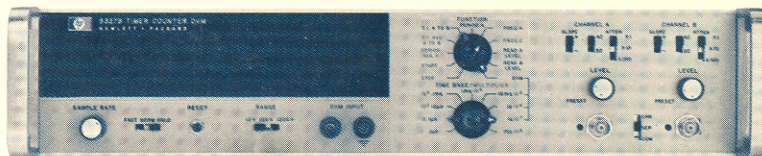
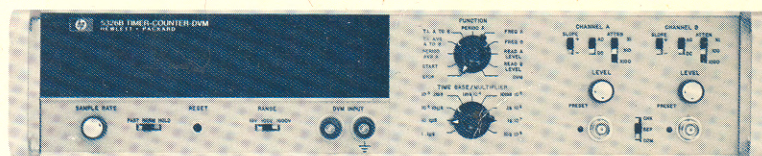


OPERATING AND SERVICE MANUAL

TIMER COUNTER DVM

5326B/5327B



HEWLETT  PACKARD

HP MANUAL SCANS

By

Artek Media

1042 Plummer Cir. SW
Rochester, MN 55902

www.artekmedia.com

"High resolution scans of obsolete technical manuals"

**ALL HP MANUALS ARE REPRODUCED
WITH PERMISSION OF
AGILENT TECHNOLOGIES INC.**

Reproduction of this scanned document or removal of this disclaimer
Will be considered in violation of both Agilent's and Artek Media's copy rights

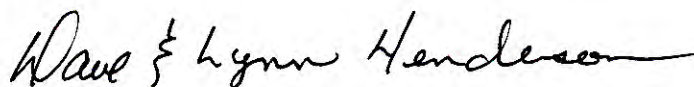
If you are looking for a quality scanned technical manual in PDF format please visit our WEB site at www.artekmedia.com or drop us an email at manuals@artekmedia.com and we will be happy to email you a current list of the manuals we have available.

If you don't see the manual you need on the list drop us a line anyway we may still be able to point you to other sources. If you have an existing manual you would like scanned please write for details, This can often be done very reasonably in consideration for adding your manual to our library.

Typically the scans in our manuals are done as follows;

- 1) Typed text pages are typically scanned in black and white at 300 dpi.
- 2) Photo pages are typically scanned in gray scale mode at 600 dpi
- 3) Schematic diagram pages are typically scanned in black and white at 600 dpi unless the original manual had colored high lighting (as is the case for some 70's vintage Tektronix manuals).

Thanks



Dave & Lynn Henderson
Artek Media

5326B/5327B

TIMER/COUNTER/DVM

OPERATING AND SERVICE MANUAL

SERIAL PREFIX:

5326B-1428A
5327B-1428A

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

SERIAL PREFIXES NOT LISTED

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

NOTE

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

Copyright HEWLETT-PACKARD COMPANY 1972
5301 STEVENS CREEK BLVD., SANTA CLARA, CALIF. 95050

Printed: FEB 1975

MANUAL PART NO. 05326-90043
MICROFICHE PART NO. 05326-90044

PRINTED IN U.S.A.

HEWLETT  PACKARD

TABLE OF CONTENTS

Section		Page
I	GENERAL INFORMATION	1-1
	1-1. Description	1-1
	1-4. Identification	1-1
	1-6. Applications	1-1
	1-8. Options	1-1
II	INSTALLATION	2-1
	2-1. Introduction	2-1
	2-3. Unpacking and Inspection	2-1
	2-5. Storage and Shipment	2-1
	2-8. Rack Installation	2-1
	2-10. Power Connection	2-1
	2-13. Remote Programming, Option 002	2-2
	2-15. Front Panel Controls	2-2
	2-19. Remote Programming Requirements	2-2
	2-22. Remote Programming Procedure	2-2
	2-24. Function Selection Programming	2-3
	2-27. Time Base Selection Programming	2-3
	2-29. Voltmeter Programming	2-3
	2-31. Trigger Level Programming	2-3
	2-34. Sample Rate Adjustment	2-3
	2-36. Remote Programming, Option 004	2-3
	2-38. Front Panel Controls	2-3
	2-40. Remote Programming Requirements	2-3
	2-43. Remote Programming Procedure	2-4
	2-45. Function Selection Programming	2-4
	2-48. Time Base Selection Programming	2-4
	2-50. Signal Conditioning Programming	2-4
	2-54. Trigger Level Programming	2-5
	2-57. Sample Rate Adjustment	2-5
	2-59. Sample Rate Disable-Computer Inhibit	2-5
	2-62. Blanking Defeat	2-5
III	OPERATION	3-1
	3-1. Introduction	3-1
	3-3. Operating Modes	3-1
	3-5. Totalizing Mode	3-1
	3-7. Frequency Modes	3-1
	3-9. Period Modes	3-1
	3-13. Time Interval Modes	3-1
	3-17. Digital Voltmeter Measurements	3-2
	3-20. Ratio	3-2
	3-23. Marker Outputs	3-2
	3-25. Hysteresis	3-2
	3-28. Time Interval Compensation	3-3
	3-30. Accuracy	3-3
IV	THEORY OF OPERATION	4-1
	4-1. Introduction	4-1
	4-3. Logic Symbols	4-1
	4-6. Gating and Logic	4-1
	4-8. Integrated Circuit Operation	4-2
	4-9. JK Master-Slave Flip-Flop	4-2
	4-11. Time-Base Decade	4-2
	4-13. Open-Collector Gate	4-2
	4-15. Logic Levels	4-3

TABLE OF CONTENTS (Continued)

Section		Page
IV	THEORY OF OPERATION (Continued)	
	4-17. Overall Counter Operation	4-3
	4-22. Frequency Modes	4-4
	4-24. Period Modes	4-4
	4-27. Time Interval Modes	4-4
	4-30. DVM Mode	4-4
V	MAINTENANCE	5-1
	5-1. Introduction	5-1
	5-3. Assembly Designations	5-1
	5-5. Test Equipment	5-1
	5-7. Assembly Connection Identification	5-1
	5-9. In-Cabinet Performance Check	5-1
	5-12. Instrument Cover Removal	5-1
	5-14. Repair	5-1
	5-15. Printed Circuit Component Replacement	5-1
	5-17. Replacing Integrated Circuits	5-2
	5-19. Adjustments	5-2
VI	REPLACEABLE PARTS	6-1
	6-1. Introduction	6-1
	6-4. Ordering Information	6-1
VII	OPTIONS AND MANUAL CHANGES	7-1
	7-1. Introduction	7-1
	7-3. Options	7-1
	7-5. Option 001, 8-Digit Display	7-1
	7-7. Option 002, Remote Programming	7-1
	7-9. Option 003, Digital Recorder Output	7-1
	7-11. Option 004, Extended Remote Programming	7-1
	7-13. Option 010, Temperature Compensated Oscillator	7-1
	7-15. Option 011, Oven Oscillator	7-1
	7-17. Field Installation of Options	7-1
	7-18. Installation of Option 001, 8th Digit	7-1
	7-20. Installation of Option 002, Remote Programming	7-2
	7-22. Installation of Option 003, Digital Recorder Output	7-2
	7-24. Installation of Option 004, Extended Remote Programming	7-2
	7-26. Installation of Option 010 and 011, Oscillator Assemblies	7-2
	7-28. Manual Changes	7-3
	7-30. Newer Instruments	7-3
	7-32. Older Instruments	7-3
VIII	SCHEMATIC DIAGRAMS	8-1
	8-1. General	8-1

LIST OF TABLES

Table		Page
1-1.	Equipment Supplied	1-1
1-2.	Accessories Available	1-1
1-3.	Specifications	1-2
2-1.	115/230 Volt Conversion	2-2
3-1.	Self-Check	3-8
4-1.	Truth Table	4-2
4-2.	Logic Levels	4-3
5-1.	Assembly Identification	5-1
5-2.	Recommended Test Equipment	5-2
5-3.	In-Cabinet Performance Check	5-3
5-4.	Adjustments	5-9
5-5.	D.P. and Annunicator Troubleshooting	5-11
5-6.	Frequency, D.P., and Annunicator Troubleshooting	5-12
5-7.	DVM, D.P., and Annunicator Troubleshooting	5-13
6-1.	Replaceable Parts, Standard Instruments	6-3
6-2.	Replaceable Parts, Options	6-20
6-3.	Manufacturers Code List	6-24
7-1.	Manual Backdating Changes	7-3
7-2.	A18 (05327-60009) Replaceable Parts	7-6
7-3.	A18 (05327-60029) Replaceable Parts	7-7
7-4.	A7 (05327-60004) Replaceable Parts	7-12

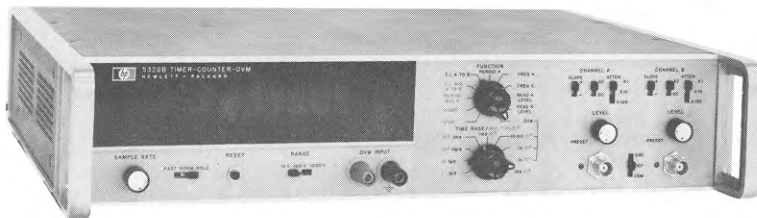
LIST OF FIGURES

Figure		Page
1-1.	Model 5326B/5327B Timer/Counter/DVM	1-0
3-1.	Hysteresis Offset	3-3
3-2.	Hysteresis Compensation	3-3
3-3.	Measurement Accuracy	3-4
3-4.	Front Panel Controls and Indicators	3-5
3-5.	Rear Panel Controls and Connectors	3-7
3-6.	Frequency A Measurements	3-10
3-7.	Frequency C Measurements	3-11
3-8.	Period Measurements	3-12
3-9.	Ratio Measurements	3-13
3-10.	Time Interval Measurements	3-14
3-11.	Digital Voltmeter and Read A Level, Read B Level Measurements	3-15
3-12.	Totalize Measurements	3-16
4-1.	Gate Symbols and Logic Comparisons	4-1
4-2.	JK Flip-Flop	4-2
4-3.	Time-Base Decode 1820-0412	4-2
4-4.	Open-Collector Gate 1820-0327	4-2
4-5.	Functional Block Diagram	4-3
4-6.	Frequency A Model Flow Diagram	4-5
4-7.	Frequency C Model Flow Diagram	4-5

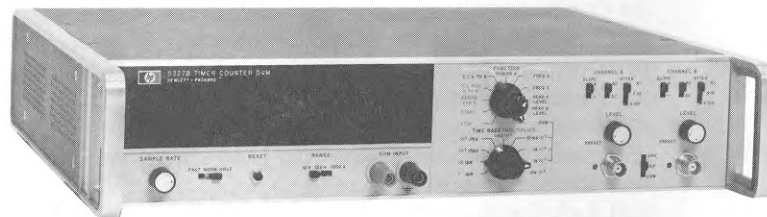
LIST OF FIGURES (Continued)

Figure		Page
4-8.	Period Mode Flow Diagram	4-6
4-9.	Period Average Mode Flow Diagram	4-6
4-10.	Time Interval Mode Flow Diagram	4-7
4-11.	Time Interval Average Mode Flow Diagram	4-7
4-12.	DVM Model Flow Diagram	4-8
4-13.	Instrument Timing Diagram	4-9
6-1.	Panel Designations	6-2
7-1.	A18 Prescaler Board Assembly (Series 1040A) (5327B Only) Schematic Diagram	7-8
7-2.	A18 Prescaler Board Assembly (Series 1116A) (5327B Only) Schematic Diagram	7-9
7-3.	A18 (05327-60009) Component Locator	7-10
7-4.	A18 (05327-60029) Component Locator	7-11
7-5.	A7 Function Control Assembly (Series 1040A) Schematic Diagram	7-13
7-6.	A7 Function Control Assembly (05327-60004) Component Locator	7-14
8-1.	Schematic Diagram Notes	8-2
8-2.	Integrated Circuit Diagrams	8-3
8-3.	Model 5327B Front and Rear Panels	8-10
8-4.	Model 5327B Top Internal View	8-11
8-5.	A1 Attenuator Assembly	8-13
8-6.	A2, A3 Amplifier/Trigger Assembly	8-15
8-7.	A4 Oscillator Assembly	8-17
8-8.	A5 Time Base Control Assembly	8-19
8-9.	A6 Sample Rate Assembly	8-21
8-10.	A7 Function Control Assembly	8-29
8-11.	A8 Display Support Assembly	8-31
8-12.	A9 Display Assembly Standard Instrument and Option 001	8-33
8-13.	A10 Right Readout Assembly	8-35
8-14.	A11 Left Readout Assembly	8-37
8-15.	A12 Voltmeter Input Amplifier Assembly	8-39
8-16.	A13 Voltmeter V to F Converter Assembly	8-41
8-17.	A14 Voltmeter Display Control Assembly	8-43
8-18.	A15, A16 Regulator/Interconnect Board Assembly	8-45
8-19.	A17 Input C Amplifier Assembly (5326B Only)	8-47
8-20.	A18 Prescaler Board Assembly (5327B Only)	8-49
8-21.	Option 002, Remote Programming Cable Assembly and Rear Panel Connector Assembly	8-51
8-22.	Option 004, Remote Programming Cable Assembly and J10 Option 003, Digital Recorder Cable Assembly	8-53
8-23.	A1 Option 004 Programmable Attenuator Assembly	8-55
8-24.	Options 010, 011, and A16 Interconnect Circuit Board	8-57
8-25.	Interconnection Diagram	Insert

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



MODEL 5326B



MODEL 5327B



POWER CORD

SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The Hewlett-Packard Model 5326B/5327B are frequency counters that have a variety of functions. The basic difference between the two models is the addition of the prescaler assembly in the 5327B. This assembly increases the upper frequency limit from 50 MHz to 550 MHz. The 5326B uses a high-sensitivity, 50-ohm input amplifier in place of the prescaler.

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

1-4. IDENTIFICATION

1-5. Hewlett-Packard uses a two-section serial number mounted on the rear panel. Earlier instruments use an 8-digit serial number (000-00000). The first three digits are a serial prefix number; the last five digits refer to the specific instrument. Later instruments use a 9-digit serial number (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

1-7. The 5326B/5327B Counters are particularly adaptable to timing measurements such as pulse width, pulse repetition frequency, and propagation delay. The time interval average mode measures time interval on repetitive signals with resolution better than one nanosecond. When used with microwave

test systems, group delay, phase, and level measurements can be performed.

1-8. OPTIONS

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

Table 1-1. Equipment Supplied

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

Table 1-2. Accessories Available

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

Table 1-3. Specifications

INPUT CHANNELS A AND B

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

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

Impedance: 1 MΩ shunted by less than 25 pF.

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

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

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

Slope: Independent selection of positive or negative slope.

Channel Inputs: Common or separate lines.

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

INPUT CHANNEL C

5327B

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

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

Impedance: 50Ω nominal.

Maximum Input: 3.5 volts rms; 5 volts peak.

Trigger Level: 0 volts.

5326B

Range: 0 to 50 MHz, dc coupled.

Sensitivity: ~~5 mV rms.~~ *S/B 50 mV RMS*
Impedance: 50Ω nominal.
Maximum Input: 5 volts rms; 7.5 volts peak.
Trigger Level: 0 volts.

CAUTION

Do not exceed voltage specification or damage will occur.

START (Totalizing and Scaling)

Range: 0 to 10 MHz.

Factor: 1 to 10⁸ selectable in decade steps.

Output: Rear panel TIME BASE BNC.

Display: Channel A input divided by scaling factor.

FREQUENCY

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

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

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

Accuracy: ±1 count displayed* ± time base accuracy

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

TIME INTERVAL

Range: 0.1 μs to 10⁸ seconds.

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

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

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

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

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

**For any waveshape, trigger error is less than

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

Table 1-3. Specifications (Continued)

TIME INTERVAL AVERAGE

Range: 0.15 ns to 10 seconds.

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

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

Frequency Counted: 10 MHz.

Accuracy: $\pm$ time base accuracy ± 2 ns

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

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

Display: ns, μ s with positioned decimal point.

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

PERIOD

Range: 0 to 10 MHz.

Input: Channel A.

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

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

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

PERIOD AVERAGE

Range: 0 to 10 MHz.

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

Input: Channel A.

Frequency Counted: 10 MHz.

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

Display: ns, μ s, with positioned decimal point.

RATIO

Display: (Any input Function) F_{ext} times
 MULTIPLIER (M).
 M = 1 to 10^8 (10 to 10^9 when prescaling)
 selectable in decade steps.

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

Model: Any input function.

Accuracy: Accuracy of selected input function
 $\pm$ trigger error of F_{ext} .

INTEGRATING DIGITAL VOLTMETER

Technique: Voltage-to-frequency conversion.

Voltage Ranges: Manual selection.

Range	Resolution	Input Impedance
(Vdc)	(1 sec integration time)	
10	100 μ V	10 M Ω
100	1 mV	10 M Ω
1000	10 mV	10 M Ω

Input: Single ended.

Polarity: Automatic polarity detection.

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

Overload Protection: 1100 Vdc all ranges.

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

Range	Stability	Linearity	Zero Offset	Counter
	(% of Reading)	(% of Range)	(% of Range)	
10V	$\pm 0.04\%$	$\pm 0.01\%$	$\pm 10.01\%$	± 1 count
100 V	$\pm 0.04\%$	$\pm 0.01\%$	$\pm 0.01\%$	± 1 count
1000 V	$\pm 0.08\%$	$\pm 0.01\%$	$\pm 0.01\%$	± 1 count

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

Table 1-3. Specifications (Continued)

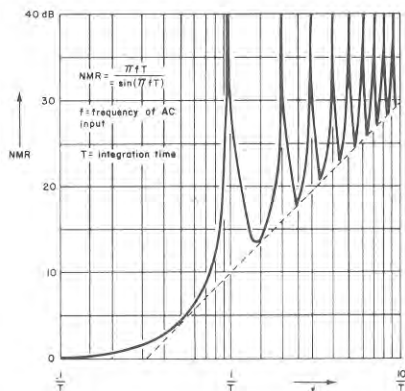
Operating Temperature: 10°C to 40°C, <80% RH.

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 μ s for full accuracy with a step function input.

AC Noise Rejection: Infinite for multiples of (measurement)¹. See graph for Normal Mode Rejection below.



TIME BASE

Crystal Frequency: 10 MHz.

Stability: Aging Rate: <3 parts in 10^7 /mo.
Temperature: $\leq \pm 2.5$ parts in 10^6 , 0° to 50°C.
Line Voltage: $\leq \pm 1$ part in 10^7 for 10% line variation.

Short-term Fluctuation: Typically <5 parts in 10^9 rms (typical) one-second average (at constant temperature).

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

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

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

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

GENERAL

Display: 7 digits (8 optional).

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

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

Sample Rate: FAST position: Continuously variable from less than 100 μ s 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 (see DVM Temperature Range).

Power Requirements: 115 or 230 volts $\pm 10\%$, 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

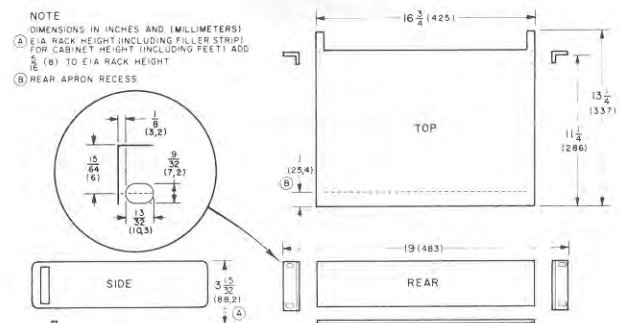


Table 1-3. Specifications (Continued)

ACCESSORIES AVAILABLE

- HP 10503A, 50 Ω 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 10542A, Remote Programming Interface
enables interfacing between the 5326/5327
Series counter with Option 004 and 40-bit
Output Register. Includes two (2) 7-bit
Digital-to-Analog Converters for level con-
trols and decoding for time base and
function selector.
- HP Cable 562A-16C, 6 ft (183 cm) to connect
5326/5327 Series with Option 003 to HP
5050B or 5055A Digital Recorder.

OPTIONS

Option 001: 8-digit display.

Option 002: Remote Programming.

Controls:

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

Control Signal:

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

Connector:

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

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

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

Code:

4-line 1-2-4-8 BCD, "1" state high. "0"
state +0.25 V at -1 mA; "1" state: +5 V
open circuit, 2.5 k Ω 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 (not supplied).

Option 004: Remote Programming including all
signal input conditions.

Controls:

All front panel controls are programmable
except FAST/NORM Mode.

Control Signal:

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

Connector:

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

Option 010 Temperature Compensated Oscillator:

Aging Rate: $< 1 \times 10^{-7}$ /month.
Temperature Stability (0° to 50°C): $< \pm 5$
 $\times 10^{-7}$.
Short Term Fluctuation (1 sec avg) $< 1 \times$
 10^{-9} rms (typical).
Warm-Up: room temp crystal.
Line Voltage (10% change): $< \pm 5 \times 10^{-8}$.

Option 011 HP 10544A Oven Oscillator:

Aging Rate: $< 5 \times 10^{-10}$ /day.
Temperature Stability (0° to 50°C):
 $< 3 \times 10^{-9}$.
Short Term Fluctuation (1 sec avg):
 $< 1 \times 10^{-11}$ rms.
Warm-Up: $< \pm 5 \times 10^{-9}$ in 15 min.
Line Voltage (10% change): $< 5 \times 10^{-9}$.

SECTION II

INSTALLATION

2-1. INTRODUCTION

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

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, as that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken knobs, etc.). If the instrument is damaged or fails to self-check (Self-Check Procedures, Table 3-1), notify the carrier and nearest Hewlett-Packard Sales and Service Office immediately (offices are listed at the back of this manual). Retain the shipping carton and padding material for the carrier's inspection. The sales and service office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. STORAGE AND SHIPMENT

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

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

b. **EXCELSIOR.** Cover painted surfaces of 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: $+167^{\circ}\text{F}$ ($+75^{\circ}\text{C}$).

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 ($\pm 10\%$) power lines with frequencies from 50 to 60 Hz. A slide switch on the rear panel permits quick conversion for operation from either voltage. Insert a narrow-blade screwdriver in the switch slot and slide the switch to the right for 230 volt operation ("230" marking exposed) or to the left for 115 volt operation ("115" marking exposed). The counter is supplied with a 115 volt fuse; be sure to change this fuse for 230 volt operation, see Table 2-1.

CAUTION

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

Table 2-1. 115/230 Volt Conversion

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

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

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

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

2-13. REMOTE PROGRAMMING, OPTION 002

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

2-15. Front Panel Controls

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

- a. FUNCTION
- b. TIME BASE/MULTIPLIER
- c. DVM RANGE
- d. CHECK function
- e. SLOPE
- f. SAMPLE RATE and HOLD
- g. LEVEL controls
- h. Input Selector (5327B only)
- i. RESET

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

- a. AC/DC
- b. SEP-COM
- c. FAST/NORM
- d. ATTEN

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

2-19. Remote Programming Requirements

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

2-22. Remote Programming Procedure

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

- a. Set FUNCTION switch to any function by START or STOP.
- b. Ground the EXT line at rear-panel REMOTE PROGRAM connector J10(17). Ground is available at J10(36).
- c. Select the desired function.
- d. Select the desired time base.
- e. Select the desired voltmeter range, if using DVM.
- f. Select the slope (+ or -) for CHANNEL A and B. This is accomplished by grounding the Slope line for (-) and leaving it open for (+). Slope A line is J10(28). Slope B line is J10(29).
- g. Select the trigger level for input signal.
- h. Adjust the display time.
- i. Manual reset is available by grounding (<.7 V) pin 34. Check is available by grounding pin 14.

2-24. Function Selection Programming

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

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

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

2-27. Time Base Selection Programming

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

.1 μ s/1	Pin 19
1 μ s/10	Pin 20
10 μ s/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 μ s 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 μ s after the ground is released.

2-36. REMOTE PROGRAMMING, OPTION 004

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

2-38. Front Panel Controls

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

2-40. Remote Programming Requirements

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

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

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

2-43. Remote Programming Procedure

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

- Set FUNCTION switch to any position but START or STOP.
- Ground the EXT line at rear-panel REMOTE PROGRAM connector J10(34). Ground is available at J10(1, 2, 15).
- Select the desired function.
- Select the desired time base.
- Select the voltmeter range, if using DVM.
- Select the signal conditioning.
- Select the trigger level for input signal.
- Adjust the display time.
- Manual reset is available by ground (<.7 V) pin 17. Check is available by grounding pin 37.

2-45. Function Selection Programming

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

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

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

2-48. Time Base Selection Programming

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

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

2-50. Voltmeter Programming

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

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

2-52. Signal Conditioning Programming

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

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

2-54. Trigger Level Programming

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

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

2-57. Sample Rate Adjustment

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

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

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

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

2-59. Sample Rate Disable-Computer Inhibit

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

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

NOTE

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

2-62. BLANKING DEFEAT

2-63. 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).

SECTION III

OPERATION

3-1. INTRODUCTION

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

3-3. OPERATING MODES

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

3-5. Totalize Mode

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

3-7. Frequency Modes

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

by prescaling (550 MHz), depending on the setting of the Input Selector switch. The INPUT C of the 5326B model counts the signal directly.

3-9. Period Modes

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

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

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

3-13. Time Interval Modes

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

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

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

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

3-17. Digital Voltmeter Measurements

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

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

3-20. Ratio

3-21. The counter may be used to measure the ratio of two signals in either the frequency or period mode. By setting the rear-panel OSC INT-EXT switch to EXT, the counter will accept an external signal (F_{ext}) for use as the internal oscillator. This frequency should be 100 Hz to 10 MHz at 1 V rms minimum to 5 V peak maximum. A second signal (F_A), applied to either INPUT A or C jack, is used as the comparator signal.

The MULTIPLIER switch controls the resolution of the display. For a ratio of frequencies, the Ratio = $\frac{F_A}{F_{\text{ext}}} = \frac{\text{DISPLAYED NUMBER}}{\text{MULTIPLIER SETTING}}$. For a ratio of periods (P), the Ratio =

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

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

3-23. MARKER OUTPUTS

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

3-25. HYSTERESIS

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

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

3-28. Time Interval Compensation

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

Figure 3-1. Hysteresis Offset

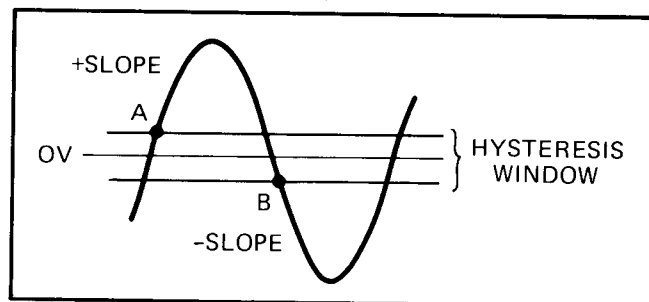
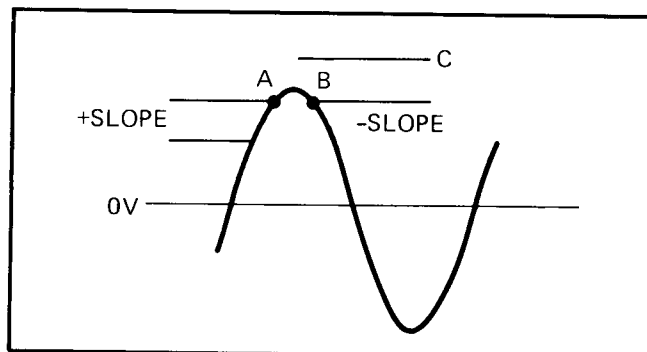


Figure 3-2. Hysteresis Compensation



3-30. ACCURACY

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

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

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

The expression

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

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

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

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

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

$$E = 3 \text{ parts in } 10^7 \text{ per month times 2 months} \\ = 6 \text{ parts in } 10^7$$

$$\text{error} = \frac{1}{(3 \times 10^6) (1 \times 10^{-1})} \pm \frac{6}{10^7} \\ = 3.3 \times 10^{-6} \pm 6 \times 10^{-7} = 3.9 \times 10^{-6} \\ \text{or } 3.9 \text{ parts in } 10^6$$

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

- The aging rate of the 10 MHz crystal standard.
- The ± 1 count ambiguity.
- 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

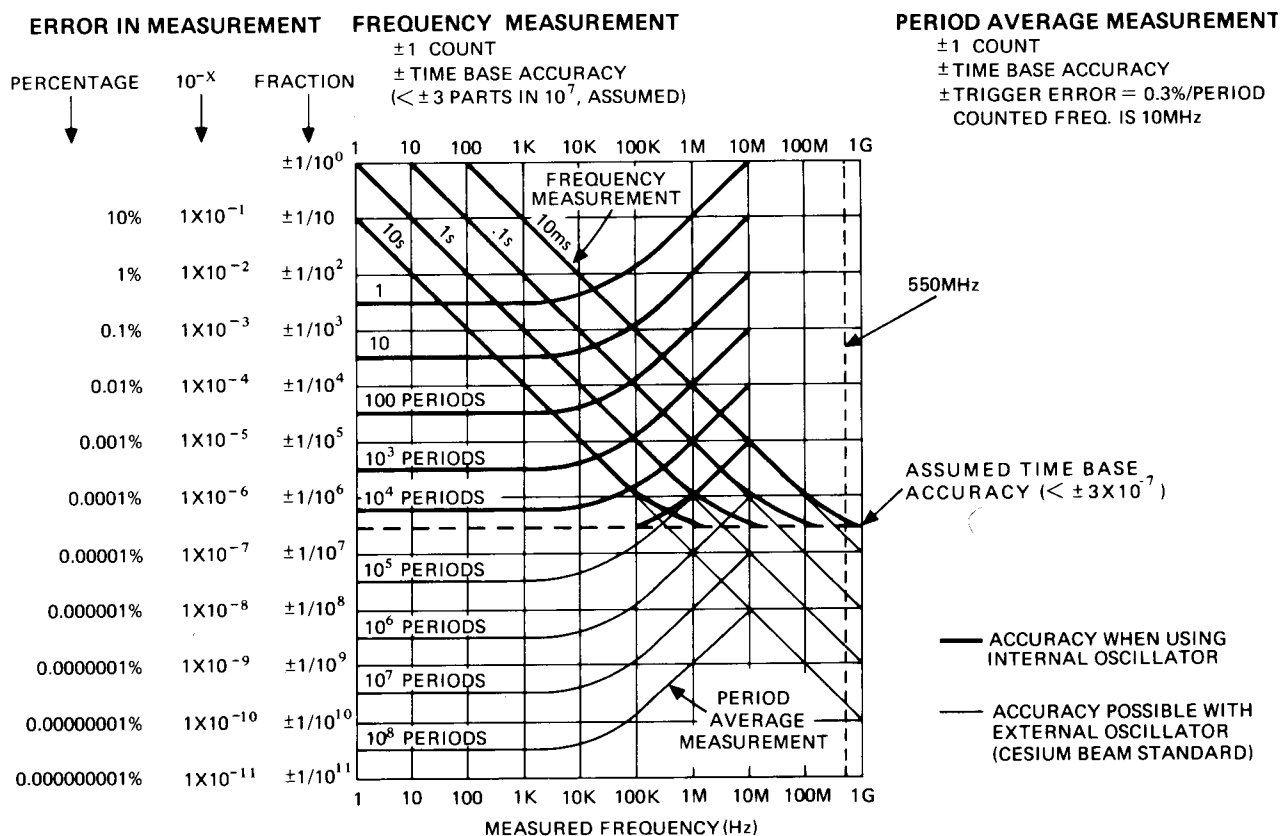
f_2 = Frequency of input signal (Hz)

n = Number of periods averaged

$e = 3 \times 10^{-3}$ (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 off-set at standardization, frequency change due to ambient temperature change, and line voltage effects). A plot of the above formula is shown in Figure 3-3.

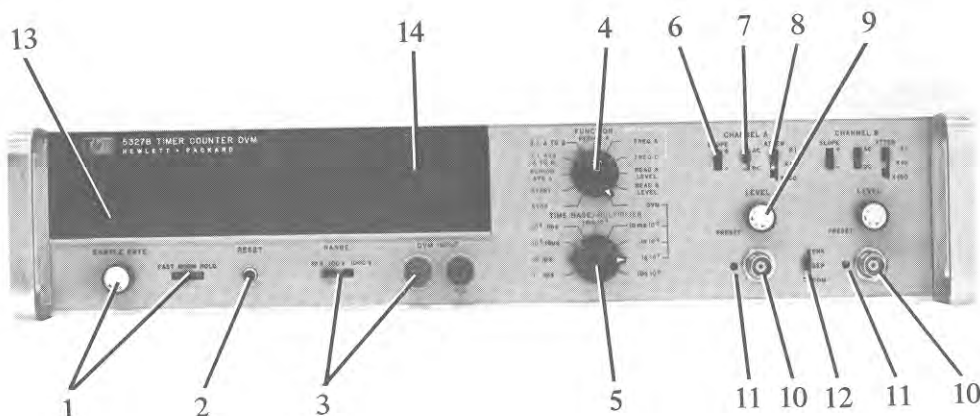
Figure 3-3. Measurement Accuracy



NOTE

FOR 550MHz INPUT (± 10) USE LINE TO RIGHT OF ACTUAL GATE LENGTH TO DETERMINE ACCURACY OF MEASUREMENT, SINCE ± 1 COUNT ERROR REPRESENTS ± 10 COUNTS OF INPUT SIGNAL WHEN PRESCALING BY 10.

Figure 3-4. Front Panel Controls and Indicators



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

- a. **FAST** - Varies display time from $<100 \mu\text{s}$ to $>20 \text{ ms}$. **STORAGE** switch (rear panel) must be ON to use this mode.

- b. **NORM** - Varies display time from $<20 \text{ ms}$ to $>5 \text{ seconds}$.

- c. **HOLD** - Holds display indefinitely.

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

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

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

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

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

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

- d. **T.I. A to B** - Sets counter to measure time interval A to B. Channel A starts measurement and Channel B stops the measurement. T.I. input range is $0.1 \mu\text{s}$ to 10^8 sec . The internal time base frequency is divided by the setting of the **MULTIPLIER** switch and totaled for subsequent display. The more cycles of the oscillator frequency that are counted during A to B time, the better the resolution. There must be 150 ns deadtime between Channel B and Channel A trigger points.

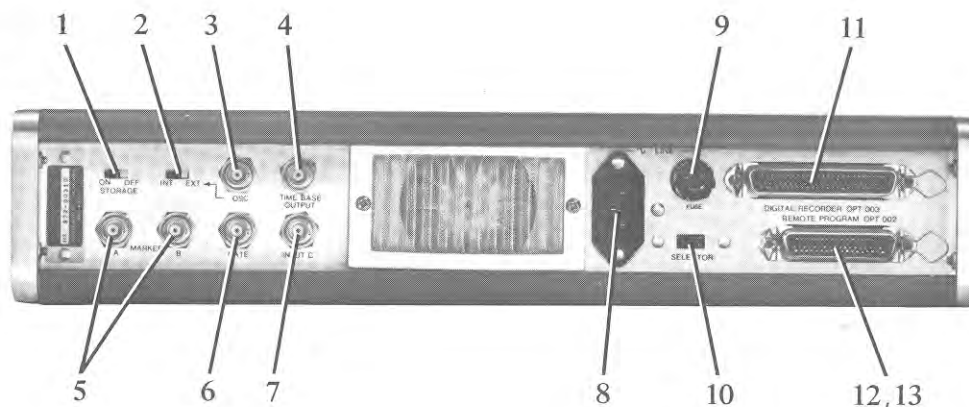
- e. **PERIOD A** - Sets counter to measure a single period of the signal applied to **CHANNEL A** input. Use **MULTIPLIER** switch to set counted internal oscillator frequency and therefore the desired resolution. Frequency input range is 0 to 10 MHz.

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

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

- g. FREQ C - Similar to FREQ A, except sets counter to measure frequency applied to INPUT C jack. 50-ohm input impedance. 3.5 V rms/5 V peak maximum input. Frequency range is 0 to 550 MHz prescaled or 0 to 50 kHz direct. The the 5326B, the frequency range is 0 to 50 MHz. See INPUT C.
- h. READ A LEVEL - Sets counter to measure trigger voltage of LEVEL A control. Trigger level = DVM readout times ATTEN setting. See TIME BASE/MULTIPLIER switch.
- i. READ B LEVEL - Same as READ A LEVEL for LEVEL B control.
- j. DVM - Sets counter to measure dc voltage applied to DVM INPUT jack. Use TIME BASE/MULTIPLIER switch to select integration time and resolution.
5. TIME BASE/MULTIPLIER switch. The function of the switch changes with each mode of operation:
- a. TOTALIZE - Determines scaling factor for input signal prior to counting.
 - b. PERIOD AVG A - Selects number of periods to be averaged.
 - c. T.I. AVG A to B - Selects number of time intervals to be averaged.
 - d. T.I. A to B - Selects scaling factor for internal oscillator signal.
 - e. PERIOD A - Selects scaling factor for internal oscillator signal.
 - f. FREQ A and FREQ C - Sets gate time.
 - g. READ A LEVEL and READ B LEVEL Not operative. 10 ms integration time is automatically selected.
 - h. DVM - Selects DVM integrating time. Decimal point and measurement units are displayed for 10 ms, .1 s, and 1 s settings only.
6. SLOPE switch. Permits triggering on positive or negative slope of input signal.
7. AC-DC switch. Selects direct or capacitor coupling for input signal. Minimum input frequency on AC setting is 20 Hz.
8. ATTEN switch. Selects attenuation for input signal. Used in conjunction with LEVEL control to set input triggering point. Maximum input: 250 V rms on all ranges except 25 V rms on X1 range above 50 kHz. Recommended input is 0.1 V rms to 2 V rms times ATTEN setting.
9. LEVEL control. Used in conjunction with ATTEN switch to determine voltage at which triggering occurs. With X1 attenuator setting, level is variable ± 3 V; on X10, ± 30 V; and X100, ± 300 V.
10. Input jacks. Input jacks to Channels A and B. Input impedance is 1 M Ω shunted by less than 25 pF. By using a 10 to 1 divider probe, input impedance can be increased to 10 M Ω .
11. Trigger lamps adjacent to input jacks indicate when amplifier triggering occurs.
12. CHK-SEP-COM-switch. (Check-separate-common)
- a. CHK - Connects internal 10 MHz time base to Channels A and B circuitry to check that unit is functioning. No indication in T.I. or T.I. Avg; ignore displayed digits in period average.
 - b. COM-SEP - Connects A and B inputs in parallel when set to COM position. When applying two separate inputs, set switch to SEP. When set to COM, input impedance is 500 k Ω shunted with less than 50 pF.
13. C (count) light. Lights when counter's main gate is open. For short-duration gate times, the annunciator circuits include a 50 ms one-shot MV to allow a visible flash of the C light.
14. * (asterisk). Indicates that proper units are not displayed with combination of function/time base selection. To interpret display, add a zero to the right of least significant digit displayed on the counter.

Figure 3-5. Rear Panel Controls and Connectors



1. STORAGE switch. When set to ON, provides display storage while new measurement is being made. In OFF position, allows continuous display of counting process.
2. OSC INT-EXT switch. In INT position, selects normal counter operation using internal time base. In EXT position, permits use of external time base.
3. OSC jack. With INT-EXT switch set to INT, provides 10 MHz, >3 V p-p output (no load), 50 Ω series impedance. With INT-EXT switch set to EXT, allows external time base input of 100 Hz to 10 MHz at 1 V rms (5 V peak maximum).
4. TIME BASE OUTPUT jack. Provides negative going > +3 V to 0 V pulses (open circuit), >50 ns wide. In START, frequency output is Channel A input frequency divided by MULTIPLIER setting.
5. MARKER A and B jacks. Provides marker outputs to intensity modulate HP 180 Oscilloscopes. Markers begin coincident with channel trigger points.
6. GATE jack. Provides >2.4 V output (open circuit) for external use. Has 50 Ω series resistance. Output is low when counter main gate is open and high when gate is closed.
7. INPUT C (5326B). 50-ohm input for 0 to 50 MHz frequency measurements. Has dc coupling and sensitivity of 5 mV rms sine wave. Trigger level is zero volts. Maximum input is ± 5 volts referenced to ground (DO NOT EXCEED).
8. AC LINE. IEC type with offset pin connected to chassis.
9. AC LINE FUSE. 1.50 A at 115 V, 800 mA at 230 V.
10. 115/230 volt switch. Insert narrow screwdriver and slide switch to show desired voltage.
11. DIGITAL RECORDER connector (Option 003 only). 50-pin connector for digital recorder interconnection.
12. REMOTE PROGRAM connector (Option 002 only). 36-pin connector to allow remote control of counter modes and functions.
13. REMOTE PROGRAM connector (Option 004 only). 50-pin connector to allow remote control of counter modes and functions.

Table 3-1. Self-Check

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

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

3. Set FUNCTION switch to STOP.

4. Set MULTIPLIER selector to 1.

5. Set CHK-SEP-COM 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 C light is on. Check that OF light goes on as display overflows. Set TIME BASE/MULTIPLIER to each position and check that counter totalizes in each position.

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

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

Period Average Self-Check

MULTIPLIER	DISPLAY	ANNUNCIATOR
1	.1	μ s
10	.10	μ s
10^2	.100	μ s
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	μ s
10	.00	μ s
10^2	.000	μ s
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 $\pm$ 1 count	μ s
10	0	μ s
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 μ s 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.

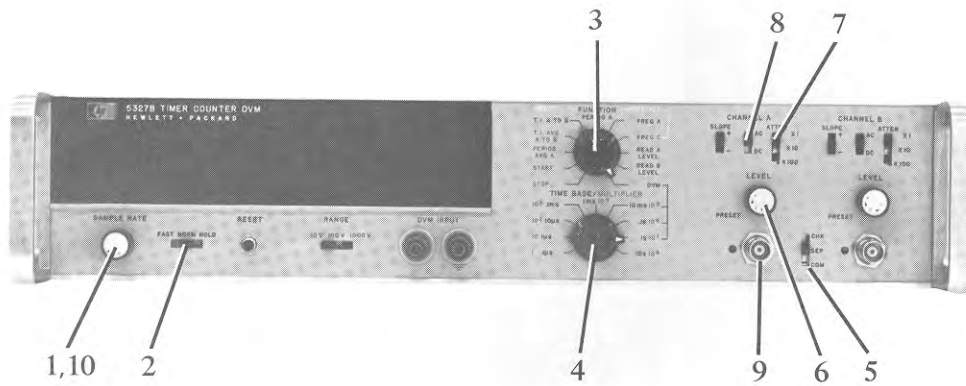
Frequency A Self Check

TIME BASE	DISPLAY	ANNUNCIATOR
.1 μ s	.01	$\pm$ 1 count GHz
1 μ s	10	$\pm$ 1 count MHz
10 μ s	10.0	$\pm$ 1 count MHz
.1 ms	10.00	$\pm$ 1 count MHz
1 ms	10.000	$\pm$ 1 count MHz
10 ms	10000.0	$\pm$ 1 count kHz
.1 s	10000.00	$\pm$ 1 count kHz
1 s	0000.000	$\pm$ 1 count kHz OF
	10000.000	$\pm$ 1 count kHz (Option 001)
10 s	000.0000	$\pm$ 1 count kHz OF
	0000.0000	$\pm$ 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 ± 0.0 V ± 1 count.	DVM Self-Check (with DVM Input Shorted)
15. Rotate CHANNEL A LEVEL control clockwise and check that display varies from at least -3.0 to +3.0 V.	TIME BASE/ MULTIPLIER
	10 ms .1s 1s
16. Repeat steps 14 and 15 for READ B LEVEL.	10 V RANGE
	.00 V ± 1 count .000 V ± 1 count .0000 V ± 1 count
	100 V RANGE
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.	.0 V ± 1 count .00 V ± 1 count .000 V ± 10 counts
	1000 V RANGE
	0 V ± 1 count .0 V ± 1 count .00V ± 10 counts

Figure 3-6. Frequency A Measurements

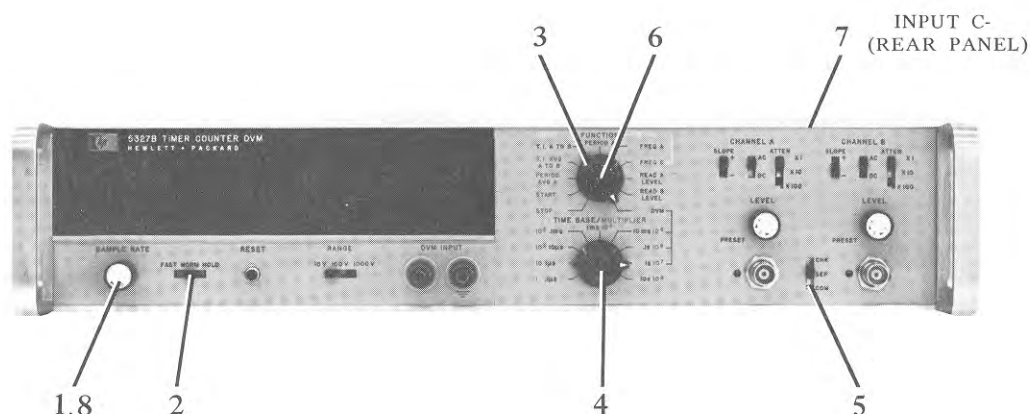


1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to FREQ A.
4. Set TIME BASE switch for desired gate time.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.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

NOTE

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

Figure 3-7. Frequency C Measurements



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

8. Adjust SAMPLE RATE control for convenient measurement interval.

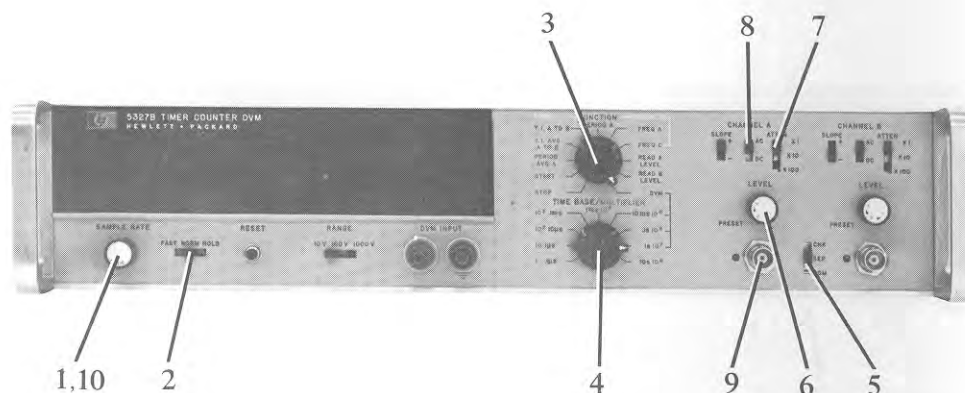
NOTE

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

CAUTION

Damage will occur if Input C voltage specifications are exceeded.

Figure 3-8. Period Measurements



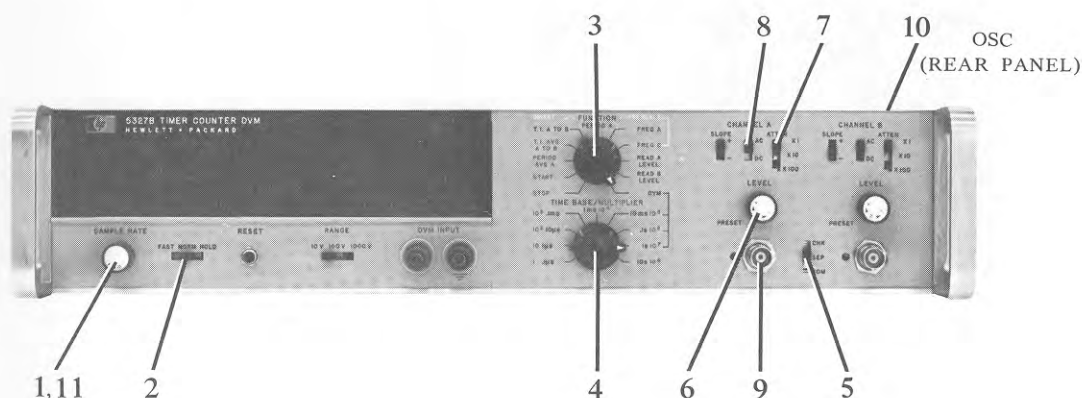
Period

1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to PERIOD A.
4. Set MULTIPLIER switch for desired resolution.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET to trigger at zero volts.
7. Set ATTN 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

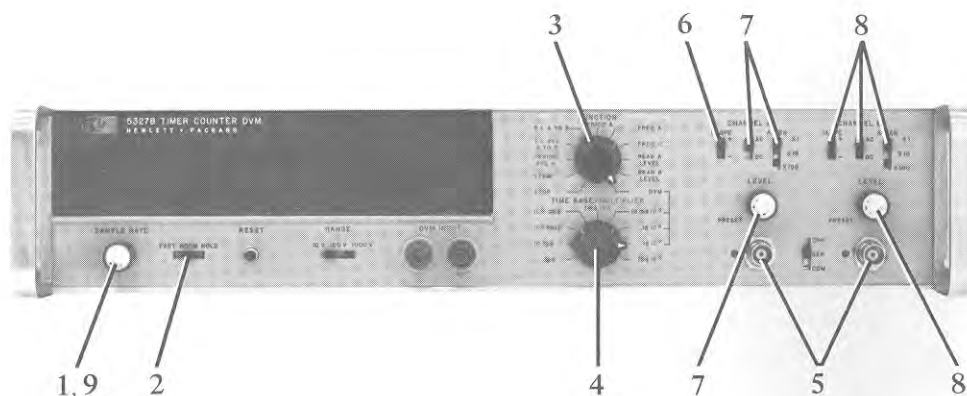
1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to PERIOD AVG A.
4. Set MULTIPLIER switch to number of periods to be averaged.
5. Set CHK-SEP-COM switch to SEP.
6. Set CHANNEL A LEVEL control to desired trigger level or to PRESET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

Figure 3-9. Ratio Measurements



1. Set SAMPLE RATE control slightly clockwise out of OFF.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set FUNCTION switch to FREQ A or FREQ C, direct or prescaled.
4. Set MULTIPLIER 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 MULTIPLIER 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 ATTN 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 ATTN 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).

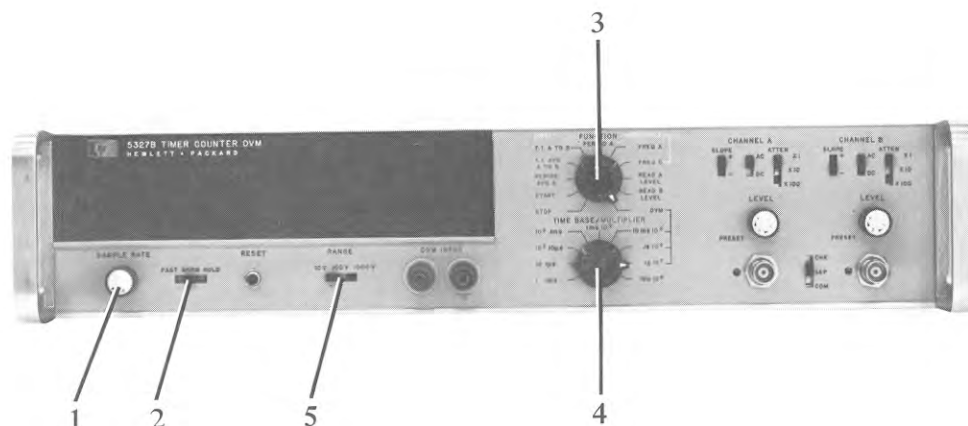
Time Interval Average

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 ATTN 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 ATTN 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 $10 \text{ MHz} \times \frac{M}{N}$ (M and N integers).

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



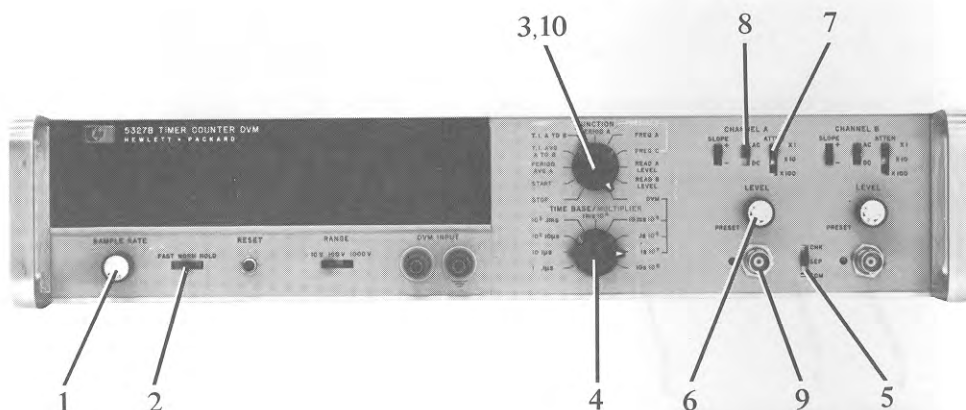
DVM

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

Read A and Read B Levels

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

Figure 3-12. Totalize Measurements



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

NOTE

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

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION

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

4-3. LOGIC SYMBOLS

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

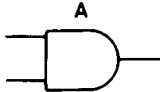
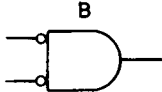
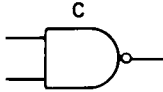
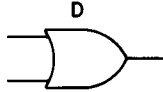
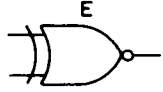
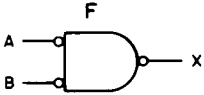
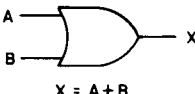
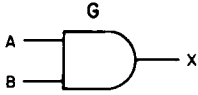
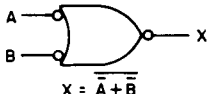
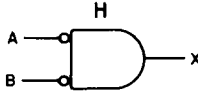
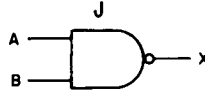
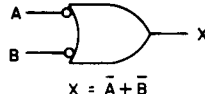
4-5. A circle at the input line of a logic symbol indicates that a low activates the function. Figure 4-1B shows that a low at both inputs produces

a high output. A circle at the output line of a logic symbol indicates a low when activated, as shown in Figure 4-1C.

4-6. Gating and Logic

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

Figure 4-1. Gate Symbols and Logic Comparisons

 AND	 INVERTED INPUT	 INVERTED OUTPUT	 OR	 EXCLUSIVE NOR							
 $X = \overline{A \cdot B}$  $X = A + B$	 $X = A \cdot B$  $X = \overline{A + B}$	 $X = \overline{A \cdot B}$  $X = \overline{A + B}$	 $X = \overline{A \cdot B}$  $X = \overline{A + B}$								
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

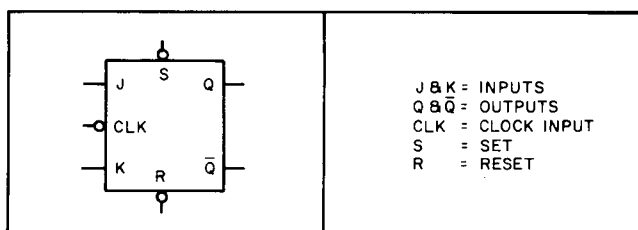


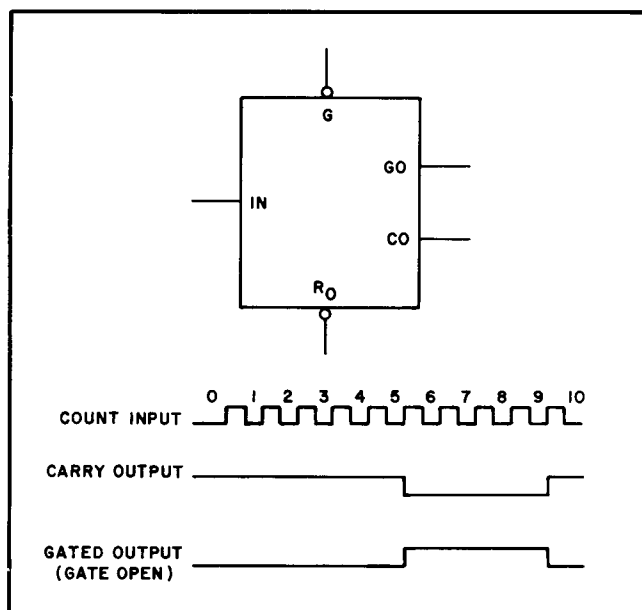
Table 4-1. Truth Table

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 Decode

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.

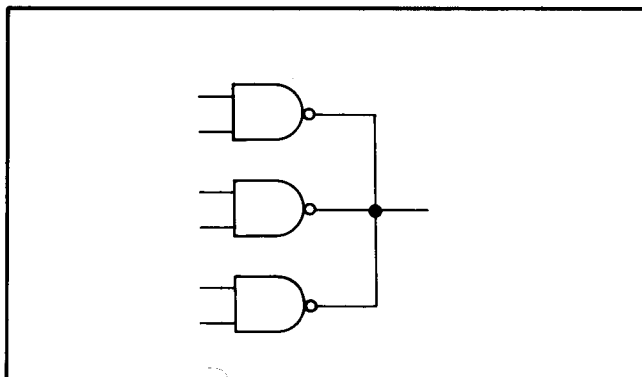
Figure 4-3. Time-Base Decode 1820-0412



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

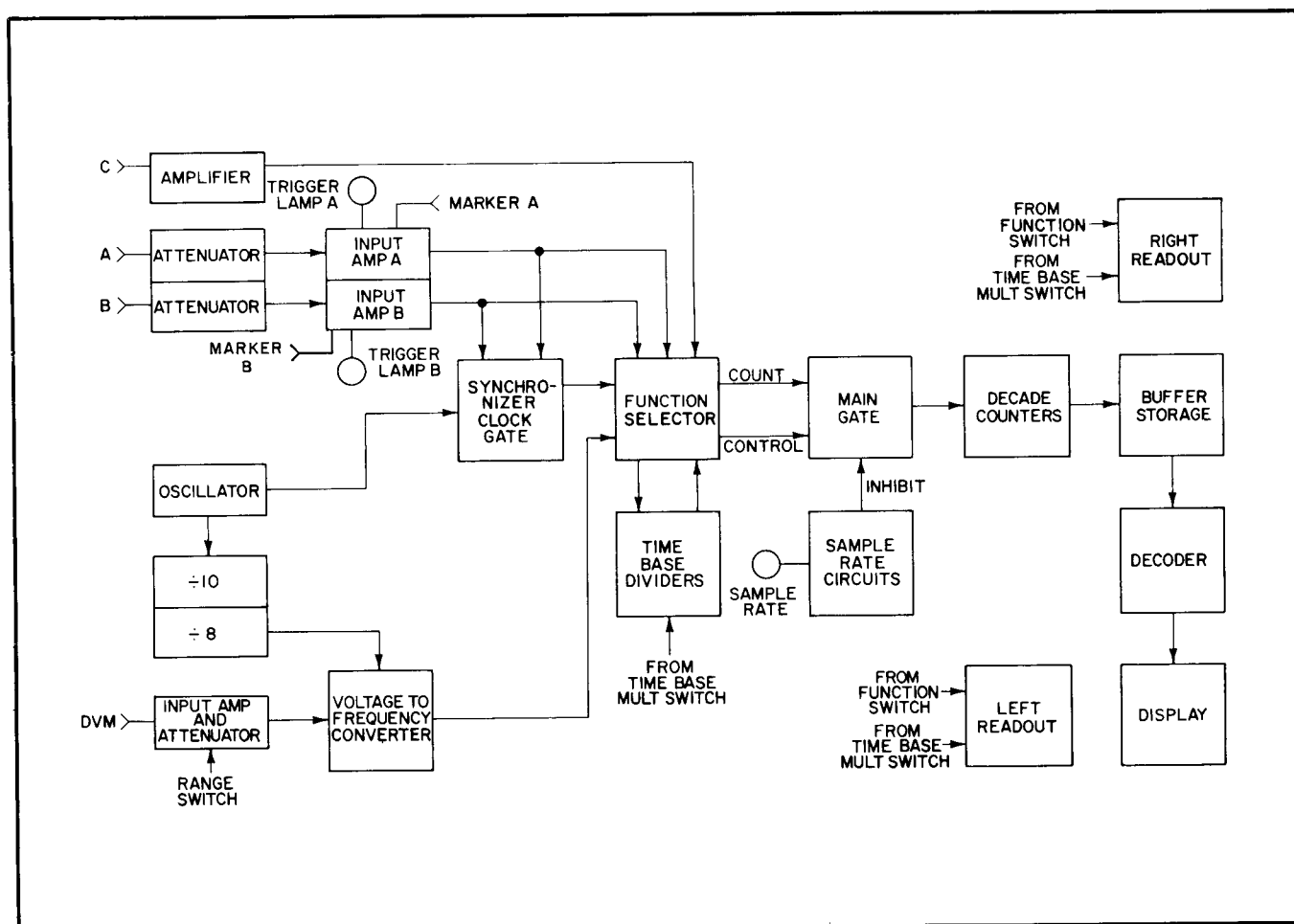
4-18. The signal connected to CHANNEL A is conditioned by the front-panel switches of the Attenuator Assembly (Figure 4-5). These switches set the operating conditions for trigger level, coupling, and

the required slope. The Input Amplifier converts the signal into narrow pulses for more efficient usage throughout the counter. In the 5327B, INPUT C provides an alternate path through the Prescaler Assembly, which divides the signal by 10 or passes it directly to the Function Control Assembly. The path taken is determined by the setting of the front-panel Input Selector switch.

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

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

Figure 4-5. Functional Block Diagram



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

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

4-22. Frequency Modes

4-23. Frequency is defined as the number of periodic events per unit of time. The counter, therefore, measures an unknown signal (COUNT) for a known length of time (Figures 4-6 and 4-7). The 10 MHz internal oscillator provides the known time and controls the opening of the main gate. The Time Base Assembly divides the oscillator frequency by powers of 10 to open the main gate from 10^{-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 8-27 for timing diagrams and a technical description.

