02 V/cm
.1 µs/cm
ac coupled



.02 V/cm
.1 µs/cm
ac coupled



— 0 V

.1 V/cm
.1 µs/cm

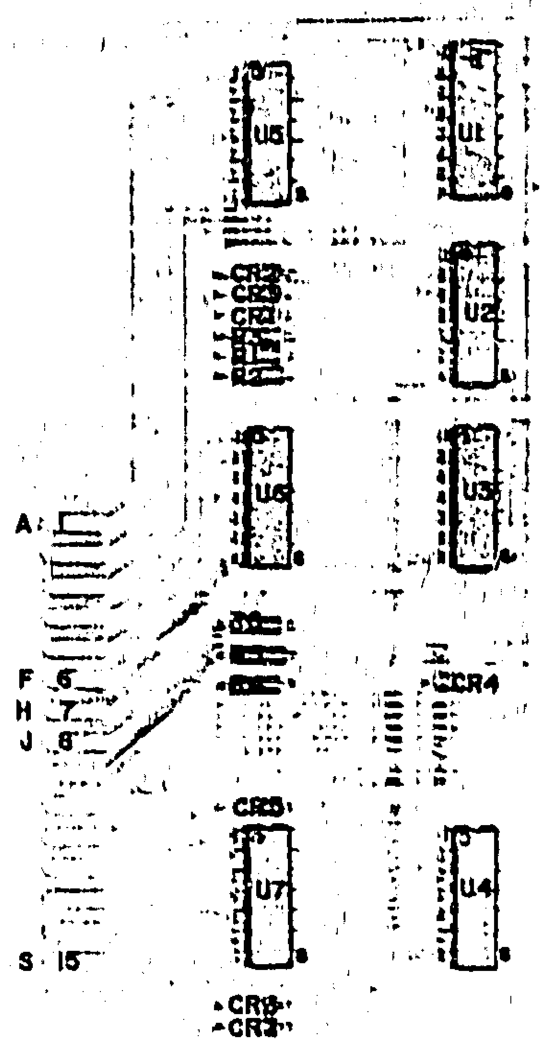
All waveforms taken through 10:1 divider probe. Divider probe's 8½" ground lead is connected to ground side of C5.

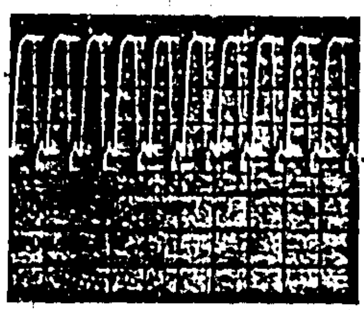
COUNTER CONTROLS:

INT-EXT (rear pan l) .... INT

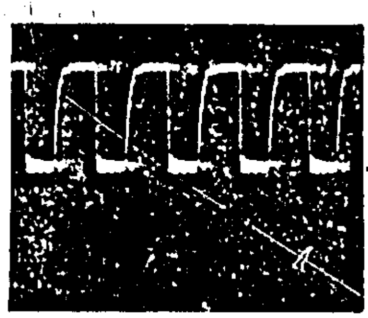
MORE DATA UNDER THIS FOLD

Part of Figure 8-9. A14 Voltmeter Display Control Assembly





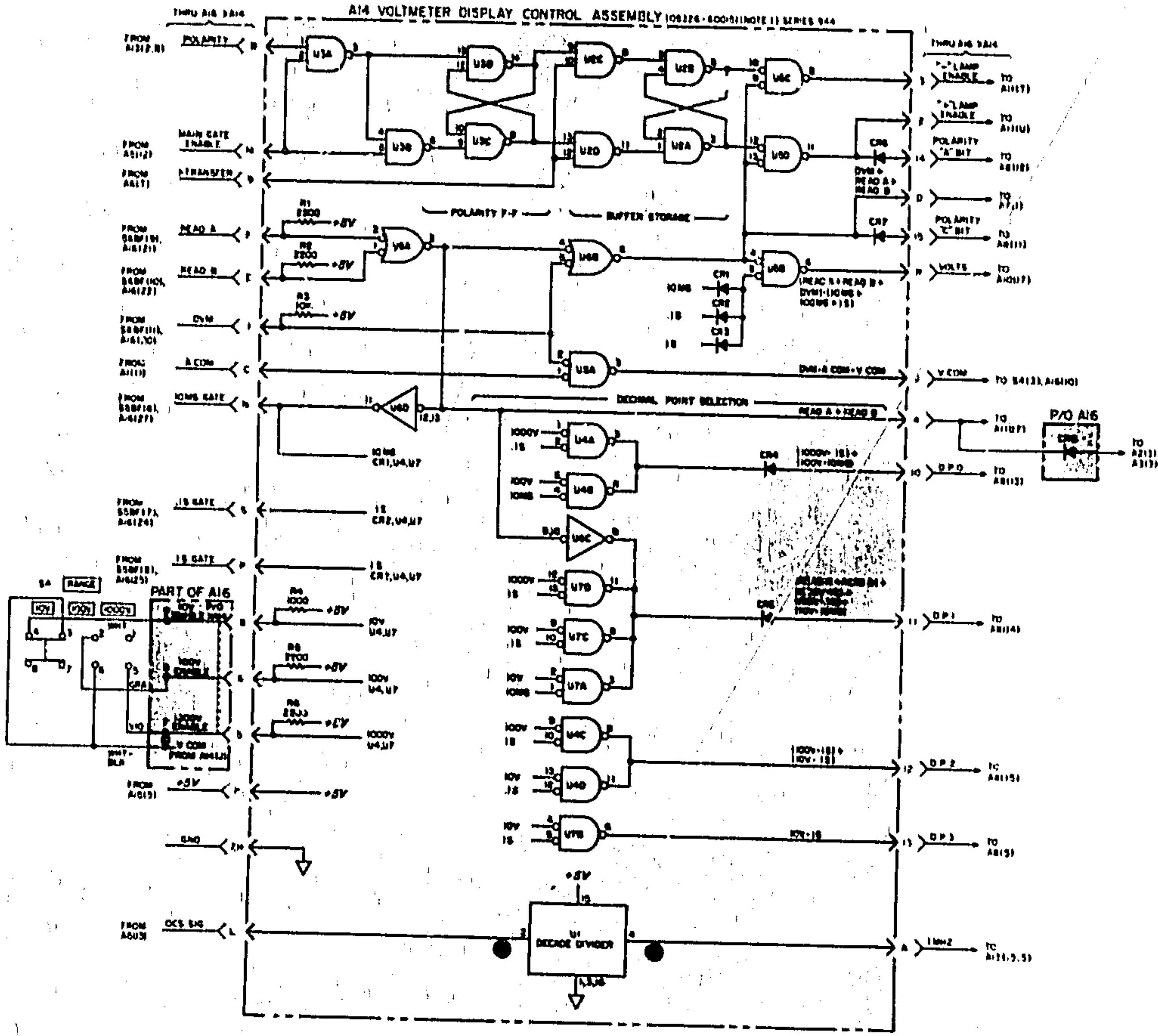
A14 U1(2)
.1 V/cm
.1 μs/cm

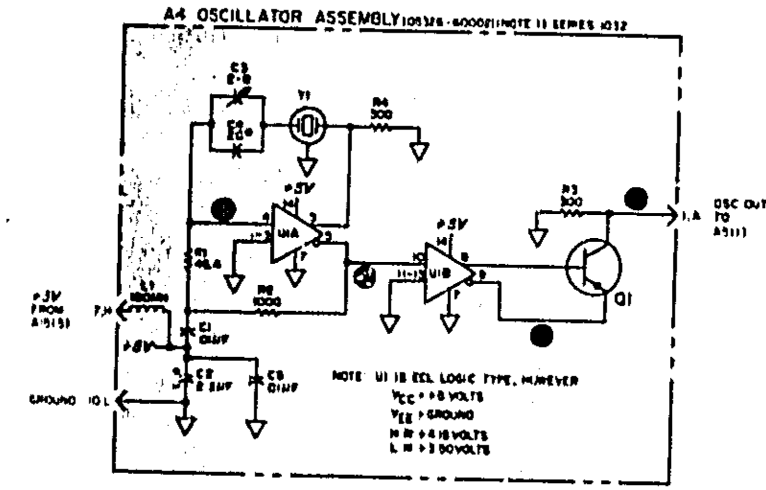


A14 U1(4)
.1 V/cm
.5 μs/cm

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

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

NO PREFIX	A4	A14	A16
S4	C1-6 L1 Q1 R1-4 U1 Y1	CR1-7 R1-6 U1-7	CR3

REFERENCE DESIGNATIONS	HP PART NUMBERS
A4	
Q1	1890-0150 2N2610
U1	1820-0142 MC1004P
A14	
CR1-7	1910-0016
U1	1820-0413
U2,3	1820-0064 MC846P
U4,5,7	1820-0274 MC1808P
U6	1820-0273 MC1806P
A16	
CR3	1901-0040

Figure 8-9. A4 Oscillator Assembly
A14 Voltmeter Display Control Assembly

Part of Figure 8-10. 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 CHANNEL 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 differentiates 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.

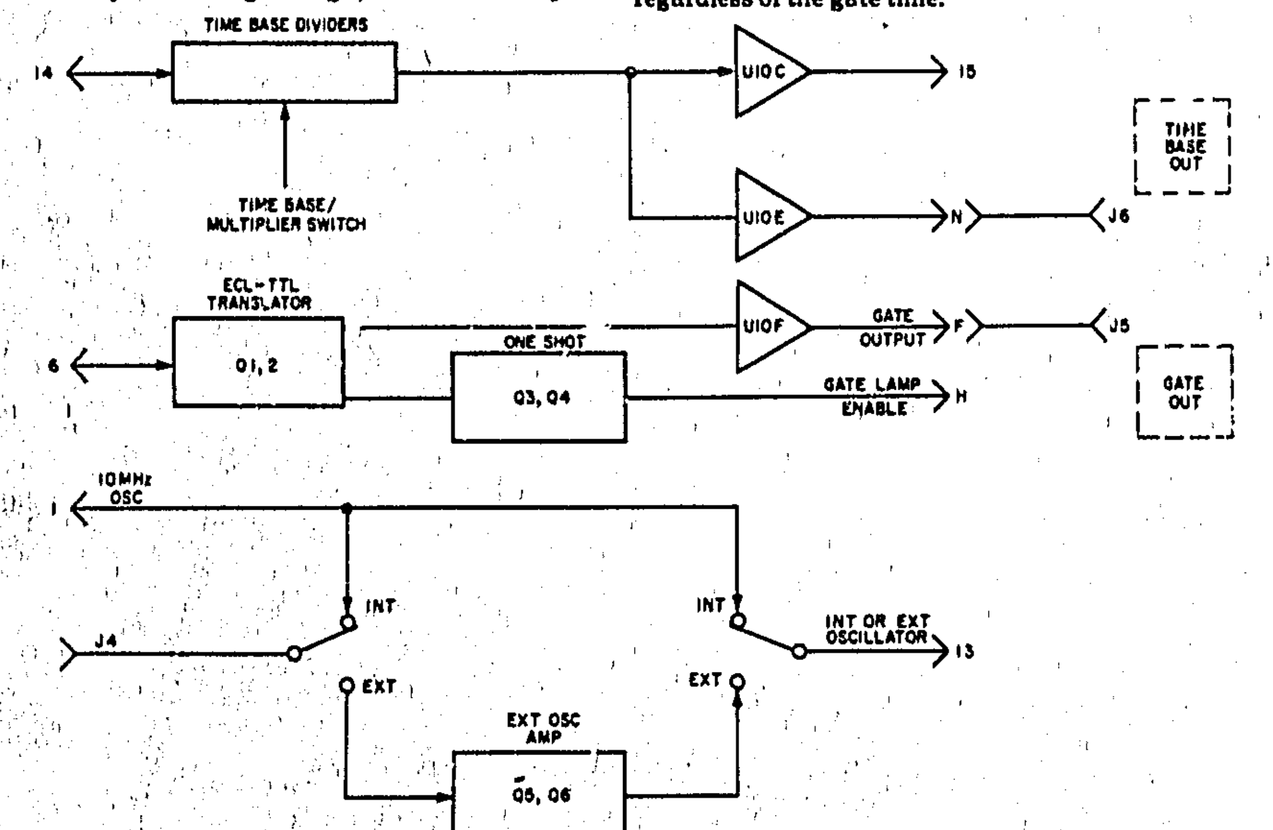
Q1 and Q2 form an ECL to TTL translator. When the main gate opens (low is main-gate enable), Q2 turns on the start one-shot Q3/Q4. During short gate-length times, this holds the gate lamp enable line low for approximately 50 ms to extend the time the gate lamp is on. When Q1 collector goes high, a low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

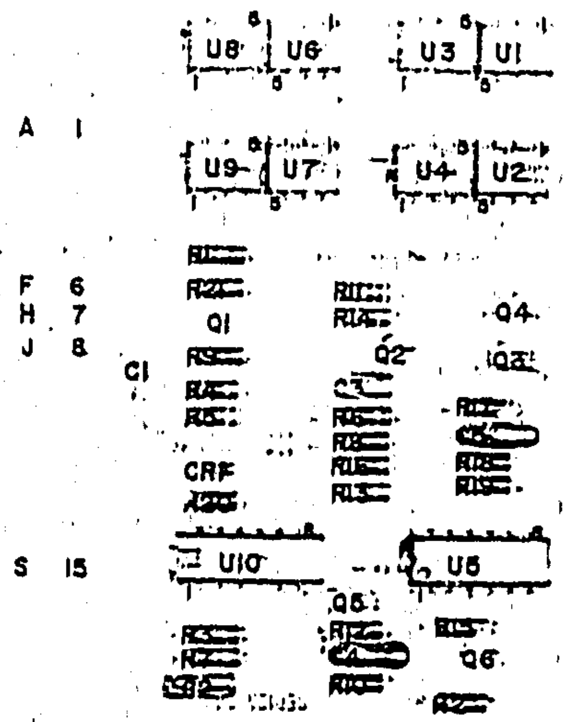
U5A and U5B select either the internal or external oscillator signal. When S7 is set to EXT, the internal oscillator signal is inhibited and the external oscillator signal passes through Schmitt trigger Q5 and Q6 to U5B and XA5(13).

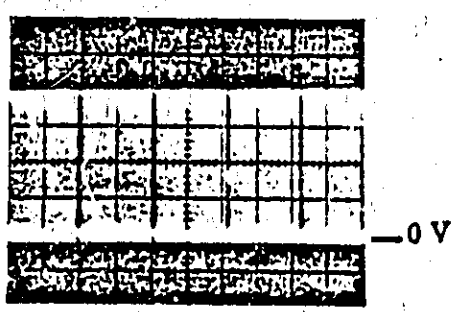
A5 TROUBLESHOOTING

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 Control, it is differentiated by C5 and R18. This 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.

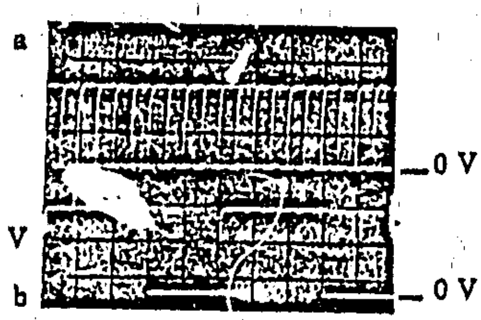




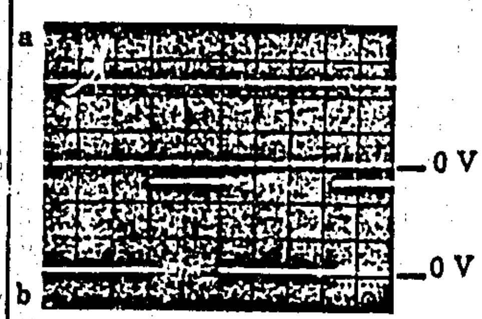


❶ .1 V/cm
.5 ms/cm

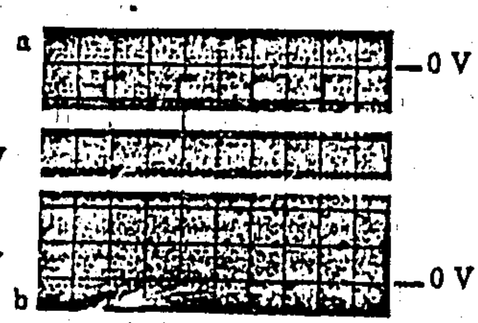
❷ .1 V/cm
.2 μs/cm



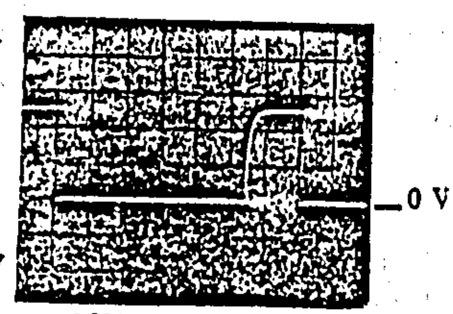
❸ a. U7(2) .2 V/cm
b. U7(4) 2 μs/cm



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

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

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

OSCILLOSCOPE CONTROLS:
(except as noted)

Use settings of A2 Assembly

AM007

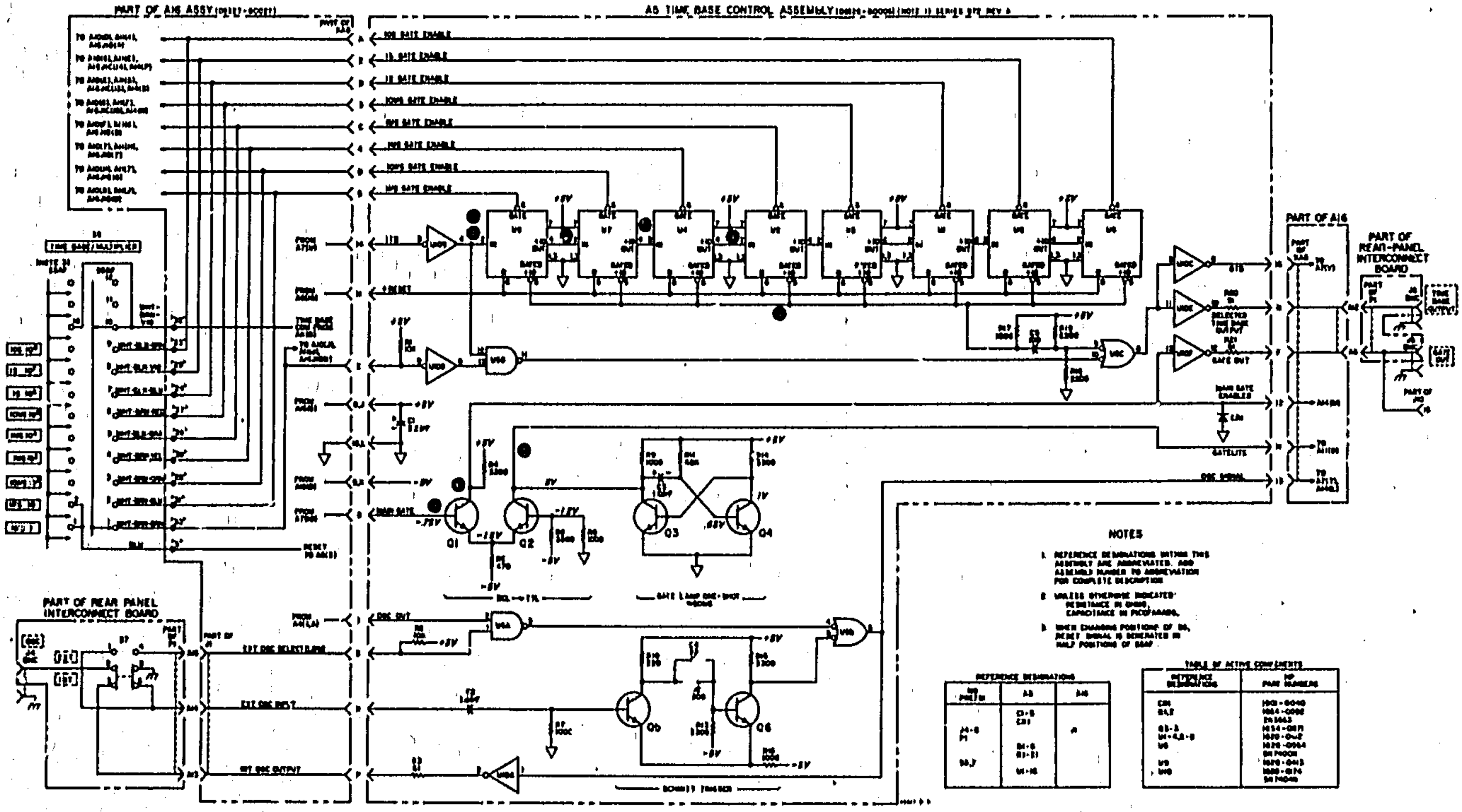


Figure 8-10. A5 Time Base Control Assembly

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(1). 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.

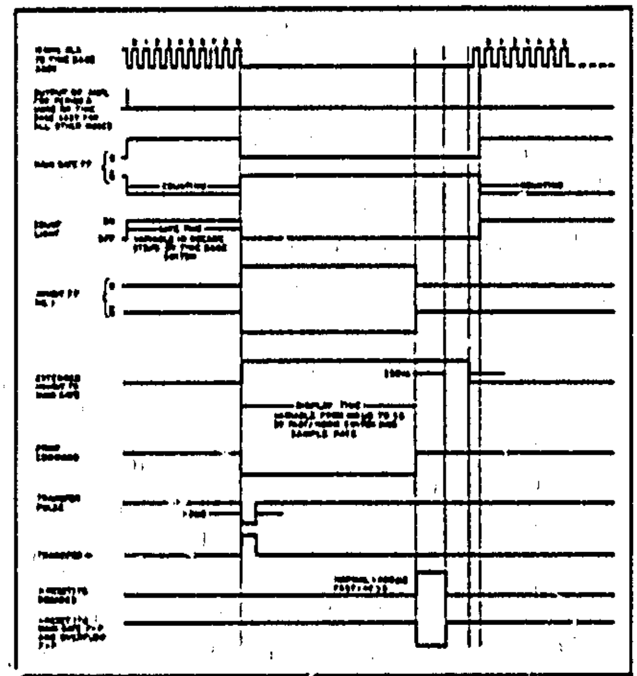
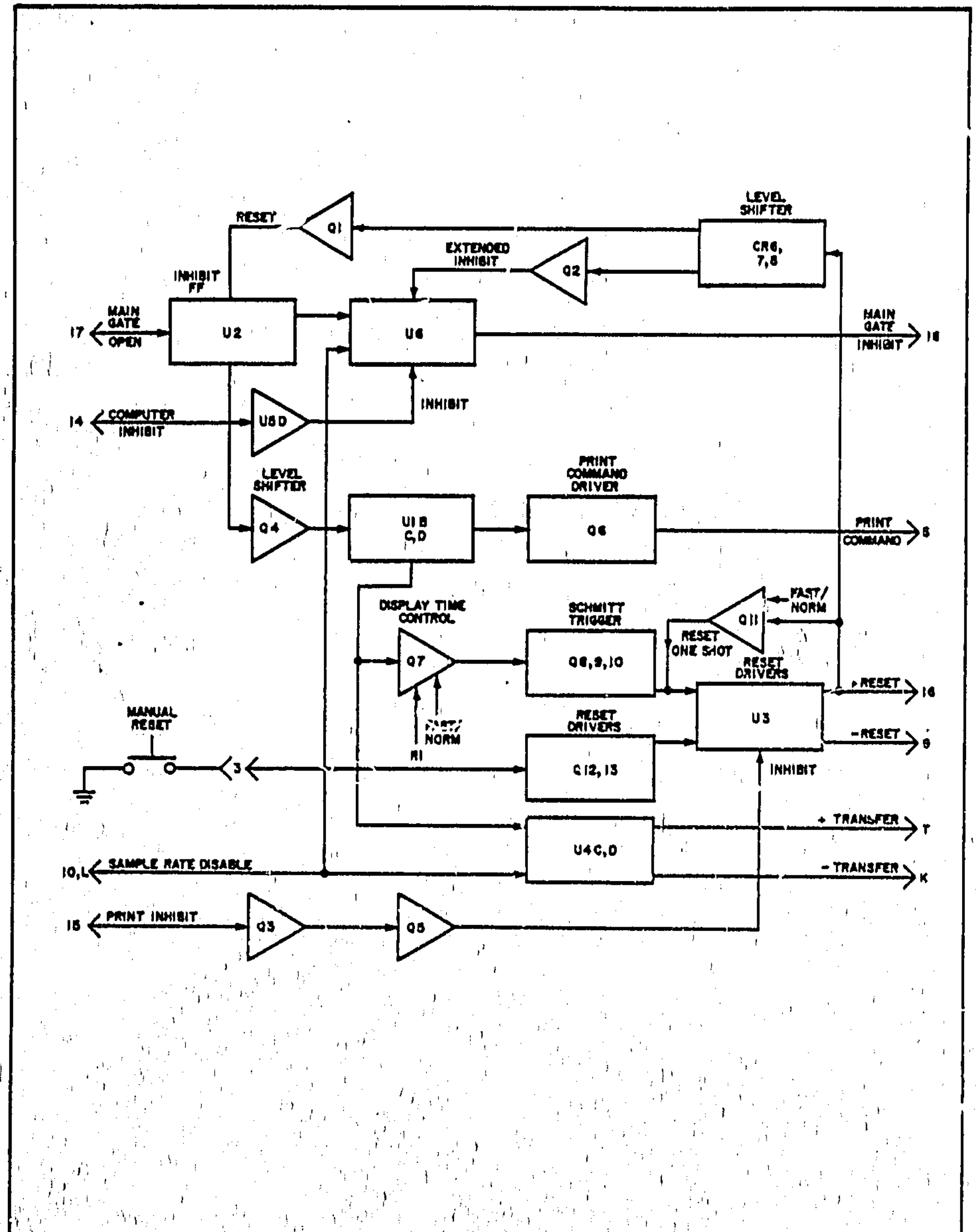


Figure 8-10
A5 TIME BASE CONTROL ASSEMBLY

(See Page 8-21)

Part of Figure 8-11. A6 Sample Rate Assembly



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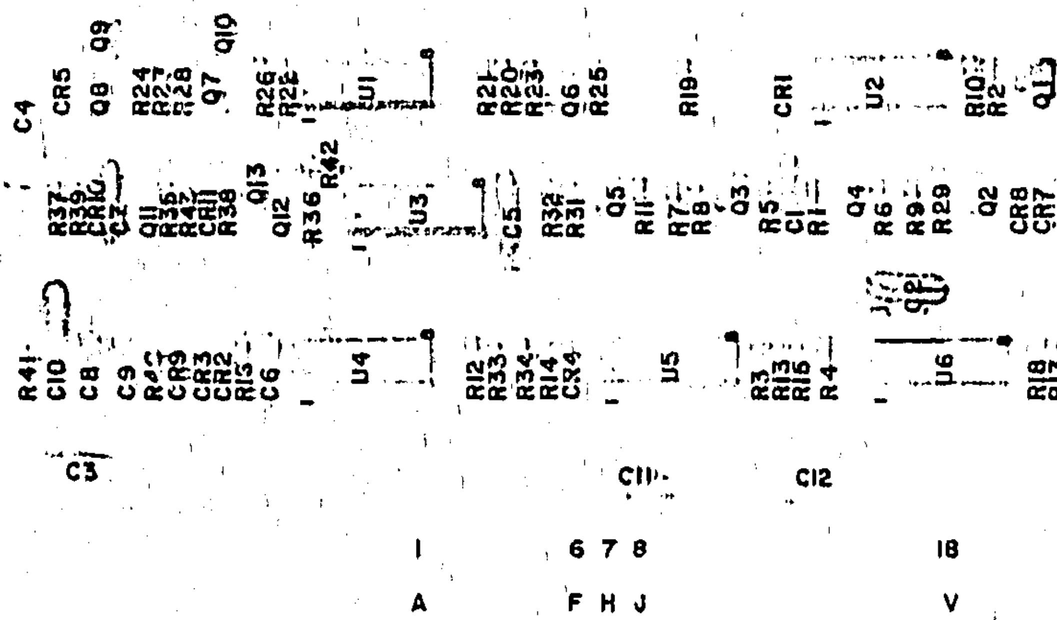
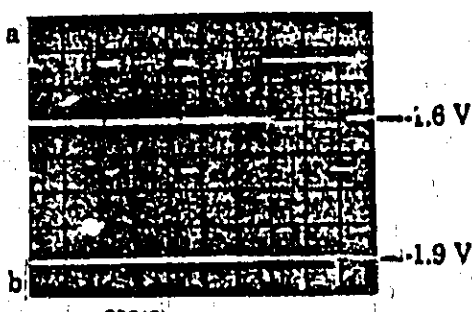
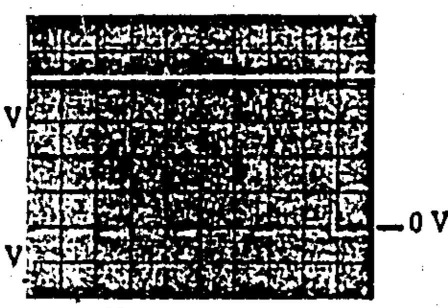
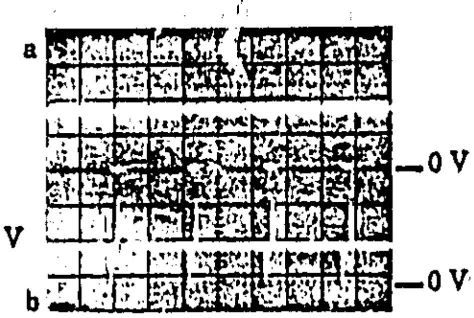




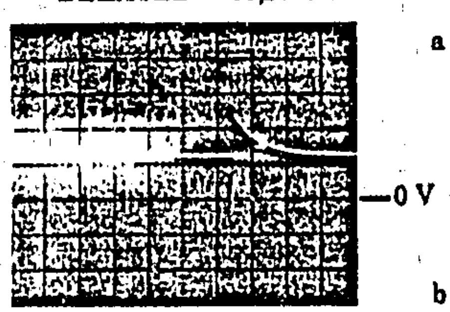
1 a. U2(2)
b. U2(9)
.05 V/cm
SWEEP to MIXED
MAIN — .5 ms/cm
DELAYED — 50 μs/cm



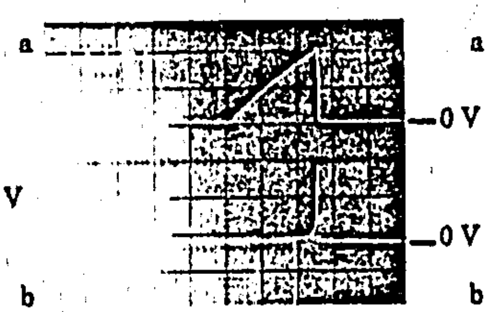
2 .1 V/cm
.5 ms/cm



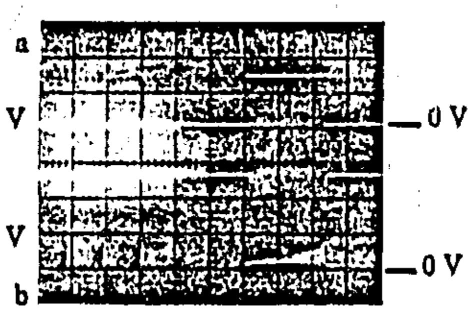
3 a. U1(6)
b. U1(9)
.2 V/cm
.5 ms/cm



4 .2 V/cm
SWEEP to MIXED
MAIN — 1 ms/cm
DELAYED — 10 μs/cm



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



6 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.

HE,LE — ECL levels
H,L — TTL levels

COUNTER CONTROLS:
Use settings of A2 Assembly

Apмо?

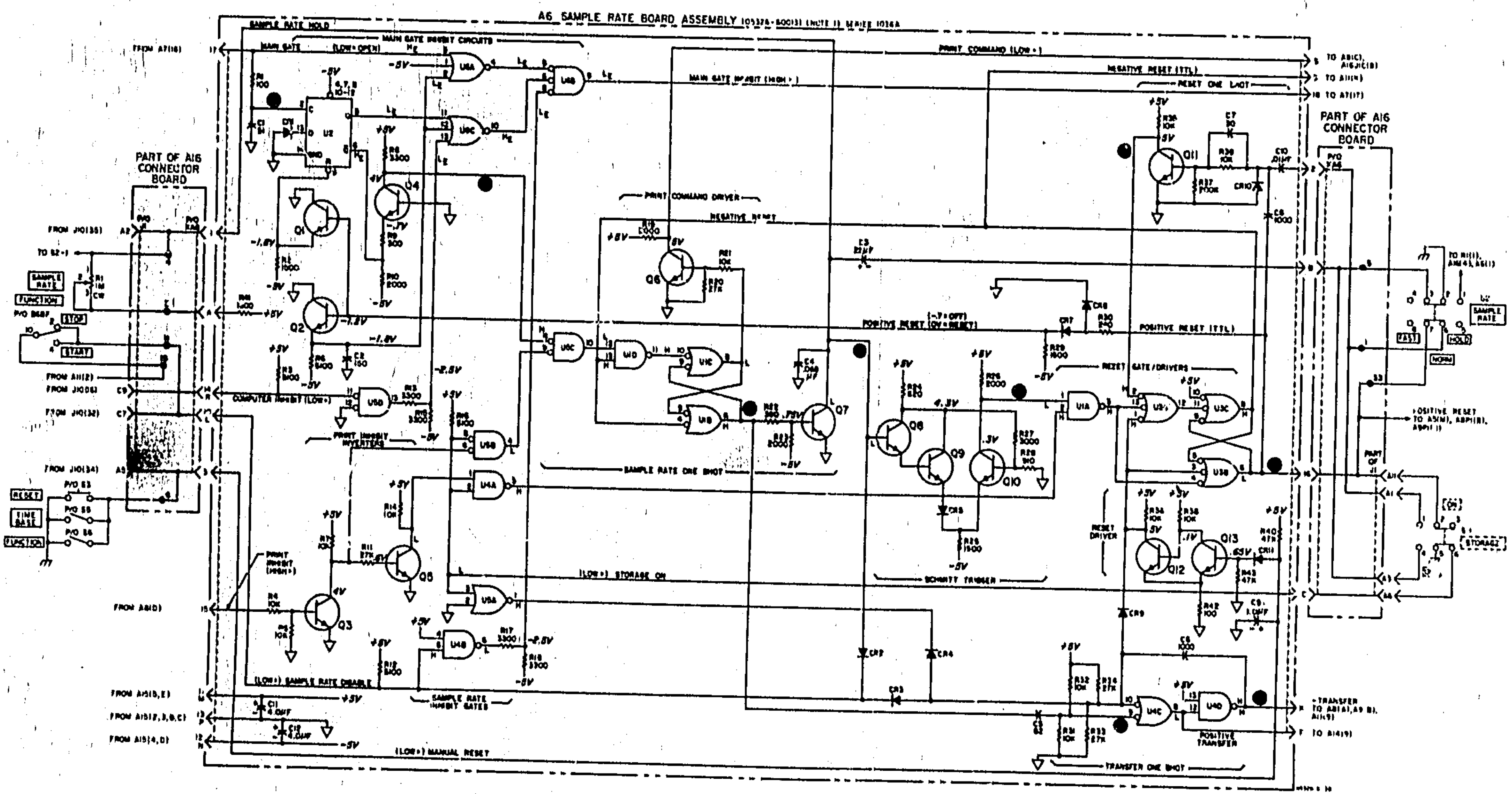


Figure 8-11. A6 Sample Rate Assembly

A7A FUNCTION CONTROL OPERATION

This assembly contains gates for the time base input, DCA inputs and main gate control. Three flip-flop circuits are included to control the main gate and oscillator gate. Amplifiers U4 and Schmitt trigger Q1 receive the INPUT C signals from jack J7.

Table below lists the truth table for the function control assembly. Incoming signals include: Channel A, Channel B, time base, voltmeter, oscillator, and amplifier C. Except for the oscillator and time base, all signals are ECL. U12A and U12C translate the TTL oscillator and time base signals to ECL.

The main gate inhibit at P1(17) controls the start of measurement time. A logic one (>2.4 V) prevents a measurement and a logic zero allows a measurement to be taken. Q2 and Q3 translate the ECL output to TTL levels for use by the time base circuits. C2 stretches the pulse to 50 nsec.

Main gate FF, U5, will open main gate U11B when U5$\overline{Q}$=0. U5 is toggled by the signal from U10A. At the end of each measurement, the main gate enable line at P1(18) goes high to start recycling on the sample rate board.

Function Selection Truth Table

Function	Main Gate Control	Input to Decade Counting Assembly	Input to Time Base
STOP	0	0	0
START	1	OTB	IA
Per. Avg.	OTB	GOSC	IA
T.I. Avg.	OTB	GOSC	IP
T.I.	1	OTB	GOSC
Period A	IA	OTB	GOSC
Freq A	OTB	IA	GOSC
Freq C	OTB	IC	GOSC
DVM (Read A,B)	OTB	IV	GOSC

IA Channel A Input
IC Channel C Input
IV DVM V-F Converter Output
IP Synchronizer Output
GOSC Gated Oscillator
OTB Output of the Time Base Dividers

Time interval measurements are controlled by the main gate U11B and the clock gate U6A.

A7A SYNCHRONIZER OPERATION

Table 1 shows a simplified schematic for the synchronizer portion of A7A and Table 2 shows the timing diagram.

This circuit allows the unit to delay taking a measurement until there is a signal present at the input. Thus, half readings and readings of zero are prevented for Frequency A only. This is accomplished by the addition of a clock gate that works with the main gate, both of which must be open in order to take a measurement. Before a start signal occurs (trigger point of CHANNEL A amplifier) Q of U2A is high and Q of U2B is low, keeping clock gate U6A closed. When the first pulse from the CHANNEL A amplifier Q of U2A goes low, U6A opens, however, the main gate U11B is closed. At the end of the time interval (trigger point of CHANNEL B Amplifier) Q of U2B goes high, closing U6A at the next positive transition of clock. A low is also generated at Q of U2B, enabling U1A at the next clock pulse. This applies a positive reset to the U6 and U1 flip-flops which during the same clock pulse returns U2A and B to their initial states, closing the gate U6A. Since the main gate is still closed, no counting has occurred.

The time base dividers control the main gate and are designed to give two output pulses; one after the first pulse and the other after counting the decade number of pulses selected by the multiplier switch. Q of U5 controls the main gate and is initially high. After the first time interval measurement Q goes low at which time the main gate is opened. After 10^n pulses have been counted, Q goes high to close the main gate. Thus, the first time interval measurement is not counted but rather serves only to open the main gate. The main gate now stays open until a decade number of time intervals have been counted. The number of clock pulses that are counted by the DCA is controlled by U6A.

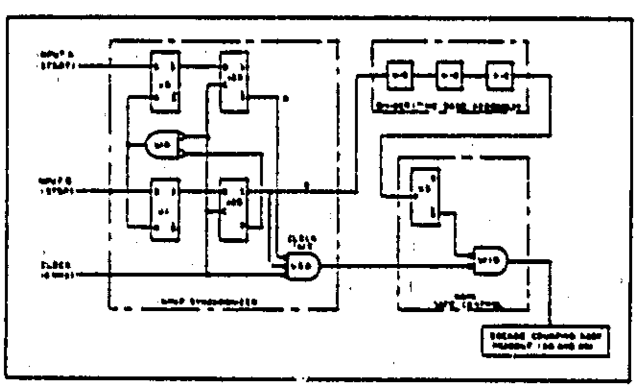


Table 2

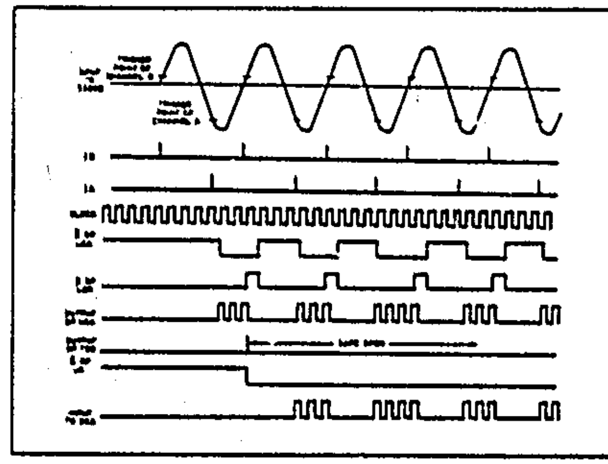
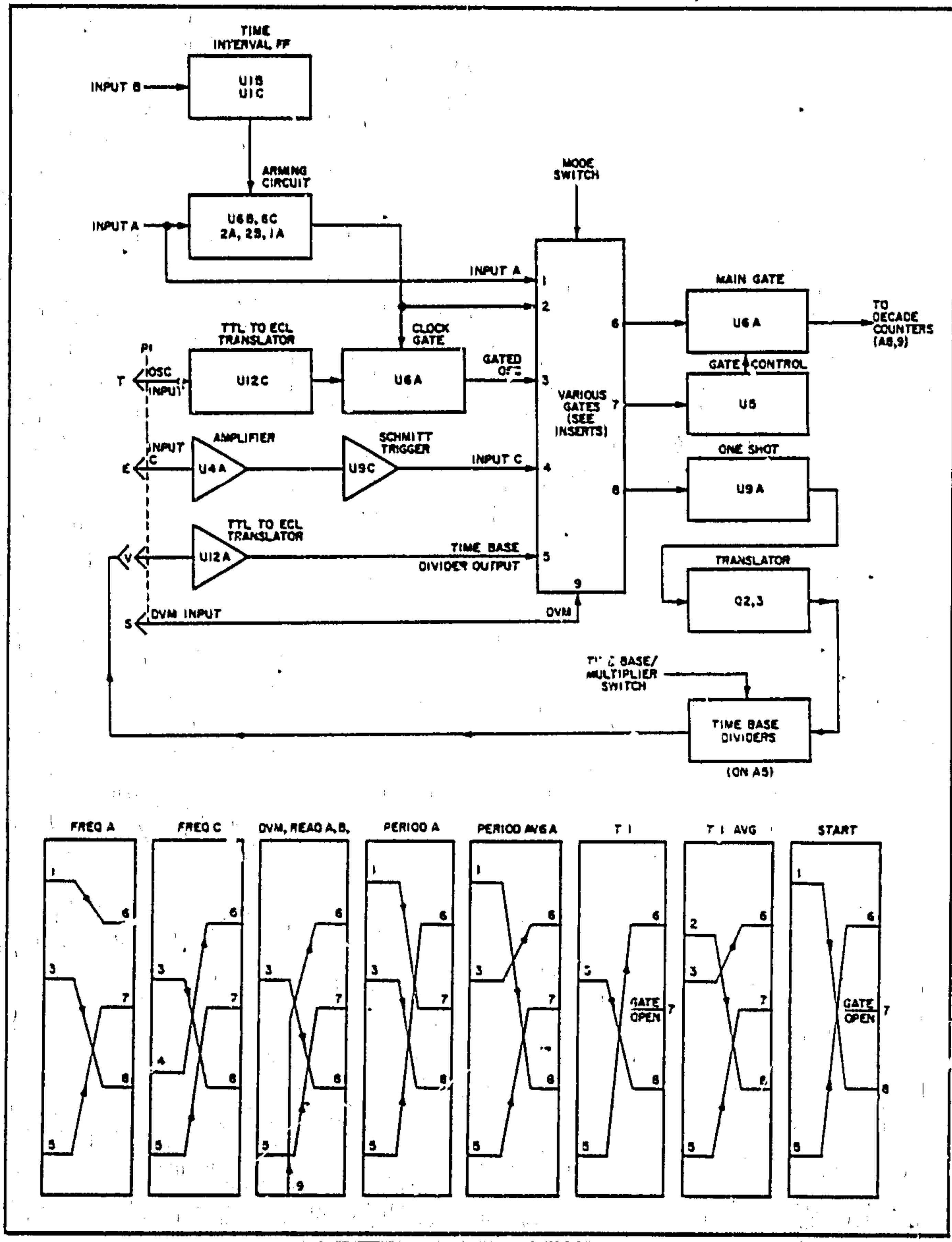


Figure ...
A6 SAMPLE P... TE ASSEMB...
(See Page 8-23)

Part of Figure 8-12. A7A Function Control Assembly



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SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

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

a. Description of part (see abbreviations below).

b. Typical manufacturer of the part in a five-digit code.

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 or 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 bulb, photocell, etc.
BT	= battery	IC	= integrated circuit	Q	= transistor	VR	= voltage regulator
C	= capacitor	J	= jack	R	= resistor	W	= cable
CP	= coupler	K	= relay	RT	= thermistor	X	= socket
CR	= diode	L	= inductor	S	= switch	Y	= crystal
DL	= delay line	LS	= loud speaker	T	= transformer	Z	= tuned cavity, network
DS	= device signaling (lamp)	M	= meter	TB	= terminal board		
E	= misc electronic part	MK	= microphone	TP	= test point		

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

01494-14

Table 6-1. Reference Designation Index

Reference Designation	Part No.	Description #	Note
A1	05326-60003	ATTENUATOR ASSY (5326A/B)	
	05326-20003	BOARD:BLANK PC	
A1C1	0160-2244	C:FXD CER 3.0 0.25 PF 500VDCW	
A1C2	0160-0939	C: FXD MICA 430 PF 5% 300 VDCW	
A1C3	0160-0378	C:FXD MICA 27PF 5%	
A1C4	0160-0161	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C5	0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	
A1C6	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C7	0160-2197	C:FXD MICA 10 PF 5%	
A1C8	0160-2146	C:FXD CER 0.02 UF +80-20% 100VDCW	
A1C9	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C10	0160-2244	C:FXD CER 3.0 0.25 PF 500VDCW	
A1C11	0160-0939	C: FXD MICA 430 PF 5% 300 VDCW	
A1C12	0160-0378	C:FXD MICA 27PF 5%	
A1C13	0160-0161	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C14	0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	
A1C15	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C16	0160-2197	C:FXD MICA 10 PF 5%	
A1C17	0160-2146	C:FXD CER 0.02 UF +80-20% 100VDCW	
A1CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A1CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A1CR3	1901-0376	DIODE:SILICON 35V	
A1CR4	1901-0376	DIODE:SILICON 35V	
A1CR5		NOT ASSIGNED	
A1CR6	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1CR7	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1CR8		NOT ASSIGNED	
A1CR9	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A1CR10	1901-0376	DIODE:SILICON 35V	
A1CR11	1901-0376	DIODE:SILICON 35V	
A1CR12		NOT ASSIGNED	
A1CR13	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1CR14	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A1DS1	2140-0047	LAMP:NEON GLOW 0.8MA	
A1DS2	2140-0047	LAMP:NEON GLOW 0.8MA	
A1J1	1251-0472	CONNECTOR:PC 12 CONTACTS	
A1J2	1251-0472	CONNECTOR:PC 12 CONTACTS	
A1J3	1250-1163	CONNECTOR:RF BNC INPUT	
A1J4	1250-1163	CONNECTOR:RF BNC INPUT	
A1Q1	1855-0334	Q:FET DUAL N-CHAN	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A1Q2	1855-0334	Q:FET DUAL N-CHAN	
A1R1	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A1R2	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A1R3	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A1R4	0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	
A1R5	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R6	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R7	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R8	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A1R9	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R10	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R11	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A1R12	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R13	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R14	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R15	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R16	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A1R17	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A1R18	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A1R19	0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	
A1R20	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R21	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R22	0698-3576	R:FXD COMP 110K OHM 5% 1/4W	
A1R23	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A1R24	2100-2905	R:VAR CERMET 10K OHM 10% LIN	
A1R25	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R26	2100-2905	R:VAR CERMET 10K OHM 10% LIN	
A1R27	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A1R28	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A1R29	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R30	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A1R31	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1R32	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1R33	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1R34	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A1S1	3101-1313	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	
A1S2	3101-1279	SWITCH:SLIDE DP 3 POSITIONS	
A1S3	3101-1279	SWITCH:SLIDE DP 3 POSITIONS	
A1S4	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	
A1S5	3101-1278	SWITCH:SLIDE DPDT	
A1S6	3101-1278	SWITCH:SLIDE DPDT	
A1S7	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	
A1S8		NSR PART OF R24	
A1S9		NSR PART OF R26	

#, See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A2	05326-60004	INPUT AMPLIFIER ASSY(5326A/B)	
A2C1	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2C2	0160-0127	C:FXD CER 1.0 UF 20% 25VDCW	
A2C3	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2C4	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A2C5	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A2C6	0160-0153	C:FXD MY 0.001 UF 10% 200VDCW	
A2C7	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A2C8	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A2C9	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2C10	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2CR1	1902-0049	DIODE:BREAKDOWN 6.19V 5%	
A2CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A2CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A2CR4	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A2CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A2L1	9140-0144	COIL:FXD RF 4.7 UH	
A2L2	9100-2255	COIL/CHOKE 0.47 UH 10%	
A2L3	9140-0144	COIL:FXD RF 4.7 UH	
A2L4	9140-0144	COIL:FXD RF 4.7 UH	
A2L5	9100-2255	COIL/CHOKE 0.47 UH 10%	
A2L6	9140-0144	COIL:FXD RF 4.7 UH	
A2L7	9140-0144	COIL:FXD RF 4.7 UH	
A2L8	9140-0142	COIL:FXD RF 2.2 UH	
A2L9	9140-0144	COIL:FXD RF 4.7 UH	
A2L10	9140-0144	COIL:FXD RF 4.7 UH	
A2Q1	1854-0092	Q:SI NPN	
A2Q2	1853-0015	Q:SI PNP	
A2Q3	1853-0015	Q:SI PNP	
A2Q4	1854-0345	Q:SI NPN	
A2Q5	1854-0345	Q:SI NPN	
A2Q6	1853-0015	Q:SI PNP	
A2Q7	1853-0015	Q:SI PNP	
A2Q8	1854-0092	Q:SI NPN	
A2Q9	1853-0015	Q:SI PNP	
A2Q10	1853-0015	Q:SI PNP	
A2Q11	1853-0015	Q:SI PNP	
A2Q12	1853-0015	Q:SI PNP	
A2Q13	1853-0015	Q:SI PNP	
A2Q14	1854-0092	Q:SI NPN	
A2Q15	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A2Q16	1854-0092	Q:SI NPN	
A2Q17	1854-0092	Q:SI NPN	
A2Q18	1854-0365	Q:SI NPN	
A2Q19	1854-0092	Q:SI NPN	
A2Q20	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A2R1	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A2R2	2100-2520	R:VAR CERMET 50 OHM 20% TYPE V 1/2W	
A2R3	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A2R4	0683-2405	R:FXD COMP 24 OHM 5% 1/4W	
A2R5	0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	
A2R6	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R8	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R9	0698-3113	R:FXD COMP 100 OHM 5% 1/8W	
A2R10	0698-3381	R:FXD COMP 150 OHM 5% 1/8W	
A2R11	0698-5175	R:FXD COMP 360 OHM 5% 1/8W	
A2R12	0698-3379	R:FXD COMP 68 OHM 5% 1/8W	
A2R13	0698-3375	R:FXD COMP 33 OHM 5% 1/8W	
A2R14	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A2R15	0698-5180	R:FXD COMP 2K OHM 5% 1/8W	
A2R16	0698-5175	R:FXD COMP 360 OHM 5% 1/8W	
A2R17	0698-3381	R:FXD COMP 150 OHM 5% 1/8W	
A2R18	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R19	0698-3113	R:FXD COMP 100 OHM 5% 1/8W	
A2R20	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R21	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A2R22	0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	
A2R23	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A2R24	2100-2521	R:VAR FLM 2000 OHM 10% LIN 1/2W	
A2R25	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A2R26	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R27	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R28	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A2R29	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A2R30	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A2R31	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A2R32	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A2R33	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A2R34	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A2R35	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A2R36	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2R37	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A2R38	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R39	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A2R40	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A2R41	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A2R42	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2R43	0683-3035	R:FXD COMP 30K OHM 5% 1/4W	
A2R44	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A2R45	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A2R46	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A2R47	0683-1065	R:FXD COMP 10M OHM 5% 1/4W	
A2R48	0683-2055	R:FXD COMP 2 MEGOHM 5% 1/4W	
A2R49, 50	0683-2715	R:FXD COMP 270 OHM 5% 1/4W	
A2U1	1820-0238	INTEGRATED CIRCUIT:DTL 2 INPUT NOR GATE	
A2U2	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A3		SAME AS A2:USE PREFIX A3	
A4	05326-60002	OSCILLATOR ASSY (5326A/B)	
	05326-20002	BOARD:BLANK PC	
A4C1	0160-0161	C:FXD MYLAR .01 μf 10%	
A4C2	0180-0197	C:FXD TANT 2.2 UF 10% 20VDCW	
A4C3	0121-0059	C:VAR CER 2-8 PF	
A4C4	0160-2264	C:FXD CER 20 PF 5% 500VDCW	
A4C5	0160-2055	C:FXD CER 0.01 UF +80-20% 100VDCW	
A4L1	9100-2276	COIL:FXD 100 UH 10%	
A4Q1	1850-0158	Q:GE PNP 2N2635	
A4R1	0698-4037	R:FXD MET FLM 46.4 OHM 1% 1/8W	
A4R2	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A4R3	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A4R4	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A4U1	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A4Y1	0410-0405	CRYSTAL:QUARTZ 10 MHZ	
A5	05326-60005	TIME BASE CONTROL ASSY (5326A/B)	
	05326-20005	BOARD:BLANK PC	
A5C1	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A5C2	0160-0127	C:FXD CER 1.0 UF 20% 25 VDCW	
A5C3	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A5C4	0160-2150	C:FXD MICA 33 PF 5%	
A5C5	0160-2204	C:FXD MICA 100PF 5%	
A5CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A5Q1	1854-0092	Q:SI NPN	
A5Q2	1854-0092	Q:SI NPN	
A5Q3	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q4	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q5	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q6	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5R1	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A5R2	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A5R3	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A5R4	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R5	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A5R6	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R8	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R9	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R10	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A5R11	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A5R12	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R13	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R14	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R15	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A5R16	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R17	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A5R18	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A5R19	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A5R20	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A5R21	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A5U1	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U2	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U3	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U4	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U5	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A5U6	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U7	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U8	1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	
A5U9	1820-0413	INTEGRATED CIRCUIT	
A5U10	1820-0174	INTEGRATED CIRCUIT:TTL HEX INVERTER	
A6	05326-60013	SAMPLE RATE ASSY (5326A/B)	
	05326-20013	BOARD:BLANK PC	
A6C1	0160-2201	C:FXD MICA 51 PF 5%	
A6C2	0160-0134	C:FXD MICA 220 PF 5%	
A6C3	0180-0228	C:FXD ELECT 22 UF 10% 15VDCW	
A6C4	0160-0166	C:FXD MY 0.068 UF 10% 200VDCW	
A6C5	0140-0193	C:FXD MICA 82 PF 5%	
A6C6	0160-0153	C:FXD MY 0.001 UF 10% 200VDCW	
A6C7	0160-2199	C:FXD MICA 30 PF 5%	
A6C8	0160-0153	C:FXD MY 0.001 UF 10% 200VDCW	
A6C9	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A6C10	0160-0161	C:FXD MICA .01 μF 2% 300VDCW	
A6C11	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A6C12	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A6CR1	1901-0040	DIODE: SILICON 30MA 30WV	
A6CR2	1901-0040	DIODE: SILICON 30MA 30WV	
A6CR3	1910-0016	DIODE: GERMANIUM 100MA/0.85V 60PIV	
A6CR4	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A6CR5	1901-0040	DIODE:SILICON 30MA 30WV	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A6CR6		NOT ASSIGNED	
A6CR7	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR8	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR9	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A6CR10	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR11	1901-0040	DIODE:SILICON 30MA 30WV	
A6Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q2	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q3	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q4	1854-0009	Q:SI NPN	
A6Q5	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q6	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q7	1854-0215	Q:SI NPN	
A6Q8	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q9	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q10	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q11	1854-0009	Q:SI NPN	
A6Q12	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q13	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6R1	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A6R2	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R3	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R4	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R5	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R6	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R7	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R8	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R9	0683-3015	R:FXD COMP 300 OHM 5% 1/4W	
A6R10	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R11	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R12	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R13	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R14	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R15	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R16	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R17	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R18	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A6R19	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R20	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R21	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R22	0683-3915	R:FXD COMP 390 OHM 5% 1/4W	
A6R23	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R24	0683-6215	R:FXD COMP 620 OHM 5% 1/4W	
A6R25	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R26	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A6R27	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A6R28	0683-9115	R:FXD COMP 910 OHM 5% 1/4W	
A6R29	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R30	0683-2415	R:FXD COMP 240 OHM 5% 1/4W	
A6R31	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R32	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R33	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R34	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R35	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R36	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R37	0683-2045	R:FXD COMP 200K OHM 5% 1/4W	
A6R38	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R39	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R40	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A6R41	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R42	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A6R43	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
A6U1	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A6U2	1820-0272	INTEGRATED CIRCUIT:DIGITAL	
A6U3	1820-0068	IC:TTL TRIPLE 3-INPUT POS NAND GATE	
A6U4	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A6U5	1820-0328	IC:TTL QUAD 2-INPUT NOR GATE	
A6U6	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7A	05326-60007	FUNCTION SELECTOR ASSY (5326A/B)	
	05326-20007	BOARD:BLANK PC FOR 5326A INSTRUMENT ONLY	
A7C1	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A7C2	0160-0336	C:FXD MICA 100 PF 1%	
A7C3	0160-2930	C:FXD CER 0.01 UF +80 -20% 100 VDCW	
A7C4	0140-0145	C:FXD 22 PF 5% 500VDCW	
A7C5	0160-2205	C:FXD 120 PF	
A7CR1	1901-0651	DIODE:SILICON 3-JUNCTION STABISTOR	
A7CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A7J1	5060-0111	CONNECTOR	
A7L1	9140-0158	COIL:FXD RF 1 UH 10%	
A7Q1	1854-0009	Q:SI NPN	
A7Q2	1854-0009	Q:SI NPN	
A7Q3	1854-0009	Q:SI NPN	
A7R1	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R2	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R3	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A7R4	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R5	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R6	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A7R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7R8	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A7R9	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7R10	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A7R11	0683-8205	R:FXD COMP 82 OHM 5% 1/4W	
A7R12	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7R13	0683-2015	R:FXD COMP 200 OHM 5% 1/4W	
A7R14	0683-2015	R:FXD COMP 200 OHM 5% 1/4W	
A7R15	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A7R16	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A7R17	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A7R18	0683-7515	R:FXD COMP 750 OHM 5% 1/4W	
A7R19	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A7R20	0683-1025	R: FXD COMP 1000 OHM 5% 1/4W	
A7R21	0683-3005	R:FXD COMP 30 OHM 5% 1/4W	
A7R22	0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	
A7R23	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7U1	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7U2	1820-0440	INTEGRATED CIRCUIT	
A7U3	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A7U4	1821-0001	TRANSISTOR ARRAY:SI NPN	
A7U5	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A7U6	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7U7	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A7U8	1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	
A7U9	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7U10	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A7U11	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A7U12	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 B	05326-60024	FUNCTION SELECTOR ASSY (5326A/B)	
	05326-20024	BOARD:BLANK PC FOR 5326B INSTRUMENT ONLY	
A7 R1	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R2	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R3	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R4	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R5	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R6	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R7	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R8	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R9	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R10	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R11	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R12	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R13	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R14	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R15	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R16	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R17	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R18	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A7 R19	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R20	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	

See introduction to this section for ordering information.

Table 6-1. Reference Designation Index (Continued)

Reference Designation	HP Part No.	Description #	Note
A7 R21	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R22	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R23	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R24	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R25	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R26	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 R27	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7 U1	1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	
A7 U2	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U3	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U4	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U5	1820-0174	INTEGRATED CIRCUIT:TTL HEX INVERTER	
A7 U6	1820-0253	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	
A7 U7	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A8	05326-60009	DISPLAY SUPPORT ASSY (5326A/B)	
	05326-20009	BOARD:BLANK PC	
A8C1	0160-2055	C:FXD CER 0.01 UF +80-10% 100VDCW	
A8C2	0160-2199	C: FXD MICA 30 PF-5% 300VDCW	
A8CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A8CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A8CR3	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A8CR4	1901-0040	DIODE: SILICON 30MA 30WV	
A8P1	1251-2035	CONN:PC 30(2X15) CONTACTS	
A8Q1	1854-0092	Q:SI NPN	
A8Q2	1854-0092	Q:SI NPN	
A8Q3	1854-0365	Q:SI NPN	
A8Q4	1854-0365	Q:SI NPN	
A8Q5	1854-0365	Q:SI NPN	
A8Q6	1854-0365	Q:SI NPN	
A8Q7	1854-0365	Q:SI NPN	
A8Q8	1854-0365	Q:SI NPN	
A8Q9	1854-0092	Q:SI NPN	
A8Q10	1854-0092	Q:SI NPN	
A8Q11	1854-0092	Q: SI NPN	
A8R1	0683-1125	R:FXD COMP 1100 OHM 5% 1/4W	
A8R2	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R3	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R4	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A8R5	0683-1255	R:FXD COMP 1.2MEGOHM 5% 1/4W	
A8R6	0683-1255	R:FXD COMP 1.2 MEGOHM 5% 1/4W	
A8R7	0683-1255	R:FXD COMP 1.2 MEGOHM 5% 1/4W	
A8R8	0683-1255	R:FXD COMP 1.2 MEGOHM 5% 1/4W	
A8R9	0683-1255	R:FXD COMP 1.2 MEGOHM 5% 1/4W	
A8R10	0683-1255	R:FXD COMP 1.2 MEGOHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A8R11	0683-2425	R:FXD COMP 2400 OHM 5% 1/4W	
A8R12	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A8R13	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A8R14	0683-2715	R:FXD COMP 270 OHM 5% 1/4W	
A8R15	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R16	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A8R17	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R18	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A8R19	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R20	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R21	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A8R22	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A8R23	0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	
A8R24	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A8R25	0683-1535	R: FXD COMP 15K OHM 5% 1/4W	
A8R26	0683-2225	R: FXD COMP 2.2K OHM 5% 1/4W	
A8U1	1820-0094	IC: DTL QUAD 2-INPUT NAND NOR GATE	
A8U2	1820-0107	IC:DTL HEX INVERTER RL:6K	
A8U3	1820-0143	INTEGRATED CIRCUIT:DIGITAL	
A8U4	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A8U5	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A8U6	1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	
A9	05326-60008	DISPLAY ASSY (5326A/B)	
	05326-20008	BOARD:BLANK PC FOR OPT 001 DELETE 60008 ADD 60025	
A9DS1	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS2	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS3	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS4	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS5	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS6	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9DS7	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 5700 SERIES	
A9R1	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R2	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R4	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R5	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R6	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R7	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R8	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R9	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R10	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A9U1	1820-0275	INTEGRATED CIRCUIT:DIGITAL	
A9U2	1820-0119	INTEGRATED CIRCUIT	
A9U3	1820-0119	INTEGRATED CIRCUIT	
A9U4	1820-0119	INTEGRATED CIRCUIT	
A9U5	1820-0119	INTEGRATED CIRCUIT	
A9U6	1820-0119	INTEGRATED CIRCUIT	
A9U7	1820-0119	INTEGRATED CIRCUIT	
A9U8	-------	NOT ASSIGNED	
A9U9	1820-0116	INTEGRATED CIRCUIT	
A9U10	1820-0116	INTEGRATED CIRCUIT	
A9U11	1820-0116	INTEGRATED CIRCUIT	
A9U12	1820-0116	INTEGRATED CIRCUIT	
A9U13	1820-0116	INTEGRATED CIRCUIT	
A9U14	1820-0116	INTEGRATED CIRCUIT	
A9U15	1820-0116	INTEGRATED CIRCUIT	
A9U16		NOT ASSIGNED	
A9U17	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U18	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U19	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U20	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U21	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U22	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U23	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A10	05326-60011	RIGHT READOUT ASSY (5326A ONLY)	
	05326-20011	BOARD:BLANK PC	
	05330-60007	BLOCK:ANNUNCIATOR	
		FOR 5326A ONLY	
A10C1	0180-0116	C:FXD ELECT 6.8 UF +-10% 35VDCW	
A10CR1	1902-[illegible]	DIODE BREAKDOWN:10.0V 5%	
A10DS1	2140-0313	LAMP:NEON GLOW	
A10DS2	2140-0313	LAMP:NEON GLOW	
A10DS3	2140-0313	LAMP:NEON GLOW	
A10DS4	2140-0313	LAMP:NEON GLOW	
A10DS5	2140-0313	LAMP:NEON GLOW	
A10DS6	2140-0313	LAMP:NEON GLOW	
A10DS7	2140-0313	LAMP:NEON GLOW	
A10DS8	2140-0313	LAMP:NEON GLOW	
A10Q1	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A10Q2	1854-03[illegible]	Q:SI NPN	
A10Q3	1854-03[illegible]	Q:SI NPN	
A10Q4	1854-03[illegible]	Q:SI NPN	
A10Q5	1854-03[illegible]	Q:SI NPN	
A10Q6	[illegible]	Q:SI NPN	
A10Q7	1854-03[illegible]	Q:SI NPN	
A10Q8	1854-03[illegible]	Q:SI NPN	
A10Q9	1854-03[illegible]	Q:SI NPN	
A10R1	[illegible]	R:FXD COMP [illegible] OHM 5% 1/4W	
A10R2	0683-10[illegible]	R:FXD COMP 10K OHM 5% 1/4W	
A10R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A10R4	0683-[illegible]	R:FXD COMP [illegible]K OHM 5% 1/4W	
A10R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R7	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R8	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R9	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R10	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R11	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R12	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R13	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R14	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10R15		NOT ASSIGNED	
A10R16		NOT ASSIGNED	
A10R17	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R18	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10R19	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10U1	1820-027[illegible]	INTEGRATED CIRCUIT:DIGITAL	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A10U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U3	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U6	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10U8	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10	05326-60023	RIGHT READOUT ASSY (5326B ONLY)	
	05326-20023	BOARD:BLANK PC	
	05330-40002	BLOCK:ANNUNCIATOR FOR 5326B ONLY	
A10 C1	0180-0116	C:FXD ELECT 6.8 UF +100-10% 25VDCW	
A10 CR1	1902-3234	DIODE BREAKDOWN:19.6V 5%	
A10 DS1	2140-0313	LAMP:NEON GLOW	
A10 DS2	2140-0313	LAMP:NEON GLOW	
A10 DS3	2140-0313	LAMP:NEON GLOW	
A10 DS4	2140-0313	LAMP:NEON GLOW	
A10 DS5	2140-0313	LAMP:NEON GLOW	
A10 DS6	2140-0313	LAMP:NEON GLOW	
A10 DS7	2140-0313	LAMP:NEON GLOW	
A10 DS8	2140-0313	LAMP:NEON GLOW	
A10 DS9	2140-0313	LAMP:NEON GLOW	
A10 Q1	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A10 Q2	1854-0365	Q:SI NPN	
A10 Q3	1854-0365	Q:SI NPN	
A10 Q4	1854-0365	Q:SI NPN	
A10 Q5	1854-0365	Q:SI NPN	
A10 Q6	1854-0365	Q:SI NPN	
A10 Q7	1854-0365	Q:SI NPN	
A10 Q8	1854-0365	Q:SI NPN	
A10 Q9	1854-0365	Q:SI NPN	
A10 Q10	1854-0365	Q:SI NPN	
A10 R1	0683-[illegible]	R:FXD COMP 8100 OHM 5% 1/4W	
A10 R2	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A10 R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A10 R4	0683-3045	R:FXD COMP 300K OHMS 5% 1/4W	
A10 R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R7	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R8	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R9	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 R10	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A10 R11	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R12	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R13	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R14	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R15	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A10 R16	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A10 R17	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 R18	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 R19	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A10 U1	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U3	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U6	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A10 U8	1820-0273	INTEGRATED CIRCUIT:DIGITAL	
A11	05326-60010	LEFT READOUT ASSY (5326A ONLY)	
	05326-20010	BOARD:BLANK PC FOR 5326A ONLY	
	05330-40002	BLOCK:ANNUNCIATOR	
	05326-80002	INDICATOR:MASK	
	05326-80009	INDICATOR:MASK	
A11C1	0160-2200	C:FXD MICA 43 PF 5%	
A11C2	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A11C3	0100-2030	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11CR1	1902-3234	DIODE BREAKDOWN:10.0V 5%	
A11DS1	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11DS2	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11DS3	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A11Q2	1854-0365	Q:SI NPN	
A11Q3	1854-0365	Q:SI NPN	
A11Q4	1854-0365	Q:SI NPN	
A11Q5	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A11R1	0683-2045	R:FXD COMP 200K OHM 5% 1/4W	
A11R2	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A11R3	0683-2035	R:FXD COMP 20K OHM 5% 1/4W	
A11R4	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A11R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11R7	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11R8	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11R9	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11R10	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11R11	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11R12	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11R13	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11U1	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U3	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A11U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U6	1820-0327	IC:TTL QUAD 2-INPUT NAND GATE	
A11U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11U8	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11	05326-60022	LEFT READOUT ASSY (5326B ONLY)	
	05326-20022	BOARD:BLANK PC FOR 5326B ONLY	
	05330-40002	BLOCK:ANNUNCIATOR	
	05326-80002	INDICATOR:MASK	
	05326-80004	INDICATOR:MASK	
A11 C1	0160-2200	C:FXD MICA 43 PF 5%	
A11 C2	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A11 C3	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11 CR1	1902-3234	DIODE:SILICON 19.6V 5%	
A11 CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A11 CR3	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A11 DS1	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS2	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS3	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS4	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 DS5	2140-0313	LAMP:NEON GLOW	
	05326-00009	BRACKET:READOUT	
A11 Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A11 Q2	1854-0365	Q:SI NPN	
A11 Q3	1854-0365	Q:SI NPN	
A11 Q4	1854-0365	Q:SI NPN	
A11 Q5	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A11 Q6	1854-0365	Q:SI NPN	
A11 Q7	1854-0365	Q:SI NPN	
A11 R1	0683-2045	R:FXD COMP 200K OHM 5% 1/4W	
A11 R2	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A11 R3	0683-2035	R:FXD COMP 20K OHM 5% 1/4W	
A11 R4	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R5	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R6	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R7	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11 R8	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A11 R9	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 R10	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 R11	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R12	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R13	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R14	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R15	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11 R16	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A11 R17	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 R18	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A11 U1	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U2	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U3	1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	
A11 U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U6	1820-0327	IC:TTL QUAD 2-INPUT NAND GATE	
A11 U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A11 U8	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A12	05326-60016	VOLTMETER INPUT AMPLIFIER ASSY (5326B ONLY)	
	05326-20016	BOARD:BLANK PC FOR 5326B ONLY	
A12C1	0160-2030	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12C2	0160-2307	C:FXD MICA 47 PF 5%	
A12C3	0160-2030	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12C4	0160-2030	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12CR1		NOT ASSIGNED	
A12CR2	1901-0376	DIODE:SILICON 35V	
A12CR3	1901-0376	DIODE:SILICON 35V	
A12CR4	1902-3083	DIODE BREAKDOWN:4.64V 2%	
A12CR5	1902-0049	DIODE:BREAKDOWN 6.19V 5%	
A12CR6	1901-0040	DIODE:SILICON 30MA 30WV	
A12K1	0490-0853	RELAY:1L OHM 1500 VDC	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A12K2		NOT ASSIGNED	
A12K3	0490-0764	RELAY:REED 0.1 AMP	
A12K4	0490-0764	RELAY:REED 0.1 AMP	
A12K5	0490-0764	RELAY:REED 0.1 AMP	
A12K6	0490-0764	RELAY:REED 0.1 AMP	
A12Q1	1850-0090	Q:GE PNP 2N964	
A12Q2		NOT ASSIGNED	
A12Q3	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q4	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q5	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q6	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A12Q7	1855-0049	Q:SI DUAL N-CHAN	
A12Q8	1854-0087	Q:SI NPN(SIMILAR TO 2N3417)	
A12Q9	1854-0087	Q:SI NPN(SIMILAR TO 2N3417)	
A12Q10	1853-0036	Q:SI PNP	
A12R1		NOT ASSIGNED	
A12R2		NOT ASSIGNED	
A12R3	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R4	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R5	0683-3045	R:FXD COMP 300K OHM 5% 1/4W	
A12R6	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R7	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R8	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R9	0683-3045	R:FXD COMP 300K OHM 5% 1/4W	
A12R10	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R11	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R12	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R13	0683-3045	R:FXD COMP 300K OHM 5% 1/4W	
A12R14	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R15	0698-7535	R:FXD FLM 98.5K OHM 0.5% 1/8W	
A12R16	0698-7618	R:FXD FLM 888K OHM 1.0%	
A12R17	0757-0466	R:FXD MET FLM 110K OHM 1% 1/8W	
A12R18	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R19	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R20	0698-3152	R:FXD MET FLM 3.48K OHM 1% 1/8W	
A12R21	2100-2503	R:VAR CERMET 20K OHM 10% TYPE P	
A12R22	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R23	0698-7618	R:FXD FLM 888K OHM 1.0% 1/4W	
A12R24	2100-2503	R:VAR CERMET 20K OHM 10% TYPE P	
A12R25	0683-8245	R:FXD COMP 820K OHM 5% 1/4W	
A12R26	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A12R27	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A12R28	0683-1645	R:FXD COMP 160K OHM 5% 1/4W	
A12R29	0698-3442	R:FXD MET FLM 237 OHM 1% 1/8W	
A12R30	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A12R31	2100-2931	R:VAR CERMET 500 OHM 10% TYPE P 3/4W	

