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Universal Counter



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5315A/B 100 MHz Universal Counter

OPERATING AND SERVICE MANUAL

Serial Prefix: 2120A

This manual applies to instruments with Serial Prefix 2120A unless accompanied by a Manual Change Sheet.

OLDER INSTRUMENTS

For Serial Prefixes 2032A and below, refer to Section VII for manual backdating.

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SAFETY CONSIDERATIONS

GENERAL

The following safety considerations should be read and fully understood before operating the HP Model 5315 series Universal Counters.

OPERATION

BEFORE APPLYING POWER verify that the power transformer primary is matched to the available line voltage and the correct fuse is installed (see Section II). Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

SERVICE

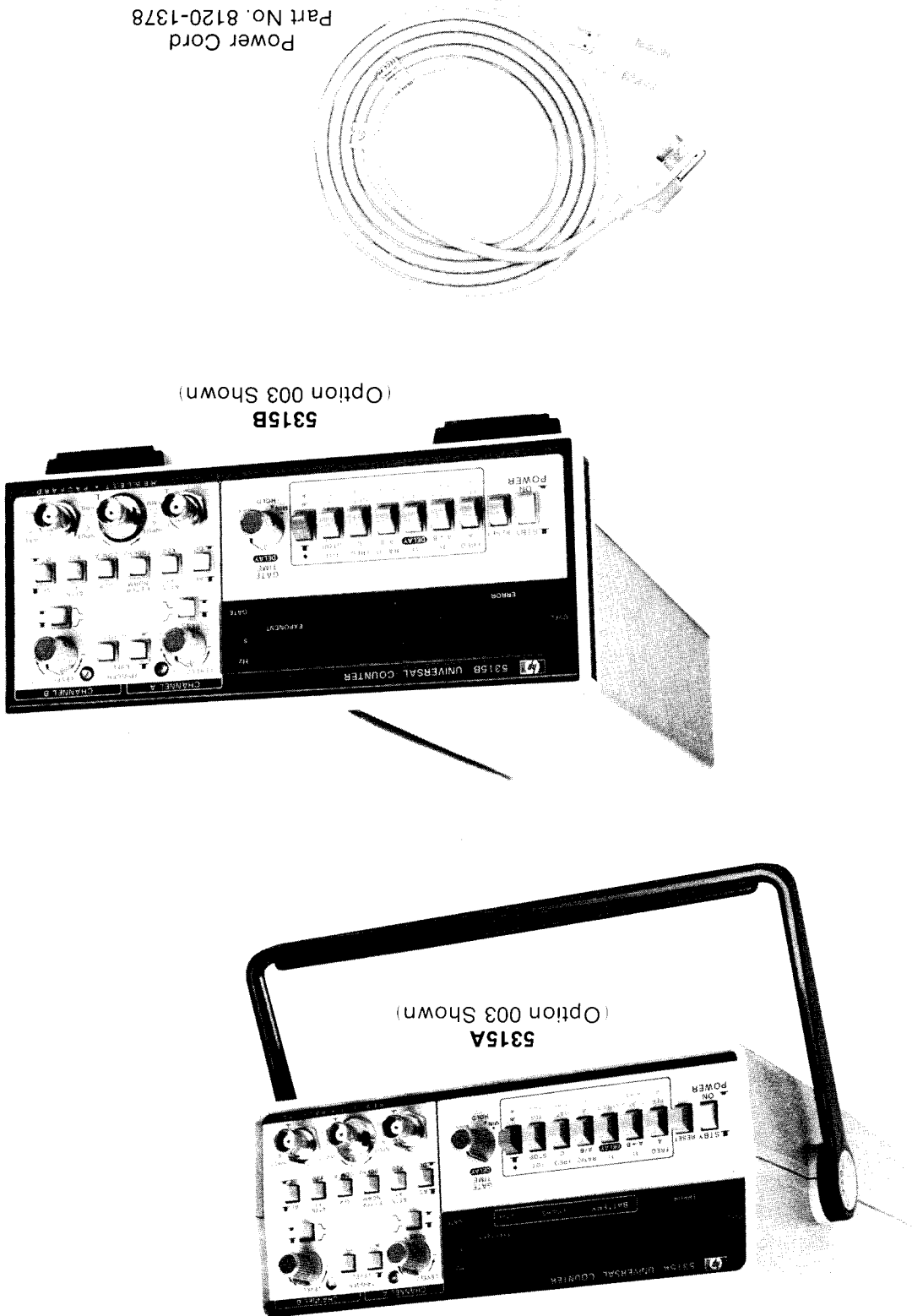
Although this equipment has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings that must be followed to ensure safe operation and to retain the equipment in safe condition. Service and adjustments should be performed only by qualified service personnel.

Any adjustment, maintenance, and repair of the opened equipment under voltage should be avoided as much as possible and, when inevitable, should be carried out by a skilled person who is aware of the hazard involved.

Capacitors inside the equipment may still be charged even if the equipment has been disconnected from its source of supply.

When it is likely that the protection has been impaired, the equipment must be made inoperative and be secured against any unintended operation.

Figure 1-1. Models 5315A and 5315B Universal Counters



SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual provides information about installation, operation, testing, adjustments, and servicing the Hewlett-Packard Model 5315A and 5315B Universal Counters, shown in *Figure 1-1*.

1-3. The 5315B is functionally identical to the 5315A. The major difference is that the 5315B is designed for rack mounting or stacking and features a metal cabinet to minimize electro-magnetic interference. (The 5315A has a high-strength plastic cabinet.)

1-4. This manual has eight sections, each covering a particular topic for using and servicing the 5315A and 5315B. The topics by section number are:

Section	Topic
I	General Information
II	Installation
III	Operation
IV	Performance Tests
V	Adjustments
VI	Replaceable Parts
VII	Manual Changes
VIII	Service

1-5. DESCRIPTION

1-6. The HP 5315A and 5315B are universal counters, measuring signals over a range from 0.1 Hz to 100 MHz. The 5315A and 5315B measure frequency, period, time interval, time interval average, time interval holdoff (delay), and ratio. A totalize function with manual or external gating is also provided. All measurements except totalize are displayed in scientific notation with up to eight digits of resolution.

1-7. Two independent input channels provide time interval measurements. Each input channel has an attenuator (X1, X20), trigger slope selector, trigger level and sensitivity control, and AC-DC coupling. A switchable low-pass filter on Channel A and three-state trigger lights are also provided.

1-8. Option 003, 1 GHz third or "C" input channel for the 5315A/B, provides frequency measurements from 50 MHz to 1 GHz. The input sensitivity is 15 mV for frequencies between 50 and 650 MHz, and 75 mV for frequencies between 650 MHz and 1 GHz. The C Channel is a 50-ohm input with a dynamic input range of 1V rms. The input is prescaled by 10 to achieve a 1 GHz frequency range. Complete specifications for the Option 003 are listed in *Table 1-1*.

1-9. SPECIFICATIONS

1-10. The instrument specifications are listed in *Table 1-1*. These specifications are the performance standards or limits against which the instrument may be tested.