4-30. DVM Mode

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

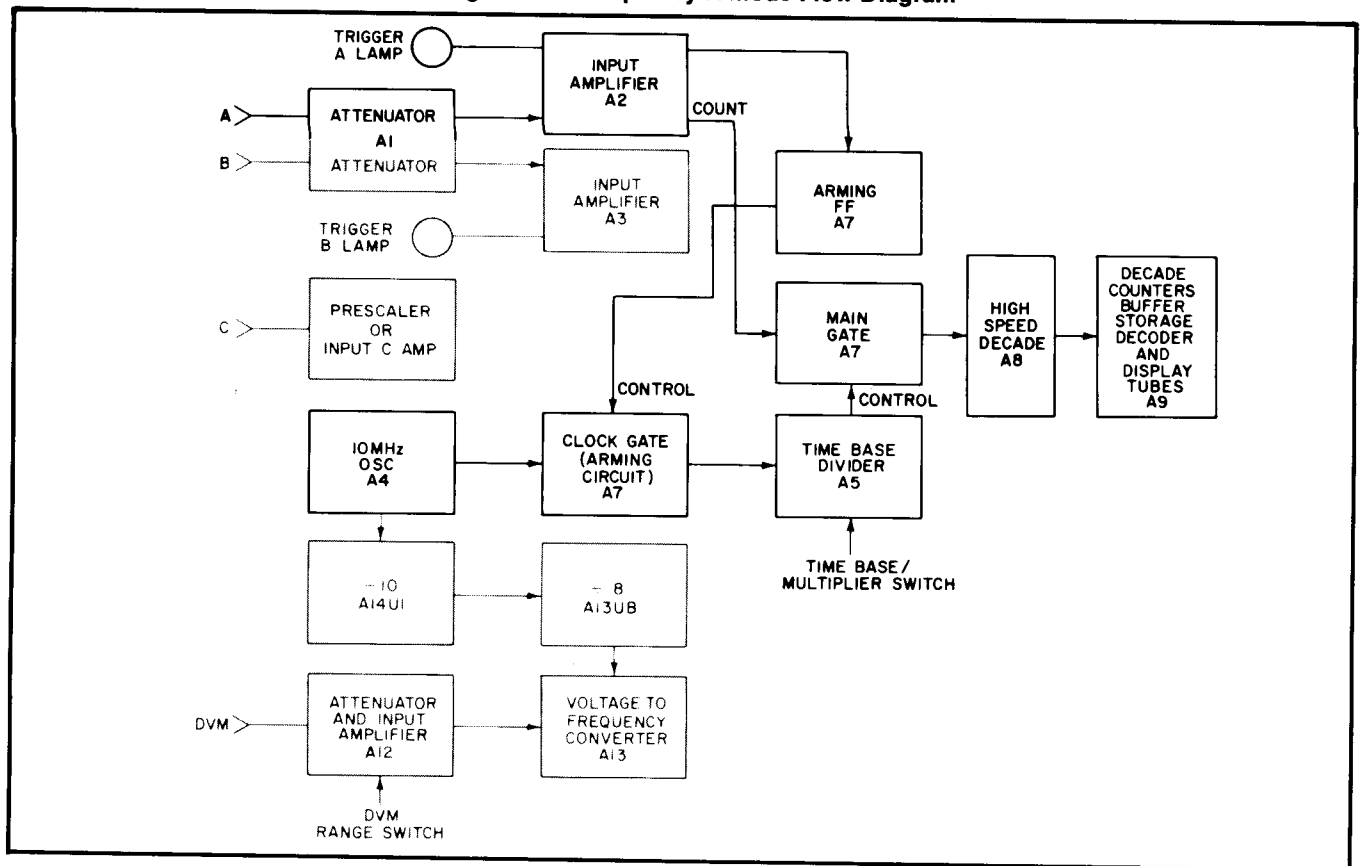


Figure 4-7. Frequency C Mode Flow Diagram

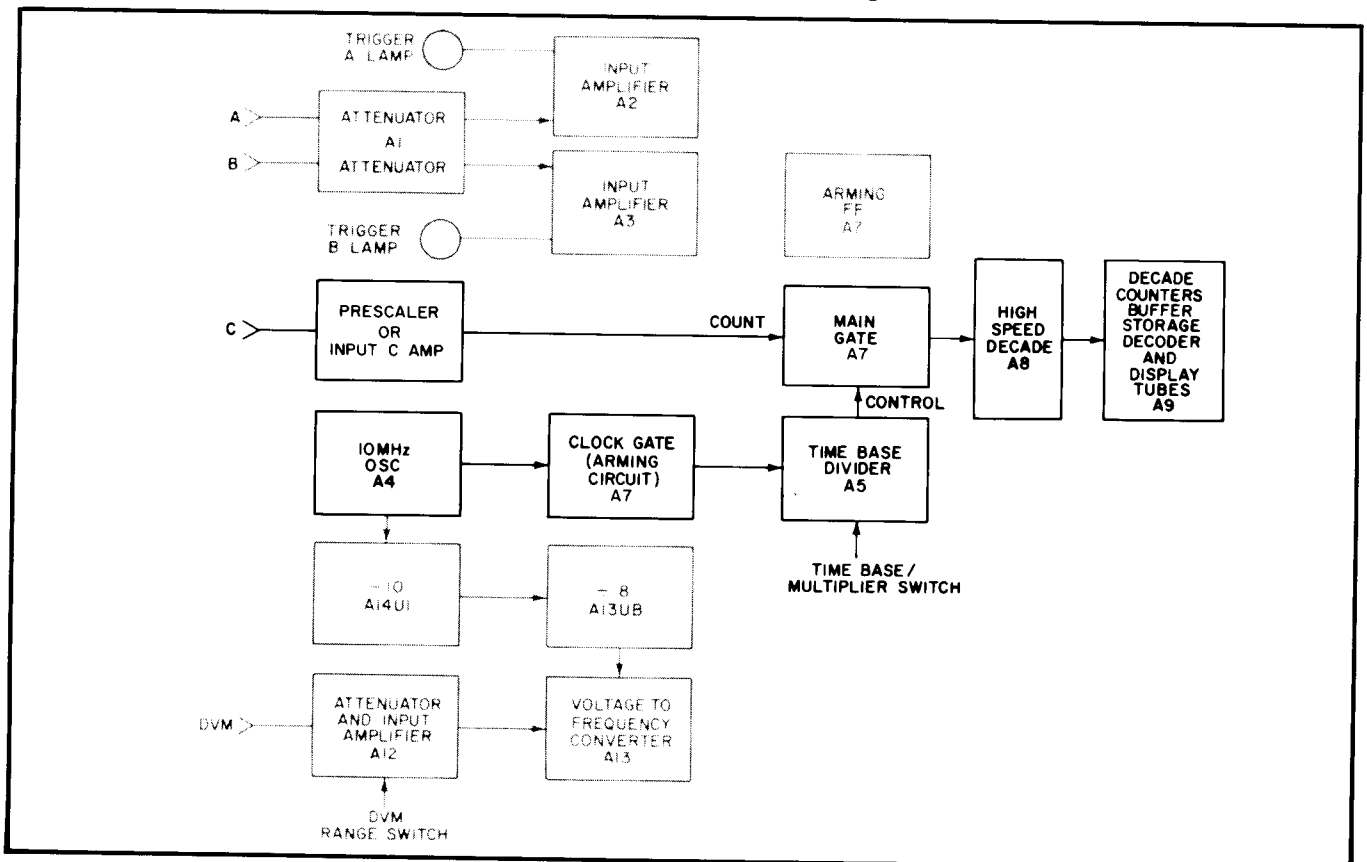


Figure 4-8. Period Mode Flow Diagram

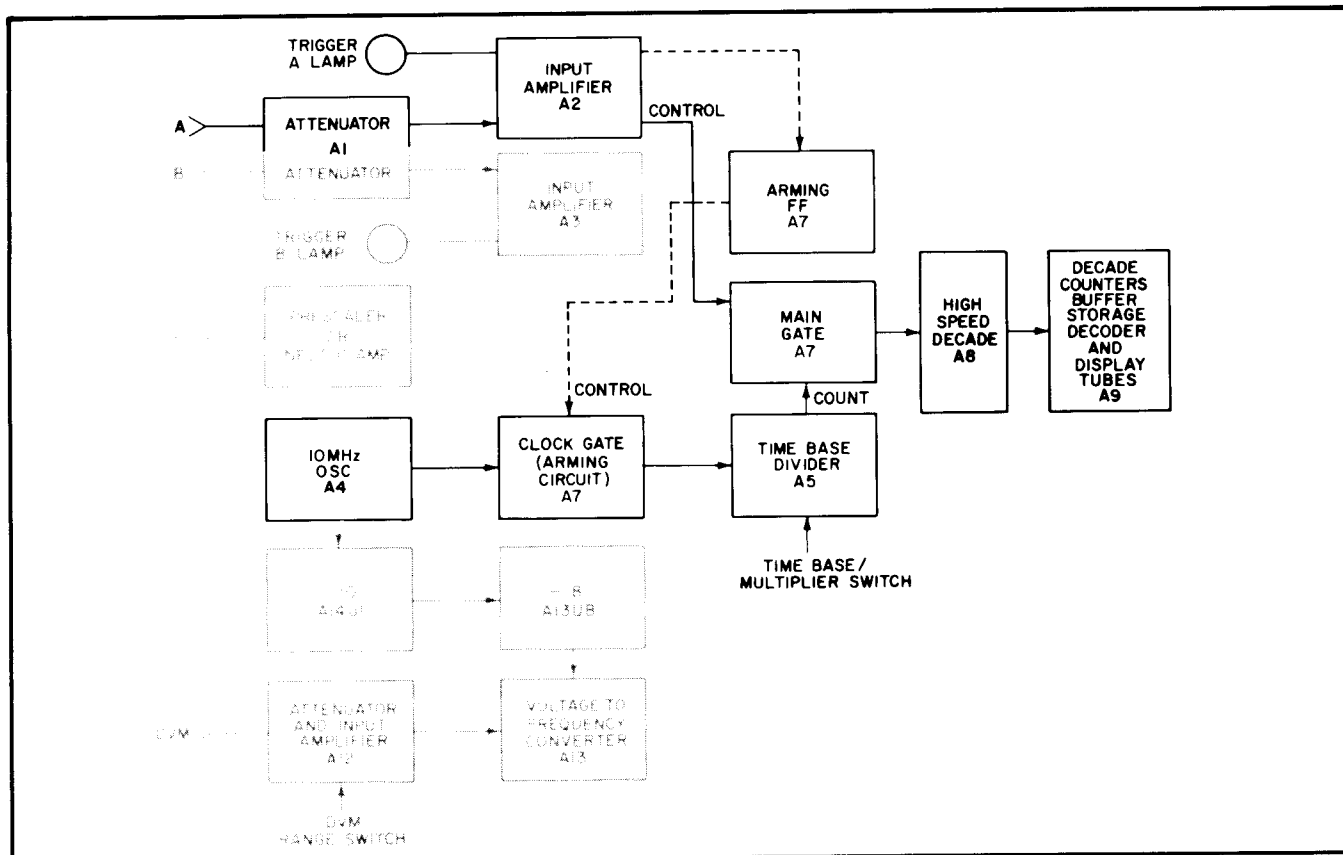


Figure 4-9. Period Average Mode Flow Diagram

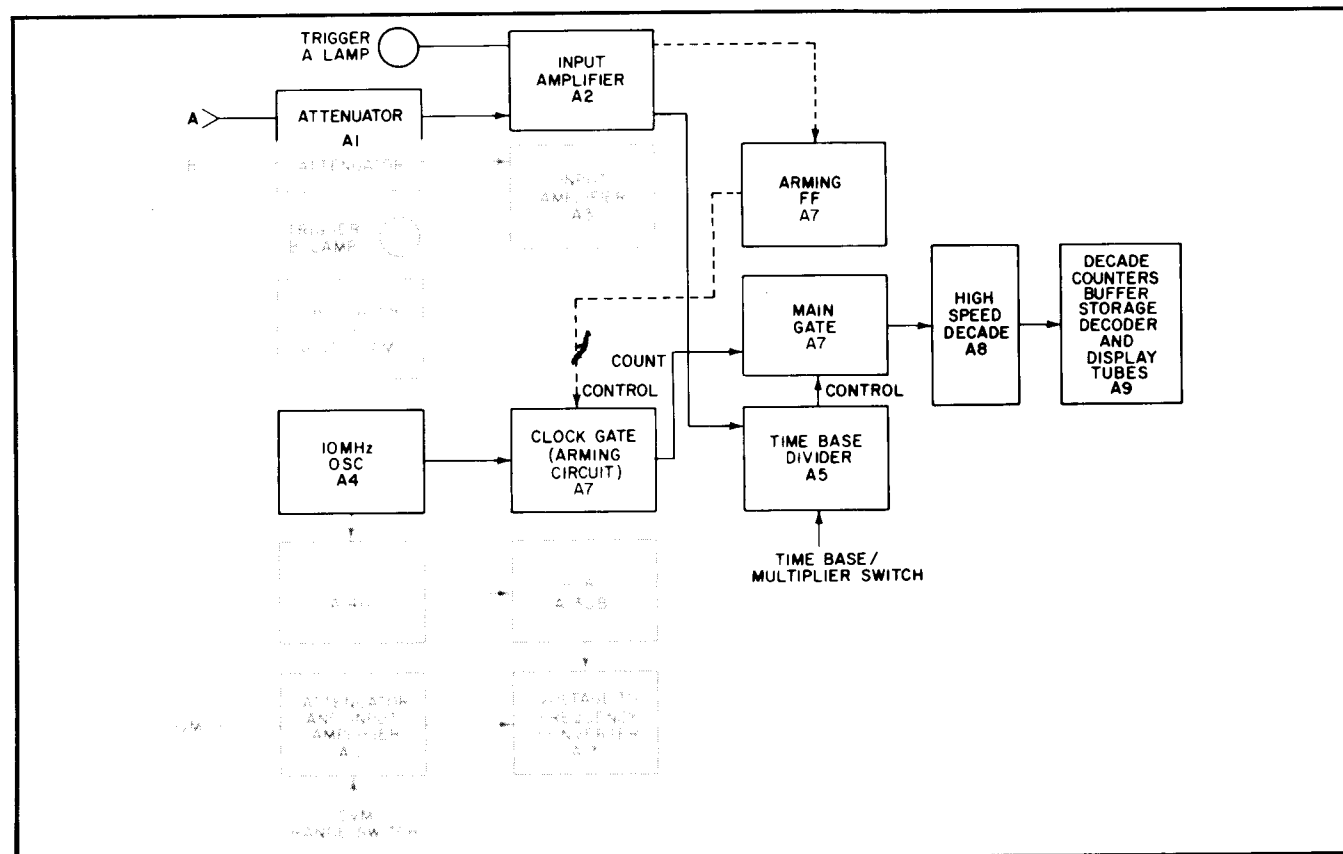


Figure 4-10. Time Interval Mode Flow Diagram

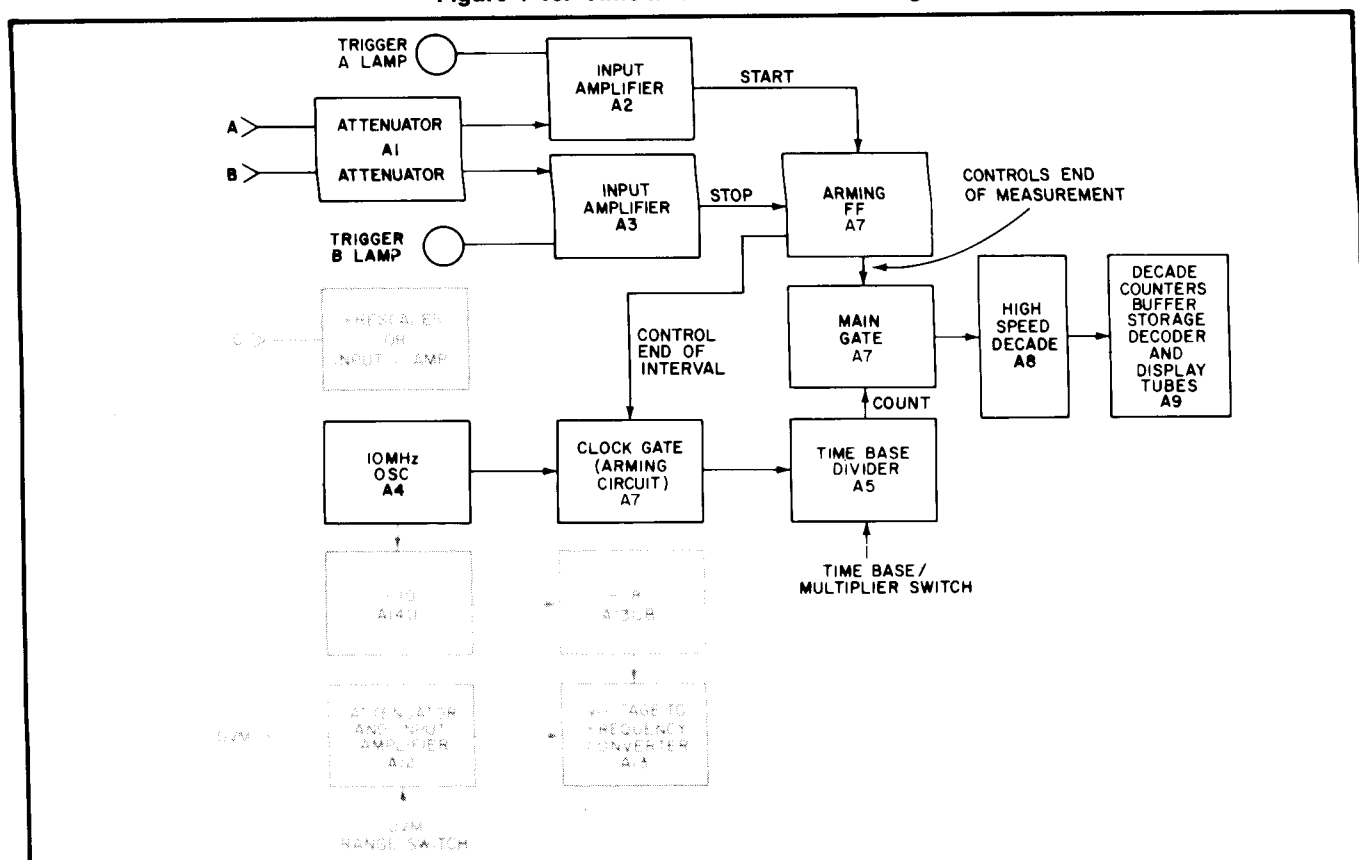


Figure 4-11. Time Interval Average Mode Flow Diagram

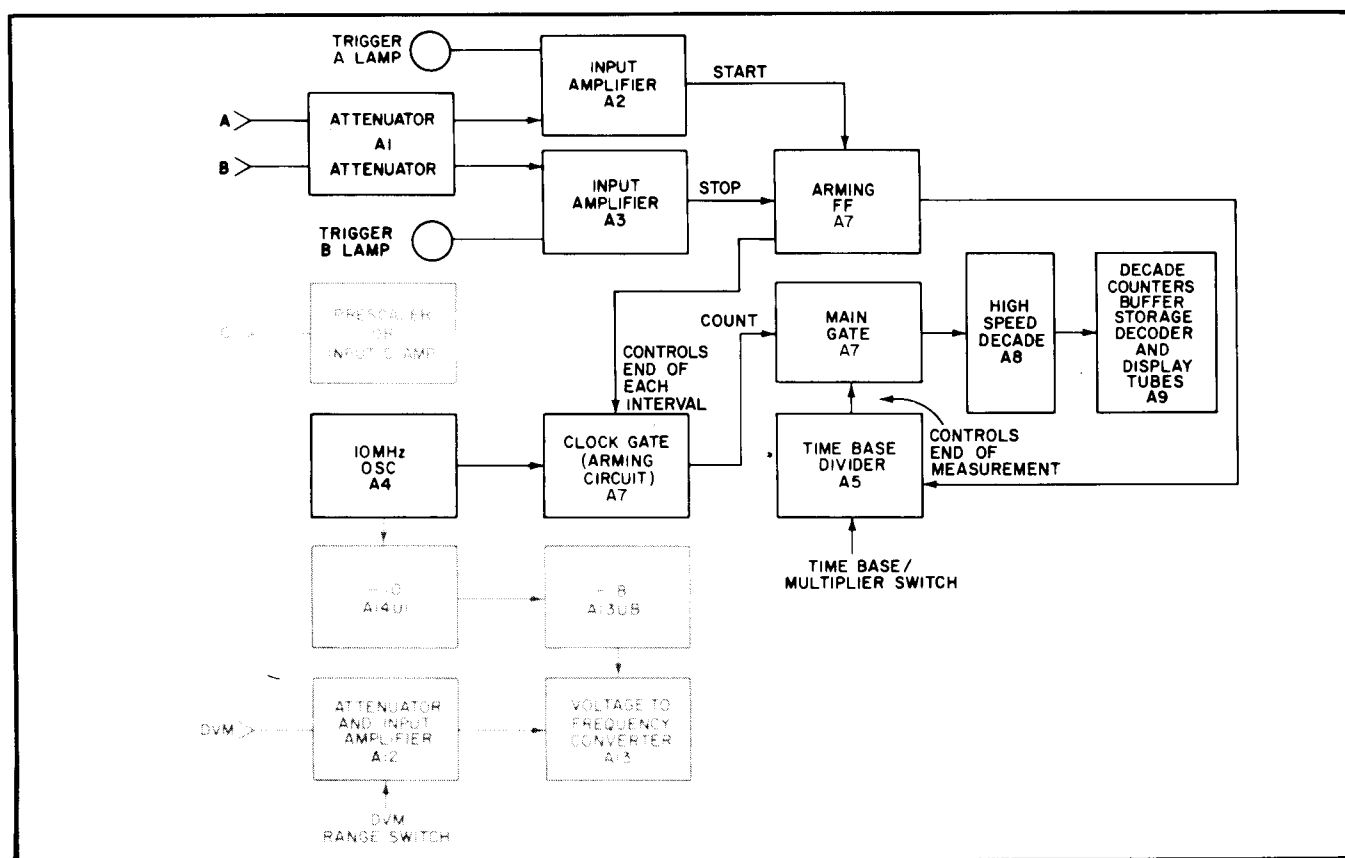


Figure 4-12. DVM Mode Flow Diagram

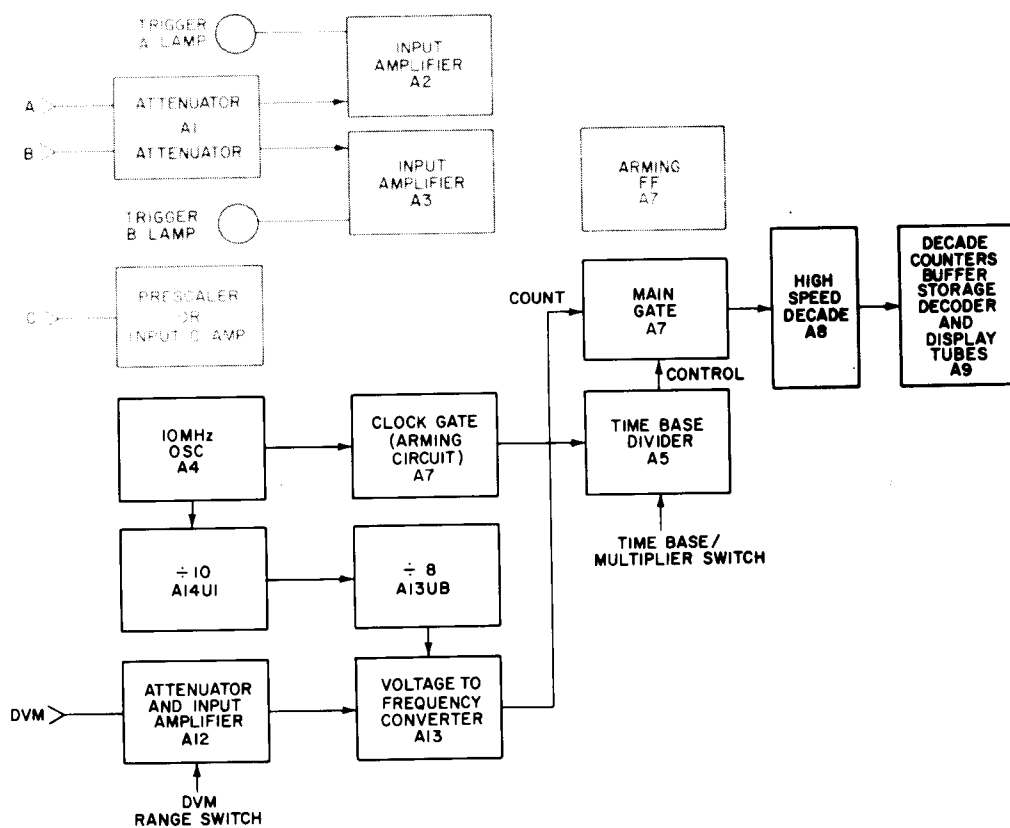
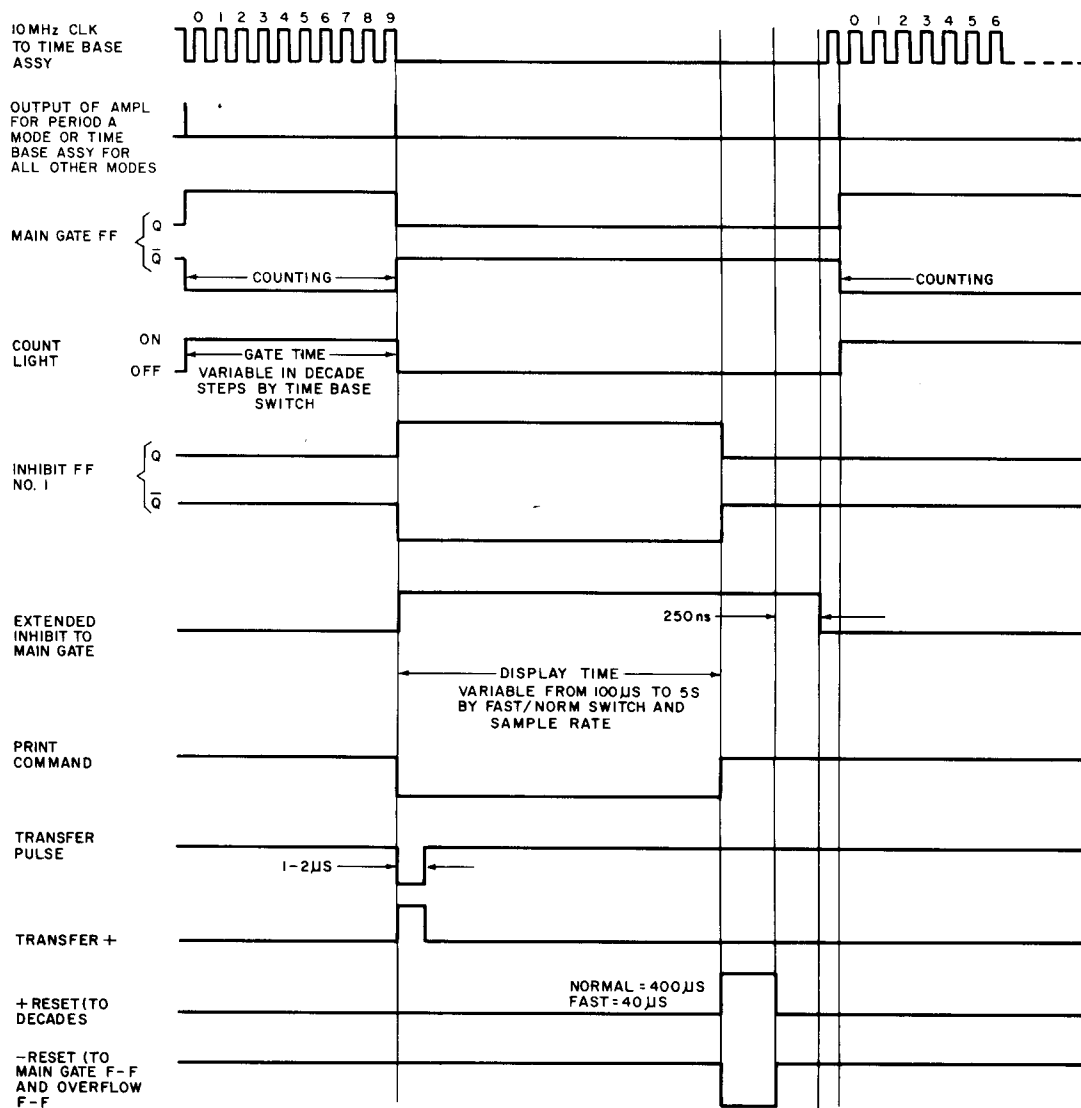


Figure 4-13. Instrument Timing Diagram



SECTION V

MAINTENANCE

5-1. INTRODUCTION

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

5-3. ASSEMBLY DESIGNATIONS

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

5-5. TEST EQUIPMENT

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

Table 5-1. Assembly Identification

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

5-7. ASSEMBLY CONNECTION IDENTIFICATION

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

5-9. IN-CABINET PERFORMANCE CHECK

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

- As part of an incoming inspection check of instrument specifications.
- Periodically, for instruments used in systems where maximum reliability is important.
- As part of a procedure to locate defective circuits.
- After any repairs or adjustments and before returning instrument to regular service.
- As a permanent record of instrument maintenance performed, because the test record pages are perforated and may be removed.

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

5-12. INSTRUMENT COVER REMOVAL

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

WARNING

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

5-14. REPAIR

5-15. Printed Circuit Component Replacement

5-16. Component lead holes in the circuit boards have plated-through walls to ensure good electrical contact between conductors on opposite sides of the board. To prevent damage to the plating and the replacement component, apply heat sparingly, and work carefully.

5-17. Replacing Integrated Circuits

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

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

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

5-19. ADJUSTMENTS

5-20. The adjustments in Table 5-4 are in the order they should be performed but should not be done unless:

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

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

Table 5-2. Recommended Test Equipment

Instrument Type	Required Characteristics	Recommended Type
Frequency Standard	1 MHz Output	HP 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	10 Hz to 10 MHz at 5 volts peak-to-peak	HP 651B
(two required)		
Audio Oscillator	2 Hz to 100 kHz at 100 mV rms	HP 202C
HF Signal Generator	50 kHz to 50 MHz at 3 V rms	HP 606B
VHF Signal Generator	10 MHz to 480 MHz	HP 608F
Frequency Doubler	240 - 550 MHz	HP 10515A
Pulse Generator	10 MHz repetition rate, 8 ns pulse width, 0.3 volts peak-to-peak output	HP 216A
Electronic Counter	0.1 Hz to 10 MHz Frequency Measurements	HP 5245L
Variable Line Transformer	103 to 127 V rms and 206 to 254 V rms	Electronic Power Stat 3PF116 (115V); 3PF216 (230V)
Voltage Standard	10 to 1000 volts, 0.01% accuracy	HP 741B
Digital Recorder	Print Rate: 10 lines/sec. Data Input: +8421 BCD parallel entry, accepts 1 = +5 V, 0 = +0.25 V. Accepts negative going +5 to 0 V print command	HP 5055A
DC Voltmeter	0 to 200 Vdc, 1 % accuracy	HP 412A
AC VTVM	0 to 250 Vac	HP 400F
RF Voltmeter	1 mV to 3 V	HP 3406A

Table 5-3. In-Cabinet Performance Check

1. TIME BASE STABILITY AND OUTPUT

a. Set counter controls as follows:

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

NOTE

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

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

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

- d. Record frequency offset on test card. For long-term stability, operate the counter continuously for at least one month. Measure frequency offset at one-month intervals.
- e. To calibrate the counter time base to the frequency standard, perform time-base adjustment in Table 5-4.

NOTE

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

- f. To check time base stability vs. line voltage variations, connect variable transformer to counter power cord. Vary line voltage $\pm 10\%$ and record frequency difference on test card; it should be ≤ 1 part in 10^7 .
- g. To check time base stability vs. temperature, vary counter operating temperature between 0° and 50°C . Record frequency difference on test card; it should be ≤ 2.5 parts in 10^6 .

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

- h. Connect oscilloscope vertical input to OSC jack on counter rear panel. Use 10:1 probe at OSC jack.
- i. Oscilloscope should display 10 MHz nominal at > 2.4 volts peak-to-peak amplitude. Record on test card.

2. DISPLAY, DECIMAL POINTS, AND DIVIDERS

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

3. FREQUENCY RESPONSE AND SENSITIVITY

CHANNEL A

- a. Set counter controls as in 1a., except TIME BASE to 1s and AC/DC switch to AC. *CHK To SEP - sep. Com*
- 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. *HP 652A*
- c. Adjust test oscillator from 20 Hz to 50 MHz, maintaining 100 mVrms input amplitude. Counter should properly display all frequencies in this range. Record on test card.
- d. Set audio oscillator frequency to 2 Hz. Counter should not count. Switch AC/DC switch to DC. Counter should count input signal.
- e. Connect a BNC T connector to Z axis input of oscilloscope. Connect counter MARKER A and B outputs to T connector.
- f. Adjust test oscillator output for 1000 Hz at 8 volts peak-to-peak indication.
- g. Set CHANNEL A LEVEL to PRESET and check that oscilloscope marker is at 0 volts.
- h. Set CHANNEL A SLOPE to +. Vary CHANNEL A LEVEL control and check that marker is variable over at least -3.0 to +3.0 volts on the positive slope of waveform.
- i. Set CHANNEL A SLOPE to -. Vary CHANNEL A LEVEL control and check that marker dot is variable over at least -3.0 to +3.0 volts on the negative slope of waveform. Record on test card.
- j. Set CHK-SEP-COM switch on COM and repeat marker test for CHANNEL B. Record on test card.
- k. Set FUNCTION selector to READ A LEVEL. Set LEVEL A to PRESET. Display should be .00 V ± 1 count.
- l. Rotate LEVEL A control clockwise just out of PRESET. Readout should be negative display of 3.00 volts or greater. Gate light should flash.
- m. Rotate LEVEL A control clockwise and check that readout decreases, crosses zero (polarity sign changes) and displays +3.00 volts or greater in the full clockwise position. Record on test card.
- n. Set FUNCTION selector to READ B LEVEL and repeat step K through M for Channel B. Record on test card.

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

- a. Disconnect oscilloscope and input to CHANNEL A. Remove 50 Ω feedthrough and connect cable to INPUT C jack.
- b. Set FUNCTION selector to FREQ C, TIME BASE to 1s, and input selector to PRESCALE.

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

- c. Use the set of frequency generators (Table 5-2) necessary to cover the input frequency from 0 to 550 MHz, while maintaining 25 mV rms input levels. Adjust TIME BASE switch as necessary for best display.
- d. Check for stable count within stability of oscillator. Record on test card.
- e. For 5327B, set input selector switch to DIRECT.
- f. Set FUNCTION selector to FREQ C and TIME BASE to 1s.
- g. Use the set of frequency generators necessary to cover the input frequency from 0 to 50 MHz, while maintaining 15 mV rms input level for the 5327B or ~~5 mV~~ rms for the 5326B. Adjust TIME BASE switch as necessary for best display. *50 mVrms 9/78*
- h. Check for stable count within stability of oscillator. Record on test card.

4. PULSE OPERATION

- a. Set counter controls as follows:

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

- b. Connect BNC T connector to oscilloscope vertical input. Connect pulse generator to T. Connect CHANNEL A input to T connector, using 50 Ω feedthrough at the counter input.
- c. Adjust pulse generator output for 10 MHz repetition rate, 15 ns pulse width at 0.3 volts peak-to-peak indication on oscilloscope.
- d. Check that counter displays the repetition rate, count light flashes, and trigger A lamp is on. Record on test card.
- e. Remove input connection from CHANNEL A input jack. Remove 50 Ω feedthrough and connect cable to INPUT C jack. Set FUNCTION selector to FREQ C. Set input selector switch to DIRECT.
- f. Check that counter displays repetition rate and count lamp flashes. Record on test card.
- g. Repeat above check for 10 kHz.

5. PERIOD AND PERIOD AVERAGE

- a. Set counter controls as in step 1a. with FUNCTION to PERIOD A and MULTIPLIER to 10³ 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 50 Ω feedthrough at oscilloscope BNC.
- c. Vary audio and test oscillator frequency from 2 Hz to 10 MHz, maintaining 100 mVrms input amplitude. Vary MULTIPLIER as needed to maintain meaningful display with change of frequency. Counter should properly display the period of the frequencies in this range within accuracy spec of the instrument. Record on test card.
- d. Set FUNCTION switch to PERIOD AVG A and repeat step c. Record on test card.

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

6. TIME INTERVAL AND TIME INTERVAL AVERAGE

- a. Set counter controls as follows:

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

- b. Connect test oscillator to CHANNEL A input. Set oscillator for 1 MHz output at 300 mVrms. Observe display of $.5 \mu s \pm 1 \text{ count} \pm \text{trigger error}$. Record on test card.
- c. Set FUNCTION to T.I. AVG and MULTIPLIER to 10^4 . Set signal source to $< 2 \text{ MHz}$. * Counter should display one half the period of the input signal

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

7. TOTALIZE

- a. Set counter controls as follows:

FUNCTION	START
MULTIPLIER	1
CHK-SEP-COM	CHK

- b. Check that display totalizes, count light (C) is on and trigger A and B lamps light. Record on test card.
- c. Using 10:1 divider probe, connect oscilloscope vertical input to TIME BASE OUTPUT jack on counter rear panel.
- d. Check that oscilloscope indicates 10 MHz negative going pulses at least 3 volts peak-to-peak, typically $> 30 \text{ nsec}$ 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 5-3. In-Cabinet Performance Check (Continued)

8. RATIO

- a. Set counter controls as follows:

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

- b. Connect test oscillator to OSC jack, using BNC T. Connect oscilloscope to T connector, using 50 Ω 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 50 Ω 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 ≥ 2.4 V with a pulse width of $< 100 \mu\text{s}$. Record on test card.
- d. Slowly rotate SAMPLE RATE clockwise and observe that the pulse width increases.
- e. Set the TIME BASE switch to 10 ms and rotate the SAMPLE RATE fully clockwise. Observe that the pulse width is > 20 ms. Record on test card.
- f. Set FAST/NORM/HOLD to NORM and turn SAMPLE RATE fully counterclockwise, just out of OFF. Observe the positive pulse width is < 20 ms. Record on test card.
- g. Slowly rotate the SAMPLE RATE clockwise, observing an increase in the pulse width.
- h. Set TIME BASE to 1s and rotate SAMPLE RATE fully clockwise. Verify that the time between flashes of the count (C) lamp is greater than 5 seconds. Record on test card.
- i. Set FUNCTION to START and check that gate output is TTL Low (< 0.4 V).
- j. Set FUNCTION to STOP and verify that gate output is TTL High (> 2.4 V).

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

10. DIGITAL VOLTMETER

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

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

- b. Set voltage standard for +10.000 volt output. Connect voltage standard to DVM input jack.
- c. Check that counter display is +10.000 volts ± 7 counts.
- d. Reverse voltage standard polarity and check for counter display of -10.000 volts ± 7 counts.
- e. Set counter RANGE switch to 100V. Set voltage standard for +100.00 volts output. Check that counter display of +100.00 volts ± 7 counts.
- f. Reverse voltage standard polarity and check for counter display of -100.00 volts ± 7 counts.
- g. Set counter RANGE switch to 1000V. Set voltage standard for +990.0 volts output. Counter display should be +990.0 ± 11 counts.

CAUTION

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

- h. Set counter RANGE switch to 10V. Counter display should be 12.500 ± 1 count.
- i. Set voltage standard for 12.490 volt output. Counter display should be 12.490 ± 7 counts.
- j. Connect a 1 M Ω , $\frac{1}{4}$ W, 1% resistor in series with the red DVM INPUT jack.
- k. Set voltage standard for 10 volts output. Counter display should be 9.090 ± 17 counts.
- l. Set RANGE switch to 100V. Counter display should be 9.09V ± 22 counts.
- m. Short DVM input terminals. Set RANGE switch as follows and check for proper readout.

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

11. DIGITAL RECORDER (Option 003)

- a. Set counter controls as follows:

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

- b. Connect oscilloscope to J9(48). Observe oscilloscope display a print command (drop from >2.4V to <0.4V) immediately after the C lamp goes out.
- c. Connect jumper from J9(25) to J9(22).
- d. Check that counter's main gate is inhibited. C light does not flash, and no print command pulses are generated.
- e. Verify proper output by connecting a 5055A printer on J9. Printed output should agree with counter display. Logic probe or voltmeter may be used to verify that output logic levels agree with instrument display. Record on test card.

Table 5-4. Adjustments

1. POWER SUPPLY A15

- a. Connect counter line cord to variable power transformer. Monitor output voltage with AC VTVM. Adjust transformer for 117 volt indication on VTVM.
- b. Turn counter SAMPLE RATE control clockwise out of OFF.
- c. Connect VTVM to A15 Pin 7 and adjust A15R10 for +16.5 V.
- d. Connect VTVM to A15 Pin 6 and adjust A15R13 for -16.5 V.

2. SENSITIVITY AND OFFSET A2, A3

- a. Connect a BNC T connector to CHANNEL A input jack.
- b. Connect test oscillator output to T connector.
- c. Connect oscilloscope vertical input to T connector, using 50 Ω feedthrough at oscilloscope input BNC.
- d. Connect counter MARKER A output to oscilloscope Z-axis input.
- e. Adjust test oscillator for 1 kHz output at 100 mV rms.
- f. Set counter controls as follows:

FUNCTION	FREQ A
CHK-SEP-COM	SEP
ATTEN	X1
AC-DC	DC
LEVEL	PRESET
- g. Set SLOPE A switch to - and + positions and observe marker position on oscilloscope waveform.
- h. On Input Amplifier board A2, adjust A2R2 SENS pot until + and - marker positions have a symmetrical offset about the zero volt axis for + and - slope switch positions.
- i. Adjust test oscillator for 1 kHz output at 200 mV rms.
- j. Set counter FUNCTION switch to T.I. A to B.
- k. On Input Amplifier, adjust A2R24 TRIG LEVEL pot until markers are at 0 volts for both + and - SLOPE switch positions.
- l. Repeat procedure for CHANNEL B input (Amplifier Board A3).

3. OPTION 004 ATTENUATOR A1

Set:

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

- a. Using an HP 412A or equivalent, measure voltage at CHANNEL A jack.
- b. Adjust R56 for < ± 1 mV reading.
- c. Measure voltage at CHANNEL B jack.
- d. Adjust R9 for < ± 1 mV reading.
- e. Set A and B attenuators to X100 position.
- f. Measure voltage at CHANNEL B jack.
- g. Adjust R32 for < ± 1 mV reading.
- h. Measure voltage at CHANNEL A jack.
- i. Adjust R33 for < ± 1 mV reading.

4. OSCILLATOR A4

- a. Connect 1 MHz frequency standard to CHANNEL A jack.
- b. Set counter controls as follows:

CHK-SEP-COM	SEP
FUNCTION	FREQ A
TIME BASE	10s
SAMPLE RATE	slightly clockwise out of OFF
- c. Remove top cover.
- d. Using insulated tuning tool, adjust A4C3 until display indicates all zeros with cover on. (Wait 10 seconds between adjustments for counter to make measurement.)

NOTE

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

5. PRESCALER ADJUSTMENTS A18 (5327B)

- a. Set counter controls as follows:

FUNCTION	FREQ C
TIME BASE	0.1s
Input Selector	PRESCALE

Table 5-4. Adjustments (Continued)

- b. With no input signal applied, adjust R3 offset pot for 0 V on U2 pin 4.
- c. Adjust R10 bias pot for 0.65 ± 0.05 V on U2 pin 3.
- d. Adjust R27 bias pot for 0.9 ± 0.05 V on U3 pin 3.
- e. Check that the previously adjusted voltage on U2 pin 3 is correct. If voltage has shifted, adjust R10 for proper reading and recheck U3 pin 3.
- f. Set HP VHF Signal Generator and doubler for 550 MHz at 1 V rms. Measure the output with an HP 3406A RF Voltmeter using a 50Ω termination at the probe. Connect signal source to INPUT C of counter.
- g. Reduce output level until counter's display becomes unstable. Adjust R3 for a stable display. Repeat this procedure until unable to obtain a stable reading. Increase signal level until display just becomes stable.
- h. Disconnect input and connect to voltmeter; reading should be 25 mV or less. Check other frequencies within the band.
- i. Set input selector switch to DIRECT.
- j. Change input signal to 50 MHz at 15 mV. Counter should display 50 MHz.

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

- a. Set counter controls as follows:

SAMPLE RATE	 slightly clockwise out of	OFF
RANGE		10 V
FUNCTION		DVM
TIME BASE		1s
- b. Connect a jumper lead across the DVM INPUT terminals.
- c. On Voltmeter Input Amplifier Assembly, adjust A12R31 ("ZERO" pot) for ± 0.0000 V ± 1 count display.
- d. Disconnect jumper and connect DC Standard to DVM INPUT terminals. Set DC Standard for ± 10 V output.
- e. On V-to-F Converter Assembly, adjust A13R16 ("+" pot) for $+10.0000$ V ± 2 counts.

- f. Reverse polarity of the DC standard.
- g. Adjust A13R15 ("-" pot) for -10.0000 V ± 2 counts.
- h. Set counter RANGE switch to 100 V.
- i. Set DC Standard for +100 volt output.
- j. On Voltmeter Input Amplifier Assembly, adjust A12R21 ("100 V" pot) for $+100.000$ volts ± 2 counts on display.
- k. Reverse polarity of DC Standard and check that display is -100.000 volts ± 2 counts. If not, adjust A12R21 and repeat steps i., j., and k., until A12R21 setting gives display of $+100.000$ V ± 2 counts and -100.000 V ± 2 counts.
- l. Set counter RANGE switch to 1000 V.

CAUTION

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

- m. Set DC Standard for +990 volts output.
- n. On A12, adjust R24 (1000 V pot) for $+990.00 \pm 2$ counts on display.

7. INPUT C AMPLIFIER A17 (5326B)

- a. Set counter controls as follows:

FUNCTION		FREQ C
TIME BASE		0.1s
- b. Set HP 606B HF Signal Generator (or equivalent) for 50 MHz at 500 mV rms. Measure the output signal of 606B with an HP 411A RF Millivoltmeter, using a 50Ω termination. Connect signal source to INPUT C of counter.
- c. Reduce output level until counter's display becomes unstable. Adjust R11 for a stable display. Repeat this procedure until unable to obtain a stable reading. Increase the signal level until display just becomes stable.
- d. Disconnect input and connect to voltmeter, reading should be less than 5 mV. Check other frequencies within the band.

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

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

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

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

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

Function Switch	Multiplier Switch	G	k	M	Hz	V	Decimal					
							10 ⁵	10 ⁴	10 ³	10 ²	10 ¹	10 ⁰
Read A Level	1					x					x	
	10					x					x	
	10 ²					x					x	
	10 ³					x					x	
	10 ⁴					x					x	
	10 ⁵					x					x	
	10 ⁶					x					x	
	10 ⁷					x					x	
	10 ⁸					x					x	
DVM	1											
	10											
	10 ²											
	10 ³											
	10 ⁴											
	10 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 5326B/5327B Test Performed by _____
 Timer/Counter/DVM
 Serial No. _____ Date _____

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

PERFORMANCE CHECK TEST CARD

8. RATIO

Range Channel A: 0 to 50 MHz
Range External Input: 100 Hz to 10 MHz

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

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

11. DIGITAL RECORDER
Print Command: +5V to 0V
Output: Corresponds to input data

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

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

- Description of part (see abbreviations below).
- Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-2.
- Manufacturer's part number.
- Total quantity used in the instrument (TQ column).

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

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order of inquiry to your local Hewlett-Packard Sales and Service Office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers.

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

- Instrument model number.
- Instrument serial number.
- Description of the part.
- 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	LEN = 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	TGI = 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		

Figure 6-1. Panel Designations

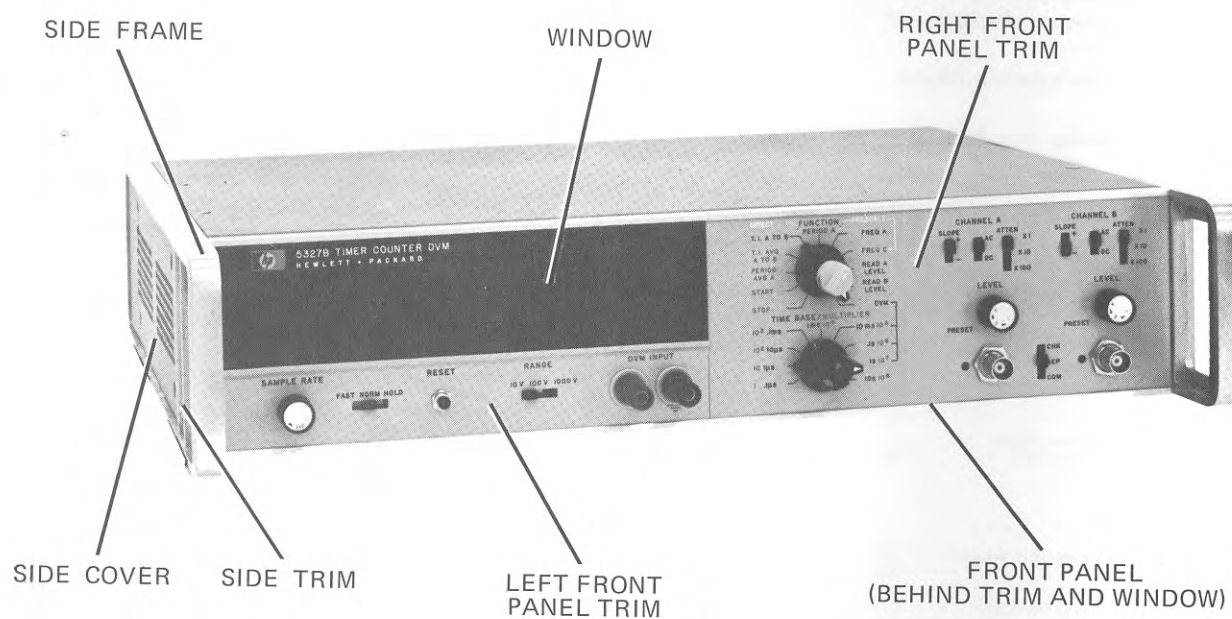


Table 6-1. Replaceable Parts, Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05326-60047	1	ATTENUATOR ASSY (SERIES 1224A) (LOADED ON 05326-20047 BLANK BOARD)	28480	05326-60047
			NOTE 1 A1R24 & A1R26 ARE NOT INCLUDED WHEN A1 IS ORDERED; ORDER A1R24 & R26 SEPARATELY		
A1C1	0160-2244	2	C:FXD CER 3.0+/-0.25 PF 500VDCW	28480	0160-2244
A1C2	0160-0939	2	C: FXD MICA 430 PF 5% 300 VDCW	28480	0160-0939
A1C3	0160-0378	2	C:FXD MICA 27PF 5%	72136	RDM15E270J5S
A1C4	0160-0161	4	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A1C5	0160-2140	2	C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A1C6	0160-2930	19	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A1C7	0160-2197	2	C:FXD MICA 10 PF 5%	72136	RDM15C100J3C
A1C8	0160-2146	2	C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A1C9	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A1C10	0160-2244		C:FXD CER 3.0+/-0.25 PF 500VDCW	28480	0160-2244
A1C11	0160-0939		C: FXD MICA 430 PF 5% 300 VDCW	28480	0160-0939
A1C12	0160-0378		C:FXD MICA 27PF 5%	72136	RDM15E270J5S
A1C13	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A1C14	0160-2140		C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A1C15	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A1C16	0160-2197		C:FXD MICA 10 PF 5%	72136	RDM15C100J3C
A1C17	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A1CR1	1910-0016	24	DIODE:GE 60 MIV	28480	1910-0016
A1CR2	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A1CR3	1901-0376	6	DIODE:SILICON 35V	28480	1901-0376
A1CR4	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A1CR6	1902-0041	4	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR7	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR9	1910-0016		DIODE:GE 60 MIV	28480	1910-0016
A1CR10	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A1CR11	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A1CR13	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR14	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1DS1	2140-0047	2	LAMP:NEON GLOW 0.8 MILLIAMPS	08806	A1C
A1DS2	2140-0047		LAMP:NEON GLOW 0.8 MILLIAMPS	08806	A1C
A1J1	1251-0472	2	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A1J2	1251-0472		CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A1J3	1250-1163	2	CONNECTOR:RF BNC INPUT	28480	1250-1163
A1J4	1250-1163		CONNECTOR:RF BNC INPUT	28480	1250-1163
A1Q1	1855-0334	2	TSTR:SI FET DUAL N-CHANNEL	17856	DN377
A1Q2	1855-0334		TSTR:SI FET DUAL N-CHANNEL	17856	DN377
A1R1	0683-2235	4	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A1R2	0683-9145	4	R:FXD COMP 910K OHM 5% 1/4W	01121	CB 9145
A1R3	0683-1015	21	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A1R4	0757-0947	2	R:FXD COMP 9100 OHM 2% 1/4W	28480	0757-0947
A1R5	0757-0973	4	R:FXD COMP 110K OHM 2% 1/4W	28480	0757-0973
A1R6	0683-1055	4	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R7	0757-0973		R:FXD COMP 110K OHM 2% 1/4W	28480	0757-0973
A1R8	0683-2215	8	R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A1R9	0683-4715	8	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R10	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R11	0683-3325	19	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A1R12	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R13	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R14	0683-2225	24	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A1R15	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A1R16	0683-2235		R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A1R17	0683-9145		R:FXD COMP 910K OHM 5% 1/4W	01121	CB 9145
A1R18	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A1R19	0757-0947		R:FXD COMP 9100 OHM 2% 1/4W	28480	0757-0947
A1R20	0757-0973		R:FXD COMP 110K OHM 2% 1/4W	28480	0757-0973
A1R21	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R22	0757-0973		R:FXD COMP 110K OHM 2% 1/4W	28480	0757-0973
A1R23	0683-2215		R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A1R24	2100-3228	2	R:VAR COMP 10K OHM 20% LIN 1/2W (SEE NOTE 1 ABOVE)	28480	2100-3228
A1R25	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R26	2100-3228		R:VAR COMP 10K OHM 20% LIN 1/2W (SEE NOTE 1 ABOVE)	28480	2100-3228
A1R27	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R28	0683-3325	6	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A1R29	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A1R30	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A1R31	0683-1005		R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1R32	0683-1005		R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1R33	0683-1005	1	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1R34	0683-1005		R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A1S1	3101-1598		SWITCH:SLIDE DP3 POSITION	28480	3101-1598
A1S2	3101-1595		SWITCH:SLIDE DP3 POSITIONS	78488	SS-93
A1S3	3101-1595		SWITCH:SLIDE DP3 POSITIONS	78488	SS-93
A1S4	3101-1596	4	SWITCH:SLIDE DPDT MINIATURE	78488	SS-91-1
A1S5	3101-1594		SWITCH:SLIDE DPDT	28480	3101-1594
A1S6	3101-1594		SWITCH:SLIDE DPDT	28480	3101-1594
A1S7	3101-1594		SWITCH:SLIDE DPDT MINIATURE	78488	SS-91-1
A1S8	3101-1594		PART OF R24		
A1S9			PART OF R26		
A2	05326-60004	2	INPUT AMPLIFIER ASSY (SERIES 972) (LOADED ON 05326-20004 BLANK BOARD)	28480	05326-60004
A2C1	0160-2930	12	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A2C2	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A2C3	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A2C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	1500225X9020A2-DYS
A2C5	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	1500225X9020A2-DYS
A2C6	0160-0153	4	C:FXD MY 0.001 UF 10% 200VDCW	56285	192P10292-PTS
A2C7	0170-0055		C:FXD MY 0.1UF 20% 200VDCW	56285	192P10402
A2C8	0170-0055	3	C:FXD MY 0.1UF 20% 200VDCW	56285	192P10402
A2C9	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A2C10	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A2CR1	1902-0049		DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A2CR2	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR3	1901-0040	28	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR4	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A2CR5	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2L1	9140-0144		COIL:FXD RF 4.7 UH	28480	28480
A2L2	9100-2255		COIL:CHOKE 0.47 UH 10%	28480	9100-2255
A2L3	9140-0144	4	COIL:FXD RF 4.7 UH	28480	9140-0144
A2L4	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A2L5	9100-2255		COIL:CHOKE 0.47 UH 10%	28480	9100-2255
A2L6	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A2L7	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A2L8	9140-0142	4	COIL:FXD RF 2.20 UH 10%	82142	09-4436-4K
A2L9	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A2L10	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A2Q1	1854-0092		TSTR:SI NPN	80131	2N3563
A2Q2	1853-0015		TSTR:SI PNP	80131	2N3640
A2Q3	1853-0015	6	TSTR:SI PNP	80131	2N3640
A2Q4	1854-0345		TSTR:SI NPN	80131	2N5179
A2Q5	1854-0345		TSTR:SI NPN	80131	2N5179
A2Q6	1853-0015		TSTR:SI PNP	80131	2N3640
A2Q7	1853-0015		TSTR:SI PNP	80131	2N3640
A2Q8	1854-0092	23	TSTR:SI NPN	80131	2N3563
A2Q9	1853-0015		TSTR:SI PNP	80131	2N3640
A2Q10	1853-0015		TSTR:SI PNP	80131	2N3640
A2Q11	1853-0015		TSTR:SI PNP	80131	2N3640
A2Q12	1853-0015		TSTR:SI PNP	80131	2N3640
A2Q13	1853-0015	8	TSTR:SI PNP	80131	2N3640
A2Q14	1854-0092		TSTR:SI NPN	80131	2N3563
A2Q15	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2Q16	1854-0092		TSTR:SI NPN	80131	2N3563
A2Q17	1854-0092		TSTR:SI NPN	80131	2N3563
A2Q18	1854-0365	3	TSTR:SI NPN	80131	2N4410
A2Q19	1854-0092		TSTR:SI NPN	80131	2N3563
A2Q20	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0683-6835		R:FXD COMP 68K OHM 5% 1/4W	01121	CB 6835
A2R2	2100-2520		R:VAR CERMET 50 OHM 20% TYPE V 1/2W	28480	2100-2520
A2R3	0683-2215	2	R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A2R4	0683-2405		R:FXD COMP 24 OHM 5% 1/4W	01121	CB 2405
A2R5	0683-3625		R:FXD COMP 3600 OHM 5% 1/4W	01121	CB 3625
A2R6	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R7	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A2R8	0683-1025	36	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R9	0698-3113	5	R:FXD CARBON 100 OHM 5% 1/8W	28480	0698-3113
A2R10	0698-3381	4	R:FXD COMP 150 OHM 5% 1/8W	28480	0698-3381
A2R11	0698-5175	4	R:FXD COMP 360 OHM 5% 1/8W	28480	0698-5175
A2R12	0698-3379	2	R:FXD COMP 68 OHM 5% 1/8W	28480	0698-3379
A2R13	0698-3375	2	R:FXD COMP 33 OHM 5% 1/8W	28480	0698-3375
A2R14	0683-1525	13	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A2R15	0698-5180	4	R:FXD COMP 2K OHM 5% 1/8W	28480	0698-5180
A2R16	0698-5175		R:FXD COMP 360 OHM 5% 1/8W	28480	0698-5175
A2R17	0698-3381		R:FXD COMP 150 OHM 5% 1/8W	28480	0698-3381
A2R18	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R19	0698-3113		R:FXD CARBON 100 OHM 5% 1/8W	28480	0698-3113
A2R20	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R21	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A2R22	0683-3625		R:FXD COMP 3600 OHM 5% 1/4W	01121	CB 3625
A2R23	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A2R24	2100-2521	2	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A2R25	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A2R26	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R27	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R28	0683-6815	9	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A2R29	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A2R30	0683-4725	5	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A2R31	0683-1035	22	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R32	0683-3315	6	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A2R33	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R34	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A2R35	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A2R36	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A2R37	0683-2235		R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235
A2R38	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R39	0683-2215		R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A2R40	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A2R41	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A2R42	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R43	0683-3035	2	R:FXD COMP 30K OHM 5% 1/4W	01121	CB 3035
A2R44	0683-3015	7	R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015
A2R45	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A2R46	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A2R47	0683-1065	2	R:FXD COMP 10M OHM 5% 1/4W	01121	CB 1065
A2R48	0683-2055	2	R:FXD COMP 2 MEGOHM 5% 1/4W	01121	CB 2055
A2R49	0683-2715	5	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A2R50	0683-2715		R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715
A2U1	1820-0238	2	INTEGRATED CIRCUIT:DTL 2 INPUT NOR GATE	04713	MC 1810P
A2U2	1820-0142	3	INTEGRATED CIRCUIT:4 INPUT,2-OR/NOR	04713	MC1004P
A3			SAME AS A2, USE PREFIX A3		
A4	05326-60002	1	OSCILLATOR ASSY (SERIES 1032) (LOADED ON 05326-20002 BLANK BOARD)	28480	05326-60002
A4C1	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C2	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A4C3	0121-0059	1	C:VAR CER 2-8 PF 300VDCW	28480	0121-0059
A4C4	0160-2264	1	C:FXD CER 20 PF 5% 500VDCW	72982	301-000-COGC-200J
A4C5	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A4L1	9100-2276	1	COIL/CHOKER 100 UH 10*	28480	9100-2276
A4Q1	1850-0158	1	TSTR:GE PNP	80131	2N2635
A4R1	0698-4037	1	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R2	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A4R3	0683-3015		R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015
A4R4	0683-3015		R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015
A4U1	1820-0142		INTEGRATED CIRCUIT:4 INPUT,2-OR/NOR	04713	MC1004P
A4Y1	0410-0405	1	CRYSTAL:QUARTZ 10 MHZ	28480	0410-0405
A5	05326-60005	1	TIME BASE CONTROL ASSY (SERIES 972) (LOADED ON 05326-20005 BLANK BOARD)	28480	05326-60005
A5C1	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5C2	0160-0127	1	C:FXD GER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A5C3	0180-0291	2	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A5C4	0160-2150	5	C:FXD MICA 33 PF 5%	28480	0160-2150
A5C5	0160-2204	2	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A5CR1	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A5Q1	1854-0092		TSTR:SI NPN	80131	2N3563
A5Q2	1854-0092		TSTR:SI NPN	80131	2N3563
A5Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5R1	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R2	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A5R3	0683-5105		R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A5R4	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R5	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A5R6	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R7	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A5R8	0683-1025		FACTORY SELECTED VALUE. R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R9	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R10	0683-2215		R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A5R11	0683-6835		R:FXD COMP 68K OHM 5% 1/4W	01121	CB 6835
A5R12	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R13	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R14	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R15	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A5R16	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R17	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R18	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A5R19	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A5R20	0683-5105		R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A5R21	0683-5105		R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A5U1	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U2	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U3	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U4	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U5	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5U6	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U7	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U8	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U9	1820-0413		IC:TTL DECADE DIVIDER 12.5 MHZ MIN.	28480	1820-0413
A5U10	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A6	05326-60013	1	SAMPLE RATE ASSY (SERIES 1224A) (LOADED ON 05326-20013 BLANK BOARD)	28480	05326-60013
A6C1	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A6C2	0160-0134	1	C:FXD MICA 220PF 5% 300VDCW	14655	RDM15F221J3C
A6C3	0180-0228	3	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A6C4	0160-0166	1	C:FXD MY 0.068 UF 10% 200VDCW	56289	192P68392-PTS
A6C5	0140-0193	1	C:FXD MICA 82 PF 5%	28480	0140-0193
A6C6	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A6C7	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A6C8	0160-0153		FACTORY SELECTED PART	56289	192P10292-PTS
A6C9	0180-0291		C:FXD MY 0.001 UF 10% 200VDCW	56289	150D105X9035A2-DYS
A6C10	0160-0161		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	192P10292-PTS
A6C11	0180-0114		C:FXD MY 0.01 UF 10% 200VDCW	56289	150D105X9035A2-DYS
A6C12	0180-0114		C:FXD ELECT 4.0 UF +100-10% 25VDCW	56289	192P10392-PTS
A6CR1	1901-0040		C:FXD ELECT 4.0 UF +100-10% 25VDCW	28480	0180-0114
A6CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	28480	0180-0114
A6CR3	1910-0016		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6CR4	1910-0016		DIODE:GE 60 WIV	07263	FDG1088
A6CR5	1910-0016		DIODE:GE 60 WIV	07263	FDG1088
A6CR6	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6CR7	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6CR8	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6CR9	1910-0016		DIODE:GE 60 WIV	07263	FDG1088
A6CR10	1901-0040		DIODE:SILICON 50 MA 30 WV	28480	1910-0016
A6CR11	1901-0040		DIODE:SILICON 50 MA 30 WV	28480	1910-0016
A6Q1	1854-0071		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A6Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
			TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6Q3	1854-0071	7	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q4	1854-0009		TSTR:SI NPN	80131	2N709
A6Q5	1854-0071	1	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q7	1854-0215		TSTR:SI NPN	80131	2N3904
A6Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q11	1854-0009		TSTR:SI NPN	80131	2N709
A6Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q13	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6R1	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R2	0683-1525	11	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R3	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R4	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R5	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R6	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R7	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R8	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R9	0683-3015		R:FXD COMP 300 OHM 5% 1/4W	01121	CB 3015
A6R10	0683-2025	6	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A6R11	0683-2735	5	R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R12	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R13	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R14	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R15	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R16	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A6R17	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R18	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A6R19	0683-5115	8	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A6R20	0683-2735		R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R21	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R22	0683-3915	3	R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915
A6R23	0683-2025	1	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A6R24	0683-6215		R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215
A6R25	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R26	0683-2025		R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A6R27	0683-3025	1	R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A6R28	0683-9115		R:FXD COMP 910 OHM 5% 1/4W	01121	CB 9115
A6R29	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R30	0683-2415	2	R:FXD COMP 240 OHM 5% 1/4W	01121	CB 2415
A6R31	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R32	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R33	0683-2735		R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R34	0683-2735		R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735
A6R35	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R36	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R37	0683-2045	1	R:FXD COMP 200K OHM 5% 1/4W	01121	CB 2045
A6R38	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R39	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A6R40	0683-4735	2	R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735
A6R41	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A6R42	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6R43	0683-4735		R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735
A6R44	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A6U1	1820-0054	1	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A6U2	1820-0272		IC:ECL TYPE D F/F	04713	MC1022P
A6U3	1820-0068	1	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6U4	1820-0054	1	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A6U5	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A6U6	1820-0147	4	IC:ECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
A7	05327-60031	1	BOARD ASSY:FUNCTION CONTROL (SERIES 1312A) (LOADED ON 05327-20004 BLANK BOARD)	28480	05327-60031
A7C1	0160-2306	1	C: FXD MICA 27 PF 5%	28480	0160-2306
A7C2	0150-0042	1	C: FXD TI 4.7 PF 5% 500VDCW	78488	TYPE GA
A7C3	0160-2150	1	C: FXD MICA 33 PF 5% 300VDCW FACTORY SELECTED PART	28480	0160-2150
A7CR1	1901-0535	2	DIODE:HYBRID HOT CARRIER	28480	1901-0535
A7R1	0683-1125	4	R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A7R2	0683-1825	6	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A7R3	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A7R4	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9U14	1820-0116	1 6	IC:4-BIT BUFF STORE GATED OUTS	2848C	1820-0116
A9U15	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	2848C	1820-0116
A9U17	1820-0729		IC:DECODER-DIVIDER	28480	1820-0729
A9U18	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U19	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U20	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U21	1820-0092	3	INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U22	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U23	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U24	1200-0477		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9XU8	1200-0477		SOCKET:IC	28480	1200-0477
A9XU16	1200-0477		SOCKET:IC	28480	1200-0477
A10	05327-60008	1	RIGHT READOUT ASSY (SERIES 1116A, REV. B) (LOADED ON 05327-20008 BLANK BOARD)	28480	05327-60008
	05326-00009	2	BRACKET:READOUT	28480	05326-00009
	05326-80008	1	INDICATOR:MASK (U,N,S,)	28480	05326-80008
	05326-80009	1	INDICATOR:MASK (V,M,HZ)	28480	05326-80009
	05326-80010	1	INDICATOR:MASK (*,K,G)	28480	05326-80010
A10CR1	05330-40002	2	BLOCK:ANNUNCIATOR	28480	05330-40002
A10CR2	1901-0040	14	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A10DS1	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A10DS2	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10DS3	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10DS4	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10DS5	2140-0313	16	LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10DS6	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10DS7	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10DS8	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10DS9	2140-0313		LAMP:NEON GLOW FROSTED 1.9 MILLIAMPS	08806	C2A-8
A10Q1	1854-0074		TSTR:SI NPN	80131	2N709
A10Q2	1854-0074	16	TSTR:SI NPN	80131	2N709
A10Q3	1854-0074		TSTR:SI NPN	80131	2N709
A10Q4	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q5	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q6	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q7	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q8	1854-0074	12	TSTR:SI NPN	28480	1854-0474
A10Q9	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q10	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q11	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q12	1854-0074		TSTR:SI NPN	28480	1854-0474
A10Q13	1854-0074		TSTR:SI NPN	28480	1854-0474
A10R1	0683-5125	6	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A10R2	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A10R3	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A10R4	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A10R5	0683-2025		R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A10R6	0683-2025	6	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A10R7	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A10R8	0683-5135		R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A10R9	0683-5135		R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A10U1	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U2	1820-0274	1	IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U3	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U4	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A10U5	1820-0310		IC:DTL TRIPLE 3-INPUT NAND GATE	04713	SC6910PK
A10U6	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A10U7	1820-0273	1	IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
	0510-0207		STANDOFF: PRESS-IN	28480	0510-0207
A11	05327-60007	1	LEFT READOUT ASSY (SERIES 1104A, REV. A) (LOADED ON 05327-20007 BLANK BOARD)	28480	05327-60007

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11C1	05326-00009	1	BRACKET:READOUT	28480	05326-00009
	05326-80002		INDICATOR:MASK	28480	05326-80002
	05326-80011		INDICATOR:MASK (EXT, C, OF)	28480	05326-80011
	05330-40002		BLOCK:ANNUNCIATOR	28480	05330-40002
	0160-2200	1	C:FXD MICA 43 PF 5%	72136	ROM15E430J3C
A11DS1	2140-0313		LAMP:NEON GLCW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A11DS2	2140-0313		LAMP:NEON GLCW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A11DS3	2140-0313		LAMP:NEON GLCW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A11DS4	2140-0313		LAMP:NEON GLCW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A11DS5	2140-0313		LAMP:NEON GLCW FROSTED 1.9 MILLIAMPS	08806	C2A-B
A11Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A11Q2	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q3	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q4	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q5	1854-0474		TSTR:SI NPN	28480	1854-0474
A11Q6	1854-0474	1	TSTR:SI NPN	28480	1854-0474
A11R1	0683-2035		R:FXD COMP 20K OHM 5% 1/4W	01121	CB 2035
A11R2	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A11R3	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R4	0683-5135		R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A11R5	0683-2025		R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A11R6	0683-5135		R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A11R7	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R8	0683-5135		R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A11R9	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R10	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A11R11	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A11R12	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A11R13	0683-5135		R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A11U1	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A11U2	1820-0274	1	IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U3	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U4	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U5	1820-0327		IC:TTL QUAD 2-INPT NAND GATE	04713	SN7401N
A11U6	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A11U7	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A11U8	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
	0510-0207		STANDOFF: PRESS-IN	28480	0510-0207
A12	05326-60016	1	VOLTMETER INPUT AMPLIFIER ASSY (SERIES 1048A) (LOADED ON 05326-20016 BLANK BOARD)	28480	05326-60016
A12C1	0160-2930	1	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A12C2	0160-2307		C:FXD MICA 47 PF 5%	28480	0160-2307
A12C3	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A12C4	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A12CR2	1901-0376	1	DIODE:SILICON 35V	28480	1901-0376
A12CR3	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A12CR4	1902-3083		DIODE BREAKDOWN:4.64V 2%	28480	1902-3083
A12CR5	1902-0049		DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A12CR6	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A12K1	0490-0853	1	RELAY:1 OHM 1500 VDC	28480	0490-0853
A12K2		4	NOT ASSIGNED		
A12K3	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A12K4	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A12K5	0490-0764		RELAY:REED 0.1 AMP	28480	0490-0764
A12K6	0490-0764	1	RELAY:REED 0.1 AMP	28480	0490-0764
A12Q1	1850-0099		TSTR:GE PNP	80131	2N964
A12Q2		7	NOT ASSIGNED		
A12Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q4	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q5	1853-0020	1	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A12Q7	1855-0049		TSTR:SI FET N-CHANNEL DUAL	28480	1855-0049
A12Q8	1854-0087		TSTR:SI NPN	80131	2N3417
A12Q9	1854-0087		TSTR:SI NPN	80131	2N3417
A12Q10	1853-0036	1	TSTR:SI PNP	80131	2N3506
A12R3	0698-7618	14	R:FXD FLN 888K OHM 1.0% 1/4W	28480	0698-7618
A12R4	0698-7618		R:FXD FLN 888K OHM 1.0% 1/4W	28480	0698-7618
A12R5	0686-3045	3	R:FXD COMP 300K OHM 5% 1/2W	01121	EB 3045
A12R6	0698-7618		R:FXD FLN 888K OHM 1.0% 1/4W	28480	0698-7618

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12R7	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R8	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R9	0686-3045		R:FXD COMP 300K OHM 5% 1/2W	01121	EB 3045
A12R10	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R11	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R12	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R13	0686-3045		R:FXD COMP 300K OHM 5% 1/2W	01121	EB 3045
A12R14	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R15	0698-7535	1	R:FXD FLM 98.5K OHM 0.5% 1/8W	28480	0698-7535
A12R16	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R17	0757-0466	1	R:FXD MET FLM 110K OHM 1% 1/8W	28480	0757-0466
A12R18	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R19	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R20	0698-3152	1	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A12R21	2100-2503	2	R:VAR CERMET 20K OHM 10% TYPE P	28480	2100-2503
A12R22	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R23	0698-7618		R:FXD FLM 888K OHM 1.0% 1/4W	28480	0698-7618
A12R24	2100-2503		R:VAR CERMET 20K OHM 10% TYPE P	28480	2100-2503
A12R25	0683-8245	1	R:FXD COMP 820K OHM 5% 1/4W	01121	CB 8245
A12R26	0683-9145		R:FXD COMP 910K OHM 5% 1/4W	01121	CB 9145
A12R27	0683-3925		R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925
A12R28	0686-1645	1	R:FXD COMP 160K OHM 5% 1/2W	01121	EB 1645
A12R29	0698-3442	1	R:FXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A12R30	0698-3136	2	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A12R31	2100-2931	1	R:VAR CERMET 500 OHM 10% TYPE P 3/4W	28480	2100-2931
A12R32	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A12R33	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A12R34	0683-9145		R:FXD COMP 910K OHM 5% 1/4W	01121	CB 9145
A12U1	1820-0223	4	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A13	05326-60017	1	VOLTMETER V-F CONVERTER ASSY (SERIES 1032A) (LOADED ON 05326-20017 BLANK BOARD)	28480	05326-60017
A13C1	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	150D225X9020A2-DYS
A13C2	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	150D225X9020A2-DYS
A13C3	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	150D225X9020A2-DYS
A13C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	150D225X9020A2-DYS
A13C5	0160-2150		C:FXD MICA 33 PF 5%	28480	0160-2150
A13C6	0160-2150		C:FXD MICA 33 PF 5%	28480	0160-2150
A13C7	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A13C8	0170-0055		C:FXD MY 0.1UF 20% 200VDCW	56285	192P10402
A13C9	0160-2150		C:FXD MICA 33 PF 5%	28480	0160-2150
A13C10	0170-0055		C:FXD MY 0.1UF 20% 200VDCW	56285	192P10402
A13C11	0160-2150		C:FXD MICA 33 PF 5%	28480	0160-2150
A13C13	0160-2249	1	C:FXD CER 4.7 PF 500VDCW	72982	3CL-NPD-4.7 PF
A13CR1	1902-0680	2	DIODE:TC REF. JEDEC TYPE	04713	1N827
A13CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A13CR3	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A13CR4	1902-0680		DIODE:TC REF. JEDEC TYPE	04713	1N827
A13CR5	1901-0179	5	DIODE:SILICON 15WV	28480	1901-0179
A13CR6	1901-0179		DIODE:SILICON 15WV	28480	1901-0179
A13CR7	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A13CR8	1901-0179		DIODE:SILICON 15WV	28480	1901-0179
A13CR9	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A13CR10	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A13CR11	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A13CR12	1901-0179		DIODE:SILICON 15WV	28480	1901-0179
A13CR13	1901-0179		DIODE:SILICON 15WV	28480	1901-0179
A13Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A13Q3	1855-0056	1	TSTR:SI FET	80131	2N4342
A13Q4	1855-0081	1	TSTR:SI FET	80131	2N5245
A13Q5	1854-0009		TSTR:SI NPN	80131	2N709
A13Q6	1854-0092		TSTR:SI NPN	80131	2N3563
A13Q7	1854-0092		TSTR:SI NPN	80131	2N3563
A13Q8	1854-0092		TSTR:SI NPN	80131	2N3563
A13Q9	1854-0092		TSTR:SI NPN	80131	2N3563
A13Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13R1	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A13R2	0757-0421	2	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13R3	0757-0421	2	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A13R4	0683-1525		R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
A13R5	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A13R6	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A13R7	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W FACTORY SELECTED PART	28480	0698-3160
A13R8	0757-0398	2	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A13R9	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A13R10	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W FACTORY SELECTED PART	28480	0698-3160
A13R11	0698-7610	4	R:FXD FLM 1.74K OHM 0.5% 1/8W	28480	0698-7610
A13R12	0757-0384	2	R:FXD FLM 20 OHM 1% 1/8W	28480	0757-0384
A13R13	0757-0384		R:FXD FLM 20 OHM 1% 1/8W	28480	0757-0384
A13R14	0698-7610	2	R:FXD FLM 1.74K OHM 0.5% 1/8W	28480	0698-7610
A13R15	2100-2705		R:VAR CERMET 1K OHM 10% TYPE P 3/4W	28480	2100-2705
A13R16	2100-2705		R:VAR CERMET 1K OHM 10% TYPE P 3/4W	28480	2100-2705
A13R17	0698-7610		R:FXD FLM 1.74K OHM 0.5% 1/8W	28480	0698-7610
A13R18	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A13R21	0698-7610		R:FXD FLM 1.74K OHM 0.5% 1/8W	28480	0698-7610
A13R24	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A13R27	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A13R28	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A13R29	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A13R30	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A13R31	0683-3915		R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915
A13R32	0683-6815	2	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
A13R33	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A13R34	0683-5615		R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615
A13R35	0683-3615		R:FXD COMP 360 OHM 5% 1/4W	01121	CB 3615
A13R36	0683-3615		R:FXD COMP 360 OHM 5% 1/4W	01121	CB 3615
A13R37	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A13R38	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A13R39	0683-4725		R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725
A13R40	0683-3915		R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915
A13R41	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A13U1	1820-0223	1	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A13U2	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A13U3	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A13U4	1820-0212		IC:ECL QUAD LINE RECEIVER	04713	MC1020P
A13U5	1820-0213		IC:ECL DUAL R-S F/F	04713	MC1014P
A13U6	1820-0276	1	INTEGRATED CIRCUIT:DIGITAL	04713	MC 1033P
A13U7	1820-0145	1	IC:DIGITAL QUAD 2-INPT NOR GATE	28480	1820-0145
A13U8	1820-0209		INTEGRATED CIRCUIT:DIGITAL	28480	1820-0209
A14	05326-60015	1	VOLTMETER DISPLAY CONTROL ASSY (SERIES 944A) (LOADED ON 05326-20015 BLANK BOARD)	28480	05326-60015
A14CR1	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A14CR2	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A14CR3	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A14CR4	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A14CR5	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A14CR6	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A14CR7	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A14R1	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A14R2	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A14R3	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A14R4	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A14R5	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A14R6	0683-2225		R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
A14U1	1820-0413		IC:TTL DECADE DIVIDER 12.5 MHZ MIN.	28480	1820-0413
A14U2	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A14U3	1820-0094		IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A14U4	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A14U5	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A14U6	1820-0273		IC:DTL QUAD 2-INPT AND GATE	28480	1820-0273
A14U7	1820-0274		IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15	05327-60020	1	BOARD ASSY:POWER SUPPLY (SERIES 1428A) (LOADED ON 05326-20020 BLANK BOARD)	28480	05327-60020
	0510-0207 2200-0145	3	NUT:CAPTIVE 4-40 X 0.188 LG SCREW:PAN HD POZI DR 4-40 X 0.438	2848C 0000C	0510-0207 08D
	5040-0409	1	SPACER:SHIELD	2848C	5040-0409
A15C1	0160-0163	1	C:FXD MY 0.033 UF 10% 200VDCW	5628S	192P33392-PTS
A15C2	0180-0114		C:FXD ELECT 4.0 UF +100-10% 25VDCW	2848C	0180-0114
A15C3	0180-0114		C:FXD ELECT 4.0 UF +100-10% 25VDCW	2848C	0180-0114
A15C4	0180-0114		C:FXD ELECT 4.0 UF +100-10% 25VDCW	2848C	0180-0114
A15C5	0180-0114		C:FXD ELECT 4.0 UF +100-10% 25VDCW	2848C	0180-0114
A15C6	0160-3878	28	C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A15C7	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A15C8	0160-3277	2	C:FXD CER 0.01 UF 20% 50VDCW	96733	G5048X103M
A15C9	0160-3277		C:FXD CER 0.01 UF 20% 50VDCW	96733	G5048X103M
A15CR1	1902-3002	2	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A15CR2	1902-0551	2	DIODE BREAKDOWN:6.19V 5%	28480	1902-0551
A15CR3	1902-0551		DIODE BREAKDOWN:6.19V 5%	28480	1902-0551
A15CR4	1902-3002		DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A15CR5	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A15CR6	1902-3094	4	DIODE BREAKDOWN:5.11V 2%	28480	1902-3094
A15CR7	1902-3094		DIODE BREAKDOWN:5.11V 2%	28480	1902-3094
A15CR8	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A15CR9	1902-3094		DIODE BREAKDOWN:5.11V 2%	28480	1902-3094
A15CR10	1902-3094		DIODE BREAKDOWN:5.11V 2%	28480	1902-3094
A15CR11	1902-3394	1	DIODE BREAKDOWN:75 V 2%	28480	1902-3394
A15CR12	1902-3429	1	DIODE BREAKDOWN:100 V 2%	28480	1902-3429
A15CR13	1901-0033	2	DIODE:SILICON 100MA 180WV	07263	FD3369
A15CR14	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A15CR15	1901-0044	4	DIODE:SILICON 20MA/1V	28480	1901-0044
A15CR16	1901-0044		DIODE:SILICON 20MA/1V	28480	1901-0044
A15CR17	1901-0044		DIODE:SILICON 20MA/1V	28480	1901-0044
A15CR18	1901-0044		DIODE:SILICON 20MA/1V	28480	1901-0044
A15F1	2110-0487	1	FUSE: 1/20 AMP	2848C	2110-0487
A15Q1	1854-0300	1	TSTR:SI NPN	28480	1854-0300
A15Q1	1205-0018	2	HEAT SINK:SEMICONDUCTOR	05820	203-C8
A15Q2	1853-0073	1	TSTR:SI PNP	28480	1853-0073
A15Q2	1205-0018		HEAT SINK:SEMICONDUCTOR	05820	203-C8
A15Q3	1854-0039	1	TSTR:SI NPN	80131	2N3053
A15Q3	1205-0033	2	HEAT SINK:SEMICONDUCTOR	05820	207-C8
A15Q4	1853-0012	1	TSTR:SI PNP	80131	2N2904A
A15Q4	1205-0033		HEAT SINK:SEMICONDUCTOR	05820	207-C8
A15Q5	1854-0232	1	TSTR:SI NPN(SELECTED FROM 2N3440)	28480	1854-0232
A15Q5	1205-0061	1	HEAT SINK:SEMICONDUCTOR	05820	209-C8
A15Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A15Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A15Q8	1854-0474		TSTR:SI NPN	28480	1854-0474
A15Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A15Q10	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A15R1	0683-2735		R:FXD COMP 27K OHM 5% 1/4W	01121	C8 2735
A15R2	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	C8 1015
A15R3	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	C8 1015
A15R4	0683-3925		R:FXD COMP 3900 OHM 5% 1/4W	01121	C8 3925
A15R5	0683-3925		R:FXD COMP 3900 OHM 5% 1/4W	01121	C8 3925
A15R6	0698-5479	1	R:FXD COMP 8.2 OHM 5% 1/2W	01121	EB 82G5
A15R7	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	C8 6815
A15R8	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	C8 6815
A15R9	0683-1325	2	R:FXD COMP 1300 OHM 5% 1/4W	01121	C8 1325
A15R10	2100-2093	2	R:VAR COMP 200 OHM 30% LIN 1/8W	28480	2100-2093
A15R11	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	C8 6815
A15R12	0683-6815		R:FXD COMP 680 OHM 5% 1/4W	01121	C8 6815
A15R13	2100-2093		R:VAR COMP 200 OHM 30% LIN 1/8W	28480	2100-2093
A15R14	0683-1325		R:FXD COMP 1300 OHM 5% 1/4W	01121	C8 1325
A15R15	0683-0275	4	R:FXD COMP 2.7 OHM 5% 1/4W	01121	C8 27G5
A15R16	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	C8 27G5
A15R17	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	C8 27G5
A15R18	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	C8 27G5
A15XF1	1251-3205	2	SOCKET, MINIATURE: SINGLE	00779	2-331272-7

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16	05327-60027	1	BOARD ASSY:CONNECTOR (SERIES 1224A) (LOADED ON 05327-20027 BLANK BOARD)	28480	05327-60027
A16C1	0180-2352	1	C:FXD ELECT 6000 UF +75-10% 15VDCW	28480	0180-2352
A16C2	0180-2296	1	C:FXD ELECT 4000 UF +75-10% 15VDCW	56285	350167-DSB(SE)
A16C3	0180-1962	1	C:FXD AL ELECT 15 UF +50-10% 250VDCW	56285	350156F250EJ4-DSB
A16C4	0180-2382	2	C:FXD AL ELECT 1500 UF +75-10% 30VDCW	56285	350293
A16C5	0180-2382		C:FXD AL ELECT 1500 UF +75-10% 30VDCW	56285	350293
A16C6	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A16CR1	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A16CR2	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A16CR3	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A16CR4	1901-0028	2	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A16CR5	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A16CR6	1901-0029	4	DIODE:SILICON 600 PIV	28480	1901-0029
A16CR7	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A16CR8	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A16CR9	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A16CR10	1901-0415	4	DIODE:SILICON 50 PIV 3A	28480	1901-0415
A16CR11	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A16CR12	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A16CR13	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A16CR14	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A16CR15	1910-0016		DIODE:GE 60 WIV	28480	1910-0016
A16CR16	1901-0460	2	DIODE:SILICON 3-JUNCTION STABISTOR	03508	ST8523
A16CR17	1901-0460		DIODE:SILICON 3-JUNCTION STABISTOR	03508	ST8523
A16CR18	1910-0034	1	DIODE:GERMANIUM 25V	28480	1910-0034
A16Q1	1854-0009		TSTR:SI NPN	80131	2N709
A16R1	0812-0021	2	R:FXD WW 0.47 OHM 5% 3W	28480	0812-0021
A16R2	0812-0021		R:FXD WW 0.47 OHM 5% 3W	28480	0812-0021
A16R3	0686-2045	1	R:FXD COMP 200K OHM 5% .5W	01121	EB 2045
A16R4	0683-0825	1	R:FXD COMP 8.2 OHM 5% 1/4W	01121	CB 8265
A16R5	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A16R6	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A16R7	0698-3153	2	R:FXD MET FLN 3.83K OHM 1% 1/8W	28480	0698-3153
A16R8	0757-0439	1	R:FXD MET FLN 6.81K OHM 1% 1/8W	28480	0757-0439
A16U1	1820-0196	1	IC:LINEAR VOLTAGE REGULATOR(INPUT) NOT ASSIGNED	28480	1820-0196
A16XA1					
A16XA2	1251-1886	11	CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA3	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA4	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA5	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA6	1251-2134	4	CONNECTOR:PC (2X18)36 CONTACTS	71785	252-18-30-340
A16XA7	1251-2134		CONNECTOR:PC (2X18)36 CONTACTS	71785	252-18-30-340
A16XA8	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA9	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA10	1251-2134		CONNECTOR:PC (2X18)36 CONTACTS	71785	252-18-30-340
A16XA11	1251-2134		CONNECTOR:PC (2X18)36 CONTACTS	71785	252-18-30-340
A16XA12	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA13	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA14	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA15	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A16XA16			NOT ASSIGNED		
A16XA17			NOT ASSIGNED		
A16XA18	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A17	05326-60031	1	BOARD ASSY:INPUT C AMPLIFIER (SERIES 1312A) 5326B ONLY (LOADED ON 05326-20031 BLANK BOARD)	28480	05326-60031
A17C1	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	1500225X9020A2-DYS
A17C2	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56285	1500225X9020A2-DYS
A17C3	0160-2049	4	C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A17C4	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A17C5	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A17C6	0180-0106	2	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A17C7	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A17C8	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A17C9	0150-0055	2	C:FXD TI DIOXIDE 10 PF 5% 500VDCW	78488	TYPE GA
A17C10	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A17C11	0150-0045	1	C:FXD TI 8.2 PF 5% 500VDCW	78488	TYPE GA
A17C12	0150-0055		C:FXD TI DIOXIDE 10 PF 5% 500VDCW	78488	TYPE GA
A17C13	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A17CR1	1901-0047	2	DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A17CR2	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A17CR3	1912-0009	1	DIODE TUNNEL:GERMANIUM 1N3712	03508	1N3712 SPEC