#[1] See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description, #	Note
A12R32	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A12R33	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A12R34	0683-9145	R:FXD COMP 910K OHM 5% 1/4W	
A12U1	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	
A13	05326-60017	VOLTMETER V-F CONVERTER ASSY (5326B ONLY)	
	05326-20017	BOARD:BLANK PC FOR 5326B ONLY	
A13C1	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C2	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C3	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C4	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A13C5	0160-2150	C:FXD MICA 33 PF 5% 300VDCW	
A13C6	0160-2150	C:FXD MICA 33 PF 5% 300VDCW	
A13C7	0160-2030	C:FXD CER 0.01 UF +80-20% 100VDCW	
A13C8	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A13C9	0160-2150	C:FXD MICA 33 PF 5% 300VDCW	
A13C10	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A13C11	0160-2150	C:FXD MICA 33 PF 5%	
A13C13	0160-2240	C:FXD CER 4.7 PF ±.25 PF 500 VDCW	
A13CR1	1902-0680	DIODE:TC REF. JEDEC TYPE	
A13CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR4	1902-0680	DIODE:TC REF. JEDEC TYPE	
A13CR5	1901-0179	DIODE:SILICON 15WV	
A13CR6	1901-0179	DIODE:SILICON 15WV	
A13CR7	1901-0535	DIODE:SILICON HOT CARRIER	
A13CR8	1901-0179	DIODE:SILICON 15WV	
A13CR9	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR10	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR11	1901-0040	DIODE:SILICON 30MA 30WV	
A13CR12	1901-0179	DIODE:SILICON 15WV	
A13CR13	1901-0179	DIODE:SILICON 15WV	
A13Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A13Q2	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A13Q3	1855-0056	Q:FET	
A13Q4	1855-0081	Q:FET	
A13Q5	1854-0009	Q:SI NPN	
A13Q6	1854-0092	Q:SI NPN	
A13Q7	1854-0092	Q:SI NPN	
A13Q8	1854-0092	Q:SI NPN	
A13Q9	1854-0092	Q:SI NPN	
A13Q10	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A13R1	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A13R2	0757-0421	R:FXD MET FLM 825 OHM 1% 1/8W	
A13R3	0757-0421	R:FXD MET FLM 825 OHM 1% 1/8W	
A13R4	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A13R5	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R6	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R7	0698-3160	R:FXD MET FLM 31.6K 1% 1/8W	
A13R8	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A13R9	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A13R10	0698-3160	R:FXD MET FLM 31.6K 1% 1/8W	
A13R11	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R12	0757-0384	R:FXD FLM 20 OHM 1% 1/8W	
A13R13	0757-0384	R:FXD FLM 20 OHM 1% 1/8W	
A13R14	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R15	2100-2705	R:VAR CERMET 1K OHM 10% TYPE P 3/4W	
A13R16	2100-2705	R:VAR CERMET 1K OHM 10% TYPE P 3/4W	
A13R17	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R18	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A13R19		NOT ASSIGNED	
A13R20		NOT ASSIGNED	
A13R21	0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	
A13R22		NOT ASSIGNED	
A13R23		NOT ASSIGNED	
A13R24	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R25		NOT ASSIGNED	
A13R26		NOT ASSIGNED	
A13R27	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R28	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A13R29	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A13R30	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A13R31	0683-3915	R:FXD COMP 390 OHM 5% 1/4W	
A13R32	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A13R33	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A13R34	0683-5615	R:FXD COMP 560 OHM 5% 1/4W	
A13R35	0683-3615	R:FXD COMP 360 OHM 5% 1/4W	
A13R36	0683-3615	R:FXD COMP 360 OHM 5% 1/4W	
A13R37	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A13R38	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A13R39	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A13R40	0683-3915	R:FXD COMP 390 OHM 5% 1/4W	
A13R41	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A13U1	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL	
A13U2	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL	
A13U3	1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL	
A13U4	1820-0212	INTEGRATED CIRCUIT:ECL LINE RECEIVER	
A13U5	1820-0214	INTEGRATED CIRCUIT:ECL R-S FLIP-FLOP	
A13U6	1820-0276	INTEGRATED CIRCUIT:DIGITAL	
A13U7	1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	
A13U8	1820-0209	INTEGRATED CIRCUIT:DIGITAL	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A14	5326-60015	VOLTMETER DISPLAY CONTROL ASSY (5326B ONLY)	
	05326-20015	BOARD:BLANK PC FOR 5326B ONLY	
A14CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR3	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR4	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR5	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR6	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14CR7	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A14R1	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14R2	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14R3	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A14R4	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A14R5	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14R6	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A14U1	1820-0413	INTEGRATED CIRCUIT:DECADE DIVIDER	
A14U2	1820-0094	IC:DTL QUAD 2-INPUT NAND NOR GATE	
A14U3	1820-0094	IC:DTL QUAD 2-INPUT NAND NOR GATE	
A14U4	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A14U5	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
A14U6	1820-0273	INTEGRATED CIRCUIT:DIGITAL	
A14U7	1820-0274	INTEGRATED CIRCUIT:DIGITAL	
		NOTE FOR 5326B's WITH SERIAL PREFIX 1124A AND ABOVE, USE PARTS LIST PROVIDED ON PAGE 6-45. A15 PART NUMBER IS 05327-60020.	
A15	05326-60001	REGULATOR ASSY (5326A/B)	
	05326-20001	BOARD:BLANK PC	
A15C1	0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	
A15C2	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C3	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C4	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C5	0180-0114	C:FXD ELECT 4.0 UF +100-10% 25VDCW	
A15C6, 7	0160-0975	C:FXD CER 0.001 UF 20% 75VDCW	
A15CR1	1902-3002	DIODE BREAKDOWN:2.37V 5%	
A15CR2	1902-0551	DIODE BREAKDOWN:6.19V 5%	
A15CR3	1902-0551	DIODE BREAKDOWN:6.19V 5%	
A15CR4	1902-3002	DIODE BREAKDOWN:2.37V 5%	
A15CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A15CR6	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR7	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR8	1901-0040	DIODE:SILICON 30MA 30WV	
A15CR9	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR10	1902-3094	DIODE BREAKDOWN:5.11V 2%	
A15CR11	1902-3394	DIODE BREAKDOWN:75 V 2%	
A15CR12	1902-3429	DIODE BREAKDOWN:100 V 2%	
A15F1	2110-0331	FUSE:0.3A	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A15F2	2110-0331	FUSE:0.3A	
A15Q1	1854-0039	Q:SI NPN	
A15Q2	1853-0012	Q:SI PNP	
A15Q3	1854-0039	Q:SI NPN	
A15Q4	1853-0012	Q:SI PNP	
A15Q5	1854-0232	Q:SI NPN(SELECTED FROM 2N3440)	
A15Q6	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A15Q7	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A15Q8	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A15Q9	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A15Q10	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A15R1	0683-2035	R:FXD COMP 20K OHM 5% 1/4W	
A15R2	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A15R3	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A15R4	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A15R5	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A15R6	0683-1505	R:FXD COMP 15 OHM 5% 1/4W	
A15R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A15R8	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A15R9	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A15R10	2100-2093	R:VAR COMP 200 OHM 30% LIN 1/8W	
A15R11	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A15R12	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A15R13	2100-2093	R:VAR COMP 200 OHM 30% LIN 1/8W	
A15R14	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A16	05326-60014	INTERCONNECT ASSY (5326A ONLY)	
	05326-20014	BOARD:BLANK PC FOR 5326A ONLY	
A16C1	0180-2352	C:FXD ELECT 6000 UF +75-10% 15VDCW	
A16C2	0180-2290	C:FXD ELECT 4000 UF +75-10%	
A16C3	0180-1962	C:FXD ELECT 15 UF +50-20% 250VDCW	
A16C4	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16C5	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A16CR4	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16CR5	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16CR6	1901-0029	DIODE:SILICON 600 PIV	
A16CR7	1901-0029	DIODE:SILICON 600 PIV	
A16CR8	1901-0029	DIODE:SILICON 600 PIV	
A16CR9	1901-0029	DIODE:SILICON 600 PIV	
A16CR10	1901-0415	DIODE:SILICON 50 PIV 3A	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	ⓗ Part No.	Description #	Note
A16CR11	1901-0415	DIODE:SILICON 50 PIV 3A	
A16CR12	1901-0415	DIODE:SILICON 50 PIV 3A	
A16CR13	1901-0415	DIODE:SILICON 50 PIV 3A	
A16R1	0812-0021	R:FXD WW 0.47 OHM 5% 3W	
A16R2	0811-1732	R:FXD WW 1 OHM 5% 3W	
A16R3	0686-2045	R:FXD COMP 200K OHM 5% .5W	
A16XA2	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA3	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA4	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA5	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA6	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16XA7	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16XA8	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA9	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16XA10	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16XA11	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16	05326-60026	INTERCONNECT ASSY (5326B ONLY)	
	05326-20014	BOARD:BLANK PC FOR 5326B ONLY	
A16 C1	0180-2352	C:FXD ELECT 6000 UF +75-10% 15VDCW	
A16 C2	0180-2390	C:FXD ELECT 4000 UF +75-10% 15 VDCW	
A16 C3	0180-1962	C:FXD ELECT 15 UF +50-20% 250VDCW	
A16 C4	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16 C5	0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	
A16 CR1	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16 CR2	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A16 CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A16 CR4	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16 CR5	1901-0045	DIODE:SILICON 0.75A 100PIV	
A16 CR6	1901-0029	DIODE:SILICON 600 PIV	
A16 CR7	1901-0029	DIODE:SILICON 600 PIV	
A16 CR8	1901-0029	DIODE:SILICON 600 PIV	
A16 CR9	1901-0029	DIODE:SILICON 600 PIV	
A16 CR10	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 CR11	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 CR12	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 CR13	1901-0415	DIODE:SILICON 50 PIV 3A	
A16 R1	0812-0021	R:FXD WW 0.47 OHM 5% 3W	
A16 R2	0811-1732	R:FXD WW 1 OHM 5% 3W	
A16 R3	0686-2045	R:FXD COMP 200K OHM 5% .5W	
A16 XA2	1251-1886	CONNECTOR:PC 30 CONTACTS	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
A16 XA3	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA4	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA5	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA6	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA7	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA8	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA9	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA10	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA11	1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	
A16 XA12	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA13	1251-1886	CONNECTOR:PC 30 CONTACTS	
A16 XA14	1251-1886	CONNECTOR:PC 30 CONTACTS	
		CHASSIS PARTS	
B1	3140-0030	MOTOR:SHADED POLE	
B1	3150-0039	FILTER:AIR	
B1	3160-0035	FAN:IMPELLER AXIAL 2-1/4 DIAM	
C1	0160-3043	C:FXD CER 2 X 0.005 UF 20% 250VAC	
F1	2110-0304	FUSE:CARTRIDGE 1.50 AMP SLOW BLOW (115V OPER)	
F1	2110-0336	FUSE:CARTRIDGE 0.8 AMP SLOW BLOW (230V OPER)	
F1	1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	
J1	1510-0039	BINDING POST:15A 1000V	
J1		FOR 5326B ONLY	
J1	1510-0040	BINDING POST:15 A 1000V	
J1		FOR 5326B ONLY	
J2	1250-1253	CONNECTOR:BNC	
J3	1250-1253	CONNECTOR:BNC	
J4	1250-1253	CONNECTOR:BNC	
J5	1250-1253	CONNECTOR:BNC	
J6	1250-1253	CONNECTOR:BNC	
J7	1250-1253	CONNECTOR:BNC (5326B)	
J7	1250-0118	CONNECTOR:(5326A)	
J8	1251-2357	CONNECTOR:AC POWER 3 MALE CONTACTS	
J9		LISTED IN OPTION 003	
J10		LISTED IN OPTION 002 ONLY	
J11	1250-0212	CONNECTOR:RF BNC	
	3050-0499	WASHER:SHOULDER (2)	
	5040-0170	SUPPORT BOARD	
Q1	1853-0233	Q:SI PNP	

#, See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
Q2	1854-0420	Q:SI NPN	
Q2	05327-20004	HEAT SINK (Q1 & Q2)	
R1	2100-2961	R:VAR COMP 1 MEGOHM 10% 10 CLOG 1/4W	
S1		PART OF R1	
S2	3101-1327	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	
S3	3101-1216	SWITCH:PUSHBUTTON SPST	
S4	3101-1327	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	
S4		FOR 5326B ONLY	
S4	5040-0702	INSULATOR:CONNECTOR	
S4		FOR 5326B ONLY	
S5	05326-60018	SWITCH ASSY:TIME BASE(WIRED)	
S5	3100-2902	SWITCH:ROTARY	
S6	05326-60019	SWITCH ASSY:FUNCTION	
S6		FOR 5326A ONLY	
S6	3100-2901	SWITCH:ROTARY	
S6	05326-60020	SWITCH ASSY:FUNCTION	
S6		FOR 5326B ONLY	
S6	3100-2903	SWITCH:ROTARY	
S7	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC (P/O 05326-20028)	
S8	3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC (P/O 05326-20028)	
S9	3101-1234	SWITCH:SLIDE DPDT	
T1	9100-2888	TRANSFORMER:POWER	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	Part No.	Description #	Note
		OTHER CABINET PARTS	
	0460-0114	TAPE:POLYURETHANE 1-1/4 IN WIDE (TOP COVER)	
	1490-0030	STAND:TILT	
	5000-0050	TRIM:SIDES	
	5060-0729	FRAME ASSY:3 X 11 (SIDE)	
	5060-0767	FOOT ASSY:FM	
	05326-00001	PANEL:FRONT	
	05326-00004	PANEL:REAR	
	05326-00008	INSULATOR (FOR BOTTOM COVER)	
	05326-00011	PLATE:CONNECTOR, LONG (J9 COVER)	
	05326-00012	PLATE:CONNECTOR, SHORT (J10 COVER)	
	05326-20012	WINDOW (5326A)	
	05326-20006	WINDOW (5326B)	
	7120-1254	TRADEMARK (HP LOGO)	
		PAINTED CABINET PARTS	
	05325-00009	COVER:BOTTOM	
	05326-00006	RIGHT FRONT PANEL TRIM	
	05326-00003	LEFT FRONT PANEL TRIM (5326A)	
	05326-60007	LEFT FRONT PANEL TRIM (5326B)	
	05326-00021	SIDE COVER	
	05326-00022	TOP COVER	
	05326-60029	KIT:RACK MOUNT	
		CONSISTING OF:	
	2370-0012	SCREW:SST FLAT HD PHL DR 6-32 x 1/4	
	2510-0047	SCREW:PAN HD POZI DR 8-32 x 0.438" LG	
	5020-0706	BRACKET:LEFT	
	5020-0707	BRACKET:RIGHT	
	05326-40002	STRIP:FILLER GRAY	
		INTERNAL AND OTHER PARTS	
	0370-0104	KNOB:BLK BAR (TIME BASE)	
	0370-0104	KNOB:BLK BAR (FUNCTION)	
	01821-67401	KNOB (LEVEL)	
	00160-67403	KNOB (SAMPLE RATE)	
	5040-0170	GUIDE:PLUG-IN PC BD (BOARD SUPPORT)	
	5060-0109	CONNECTOR:15 CONTACTS	
	05326-00010	SHIELD:NIXIE	
	05326-00016	CHASSIS	
	05326-20028	BOARD: BLANK (REAR PANEL INTERCONNECT)	
	05326-60032	CABLE ASSY:POWER	
	8120-1348	CORD:LINE	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A9	05326-60025	DISPLAY ASSY (OPTION 001 ONLY)	
	05326-20008	BOARD:BLANK PC OPTION 001 ONLY	
A9DS1	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9DS2	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9DS3	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9DS4	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9DS5	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9DS6	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9DS7	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9DS8	1970-0042	TUBE:NUMERICAL INDICATOR	
	1200-0405	SOCKET:TUBE FOR 8700 SERIES	
A9R1	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R2	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R3	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A9R4	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R5	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R6	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R7	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R8	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R9	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9R10	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A9R11	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A9U1	1820-0275	INTEGRATED CIRCUIT:DIGITAL	
A9U2	1820-0110	INTEGRATED CIRCUIT	
A9U3	1820-0119	INTEGRATED CIRCUIT	
A9U4	1820-0119	INTEGRATED CIRCUIT	
A9U5	1820-0119	INTEGRATED CIRCUIT	
A9U6	1820-0119	INTEGRATED CIRCUIT	
A9U7	1820-0119	INTEGRATED CIRCUIT	
A9U8	1820-0119	INTEGRATED CIRCUIT	
A9U9	1820-0116	INTEGRATED CIRCUIT	
A9U10	1820-0116	INTEGRATED CIRCUIT	
A9U11	1820-0116	INTEGRATED CIRCUIT	
A9U12	1820-0116	INTEGRATED CIRCUIT	
A9U13	1820-0116	INTEGRATED CIRCUIT	
A9U14	1820-0116	INTEGRATED CIRCUIT	
A9U15	1820-0116	INTEGRATED CIRCUIT	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Continued)

Reference Designation	⊕ Part No.	Description #	Note
A9U16	1820-0110	INTEGRATED CIRCUIT	
A9U17	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U18	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U19	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U20	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U21	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U22	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U23	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
A9U24	1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	
P1		5328A/B OPT 002 REMOTE PROGRAMMING	
P1		DELETE P1A 5060-0109	
P1		ADD REMOTE CABLE ASSY 05328-60006	
J10	1251-0085	CONNECTOR:FEMALE 36-PIN MINAT	
P1A, B, C	5060-0113	CONNECTOR:45 CONTACT	
P2		5328A/B OPT 003 DIGITAL RECORDER	
P2		ADD PRINTER CABLE ASSY 05328-60012	
P2		1251-0087 IS J9 ON SCHEMATIC	
J9	1251-0087	CONNECTOR:FEMALE 50-PIN MINAT	
P1, 2	1251-2262	CONN:PC 20 (2 x 10) CONTACTS	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5328A	TQ 5328B
0121-0059	C:VAR CER 2-8 NPO	72982	538-011-COPO-89R	1	1
0140-0159	C:FXD MICA 300 PF 2% 300VDCW	28480	0140-0159	1	1
0140-0193	C:FXD MICA 82 PF 5%	28480	0140-0193	1	1
0160-0134	C:FXD MICA 220 PF 5% 500VDCW	91418	TA	1	1
0160-0153	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS	4	4
0160-0161	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS	3	3
0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	56289	192P33392-PTS	1	1
0160-0166	C:FXD MY 0.0068 UF 10% 200VDCW	56289	192P68392-PTS	1	1
0160-0336	C:FXD MICA 100 PF 1%	28480	0160-0336	1	
0160-0378	C:FXD MICA 27PF 5%	72136	RDM15E270J5S	2	2
0160-0075	C:FXD CER 0.001 UF 20% 75VDCW			2	2
0160-0939	C:FXD MICA 430 PF 5% 300 VDCW	28480	0160-0939	2	2
0160-2055	C:FXD CER .01 UF +80-20% 100VDCW	28480	0160-2055	10	10
0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B	2	2
0160-2146	C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA	2	2
0160-2150	C:FXD MICA 33 PF 5%	28480	0160-2150	1	2
0160-2197	C:FXD MICA 10 PF 5%	72136	RDM15C100J3C	2	2
0160-2199	C:FXD MICA 30 PF 5%	28480	0160-2199	1	1
0160-2200	C:FXD MICA 43 PF 5%	72136	RDM15E430J3C	1	1
0160-2201	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C	1	1
0160-2204	C:FXD MICA 100PF 5%	72136	RDM15F101J3C	1	1
0160-2205	C:FXD MICA 120 PF 5% 300VDCW	28480	0160-2205	1	1
0160-2244	C:FXD CER 3.0 0.25 PF 500VDCW	28480	0160-2244	2	2
0160-2264	C:FXD CER 20 PF 5% 500VDCW	28480	0160-2264	1	1
0160-2307	C:FXD MICA 47 PF 5%	28480	0160-2307		1
0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA		
0160-3043	C:FXD CER 2 X 0.005 UF 20% 250VAC	56289	29C147A-CDH	1	1
0170-0024	C:FXD MY 0.022UF 20% 200VDCW	56289	192P22302	1	1
0170-0055	C:FXD MY 0.1UF 20% 200VDCW	56289	192P10402	4	6
0180-0197	C:FXD ELECT 2.2 UF +100-10% 25VDCW	28480	0180-0197	9	9
0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS	6	10
0180-0228	C:FXD ELECT 22 UF 10% 15VDCW	28480	0180-0228	1	1
0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS	3	3
0180-1962	C:FXD ELECT 15 UF +50-20% 250VDCW	56289	39D156F250EJ4-DSB	1	1
0180-2296	C:FXD ELECT 4000 UF +75-10% 15VDCW	56289	39D167-DSB	1	1
0180-2297	C:FXD ELECT 700 UF +75-10% 30VDCW	56289	39D170-DSB	2	2
0180-2352	C:FXD ELECT 6000 UF -10+75% 15VDCW	28480	0180-2352	1	1
0340-0162	INSULATOR:TRANSISTOR	28480	0340-0162	2	2
0370-0104	KNOB:BLK BAR W/ARROW 1/4" SHAFT	28480	0370-0104	1	1
0410-0161	COMPONENT:OVEN	82647	4ST1-2	1	1
0410-0175	CRYSTAL:QUARTZ 10 MHZ	28480	0410-0175	1	1
0490-0764	RELAY:REED 0.1 AMP	28480	0490-0764		4
0490-0853	RELAY:1 OHM 1500 VDC	28480	0490-0853		1
0683-1005	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005	8	8
0683-1015	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015	20	19
0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025	30	31
0683-1035	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035	19	45
0683-1045	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045	6	6
0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055	10	10
0683-1065	R:FXD COMP 10M OHM 5% 1/4W	01121	CB 1065	2	2
0683-1125	R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125	1	1
0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225	1	1
0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	01121	CB 1325	2	2
0683-1505	R:FXD COMP 15 OHM 5% 1/4W	01121	CB 1505	1	1
0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525	10	10
0683-1645	R:FXD COMP 160K OHM 5% 1/4W	01121	CB 1645		1
0683-2015	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015	2	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Part No.	Description #	Mfr.	Mfr. Part No.	TQ 6920A	TQ 6920B
0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025	10	10
0683-2035	R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035	2	2
0683-2045	R:FXD COMP 200K OHM 5% 1/4W	01121	CB 2045	2	2
0683-2055	R:FXD COMP 2 MEGOHM 5% 1/4W	01121	CB 2055	2	2
0683-2215	R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215	7	7
0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225	17	22
0683-2235	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235	4	4
0683-2405	R:FXD COMP 24 OHM 5% 1/4W	01121	CB 2405	2	2
0683-2415	R:FXD COMP 240 OHM 5% 1/4W	01121	CB 2415	1	1
0683-2425	R:FXD COMP 2400 OHM 5% 1/4W	01121	CB 2425	1	1
0683-2715	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715	1	1
0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725	2	2
0683-2735	R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735	5	5
0683-3015	R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015	5	5
0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025	9	9
0683-3035	R:FXD COMP 30K OHM 5% 1/4W	01121	CB 3035	2	2
0683-3005	R:FXD COMP 30 OHM 5% 1/4W	01121	CB 3005	1	1
0683-3045	R:FXD COMP 300K OHM 5% 1/4W	01121	CB 3045		2
0683-3315	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315	11	0
0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325	12	10
0683-3615	R:FXD COMP 360 OHM 5% 1/4W	01121	CB 3615		2
0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	01121	CB 3625	4	4
0683-3915	R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915	1	8
0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925	3	4
0683-3935	R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935	8	9
0683-4715	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715	5	6
0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725	4	0
0683-5105	R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105	9	4
0683-5115	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115	2	2
0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125	6	10
0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625	1	1
0683-5615	R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615		1
0683-6215	R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215	1	1
0683-6225	R:FXD COMP 6200 OHM 5% 1/4W	01121	CB 6225	1	1
0683-6815	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815	6	7
0683-6835	R:FXD COMP 68K OHM 5% 1/4W	01121	CB 6835	3	4
0683-7515	R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515	1	
0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	01121	CB 7525	7	7
0683-8205	R:FXD COMP 82 OHM 5% 1/4W	01121	CB 8205	1	1
0683-8245	R:FXD COMP 820K OHM 5% 1/4W	01121	CB 8245		1
0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	01121	CB 9125	2	2
0683-9145	R:FXD COMP 910K OHM 5% 1/4W	01121	CB 9145	2	4
0686-2045	R:FXD COMP 200K OHM 5% .5W	01121	EB 2045	1	1
0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	14674	C4		2
0698-3152	R:FXD MET FLM 3.48K 1% 1/8W	14674	C4		1
0698-3160	R:FXD MET FLM 31.6K 1% 1/8W	14674	C4		2
0698-3378	R:FXD COMP 33 OHM 5% 1/8W	28480	0698-3378	2	2
0698-3379	R:FXD COMP 68 OHM 5% 1/8W	28480	0698-3379	2	2
0698-3381	R:FXD COMP 150 OHM 5% 1/8W	28480	0698-3381	4	4
0698-3442	R:FXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442		1
0698-3576	R:FXD COMP 110K OHM 5% 1/4W	28480	0698-3576	4	4
0698-4037	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037	1	1
0698-5175	R:FXD COMP 360 OHM 5% 1/8W	28480	0698-5175	4	4
0698-5180	R:FXD COMP 2K OHM 5% 1/8W	28480	0698-5180	2	2
0698-7535	R:FXD FLM 98.9K OHM 0.5% 1/8W	28480	0698-7535		1
0698-7610	R:FXD FLM 1.74K OHM 0.5% 1/8W	28480	0698-7610		4
0698-7618	R:FXD FLM [illegible]K OHM 1.0% 1/4W	28480	0698-7618		14

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
0757-0384	R:FXD FLM 20 OHM 1% 1/8W	28480	0757-0384		2
0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398		2
0757-0421	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421		4
0757-0466	R:FXD MET FLM 110K OHM 1% 1/8W	28480	0757-0466		1
0811-1732	R:FXD WW 1 OHM 5% 3W	28480	0811-1732	1	1
0812-0021	R:FXD WW 0.47 OHM 5% 3W	28480	0812-0021	1	1
1200-0405	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207	7	7
1250-0083	CONNECTOR:BNC	28480	1250-0083	6	6
1250-0212	CONNECTOR:JACK CHASSIS BNC	95712	30409-1	1	1
1250-1163	CONNECTOR:RF BNC INPUT	28480	1250-1163	2	2
1251-0085	CONNECTOR:FEMALE 36-PIN MINAT	28480	1251-0085		
1251-0087	CONNECTOR:FEMALE 50-PIN MINAT	28480	1251-0087		
1251-0472	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300	2	2
1251-1886	CONNECTOR:PC 30 CONTACTS	28480	1251-1886	6	9
1251-2034	CONN:PC 20(2X10) CONTACTS	76530	65-7160		
1251-2035	CONN:PC 30(2X15) CONTACTS	76530	65-7160	1	1
1251-2134	CONNECTOR:PC (2X18)36 CONTACTS	71785	252-18-30-340	4	4
1251-2357	CONNECTOR:AC POWER 3 MALE CONTACTS	82389	EAC-301	1	1
1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014	1	1
1490-0030	STAND:TILT	28480	1490-0030	1	1
1510-0039	BINDING POST:15A 1000V	58474	DF 21BC		1
1510-0040	BINDING POST:15 A 1000V	58474	DF 21 MAROON		1
1820-0054	IC:TTL QUAD 2-INPUT NAND GATE	01295	SN7400N	4	9
1820-0068	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N	1	1
1820-0092	INTEGRATED CIRCUIT:MIXER DRIVER	28480	1820-0092	7	7
1820-0094	IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X	1	3
1820-0102	INTEGRATED CIRCUIT:J-K FLIP FLOP	04713	MC1013P	4	3
1820-0119	INTEGRATED CIRCUIT	28480	1820-0119	14	14
1820-0142	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	04713	MC1004P	4	4
1820-0145	INTEGRATED CIRCUIT:QUAD,2INPUT NOR	04713	MC1010P	3	1
1820-0147	INTEGRATED CIRCUIT:ECL 3-INPUT NOR GATE	04713	SC 7011PK	4	1
1820-0174	INTEGRATED CIRCUIT:TTL HEX INVERTER	01295	SN8199	1	2
1820-0201	INTEGRATED CIRCUIT:OPERATIONAL AMPL	04713	MC1439G		3
1820-0209	INTEGRATED CIRCUIT:DIGITAL	28480	1820-0209		1
1820-0212	INTEGRATED CIRCUIT:ECL LINE RECEIVER	04713	SC7014PK		1
1820-0213	INTEGRATED CIRCUIT:ECL R-S FLIP-FLOP	04713	SC7015PK		1
1820-0223	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223		1
1820-0238	INTEGRATED CIRCUIT:DTL 2 INPUT NOR GATE	04713	MC 1810P	2	2
1820-0265	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	04713	MC1035P	2	4
1820-0277	INTEGRATED CIRCUIT:DIGITAL	04713	SC 7022PK	2	2
1820-0273	INTEGRATED CIRCUIT:DIGITAL	04713	MC 1806P	1	2
1820-0274	INTEGRATED CIRCUIT:DIGITAL	04713	MC 1808P	13	16
1820-0279	INTEGRATED CIRCUIT:DIGITAL	04713	SC 7025PK	1	1
1820-0276	INTEGRATED CIRCUIT:DIGITAL	04713	MC 1033P		1
1820-0307	IC:DTL HEX INVERTER 9L16X	07263	U6A993659X	1	1
1820-0327	IC:TTL QUAD 2-INPUT NAND GATE	01295	SN4446	1	1
1820-0328	IC:TTL QUAD 2-INPUT NOR GATE	18324	N7402N	1	1
1820-0412	INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412	7	7
1820-0413	INTEGRATED CIRCUIT	28480	1820-0413	1	2
1820-0440	INTEGRATED CIRCUIT	04713	MC 1016P	1	
1821-0001	TRANSISTOR ARRAY:SI NPN	02735	CA3046	1	1
1850-0099	Q:GE PNP 2N904	80131	2N904		1
1850-0100	Q:GE PNP 2N2030	01295	2N2030	1	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
1853-0012	Q:SI PNP	04713	2N2904A	2	2
1853-0015	Q:SI PNP	04713	MPS3640-5	20	20
1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020	4	0
1853-0036	Q:SI PNP	04713	SPS 3612		1
1853-0233	Q:SI PNP	01295	TIP 32	1	1
1854-0009	Q:SI NPN	04713	2N709	9	3
1854-0039	Q:SI NPN	04713	2N3053	2	2
1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071	22	26
1854-0087	Q:SI NPN(SIMILAR TO 2N3417)	28480	1854-0087		2
1854-0092	Q:SI NPN	07263	2N3563	10	22
1854-0215	Q:SI NPN	04713	SPS3611	1	1
1854-0232	Q:SI NPN(SELECTED FROM 2N3440)	28480	1854-0232	1	1
1854-0345	Q:SI NPN	02735	2N5179	4	4
1854-0365	Q:SI NPN	04713	SPS 3321	17	20
1854-0420	Q:SI NPN	01295	TIP 31	1	1
1855-0049	Q:SI DUAL N-CHAN	28480	1855-0049		1
1855-0056	Q:FET	07263	2N4342		1
1855-0081	Q:FET	01295	2N5245		1
1855-0334	Q:FET DUAL N-CHAN	17856	DN377	2	2
1901-0029	DIODE:SILICON 600 PIV	28480	1901-0029	4	4
1901-0040	DIODE:SILICON 30MA 30WV	07263	FDG1088	16	21
1901-0045	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7	2	2
1901-0179	DIODE:SILICON 15WV	28480	1901-0179		0
1901-0376	DIODE:SILICON 35V	28480	1901-0376	4	6
1901-0535	DIODE:HOT CARRIER	28480	1901-0535		1
1901-0415	DIODE:SILICON 50 PIV 3A	28480	1901-0415	4	4
1901-0661	DIODE:SILICON 3-JUNCTION STABISTOR	28480	1901-0661	2	2
1902-0041	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98	4	4
1902-0049	DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122	2	3
1902-0551	DIODE BREAKDOWN:6.19V 5%	28480	1902-0551	2	2
1902-0680	DIODE:TC REF. JEDEC TYPE	04713	1N827		2
1902-3002	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002	2	2
1902-3083	DIODE BREAKDOWN:4.64V 2%	28480	1902-3083		1
1902-3094	DIODE BREAKDOWN:5.11V 2%	28480	1902-3094	4	4
1902-3301	DIODE BREAKDOWN:34.8V 5%	28480	1902-3301	2	1
1902-3345	DIODE:SILICON 51.1V	28480	1902-3345		1
1902-3394	DIODE BREAKDOWN:75 V 2%	28480	1902-3394	1	1
1902-3429	DIODE BREAKDOWN:100 V 2%	28480	1902-3429	1	1
1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361	19	24
1970-0042	TUBE:NUMERICAL INDICATOR	83594	B-5750-S	7	1
2100-2093	R:VAR COMP 200 OHM 30% LIN 1/8W	28480	2100-2093	2	2
2100-2503	R:VAR CERMET 20K OHM 10% TYPE P	28480	2100-2503		2
2100-2520	R:VAR CERMET 50 OHM 20% TYPE V 1/2W	28480	2100-2520	2	2
2100-2521	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521	2	2
2100-2705	R:VAR CERMET 1K OHM 10% TYPE P 3/4W	28480	2100-2705		2
2100-2909	R:VAR CERMET 10K OHM 10% LIN	28480	2100-2909	2	2
2100-2931	R:VAR CERMET 500 OHM 10% TYPE P 3/4W	28480	2100-2931		1
2100-3001	R:VAR COMP 1 MEGOHM 10% 10 CLOG 1/4W	28480	2100-3001	1	1
2110-0010	FUSE:CARTRIDGE 0.5 AMP SLOW BLOW	75915	313,500H	1	1
2110-0331	FUSE:0.3A	71400	GMW 3/10	2	2
2100-0304	FUSE:SLO BLO 1.50 AMP	71400	MDX-1-1/2A	1	1
2140-0047	LAMP:NEON GLOW 0.3MA	24455	A1C	2	2
2140-0319	LAMP:NEON GLOW	24455	C2A-B	11	14
3100-2901	SWITCH:ROTARY	28480	3100-2901	1	
3100-2902	SWITCH:ROTARY	28480	3100-2902	1	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

HP Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5328A	TQ 5328B
3100-2903	SWITCH:ROTARY	28480	3100-2903		1
3101-0199	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	79727	G126-0014	2	2
3101-1216	SWITCH:PUSHBUTTON SPST	82389	85-1034	1	1
3101-1244	SWITCH:SLIDE DPDT	82389	11A-1242	1	1
3101-1278	SWITCH:SLIDE DPDT	79727	G-126-0007	2	2
3101-1279	SWITCH:SLIDE DP 3 POSITIONS	79727	G-128-5-0016	2	2
3101-1311	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	79727	G126-0020	2	2
3101-1314	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	79727	G1285-0004	1	1
3101-1327	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	79727	G1285-0006	1	2
3140-0030	MOTOR:SHADED POLE	28480	3140-0030	1	1
3150-0039	FILTER:AIR	28480	3150-0039	1	1
3160-0036	FAN:IMPELLER AXIAL 2-1/4 DIAM	04870	2 1/4 MIW 128 5	1	1
5000-0050	TRIM:SIDES	28480	5000-0050	1	1
5000-0729	COVER:SIDE FM	28480	5000-0729	1	1
5040-0702	INSULATOR:CONNECTOR	28480	5040-0702		1
5000-0100	CONNECTOR:16 CONTACT	28480	5000-0100	1	1
5060-0111	CONNECTOR	28480	5060-0111	1	
5060-0113	CONNECTOR:45 CONTACT	28480	5060-0113	1	
5060-0729	FRAME ASSY:3 X 11(SIDE)	28480	5060-0729	1	1
5060-0767	FOOT ASSY:FM	28480	5060-0767	5	5
8120-1348	CABLE ASSY:POWER, DETACHABLE	70903	KHS-7041	1	1
9100-2270	COIL:FXD 100 UH 10%				1
9100-2255	COIL/CHOKE 0.47 UH 10%	28480	9100-2255	4	4
9100-2088	TRANSFORMER:POWER	28480	9100-2088	1	1
9140-0142	COIL:FXD RF 2.2 UH	28480	9140-0142	2	2
9140-0144	COIL:FXD RF 4.7 UH	28480	9140-0144	14	14
9140-0198	COIL:FXD RF 1 UH 10%	99800	1025-20	1	
00180-67403	KNOB ASSY	28480	00180-67403	1	1
01821-67401	KNOB ASSY	28480	01821-67401	1	1
05329-00008	COVER:TOP	28480	05329-00008	1	1
05329-00009	COVER:BOTTOM	28480	05329-00009	1	1
05326-00001	PANEL:FRONT	28480	05326-00001	1	1
05326-00003	PANEL:FRONT TRIM	28480	05326-00003	1	
05326-00005	CHASSIS	28480	05326-00005	1	1
05326-00006	PANEL:FRONT EXTRACTOR	28480	05326-00006		1
05326-00007	PANEL:FRONT TRIM	28480	05326-00007		1
05326-00008	INSULATOR	28480	05326-00008	1	1
05326-00009	BRACKET:READOUT	28480	05326-00009	3	3
05326-00010	SHIELD:MIXER	28480	05326-00010	1	1
05326-00011	PLATE:CONNECTOR,LONG	28480	05326-00011	1	1
05326-00012	PLATE:CONNECTOR,SHORT	28480	05326-00012	1	1
05326-00013	SPACER:LONG	28480	05326-00013	1	
05326-20001	BOARD:BLANK PC	28480	05326-20001	1	1
05326-20002	BOARD:BLANK PC	28480	05326-20002	1	1
05326-20003	BOARD:BLANK PC	28480	05326-20003	1	1
05326-20005	BOARD:BLANK PC	28480	05326-20005	1	1
05326-20006	WINDOW	28480	05326-20006		
05326-20007	BOARD:BLANK PC	28480	05326-20007	1	
05326-20008	BOARD:BLANK PC	28480	05326-20008	1	1
05326-20009	BOARD:BLANK PC	28480	05326-20009	1	1
05326-20010	BOARD:BLANK PC	28480	05326-20010	1	
05326-20011	BOARD:BLANK PC	28480	05326-20011	1	1
05326-20012	WINDOW	28480	05326-20012	1	
05326-20013	BOARD:BLANK PC	28480	05326-20013	1	1
05326-20014	BOARD:BLANK PC	28480	05326-20014	1	1
05326-20015	BOARD:BLANK PC	28480	05326-20015		1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
05326-20016	BOARD:BLANK PC	28480	05326-20016	[illegible]	[illegible]
05326-20017	BOARD:BLANK PC	28480	05326-20017	[illegible]	1
05326-20022	BOARD:BLANK PC	28480	05326-20022	[illegible]	1
05326-20024	BOARD:BLANK PC	28480	05326-20024	[illegible]	1
05326-60001	REGULATOR ASSY	28480	05326-60001	1	1
05326-60002	OSCILLATOR ASSY	28480	05326-60002	1	1
05326-60003	ATTENUATOR ASSY	28480	05326-60003	1	1
05326-60004	INPUT AMPLIFIER ASSY	28480	05326-60004	1	1
05326-60005	TIME BASE CONTROL ASSY	28480	05326-60005	1	1
05326-60007	FUNCTION SELECTOR ASSY	28480	05326-60007	1	1
05326-60008	DISPLAY ASSY	28480	05326-60008	1	1
05326-60009	DISPLAY SUPPORT ASSY	28480	05326-60009	1	1
05326-60010	LEFT READOUT ASSY	28480	05326-60010	1	1
05326-60011	RIGHT READOUT ASSY	28480	05326-60011	1	1
05326-60013	SAMPLE RATE ASSY	28480	05326-60013	1	1
05326-60014	INTERCONNECT ASSY	28480	05326-60014	1	1
05326-60015	VOLTMETER DISPLAY CONTRIN. ASSY	28480	05326-60015	1	1
05326-60016	VOLTMETER INPUT AMPLIFIER ASSY	28480	05326-60016		1
05326-60017	VOLTMETER V-F CONVERTER ASSY	28480	05326-60017		1
05326-60018	SWITCH ASSY:TIME BASE(MIRROR)	28480	05326-60018	1	1
05326-60019	SWITCH ASSY:FUNCTION	28480	05326-60019	1	
05326-60020	SWITCH ASSY:FUNCTION	28480	05326-60020		1
05326-60021	CABLE ASSY:VOLTMETER	28480	05326-60021		1
05326-60022	LEFT READOUT ASSY	28480	05326-60022	1	1
05326-60023	RIGHT READOUT ASSY	28480	05326-60023		1
05326-60024	FUNCTION SELECTOR ASSY	28480	05326-60024		1
05326-60026	INTERCONNECT ASSY	28480	05326-60026		1
05326-60027	CABLE ASSY:INPUT C	28480	05326-60027	1	1
05326-80002	INDICATOR:MASK	28480	05326-80002	1	1
05326-80004	INDICATOR:MASK	28480	05326-80004		1
05326-80006	WINDOW:FILM	28480	05326-80006	1	1
05326-80009	INDICATOR:MASK	28480	05326-80009	1	1
05330-40002	BLOCK:ANNUNCIATOR	28480	05330-40002	1	1
5212A-128	BRACKET:FAN	28480	5212A-128	1	1
5212A-478	SPACER:FILTER	28480	5212A-478	1	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Continued)

℘ Part No.	Description #	Mfr.	Mfr. Part No.	TQ 5326A	TQ 5326B
0683-1005	RES FXD COMP 10 OHM 5% 1/4W	01121	CB 1005		
0683-1025	RES FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025		
0683-7525	RES FXD COMP 7500 OHM 5% 1/4W	01121	CB 7525		
1200-0409	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207		
1820-0092	INTEGRATED CIRCUIT:NIXIE DRIVER	28480	1820-0092		
1820-0117	INTEGRATED CIRCUIT	28480	1820-0117		
1820-0119	INTEGRATED CIRCUIT	28480	1820-0119		
1820-0275	INTEGRATED CIRCUIT:DIGITAL	04713	SC 7023PK		
1970-0047	TUBE:NUMERICAL INDICATOR	83594	B-5750-S		
05326-20008	BOARD:BLANK PC	28480	05326-20008		
05326-60025	DISPLAY ASSY	28480	05326-60025		

See introduction to this section for ordering information

Table 6-3. Manufacturers Code List

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Revised: October [illegible]

From: FSC Handbook Supplements

Table 6-3. Manufacturers Code List (Continued)

Code No.	Manufacturer	Address
[illegible]	[illegible] Edison Co.	Manchester, N.H.
[illegible]	Power Design Pacific Inc.	Palo Alto, Calif.
[illegible]	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
[illegible]	Signetics Corp.	Sunnyvale, Calif.
[illegible]	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
[illegible]	TRW Elect. Comp. Div.	Des Plaines, Ill.
[illegible]	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
[illegible]	Vishay Instruments Inc.	Malvern, Pa.
[illegible]	E. I. DuPont and Co., Inc.	Wilmington, Del.
[illegible]	Durant Mfg. Co.	Milwaukee, Wis.
[illegible]	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
[illegible]	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
[illegible]	[illegible]	Baldwin Park, Calif.
[illegible]	[illegible] Electronics	[illegible], N.Y.
[illegible]	Electra Mfg. Co.	Independence, Kansas
[illegible]	General Atronics Corp.	Philadelphia, Pa.
[illegible]	[illegible], Inc.	Long Island City, N.Y.
[illegible]	Fafnir Bearing Co., The	New Britain, Conn.
[illegible]	Fansteel Metallurgical Corp.	N. Chicago, Ill.
[illegible]	[illegible] Corp.	Indianapolis, Ind.
[illegible]	British Radio Electronics Ltd.	Washington, D.C.
[illegible]	G.E. Lamp Division	Nela Park, Cleveland, Ohio
[illegible]	General Radio Co.	West Concord, Mass.
[illegible]	[illegible] Inc., Comp. Div.	Huntington, Ind.
[illegible]	[illegible] Inc.	San Juan Capistrano, Calif.
[illegible]	[illegible] Corp.	New Rochelle, N.Y.
[illegible]	Grobet File Co. of America, Inc.	Carlstadt, N.J.
[illegible]	[illegible] Co.	[illegible], Calif.
[illegible]	Hamilton Watch Co.	Lancaster, Pa.
[illegible]	Specialties Mfg. Co., Inc.	Stratford, Conn.
[illegible]	Hewlett-Packard Co.	Palo Alto, Calif.
[illegible]	Heyman Mfg. Co.	Kenilworth, N.J.
[illegible]	Industrial Retaining Ring Co., Inc.	Little Falls, N.J.
[illegible]	G. E. Receiving Tube Dept.	Owensboro, Ky.
[illegible]	Lectrohm Inc.	Chicago, Ill.
[illegible]	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
[illegible]	Cunningham, W. H. & Hill, Ltd.	Toronto Ontario, Canada
[illegible]	P. R. Mallory & Co. Inc.	Indianapolis, Ind.
[illegible]	Mechanical Industries Prod. Co.	Akron, Ohio
[illegible]	Miniature Precision Bearings, Inc.	Keene, N.H.
[illegible]	Muter Co.	Chicago, Ill.
[illegible]	C. A. Norgren Co.	Englewood, Colo.
[illegible]	Ohmite Mfg. Co.	Skokie, Ill.
[illegible]	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
[illegible]	Polaroid Corp.	Cambridge, Mass.
[illegible]	Precision Thermometer & Inst. Co.	Southampton, Pa.
[illegible]	[illegible] Microwave & Power Tube Div.	Waltham, Mass.
[illegible]	Rowan Controller Co.	Westminster, Md.
[illegible]	Sanborn Company	Waltham, Mass.
[illegible]	Shallcross Mfg. Co.	Selma, N.C.
[illegible]	Simpson Electric Co.	Chicago, Ill.
[illegible]	Sonotone Corp.	Elmsford, N.Y.
[illegible]	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
[illegible]	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
[illegible]	Sprague Electric Co.	North Adams, Mass.
[illegible]	Telex Corp.	Tulsa, Okla.
[illegible]	Thomas & Betts Co.	Elizabeth, N.J.
[illegible]	[illegible] Electrical Inst. Co.	[illegible], Ohio
[illegible]	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
[illegible]	Universal Electric Co.	Owosso, Mich.
[illegible]	[illegible] Leonard Electric Co.	Mt. Vernon, N.Y.
[illegible]	[illegible] Electric Co., Inc.	New York, N.Y.
[illegible]	Weston Inst. Inc., Weston Newark	Newark, N.J.
[illegible]	[illegible] Mfg. Co.	Chicago, Ill.
[illegible]	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
[illegible]	Allen Mfg. Co.	Hartford, Conn.
[illegible]	Allied Control	New York, N.Y.
[illegible]	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
[illegible]	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
[illegible]	Atlantic India Rubber Works, Inc.	Chicago, Ill.
[illegible]	Amperite Co., Inc.	Union City, N.J.
[illegible]	ADC Products Inc.	Minneapolis, Minn.
[illegible]	Belden Mfg. Co.	Chicago, Ill.
[illegible]	Bird Electronic Corp.	Cleveland, Ohio
[illegible]	Birnbach Radio Co.	New York, N.Y.
[illegible]	Bliley Electric Co., Inc.	Erie, Pa.
[illegible]	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
[illegible]	Bud Radio, Inc.	Willoughby, Ohio
[illegible]	Cambridge Thermionic Corp.	Cambridge, Mass.
[illegible]	Camloc Fastener Corp.	Paramus, N.J.
[illegible]	Cardwell Condenser Corp.	Lindenhurst L.I., N.Y.
[illegible]	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
[illegible]	Chicago Condenser Corp.	Chicago, Ill.
[illegible]	Calif. Spring Co., Inc.	Pico Rivera, Calif.
[illegible]	CTS Corp.	Elkhart, Ind.
[illegible]	ITT Cannon Electric Inc.	Los Angeles, Calif.
[illegible]	Cinema, Div. Aerovox Corp.	Burbank, Calif.
[illegible]	C. P. Clare & Co.	Chicago, Ill.
[illegible]	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
[illegible]	Commercial Plastics Co.	Chicago, Ill.
[illegible]	Cornish Wire Co., The	New York, N.Y.
[illegible]	Coto Coil Co., Inc.	Providence, R.I.
[illegible]	Chicago Miniature Lamp Works	Chicago, Ill.
[illegible]	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
[illegible]	Dow Corning Corp.	Midland, Mich.
[illegible]	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
[illegible]	Dialight Corp.	Brooklyn, N.Y.
[illegible]	Indiana General Corp., Electronics Div.	Keasbey, N.J.
[illegible]	General Instrument Corp., Cap. Div.	Newark, N.J.
[illegible]	Drake Mfg. Co.	Harwood Heights, Ill.
[illegible]	Hugh H. Eby Inc.	Philadelphia, Pa.
[illegible]	Gudeman Co.	Chicago, Ill.
[illegible]	Elastic Stop Nut Corp.	Union, N.J.
[illegible]	Robert M. Hadley Co.	Los Angeles, Calif.
[illegible]	Erie Technological Products, Inc.	Erie, Pa.
[illegible]	Hansen Mfg. Co., Inc.	Princeton, Ind.
[illegible]	H. M. Harper Co.	Chicago, Ill.
[illegible]	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.
[illegible]	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
[illegible]	Amperex Elect. Co.	Hicksville, L.I., N.Y.
[illegible]	Bradley Semiconductor Corp.	New Haven, Conn.
[illegible]	Carling Electric, Inc.	Hartford, Conn.
[illegible]	[illegible] Mfg. Co.	Trenton, N.J.
[illegible]	George K. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.
[illegible]	Federal Screw Products Inc.	Chicago, Ill.
[illegible]	Fischer Special Mfg. Co.	Cincinnati, Ohio
[illegible]	General Industries Co., The	Elyria, Ohio
[illegible]	Goshen Stamping & Tool Co.	Goshen, Ind.
[illegible]	JFD Electronics Corp.	Brooklyn, N.Y.
[illegible]	Jennings Radio Mfg. Corp.	San Jose, Calif.
[illegible]	[illegible] Corp.	Ridgefield, N.J.
[illegible]	Signalite Inc.	Neptune, N.J.
[illegible]	J. H. Winns, and Sons	Winchester, Mass.
[illegible]	Industrial Condenser Corp.	Chicago, Ill.
[illegible]	R. F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
[illegible]	E. F. Johnson Co.	Waseca, Minn.
[illegible]	International Resistance Co.	Philadelphia, Pa.
[illegible]	Keystone Carbon Co., Inc.	St. Marys, Pa.
[illegible]	CTS Knights Inc.	Sandwich, Ill.
[illegible]	Kulka Electric Corporation	Mt. Vernon, N.Y.
[illegible]	Lenz Electric Mfg. Co.	Chicago, Ill.
[illegible]	Littelfuse, Inc.	Des Plaines, Ill.
[illegible]	Lord Mfg. Co.	Erie, Pa.
[illegible]	C. W. Marwedel	San Francisco, Calif.
[illegible]	General Instrument Corp., Micamold Division	Newark, N.J.
[illegible]	James Millen Mfg. Co., Inc.	Malden, Mass.
[illegible]	J. W. Miller Co.	Los Angeles, Calif.
[illegible]	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
[illegible]	Mueller Electric Co.	Cleveland, Ohio
[illegible]	National Union	Newark, N.J.
[illegible]	Oak Manufacturing Co.	Crystal Lake, Ill.
[illegible]	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
[illegible]	Pacific Metals Co.	San Francisco, Calif.
[illegible]	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
[illegible]	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
[illegible]	American Machine & Foundry Co., Potter & Brumfield Div.	Princeton, Ind.
[illegible]	TRW Electronic Components Div.	Camden, N.J.
[illegible]	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
[illegible]	Resistance Products Co.	Harrisburg, Pa.
[illegible]	Rubbercraft Corp. of Calif.	Torrance, Calif.
[illegible]	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
[illegible]	Sigma [illegible]	So. Braintree, Mass.
[illegible]	Signal Indicator Corp.	New York, N.Y.
[illegible]	Struthers-Dunn Inc.	Pitman, N.J.
[illegible]	Speciality Leather Prod. Co.	Newark, N.J.
[illegible]	Thompson-Bremer & Co.	Chicago, Ill.
[illegible]	Tilley Mfg. Co.	San Francisco, Calif.
[illegible]	Stackpole Carbon Co.	St. Marys, Pa.
[illegible]	[illegible] Thomson Corp.	Waltham, Mass.
[illegible]	Tinnerman Products, Inc.	Cleveland, Ohio
[illegible]	Transformer Engineers	San Gabriel, Calif.
[illegible]	Ucinite Co.	Newtonville, Mass.
[illegible]	[illegible] Inc.	Long Island City, N.Y.
[illegible]	Veeder Root, Inc.	Hartford, Conn.
[illegible]	Wenco Mfg. Co.	Chicago, Ill.
[illegible]	Continental Wirt Electronics Corp.	Philadelphia, Pa.
[illegible]	Zierick Mfg. Corp.	New Rochelle, N.Y.
[illegible]	Mepco Division of Sessions Clock Co.	Morristown, N.J.
[illegible]	Prestole Corp.	Toledo, Ohio
[illegible]	Scientific Alloy Products Co.	Elizabeth, N.J.
[illegible]	Electronic Industries Association. Any brand tube meeting EIA standards	Washington, DC.
[illegible]	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
[illegible]	United Transformer Corp.	New York, N.Y.
[illegible]	Oxford Electric Corp.	Chicago, Ill.
[illegible]	Bourns, Inc.	Riverside, Calif.
[illegible]	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio

[illegible]
Revised October 1968

From: FSC Handbook Supplements

Table 6-3. Manufacturers Code List (Continued)

Code No.	Manufacturer	Address
[illegible]	All Star Products Inc.	Defiance, Ohio
[illegible]	Avery Label Co.	Monrovia, Calif.
[illegible]	Hammarlund Co., Inc.	Mars Hill, N.C.
[illegible]	Stevens, Arnold, Co., Inc.	Boston, Mass.
[illegible]	Dimco Gray Co.	Dayton, Ohio
[illegible]	International Instruments, Inc.	Orange, Conn.
[illegible]	Grayhill Co.	LaGrange, Ill.
[illegible]	Triad Transformer Corp.	Venice, Calif.
[illegible]	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
[illegible]	Military Specification	
[illegible]	International Rectifier Corp.	El Segundo, Calif.
[illegible]	Airpax Electronics, Inc.	Cambridge, Maryland
[illegible]	Daily Controls, Div. Daily Wright Corp.	Watertown, Mass.
[illegible]	Carter Precision Electric Co.	Skokie, Ill.
[illegible]	[illegible] Foundry Inc., Cooper Hewitt Electric Div.	Hoboken, N.J.
[illegible]	Electro Regulator Corp.	Norwalk, Conn.
[illegible]	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
[illegible]	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Paramus, N.J.
[illegible]	Magnetic Industries, Inc.	Greenwich, Conn.
[illegible]	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
[illegible]	Astron Corp.	East Newark, Harrison, N.J.
[illegible]	Switchcraft, Inc.	Chicago, Ill.
[illegible]	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
[illegible]	Phillips-Advance Control Co.	Joliet, Ill.
[illegible]	Research Products Corp.	Madison, Wis.
[illegible]	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
[illegible]	Vector Electronic Co.	Glendale, Calif.
[illegible]	Norwell Corp.	Los Angeles, Calif.
[illegible]	Carr Fastener Co.	Cambridge, Mass.
[illegible]	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
[illegible]	General Instrument Corp., Capacitor Div.	Darlington, S.C.
[illegible]	ITT Wire and Cable Div.	Los Angeles, Calif.
[illegible]	Victory Eng. Corp.	Springfield, N.J.
[illegible]	Bendix Corp., Red Bank Div.	Red Bank, N.J.
[illegible]	Hubbell Corp.	Mundelein, Ill.
[illegible]	Bosan Inc.	Newport Beach, Calif.
[illegible]	Smith, Herman H., Inc.	Brooklyn, N.Y.
[illegible]	Tech Labs	Palisades Park, N.J.
[illegible]	Central Screw Co.	Chicago, Ill.
[illegible]	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
[illegible]	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
[illegible]	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
[illegible]	Model Eng. and Mfg., Inc.	Huntington, Ind.
[illegible]	Loyd Scruggs Co.	Festus, Mo.
[illegible]	Aeronautical Inst. & Radio Co.	Lodi, N.J.
[illegible]	Arco Electronics Inc.	Great Neck, N.Y.
[illegible]	A.J. Glesener Co., Inc.	San Francisco, Calif.
[illegible]	TRW Capacitor Div.	Ogallala, Neb.
[illegible]	Sarkes Tarzian, Inc.	Bloomington, Ind.
[illegible]	Boonton Molding Company	Boonton, N.J.
[illegible]	A.B. Boyd Co.	San Francisco, Calif.
[illegible]	R.M. Bracamonte & Co.	San Francisco, Calif.
[illegible]	Koiled Kords, Inc.	Hamden, Conn.
[illegible]	Seamless Rubber Co.	Chicago, Ill.
[illegible]	Fafnir Bearing Co.	Los Angeles, Calif.
[illegible]	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
[illegible]	Precision Rubber Products Corp.	Dayton, Ohio
[illegible]	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.
[illegible]	Seastrom Mfg. Co.	Glendale, Calif.
[illegible]	Marco Industries	Anaheim, Calif.
[illegible]	Philco Corporation (Lansdale Division)	Lansdale, Pa.
[illegible]	Western Fibrous Glass Products Co.	San Francisco, Calif.
[illegible]	Van Waters & Rogers Inc.	San Francisco, Calif.
[illegible]	Tower Mfg. Corp.	Providence, R.I.
[illegible]	Cutler-Hammer, Inc.	Lincoln, Ill.
[illegible]	Gould National Batteries, Inc.	St. Paul, Minn.
[illegible]	General Mills, Inc.	Buffalo, N.Y.
[illegible]	Graybar Electric Co.	Oakland, Calif.
[illegible]	G.E. Distributing Corp.	Schenectady, N.Y.
[illegible]	United Transformer Co.	Chicago, Ill.
[illegible]	United Shoe Machinery Corp.	Beverly, Mass.
[illegible]	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
[illegible]	United Carr Fastener Corp.	Chicago, Ill.
[illegible]	Bearing Engineering Co.	San Francisco, Calif.
[illegible]	ITT Cannon Elect. Inc., Salem Div.	Salem, Mass.
[illegible]	Connor Spring Mfg. Co.	San Francisco, Calif.
[illegible]	Miller Dial & Nameplate Co.	El Monte, Calif.
[illegible]	Radio Materials Co.	Chicago, Ill.
[illegible]	Augat Inc.	Attleboro, Mass.
[illegible]	Dale Electronics, Inc.	Columbus, Nebr.
[illegible]	Elco Corp.	Willow Grove, Pa.
[illegible]	Gremar Mfg. Co., Inc.	Wakefield, Mass.
[illegible]	K F Development Co.	Redwood City, Calif.
[illegible]	Malco Mfg. Co., Inc.	Chicago, Ill.
[illegible]	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
[illegible]	Nahm-Bros. Spring Co.	Oakland, Calif.
[illegible]	Tru-Connector Corp.	Peabody, Mass.
[illegible]	Elgeet Optical Co. Inc.	Rochester, N.Y.
[illegible]	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
[illegible]	IMC Magnetics Corp.	Westbury Long Island, N.Y.
[illegible]	Hudson Lamp Co.	Kearny, N.J.
[illegible]	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
[illegible]	Robbins & Myers Inc.	Palisades Park, N.J.
[illegible]	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
[illegible]	Waters Mfg. Co.	Culver City, Calif.
[illegible]	G.V. Controls	Livingston, N.J.
[illegible]	General Cable Corp.	Bayonne, N.J.
[illegible]	Phelps Dodge	Yonkers, N.Y.
[illegible]	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
[illegible]	Scientific Electronics Products, Inc.	Loveland, Colo.
[illegible]	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
[illegible]	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
[illegible]	South Chester Corp.	Chester, Pa.
[illegible]	Wire Cloth Products, Inc.	Bellwood, Ill.
[illegible]	Automatic Metal Products Co.	Brooklyn, N.Y.
[illegible]	Worcester Pressed Aluminum Corp.	Worcester, Mass.
[illegible]	Magnecraft Electric Co.	Chicago, Ill.
[illegible]	George A. Philbrick Researchers, Inc.	Boston, Mass.
[illegible]	Allies Products Corp.	Dania, Fla.
[illegible]	Continental Connector Corp.	Woodside, N.Y.
[illegible]	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
[illegible]	National Coil Co.	Sheridan, Wyo.
[illegible]	Vitramon, Inc.	Bridgeport, Conn.
[illegible]	Gordos Corp.	Bloomfield, N.J.
[illegible]	Methode Mfg. Co.	Rolling Meadows, Ill.
[illegible]	[illegible] Engineering Co.	Chicago, Ill.
[illegible]	Dage Electric Co., Inc.	Franklin, Ind.
[illegible]	[illegible] Mfg. Co.	[illegible], Ill.
[illegible]	[illegible] Co.	Chicago, Ill.
[illegible]	Microwave Assoc., West Inc.	Sunnyvale, Calif.
[illegible]	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
[illegible]	Thordarson Meissner Inc.	Mt. Carmel, Ill.
[illegible]	Solar Manufacturing Co.	Los Angeles, Calif.
[illegible]	Micro-Switch, Div. of Minn.-Honeywell	Freeport, Ill.
[illegible]	[illegible] Screw Co.	Chicago, Ill.
[illegible]	Microwave Associates, Inc.	Burlington, Mass.
[illegible]	Excel Transformer Co.	Oakland, Calif.
[illegible]	[illegible] Inc.	Orchard Park, N.Y.
[illegible]	San Fernando Elect. Mfg. Co.	San Fernando, Calif.
[illegible]	Thomas Ind. Inc.	Long Is., N.Y.
[illegible]	Industrial Retaining Ring Co.	Irvington, N.J.
[illegible]	Automatic & Precision Mfg.	Englewood, N.J.
[illegible]	[illegible] Resistor Corp.	Yonkers, N.Y.
[illegible]	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
[illegible]	R-Tronics, Inc.	Jamaica, N.Y.
[illegible]	Rubber Teck, Inc.	Gardena, Calif.
[illegible]	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
[illegible]	Microdot, Inc.	So. Pasadena, Calif.
[illegible]	Sealectro Corp.	Mamaroneck, N.Y.
[illegible]	[illegible] Mfg. Co.	Burbank, Calif.
[illegible]	ETC Inc.	Cleveland, Ohio
[illegible]	General Mills Inc., Electronics Div.	Minneapolis, Minn.
[illegible]	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
[illegible]	North Hills Electronics, Inc.	Glen Cove, N.Y.
[illegible]	International Electronic Research Corp.	Burbank, Calif.
[illegible]	Columbia Technical Corp.	New York, N.Y.
[illegible]	Varian Associates	Palo Alto, Calif.
[illegible]	Allied Corp.	[illegible], Mass.
[illegible]	Marshall Ind., Capacitor Div.	[illegible], Calif.
[illegible]	Control Switch Division, Controls Co. of America	El Segundo, Calif.
[illegible]	Delevan Electronics Corp.	East Aurora, N.Y.
[illegible]	Wilco Corporation	Indianapolis, Ind.
[illegible]	[illegible] Corp.	Whippany, N.J.
[illegible]	Renbrandt, Inc.	Boston, Mass.
[illegible]	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
[illegible]	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

Code No.	Manufacturer	Address
0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J.
[illegible]	ETA	England
[illegible]	Precision Instrument Components Co	Van Nuys, Calif.
[illegible]	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
[illegible]	Rubber Eng. & Development	Hayward, Calif.
[illegible]	A "N" D Mfg. Co	San Jose, Calif.
[illegible]	Cooltron	Oakland, Calif.
[illegible]	California Eastern Lab	Burlingame, Calif.
[illegible]	S.K. Smith Co	Los Angeles, Calif.

SECTION VII

OPTIONS AND MANUAL CHANGES

7-1. OPTIONS

7-2. Options 001 through 003 are available for both the 5326A and 5326B models.

7-3. Option 001, 8-Digit Display

7-4. Option 001 consists of Display Assembly 05326-60025 in place of 05326-60008. The schematic diagram for A9 shows both assemblies. The parts list in Section VI lists parts for both assemblies.

7-5. Option 002, Remote Programming

7-6. Option 002 consists of Remote Connector Assembly 05326-60006. This assembly consists of a wiring harness, a 36-pin connector 1251-0085, and a 45-pin connector 5060-0113. Programming instructions are given in Section II. A schematic diagram is included in Section VIII.

7-7. Option 003, Digital Recorder Output

7-8. Option 003 consists of Digital Recorder Cable Assembly 05326-60012 for the +8421 output TTL compatible. This assembly comprises a wiring harness, a 50-pin connector 1251-0087, and two 1251-2034. A schematic diagram is included in Section VIII.

7-9. FIELD INSTALLATION OF OPTIONS IN MODEL 5326A/B

7-10. Installation of Option 001, 8-Digit Display

Parts required to install this option are:

1820-0119 Decade Counter U-8
1820-0116 Buffer Storage U-16
1820-0092 Decoder Driver U-24
0683-7525 7.5K ohm ¼-watt resistor R11
1200-0405 Display tube socket
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 and display support boards A9 and A8 from the Model 5326A/B by pulling up on display support board A8. Separate A8 and A9.

d. Install parts on A9 as shown in component locator photo on Page 8-31 and solder in place.

e. Resistor R10 carries the overflow information from the decades and can be placed in one of two locations. Move R10 to the location shown in component locator photo. In this location R10 connects to pin 8 of U8. See A9 schematic on Page 8-31, Figure 8-15.

f. Perform steps 1-7 of the Self-Check on Page 3-9, Table 3-1. Especially note that the OF (overflow) lamp lights when the left-most digit changes from 9 to 0.

7-11. Installation of Option 002, Remote Programming

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 ⅝-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 nuts holding rear panel BNC's. For instruments without this board, see note following step m.

c. Remove two screws holding P1A, 1¼-inch long black pressure connector, to 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 rear-panel interconnect board from the instrument and separate it from P1A by removing two screws.

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

g. Assemble rear-panel interconnect board and the new 5-inch long pressure connector P1 with the three 6-32 x ⅝-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, Page 8-10, Figure 8-4.

CAUTION

SCREWS LONGER THAN ¼-INCH WILL DAMAGE P1.

i. Gently reinstall rear panel. Install BNC lock nuts finger tight.

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.

NOTE

Below serial number 00130 on the 5326A and 00120 on the 5326B, the rear panel switches and BNC's were interconnected with hand wiring and no rear-panel interconnect board was installed, as shown in the picture on Page 8-11. Installation procedure for these instruments is similar except that the Remote Programming cable must be modified by: 1) removing the black wire from terminal A10 and attach to chassis ground at J4. See Page 8-49 for terminal identification; 2) remove the blue wire from terminal B8 and attach to terminal A10. The wires from the old pressure connector A1A must be unsoldered and attached to the corresponding pins of the new pressure connector.

7-12. Installation of Option 003, Digital Recorder Output

Order digital recorder cable assembly HP Part No. 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 then remove display support board A8 and display board A9 by pulling up on A8.

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

d. Slide the connectors on the A9 board, as shown in the photograph on Page 8-11. The connector with the long wires attaches to P1(J1) and is positioned so pin 1 is towards the front of the instrument. The other connector attaches to P2(J2), and pin 1 is towards the rear of the instrument.

e. Position the cable so it passes between A8 and A11, completely clearing A8. Note that this differs from Figure 8-4, Page 8-11. Reinstall A8 and A9.

f. Route the cable around T1 as in the photograph.

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

7-13. MANUAL CHANGES

7-14. This manual applies directly to Models 5326A having serial prefix 1044A and 5326B having serial prefix 1124A (refer to paragraph 1-4).

7-15. Newer Instruments

7-16. For instruments with serial prefixes above 1044A for the 5326A and 1124A for the 5326B, a separate manual is needed. For 5326A's with 1115A and above, order "5326A/5327A Timer/Counter" manual. For 5326B's with 1125A and above, order "5326B/5327B Timer/Counter/DVM" manual.

7-17. Older Instrument

7-18. To adapt this manual to instruments having a serial prefix prior to 1044A for the 5326A or 1124A for the 5326B, perform the backdating that applies to your instrument's serial prefix, as listed in the table below.

5326A With Serial Prefix:	Perform Change:
944	1, 2, 3, 4, 5
960	2, 3, 4, 5
972	3, 4, 5
1032	4, 5
1036	5

5326B With Serial Prefix	Perform Change
944	1, 2, 3, 4, 5, 6, 7
960	2, 3, 4, 5, 6, 7
972	3, 4, 5, 6, 7
1032	4, 5, 6, 7
1036	5, 6, 7
1048	7

BACKDATING MANUAL CHANGES

CHANGE 1

Page 6-25, Table 6-1:
Change part number of J2 through J6 to 1250-0083.
Change J7 to 1250-0083 for both 5326A and 5326B.

Page 6-26, Table 6-1:
Change part number of S7 and S8 to 3101-0199.
Delete indication that J2 through J7 and S7 and S8 are part of PC board 05326-20028.

CHANGE 2

Page 6-6, Table 6-1:
Delete A3R49, 50.
Change A5C2 to 0160-3060 C:FXD CER 0.1 UF 25VDCW.

Page 6-7, Table 6-1:
Change A5R7 to 0683-1035 10K ohms.

Page 6-14, Table 6-1:
Change A10CR1 to 1902-3301 84.8 V.

Page 6-15, Table 6-1:
Change A10CR1 to 1902-3301 84.8 V.

Page 6-17, Table 6-1:
Change A11CR1 to 1902-3301 84.8 V.

Page 8-17, Figure 8-8:
Delete A3R49, R50 from schematic.
Change REFERENCE DESIGNATION table to R1-48.
Delete SERIES 972 at top of schematic.

Page 8-21, Figure 8-10:
Change A5C2 to 0.1 UF.
Change A5R7 to 10K.

Page 8-33, Figure 8-16:
Change A10CR1 in schematic to 84.8 V.
Change all +155 V points to +140 V.
Change CR1 in TABLE to 1902-3301.
Delete SERIES 972 at top of schematic.

Page 8-35, Figure 8-17:
Change A11CR1 in schematic to 84.8 V.
Change all +155 V point to +140 V.
Change CR1 in TABLE to 1902-3345.
Delete SERIES 972 at top of schematic.

Page 8-37, Figure 8-18:
Change A11CR1 in schematic to 84.8 V.
Change all +155 V points to +140 V.
Change CR1 in TABLE to 1902-3345.
Delete SERIES 972 at top of schematic.

CHANGE 3

Page 6-6, Table 6-1:
Change A4C2 to 0180-0114 C:FXD ELECT 4.0 UF +100-10% 25VDCW.
Change A4C3 to 0180-0174 C:VAR CER 3-10 PF.
Delete A4C5 and A4L1.

Page 6-20 and 6-21, Table 6-1:
Change A18C5, C8, and C9 to 0150-0023 C:FXD CER 2000 PF 20% 1000VDCW.
Add A18C12 0160-2249 C:FXD CER 4.7 PF ±0.25 PF 500VDCW.
Delete A18C13 0160-2249 C:FXD CER 4.7 PF ±0.25 PF 500VDCW.
Add A18R19, R20 0683-3915 R:FXD COMP 390 OHM 5% ¼W.
Add A18R22, R23, R26 0683-1035 R:FXD COMP 10K OHM 5% ¼W.
Add A18R25 0683-1025 R:FXD COMP 1000 OHM 5% ¼W.
Change A18U1, U2, U3 to 1820-0201.

Page 6-22, Table 6-1:
Delete A15C6, C7 .001 μF 0160-0953.

Page 6-27, Table 6-2:
Change Chassis part number to 05326-00005.

Page 8-19, Figure 8-9:
Replace A4 OSCILLATOR ASSY schematic and reference designation table with Figure 7-2.
Replace A4 parts locator photo with Figure 7-1.

CHANGE 3 (Cont'd)

Page 8-31, Figure 8-16:
Delete SERIES 1032A at top of schematic.
Change U7 and U8 to show pin 10 of both IC's connected directly to ground.

Page 8-43, Figure 8-20:
Replace A18 VOLTMTER VOLTAGE to FREQUENCY CONVERTER ASSY schematic with Figure 7-4.
Replace A18 component locator photo with Figure 7-3.

Page 8-47, Figure 8-22:
Delete A16C6, C7 from schematic.
Change reference designation table to C1-5.
Delete SERIES 1032A REV B from top of schematic.

CHANGE 4

Page 6-9, Table 6-1:
Delete A7AC5 120 PF 0160-2205
Change A7AR6 to 1000 ohms 0683-1025

Page 6-7, Table 6-1:
Change A6C10 to 3000 PF 0140-0159

Page 8-25, Figure 8-12:
Delete A7AC5 from schematic
Change A7AR6 to 1000 ohms
Change SERIES number at top of schematic to 944A

Page 8-23, Figure 8-11:
Change A6C10 in schematic to 3000 PF.