Table 1-1. 5315A/B Specifications*

INPUT CHARACTERISTICS: (Channel A and Channel B)																																									
Range: DC coupled, 0 to 100 MHz. AC coupled, 30 Hz to 100 MHz.																																									
Sensitivity: 10 mV rms sine wave to 10 MHz. 25 mV rms sine wave to 100 MHz. 75 mV peak-to-peak pulse at minimum pulse width of 5 ns.																																									
NOMINAL can be varied continuously up to 500 mV rms by adjusting SENSITIVITY control. In SENSITIVITY mode, trigger level is automatically set to 0V NOMINAL .																																									
Dynamic Range: 30 mV to 5V peak-to-peak, 0 to 10 MHz. 75 mV to 5V peak-to-peak, 10 to 100 MHz.																																									
Signal Operating Range: +2.5V DC to -2.5V DC.																																									
Coupling: AC or DC, switchable.																																									
Filter: Low pass, switchable in or out of Channel A.																																									
Impedance: 1 MΩ NOMINAL shunted by less than 40 pF.																																									
Attenuator: X1 or X20 NOMINAL .																																									
Trigger Level: Variable between +2.5V DC and -2.5V DC.																																									
Slope: Independent selection of + or - slope.																																									
Common Input: All specifications are the same for Common A except the following:																																									
Sensitivity: 20 mV rms to 10 MHz, 50 mV rms to 100 MHz, 150 mV peak-to-peak.																																									
Dynamic Range: 60 mV-5V peak-to-peak 0-10 MHz, 150 mV-5V peak-to-peak 10-100 MHz.																																									
Impedance: 500 kΩ (Nom) shunted by less than 70 pF.																																									
Damage Level: AC&DC × 1: 250V (DC + AC rms) 6 × 10 ⁵ V rms Hz/FREQ 6V rms AC&DC × 20: 2.4 kHz to 100 kHz >100 kHz DC to 28 kHz 500V (DC + AC peak) 1 × 10 ⁷ V rms Hz/FREQ 100V rms >100 kHz																																									
FREQUENCY (Channel A) Range: 0.1 Hz to 100 (burst or cw).																																									
NOTE Between 0.1 Hz and 0.14 Hz, the resolution is one millihertz.																																									
LSD Displayed: 10 Hz to 1 nHz depending upon gate time and input signal. At least 7 digits displayed per second of gate time.																																									
**Resolution: $\pm \text{LSD} \pm 1.4 \times \frac{\text{Gate Time}}{\text{Trigger Error}} \times \text{FREQ, FREQ} < 10 \text{ MHz.}$																																									
Accuracy: $\pm \text{Resolution} \pm (\text{time base error}) \times \text{FREQ.}$ **Best Case Resolution for 1 Second Gate																																									
<table><tr><td>100 Hz</td><td>1 kHz</td><td>10 kHz</td><td>1 MHz</td><td>10 MHz</td><td>100 MHz</td></tr><tr><td>±0.004 Hz</td><td>±0.004 Hz</td><td>±0.01 Hz</td><td>±0.1 Hz</td><td>±1 Hz</td><td>±10 Hz</td></tr><tr><td>±0.002 Hz</td><td>±0.002 Hz</td><td>±0.01 Hz</td><td>±0.1 Hz</td><td>±1 Hz</td><td>±10 Hz</td></tr><tr><td>±0.0005 Hz</td><td>±0.001 Hz</td><td>±0.01 Hz</td><td>±0.1 Hz</td><td>±1 Hz</td><td>±10 Hz</td></tr><tr><td>±0.0003 Hz</td><td>±0.0012 Hz</td><td>±0.01 Hz</td><td>±0.1 Hz</td><td>±1 Hz</td><td>±10 Hz</td></tr><tr><td>±0.001 Hz</td><td>±0.01 Hz</td><td>±0.1 Hz</td><td>±1 Hz</td><td>±1 Hz</td><td>±10 Hz</td></tr></table> This chart shows best case frequency reduction versus input sine wave rms amplitude. This is best case because noise from the signal source is assumed to be zero; the trigger error is produced only by the counter's noise (i.e., 120 μV rms).						100 Hz	1 kHz	10 kHz	1 MHz	10 MHz	100 MHz	±0.004 Hz	±0.004 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz	±0.002 Hz	±0.002 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz	±0.0005 Hz	±0.001 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz	±0.0003 Hz	±0.0012 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz	±0.001 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±1 Hz	±10 Hz
100 Hz	1 kHz	10 kHz	1 MHz	10 MHz	100 MHz																																				
±0.004 Hz	±0.004 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz																																				
±0.002 Hz	±0.002 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz																																				
±0.0005 Hz	±0.001 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz																																				
±0.0003 Hz	±0.0012 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±10 Hz																																				
±0.001 Hz	±0.01 Hz	±0.1 Hz	±1 Hz	±1 Hz	±10 Hz																																				
PERIOD																																									
Range: 10 ns to 10 ⁵ s.																																									
LSD Displayed: 100 ns to 1 fs depending upon gate time and input signal. At least 7 digits displayed per second of gate time.																																									
Resolution: $\pm \text{LSD} \pm 1.4 \times \frac{\text{Gate Time}}{\text{Trigger Error}} \times \text{PER, PER} > 100 \text{ ms.}$																																									
Accuracy: $\pm \text{Resolution} \pm (\text{time base error}) \times \text{PER.}$																																									
TIME INTERVAL																																									
Range: 100 ns to 10 ⁵ s.																																									
LSD Displayed: 100 ns.																																									
Resolution: $\pm \text{LSD} \pm \text{Start Trigger Error} \pm \text{Stop Trigger Error.}$																																									
Accuracy: $\pm \text{Resolution} \pm (\text{time base error}) \times \text{TI.}$																																									
TIME INTERVAL AVERAGE																																									
Range: 0 ns to 10 ⁵ s.																																									
LSD Displayed: 100 ns to 10 ps depending upon gate time and input signal. See table in Definitions section.																																									
Resolution: $\pm \text{LSD} \pm \frac{\sqrt{N}}{\text{Start Trigger Error}} \pm \frac{\sqrt{N}}{\text{Stop Trigger Error}}$																																									
Accuracy: $\pm \text{Resolution} \pm (\text{time base error}) \times \text{TI} \pm 4 \text{ ns.}$																																									
Number of intervals averaged (N): N = Gate Time × FREQ.																																									
Minimum Dead Time (stop to start): 200 ns.																																									
TIME INTERVAL DELAY (Holdoff) Front panel gate time knob inserts a variable delay of NOMINALLY 500 μs to 20 ms between START (Channel A) and enabling of STOP (Channel B). Electrical inputs during delay time are ignored. Delay time may be digitally measured by simultaneously pressing T.L. Averaging, T.L. Delay, and blue key. Other specifications of T.L. Delay are identical to Time Interval.																																									
RATIO Range: 0.1 Hz to 100 MHz, both channels.																																									
LSD: $2.5 \times \text{Period A} \times \text{Ratio. (rounded to nearest decade)}$																																									
Resolution: $\pm \text{LSD} \pm \frac{\text{Gate Time}}{\text{B Trigger Error}} \times \text{Ratio.}$																																									
Accuracy: Same as resolution. Highest frequency input is connected to Channel A to achieve specified accuracy.																																									
TOTALIZE																																									
Manual: A Gated by B: Range: 0 to 100 MHz.																																									
Totalizes input A between two events of B. Instrument must be reset to make new measurement. Gate opens on A slope, closes on B slope.																																									
Range: 0 to 100 MHz.																																									
Resolution: $\pm 1 \text{ count.}$																																									
Accuracy: $\pm 1 \text{ count} \pm \text{B Trigger Error} \times \text{Frequency A.}$																																									

*Specifications describe the instrument's warranted performance. Supplemental characteristics are intended to provide information useful in applications of the instrument by giving **TYPICAL** or **NOMINAL**, but nonwarranted performance parameters. Definition of terms is provided at the end of the specification section. For a more detailed explanation, see HP Application Note 200-4 "Understanding Frequency Counter Specifications".