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17J1	1250-0836	2	CONNECTOR:RF SUB-MINIATURE	98291	50-053-0000
A17L1	9100-2259	1	COIL/CHOKE 1.50 UH 10%	59800	1025-24
A17L2	9100-2280		COIL/CHOKE RF 1.80 UH 10%	82142	09-4436-3K
A17L3	9140-0142		COIL:FXD RF 2.20 UH 10%	82142	09-4436-4K
A17L4	9100-2256	1	COIL/CHOKE 0.56 UH 10%	13015	09-4426-3K
A17Q1	1853-0015		TSTR:SI PNP	80131	2N3640
A17Q2	1853-0015		TSTR:SI PNP	80131	2N3640
A17Q3	1854-0092		TSTR:SI NPN	80131	2N3563
A17Q4	1854-0345		TSTR:SI NPN	80131	2N5175
A17R1	0760-0012	1	R:FXD MET QX 51 OHM 2% 1W	28480	0760-0012
A17R2	0758-0093	1	R:FXD MET QX 56 OHM 5% 1/4W	28480	0758-0093
A17R3	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A17R4	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A17R5	0683-1515		R:FXD COMP 150 OHM 5% 1/4W	01121	CB 1515
A17R6	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A17R7	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A17R8	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A17R9	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A17R10	0683-2215		R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A17R11	2100-2633	2	R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A17R12	0683-2015	3	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A17R13	0683-2015		R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A17R14	0683-1515		R:FXD COMP 150 OHM 5% 1/4W	01121	CB 1515
A17R15	0683-5105		R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A17R16	0683-7515		R:FXD COMP 750 OHM 5% 1/4W	01121	CB 7515
A17R17	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A17R18	0683-1225		R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A17R19	0683-3625		R:FXD COMP 3600 OHM 5% 1/4W	01121	CB 3625
A17R21	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A17R22	0757-0284	1	R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A17R23	0757-0280	1	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A17R24	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A17R25	0683-5615		R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615
A17R26	0757-0416	1	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A17U1	1858-0004	1	TSTR ARRAY:SI NPN DUAL DIFF. AMPL.	28480	1858-0004
A17U2	1820-0147		IC:ECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
	05326-00031	1	SHIELD:NOISE	28480	05326-00031
A18	05327-60033	1	BOARD ASSY:HIGH SENSITIVITY PRESCALER (SERIES 1248A) (LOADED ON 05327-20033 BLANK BOARD)	28480	05327-60033
A18C1	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X901582-DYS
A18C2	0160-2049	3	C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A18C3	0160-3879		C:FXD CER 0.01 UF 20% 100VDCW	72982	8121-B112-X7R-103M
A18C4	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A18C5	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X901582-DYS
A18C6	0160-3879		C:FXD CER 0.01 UF 20% 100VDCW	72982	8121-B112-X7R-103M
A18C7	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C8	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C9	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C10	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C11	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C12	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C13	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C14	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C15	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C16	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C17	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C18	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C19	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C20	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C21	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C22	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C23	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C24	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C25	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C26	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C27	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18C28	0160-3879		C:FXD CER 0.01 UF 20% 100VDCW	72982	8121-B112-X7R-103M
A18C29	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A18CR1	1901-0050	2	DIODE:SI 200 MA AT 1V	07263	FDA 6308
A18CR2	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18CR3	1901-0040	2	DIODE:SILICON 50 MA 30 MV	07263	FDG1088
A18CR4	1901-0040		DIODE:SILICON 50 MA 30 MV	07263	FDG1088
A18CR5	1901-0040		DIODE:SILICON 50 MA 30 MV	07263	FDG1088
A18CR6	1901-0040		DIODE:SILICON 50 MA 30 MV	07263	FDG1088
A18F1	2110-0436		FUSE:1/10 AMP 125V	2848C	2110-0436
A18F2	2110-0436	2	FUSE:1/10 AMP 125V	2848C	2110-0436
A18J1	1250-0836		CONNECTOR:RF SUB-MINIATURE	98291	50-053-0000
A18L1	9100-1788		COIL:CHOKER	02114	VK200-10/48
A18L2	9100-1788		COIL:CHOKER	02114	VK200-10/48
A18Q1	1854-0345		TSTR:SI NPN	80131	2N5175
A18Q2	1854-0092	2	TSTR:SI NPN	80131	2N3563
A18R1	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R2	0698-5996		R:FXD COMP 560 OHM 5% 1/8W	28480	0698-5996
A18R3	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A18R4	0683-3925		R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925
A18R5	0698-3378	5	R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R6	0698-3378	5	R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R7	0698-3111		R:FXD COMP 30 OHM 5% 1/8W	28480	0698-3111
A18R8	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R9	0683-2015		R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
			FACTORY SELECTED VALUE		
A18R10	2100-2413	2	R:VAR FLN 200 OHM 10% LIN 1/2W	28480	2100-2413
A18R11	0698-6283	2	R:FXD COMP 10 OHM 5% 1/8W	01121	BB 1005
A18R12	0683-1505	2	R:FXD COMP 15 OHM 5% 1/4W	01121	CB 1505
A18R13	0698-3374	4	R:FXD CARBON 20 OHM 5% 1/8W	28480	0698-3374
A18R14		5	NOT ASSIGNED		
A18R15	0698-5180		R:FXD COMP 2K OHM 5% 1/8W	28480	0698-5180
A18R16	0698-3378		R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R17	0698-3374		R:FXD CARBON 20 OHM 5% 1/8W	28480	0698-3374
A18R18	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R19	0698-5180	4	R:FXD COMP 2K OHM 5% 1/8W	28480	0698-5180
A18R20	0698-3111		R:FXD COMP 30 OHM 5% 1/8W	28480	0698-3111
A18R21	0698-5996		R:FXD COMP 560 OHM 5% 1/8W	28480	0698-5996
A18R22	0698-4131		R:FXD COMP 56 OHM 5% 1/8W	28480	0698-4131
A18R23	0698-4131		R:FXD COMP 56 OHM 5% 1/8W	28480	0698-4131
A18R24	0698-3111	2	R:FXD COMP 30 OHM 5% 1/8W	28480	0698-3111
A18R25	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R26	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
			FACTORY SELECTED VALUE.		
A18R27	2100-2413		R:VAR FLN 200 OHM 10% LIN 1/2W	28480	2100-2413
A18R28	0698-6283	2	R:FXD COMP 10 OHM 5% 1/8W	01121	BB 1005
A18R29	0698-5177		R:FXD COMP 820 OHM 5% 1/8W	28480	0698-5177
A18R30	0698-5177		R:FXD COMP 820 OHM 5% 1/8W	28480	0698-5177
A18R31	0683-1505		R:FXD COMP 15 OHM 5% 1/4W	01121	CB 1505
A18R32			NOT ASSIGNED		
A18R33	0698-3374	1	R:FXD CARBON 20 OHM 5% 1/8W	28480	0698-3374
A18R34	0698-8073		R:FXD COMP 1.6K OHM 5% 1/8W	01121	BB 1625
A18R35	0698-3378		R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R36	0698-3111		R:FXD COMP 30 OHM 5% 1/8W	28480	0698-3111
A18R37	0698-3378		R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R38	0698-3374	1	R:FXD CARBON 20 OHM 5% 1/8W	28480	0698-3374
A18R39	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R40	0698-4131		R:FXD COMP 56 OHM 5% 1/8W	28480	0698-4131
A18R41	0698-5563		R:FXD CARBON 180 OHM 5% 1/8W	28480	0698-5563
A18R42	0698-4131		R:FXD COMP 56 OHM 5% 1/8W	28480	0698-4131
A18R43	0698-3111	1	R:FXD COMP 30 OHM 5% 1/8W	28480	0698-3111
A18R44	0698-3113		R:FXD CARBON 100 OHM 5% 1/8W	28480	0698-3113
A18R45			NOT ASSIGNED		
A18R46	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R47	0683-3905		R:FXD COMP 39 OHM 5% 1/4W	01121	CB 3905
A18R48	0683-8215	1	R:FXD COMP 820 OHM 5% 1/4W	01121	CB 8215
A18R49	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R50	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R51	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R52	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R53		1	NOT ASSIGNED		
A18U1	5088-7002		IC:LIMITER	2848C	5088-7002
A18U2	1826-0084		IC:LINEAR	28480	1826-0084
A18U3	1826-0085		IC: LINEAR	28480	1826-0085
OR					
A18U3	1826-0151	1	IC: LINEAR	28480	1826-0151
A18U4	1820-0736	1	IC: DIGITAL	28480	1820-0736
OR		1			
A18U4	1820-0558		IC: DUAL-BINARY	28480	1820-0558
A18U5	1820-0714		IC: DIGITAL QUINARY DIVIDER	28480	1820-0714
A18U6	1820-0489		IC: ECL	28480	1820-0489
A18U7	1821-0001		TRANSISTOR ARRAY:SI NPN	02735	CA3046
A18U8	1821-0001	2	TRANSISTOR ARRAY:SI NPN	02735	CA3046

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18U9	1820-0802	1	IC:ECL QUAD 2-INPT NOR GATE	04713	MC10102L
			CHASSIS PARTS		
B1	3150-0039	1	FILTER:AIR	28480	3150-0039
B1	3140-0030	1	MOTOR:SHADED POLE	28480	3140-0030
B1	3160-0035	1	FAN:IMPELLER AXIAL 2-1/4 DIAM	04870	2 1/4 RHF 125 S
B1	5212A-128	1	BRACKET:FAN	28480	5212A-128
C1	0160-3043	1	C:FXD CER 2 X 0.005 UF 20% 250VAC	56289	29C147A-CDH
F1	2110-0020	1	FUSE:0.8A 250V SLOW-BLOW	75915	313.80GS
F1	2110-0304	1	FUSE:CARTRIDGE 1.5 AMP 250V SLOW-BLOW	7140C	MDX-1-1/2A
F1	1400-0084	1	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
J1	1510-0075	1	BINDING POST ASSY:BLACK	28480	1510-0075
J1	1510-0074	1	BINDING POST ASSY:SAFETY RED INSULATOR	28480	1510-0074
J2	1250-1253	5	CONNECTOR:RF BNC MOUNT JACK	24931	28JR194-1
J3	1250-1253		CONNECTOR:RF BNC MOUNT JACK	24931	28JR194-1
J4	1250-1253		CONNECTOR:RF BNC MOUNT JACK	24931	28JR194-1
J5	1250-1253		CONNECTOR:RF BNC MOUNT JACK	24931	28JR194-1
J6	1250-1253		CONNECTOR:RF BNC MOUNT JACK	24931	28JR194-1
J8	1251-2357	1	SOCKET:3-PIN MALE POWER RECEPTACLE	82385	EAC-301
J11	1250-0212	1	CONNECTOR:JACK CHASSIS BNC	95712	30409-1
P1	5060-0109	2	CONNECTOR:15 CONTACTS	28480	5060-0109
Q1	1853-0233	1	TSTR:SI PNP	01295	TIP 32
Q1	05327-20024	2	HEAT SINK FOR Q1 AND Q2	28480	05327-20024
Q2	1854-0420	1	TSTR:SI PNP	28480	1854-0420
Q2	05327-20024		HEAT SINK FOR Q1 AND Q2	28480	05327-20024
R1	2100-2961	1	R:VAR COMP 1 MEGOHM 10% 10 CLOG 1/4W	28480	2100-2961
R1	00180-67403	2	KNOB ASSY	28480	00180-67403
S1			PART OF R1		
S2	3101-1599	2	SWITCH:SLIDE DP3T 0.5A 125V AC/DC (FAST-NORM-HOLD)	28480	3101-1599
S3	3101-1216	1	SWITCH:PUSHBUTTON SPST (RESET)	82385	85-1034
S4	3101-1599		SWITCH:SLIDE DP3T 0.5A 125V AC/DC (RANGE)	28480	3101-1599
S5	05326-60018	1	SWITCH ASSY:TIME BASE(WIRED)	28480	05326-60018
S6	05326-60020	1	SWITCH ASSY:FUNCTION (WIRED) 5326B	28480	05326-60020
S6	05327-60017	1	SWITCH ASSY:FUNCTION (WIRED) 5327B	28480	05327-60017
S7	3101-1596		SWITCH:SLIDE DPDT MINIATURE (OSC-INT/EXT)	78488	SS-91-1
S8	3101-1596		SWITCH:SLIDE DPDT MINIATURE (STORAGE)	78488	SS-91-1
S9	3101-1234	1	SWITCH:SLIDE DPDT (SELECTOR 115/230V)	82385	11A-1242
T1	9100-3020	1	TRANSFORMER:POWER	28480	9100-3020
			OTHER CABINET PARTS		
	0460-0114	12	TAPE:POLYURETHANE 1-1/4 IN WIDE	85471	TESAMQLL-2
	1490-0030	1	STAND:TILT	28480	1490-0030
	5000-0050	2	TRIM:SIDES	28480	5000-0050
	5060-0729	2	FRAME ASSY:3 X 11(SIDE)	28480	5060-0729
	5060-0767	5	FCGT ASSY:FM	28480	5060-0767
	05326-00001	1	PANEL:FRONT	28480	05326-00001
	05326-00032	1	PANEL:REAR	28480	05327-00032
	05326-00008	1	INSULATOR	28480	05326-00008
	05326-00011	1	PLATE:CONNECTOR, LONG (J9 COVER)	28480	05326-00011
	05327-20016		WINDOW (5327B)		
	05326-20006	1	WINDOW (5326B)	28480	05326-20006
	7120-1254	1	TRADEMARK (HP LOGO)	28480	7120-1254
			PAINTED CABINET PARTS		
	05325-00009	1	COVER:BOTTOM(OPT X95)	28480	05325-00009
	05330-00033	1	BOTTOM COVER	28480	05330-00033
	05326-00006	1	PANEL:FRONT PANEL TRIM (OPT A85/X95)	28480	05326-00006
	05327-00007	1	PANEL:RIGHT FRONT TRIM(5327B)STANDARD	28480	05327-00007
	05326-00026	1	PANEL:RIGHT FRONT TRIM(5326B)STANDARD	28480	05326-00026
	05326-00025	1	PANEL:LEFT FRONT TRIM(STANDARD)	28480	05326-00025
	05326-00007	1	PANEL:LEFT FRONT PANEL TRIM (5326B) OPT A85/X95	28480	05326-00007
	05326-00029	1	SIDE COVER:STANDARD COLOR	28480	05326-00029
	05326-00021	2	SIDE COVER:OPT X95	28480	05326-00021
	05326-00022	1	TOP COVER(OPT X95)	28480	05326-00022

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	05326-00030	1	TOP COVER:STANDARD COVER	2848C	05326-00030
	05326-60029	2	KIT:RACK MOUNT(OPT A85/X95)	28480	05326-60029
	05326-60029		KIT:RACK MOUNT(OPT A85/X95)	2848C	05326-60029
	05326-60046	1	KIT:RACK MOUNT(STANDARD) CONSISTING OF:	2848C	05326-60046
	2370-0012	3	SCREW:SST FLAT HD PHL DR 6-32 X 1/4	2848C	2370-0012
	2510-0047	4	SCREW:PAN HD POZI DR 8-32 X 0.438" LG	00000	08D
	5020-0706	1	BRACKET:LEFT	28480	5020-0706
	5020-0707	1	BRACKET:RIGHT	2848C	5020-0707
	05326-40002	1	STRIP:FILLER GRAY	2848C	05326-40002
			INTERNAL AND OTHER PARTS		
	0370-0104	2	KNOB: BLK BAR W/ARROW 1/4" SHAFT (FUNCTION (FUNCTION 5326B)	28480	0370-0104
	0340-0734	2	INSULATOR: BINDING POST, RED	28480	0340-0734
	0340-0733	2	INSULATOR: BINDING POST, BLACK	28480	0340-0733
	0340-0765		INSULATOR: TRANSISTOR	28480	0340-0765
	0370-0104		KNOB: BLK BAR W/ARROW 1/4" SHAFT (TIME BASE)	28480	0370-0104
	0370-0163	1	KNOB: BAR BLK 0.500" DIA (FUNCTION 5327B)	28480	0370-0163
	1200-0147		BUSHING: TRANSISTOR	28480	1200-0081
	01821-67401	2	KNOB: TRIGGER LEVEL	28480	01821-67401
	05326-20046	1	BOARD:BLANK (REAR PANEL CONNECTOR)	2848C	05326-20046
	05326-60032	1	CABLE ASSY:POWER	28480	05326-60032
	05326-60021	1	CABLE ASSY:VOLTMETER	28480	05326-60021
	05326-00019	2	SPACER(DVM JACKS, WHITE)	28480	05326-00019
	05326-00018	1	CHASSIS	2848C	05326-00018
	05326-00010	1	SHIELD:NIXIE	28480	05326-00010
	05327-60011	1	CABLE ASSY:PRESCALER	28480	05327-60011
	05326-00033	1	ADAPTER:CONNECTOR	28480	05326-00033
	5040-0345	4	INSULATOR:DVM JACKS, JADE GRAY	28480	5040-0345
	8120-1378	1	CABLE ASSY:AC POWER CORD	70903	KH-7081
	5060-0109		CONNECTOR:15 CONTACTS	28480	5060-0109
	5040-0170	5	GUIDE:PLUG-IN PC BOARD	28480	5040-0170

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

Table 6-2. Replaceable Parts, Options

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9	05326-60025	17	(OPTION 001 (8 DIGIT DISPLAY) DELETE A9 05326-60008 AND REPLACE WITH A9 05326-60025. DISPLAY ASSY (SERIES 1032A) LOADED ON 05326-20008 BLANK BOARD.	28480	05326-60025
A9DS1	1970-0042	8	TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS1	1200-0405	8	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS2	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS2	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS3	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS3	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS4	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS4	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS5	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS5	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS6	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS6	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS7	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS7	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9DS8	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A9DS8	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A9R1	0683-1025	2	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R2	0698-8431	8	R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R3	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A9R4	0698-8431		R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R5	0698-8431		R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R6	0698-8431		R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R7	0698-8431		R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R8	0698-8431		R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R9	0698-8431		R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R10	0683-1005	2	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A9R11	0698-8431		R:FXD COMP 7500 OHM 5% 1/4W	28480	0698-8431
A9R12	0683-1005		R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A9U1	1820-0275	1	IC:ECL TO TTL QUAD 2-INPT OR TRANS.	04713	MC1035P
A9U2	1820-0119 Δ	7	IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U3	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U4	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U5	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U6	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U7	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U8	1820-0119 Δ		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A9U9	1820-0116	8	IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U10	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U11	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U12	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U13	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U14	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U15	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U16	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A9U17	1820-0729	1	IC:DECODER-DIVIDER	28480	1820-0729
A9U18	1820-0092	7	INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U19	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U20	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U21	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U22	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U23	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9U24	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A9XU8	1200-0477	3	SOCKET:IC	28480	1200-0477
A9XU16	1200-0477		SOCKET:IC	28480	1200-0477
A9XU24	1200-0477		SOCKET:IC	28480	1200-0477

See introduction to this section for ordering information

ΔFOR THIS INSTRUMENT, 1820-0232's ARE DIRECTLY INTERCHANGEABLE WITH THE 1820-0119's.

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
J10 W2P1 W2P2	05327-60013 1251-0085 5060-0113 1200-0063	1 1	OPTION 002 (REMOTE PROGRAMMING). DELETE 5060-0109 15 CONTACT CONNECTOR AND ADD 05327-60013 CABLE ASSY. CABLE ASSY:PROGRAMMING CONNECTOR:FEMALE 36-PIN MINAT CONNECTOR:45 CONTACT LUG:CRIMP	28480 28480 28480 28480	05327-60013 1251-0085 5060-0113 1200-0063
J9 W1P1 W1P2	1251-0087 1251-2262 1251-2262	1 2	OPTION 003 (DIGITAL OUTPUT). ADD 05326-60012 CABLE ASSY. CONNECTOR:FEMALE 50-PIN MINAT CONNECTOR:PC(2 X 10) 20 CONTACTS CONNECTOR:PC(2 X 10) 20 CONTACTS	28480 76530 76530	1251-0087 251-10-30-400 251-10-30-400
	05327-60034	1	OPTION 004 BOARD ASSY:REMOTE ATTENUATOR (SERIES 1224A) (LOADED ON 05327-20034 BLANK BOARD).	28480	05327-60034
A1C1 A1C2 A1C3	0150-0031 0150-0031 0140-0221	2 2	C:FxD TI 2 PF 5% 500VDCW C:FxD TI 2 PF 5% 500VDCW C:FxD MICA 220 PF 1%	78488 78488 28480	TYPE 6A TYPE 6A 0140-0221
A1C4 A1C5 A1C6 A1C7 A1C8	0140-0221 0160-0207 0160-0207 0140-0149 0140-0149	2 3	C:FxD MICA 220 PF 1% C:FxD MYLAR 0.01UF 5% 200VDCW C:FxD MYLAR 0.01UF 5% 200VDCW C:FxD MICA 470 PF 5% C:FxD MICA 470 PF 5%	28480 28480 28480 72136 72136	0140-0221 0160-0207 0160-0207 DM15F471J3S DM15F471J3S
A1C9 A1C10 A1C11 A1C12 A1C13	0160-2055 0160-3028 0160-2055 0160-3028 0140-0199	2 2 2 2	C:FxD CER 0.01 UF +80-20% 100VDCW C:FxD CER 10PF 10% 75VDCW C:FxD CER 0.01 UF +80-20% 100VDCW C:FxD CER 10PF 10% 75VDCW C:FxD MICA 240 PF 5%	56289 12574 56289 12574 28480	C023F101F103ZS22-C0H MIN-C-10-K C023F101F103ZS22-C0H MIN-C-10-K 0140-0199
A1C14 A1C15 A1C16 A1C17 A1C18 A1C19	0140-0199 1910-0016 1910-0016 1910-0016 1902-0025	8 1	C:FxD MICA 240 PF 5% DIODE:GE 60 WIV DIODE:GE 60 WIV DIODE:GE 60 WIV DIODE,BREAKDOWN:10.0V 5% 400 MW	28480 28480 28480 28480 28480	0140-0199 1910-0016 1910-0016 1910-0016 1902-0025
A1C20 A1C21 A1C22 A1C23 A1C24	1902-0057 1910-0016 1906-0024 1906-0024 1906-0025	1 4 4	DIODE BREAKDOWN:6.49V DIODE:GE 60 WIV DIODE ASSY:SI DIODE ASSY:SI DIODE ASSY:SI	28480 28480 28480 28480 28480	1902-0057 1910-0016 1906-0024 1906-0024 1906-0025
A1C25 A1C26 A1C27 A1C28 A1C29	1906-0025 1901-0040 1901-0040 1901-0040 1901-0040	10	DIODE ASSY:SI DIODE:SILICON 50 MA 30 WV DIODE:SILICON 50 MA 30 WV DIODE:SILICON 50 MA 30 WV DIODE:SILICON 50 MA 30 WV	28480 07263 07263 07263 07263	1906-0025 FDG1088 FDG1088 FDG1088 FDG1088
A1C30 A1C31 A1C32 A1C33 A1C34	1910-0016 1901-0040 1901-0040 1910-0016 1901-0040	4	DIODE:GE 60 WIV DIODE:SILICON 50 MA 30 WV DIODE:SILICON 50 MA 30 WV DIODE:GE 60 WIV DIODE:SILICON 50 MA 30 WV	28480 07263 07263 28480 07263	1910-0016 FDG1088 FDG1088 1910-0016 FDG1088
A1C35 A1C36 A1C37 A1C38 A1C39	1901-0040 1906-0025 1906-0025 1906-0024 1906-0024	4	DIODE:SILICON 50 MA 30 WV DIODE ASSY:SI DIODE ASSY:SI DIODE ASSY:SI DIODE ASSY:SI	07263 28480 28480 28480 28480	FDG1088 1906-0025 1906-0025 1906-0024 1906-0024
A1C40 A1C41 A1C42 A1C43 A1C44	1901-0376 1901-0376 1901-0376 1901-0376 1901-0040	4	DIODE:SILICON 35V DIODE:SILICON 35V DIODE:SILICON 35V DIODE:SILICON 35V DIODE:SILICON 50 MA 30 WV	28480 28480 28480 28480 07263	1901-0376 1901-0376 1901-0376 1901-0376 FDG1088
A1C45 A1C46 A1C47 A1C48 A1C49	1910-0016 1910-0016 1902-0041 1902-0041 1902-0041	4	DIODE:GE 60 WIV DIODE:GE 60 WIV DIODE:BREAKDOWN 5.11V 5% DIODE:BREAKDOWN 5.11V 5% DIODE:BREAKDOWN 5.11V 5%	28480 28480 04713 04713 04713	1910-0016 1910-0016 SZ10939-98 SZ10939-98 SZ10939-98
A1C50 A1C51 A1C52 A1C53	1902-0041 1901-0040 2140-0047 2140-0047	2 2	DIODE:BREAKDOWN 5.11V 5% DIODE:SILICON 50 MA 30 WV LAMP:NEON GLOW 0.8 MILLIAMPS LAMP:NEON GLOW 0.8 MILLIAMPS	04713 07263 08806 08806	SZ10939-98 FDG1088 A1C A1C
A1J1	1251-0472	2	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300

See introduction to this section for ordering information

Model 5326/27B
Replaceable Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1J2	1251-0472	2	CONNECTOR:PG 12 CONTACTS	71785	252-06-30-300
A1J3	1250-1163		CONNECTOR:RF BNC INPUT	2848C	1250-1163
A1J4	1250-1163		CONNECTOR:RF BNC INPUT	2848C	1250-1163
A1K1	0490-0399		RELAY:REED ASSY, 1200 OHM 12VDC	28480	0490-0399
A1K2	0490-0399	1	RELAY:REED ASSY, 1200 OHM 12VDC	28480	0490-0399
A1K3	0490-0399		RELAY:REED ASSY, 1200 OHM 12VDC	28480	0490-0399
A1K4	0490-0399		RELAY:REED ASSY, 1200 OHM 12VDC	28480	0490-0399
A1K5	0490-0399		RELAY:REED ASSY, 1200 OHM 12VDC	28480	0490-0399
A1Q1	1854-0039		TSTR:SI NPN	80131	2N3053
A1Q2	1853-0001	1	TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A1Q3	1854-0215	6	TSTR:SI NPN	80131	2N3904
A1Q4	1854-0215	4	TSTR:SI NPN	80131	2N3904
A1Q5	1853-0036		TSTR:SI PNP	80131	2N3906
A1Q6	1853-0036		TSTR:SI PNP	80131	2N3906
A1Q7	1854-0215		TSTR:SI NPN	80131	2N3904
A1Q8	1854-0215	2	TSTR:SI NPN	80131	2N3904
A1Q9	1853-0036		TSTR:SI PNP	80131	2N3906
A1Q10	1853-0036		TSTR:SI PNP	80131	2N3906
A1Q11	1854-0215		TSTR:SI NPN	80131	2N3904
A1Q12	1854-0215	2	TSTR:SI NPN	80131	2N3904
A1Q13	1855-0334		TSTR:SI FET DUAL N-CHANNEL	17856	DN377
A1Q14	1855-0334		TSTR:SI FET DUAL N-CHANNEL	17856	DN377
A1R1	0698-6123		R:FxD COMP 20K OHM 5% 1/8W	28480	0698-6123
A1R2	0698-6123	6	R:FxD COMP 20K OHM 5% 1/8W	28480	0698-6123
A1R3	0698-5565		R:FxD CARBON 2.2K OHM 5% 1/8W	28480	0698-5565
A1R4	0698-5565		R:FxD CARBON 2.2K OHM 5% 1/8W	28480	0698-5565
A1R5	0686-1515		R:FxD COMP 150 OHM 5% 1/2W	01121	EB 1515
A1R6	0686-1815	1	R:FxD COMP 180 OHM 5% 1/2W	01121	EB 1815
A1R7	0698-3381	6	R:FxD COMP 150 OHM 5% 1/8W	28480	0698-3381
A1R8	0698-3381	2	R:FxD COMP 150 OHM 5% 1/8W	28480	0698-3381
A1R9	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A1R10	0698-5103		R:FxD COMP 430 OHM 5% 1/8W	28480	0698-5103
A1R11	0698-5103		R:FxD COMP 430 OHM 5% 1/8W	28480	0698-5103
A1R12	0698-7965	2	R:FxD COMP 330K OHM 5% 1/8W	01121	BB 3345
A1R13	0698-7966	2	R:FxD COMP 680K OHM 5% 1/8W	01121	BB 6845
A1R14	0698-7966		R:FxD COMP 680K OHM 5% 1/8W	01121	BB 6845
A1R15	0698-7965		R:FxD COMP 330K OHM 5% 1/8W	01121	BB 3345
A1R16	0757-0467		R:FxD MET FLM 121K OHM 1% 1/8W	28480	0757-0467
A1R17	0757-0467	2	R:FxD MET FLM 121K OHM 1% 1/8W	28480	0757-0467
A1R18	0698-3381		R:FxD COMP 150 OHM 5% 1/8W	28480	0698-3381
A1R19	0683-3015		R:FxD COMP 300 OHM 5% 1/4W	01121	CB 3015
A1R20	0698-3381		R:FxD COMP 150 OHM 5% 1/8W	28480	0698-3381
A1R21	0683-3015	2	R:FxD COMP 300 OHM 5% 1/4W	01121	CB 3015
A1R22	0698-5568		R:FxD CARBON 36K OHM 5% 1/8W	28480	0698-5568
A1R23	0698-6244		R:FxD COMP 3.3K OHM 5% 1/8W	01121	BB 3325
A1R24	0698-5568	2	R:FxD CARBON 36K OHM 5% 1/8W	28480	0698-5568
A1R25	0698-6244		R:FxD COMP 3.3K OHM 5% 1/8W	01121	BB 3325
A1R26	0683-1515		R:FxD COMP 150 OHM 5% 1/4W	01121	CB 1515
A1R27	0683-1515		R:FxD COMP 150 OHM 5% 1/4W	01121	CB 1515
A1R28	0698-6381	2	R:FxD COMP 11K OHM 5% 1/8W	28480	0698-6381
A1R29	0698-6381		R:FxD COMP 11K OHM 5% 1/8W	28480	0698-6381
A1R30	0698-7097		R:FxD COMP 1 MEGOHM 5% 1/8W	01121	BB 1055
A1R31	0698-7097		R:FxD COMP 1 MEGOHM 5% 1/8W	01121	BB 1055
A1R32	2100-2574	2	R:VAR CERMET 500 OHM 10% LIN 1/2W	28480	2100-2574
A1R33	2100-2574	2	R:VAR CERMET 500 OHM 10% LIN 1/2W	28480	2100-2574
A1R34	0698-7964		R:FxD COMP 100K OHM 5% 1/8W	01121	BB 1045
A1R35	0698-7964		R:FxD COMP 100K OHM 5% 1/8W	01121	BB 1045
A1R36	0698-3381		R:FxD COMP 150 OHM 5% 1/8W	28480	0698-3381
A1R37	0698-3381	4	R:FxD COMP 150 OHM 5% 1/8W	28480	0698-3381
A1R38	0698-5174		R:FxD COMP 200 OHM 5% 1/8W	28480	0698-5174
A1R39	0698-5174		R:FxD COMP 200 OHM 5% 1/8W	28480	0698-5174
A1R40	0698-6984		R:FxD COMP 470 OHM 5% 1/8W	28480	0698-6984
A1R41	0698-6984	2	R:FxD COMP 470 OHM 5% 1/8W	28480	0698-6984
A1R42	0698-7097		R:FxD COMP 1 MEGOHM 5% 1/8W	01121	BB 1055
A1R43	0698-7097		R:FxD COMP 1 MEGOHM 5% 1/8W	01121	BB 1055
A1R44	0698-6244	2	R:FxD COMP 3.3K OHM 5% 1/8W	01121	BB 3325
A1R45	0698-6244		R:FxD COMP 3.3K OHM 5% 1/8W	01121	BB 3325
A1R46	0698-5561		R:FxD COMP 6.8 OHM 5% 1/8W	28480	0698-5561
A1R47	0698-5561		R:FxD COMP 6.8 OHM 5% 1/8W	28480	0698-5561
A1R48	0698-5174	2	R:FxD COMP 200 OHM 5% 1/8W	28480	0698-5174
A1R49	2100-3228		R:VAR COMP 10K OHM 20% LIN 1/2W	28480	2100-3228
A1R50	0698-5174		R:FxD COMP 200 OHM 5% 1/8W	28480	0698-5174
A1R51	2100-3228		R:VAR COMP 10K OHM 20% LIN 1/2W	28480	2100-3228
A1R52	0698-5565		R:FxD CARBON 2.2K OHM 5% 1/8W	28480	0698-5565

Continued on
next page

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R53	0698-5565		R:FXD CARBON 2.2K OHM 5% 1/8W	28480	0698-5565
A1R54	0698-5565		R:FXD CARBON 2.2K OHM 5% 1/8W	28480	0698-5565
A1R55	0698-5565		R:FXD CARBON 2.2K OHM 5% 1/8W	28480	0698-5565
A1R56	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A1S1	3101-1598	3	SWITCH:SLIDE DP3 POSITION	28480	3101-1598
A1S2	3101-1598		SWITCH:SLIDE DP3 POSITION	28480	3101-1598
A1S3	3101-1598		SWITCH:SLIDE DP3 POSITION	28480	3101-1598
A1S4	3101-1596	4	SWITCH:SLIDE DPDT MINIATURE	78488	SS-91-1
A1S5	3101-1596		SWITCH:SLIDE DPDT MINIATURE	78488	SS-91-1
A1S6			PART OF R49		
A1S7			PART OF R51		
A1S8	3101-1596		SWITCH:SLIDE DPDT MINIATURE	78488	SS-91-1
A1S9	3101-1596		SWITCH:SLIDE DPDT MINIATURE	78488	SS-91-1
A1U1	1820-0274	1	IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A1U2	1820-0287	2	IC:DIGITAL QUAD 2-INPT NAND GATE	28480	1820-0287
A1U3	1820-0625	1	IC:HTL TRIPLE LEVEL TRANSLATOR(TTL-HTL)	04713	MC666P
A1U4	1820-0287		IC:DIGITAL QUAD 2-INPT NAND GATE	28480	1820-0287
J10	1251-0087		CONNECTOR:FEMALE 50-PIN MINAT	28480	1251-0087
W2	05327-60019	1	CABLE ASSY	28480	05327-60019
W2	1200-0063	1	LUG:CRIMP	28480	1200-0063
A4	05327-60036	1	OPTION 010 (NOT FIELD REPAIRABLE). TEMPERATURE CONTROLLED OSCILLATOR	28480	05327-60036
A4			OPTION 011.(NOT FIELD REPAIRABLE,		
A4	10544-60011	1	OVEN CONTROLLED OSCILLATOR FOR REPLACEMENT OR REPAIR, ORDER REBUILT ASSY 10544-60511.)	28480	10544-60011

See introduction to this section for ordering information

Table 6-3. Manufacturers Code List

Mfr. No.	Manufacturer Name	Address	Zip Code
00000	No M/F Description for this Mfg Number		
00000	U.S.A. Common	Any Supplier of U.S.A.	
00779	AMP Inc.	Harrisburg, Pa.	77105
01121	Allen Bradley Co.	Milwaukee, Wis.	53204
01295	Texas Instruments Inc. Semi. Comp. Div.	Dallas, Tex.	75231
02114	Ferroxcube Corp.	Saugerties, N.Y.	12477
02735	RCA Solid State & Receiving Tube Div.	Somerville, N.J.	08876
03508	G.E. Co. Semiconductor Prod. Dept.	Syracuse, N.Y.	13201
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Ariz.	85008
04870	P M Motor Co.	Westchester, Ill.	60156
05820	Wakefield Engineering Inc.	Wakefield, Mass.	01880
07263	Fairchild Camera & Inst. Corp. Semicon. Div.	Mountain View, Calif.	94040
08806	G.E. Co. Miniature Lamp Dept.	Cleveland, Ohio	44112
12040	National Semiconductor Corp.	Danbury, Conn.	06810
12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N.M.	87108
13019	Airco Supply Co. Inc.	Wichita, Kans.	67213
14655	Cornell Dublier Elect. Div. Federal Pacific Elect. Co.	Newark, N.J.	07105
17856	Siliconix Inc.	Sunnyvale, Calif.	94086
24931	Specialty Connector Co. Inc.	Indianapolis, Ind.	46227
28480	Hewlett-Packard Co. Corporate HQ	Your Nearest HP Office	
56289	Sprague Electric Co.	N. Adams, Mass.	01247
70903	Belden Corp.	Chicago, Ill.	60644
71400	Bussman Mfg. Div. McGraw-Edison Co.	St. Louis, Mo.	63017
71785	Cinch Mfg. Co. Div. TRW Inc.	Elk Grove Village, Ill.	
72136	Electro Motive Mfg. Co. Inc.	Willimantic, Conn.	06226
72982	Erie Technological Prod. Inc.	Erie, Pa.	16512
75915	Littlefuse Inc.	Des Plaines, Ill.	60016
76530	Cinch Monadnock Mills Div. TRW Inc.	City of Industry, Calif.	91746
78488	Stackpole Carbon Co.	St. Marys, Pa.	15857
80031	Mepco Div. Sessions Clock Co.	Morristown, N.J.	07960
80131	Electronic Industries Association	Washington, D.C.	20006
82142	Airco Speer Elect. Comp.	Du Bois, Pa.	15801
82389	Switchcraft Inc.	Chicago, Ill.	60630
83594	Burroughs Corp. Elect. Comp. Div.	Plainsfield, N.J.	07061
85471	Boyd A.B. Co.	San Francisco, Calif.	94103
91418	Radio Materials Co.	Chicago, Ill.	60646
95712	Bendix Corp. The Microwave Device Div.	Franklin, Ind.	46131
96733	San Fernando Elect. Mfg. Co.	San Fernando, Calif.	91341
98291	Sealectro Corp.	Mamaroneck, N.Y.	10544
99800	Delevan Electronics Corp.	E. Aurora, N.Y.	14052

SECTION VII

OPTIONS AND MANUAL CHANGES

7-1. INTRODUCTION

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

7-3. OPTIONS

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

7-5. Option 001, 8-Digit Display

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

7-7. Option 002, Remote Programming

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

7-9. Option 003, Digital Recorder Output

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

7-11. Option 004, Extended Remote Programming

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

7-13. Option 010 Temperature Compensated Oscillator

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

7-15. Option 011 Oven Oscillator

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

7-17. FIELD INSTALLATION OF OPTIONS

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

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

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

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

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

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

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

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

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

7-20. Installation of Option 002, Remote Programming

7-21. To install remote programming capability in units not so equipped, order remote cable assembly HP Part No. 05327-60013, two 4-40 x 1/4-inch machine screws, and one 6-32 x 5/8-inch machine screw with hex nut.

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

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

c. Remove two screws holding P1A, and 1 7/8-inch-long, black, pressure connector to the motherboard A16.

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

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

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

g. Assemble the rear-panel interconnect board and the new 5-inch-long pressure connector P1 with three 6-32 x 5/8-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 1/4-inch screws. Do not tighten screws. Route cable as shown in the top internal photo of instrument, Figure 8-4.

CAUTION

SCREWS LONGER THAN 1/4-INCH WILL DAMAGE P1.

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

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

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

l. Tighten BNC lock nuts and reassemble instrument.

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

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

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

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

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

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

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

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

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

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

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

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

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

7-27. Remove the standard oscillator A4 and insert the option into the XA4 connector. The Option 011 assembly must be mounted to the interconnect board with two 6 x 32, 3/8-inch screws. Place the fiber washers on the underside of the board.

7-28. MANUAL CHANGES

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

7-30. NEWER INSTRUMENTS

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

7-32. Older Instruments

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

NOTE

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

Table 7-1. Manual Backdating Changes

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

CHANGE 1

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

Page 6-14, Table 6-1:
Change A15R1 to "0683-2035, R:FXD COMP 20K OHM 5% 1/4W 01121 CB 2035."

Change A15R6 to "0686-1505 R:FXD COMP 15 OHM 5% 1/4W 01121 EB 1505."

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

Delete "A15XF1 1400-0110 FUSE HOLDER."

Page 8-45, Figure 8-18:

Change A15 R1 to "20K."

Change A15 R6 to "15 OHM."

Delete F1. Q8 emitter connects directly to XA15 (1,A).

Change board series number to 1224A.

CHANGE 2

Page 1-2, Table 1-3:

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

Page 6-16, Table 6-1:

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

Page 8-48, Figure 8-20:

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

Page 6-18, Table 6-1:

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

CHANGE 3

Page 1-1, Paragraph 1-9:

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

Model 5326/27B
Options and Manual Changes

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

Page 8-21, Figure 8-9:
On schematic, delete A6R44. A6C10 connects directly to A6(2).

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

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

Page 6-15, Table 6-1:
Delete A16C6, A16CR18, A16Q1, A16R4, A16R5, A16R6, A16R7, A16R8, and A16U1.

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

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

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

CHANGE 4

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

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

CHANGE 5

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

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

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

CHANGE 6

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

CHANGE 7

Pages 6-15 and 6-16, Table 6-1:
Change A17CR3 to "1912-0007."
Change A17Q4 to "1854-0092."
Change "A17R21 to 0683-3625 R:FXD COMP 3600 OHM 5% 1/4W 01121 CB 3625."
Change A17R22 to "0683-1515 R:FXD COMP 150 OHM 5% 1/4W 01121 CB 1515."
Change A17R23 to "0683-1025 R:FXD 1000 OHM 5% 1/4W 01121 CB 1025."
Change A17R26 to "0683-5615 R:FXD COMP 560 OHM 5% 1/4W 01121 CB 5615."
Delete "05326-00031 SHIELD: NOISE."
Change board series to "1128A."

Page 8-47, Figure 8-19:
Change A17R21 to "3600 OHMS."
Change A17R26 to "560 OHMS."
Change A17CR3 to "1912-0007."
Change A17Q4 to "1854-0092."
Change board series to "1128."

CHANGE 8

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

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

CHANGE 9

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

Page 6-14, Table 6-1:
Change A15CR15-18 to "1901-0040."
Change A15R17, 18 to "0683-0395 R:FXD 3.9 OHM 5% 1/4W 01121 CB 3965."
Change Board series numbers to "1040A."

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

Page 7-11, Table 7-4:
Change A7C2 to "0160-0333 C:FXD MICA 15 PF 5% 500 VDCW 00853 RDM15C15OD3C."
Change A7 Board Series to 1040A.

Page 8-29, Figure 8-10:
Change A7C2 to 15 PF.

Page 6-7, Table 6-1:
Change A6R19 to "0683-2025 R: FXD
COMP 2000 OHM 5% 1/4W 01121 CB 2025."
Change A6 Board Series Number to 1036A.

CHANGE 10

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

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

CHANGE 11

Table 6-1:
Change part numbers to read:
COVER-SIDE 3x11 5000-0729, 2 ea.
COVER-TOP 05325-00008, 1 ea.
INSULATOR (Q1&Q2) 0340-0162, 1 ea.

NOTE

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

CHANGE 12

Page 6-14, Table 6-1:
Change A15F1 from 2110-0487 (1/20 A) to
2110-0460 (1/32 A).
Change A15R6 from 0698-5479 (8.2 OHM)
to 0686-1305 (13 OHM); MFR PART NO.
EB 82G5 to EB 1305.
Change A15XF1 from 1251-3205 Qty 2 to
1400-0110 Qty 1; Change description from
SOCKET, MINIATURE: SINGLE to
BODY: FUSEHOLDER; Change MFR
CODE from 00779 to 71400; Change MFR
PART NO. from 2-331272-7 to "P/O HWA
FUSEHOLDER."
Change A15 board series from 1428A to
1312A.

Page 8-45, Figure 8-18, A15 Schematic
Diagram:

Change A15F1 value from 1/20A to 1/32A.
Change A15R6 value from 8.2 ohm to 13 ohm.
Change board series from 1428A to 1312A.

Model 5326/27B
Options and Manual Changes

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18	05327-60009	1	PRESALER ASSY (SERIES 1040A) (LOADED ON 05327-20009 BLANK BOARD)	28480	05327-60009
A18C1	3050-0062 0180-0197	2	WASHER: FLAT, BAKELITE C:FXD ELECT 2.2 UF 10% 20VDCW	00000 56289	DBD 150D225X9020A2-DYS
A18C2	0160-0975		C:FXD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C3	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A18C4	0160-0975		C:FXD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C5	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A18C7	0160-0975		C:FXD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C8	0140-0225	2	C:FXD MICA 300 PF 1%	28480	0140-0225
A18C9	0160-0975		C:FXD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C10	0160-0975		C:FXD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C11	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C12	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C13	0160-2049	4	C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A18C14	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A18CR1	1902-3002		DIODE BREAKDOWN: 2.37V 5%	28480	1902-3002
A18CR2	1912-0007		DIODE: TUNNEL EIA TYPE 1N3714	03508	1N3714 SPEC
A18CR3	1902-3048	2	DIODE BREAKDOWN: SILICON 3.48V 5%	28480	1902-3048
A18J1	1250-0836	2	CONNECTOR: RF SUB-MINIATURE	98291	50-053-0000
A18L2	9100-2251		COIL: FXD RF 0.22 UH 10%	28480	9100-2251
A18Q1	1853-0015		TSTR: SI PNP	80131	2N3640
A18Q2	1854-0092		TSTR: SI NPN	80131	2N3563
A18Q3	1854-0092		TSTR: SI NPN	80131	2N3563
A18R1	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A18R2	2100-2521		R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A18R3	0683-5105		R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A18R4	0683-5105		R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105
A18R5	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A18R6	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R7	0698-3378		R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R8	0683-1815		R:FXD COMP 180 OHM 5% 1/4W	01121	CB 1815
A18R9	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R10	0683-2215		R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215
A18R11	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R12	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R13	0683-1825		R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R14	0683-2015		R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A18R15	0683-2015		R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A18R16	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R17	0683-1515	2	R:FXD COMP 150 OHM 5% 1/4W	01121	CB 1515
A18R18	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R19	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A18R20	0683-8205	2	R:FXD COMP 82 OHM 5% 1/4W	01121	CB 8205
A18R21	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A18R22	0683-2025		R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A18R23	0683-3315		R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315
A18R24	0683-2405		R:FXD COMP 24 OHM 5% 1/4W	01121	CB 2405
A18U1	5088-7002		IC: LIMITER	28480	5088-7002
A18U2	5088-7001		IC: AMP AND TRIG	28480	5088-7001
A18U3	1820-0736		IC: DIGITAL	28480	1820-0736
A18U4	1820-0714	1	IC: DIGITAL QUINARY DIVIDER	28480	1820-0714
A18U5	1820-0489		IC: ECL	28480	1820-0489
A18U6	1820-0147		IC: ECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
A18U7	1858-0004		TSTR ARRAY: SI NPN DUAL DIFF. AMPL.	28480	1858-0004
A18XU2	1251-1556	45	CONNECTOR: SINGLE CONTACT	00779	2-330808-8

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18	05327-60029	1	BOARD ASSY:PRESCALER (SERIES 1116A) (LOADED ON 05327-20029 BLANK BOARD)	28480	05327-60029
A18C1	0180-0197		C:FxD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C2	0160-0975		C:FxD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C3	0180-0106		C:FxD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A18C4	0160-0975		C:FxD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C5	0180-0106		C:FxD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A18C6	0160-0975		C:FxD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C7	0160-0975		C:FxD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C8	0140-0225		C:FxD MICA 300 PF 1%	28480	0140-0225
A18C9	0160-0975		C:FxD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C10	0160-0975		C:FxD CER 0.001 UF 20% 75VDCW	12574	SSM-.001-98
A18C11	0180-0197		C:FxD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C12	0180-0197		C:FxD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A18C13	0160-2049		C:FxD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A18C14	0160-2049		C:FxD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
A18CR1	1902-3002		DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A18CR2	1912-0007		DIODE:TUNNEL EIA TYPE 1N3714	03508	1N3714 SPEC
A18CR3	1902-3048		DIODE BREAKDOWN:SILICON 3.48V 5%	28480	1902-3048
A18J1	1250-0836		CONNECTOR:RF SUB-MINIATURE	98291	50-053-0000
A18L1	9140-0158		COIL:FxD RF 1 UH 10%	99800	1025-20
A18L2	9100-2251		COIL:FxD RF 0.22 UH 10%	28480	9100-2251
A18Q1	1853-0015		TSTR:SI PNP	80131	2N3640
A18Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A18Q3	1854-0092		TSTR:SI NPN	80131	2N3563
A18R1	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A18R2	2100-2521		R:VAR FLN 2000 OHM 10% LIN 1/2W	28480	2100-2521
A18R3	0683-5105		R:FxD COMP 51 OHM 5% 1/4W	01121	CB 5105
A18R4	0683-5105		R:FxD COMP 51 OHM 5% 1/4W	01121	CB 5105
A18R5	0683-1045		R:FxD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A18R6	0683-1025		R:FxD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R7	0698-3378		R:FxD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A18R8	0683-1815		R:FxD COMP 180 OHM 5% 1/4W	01121	CB 1815
A18R9	0683-1825		R:FxD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R10	0683-2215		R:FxD COMP 220 OHM 5% 1/4W	01121	CB 2215
A18R11	0683-1825		R:FxD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R12	0683-1825		R:FxD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R13	0683-1825		R:FxD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A18R14	0683-2015		R:FxD COMP 200 OHM 5% 1/4W	01121	CB 2015
A18R15	0683-2015		R:FxD COMP 200 OHM 5% 1/4W	01121	CB 2015
A18R16	0683-1025		R:FxD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A18R17	0683-1515		R:FxD COMP 150 OHM 5% 1/4W	01121	CB 1515
A18R18	0683-4315		R:FxD COMP 430 OHM 5% 1/4W	01121	CB 4315
A18R19	0683-5115		R:FxD COMP 510 OHM 5% 1/4W	01121	CB 5115
A18R20	0683-8205		R:FxD COMP 82 OHM 5% 1/4W	01121	CB 8205
A18R21	0683-1015		R:FxD COMP 100 OHM 5% 1/4W	01121	CB 1015
A18R22	0683-2025		R:FxD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A18R23	0683-3315		R:FxD COMP 330 OHM 5% 1/4W	01121	CB 3315
A18R24	0683-2405		R:FxD COMP 24 OHM 5% 1/4W	01121	CB 2405
A18R25	0698-3374		R:FxD CARBON 20 OHM 5% 1/8W	28480	0698-3374
A18R26	0683-3615		R:FxD COMP 360 OHM 5% 1/4W	01121	CB 3615
A18R27	0683-2715		R:FxD COMP 270 OHM 5% 1/4W	01121	CB 2715
A18R28	2100-2670		R:VAR CERMET 20 OHM 30% LIN 1/2W	28480	2100-2670
A18U1	5088-7002		IC:LIMITER	28480	5088-7002
A18U2	5088-7001		IC:AMP AND TRIG	28480	5088-7001
A18U3	1820-0736		IC:DIGITAL	28480	1820-0736
A18U4	1820-0784		IC:BINARY-QUINARY	28480	1820-0784
A18U5	1820-0489		IC:ECL	28480	1820-0489
A18U6	1820-0147		IC:ECL TRIPLE 3-INPT NOR GATE	04713	MC1007P
A18U7	1858-0004		TSTR ARRAY:SI NPN DUAL DIFF. AMPL.	28480	1858-0004
A18U8	1820-0790		IC:DIGITAL	28480	1820-0790
A18XU2	1251-1556	31	CONNECTOR:SINGLE CONTACT	00779	2-330808-8
A18XU4	1251-1556		CONNECTOR:SINGLE CONTACT	00779	2-330808-8
A18XU4	1205-0243	1	HEAT DISSIPATOR	28480	1205-0243
A18XU4	1205-0244	1	RETAINER	28480	1205-0244
A18XU4	0520-0129	2	SCREW:PAN HD POZI DR 2-56 X 0.312" LG	00000	080
A18XU4	0610-0001	2	NUT:HEX 2-56 X 0.188"	00000	080
A18XU4	3050-0062	1	WASHER:FLAT, BAKELITE	00000	080
A18XU4	3050-0079	2	WASHER:NYLON 0.1875" OD	00000	080

See introduction to this section for ordering information

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

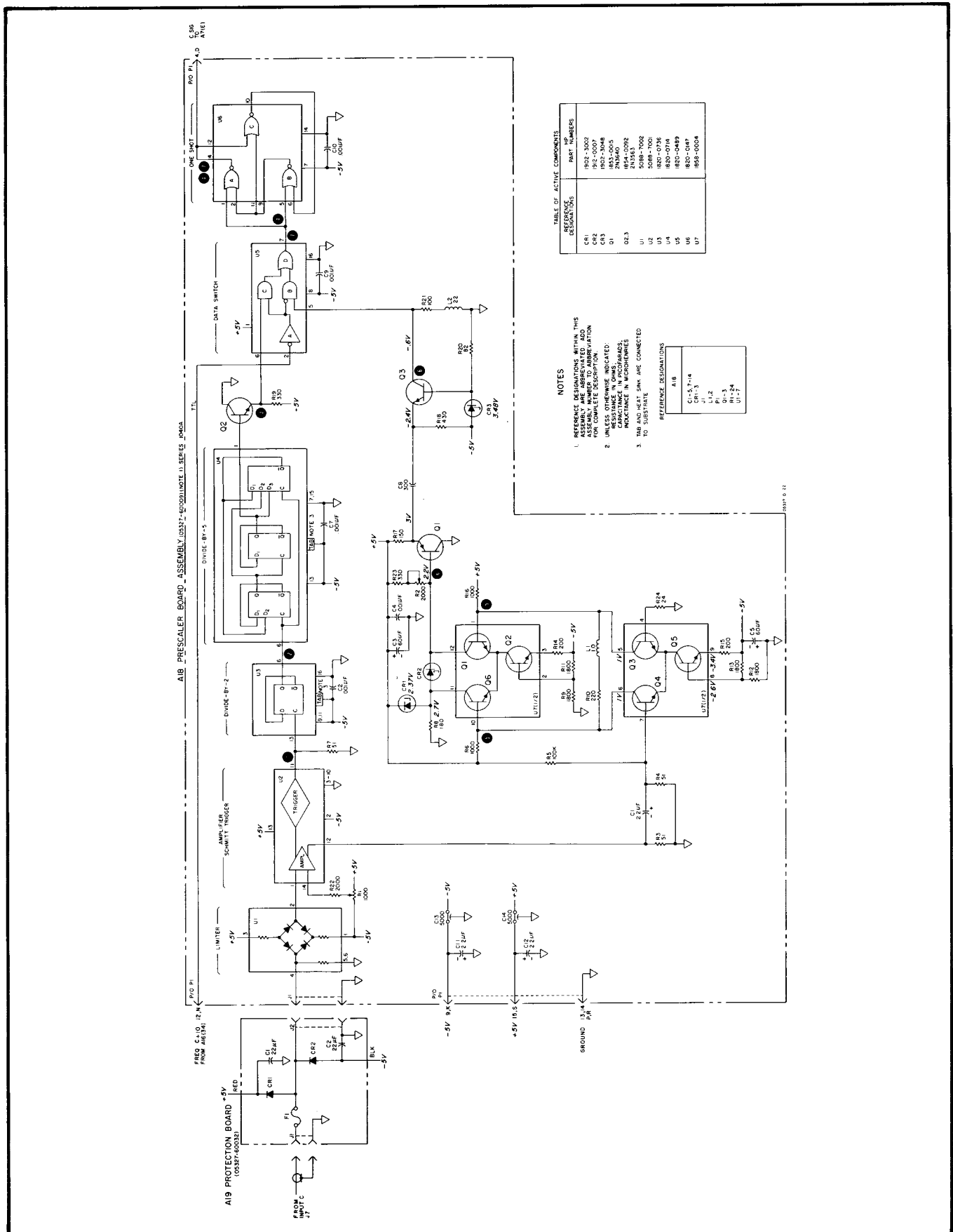


Figure 7-2. A18 Prescaler Board Assembly (5327B Only)

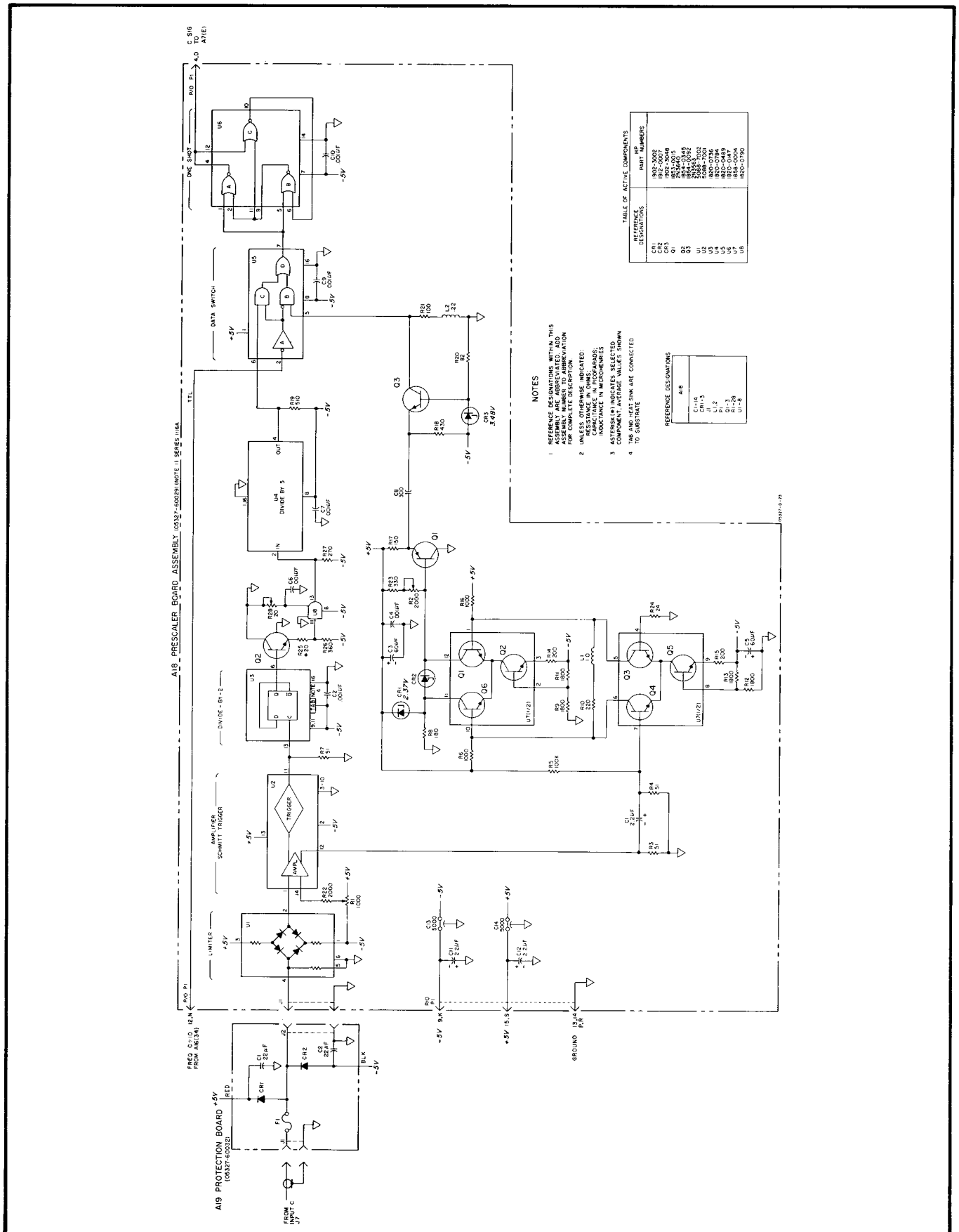
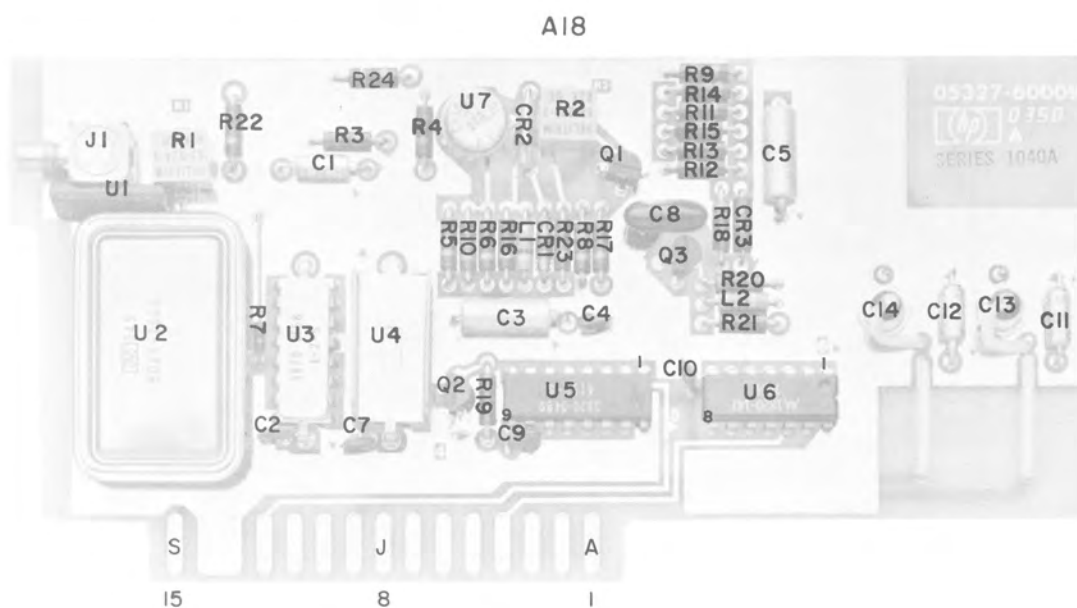


Figure 7-3. A18 (05327-60009) Component Locator



SECTION VIII

SCHEMATIC DIAGRAMS

8-1. GENERAL

8-2. This section contains the following:

- a. Schematic diagram notes.
- b. Schematics.
- c. Component locators.
- d. IC outline drawings.
- e. Waveforms.
- f. Simplified block diagrams.
- g. Theory of operation.
- h. Troubleshooting.

Figure 8-1. Schematic Diagram Notes

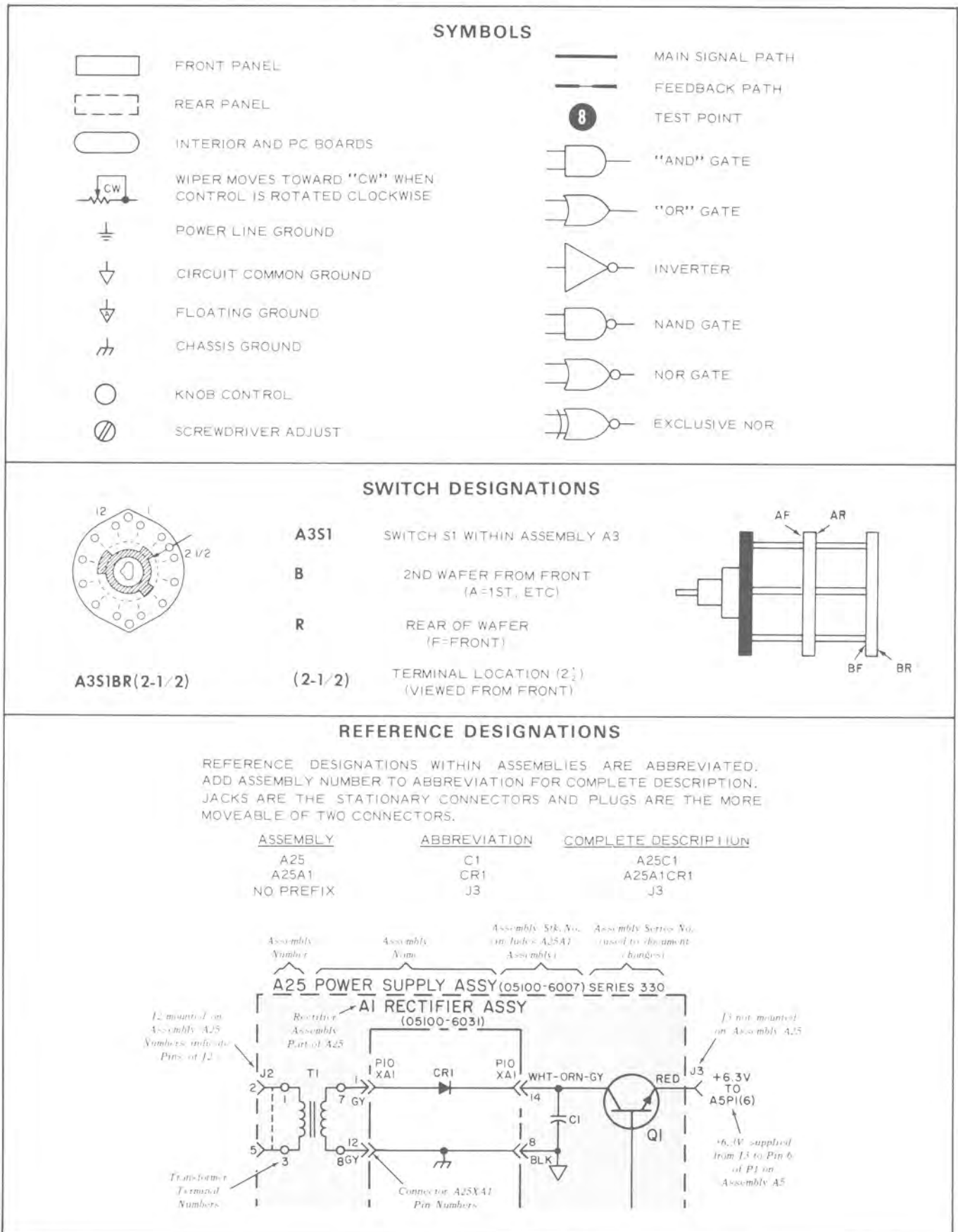
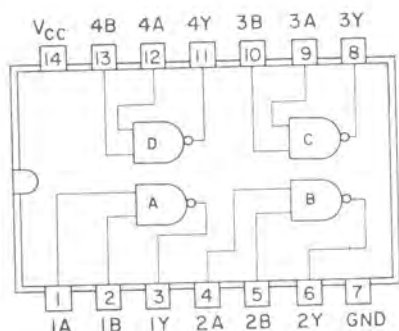


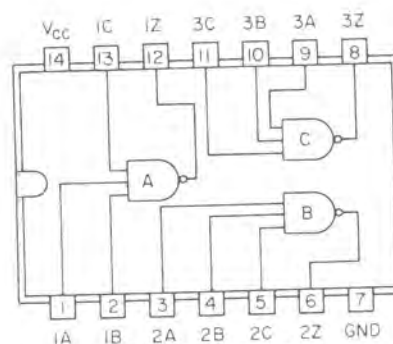
Figure 8-2. Integrated Circuit Diagrams

1820-0054



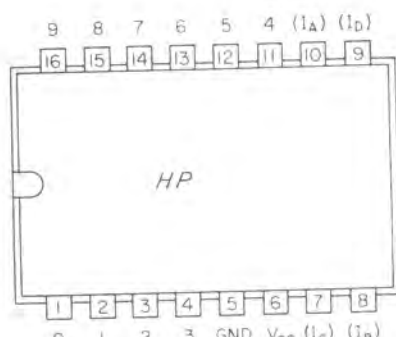
1820-0054(SN7400N)
QUADRUPLE 2-INPUT POSITIVE NAND GATE
NOTE: POSITIVE LOGIC $Y = \overline{AB}$

1820-0068



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

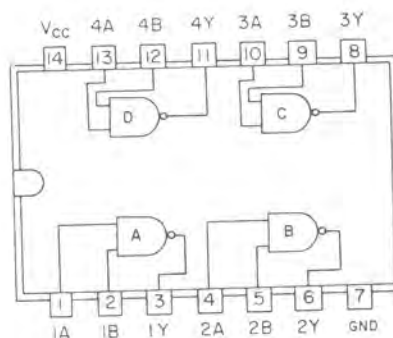
1820-0092



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

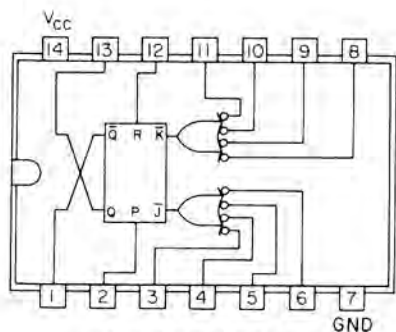
1820-0094



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
1	2	13
0	0	Q ⁿ
0	1	1
1	0	0
1	1	ND

ALL J-K INPUTS
ARE STATIC

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

$\bar{J}_D$	$\bar{K}_D$	Q ⁿ⁺¹
·	·	13
0	0	Q ⁿ
0	1	0
1	0	1
1	1	Q ⁿ

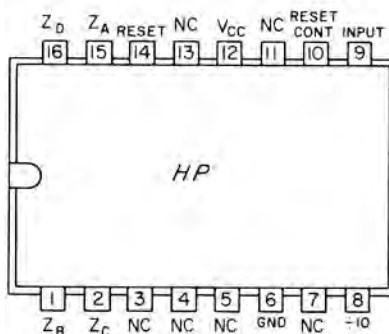
ALL OTHER J-K
INPUTS AND THE
R-S INPUTS ARE
AT A "0" LEVEL

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

$\bar{J}$	$\bar{K}$	C _D	Q ⁿ
·	·	·	13
0	0	0	Q ⁿ
0	0	1	Q ⁿ
0	1	1	1
1	0	1	0
1	1	1	Q ⁿ

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

1820-0117



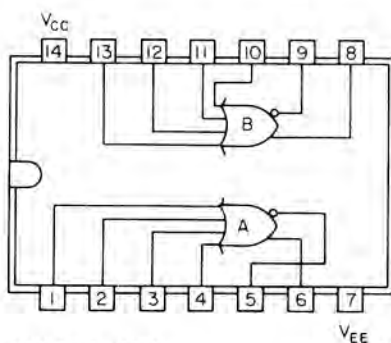
1820-0117, 0119, 0232
BLANKING DECADE COUNTER
NEGATIVE LOGIC 1 = LOW
0 = HIGH

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 B RESET PULSE	H	H	H	H
RESET CONTROL LOW B RESET PULSE	L	L	L	L

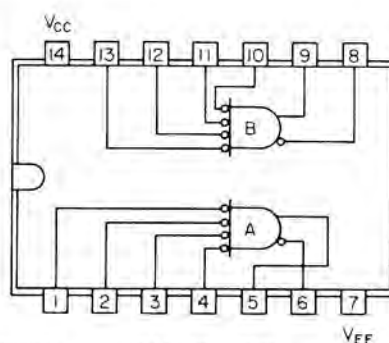
POSITIVE PULSE APPLIED TO RESET WILL
A. RESET A, B, C & D TO LOW IF RESET
CONTROL IS LOW.
B. RESET A, B, C & D TO HIGH IF RESET
CONTROL IS HIGH
C. THE -10 OUTPUT WILL ALWAYS BE
RESET TO HIGH STATE

1820-0142



POSITIVE LOGIC:
5 = 1+2+3+4
6 = 1+2+3+4

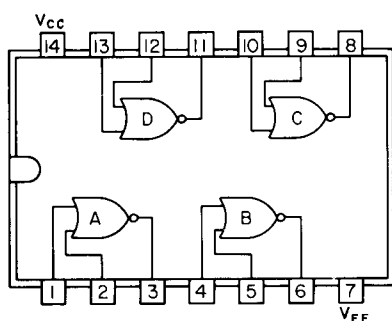
1820-0142(MC1004P)
ECL DUAL 4-INPUT 2-OR, 2-NOR



NEGATIVE LOGIC:
5 = 1·2·3·4
6 = 1·2·3·4

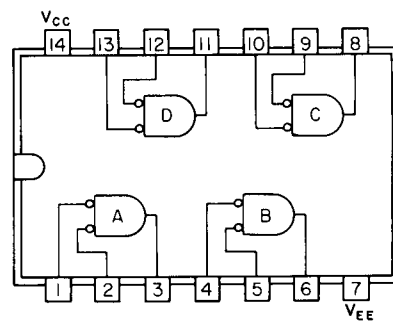
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0145



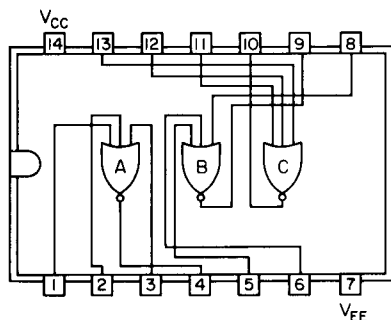
POSITIVE LOGIC:
 $3 = 1 + 2$

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



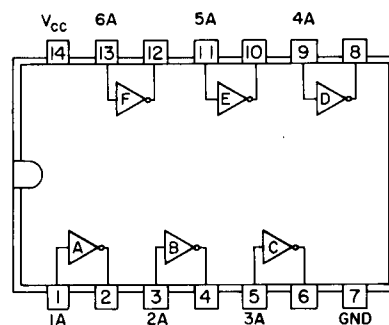
NEGATIVE LOGIC:
 $3 = 1 \cdot 2$

1820-0147

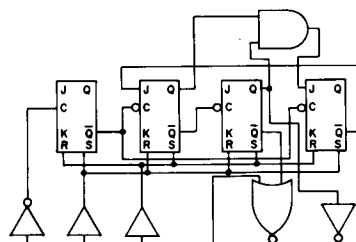
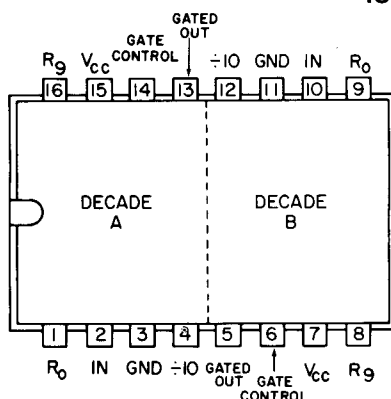


1820-0147 (MC1007P)
TRIPLE 3-INPUT GATES

1820-0174



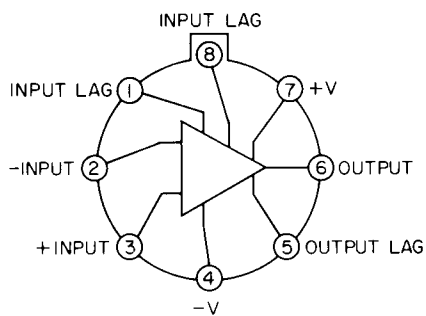
1820-0198 and 1820-0199



DECADE	CLOCK (COUNT) INPUT	RESET 0 INPUT	RESET 9 INPUT	GATE CONTROL	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	1820-0412	
2	1	16	14	13	4	15	3	1820-0413	
2	1	16	14	13	4	15	3	1820-0226	
2	1	16	14	13	4	15	3	1820-0227	

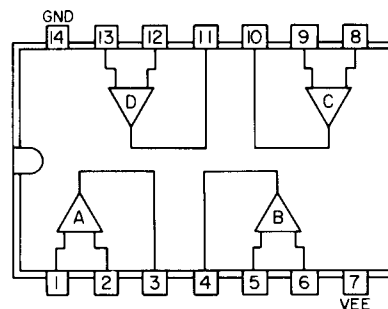
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0201



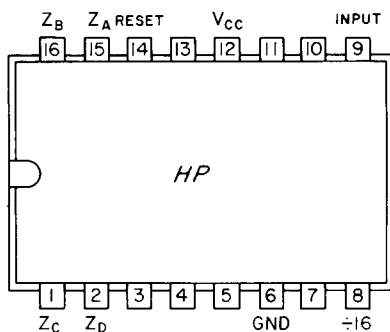
1820-0201 (MC1439G)
OPERATIONAL AMPLIFIER

1820-0212



1820-0212
QUADRUPLE LINE RECEIVER

1820-0209



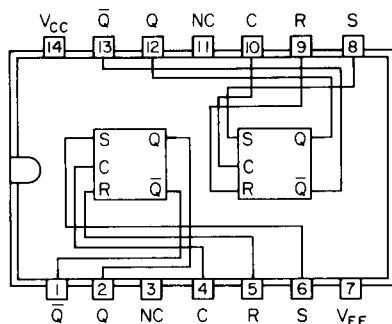
1820-0209
DIVIDE BY 16 COUNTER
NEGATIVE LOGIC 1=LOW
0=HIGH

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



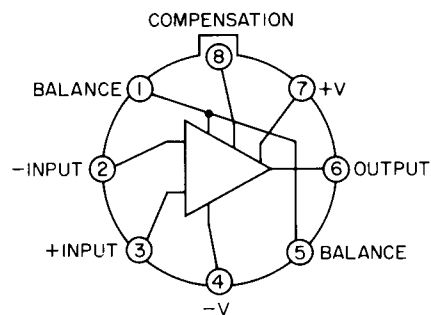
1820-0213 (MC1014P)
DUAL RS FF

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

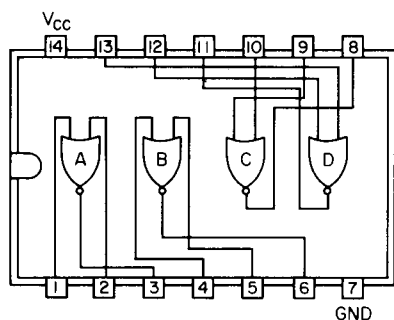
1820-0223



1820-0223 (LM 301A)
OPERATIONAL AMPLIFIER

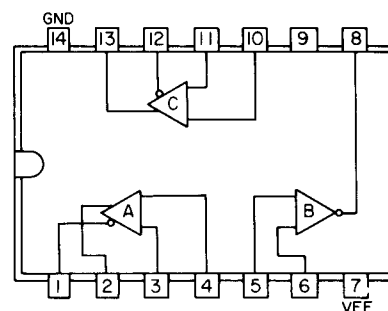
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0238



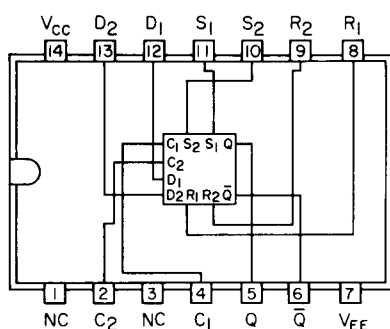
1820-0238 (MC1810P)
QUAD 2-INPUT NOR GATES

1820-0253



1820-0253
TRIPLE DIFFERENTIAL AMPLIFIER

1820-0272



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

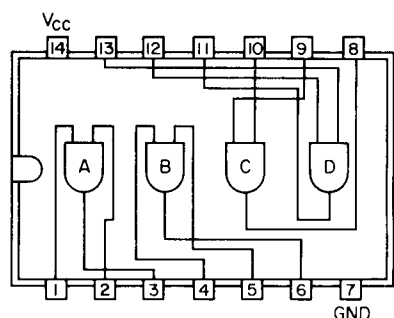
CLOCKED TRUTH TABLE				
	D	C	Q^{n+1}	$\bar{Q}^{n+1}$
PIN No.	12 OR 13	2 OR 4	5	6
	0	0	Q^n	$\bar{Q}^n$
	1	0	Q^n	$\bar{Q}^n$
	0	1*	0	1
	1	1*	1	0

*A "1" 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.