CHANGE 5

Page 6-24, Table 6-1:
Change A16C1 to 4000 µF, 0180-2296, 15 VDCW
Change A16C2 to 1000 µF, 0180-2295, 15 VDCW

Page 8-47, Figure 8-22:
Change A16C1 in schematic to 4000 µF
Change A16C2 to 1000 µF.
Change SERIES number at top of schematic to 944A.

CHANGE 6

Page 6-18 and 19, Table 6-1:
Add A19K2 Relay 12 Volt 0490-0858
Add A19R8 RF 100 K ohms 5% 1/4W 0683-1045
Add A19R1 RF 4700 ohms 5% 1/4W 0683-4725
Add A19Q2 Silicon NPN 1854-0071
Add A19CR1 Silicon 1901-0025.

Page 8-39, Figure 8-19:
Replace A19 component locator with Figure 7-5.
Replace A19 schematic with Figure 7-6 (board series 944A).

Page 1-2, Table 1-1:
In the first table under "Integrating Digital Voltmeter," change the input impedance for the 10 V range to read ">1000 M Ω."

Page 5-11, Table 5-4, Step 10 b:
Change to read "Counter display should be 10,000 ±17 counts."

CHANGE 7

Page 8-45, Figure 8-21:
Delete A15 schematic, component locator, and parts list.

Use A16 schematic and component locator on page 8-47 and parts list Page 6-23, Table 6-1. A15 part number becomes 05326-60001 Series 1032A.

Page 6-26, Table 6-1 (For 5326B Only):
Delete: Heat Sink 05327-20024 1 ea.
Add: Q Insulator 0340-0169 2 ea.
Change part numbers to read:
Cov.-Side 3 x 11 5000-0729 2 ea.
Cov.-Top 05326-00006 1 ea.

NOTE

If replacement of any of the parts is required (Change 7 only), replace with new parts.

Figure 7-1. A4 Oscillator Component Locator

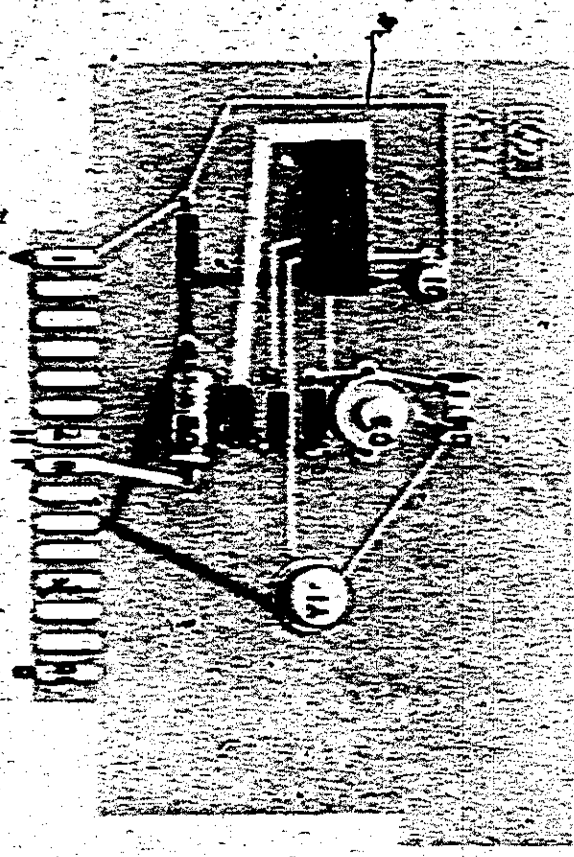


Figure 7-8. A4 Oscillator Schematic Diagram

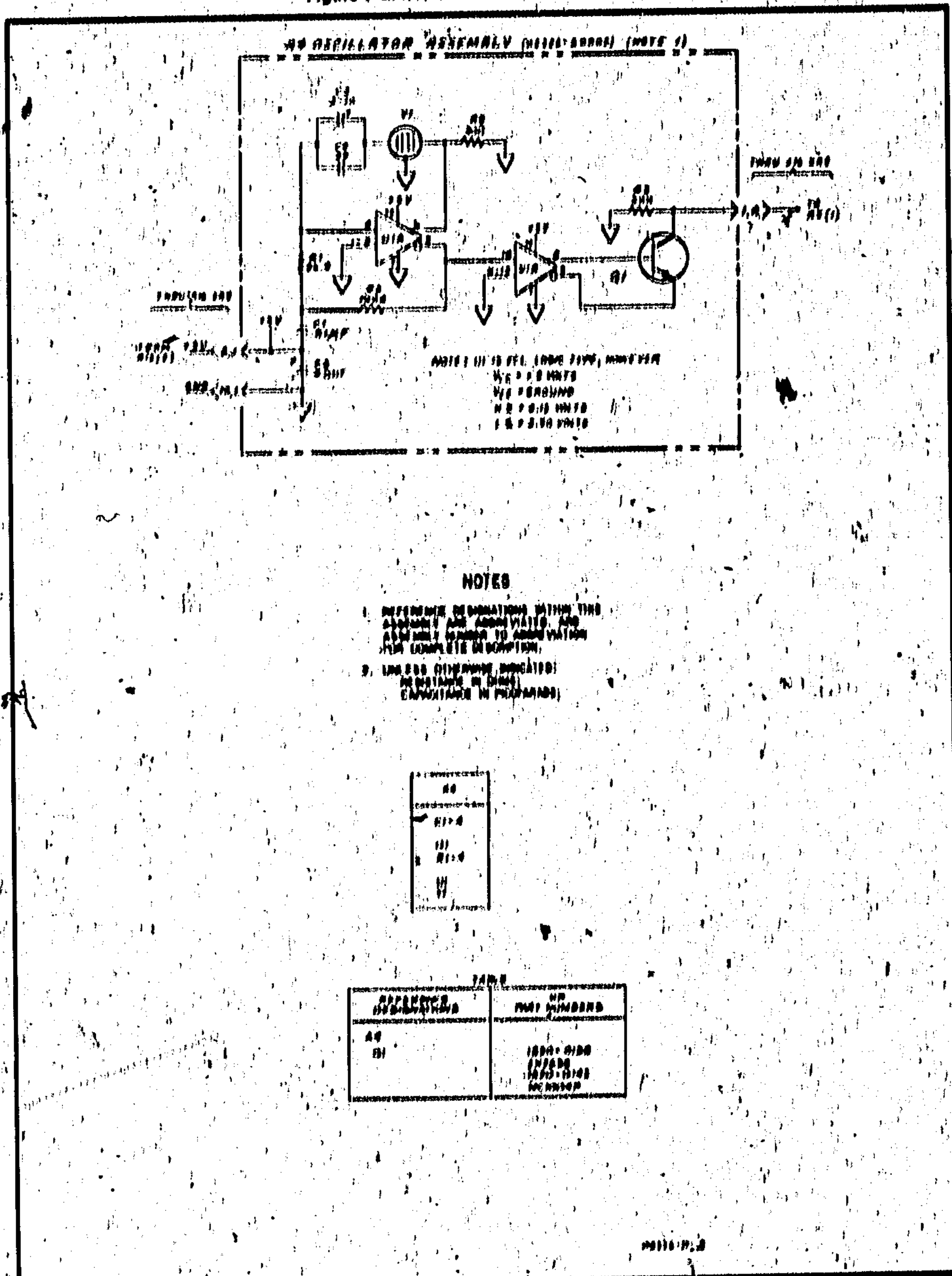


Figure 7-8. A13 Voltmeter V-to-F Converter Component Locator

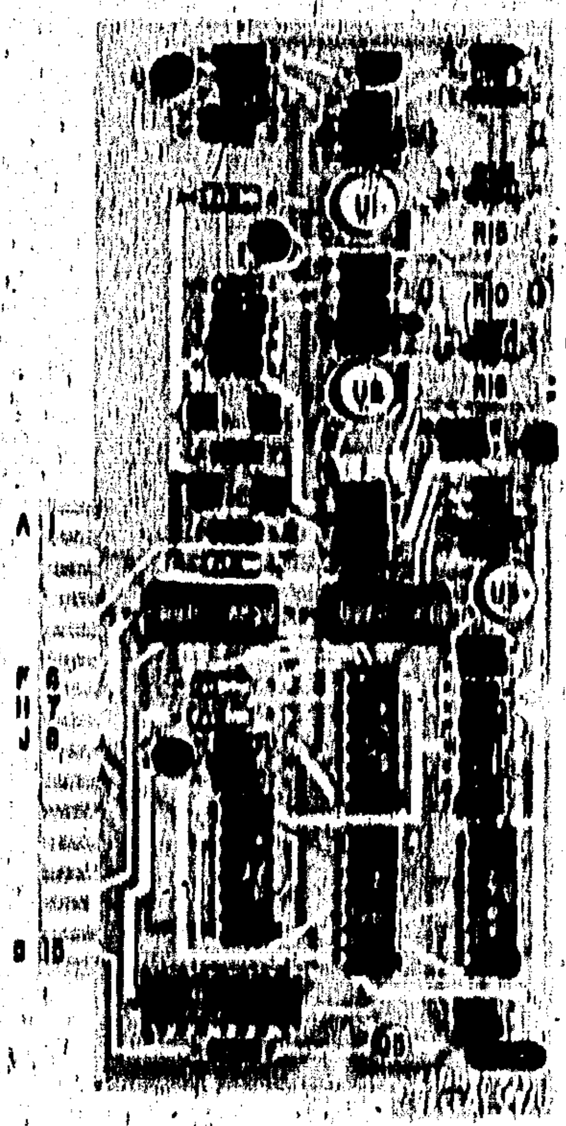


Figure 7-4. A13 Voltmeter V to F Converter Schematic Diagram

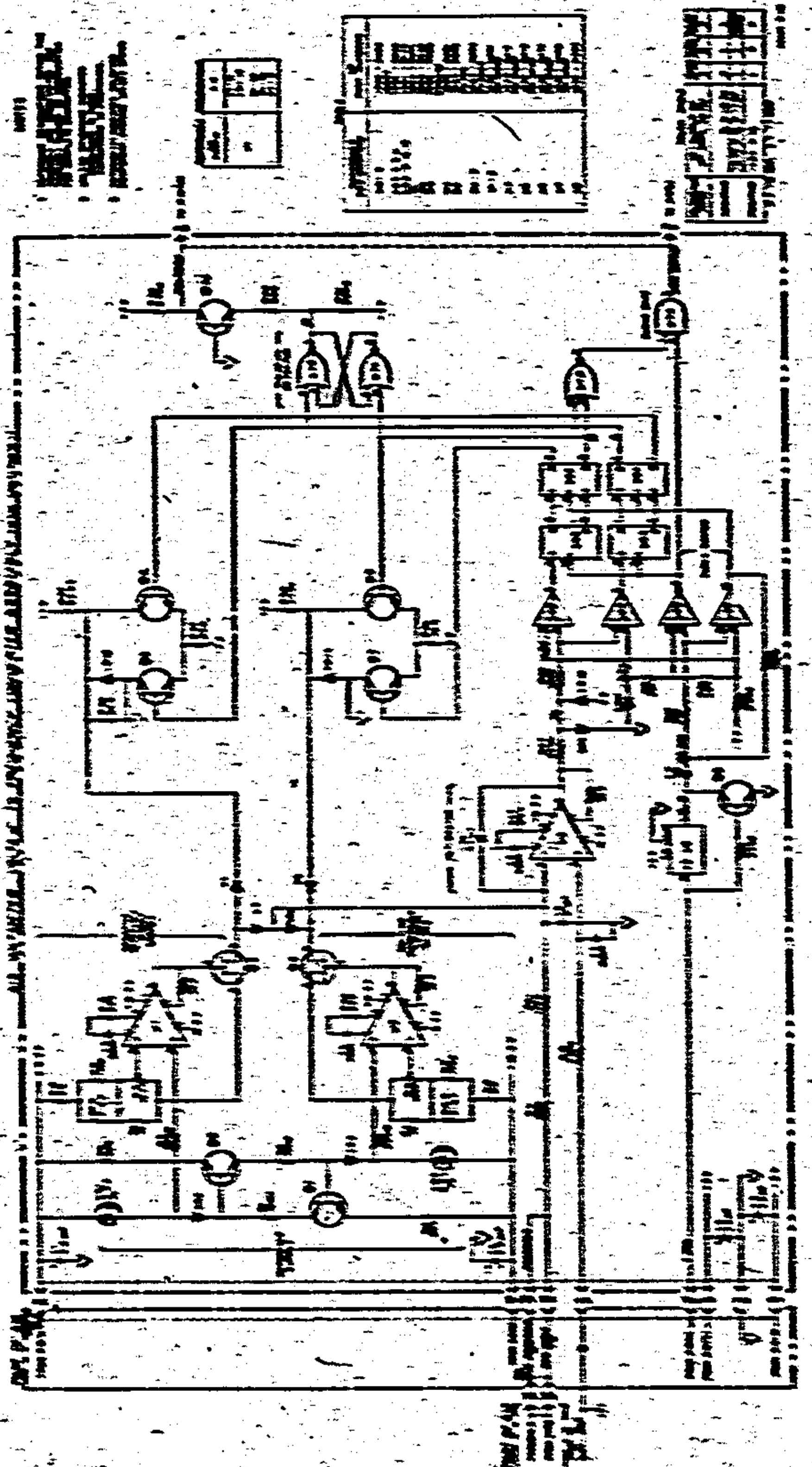


Figure 7-5. A12 Component Locator

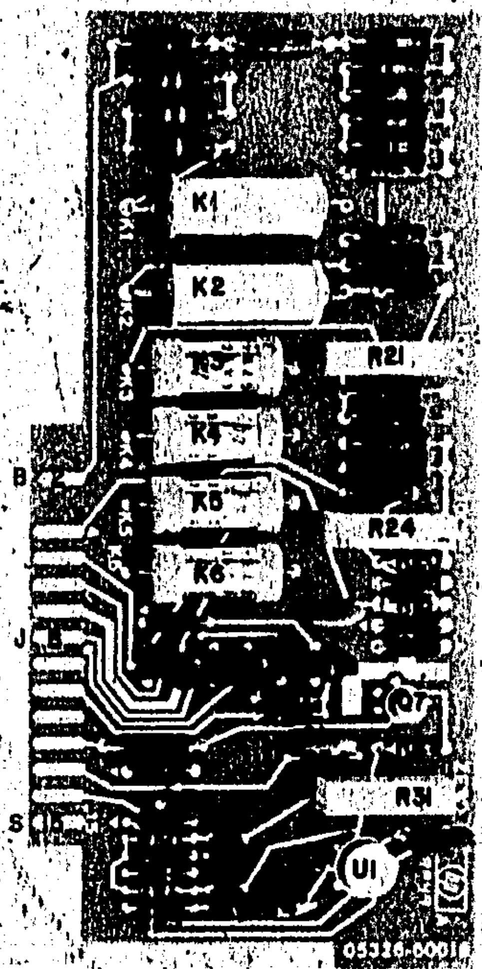


Figure 7-6. A12 Voltmeter Input Amplifier Schematic Diagram

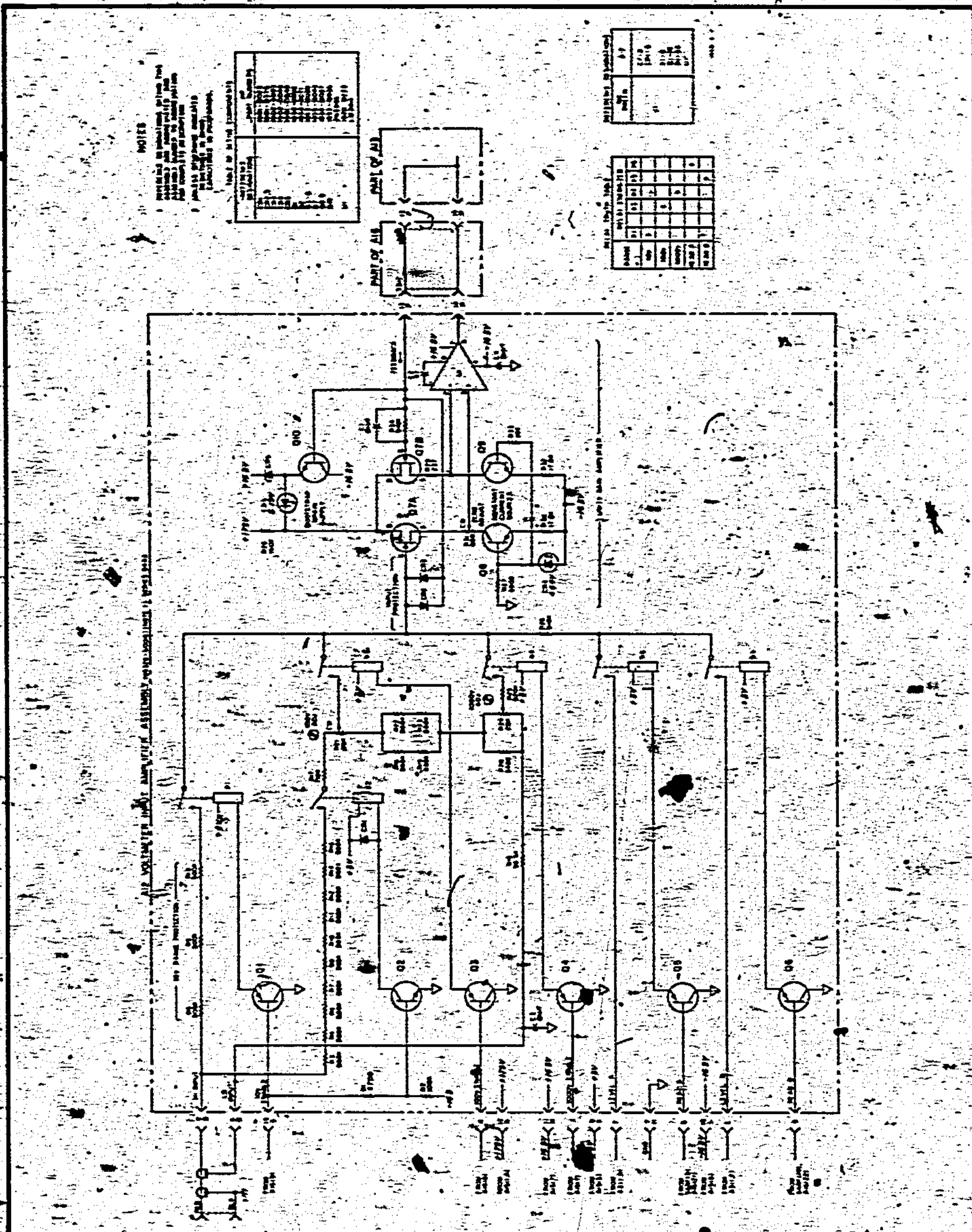
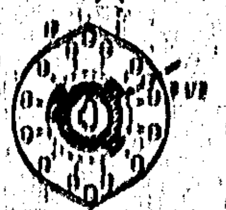


Figure 8-1. Schematic Diagram Notes

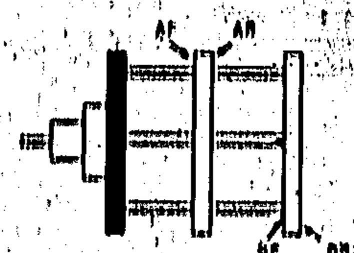
SYMBOLS

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

SWITCH DESIGNATIONS



	A3S1	SWITCH S1 WITHIN ASSEMBLY A3
	B	2ND WAFER FROM FRONT (A=1ST, ETC)
	R	REAR OF WAFER (F=FRONT)
A3S1BR(2-1/2)	(2-1/2)	TERMINAL LOCATION (2 1/2) (VIEWED FROM FRONT)



REFERENCE DESIGNATIONS

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

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

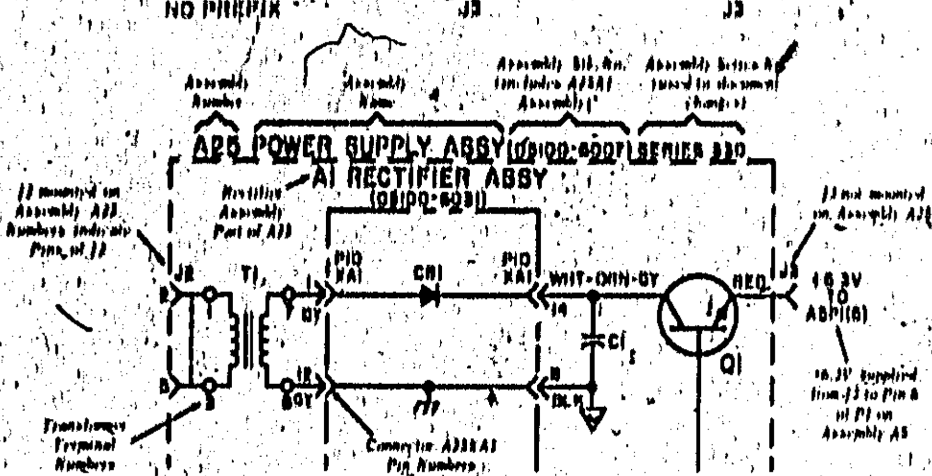
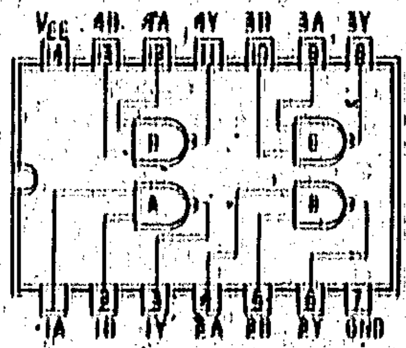


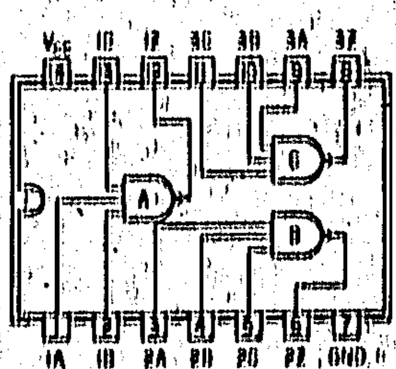
Figure 8-2. Integrated Circuit Diagrams

1820-0054



1820-0054(SN7400N)
QUADRUPLE 2-INPUT POSITIVE NAND GATE
NOTE: POSITIVE LOGIC Y = AB

1820-0058



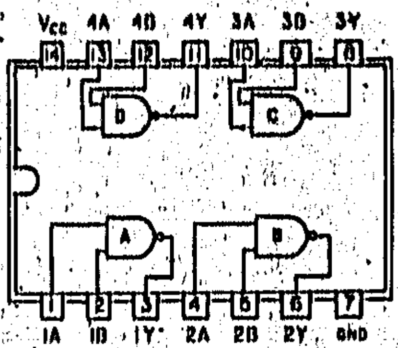
1820-0058(SN7410N)
TRIPLE 3-INPUT POSITIVE NAND GATE
POSITIVE LOGIC Y = ABC

1820-0092

1820-0092
DRIVER
NEGATIVE LOGIC

$I_A(1)$	$I_B(2)$	$I_C(4)$	$I_D(8)$	"ON" 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 10-15				NONE

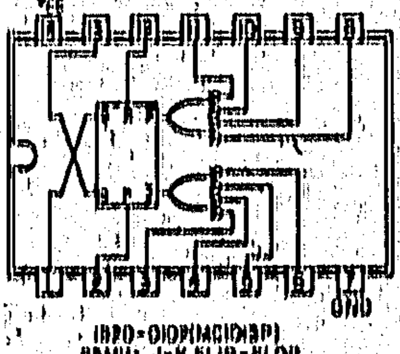
1820-0094



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(MC1013P)
85MHz J-K FLIP-FLOP

R-S TRUTH TABLE

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

ALL J-K INPUTS ARE STATIC

$J_D \cdot K_D$ TRUTH TABLE

J_D	K_D	Q^{n+1}
t_n	t_n	t_{n+1}
0	0	Q^n
0	1	0
1	0	1
1	1	$\overline{Q}^n$

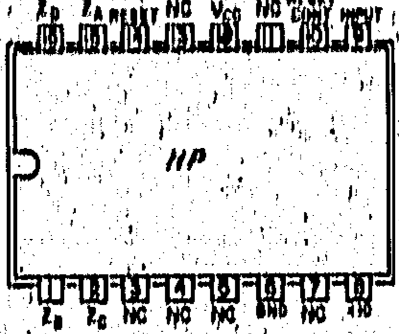
ALL OTHER J-K INPUTS AND THE R-S INPUTS ARE AT A "0" LEVEL.

CLOCKED J-K TRUTH TABLE

J	K	C_D	Q^{n+1}
t_n	t_n	t_n	t_{n+1}
[illegible]	[illegible]	0	Q^n
0	0	1	Q^n
0	1	1	[illegible]
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



1820-0117,0119,0232
BLANKING DECADE COUNTER
NEGATIVE LOGIC 1= LOW
0= HIGH.

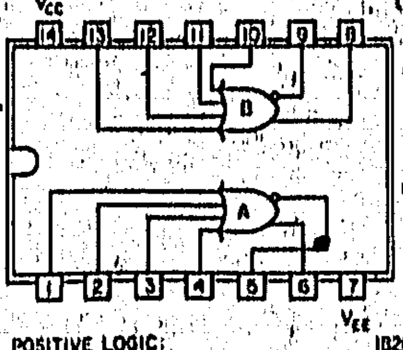
TRUTH TABLE

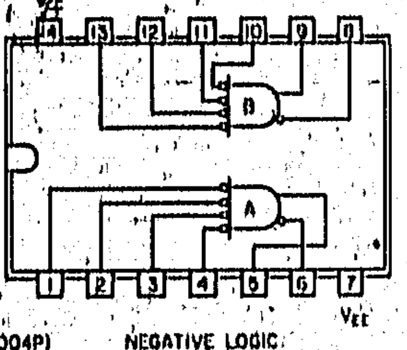
	OUTPUT			
[illegible]	A	B	C	D
0	H	H	H	H
1	L	H	H	H
2	H	L	H	H
3	L	L	H	H
4	H	H	L	H
5	L	H	L	H
6	H	L	L	H
7	L	L	L	H
8	H	H	H	L
9	L	H	H	L
[illegible]	H	H	H	H
[illegible]	L	L	L	L

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





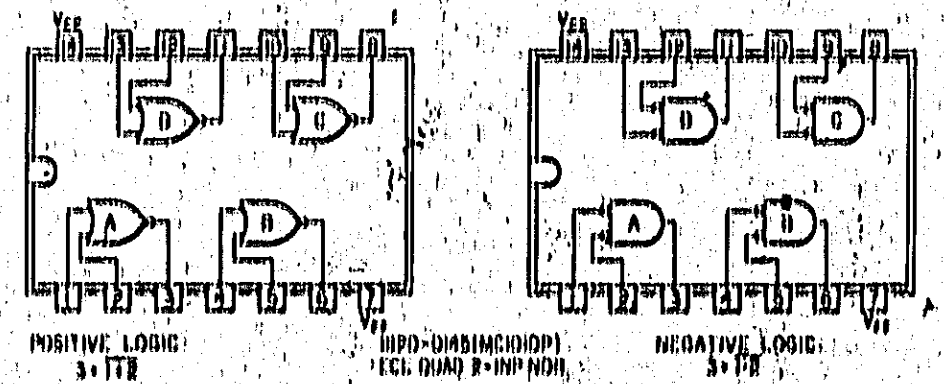
POSITIVE LOGIC:
$5 = \overline{1+2+3+4}$
$6 = 1+2+3+4$

1820-0142(MC1004P)
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

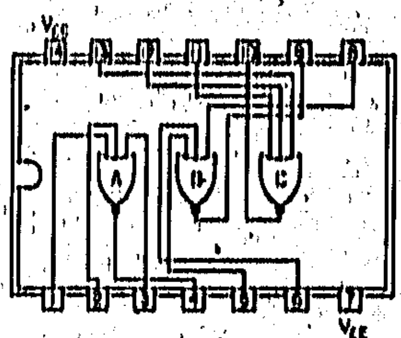


POSITIVE LOGIC 3 = ITE

1820-0145(MC1010P) ECL QUAD 2-INP NOR

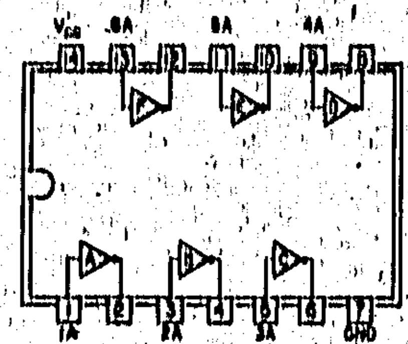
NEGATIVE LOGIC 3 = TE

1820-0147

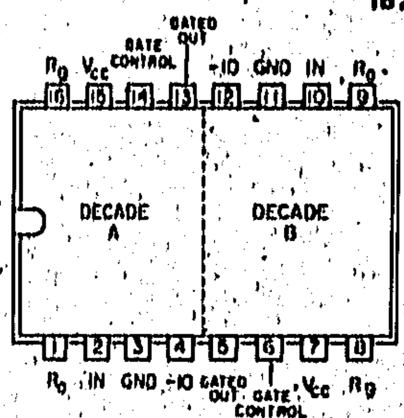


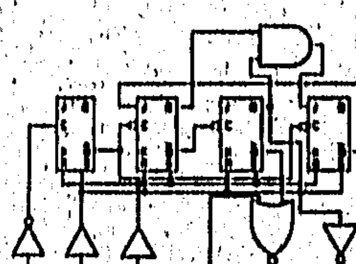
1820-0147 (MC 1007P) TRIPLE 3-INPUT GATES

1820-0174



1820-0198 and 1820-0199

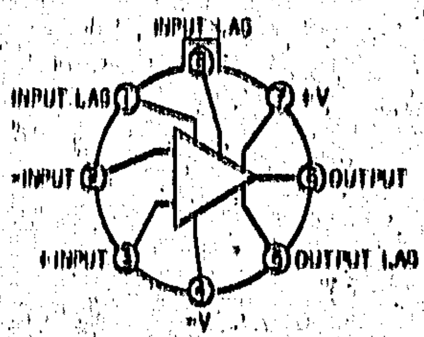




DECADE	CLOCK (COUNT) INPUT	RESET 0 INPUT	RESET 9 INPUT	GATE CONT	GATED OUTPUT	÷10 CARRY	V_{CC}	GND	HP PART NUMBER
A	2	1	16	14	13	4	15	3	1820-0198
B	10	9	8	6	5	12	7	11	1820-0199
PINS									
	2	1	8	6	5	4	7	3	[illegible]
	2	1	16	14	13	4	15	3	[illegible]

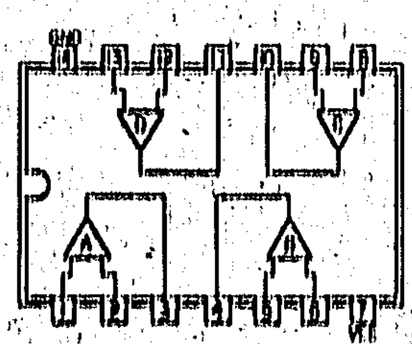
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0201



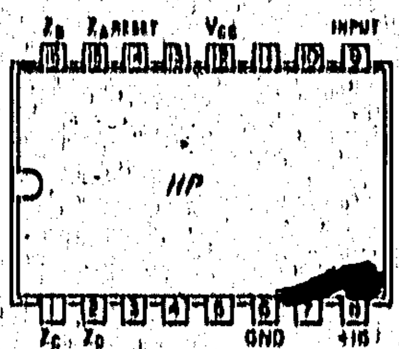
1820-0201 (MC 1439G)
OPERATIONAL AMPLIFIER

1820-0212



1820-0212
QUADRUPLE LINE RECEIVER

1820-0209



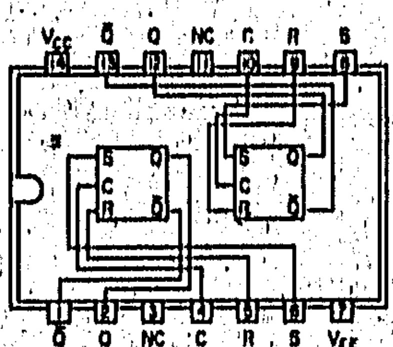
1820-0209
DIVIDE BY 16 COUNTER
NEGATIVE LOGIC 1=LOW
0=HIGH

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



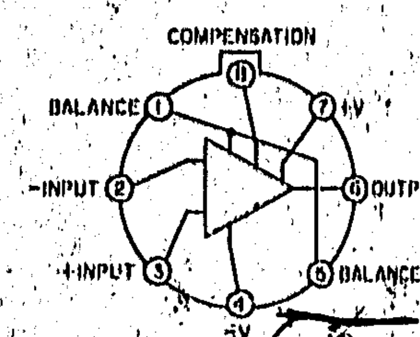
TRUTH TABLE

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

*EITHER STATE
N.D.=NOT DEFINED

1820-0213 (MC1014P)
DUAL RS FF

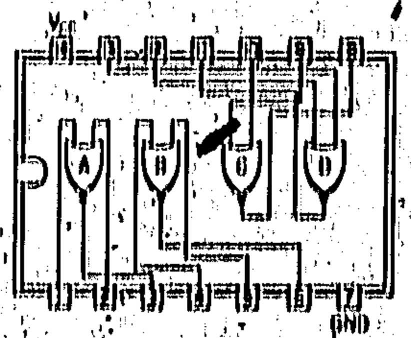
1820-0223



1820-0223 (LM 301A)
OPERATIONAL AMPLIFIER

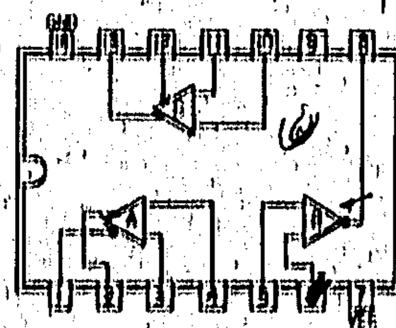
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0238



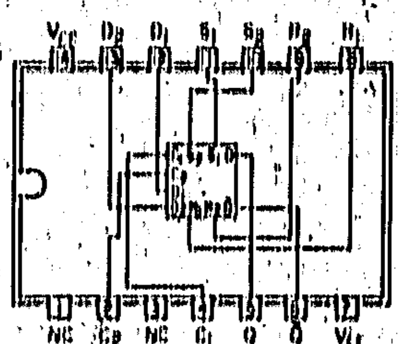
1820-0238 (MC1010P)
QUAD 2-INPUT NOR GATES

1820-0253



1820-0253
TRIPLE DIFFERENTIAL AMPLIFIER

1820-0272



1820-0272 (MC1022P)
TYPE "D" FLIP-FLOP

CLOCKED TRUTH TABLE

	D	C	Q^{n+1}	$\bar{Q}^{n+1}$
PIN NO.	12 OR 13	2 OR 4	5	6
	0	0	Q^n	$\bar{Q}^n$
	1	0	Q^n	$\bar{Q}^n$
	0	1*	0	1
	1	1*	1	0

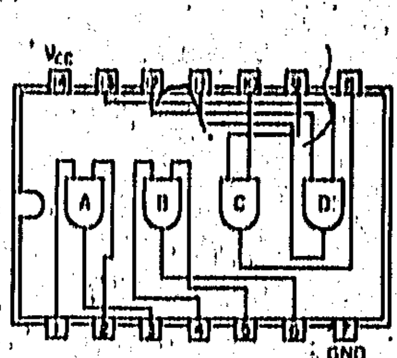
*A "1" ON CLOCK INPUT IS DEFINED FOR THIS FLIP-FLOP AS A CHANGE IN LEVEL FROM A LOW INPUT TO A HIGH INPUT.

R-S TRUTH TABLE

	R	S	Q^{n+1}	$\bar{Q}^{n+1}$
PIN NO.	8 OR 9	10 OR 11	5	6
	0	0	Q^n	$\bar{Q}^n$
	0	1	1	0
	1	0	0	1
	1	1	ND	ND

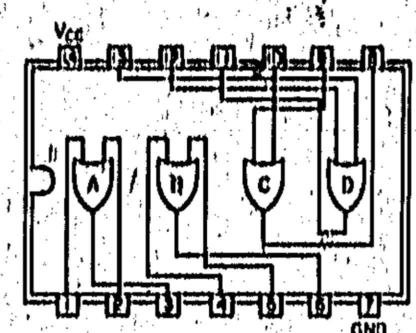
ND = NOT DEFINED

1820-0273



1820-0273 (MC1006P)
QUAD 2-INPUT AND GATES

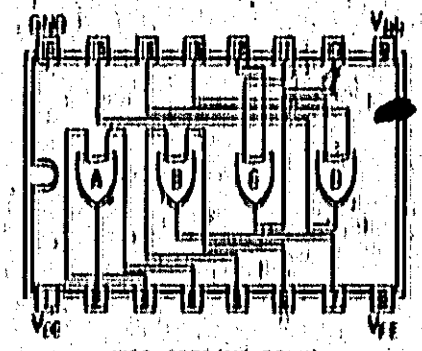
1820-0274



1820-0274 (MC1008P)
QUAD 2-INPUT OR GATES

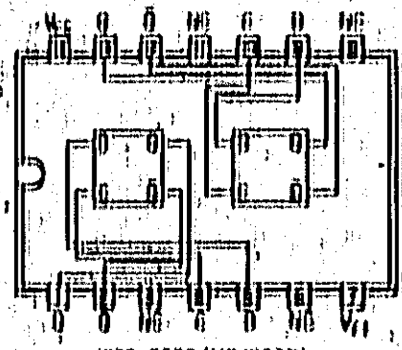
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0275



1820-0275 (MC1039P)
QUAD TRANSLATOR 2-INPUT OR GATES

1820-0276

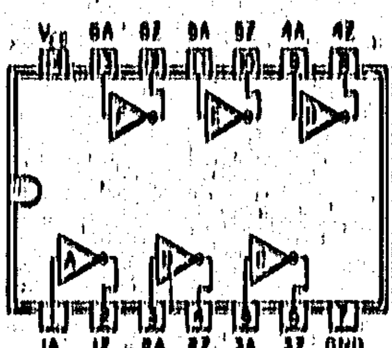


TRUTH TABLE

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

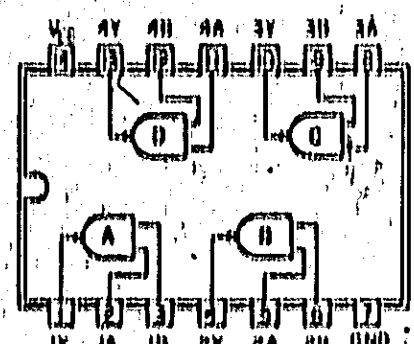
1820-0276 (MC1033P)
DUAL RS FF

1820-0307



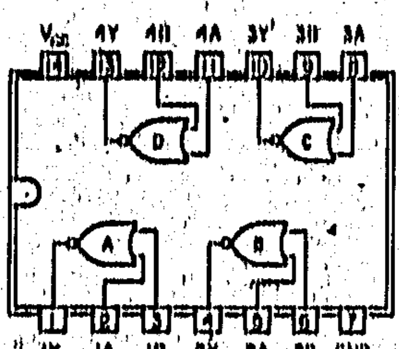
1820-0174, 0307 (MC10270)
HEX INVERTER

1820-0327



1820-0327 (SN7401N)
QUAD 2-INPUT NAND WITH OPEN COLLECTOR
POSITIVE LOGIC: $Y = \overline{AB}$

1820-0328



1820-0328 (SN7402N)
QUAD 2-INPUT NOR GATE
POSITIVE LOGIC: $Y = \overline{A+B}$

Figure 8-3. Front and Rear Panel Designations

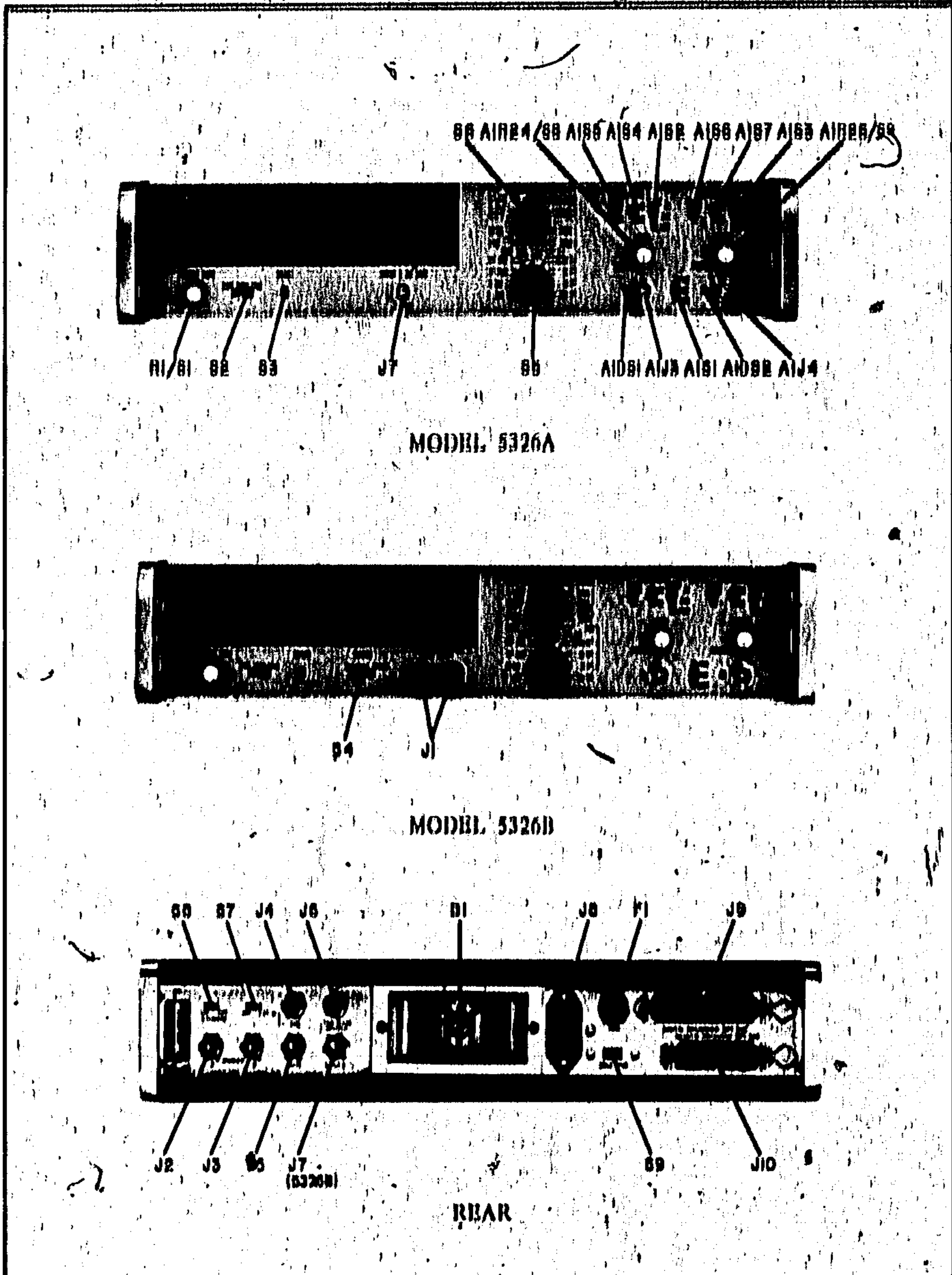


Figure 8-4. 5820A Top Internal

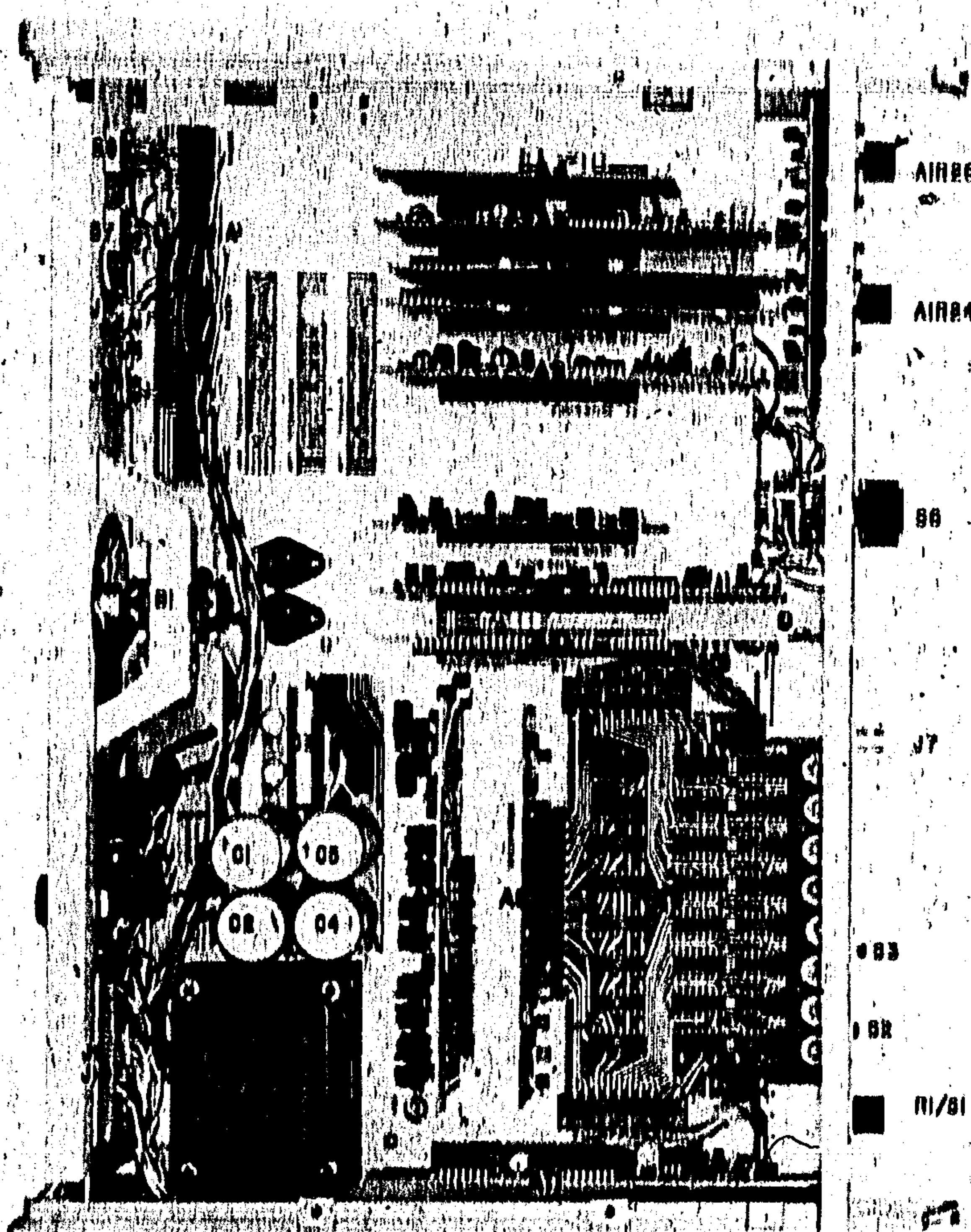


Figure 8-5. 5926B Top Internal

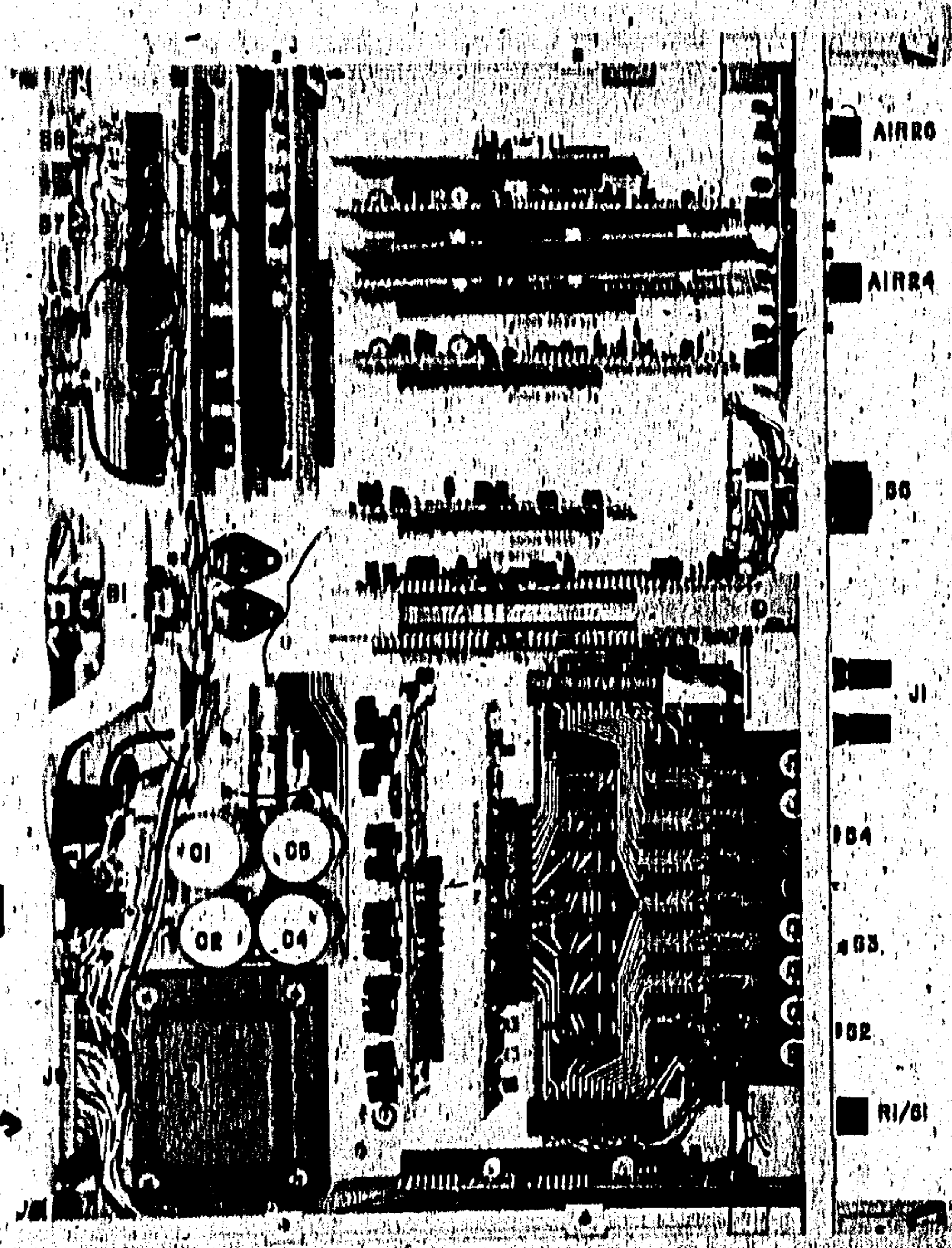
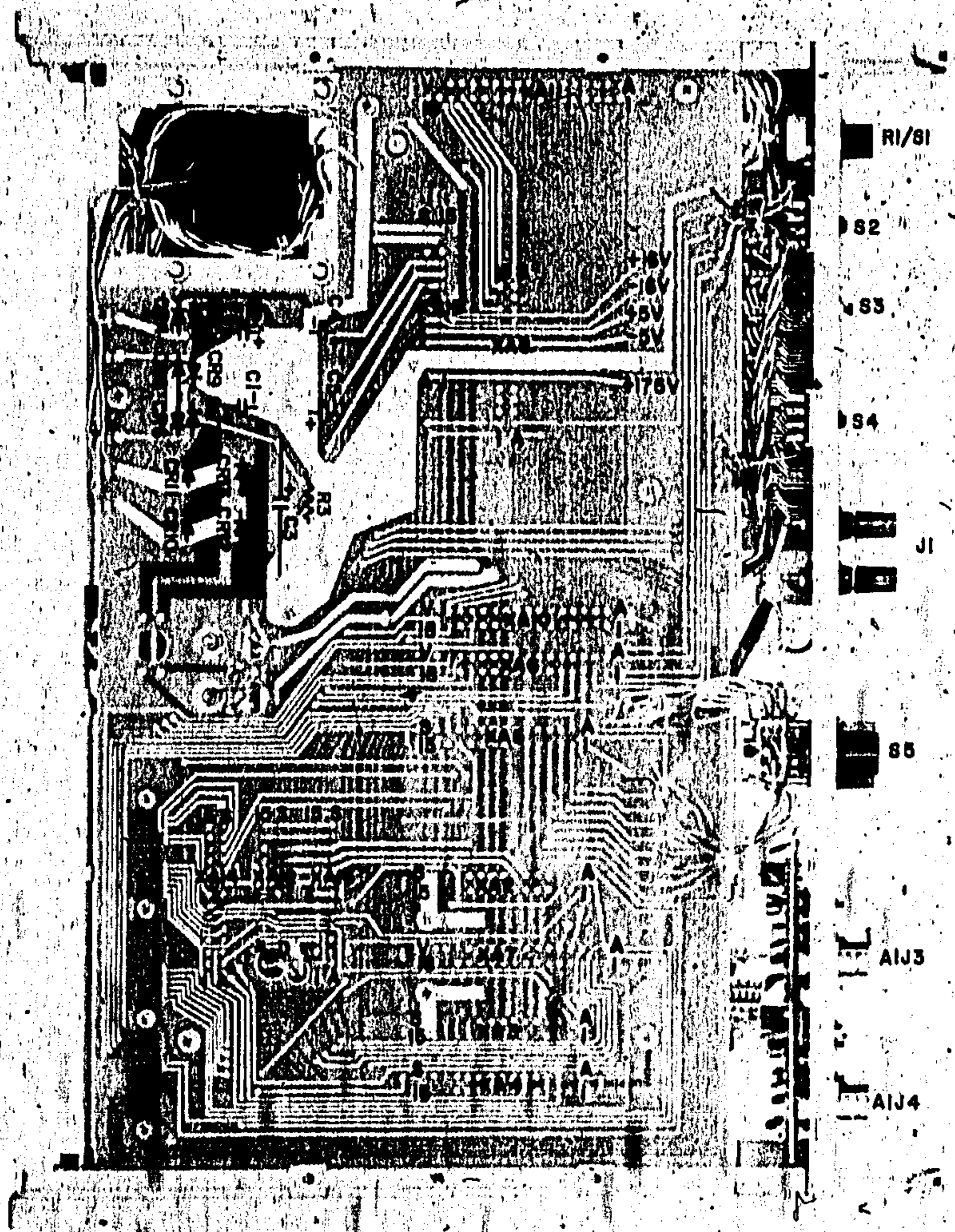


Figure 8-6. 5326A/B Bottom Internal



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.

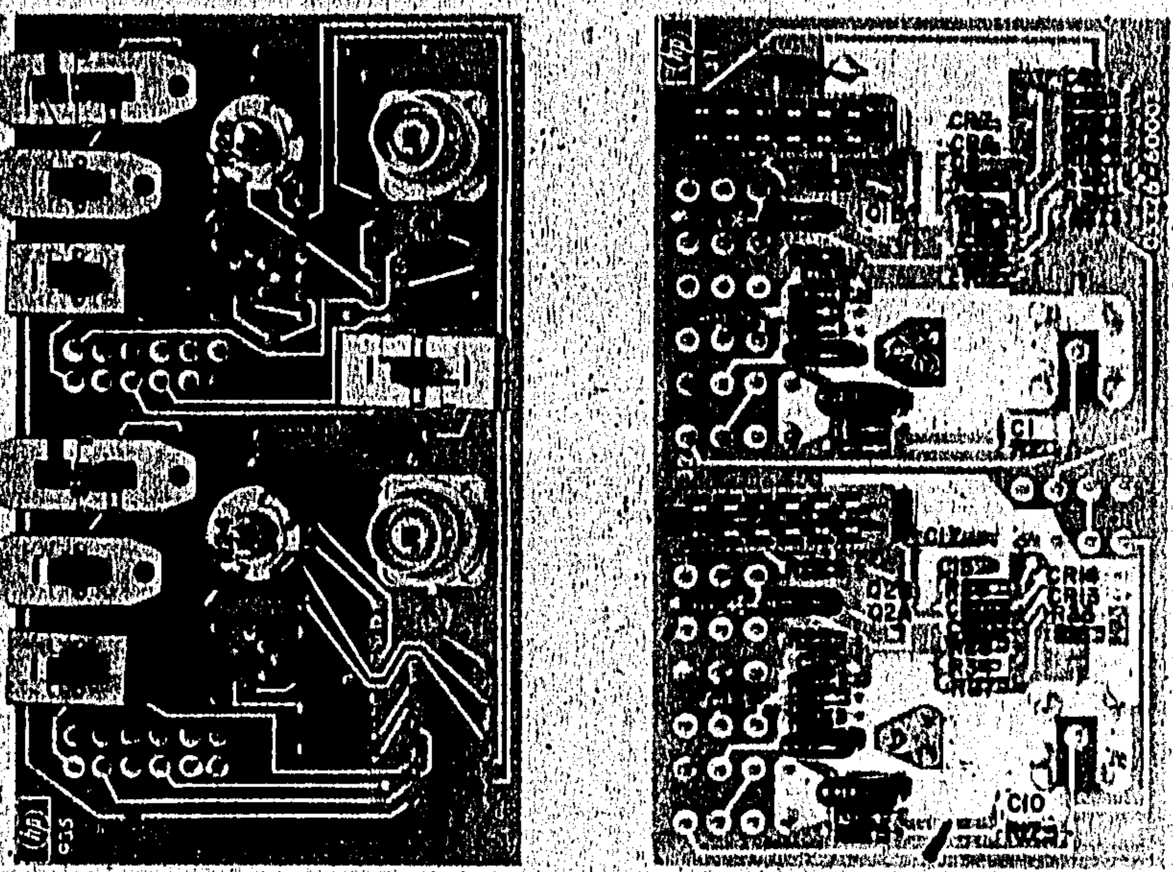
When AC/DC switch S4 is set to AC, C4 is in series with the signal path. CR3 and CR4 limit the input amplitude to Q1A to approximately ±5.8 volts. R7 and R8 provide current limiting. C5 compensates Q1A input capacitance.

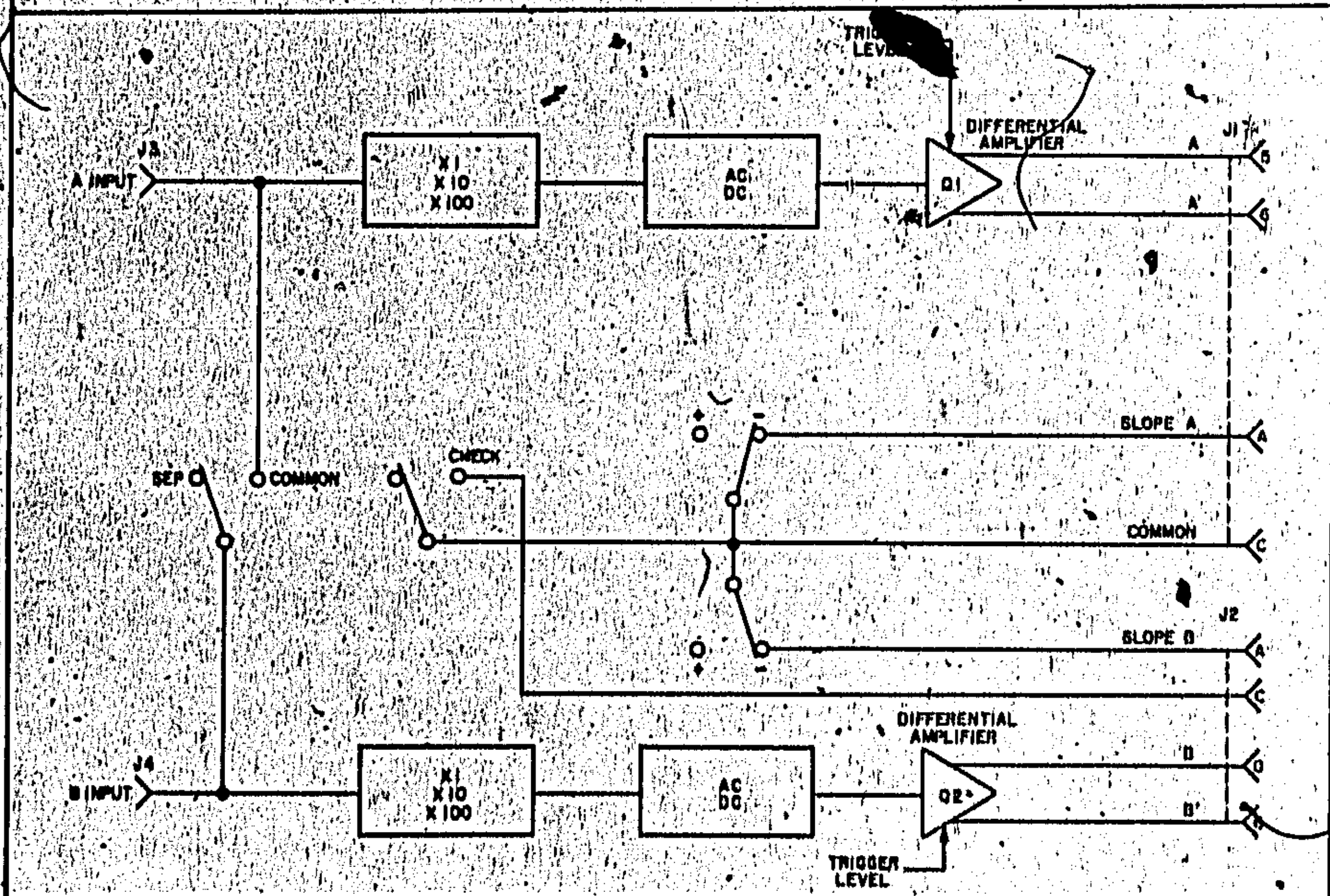
Q1A and Q1B form a differential amplifier connected as source followers. The outputs are fed to A2 via pins 5 and 6 of J1. LEVEL potentiometer R24 determines the trigger level on Q1B gate. The trigger level can be preset to zero volts or varied from -3 to +3 volts; or with the LEVEL control set to PRESET, 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.

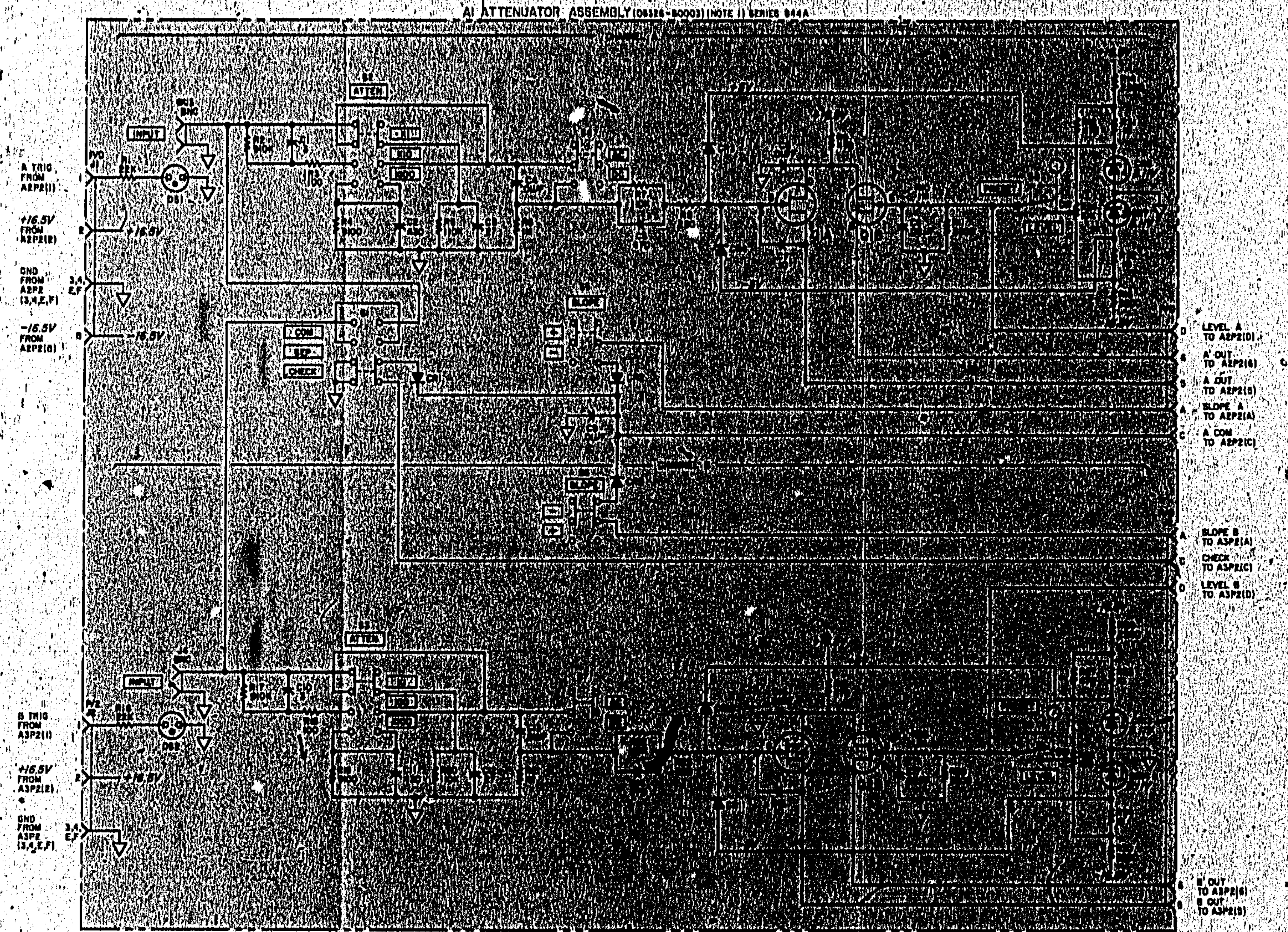
COM-SEP-CHK switch S1 connects inputs A and B in parallel when set to COM and grounds J2(C) via CR1 for the check mode.

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





TRIGGER LEVEL
DIFFERENTIAL AMPLIFIER
J3
A INPUT
X1
X10
X100
AC
DC
Q1
A
A'
J1
SEP
COMMON
CHECK
SLOPE A
COMMON
J2
SLOPE B
DIFFERENTIAL AMPLIFIER
J4
B INPUT
X1
X10
X100
AC
DC
Q2
B
B'
TRIGGER LEVEL



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	1855-0324

05326-B-1

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

Figure 8-7. 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).

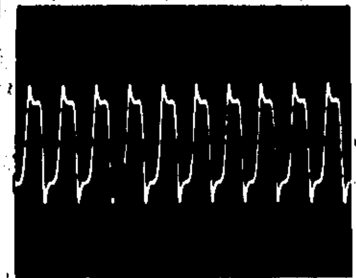
A2 TROUBLESHOOTING

When tracing the signal through the amplifier assembly, a good starting point is the collector of Q4, 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.