Table 1-1. 5315A/B Specifications (Continued)

TIME BASE	
Frequency: 10 MHz. Aging Rate: <3 parts in 10 ⁷ /mo. Temperature: ≤±5 parts in 10 ⁶ , 0 to 50°C. Line Voltage: ≤±1 part in 10 ⁷ for ±10% variation.	
GENERAL	
Check: Counts internal 10 MHz reference frequency over gate time range NOMINALLY 500 μs to 20 ms. Error Light: LED warning light activated if logic error is found during instrument turn-on self-check. Display: 8-digit amber LED display, with engineering units annunciator. Overflow: Only frequency and totalize measurements will overflow. In case of overflow, eight least significant digits will be displayed and amber front panel overflow LED will be actuated. All other measurements which would theoretically cause a display of more than 8 digits will result in the display of the 8 most significant digits. Gate Time: Continuously variable, NOMINALLY from 60 ms to 10 s or 1 period of the input, whichever is longer. Sample Rate: Up to 5 readings per second NOMINAL except in time interval mode, where it is continuously variable NOMINALLY from 4 readings per second to 1 reading every 10 seconds via Gate Time control. Operating Temperature: 0° to 50°C. Power Requirements: Internally switch selectable 100, 120, 220, or 240V (+5%, -10%) 48-66 Hz; 15 VA maximum. Weight: Net, 2.2 kg (4 lbs, 12 oz.); Shipping, 4.1 kg (9 lbs.). Dimensions: 238 mm W × 98 H × 276 mm D (9 3/8 × 3 7/8 × 10 7/8 in.).	
OPTIONS	
Option 001: Temperature Compensated Time Base (TCXO) Frequency: 10 MHz. Aging Rate: <1 part in 10 ⁷ /mo. Temperature: ≤1 part in 10 ⁶ , 0° to 40°C. Line Voltage: <1 part in 10 ⁶ for ±10% variation. Option 002: Battery (5315A only) Type: Rechargeable lead-acid (sealed). Capacity: TYPICALLY 4 hours of continuous operation at 25°C. Recharging Time: TYPICALLY 16 hours to 98% of full charge, instrument nonoperating. Charging circuitry included with Option. Batteries not charged during instrument operation. Low Voltage Indicator: Instrument turns itself off automatically when low battery conditions exist. Discharge LED flashes slowly when this happens. Discharge LED is on whenever battery is supplying power to instrument. Charge LED indicates state of charge of battery during charging only and is on whenever battery is charged to 95% NOMINAL of capacity. Charge LED flashes when 90% NOMINAL of charge taken out is replaced. Charge LED is off if charge is less than 70% NOMINAL of capacity. Line Failure Protection: Instrument automatically switches to battery in case of line failure. Weight: Option 002 adds 1.4 kg (3 lbs.) to weight of instrument.	
Option 004 (for 5315A): High Stability Time Base (Oven Oscillator) Frequency: 10 MHz. Aging Rate: <1 part in 10 ⁷ /mo. (after 10 day warm up). Temperature: ±1 part in 10 ⁷ , 0° to 50°C. Line Voltage: ≤1 part in 10 ⁷ for ±10% variation. Option 004 (for 5315B): High Stability Time Base (Oven Oscillator) Frequency: 10 MHz. Aging Rate: <5 parts in 10 ⁸ /mo. Temperature: <2 parts in 10 ⁸ , 0° to 67°C. Line Voltage: ≤1 part in 10 ⁷ for ±10% variation.	
Option 004 (for 5315B): High Stability Time Base (Oven Oscillator) Frequency: 10 MHz. Aging Rate: <5 parts in 10 ⁸ /mo. Temperature: <2 parts in 10 ⁸ , 0° to 67°C. Line Voltage: ≤1 part in 10 ⁷ for ±10% variation.	
5315B: Rack and stack metal case with rear panel, switchable AC power line module. Specifications same as 5315A except as follows: Rack Mount Kit: 5061-0072 recommended. Oscillator Output: 10 MHz, 50 mV p-p into 50Ω load on rear panel. External Frequency Standard Input: 10 MHz, 1V rms into 500Ω on rear panel. Requires internal selection. Dimensions: 212 mm W × 81 mm H × 345 mm D (8 3/8 × 3 1/2 × 13 3/4 in.). Weight: Net, 3.2 kg (7 lbs, 2 oz.); Shipping, 4.5 kg (10 lbs.).	
WARRANTY	
ALL COMPONENTS IN OPTION 002, EXCEPT THE BATTERY, ARE WARRANTED FOR ONE FULL YEAR, BATTERY BT-1, (HP PART NO. 1400-0253) IS NOT WARRANTED.	

Table 1-1. 5315A/B Specifications (Continued)

DEFINITIONS	
Resolution: Smallest discernible change of measurement result due to a minimum change in the input.	
Accuracy: Deviation from the actual value as fixed by universally accepted standards of frequency and time.	
Least Significant Digit (LSD) Displayed: Frequency:	
$2.5 \times 10^{-7} \times \text{FREQ}, \text{ FREQ} < 10 \text{ MHz.}$	Gate Time
$2.5 \times 10^{-7} \times \text{FREQ}, \text{ FREQ} \geq 10 \text{ MHz.}$	Gate Time
	Period:
$2.5 \times 10^{-7} \times \text{PER}, \text{ PER} > 100 \text{ ns.}$	Gate Time
$2.5 \times 10^{-7} \times \text{PER}_2, \text{ PER} \leq 100 \text{ ns.}$	Gate Time

All above calculations should be rounded to nearest decade (i.e., 0.5 Hz will become 10 Hz and 0.4 ns will be 0.1 ns).

Trigger Error:

$$\frac{\sqrt{(120 \times 10^{-6})^2 + e_n^2}}{\text{Input slew rate at trigger point}} \quad \text{seconds rms}$$

where e_n is the rms noise voltage of the input for a 100 MHz bandwidth.

NOTES:

† Due to arithmetic truncation, quantization error will be ± 1 or ± 2 counts of the LSD as follows:

± 2 counts of LSD if $\frac{\text{LSD}}{\text{FREQ or PER}} < 1 \times 10^{-7} \text{ FREQ} < 10 \text{ MHz.}$

± 2 counts of LSD if $\frac{\text{LSD}}{\text{FREQ or PER}} < \frac{1}{1/(\text{Gate Time})} \text{ FREQ} \geq 10 \text{ MHz.}$

± 1 count of LSD for all other cases.