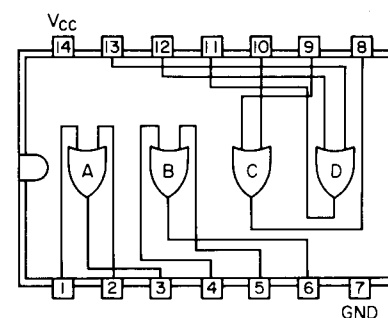
N.D. = NOT DEFINED

1820-0273



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

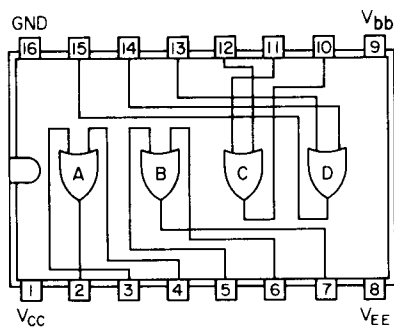
1820-0274



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

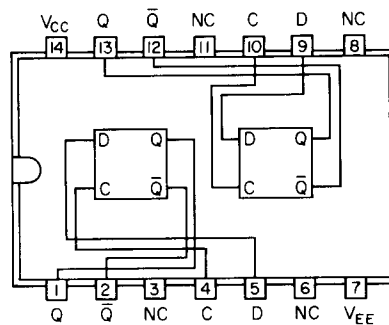
Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0275



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

1820-0276

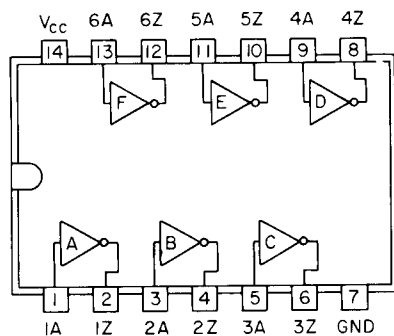


TRUTH TABLE

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

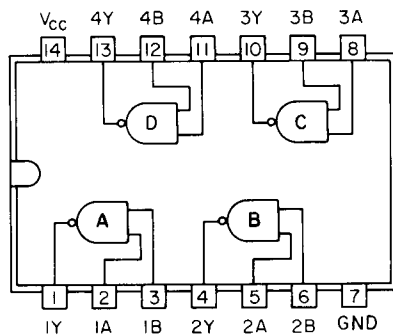
1820-0276 (MC1033P)
DUAL RS FF

1820-0307



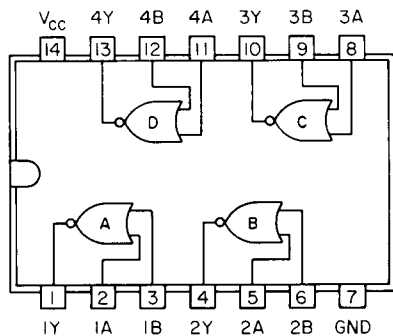
1820-0307 (MC1027D)
HEX INVERTER

1820-0327



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

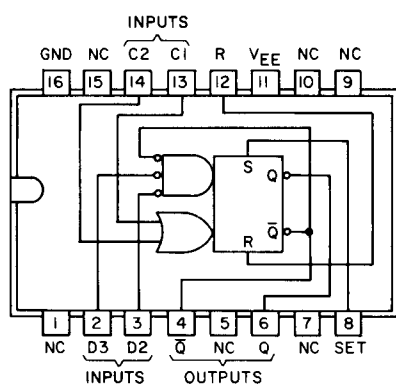
1820-0328



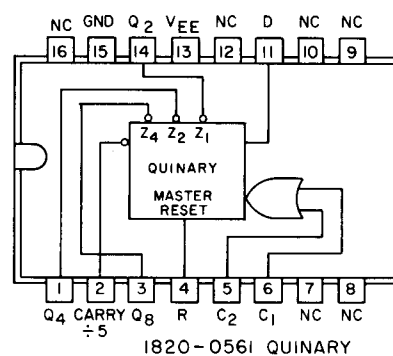
1820-0328 (SN7402N)
QUAD 2-INPUT NOR GATE
POSITIVE LOGIC: $Y = \overline{A+B}$

Figure 8-2. Integrated Circuit Diagrams (Continued)

1820-0558



1820-0561



1858-0004

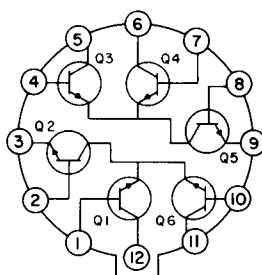


Figure 8-3. Model 5327B Front and Rear Panels

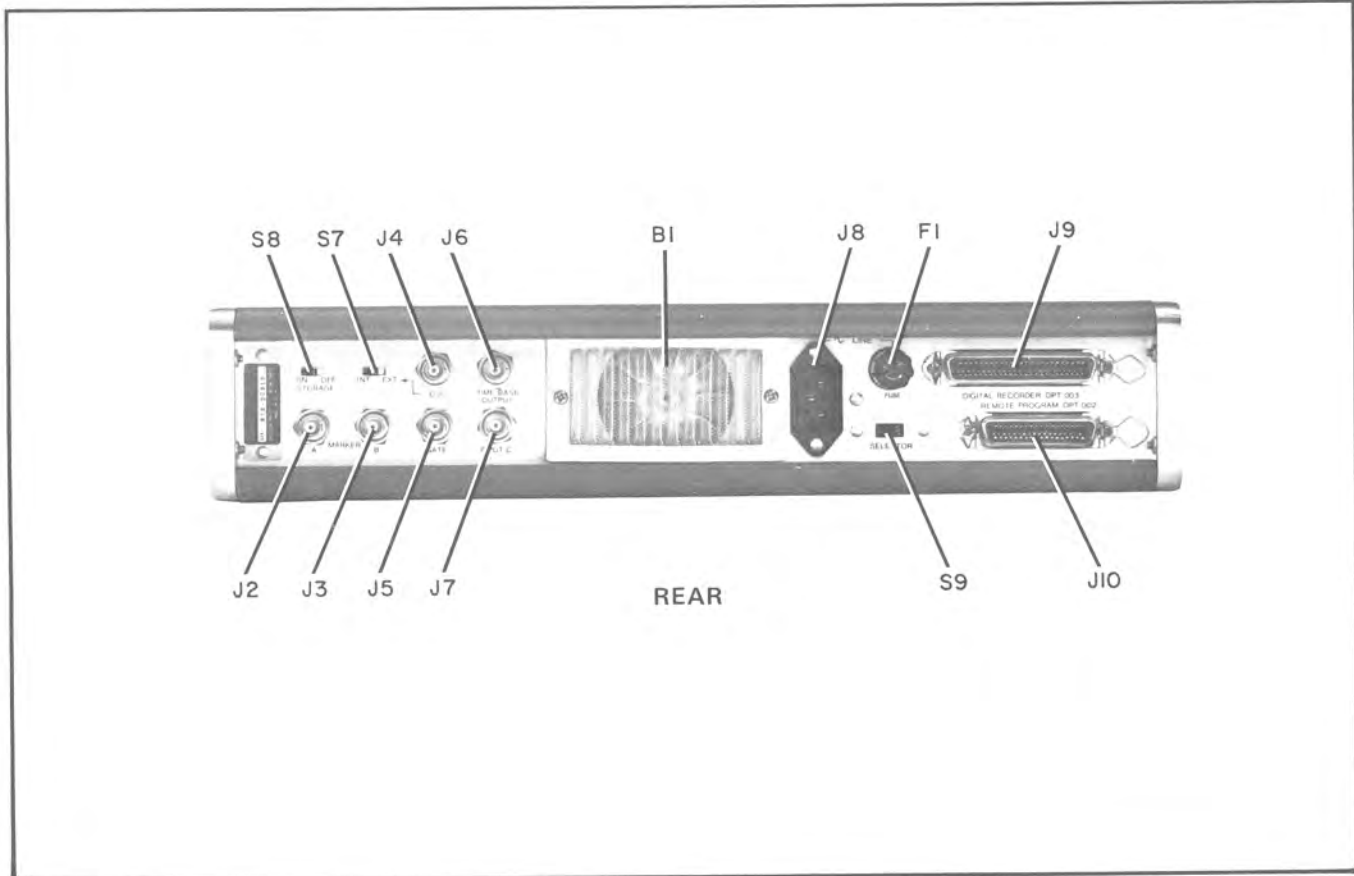
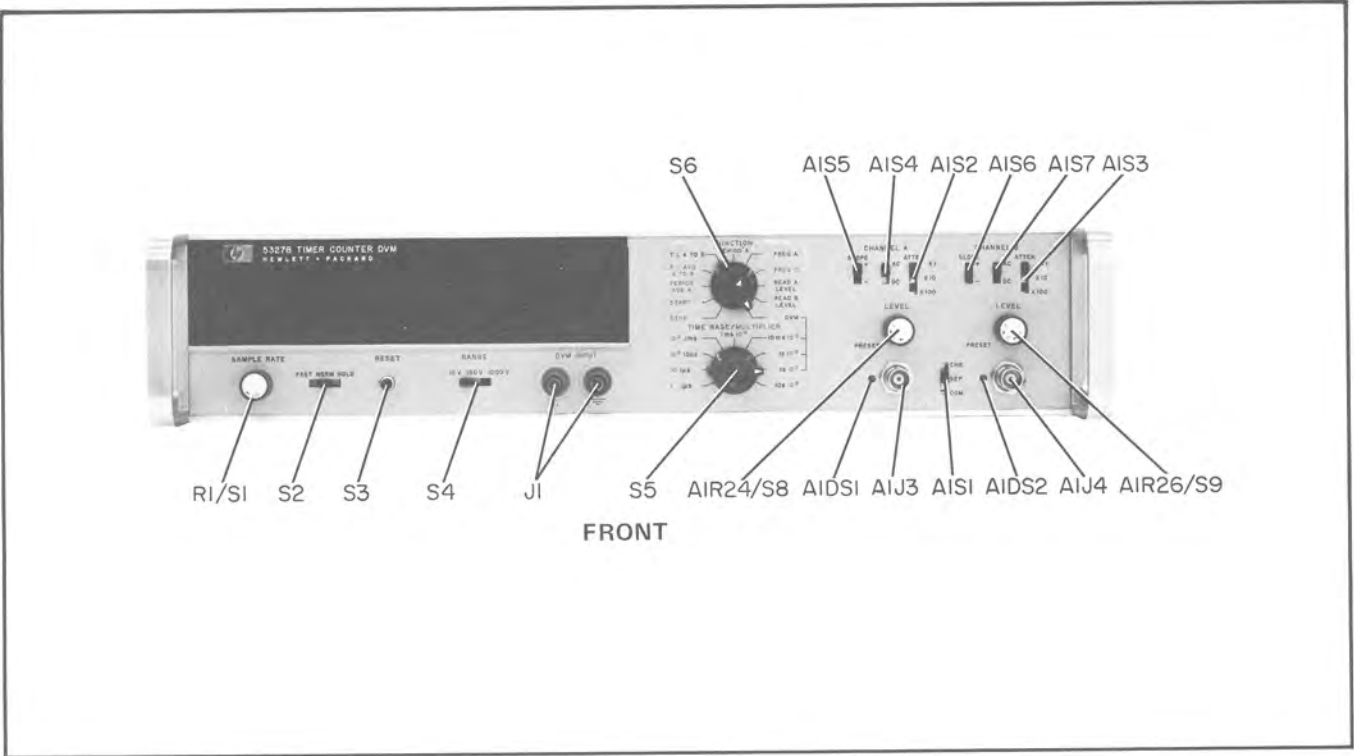
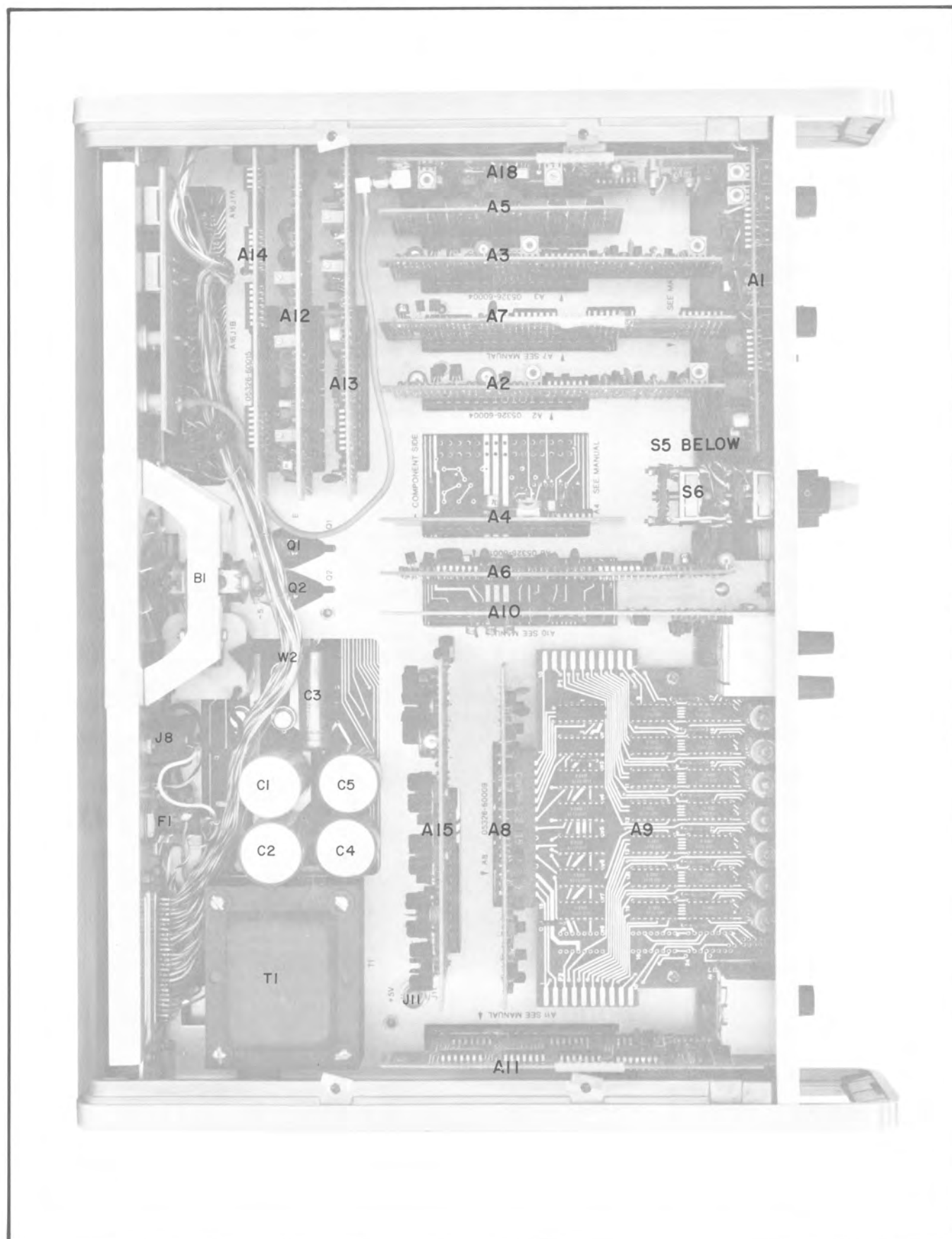


Figure 8-4. Model 5327B Top Internal View



A1 ATTENUATOR OPERATION

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

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

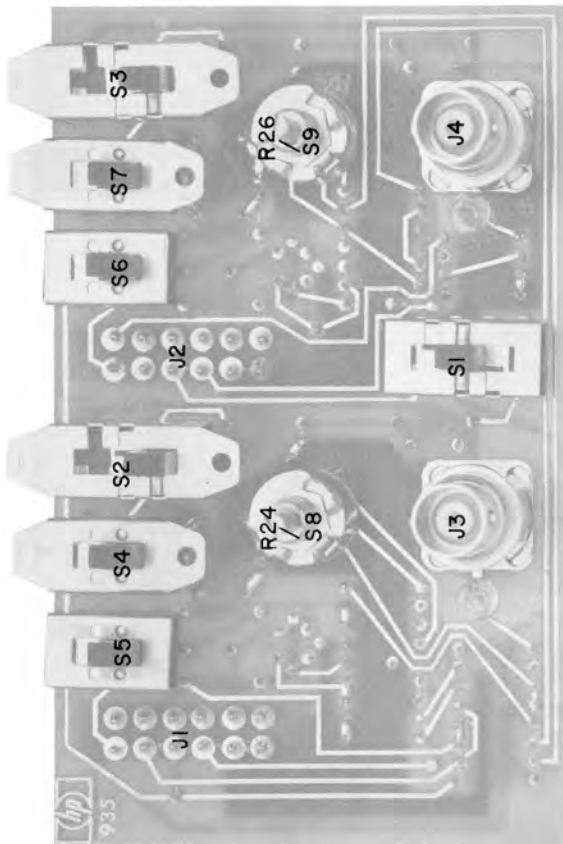
Q1A and Q1B form a differential amplifier connected as source followers. The outputs are fed to A2 via pins 5 and 6 of J1. LEVEL potentiometer R24 determines the trigger level on Q1B gate. The trigger level can be preset to zero volts or varied from -3 to +3 volts; or with the LEVEL control set to PRESET,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

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

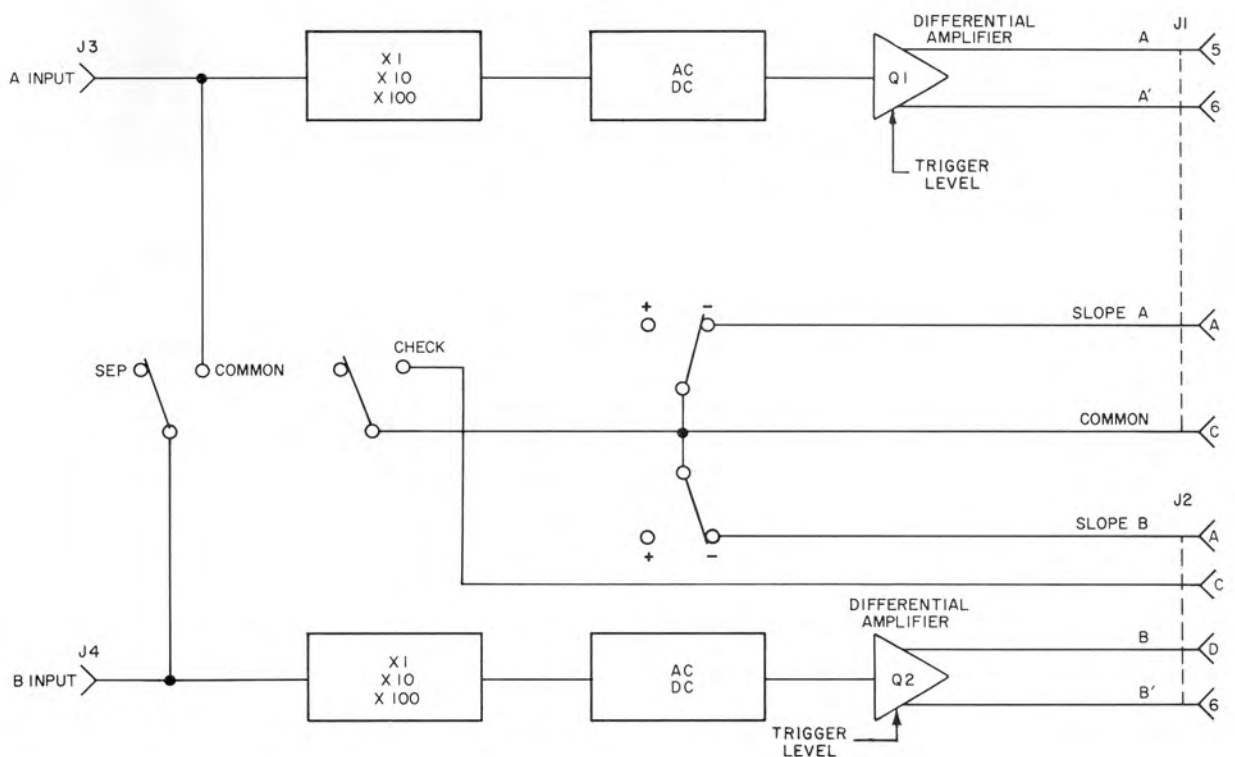
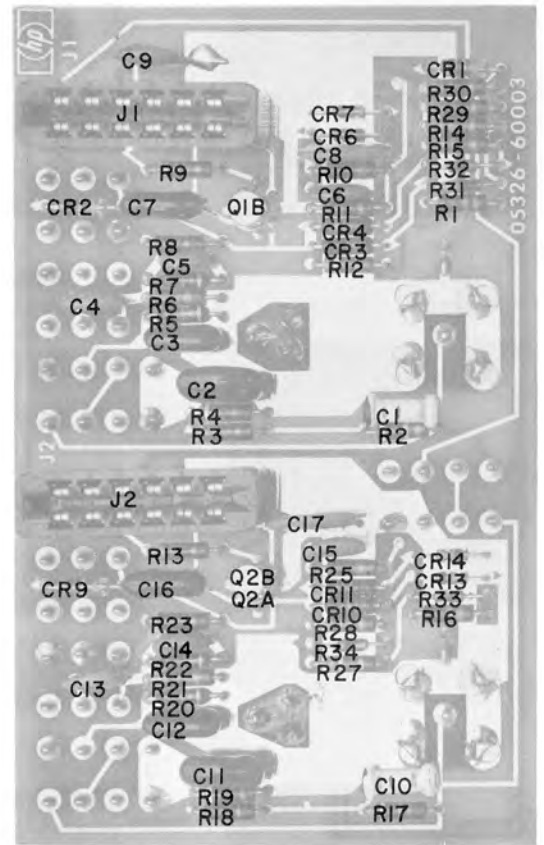
COM-SEP-CHK switch S1 connects inputs A and B in parallel when set to COM and grounds J2(C) via CR1 for the check mode.

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

TOP

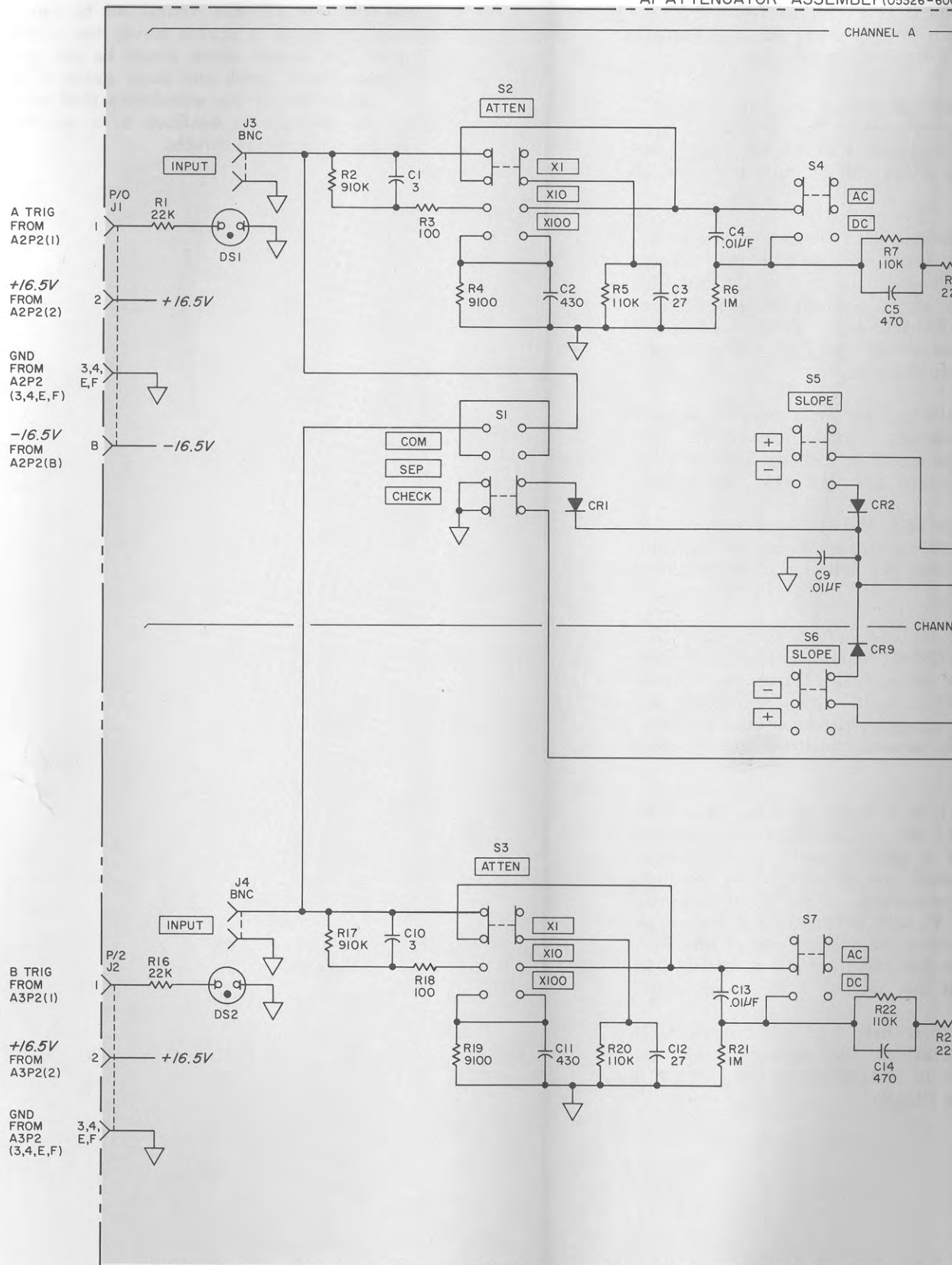


BOTTOM

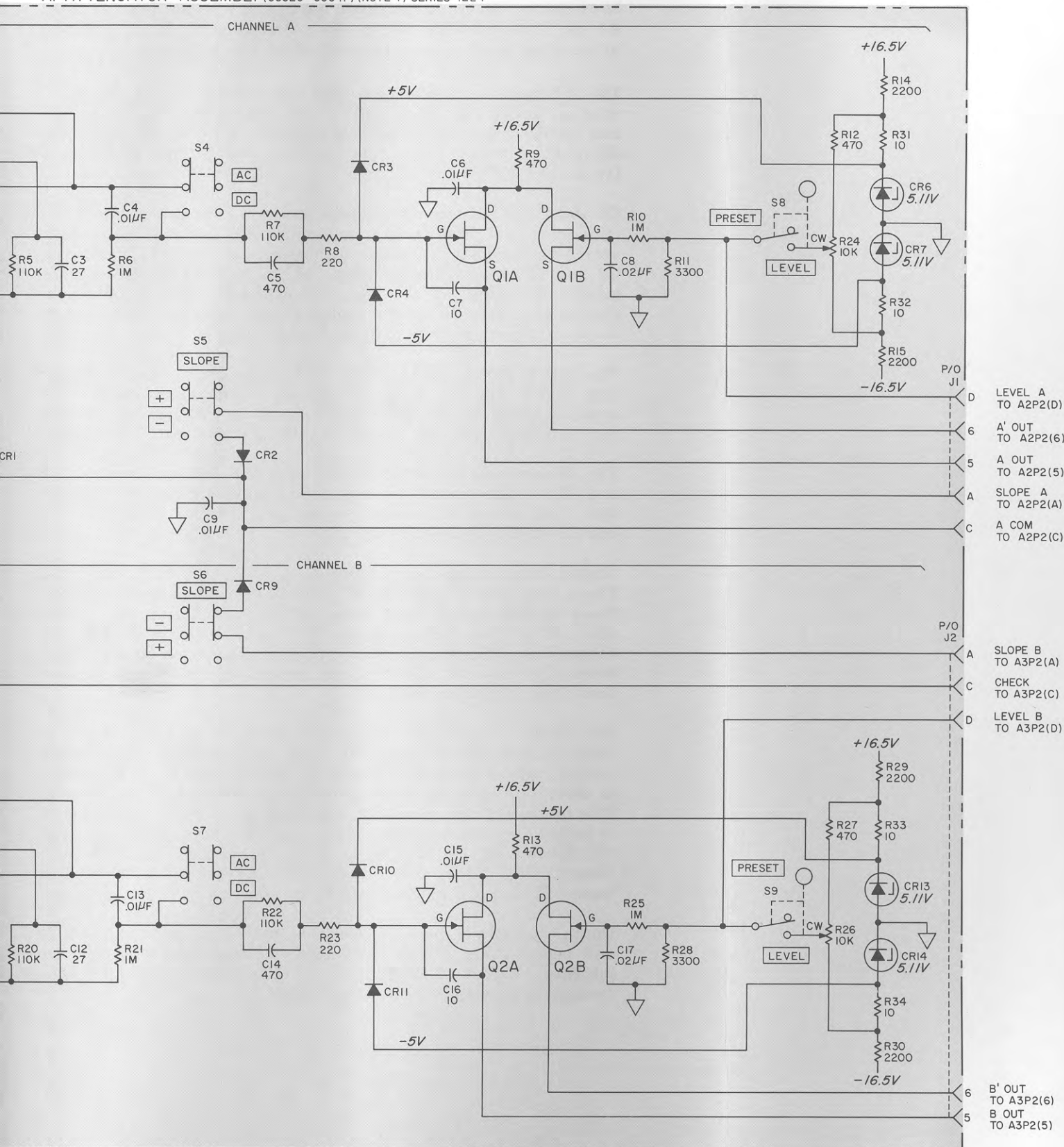


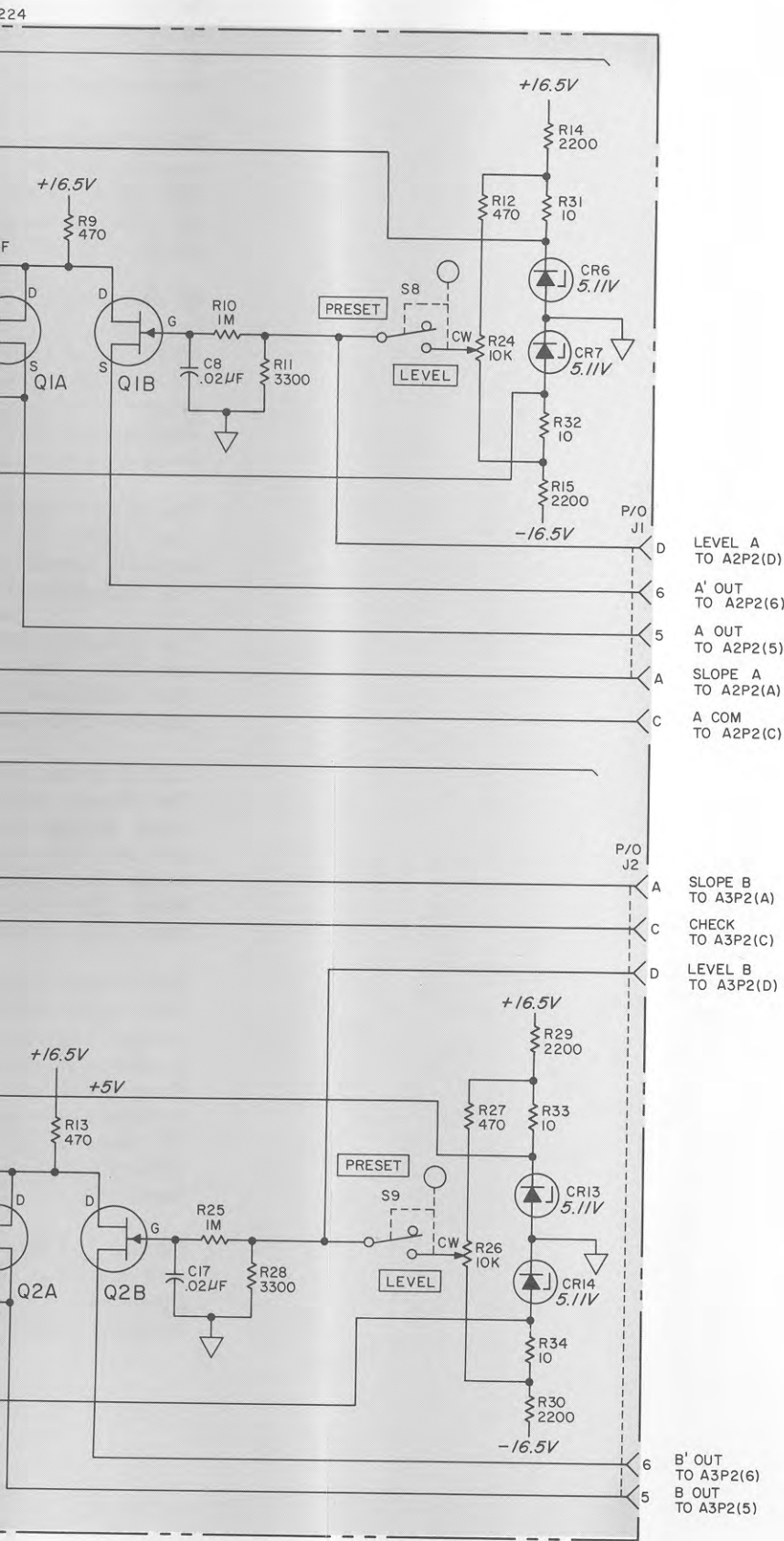
AI ATTENUATOR ASSEMBLY (05326-60)

CHANNEL A



AI ATTENUATOR ASSEMBLY (05326-60047) (NOTE 1) SERIES 1224





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
CI-17 CR1-4,6,7, 9-11,13,14 DS1,2 J1-4 Q1,2 R1-34 SI-9

TABLE OF ACTIVE COMPONENTS

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

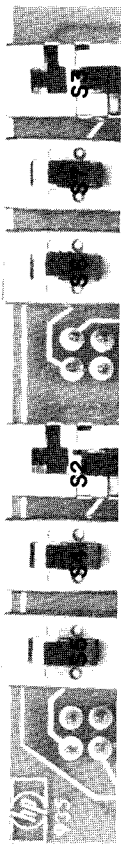
05326-D-1A

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

Figure 8-5. A1 Attenuator Assembly

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.



J3
A INPUT

SEP

J4
B INPUT

Figure 8-5
A1 ATTENUATOR ASSEMBLY
(See Page 8-13)

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.

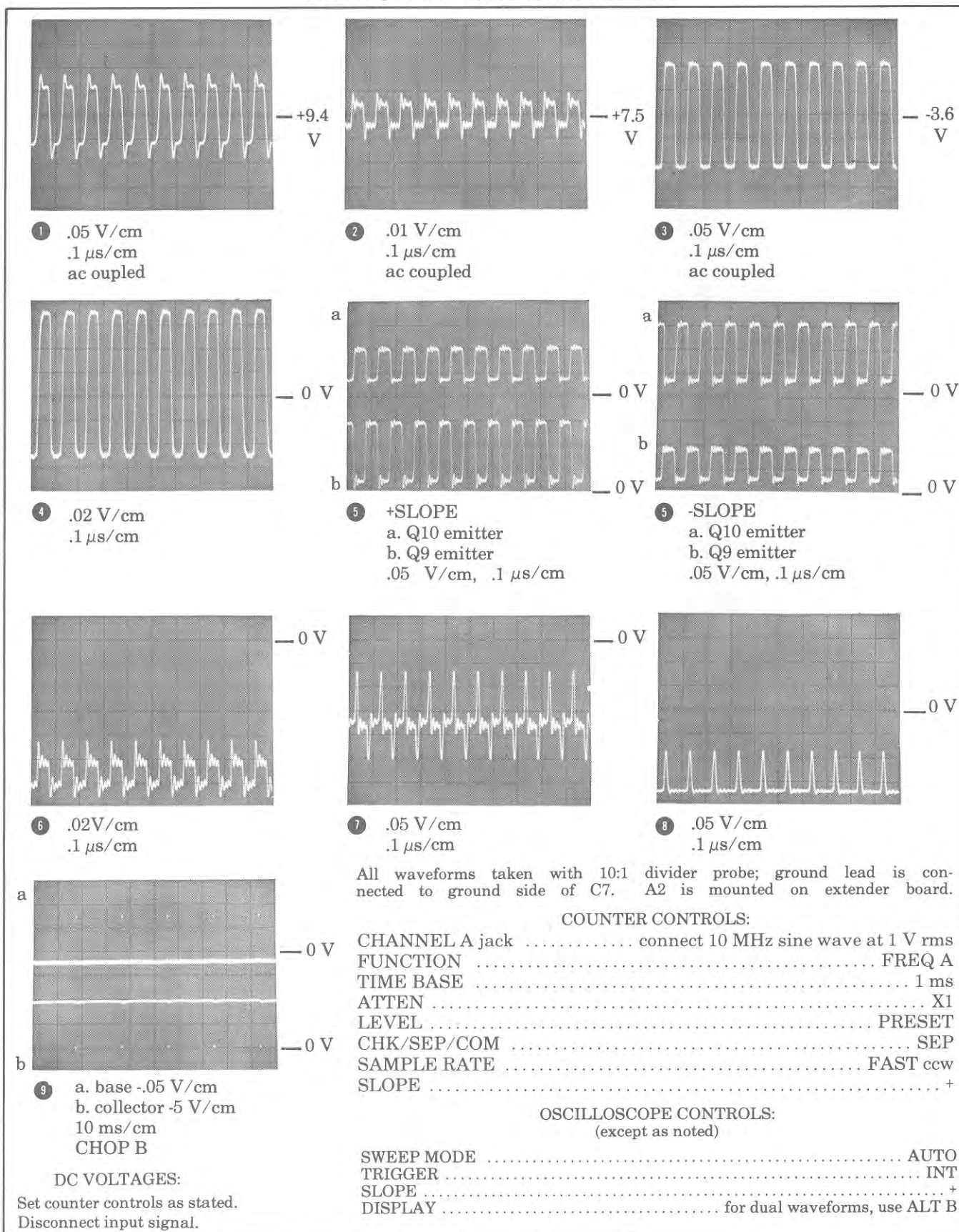
The differentiator circuit consists of Q13 and feedback network L8 and R32. The circuit develops 10 ns pulses at the collector of Q13. CR3 and CR4 bias Q13 so that the collector circuit is compatible with ECL output driver U2B.

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.

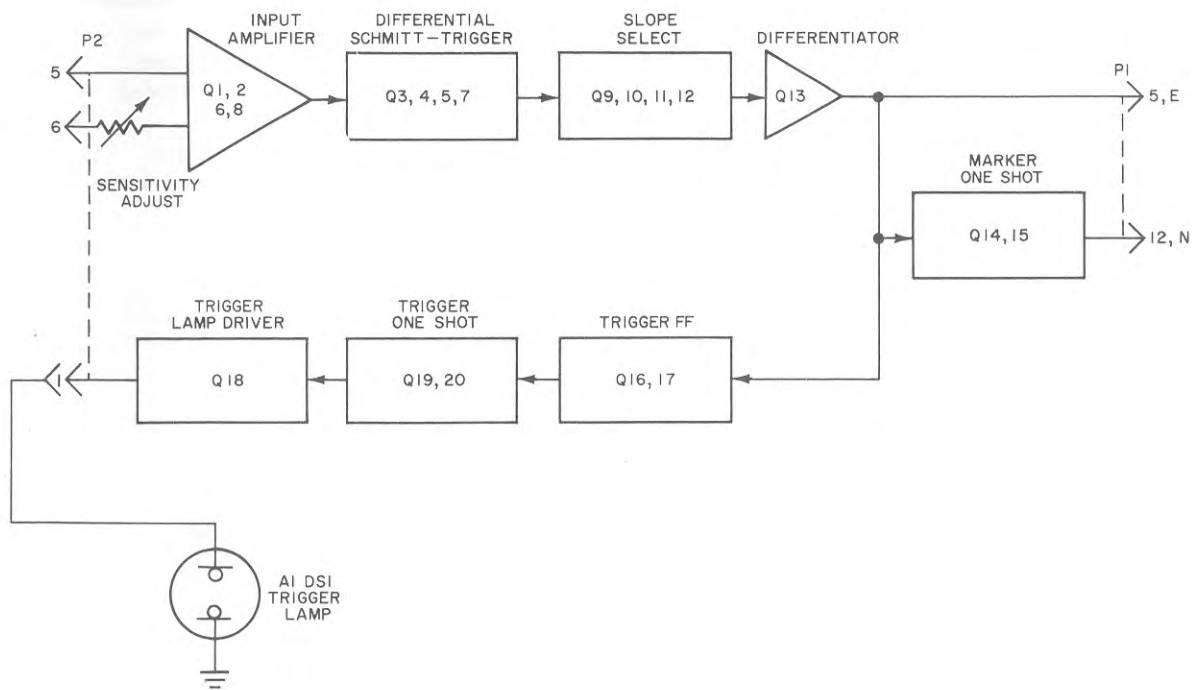
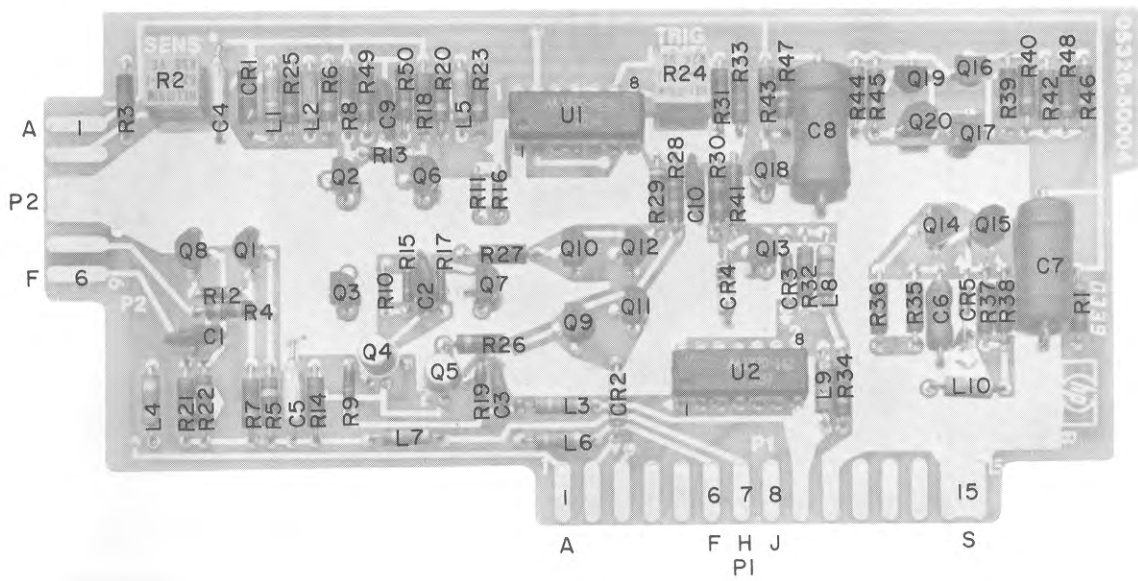
The marker circuit, Q15 and Q14, is a pulse stretcher that provides a low marker output at P1(12, N). When the input amplifier circuits trigger, U2B(8) provides a positive spike to Q14 base to drive Q14 collector below ground and allow CR5 to conduct. This makes the charge on C6 more positive. When U2B(8) 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.

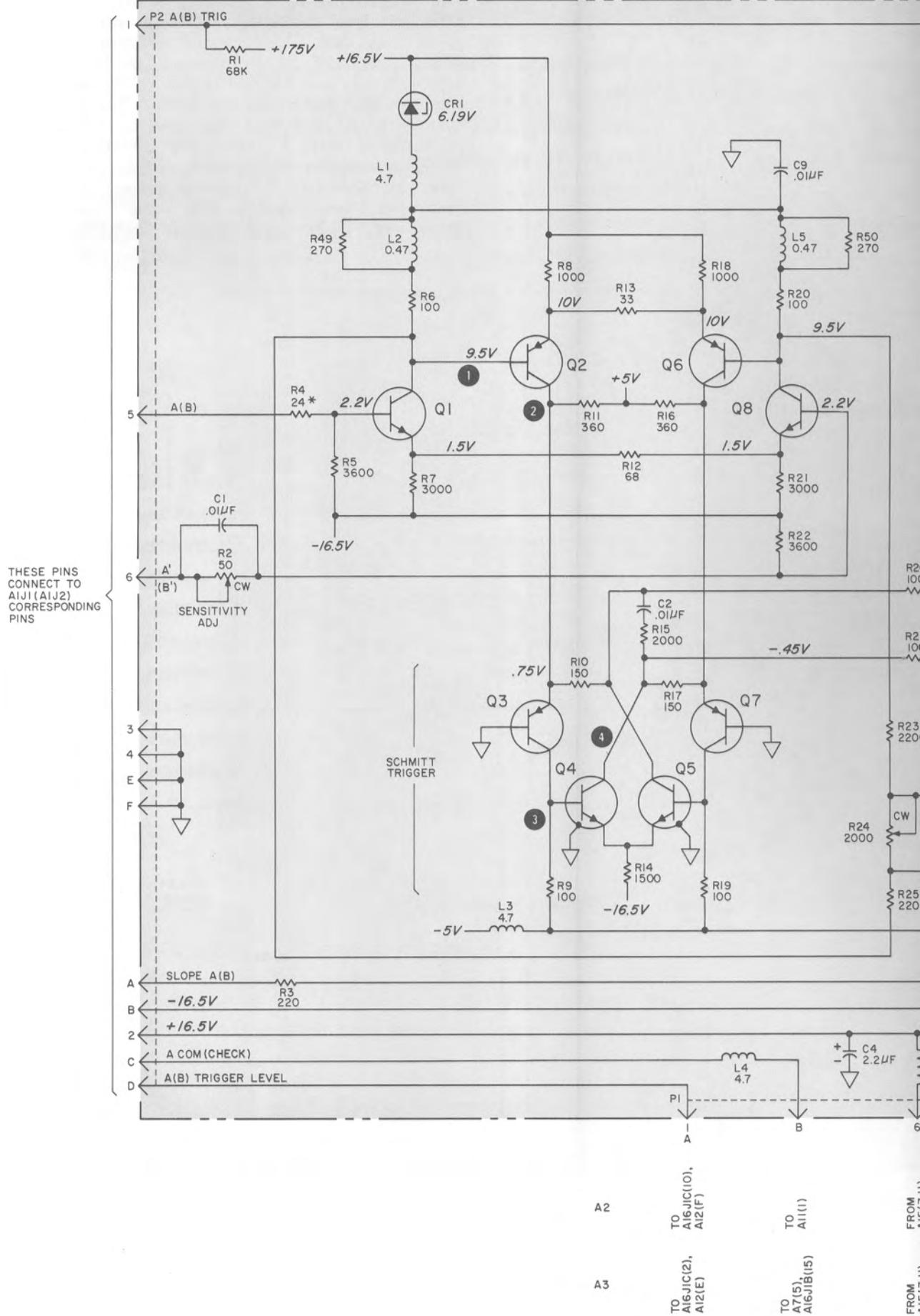
During the check mode, A1P1(C) is held high to disable U2B and enable U2A. With U2B disabled, the marker pulses are inhibited. With U2A enabled, the 10 MHz check signal at P1(4,D) connects to the amplifier output line P1(5,E).

Part of Figure 8-6. Input Amplifier Assembly

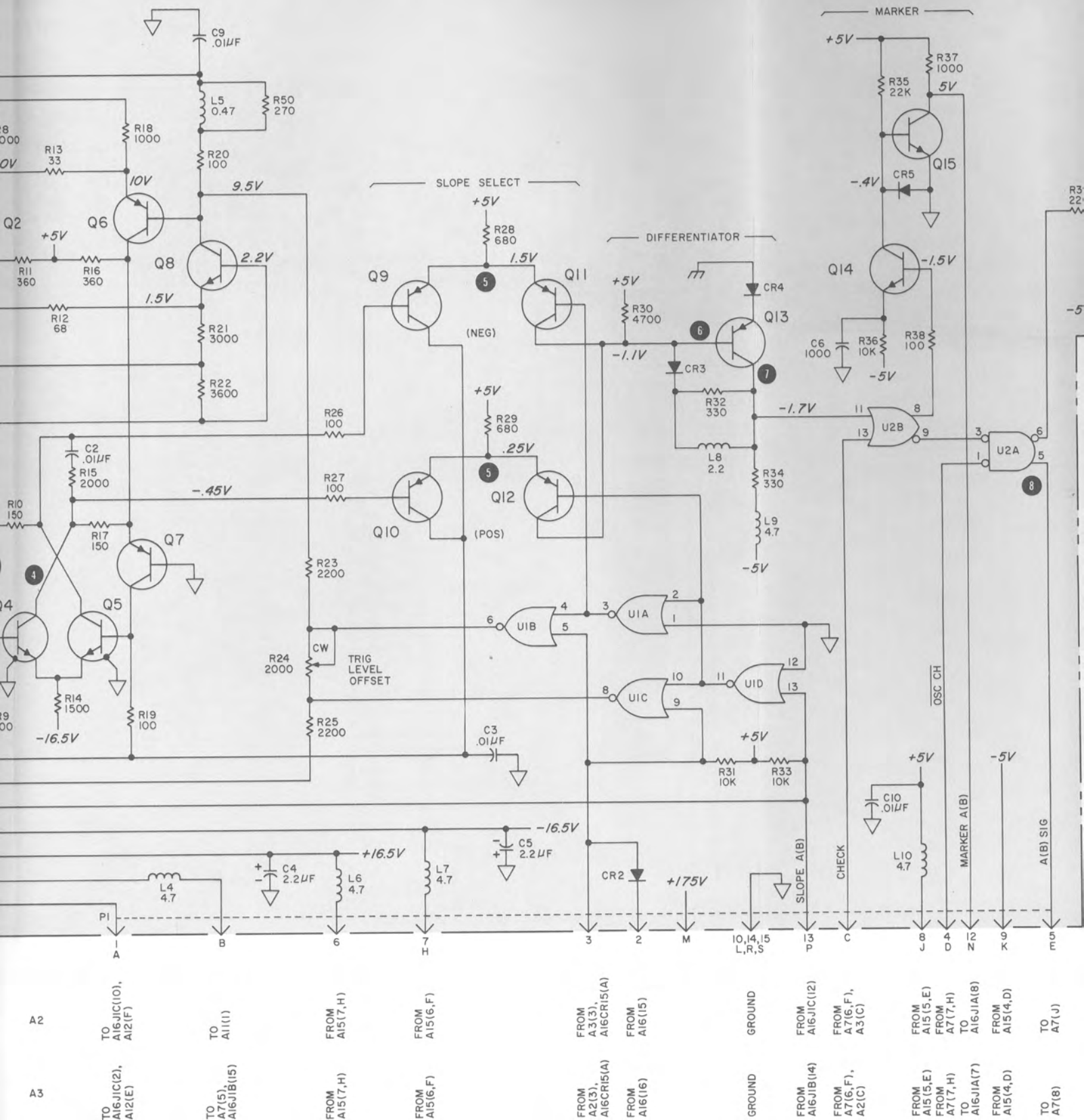


MORE DATA UNDER FOLD





A2 (A3) INPUT AMPLIFIER ASSEMBLY (05326-60004) (NOTE 1) SERIES 972



Model 5326/27B Schematic Diagrams

R ASSEMBLY (05326-60004) (NOTE 1) SERIES 972

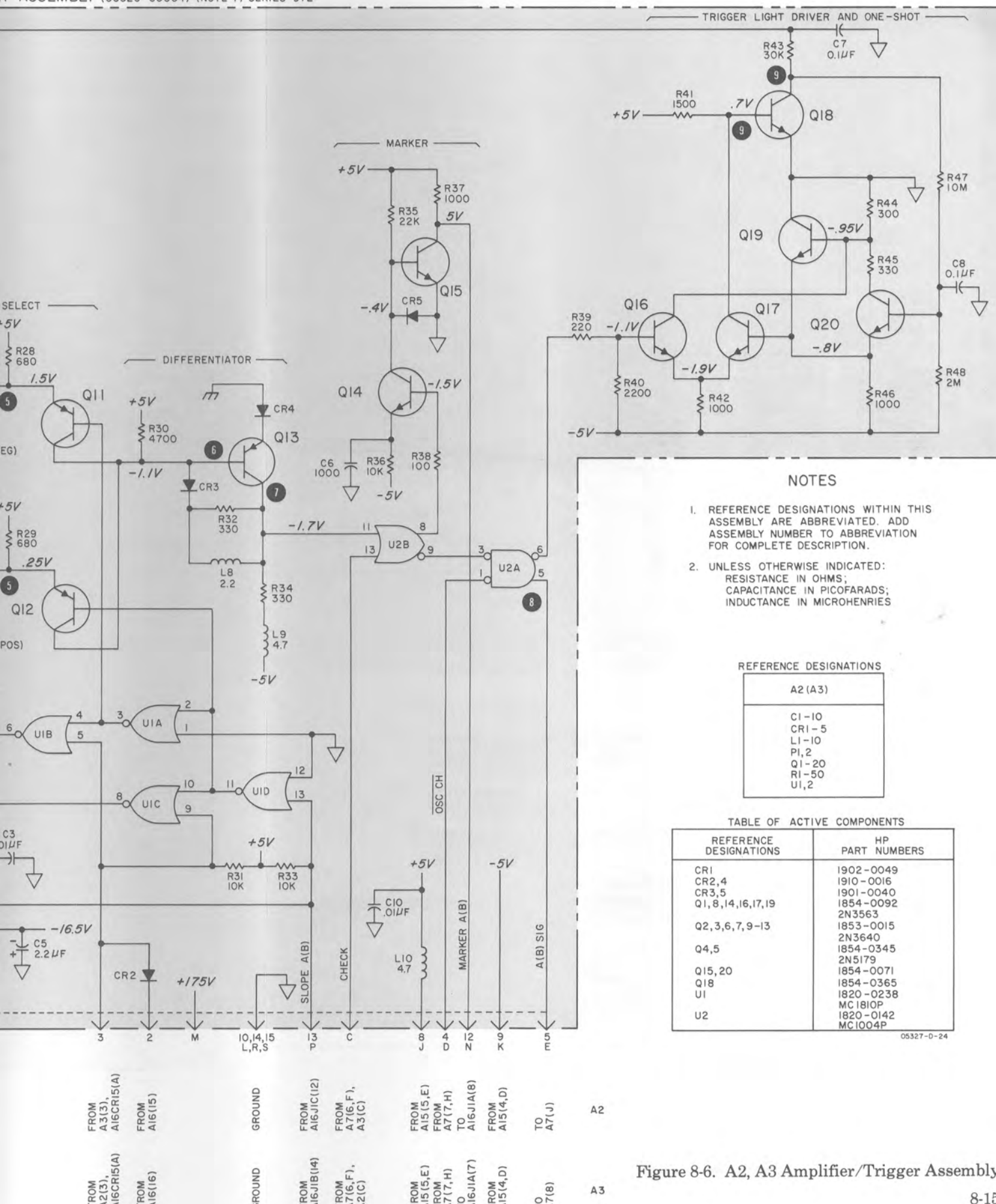
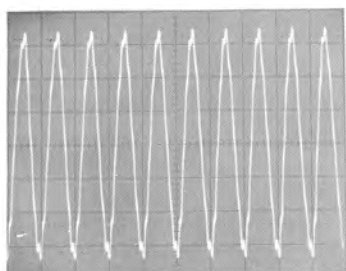
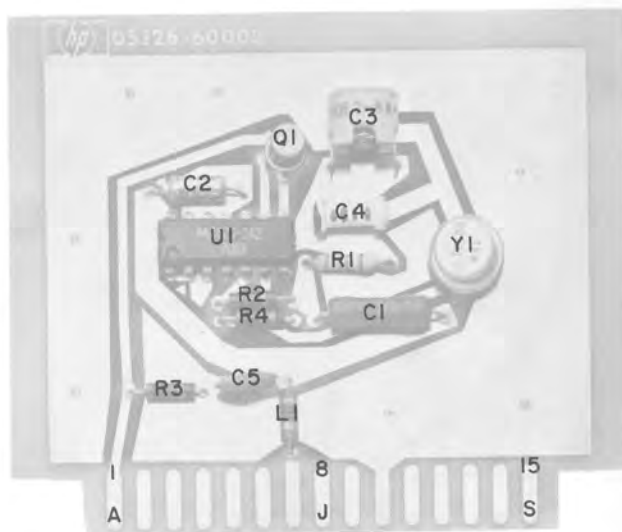
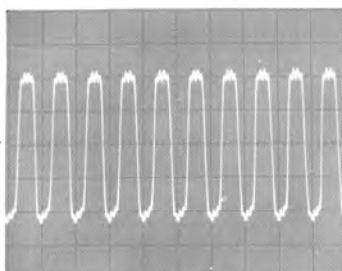


Figure 8-6. A2, A3 Amplifier/Trigger Assembly

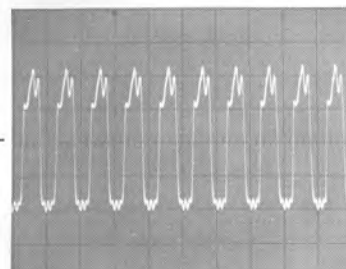
Part of Figure 8-7. A4 Oscillator Assembly



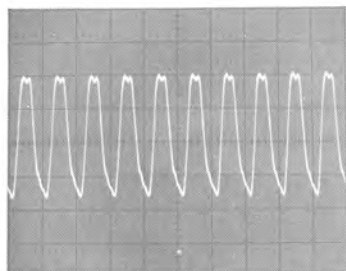
1 .01 V/cm
.1 μs/cm
ac coupled



2 .02 V/cm
.1 μs/cm
ac coupled



3 .02 V/cm
.1 μs/cm
ac coupled

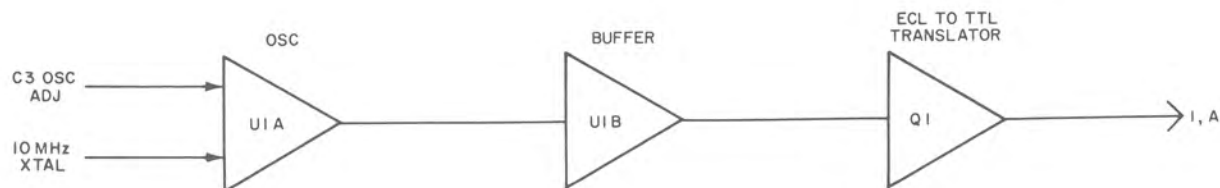


4 .1 V/cm
.1 μs/cm

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

COUNTER CONTROLS:

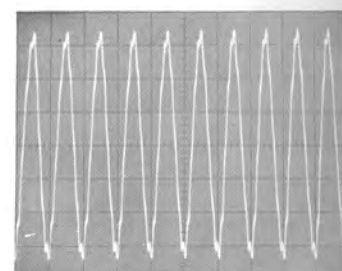
INT-EXT (rear panel) INT



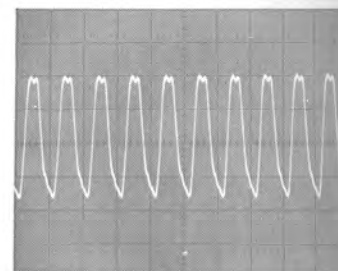
A4 OSCILLATOR OPERATION

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.

Model 5326/27B
Schematic Diagrams



1 .01 V/cm
.1 μ s/cm
ac coupled



4 .1 V/cm
.1 μ s/cm

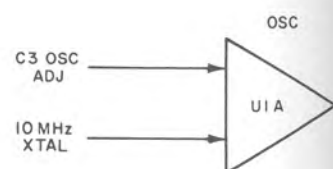
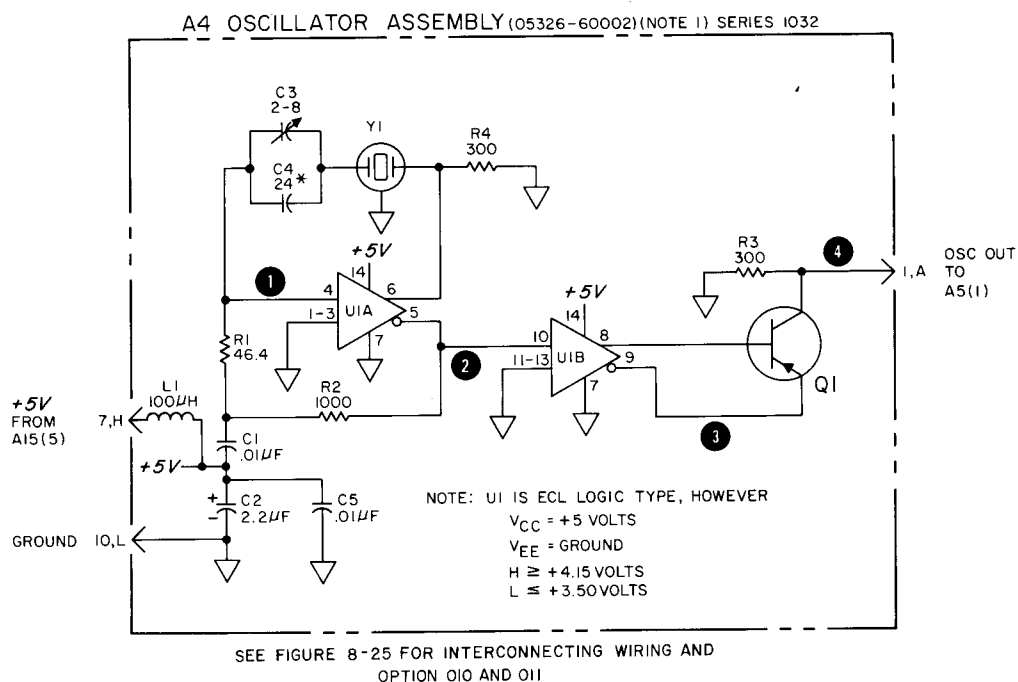


Figure 8-6
A2, A3 AMPLIFIER/TRIGGER ASSEMBLY

(See Page 8-15)



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 PICO FARADS;
 INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A4
C1-5 L1 Q1 R1-4 U1 Y1

TABLE OF ACTIVE COMPONENTS

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

05327-D-6

Figure 8-7. A4 Oscillator Assembly

Part of Figure 8-8. Time Base Control Assembly

A5 TIME BASE OPERATION

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

When a particular decade receives a gate-enable signal the corresponding gated output line is enabled. For example, if S5 is set to .1 second U1(6) is grounded. This gates the divided signal out on U1(5). The gated outputs are connected together on a common line to C5. C5 differentiates the high to low transitions into approximately 100 ns pulses at U5C(8). When S5 is set to .1 μ s, 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

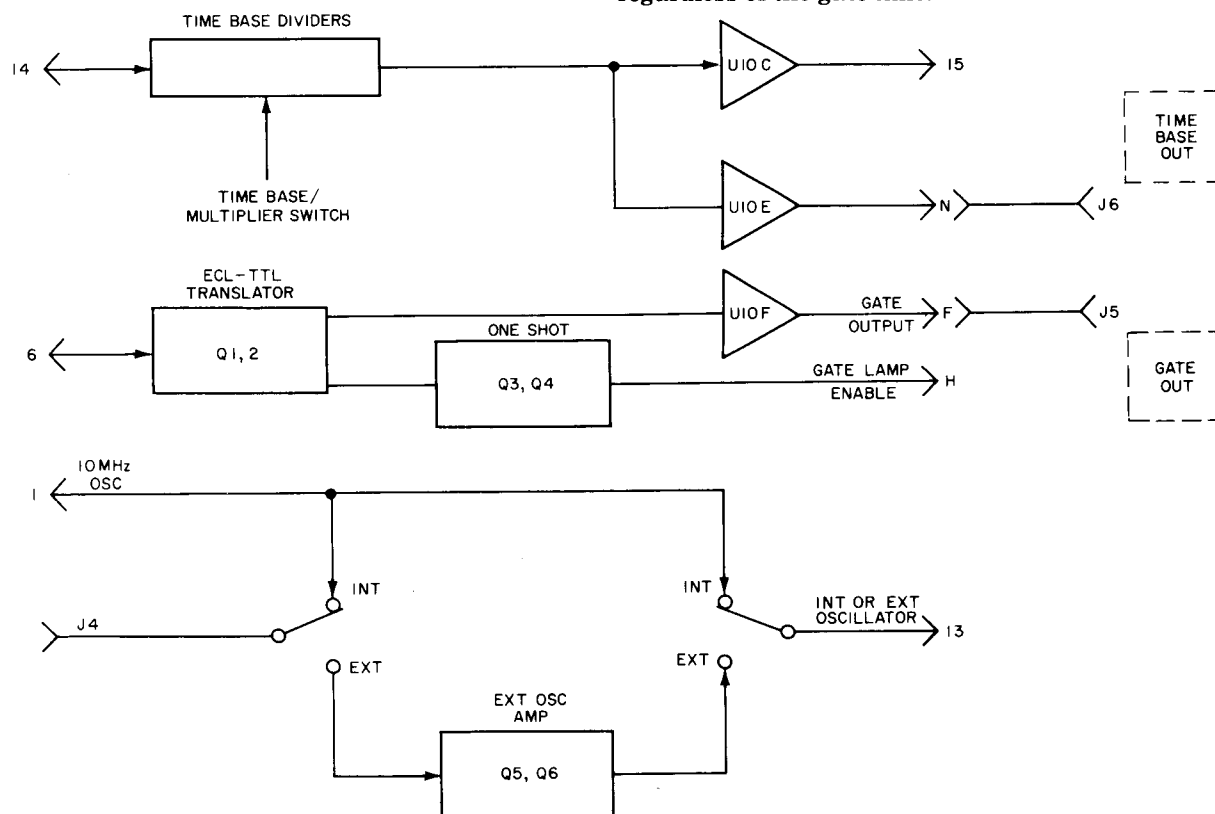
at U10F(12) and routed to the GATE OUT jack J5.

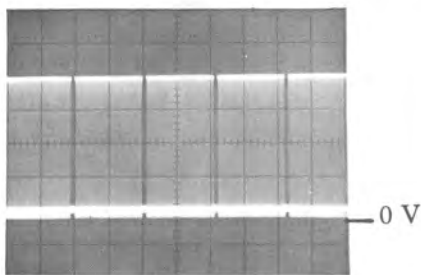
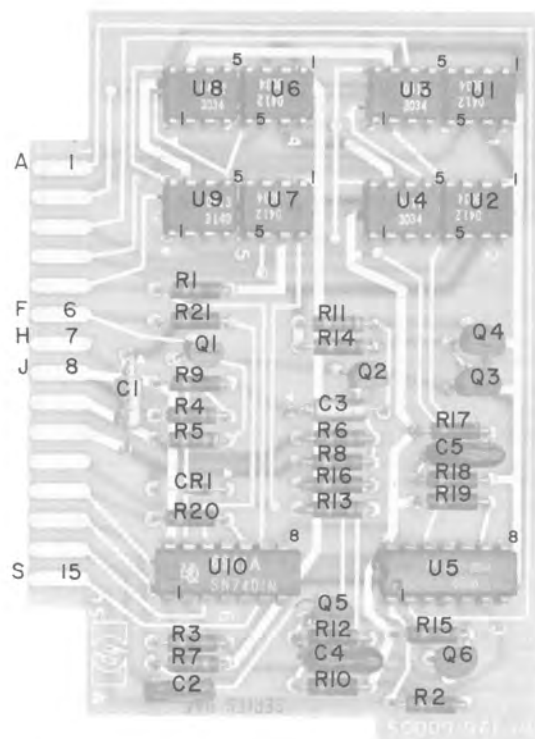
U5A and U5B select either the internal or external oscillator signal. When S7 is set to EXT, the internal oscillator signal is inhibited and the external oscillator signal passes through Schmitt trigger Q5 and Q6 to U5B and XA5(13).

A5 TROUBLESHOOTING

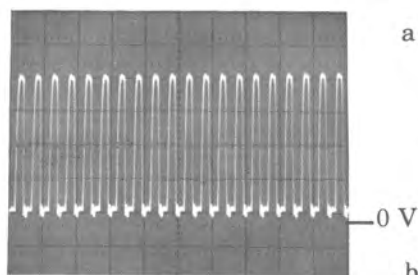
When troubleshooting the Time Base Dividers, place the FUNCTION switch to START and CHK/SEP/COM to CHK. Step the TIME BASE switch through each position and note the counter's display. When the counter stops totalizing, check for a low on pin 6 of the selected decade. If the counter does not totalize 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 Selector, it is differentiated by C5 and R18. The produces extremely sharp pulses, which are best observed when the gate time is 0.1 μ s (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.

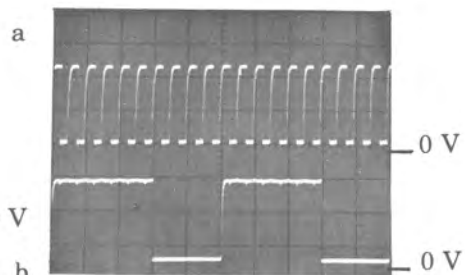




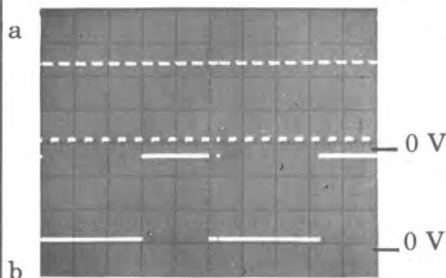
1 .1 V/cm
.5 ms/cm



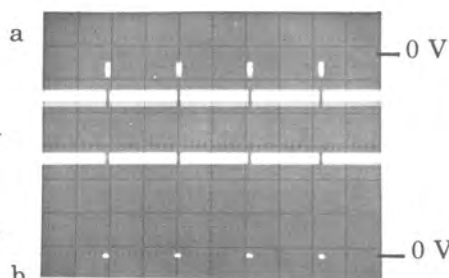
2 .1 V/cm
.2 μ s/cm



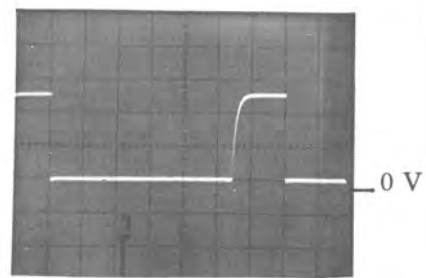
3 a. U7(2) .2 V/cm
b. U7(4) 2 μ s/cm



4 a. U2(2) .2 V/cm
b. U2(5) .2 ms/cm



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



6 .2 V/cm
10 ms/cm
SAMPLE RATE - NORM
SWEEP MODE - NORM

COUNTER CONTROLS:

(except as noted)

Use settings of A2 Assembly

DC VOLTAGES:

Set counter controls as stated.

Disconnect input signal. Push RESET.