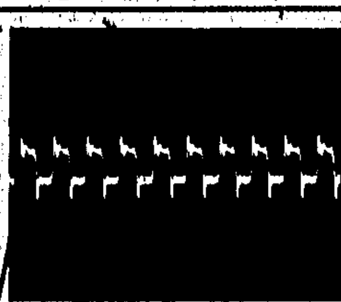
Figure 8-7
A1 ATTENUATOR ASSEMBLY

(See Page 8-15)

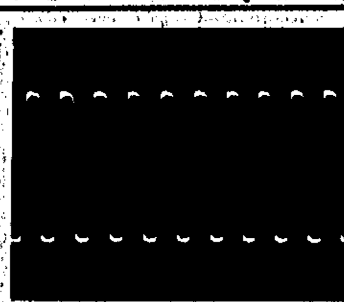
Part of Figure 8-8. Input Amplifier Assembly



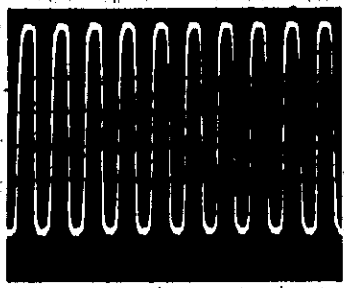
.05 V/cm
.1 μs/cm
ac coupled



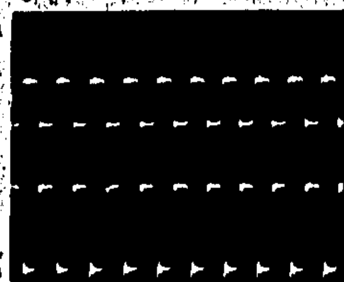
.01 V/cm
.1 μs/cm
ac coupled



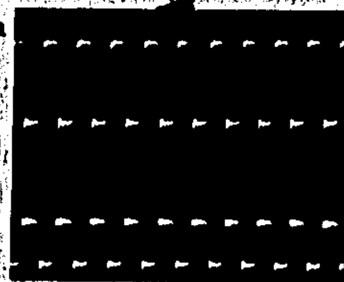
.05 V/cm
.1 μs/cm
ac coupled



.02 V/cm
.1 μs/cm

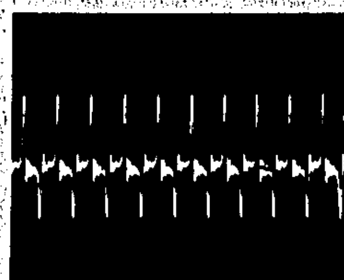


+SLOPE
a. Q10 emitter
b. Q9 emitter
.05 V/cm, .1 μs/cm

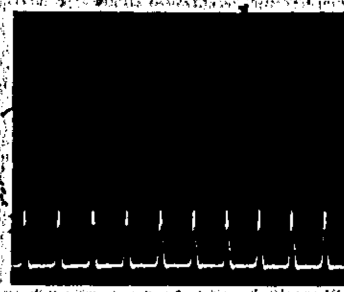


-SLOPE
a. Q10 emitter
b. Q9 emitter
.05 V/cm, .1 μs/cm

.02V/cm
.1 μs/cm

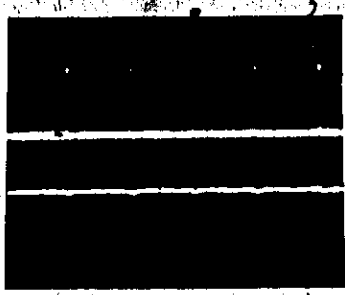


.05 V/cm
.1 μs/cm



.05 V/cm
.1 μs/cm

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



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

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

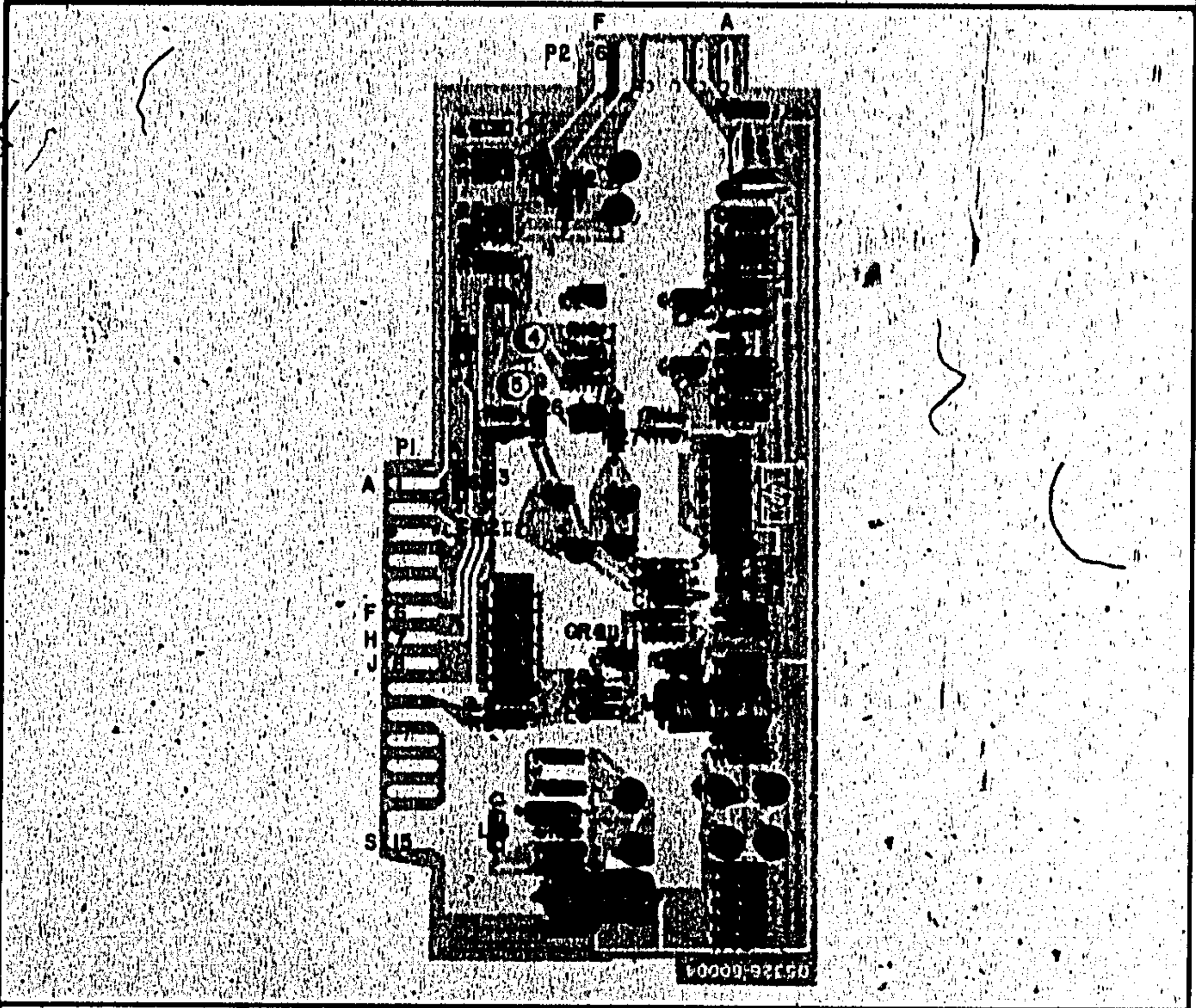
COUNTER CONTROLS:

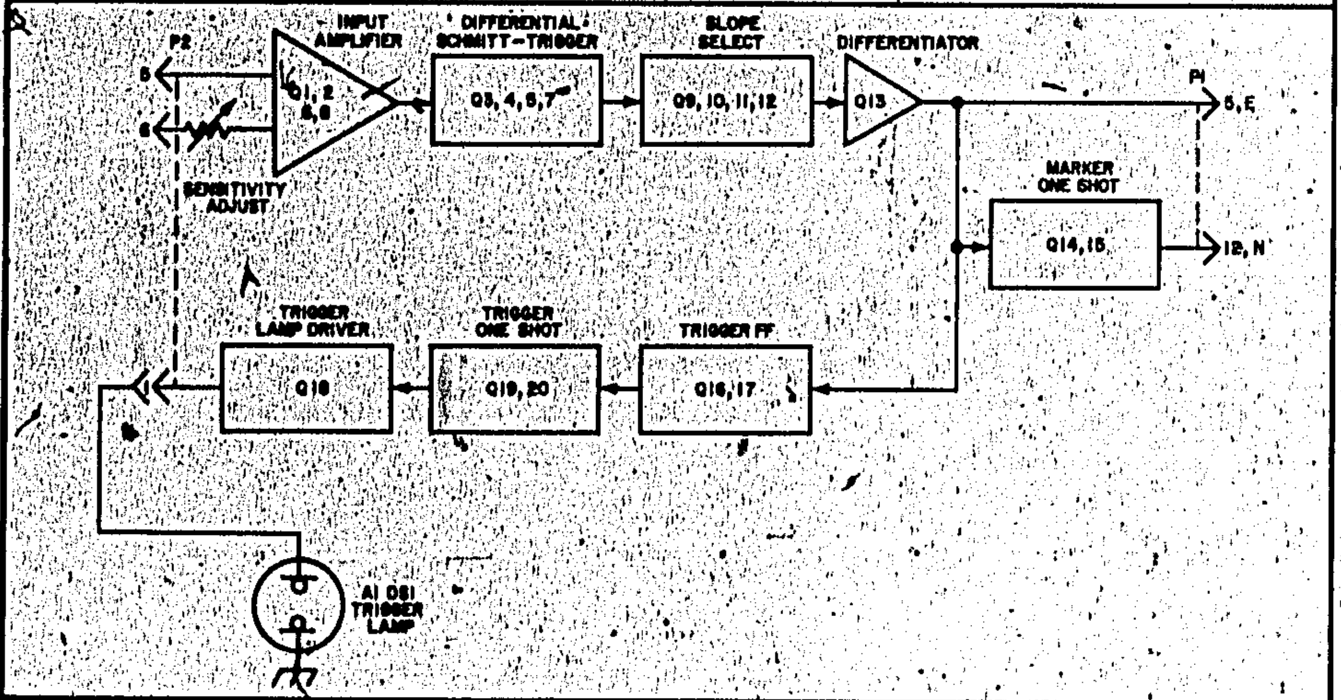
CHANNEL A jack .... connect 10 MHz sine wave at 1 V rms
FUNCTION .... FREQ A
TIME BASE .... 1 ms
ATTEN X1
LEVEL .... PRESET
CHK/SEP/COM .... SEP
SAMPLE RATE .... FAST ccw
SLOPE .... +

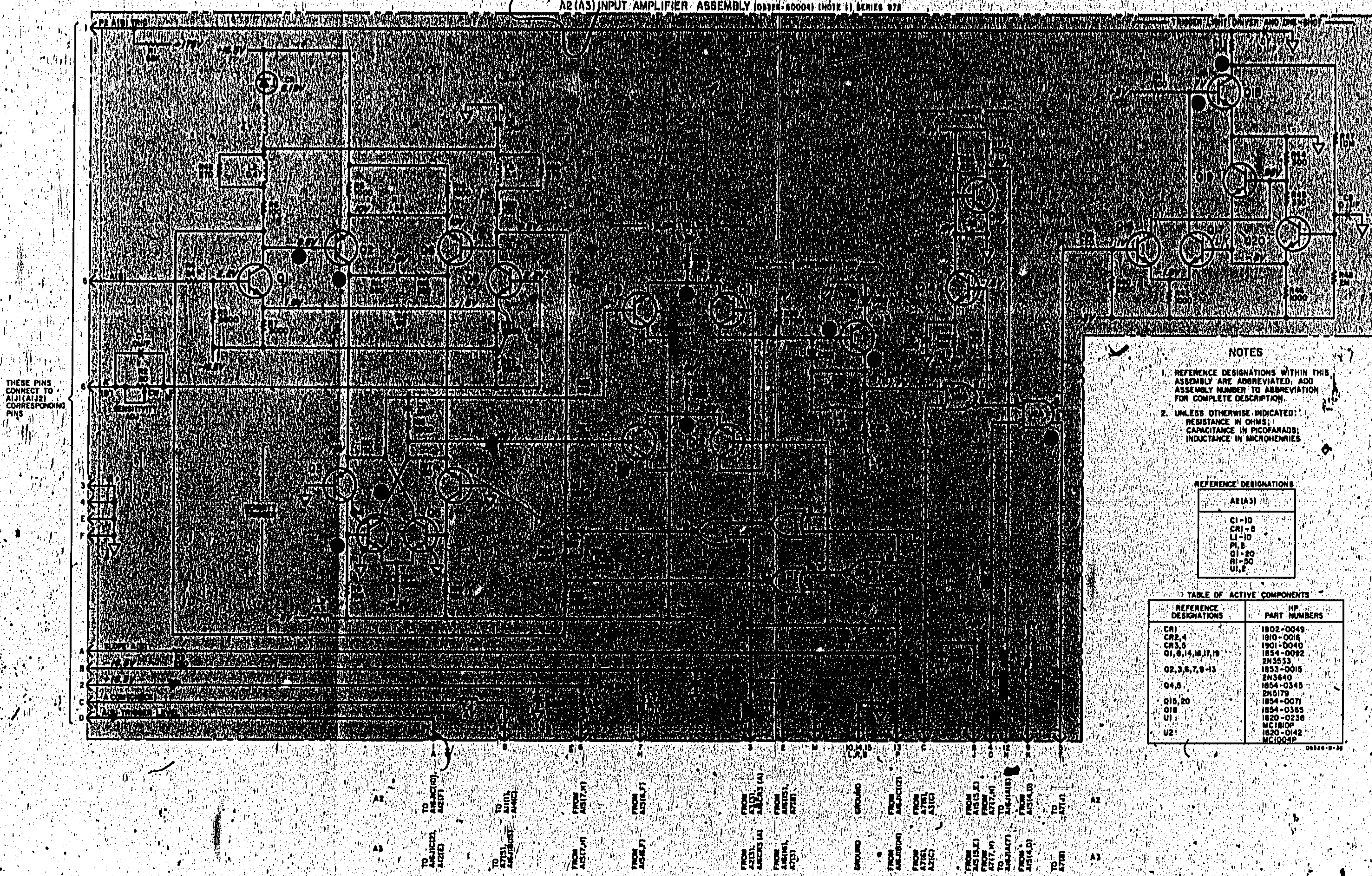
OSCILLOSCOPE CONTROLS:
(except as noted)

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

MORE DATA UNDER FOLD


F
A
P2
P1
A
F
H
J
S
15


P2
5
6
INPUT AMPLIFIER
SENSITIVITY ADJUST
DIFFERENTIAL SCHMITT-TRIGGER
Q3, 4, 5, 7
SLOPE SELECT
Q9, 10, 11, 12
DIFFERENTIATOR
Q13
P1
5, E
MARKER ONE SHOT
Q14, 15
12, N
TRIGGER LAMP DRIVER
Q18
TRIGGER ONE SHOT
Q19, 20
TRIGGER FF
Q16, 17
A1 DS1 TRIGGER LAMP



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

A2(A3)
C1-10 CR1-6 L1-10 P1,2 Q1-20 R1-50 U1,2

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1	1902-0049
CR2,4	1910-0016
CR3,5	1901-0040
Q1,8,14,16,17,19	1854-0092 2N3563
Q2,3,6,7,9-13	1853-0015 2N3640
Q4,5	1854-0345 2N5179
Q15,20	1854-0071
Q18	1854-0365
U1	1820-0238 MC1810P
U2	1820-0142 MC1004P

05320-B-30

Figure 8-8. A2, A3 Input Amplifier 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.

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 U5C 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.

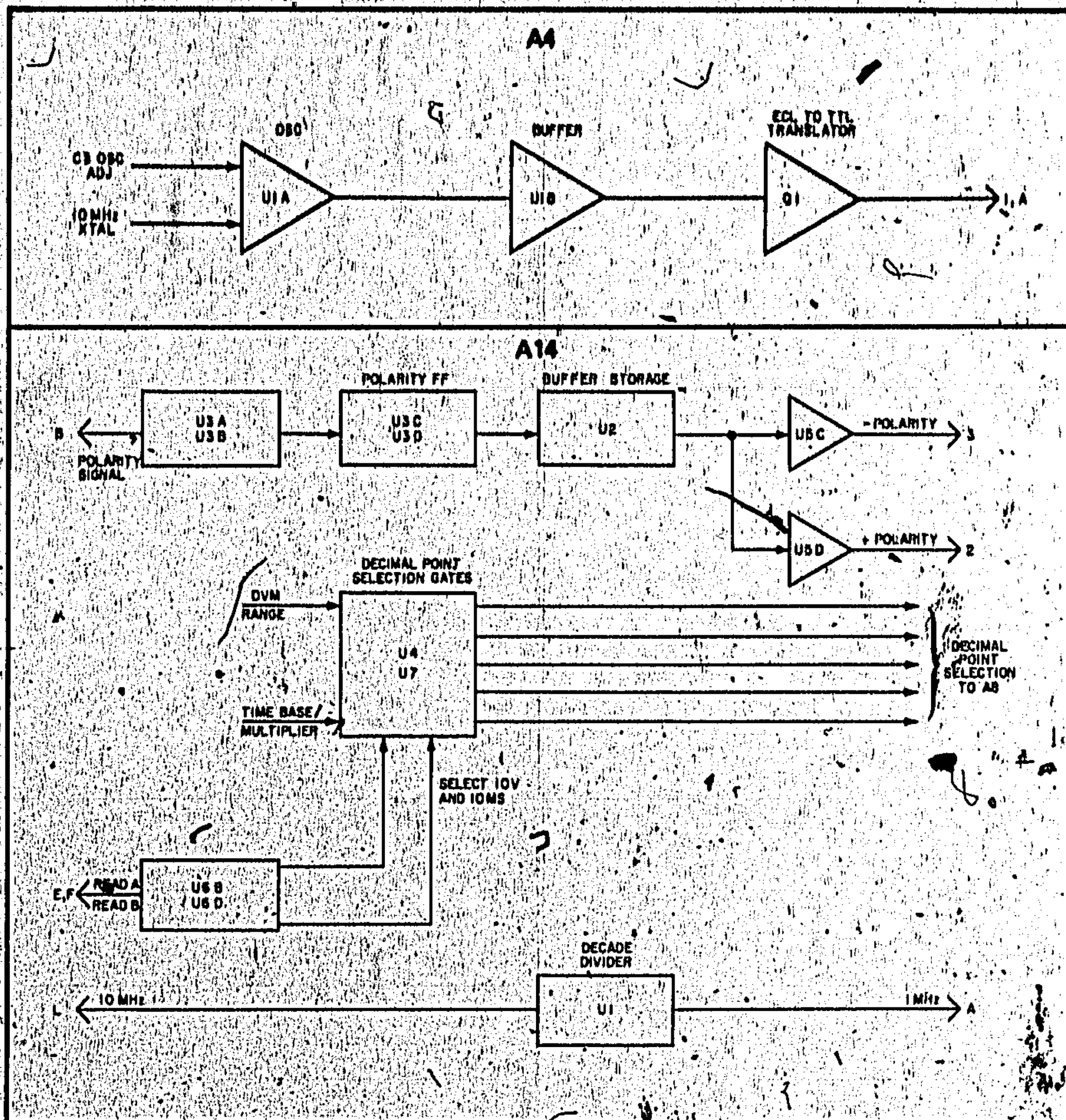
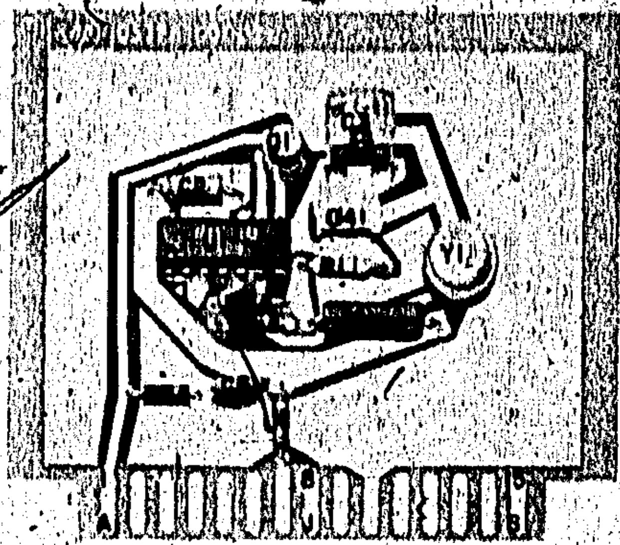
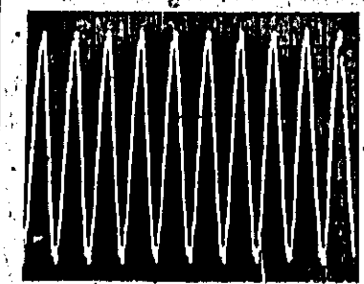


Figure 8-8
A2, A3 INPUT AMPLIFIER ASSEMBLY

(See Page 8-17)

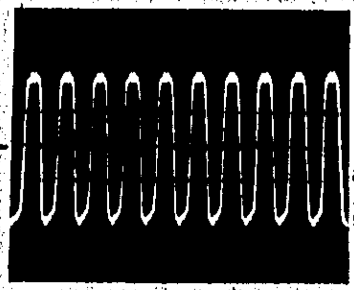
Part of Figure 8-9. A4 Oscillator Assembly





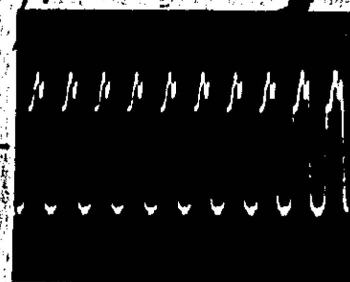
.01 V/cm
.1 μs/cm
ac coupled

— +3.7 V —

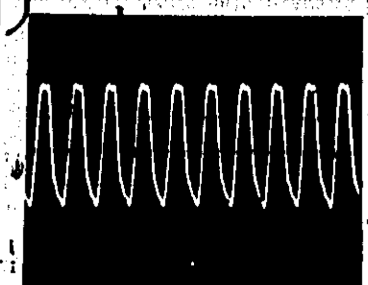


.02 V/cm
.1 μs/cm
ac coupled

— +3.7 V —



.02 V/cm
.1 μs/cm
ac coupled



— 0 V

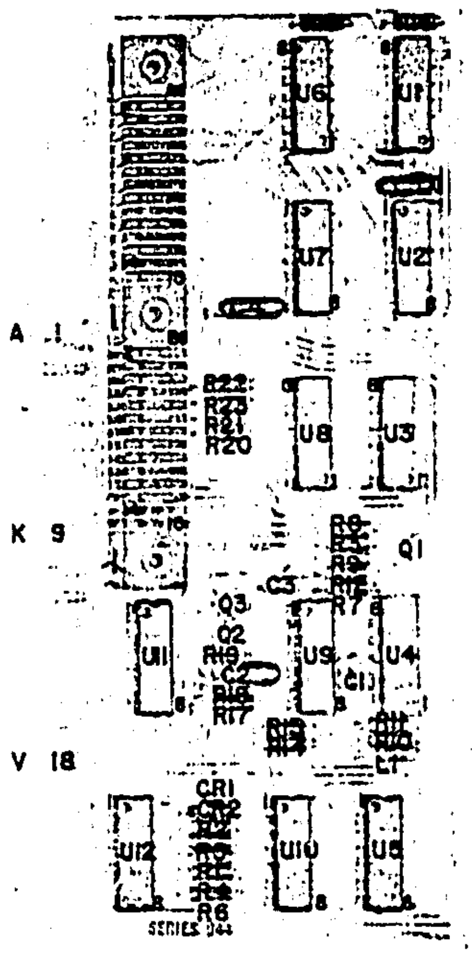
.1 V/cm
.1 μs/cm

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

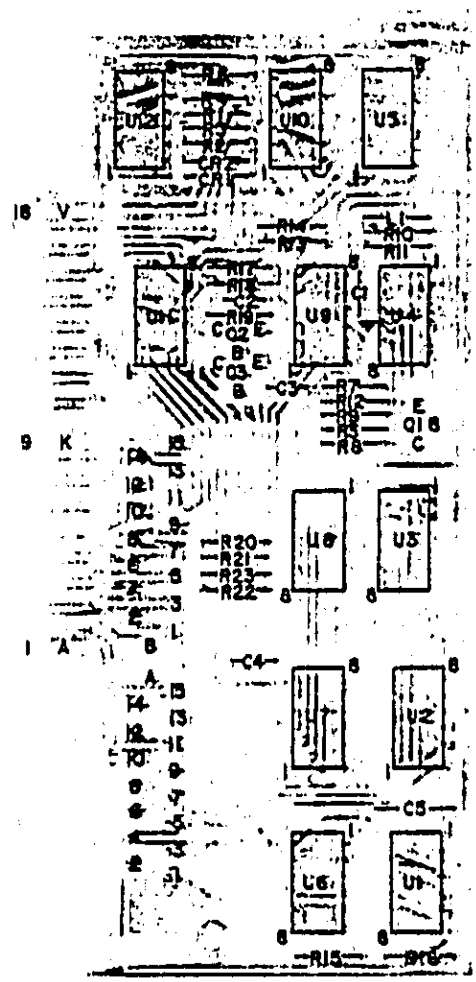
COUNTER CONTROLS:

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

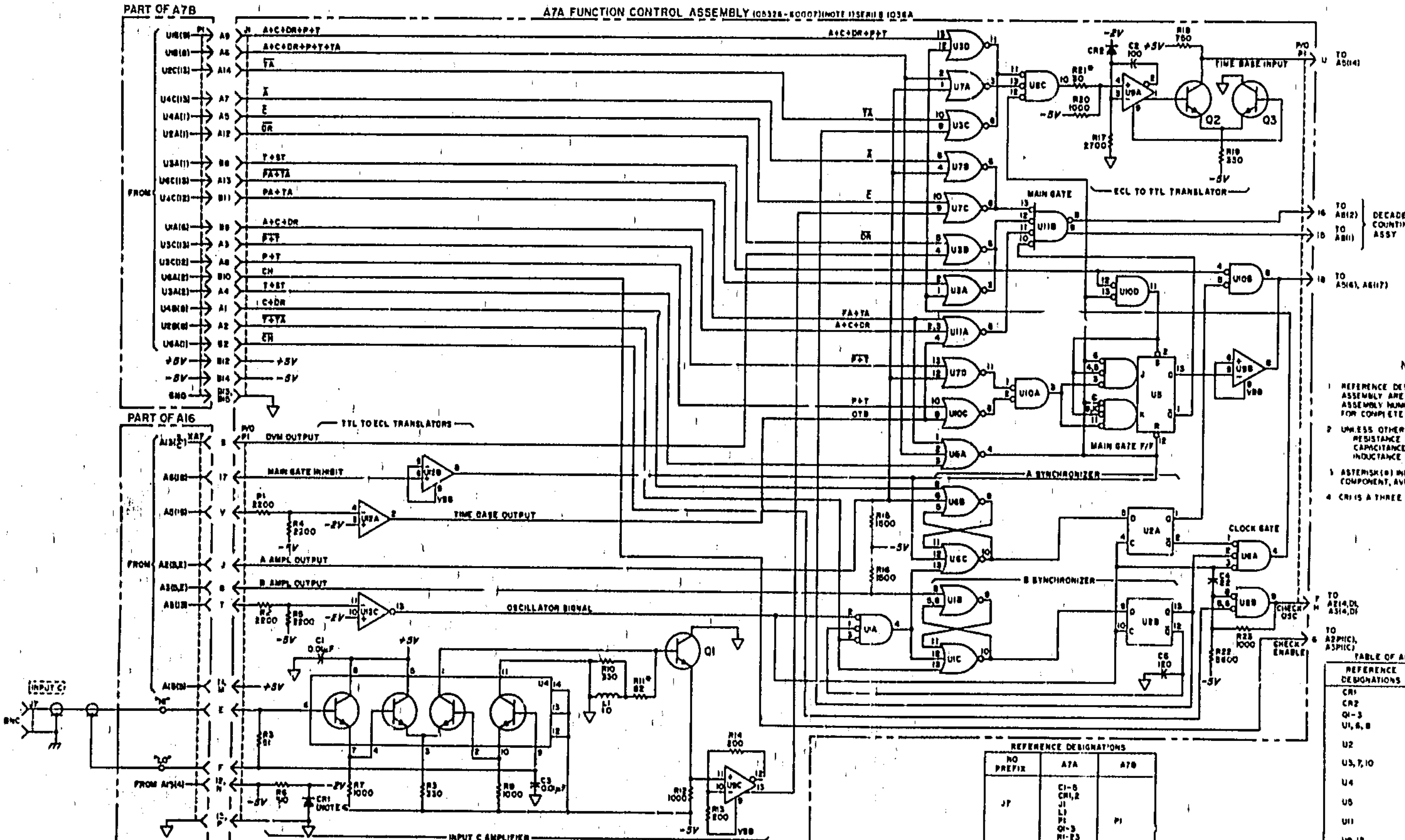
MORE DATA UNDER THIS FOLD



A7A FRONT



A7A REAR



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED
   RESISTANCE IN OHMS,
   CAPACITANCE IN PICOFARADS,
   INDUCTANCE IN MICROHENRIES
3. ASTERISK(*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. CR1 IS A THREE JUNCTION DIODE.

REFERENCE DESIGNATIONS

NO PREFIX	A7A	A7B
J7	C1-6 CR1,2 J1 L1 P1 Q1-3 R1-23 U1-12	P1

TABLE OF ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1	1901-0651
CR2	1901-0040
Q1-3	1854-0009
U1, 6, 8	1820-0147 MC 1007P
U2	1820-0440 MC1016
U3, 7, 10	1820-0145 MC 1010P
U4	1821-0001 RCA 3046
U5	1820-0102 MC 1013P
U11	1820-0142 MC 1004P
U9, 12	1820-0253 MC 1035P

Figure 8-12. A7A Function Control Assembly

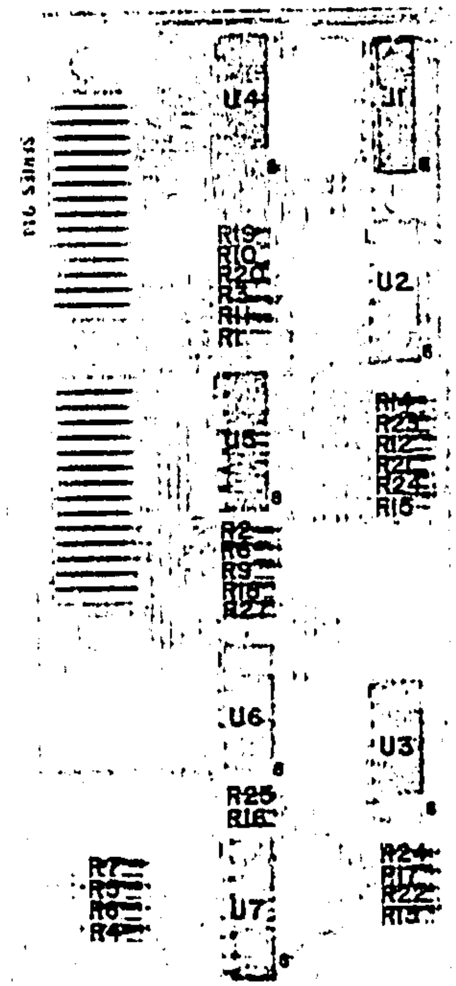
A7B FUNCTION CONTROL OPERATION

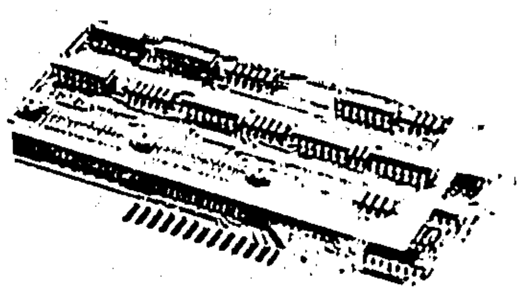
Mode selection for the counter is controlled by FUNCTION switch S6. S6BF selects the operating mode. The function common line will be grounded during INTERNAL operation. S6AF provides reset output when the FUNCTION switch is between detents. When the FUNCTION switch is set to START or STOP, S6AR grounds the sample rate disable line to disable the sample rate circuits on A6.

R1 through R9 are pull up resistors for the FUNCTION switch. U5 and U7 are DTL drivers for the TTL to ECL level shifters. R10 through R27 shift the voltage levels of the inputs of differential amplifiers U4, U2, U3, and U6.

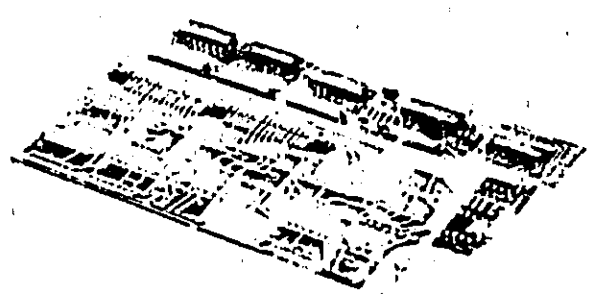
The differential amplifiers provide inverted and non-inverted outputs. As an example of operation, if U4C(10) is positive with respect to U4C(11), U4C(12) is ECL logic one and U4C(13) is ECL logic zero. If the reverse is true, the opposite logic output states will occur. In FREQ A mode, U4C(12) is ECL low. The differential amplifier outputs are either routed to A7A directly or added in U1A and U1B.

CR1, a 3-junction diode, and R26 provide -2 volt bias for the differential amplifiers.





OPERATING POSITION



SERVICE POSITION

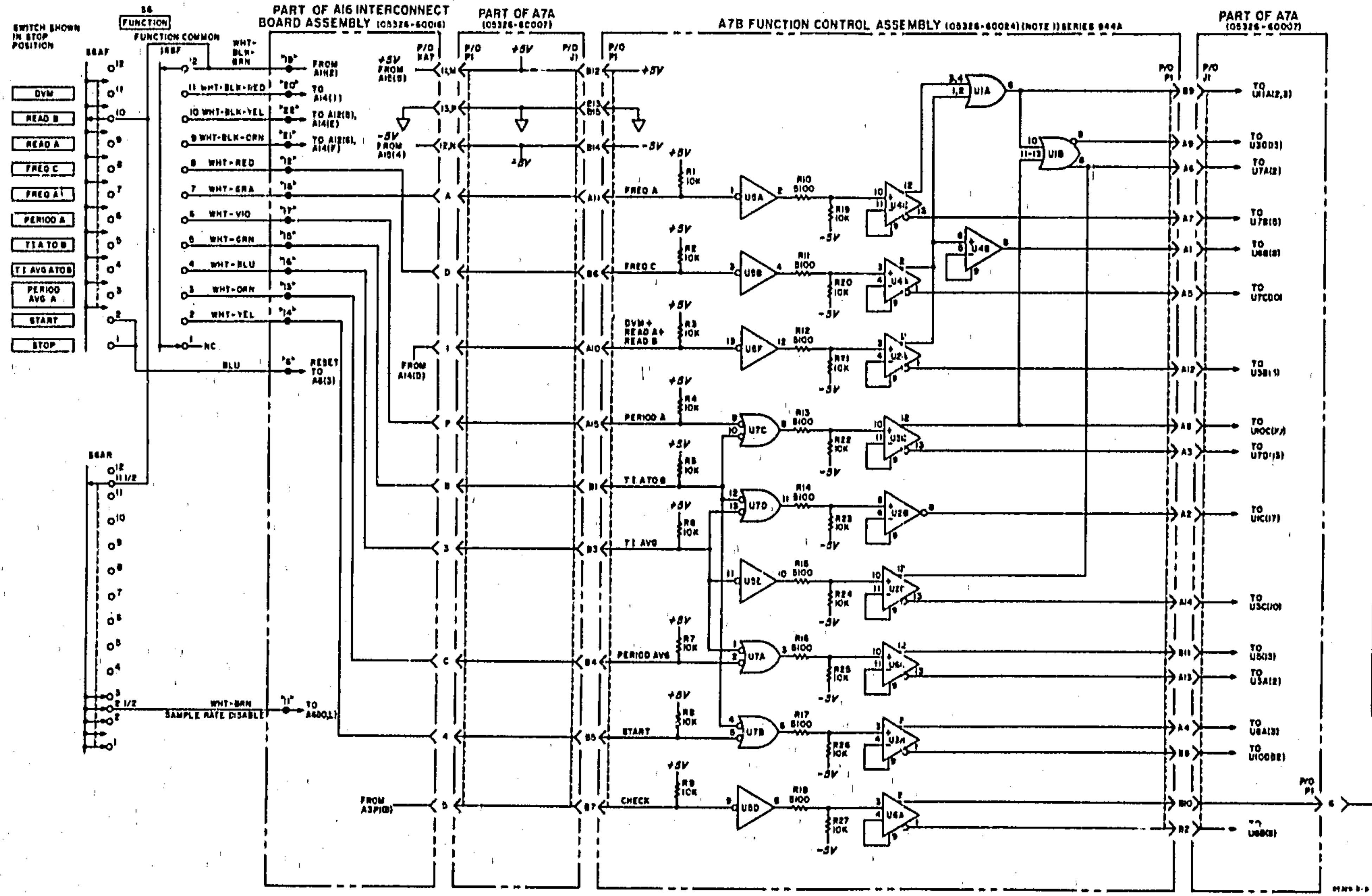


Figure 8-13. A7B Function Control Assembly

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

NO PREFIX	A7A	A7B
S6	J1 P1	P1 R1-27 U1-7

TABLE OF ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
U1	1820-0142 MC1004P
U2-4,6	1820-0263 SN7403N
U5	1820-0174
U7	1820-0064 SN7400N

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 10^0 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 R3 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(10^3). 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 10^7.
2. CHK/SEP/COM switch to CHK.
3. FUNCTION switch to START.
4. Press RESET.

The High-Speed Decode 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	U3(13)	U4(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.

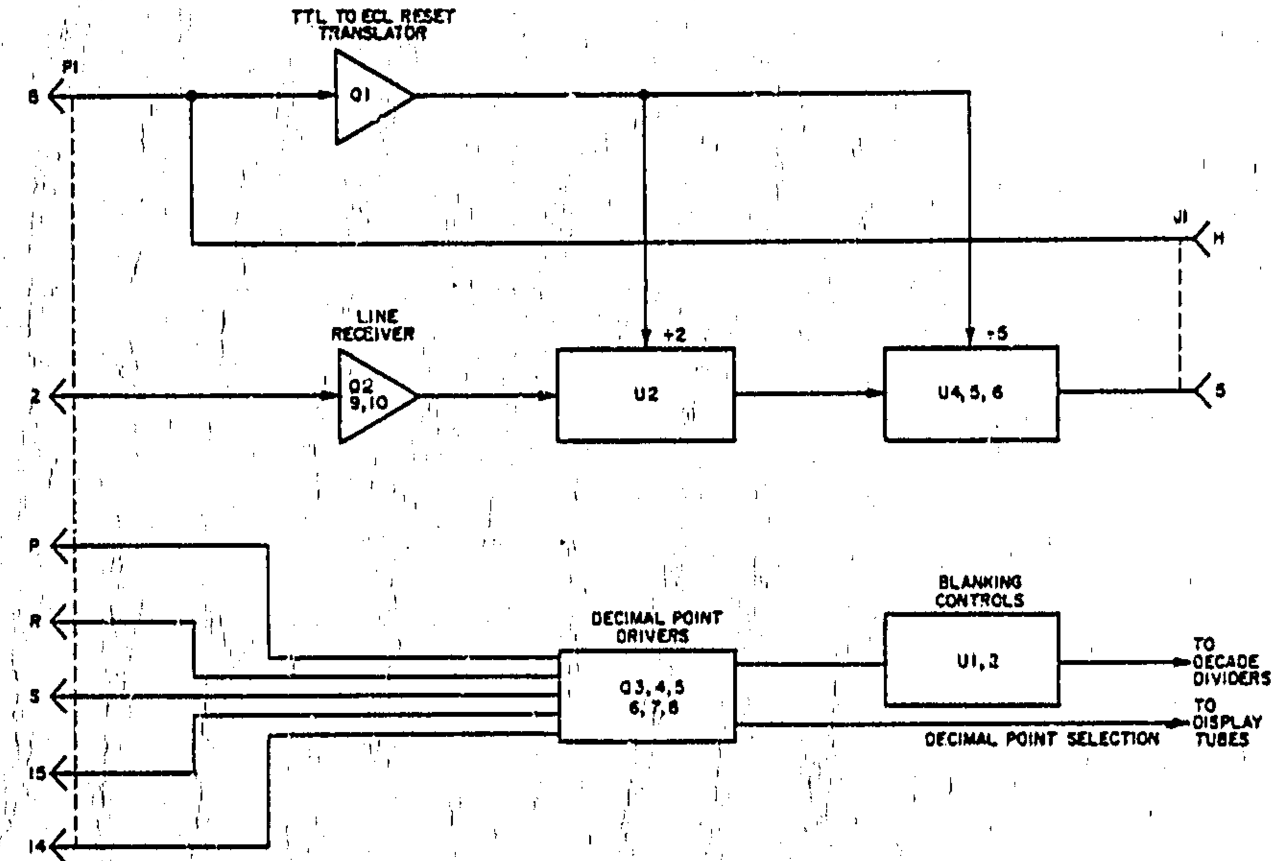
DECIMAL POINT. To check the decimal point circuitry, set FUNCTION switch to PERIOD AVG and position the TIME BASE switch to pull the required D.P. line Low.

LINE	MULTIPLIER POSITION	DRIVER
D.P.0	1	Q8
D.P.1	10	Q7
D.P.2	10^2	Q6
D.P.3	10^4	Q5
D.P.4	10^7	Q4
D.P.5	10^8	Q3

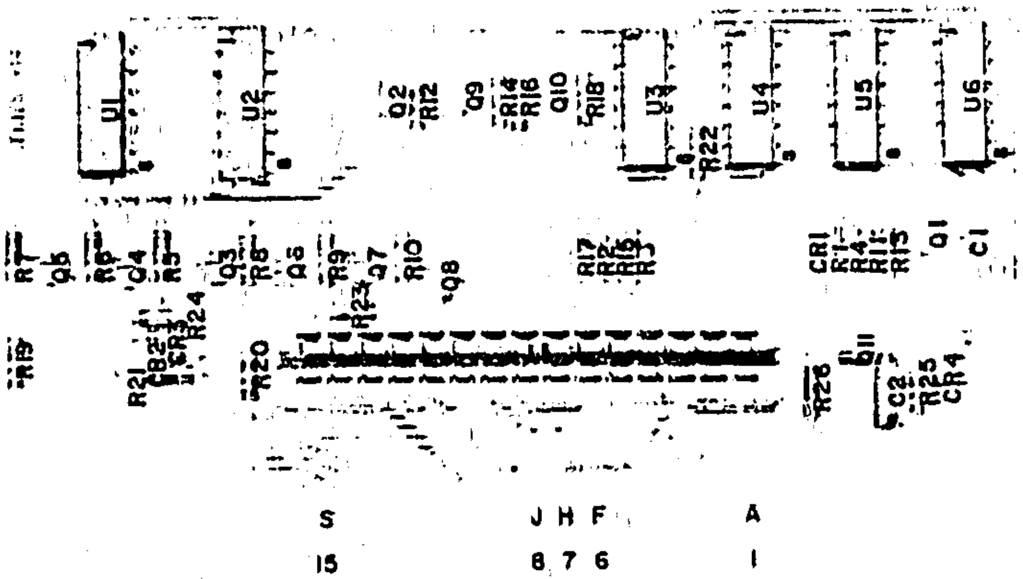
BLANKING. To check the blanking circuitry, set the FUNCTION switch to PERIOD AVG and MULTIPLIER switch to 1. All digits, except the first one, should now be blanked. If another digit is lit, check that line at A8J1 for a High level, which indicates a problem on that line.

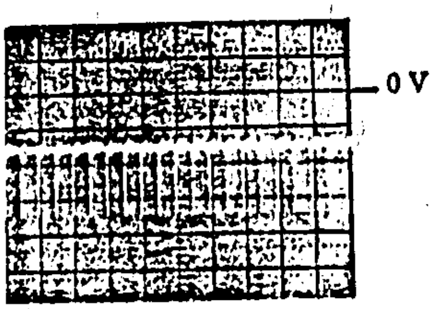
Figure 8-13
A7B FUNCTION CONTROL ASSEMBLY
(See Page 8-27)

Part of Figure 8-14. A8 Display Support Assembly



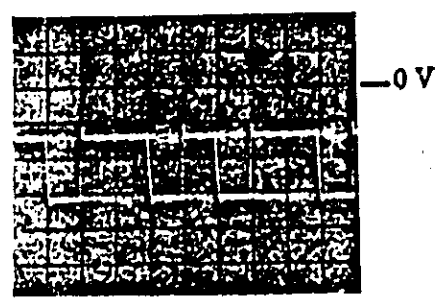
MORE DATA UNDER THIS FOLD



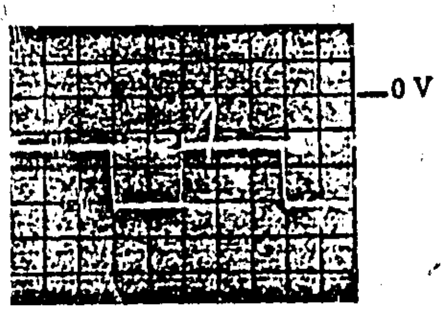


1

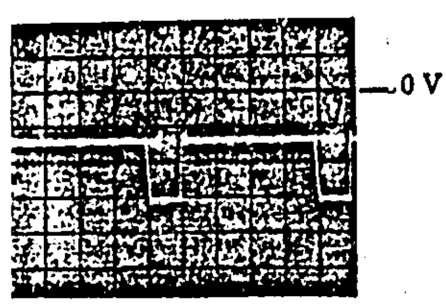
2



3



4



5

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

COUNTER CONTROLS:
Use settings of A2 Assembly

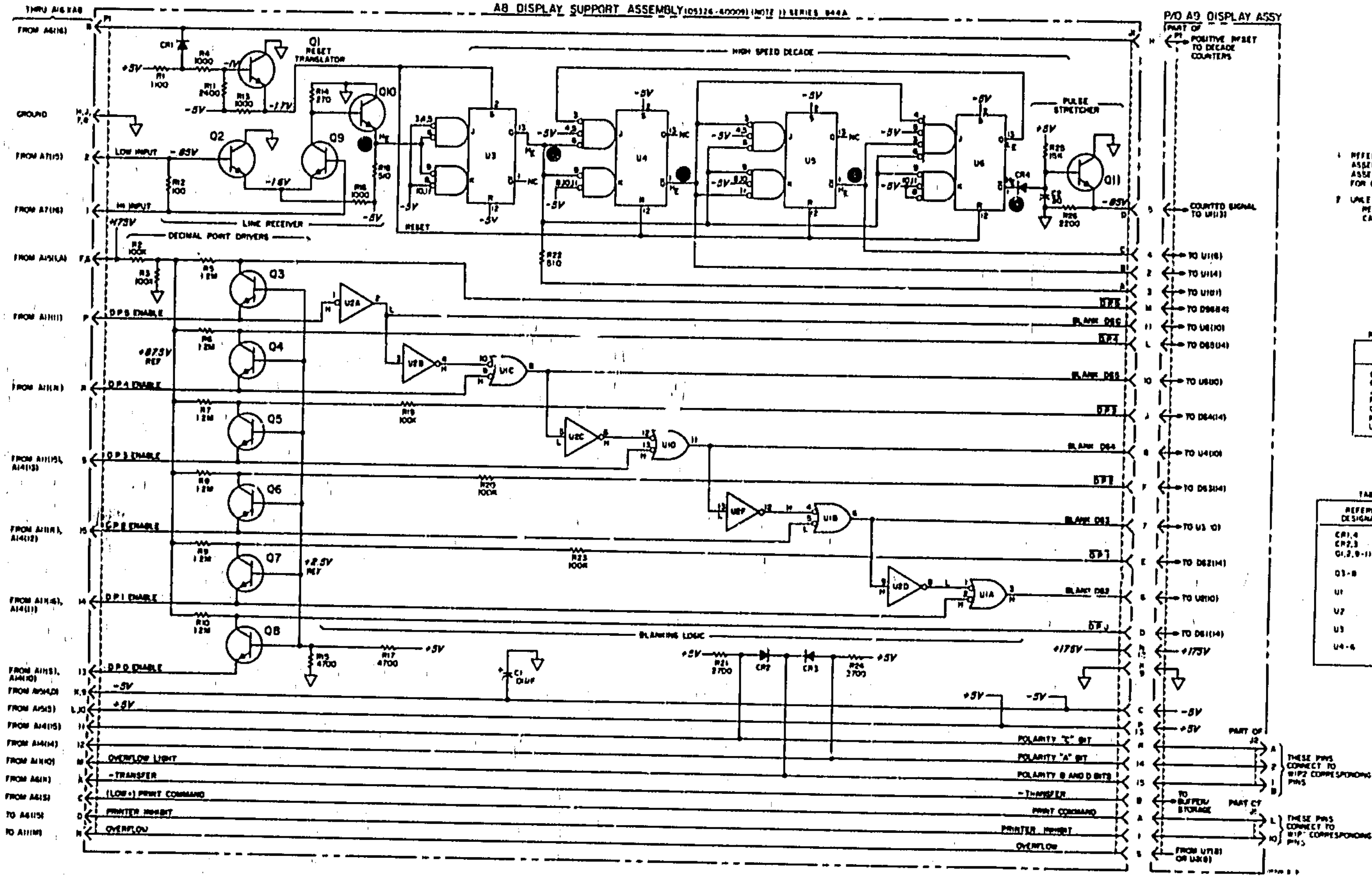
DC VOLTAGES:

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. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS.

REFERENCE DESIGNATIONS

A8	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
Q1,2,9-11	1854-0092 2N3563
Q3-8	1854-0365 2N4410
U1	1820-0094 MC846P
U2	1820-0307 MC836P
U3	1820-0143 MC1027
U4-6	1820-0102 MC1013P

Figure 8-14. 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 10¹ 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 J3 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 <8 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/SEF/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.

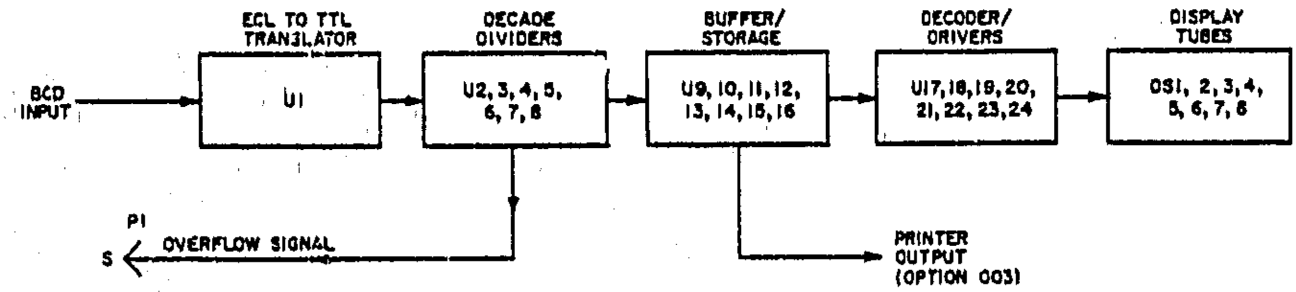
Start by checking the Buffer-Storage outputs (U9-U15) for the BCD code of the number that should be displayed, rather than what is displayed (see Table 1). Check that the Buffer-Storage code pulls the proper decimal line low on the BCD-to-Decimal Decoder.

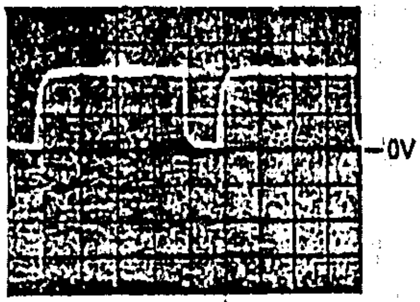
Table 1

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

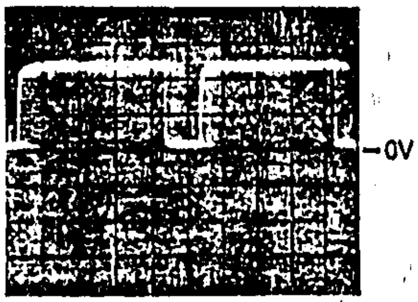
Figure 8-14
A9 DISPLAY SUPPORT ASSEMBLY
(See Page 8-29)

Part of Figure 8-15. A9 Display Assembly (Option 001)

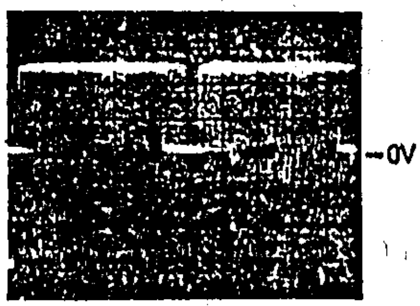




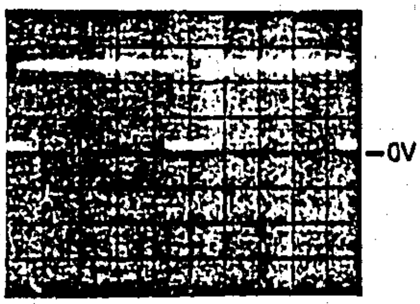
U1(15)
.2 V/cm
.2 μs/cm



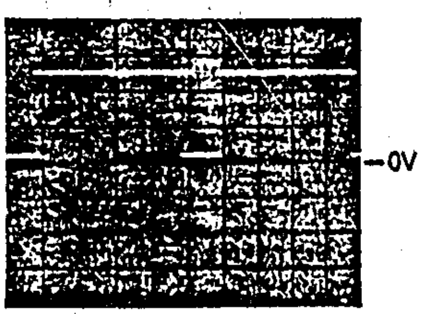
U2(8)
.2 V/cm
2 μs/cm



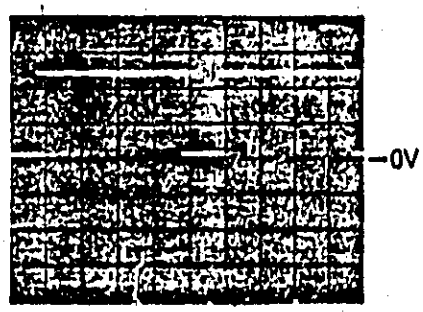
U3(8)
.2 V/cm
20 μs/cm



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



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



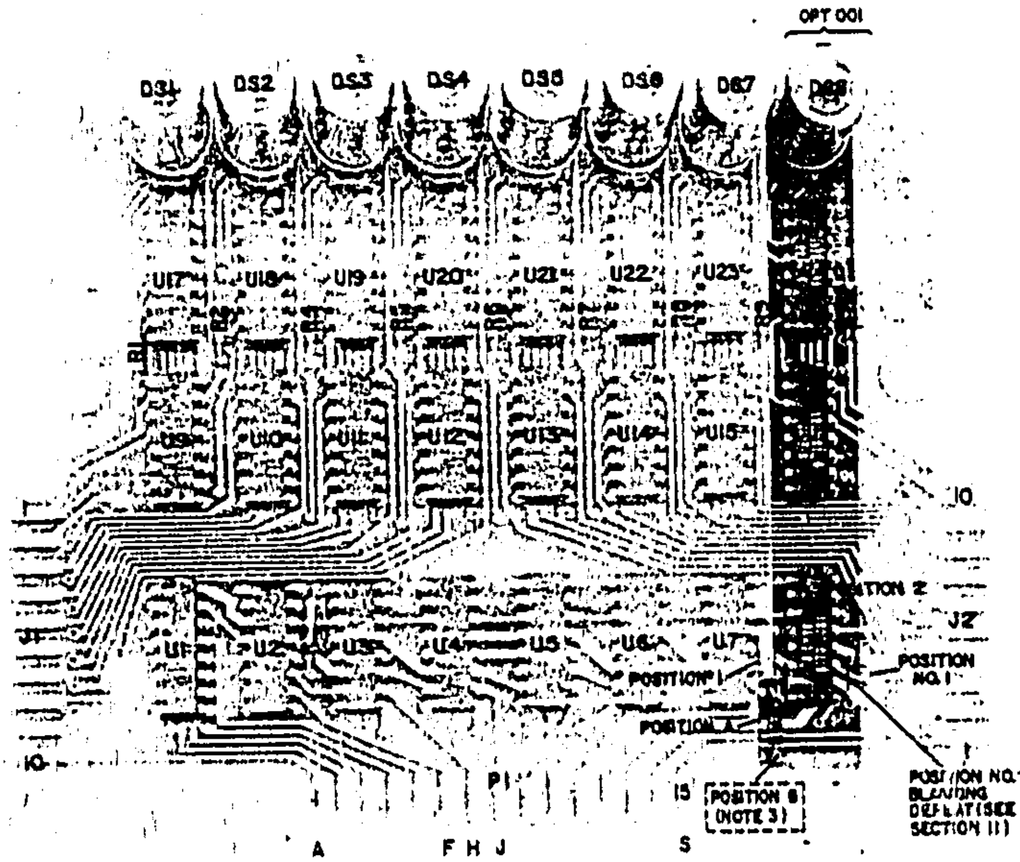
U6(8)
.2 V/cm
20 ms/cm

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



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. R10 IS WIRED TO B FOR OPTION 001.

REFERENCE DESIGNATIONS

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

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A8	
CR2,3	1901-0016
A9	
U1	1820-0275 MC1039P
U2-8	1820-0119
U9-16	1820-0116
U17-24	1820-0092

Apron

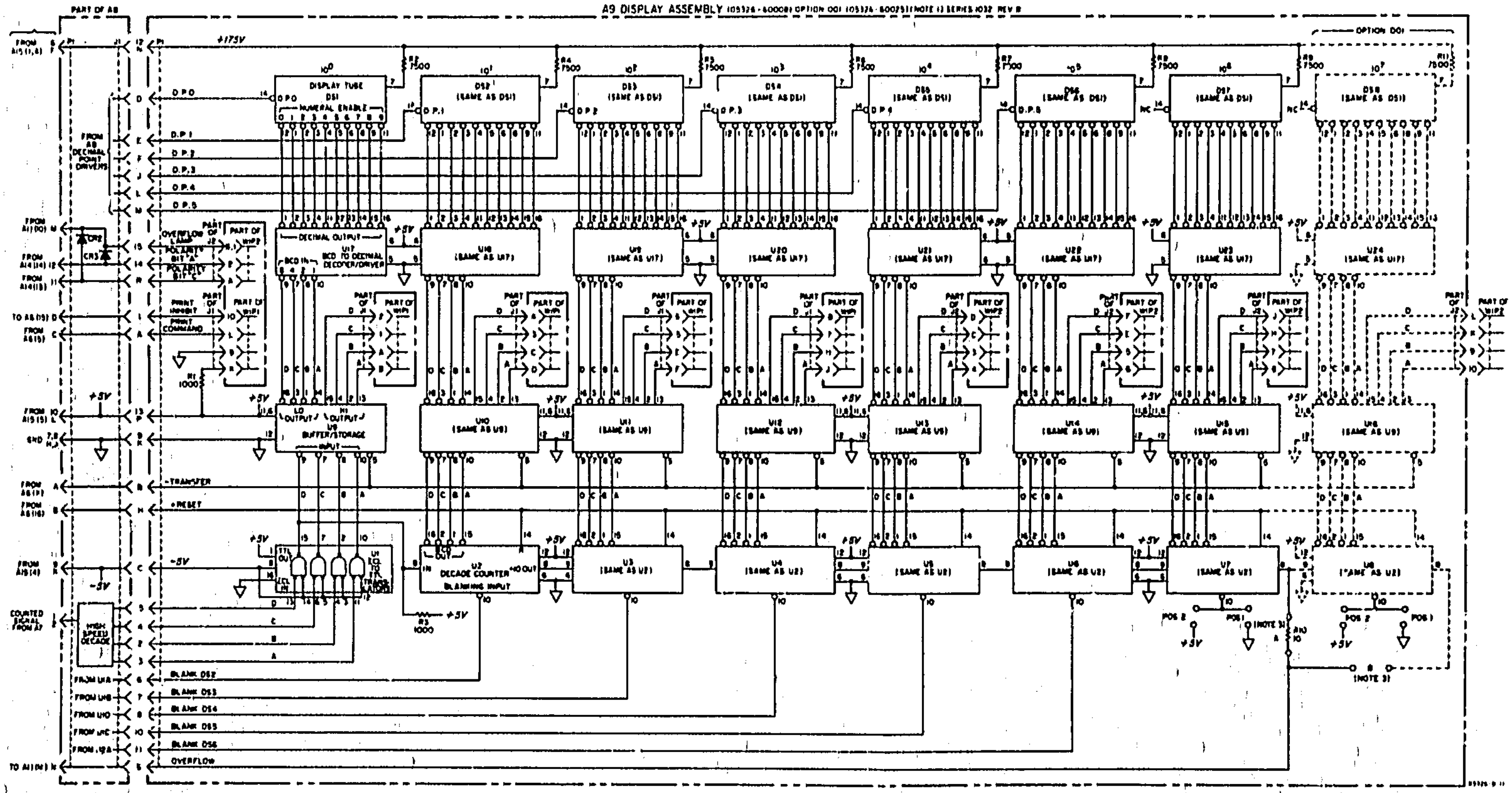


Figure 8-15. A9 Display Assembly (Option 001)

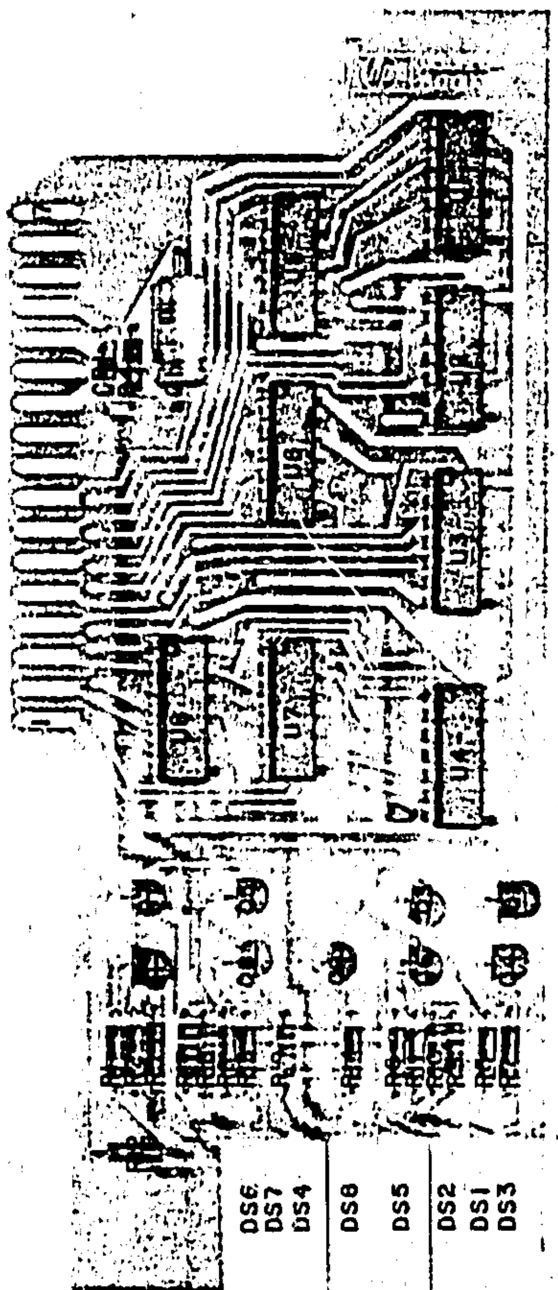
A10 RIGHT READOUT ASSEMBLY

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 (<1 volts) to the emitter of any driver transistor will light the given neon. When a DTL high is applied on the emitters, the transistor reverse biases, to turn off the neon lamps. Q1 and R1, 2, 3 provide a reference of 2.0 V to the bases of the drivers.

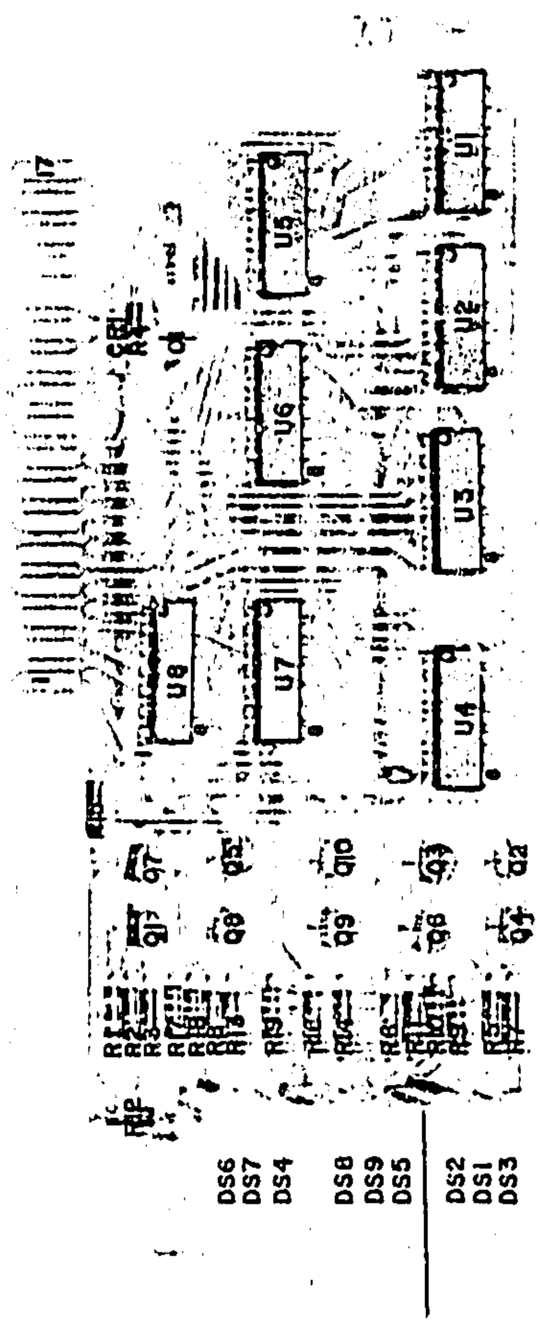
Selecting a mode and time base pulls these lines low, activating a gate. This low on the gate output will forward bias the driver transistor, to turn on the annunciator lamp. For example, selection of the frequency and 1 ms makes the output of U4B low, turning on Q2 to light DS1. U8C(3) is also low, lighting DS2.

For time interval average or period average modes, U8A is activated and depending on the time base switch setting either Q5, DS4, U8D, Q7, and DS6, or Q9, DS8, U8D, Q7, and DS6. Similiary, period or time interval modes togethur with various time base settings will select either microseconds, milliseconds, or seconds.

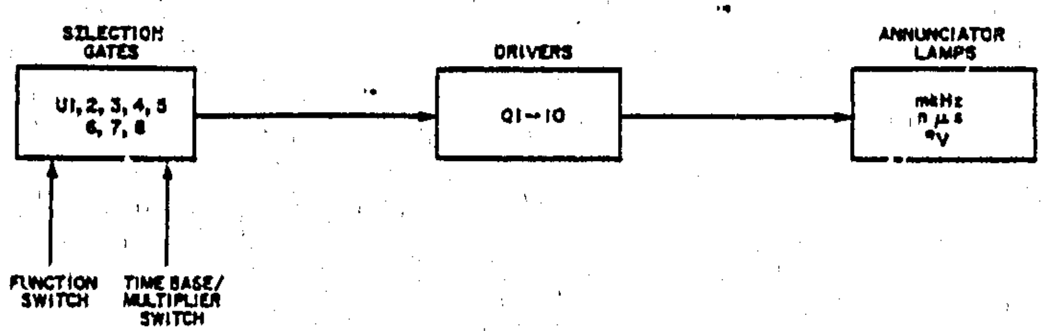
The asterisk (*) annunciator (DS5) is activated for four combinations of function-time base settings. An asterisk indicates that the least significant digit and the proper units cannot be displayed. CR1 and R4 establish the 155 V for the annunciators.

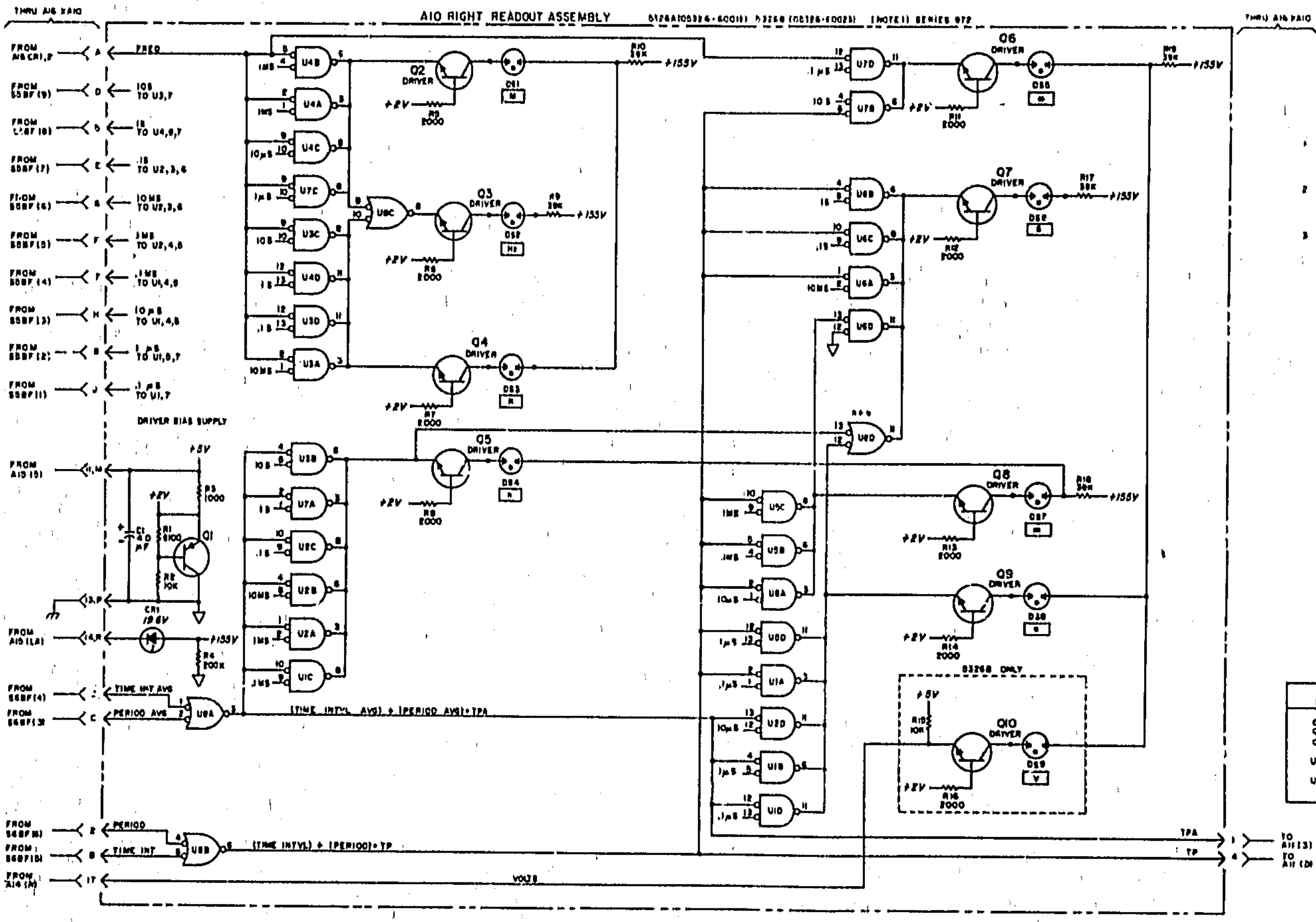

DS6
DS7
DS4
DS8
DS5
DS2
DS1
DS3

5326A


DS6
DS7
DS4
DS8
DS9
DS5
DS2
DS1
DS3

5326B


SELECTION GATES
U1, 2, 3, 4, 5
6, 7, 8
DRIVERS
Q1→10
ANNUNCIATOR LAMPS
FUNCTION SWITCH
TIME BASE/ MULTIPLIER SWITCH



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

A10
C1 CR1 DS1 - 9 Q1 - 10 R1 - 19 U1 - 8

TABLE

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1	1902-3234
Q1	1853-0020
Q2-10	1854-0365 2N4410
U1-7	1820-0276 MC1808P
U8	1820-0273 MC1806P

Figure 8-16. 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 of 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.

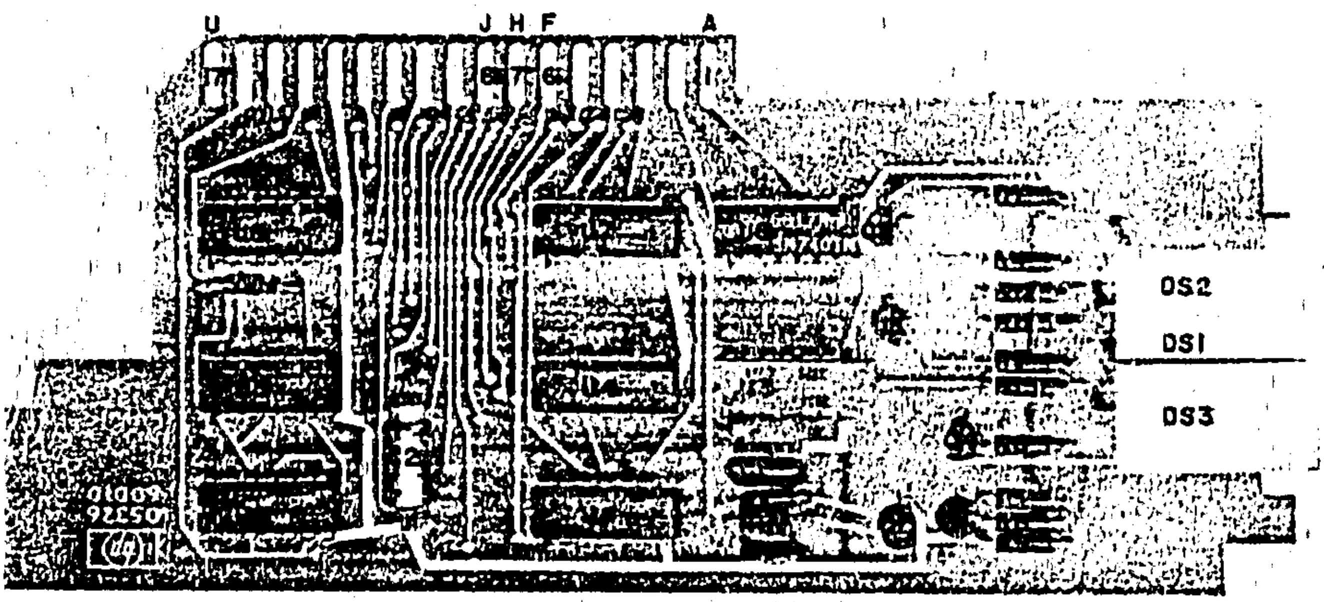
Decimal selection and resultant blanking are accomplished by the negative logic AND gates. For any pair of low inputs, a specific decimal point line is held low, lighting the decimal point. There are a number of combinations for each decimal; therefore, the output of each AND gate is paralleled to give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

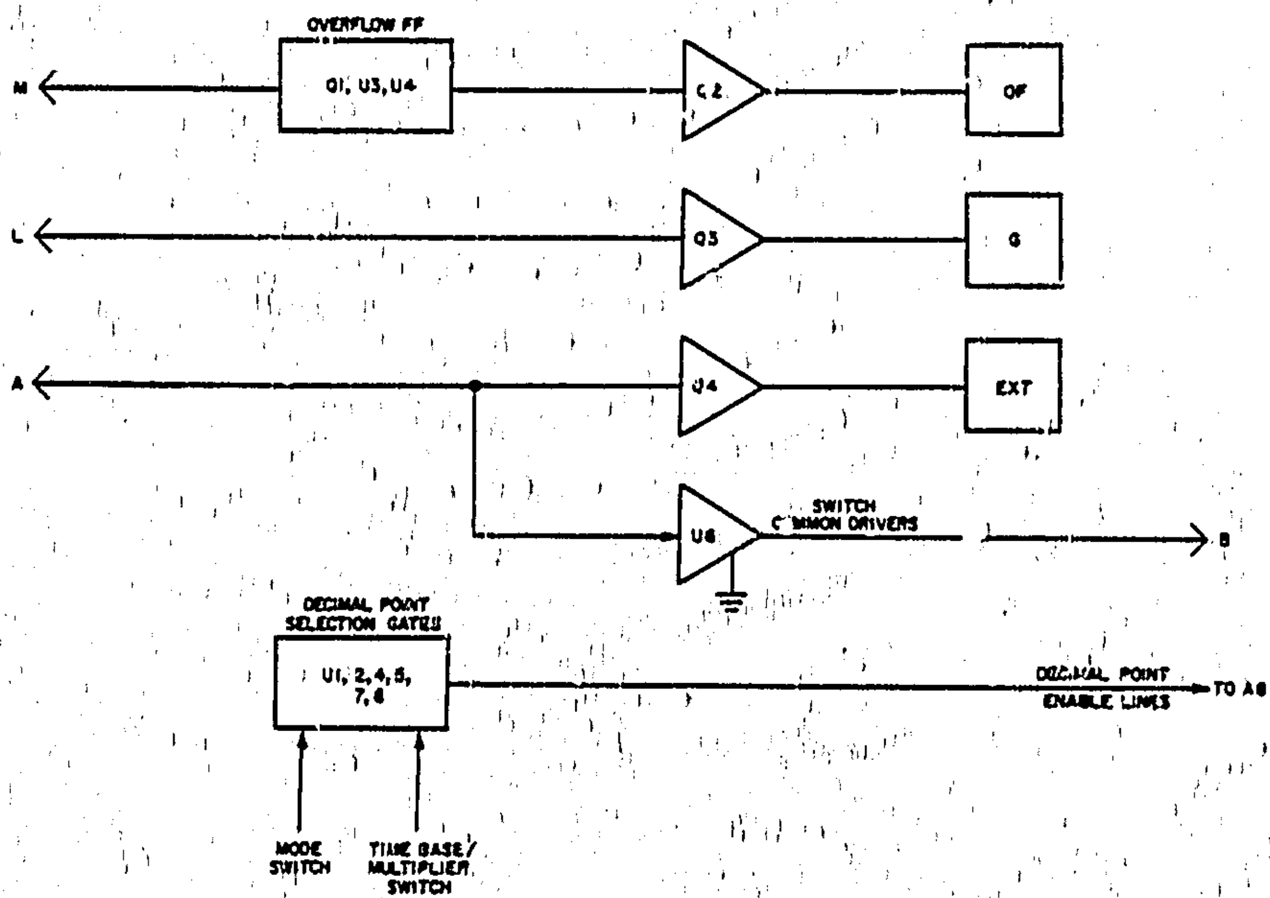
A11 TROUBLESHOOTING

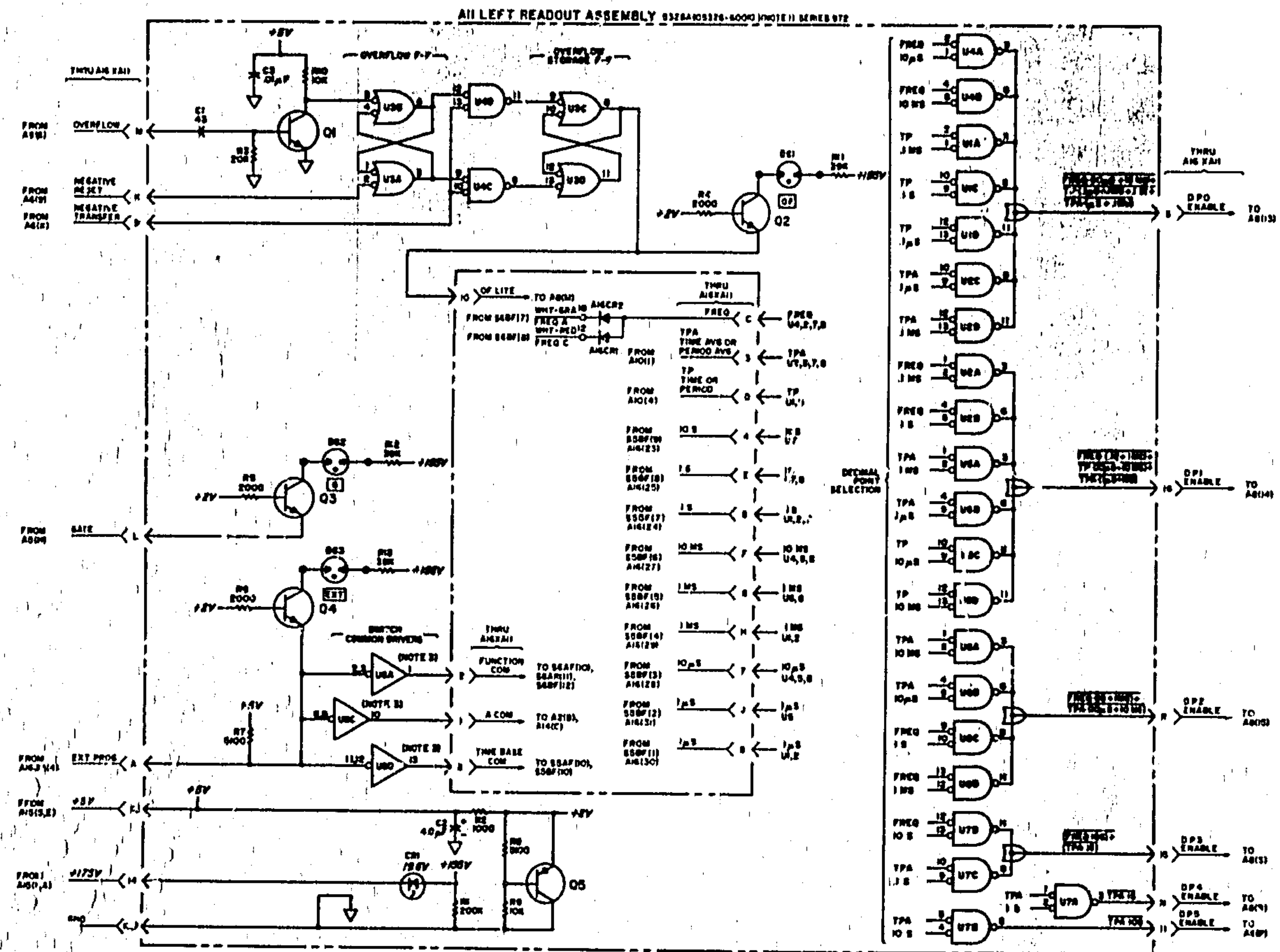
Select the specific function mode and time base combination that is faulty. Check the gate that is common to the two lines. Refer to Table 5-5 for the proper annunciator lighting conditions.