1-11. OPTIONS

1-12. The options available for the 5315A/B are listed below. Specifications for the options are given in *Table 1-1* and full descriptions begin with paragraph 3-62. If an option is included in the initial order, it will be installed at the factory and will be ready for operation upon receipt. Options 002 and 006 are available as retrofit kits for field installation. For field installation of Options 001, 002, 003, and 004, refer to the appropriate installation instructions in Section II. The Option 006 retrofit kit contains installation instructions.

Option	Description
001	Temperature Compensated Time Base TCXO*
002	Battery and Charger (for Model 5315A only)
003	C Channel 1 GHz Input
004	High Stability Time Base—Oven-Contained Oscillator*
006	Offset/Normalizer (Used with Model 5315B only)

*Only one of either Option 001 or 004 can be installed.

NOTE

For Model 5315A (only), one of the following options *must* be included with each order.

Option 100: 90-105 VAC; 48-66 Hz
Option 120: 108-126 VAC; 48-66 Hz
Option 220: 198-231 VAC; 48-66 Hz
Option 240: 216-252 VAC; 48-66 Hz

1-13. SAFETY CONSIDERATIONS

1-14. The 5315A/5315B Universal Counters are Safety Class I instruments, designed according to international safety standards. This operating and service manual contains information, cautions, and warnings which must be followed by the user to ensure safe operation and keep the instrument in safe condition.

1-15. INSTRUMENT IDENTIFICATION

1-16. Hewlett-Packard instruments have 2-section, 10-character serial numbers (0000A00000), usually on the rear panel. The four-digit serial prefix identifies instrument changes. If the serial prefix of your instrument differs from that listed on the title page of this manual, there are differences between this manual and your instrument. Instruments having higher serial prefixes are covered with a "Manual Changes" sheet included with this manual. If the change sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed at the back of this manual. Instruments having a lower serial prefix number than that listed on the title page are covered in Section VII.

1-17. ACCESSORIES

1-18. Table 1-2 lists accessory equipment supplied and Table 1-3 lists accessories available.

Table 1-2. Accessories Supplied	
Description	HP Part Number
Detachable Power Cord, 229 cm (7½ feet)	8120-1378

Table 1-3. Accessories Available

Description	HP Part Number
Rack Mount Kit (5315B Only)	5061-0072

1-19. RECOMMENDED TEST EQUIPMENT

1-20. The test equipment listed in Table 1-4 is recommended for use during performance tests, adjustments, and troubleshooting. Substitute test equipment may be used if it meets the critical specifications listed in the table.

Table 1-4. Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use
Oscilloscope	100 MHz Bandwidth	HP 1740A	A,T
Synthesizer/Function Generator	0.1–10 MHz, 5–120 mVrms Sine and Square wave output	HP 3325A	P,A,T
Signal Generator	10–100 MHz, 5–100 mVrms	HP 8654A	P
Synthesized Generator	50–1000 MHz, +1 to –14 dBm	HP 8660C/86602A	P
DC Voltmeter	20V Range, 0.05V Resolution	HP 3465A	A,T
50Ω Feedthrough	BNC Type		P,A,T
Tee Connector	BNC Type	1250-0781	A,T
Power Splitter	50 MHz–1 GHz; Calibrated Output	HP 11667A	P
Cables (3)	4 BNC 50Ω	11170C	A,T
Power Meter/Sensor	50 MHz–1 GHz; –9 to –24 dBm	HP 436A/8481A	P
10 dB Attenuator		HP 8491A	P
Adapter, Coaxial (2 required)	Type N (male)-to- BNC (female)	1250-0780	P
Adapter, Coaxial	Type N (male)-to- BNC (male)	1250-0082	P

* P = Performance Tests, A = Adjustments, T = Troubleshooting

SECTION II INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information for unpacking, inspection, storage, and installation.

2-3. UNPACKING AND INSPECTION

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

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. The HP 5315A/B requires a power source of 100-, 120-, 220-, or 240-volt ac, +5%, -10%, 48 to 66 Hz single phase. Power consumption is approximately 12 watts. The 5315A (only) may also be powered by the Option 002 Battery Pack. See Section I, Specifications and Section VIII, paragraph 8-65, for description.

2-8. Line Voltage Selection

CAUTION

Before connecting the instrument to ac power lines, be sure that the voltage selector is properly positioned as described below.

2-9. The 5315A is preset at the factory to one of four line voltage selections. Refer to the rear panel label (see Figure 2-7) to determine which of the following settings is preselected:

Option 100: 90 to 105 VAC; 48-66 Hz
Option 120: 108 to 126 VAC; 48-66 Hz
Option 220: 198 to 231 VAC; 48-66 Hz
Option 240: 216 to 252 VAC; 48-66 Hz