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

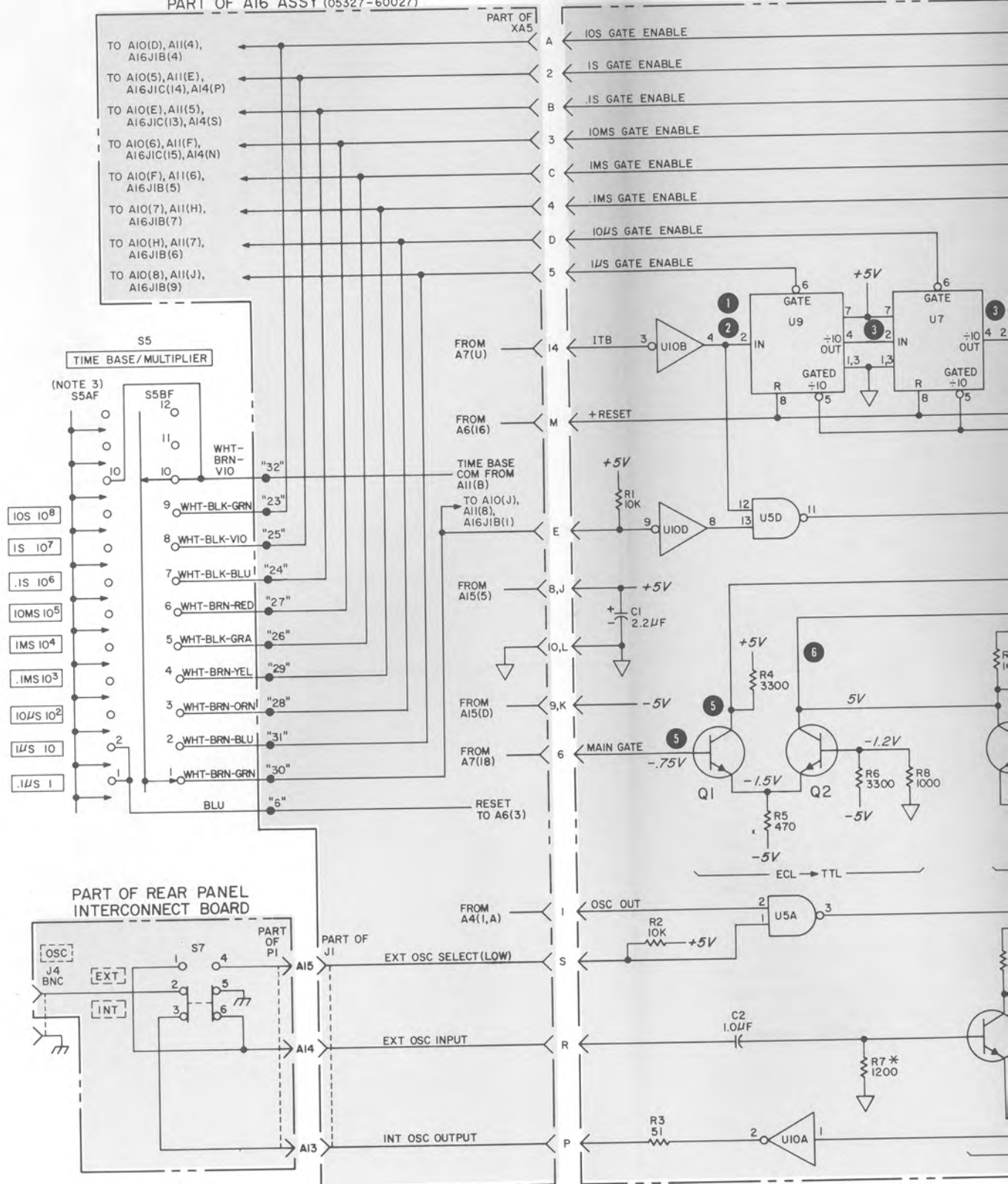
OSCILLOSCOPE CONTROLS:

(except as noted)

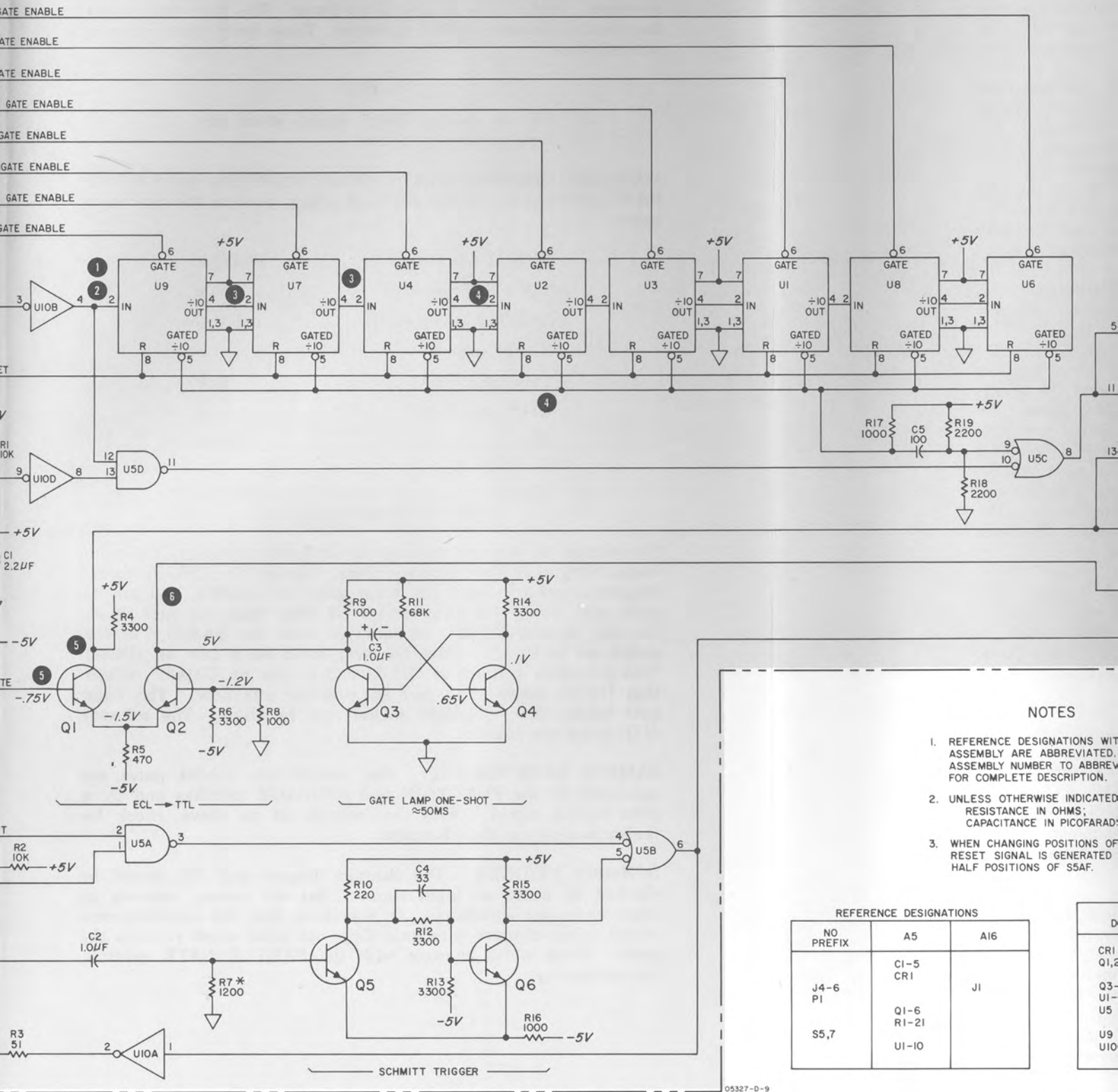
Use settings of A2 Assembly

PART OF A16 ASSY (05327-60027)

A5



A5 TIME BASE CONTROL ASSEMBLY (05326-60005) (NOTE 1) SERIES 972 REV A





Part of Figure 8-9. A6 Sample Rate Assembly

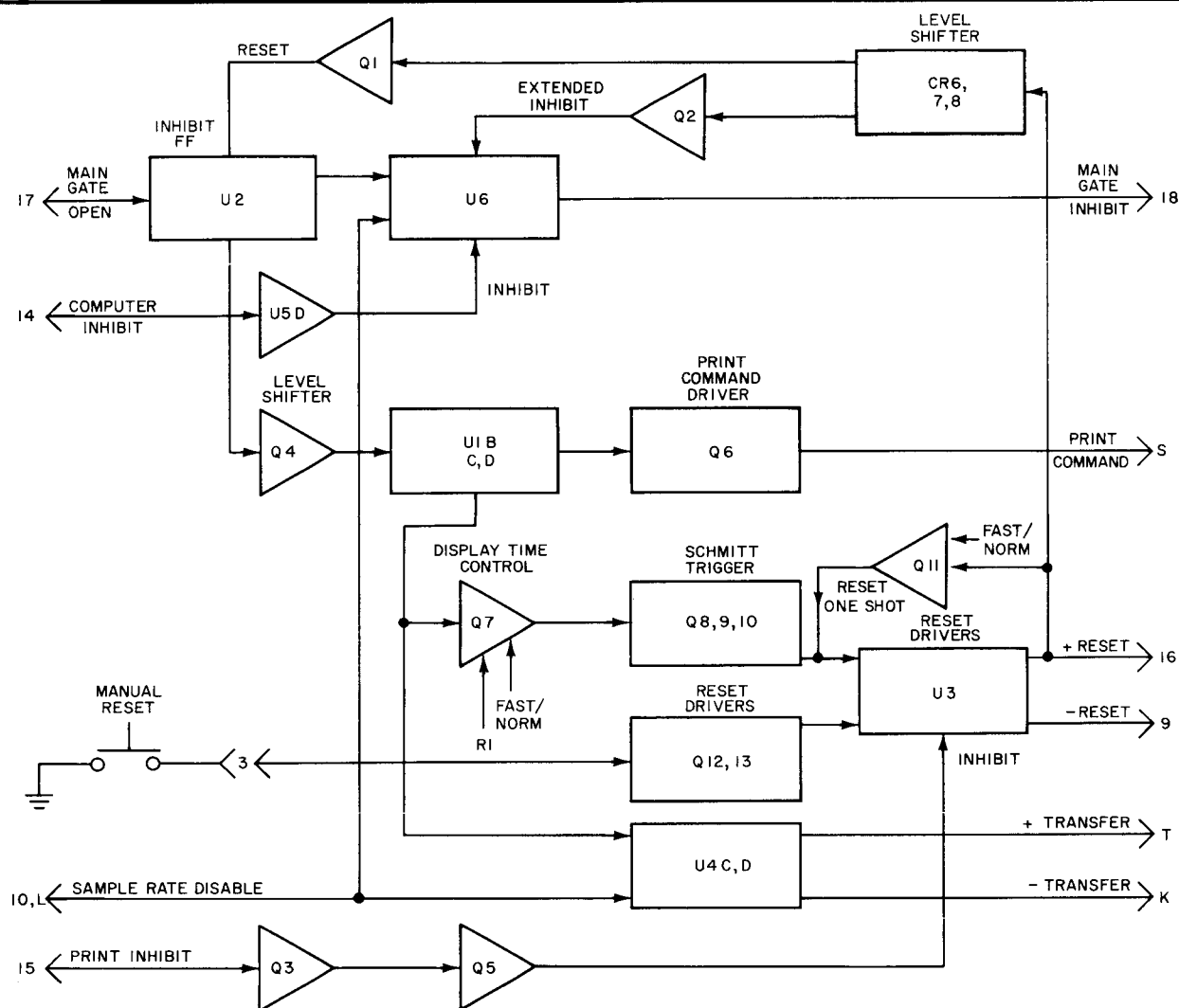


TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2,5,7,8,10,11 CR3,4,9 Q1-3,5,6,8-10,12,13 Q4,11	1901-0040 1910-0016 1854-0071 1854-0009 2N709
Q7	1854-0215 2N3904
U1,4	1820-0054 SN7400N
U2	1820-0272 MC1022P
U3	1820-0068 SN7410N
U5	1820-0328 SN7402N
U6	1820-0147

05326-D-5

REFERENCE DESIGNATIONS

NO PREFIX	A6	A16
	CI-12 CRI-5, 7-11	
	Q1-13 RI-44	J1
RI S2,3,5, 6,8	UI-6	

DELETED: CR6

NOTES

- REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
- UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS;
- ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUE SHOWN.

ard is best accomplished when
 procedure given below examines
 circuit is in a working, but static,
 or listed. The schematic shows
 ed. These levels should be used

signal when per-

MAND DRIVER, and SAMPLE
 shooting, perform the procedure

..... FREQ A
 1 s
 HOLD
 +
 SEP
 ON
 full cw
 full ccw
 (lamp fires)

o set these circuits to the point
 es. Varying the LEVEL control
 gate for 1-second, and pin 17
 U2 sets when the gate closes
 set with the SAMPLE RATE
 es, check for a Low on U5C(8).
 and a Low on U1D(6). Check
 collector sets Low. The main
 now be High. The collector

sample rate inhibit gates are
 STORAGE switches and by a
 ntrols set as above, check for

itt Trigger and Q7 should be
 . Set the counter controls as
 aveform five, the repetition rate
 ne, but pulse width remains the
 the SAMPLE RATE controls,

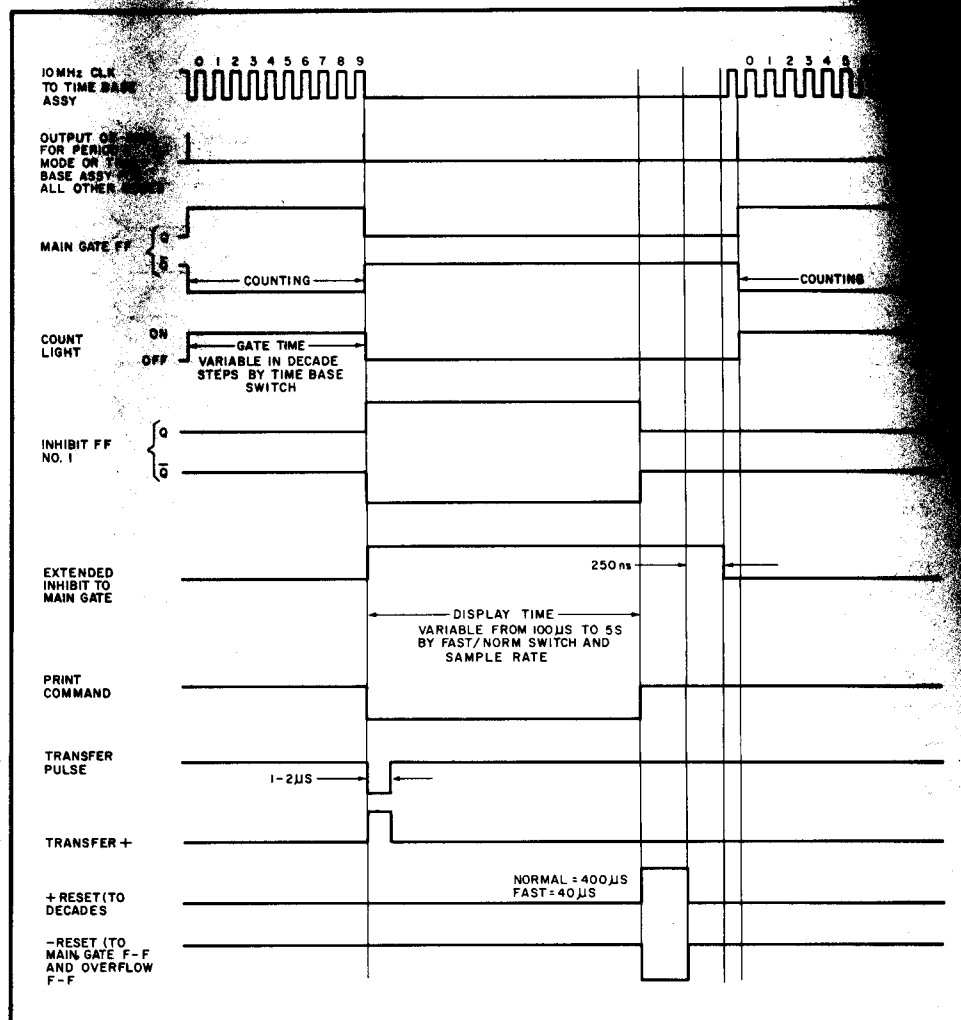


Figure 8-8
 A5 TIME BASE CONTROL ASSEMBLY

(See Page 8-19)

A6 TROUBLESHOOTING

rates for the input
ous operating modes.
fer, print command,
the circuits receive
reset signals. The
play-hold functions.

following operating
to FAST, no printer
and main gate open.
, which sets inhibit
to generate a high
ated at Q4 collector
er inhibit is present
point, and the high
e resulting high on
ector, which is the
on U1B(6) activates
positive and negative

goes low to turn off
o charge C4 for the
ORM position. R1
required to bring
Schmitt Trigger Q8
The reset will be
1A(3) will go low,
ut at A6(16). The
n addition to being

using through level
on Q1 and applies
2, which maintains
of the reset pulse.
ain-gate circuits are

a sufficiently long
ely 40 μ s or 400 μ s,
For NORM sample
The sample rate
mode and maintains
s main-gate inhibit
base through CR2.

o maintain transfer
s the reset one-shot
is depressed (reset
same time to clear
n-gate inhibit, even
signal is low if the
ASE or FUNCTION
generated between

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.

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 μ s or 400 μ s, 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 board is in a similar manner to each section separately. Perform the circuit levels as a reference.

Do not
formi

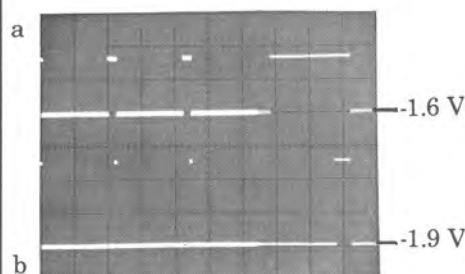
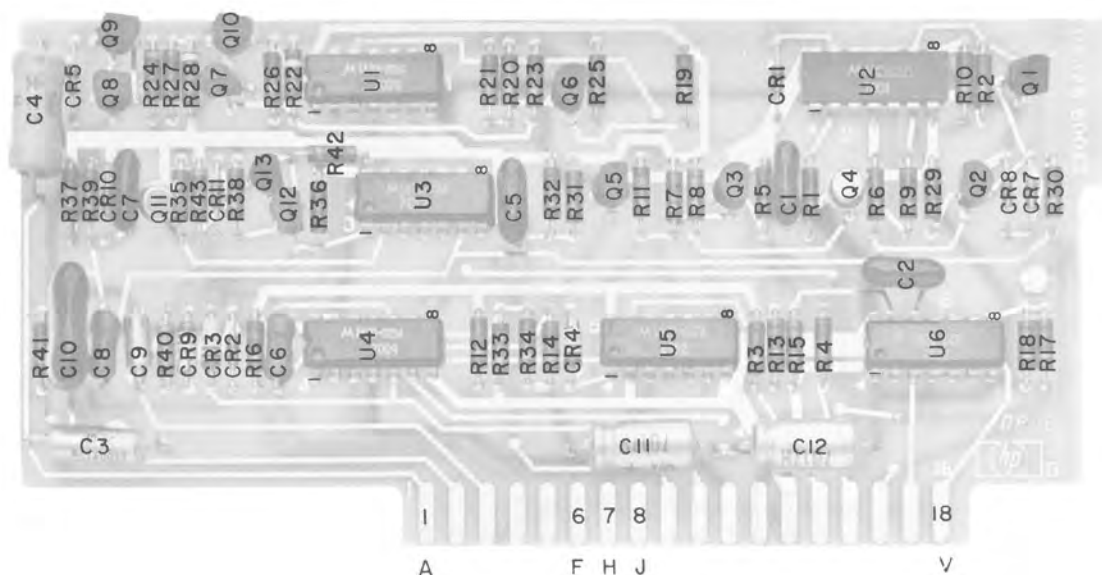
MAIN GATE INHIBIT
RATE ONE-SHOT
below.

FUN
TIME
SAM
SLO
CHK
STO
LEVI
Push
LEVI

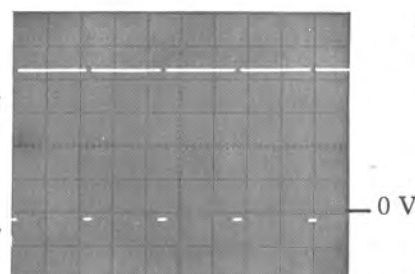
The purpose of the
immediately after
triggers a pulse t
goes Low during
(positive transition
switch set to HO
This generates a
that U4C(8) pulse
gate inhibit line
of Q7 is not now af

SAMPLE RATE
controlled by the
print inhibit sign
the levels shown on

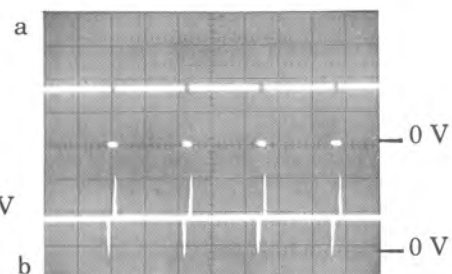
SCHMITT TRIGG
checked by using
listed under the v
of the pulses char
same. Pulse wid
but not spacing.



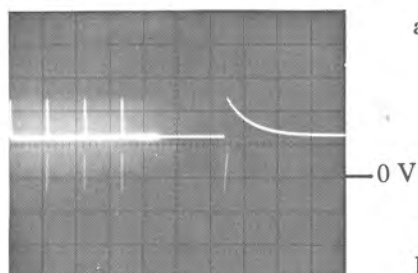
1 a. U2(2)
b. U2(9)
.05 V/cm
SWEEP to MIXED
MAIN — .5 ms/cm
DELAYED — 50 μ s/cm



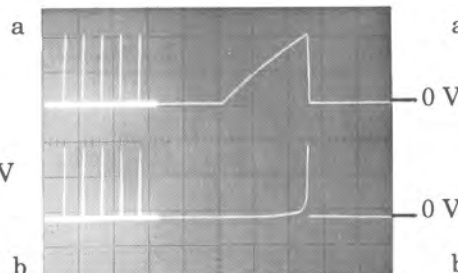
2 .1 V/cm
.5 ms/cm



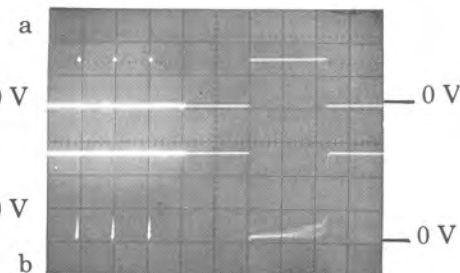
3 a. U1(6)
b. U1(9)
.2 V/cm
.5 ms/cm



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



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



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

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

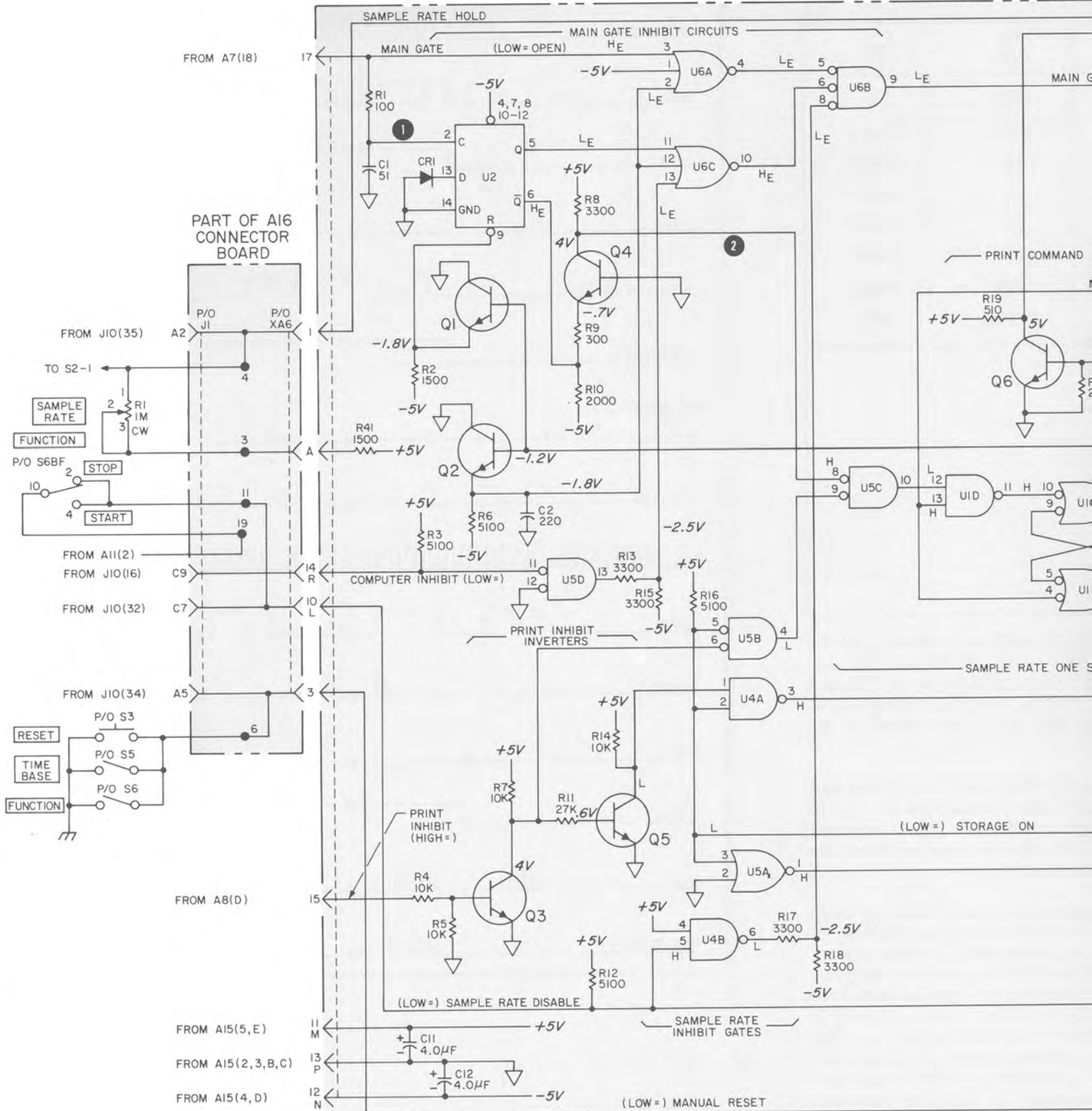
OSCILLOSCOPE CONTROLS:
Use settings of A2 Assembly

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

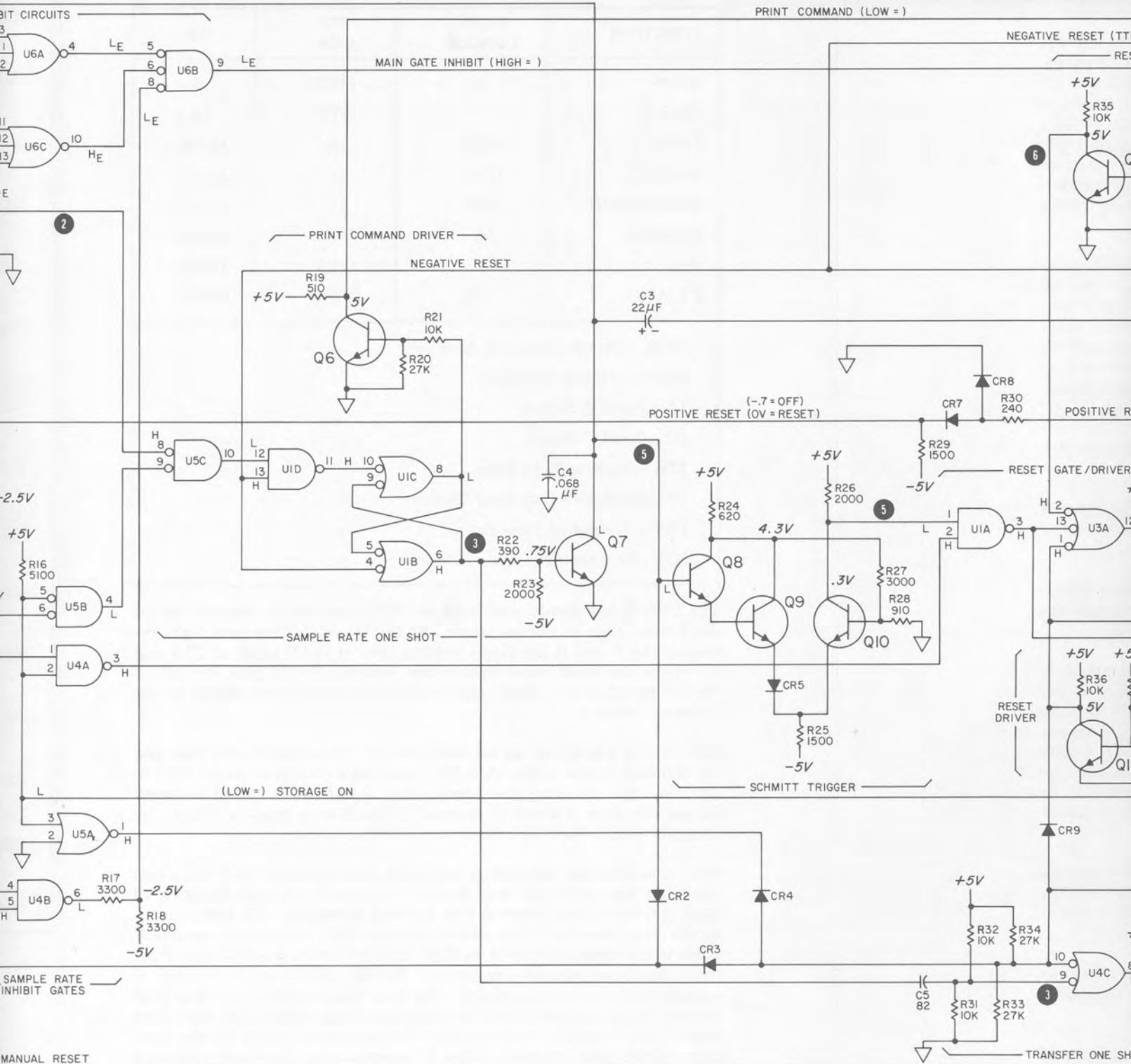
HE,LE — ECL levels
H,L — TTL levels

COUNTER CONTROLS:
Use settings of A2 Assembly

A6 SAMPLE RATE BOARD ASSEMBLY



A6 SAMPLE RATE BOARD ASSEMBLY (05326-60013) (NOTE 1) SERIES 1132



(NOTE 1) SERIES 1132

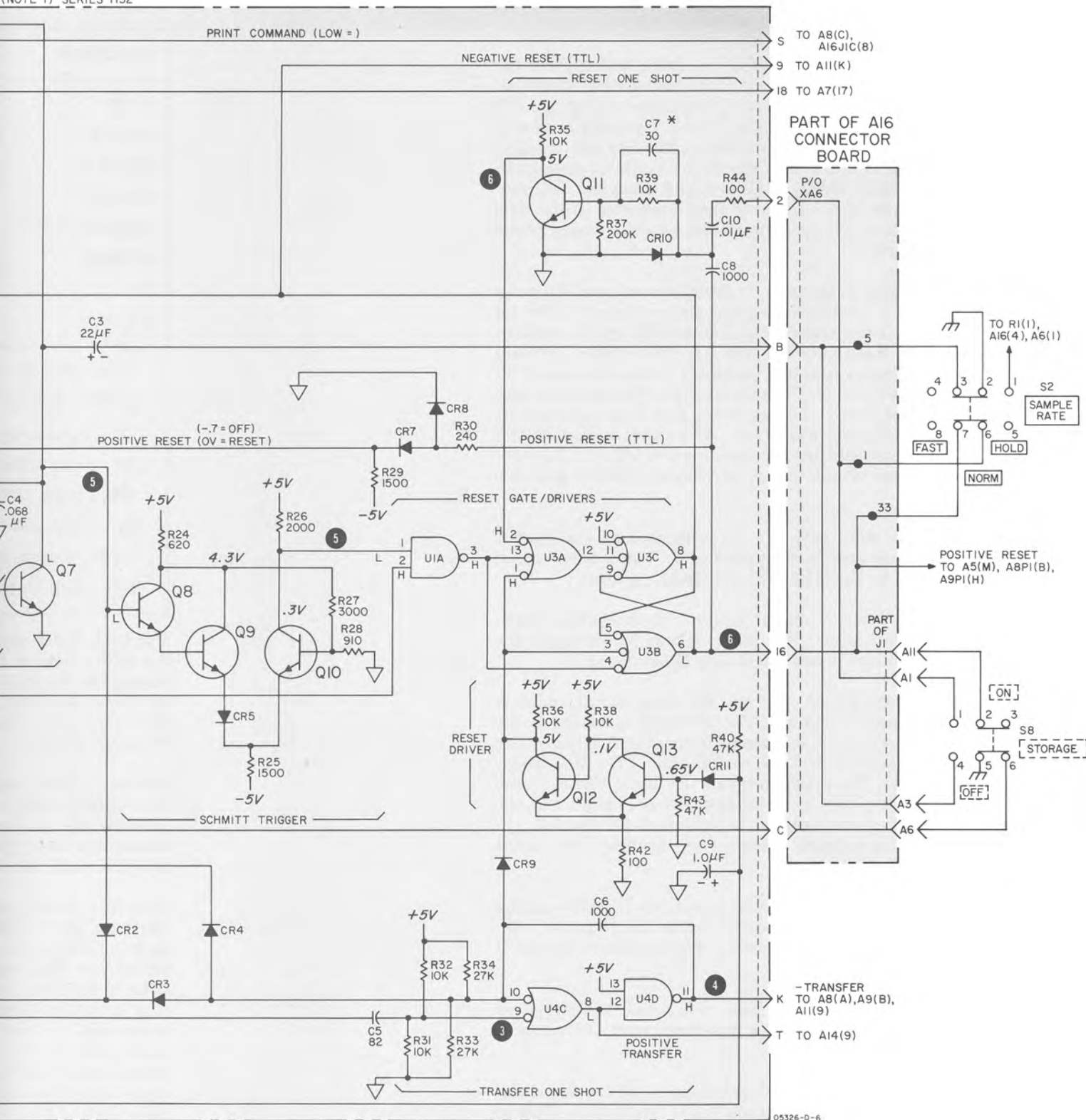
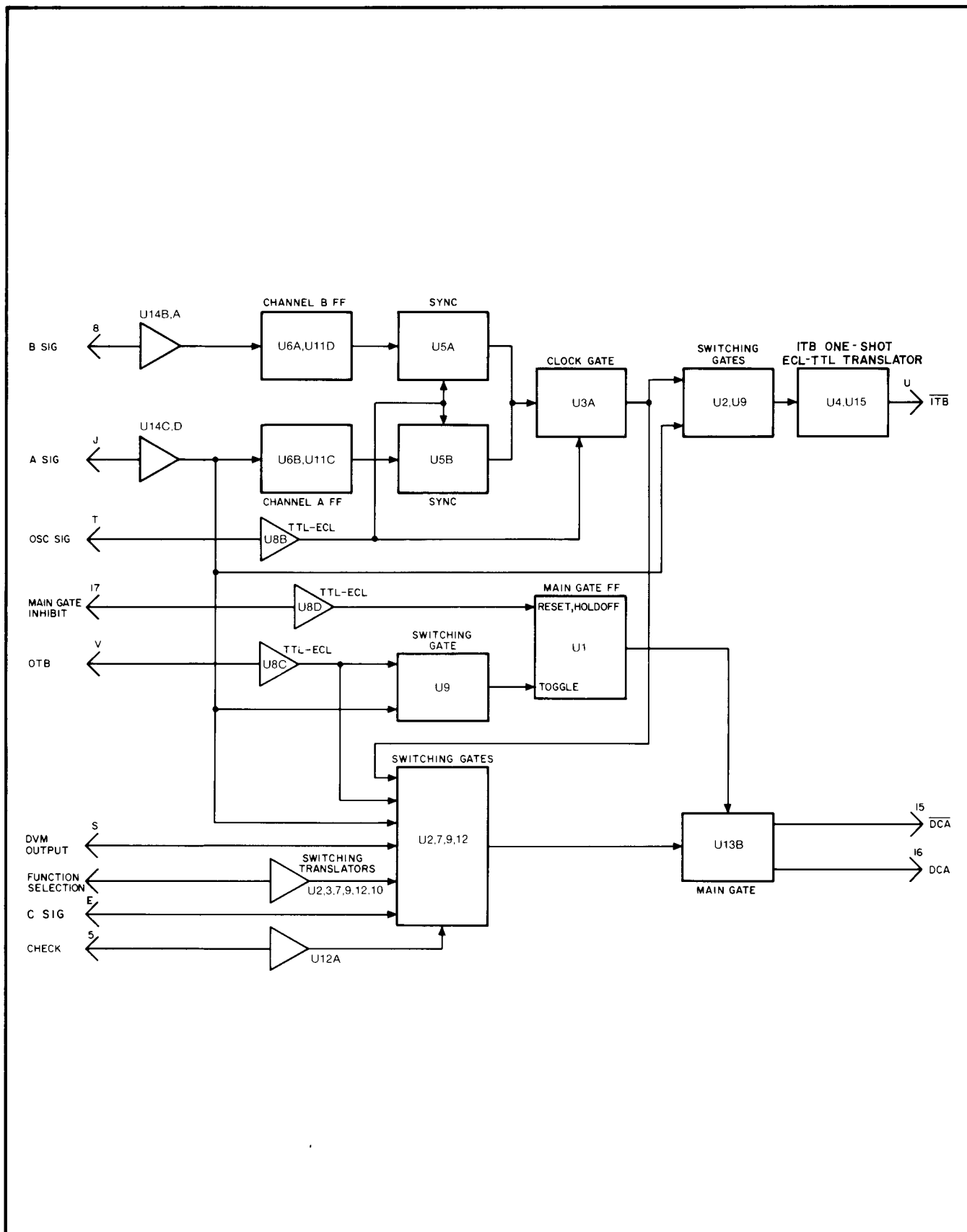


Figure 8-9. A6 Sample Rate Assembly

Part of Figure 8-10. A7 Function Control Assembly



MORE DATA UNDER THIS FOLD

in 18). The oscillator signal goes turns, and is set out through the ay. When the B signal occurs, the sets U5A, closing the clock gate.

Interconnections

	TO DCA	ITB
	OTB	0
	OTB	IA
	IA	GOSC
	IC	GOSC
	IV	GOSC
	OTB	GOSC
	OTB	GOSC
	GOSC	STI

ly

t

al

U6(11) and waits about 50 ns for t this point, U6(10) goes high, re- g lows at the D input of U5A and s positive, U6(10) goes low (about d U5A and B are closed to the

an A, U5A would be set first, and ould take about 150 ns for U5A to ove; so if an A signal occurred . If the B-to-a delay is>150 ns, the described above.

input synchronizers work the same d) is counted for the duration of being averaged. The first input A nables U3A to gate an oscillator e dividers are now set to zero, from

During this time, a channel B e first time interval; but this first in gate was closed. The time base to pass clock pulses for the dur- intervals, the time base returns a

Part of Figure 8-10. A7 Function Control Assembly

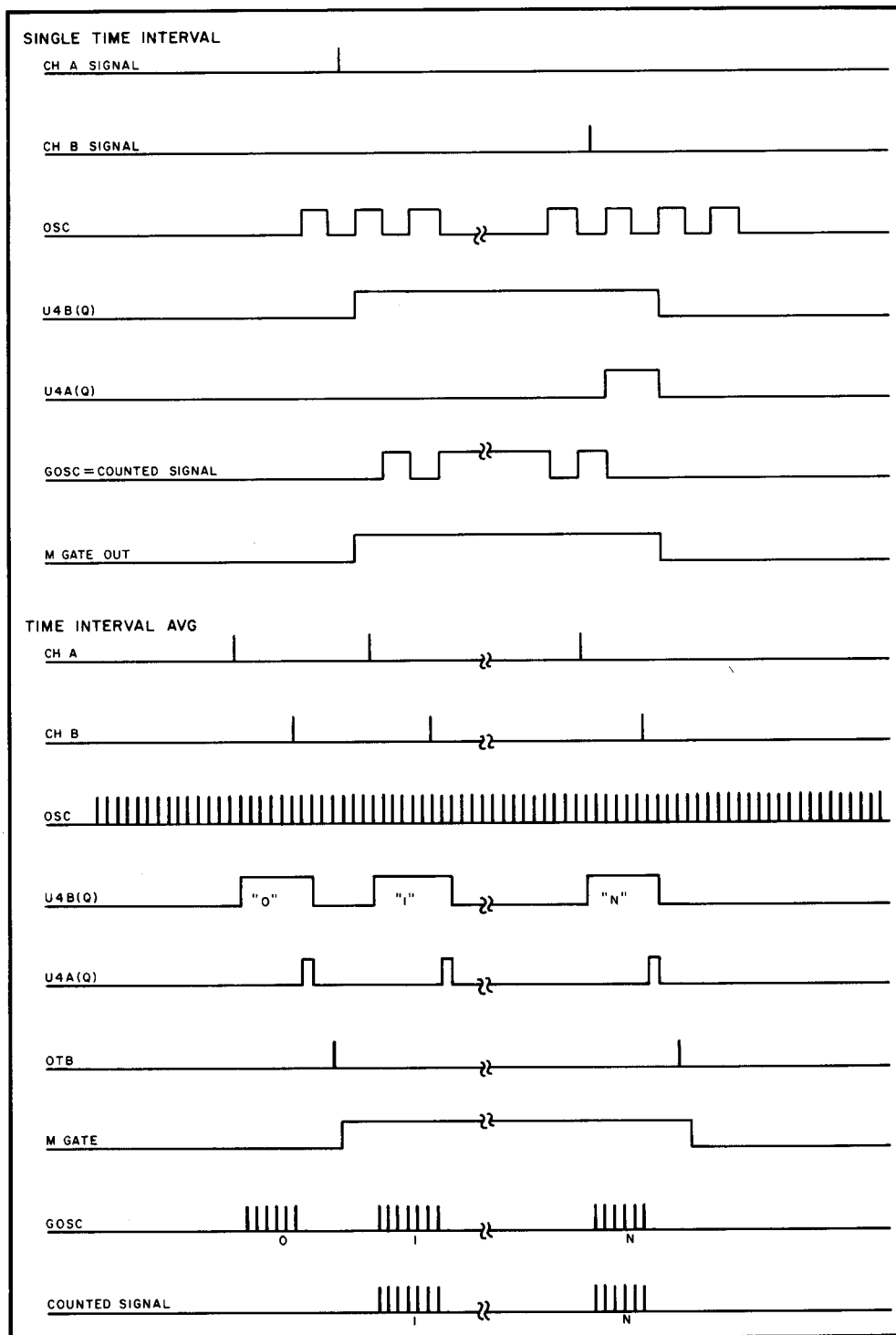


Figure 8-9
A6 SAMPLE RATE ASSEMBLY

(See Page 8-21)

one-shots, and trans-
time base, and input
counting assemblies.
each function of the

mode will explain the
to the other functions.
n gate inhibit (pin 17)
. Upon the arrival of
flip-flop sets, making
e oscillator signal (pin
d arms the oscillator
connected to the time
negative-going pulses

the 1st and Nth pulse
front panel). The 1st
ECL by U8 and then
This opens the main
counts the signal (in
al of the 2nd time base
ate U13B and signal-
returns a High MINH
rizer U5, and ITB one-
lay. MINH goes low

oggled by the input A
. The counted signal
tch setting.

the time base, which
ese pulses toggle the
periods of A.

input signal, which is
Q C operation is the
rizer U5B is held on by
tion TTL/ECL trans-
REQ A, FREQ C, etc)
k-ohm pullups on the
ifier A2 and A3. In
negative 10 ns pulses

, but U1 is set contin-
by the output of U5B.
synchronizer U5A and B

pleted, the flip-flops
en reset. Two condi-

gnal, the A signal will
flip-flop (see Timing
oscillator occurs after
te and instructing A6

that the measurement has started (pin 18). The oscillator signal goes
to the time base and is divided, returns, and is set out through the
main gate to A8 for subsequent display. When the B signal occurs, the
leading edge of the next clock pulse sets U5A, closing the clock gate.

Table I. Functional Interconnections

FUNCTION	MGFF TOGGLE	TO DCA	ITB
STOP	0	OTB	0
START	1	OTB	IA
FREQ A	OTB	IA	GOSC
FREQ C	OTB	IC	GOSC
DVM+RA+RB	OTB	IV	GOSC
PERIOD	IA	OTB	GOSC
T.I.	1	OTB	GOSC
T.I. AVG.	OTB	GOSC	STI
DCA - Decade Counting Assembly GOSC - Gated Oscillator IA - Input A Signal IC - Input C Signal ITB - Input to Time Base IV - DVM V-F Converter Output OTB - Output of Time Base STI - Synchronized Time Interval			

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

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

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

A7 FUNCTION CONTROL OPERATION

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

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

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

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

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

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

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

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

First — if a channel A signal occurs before a B signal, the A signal will set the channel A flip-flop before the B sets the B flip-flop (see Timing Diagram). When the first leading edge of the oscillator occurs after the A F-F is set, U5B is set, opening the clock gate and instructing A6

that the measurement is made from the leading edge of the main gate to A8

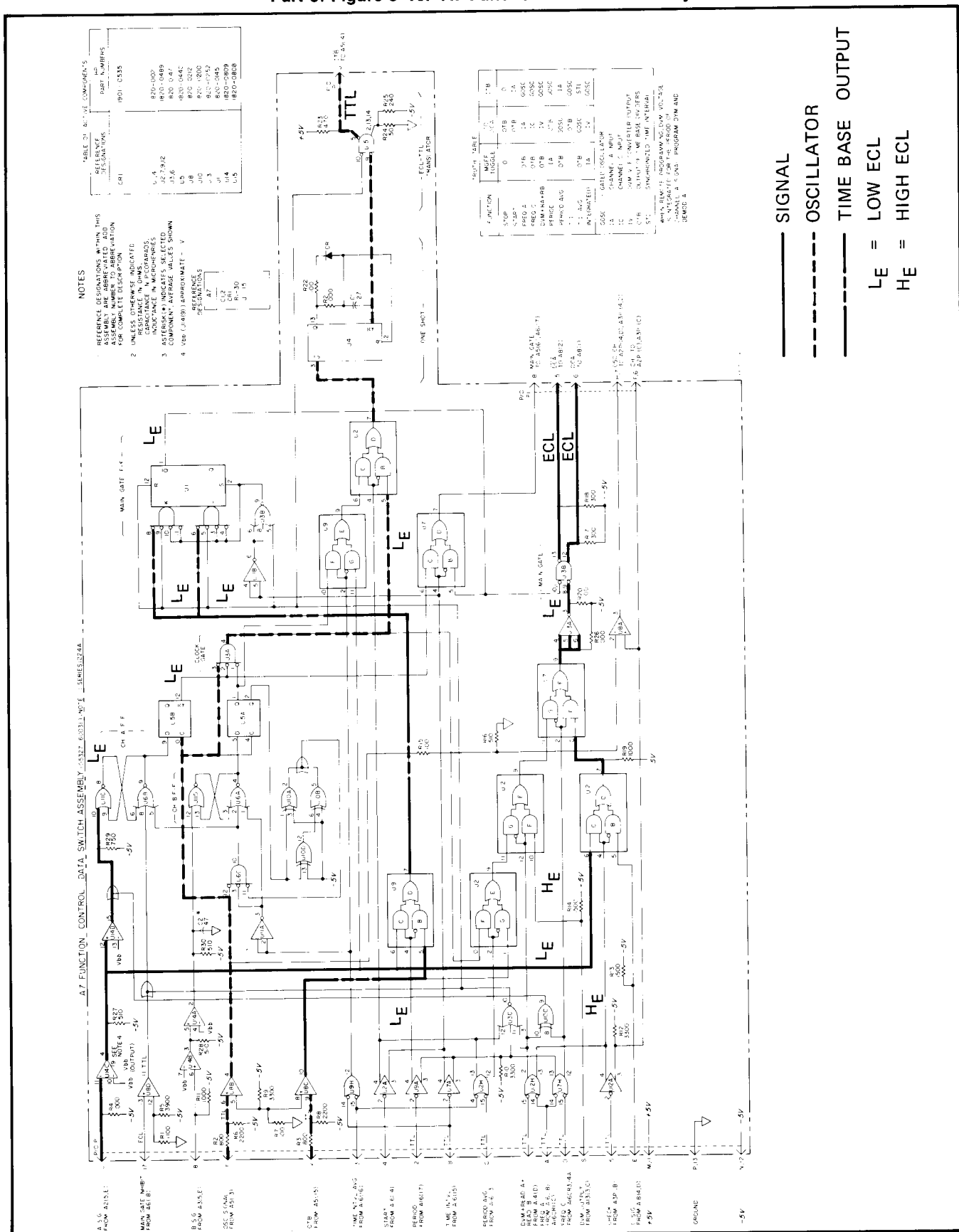
FUNCTION
STOP
START
FREQ A
FREQ C
DVM+RA+RB
PERIOD
T.I.
T.I. AVG.
DCA - Decade Counter A
GOSC - Gate Oscillator
IA - Input A
IC - Input C
ITB - Input Trigger B
IV - DVM V
OTB - Output Trigger B
STI - Synchronizer Trigger Input

The U5A $\bar{Q}$ low on the falling edge of the input signal setting the A and B flip-flops. When the clock signal arrives 10 ns after the "cleared" state.

Second — if a B signal occurs before a A signal, no counting would occur until the complete the reset signal during this time. A signal would set the B flip-flop.

With time interval mode, the operation is similar to period, but the oscillator is counted for each individual input signal. The input signal sets flip-flop U5B, which produces a pulse to the time base input one-shot U4. The output pulse to the time base input one-shot U4 is the output pulse to the time base input one-shot U4. The output pulse to the time base input one-shot U4 is the output pulse to the time base input one-shot U4.

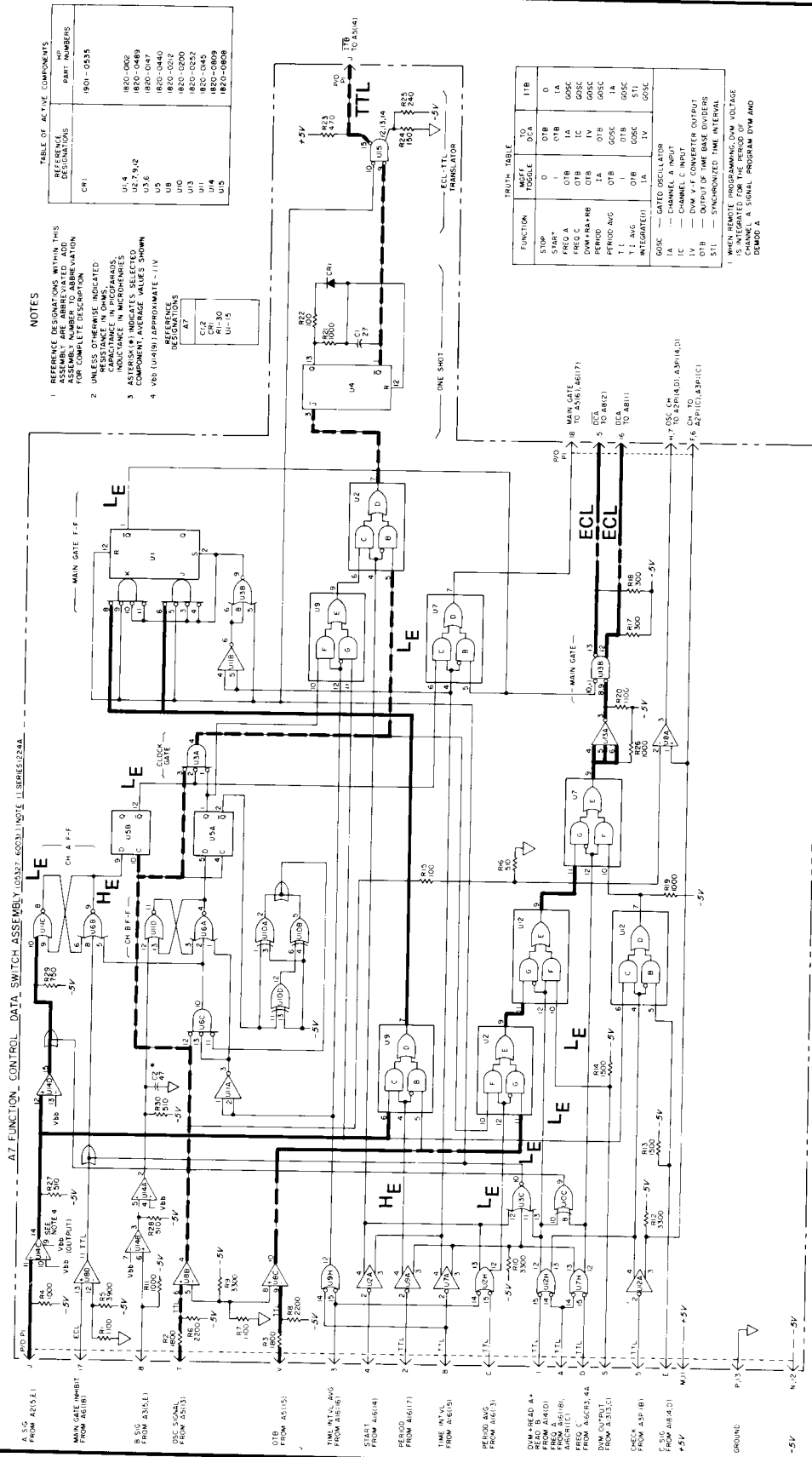
FREQ A Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly



Model 5326/27B

Schematic Diagrams

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



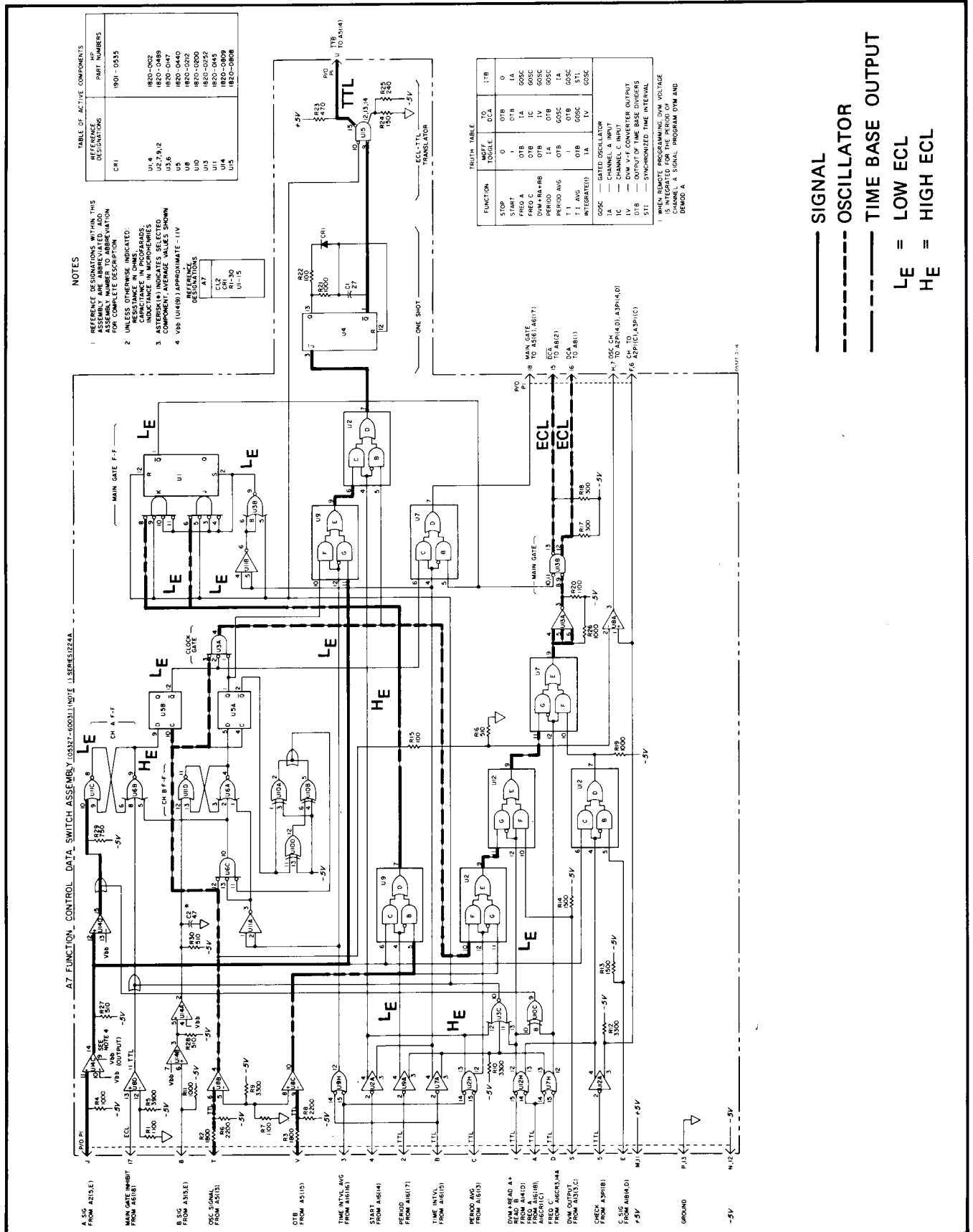
— SIGNAL

----- OSCILLATOR

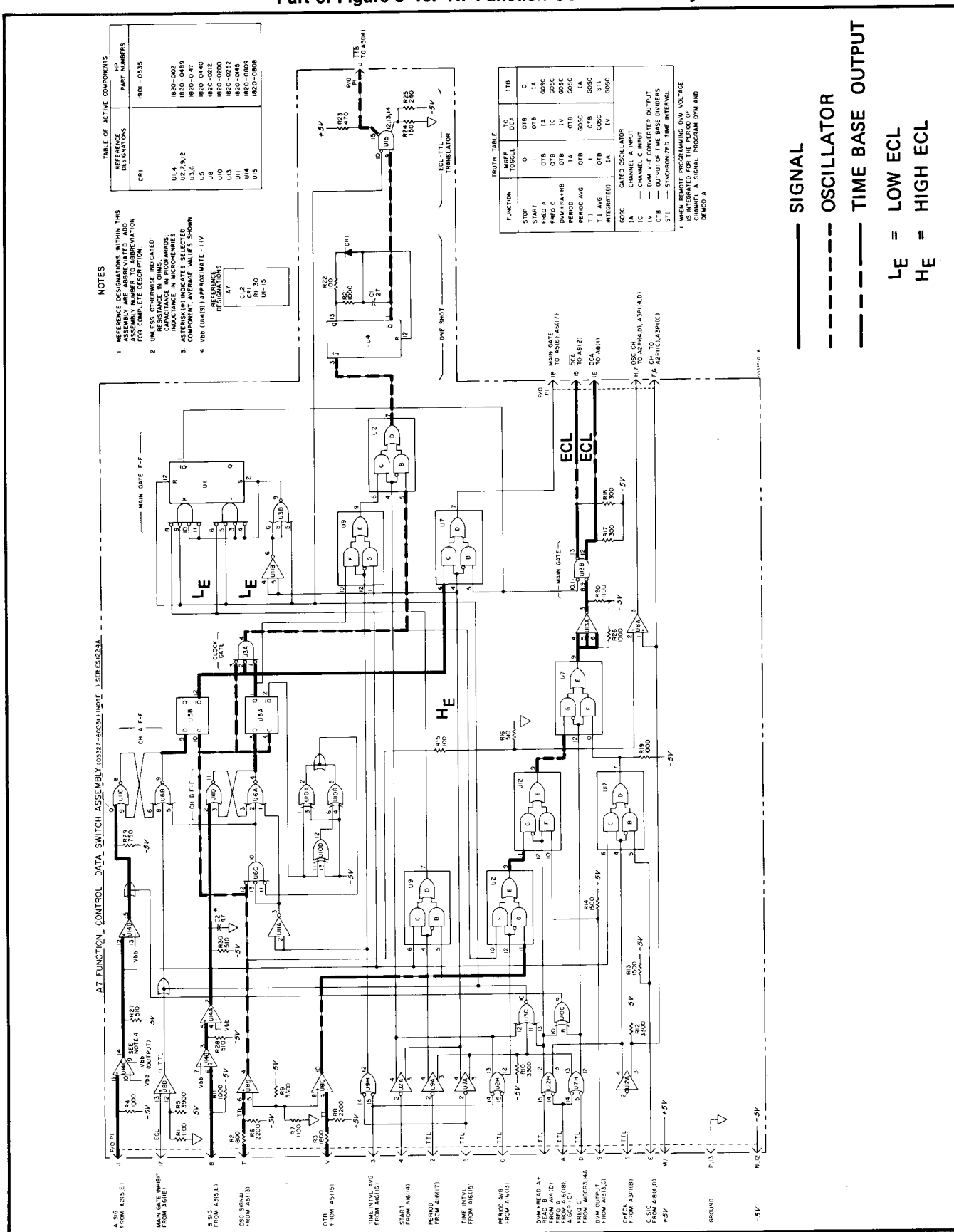
--- TIME BASE OUTPUT

$$L_F = \text{LOW ECL}$$
$$H_E = \text{HIGH ECL}$$

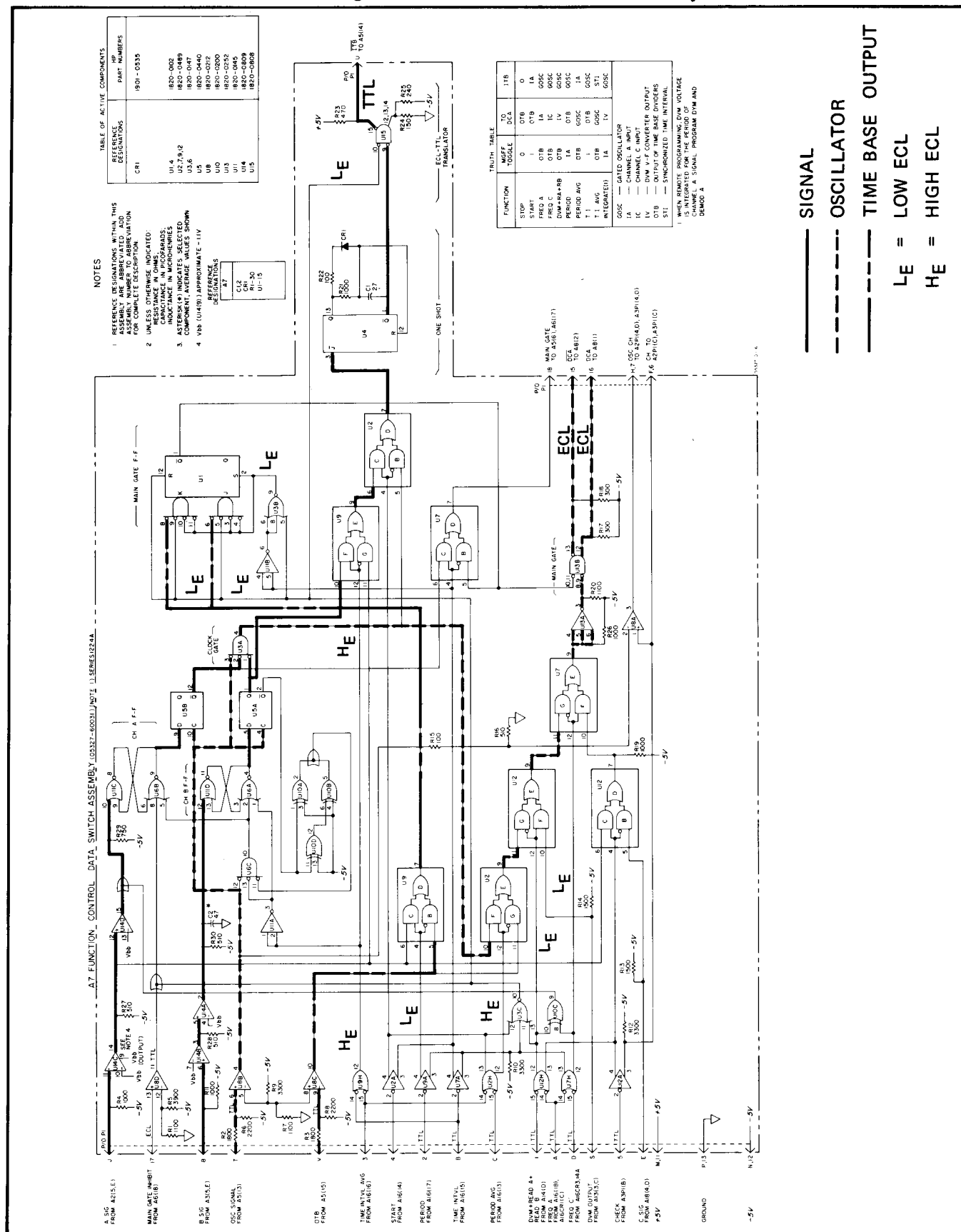
Period Average Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly



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



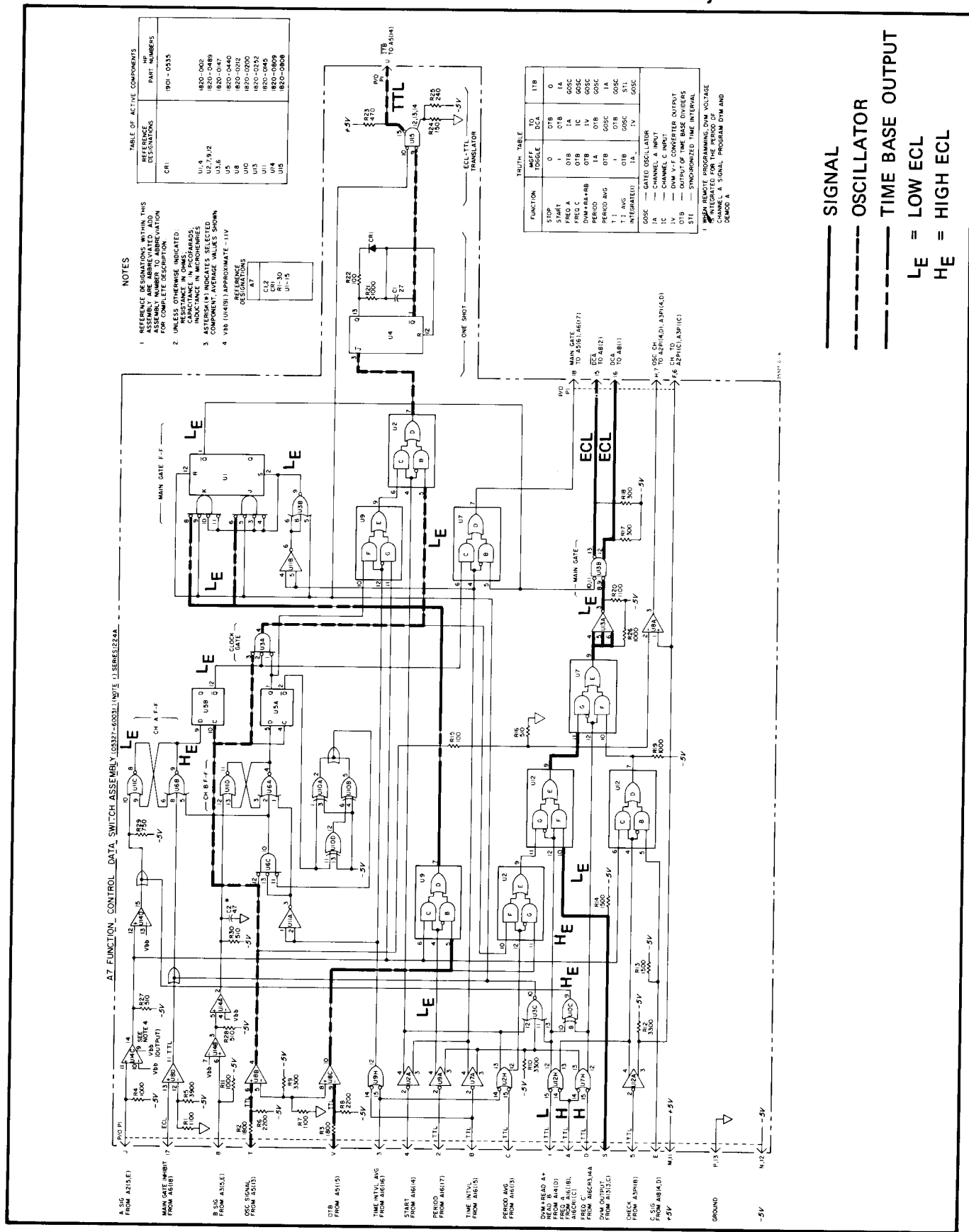
Time Interval Average Flow Diagram
Part of Figure 8-10. A7 Function Control Assembly



Model 5326/27B

Schematic Diagrams

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



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	10^6	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.

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
weighted DCD
display. A t
1....2....3....0....1
FUNCTION s
(refer to the t
their levels de
U4 pin 3 and

DISPLAY
1
2
3
4
5
6
7
8
9
10
11

reconnect the display
A16. In addition,
decimal point drivers,
U3 through U6.
noise levels on the
divides by two and the
The decade supplies
the 10⁰ display tube.
to the next decade
reset signal to ECL

in conjunction with logic
points. R15 and R17
R19, R20, and R23
7.5 volts pre-bias for
connect the off decimals
low.

is received at P1(S)
point enable line 3
point on A9DS4(10³).
blank A9 U4. When
also high to unblank
DS2. DS5 and DS6
and DS7 and DS8

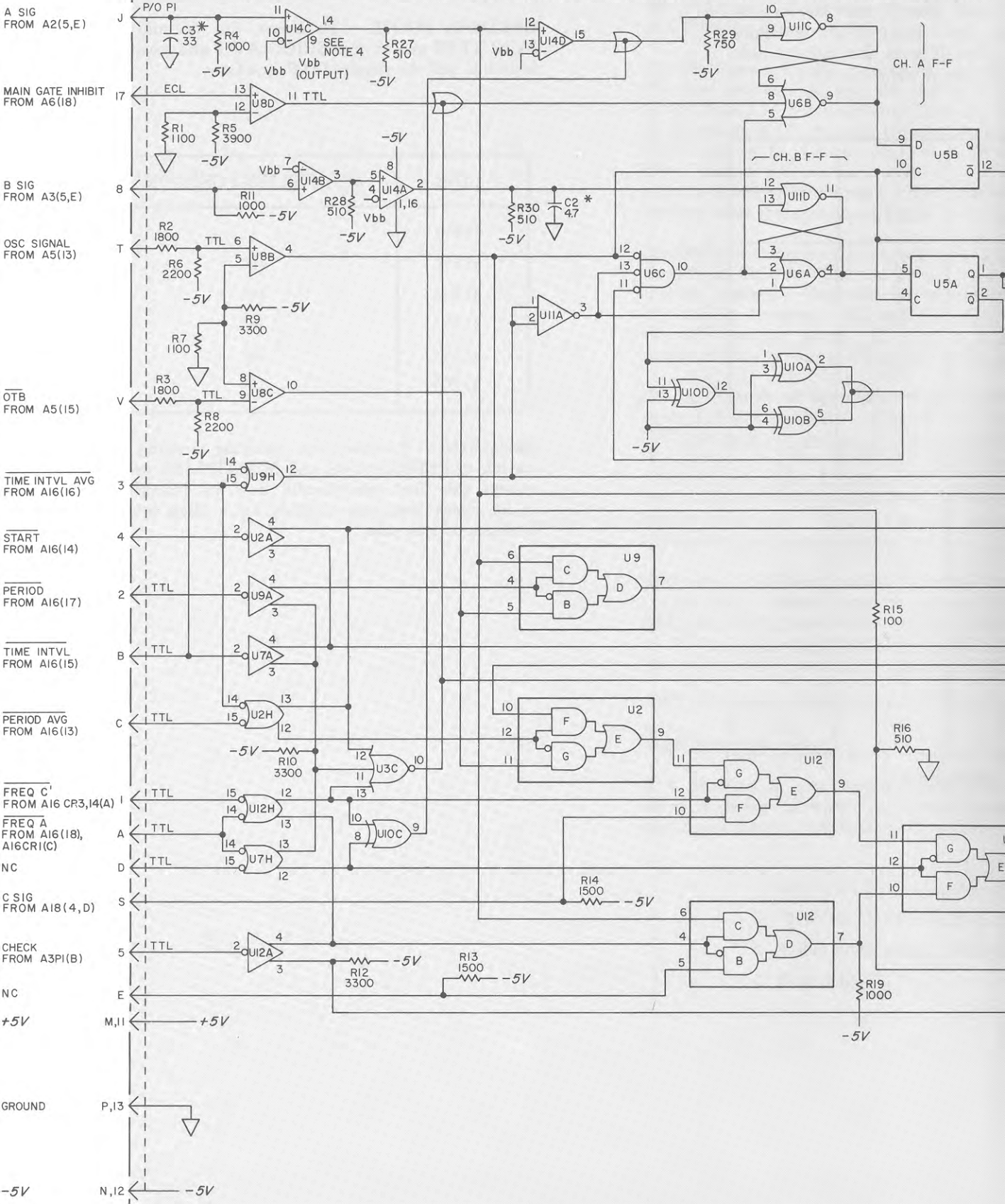
the digital recorder
and J1(15) go low.
low. When J1(15),
on the annunciator

not readily apparent
step-through method

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			

A7 FUNCTION CONTROL DATA SWITCH ASSEMBLY (05327-60031) (NOTE 1)

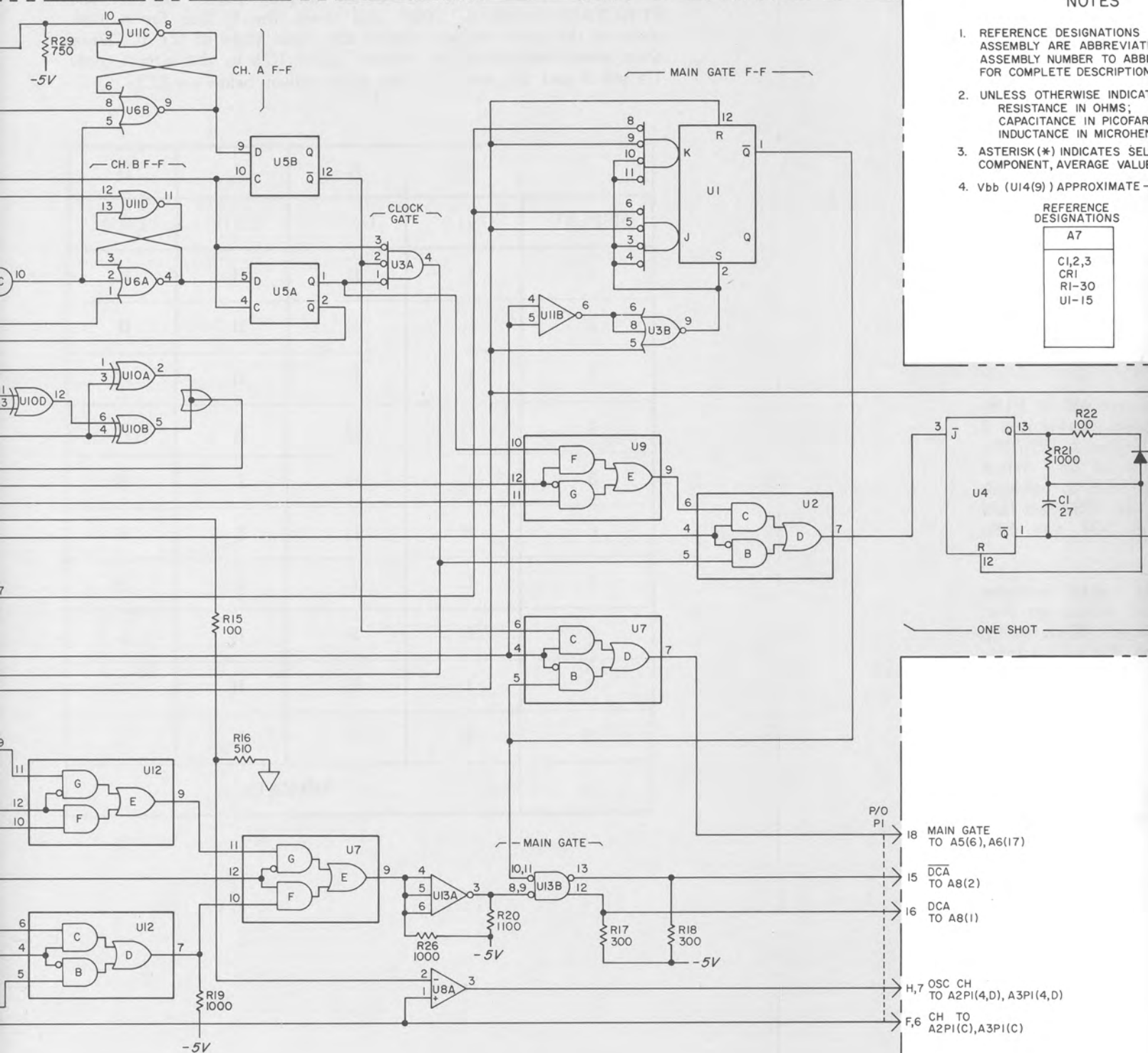


1. REFERENCE DESIGNATIONS ARE ABBREVIATED TO THE FIRST LETTER OF THE ASSEMBLY NUMBER TO ABBREVIATE THE PART NUMBER FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED, RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRYS.
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUE.
4. V_{bb} (U14(9)) APPROXIMATE -

REFERENCE DESIGNATIONS

A7

C1,2,3
CR1
R1-30
U1-15



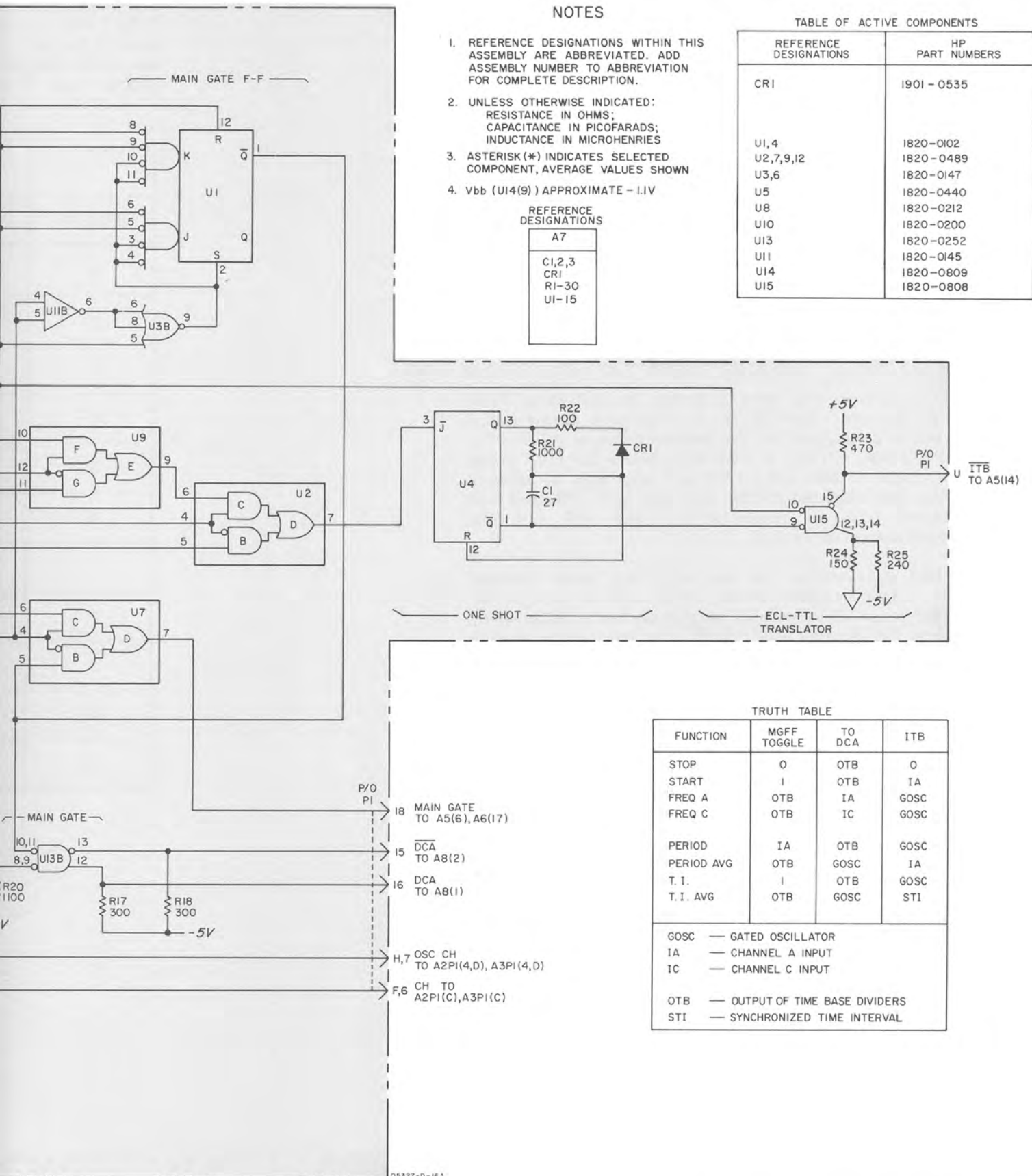
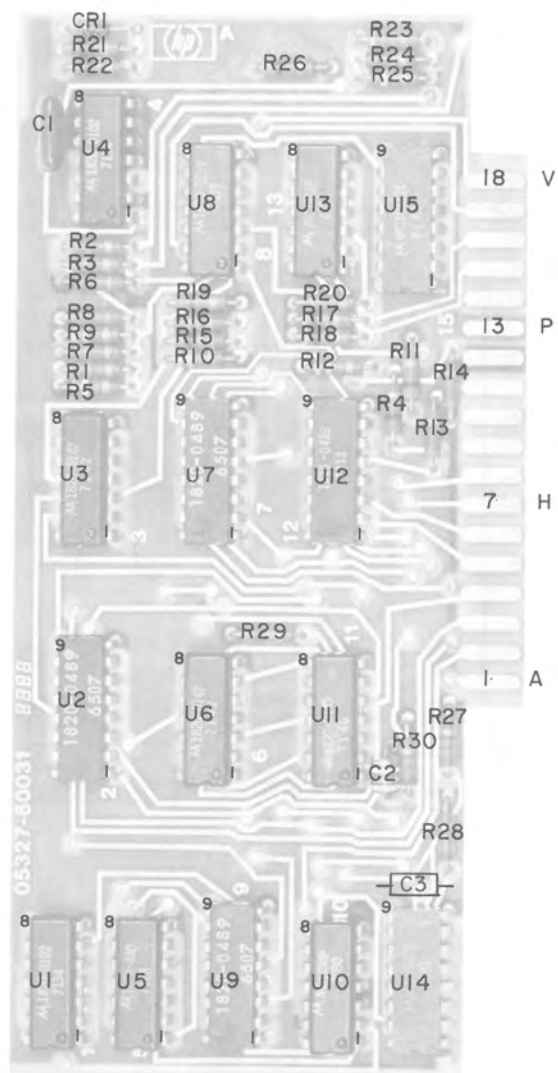


Figure 8-10. A7 Function Control Assembly



output lines that are binary
T button and note the counter's
follows: The display counts
display reads "0," set the
check the C line for a Low
e input lines of the IC, since
other IC's in the circuit (note
s given below are ECL.