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.


U
J H F
A
DS2
DS1
DS3


OVERFLOW FF
Q1, U3, U4
M
OF
L
Q3
G
A
U4
EXT
U6
SWITCH
C MMON DRIVERS
B
DECIMAL POINT
SELECTION GATES
U1, 2, 4, 5,
7, 8
DECIMAL POINT
ENABLE LINES
TO A8
MODE
SWITCH
TIME BASE/
MULTIPLIER
SWITCH



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. OPEN COLLECTOR OUTPUTS

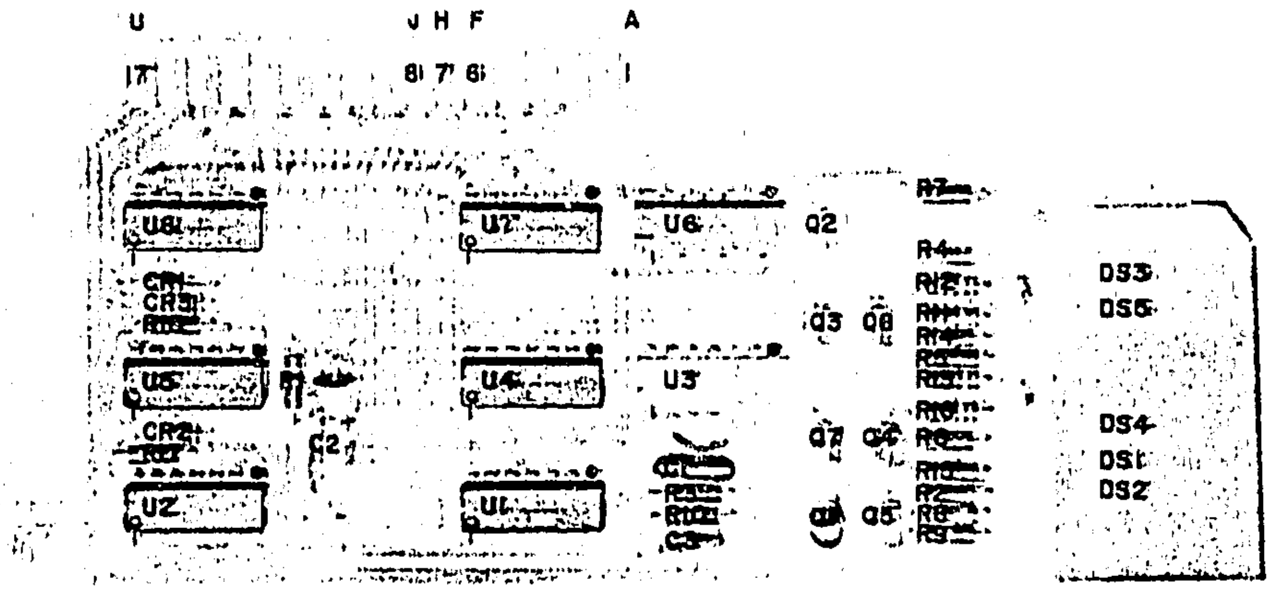
REFERENCE DESIGNATIONS

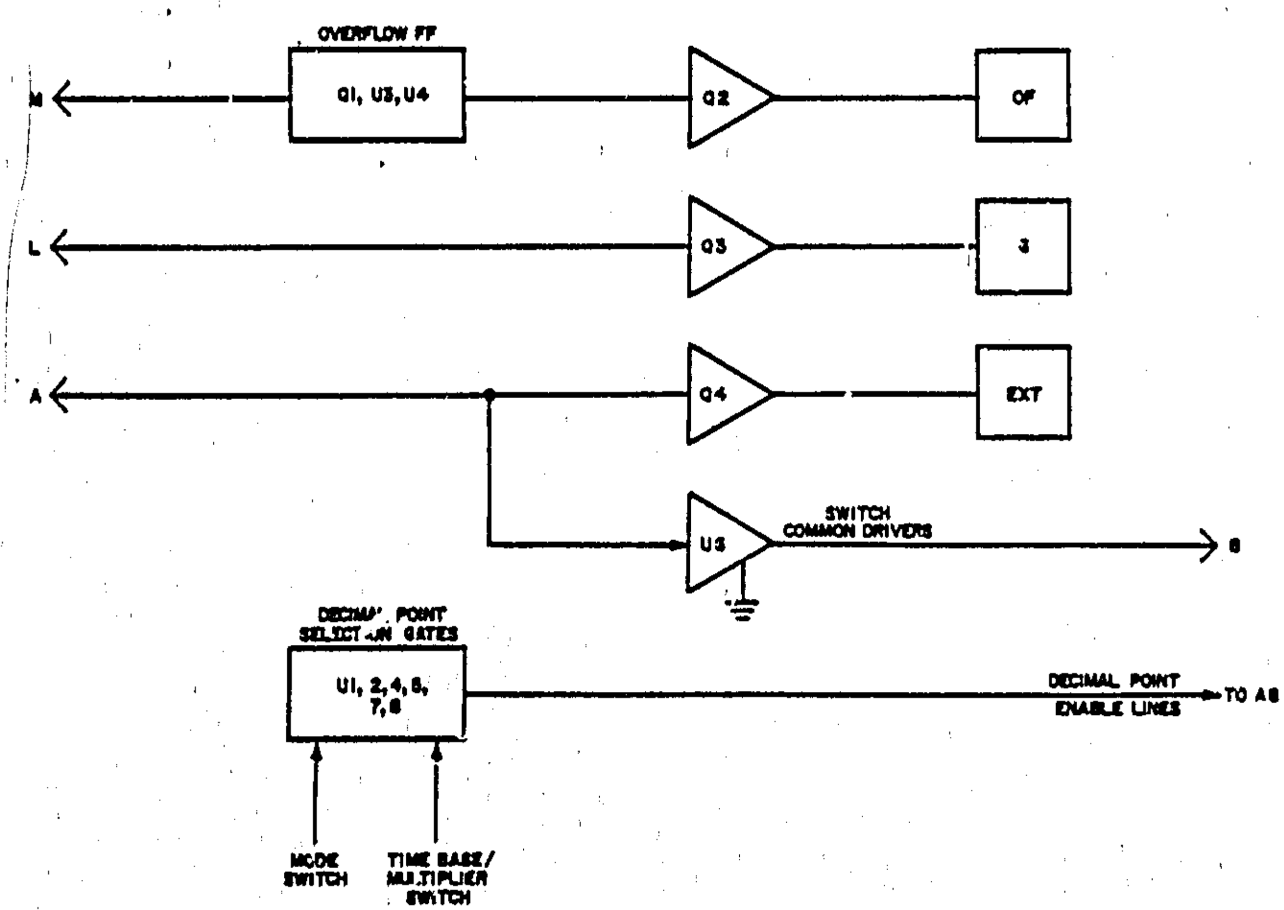
A11	A16
C1-3 CR1-3 DS1-3 Q1-5 R1-13 U1-8	CR1,2

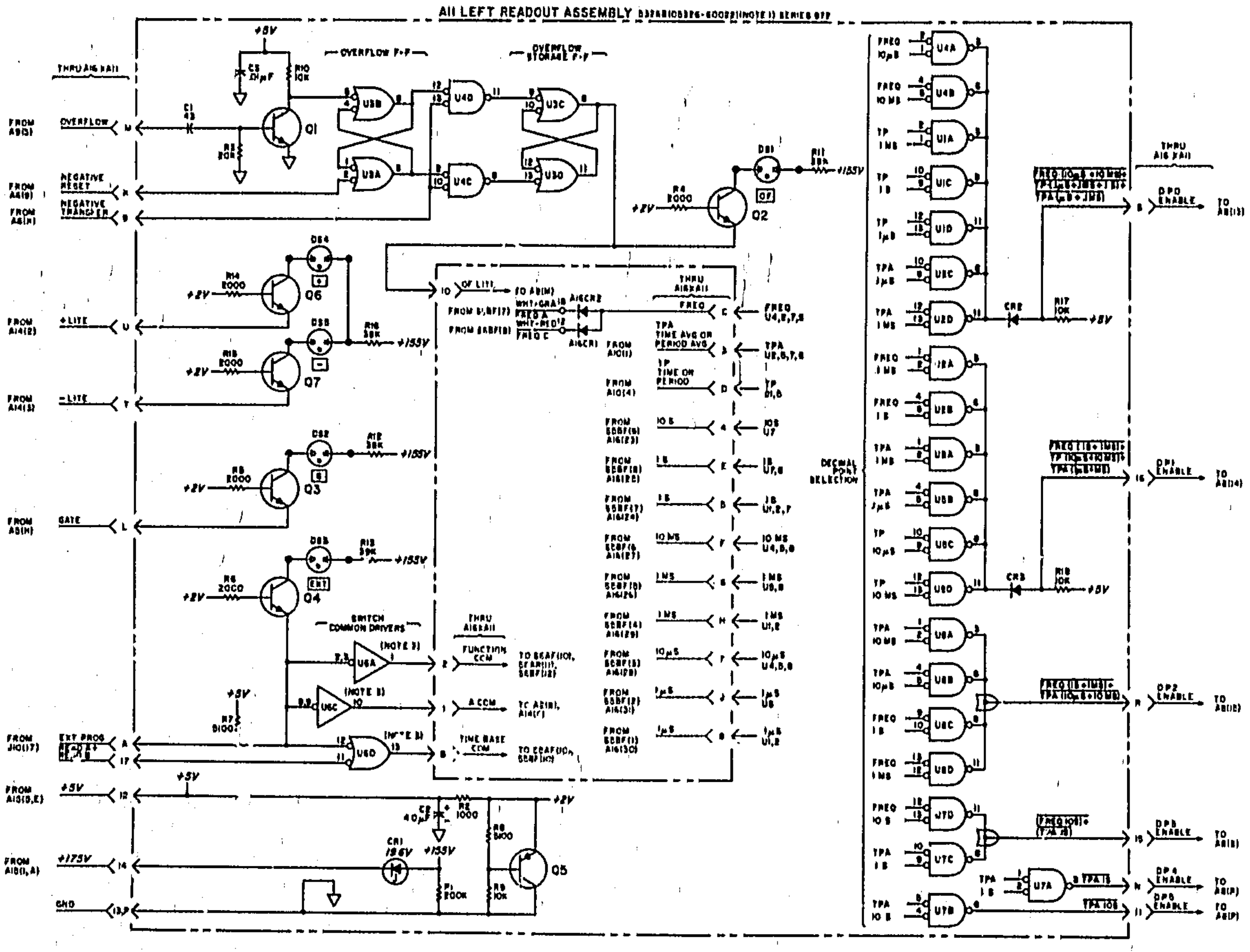
TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A11	
CR1	1902-3234
Q1	1854-0071
Q2-4	1854-0363 EN440
Q5	1853-0020
U1,2,4,5,7,8	1820-0274 MC908P
U3	1820-0054 SN7400N
U6	1820-0327 SN7401N
A16	
CR1,2	1910-0016

Figure 8-17. A11 5326A Left Readout Assembly


U
J H F
A
17
8 7 6
1
U8
U7
U6
Q2
R7
R4
DS3
DS5
CR1
CR3
Q3
Q8
U5
U4
U3
DS4
CR2
C2
Q7
Q4
DS1
DS2
U2
U1
C1
Q5
R2
C3


OVERFLOW FF
Q1, U3, U4
M
Q2
OF
L
Q3
3
A
Q4
EXT
U3
SWITCH
COMMON DRIVERS
8
DECIMAL POINT
SELECTION GATES
U1, 2, 4, 5,
7, 8
DECIMAL POINT
ENABLE LINES
TO A8
MODE
SWITCH
TIME BASE/
MULTIPLIER
SWITCH



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. OPEN COLLECTOR OUTPUTS

REFERENCE DESIGNATIONS

A11	A16
C1-3 CR1-3 DS1-5 Q1-5 R1-18 U1-8	CR1,2

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A11	
CR1	1902-3234
Q1	1854-0071
Q2-4	1854-0265 2N4410
C5	1853-0020
U1,2,4,5,7,8	1820-0274 MC1808P
U3	1820-0054 SN7400N
U6	1820-0327 SN7401N
A16	
CR1,2	1910-0016

Figure 8-18. A11 5326B 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.

A12 TROUBLESHOOTING

Set FUNCTION to DVM, TIME BASE to .1 s and RANGE to 10 V. I assembly is functioning on the 10 V range, go to step 2.

Figure 8-18
A11 5326B LEFT READOUT ASSEMBLY

(See Page 8-27)

1. a) Use a jumper to short Q7A gate to the HI input at R5.

   b) Connect a power supply to the DVM input terminals. Set the power supply to 0 volts, +12 volts and -12 volts. If the proper voltage is displayed, proceed to step 2.

   c) Remove the connection on the DVM inputs and remove A13. Place the jumper on A12 from Q7B gate to ground. Measure the voltage at the sources of Q7A and Q7B. This should be between 0.5 V and 3.5 V.

   d) Measure the voltage drop across R29 and R31. This should be within about 10% of 50 mV and 100 mV, respectively. If not, check the constant current sources.

   e) Measure the voltage at the drain of Q7A and Q7B. This should be between 6.2 V and 7.0 V. If not, check the bootstrap drain supply.

   f) Measure the voltage difference between Q7A and Q7B sources. If greater than 50 mV, replace Q7.

   g) Remove the jumper and install A13. Check the reading and adjust the zero pot on A12 for zero display.

   h) If zero display is not possible, measure the voltage across R34. If this is greater than 1 mV, suspect Q7.

   i) Measure the voltage between U1(2) and U1(3). If greater than 10 mV, U1 is probably defective.

   j) Connect +12 V and -12 V to the DVM input terminals. If the two readings are not correct, measure the voltage between U1(2) and U1(3). If greater than 10 mV, replace U1.

   k) Disconnect power supply and short DVM input terminals. If zero reading is drifting, monitor the voltage between U1(2) and U1(3). If drifting, replace U1.

2. a) Remove any jumper remaining on the board. Set RANGE switch to 10 V. Short the DVM input terminals.

   b) Vary the Channel A and Channel B Level pots. The display should stay zero. If not, check relay K5 and K6.

   c) Connect 10 V to the DVM terminals. If display is drifting, K1 is open. If the display is 5.25 V, K3 or K4 is shorted.

   d) Set RANGE switch to 100 V. If display is drifting, K3 is open. If reading is 5.5 V, K1 is shorted.

   e) Set RANGE switch to 1000 V. If reading is not correct, check K4.

   f) Connect 1000 V to DVM input terminals. If display is over-ranging, K1 is breaking down.

CAUTION

USE ADEQUATE PRECAUTIONS WHEN PERFORMING ABOVE STEPS.

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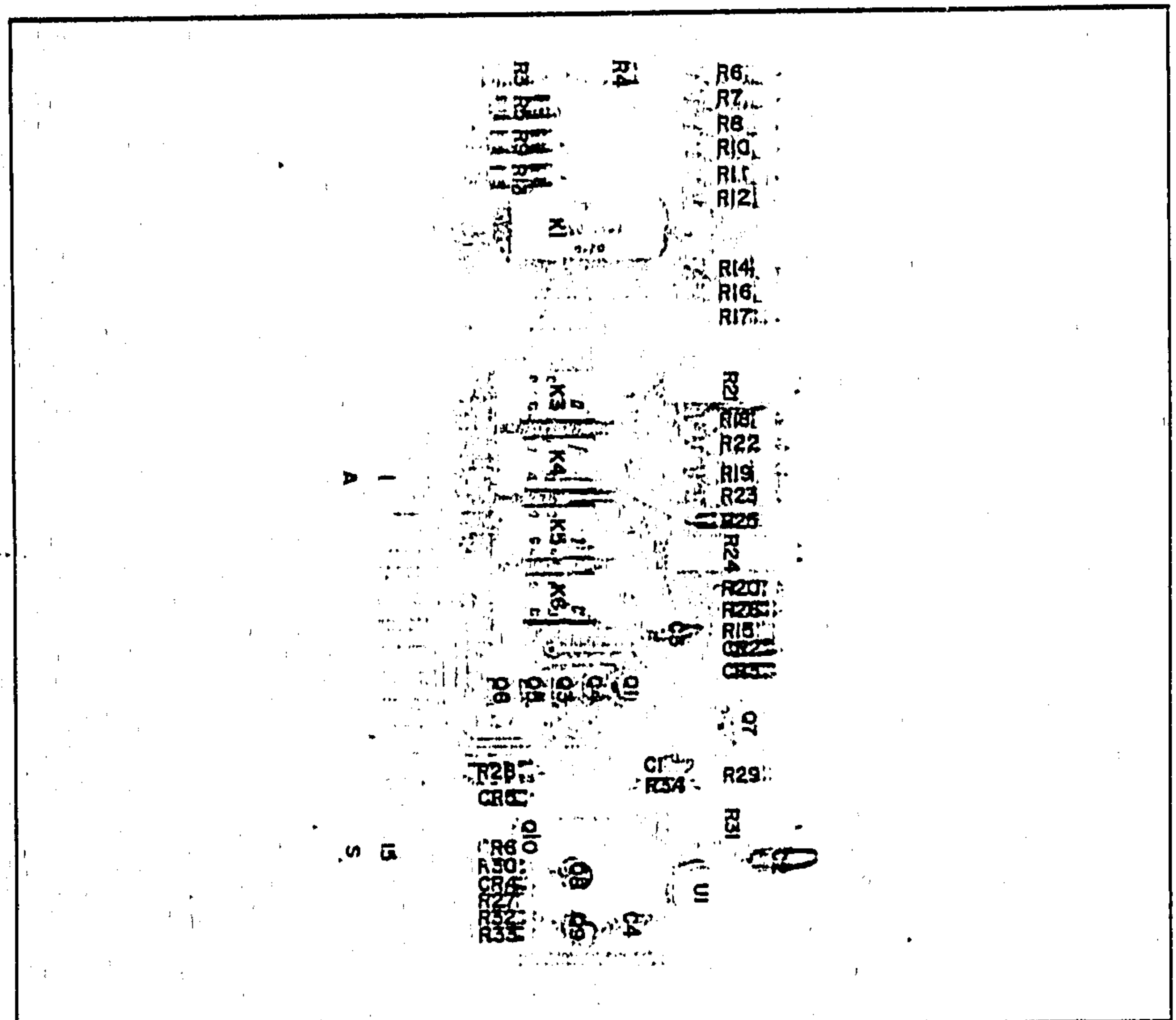
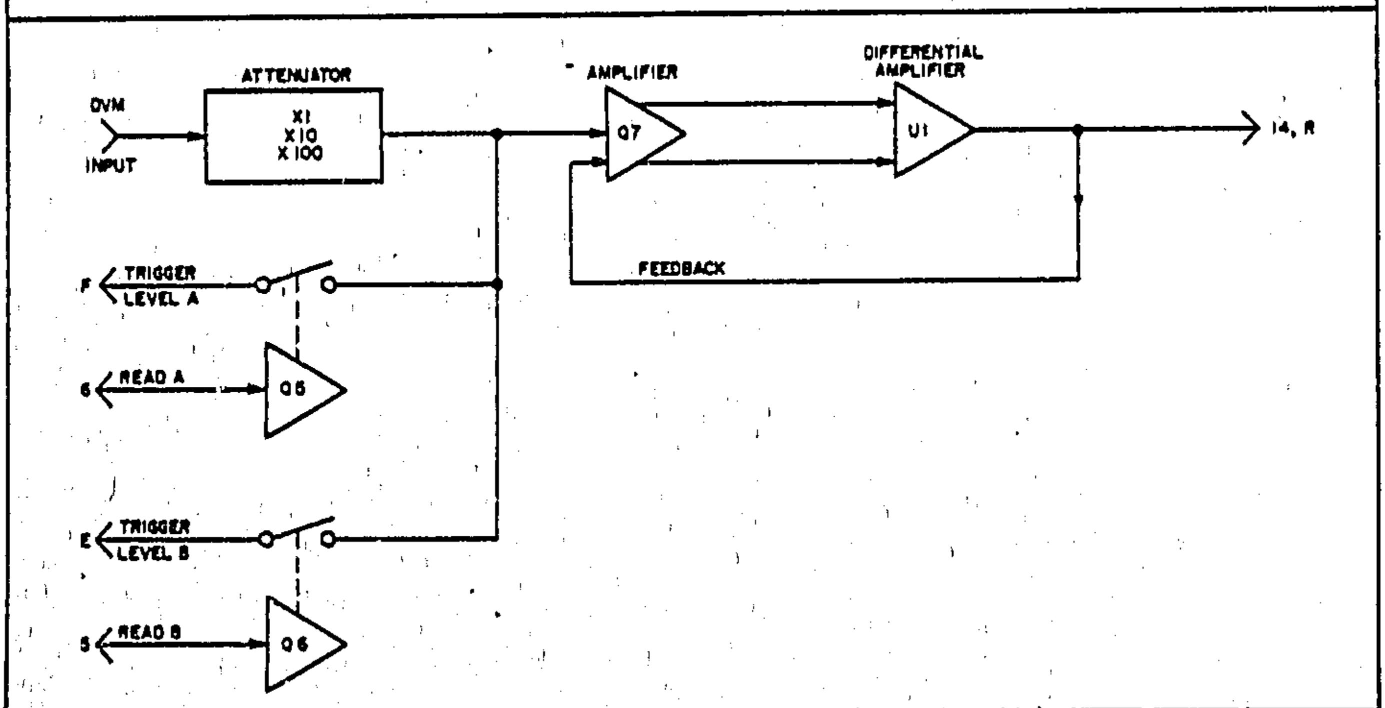
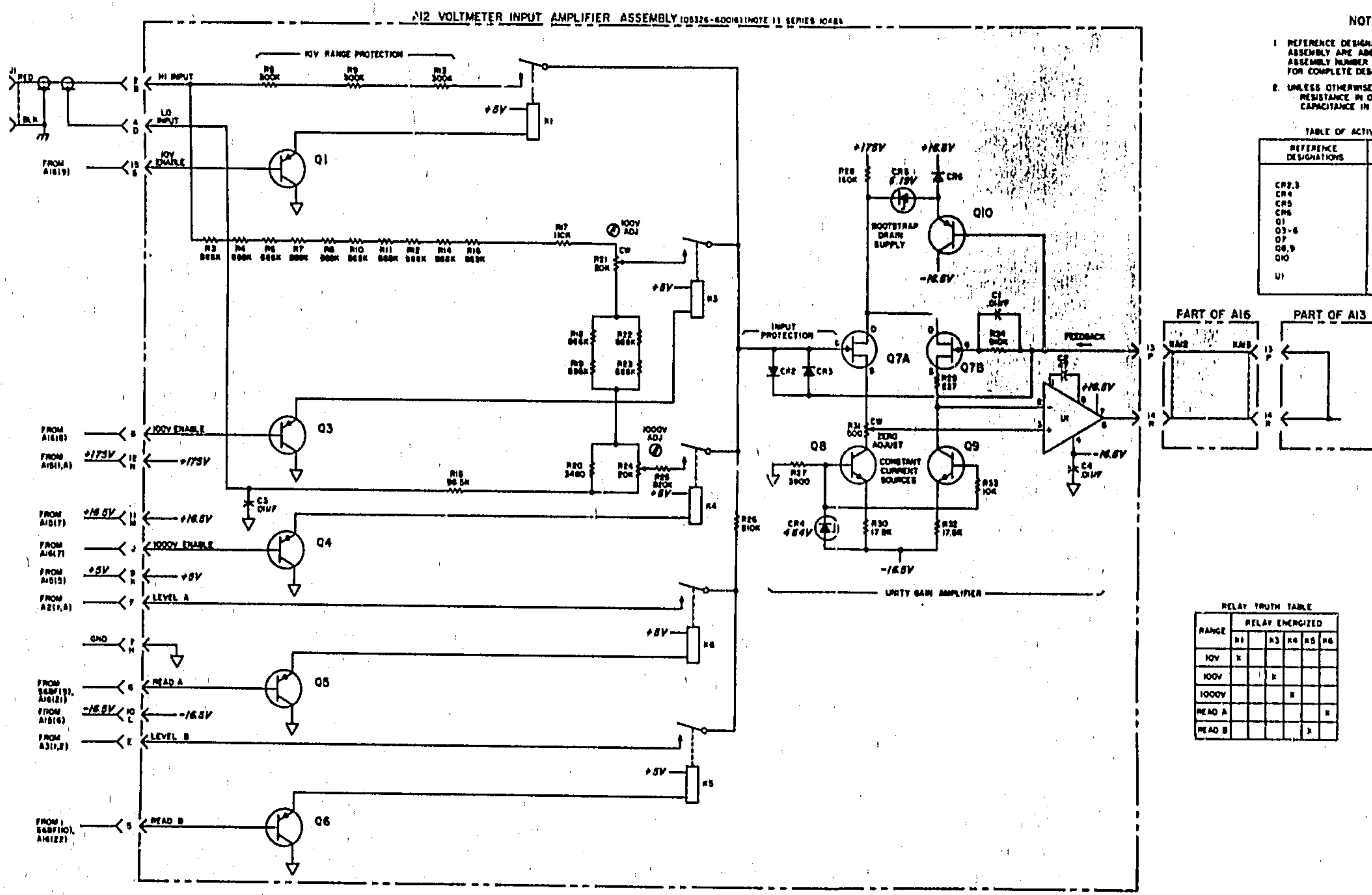


R4
R6
R7
R8
R10
R12
K1
R14
R16
R17
R21
R18
R22
R19
R23
R25
R24
R20
R26
R15
K3
K4
K5
K6
A
Q7
R28
C1
R34
R29
R31
U1
R30
R27
R33
S



DVM
INPUT
ATTENUATOR
X1
X10
X100
AMPLIFIER
Q7
DIFFERENTIAL
AMPLIFIER
U1
14, R
FEEDBACK
F
TRIGGER
LEVEL A
6
READ A
Q5
E
TRIGGER
LEVEL B
5
READ B
Q6

AP4...



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	1820-0223 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
J1	C1-4 CR2-6 K1,3-6 Q1,3-10 R3-34 U1

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

Figure 8-19. 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 CR4 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.

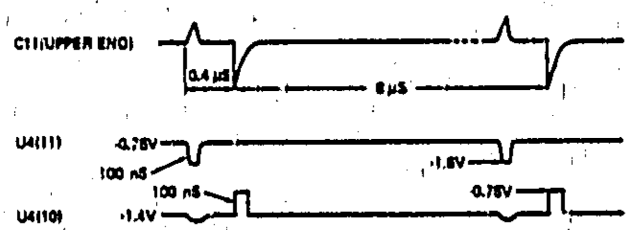
U6B and U5B control the positive reference current in much the same way as U6A and U5A to evaluate input signals with a positive polarity. U7B and C detect polarity and Q10 translates the output of U7B to DTL levels. Q10 is conducting for negative polarity.

A13 TROUBLESHOOTING

If assembly has nonlinearity on one polarity, go to step 4. If DVM drifts, go to step 5.

1. a) Short out C8 and measure the voltage at Q3 and Q4 sources. Q3 source should be between +9.8 V and +11 V. Q4 source should be between -9.8 V and -11 V.

   b) Check the waveform at U4(10) and U4(11), syncing the scope from the upper end of C11 (junction with R23).



If these waveforms are incorrect, check U4C and U4D. If the waveform at C11 is wrong, check U8.

   c) Test the digital part of the assembly by first shorting out CR9 and then CR10. Check the voltage at the test points shown below.

	U5(2)	U5(13)	Q8 Col.	Q9 Col.	Readout
CR9 jumpered	-0.75	-1.6	+1	+1.6	-12.500
CR10 jumpered	-1.6	-0.75	-0.7	-0.7	+12.500

   d) If U5(2) and U5(13) are correct, proceed to step e. If not, check these additional test points.

	U4(3)	U4(4)	U6(1)	U6(13)
CR9 jumpered	-0.75	-0.75	-0.75	-0.75
CR10 jumpered	-1.6	-1.6	-1.6	-1.6

   e) If the above checks are correct, but the readout is incorrect, suspect U7.

   f) If U6(1) and U6(13) are wrong, check Q7, Q9, and Q6, Q8 respectively, plus diodes CR5 through CR8.

2. Reference current source check.

   a. C8 should still be jumpered. Measure the voltages across CR1 and CR4. These should be between 5.9 V and 6.5 V. If incorrect, measure across R1 and R4. This should be between 10 and 12.5 V.

   If incorrect, check the reference supply and reference diodes.

   b. Measure the voltage (to ground) at Q3 and Q4 sources and gates.

FET	Source	Gate
Q3	+9.8 to +11.0	+10 to +14
Q4	-9.8 to -11.0	-10 to -14

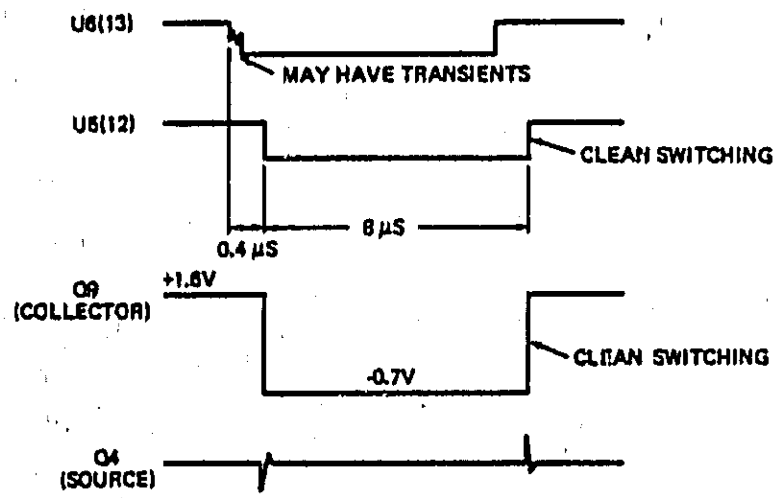
If the voltages are wrong, but about the correct voltage difference exists between the source and gate, check operation amplifier U1 or U2. Otherwise suspect the FET.

3. a) Remove the jumper from C8. If DVM still does not operate, check the integrator or CR5 through CR8.

   b) Measure the voltage at U3(2) and U3(3). If less than 20 mV, suspect U3.

Figure 8-19
A12 VOLTMETER INPUT AMPLIFIER ASSEMBLY
(See Page 8-39)

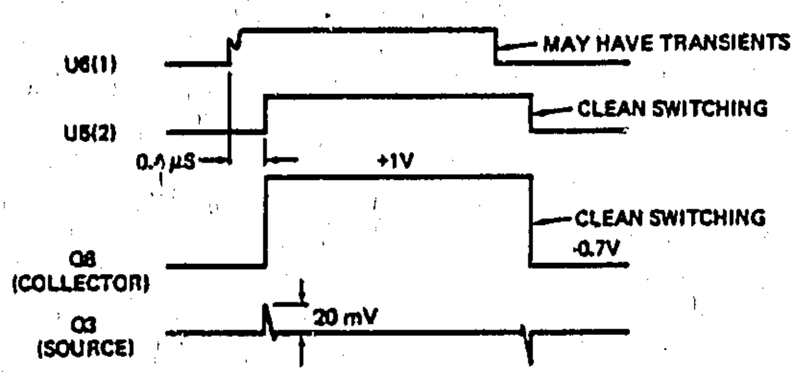
4. **Positive nonlinearity.** If nonlinearity exists when measuring positive voltages, connect +6.25 V to the DVM input and check the waveforms drawn below for switching transients.



Check the parts that are generating the first wrong waveform. If the waveforms are correct, check diodes CR5, CR6, CR7, CR8, CR12, and CR13.

5. **Negative nonlinearity**

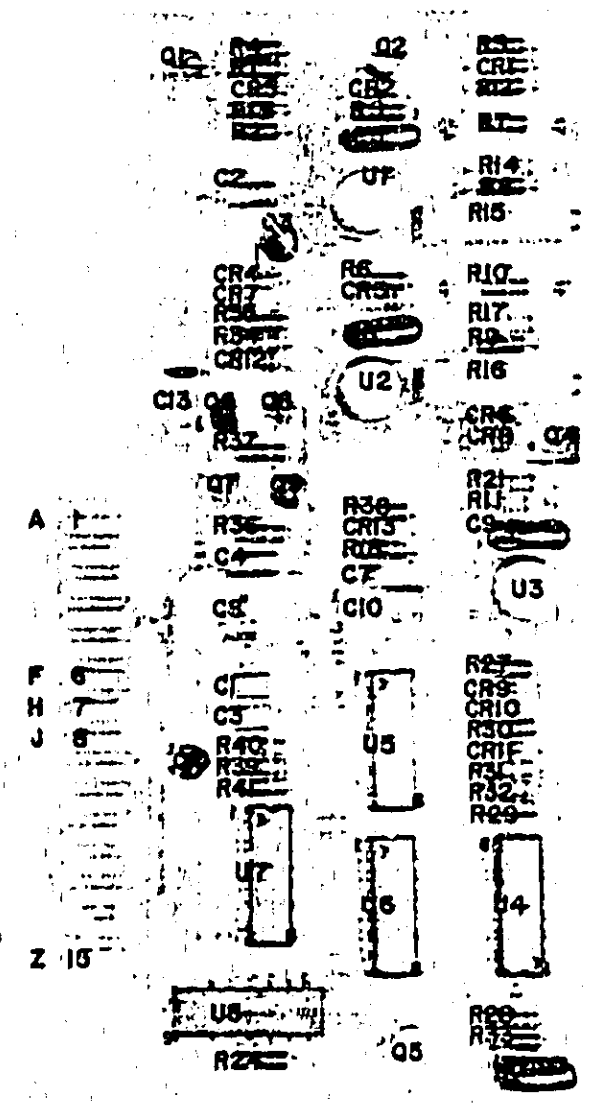
If nonlinearity exists while measuring negative voltages, connect -6.25 V to the DVM terminals and check the waveforms drawn below for switching transients.

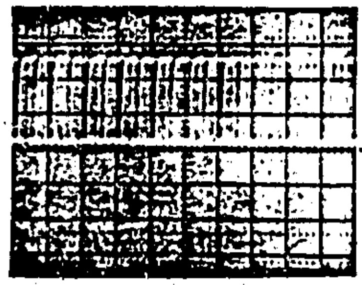


6. **Excessive Drift**

For excessive drift after turn-on or after aging, check for the components that are drifting, using another DVM.

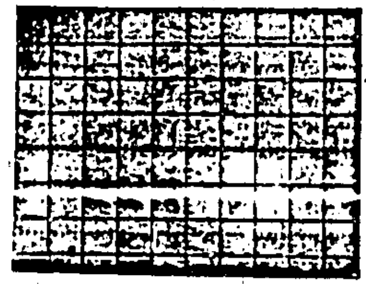
MORE DATA UNDER THIS FOLD





U8(9)
.1 V/cm
2 μs/cm

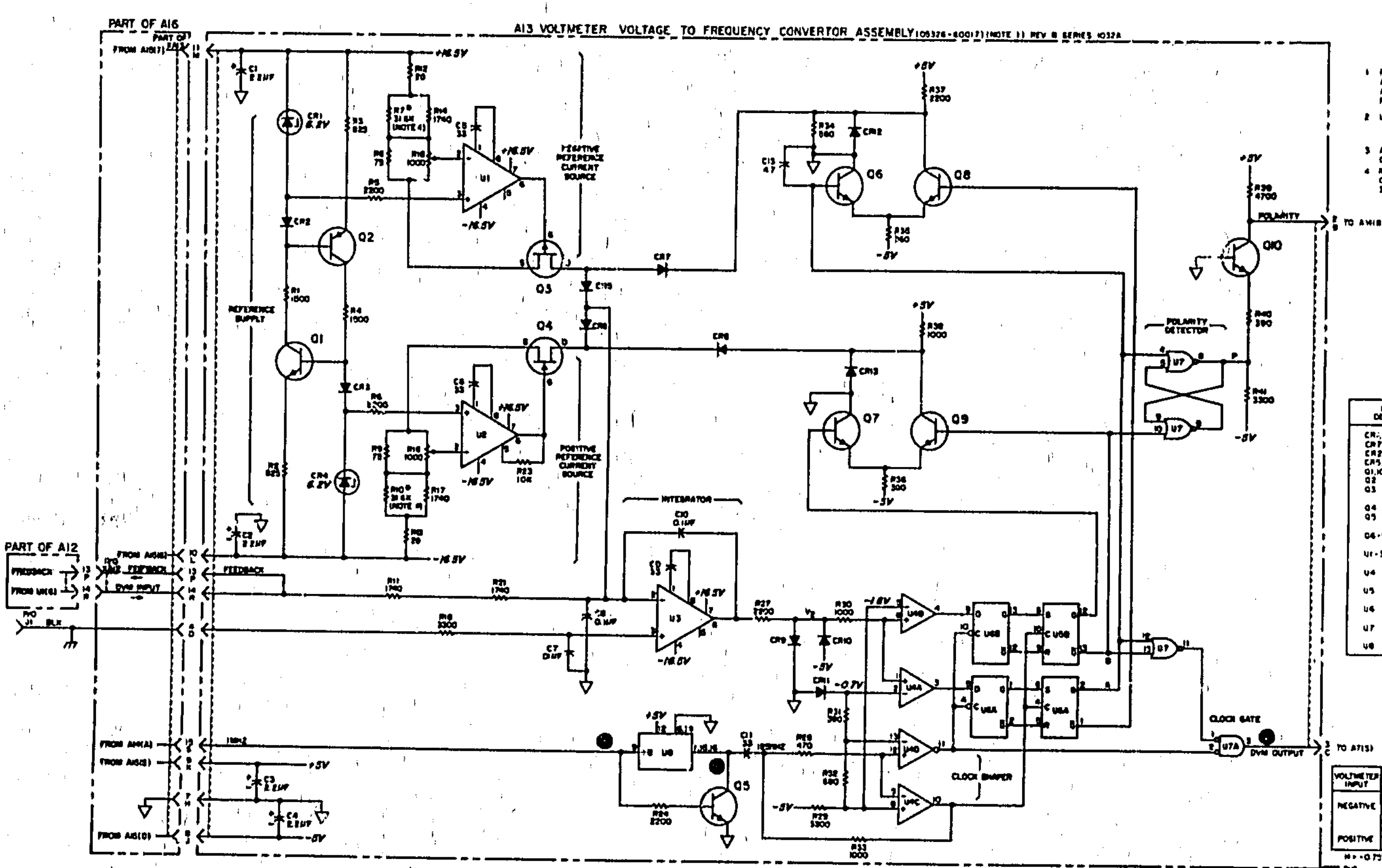
Q5 Collector
.2 V/cm
5 μs/cm



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



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 VALUES SHOWN
4. R7 AND R10 ARE SELECTED FROM ONE OF THE FOLLOWING FOUR VALUES: 31.6K, 61.9K, 196K OR OPEN

REFERENCE DESIGNATIONS

NO PREFIX	A13
J1	C1-11,13 CR1-19 Q1-10 R1-41 U1-8

C12 DELETED
R19,20,22,23,25,26 DELETED

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,4	1902-0480
CR7	1901-0535
CR2,3,9-11	1901-0040
CR5,6,8,12,13	1901-0179
Q1,10	1854-0071
Q2	1851-0020
Q3	1855-0056 2N4342
Q4	1855-0081
Q5	1854-0009 2N709
Q6-9	1854-0092 2N3563
U1-3	1820-1223 MC14399
U4	1820-0912 MC1020P
U5	1820-0913 MC10101P
U6	1820-0276 MC1033P
U7	1820-0145 MC1010P
U8	1820-0209

TRUTH TABLE

VOLTMETER INPUT	V2 = OUTPUT OF OP AMP U2(6)	AFTER CLOCK PULSE A	B	P
NEGATIVE	$V_2 > -0.7V$	H	L	L
	$-0.7V > V_2 > -1.3V$	L	L	PREVIOUS STATE
POSITIVE	$-1.8V > V_2$	L	H	H

H = -0.75V, L = -1.60V

Figure 8-20. A13 Voltmeter V to F Converter Assembly

A15-A16 POWER SUPPLY OPERATION

The power supply provides +175 V, +16.5 V and +5 V. Transformer T1 has a 115/220 V 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 aseries pass regulator. A constant reference voltage is developed across CR11 and CR12 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 and 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.

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.

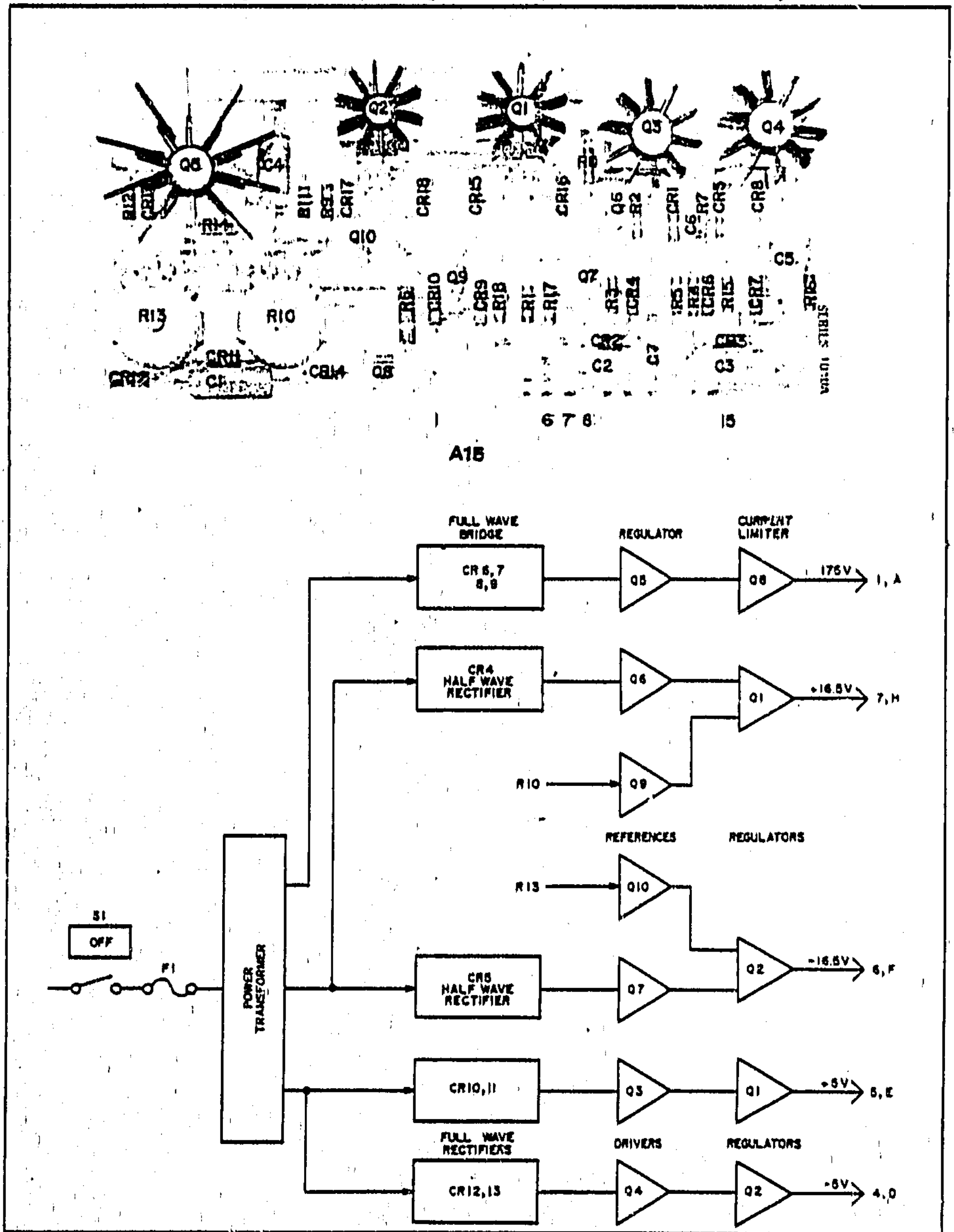
Note that the 16.5 V supply is needed for operation of the 5 V supply. If the + or -16.5 V supply fails, the corresponding 5 V supply will be inoperative.

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

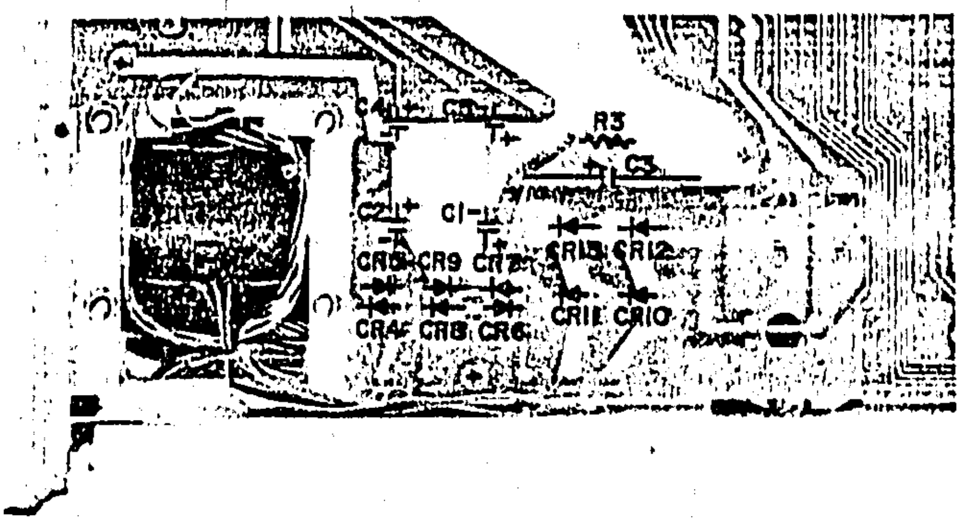
See introduction to this section for ordering information

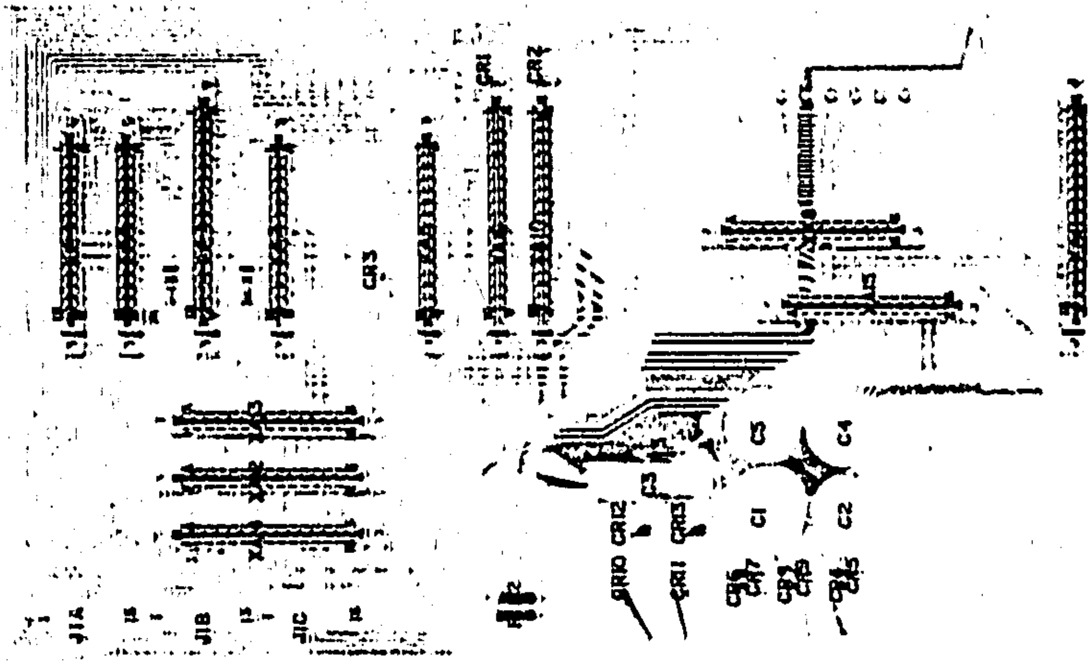
Figure 8-20
A13 VOLTMETER V TO F CONVERTER ASSEMBLY
(See Page 8-43)

Part of Figure 8-21. A15, A16 Regulator Board, Interconnect Board Assembly

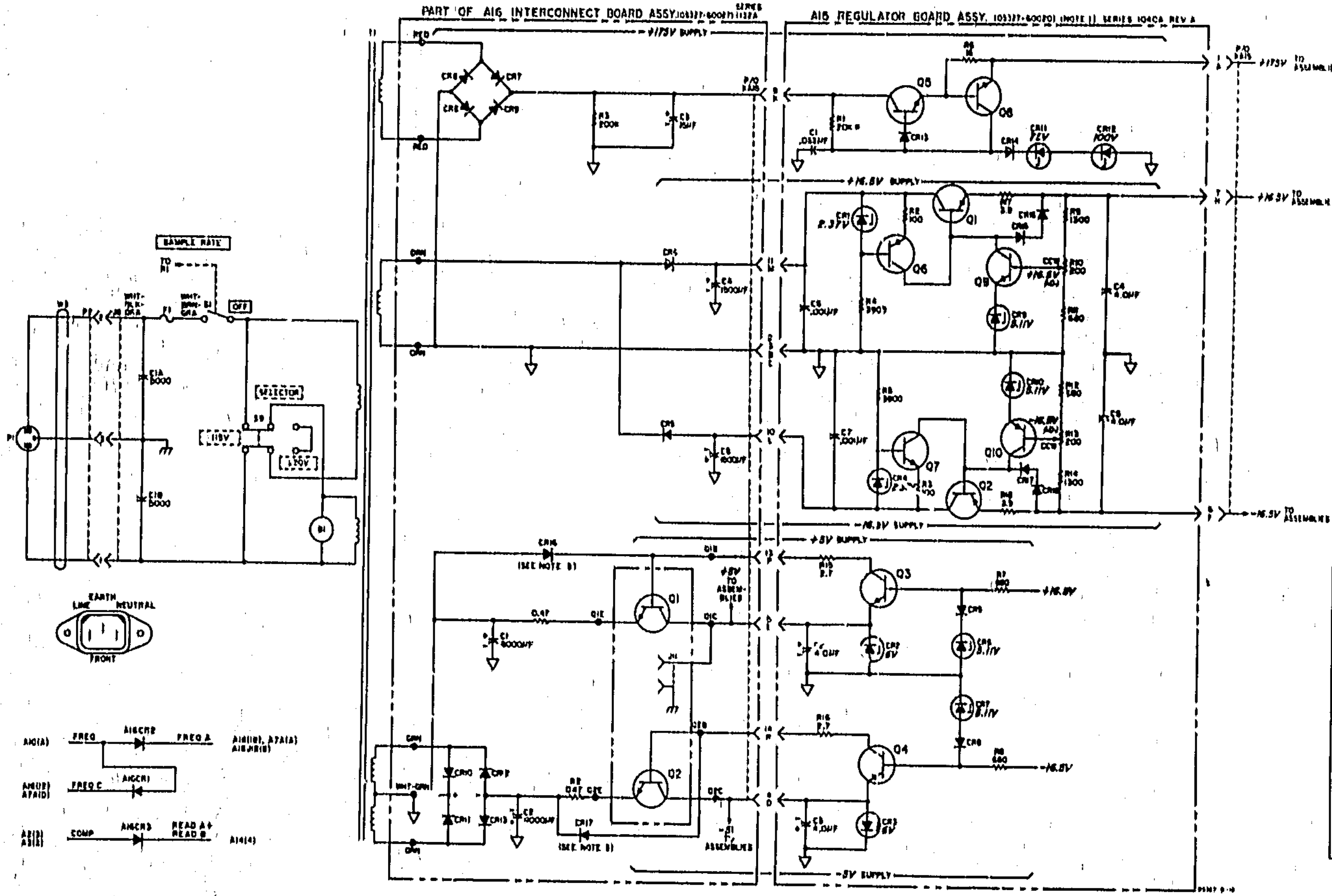


MORE DATA UNDER THIS FOLD





A16



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. A15 Q1-5 HAVE HEAT SINK.
4. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.
5. CR16 AND CR17 ARE 3-JUNCTION SILICON DIODES.

REFERENCE DESIGNATIONS

NO PREFIX	A15	A16
B1 C1 F1 J8, J11 P7 Q1,2 S1,9 T1 W3	C1-7 CR1-18 Q1-10 R1-18	C1-5 CR4-13, 16,17 R1-3

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
NO PREFIX	
Q1	1853-0233
Q2	1854-0420
A15	
CR1,4	1902-3002
CR2,3	1902-0551
CR5,8,15-18	1901-0040
CR6,7,9,10	1902-3094
CR11	1902-3184
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
A16	
CR4,5	1901-0045
CR6-9	1901-0029
CR10-13	1901-0418
CR16,17	1901-0460

Figure 8-21. A15 Regulator Board, A16 Interconnect Board Assembly (5326B with Serial Prefix 1124A and above only)

A15-A16 POWER SUPPLY OPERATION

The power supply provides +175 V, +16.5 V and +5 V. Transformer T1 has a 115/220 V 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 CR12 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 Q6 performs the same function as CR11 and 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.

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.

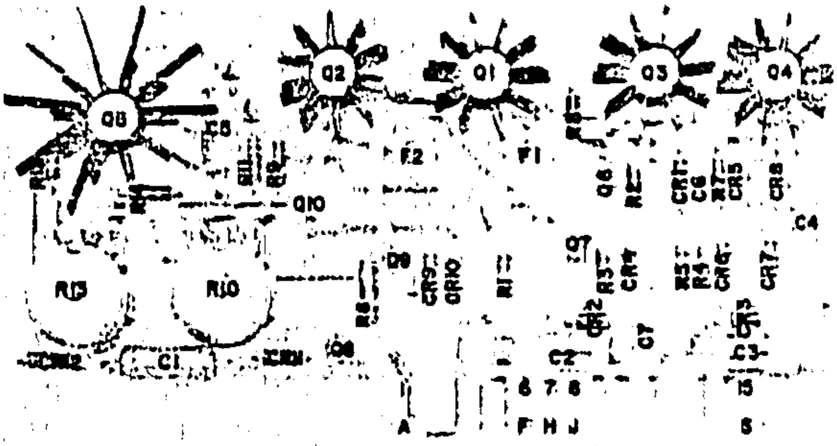
CR1 clamps the output at 6 V to provide protection for the IC's in case the 16.5 V or 175 V line should momentarily short to the 5 V line. CR5 provides thermal compensation for Q3.

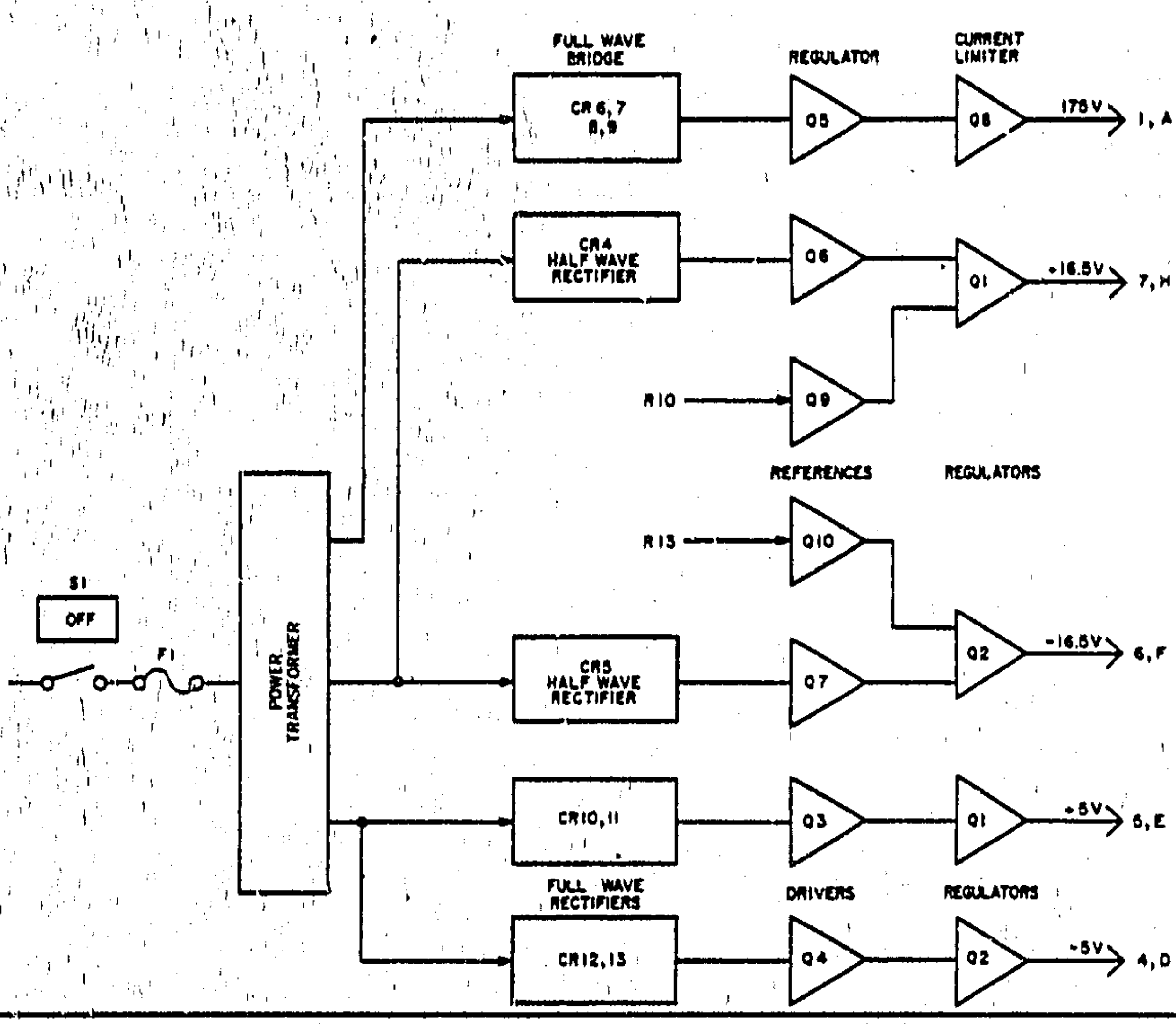
Note that the 16.5 V supply is needed for operation of the 5 V supply. If the + or -16.5 V supply fails, the corresponding 5 V supply will be inoperative.

Figure 8-21
A15 REGULATOR BOARD,
A16 INTERCONNECT BOARD ASSEMBLY
(5328B with Serial Prefix 1124A and above only)

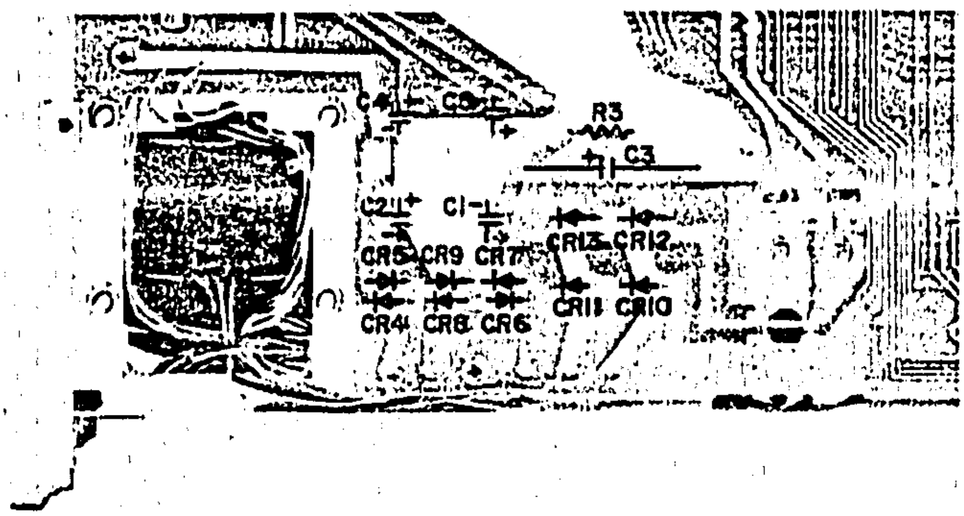
(See Page 8-45)

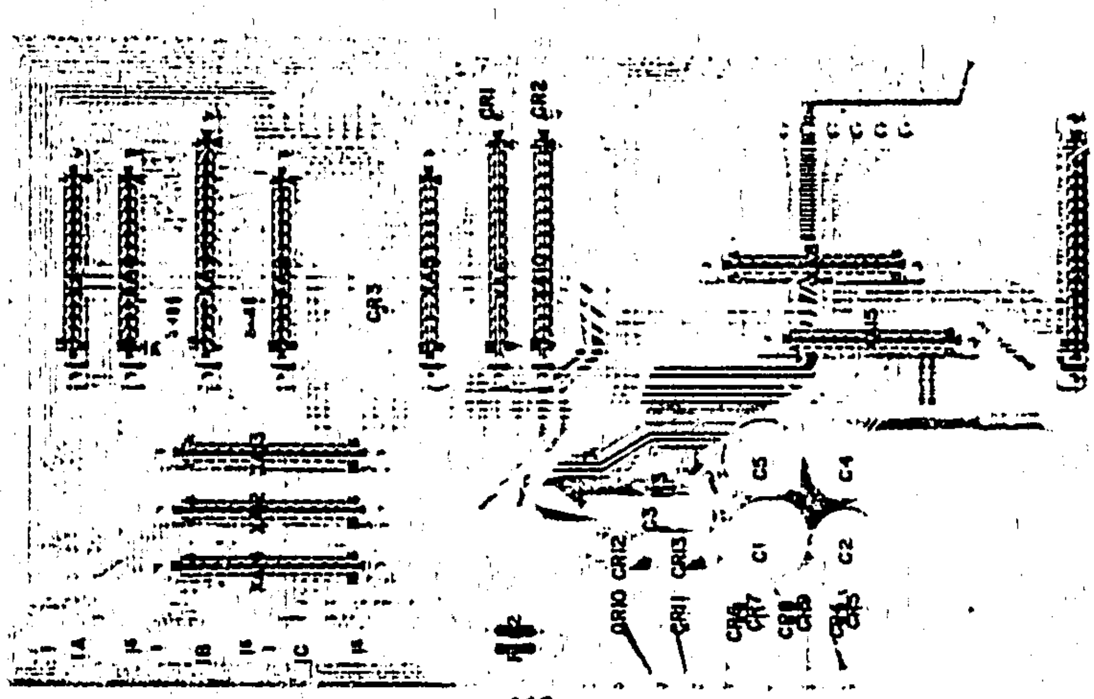
Part of Figure 8-22. A15, A16 Regulator Board, Interconnect Board Assembly



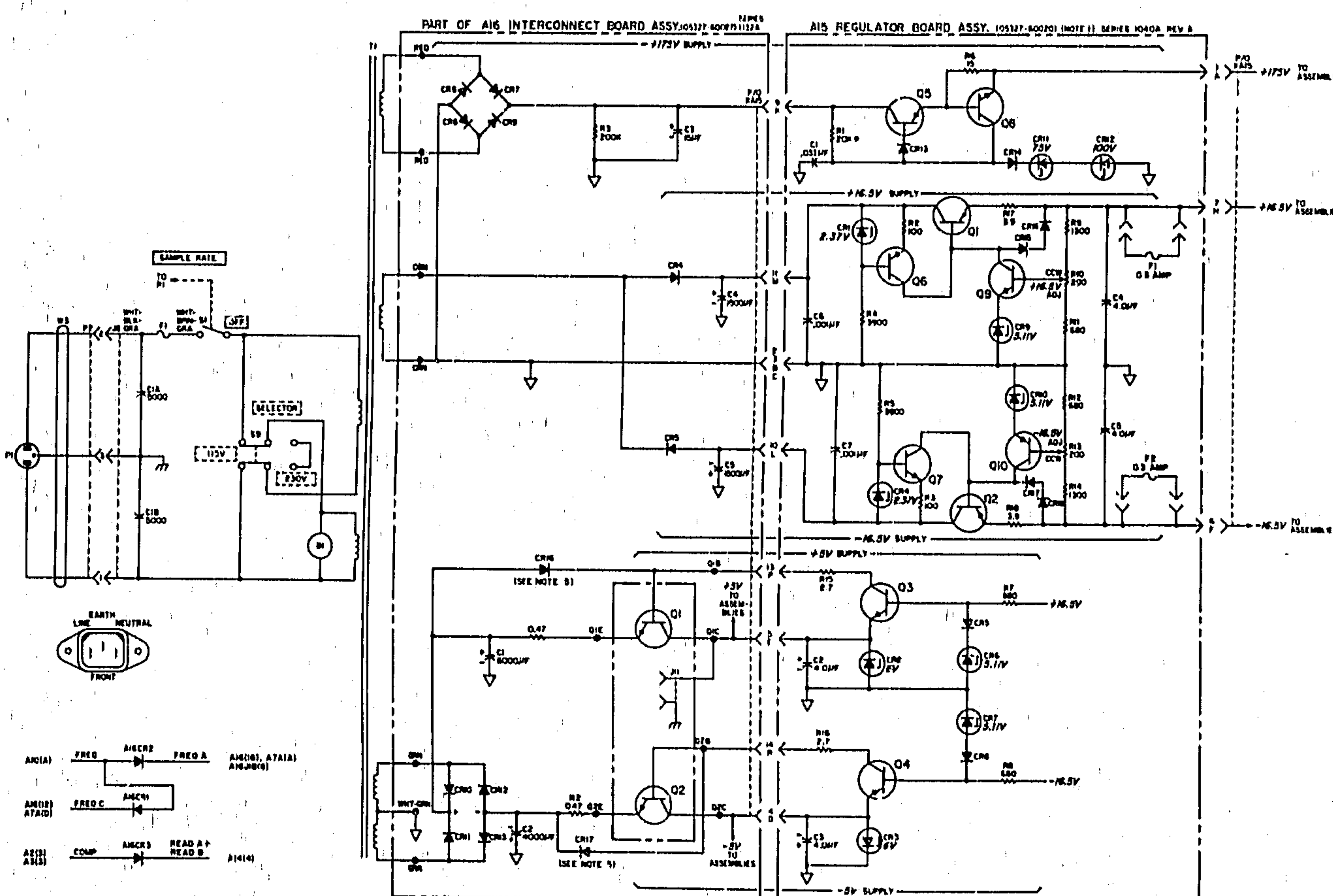


MORE DATA UNDER THIS FOLD





A16



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. A15 Q1-5 HAVE HEAT SINK.
4. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.
5. CR16 AND CR17 ARE 3-JUNCTION SILICON DIODES.