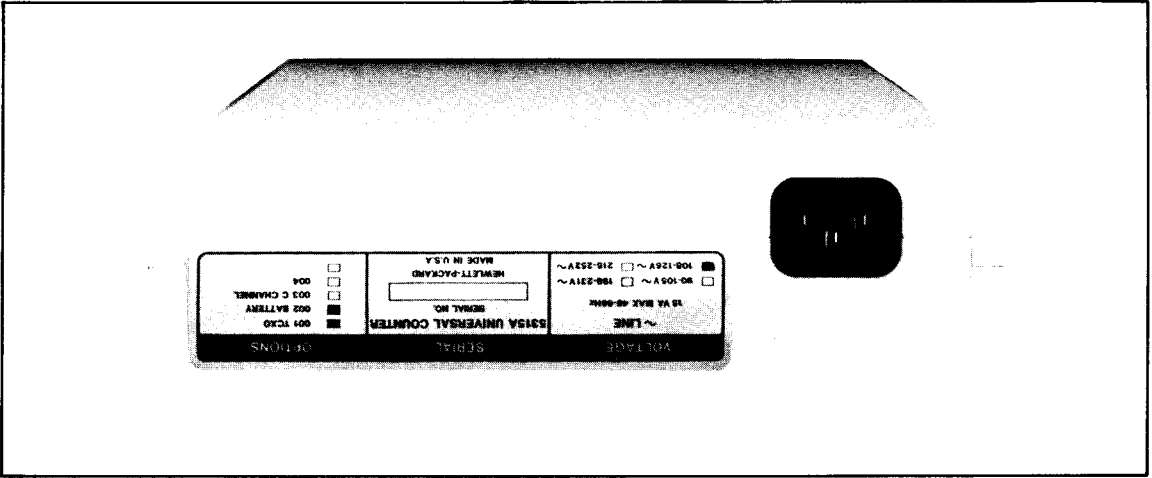
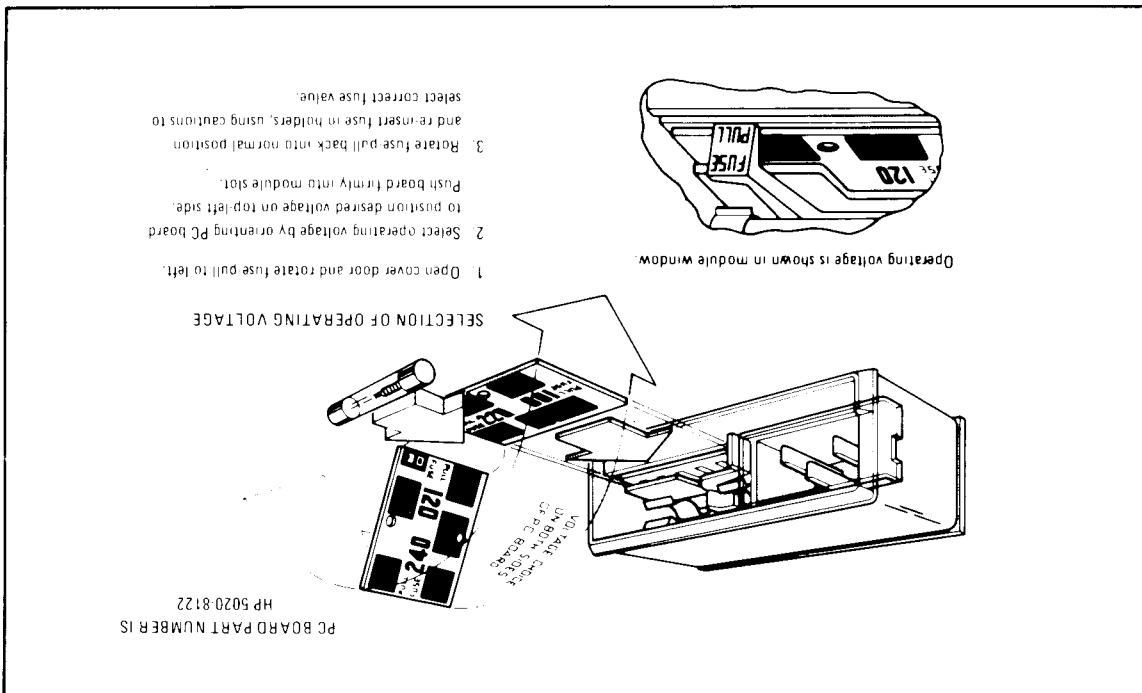


Figure 2-7. 5315A Line Voltage Selection Label

- 2-12. Power line voltage connections are selected by the position of the plug-in circuit card in the module. When the card is plugged in to the module, the only visible markings on the card indicate the line voltage to be used. The correct value of line fuse, with a 250-volt rating, must be installed after the card is inserted. This instrument uses a 0.25A fuse (HP Part No. 2110-0201) for 100/120-volt operation; a 0.12A fuse (HP Part No. 2110-0318) for 220/240-volt operation.
- 2-13. To convert from one line voltage to another, the power cord must be disconnected from the power module before the sliding window covering the fuse and card compartment can be moved to expose the fuse and circuit card.
- 2-14. Pull on the fuse lever to remove the fuse and then pull the card out of the module. The fuse lever must be held to one side to extract and insert the card. Insert the card so the marking that agrees with the line voltage to be used is visible.
- 2-15. Return fuse lever to normal position, insert correct fuse, slide plastic window over the compartment, and connect the power cord to complete the conversion.

Figure 2-2. 5315B Line Voltage Selection Card



- 2-10. Changing the 5315A power line voltage selector requires opening the cabinet. Instructions for changing the line voltage setting are given in Section V.
- 2-11. The 5315A has a rear-panel power module that contains a printed-circuit line voltage selector to select 100-, 120-, 220-, or 240-volt ac operation (see Figure 2-2). Before applying power, the pc selector must be set to the correct position and the correct fuse must be installed as described below.

2-16. Power Cable

WARNING

BEFORE SWITCHING ON THIS INSTRUMENT, THE PROTECTIVE EARTH TERMINALS OF THIS INSTRUMENT MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR OF THE (MAINS) POWER CORD. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

2-17. The 5315A/B is shipped with a three-wire power cable. When the cable is connected to an appropriate ac power source, this cable connects the chassis to earth ground. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to *Figure 2-3* for the part numbers of the power cable and plug configurations available.

2-18. Operating Environment

2-19. **TEMPERATURE.** The 5315A/B may be operated in temperatures from 0°C to 50°C.

2-20. **HUMIDITY.** The 5315A/B may be operated in environments with humidity up to 95%. However, it should be protected from temperature extremes which cause condensation in the instrument.

2-21. **ALTITUDE.** The 5315A/B may be operated at altitudes up to 4,600 metres (15,000 feet).