	C	D
	U5(1)	U6(1)
	H	H
	H	H
	H	H
	L	H
	L	H
	L	H
	L	H
	H	L
	H	L
	H	H

REPEATS

Decimal Point and Blanking

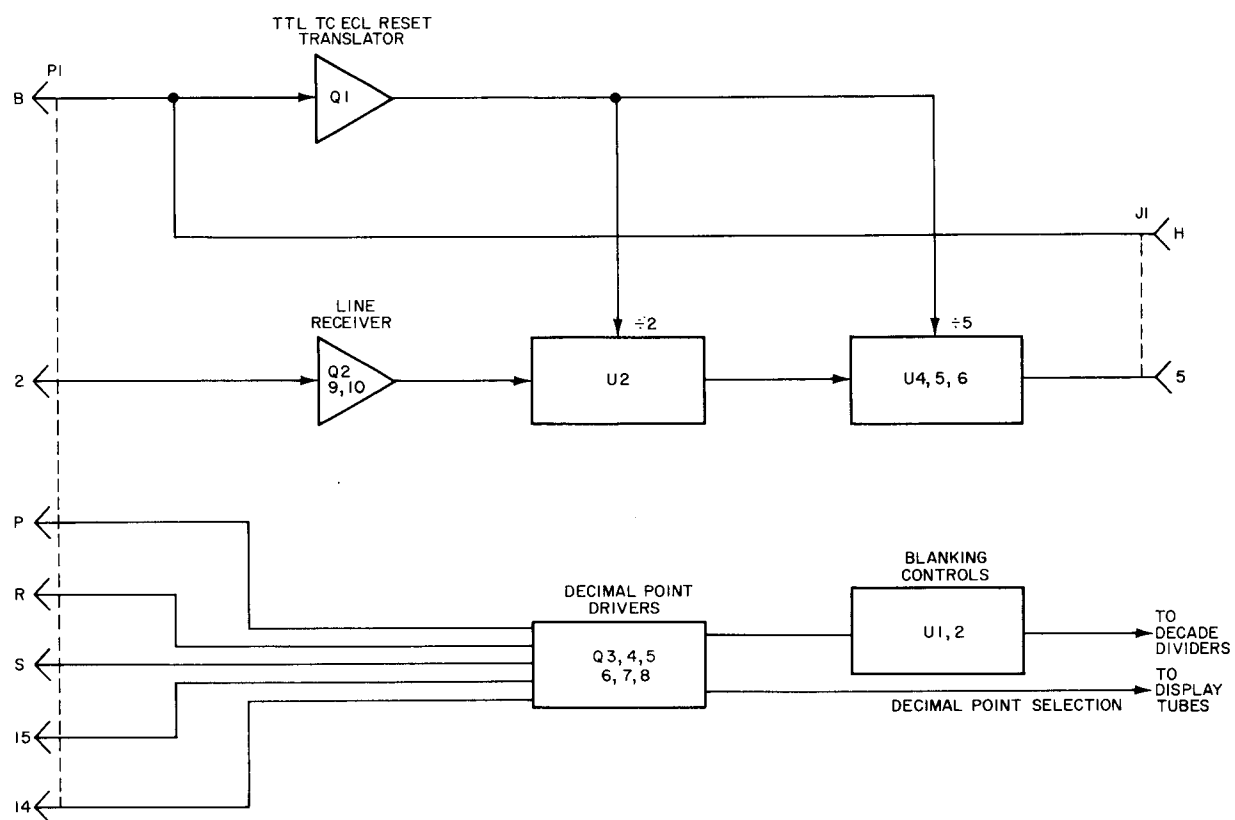
Before testing the decimal point and blanking circuitry, set the CHK/SEP/COM switch to SEP and disconnect the input signal.

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.

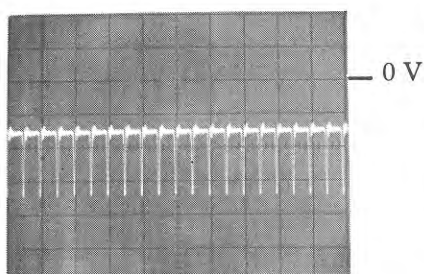
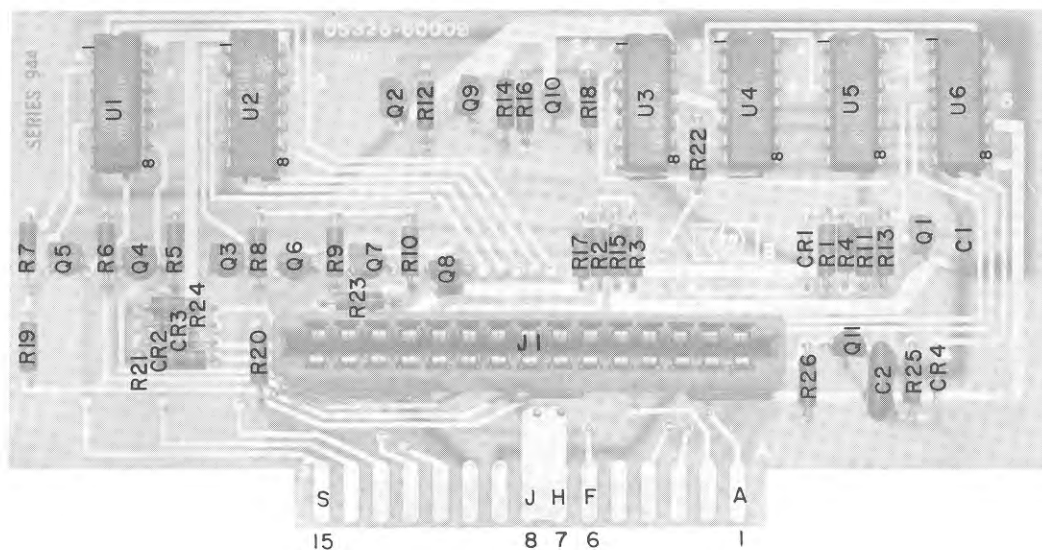
LINE	MULTIPLIER POSITION	DRIVER
D.P.0	1	Q8
D.P.1	10	Q7
D.P.2	10 ²	Q6
D.P.3	10 ⁶	Q5
D.P.4	10 ⁷	Q4
D.P.5	10 ⁸	Q3

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.

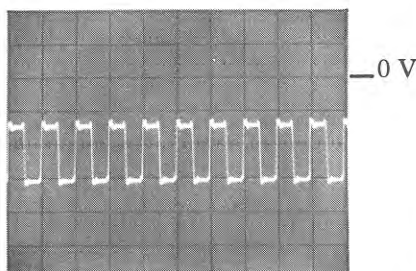
Part of Figure 8-11. A8 Display Support Assembly



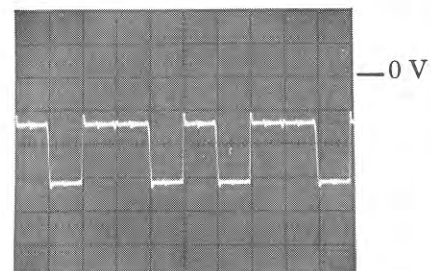
MORE DATA UNDER THIS FOLD



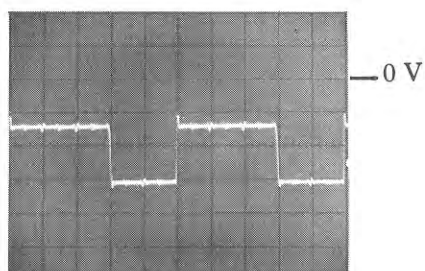
1



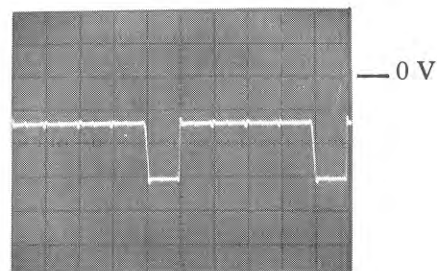
2



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:

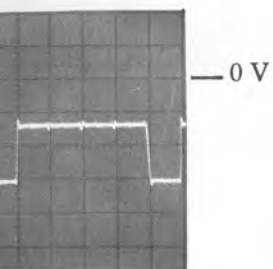
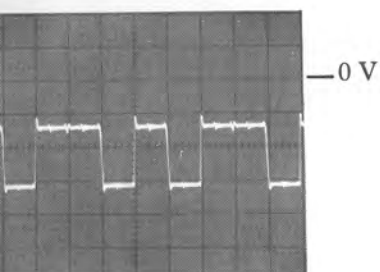
VOLTS/CM05 V/cm

TIME/CM2 μ s/cm

SWEEP MODE AUTO

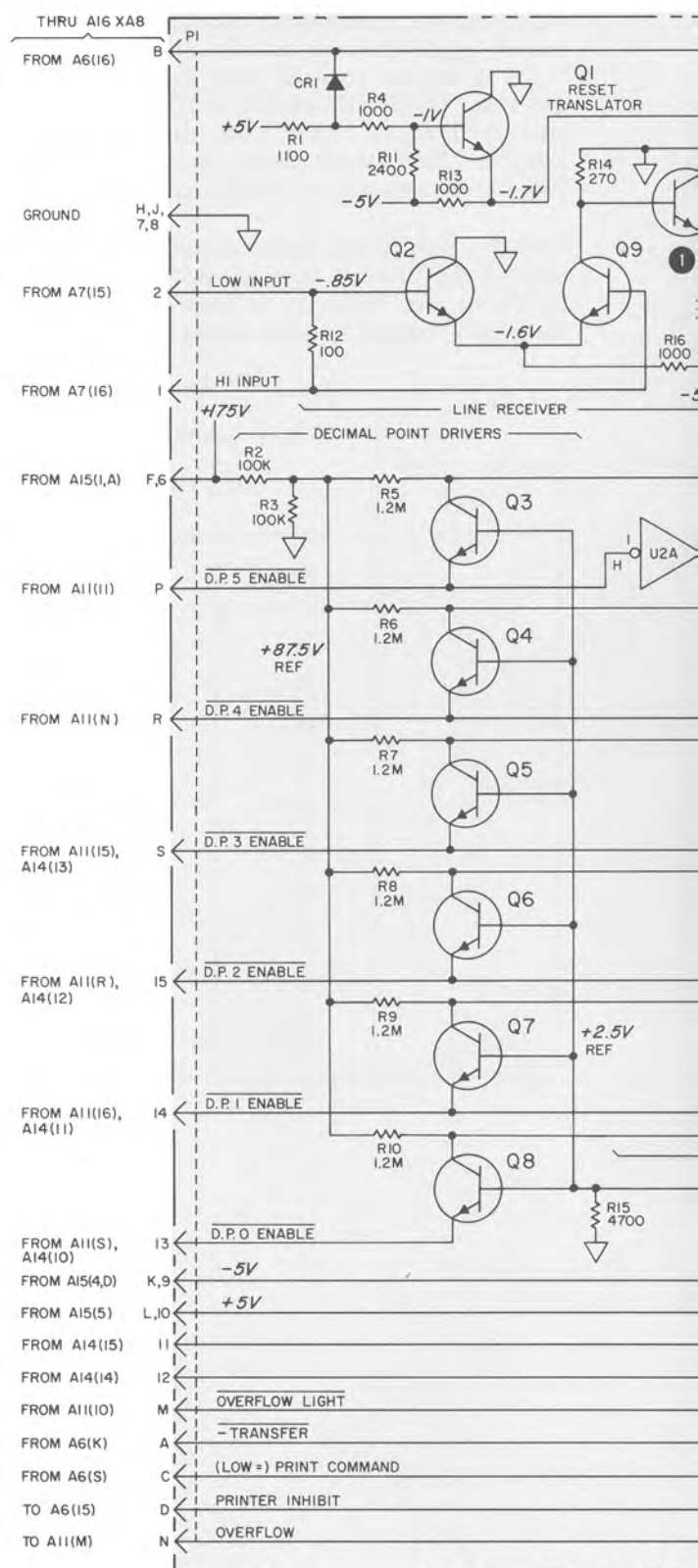
TRIGGER INT

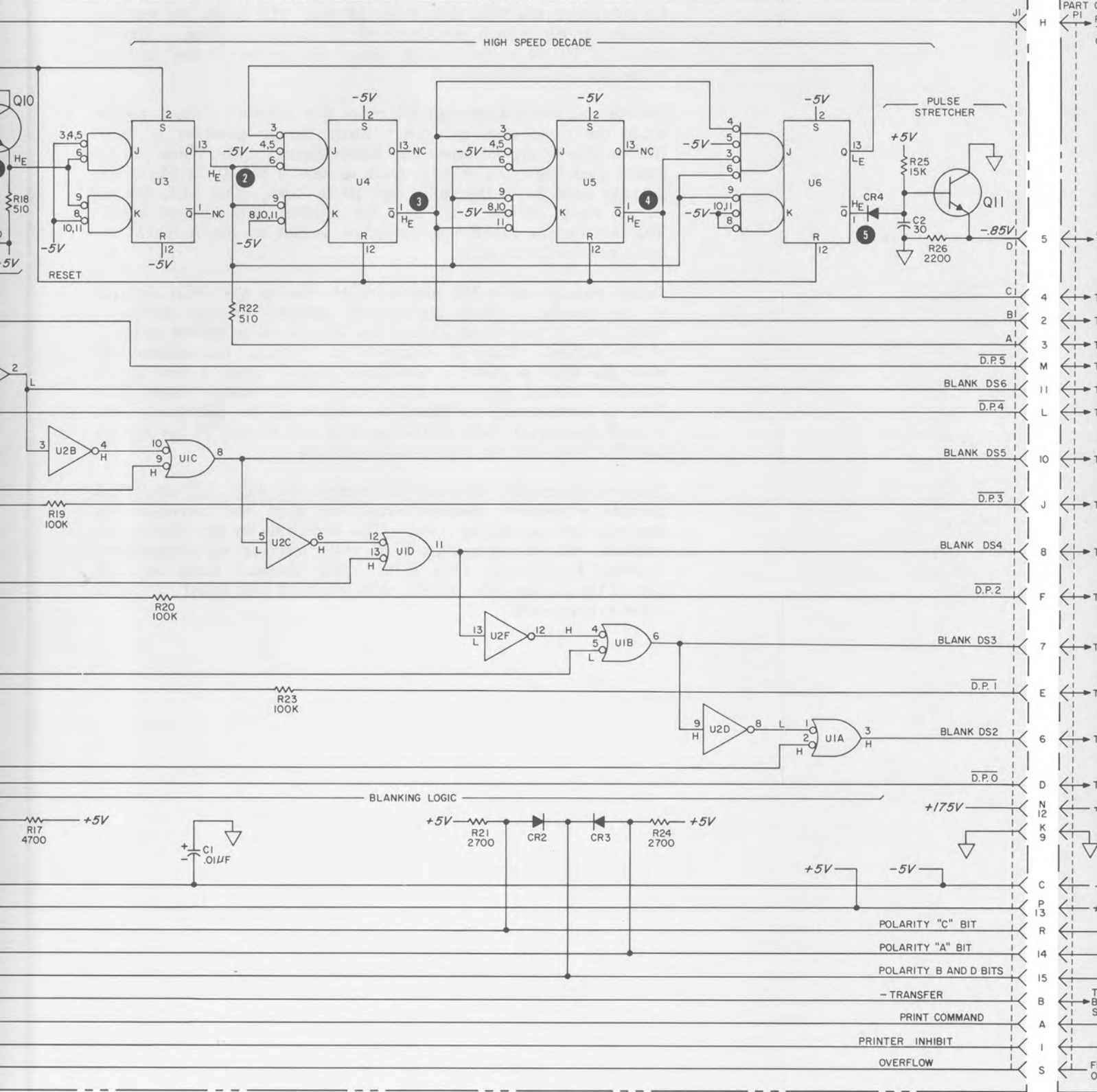
SLOPE +

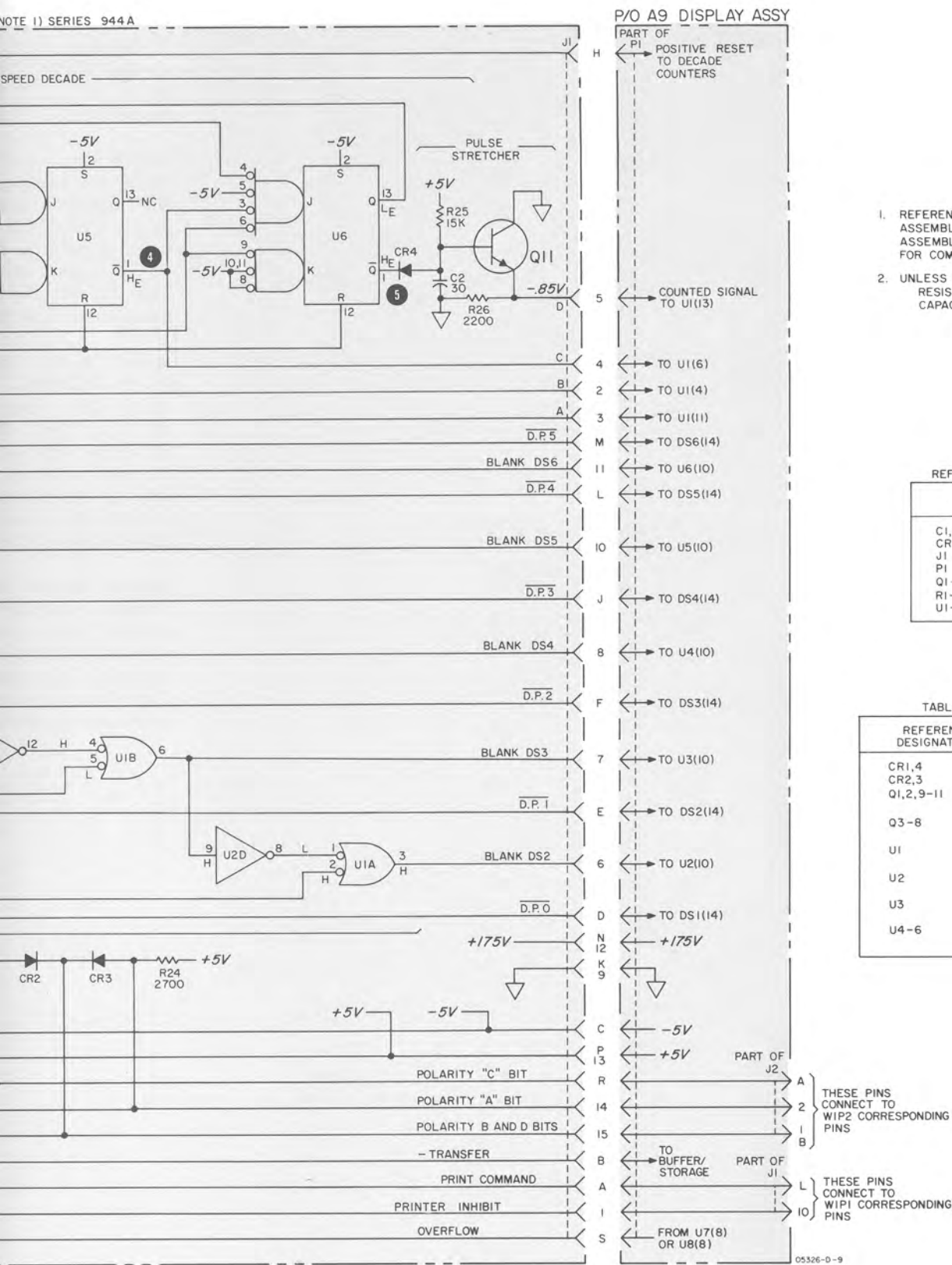


SCOPE CONTROLS:

..... .05 V/cm
2 μ s/cm
 AUTO
 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;

REFERENCE DESIGNATIONS

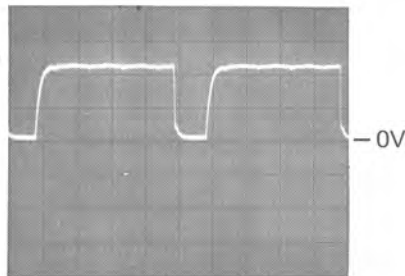
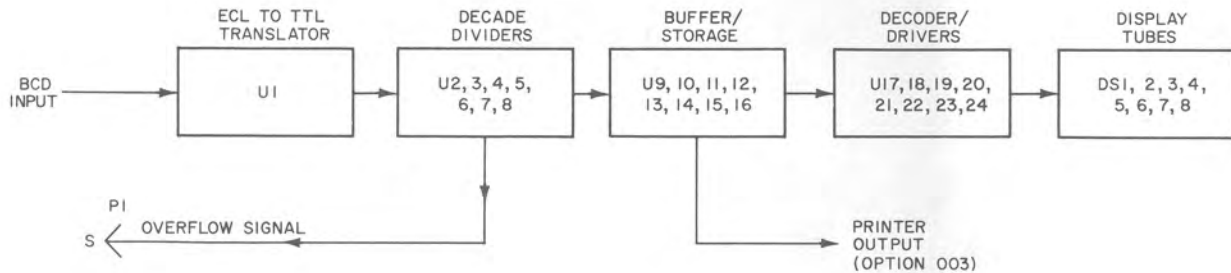
A8	A9
C1,2 CR1-4 J1 PI Q1-11 R1-26 U1-6	J1,2 PI

TABLE OF ACTIVE COMPONENTS

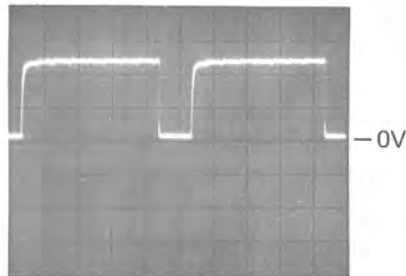
REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,4	1901-0040
CR2,3	1910-0016
Q1,2,9-11	1854-0092
	2N3563
Q3-8	1854-0365
	2N4410
U1	1820-0094
	MC846P
U2	1820-0307
	MC836F
U3	1820-0143
	MC1027
U4-6	1820-0102
	MC1013P

Figure 8-11. A8 Display Support Assembly

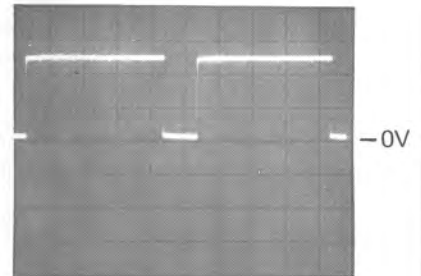
Part of Figure 8-12. A9 Display Assembly (Option 001)



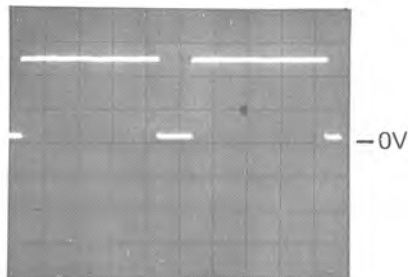
U1(15)
.2 V/cm
.2 μ s/cm



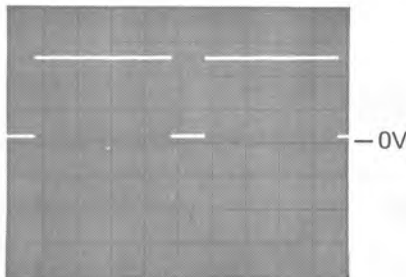
U2(8)
.2 V/cm
2 μ s/cm



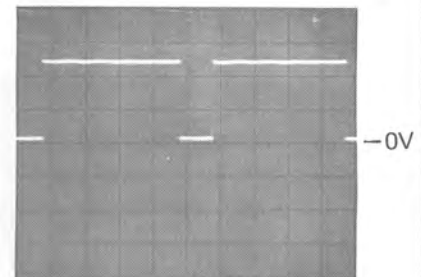
U3(8)
.2 V/cm
20 μ s/cm



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

A9 TROUBLESHOOTING

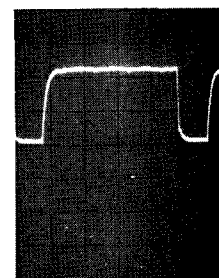
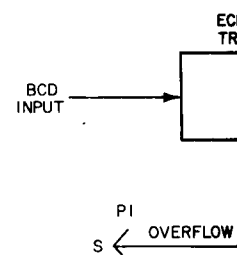
The A9 Display Assembly may be set up for troubleshooting with either of two methods. A highly accurate oscillator may be used for a front-panel input signal. Any difference in count from the input signal is then immediately obvious on the display. Check for the proper signal division of the decade counter 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.

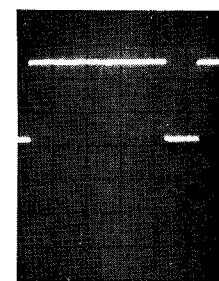
Table 1

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

Model 5326/27B Schematic Diagrams



U1(15)
.2 V/cm
.2 μs/cm



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

All waveforms
probe. Center li
Triggering is in

Figure 8-11
A8 DISPLAY SUPPORT ASSEMBLY

(See Page 8-31)

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 J9 when Option 003 is included.

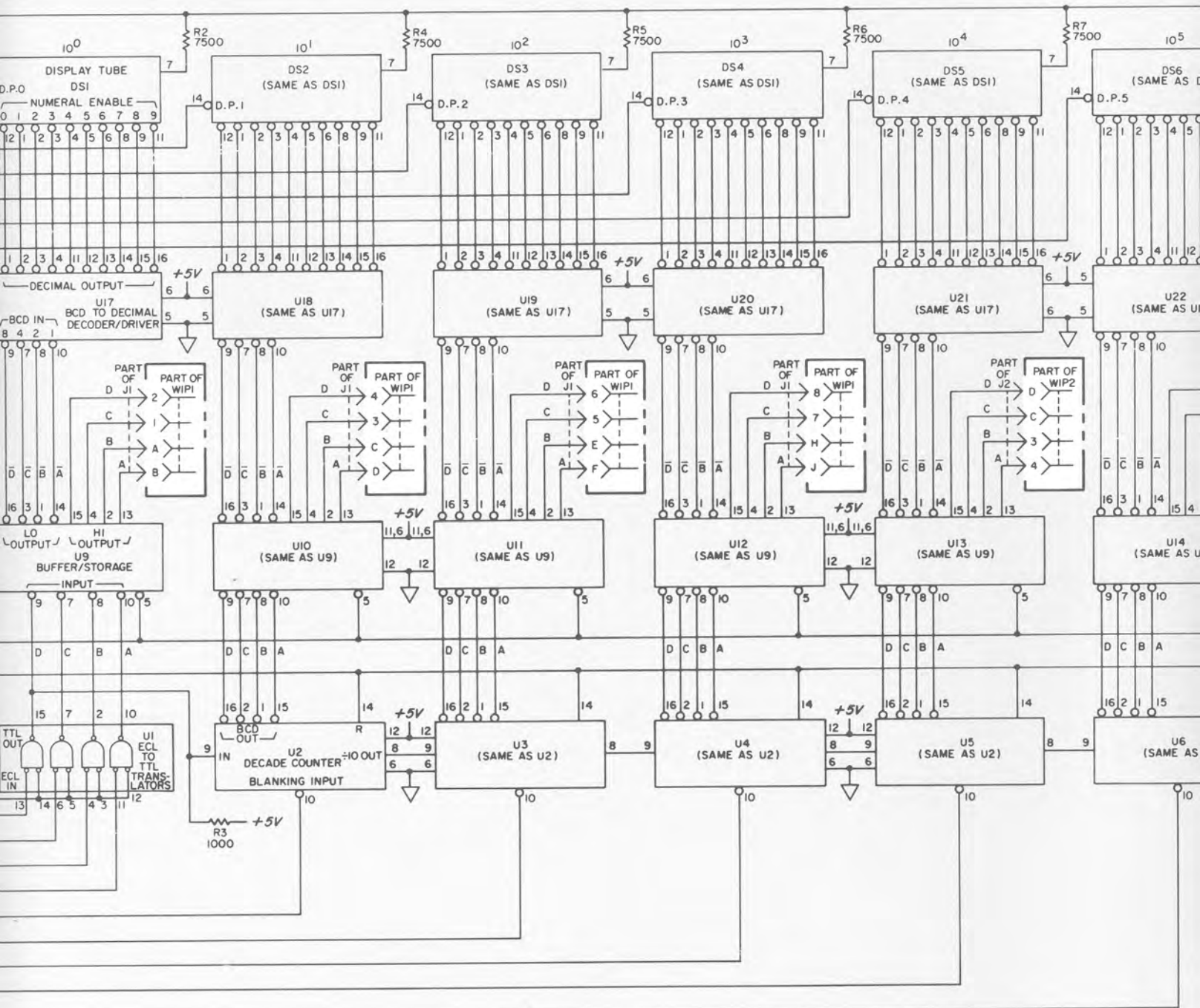
Decoder drivers U17 through U23 receive the -8421 BCD data and provide a decoded decimal output to light the corresponding numeral on the display tube. The terminal for an illuminated numeral will be approximately +2 volts whereas an extinguished numeral is typically +100 volts. The decimal point terminal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

A9 TROUBLESHOOTING

The A9 Display Assembly can be checked by either of two methods. If a front-panel input signal is then input, proper signal division. As an alternate method, use the FUNCTION and the TIME BASE until the problem appears. Use the TIME BASE until the problem appears.

Start by checking the code of the number displayed (see Table 1) the proper decimal

DISPLAYED DIGIT
0
1
2
3
4
5
6
7
8
9
Blank



OPTION 001 (05326-60025) (NOTE 1) SERIES 1032 REV B

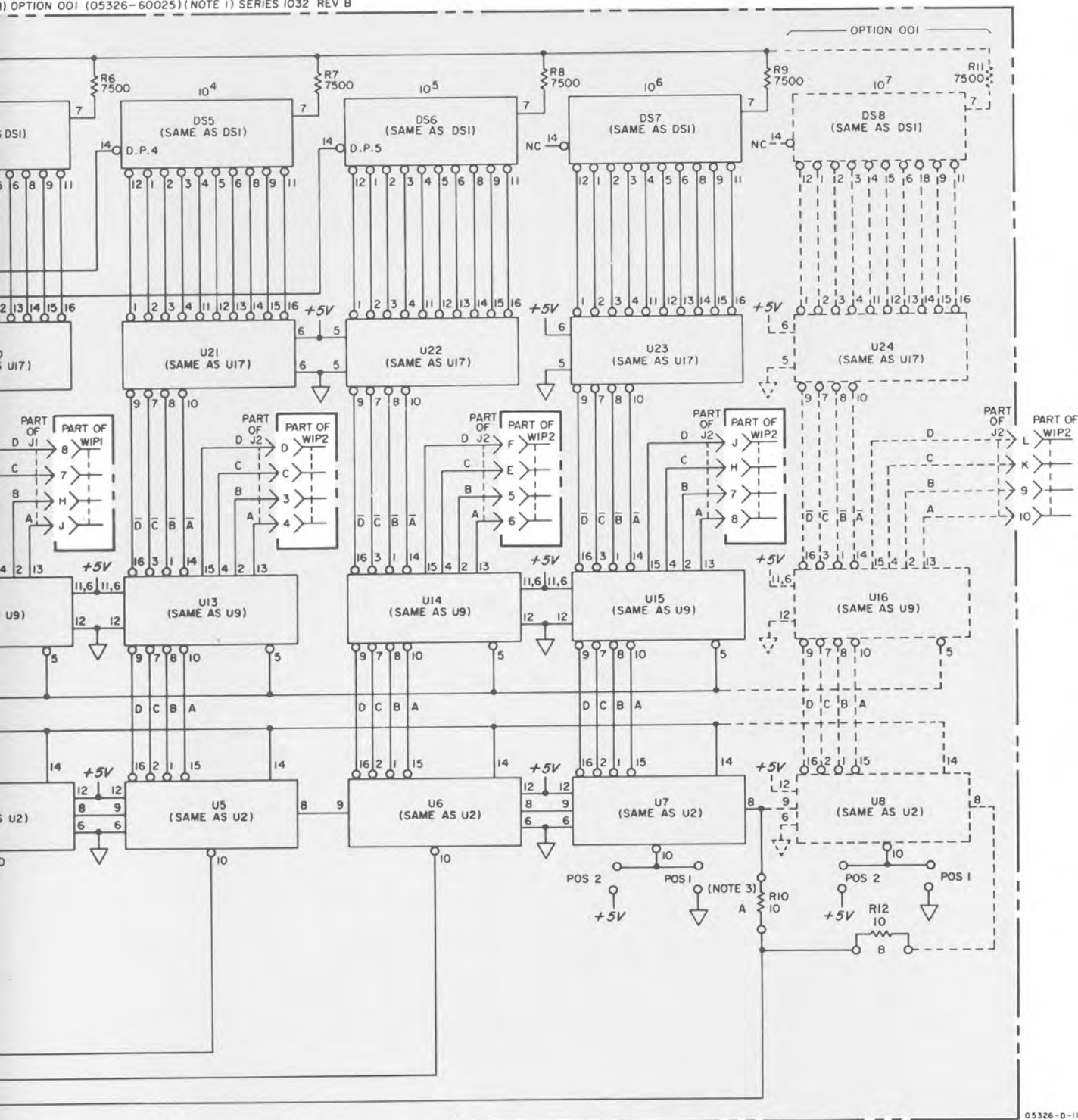


Figure 8-12. A9 Display Assembly Standard Instrument and Option 001.

A10 RIGHT READOUT OPERATION

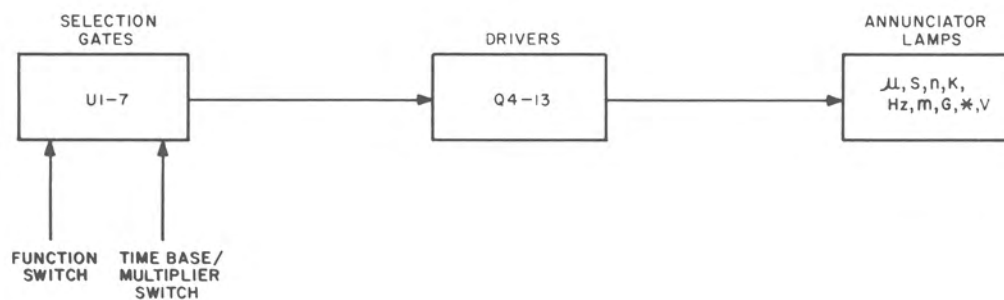
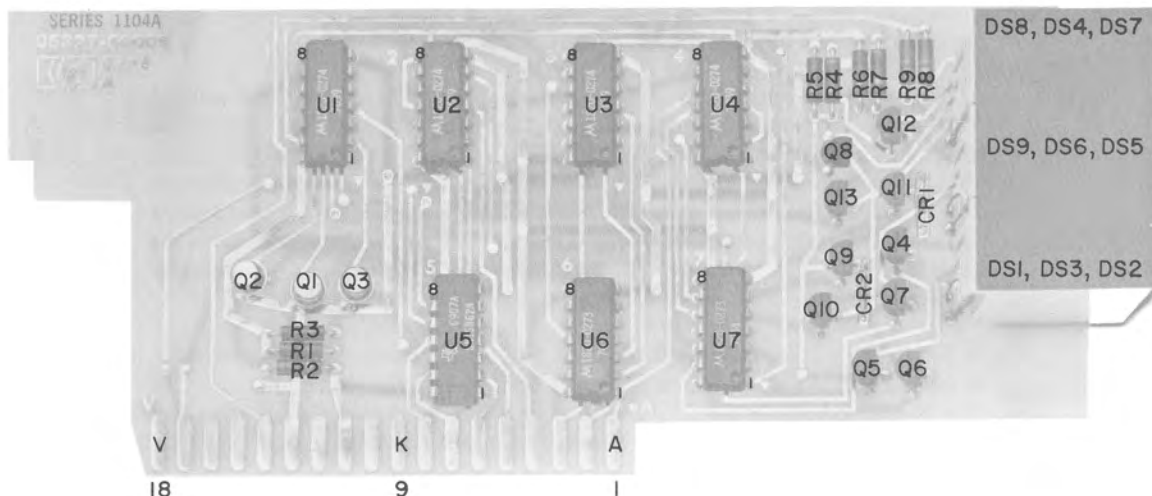
The right readout contains DTL logic to provide the proper measurement units for a given setting of the front-panel controls. A10 logic is negative true, and a low (≤ 0.8 volts) to the emitter of any driver transistor will light the given neon. When a DTL high is applied on the emitters, the transistor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

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

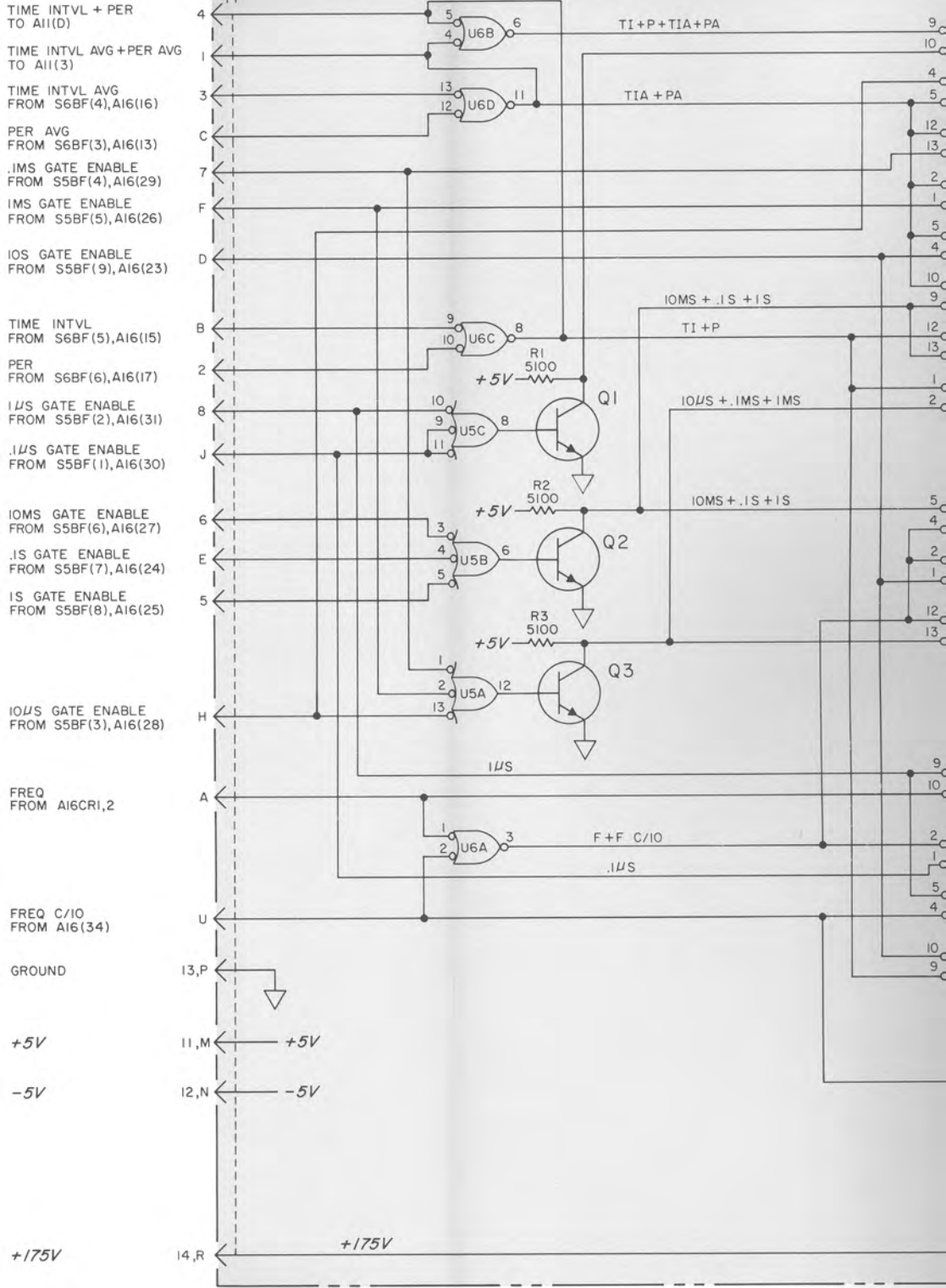
The asterisk (*) annunciator (DS8) is activated when the counter is in the time interval or period mode and the time base is 10s. An asterisk indicates the proper units are not displayed.

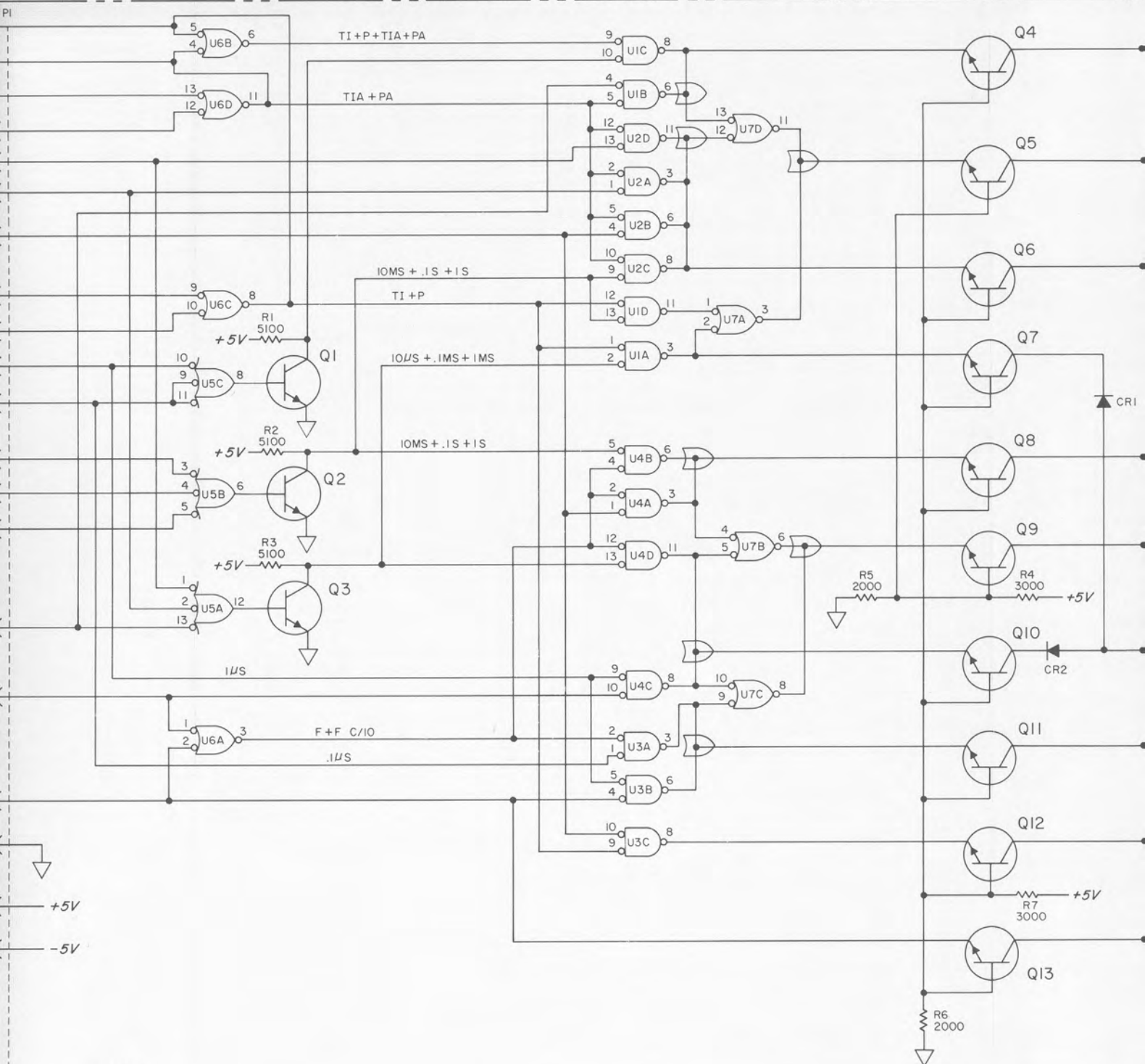
A10 TROUBLESHOOTING

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

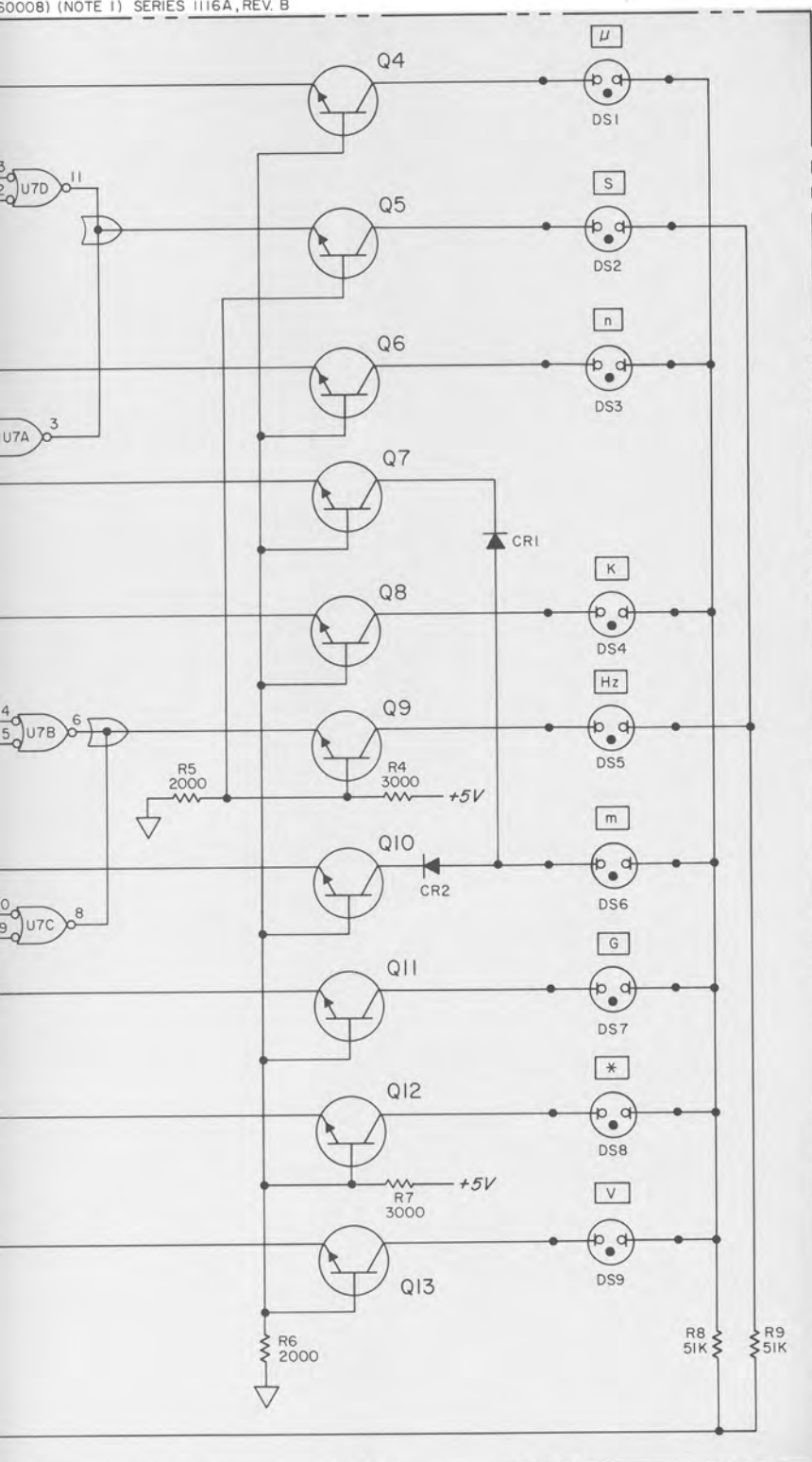


AIO RIGHT READOUT BOARD ASSEMBLY





50008) (NOTE 1) SERIES 1116A, REV. B



NOTES

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

REFERENCE DESIGNATIONS

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

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2	1901-0040
Q1-3	1854-0009 2N709
Q4-13	1854-0474 2N5551
U1-4	1820-0274 MC 1808
U5	1820-0310 MC 862
U6,7	1820-0273

Figure 8-13. A10 Right Readout Assembly

A11 LEFT READOUT OPERATION

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

The overflow signal from the $\div 10$ 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.

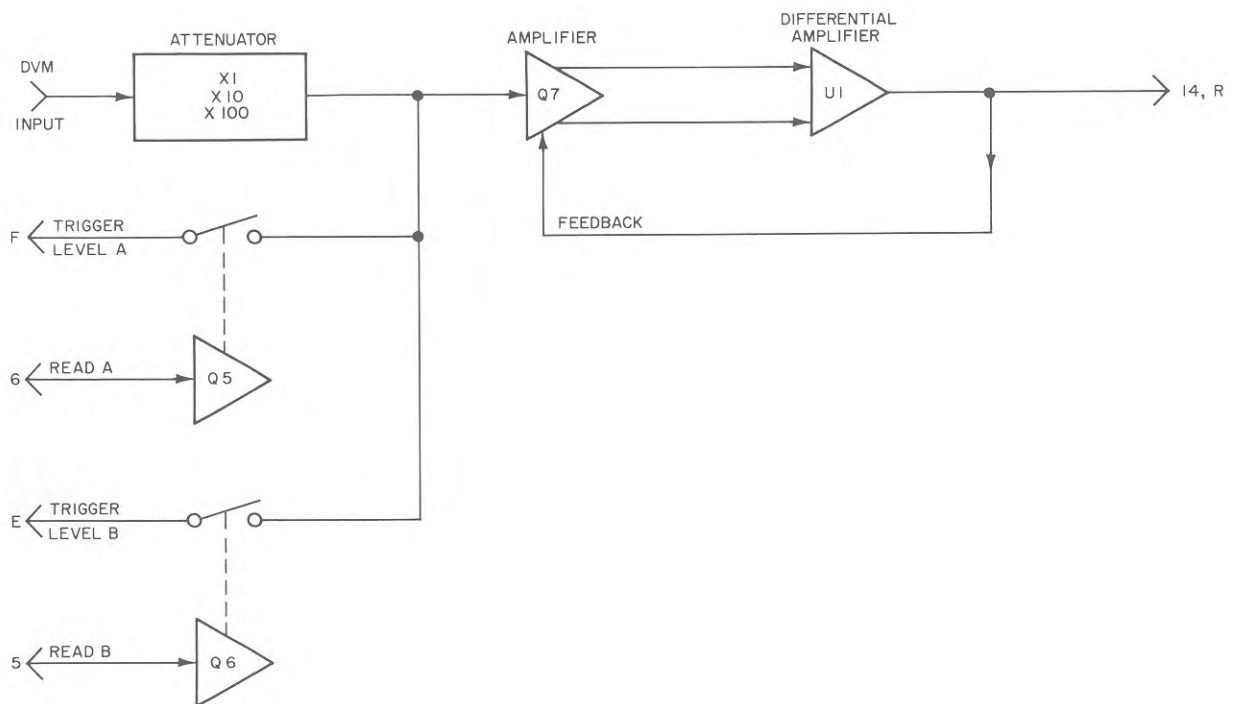
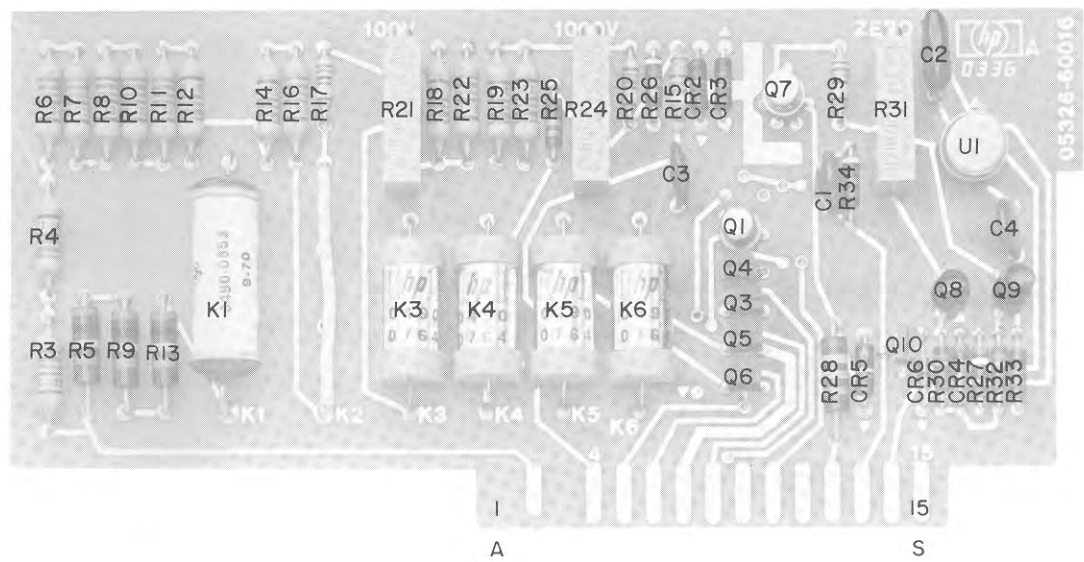
Decimal selection and resultant blanking are accomplished by the negative logic AND gates. For any pair of low inputs, a specific decimal point line is held low, lighting the decimal point. There are a number of combinations for each decimal; therefore, the output of each AND gate is paralleled to give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

A11 TROUBLESHOOTING

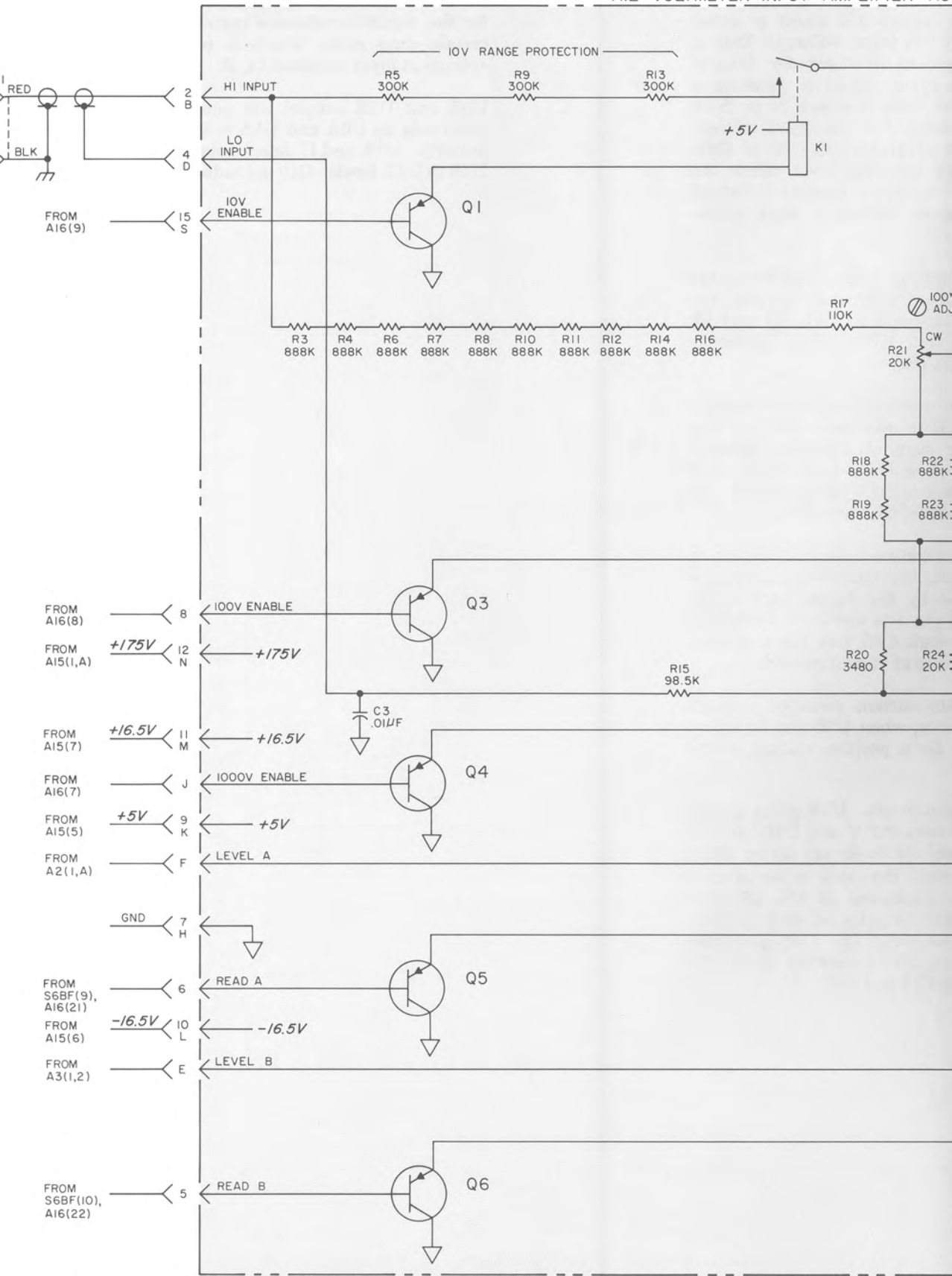
Select the specific function mode and time base combination that is faulty. Check the gate that is common to the two lines. Refer to Table 5-5 for the proper annunciator lighting conditions.

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.



A12 VOLTMETER INPUT AMPLIFIER AS



Q6

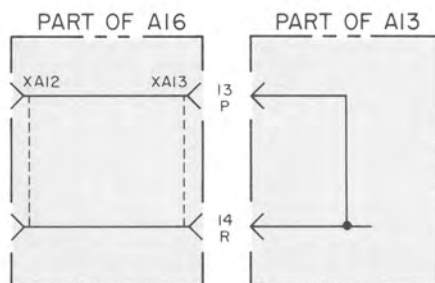
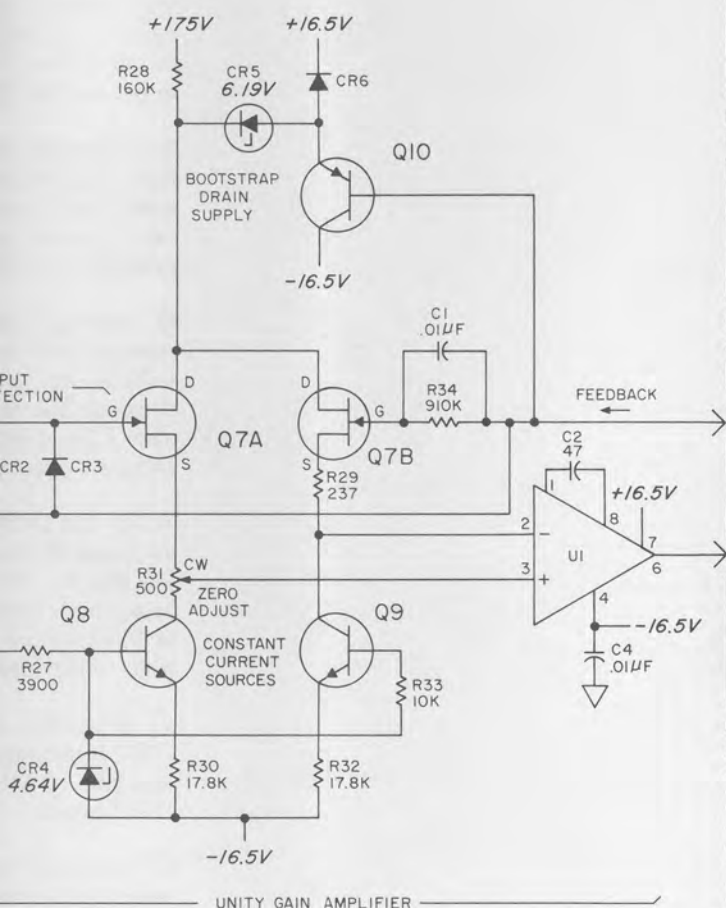
Model 5326/27B Schematic Diagrams

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
U1	2N3906
	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

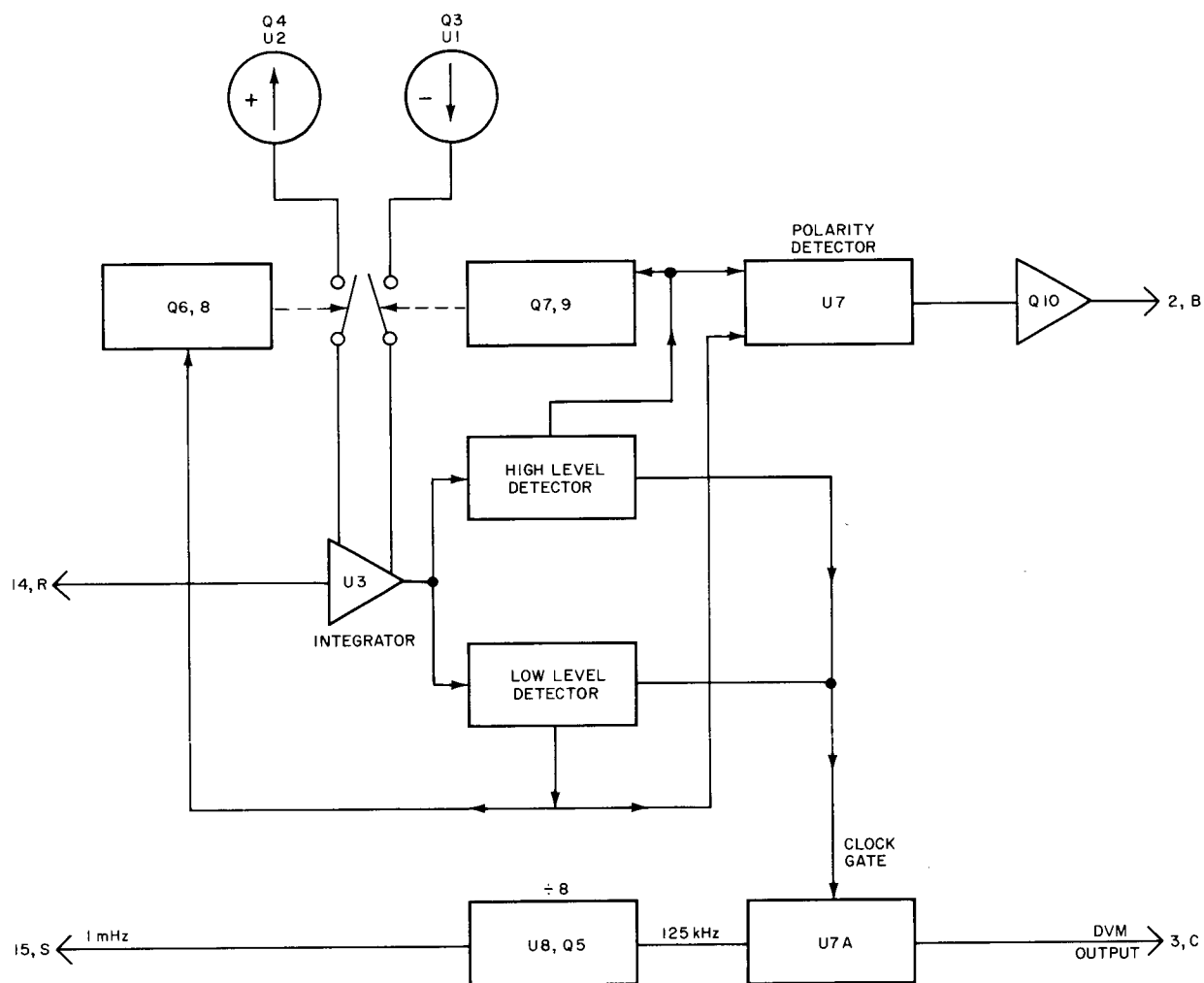
NO PREFIX	A12
J1	C1-4 CR2-6 K1,3-6 Q1,3-10 R3-34 U1

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

05326-0-15

Figure 8-15. A12 Voltmeter Input Amplifier Assembly

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



MORE DATA UNDER THIS FOLD

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.

14, R ←

15, S ←

Figure 8-15
A12 VOLTMETER INPUT AMPLIFIER ASSEMBLY

(See Page 8-39)

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 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.

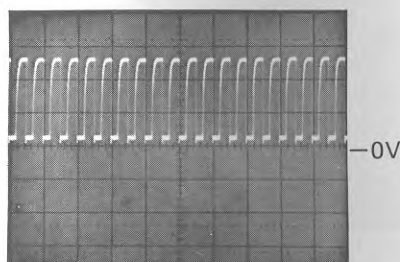
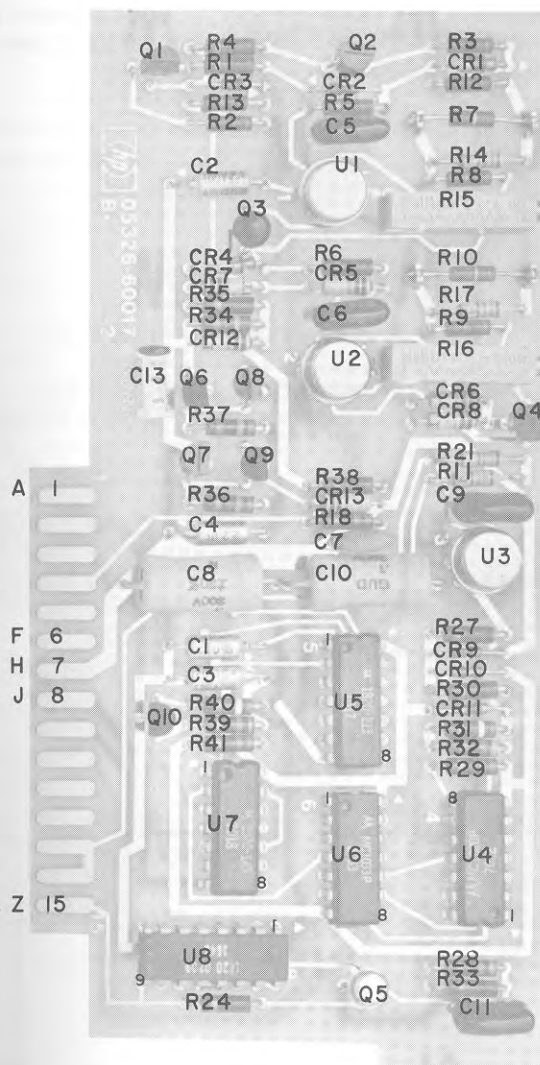
When the DVM input is negative, the negative reference current is switched through diode CR5 into the summing node of the integrator U3 pin 2. This operation is controlled by the digital part of the assembly. If pin 2 of U5A is high and pin 1 is low (A=1), diode CR7 is back biased to route Q3 current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

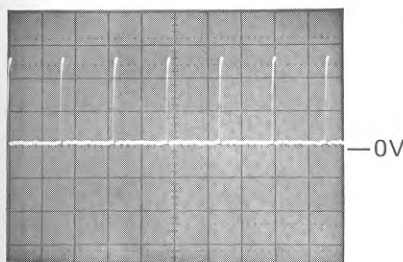
U4 is a quad comparator with ECL output levels. U4A gives a high output if the output of U3(V2) is greater than -0.7 V and U4B pin 4 is low if V2 is less than -1.8 V. These threshold levels are set by CR11 and R29, 31, 32. U4C and D differentiate the clock input after it passes through the divide-by-8 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 to the master and U5A the slave for the negative reference voltage at input terminal.

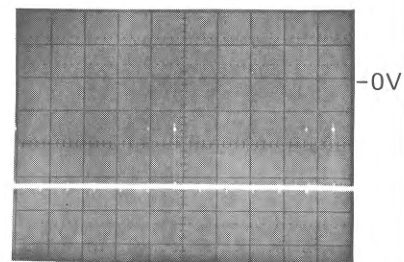
U6B and U5B control the same way as U6A and U5A polarity. U7B and C de U7B to DTL levels. Q10



1 U8(9)
.1 V/cm
2 μ s/cm



2 Q5 Collector
.2 V/cm
5 μ s/cm



3 U7(3)
.05 V/cm
10 μ s/cm

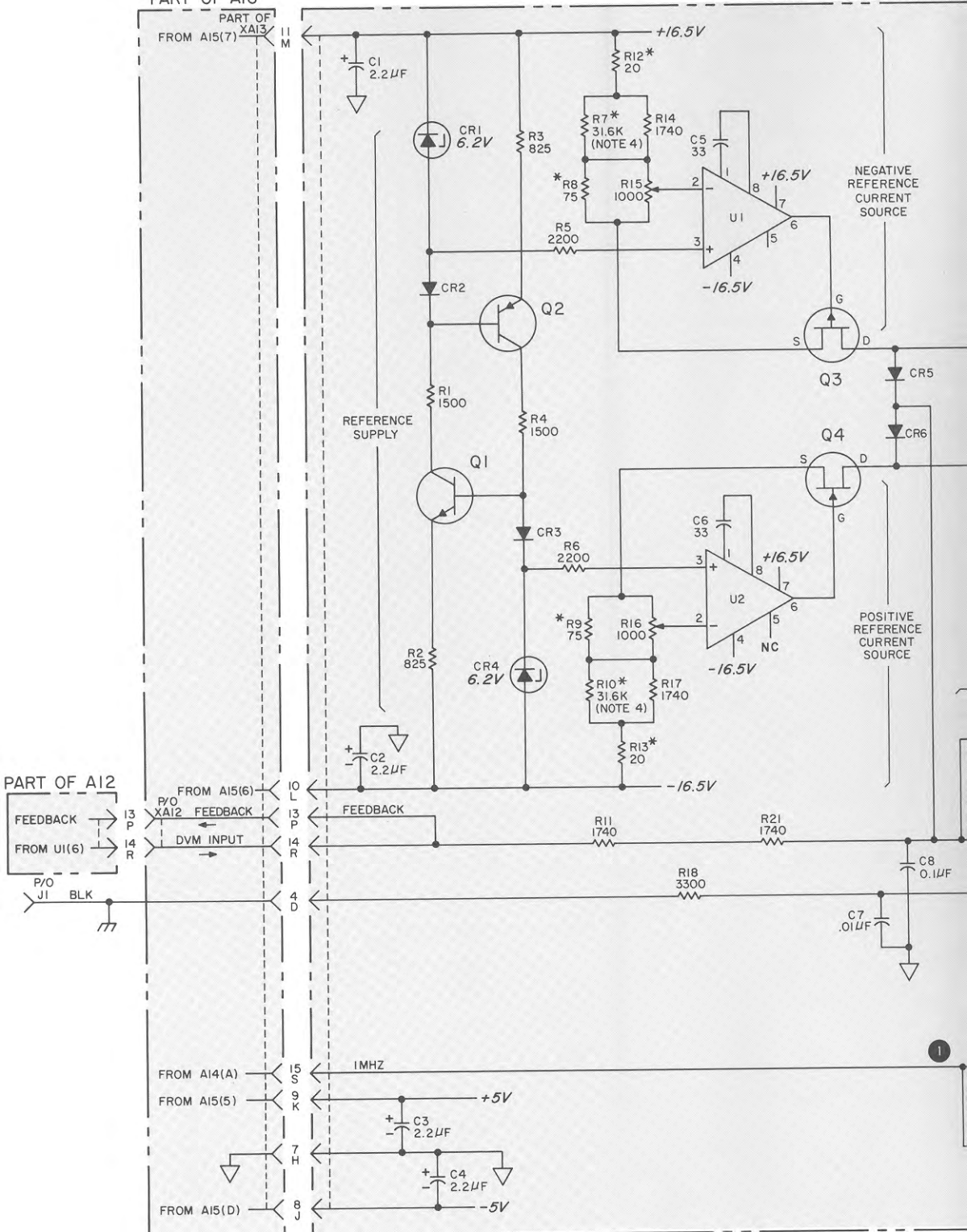
All waveforms dc coupled through 10:1 divider probe. Divider probe ground connected to junction to C1 and C3. Triggering is internal ac. Zero volts in center line of graticule.