REFERENCE DESIGNATIONS

NO PREFIX	A15	A16
B1		
C1	C1-7	C1-5
	CR1-18	CR4-13, 16,17
	F1,2	
F1		
J8, J11		
P2		
Q1,2	Q1-10	
	R1-18	R1-3
S1,9		
T1		
W3		

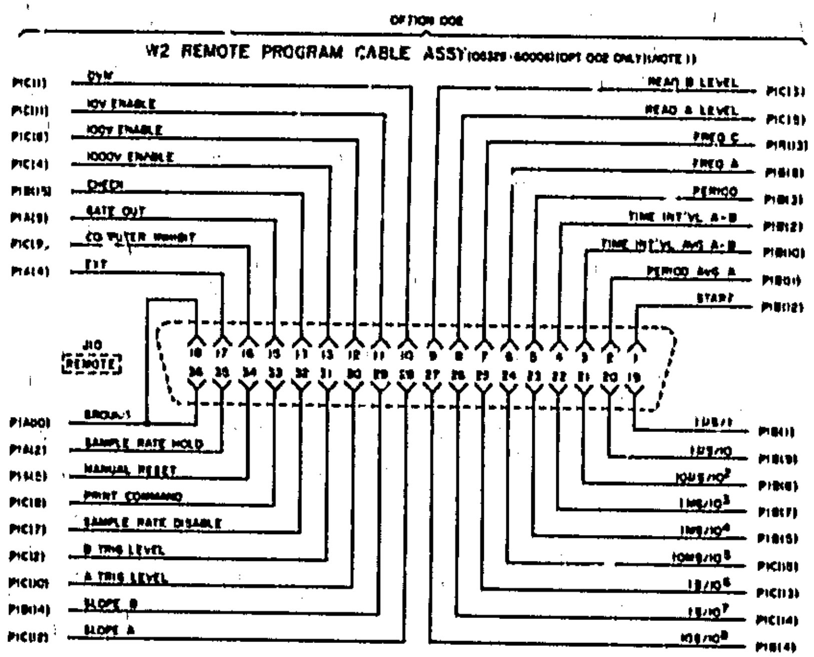
TABLE OF ACTIVE COMPONENTS

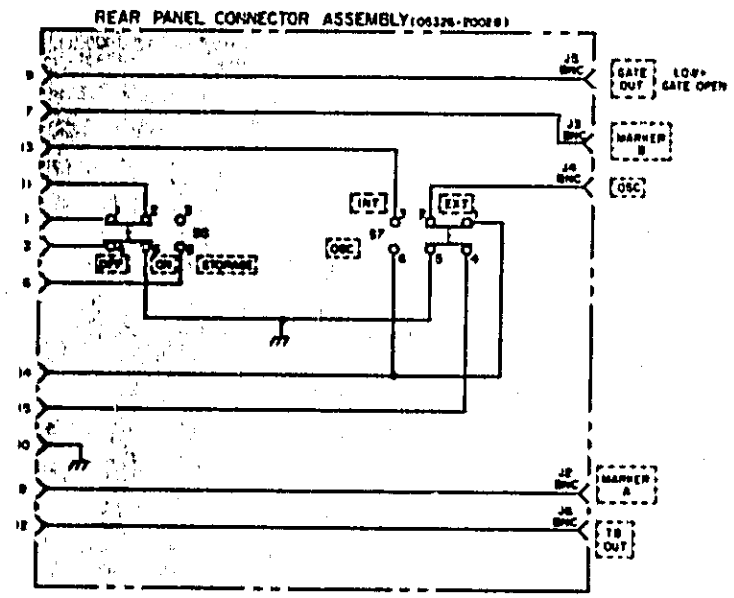
REFERENCE DESIGNATIONS	HP PART NUMBERS
NO PREFIX	
Q1	1853-0233
Q2	1854-0420
A15	
CR1,4	1902-3002
CR2,3	1902-0551
CR5,8,15-18	1901-0040
CR6,7,9,10	1902-3094
CR11	1902-3396
CR12	1902-3429
CR13,14	1901-0033
Q1	1854-0300
Q2	1853-0073
Q3	1854-0039 2N3053
Q4	1853-0012 2N2904A
Q5	1854-0232
Q6,10	1853-0020
Q7,9	1854-0071
Q8	1854-0474
A16	
CR4,5	1901-0045
CR6-9	1901-0029
CR10-13	1901-0415
CR16,17	1901-0460

Figure 8-22. A15 Regulator Board, A16 Interconnect Board Assembly

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Start/Stop	1	BRN	B12	A16(14), A7A(4)	L = Start Open = Stop
Period Avg A	2	RED	B11	A16(13), A7A(C), A10(C)	L = Enable
Time Intvl Avg	3	ORN	B10	A16(16), A7A(3), A10(3), A3(2)	↑
Time Intvl	4	YEL	B2	A16(15), A7A(B), A10(B), A2(2)	
Period	5	GRN	B3	A16(17), A7A(2), A10(2)	
Freq A	6	BLU	B8	A16(18), A7A(A), A16CR2(C)	
Freq C	7	VIO	B13	A16(12), A7A(D), A16CR1(C)	
Read A	8	GRA	C5	A16(21), A12(6), A14(F)	
Read B	9	WHT	C3	A16(22), A12(5), A14(E)	
DVM	10	WHT-BLK	C1	A16(20), A14(A)	
10 V Range	11	WHT-BRN	C11	A16(9), A12(15), A14(8)	
100 V Range	12	WHT-RED	C6	A16(8), A12(8), A14(6)	
1000 V Range	13	WHT-ORN	C4	A16(7), A12(J), A14(5)	
.1 μs/10^0	19	WHT-BLK-BRN	B1	A16(30), A5(E), A10(J), A11(8)	
1 μs/10^1	20	WHT-BLK-RED	B9	A16(31), A5(5), A10(8), A11(J)	
10 μs/10^2	21	WHT-BLK-ORN	B6	A16(28), A5(D), A10(H), A11(7)	
.1 ms/10^3	22	WHT-BLK-YEL	B7	A16(29), A5(4), A10(7), A11(H)	
1 ms/10^4	23	WHT-BLK-GRN	B5	A16(26), A5(C), A10(F), A11(6)	
10 ms/10^5	24	WHT-BLK-BLU	C15	A16(27), A5(3), A10(6), A14(N), A11(F)	
.1 s/10^6	25	WHT-BLK-VIO	C13	A16(24), A5(B), A10(E), A14(S), A11(5)	
1 s/10^7	26	WHT-BLK-GRA	C14	A16(25), A5(2), A10(5), A14(7), A11(E)	↓
10 s/10^8	27	WHT-BRN-RED	B4	A16(23), A5(A), A10(D), A11(4)	L = Enable
Slope A	28	WHT-BRN-ORN	C12	A2(13)	L = Minus Open = Plus
Slope B	29	WHT-BRN-YEL	B14	A3(13)	L = Minus Open = Plus
Level A	30	WHT-BRN-GRN	C10	A2(1), A12(F)	+3 to -3 V x Atten = Trig Level
Level B	31	WHT-BRN-BLU	C2	A3(1), A12(E)	+3 to -3 V x Atten = Trig Level
Sample Rate Disable	32	WHT-BRN-VIO	C7	A6(10), S6	L = Inhibit Sample Rate
Print Command	33	WHT-BRN-GRA	C8	A6(S), J9(48)	L = Causes Print
Reset	34	WHT-RED-ORN	A5	A16(6), A6(3)	L = Reset
Hold	35	WHT-RED-YEL	A2	A10(4), A6(1)	L = Maintain Display
Int/Ext	17	WHT-VIO	A4	A11(A)	Open = Int L = Ext
Computer Inhibit	16	WHT-BLU	C9	A6(14)	L = Inhibits Counter
Gate Out	15	WHT-GRN	A9	A5(F)	H = Gate Closed L = Gate Open
Check	14	WHT-YEL	B15	A3(B)	L = Check
Ground	18, 36	BLK	A10	GROUND	

Logic Levels (Input) H > +2.0 V, L < +0.8 V
Logic Levels (Output) H > +2.4 V, L < +0.4 V





1 IN STANDARD INSTRUMENT, ONLY W2P1A IS WIRED

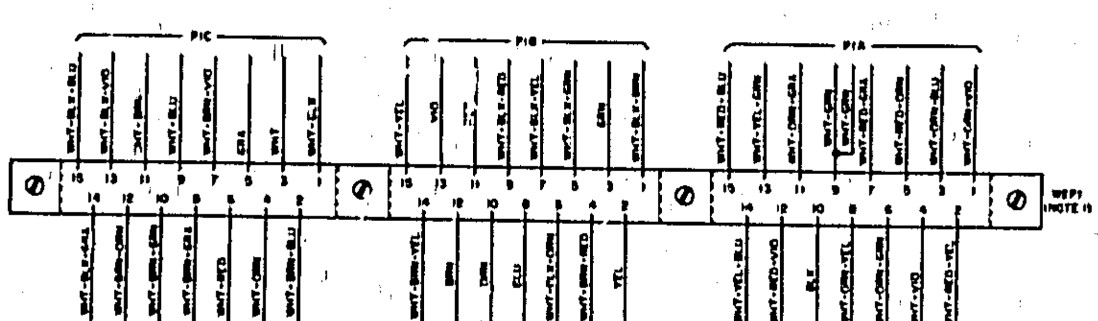


Figure 8-23. W2 Remote Program Cable Assembly, Rear Panel Connector

DIGITAL RECORDER OUTPUT — OPTION 003

Option 003 includes cable assembly W1 and rear panel connector J9. The counter provides +8421 BCD and control line inputs and outputs for use with a printer or other date storage devices.

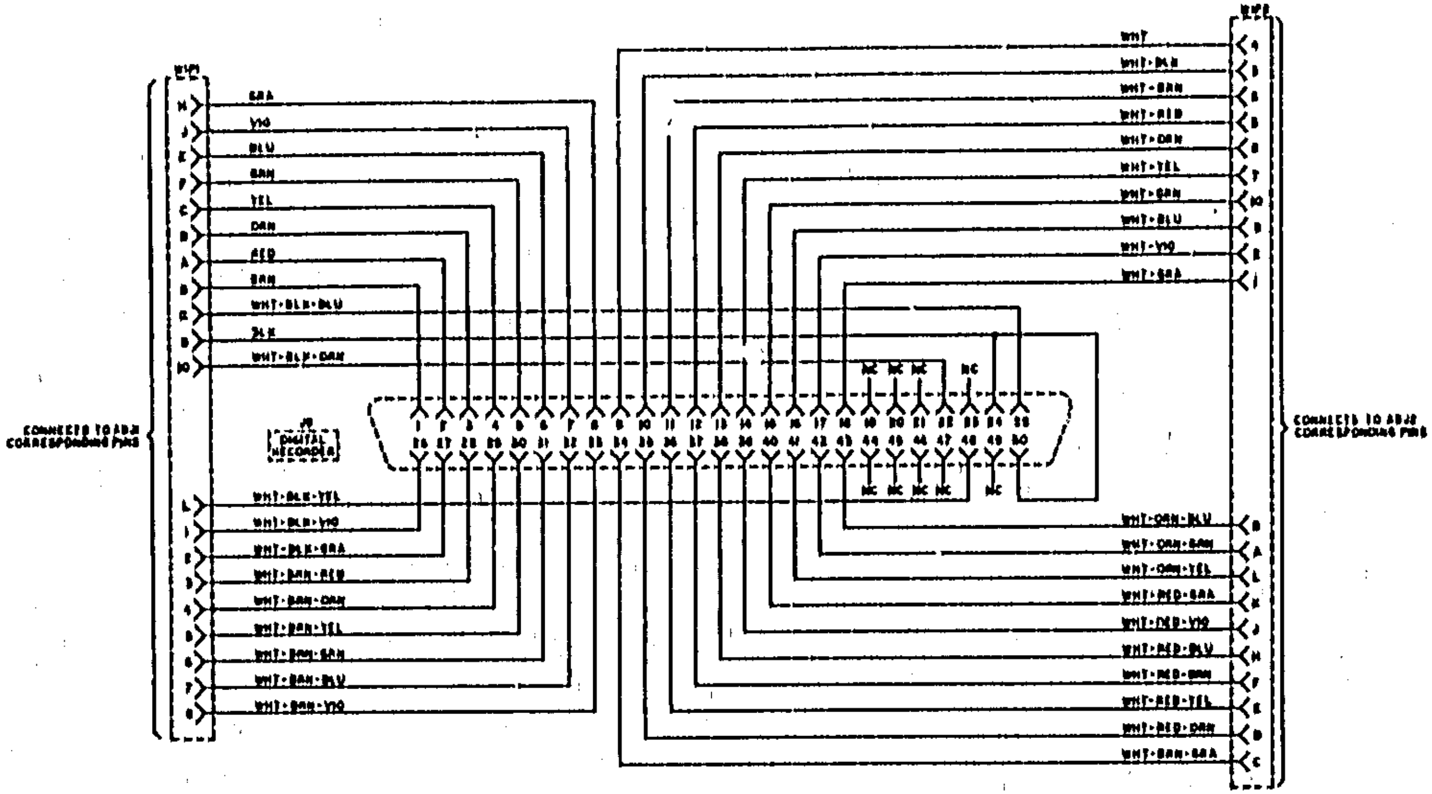
The annunciator lines (J9-17, 18, 42, and 43) supply overflow, plus, and minus outputs as follows:

FUNCTION	BCD				
	8	4	2	1	
Overflow	L	L	L	L	
+	H	H	L	L	5326B Only
-	H	H	L	H	5326B Only
All Other Times	H	H	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 volt 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).

NOTE

J9 wiring connects to A9 Display Board.



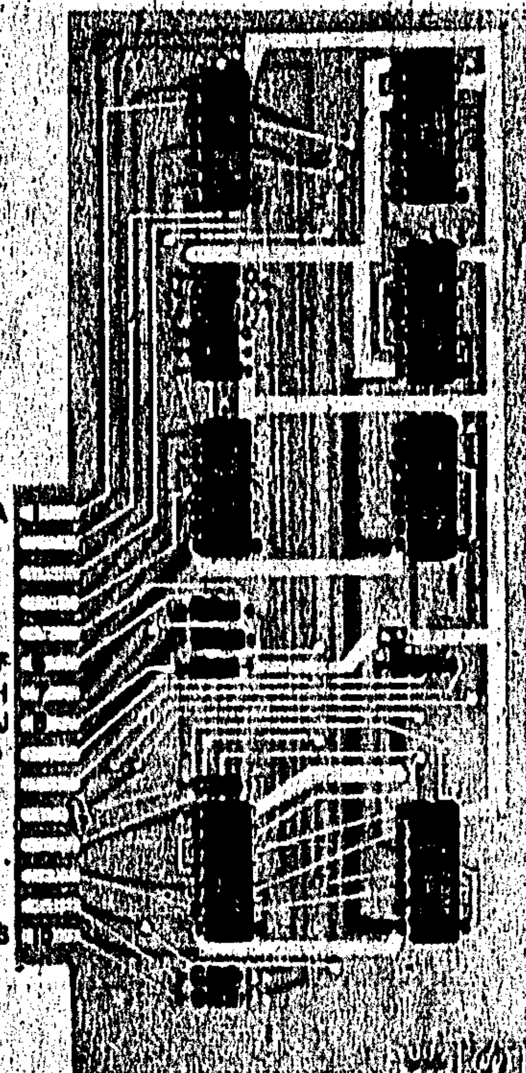
DIGITAL RECORDER JACK PIN FUNCTIONS

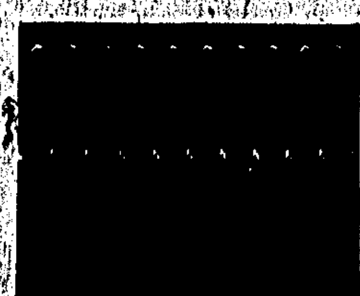
COLUMN OR FUNCTION	BCD WEIGHT 8	4	2	1
	J9 PIN NUMBER			
10^0	27	26	2	1
10^1	29	28	4	3
10^2	31	30	6	5
10^3	33	32	8	7
10^4	35	34	10	9
10^5	37	36	12	11
10^6	39	38	14	13
10^7	41	40	16	15
ANNUNCIATOR	43	42	18	17
+5 VOLTS (TTL SOURCE)	PIN 22			
GROUND	PINS 24, 50			
PRINT COMMAND	PIN 48			
INHIBIT	PIN 22			
NO CONNECTION	PINS 19, 20, 21, 25, 44, 45, 46, 47, 49			

1 J9 PINS ARE WIRED TO A8 DISPLAY ASSEMBLY

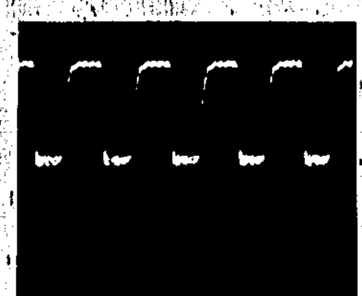
Figure 8-24. W1, J9 Printer Cable Assembly

Part of Figure 8-9. A14 Voltmeter Display Control Assembly





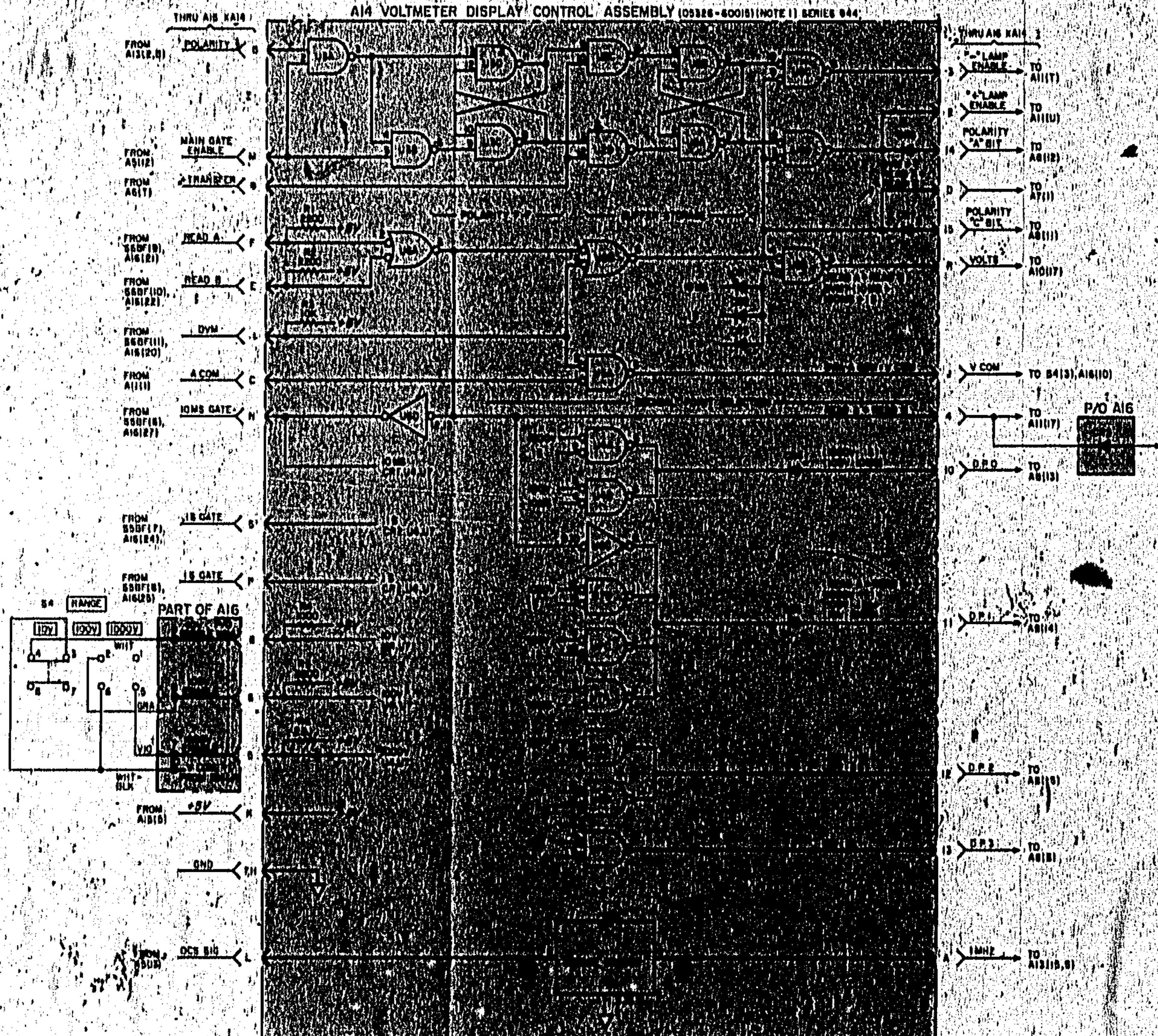
A14 U1(2)
.1 V/cm
.1 μs/cm

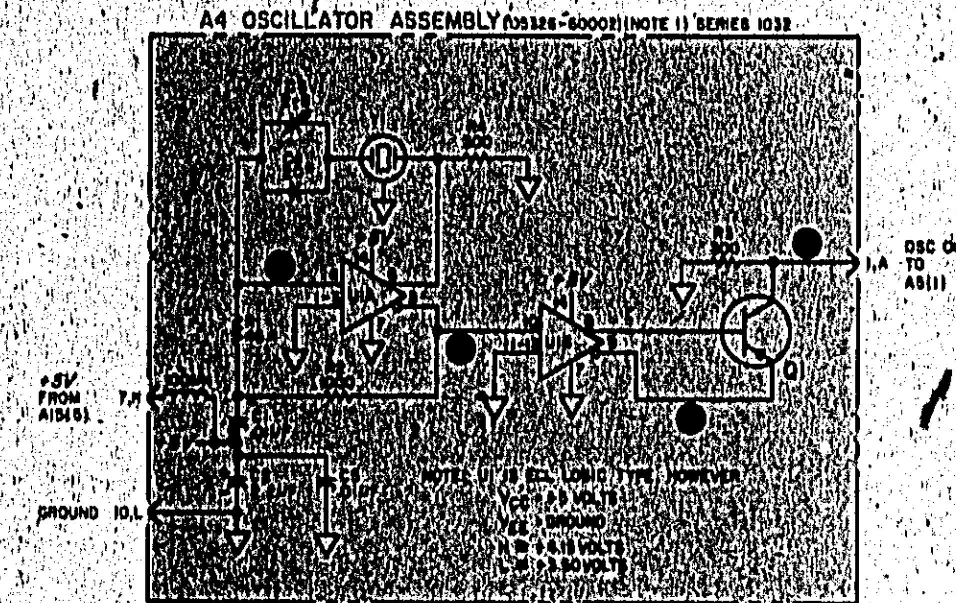


A14 U1(4)
.5 V/cm
.5 μs/cm

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

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

NO PREFIX	A4	A14	A16
S4	C1-5 L1 Q1 R1-4 U1 Y1	CR1-7 R1-6 U1-7	CR3

REFERENCE DESIGNATIONS	HP PART NUMBERS
A4	
Q1	1850-0158 2N2635
U1	1820-0142 MC1004P
A14	
CR1-7	1910-0016
U1	1820-0413
U2,3	1820-0094 MC846P
U4,5,7	1820-0274 MC1806P
U6	1820-0273 MC1805P
A16	
CR3	1901-0040

05326-0-55

Figure 8-9. A4 Oscillator Assembly
A14 Voltmeter Display Control Assembly

Part of Figure 8-10. 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 CHANNEL 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 differentiates 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.

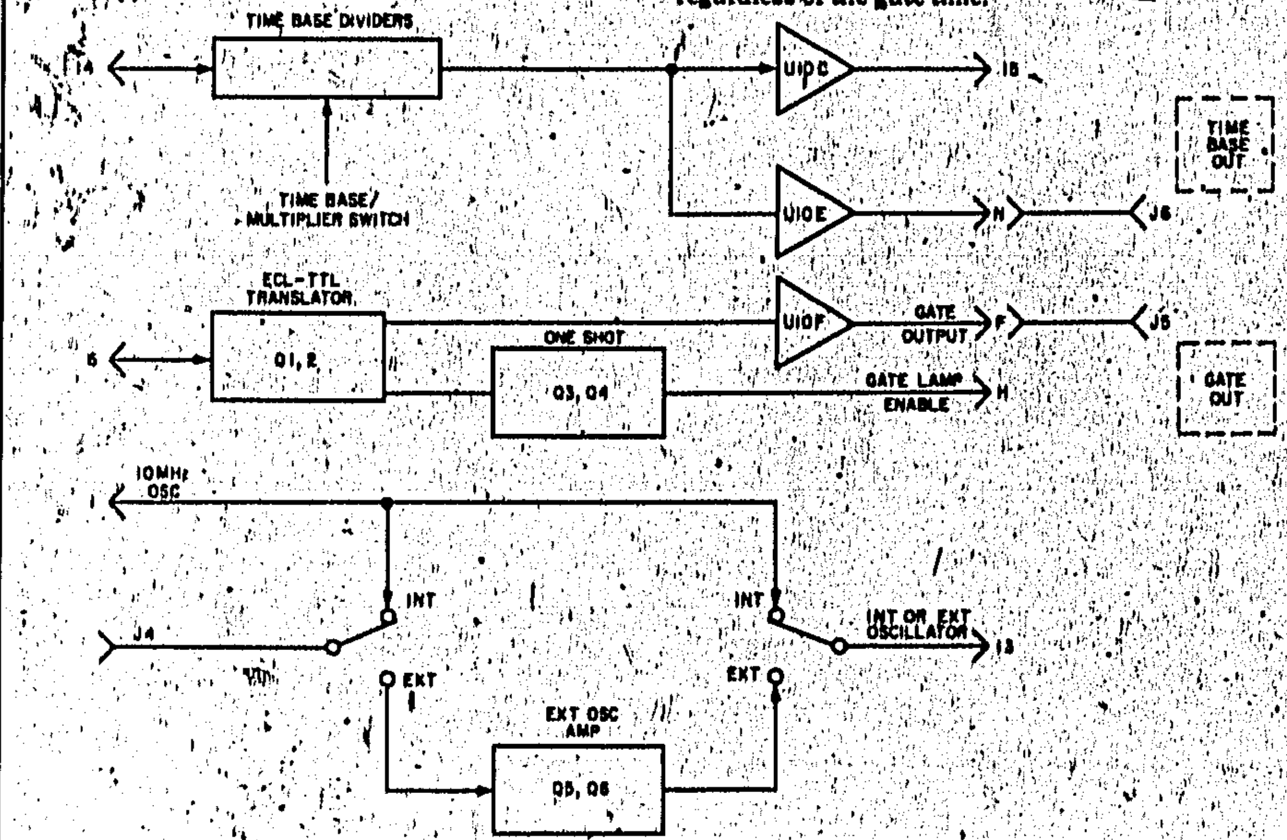
Q1 and Q2 form an ECL to TTL translator. When the main gate opens (low is main-gate enable), Q2 turns on the start one-shot Q3/Q4. During short gate-length times, this holds the gate lamp enable line low for approximately 50 ms to extend the time the gate lamp is on. When Q1 collector goes high, a low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

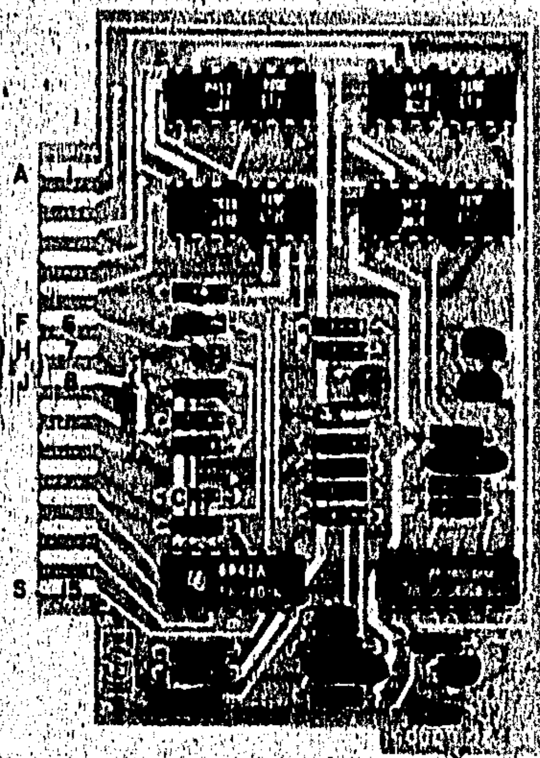
U5A and U5B select either the internal or external oscillator signal. When S7 is set to EXT, the internal oscillator signal is inhibited and the external oscillator signal passes through Schmitt trigger Q5 and Q6 to U5B and XA5(13).

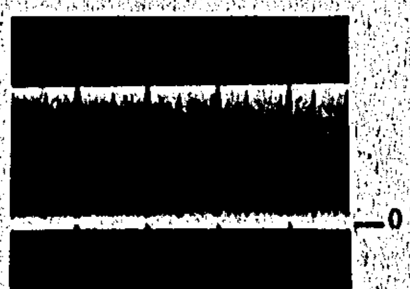
A5 TROUBLESHOOTING

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 Control, it is differentiated by C5 and R18. This 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.

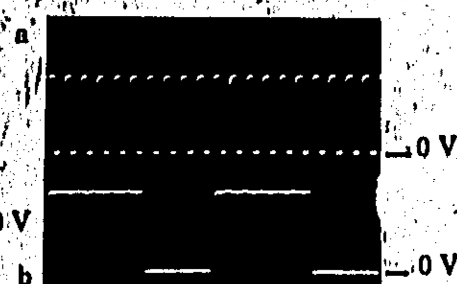




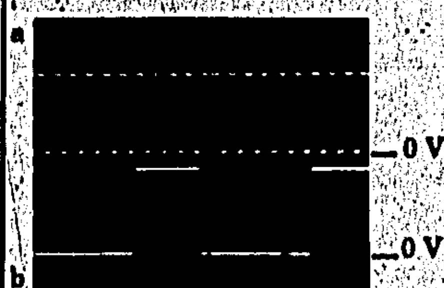


.1 V/cm
.5 ms/cm

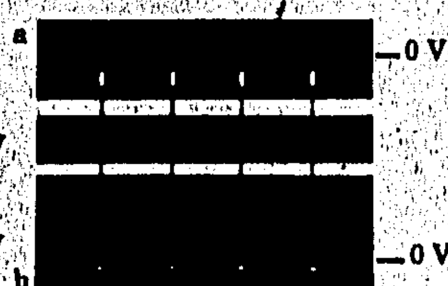
.1 V/cm
.2 μs/cm



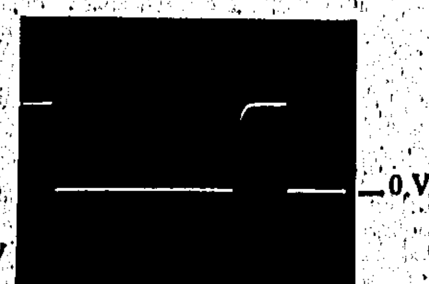
a. U7(2) .2 V/cm
b. U7(4) 2 μs/cm



a. U2(2) .2 V/cm
b. U2(5) .2 ms/cm



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



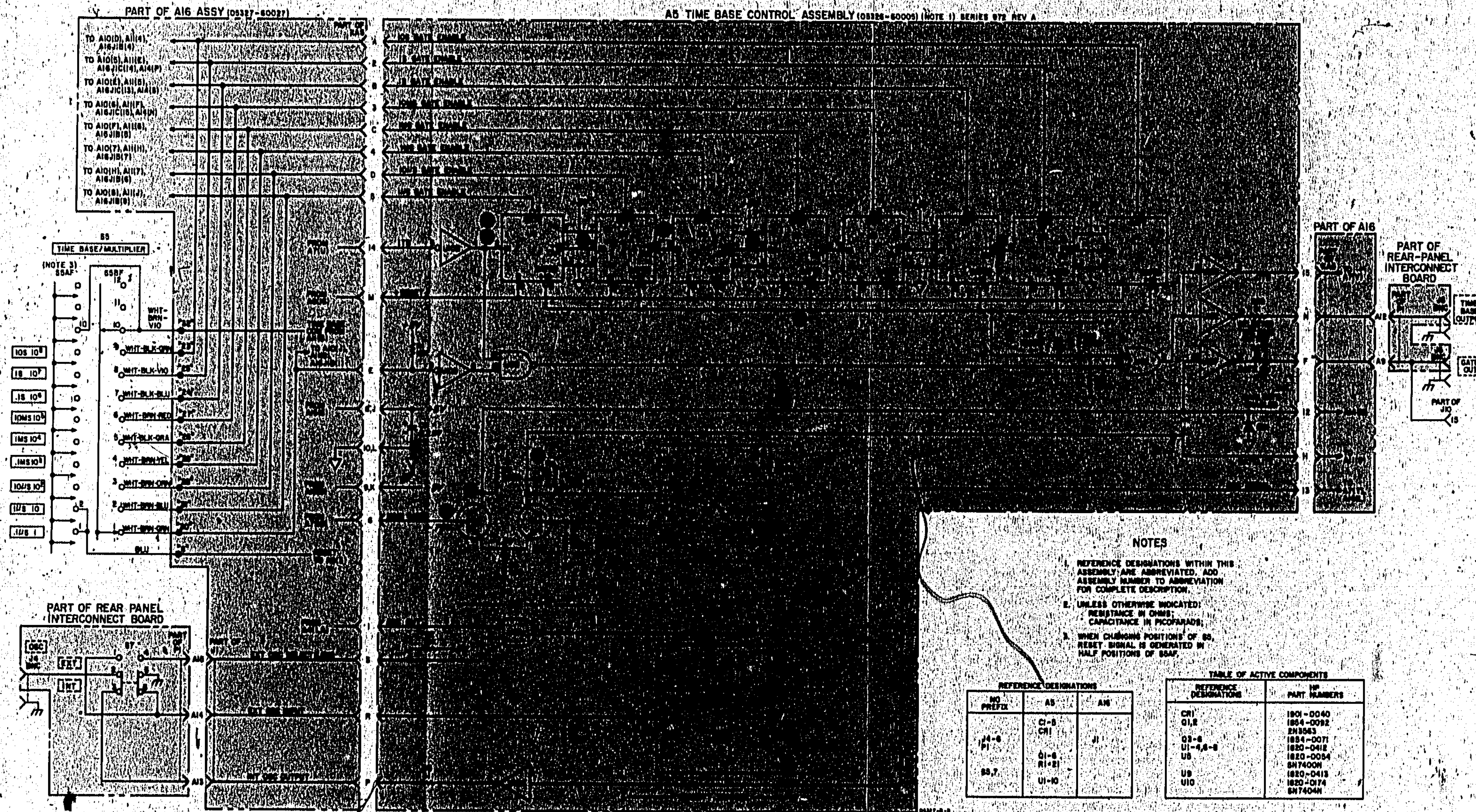
.2 V/cm
10 ms/cm
SAMPLE RATE - NORM
SWEEP MODE - NORM

COUNTER CONTROLS:
(except as noted)
Use settings of A2 Assembly

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

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

OSCILLOSCOPE CONTROLS:
(except as noted)
Use settings of A2 Assembly



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. WHEN CHANGING POSITIONS OF S5, RESET SIGNAL IS GENERATED IN HALF POSITIONS OF S5AF.

REFERENCE DESIGNATIONS

NO PREFIX	A5	A16
J4-6 P1 S5,7	C1-5 CR1 Q1-6 R1-21 U1-10	J1

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1	1901-0040
Q1,2	1854-0092 2N3563
Q3-6	1854-0071
U1-4,6-8	1820-0412
U5	1820-0054 SN7400N
U9	1820-0413
U10	1820-0174 SN7404N

Figure 8-10. 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 U5D(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(1). 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.

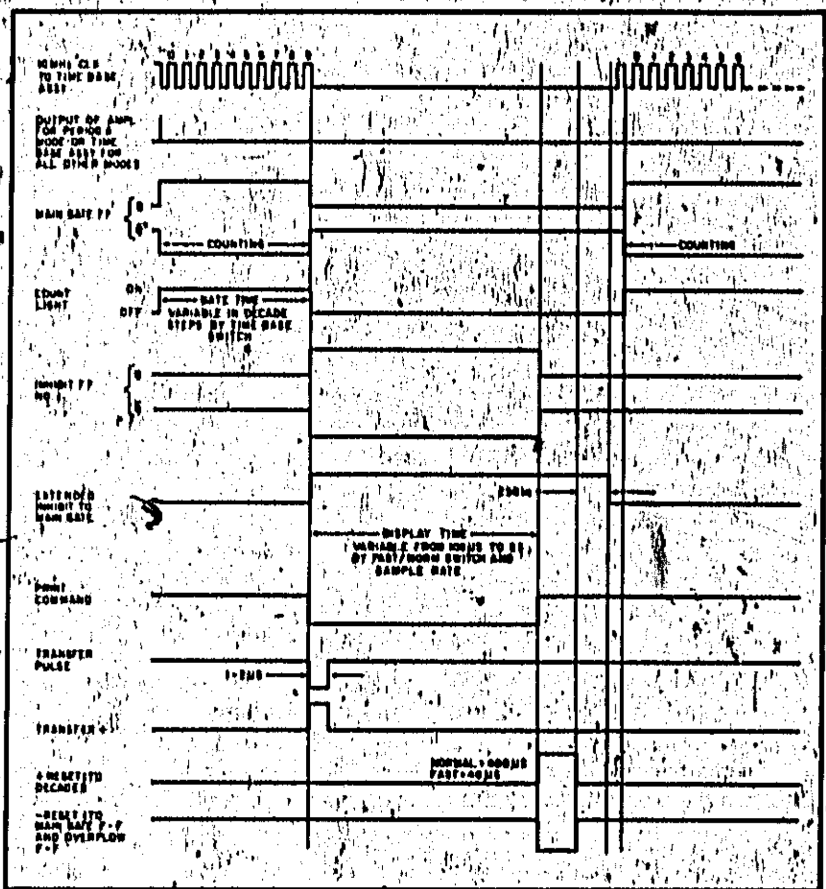
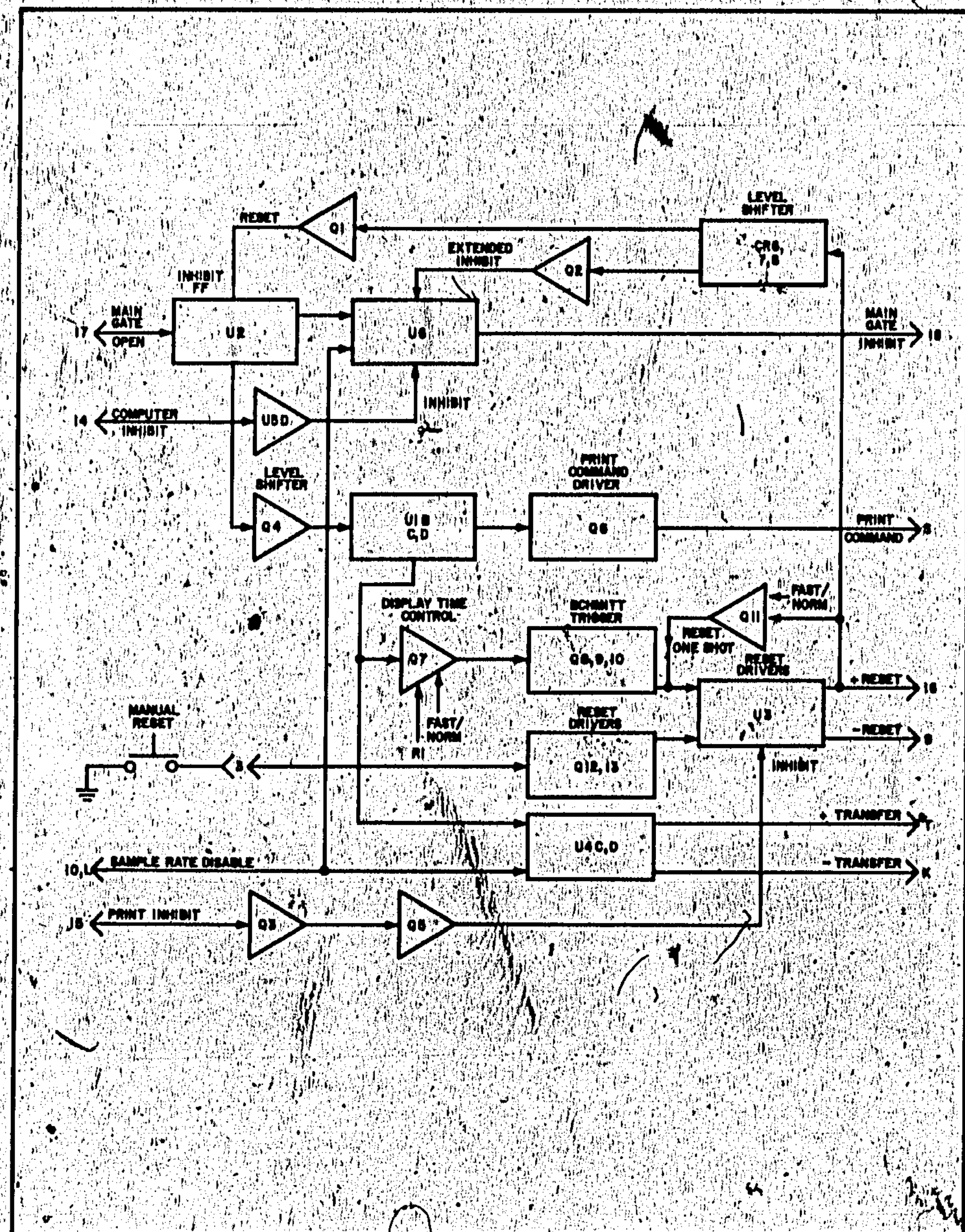


Figure 8-10
A5 TIME BASE CONTROL ASSEMBLY

(See Page 8-21)

Part of Figure 8-11. A6 Sample Rate Assembly



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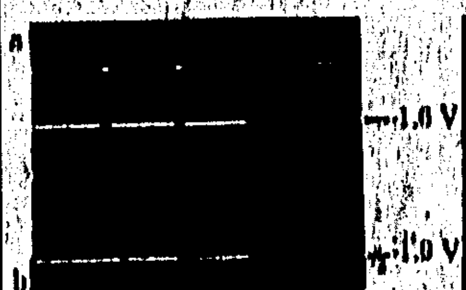
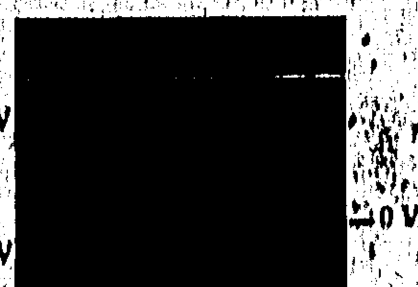
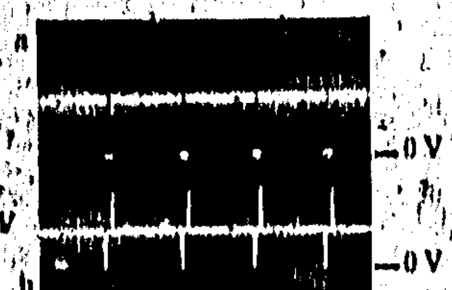


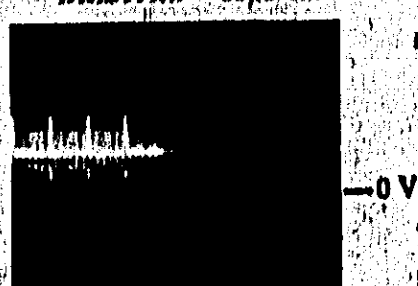
a. U2(2)
b. U2(0)
.05 V/cm
SWEEP to MIXED
MAIN — .5 ms/cm
DELAYED — 50 µs/cm



.1 V/cm
.5 ms/cm

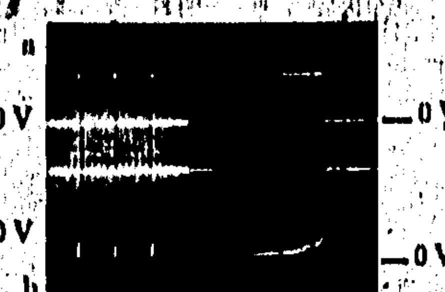


a. U1(6)
b. U1(9)
.2 V/cm
.5 ms/cm



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

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



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.

HE,LE — ECL levels
H,L — TTL levels

COUNTER CONTROLS:
Use settings of A2 Assembly

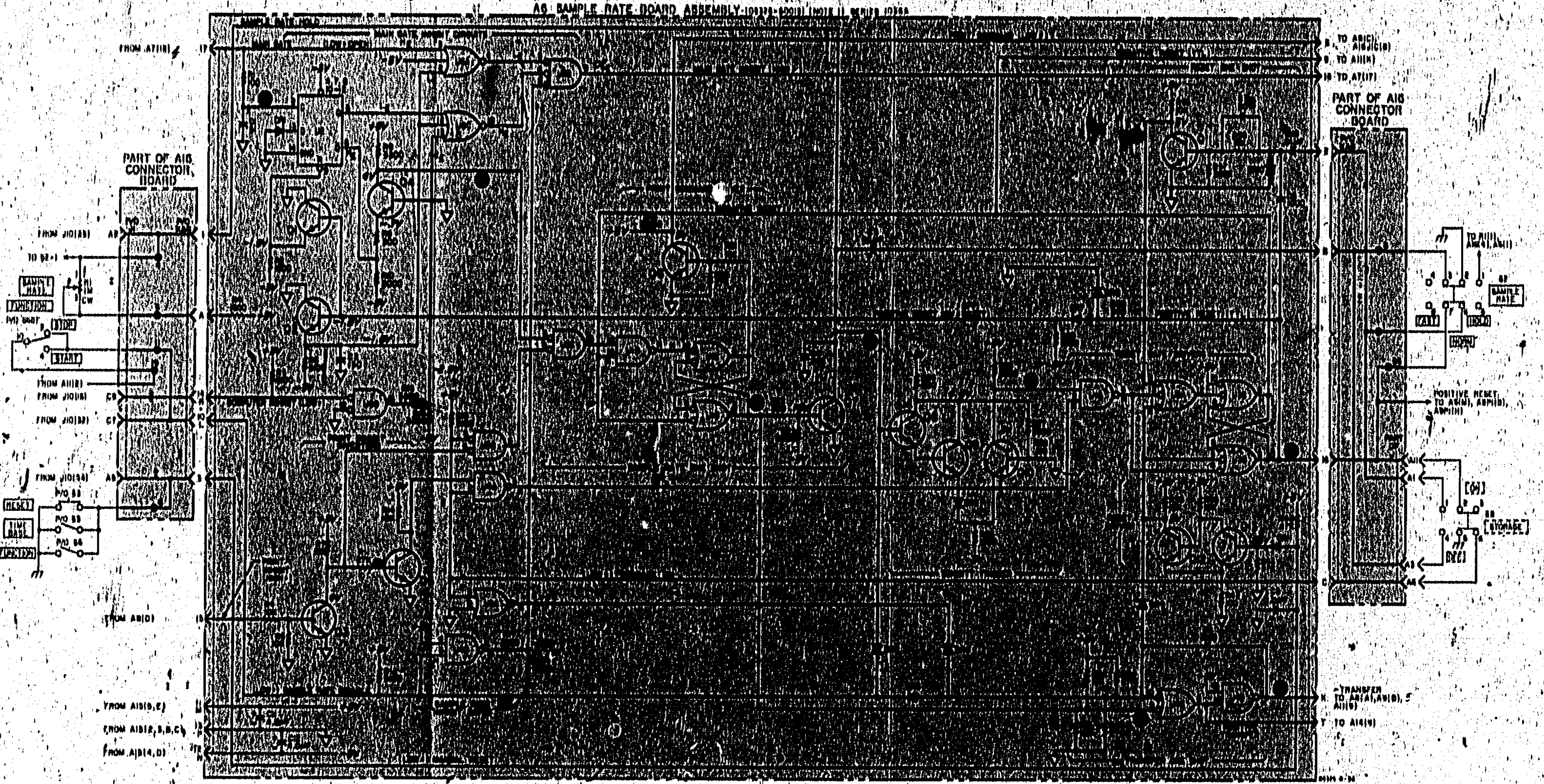


Figure 8-11. A6 Sample Rate Assembly

A7A FUNCTION CONTROL OPERATION

This assembly contains gates for the time base input, DCA inputs and main gate control. Three flip-flop circuits are included to control the main gate and oscillator gate. Amplifiers U4 and Schmitt trigger Q1 receive the INPUT C signals from jack J7.

Table below lists the truth table for the function control assembly. Incoming signals include: Channel A, Channel B, time base, voltmeter, oscillator, and amplifier C. Except for the oscillator and time base, all signals are ECL. U12A and U12C translate the TTL oscillator and time base signals to ECL.

The main gate inhibit at P1(17) controls the start of measurement time. A logic one (>2.4 V) prevents a measurement and a logic zero allows a measurement to be taken. Q2 and Q3 translate the ECL output to TTL levels for use by the time base circuits. Q2 stretches the pulse to 50 nsec.

Main gate FF, U5, will open main gate U11B when $U5\bar{Q}=0$. U5 is toggled by the signal from U10A. At the end of each measurement, the main gate enable line at P1(18) goes high to start recycling on the sample rate board.

Function Selection Truth Table

Function	Main Gate Control	Input to Decade Counting Assembly	Input to Time Base
STOP	0	0	0
START	1	OTB	IA
Per. Avg.	OTB	GOSC	IA
T.I. Avg.	OTB	GOSC	IP
T.I.	1	OTB	GOSC
Period A	IA	OTB	GOSC
Freq A	OTB	IA	GOSC
Freq C	OTB	IC	GOSC
DVM (Read A,B)	OTB	IV	GOSC

IA Channel A Input
IC Channel C Input
IV DVM V-F Converter Output
IP Synchronizer Output
GOSC Gated Oscillator
OTB Output of the Time Base Dividers

Time interval measurements are controlled by the main gate U11B and the clock gate U6A.

A7A SYNCHRONIZER OPERATION

Table 1 shows a simplified schematic for the synchronizer portion of A7A and Table 2 shows the timing diagram.

This circuit allows the unit to delay taking a measurement until there is a signal present at the input. Thus, half readings and readings of zero are prevented for Frequency A only. This is accomplished by the addition of a clock gate that works with the main gate, both of which must be open in order to take a measurement. Before a start signal occurs (trigger point of CHANNEL A amplifier) Q of U2A is high and Q of U2B is low, keeping clock gate U6A closed. When the first pulse from the CHANNEL A amplifier Q of U2A goes low, U6A opens, however, the main gate U11B is closed. At the end of the time interval (trigger point of CHANNEL B Amplifier) Q of U2B goes high, closing U6A at the next positive transition of clock. A low is also generated at Q of U2B, enabling U1A at the next clock pulse. This applies a positive reset to the U6 and U1 flip-flops which during the same clock pulse returns U2A and B to their initial states, closing the gate U6A. Since the main gate is still closed, no counting has occurred.

The time base dividers control the main gate and are designed to give two output pulses; one after the first pulse and the other after counting the decade number of pulses selected by the multiplier switch. Q of U5 controls the main gate and is initially high. After the first time interval measurement Q goes low at which time the main gate is opened. After 10^n pulses have been counted, Q goes high to close the main gate. Thus, the first time interval measurement is not counted but rather serves only to open the main gate. The main gate now stays open until a decade number of time intervals have been counted. The number of clock pulses that are counted by the DCA is controlled by U6A.

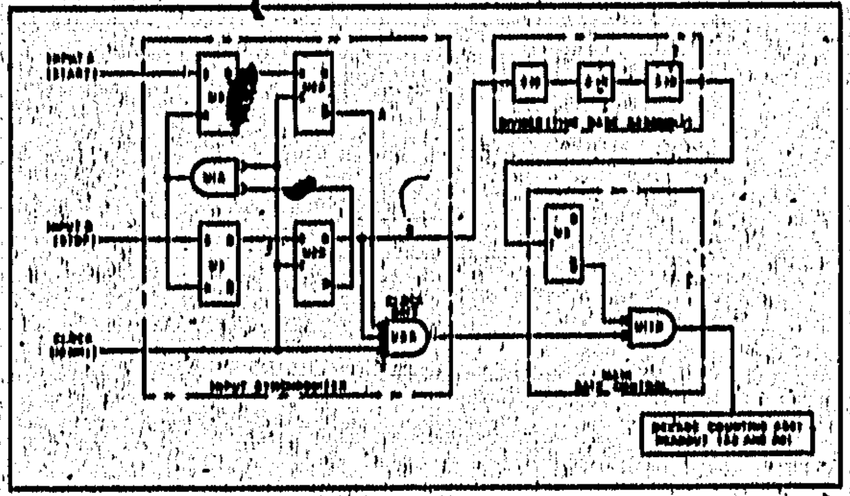


Table 2

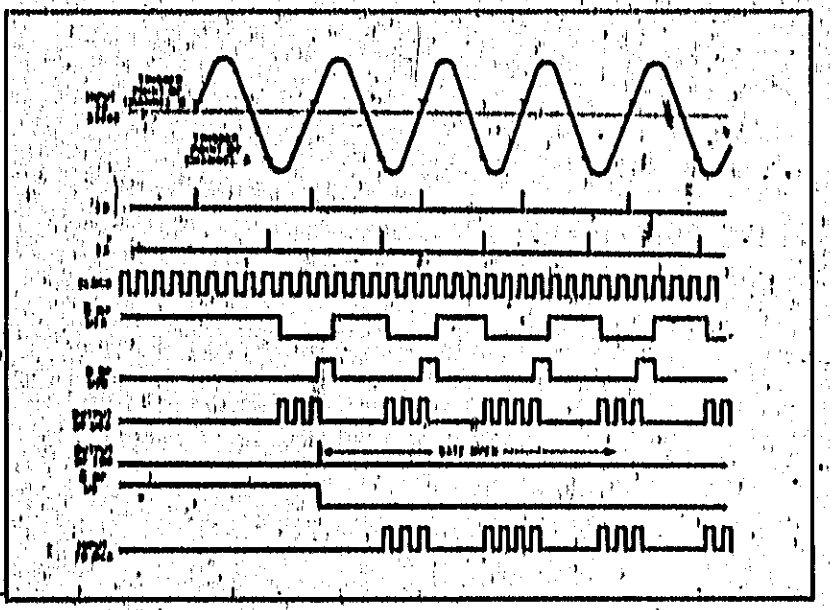
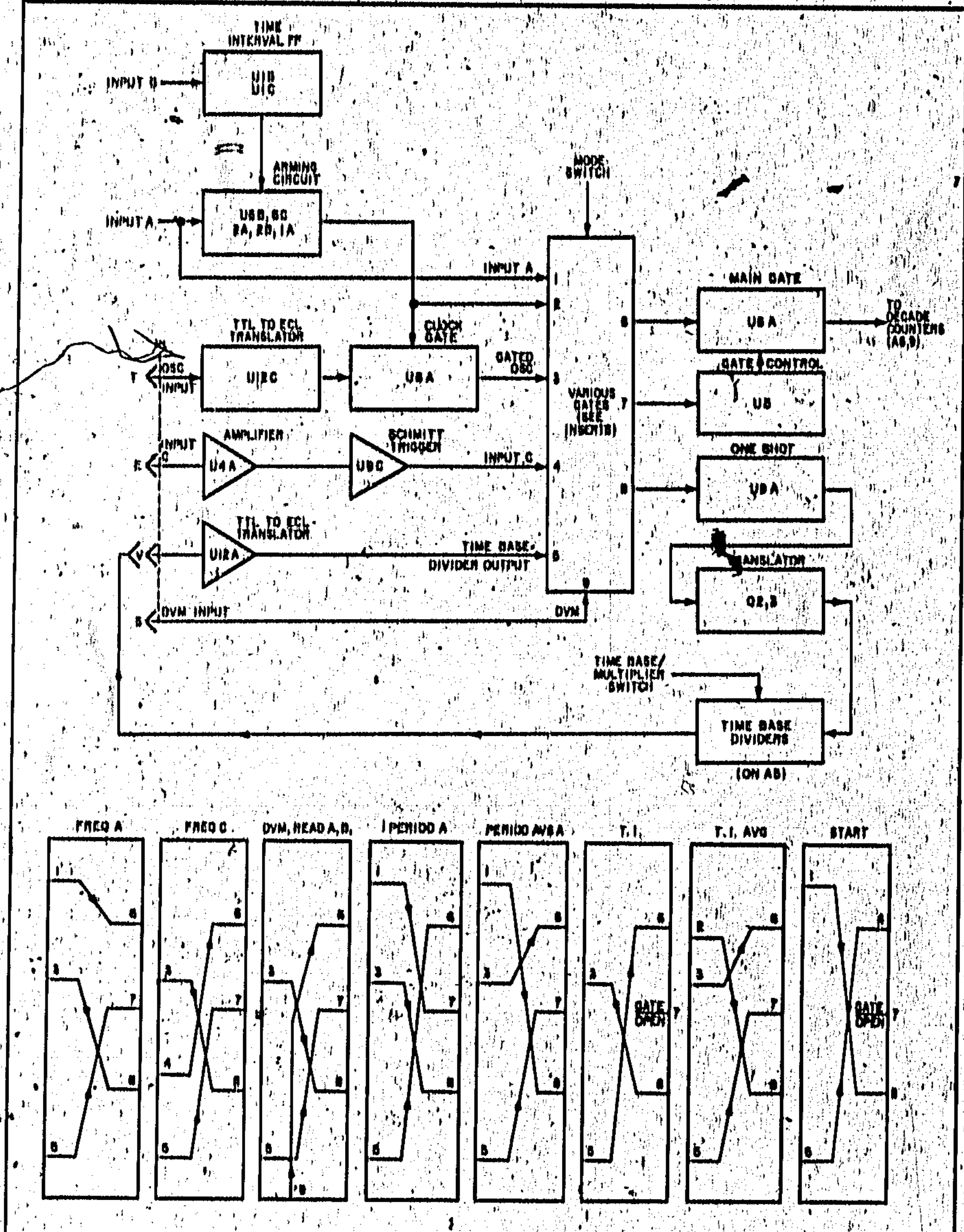


Figure 8-11
A6 SAMPLE RATE ASSEMBLY

(See Page 8-23)

Part of Figure 8-12. A7A Function Control Assembly



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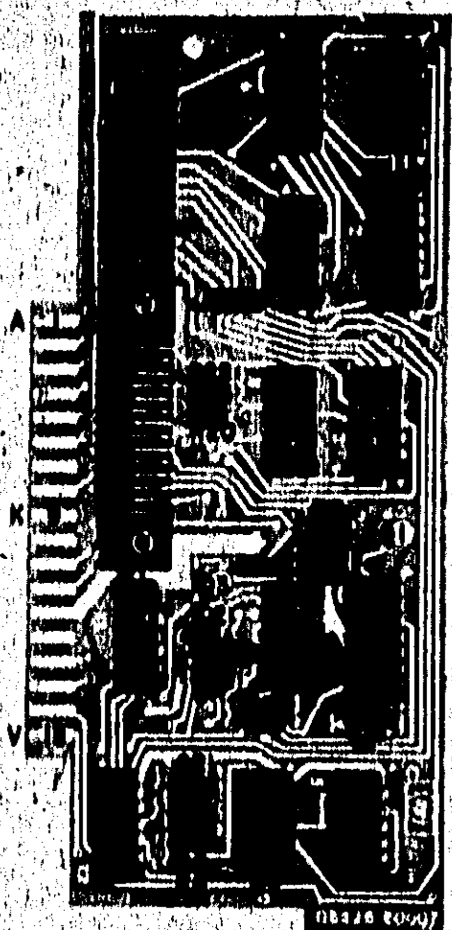
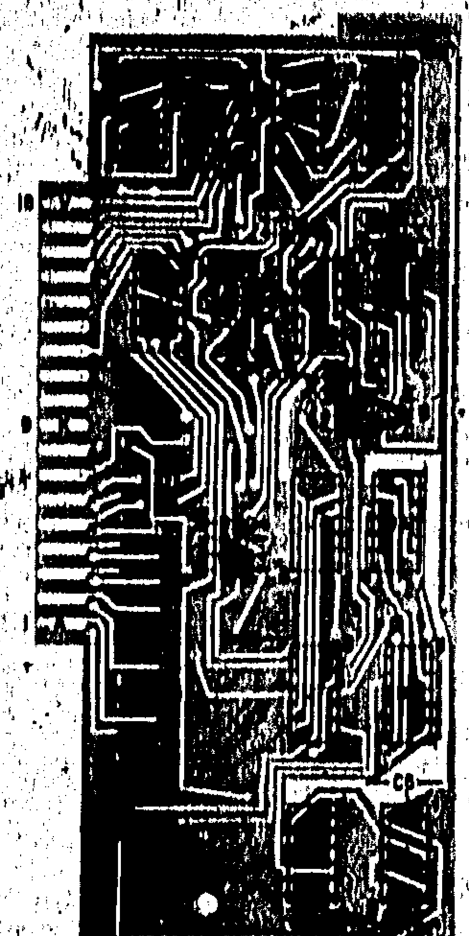
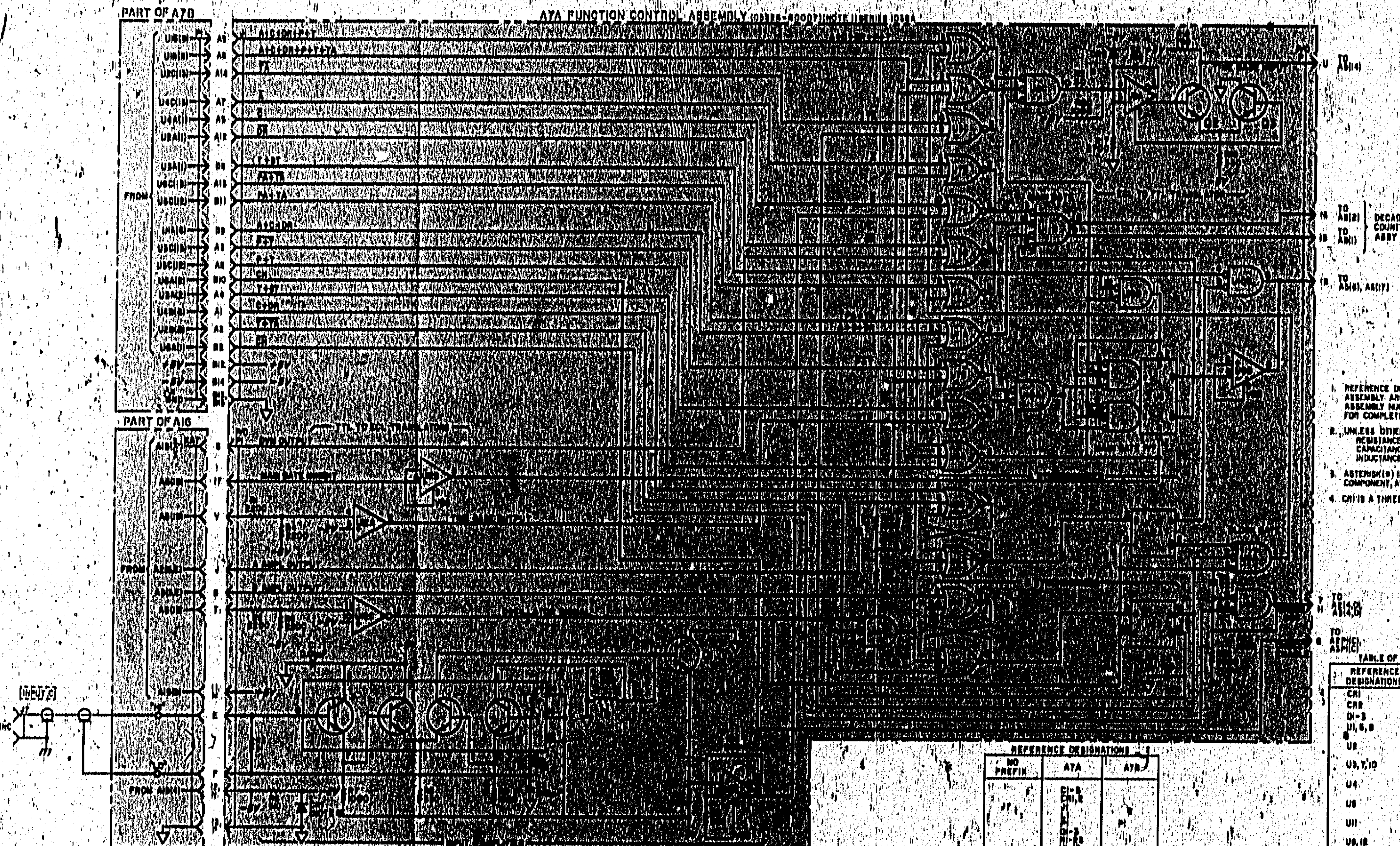


A7A FRONT



A7A REAR



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 VALUE SHOWN.
4. CR1 IS A THREE JUNCTION DIODE.

REFERENCE DESIGNATIONS

NO PREFIX	A7A	A7B
[illegible]	C1-8 CR1,2 J1 Q1-3 R1-23 U1-12	P1

TABLE OF ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1	1901-0581
CR2	1901-0040
Q1-3	1854-0005
U1, 6, 8	1820-0147 MC1007P
U2	1820-0440 MC1016
U3, 7, 10	1820-0148 MC1010P
U4	1821-0001 RCA 3046
U5	1820-0102 MC1013P
U11	1820-0142 MC1004P
U9, 12	1820-0253 MC1035P

5326-B-818

Figure 8-12. A7A Function Control Assembly

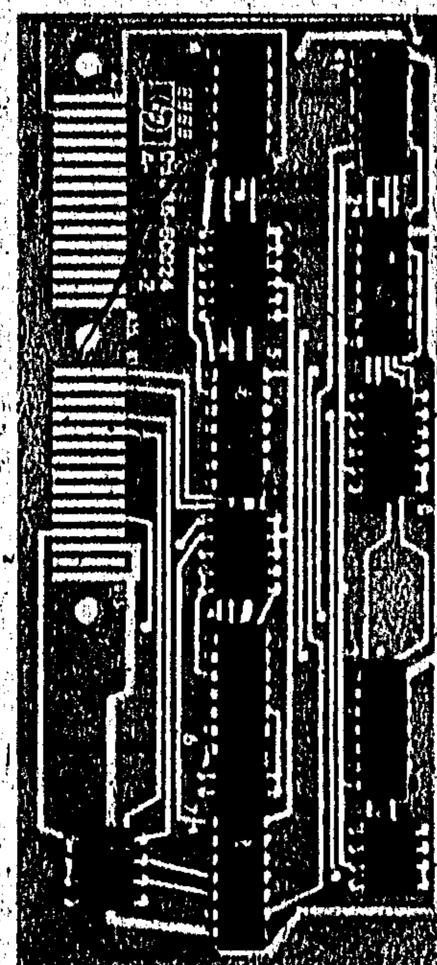
A7B FUNCTION CONTROL OPERATION

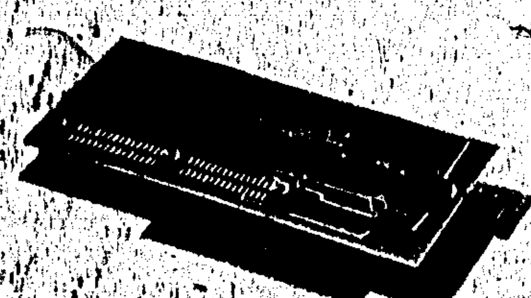
Mode selection for the counter is controlled by FUNCTION switch S6. S6BF selects the operating mode. The function common line will be grounded during INTERNAL operation. S6AF provides reset output when the FUNCTION switch is between detents. When the FUNCTION switch is set to START or STOP, S6AR grounds the sample rate disable line to disable the sample rate circuits on A6.

R1 through R9 are pull up resistors for the FUNCTION switch. U5 and U7 are DTL drivers for the TTL to ECL level shifters. R10 through R27 shift the voltage levels of the inputs of differential amplifiers U4, U2, U3, and U6.

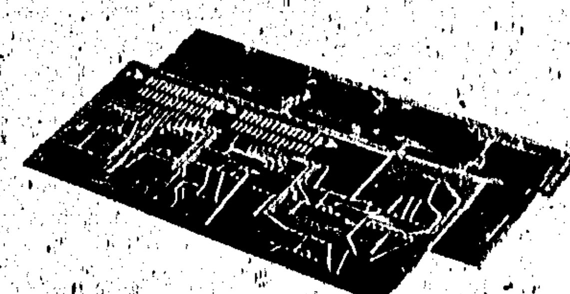
The differential amplifiers provide inverted and non-inverted outputs. As an example of operation, if U4C(10) is positive with respect to U4C(11), U4C(12) is ECL logic one and U4C(13) is ECL logic zero. If the reverse is true, the opposite logic output states will occur. In FREQ A mode, U4C(12) is ECL low. The differential amplifier outputs are either routed to A7A directly or added in U1A and U1B.

CR1, a 3-junction diode, and R28 provide -2 volt bias for the differential amplifiers.

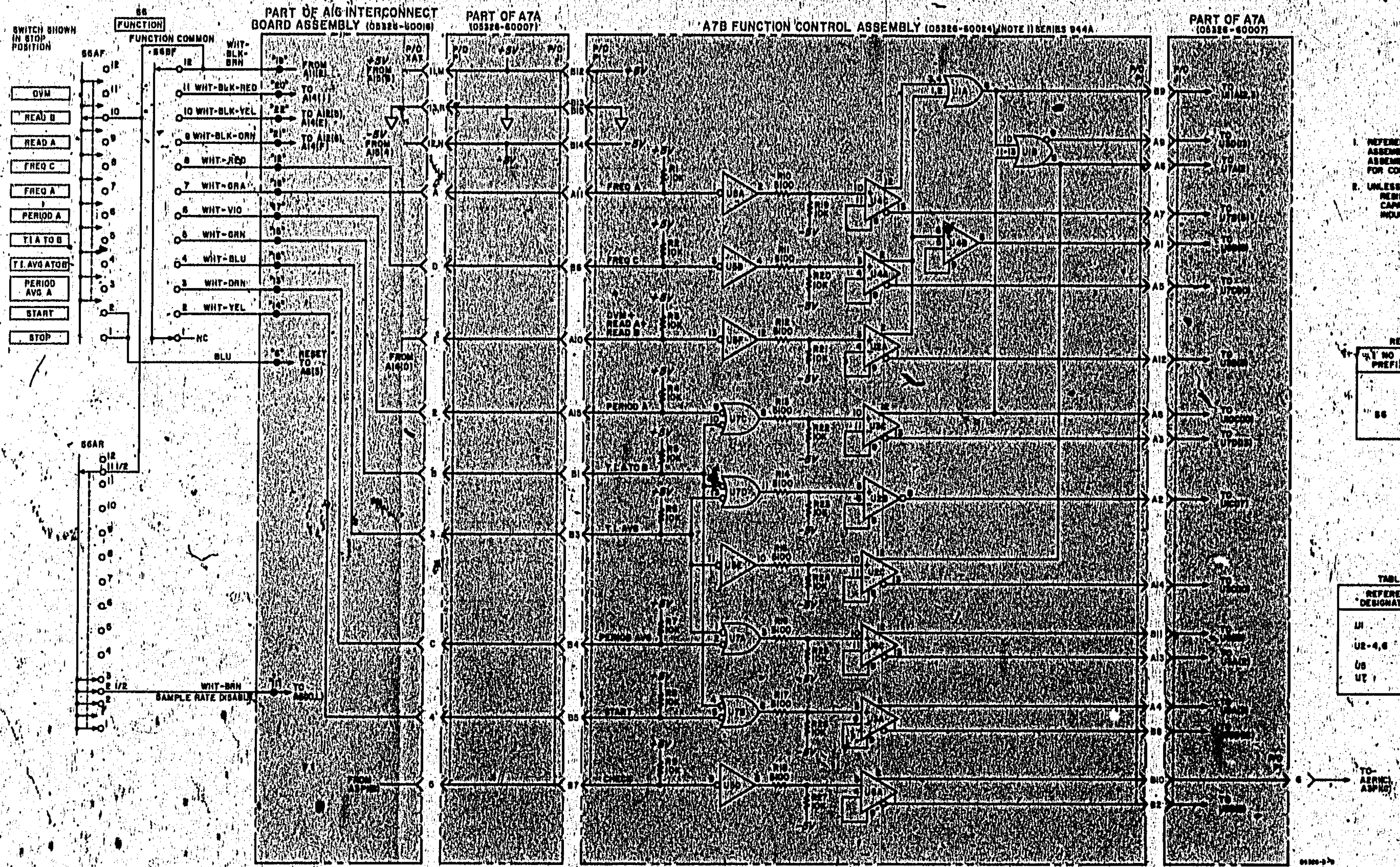




OPERATING POSITION



SERVICE POSITION



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

NO PREFIX	A7A	A7B
S6	J1 P1	P1 R1-27 U1-7

TABLE OF ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
U1	1820-0142 MC1004P
U2-4,6	1820-0283 SN7403N
U5	1820-0174
U7	1820-0054 SN7400N

Figure 8-13. A7B Function Control Assembly

A8 DISPLAY SUPPORT OPERATION

The display support assembly A8 serves to interconnect the display assembly A9 with the interconnect assembly A10. 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 10^0 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. R16 and R17 provide operating bias for Q3 through Q8. R19, R20, and R23 are current limiters. R2 and R3 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(8) from A11, Q5 conducts. With Q5 on, decimal point enable line 3 (DP3) is pulled to ground to light the decimal point on A9DS4(10^3). Also with P1(8) 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 10^7.
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	U3(13)	U4(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.

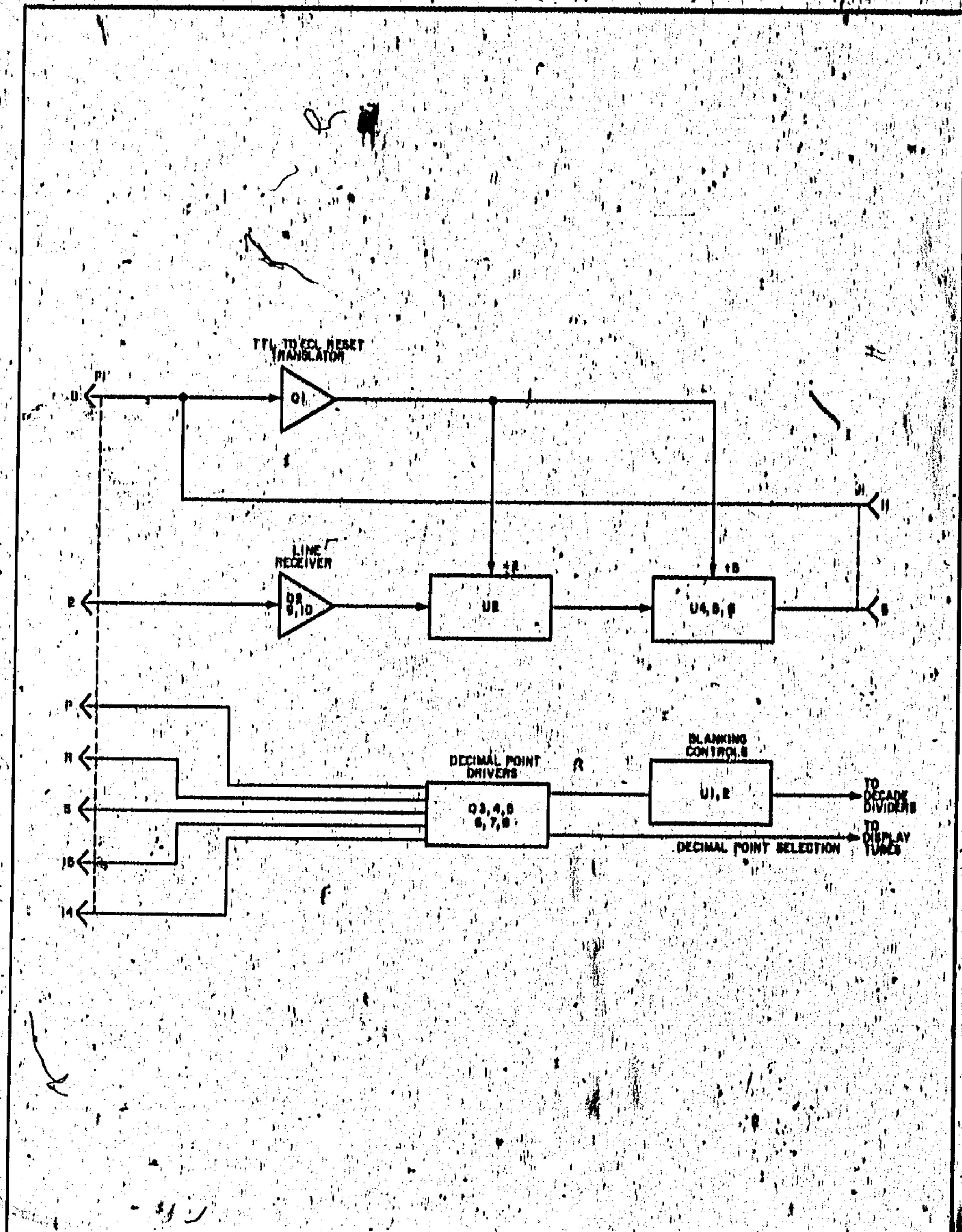
DECIMAL POINT. To check the decimal point circuitry, set FUNCTION switch to PERIOD AVG and position the TIME BASE switch to pull the required D.P. line Low.