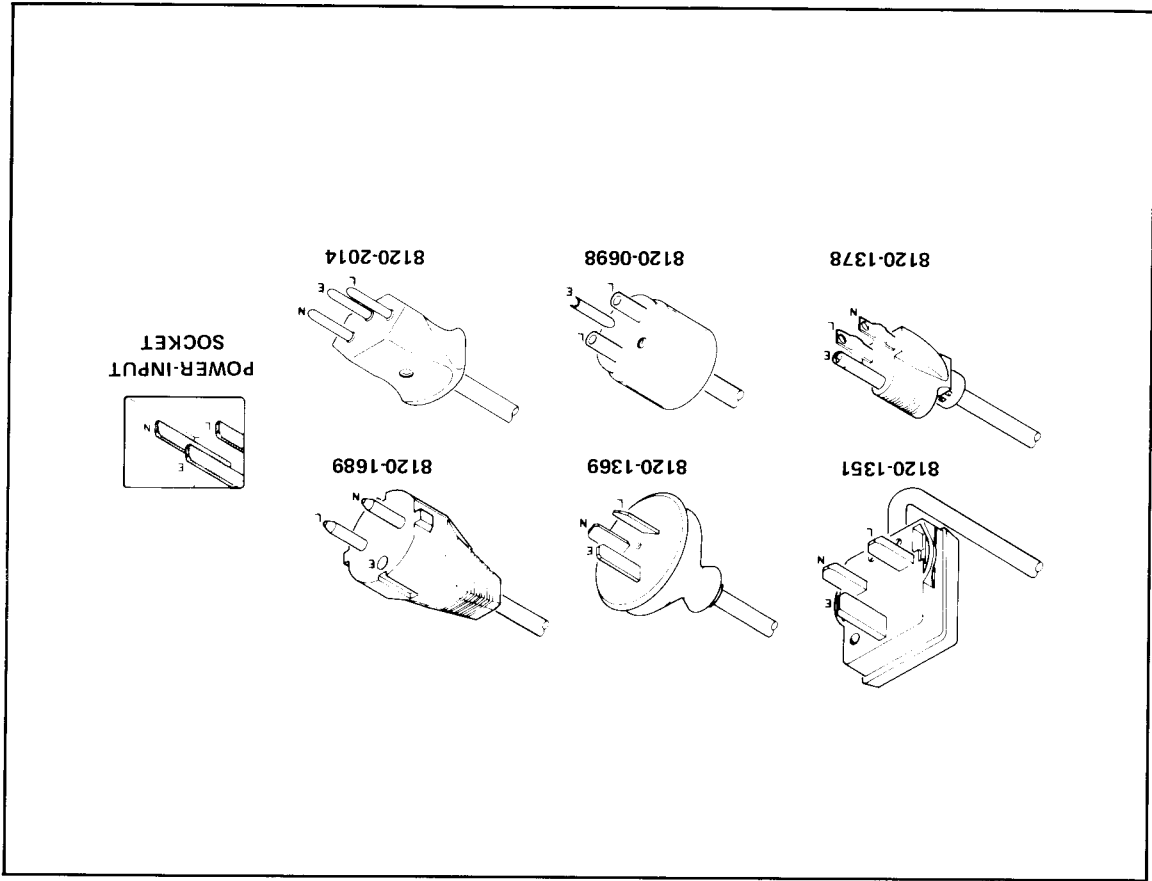


Figure 2-3. Power Cable HP Part Numbers versus Mains Plugs Available

2-30. The following paragraphs provide instructions for field installation of Options 001, 002, 003, and 004. Any of the options may be installed after the purchase of the Model 5315A or 5315B by ordering the appropriate parts listed in *Table 2-1* and performing the installation procedure for that option. Field installation instructions for the Model 5315B Option 006 are contained in the Installation and Service Manual.

2-29. FIELD INSTALLATION OF OPTIONS

- f. In any correspondence, refer to the instrument by model number and full serial number.
 - e. Mark the shipping container "FRAGILE" to ensure careful handling.
 - d. Seal the shipping container securely.
 - c. Use a layer of shock-absorbing material 70 to 100 mm (3- to 4-inches) thick around all sides of the instrument to provide firm cushioning and prevent movement inside the container. Protect control panel with cardboard.
 - b. Use a strong shipping container. A double-wall carton made of 2.4 MPa (350 psi) test material is adequate.
 - a. Wrap instrument in heavy paper or plastic. (If shipping to Hewlett-Packard office or service center, attach a tag indicating type of service required, return address, model number, and full serial number.)
- 2-28. OTHER PACKAGING. The following general instructions should be used for repackaging with commercially available materials:

2-27. ORIGINAL PACKAGING. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-26. Packaging

2-25. The instrument should also be protected from temperature extremes which cause condensation within the instrument.

Temperature -40°C to +75°C
Humidity Up to 95%
Altitude 7,620 metres (25,000 feet)

2-24. The instrument may be stored or shipped in environments with the following limits:

2-23. Environment

2-22. STORAGE AND SHIPMENT

2-31. Part Numbers for Ordering Option Kits

2-32. To obtain the necessary parts for installation of an option, order by part number as listed below (refer to Section VI for ordering information).

Table 2-1. Option Parts for Field Installation

Option	Description	HP Part Number
001	Temperature Compensated Time Base *	05315-60007
002	Battery Pack Retrofit Kit For 5315A with serial numbers prefixed 2120A and above For 5315A with serial numbers prefixed 1812A through 2032A	05315-60113 05315-60105
003	Channel C (Input to 1 GHz) Channel C Assembly A9 Special BNC Connector Teflon Insulator Hex Nut Lockwasher Connector Fuse .125A Front Panel (5315A; serial numbers prefixed 2120A and above) Front Panel (5315A; serial numbers prefixed 1812A through 2032A) Front Panel (5315B; serial numbers prefixed 2120A and above) Front Panel (5315A; serial numbers prefixed 2120A and above) Screws 6-32 × .250" Pan Head Pozidriv (4 each) Reset Cable Assembly (W2); used on instruments with serial numbers prefixed 1812A to 1920A.	05315-60009 05305-60205 05305-20105 0590-0038 2190-0124 05305-60206 2110-0301 05315-00027 05315-00004 05315-00029 05315-00008 2360-0113 05315-60106
004; 5315A	Oven-Contained Time Base *	05315-60017
004; 5315B	Oven-Contained Time Base * Screws securing Oscillator Mounting Bracket to left side frame and A1 motherboard. 6-32 × .312" Pan Head Pozidriv w/lock (4 each)	05315-60112 2360-0115 2360-0113
006; 5315B	Offset/Normalizer Module ** Retrofit Kit	05315-60110

*The mounting hardware for the standard oscillator is used to mount Options 001 and 004 (5315A), or the A15A1 Assembly of Option 004 (5315B).
**Includes installation instructions, parts and hardware.

- e. If the oven oscillator (Option 004) is installed, add a short insulated jumper wire at A1W1 (refer to the 5315A A1 Assembly Schematic).
- f. Perform the Option 002 adjustment as described in Section V.
- g. Replace the top cover. Position the cable harness so the cable will not be pinched by the cover.

Connectors on this harness are polarized; do not force the connectors.

NOTE

- d. Connect J1 of the A6 Charger assembly to J4 of the A1 Motherboard assembly using cable harness supplied. Position cable negative battery terminal lead beside the battery cover (refer to Figure 5-3).
- c. Position the bracket assembly, with A6 and B1 installed, onto the six mounting posts on the inside top cover, placing the charger toward the front and the battery toward the rear of the instrument. Secure with six press-on retainers supplied. The "ground clip" should be positioned as shown in Figure 5-4.
- b. Remove the instrument top cover by removing the four screws accessible from the cabinet bottom.
- a. Remove the AC power cord.

Option 002 may be installed only in Model 5315A. Installation should be performed by qualified service personnel only.

NOTE

Option 002 consists of a rechargeable battery and charger assembly (A6), which are installed in the top cover of Model 5315A. To install Option 002, proceed as follows:

2-35. Installation of Battery Pack and Charger Option 002

- h. Replace A1 Motherboard, the four spacers and the top cover.
- g. Perform Option 001 adjustment as described in Section V.
- f. Secure the assembly by installing the two screws through L-brackets with lockwashers and hex nuts.
- e. Insert the A7 TCXO assembly, with components facing to the outside of the instrument, into J2 of the A1 Motherboard assembly. See Figure 5-3.
- d. Remove the two screws that secure the existing reference oscillator; remove the oscillator circuit board.
- c. Remove the A1 Motherboard by removing the three screws located on either side of transformer T1, and center of the board. Save the four plastic spacers.
- b. Remove the instrument top cover. For Model 5315A, this requires removal of the four screws accessible from the cabinet bottom. For Model 5315B, loosen the single screw on the top rear center of the top cover and slide top backwards.
- a. Remove the AC power cord.

Option 001 consists of a Temperature Compensated Crystal Oscillator, which replaces the standard oscillator. To install Option 001, proceed as follows:

2-33. Installation of TCXO Option 001

2-37. Installation of C Channel Option 003

2-38. Option 003 consists of a 1 GHz Channel Assembly (A9) which plugs into an existing motherboard connector. Procedures are provided for the installation of Option 003 in Model 5315A (paragraph 2-39) and Model 5315B (paragraph 2-40).

NOTE

If Option 003 is to be installed in a 5315A/B with a Serial Prefix of 1920A or earlier, the following modifications must be performed.