SAMPLE RATE NORM CCW
FUNCTION READ A

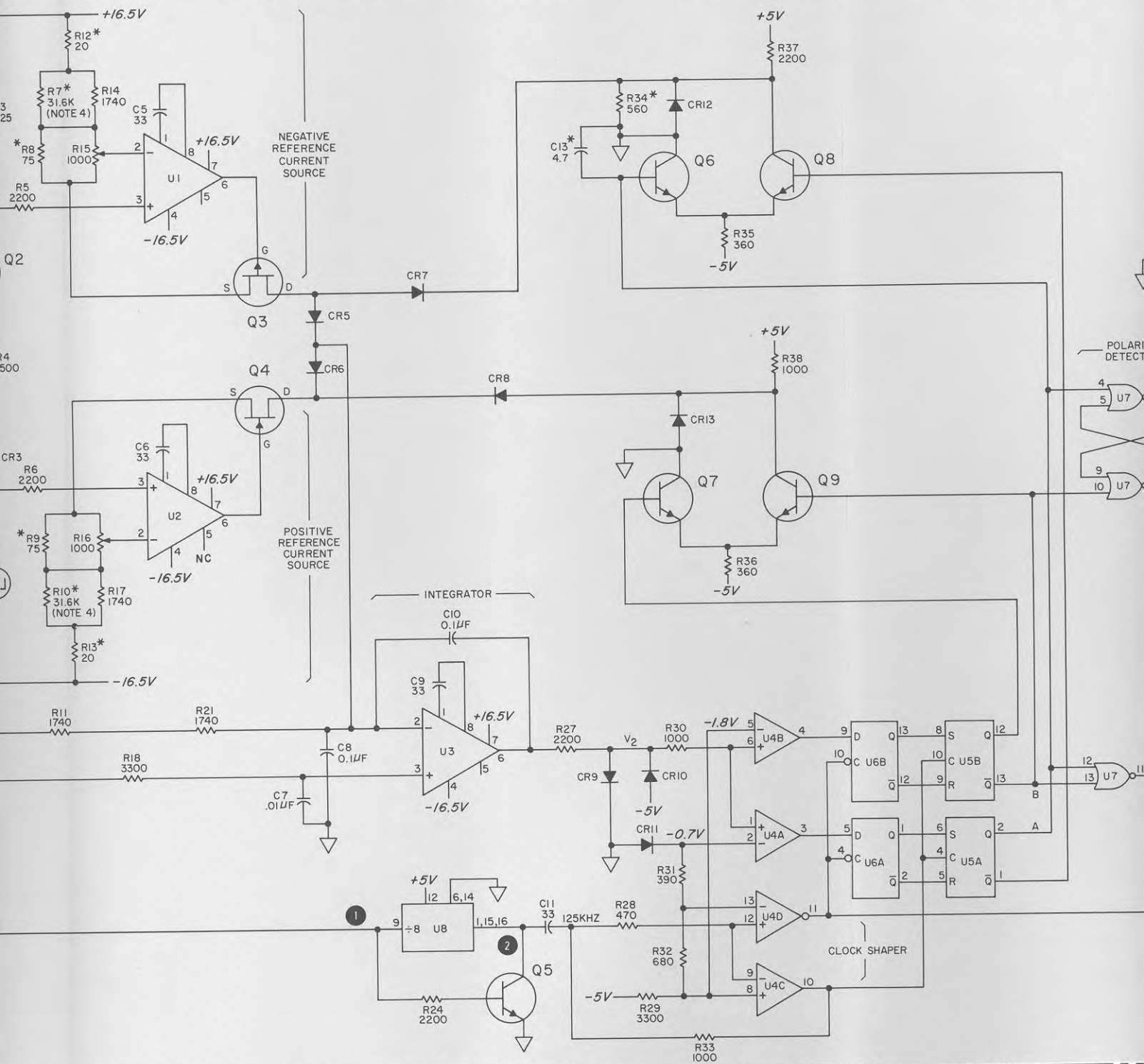
A LEVEL for 2.10 V readout

PART OF A16

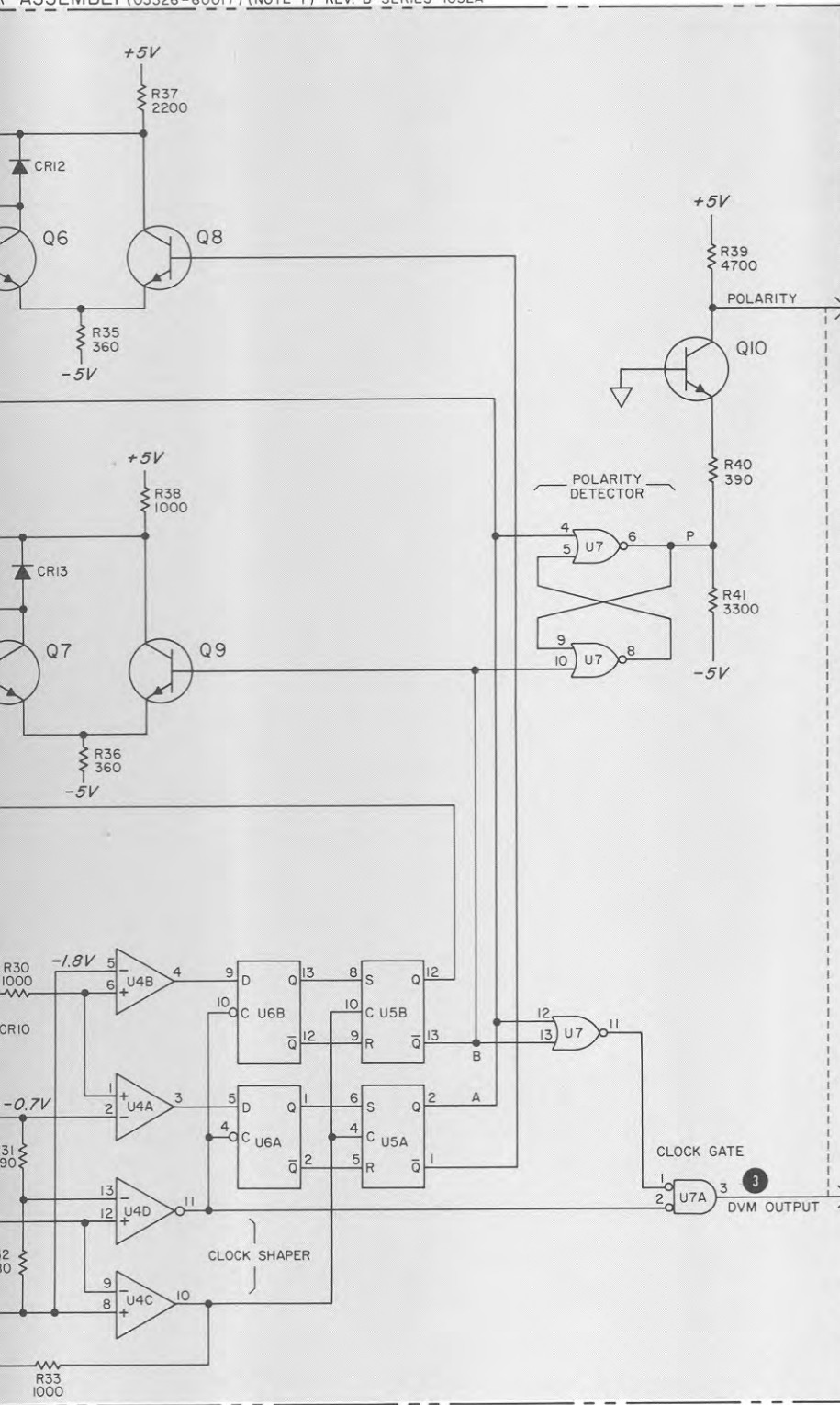
A13 VOLTMEETER VOL



A13 VOLTMEETER VOLTAGE TO FREQUENCY CONVERTOR ASSEMBLY (05326-60017) (NOTE 1) REV. B SERIES 1032A



R ASSEMBLY (05326-60017) (NOTE 1) REV. B SERIES 1032A



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 PICO FARADS;
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, 19.6K 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	1902-0680
CR7	1901-0535
CR2,3,9-11	1901-0040
CR5,6,8,12,13	1901-0179
Q1,10	1854-0071
Q2	1853-0020
Q3	1855-0056
	2N4342
Q4	1855-0081
Q5	1854-0009
	2N709
Q6-9	1854-0092
	2N3563
U1-3	1820-0223
	MC14399
U4	1820-0212
	MC1020P
U5	1820-0213
	MC1014P
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
	$-0.7V > V_2 > -1.8V$	L	L	PREVIOUS STATE
POSITIVE	$-1.8V > V_2$	L	H	H

H = -0.75V, L = -1.60V

05326-D-16

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

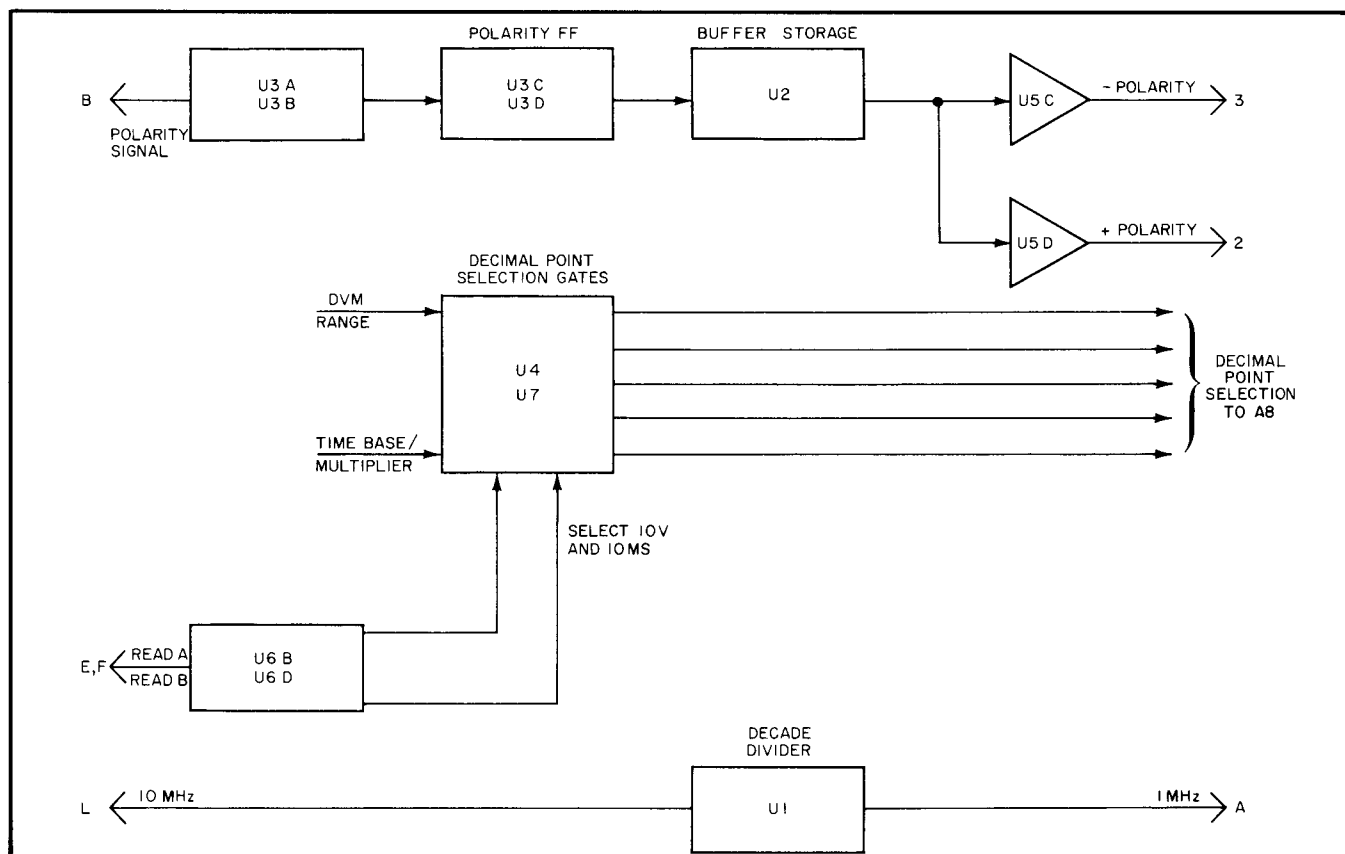
A14 VOLTMETER DISPLAY CONTROL OPERATION

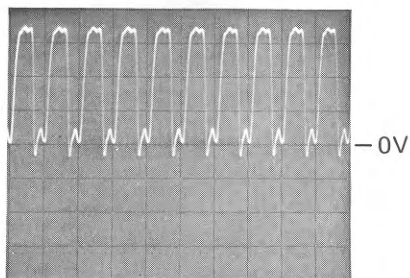
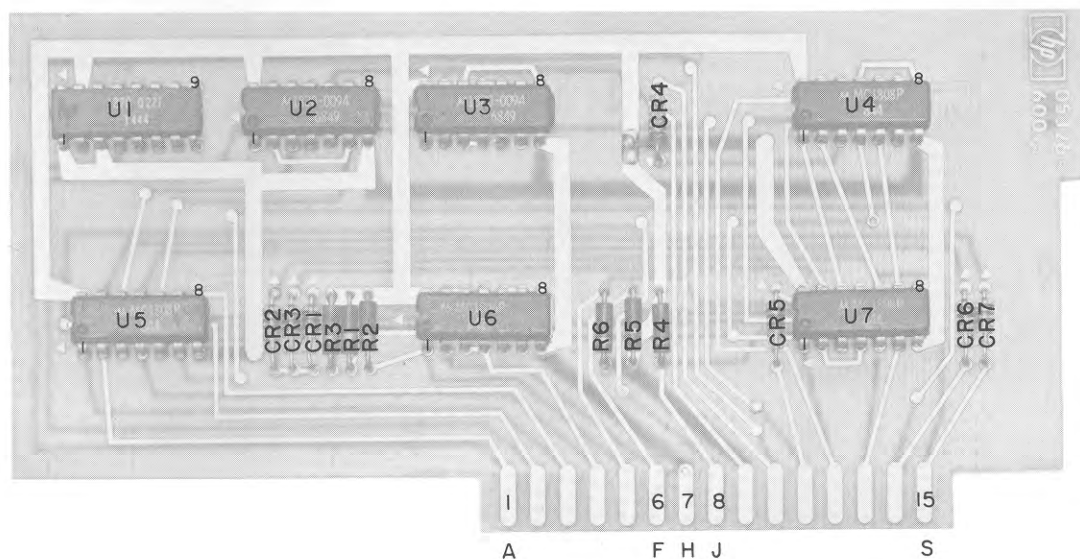
This board activates the "volts", "+", or "-" annunciators, provides the 1 MHz required by A13, and selects the decimal point for three settings of the time base switch.

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

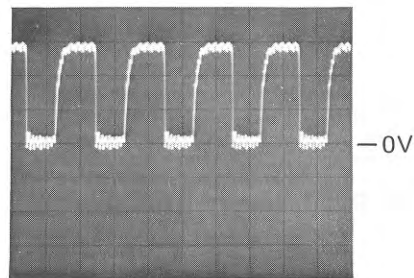
Gates U5C and D activate either the + or - front panel lamp when the unit is in the DVM, READ A, or READ B mode. The volts annunciator is activated by U5B whenever the mode is DVM, READ A, or READ B and when the time base is 10 ms, 100 ms, or 1 sec. U5A removes the ground from the DVM range switch when 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.





① A14 U1(2)
.1 V/cm
.1 μ s/cm

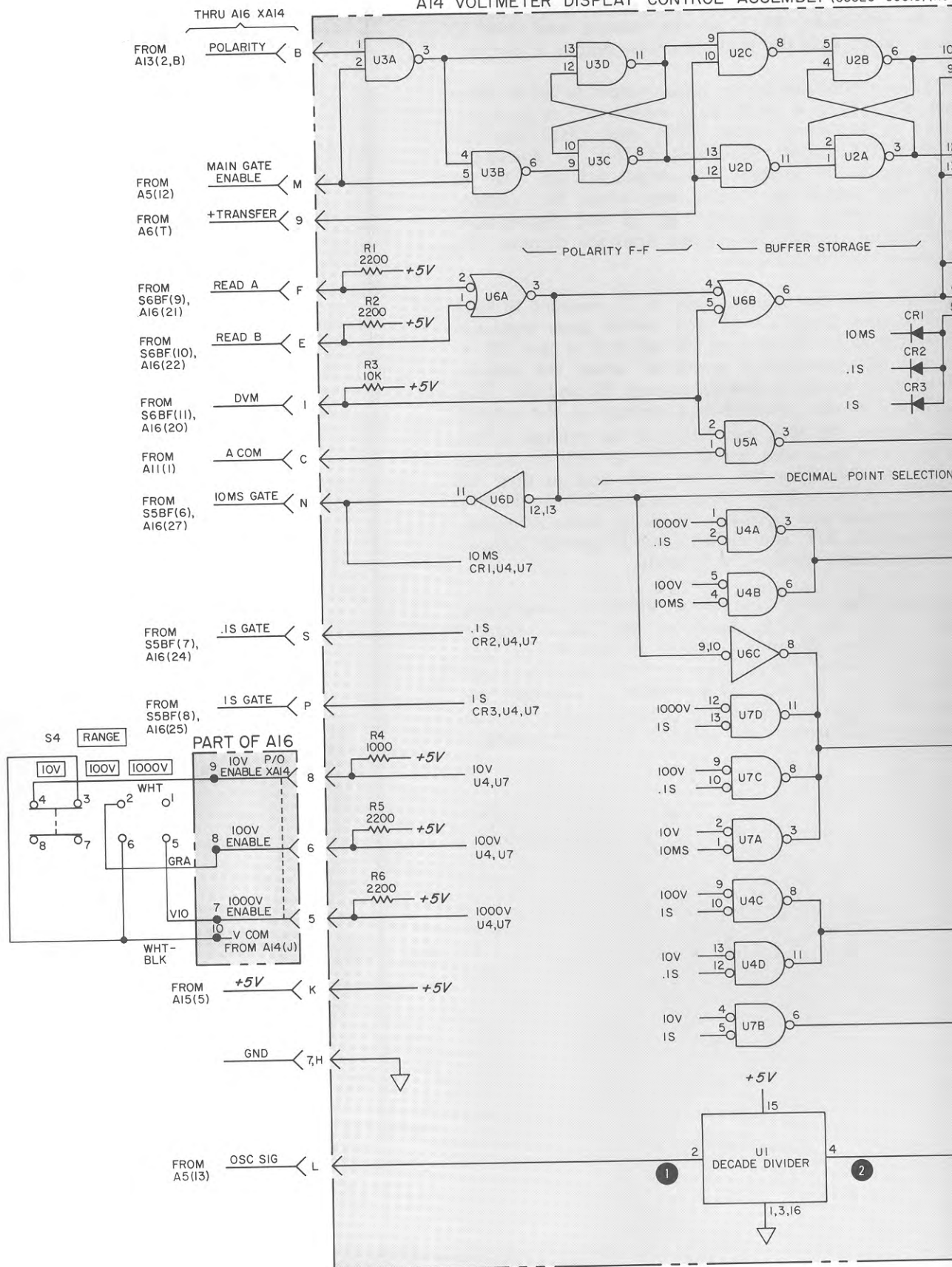


② A14 U1(4)
.1 V/cm
.5 μ s/cm

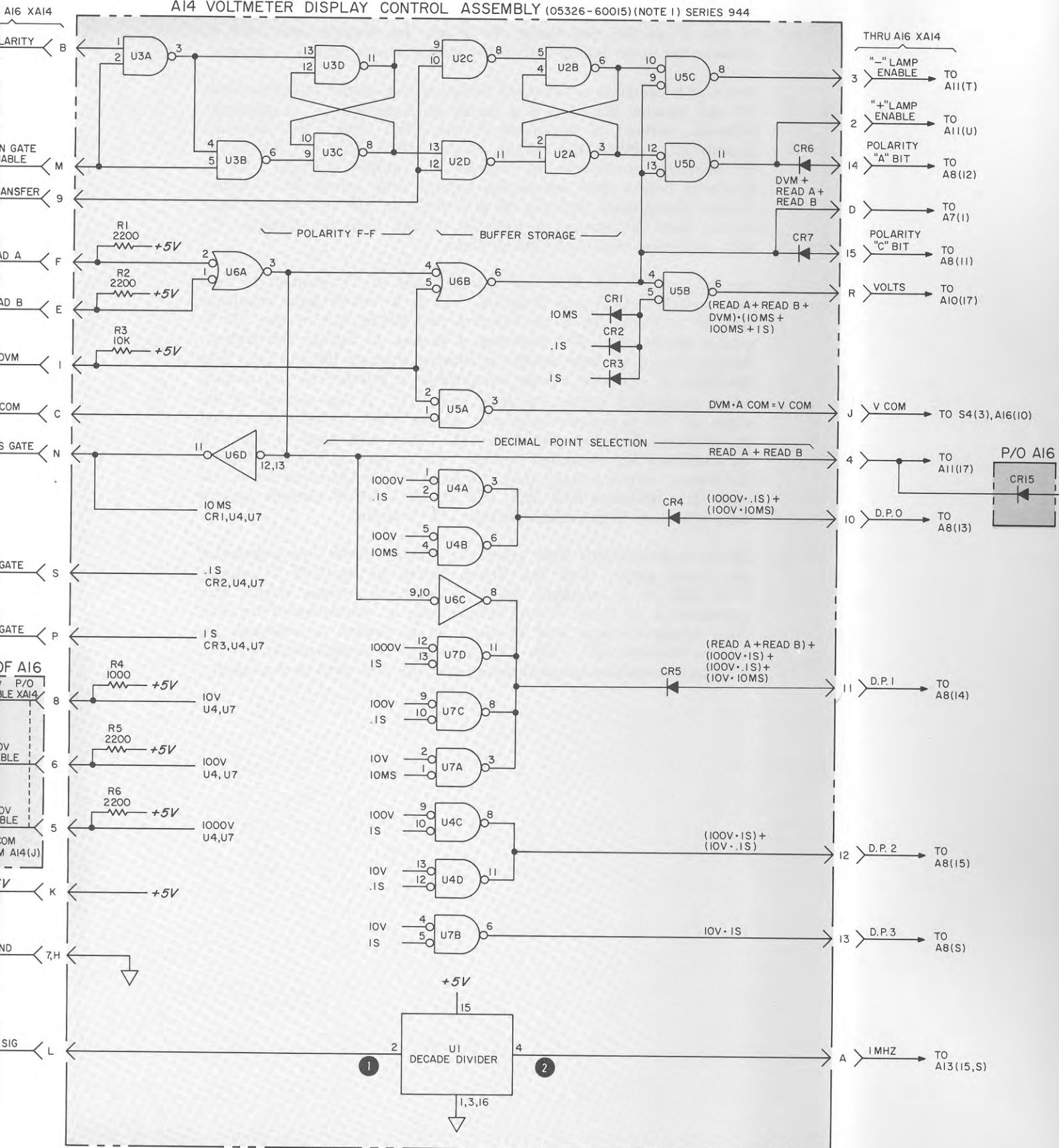
All waveforms dc coupled through 10:1 divider probe. Divider probe ground is connected to U2(7). Zero volt center line as indicated.

Counter Controls: INT-EXT (rear panel) INT

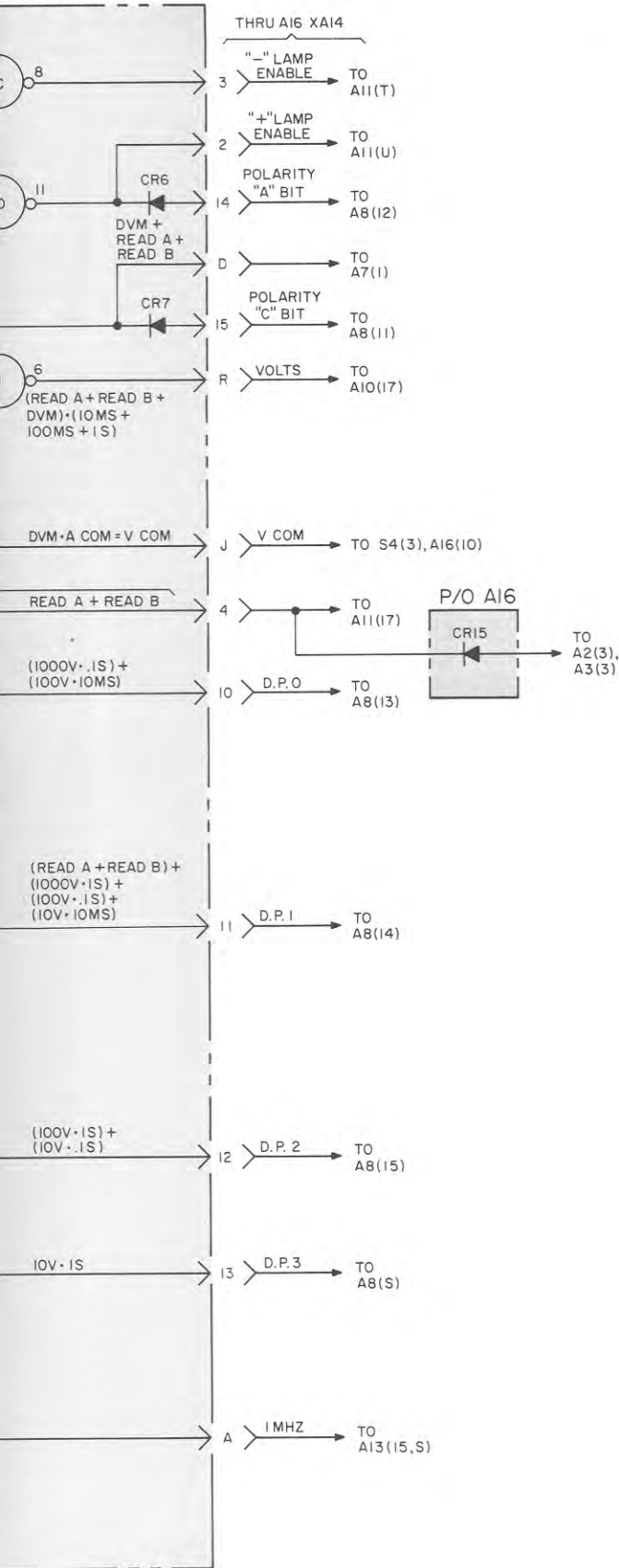
A14 VOLTMETER DISPLAY CONTROL ASSEMBLY (05326-60015) (NOT)



A14 VOLTMETER DISPLAY CONTROL ASSEMBLY (05326-60015) (NOTE 1) SERIES 944



SERIES 944



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

NO PREFIX	A14	A16
S4	CR1-7 R1-6 U1-7	CR15

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
A14 CR1-7 U1 U2,3 U4,5,7 U6	1910-0016 1820-0413 1820-0094 MC 846P 1820-0274 1820-0273 MC1806P
A16 CR15	1901-0040

05326-0-3

Figure 8-17. A14 Voltmeter Display Control Assembly

A15-A16 POWER SUPPLY OPERATION

The power supply provides +175, +16.5 V and +5 V. Transformer T1 has a 115/220 primary and secondaries with open circuit voltages of 181 V at the red leads, 21 V at the orange, and 18.6 V between the green leads, with the winding center tapped to ground.

A15 CR6-9 comprise a full-wave bridge whose output is fed to filter C3 and bleeder R3. Q5 is a series pass regulator. A constant reference voltage is developed across CR11 and 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&CR12 in the 175 V supply except that R10 provides a means to adjust the output. Assume that a Q1 base current is flowing through R2 and Q6. The resulting Q1 collector current establishes a voltage at the output, which is divided across R9, R10, and R11. If the voltage at the wiper of R10 is greater than that across CR9, Q9 will be turned on, shunting base current from Q1. This will tend to turn off Q1 and lower the regulated voltage. Thus, varying R10 establishes the largest output voltage that can exist before Q9 turns on to cut back Q1. Resistors R17, R18, and diodes CR15-18 provide current limit action at 180 mA similar to the +175 V supply.

Q6 is a preregulator that gives the circuit better line regulation and lower ripple than the Zener diodes of the 175 V supply. With CR1 as a reference, Q6 is a constant current circuit that maintains a Q1 base current independent of variations of the input (line voltage changes and ripple). R4 is needed to establish the current through CR1. The -16.5 V supply is complementary. The 5 V supplies are also complementary and only the + will be discussed.



The output from the T1 green leads is fed through full wave rectifier CR10 and CR11 into filter C1. It then passes through overload current limiter R1 and into the series pass regulator Q1, to the 5 V output at Q1C. Q3 is a driver for Q1 and has approximately 5.75 V on its base, developed across CR6 and CR5 by the current from the 16.5 V supply through R7. If the voltage at the emitter 5.1 V, Q3 is turned on providing base current to turn on Q1, raising the output voltage. Q3 turns off when its emitter gets above 5.1 V. C2 is the output filter to maintain a low output impedance at high frequencies.

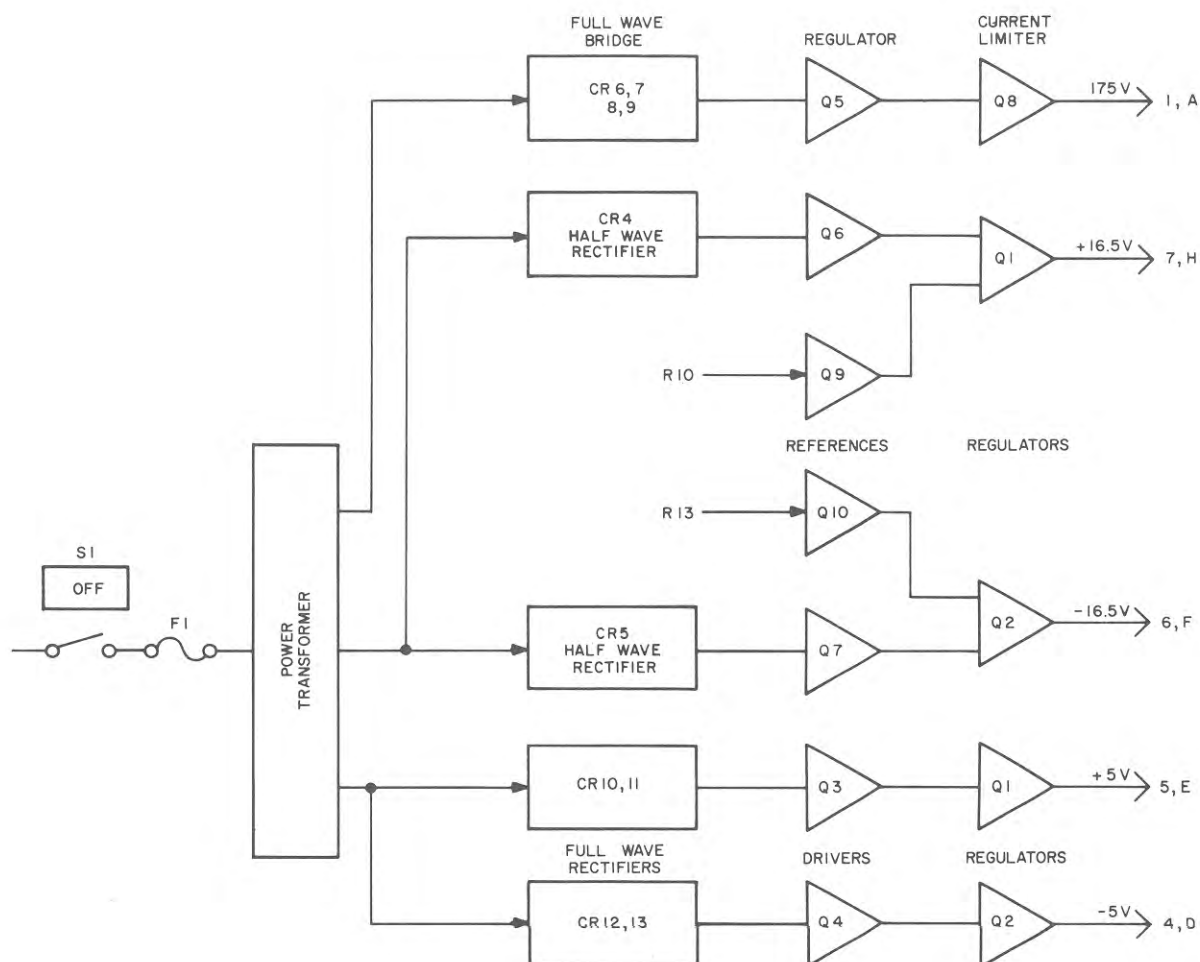
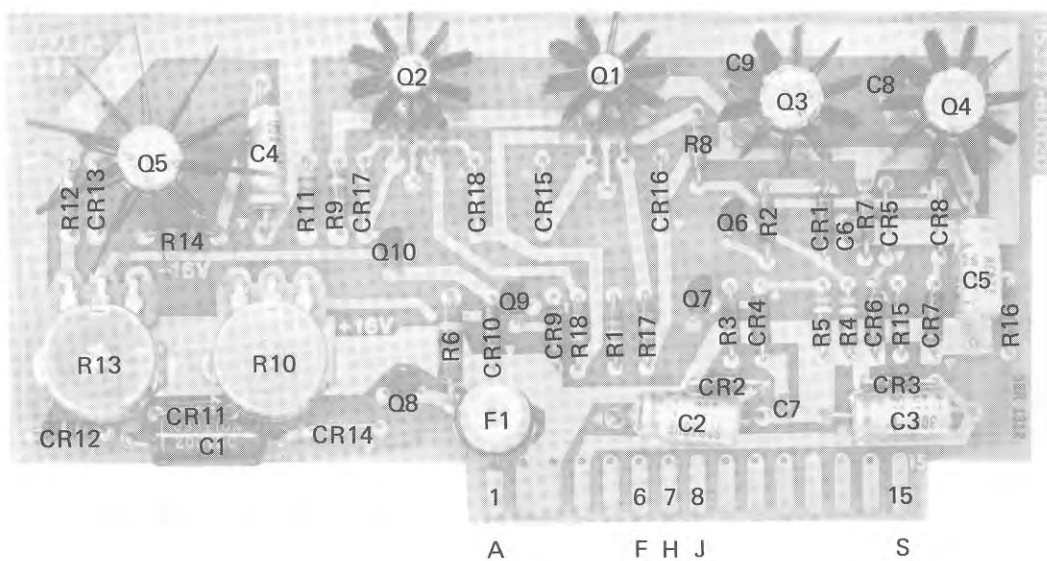
CR2 clamps the output at 6 V to provide protection for the IC's in case the 16.5 V or 175 V line should momentarily short to the 5 V line. CR5 provides thermal compensation for Q3.

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

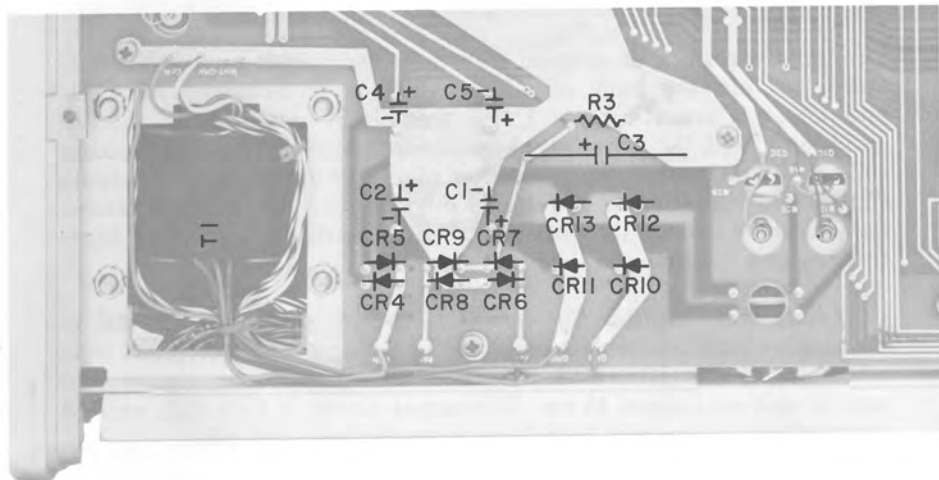
Figure 8-17
A14 VOLTMETER DISPLAY CONTROL ASSEMBLY

(See Page 8-43)

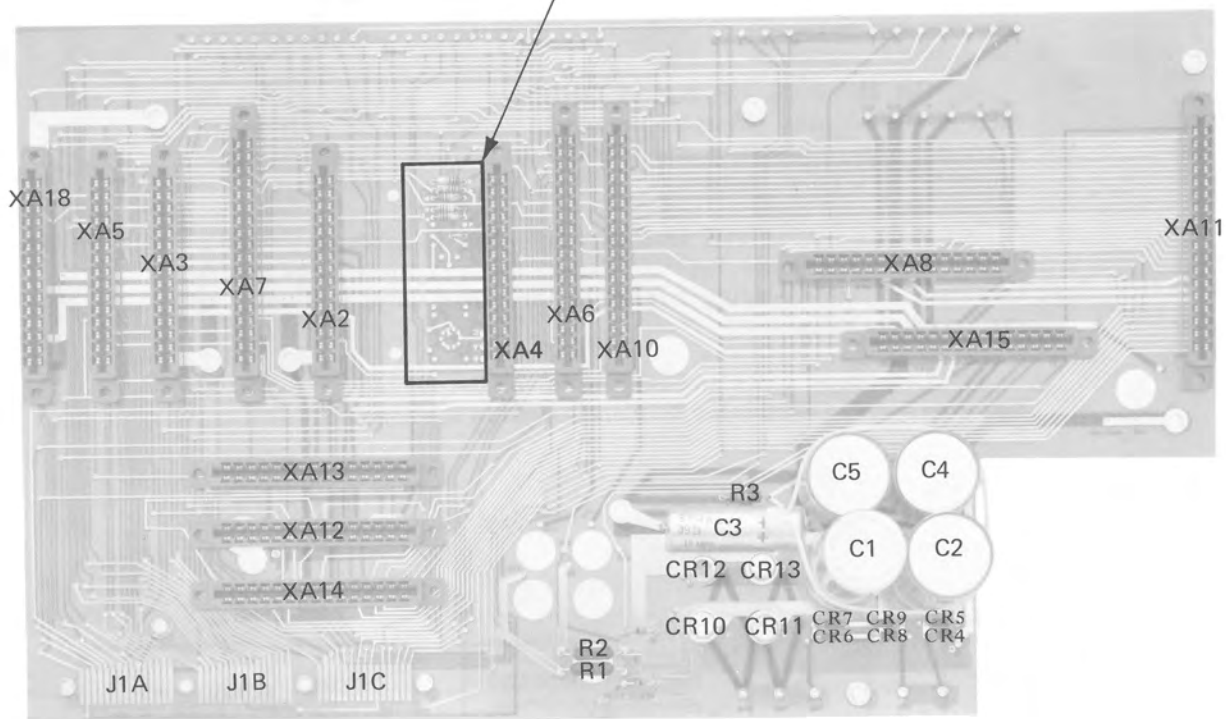
Part of Figure 8-18. A15, A16 Regulator/Interconnect Board Assembly

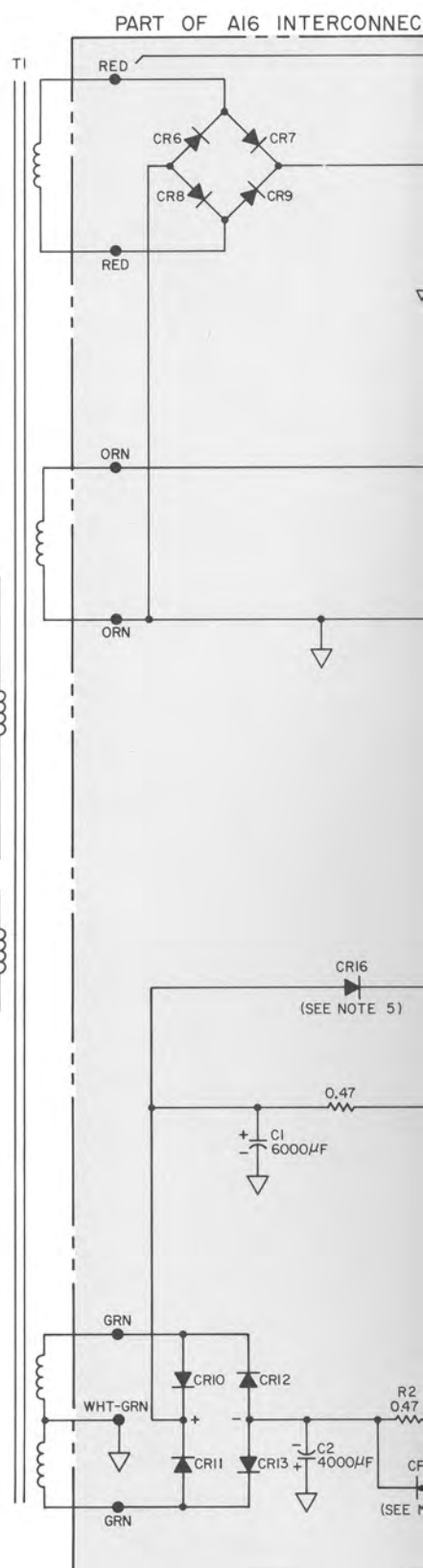
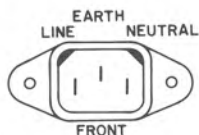


MORE DATA UNDER THIS FOLD



SEE FIGURE 8-24

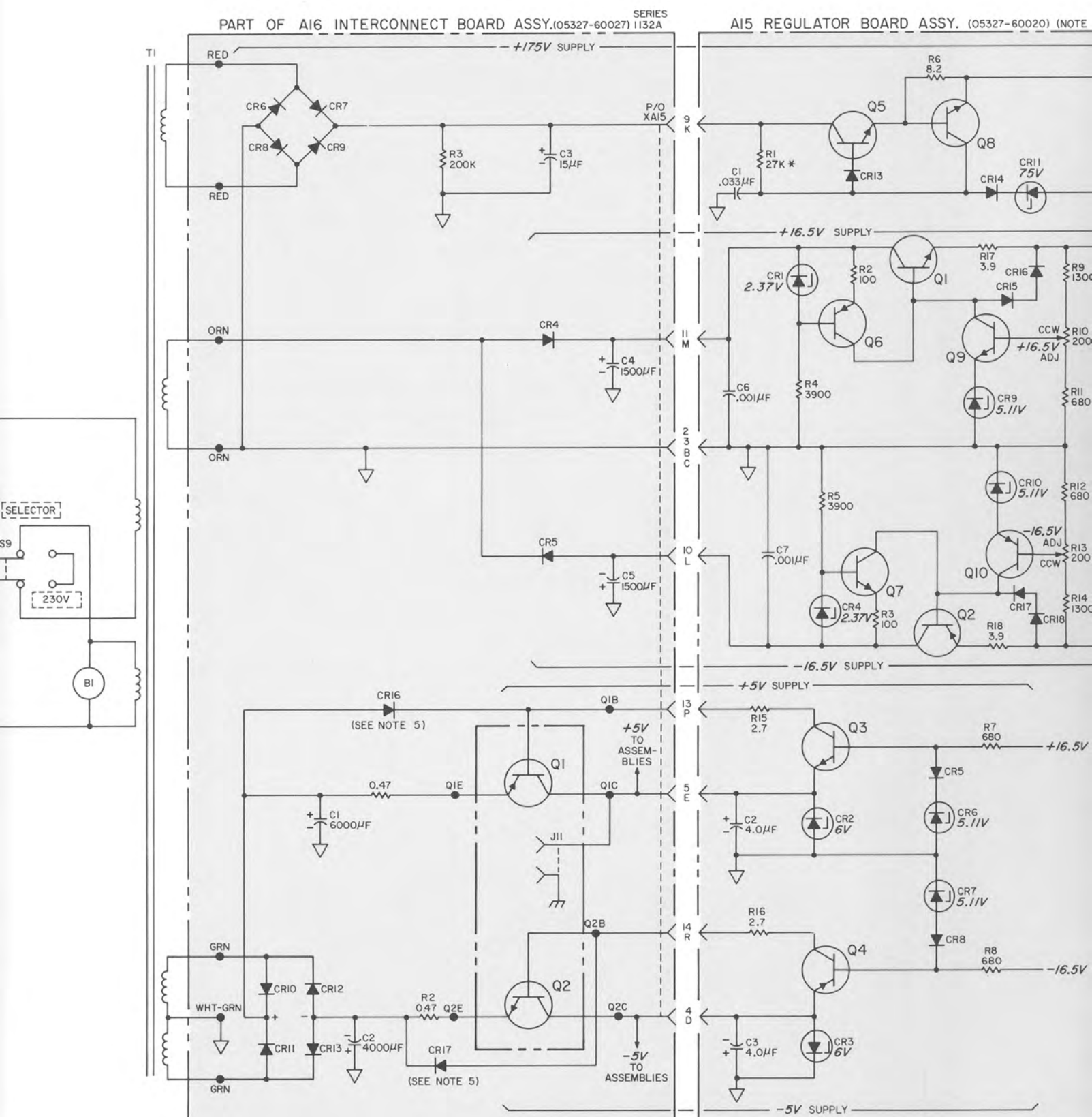




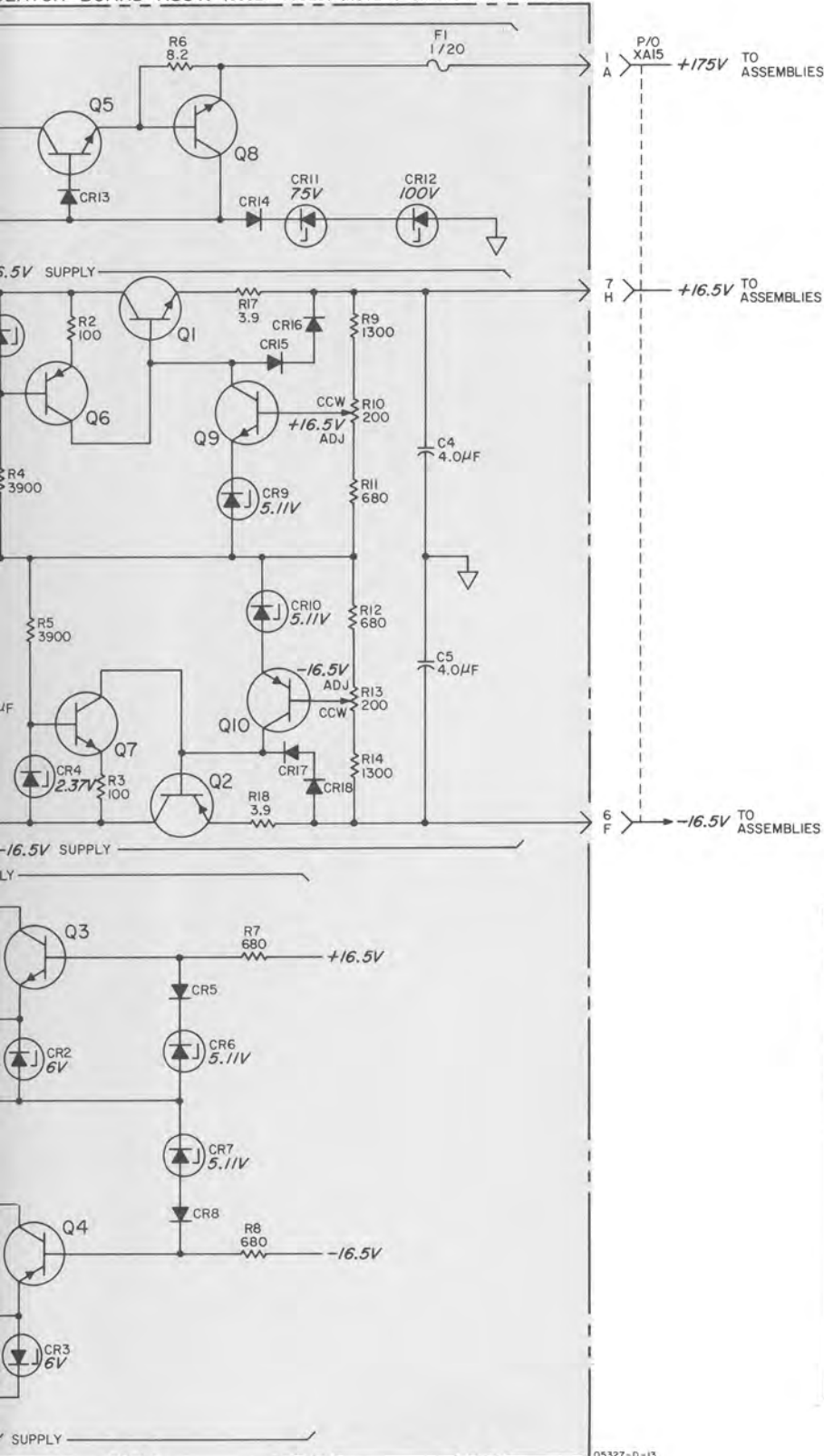
PART OF AI6 INTERCONNECT BOARD ASSY.(05327-60027) 1132A

SERIES

AI5 REGULATOR BOARD ASSY. (05327-60020) (NOTE



ULATOR BOARD ASSY. (05327-60020) (NOTE 1) SERIES 1428A REV. D



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
BI CI	CI-7 CR1-18	CI-5 CR4-13, 16,17
FI J8, J11 P2 Q1, 2 SI, 9 TI W3	FI Q1-10 RI-18	RI-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	1902-3394
CR12	1902-3429
CR13, 14	1901-0033
Q1	1854-0300
Q2	1853-0073
Q3	1854-0039
Q4	2N3053
Q5	1853-0012
Q6, 10	2N2904A
Q7, 9	1854-0232
Q8	1853-0020
A16	
CR4, 5	1854-0071
CR6-9	1854-0474
CR10-13	1901-0045
CR16, 17	1901-0029
	1901-0415
	1901-0460

Figure 8-18. A15, A16 Regulator/Interconnect Board Assembly

A17 INPUT C AMPLIFIER OPERATION

The input amplifier performs two functions: it provides a channel for increased sensitivity and it produces narrow pulses for efficient usage by other counter circuits. The amplifier is not controlled by any front-panel switches.

The input signal is dc coupled into a 50 ohm input impedance (R1) and is fed into the input amplifier, which is protected by R2, CR1, and CR2. Current source U1Q5 feeds the balanced differential amplifier U1Q3, Q4. The twin outputs are loaded by R10 and peaking coil L2. The signal flows to another amplifier circuit, whose outputs control the triggering of the tunnel diode, CR3. The diode is biased for maximum sensitivity with R11. When the diode fires, it produces fast rise and fall times on the input signal.

High-impedance emitter followers (Q1, Q2) ac couple the signal to the single-ended differential amplifier of Q3 and Q4. The short time constants of C9, R18, and C12, R23 differentiate the signal into narrow spikes of about 15 ns. The output circuit of C11, R22, and L4 approaches resonance at high frequencies for improved gain.

The signal is then fed to the one-shot multivibrator U2. The one-shot output goes High (U2, pin 4) when the input goes low. The output goes Low again after about 12 ns, when the level changes have propagated through the gates in a domino effect.

SENSITIVITY ADJUSTMENT

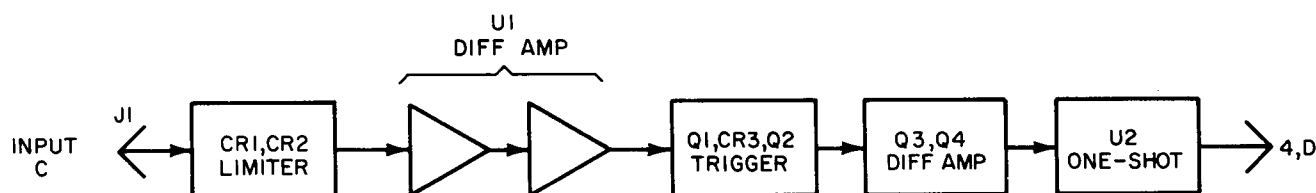
- a. Set counter controls as follows:

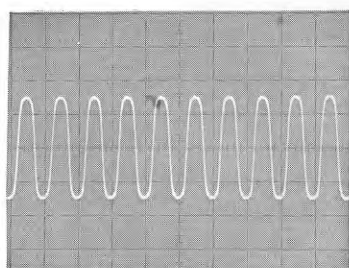
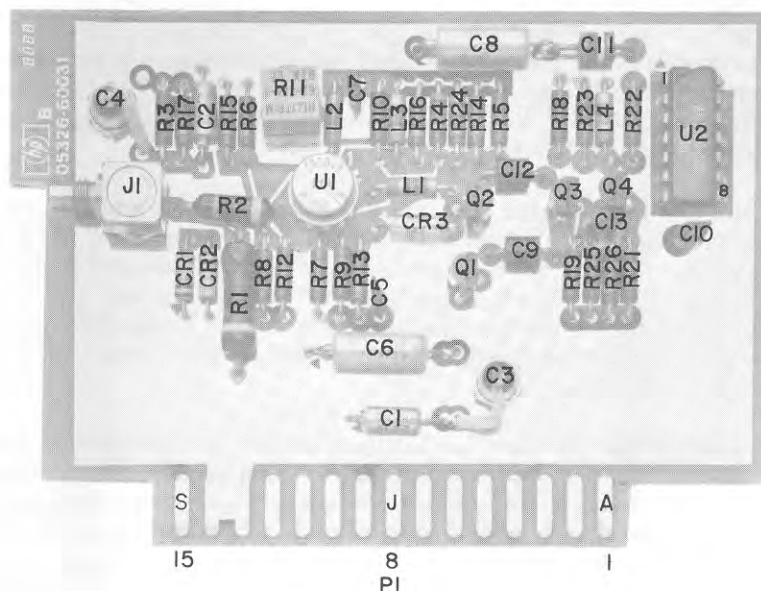
FUNCTION FREQ C
TIME BASE 0.1 S

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

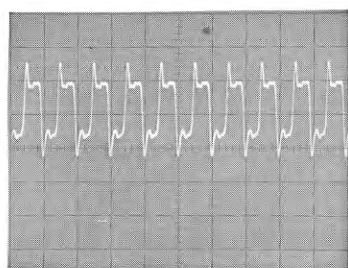
- c. Reduce output level until counter's display becomes unstable. Adjust R11 for a stable display. Repeat this procedure until unable to obtain a stable reading. Increase the signal level until display just becomes stable.

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

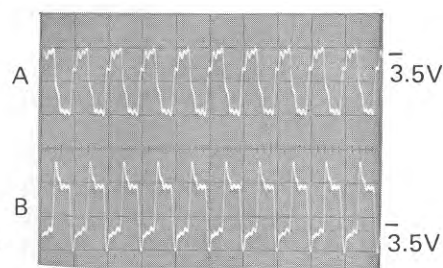




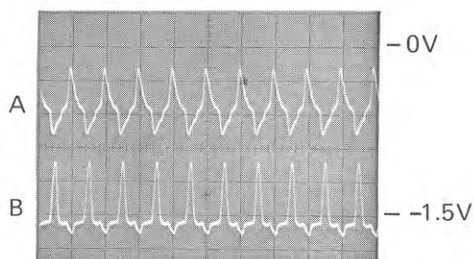
1 .05 V/cm
.1 μs/cm



2 .05 V/cm
.1 μs/cm



3 a. Q1 (base)
b. Q2 (base)
.02 V/cm
.1 μs/cm
ALT B



4 a. Q4 b. U2(4)
.05 V/cm
.1 μs/cm
ALT B

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

All waveforms taken with 10:1 divider probe; ground lead is connected to ground side of C6. A17 is mounted on extender board.

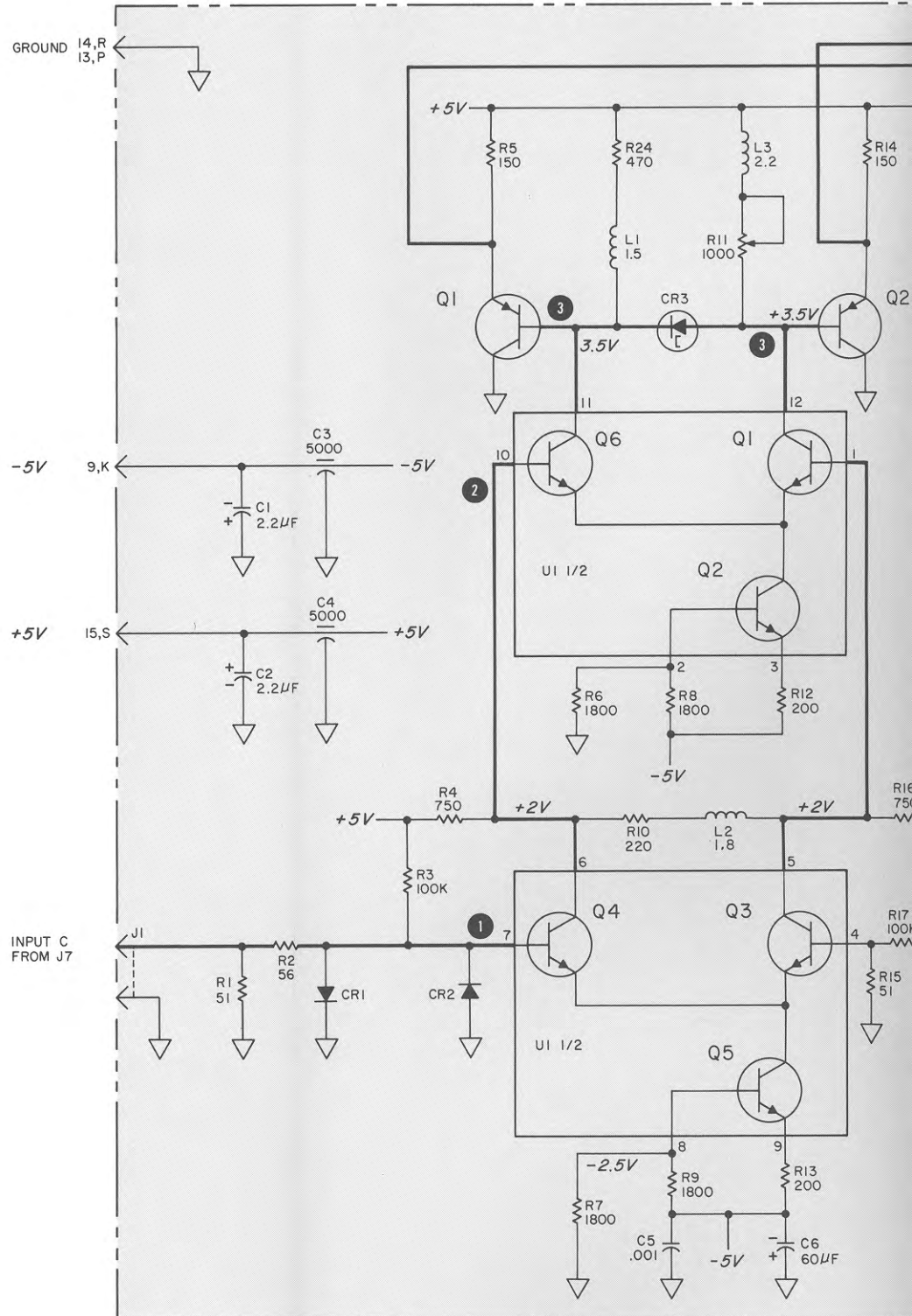
COUNTER CONTROLS:

INPUT C jack connect 10 MHz sine wave at 1 V rms
FUNCTION FREQ C
TIME BASE 1 ms
CHK/SEP/COM SEP

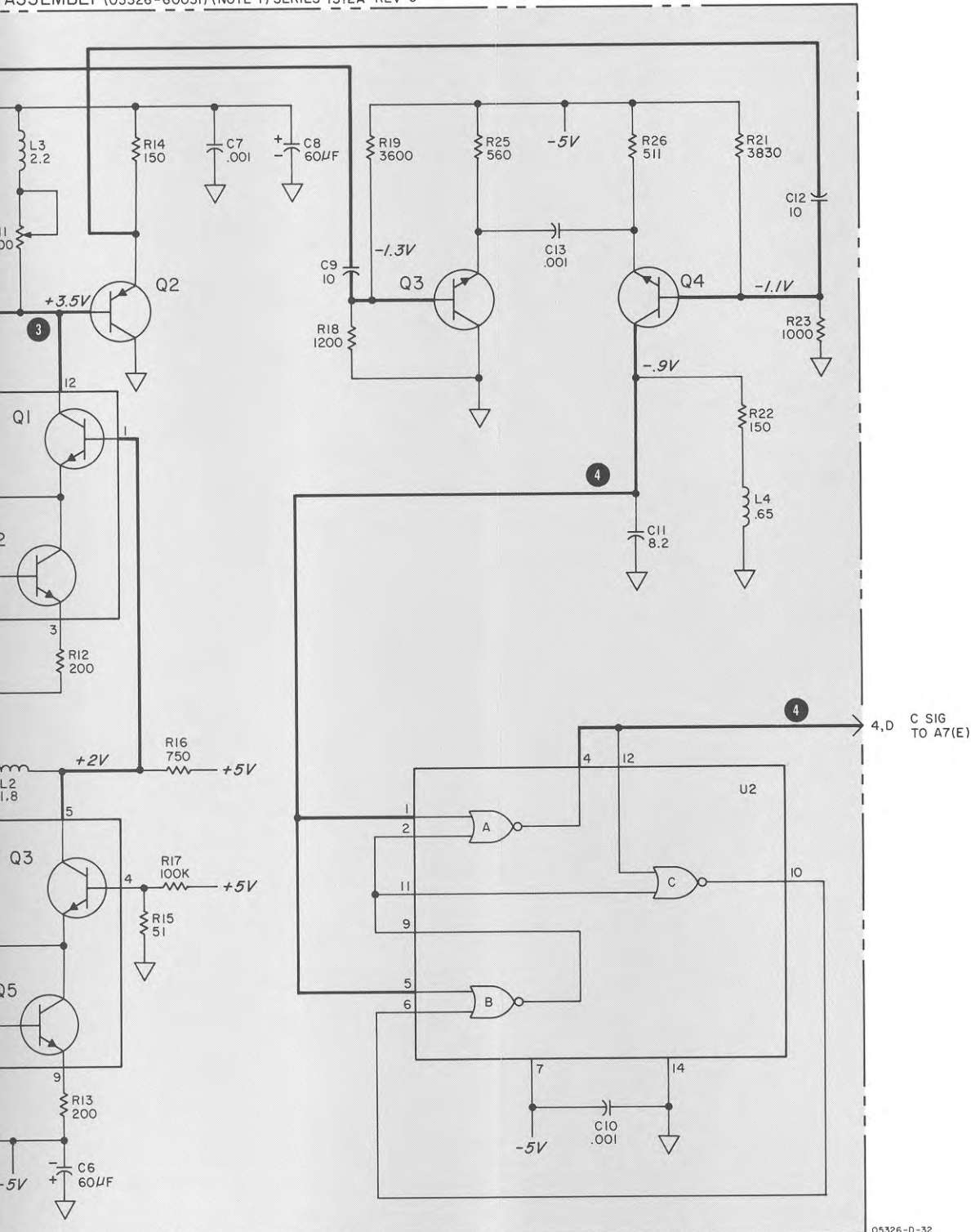
OSCILLOSCOPE CONTROLS:

SWEEP MODE AUTO
TRIGGER INT
SLOPE +

AI7 INPUT C AMPLIFIER ASSEMBLY (05326-60)



ASSEMBLY (05326-60031) (NOTE 1) SERIES 1312A REV C



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. THE FULL REFERENCE DESIGNATION AND ASSEMBLY NUMBER TO ABBREVIATION CORRELATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED, RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRIES.

TABLE OF ACTIVE COMPONENTS

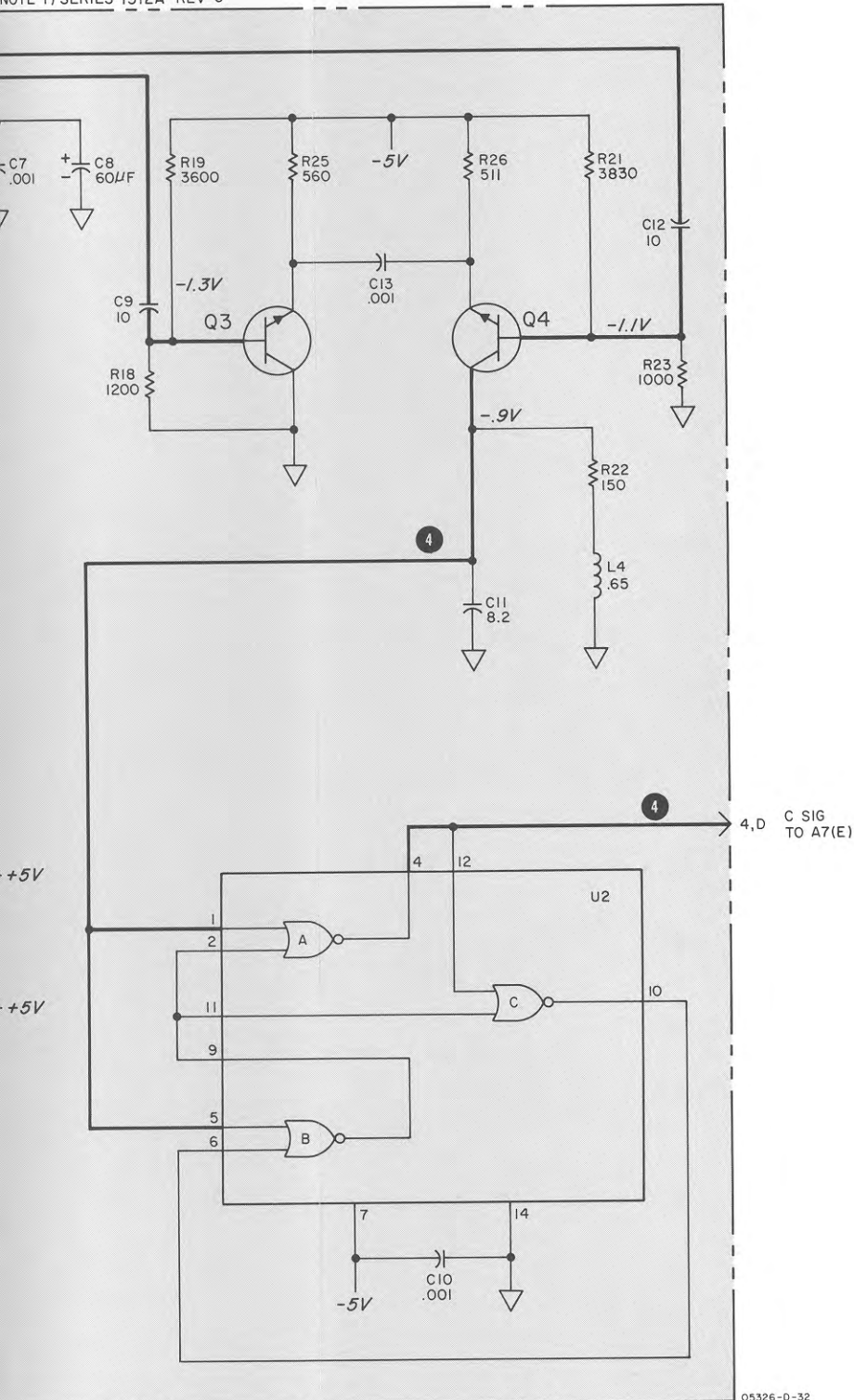
REFERENCE DESIGNATIONS	PART
CR1,2	1901-00
CR3	1912-00
Q1,2	1853-00
Q3	1854-00
Q4	1854-03
U1	1858-00
U2	1820-00

REFERENCE DESIGNATIONS

A1
C1-13
CR1-3
L1-4
Q1-4
R1-19,
21-26
U1,2

Figure 8-19. A17 Input C Amplifier
(53)

NOTE 1) SERIES 1312A REV C



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 PICO FARADS;
INDUCTANCE IN MICROHENRIES

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2	1901-0047
CR3	1912-0009
Q1,2	1853-0015
Q3	1854-0092
Q4	1854-0345
U1	1858-0004
U2	1820-0147

REFERENCE DESIGNATIONS

A1
C1-13
CR1-3
L1-4
Q1-4
R1-19,
21-26
U1,2

Figure 8-19. A17 Input C Amplifier Assembly
(5326B Only)

A18 PRESCALER OPERATION

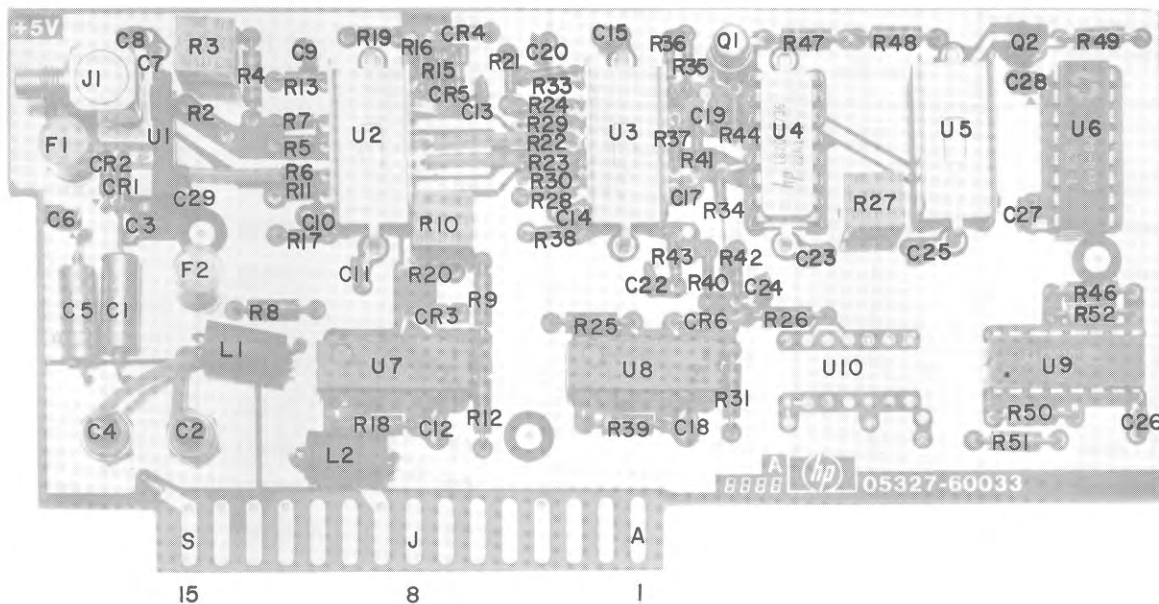
The prescaler board serves as a direct amplifier-trigger or as a divide-by-ten amplifier-trigger, with the function controlled by a front-panel input selector switch. With the switch in the PRESCALE position, the circuit performs as follows:

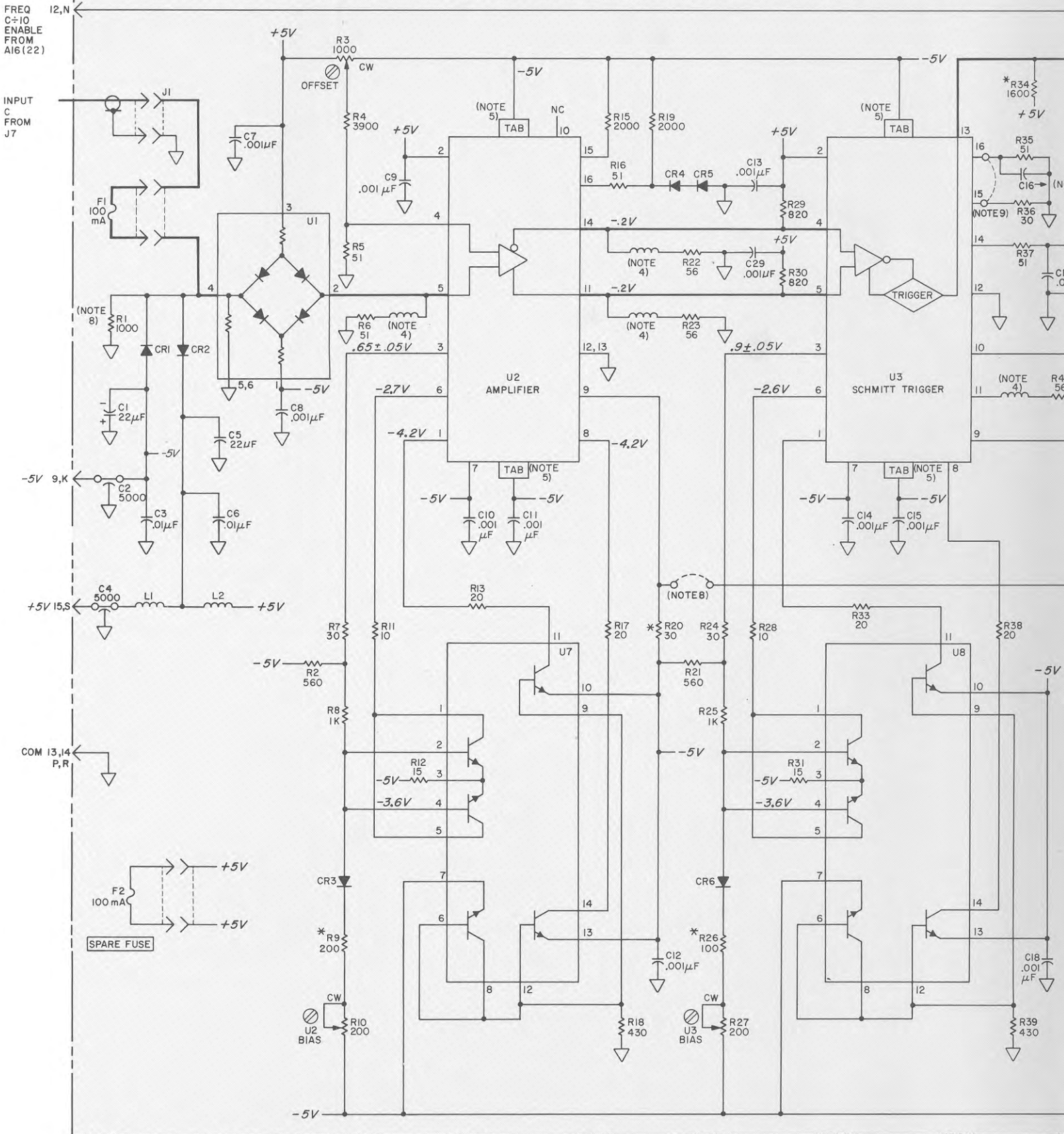
The signal is fed into the 50 Ω input of J1. CR1, CR2, and U1 provide protection above 3.5 V rms or 5 V peak. There is about 2 dB loss through U1. The signal is passed to U2 amplifier, which is biased for sensitivity by R3. U3 amplifies the differential input and shapes the signal into a square wave. U4 and U5 combine to divide the signal by ten and Q2 translates the signal from EECL to ECL levels before presenting it to the data switch.

The direct signal, also from U3(13), bypasses the divider network and is sent to the data switch through the level translator Q1. The setting of the INPUT SELECTOR switch determines whether the data switch will accept the direct or prescaled signal. Pin 2 of U6 is High for direct and Low for prescaled. U9 shapes the positive, square-shaped pulses into narrow spikes before sending the signal to A7 Function board. U7, U8, and U10 (a production option) are constant-current sources for the amplifier circuits.

A18 TROUBLESHOOTING

Before troubleshooting the circuits, check the input protection fuse. If problem is in direct mode only, check Q1 and U6. If problem is in pre-scale mode only, check U4, U5, U6, and Q2. If a problem is found in the amplifiers (U2 and U3), remove the input signal and check the dc voltages supplied by the constant-current sources U7 and U8.





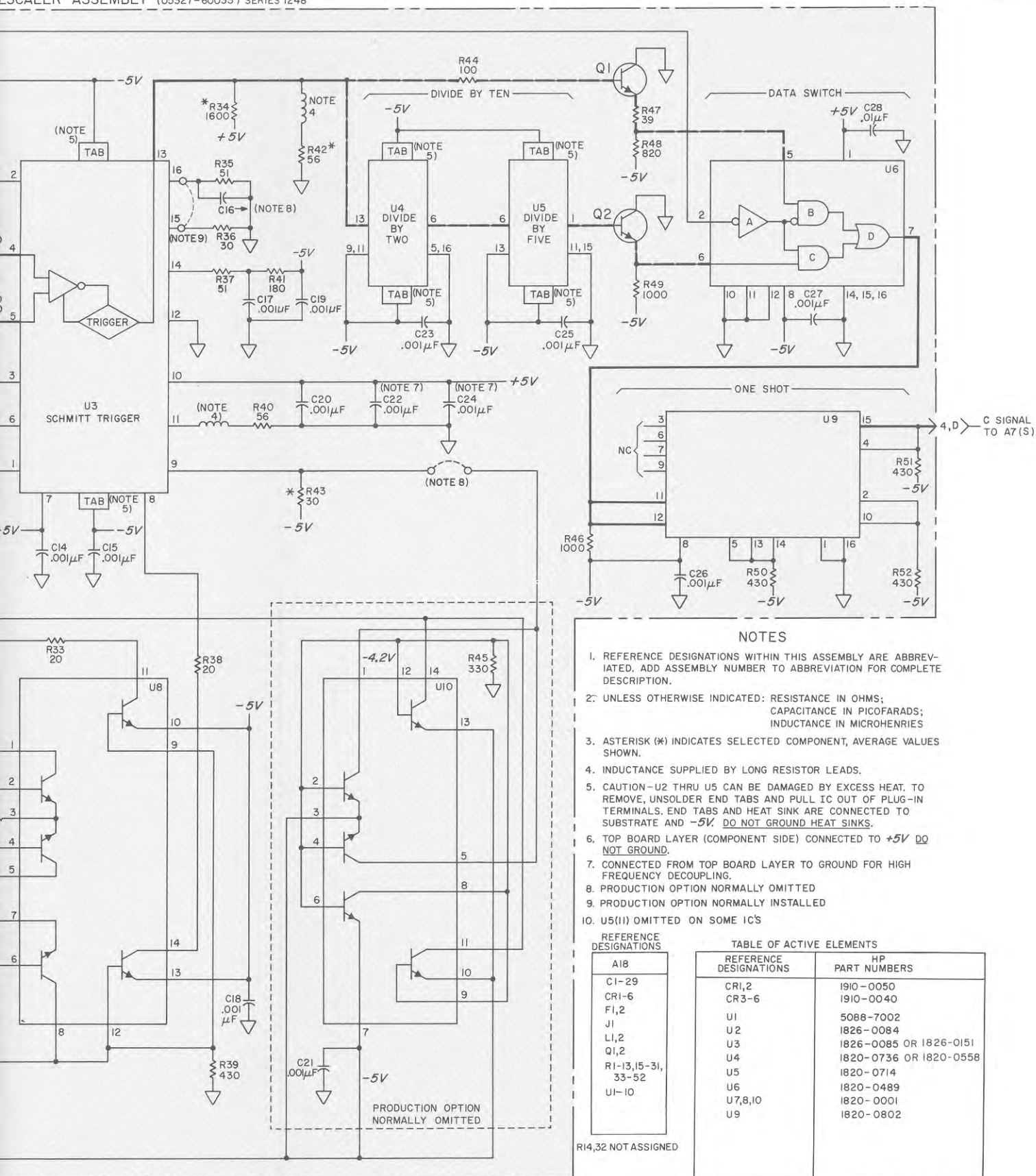


Figure 8-20. A18 Prescaler Board Assembly
(5327B Only)

OPTION 002 REMOTE PROGRAMMING

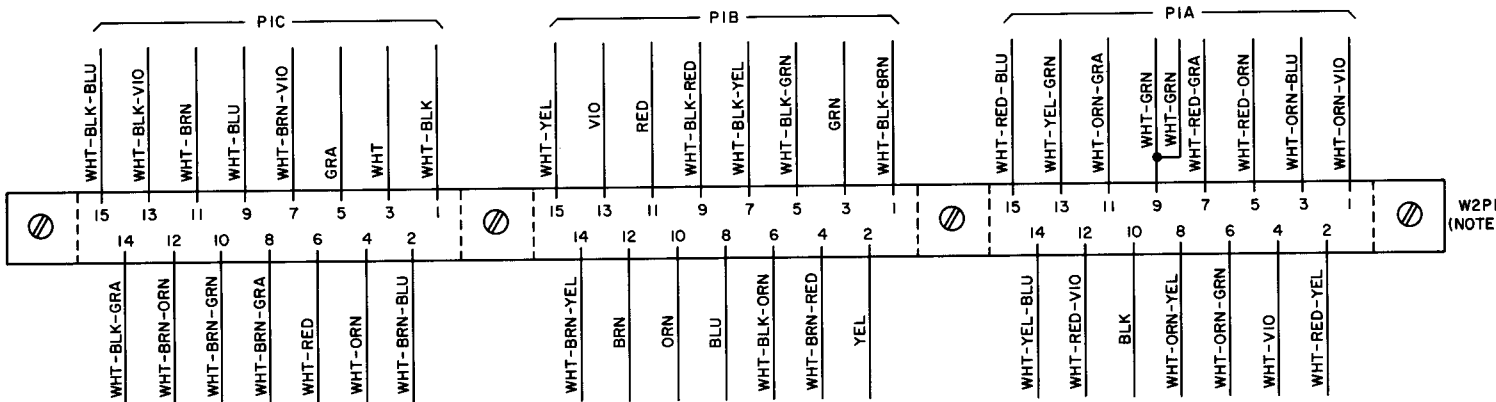
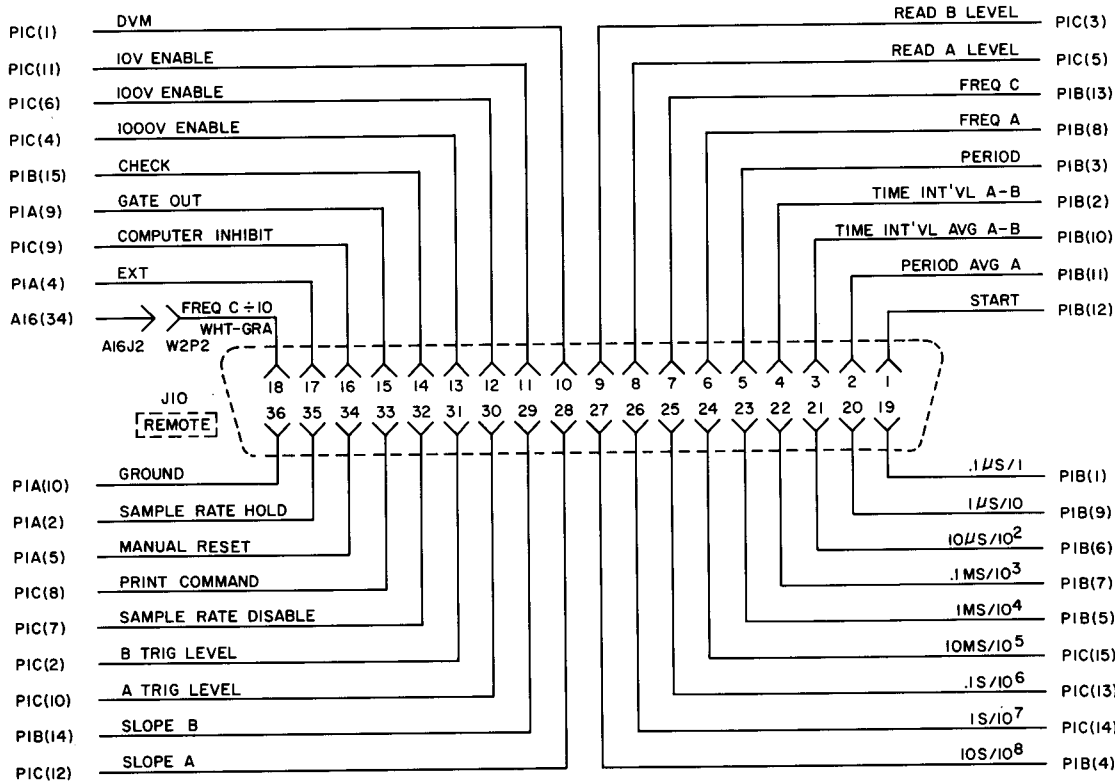
See Section II for programming information.