LINE	MULTIPLIER POSITION	DRIVER
D.P.0	1	Q8
D.P.1	10	Q7
D.P.2	10^2	Q6
D.P.3	10^4	Q5
D.P.4	10^7	Q4
D.P.5	10^9	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 8-13
A7B FUNCTION CONTROL ASSEMBLY
(See Page 8-27)

Part of Figure 8-16. A8 Display Support Assembly



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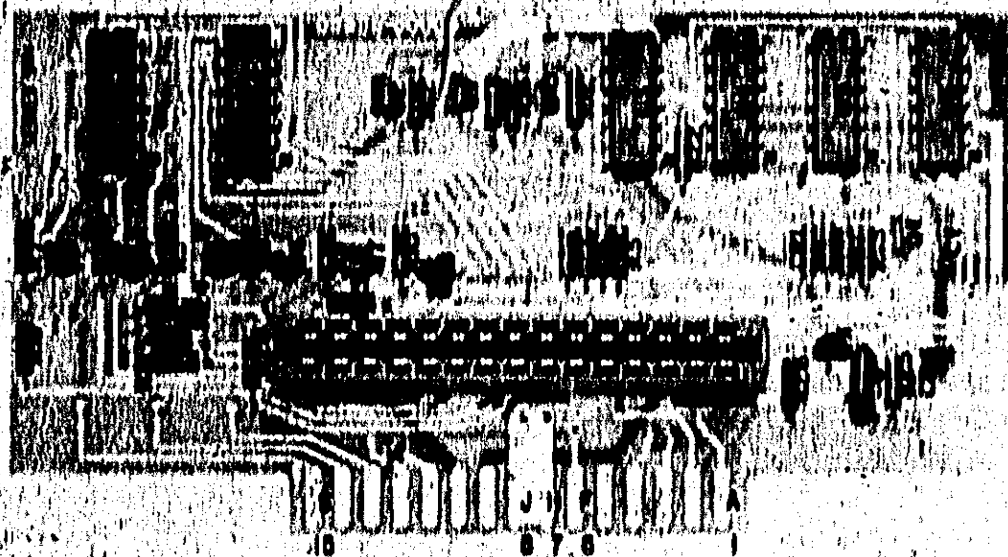
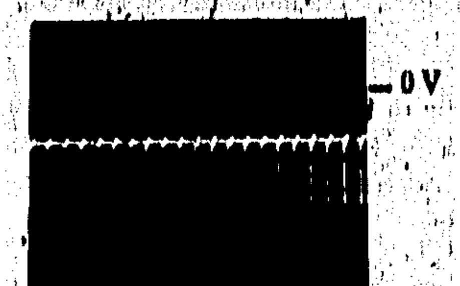
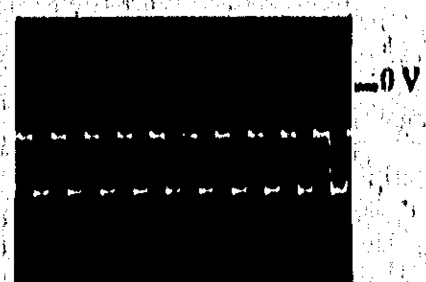
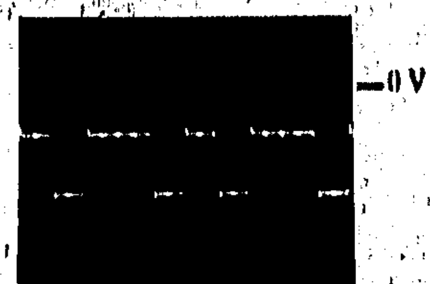
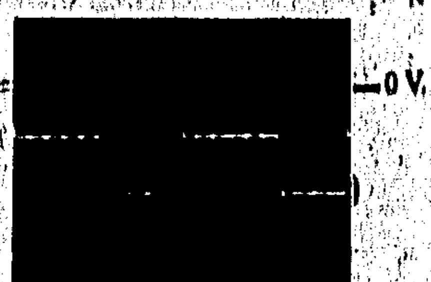
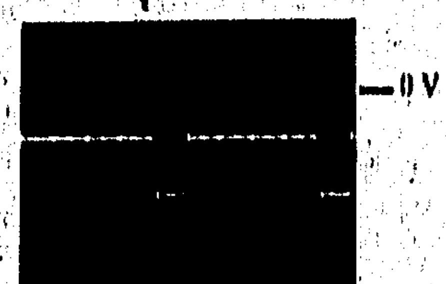












All waveforms taken with 10:1 divider probe; ground lead is connected to junction of R15, R3.

COUNTER CONTROLS:
Use settings of A2 Assembly

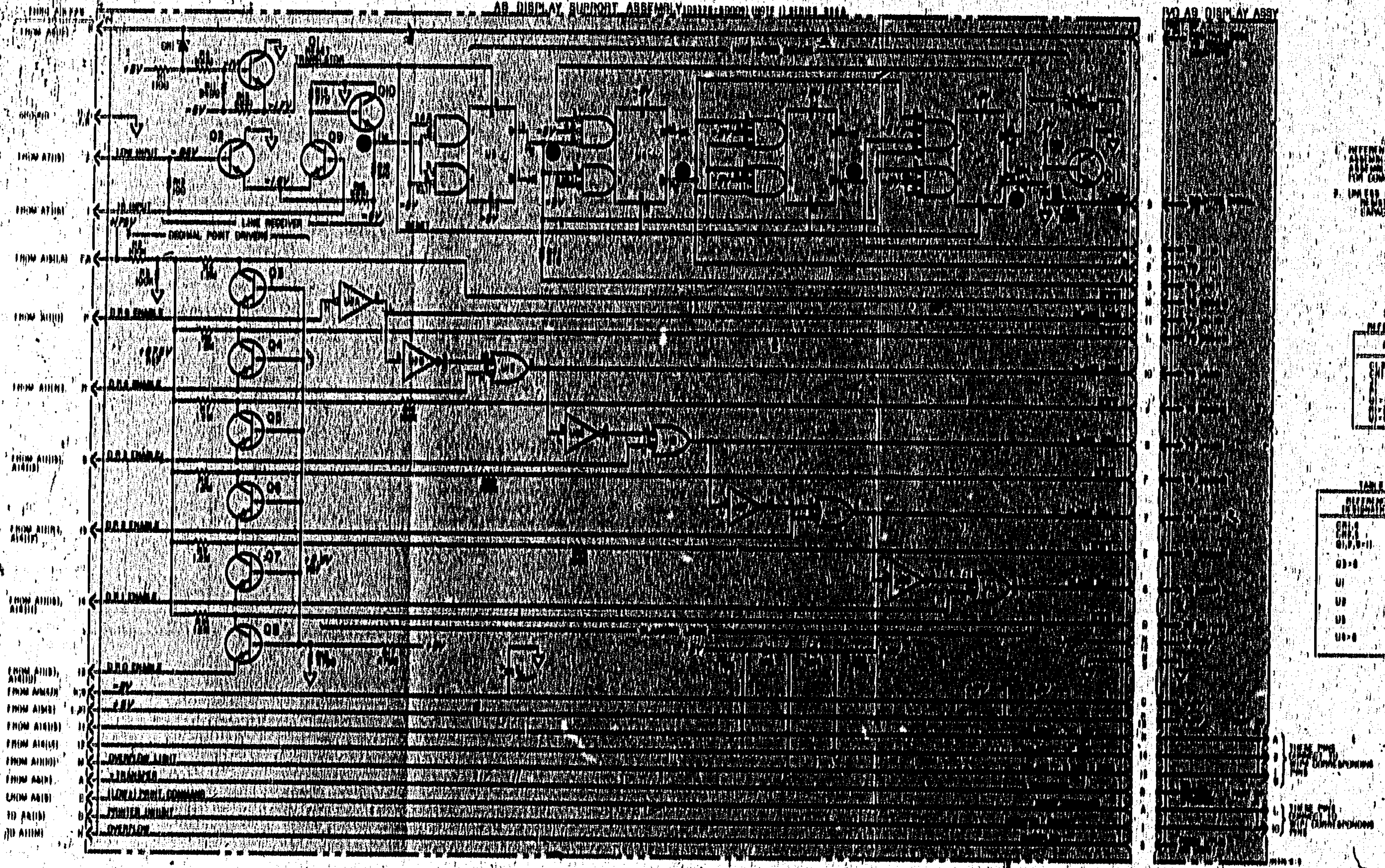
DC VOLTAGES:

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. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS.

REFERENCE DESIGNATIONS

A8	A9
[illegible]	[illegible]

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2	[illegible]
CR3,4	[illegible]
Q1,2,9-11	[illegible]
Q3-8	[illegible]
U1	[illegible]
U2	[illegible]
U3	[illegible]
U4-8	[illegible]

Figure 8-14. 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' 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 +45 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.

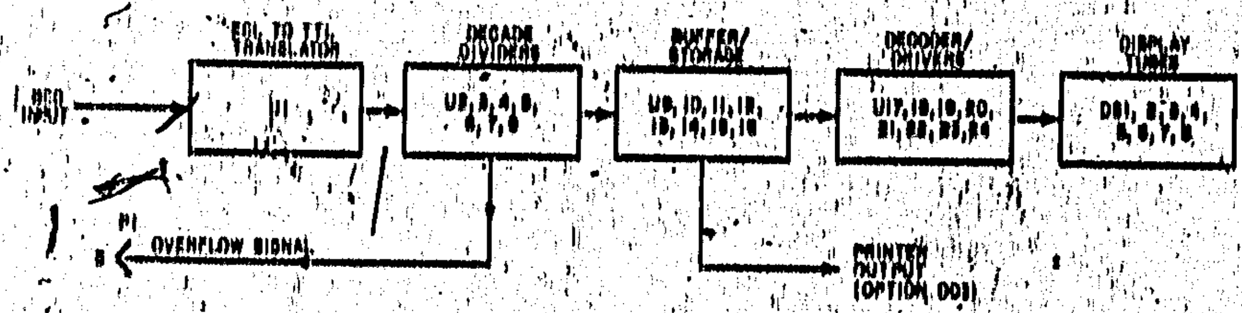
Table 1

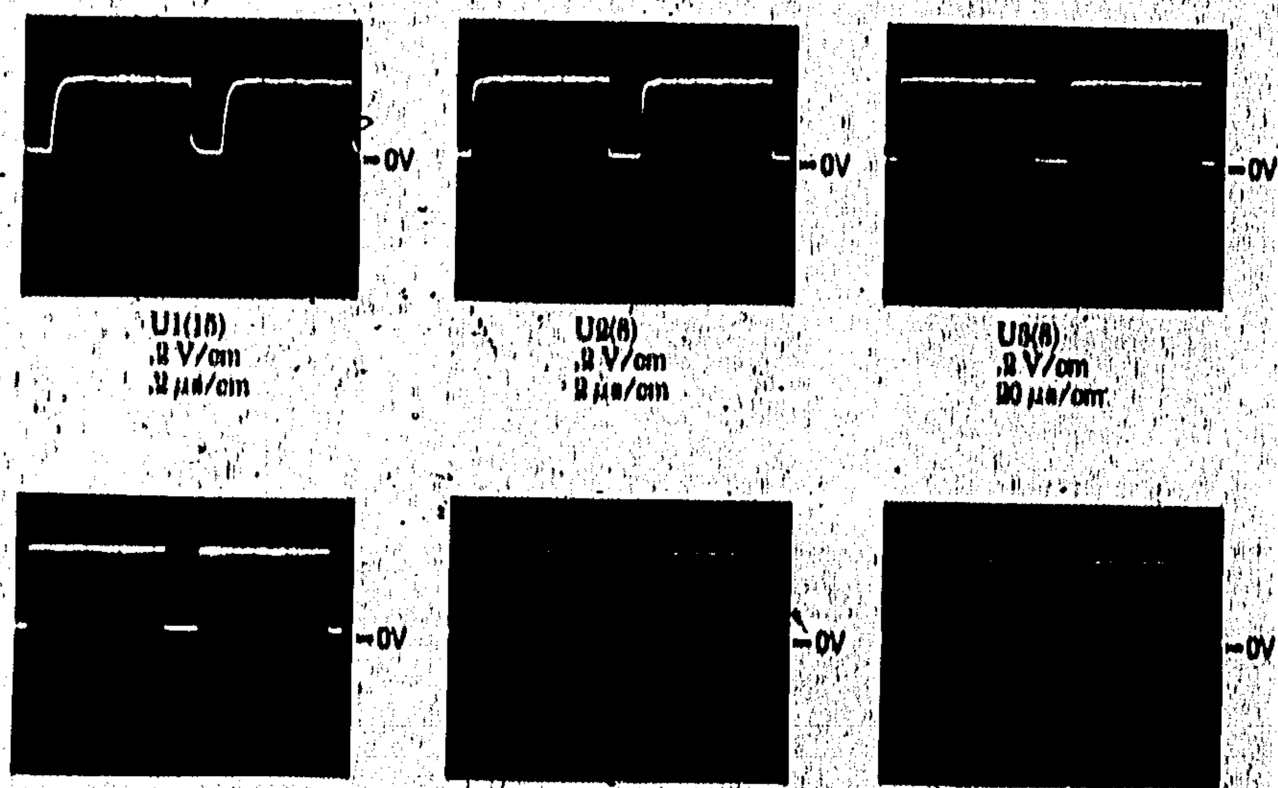
DISPLAYED DIGIT	BUFFER STORAGE BCD (TTL)			
	8	4	2	1
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L
Blank	L	L	L	L

Figure 8-14
A8 DISPLAY SUPPORT ASSEMBLY

(See Page 8-29)

Part of Figure 8-15. A8 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

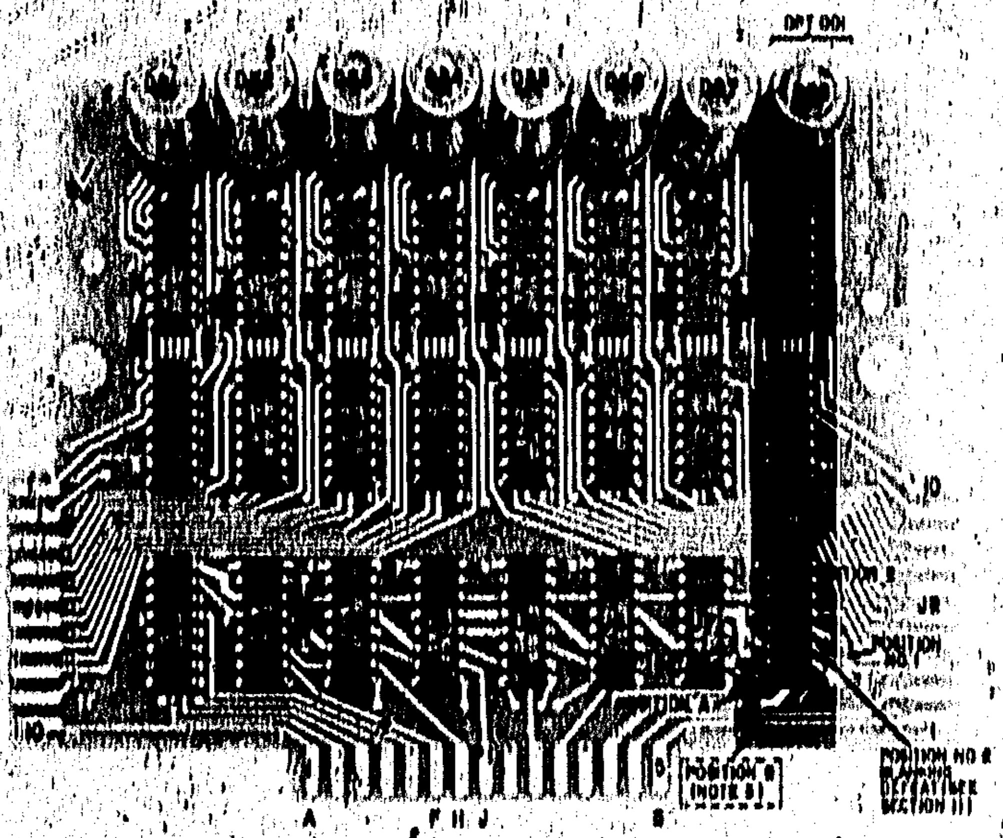
U6(8)
.2 V/cm
20 ms/cm

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



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. R10 IS WIRED TO B FOR OPTION 001.

REFERENCE DESIGNATIONS

NO PREFIX	A8	A9
	CR1,2	DS1-8
	J1	J1,2
	P1	P1
		R1-11
		U1-24
W1P1,P2		

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A8	
CR1,2	1901-0016
A9	
U1	1820-0779 MC1039P
U2-8	1820-1118
U9-16	1820-1116
U17-24	1820-0002

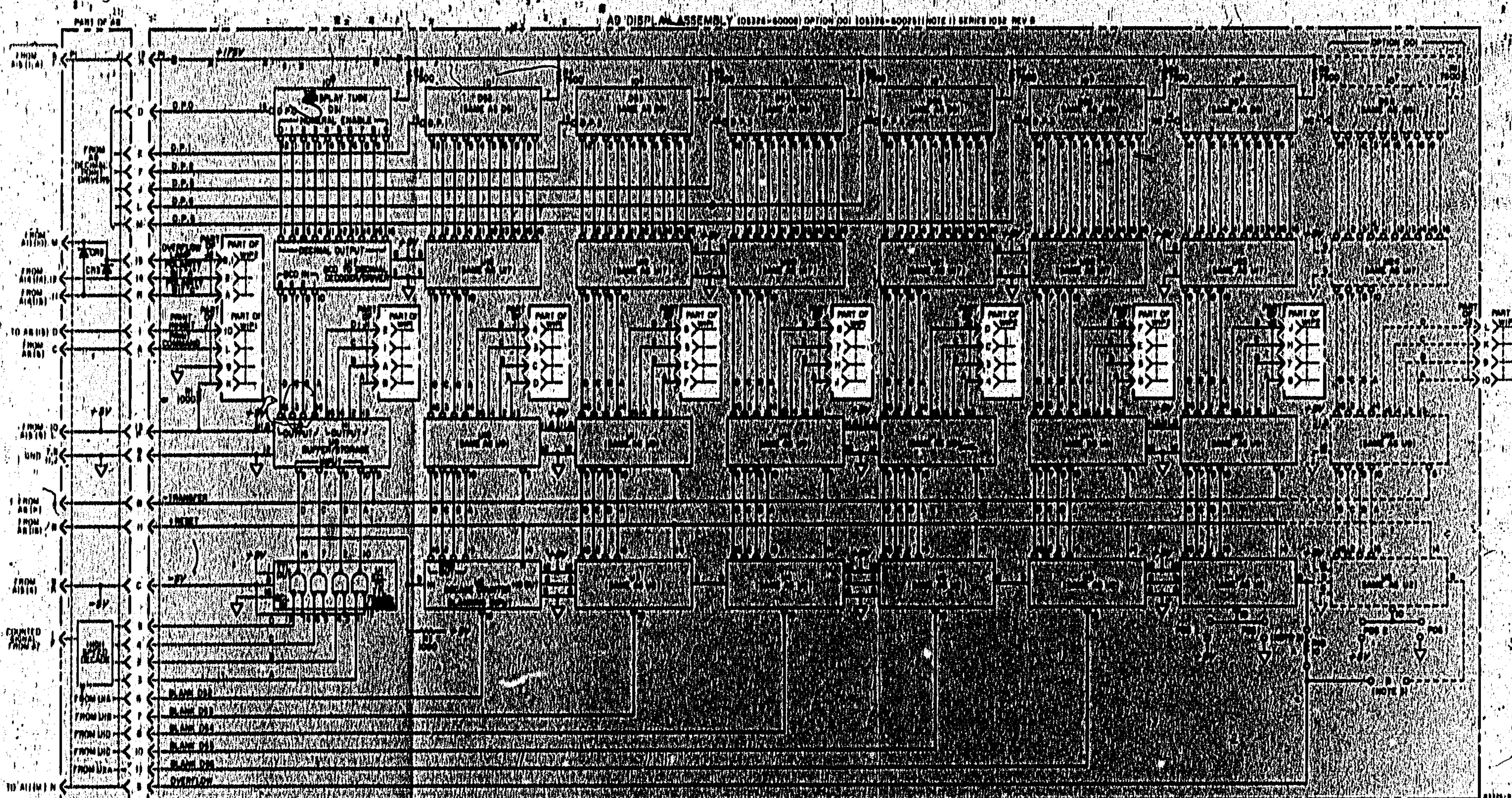


Figure 8-15. A9 Display Assembly (Option 001)

A10 RIGHT READOUT ASSEMBLY

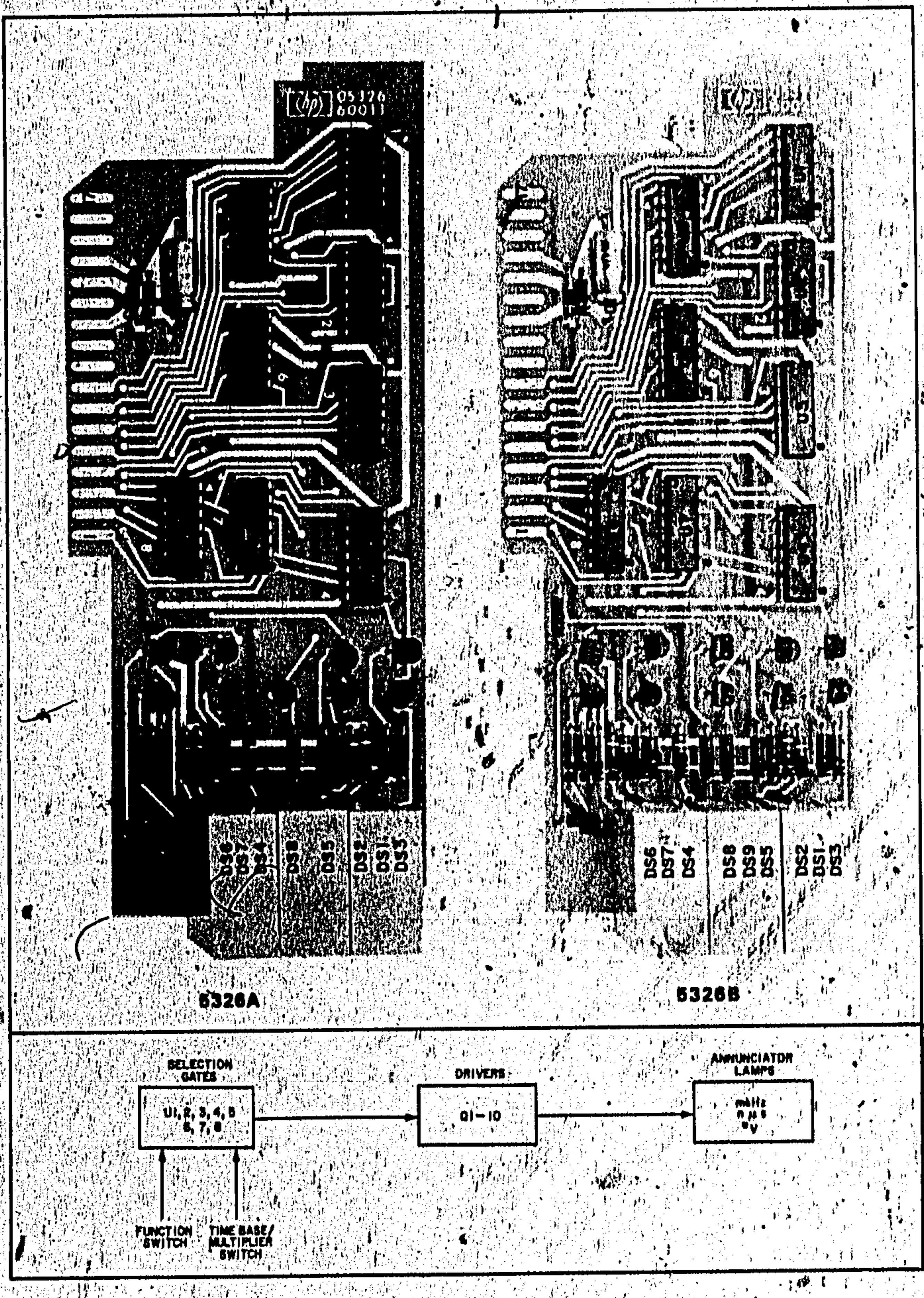
The right readout contains DTL logic to provide the proper measurement units for a given setting of the front panel controls. A10 logic is negative true, and a low (<1 volts) to the emitter of any driver transistor will light the given neon. When a DTL high is applied on the emitters, the transistor reverse biases, to turn off the neon lamps. Q1 and R1, 2, 3 provide a reference of 2.0 V to the bases of the drivers.

Selecting a mode and time base pulls 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 the frequency and 1 ms makes the output of U4B low, turning on Q2 to light DS1. U8C(8) is also low, lighting DS2.

For time interval average or period average modes, U8A is activated and depending on the time base switch setting either Q5, DS4, U8D, Q7, and DS6, or Q9, DS8, U8D, Q7, and DS6. Similiary, period or time interval modes together with various time base settings will select either microseconds, milliseconds, or seconds.

The asterisk (*) annunciator (DS5) is activated for four combinations of function-time base settings. An asterisk indicates that the least significant digit and the proper units cannot be displayed. CR1 and R4 establish the 155 V for the annunciators.

Figure 8-13
A7B FUNCTION CONTROL ASSEMBLY
(See Page 8-27)



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

SLOPE

HB,LB = ECL Levels
H,L = TTL Levels

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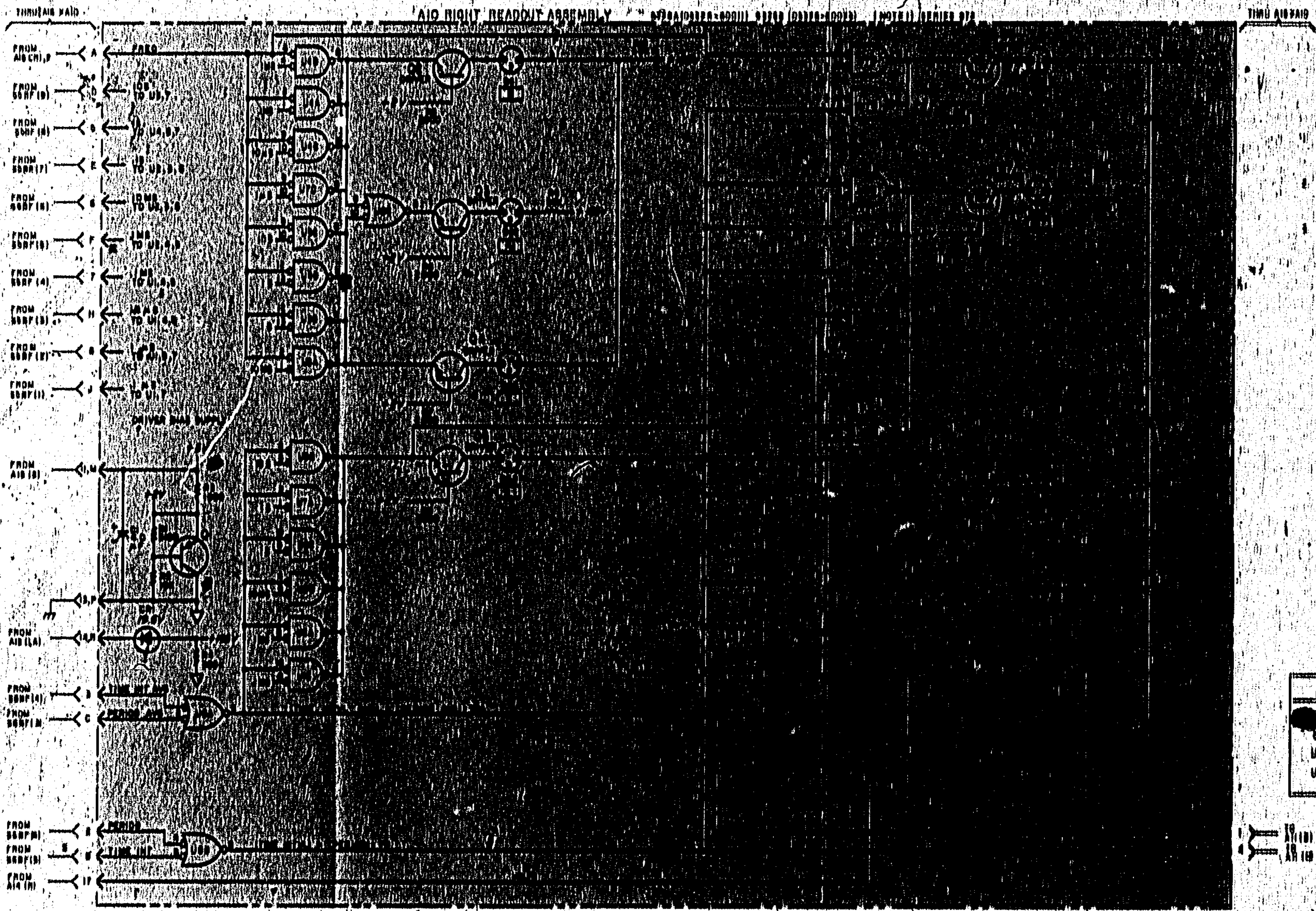


NOTES

Figure 8-16. 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 of 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).

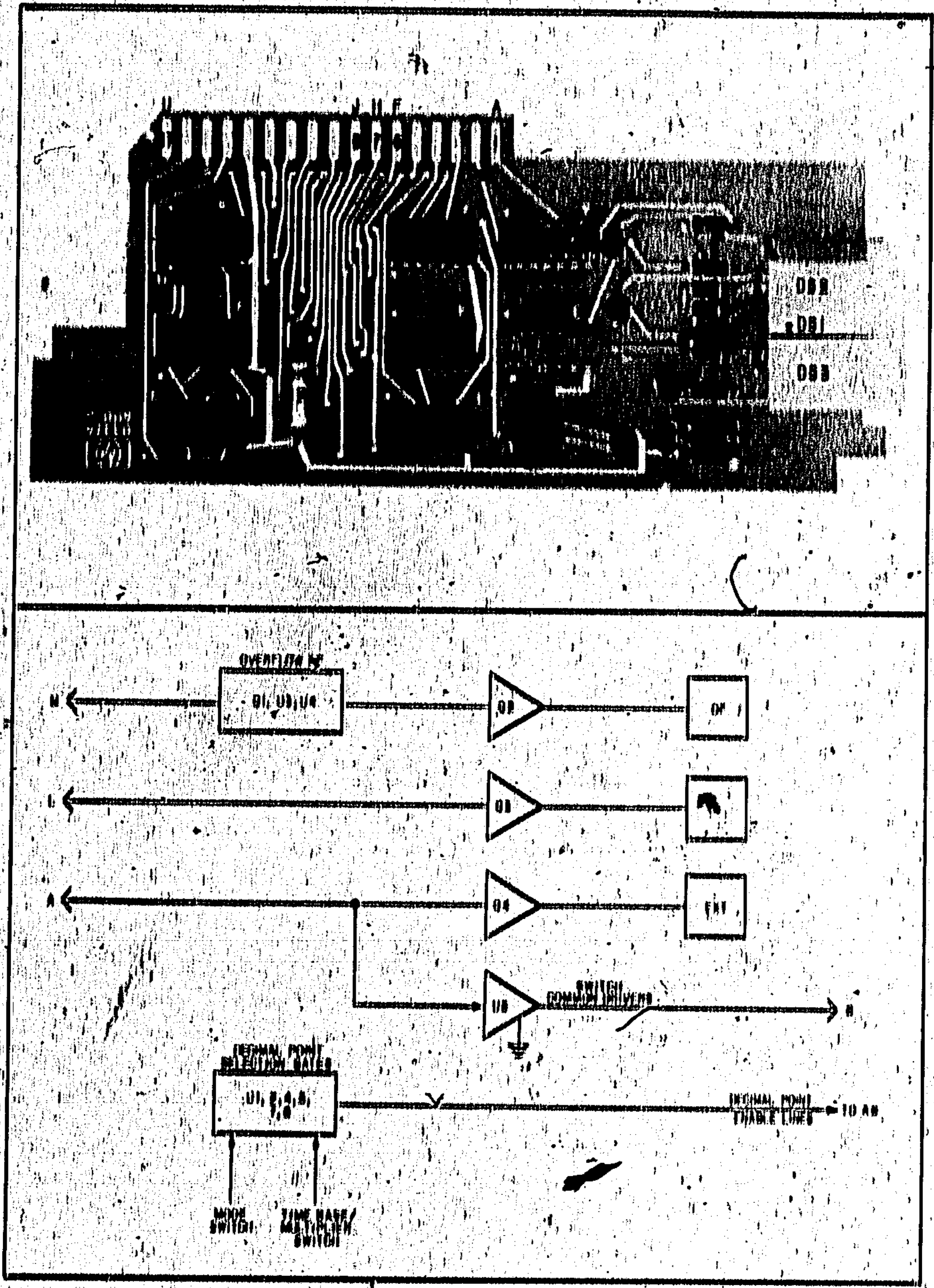
A11 TROUBLESHOOTING

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 U1 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. A8 Display Support Assembly



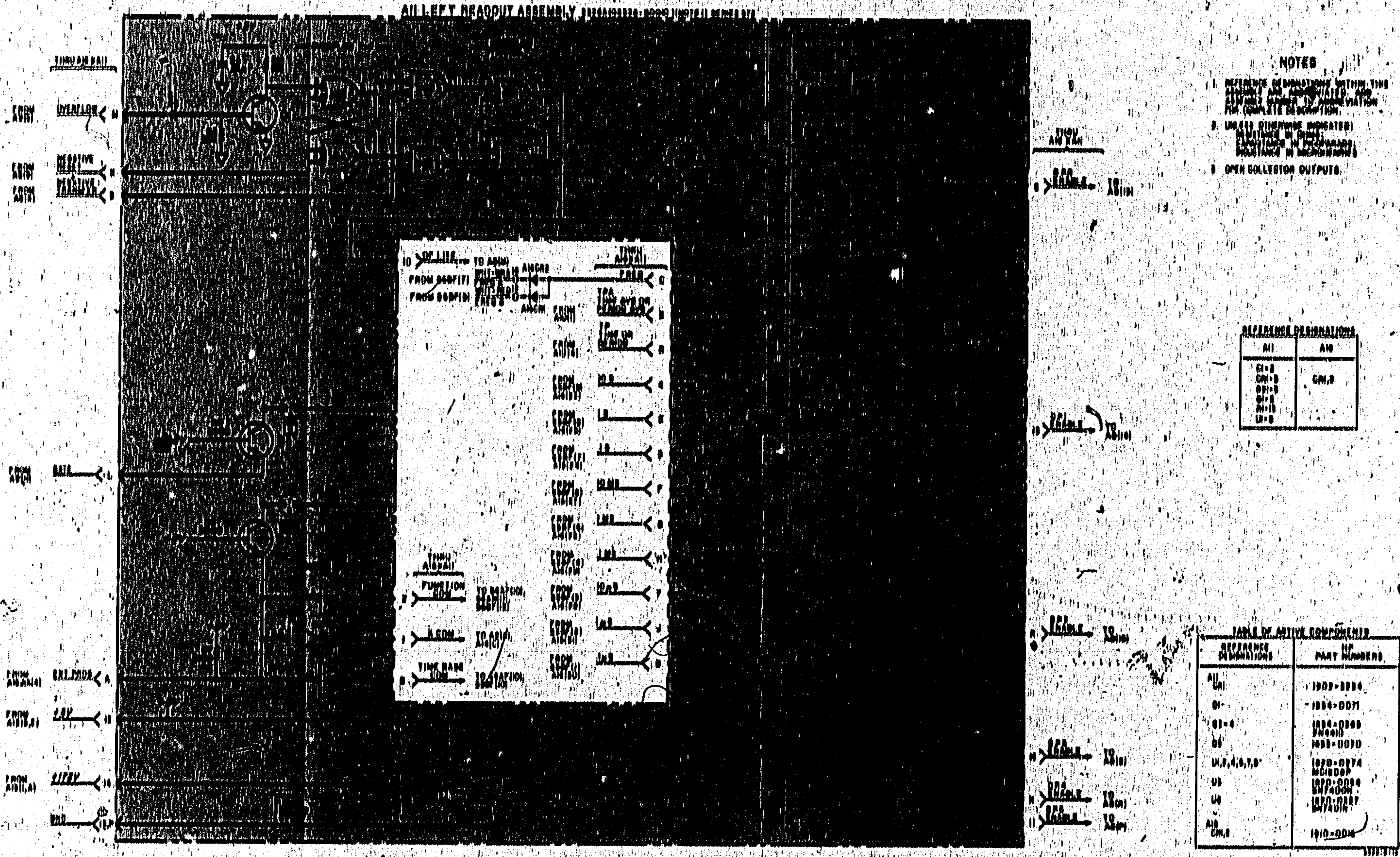
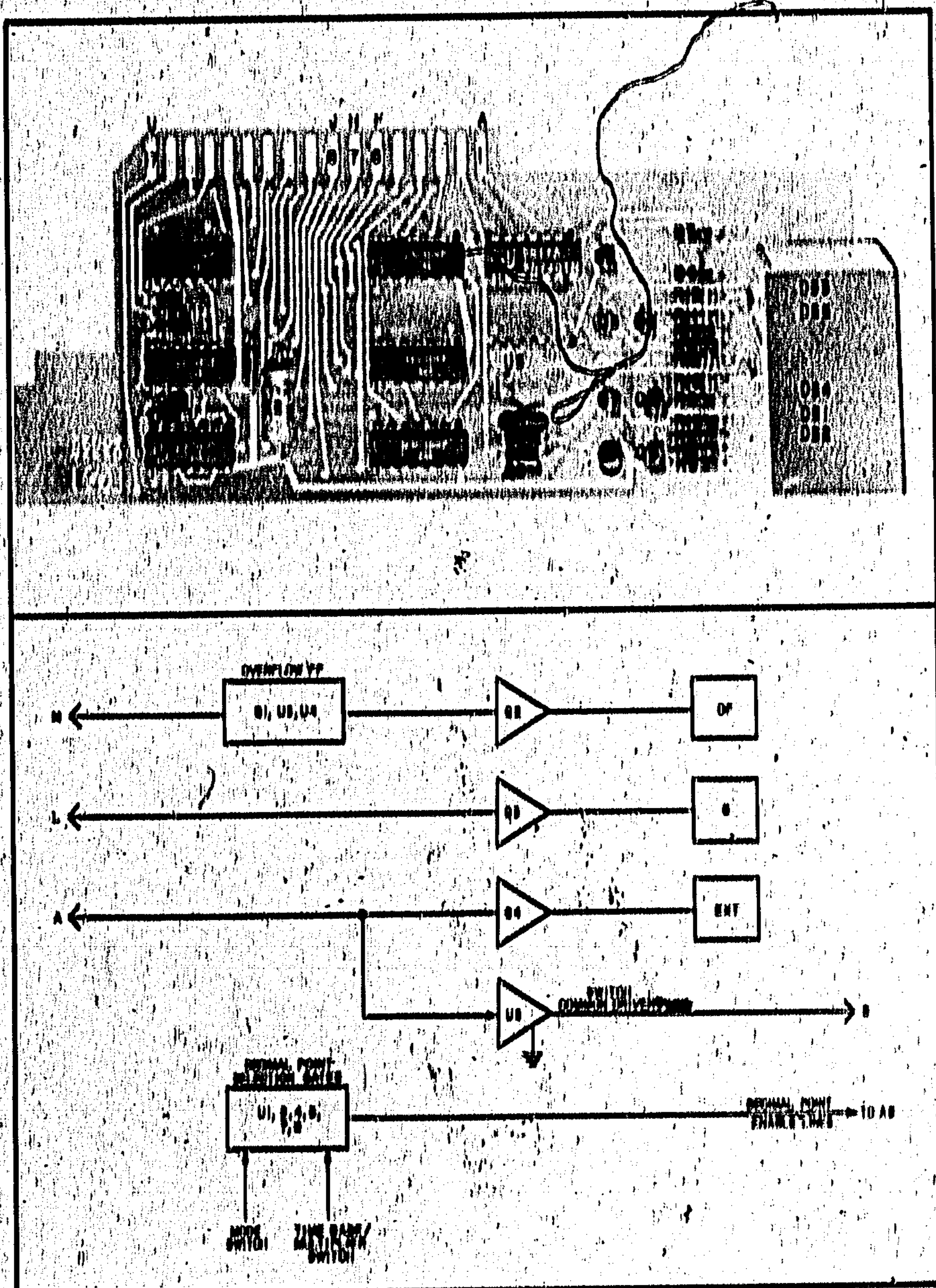
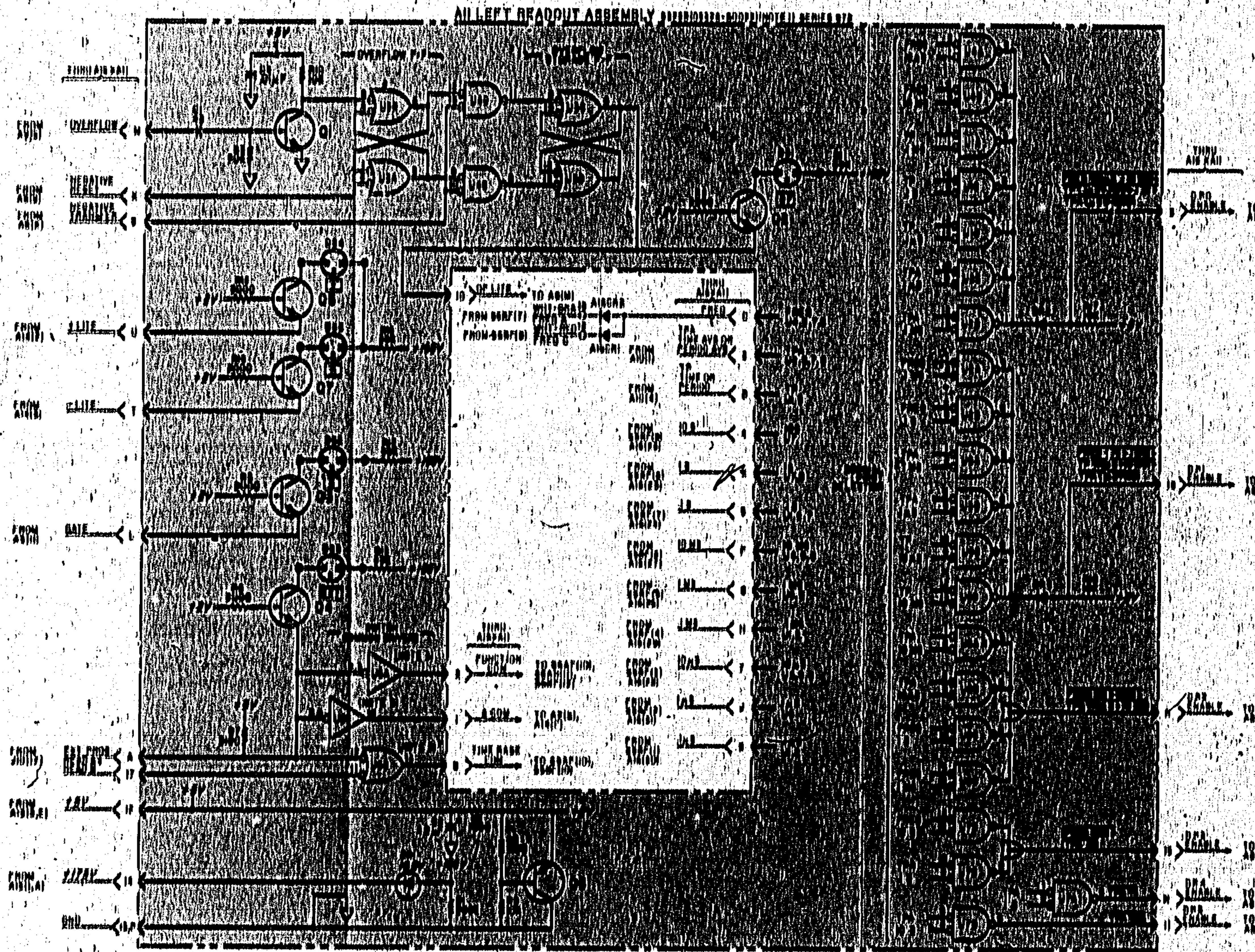


Figure 8-17. A11 5326A Left Readout Assembly.


L
A
EXT



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. OPEN COLLECTOR OUTPUTS.

REFERENCE DESIGNATIONS

A11	A18
[illegible]	[illegible]

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A11 CR1	[illegible]
Q1	[illegible]
Q2-4	[illegible]
Q5	[illegible]
U1,2,4,5,7,8	[illegible]
U3	[illegible] SN7400N
U6	[illegible]
A18 CR1,2	[illegible]

Figure 8-16. A11 5328B Left Readout Assembly

Model 5326
Schematic

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.

A12 TROUBLESHOOTING

Set FUNCTION to DVM, TIME BASE to .1 s and RANGE to 10 V. If assembly is functioning on the 10 V range, go to step 2.

Figure 8-18
A11 5326B LEFT READOUT ASSEMBLY

(See Page 8-37)

1. a) Use a jumper to short Q7A gate to the HI input at R5.

   b) Connect a power supply to the DVM input terminals. Set the power supply to 0 volts, +12 volts and -12 volts. If the proper voltage is displayed, proceed to step 2.

   c) Remove the connection on the DVM inputs and remove A13. Place the jumper on A12 from Q7B gate to ground. Measure the voltage at the sources of Q7A and Q7B. This should be between 0.5 V and 3.5 V.

   d) Measure the voltage drop across R29 and R31. This should be within about 10% of 50 mV and 100 mV, respectively. If not, check the constant current sources.

   e) Measure the voltage at the drain of Q7A and Q7B. This should be between 6.2 V and 7.0 V. If not, check the bootstrap drain supply.

   f) Measure the voltage difference between Q7A and Q7B sources. If greater than 50 mV, replace Q7.

   g) Remove the jumper and install A13. Check the reading and adjust the zero pot on A12 for zero display.

   h) If zero display is not possible, measure the voltage across R34. If this is greater than 1 mV, suspect Q7.

   i) Measure the voltage between U1(2) and U1(3). If greater than 10 mV, U1 is probably defective.

   j) Connect +12 V and -12 V to the DVM input terminals. If the two readings are not correct, measure the voltage between U1(2) and U1(3). If greater than 10 mV, replace U1.

   k) Disconnect power supply and short DVM input terminals. If zero reading is drifting, monitor the voltage between U1(2) and U1(3). If drifting, replace U1.

2. a) Remove any jumper remaining on the board. Set RANGE switch to 10 V. Short the DVM input terminals.

   b) Vary the Channel A and Channel B Level pots. The display should stay zero. If not, check relay K5 and K6.

   c) Connect 10 V to the DVM terminals. If display is drifting, K1 is open. If the display is 5.25 V, K3 or K4 is shorted.

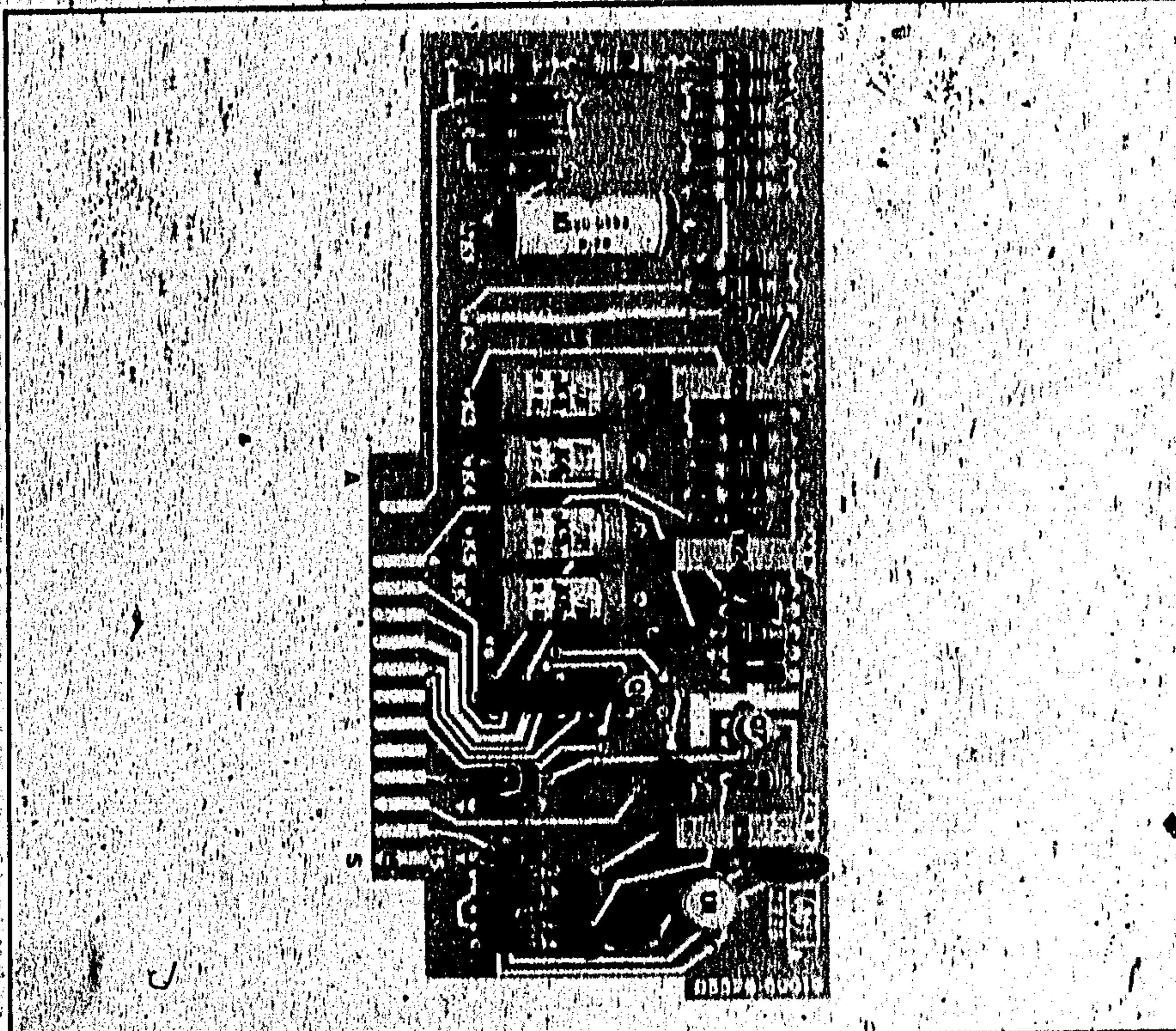
   d) Set RANGE switch to 100 V. If display is drifting, K3 is open. If reading is 5.5 V, K1 is shorted.

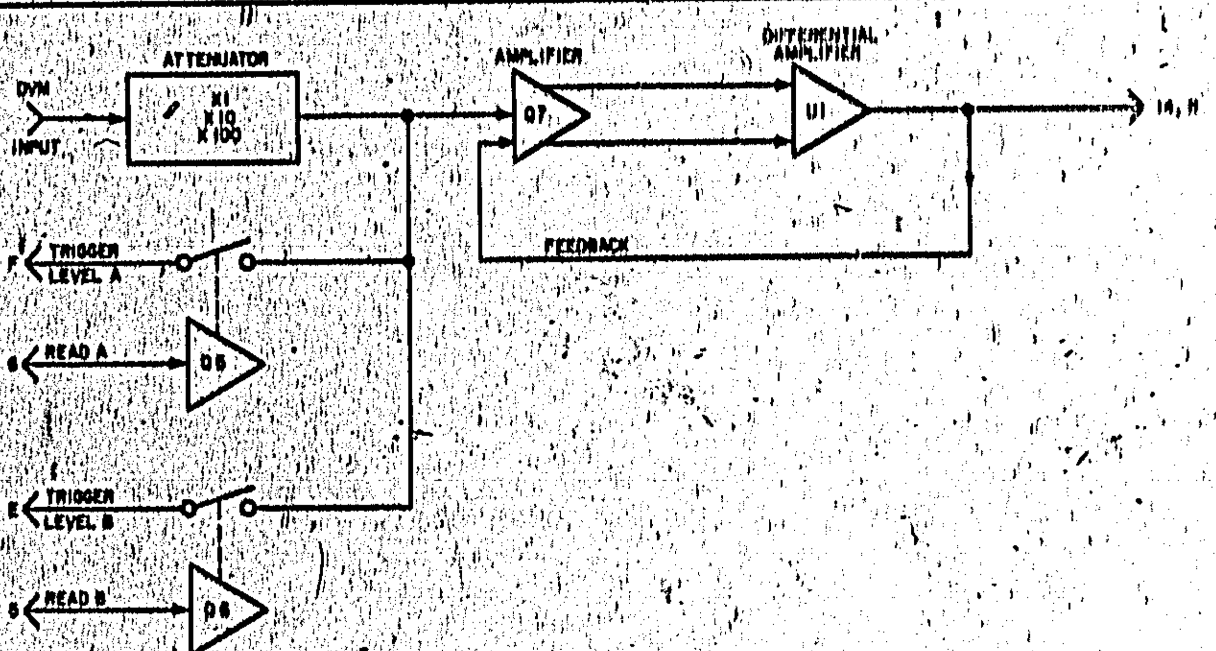
   e) Set RANGE switch to 1000 V. If reading is not correct, check K4.

   f) Connect 1000 V to DVM input terminals. If display is overranging, K1 is breaking down.

CAUTION

USE ADEQUATE PRECAUTIONS WHEN PERFORMING ABOVE STEPS.




ATTENUATOR
X1
X10
X100
DVM
INPUT
AMPLIFIER
Q7
DIFFERENTIAL
AMPLIFIER
U1
14, H
FEEDBACK
F
TRIGGER
LEVEL A
READ A
Q5
E
TRIGGER
LEVEL B
5
READ B
Q6

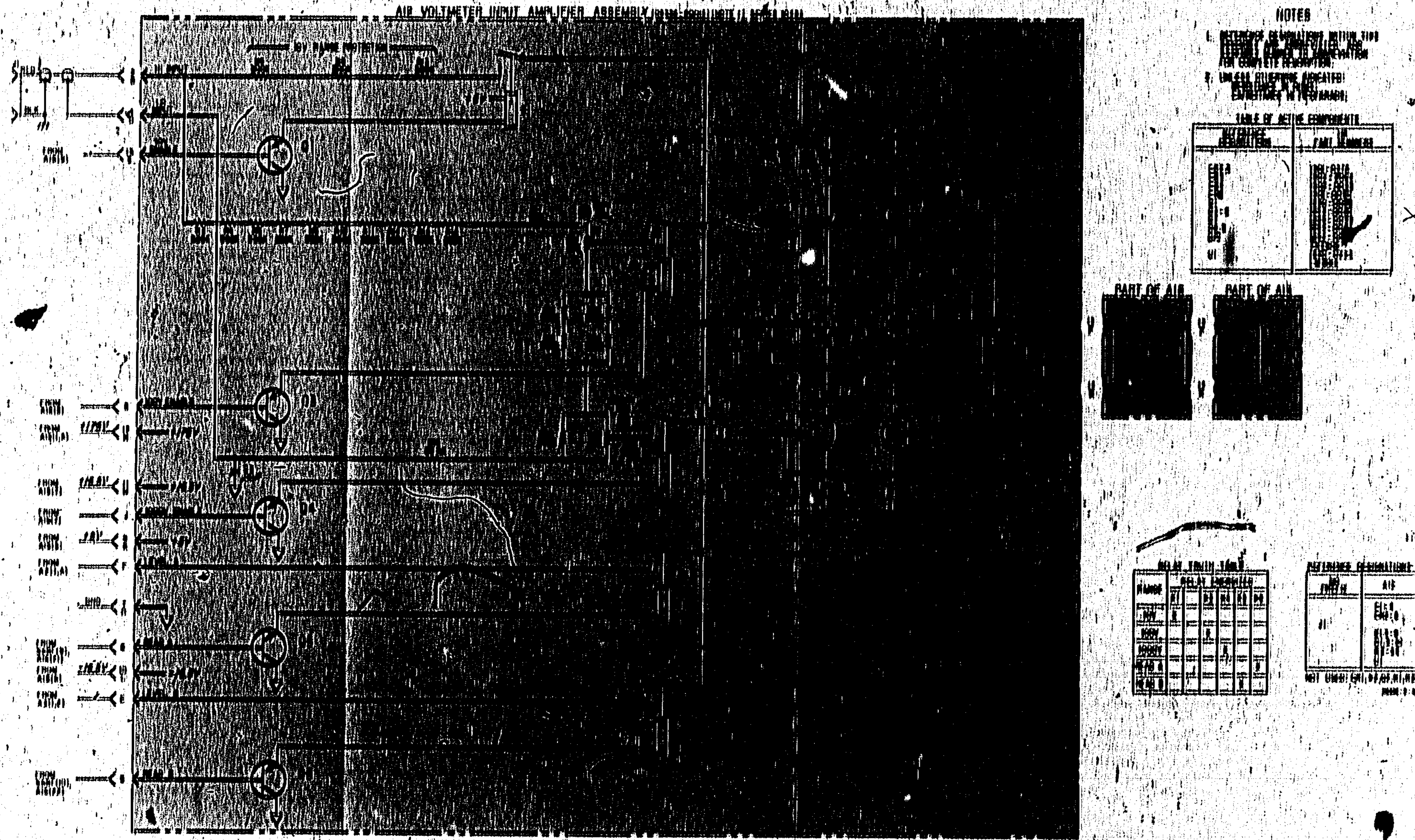


Figure 8-19. A18 Voltmeter Input Amplifier Assembly

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 A9U11B 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 8 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 develops 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 CR4 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 13 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(V3) is greater than -0.7 V and U4B pin 4 is low if V3 is less than -1.6 V. These threshold levels are set by CR11 and R29, 31, 33. U4C and D differentiate the clock input after it passes through the divide-by-8 circuit consisting of U5, Q5, and R34. 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 R38.

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, B.

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.

A12 TROUBLESHOOTING

If assembly has nonlinearity on one polarity, go to step 4. If DVM drifts, go to step 6.

1. a) Short out C8 and measure the voltage at Q3 and Q4 sources. Q3 source should be between +9.8 V and +11 V. Q4 source should be between -9.8 V and -11 V.

   b) Check the waveform at U4(10) and U4(11), syncing the scope from the upper end of C11 (junction with R88).

If these waveforms are incorrect, check U4C and U4D. If the waveform at C11 is wrong, check U8.

   c) Test the digital part of the assembly by first shorting out CR9 and then CR10. Check the voltage at the test points shown below.

	U5(8)	U5(10)	Q8 Col.	Q9 Col.	Readout
CR9 Jumpered	-0.75	+1.6	+1	+1.6	-19,500
CR10 Jumpered	+1.6	-0.75	-0.7	-0.7	+19,500

   d) If U5(8) and U5(10) are correct, proceed to step e. If not, check these additional test points.

	U4(8)	U4(4)	U6(4)	U6(10)
CR9 jumpered	-0.75	-0.75	-0.75	-0.75
CR10 jumpered	+1.6	+1.6	+1.6	+1.6

   e) If the above checks are correct, but the readout is incorrect, suspect U7.

   f) If U6(1) and U6(10) are wrong, check Q7, Q9, and Q6, Q8 respectively, plus diodes CR5 through CR8.

2. Reference current source check.

   a. Q8 should still be jumpered. Measure the voltages across CR1 and CR4. These should be between 5.9 V and 6.5 V. If incorrect, measure across R1 and R4. This should be between 10 and 12.5 V.

   If incorrect, check the reference supply and reference diodes.

   b. Measure the voltage (to ground) at Q3 and Q4 sources and gates.

FET	Source	Gate
Q3	+9.8 to +11.0	+10 to +14
Q4	-9.8 to -11.0	-10 to -14

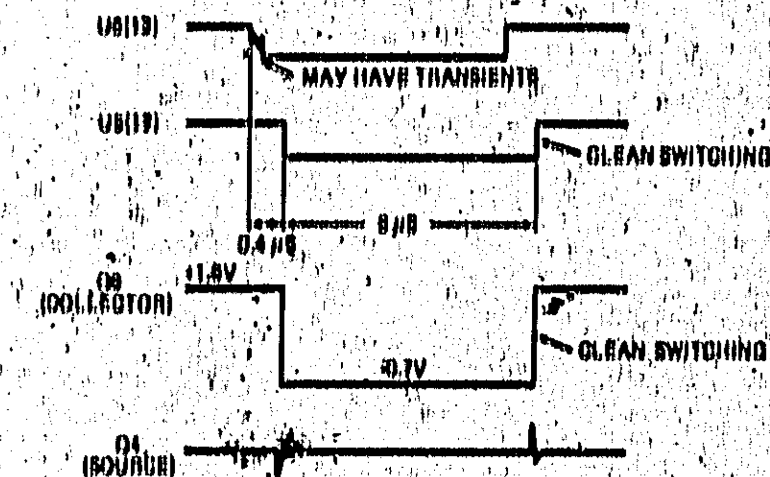
If the voltages are wrong, but about the correct voltage difference exists between the source and gate, check operation amplifier U1 or U2. Otherwise suspect the FET.

3. a) Remove the jumper from C8. If DVM still does not operate, check the integrator or CR5 through CR8.

   b) Measure the voltage at U8(2) and U8(3). If less than 80 mV, suspect U8.

Figure 8-10
A12 VOLTMETER INPUT AMPLIFIER ASSEMBLY
(See Page 8-30)

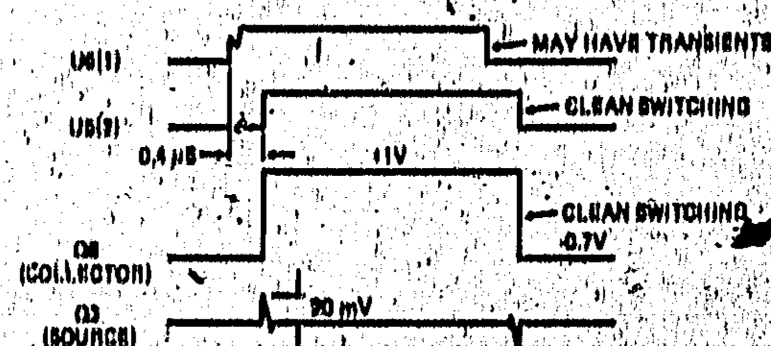
4. **Positive nonlinearity.** If nonlinearity exists when measuring positive voltages, connect +6.25 V to the DVM input and check the waveforms drawn below for switching transients.



Check the parts that are generating the first wrong waveform. If the waveforms are correct, check diodes CR5, CR6, CR7, CR8, CR12, and CR13.

5. **Negative nonlinearity**

If nonlinearity exists while measuring negative voltages, connect -6.25 V to the DVM terminals and check the waveforms drawn below for switching transients.



6. **Excessive Drift**

For excessive drift after turn-on or after aging, check for the components that are drifting, using another DVM.

MORE DATA UNDER THIS FOLD

7. Zero Drift

Verify that the drift is not in the A12 assembly. Measure between U8(2) and U8(6) with a floating DVM. This should read ≤10 mV with the drift 0.2 mV. Replace U8 if the drift is excessive.

8. Full Scale Drift

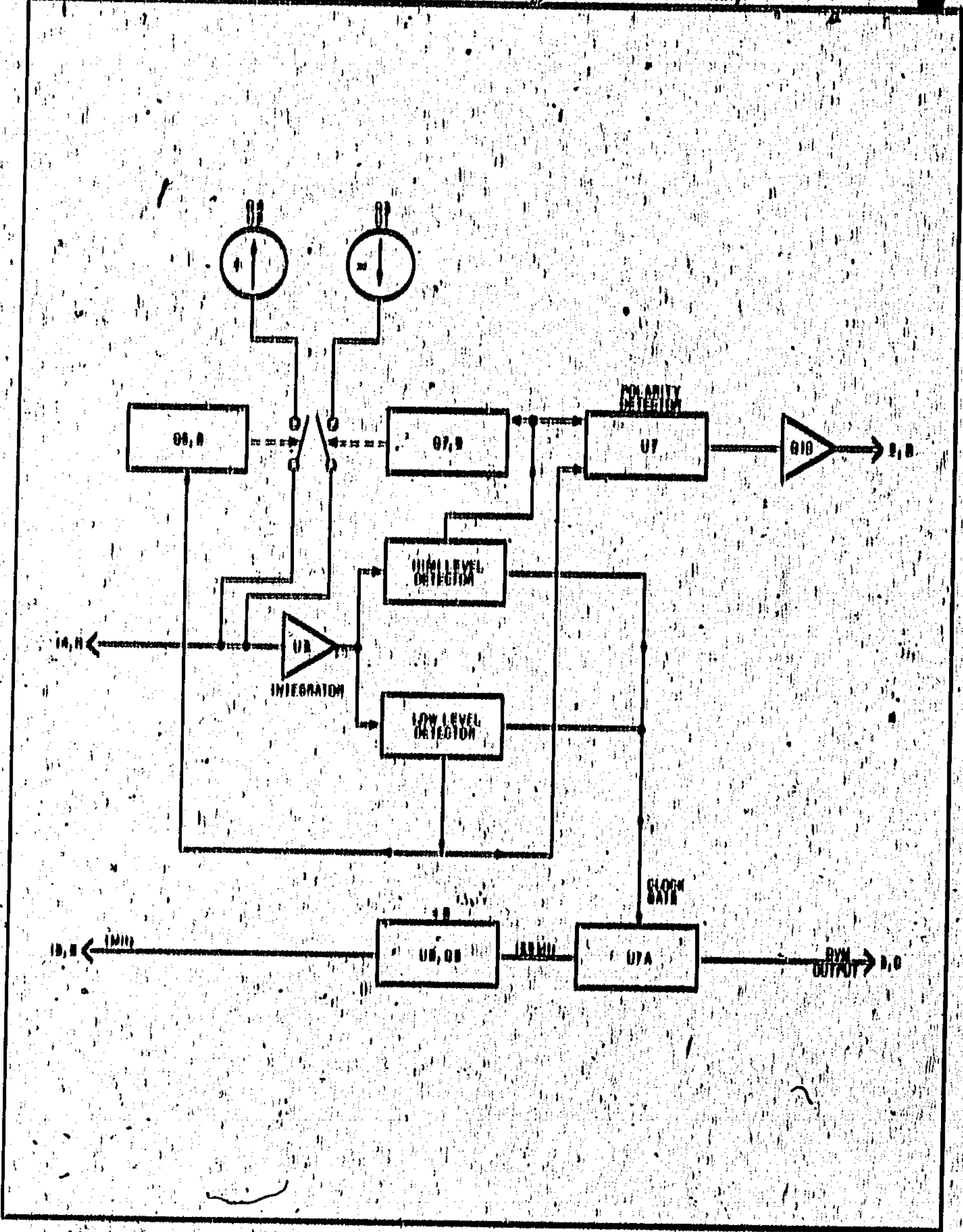
Using a floating DVM, measure the voltage across CR1 and CR4.

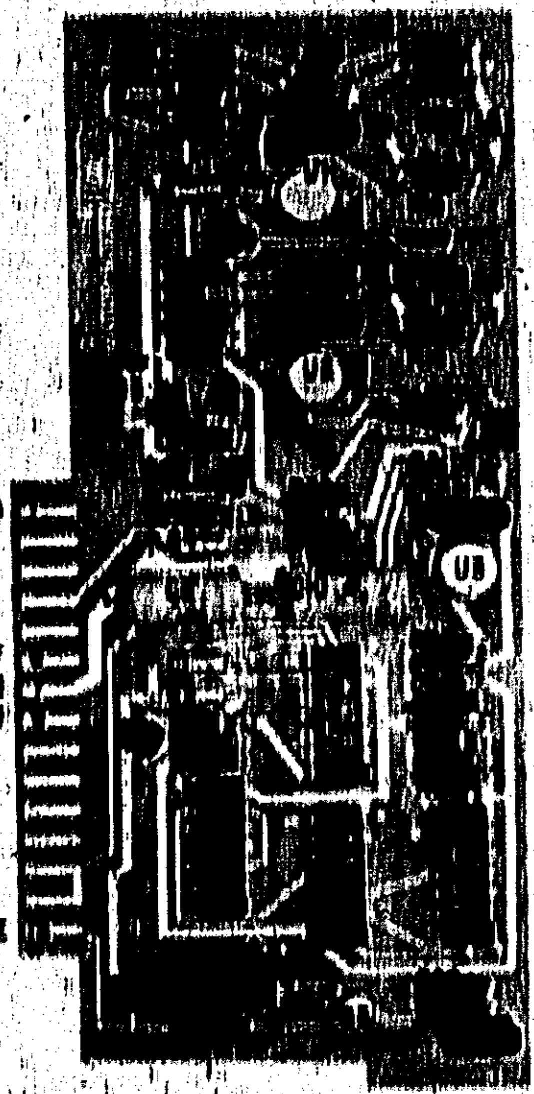
NOTE

Be certain to connect the LO terminal of the DVM to the cathode of CR1 (+16.5 V supply) and the anode of CR4 (-16.5 V supply) when making the above measurement, diode should measure 6.2 V with drift <0.2 mV. Replace the diode that exhibits excessive drift. Measure the voltage between U1(2) and U1(6), connecting the LO terminal of the DVM to pin 6. The difference in potential should be ≤10 mV, with drift <0.2 mV.

Repeat the above measurement on U2. Replace the defective component.

Part of Figure 8-30. A18 Voltmeter V to F Converter Assembly

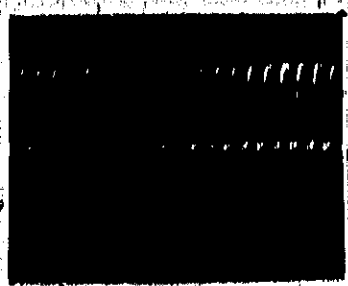




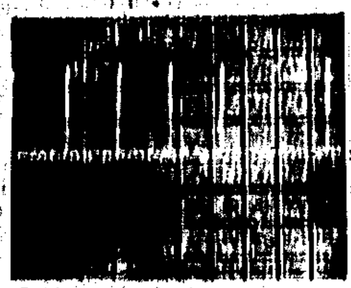
A

F
H
J

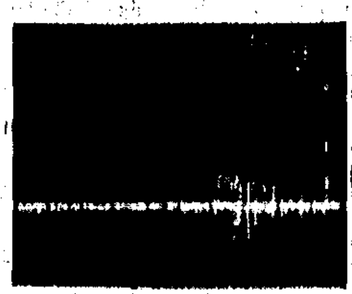
Z



U8(9)
.1 V/cm
5 μs/cm



Q5 Collector
.5 V/cm
5 μs/cm



U7(8)
.05 V/cm
10 μs/cm

All waveforms dc coupled through 10:1 divider probe. Divider probe ground connected to junction to Q3 and Q5. Triggering is internal ac. Zero volts in center line of graticule.