1. On A1 Motherboard, using diagonal pliers, clip off pin 1 of A1J6.
2. On A9 C Channel, install the RESET CABLE W2 (HP Part No. 05315-60106), by soldering the end (opposite the connector pin) into the vacant printed circuit pad next to pin 1 of P1.
3. Perform the following installation procedure. When finished, insert the connector end of RESET CABLE W2 into A1J7, pin 15 to complete the installation.

2-39. To install Option 003 in HP Model 5315A, proceed as follows:

- a. Remove the AC power cord.
- b. Remove the instrument top cover (MP 12) by removing the four screws accessible from the cabinet bottom.
- c. Remove the LEVEL/SENS and GATE TIME control knobs.
- d. Remove the three screws which secure the motherboard to cabinet bottom. Remove the handle (MP 3) and the four black spacers (MP 4) and lift the entire instrument straight up and out.
- e. Remove the front panel hex nuts on the CHANNEL A and B BNC's and the three control hex nuts.
- f. Remove the 1/4" hex nut on the left rear side of the A2 Display Assembly. Pull the front panel (MP6) forward until it clears the control shafts and input jacks. Note the spacer between the front panel and A2 Assembly.

NOTE

If the old front panel has bezels installed in the holes, transfer them to the replacement panel.

- g. Remove the four screws securing the A4 Input Amplifier.
- h. Remove the A3/A4 assembly by gently lifting on the rear edge of A4, until the pins come free of motherboard connector A1 J5.
- i. Position the A9 C Channel assembly, component side up and protruding connector pins toward rear of instrument, over A1 motherboard jack J6. Install by gently pressing the row of connector pins into J6 until the assembly rests on the spacers mounted on A1. Secure with four screws provided.
- j. Install the Special Input BNC (provided) in the INPUT C position (center) of the 5315A replacement front panel (provided) as illustrated in Section III, Figure 3-12.
- k. Connect the SMC connector on A9 W1 to the INPUT C BNC; loosely install the new front panel; set the instrument into the cabinet bottom.

- l. Perform Option 003 adjustment as described in Section V.
 - m. Remove the instrument from the cabinet bottom and replace the A3/A4 Input Amplifier.
 - n. Position the front panel, and reinstall the CHANNEL A and B BNC and three control hex nuts. Replace the LEVEL/SENS and GATE TIME control knobs.
 - o. Reinstall the instrument into the cabinet bottom and secure with three screws. Replace the handle and four black spacers. Replace the cabinet top cover.
- 2-40. To install Option 003 in HP Model 5315B proceed as follows:
- a. Remove the AC power cord.
 - b. Remove the instrument top cover (MP 12) by removing the screw which secures the carrying handle (MP 11) at rear of instrument. Slide the cover backward until free.
 - c. Remove the gray trim strip (MP 16) from top of the instrument front frame (MP 17).
 - d. Remove the four screws which secure the front panel (MP 21). The front feet of the instrument must be removed to access the two screws on the frame bottom.
- NOTE**
- Steps e & f apply only to instruments with serial numbers prefixed 1812A through 2032A. For all instruments, continue with step g.
- e. Remove the two screws which secure the support bracket, on the left side of A1 motherboard, to the instrument side frame.
 - f. Remove the two screws and bracket which secure the A1 power supply heat sink to the instrument side frame.
 - g. Remove the two screws at the rear edge of A1 motherboard.
 - h. Disconnect the three power transformer secondary wires (BLU, BLU, WHT-BLU) from the A1 Motherboard, by pulling the push-on connectors straight up and off the test pins. Remove the OSC OUT wire which connects J8 to A1 Motherboard in the same manner.
- NOTE**
- HP 5315B instruments with serial number 1832A00001 to 1832A00120 do not have "push on" connectors on the transformer secondary terminals or EXT REF wires. Carefully unsolder and resolder the wires on these instruments to complete installation.
- i. Carefully pull the entire instrument straight forward, through the front frame, and clear of the cabinet.
 - j. Remove the LEVEL/SENS and GATE TIME front panel control knobs.
 - k. Remove the front panel hex nuts on CHANNEL A and B INPUT BNC's and the three control hex nuts.
 - l. Remove the 1/4" hex nut on the left side (back) of the A2 Display Assembly, and pull the front panel (MP21) straight forward, until clear. Note the spacer between the front panel and the A2 assembly.
 - m. Remove the A3/A4 assembly by gently lifting on the rear edge of A4, until the pins come free of motherboard connector A1 J5.
 - n. Position the A9 C Channel assembly, component side up with the protruding connector pins toward rear of instrument, over A1 motherboard jack J6. Install by gently pressing the row of connector pins into J6 until the assembly tests on the spacers mounted on A1. Secure with four screws provided.

- o. Install the Special Input BNC (provided) in the INPUT C position (center) of the 5315B replacement front panel (provided) as illustrated in Section III, *Figure 3-12*.
- p. Connect the SMC connector on A9W1 to the INPUT C BNC, and loosely install the new front panel.
- q. Position the cabinet and A1 motherboard assembly side by side, with the cabinet facing to the rear. Route the three power transformer secondary wires through the cabinet side frame and reconnect to A1 motherboard test pins. Ensure the wire colors match the pins as labeled.
- r. Carefully replace AC power cord, and perform Option 003 adjustment as described in Section V.
- s. Disconnect the power transformer secondary wires. Reinstall the A3/A4 Input Amplifier assembly.
- t. Reinstall the instrument into the cabinet by reversing steps a through l. Be sure that the A1 motherboard fits into the board guides.

2-41. Installation of Oven Oscillator Option 004 (5315A)

- 2-42. Option 004 consists of an oven-contained oscillator assembly (A14), which plugs into the reference oscillator connector J2 on the motherboard. Option 004 replaces the standard oscillator assembly (A13) or the TCXO assembly. To install Option 004 in the 5315A, proceed as follows:
 - a. Remove the AC power cord.
 - b. Remove the instrument top cover by removing the four screws accessible from the cabinet bottom.
 - c. If battery pack Option 002 is installed, disconnect the 11-conductor cable assembly W4 at the motherboard connector.
 - d. Remove the four spacers (MP4) and the three screws used to secure the A1 motherboard. Two of the screws are located on either side of transformer T1 with the other in the center of the board.
 - e. Remove the two screws which secure the existing reference oscillator assembly. Remove the assembly.
 - f. Position the A14 oven oscillator assembly with the components facing the left side of the instrument. Insert A14P2 into the motherboard jack (A1J2) from which the previous assembly was removed.
 - g. Secure the assembly to the motherboard by installing the two screws through the L-brackets.
 - h. If battery Option 002 is also installed, add a short insulated jumper wire on the A1 motherboard at the location labeled "W1."
 - i. Perform the 5315A Option 004 adjustment as described in Section V.
 - j. Install and secure A1 motherboard with the three screws. Replace the top cover with the four screws.