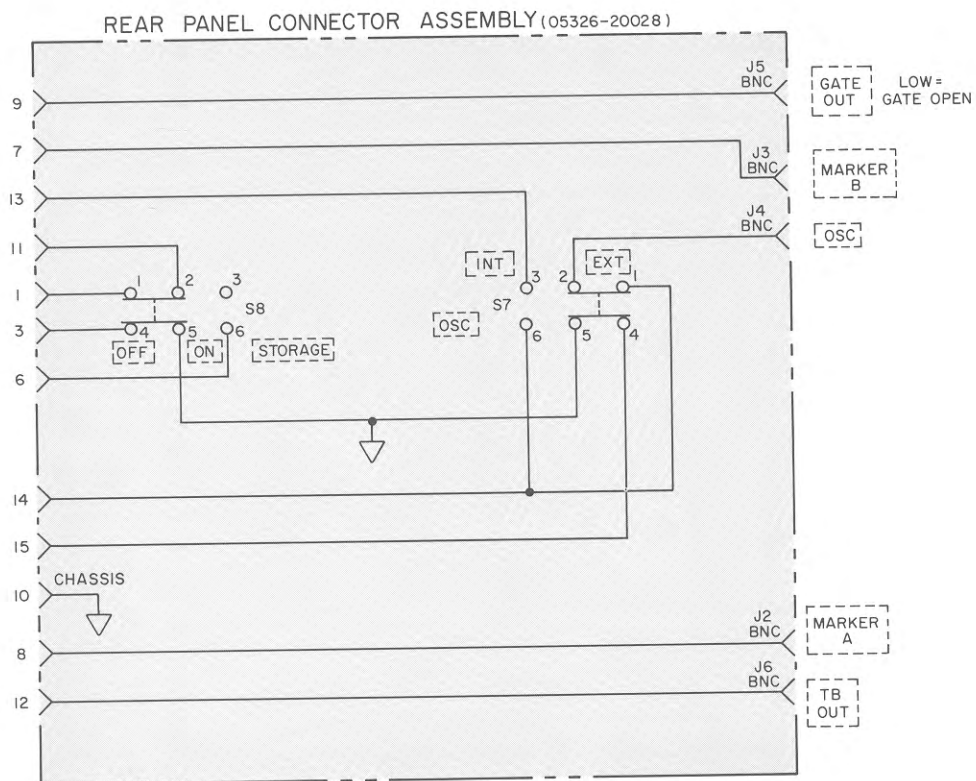
Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Start	1	Brn	B12	A16(14)	L = Start Open = Stop
Period Avg A	2	Red	B11	A16(13)	L = Enable
Time Intvl Avg	3	Orn	B10	A16(16)	
Time Intvl	4	Yel	B2	A16(15)	
Period	5	Grn	B3	A16(17)	
Freq A	6	Blu	B8	A16(18)	
Freq C	7	Vio	B13	A16(12)	
Read A Level	8	Gra	C5	A16(21)	
Read B Level	9	Wht	C3	A16(22)	
DVM	10	Wht-Blk	C1	A16(20)	
10 V Enable	11	Wht-Brn	C11	A16(9)	
100 V Enable	12	Wht-Red	C6	A16(8)	
1000 V Enable	13	Wht-Orn	C4	A16(7)	L = Enable
Check	14	Wht-Yel	B15	XA3(B)	L = Check
Gate Out	15	Wht-Grn	A9	XA5(F)	H = Gate Closed L = Gate Open
Computer Inhibit	16	Wht-Blu	C9	XA6(14)	L = Inhibit
Ext	17	Wht-Vio	A4	XA11(A)	H = Int L = Ext
Freq C ÷ 10	18	Wht-Gra	(W2P2)	A16(34)	L = Enable
.1 μ s/1	19	Wht-Blk-Brn	B1	A16(30)	
1 μ s/10 ¹	20	Wht-Blk-Red	B9	A16(31)	
10 μ s/10 ²	21	Wht-Blk-Orn	B6	A16(28)	
.1 ms/10 ³	22	Wht-Blk-Yel	B7	A16(29)	
1 ms/10 ⁴	23	Wht-Blk-Grn	B5	A16(26)	
10 ms/10 ⁵	24	Wht-Blk-Blu	C15	A16(27)	
.1 s/10 ⁶	25	Wht-Blk-Vio	C13	A16(24)	
1 s/10 ⁷	26	Wht-Blk-Gra	C14	A16(25)	
10 s/10 ⁸	27	Wht-Blk-Red	B4	A16(23)	L = Enable
Slope A	28	Wht-Brn-Orn	C12	XA2(13,P)	L = Minus Open = Plus
Slope B	29	Wht-Brn-Yel	B14	XA3(13,P)	L = Minus Open = Plus

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
A Trig Level	30	Wht-Brn-Grn	C10	XA2(1,A)	+3 V to -3 V
B Trig Level	31	Wht-Brn-Blu	C2	XA3(1,A)	+3 V to -3 V
Sample Rate Disable	32	Wht-Brn-Vio	C7	A16(11)	L = Disable
Print Command	33	Wht-Brn-Gra	C8	XA6(S)	L = Causes Print
Manual Reset	34	Wht-Red-Orn	A5	A16(6)	L = Reset
Sample Rate Hold	35	Wht-Red-Yel	A2	A16(4)	L = Maintain Display
Ground	36	Blk	A10	Ground	
Logic levels (Input) H $\geq$ +2.0 V, L $\leq$ +0.8 V (Output) H $\geq$ +2.4 V, L $\leq$ +0.4 V					

OPTION 002

W2 REMOTE PROGRAM CABLE ASSY (05326-60006) (OPT. 002 ONLY) (NOTE 1)





NOTES

1. IN STANDARD INSTRUMENT, ONLY W2PIA IS WIRED.

05327-D-26

Figure 8-21. Option 002, Remote Programming Cable Assembly and Rear Panel Connector Assembly

OPTION 003, DIGITAL RECORDER OUTPUT

Option 003 includes cable assembly W1 and rear panel connector J9. The counter (A9 Display Assembly) provides +8421 BCD and control line inputs and outputs for use with a printer or other data storage devices.

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

FUNCTION	BCD
Overflow + -	8 4 2 1
	L L L L
	H L H L
	H L H H

When the print command line at J9(48) goes low, it indicates that the counter has completed a measurement and the data output may be interrogated. When the inhibit line is held High, the data output is maintained. The line must go high less than 30 μ s after the print command goes low. The +5 V reference line (J9-25) has a 1K source impedance and is used for data level references. The 0 volt or ground reference connects to J9(24, 50).

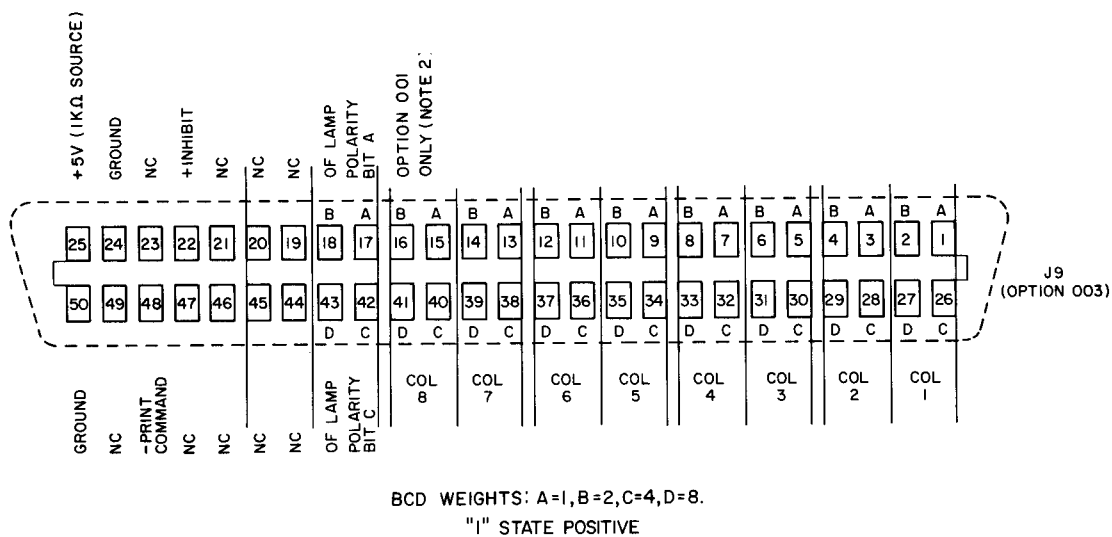
OPTION 004, EXTENDED REMOTE PROGRAMMING

See Section II for remote programming information.

Option 004 Pin Connections

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Ground	1	Blk			
Ground	2	Blk			
-16.5 V Output	3	Orn			
+16.5 V Output	4	Yel			
+5 V Output	5	Grn			
Sep-Com	6	Blu		A1 Cable Point 4	
Ac-Dc Chan B	7	Vio		A1 Cable Point 7	
No connection	8	Gra			
X10 Atten B	9	Wht		A1 Cable Point 5	
X100 Atten B	10	Wht-Blk		A1 Cable Point 6	
Ac-Dc Chan A	11	Wht-Brn		A1 Cable Point 8	
No connection	12	Wht-Red			
X10 Atten A	13	Wht-Orn		A1 Cable Point 2	
X100 Atten A	14	Wht-Yel		A1 Cable Point 3	

Function	J10 Pin No.	Wire Color	W2P1 Pin No.	Circuit Board Terminals	Level
Ground	15	Blk	A10		
Sample Rate Hold	16	Wht-Blu	A2	A16(4)	L = Maintain Disable
Manual Reset	17	Wht-Vio	A5	A16(6)	L = Reset
Print Command	18	Wht-Gra	C8	XA6(S)	L = Causes Print
Sample Rate Disable	19	Wht-Blk-Brn	C7	A16(11)	L = Disable
Trig Level B	20	Wht-Blk-Red	C2	XA3(1, A)	+3 V to -3 V
Trig Level A	21	Wht-Blk-Orn	C10	XA2(1, A)	+3 V to -3 V
Slope B	22	Wht-Blk-Yel	B14	XA3(13, P)	L = Minus Open = Plus
Slope A	23	Wht-Blk-Grn	C12	XA2(13, P)	L = Minus Open = Plus
10 ms/10 ⁵	24	Wht-Blk-Blu	C15	A16(27)	L = Enable
1 ms/10 ⁴	25	Wht-Blk-Vio	B5	A16(26)	
.1 ms/10 ³	26	Wht-Blk-Gra	B7	A16(29)	
10 μs/10 ²	27	Wht-Brn-Red	B6	A16(28)	
.1 μs/1	28	Wht-Brn-Orn	B1	A16(30)	
1 μs/10	29	Wht-Brn-Yel	B9	A16(31)	
.1 s/10 ⁶	30	Wht-Brn-Grn	C13	A16(24)	
1 s/10 ⁷	31	Wht-Brn-Blu	C14	A16(25)	
10 s/10 ⁸	32	Wht-Brn-Vio	B4	A16(23)	
Freq C ÷ 10	33	Wht-Brn-Gra	W2P2	A16(34)	
Ext	34	Wht-Red-Orn	A4	XA11(A)	
Computer Inhibit	35	Wht-Red-Yel	C9	XA6(4)	L = Inhibit
Gate Output	36	Wht-Red-Grn	A9	XA5(F)	H = Gate Closed L = Gate Open
Check	37	Wht-Red-Blu	B15	XA3(B)	L = Check
1000 V Enable	38	Wht-Red-Vio	C4	A16(7)	L = Enable
100 V Enable	39	Wht-Red-Gra	C6	A16(8)	
10 V Enable	40	Wht-Orn-Yel	C11	A16(9)	
Freq C	41	Wht-Orn-Grn	B13	A16(12)	
Freq A	42	Wht-Orn-Blu	B8	A16(18)	
Period	43	Wht-Orn-Vio	B3	A16(17)	
Time Intvl	44	Wht-Orn-Gra	B2	A16(15)	
Time Intvl Avg	45	Wht-Yel-Grn	B10	A16(16)	
Start	46	Wht-Yel-Blu	B12	A16(14)	
Period Avg	47	Wht-Yel-Vio	B11	A16(13)	
Read A Level	48	Wht-Yel-Gra	C5	A16(21)	
Read B Level	49	Wht-Grn-Blu	C3	A16(22)	L = Enable
DVM	50	Wht-Grn-Vio	C1	A16(20)	L = Enable



NOTES

1. IN STANDARD INSTRUMENT, ONLY W2PIA IS WIRED.
2. OUTPUT FROM COLUMN B IS AVAILABLE ONLY WHEN OPTION 001 IS ADDED.

05327-D-27B

Figure 8-22. Option 004, Remote Programming Cable Assembly and J10 Option 003, Digital Recorder Cable Assembly

A1 OPTION 004 OPERATION

The remote programmable attenuator board attenuates the input signal and routes it to the amplifier boards. The signals from inputs A and B are routed through identical paths.

In the X1 position K2 is closed and the signal is routed directly to K4, which is open with ac coupling and closed with dc. R30 provides the 1 M Ω input impedance. R34, R38, and C7 compensate for high frequency roll-off and also limit the input current to Q1A. Diodes CR25 and CR27 limit the voltage at the input of Q13A to ± 5.8 V. Q13A operates as a source follower with a high input impedance and a low output impedance to the amplifier boards. Q1B operates as a source follower, supplying the amplifiers with the dc trigger-level voltage generated either by R49, CR32, and CR33, or from an external analog input (J10). R46, 44, 42, and C13 filter the trigger-level voltage.

In the X1 position, K2 and K4 are closed providing a direct path for the input signal to the gate of Q13A. In the X10 position, K2 is open and diodes CR7 and CR9 are turned on, shorting R16 to ground. R12, R14, and R16 form the dc attenuator. The ac (high frequency) attenuator is formed by C1 and stray capacitance in the circuit.

In the X100 position, K2 is open, CR7 and CR9 are off, and CR21 and CR23 are turned on. C3 and R28 are thus connected to ground. R12, R14, and R28 form the dc portion of the attenuator, while C1, C3, and stray capacitance form the high frequency portion of the attenuator.

The circuitry to drive AC/DC relay K4, and SEP/COM relay K1 is provided by U3 A&C. U3's output is at HTL levels (+12 V, +1.5 V) and thus is sufficient to drive the relays directly. U3's input is at DTL levels and is compatible with remote programming levels. K2 is driven by Q7 and is open when CR7 and CR9 or CR21 and CR23 are on.

Diode pairs CR7 and CR9 are driven by emitter followers Q3 and Q6, which, in turn, are driven by HTL gates U2D AND U2C. U2's power supply, consisting of Q1 and Q2, is +8.9 V and -5.6 V rather than the usual +15 V and 0 V. This special bias moves the HTL input threshold to +1.9 V, rather than the normal +7.5 V. U2D can now be driven by DTL gate U1B. The output swing of U2D is +9 V to -4 V, providing the diode quad CR7 and CR9 with positive turn-on and turn-off signals. R9 is adjusted to minimize the offset voltage of the quad.

ADJUSTMENTS

Set:

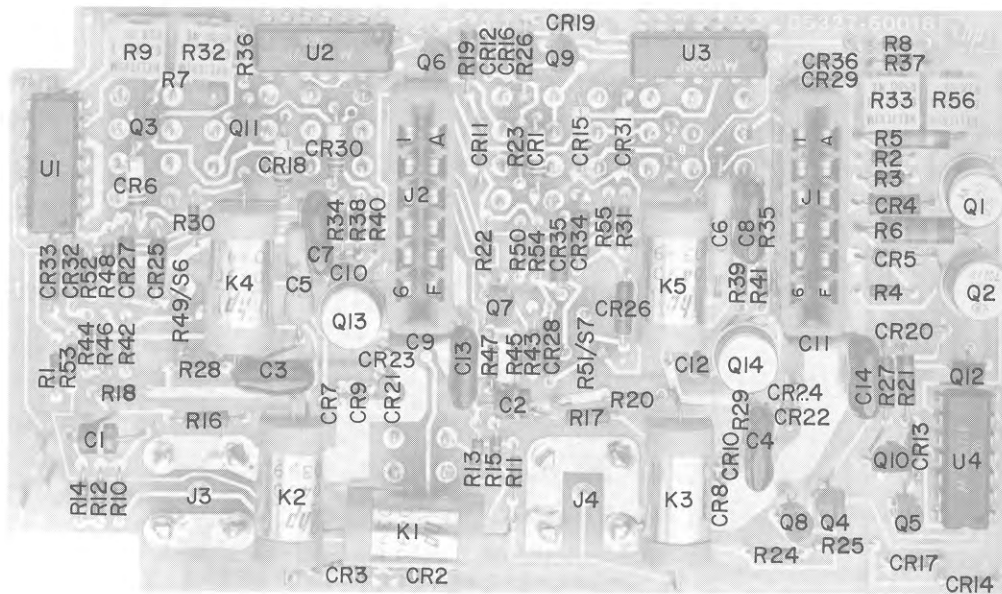
TIME BASE	0.1 sec.
AC/DC	DC
SEP/COM	SEP
ATTEN A/B	X10

1. Using an HP 412A or equivalent, measure voltage at CHANNEL A jack.
2. Adjust R56 for $< \pm 1$ mV reading.
3. Measure voltage at CHANNEL B jack.
4. Adjust R9 for $< \pm 1$ mV reading.
5. Set A and B attenuators to X100 position.
6. Measure voltage at CHANNEL B jack.
7. Adjust R32 for $< \pm 1$ mV reading.
8. Measure voltage at CHANNEL A jack.
9. Adjust R33 for $< \pm 1$ mV reading.

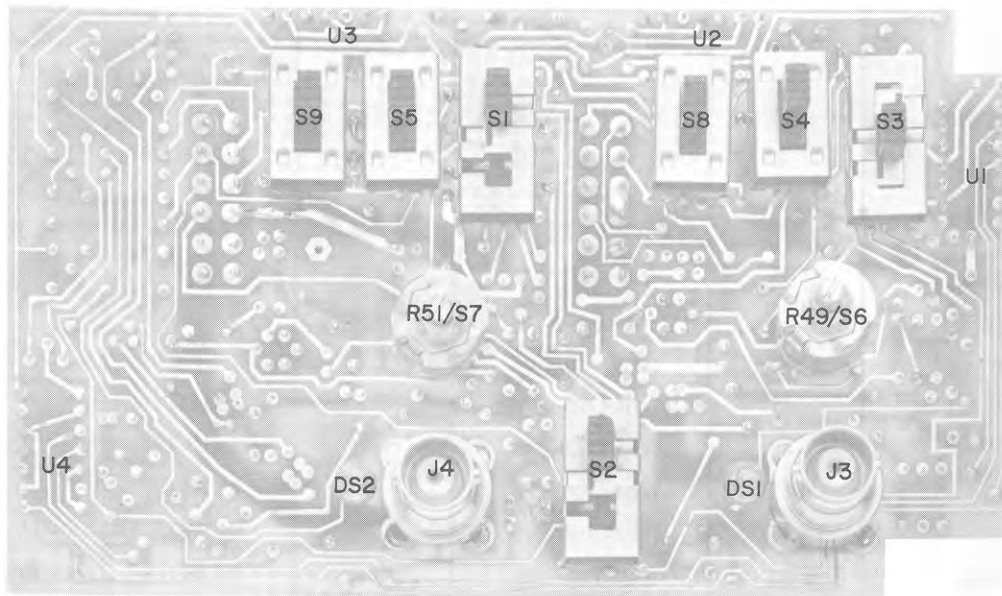
Figure 8-22
OPTION 004, REMOTE PROGRAMMING CABLE ASSEMBLY
AND J10 OPTION 003, DIGITAL RECORDER CABLE ASSEMBLY

(See Page 8-53)

Part of Figure 8-23. Option 004 Programmable Attenuator Assembly



TOP VIEW



BOTTOM VIEW

◀ MORE DATA UNDER THIS FOLD

NOTES

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

REFERENCE DESIGNATIONS

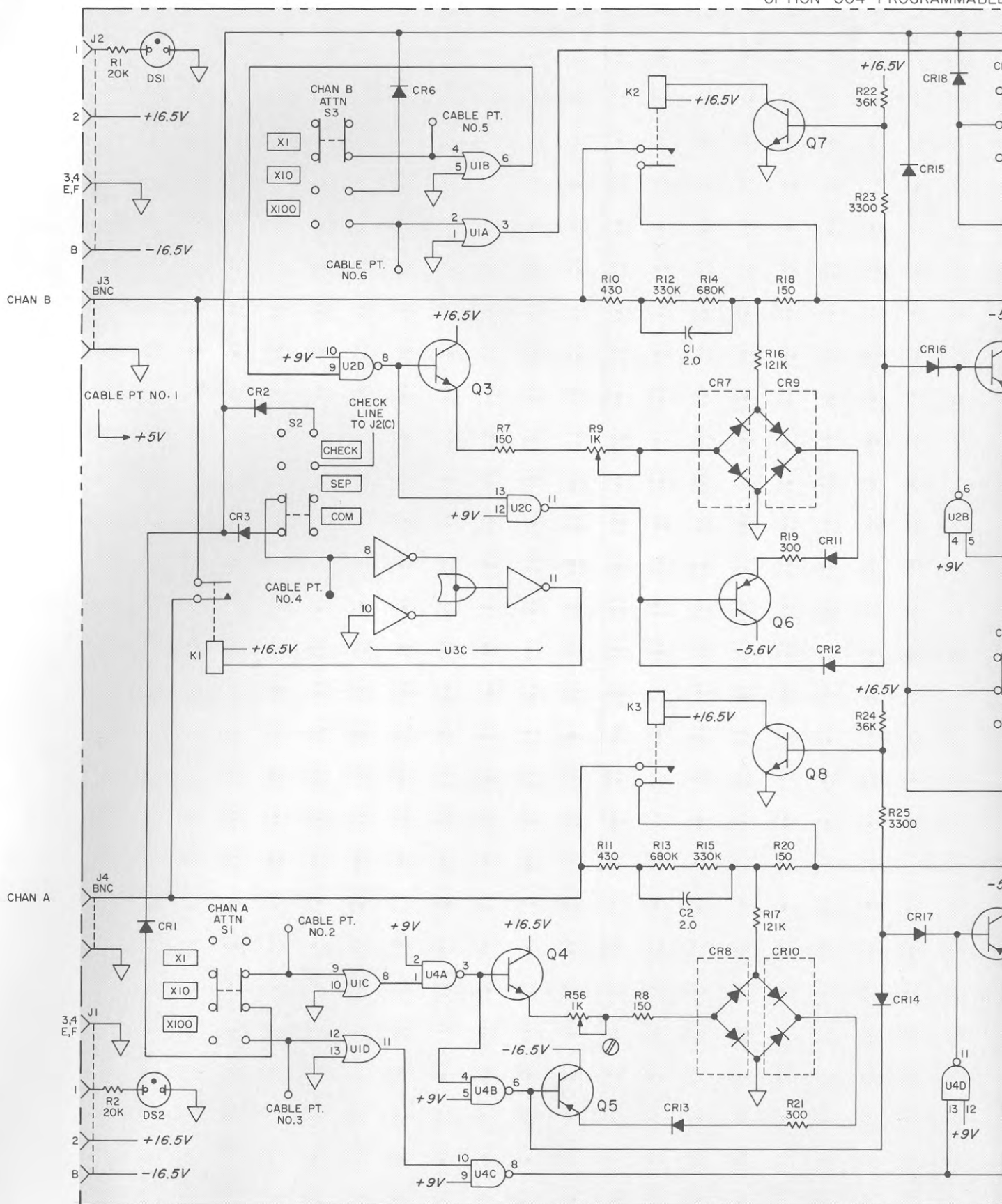
AI, OPT. 004

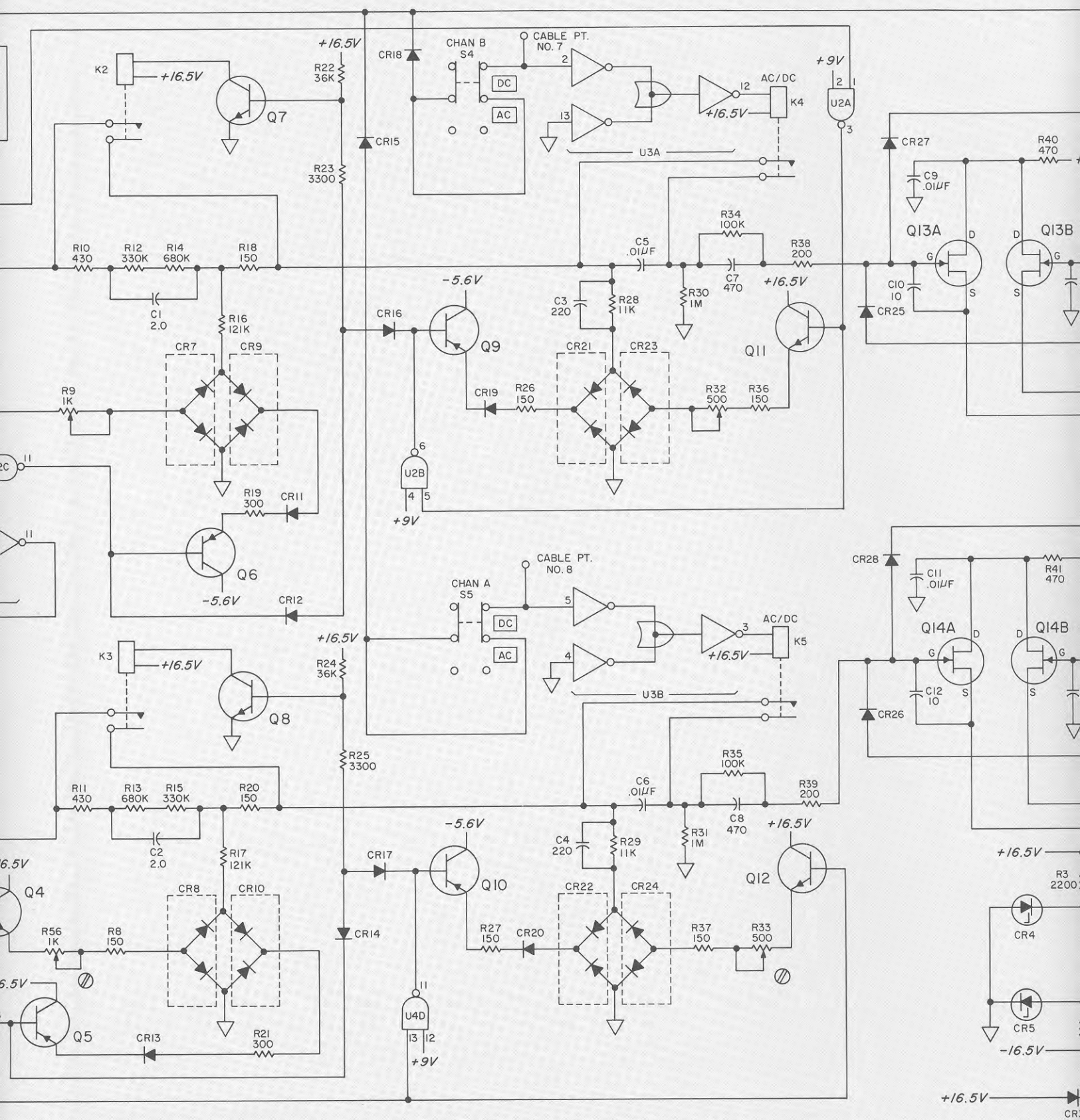
CI-14
CRI-36
DS1,2
JI-4
KI-5
Q1-14
RI-56
SI-9
UI-4

CABLE POINT	WIRE COLOR	DESTINATION
1	GRN	+ 5V
2	WHT-ORN	J10 (13)
3	WHT-YEL	J10 (14)
4	BLU	J10 (6)
5	WHT	J10 (9)
6	WHT-BLK	J10 (10)
7	VIO	J10 (7)
8	WHT-BRN	J10 (11)

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CRI-3,6,15,18,30,31	1910-0016
CR4	1902-0025
CR5	1902-0057
CR7,8,23,24	1906-0024
CR9,10,21,22	1906-0025
CR11-14,16,17, 19,20,29,36	1901-0040
CR25-28	1901-0376
CR32-35	1902-0041
Q1	1854-0039
Q2	1853-0001
Q3,4,7,8,11,12	1854-0215
Q5,6,9,10	1853-0036
Q13,14	1855-0334
U1	1820-0274
U2,4	1820-0287
U3	1820-0625





Fig

Model 5326/27B
Schematic Diagrams

OR ASSEMBLY (05327-60034)(NOTE 1) SERIES 1040A

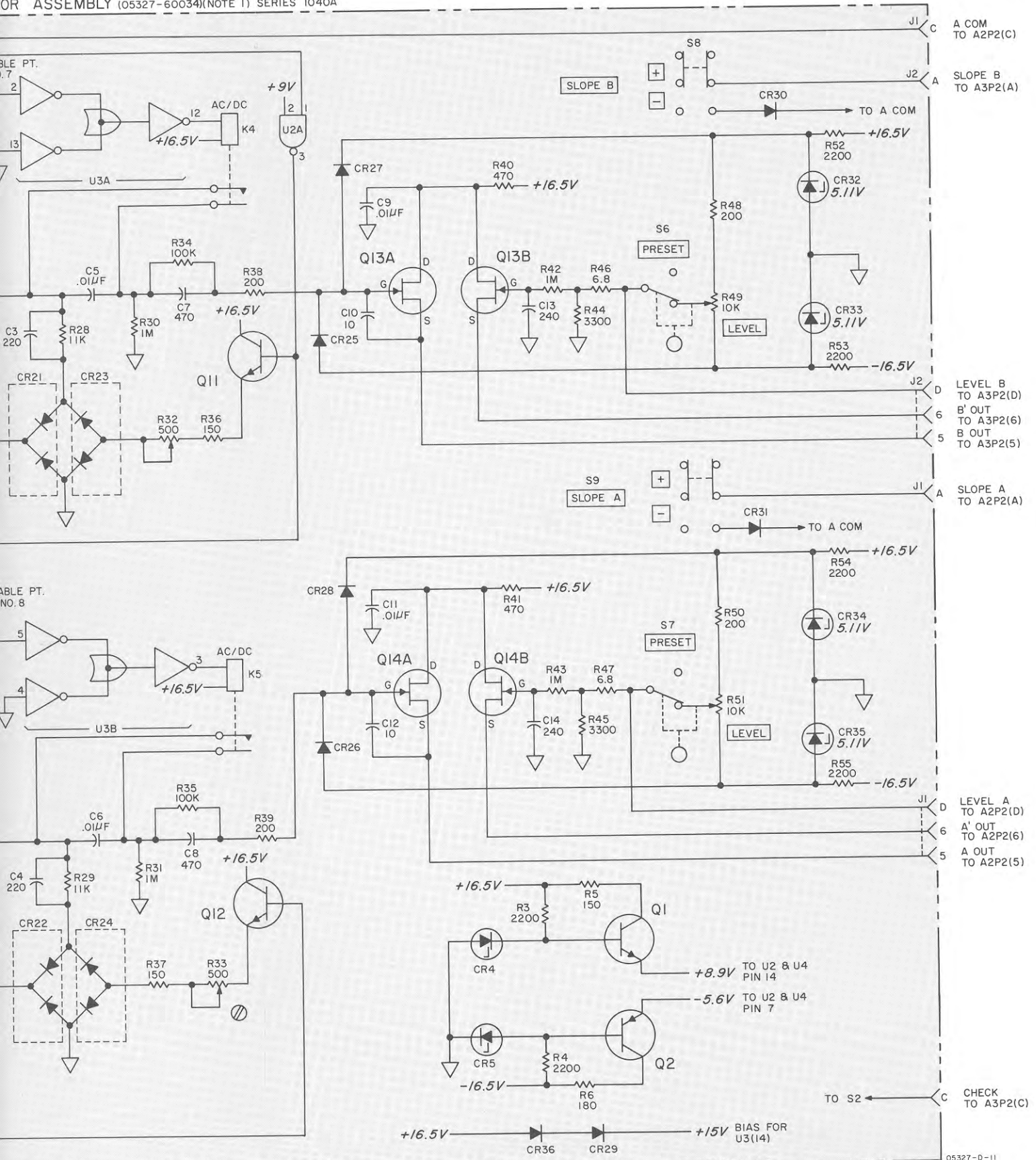
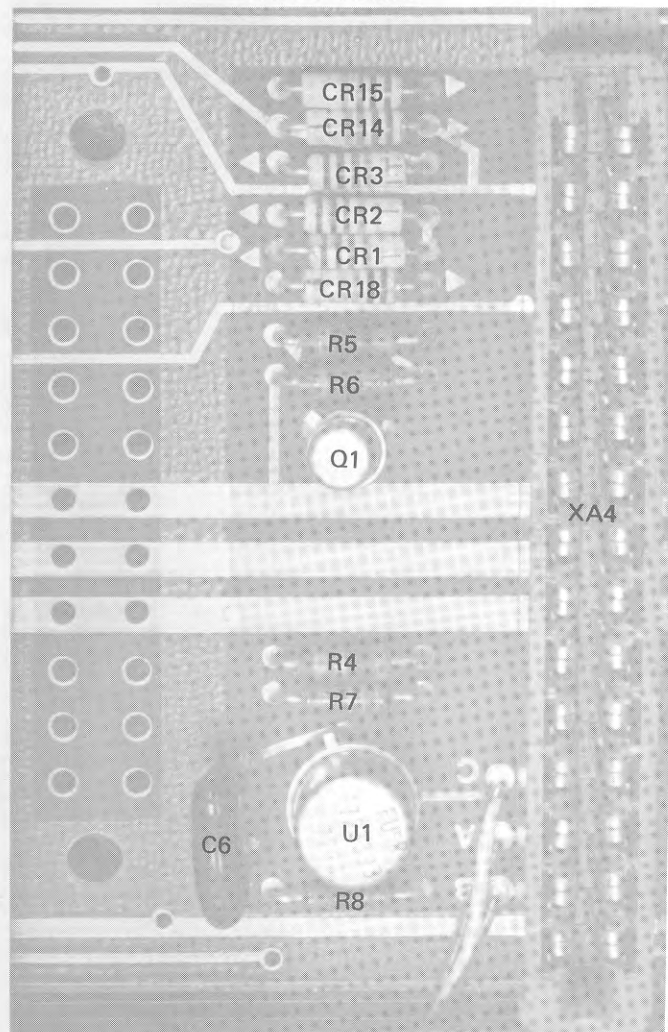
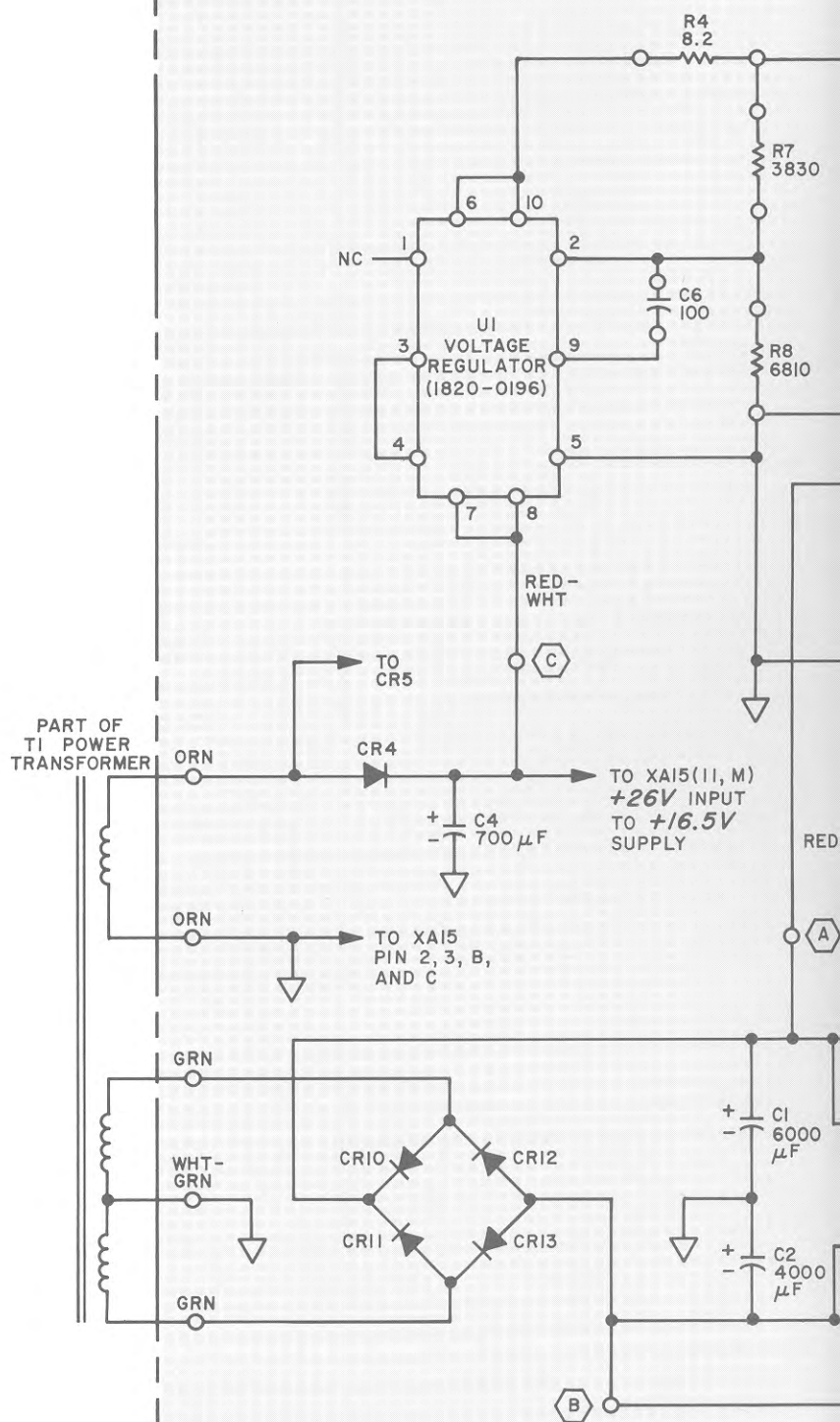


Figure 8-23. A1 Option 004 Programmable Attenuator Assembly

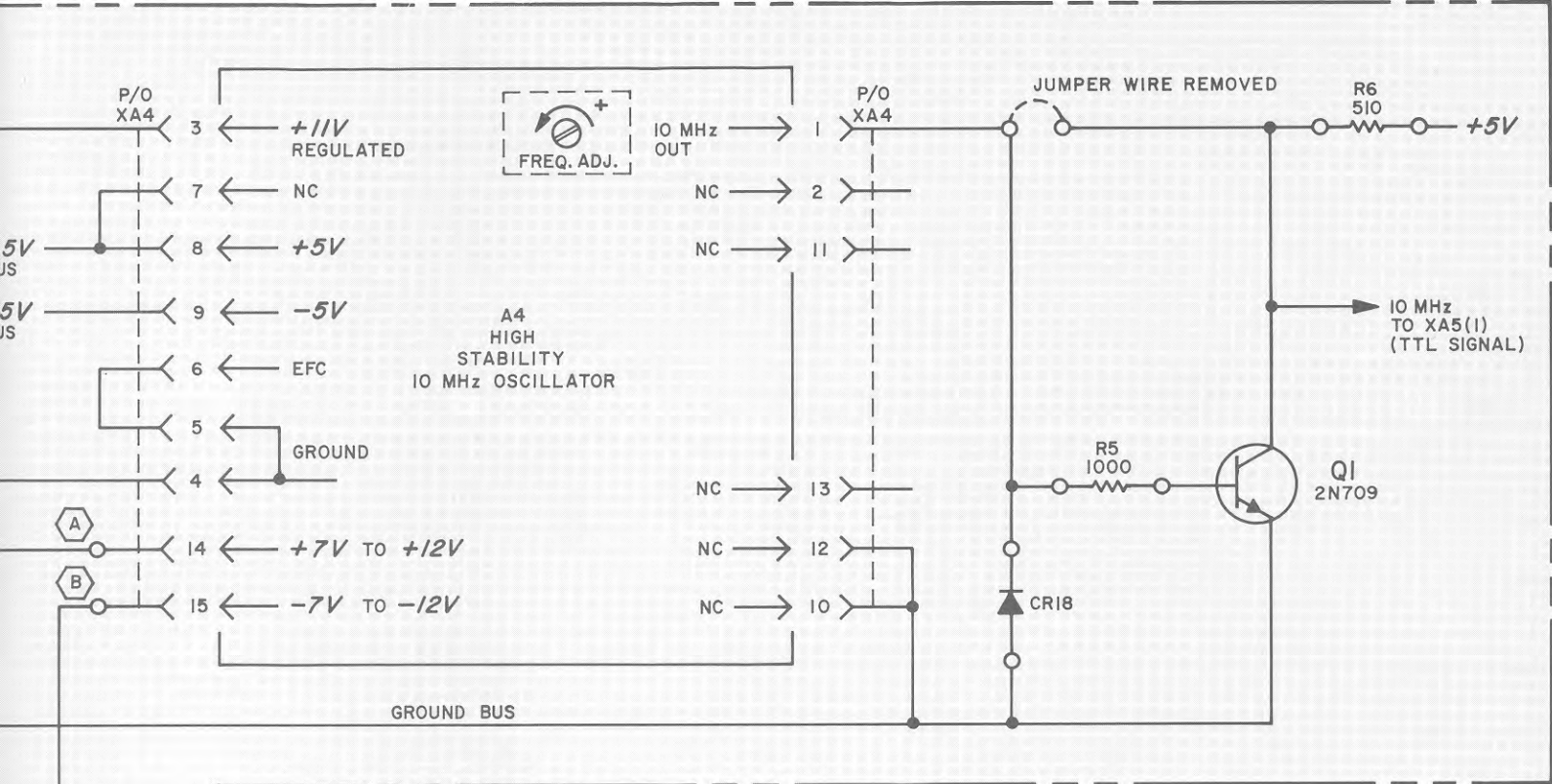
↑
FRONT PANEL



TOP VIEW
OF
A16



INTERCONNECT CIRCUIT BOARD (PARTIAL DIAGRAM) (05327-60027) SERIES I224A



VIO

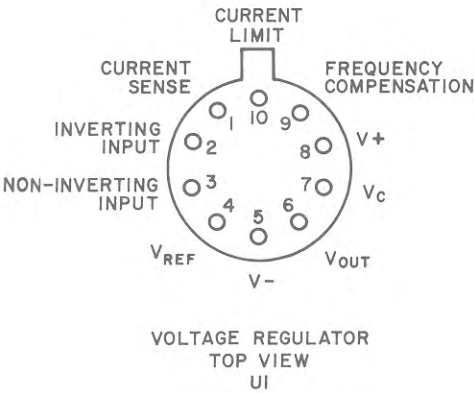


TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR4	1901-0028
CR10-13	1901-0415
CR18	1910-0034
Q1	1854-0009 2N709
UI	1820-0196

5326-B-11

Figure 8-24. Options 010, 011, and A16 Interconnect Circuit Board

HEWLETT · PACKARD

ELECTRONIC INSTRUMENTATION SALES AND SERVICE

UNITED STATES, CENTRAL AND SOUTH AMERICA, CANADA

UNITED STATES

ALABAMA
8290 Whitesburg Dr., S.E.
P.O. Box 4207
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA
2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 244-1361
TWX: 910-951-1330

2424 East Aragon Rd.
Tucson 85706
Tel: (602) 889-4661

CALIFORNIA
1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000
TWX: 910-592-1288

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

6515 Arizona Place
Los Angeles 90045
Tel: (213) 776-7500
TWX: 910-335-2000

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2220 Watt Ave.
Sacramento 95825
Tel: (916) 482-1463
TWX: 910-367-2092

9606 Aero Drive
P.O. Box 23333
San Diego 92123
Tel: (714) 279-3200
TWX: 910-335-2000

COLORADO
5600 South Ulster Parkway
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel: (203) 389-6551
TWX: 710-465-2029

FLORIDA
P.O. Box 24210
2805 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099

P.O. Box 13910
6177 Lake Ellenor Dr.
Orlando 32809
Tel: (305) 859-2900
TWX: 810-850-0113

GEORGIA
P.O. Box 28234
450 Interstate North
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

HAWAII
2875 So. King Street
Honolulu 96814
Tel: (808) 955-4455

ILLINOIS
5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA
3839 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 910-341-3263

IOWA
1902 Broadway
Iowa City 52240
Tel: (319) 338-9466
Night: (319) 338-9467

LOUISIANA
P.O. Box 840
3239 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND
6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-9157

20010 Century Blvd.
Germanstown 20767
Tel: (31) 428-0700

P.O. Box 1648
2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS
32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN
23855 Research Drive
Farmington 48024
Tel: (313) 476-6400
TWX: 810-242-2900

MINNESOTA
2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI
11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

148 Weldon Parkway
Maryland Heights 63043
Tel: (314) 567-1455
TWX: 910-764-0830

NEVADA
Las Vegas
Tel: (702) 382-5777

NEW JERSEY
W. 120 Century Rd.
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

NEW MEXICO
P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 265-3713
TWX: 910-989-1665

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 626-2485
TWX: 910-983-0550

NEW YORK
6 Automation Lane
Computer Park
Albany 12205
Tel: (518) 458-1550
TWX: 710-441-8270

1219 Campville Road
Endicott 13760
Tel: (607) 754-0050
TWX: 510-252-0890

New York City
Manhattan, Bronx
Contact Paramus, NJ Office
Tel: (201) 265-5000

Brooklyn, Queens, Richmond
Contact Woodbury, NY Office
Tel: (516) 921-0300

82 Washington Street
Poughkeepsie 12601
Tel: (914) 454-7330
TWX: 510-248-0012

39 Saginaw Drive
Rochester 14623
Tel: (716) 473-9500
TWX: 510-253-9981

5858 East Molloy Road
Syracuse 13211
Tel: (315) 454-2486
TWX: 710-541-0482

1 Crossways Park West
Woodbury 11797
Tel: (516) 921-0300
TWX: 510-221-2168

NORTH CAROLINA
P.O. Box 5188
1923 North Main Street
High Point 27262
Tel: (919) 885-8101
TWX: 510-926-1516

SOUTH CAROLINA
6941-O N. Trenholm Road
Columbia 29260
Tel: (803) 782-6493

OHIO
16500 Sprague Road
Cleveland 44130
Tel: (216) 243-7300
Night: 243-7305
TWX: 810-423-9431

330 Progress Rd.
Dayton 45449
Tel: (513) 859-8202
TWX: 810-459-1925

6665 Busch Blvd.
Columbus 43229
Tel: (614) 846-1300

OKLAHOMA
P.O. Box 32008
Oklahoma City 73132
Tel: (405) 721-0200
TWX: 910-830-6862

OREGON
17850 SW Boones Ferry Road
Tualatin 97062
Tel: (503) 620-3350
TWX: 910-467-8714

PENNSYLVANIA
111 Zeta Drive
Pittsburgh 15238
Tel: (412) 782-0400
Night: 782-0401
TWX: 710-795-3124

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel: (215) 265-7000
TWX: 510-660-2670

RHODE ISLAND
873 Waterman Ave.
East Providence 02914
Tel: (401) 434-5535
TWX: 710-381-7573

TENNESSEE
Memphis
Tel: (901) 274-7472

TEXAS
P.O. Box 1270
201 E. Arapaho Rd.
Richardson 75080
Tel: (214) 231-6101
TWX: 910-867-4723

P.O. Box 27409
6300 Westpark Drive
Suite 100
Houston 77027
Tel: (713) 781-6000
TWX: 910-881-2645

231 Billy Mitchell Road
San Antonio 78226
Tel: (512) 434-4171
TWX: 910-871-1170

UTAH
2890 South Main Street
Salt Lake City 84115
Tel: (801) 487-0715
TWX: 910-925-5681

VIRGINIA
P.O. Box 9854
2914 Hungary Springs Road
Richmond 23228
Tel: (804) 285-3431
TWX: 710-956-0157

WASHINGTON
Bellevue Office Pk.
1203 - 114th SE
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2446

***WEST VIRGINIA**
Charleston
Tel: (304) 345-1640

WISCONSIN
9431 W. Beloit Road
Suite 117
Milwaukee 53227
Tel: (414) 541-0550

FOR U.S. AREAS NOT LISTED:
Contact the regional office nearest you: Atlanta, Georgia ... North Hollywood, California ... Paramus, New Jersey ... Skokie, Illinois. Their complete addresses are listed above.

*Service Only

CENTRAL AND SOUTH AMERICA

ARGENTINA
Hewlett-Packard Argentina
S.A.C.I.
Lavalle 1171 - 3°
Buenos Aires
Tel: 35-0436, 35-0627, 35-0341
Telex: 012-1009
Cable: HEWPACK ARG

BOLIVIA
Stambuk & Mark (Bolivia) LTDA.
Av. Mariscal, Santa Cruz 1342
La Paz
Tel: 40626, 53163, 52421
Telex: 3560014
Cable: BUKMAR

BRAZIL
Hewlett-Packard Do Brasil
I.E.C. Ltda.
Rua Frei Caneca 1119
01307 Sao Paulo-SP
Tel: 288-7111, 287-5858
Telex: 309151/2/3
Cable: HEWPACK Sao Paulo

Hewlett-Packard Do Brasil
I.E.C. Ltda.
Praça Dom Feliciano, 78
90000-Porto Alegre-RS
Rio Grande do Sul (RS) Brasil
Tel: 25-8470
Cable: HEWPACK Porto Alegre

Hewlett-Packard Do Brasil
I.E.C. Ltda.
Rua da Matriz, 29
20000-Rio de Janeiro-GB
Tel: 266-2643
Telex: 210079 HEWPACK
Cable: HEWPACK Rio de Janeiro

CHILE
Héctor Calcaín y Cia, Ltda.
Casilla 16,475
Santiago
Tel: 423 96
Cable: CALCAGNI Santiago

COLOMBIA
Instrumentación
Henrik A. Langebaek & Kier S.A.
Carrera 7 No. 48-59
Apartado Aéreo 6287
Bogotá, D.E.
Tel: 45-78-06, 45-55-46
Cable: AARIS Bogotá
Telex: 44400INSTCO

COSTA RICA
Lic. Alfredo Gallegos Gurdian
Apartado 10159
San José
Tel: 21-86-13
Cable: GALGUR San José

ECUADOR
Laboratorios de Radio-Ingeniería
Calle Guayaquil 1246
Post Office Box 3199
Quito
Tel: 212-486; 219-185
Cable: HORVATH Quito

EL SALVADOR
Electronic Associates
Apartado Postal 1682
Centro Comercial Gigante
San Salvador, El Salvador C.A.
Paseo Escalon 4649-4° Piso
Tel: 23-44-60, 23-32-37
Cable: ELECAS

GUATEMALA
IPESA
Avenida La Reforma 3-48,
Zona 9
Guatemala
Tel: 63627, 64736
Telex: 4192 TELTRO GU

MEXICO
Hewlett-Packard Mexicana,
S.A. de C.V.
Torres Adalid No. 21, 11° Piso
Col. del Valle
Mexico 12, D.F.
Tel: 543-42-32
Telex: 017-74-507

NICARAGUA
Roberto Terán G.
Apartado Postal 689
Edificio Terán
Managua
Tel: 3451, 3452
Cable: ROTERAN Managua

PANAMA
Electrónica Balboa, S.A.
Apartado Postal 5167
Ave. Manuel Espinosa No. 13-50
Bldg. Alina
Panama City
Tel: 230833
Telex: 3481103, Curunda,
Canal Zone
Cable: ELECTRON Panama City

PARAGUAY
Z. J. Melamed S.R.L.
Division: Aparatos y Equipos
Medicos
Division: Aparatos y Equipos
Scientificos y de
Investigación
P.O. Box 676
Chile, 482, Edificio Victoria
Asunción
Tel: 4-5089, 4-6272
Cable: RAMEL

PERU
Compañía Electro Médica S.A.
Ave. Enrique Canaval 312
San Isidro
Casilla 1030
Lima
Tel: 22-3900
Cable: ELMED Lima

PUERTO RICO
San Juan Electronics, Inc.
P.O. Box 5167
Ponce de Leon 154
Pda. 3-PTA de Tierra
San Juan 00906
Tel: (809) 725-3342, 722-3342
Cable: SATRONICS San Juan
Telex: SATRON 3450 332

URUGUAY
Pablo Ferrando S.A.
Comercial e Industrial
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel: 40-3102
Cable: RADIUM Montevideo

VENEZUELA
Hewlett-Packard de Venezuela
C.A.
Apartado 50933
Edificio Segre
Tercera Transversal
Los Ruices Norte
Caracas 107
Tel: 35-00-11
Telex: 21146 HEWPACK
Cable: HEWPACK Caracas

FOR AREAS NOT LISTED,

CONTACT:
Hewlett-Packard
Inter-Américas
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 493-1501
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd.
11748 Kingsway Ave.
Edmonton T5C 0X5
Tel: (403) 452-3670
TWX: 610-831-2431

Hewlett-Packard (Canada) Ltd.
915-42 Avenue S.E.
Calgary T2G 1Z1
Tel: (403) 262-4279

BRITISH COLUMBIA
Hewlett-Packard (Canada) Ltd.
837 E. Cordova Street
Vancouver V6A 3R2
Tel: (604) 254-0531
TWX: 610-922-5059

MANITOBA
Hewlett-Packard (Canada) Ltd.
513 Century St.
St. James R3L 4G7
Winnipeg R3H 0L8
Tel: (204) 786-7581
TWX: 610-671-3531

NOVA SCOTIA
Hewlett-Packard (Canada) Ltd.
2745 Dutch Village Rd.
Halifax B3L 4G7
Tel: (902) 455-0511
TWX: 610-271-4482

ONTARIO
Hewlett-Packard (Canada) Ltd.
275 Woodward Dr.
Ottawa K2C 0P9
Tel: (613) 225-8530
TWX: 610-422-8968

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
Mississauga L4V 1L9
Tel: (416) 678-9430
TWX: 610-492-4246

QUEBEC
Hewlett-Packard (Canada) Ltd.
275 Hymus Boulevard
Pointe Claire H9R 1G7
Tel: (514) 561-6520
TWX: 610-422-3022
Telex: 05-821521 HPCL

Hewlett-Packard (Canada) Ltd.
2376 Galvani Street
Ste-Foy GIN 4G4
Tel: (418) 688-8710

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett-Packard (Canada) Ltd. in Mississauga

HEWLETT · PACKARD

ELECTRONIC INSTRUMENTATION SALES AND SERVICE

EUROPE, AFRICA, ASIA, AUSTRALIA

EUROPE

AUSTRIA
Hewlett-Packard Ges.m.b.H.
Hendelskai 52/3
P.O. Box 7
A-1205 Vienna
Tel: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

BELGIUM
Hewlett-Packard Benelux
S.A./N.V.
Avenue de Col-Vert, 1.
(Groenkranslaan)
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 33 494 paloben br

DENMARK
Hewlett-Packard A/S
Datvej 38
DK-3460 Birkerød
Tel: (01) 81 66 40
Cable: HEWPAK AS
Telex: 166 40 hp as
Hewlett-Packard A/S
Torvet 9
DK-8500 Silkeborg
Tel: (06) 82-71-66
Telex: 166 40 hp as
Cable: HEWPAK AS

FINLAND
Hewlett-Packard Oy
Bulevardi 26
P.O. Box 12185
SF-00120 Helsinki 12
Tel: (00) 13730
Cable: HEWPAK OY Helsinki
Telex: 12-15363 hel

FRANCE
Hewlett-Packard France
Quartier de Courtaboeuf
Boite Postale No. 6
F-91401 Orsay
Tel: (1) 907 78 25
Cable: HEWPAK Orsay
Telex: 60048
Hewlett-Packard France
Agence Regionale
4 Quai des Etoiles
F-93321 Lyon Cedex 1
Tel: (78) 42 53 45
Cable: HEWPAK Lyon
Telex: 31617

Hewlett-Packard France
Zone Aéronautique
Avenue Clement Ader
F-31770 Colomiers
Tel: (61) 86 81 55
Telex: 51957
Hewlett-Packard France
Agence Regionale
Boulevard Facot-Gamarra
Boite Postale No. 11
F-13100 Lagny
Tel: (47) 24 00 66
Telex: 41770
Hewlett-Packard France
Agence Regionale
63, Avenue de Rochester
F-35000 Rennes
Tel: (09) 36 33 21
Telex: 74912 F

Hewlett-Packard France
Agence Regionale
74, Allée de la Robertsau
F-67000 Strasbourg
Tel: (88) 35 23 20/21
Telex: 89141
Cable: HEWPAK STRBG

GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Bernersstrasse 117
Postfach 560 140
D-6000 Frankfurt 56
Tel: (0611) 50 04-1
Telex: 41 32 49 fra
Hewlett-Packard GmbH
Vertriebsbüro Böblingen
Herrenbergerstrasse 110
D-7030 Böblingen, Württemberg
Tel: (07031) 66 72 87
Cable: HEPAK Böblingen
Telex: 72 65 339 bbn
Hewlett-Packard GmbH
Vertriebsbüro Düsseldorf
Vogelsanger Weg 38
D-4000 Düsseldorf
Tel: (0211) 63 80 31/38
Telex: 85/86 533 hppd d

IRELAND
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 648413
Blue Star, Ltd.
1-1-117/1
Sarolini Devi Road
Secunderabad 500 003
Tel: 763 91, 773 93
Cable: BLUEFROST
Telex: 459
Blue Star, Ltd.
23/24 Second Line Beach
Madras 600 001
Tel: 23954
Telex: 379
Cable: BLUESTAR
Blue Star, Ltd.
2nd Floor Bistapur
Jamshedpur 831 001
Tel: 38 04
Cable: BLUESTAR
Telex: 240
Blue Star, Ltd.
Bah Boin Trading Coy. N.V.
Djalah Merdeka 29
Bandung
Tel: 4915; 61560
Cable: ILMU
Telex: 86-089
Blue Star, Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
Tel: 45 78 87
Telex: 4093
Cable: FROSTBLUE
Blue Star, Ltd.
Band Box House
Prabhadevi
Bombay 400 025
Tel: 45 73 01
Telex: 3751
Cable: BLUESTAR
Blue Star, Ltd.
14/40 Civil Lines
Kampur 208 001
Tel: 6 88 82
Cable: BLUESTAR
Blue Star, Ltd.
7 Hare Street
P.O. Box 506
Calcutta 700 001
Tel: 23-0131
Telex: 655
Cable: BLUESTAR
Blue Star, Ltd.
Blue Star House
24 Ring Road
Osaka
Laipat Nagar
New Delhi 110 024
Tel: 62 32 76
Telex: 2463
Cable: BLUESTAR
Blue Star, Ltd.
Blue Star House
11/114 Magarath Road
Bangalore 560 025
Tel: 55668
Telex: 430
Cable: BLUESTAR

Hewlett-Packard GmbH
Vertriebsbüro Hamburg
Wendensil, 23
D-2000 Hamburg 1
Tel: (040) 24 13 93
Cable: HEWPAKSA Hamburg
Telex: 21 63 032 hphd d
Hewlett-Packard GmbH
Vertriebsbüro Hannover
Mellendorfer Strasse 3
D-3000 Hannover-Kleefeld
Tel: (0511) 95 05 26
Hewlett-Packard GmbH
Vertriebsbüro Nürnberg
Hersbruckerstrasse 42
D-8500 Nürnberg
Tel: (0911) 57 10 66
Telex: 623 860
Hewlett-Packard GmbH
Vertriebsbüro München
Unterhachinger Strasse 28
ISAR Center
D-8012 Otterbrunn
Tel: (089) 601 30 61/7
Telex: 52 49 85
Cable: HEWPAKSA München
(West Berlin)
Hewlett-Packard GmbH
Vertriebsbüro Berlin
Wilmsdorfer Strasse 113/114
D-1000 Berlin W. 12
Tel: (030) 3137046
Telex: 18 34 05 hpbld d

GREECE
Kostas Karayannis
18, Ermo Street
GR-Athens 126
Tel: 8080337, 8080359,
8080429, 8018693
Cable: RAKAR Athens
Telex: 21 59 62 rkar gr
Hewlett-Packard S.A.
Mediterranean & Middle East
Operations
35 Kolokotroni Street
Platia Kefallariou
GR-Kifissia-Athens
Tel: 8080337, 8080358,
8080429, 8018693
Hewlett-Packard Italiana S.p.A.
Via Amerigo Vesputici 2
I-20124 Milan
Tel: (2) 6251 (10 lines)
Cable: HEWPAKIT Milan
Telex: 32046
Hewlett-Packard Italiana S.p.A.
Vicolo Pastori, 3
I-35100 Padova
Tel: (49) 66 40 52
Telex: 32046 via Milan
Hewlett-Packard Italiana SPA
Via Medaglie d'Oro, 2
I-56100 Pisa
Tel: (050) 500022
Hewlett-Packard Italiana S.p.A.
Via Colla, 24
I-10129 Turin
Tel: (11) 53 82 64
Telex: 32046 via Milan
LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue de Col-Vert, 1
(Groenkranslaan)
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 33 494
NETHERLANDS
Hewlett-Packard Benelux/N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 1011
Tel: 5411522
Cable: HEWPAK Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nevsveien 13
Box 149
N-1344 Naslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n

PORTUGAL
Teletrac-Empresa Técnica de
Equipamentos Eléctricos S.A.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRAC Lisbon
Telex: 1598
SPAIN
Hewlett-Packard Española, S.A.
Irenez No 8
E-Madrid 16
Tel: 458 26 00
Telex: 23515 hpe
Hewlett-Packard Española, S.A.
Milanesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e
Hewlett-Packard Española S.A.
Av Ramon y Cajal, 1
Edificio Sevilla I, planta 9
E-Seville
Via Colla, 24
I-10129 Turin
Tel: (11) 53 82 64
Telex: 32046 via Milan
LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue de Col-Vert, 1
(Groenkranslaan)
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 33 494
NETHERLANDS
Hewlett-Packard Benelux/N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 1011
Tel: 5411522
Cable: HEWPAK Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nevsveien 13
Box 149
N-1344 Naslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n

PORTUGAL
Teletrac-Empresa Técnica de
Equipamentos Eléctricos S.A.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRAC Lisbon
Telex: 1598
SPAIN
Hewlett-Packard Española, S.A.
Irenez No 8
E-Madrid 16
Tel: 458 26 00
Telex: 23515 hpe
Hewlett-Packard Española, S.A.
Milanesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e
Hewlett-Packard Española S.A.
Av Ramon y Cajal, 1
Edificio Sevilla I, planta 9
E-Seville
Via Colla, 24
I-10129 Turin
Tel: (11) 53 82 64
Telex: 32046 via Milan
LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue de Col-Vert, 1
(Groenkranslaan)
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 33 494
NETHERLANDS
Hewlett-Packard Benelux/N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 1011
Tel: 5411522
Cable: HEWPAK Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nevsveien 13
Box 149
N-1344 Naslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n

PORTUGAL
Teletrac-Empresa Técnica de
Equipamentos Eléctricos S.A.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRAC Lisbon
Telex: 1598
SPAIN
Hewlett-Packard Española, S.A.
Irenez No 8
E-Madrid 16
Tel: 458 26 00
Telex: 23515 hpe
Hewlett-Packard Española, S.A.
Milanesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e
Hewlett-Packard Española S.A.
Av Ramon y Cajal, 1
Edificio Sevilla I, planta 9
E-Seville
Via Colla, 24
I-10129 Turin
Tel: (11) 53 82 64
Telex: 32046 via Milan
LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue de Col-Vert, 1
(Groenkranslaan)
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 33 494
NETHERLANDS
Hewlett-Packard Benelux/N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 1011
Tel: 5411522
Cable: HEWPAK Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nevsveien 13
Box 149
N-1344 Naslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n

PORTUGAL
Teletrac-Empresa Técnica de
Equipamentos Eléctricos S.A.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRAC Lisbon
Telex: 1598
SPAIN
Hewlett-Packard Española, S.A.
Irenez No 8
E-Madrid 16
Tel: 458 26 00
Telex: 23515 hpe
Hewlett-Packard Española, S.A.
Milanesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e
Hewlett-Packard Española S.A.
Av Ramon y Cajal, 1
Edificio Sevilla I, planta 9
E-Seville
Via Colla, 24
I-10129 Turin
Tel: (11) 53 82 64
Telex: 32046 via Milan
LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue de Col-Vert, 1
(Groenkranslaan)
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 33 494
NETHERLANDS
Hewlett-Packard Benelux/N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 1011
Tel: 5411522
Cable: HEWPAK Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nevsveien 13
Box 149
N-1344 Naslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n

TURKEY
Teletrac Engineering Bureau
Saglik Sok No. 15/1
Ayaspaşa-Beyoglu
P.O. Box 437 Beyoglu
TR-Istanbul
Tel: 49 40 40
Cable: TELETRAC Istanbul
Telex: 668068
UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 648413
Hewlett-Packard Ltd.
"The Grifons"
Stamford New Road
GB-Atrincham, Cheshire
Tel: (061) 928-9021
Telex: 668068
Hewlett-Packard, Ltd.
c/o Makro
South Service Wholesale Centre
Amber Way
Halesowen Industrial Estate
GB-Worce.
Tel: Birmingham 7860
Hewlett-Packard Ltd's registered
address for V.A.T. purposes
only
70, Finsbury Pavement
London, EC2A1SX
Registered No: 680597
SWEDEN
Hewlett-Packard Sverige AB
Enghjertsågen 1-3
Fack
S-161 20 Bromma 20
Tel: (08) 730 0550
Cable: MEASUREMENTS
Stockholm
Telex: 10721
Hewlett-Packard Sverige AB
Hagakersgatan 9
S-431 41 Mölndal
Tel: (031) 27 68 00/01
Telex: Via Bromma
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard Ges.m.b.H.
Hendelskai 52/3
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 Geneva
Switzerland
Tel: (022) 41 54 00
Cable: HEWPAKSA Geneva
Telex: 2 24 86

TURKEY
Teletrac Engineering Bureau
Saglik Sok No. 15/1
Ayaspaşa-Beyoglu
P.O. Box 437 Beyoglu
TR-Istanbul
Tel: 49 40 40
Cable: TELETRAC Istanbul
Telex: 668068
UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 648413
Hewlett-Packard Ltd.
"The Grifons"
Stamford New Road
GB-Atrincham, Cheshire
Tel: (061) 928-9021
Telex: 668068
Hewlett-Packard, Ltd.
c/o Makro
South Service Wholesale Centre
Amber Way
Halesowen Industrial Estate
GB-Worce.
Tel: Birmingham 7860
Hewlett-Packard Ltd's registered
address for V.A.T. purposes
only
70, Finsbury Pavement
London, EC2A1SX
Registered No: 680597
SWEDEN
Hewlett-Packard Sverige AB
Enghjertsågen 1-3
Fack
S-161 20 Bromma 20
Tel: (08) 730 0550
Cable: MEASUREMENTS
Stockholm
Telex: 10721
Hewlett-Packard Sverige AB
Hagakersgatan 9
S-431 41 Mölndal
Tel: (031) 27 68 00/01
Telex: Via Bromma
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard Ges.m.b.H.
Hendelskai 52/3
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 Geneva
Switzerland
Tel: (022) 41 54 00
Cable: HEWPAKSA Geneva
Telex: 2 24 86

TURKEY
Teletrac Engineering Bureau
Saglik Sok No. 15/1
Ayaspaşa-Beyoglu
P.O. Box 437 Beyoglu
TR-Istanbul
Tel: 49 40 40
Cable: TELETRAC Istanbul
Telex: 668068
UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 648413
Hewlett-Packard Ltd.
"The Grifons"
Stamford New Road
GB-Atrincham, Cheshire
Tel: (061) 928-9021
Telex: 668068
Hewlett-Packard, Ltd.
c/o Makro
South Service Wholesale Centre
Amber Way
Halesowen Industrial Estate
GB-Worce.
Tel: Birmingham 7860
Hewlett-Packard Ltd's registered
address for V.A.T. purposes
only
70, Finsbury Pavement
London, EC2A1SX
Registered No: 680597
SWEDEN
Hewlett-Packard Sverige AB
Enghjertsågen 1-3
Fack
S-161 20 Bromma 20
Tel: (08) 730 0550
Cable: MEASUREMENTS
Stockholm
Telex: 10721
Hewlett-Packard Sverige AB
Hagakersgatan 9
S-431 41 Mölndal
Tel: (031) 27 68 00/01
Telex: Via Bromma
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard Ges.m.b.H.
Hendelskai 52/3
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 Geneva
Switzerland
Tel: (022) 41 54 00
Cable: HEWPAKSA Geneva
Telex: 2 24 86

AFRICA, ASIA, AUSTRALIA

ANGOLA
Teletrac-Empresa Técnica de
Equipamentos Eléctricos
SARL
Rua de Barbosa, Rodrigues,
42-1°, D1°
P.O. Box 6487
Luanda
Cable: TELETRAC Luanda
AUSTRALIA
Hewlett-Packard Australia
Pty. Ltd.,
31-51 Joseph Street
Victoria, 3130
Tel: 89 6351
Cable: HEWPAK Melbourne
Telex: 31 024
Hewlett-Packard Australia
Pty. Ltd.,
31 Bridge Street
Pymble,
New South Wales, 2073
Tel: 449 6566
Telex: 21561
Cable: HEWPAK Sydney
Hewlett-Packard Australia
Pty. Ltd.,
97 Churchill Road
Prospect 5082
South Australia
Tel: 44 8151
Cable: HEWPAK Adelaide
Hewlett-Packard Australia
Pty. Ltd.,
Casablanca Buildings
188 Adelaide Terrace
Perth, W.A. 6000
Tel: 25-6800
Cable: HEWPAK Perth
Hewlett-Packard Australia
Pty. Ltd.,
10 Woolley Street
P.O. Box 191
Dichenham A.C.T. 2602
Tel: 49-8194
Cable: HEWPAK Canberra ACT
Hewlett-Packard Australia
Pty. Ltd.,
2nd Floor, 49 Gregory Terrace
Brisbane, Queensland, 4000
Tel: 29 1544
CEYLON
United Electronics Ltd.
P.O. Box 681
50, Park St.
Colombo 2
Tel: 26596
Cable: HOTPOINT Colombo
CYPRUS
Kyptronics
19 Gregorios & Xenopoulos Road
P.O. Box 1152
CY-Nicosia
Tel: 45628/29
Cable: KYPTRONICS PANDEHIS

ETHIOPIA
African Salespower & Agency
Private Ltd., Co.
P.O. Box 718
58/59 Cunningham St.
Addis Ababa
Tel: 12285
Cable: ASACO Addisababa
HONG KONG
Schmidt & Co. (Hong Kong) Ltd.
P.O. Box 297
Connaught Centre
39th Floor
Connaught Road, Central
Hong Kong
Tel: 240158, 232735
Telex: 841765
Cable: SCHMIDTCC Hong Kong
INDIA
Blue Star Ltd.
Kasturi Buildings
Gumdhedi Tata Rd.
Bombay 400 020
Tel: 29 50 21
Telex: 3751
Cable: BLUEFROST
Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
Tel: 45 78 87
Telex: 4093
Cable: FROSTBLUE
Blue Star Ltd.
Band Box House
Prabhadevi
Bombay 400 025
Tel: 45 73 01
Telex: 3751
Cable: BLUESTAR
Blue Star Ltd.
14/40 Civil Lines
Kampur 208 001
Tel: 6 88 82
Cable: BLUESTAR
Blue Star Ltd.
7 Hare Street
P.O. Box 506
Calcutta 700 001
Tel: 23-0131
Telex: 655
Cable: BLUESTAR
Blue Star Ltd.
Blue Star House
24 Ring Road
Osaka
Laipat Nagar
New Delhi 110 024
Tel: 62 32 76
Telex: 2463
Cable: BLUESTAR
Blue Star Ltd.
Blue Star House
11/114 Magarath Road
Bangalore 560 025
Tel: 55668
Telex: 430
Cable: BLUESTAR

INDONESIA
Bah Boin Trading Coy. N.V.
Djalah Merdeka 29
Bandung
Tel: 4915; 61560
Cable: ILMU
Telex: 86-089
IRAN
Multi Corp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-Tehran
Tel: 83 10 35-39
Cable: MULTICORP Tehran
Telex: 2893 MCI TN
ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569
JAPAN
Yokogawa-Hewlett-Packard Ltd.
Onashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: THPMARKET TOK 23-724
Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA
Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamisazasima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171
Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2-4-2 Shinohara-Kita
Kohoku-ku
Yokohama 222
Tel: 045-432-1504
Telex: 382-3204 YHP YOK

IRAN
Multi Corp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-Tehran
Tel: 83 10 35-39
Cable: MULTICORP Tehran
Telex: 2893 MCI TN
ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569
JAPAN
Yokogawa-Hewlett-Packard Ltd.
Onashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: THPMARKET TOK 23-724
Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA
Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamisazasima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171
Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2-4-2 Shinohara-Kita
Kohoku-ku
Yokohama 222
Tel: 045-432-1504
Telex: 382-3204 YHP YOK

IRAN
Multi Corp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-Tehran
Tel: 83 10 35-39
Cable: MULTICORP Tehran
Telex: 2893 MCI TN
ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569
JAPAN
Yokogawa-Hewlett-Packard Ltd.
Onashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: THPMARKET TOK 23-724
Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA
Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamisazasima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171
Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2-4-2 Shinohara-Kita
Kohoku-ku
Yokohama 222
Tel: 045-432-1504
Telex: 382-3204 YHP YOK

IRAN
Multi Corp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-Tehran
Tel: 83 10 35-39
Cable: MULTICORP Tehran
Telex: 2893 MCI TN
ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569
JAPAN
Yokogawa-Hewlett-Packard Ltd.
Onashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: THPMARKET TOK 23-724
Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA
Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamisazasima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171
Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2-4-2 Shinohara-Kita
Kohoku-ku
Yokohama 222
Tel: 045-432-1504
Telex: 382-3204 YHP YOK

ANGOLA
Teletrac-Empresa Técnica de
Equipamentos Eléctricos
SARL
Rua de Barbosa, Rodrigues,
42-1°, D1°
P.O. Box 6487
Luanda
Cable: TELETRAC Luanda
AUSTRALIA
Hewlett-Packard Australia
Pty. Ltd.,
31-51 Joseph Street
Victoria, 3130
Tel: 89 6351
Cable: HEWPAK Melbourne
Telex: 31 024
Hewlett-Packard Australia
Pty. Ltd.,
31 Bridge Street
Pymble,
New South Wales, 2073
Tel: 449 6566
Telex: 21561
Cable: HEWPAK Sydney
Hewlett-Packard Australia
Pty. Ltd.,
97 Churchill Road
Prospect 5082
South Australia
Tel: 44 8151
Cable: HEWPAK Adelaide
Hewlett-Packard Australia
Pty. Ltd.,
Casablanca Buildings
188 Adelaide Terrace
Perth, W.A. 6000
Tel: 25-6800
Cable: HEWPAK Perth
Hewlett-Packard Australia
Pty. Ltd.,
10 Woolley Street
P.O. Box 191
Dichenham A.C.T. 2602
Tel: 49-8194
Cable: HEWPAK Canberra ACT
Hewlett-Packard Australia
Pty. Ltd.,
2nd Floor, 49 Gregory Terrace
Brisbane, Queensland, 4000
Tel: 29 1544
CEYLON
United Electronics Ltd.
P.O. Box 681
50, Park St.
Colombo 2
Tel: 26596
Cable: HOTPOINT Colombo
CYPRUS
Kyptronics
19 Gregorios & Xenopoulos Road
P.O. Box 1152
CY-Nicosia
Tel: 456