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

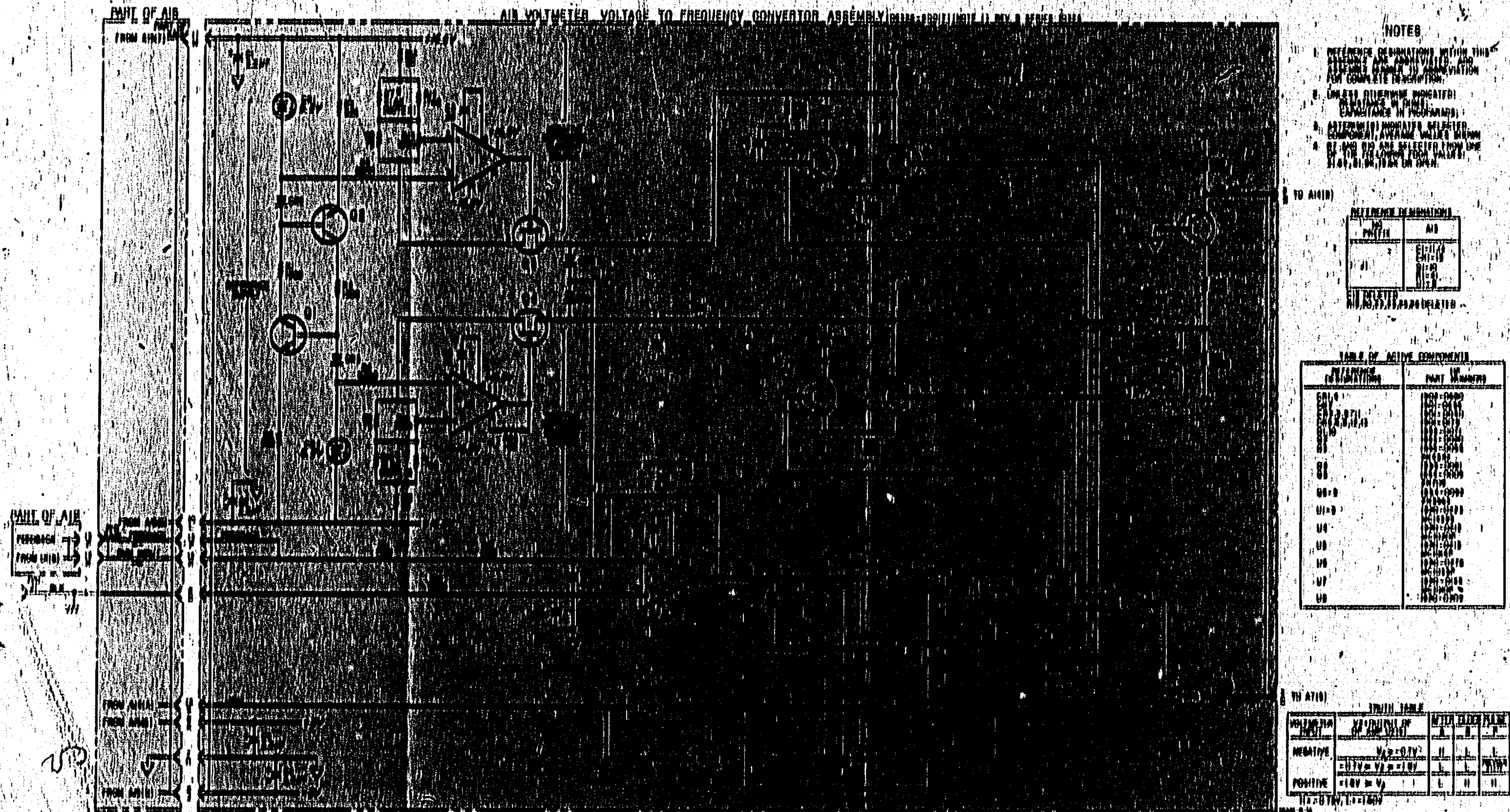


Figure 8-30. A18 Voltmeter V to F Converter Assembly

A15-A16 POWER SUPPLY OPERATION

The power supply provides +175 V, +16.5 V and +5 V. Transformer T1 has a 115/230 V primary and secondaries with open circuit voltages of 181 V at the red leads, 21 V at the orange, and 18.8 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 CR12 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 and 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 R8 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.

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.

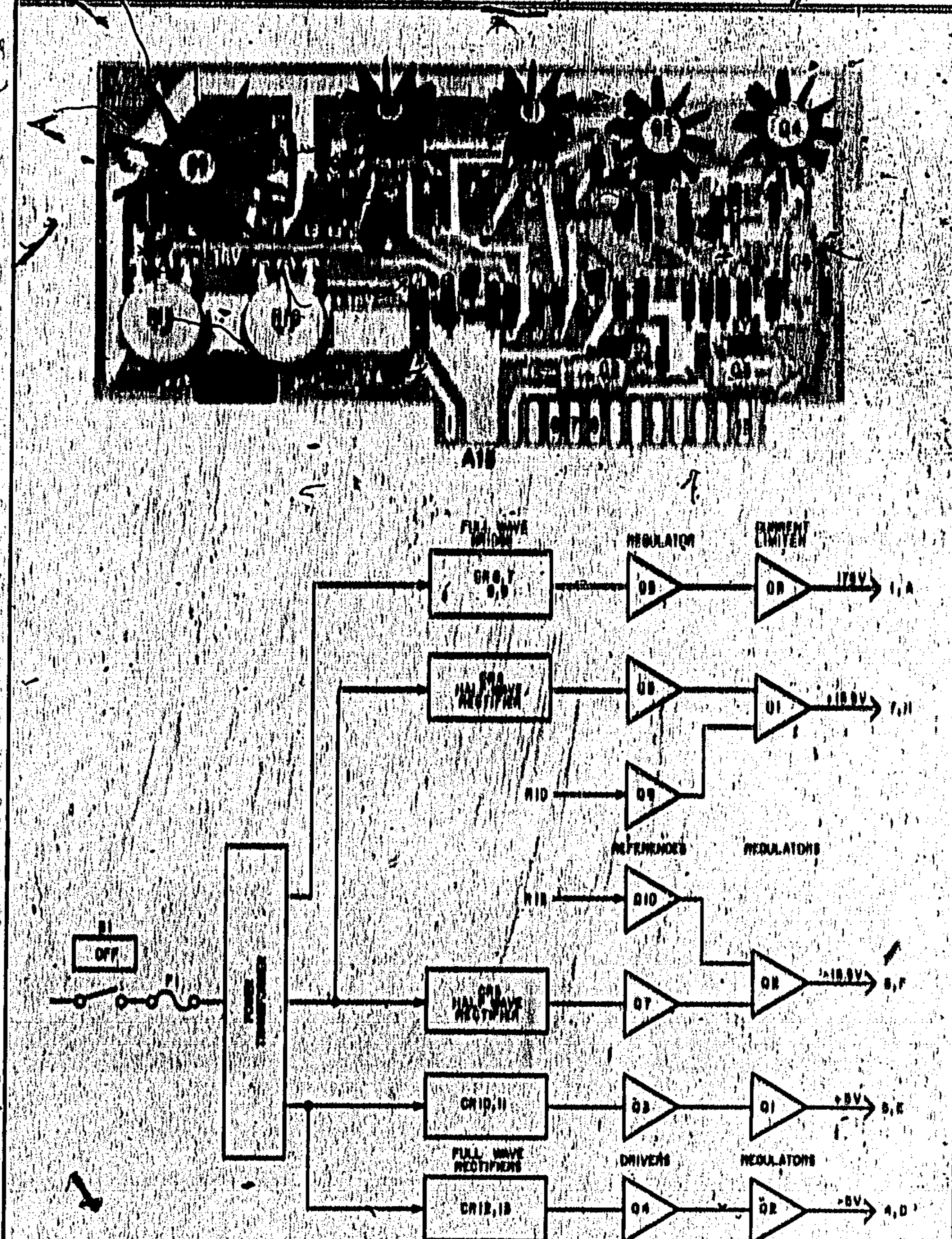
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

See introduction to this section for ordering information

Figure 8-20
A13 VOLTMETER V TO F CONVERTER ASSEMBLY

(See Page 8-43)

Part of Figure 8-21. A15, A16 Regulator Board, Interconnect Board Assembly



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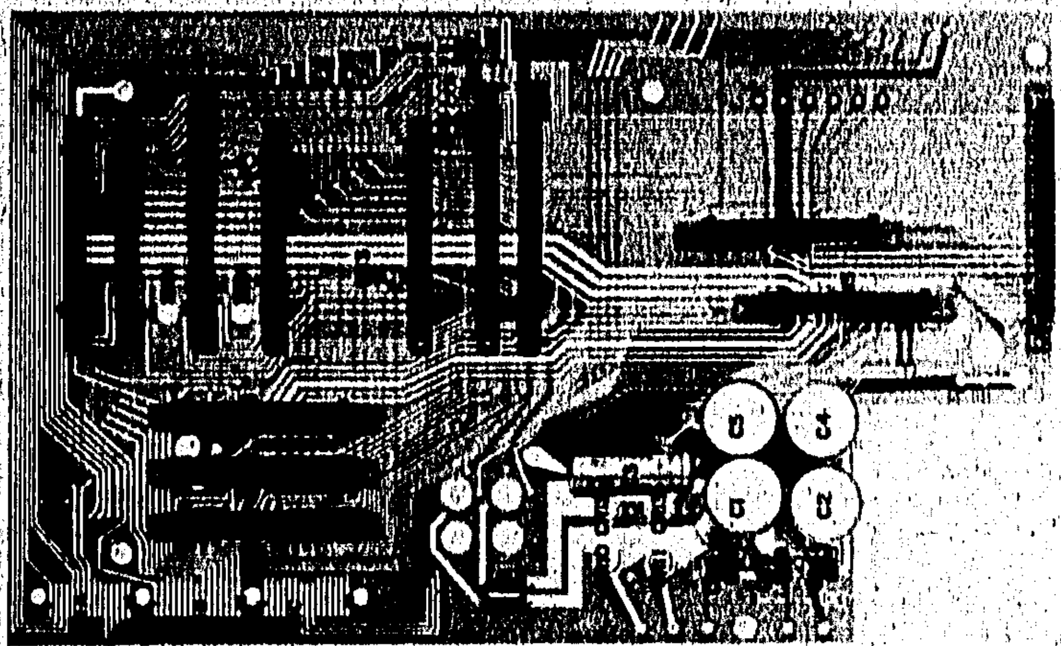

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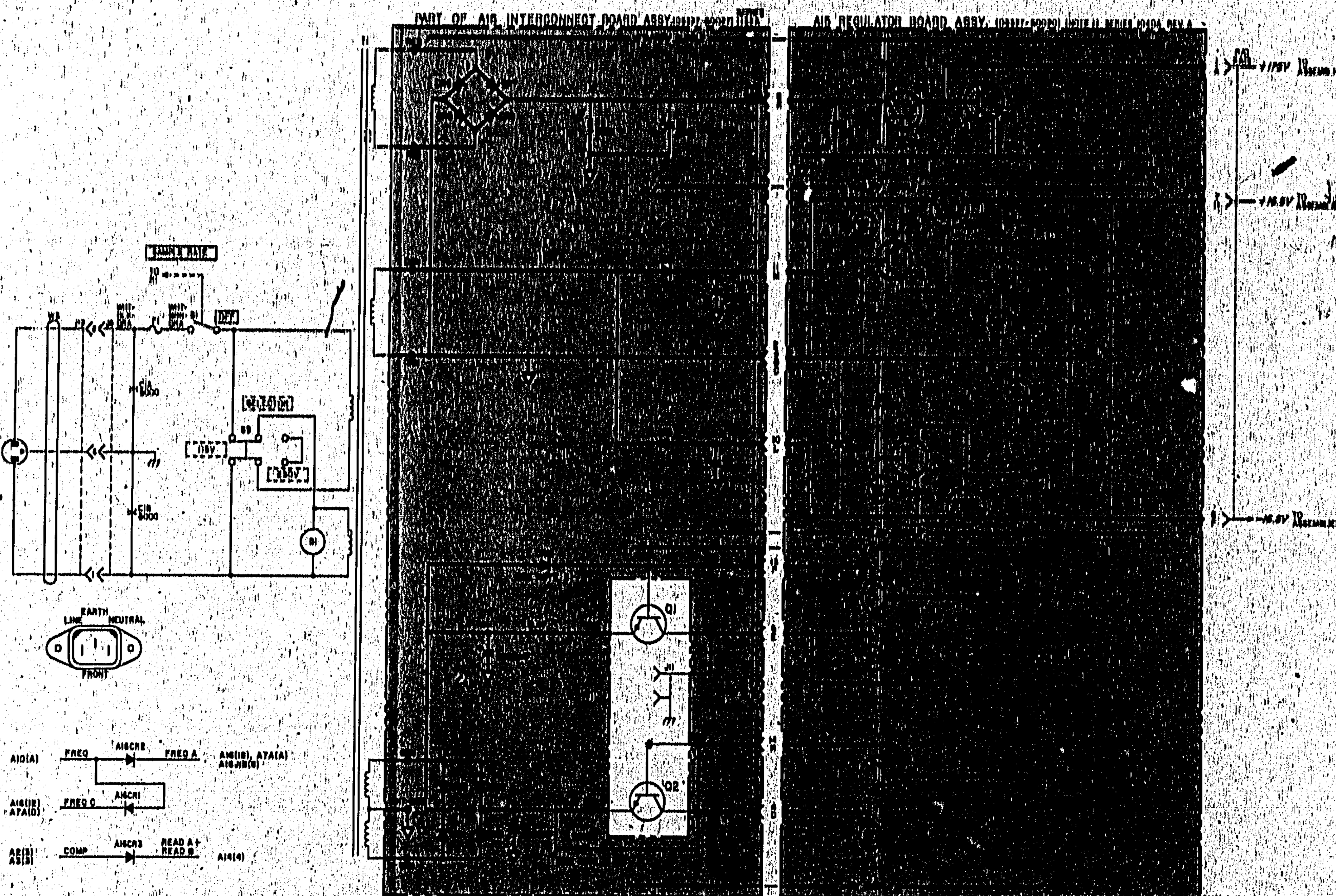


NOTES

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 PICOFARADS.
3. A15 Q1-8 HAVE HEAT SINK.
4. ASTERISK (*) INDICATES SELECTED COMPONENT; AVERAGE VALUES SHOWN.
5. CR16 AND CR17 ARE 3-JUNCTION SILICON DIODES.

REFERENCE DESIGNATIONS

NO PREFIX	A15	A16
B1 C1	C1-7 CR1-18	C1-6 CR4-13, 16,17
F1 J9, J11 P1 Q1,2	Q1-10 R1-18	R1-3
S1,3 T1 W3		

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
NO PREFIX	
Q1	1853-0281
Q2	1854-0420
A15	
CR1,4	1902-3002
CR2,3	1902-0551
CR5,8,15-18	1901-0040
CR6,7,9,10	1902-3094
CR11	1902-3194
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
A16	
CR4,8	1901-0045
CR5-9	1901-0028
CR10-15	1901-0415
CR16,17	1901-0460

Figure 8-21. A15 Regulator Board, A16 Interconnect Board Assembly (5326B with Serial Prefix 1124A and above only)

A15-A16 POWER SUPPLY OPERATION

The power supply provides ±175 V, ±16.5 V and ±5 V. Transformer T1 has a 115/230 V primary and secondaries with open circuit voltages of 161 V at the red leads, 21 V at the orange, and 18.5 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 CR12 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 R5. 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 and 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.

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 Q10. Q8 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, Q8 is turned on providing base current to turn on Q1, raising the output voltage. Q8 turns off when its emitter gets above 5.1 V. C2 is the output filter to maintain a low output impedance at high frequencies.

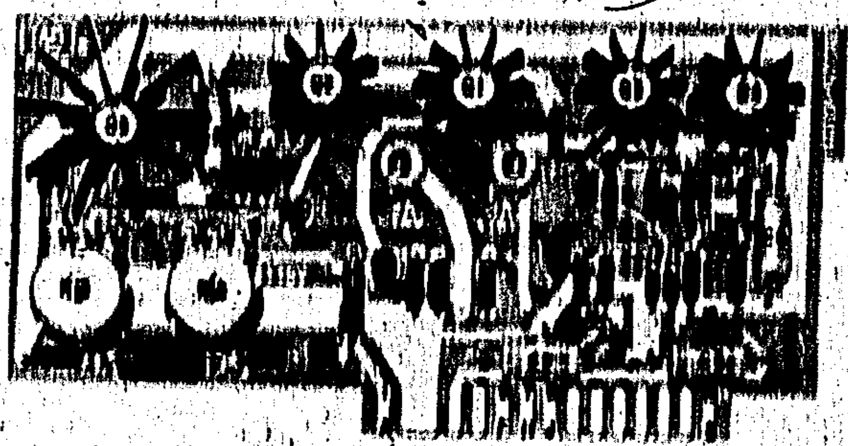
CR8 clamps the output at 6 V to provide protection for the IC's in case the 16.5 V or 175 V line should momentarily short to the 5 V line. CR5 provides thermal compensation for Q8.

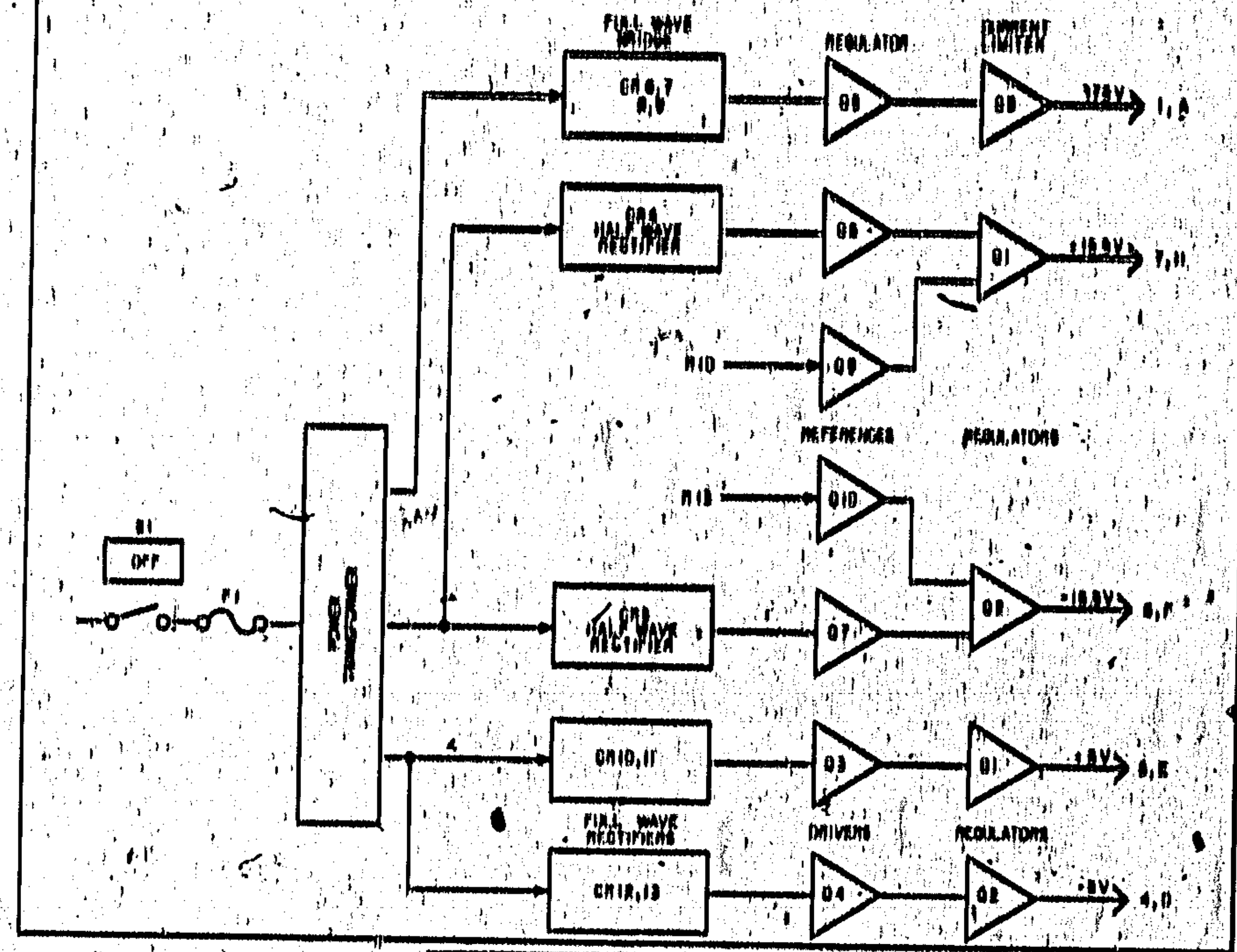
Note that the 16.5 V supply is needed for operation of the 5 V supply. If the + or -16.5 V supply fails, the corresponding 5 V supply will be inoperative.

Figure 8-21
A15 REGULATOR BOARD,
A16 INTERCONNECT BOARD ASSEMBLY
(5328B with Serial Prefix 1124A and above only)

(See Page 8-45)

Part of Figure 8-22. A15, A16 Regulator Board, Interconnect Board Assembly





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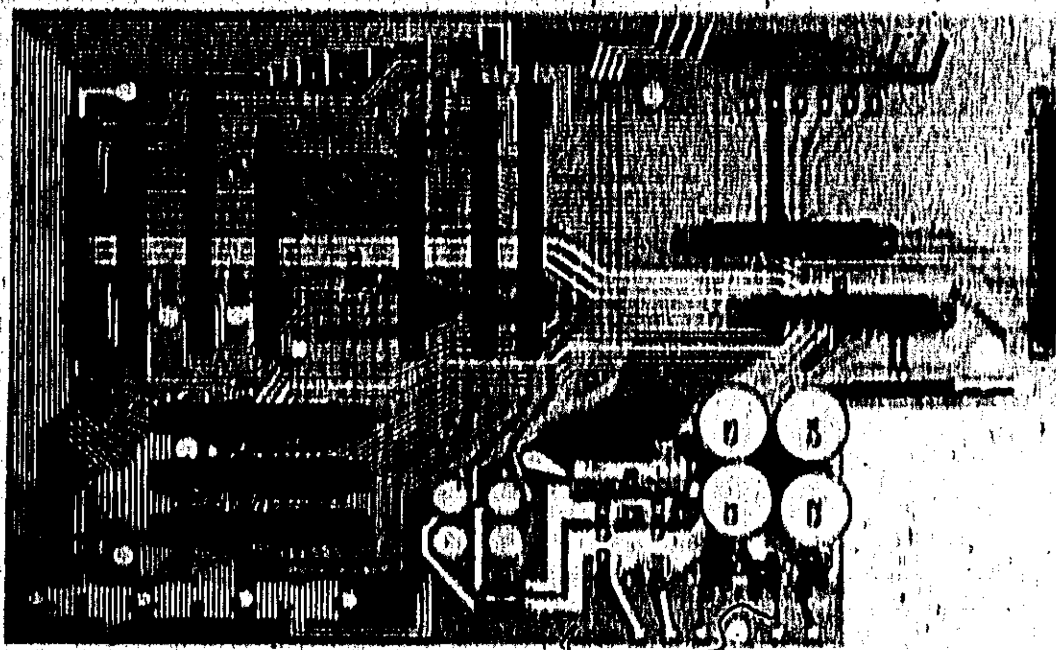

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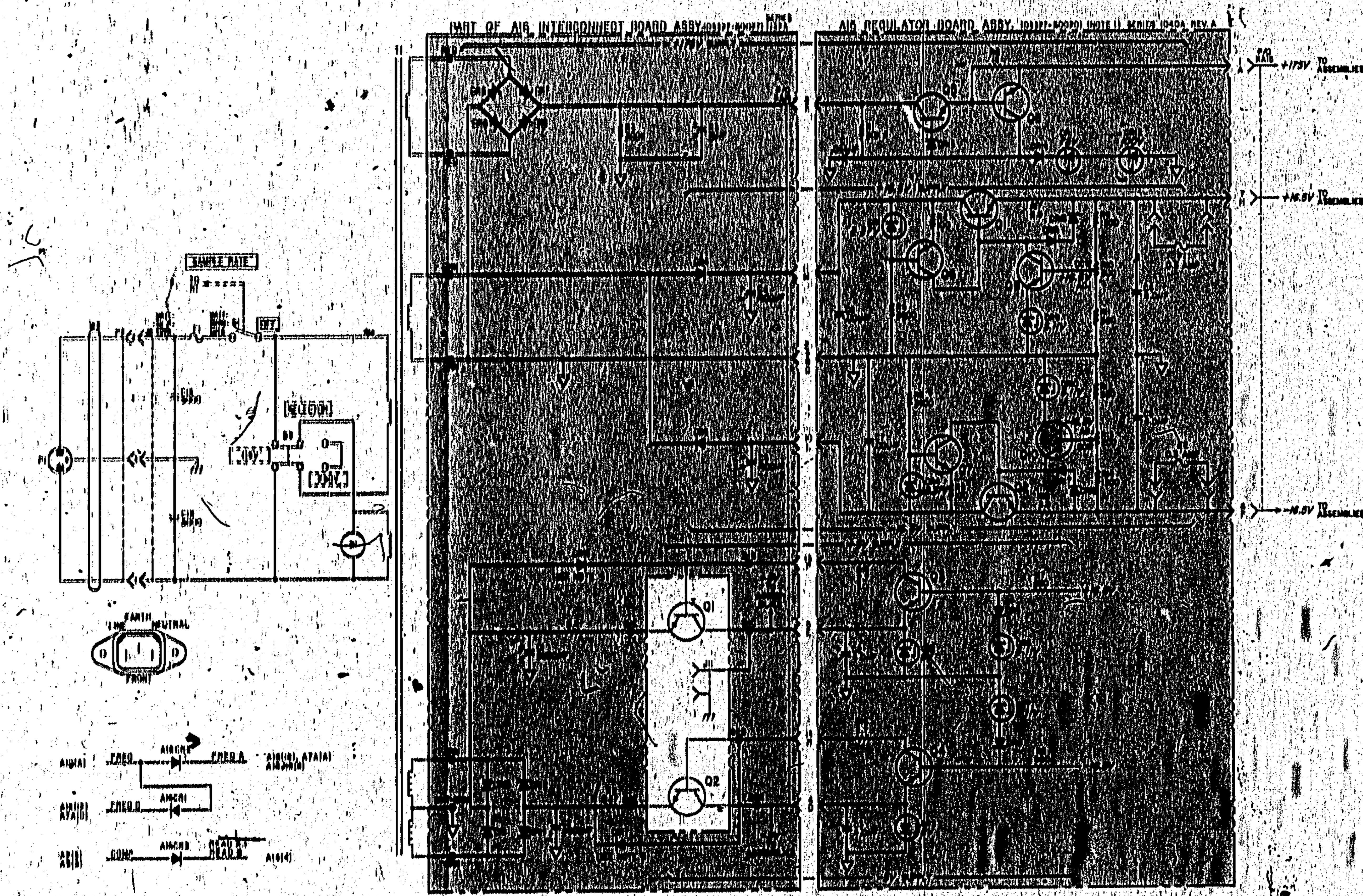


NOTES

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 PICOFARADS;
3. A15 Q1-5 HAVE HEAT SINK.
4. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.
5. CR16 AND CR17 ARE 3-JUNCTION SILICON DIODES.

REFERENCE DESIGNATIONS

NO PREFIX	A15	A16
B1		
C1	C1-7	C1-6
	CR1-16	CR4-13, 16,17
	F1,2	
F1		
J6, J11		
P2		
Q1,2	Q1-10	
	R1-16	R1-3
S1, 9		
T1		
W3		

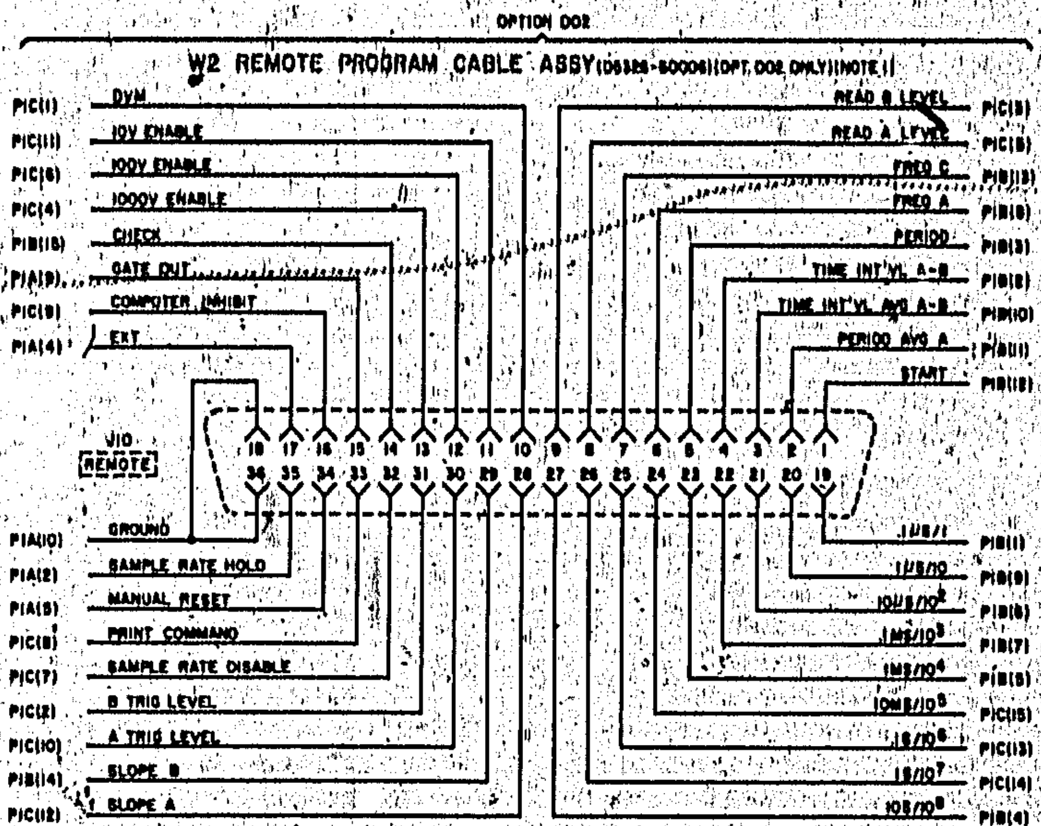
TABLE OF ACTIVE COMPONENTS

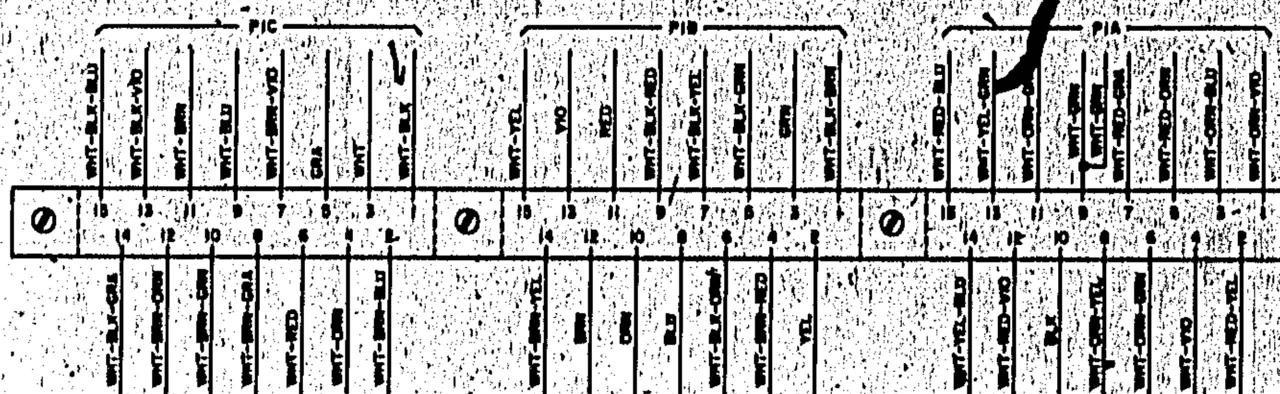
REFERENCE DESIGNATIONS	HP PART NUMBERS
NO PREFIX	
Q1	1853-0233
Q2	1854-0420
A15	
CR1,4	1902-3002
CR2,3	1902-0644
CR5,8,15-16	1901-0040
CR6,7,9,10	1902-3094
CR11	1902-3394
CR12	1902-3429
CR13,14	1901-0033
Q1	1854-0300
Q2	1853-0073
Q3	1854-0039 2N3053
Q4	1853-0012 2N2904A
Q5	1854-0232
Q6,10	1853-0020
Q7,9	1854-0071
Q8	1854-0474
A16	
CR4,5	1901-0045
CR6-9	1901-0029
CR10-13	1901-0415
CR16,17	1901-0460

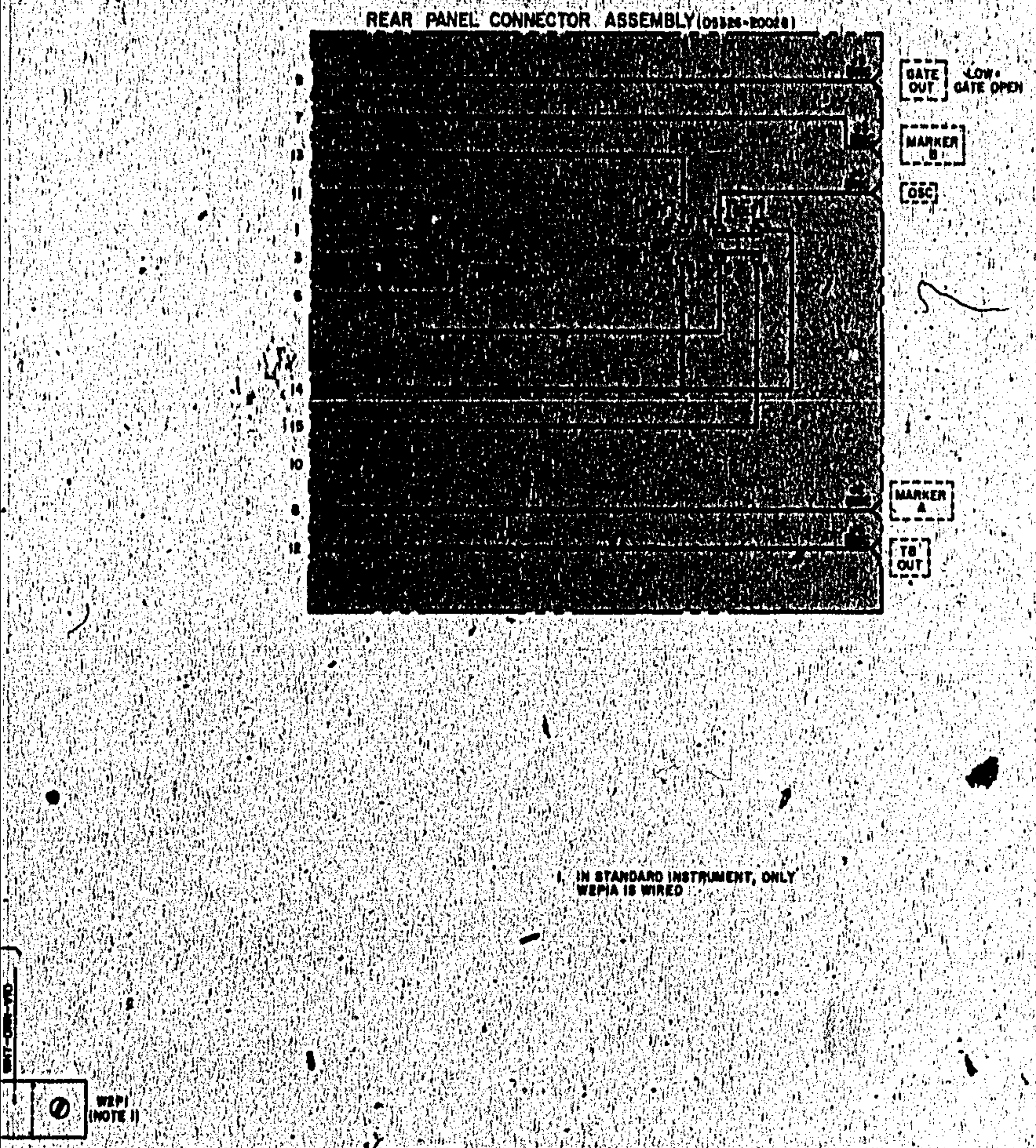
Figure 8-22. A15 Regulator Board, A16 Interconnect Board Assembly

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Start/Stop	1	BRN	B12	A16(14), A7A(4)	L = Start Open = Stop
Period Avg A	2	RED	B11	A16(13), A7A(C), A10(C)	L = Enable
Time Intvl Avg	3	ORN	B10	A16(16), A7A(3), A10(3), A3(2)	
Time Intvl	4	YEL	B2	A16(15), A7A(B), A10(B), A2(2)	
Period	5	GRN	B3	A16(17), A7A(2), A10(2)	
Freq A	6	BLU	B8	A16(18), A7A(A), A16CR2(C)	
Freq C	7	VIO	B13	A16(12), A7A(D), A16CR1(C)	
Read A	8	GRA	C5	A16(21), A12(6), A14(F)	
Read B	9	WHT	C3	A16(22), A12(5), A14(E)	
DVM	10	WHT-BLK	C1	A16(20), A14(A)	
10 V Range	11	WHT-BRN	C11	A16(9), A12(15), A14(8)	
100 V Range	12	WHT-RED	C6	A16(8), A12(8), A14(6)	
1000 V Range	13	WHT-ORN	C4	A16(7), A12(J), A14(5)	
.1 μs/10^0	19	WHT-BLK-BRN	B1	A16(30), A5(E), A10(J), A11(8)	
1 μs/10^1	20	WHT-BLK-RED	B9	A16(31), A5(5), A10(8), A11(J)	
10 μs/10^2	21	WHT-BLK-ORN	B6	A16(28), A5(D), A10(H), A11(7)	
.1 ms/10^3	22	WHT-BLK-YEL	B7	A16(29), A5(4), A10(7), A11(H)	
1 ms/10^4	23	WHT-BLK-GRN	B5	A16(26), A5(C), A10(F), A11(6)	
10 ms/10^5	24	WHT-BLK-BLU	C15	A16(27), A5(3), A10(6), A14(N), A11(F)	
.1 s/10^6	25	WHT-BLK-VIO	C13	A16(24), A5(B), A10(E), A14(S), A11(5)	
1 s/10^7	26	WHT-BLK-GRA	C14	A16(25), A5(2), A10(5), [illegible], A11(E)	
10 s/10^8	27	WHT-BRN-RED	B4	A16(23), A5(A), A10(D), [illegible]	L = Enable
Slope A	28	WHT-BRN-ORN	C12	A2(13)	L = Minus Open = Plus
Slope B	29	WHT-BRN-YEL	B14	A3(13)	L = Minus Open = Plus
Level A	30	WHT-BRN-GRN	C10	A2(1), A12(F)	+3 to -3 V x Atten = Trig Level
Level B	31	WHT-BRN-BLU	C2	A3(1), A12(E)	+3 to -3 V x Atten = Trig Level
Sample Rate Disable	32	WHT-BRN-VIO	C7	A6(10), S6	L = Inhibit Sample Rate
Print Command	33	WHT-BRN-GRA	C8	A6(8), J9(48)	L = Causes Print
Reset	34	WHT-RED-ORN	A5	A16(6), A6(3)	L = Reset
Hold	35	WHT-RED-YEL	A2	A16(4), A6(1)	L = Maintain Display
Int/Ext	17	WHT-VIO	A4	A11(A)	Open = Int L = Ext
Computer Inhibit	16	WHT-BLU	C9	A6(14)	L = Inhibits Counter
Gate Out	15	WHT-GRN	A9	A5(F)	H = Gate Closed L = Gate Open
Check	14	WHT-YEL	B15	A3(B)	L = Check
Ground	18, 36	BLK	A10	GROUND	

Logic Levels (Input) H > +2.0 V, L < +0.8 V
Logic Levels (Output) H > +2.4 V, L < +0.4 V


OPTION 002
W2 REMOTE PROGRAM CABLE ASSY
DVM
10V ENABLE
100V ENABLE
1000V ENABLE
CHECK
GATE OUT
COMPUTER INHIBIT
EXT
READ B LEVEL
READ A LEVEL
FREQ C
FREQ A
PERIOD
TIME INT'VL A-B
TIME INT'VL AVG A-B
PERIOD AVG A
START
J10
REMOTE
GROUND
SAMPLE RATE HOLD
MANUAL RESET
PRINT COMMAND
SAMPLE RATE DISABLE
B TRIG LEVEL
A TRIG LEVEL
SLOPE B
SLOPE A


PIC
PIB
PIA



1. IN STANDARD INSTRUMENT, ONLY W2P1A IS WIRED

Figure 8-23. W2 Remote Program Cable Assembly, Rear Panel Connector

DIGITAL RECORDER OUTPUT — OPTION 003

Option 003 includes cable assembly W1 and rear panel connector J9. The counter provides +8421 BCD and control line inputs and outputs for use with a printer or other data storage devices.

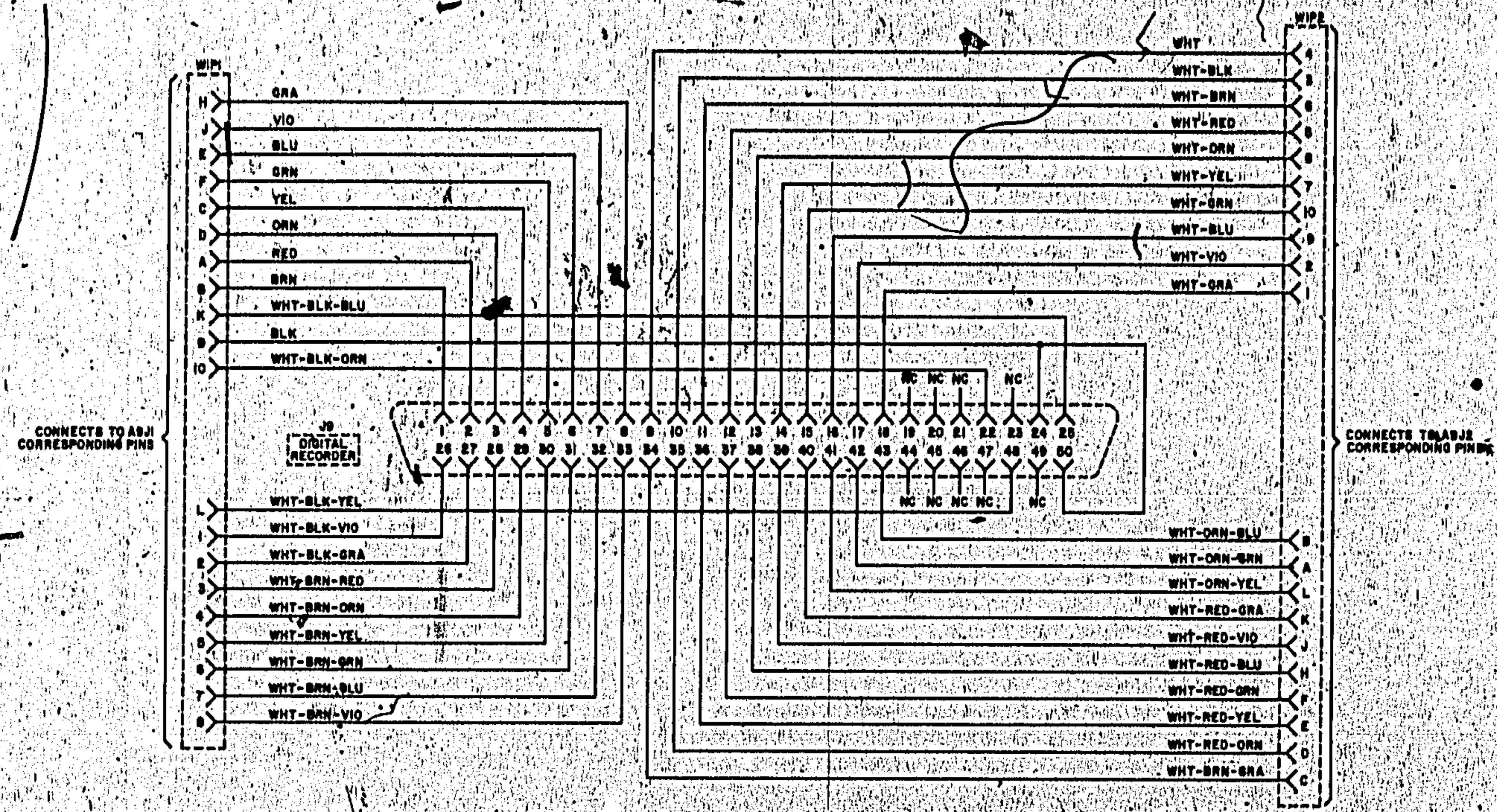
The annunciator lines (J9-17, 18, 42, and 43) supply overflow, plus, and minus outputs as follows:

FUNCTION	BCD				
	8	4	2	1	
Overflow	L	L	L	L	
+	H	H	L	L	5326B Only
-	H	H	L	H	5326B Only
All Other Times	H	H	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 volt 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).

NOTE

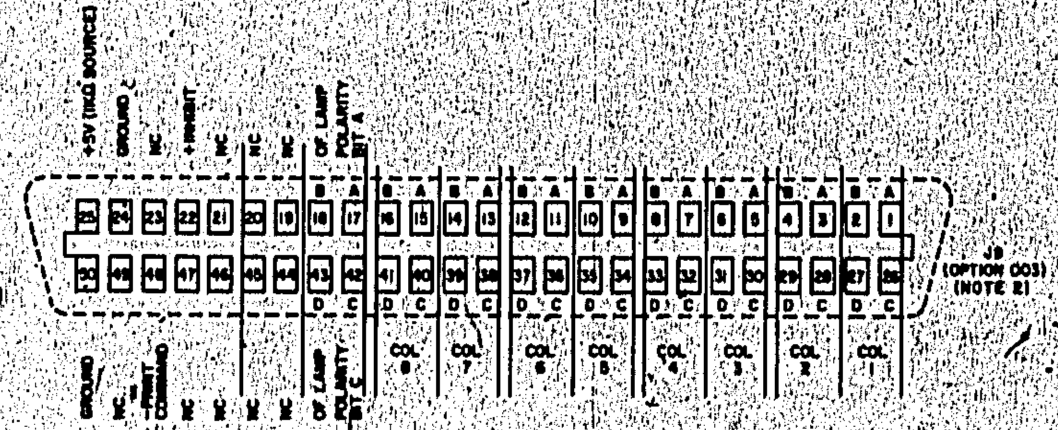
J9 wiring connects to A9 Display Board.



DIGITAL RECORDER JACK PIN FUNCTIONS

COLUMN OR FUNCTION	BCD WEIGHT			
	8	4	2	1
	J9 PIN NUMBER			
10^0	27	26	2	1
10^1	29	28	4	3
10^2	31	30	6	5
10^3	33	32	8	7
10^4	35	34	10	9
10^5	37	36	12	11
10^6	39	38	14	13
10^7	41	40	16	15
ANNUNCIATOR	43	42	18	17
+5 VOLTS (1K SOURCE IMP)	PIN 25			
GROUND	PINS 24, 50			
PRINT COMMAND	PIN 48			
INHIBIT	PIN 22			
NO CONNECTION	PINS 19, 20, 21, 23, 44, 45, 46, 47, 49			

5328-B-19



1. J9 PINS ARE WIRED TO A9 DISPLAY ASSEMBLY.

Figure 8-24. W1, J9 Printer Cable Assembly

SERVICE NOTE

SUPERSEDES:
None

5326/5327
Listing of PC Boards
All Serials

This Service Note lists the commonality of plug-in boards between all the models of the 5326/27 family of counters. Such information may be useful in shortening repair times by borrowing a board from a good instrument to confirm a diagnosis.

The 5326/27 family use several basic building blocks which are combined to provide the various capabilities. These are summarized below:

5326C - 50 MHz-Frequency Period Average, Totalize

5326A - Add Time Interval to 5326C

5326B - Add DVM function to 5326A

5327A/B/C - Same as corresponding 5326, except 550 MHz prescaler is added.

See other side for tabulation of pc boards used in the instruments.

REG/sg/WO

4/72-02

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#	NAME	5326A prefix 1044A & below	5326A prefix 1116A & above	5327A	5326B prefix 1124A & below	5326B prefix 1128A & above	5327B	5326C	5327C
A1	Atten	05326-60003						05326-60030	
A1	Opt 004		05327-60018			05327-60018			
A2	Input Amp	05326-60004							
A3	Input Amp	05326-60004						----------	
A4	OSC	05326-60002							
A5	Time Base	05326-60005							
A6	Sample Rate	05326-60013							
A7	Function	05326-60007/24	05327-60004		05326-60007/24	05327-60004		05326-60045	
A8	Display Support	05326-60009							
A9	Display	05326-60008 (60025 Option 01)							
A10	Right Readout	05326-60011	05327-60002		05326-60023	05327-60008		05326-60036	
A11	Left Readout	05326-60010	05327-60003		05326-60022	05327-60007		05326-60035	
A12	DVM Atten	------------------			05326-60016			----------	
A13	DVM V-F	------------------			05326-60017			----------	
A14	DVM Logic	------------------			05326-60015			----------	
A15	Power Supply Regulator	05326-60001 or 05327-60020							
A17	Direct Amp Amp	-----	05326-60031	-----	-----	05326-60031	----------------		
A18	Prescaler	------------		05327-60000 or 60020			05327-60000 or 60020		05327-60009 or 60029

5326A/5327A-3
5326B/5326B-3
5326C/5326C-3

SERVICE NOTE

SUPERSEDES:

None

5326/5327 Input Attenuator Noise Solution

In the past some problems have been encountered in the field with jumpy marker outputs and/or unexplainable noise on the A and B inputs. This note is to document the solutions available for these problems.

The cause of these problems has been traced to a single source, noisy neon trigger level lights. Some small percentage of the neon bulbs used as trigger level indicators get noisy with age. This noise is coupled back to the markers and channels A and B causing the symptoms.

To solve this problem change the noisy lamp to one that isn't noisy. The lamps involved are A1 DS1 and/ or A1 DS2 HP P/N 2140-0047. These are shown in the 5326/5327 manuals on the A1 schematics and component locators.

This repair may be charged to warranty only if the instrument is in warranty.

LM/sg/WO

12/72-02

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SERVICE NOTE

Supersedes:

None

5326/5327 all models and serial numbers

Extra Insulation for the + and - 5 volt regulators

Here is a solution for a problem we have experienced in 5326 and 5327 Universal Counters. The +5 volt and -5 volt regulators (Q1 and Q2) in these counters have shown more of a tendency to fail than other components in the counter, but no more! Here are the parts and instructions necessary to cure this problem in the field.

PARTS LIST

Insulator: Kapton	2 ea	0340-0765
Washer #8 size	2 ea	3050-0001
Bushing	2 ea	1200-0081
Heat Sink Compound	1 ea	8500-0269

INSTRUCTIONS:

1. Unplug instrument and remove top and bottom covers.
2. Remove one screw, one nut, and one solder lug holding Q1, and the heat sink to chassis.
3. Apply liberal amounts of heat sink compound (HP Part No. 8500-0269) to both sides of insulator (HP Part No. 0340-0765). Tip Q1 up and slide insulator between Q1 and heat sink lining up hole in insulator with mounting hole in Q1 and hole in heat sink.
4. Secure Q1 to chassis and heat sink by inserting screw first through Q1, then the mica insulator, then the heat sink, and then the chassis. Tighten assembly, making sure that Q1 does not touch the side of the heat sink. From the bottom of the instrument put #8 washer and bushing on the screw, then the solder lug, then the nut. See Figures 1 and 2.

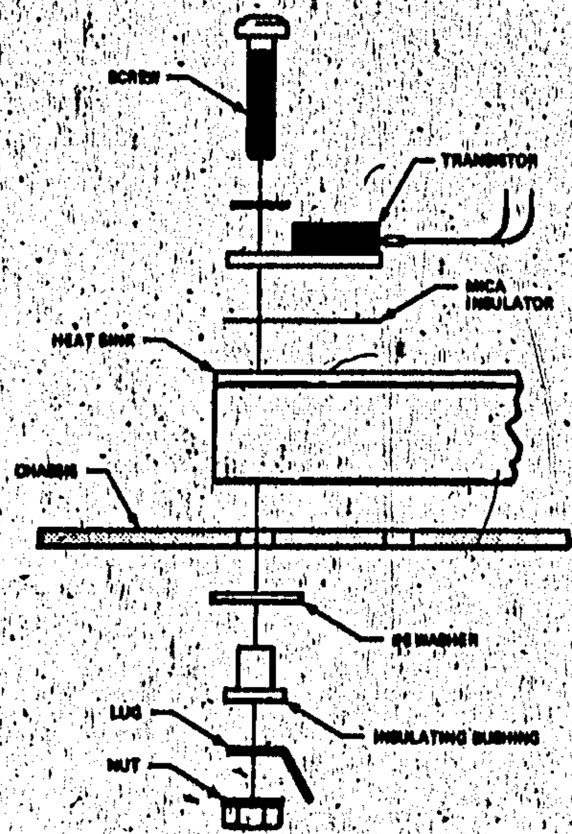

Figure 1. Exploded View

5. Repeat steps 2, 3 and 4 for Q2.
6. Check +5 volt and -5 volt regulation at high and low line voltage. Shake instrument to insure Q1 and Q2 are properly secured.
7. Replace top and bottom covers.

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7/75-02

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For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181 • West (213) 877-1281. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, Post Office Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan, Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

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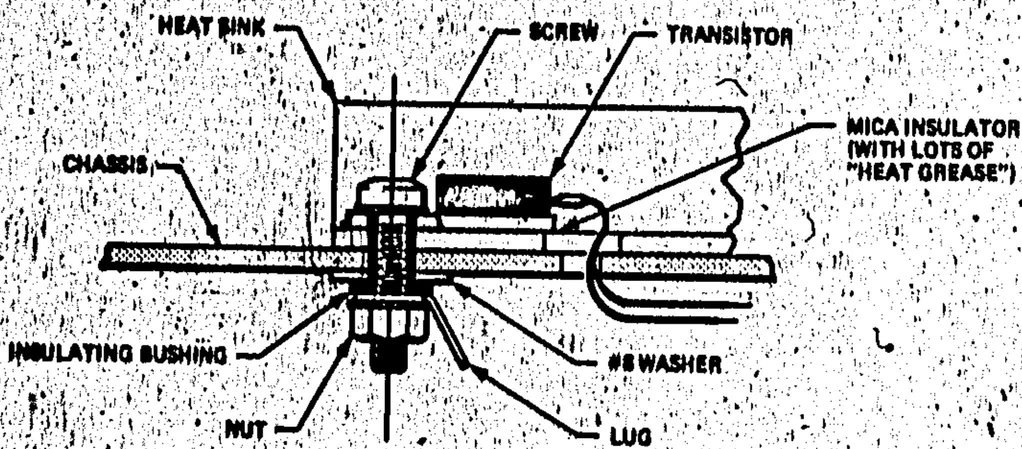

Figure 2. Completed Assembly

SERVICE NOTE

Supersedes:
None

Field Installation of Option 011

For all models of the 5326/5327 Universal Counter

This service note contains instructions and parts lists needed for field installation of the option 011 high stability oscillator. Installation procedures vary with the age of the counter, however all procedures are documented here. For the oldest counters, installation of this option is not recommended because of the high material and labor costs involved. Table 1 below, gives a serial number prefix break down of which procueduro to use and/or which counters are not recommended for installation.

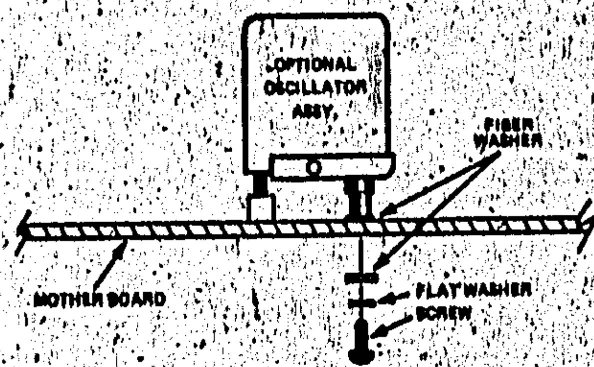

Figure 1

INSTALLATION OF OPTION 011 (When no extra parts are required).

1. Unplug counter and remove top and bottom cover.
2. Remove A4 oscillator board and in its place install the option 011 oscillator assembly.
3. Install 2 screws and washers (see Figure 1) and secure option 011 oscillator assembly.
4. Check oscillator frequency using procedure included with this note

HP Part No.	Qty	Description
10544-60011	1	Crystal Oscillator
3050-0023	2	No. 6 Fiber Washer
3050-0003	2	No. 6 Fiber Washer
3050-0016	2	No. 6 Flat washer, nickel Brass plating
2360-0117	2	6/32 x 3/8 pan head screw

Table 1. Serial Number Prefix Table

Model	Can not be installed	Extra components required in order to install	No extra components needed
26A	below 1136	1136 to 1124	1240 & above
27A	below 1220.	1220 to 1224	1236 & above
26B	below 1136	1136 to 1224	1240 & above
27B	below 1132	1132 to 1220	1224 & above
26C	below 1136	1136 to 1224	1236 & above
27C	below 1136	1136 to 1224	1236 & above

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7/73-02

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INSTALLATION OF OPTION 011 (When no extra components must be added).

1. Unplug counter and remove top and bottom covers.
2. Remove A4 crystal assembly and install components using Figure 3, 4, 5 and parts list in Table 2 as reference.
3. Install option 011 crystal assembly in place of the A4 assembly and secure in place with 2 screws - see Figure 2.
4. Check Option 011 frequency as outlined in procedure included with this note.

FREQUENCY ADJUSTMENT PROCEDURE FOR OPTION 011 OSCILLATOR.

NOTE

The counter must have primary power applied for at least 24 hours to allow the oscillator temperature to stabilize.

1. Set controls on oscilloscope as follows:
   CHANNEL A 0.2 V/cm; DC coupled; + up
   SWEEP 0.05 μsec/cm
   TRIGGER: EXT, + slope, ACF
   MODE to NORM
   DISPLAY to CHANNEL A
2. Connect a suitable 1 MHz, 5 MHz or 10 MHz frequency standard (such as an HP Cesium Beam) to the EXT Input on oscilloscope.
3. Connect Oscilloscope Channel A to OSC. BNC available on counter rear panel.
4. Adjust oscillator FREQUENCY ADJ for minimum sideways movement of the oscillator signal.

Table 2

Ref. Desig.	HP P/N	Qty	
A16C6	0160-2204	1	C: FXD 100 pf
A16CR18	1910-0034	1	DIODE: Ger
A16Q1	1854-0000	1	Transistor: SIL NPN 2N700
A16R4	0683-0825	1	FXD 8.2 OHM 1/4W
A16R5	0683-1025	1	FXD 1000 OHM 1/4W
A16R6	0683-5115	1	FXD 510 OHM 1/4W
A16R7	0698-3153	1	FXD 3830 OHM 1% 1/8W
A16R8	0757-0439	1	FXD 6810 OHM 1% 1/8W
A16U1	1820-0196	1	IC: Voltage Regulator
	10544-60011	1	Crystal Oscillator
	3050-0023	2	No. 6 Fiber Washer
	3050-0003	2	No. 6 Fiber Washer
	3050-0016	2	No. 6 Flat Washer, nickel, brass plating
	2360-0117	2	6/32 x 3/8 pan hd screw

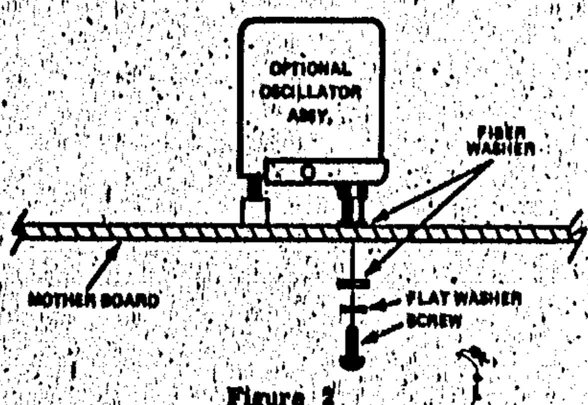
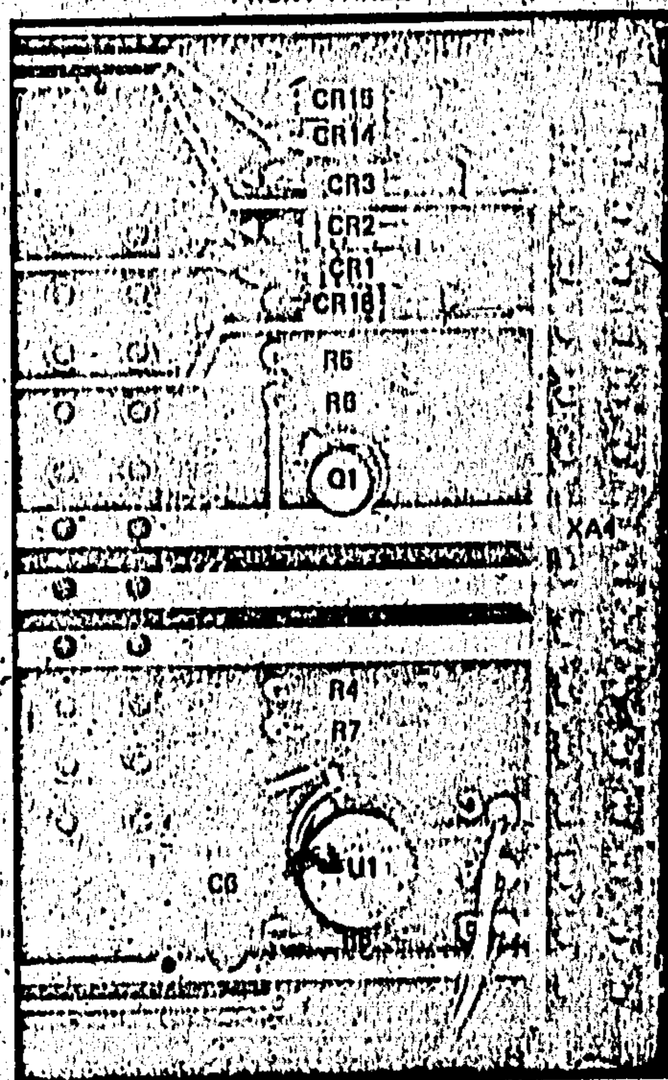


Figure 2

FRONT PANEL



TOP VIEW
OF
A16
Figure 3

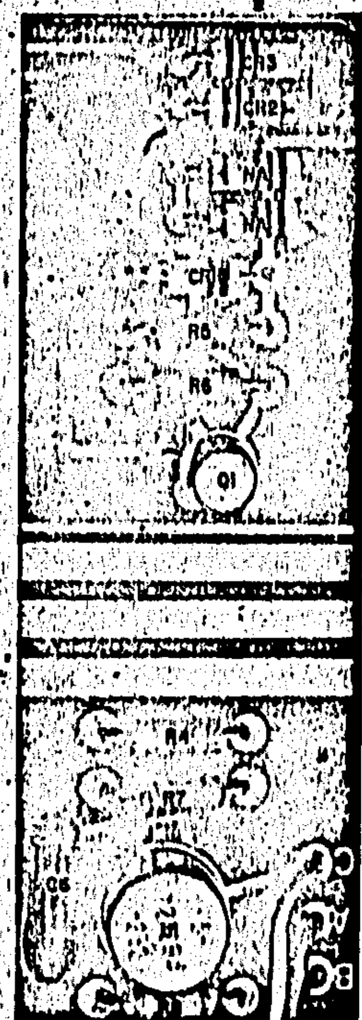


Figure 4

127

OPTIONS 010 AND 011 A16 INTERCONNECT CIRCUIT BOARD (PARTIAL DIAGRAM) (05057-60026/27/28) SERIES 1234A

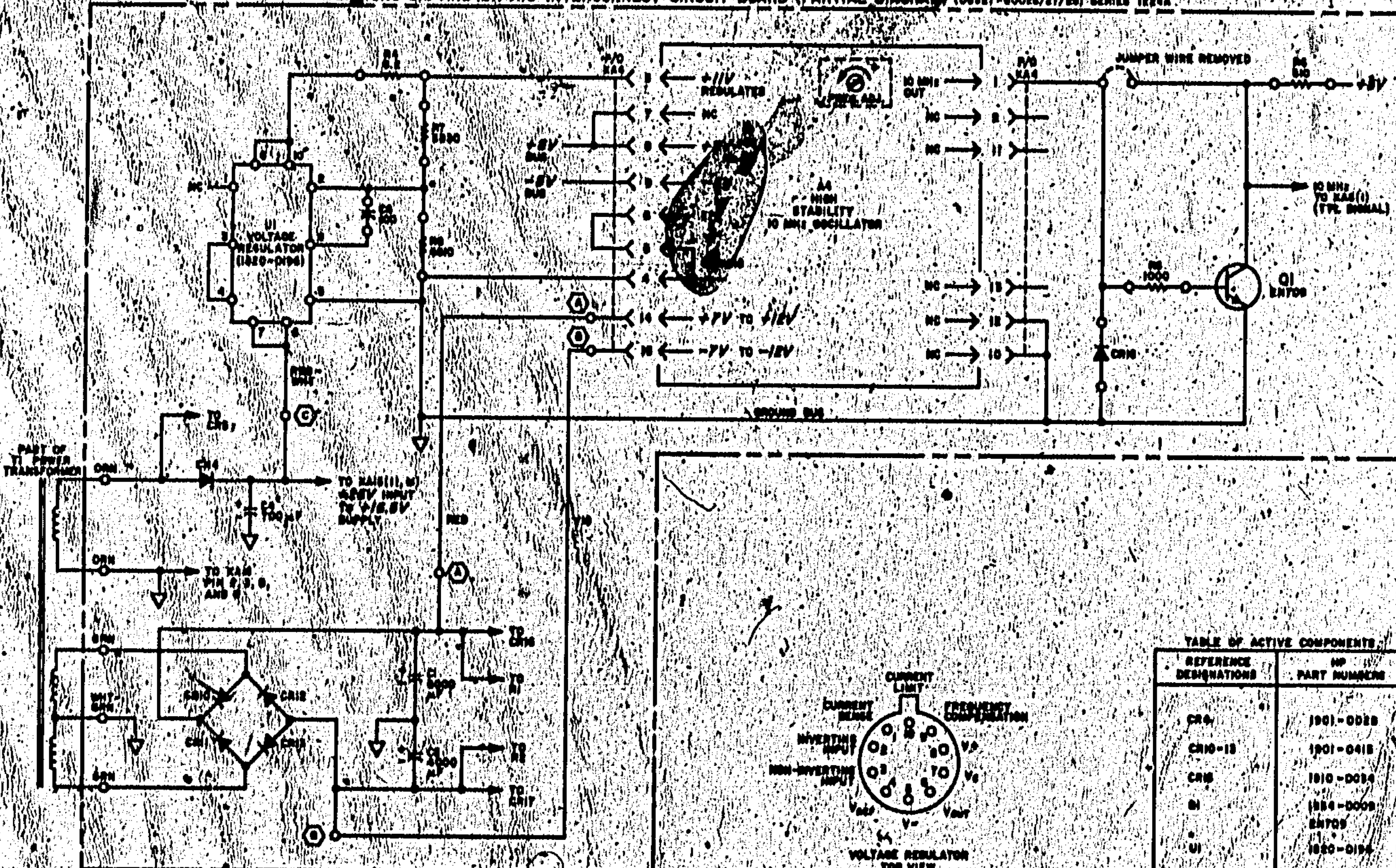


TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR9	1901-0028
CR10-13	1901-0418
CR15	1910-0034
Q1	1854-0009 2N709
U1	1820-0196

SERVICE NOTE

Supersedes:

None

Field Installation of Option 010 Model 5326/27 Counters
Serial number prefix 1032 and above

This service note contains installation instructions needed for field installation of the option 010 Temperature Compensated Crystal Oscillator (TCXO) HP Part No. 05327-60036. This option may be installed in any 5326/27 counter with serial number prefix 1032 and above.

Installation Instructions:

1. Unplug counter and remove top cover.
2. Remove the A4 oscillator assembly and install the TCXO in its place.
3. Adjust the frequency of the TCXO using the following procedure.

Frequency Adjustment procedure:

NOTE: This procedure should be performed with the instrument open and the TCXO as near 25°C (approximately room temperature) as possible.

1. Connect a 5245L (or equivalent) to OSC BNC on back of counter.
2. Set 5245L to frequency and 1 second time base.
3. Adjust screw on top of TCXO assembly until 5245L read-out matches the frequency stamped on TCXO.

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7/73-02

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For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181. • West (213) 877-1281. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, Post Office Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan, Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

Printed in U.S.A.

SERVICE NOTE

Supersedes:
None

Added protection for the +175 Volt power supply in 5326/5327 Universal Counters

Failures that short the +175 Volt power supply to ground can cause extensive damage inside a counter.

To protect the 5326 and the 5327 model universal counters from these failures, the 175 volt supply is current limited. To provide added protection in applications where it might be needed, this service note contains instructions and parts list for adding a fuse in the 175 volt line.

Instructions:
(For instruments with serial prefix 1312 & above.)

1. Turn off instrument, disconnect power cord and remove top cover.
2. Remove and examine A15 power supply board. If a fuse is present on the board the 175 volt supply is already fused and no further protection is needed. If no fuse is present continue to step 3.
3. Remove the jumper soldered between the two plated-through holes in trace connected to A15 pin 1.
4. Solder fuse holder (P/N 1400-0110) in plated-through holes. Install fuse.
5. Install A15 power supply in counter, replace top cover and check instrument for proper operation.

Serial Prefix below 1312.

1. Turn off instrument, disconnect power cord and remove top cover.
2. Remove A15 power supply board from instrument. Remove A15R6 and clean plated-through holes.
3. Using a razor blade, carefully remove approximately 1/8" of the trace between A15 pin 1 and the plate-through hole for A15R6 that the trace connects to.
4. Install the 13Ω resistor (P/N 0686-1305) in place of A15R6.
5. Bend the pins on the fuse holder (P/N 1400-0110) out at right angles and solder holder to either side of cut trace on A15. Install fuse.

Note

Be sure that the fuse holder is securely held to board by the solder and that no solder bridges the cut in the trace.

6. Install A15 in counter, replace top cover and check instrument for proper operation.

Parts List

Reference Des.	HP P/N	Qty	Description
F1	2110-0460	1	Fuse: 1/32 amp.
R6	0686-1305	1	R: FXD Comp 13 ohm 5% 1/2W
XF1	1400-0110	1	Body fuse holder

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Printed in U.S.A.

5326/27A-6
5326/27B-6
5326/27C-6

SERVICE NOTE

Supersedes:
None

NIXIE DRIVER WARNING
For all models of 5326/27 Universal Counters

Batch number 2575 of the nixie driver circuits (P/N 1820-0092) in these counters have been failing at a rate higher than we like. Even though only a small number of the circuits in this batch are weak, all of them have been pulled from the stocking bins. There are, however, some nixie drivers from this batch presently in use in instruments. If they have not failed DO NOT replace them. If they do fail replace them with an 1820-0092 with a batch number other than 2575.

LM/ka/WO

05-74-2

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SERVICE NOTE

Supersedes:
5326A,B,C-9A
5327A,B,C-9A

HP MODEL 5326/5327 FREQUENCY COUNTERS

Serial Numbers:
5326A — 1312A-01906 to 1312A-03900
5326B — 1312A-02141 to 1312A-03016
5326C — 1312A-00401 to 1312A-00676
5327A — 1312A-00300 to 1312A-00500
5327B — 1312A-00546 to 1312A-00946
5327C — 1312A-00546 to 1312A-00606

ADDED PROTECTION TO PREVENT THE +175 VOLT FUSE FROM BLOWING

In order to prevent the +175 volt power supply fuse from blowing, a new limiting resistor (R6-HP/PN 0698-5470), fuse (HP/PN 2110-0407) and fuse adapters (HP/PN 1251-3205) must be added to Regulator Board Assy (A15).

If the +175V fuse is blowing, first check to see if the problem is not caused by short circuits in the instrument, then perform this modification.

PARTS REQUIRED

Quantity	Ref. Desig.	Description	HP Part No.
1	A15R6	Resistor Fixed 8.2Ω 5%	0698-5470
2	—	Mini-Socket	1251-3205
1	A15F1	Fuse (50 mA)	2110-0407

INSTALLATION PROCEDURE

1. Remove A15 Regulator Assy (HP/PN 05327-60020) from instrument.
2. Remove A15R6 (13Ω) and install new value of R6 (8.2Ω 5%).
3. Insert Mini-Sockets into existing fuse holder socket.
4. Insert new 50mA fuse into modified fuse holder socket.
5. Return instrument to original configuration and ensure +175V supply fuse doesn't fail.
6. Check instrument for proper operation.

TM/ka/WA

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5326B/5327B-U-9B
5326C/5327C-U-9B

SERVICE NOTE

Supercedes:
5326A,B,C-U-9A
5327A,B,C-U-9A

HP MODEL 5326/5327 FREQUENCY COUNTERS

SERIAL NUMBERS:

5326A - 1328U00196 to 1339U-00293
5326B - 1328U00133 to 1339U-00389
5326C - 1327U00279 to 1340U-00222
5327A - 1327U00121 to 1339U-00169
5327B - 1328U00171 to 1339U-00159
5327C - 1328U00151 to 1340U-00188

ADDED PROTECTION TO PREVENT THE +175 VOLT FUSE FROM BLOWING

In order to prevent the +175 volt power supply fuse from blowing, a new limiting resistor (R6-HP/PN 0698-5479), fuse (HP/PN 2110-0487) and fuse adaptors (HP/PN 1251-3205) must be added to Regulator Board Assy (A15).

If the +175V fuse is blowing, first check to see if the problem is not caused by short circuits in the instrument, then perform this modification.

PARTS REQUIRED

Quantity	Ref. Desig.	Description	HP Part No.
1	A15R6	Resistor Fixed 0.2Ω 5%	0698-5479
2	-	Mini-Socket	1251-3205
1	A15F1	Fuse (50mA)	2110-0487

INSTALLATION PROCEDURE

1. Remove A15 Regulator Assy (HP/PN 05327-60020) from instrument.
2. Remove A15R6 (13Ω) and install new value of R6 (0.2Ω 5%)
3. Insert Mini-Socket into existing fuse holder socket.
4. Insert new 50mA fuse into modified fuse holder socket.
5. Return instrument to original configuration and ensure +175V supply fuse doesn't fail.
6. Check instrument for proper operation.

JK/oo/WA

8/74-14

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