2-43. Installation of Oven Oscillator Option 004 (5315B)

2-44. Option 004 consists of an Oven Module Assembly (A15) with mounting bracket and an interconnect board, which plugs into the reference oscillator connector J2 on the A1 mother-board. This assembly replaces the standard oscillator assembly (A13) or the Option 001 TCXO assembly (A7). To install Option 004 in the 5315B, proceed as follows:

- a. Disconnect the 5315B power cord.
- b. Remove the instrument top cover (MP12) by removing the carrying handle screw (MP11) at rear of instrument. Slide the cover toward the rear until free.
- c. Remove the bottom cover (MP8) by loosening the captive screw (at the rear edge of the cover). Slide cover toward the rear until free.
- d. Remove the two screws which secure the existing reference oscillator assembly. Remove the assembly.
- e. Position the oven module and bracket assembly with the flat surface of the bracket facing the left side strut and the foot of the bracket over the hole near the center of the mother-board. Guide the bracket into place against the side strut. The lower edge of the bracket should be inserted in the space between the edge of the motherboard and the side strut, (between the rear deck and board guide).
- f. Secure the bracket to the side strut using three 6-32 $\times$ 3/8 inch screws; secure to mother-board using a similar screw.
- g. Insert the interconnect board (A15A1) into connector A1J2 of the motherboard assembly. The components should face the left side of instrument.
- h. Secure the interconnect board by installing the two 6-32 $\times$ 1/4 inch screws through the L-brackets.
- i. Perform Option 004 adjustment as described in Section V.
- j. Replace the bottom and top covers.

SECTION III OPERATION

3-1. INTRODUCTION

3-2. This section provides operating information for the 5315A/B Universal Counter. Descriptions of all front panel controls, connectors, and indicators as well as an operator's check, operating instructions, and operator's maintenance are provided.

3-3. OPERATING CHARACTERISTICS

3-4. The 5315A/B is a 100 MHz and 100 ns full universal counter, capable of Frequency, Period, Time Interval, Ratio, and Totalize type measurements. To maximize resolution, the 5315A/B uses a reciprocal counting technique for frequencies below 10 MHz, automatically switching to conventional frequency counting for frequencies above 10 MHz. The gate time is continuously adjustable from 50 ms to 10 s, on the front panel. The internal microcomputer performs the calculations, and automatically compensates for the arbitrary gate time. The display is given in scientific notation (i.e., exponents of blank, ± 3 , ± 6 , or ± 9). The input amplifiers are optimized for both time interval and frequency measurements.

3-5. When the optional third input channel is installed, the ("C") frequency range of the counter is extended to 1 GHz. The input sensitivity can be decreased, continuously, up to 20 dB nominally (in the range of 50 to 500 MHz) and 10 dB nominally (in the range of 500 to 1000 MHz).

3-6. MODES OF OPERATION

3-7. The 5315A/B provides ten modes of operation and two check functions. The resolution and accuracy for each mode except A Armed by B is provided in Table 1-1. The modes of operation are described in the following paragraphs:

FREQ A (Frequency A)
PER A (Period A)
T.I. A-B | Time Interval A (start)-to-B (stop)|
T.I. AVG. A-B (Time Interval Average A-to-B)
T.I. DELAY (Holdoff)
RATIO A/B (Ratio A-to-B)
A BY B (Gated Totalize)
A-Armed-By-B Mode
FREQ C (Option 003)
TOT (Manual Totalize)
CHECK
Display Check

3-8. FREQ A (Frequency A Mode)

3-9. Frequency measurements are made by connecting a signal (up to 100 MHz) to INPUT A, and pressing the FREQ A key (with the Blue Shift key out). Select the appropriate input signal conditioning and adjust the LEVEL/SENS control (with TRIGGER LEVEL/SENSITIVITY key to TRIGGER LEVEL) to optimum trigger point. The optimum trigger point may be determined by centering the LEVEL/SENS control within the triggering range, indicated by the flashing trigger light. The GATE TIME control determines the resolution of the measurement, and may be displayed by pressing the GATE TIME function key and Blue Shift key. The gate time range when FREQ A is pressed is 60 ms to 10 s, typical. However a gate time range of 500 μ s to 30 ms is available by pressing T.I. DELAY and TOT STOP/START simultaneously. When the Blue Shift key is OUT, the 5315A/B will be in FREQ A. When the Blue Shift key is IN, the 5315A/B will be in PER A. PER A is discussed in the following paragraph.

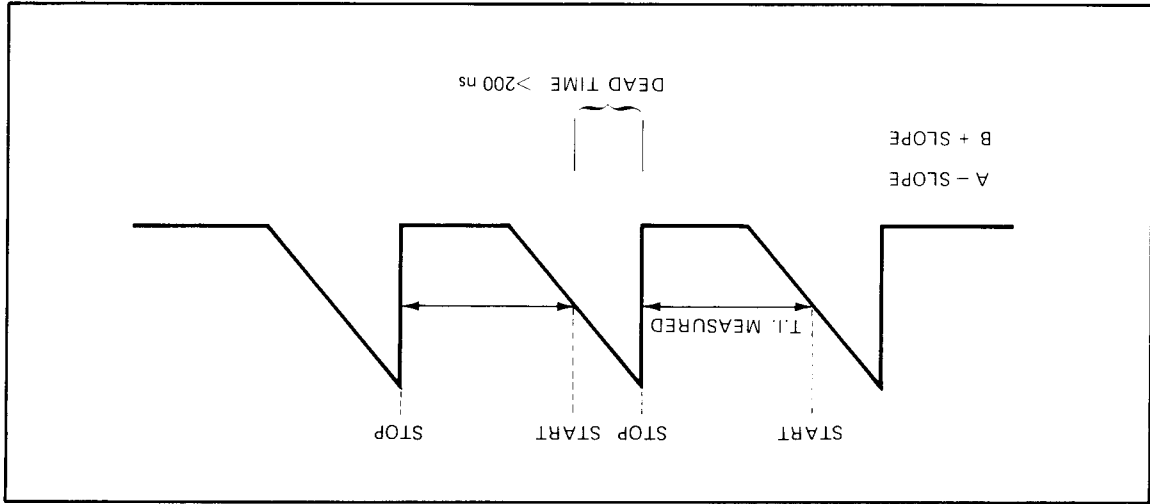


Figure 3-1. T.L. Average Dead Time

3-16. In the T.L. AVG mode, there must be at least 200 ns dead time. Dead time occurs between the preceding time interval stop event and the current time interval start event, as shown in Figure 3-1. This means that in T.L. AVG mode, the repetition rate must be less than 5 MHz.

3-15. The T.L. Average mode provides greater resolution of time interval measurements than single-shot T.L. mode. In the T.L. AVG mode, the gate time control varies the number of events of time intervals averaged (approximately $\text{GATE TIME} \times \text{REP RATE}$). The resolution of the measurement is improved by the $\sqrt{N}$, where N is the number of time intervals averaged. A limited range of negative T.L. measurements (i.e., B triggers before A) are possible in T.L. AVG mode.

3-14. T.L. AVG A-B (Time Interval Average A-to-B) Mode

3-13. T.L. A-B measures the time interval between a START signal at INPUT A and a STOP signal at INPUT B. If both the START and STOP signals are derived from the same signal, connect the signal to INPUT A and set the SFP/COM A key to the COM A position (IN). Separate slope and Level/Sensitivity controls for each channel allow variable triggering on either positive or negative going slope. A single-shot time interval measurement may be made over a range of 100 nanoseconds up to 8 digits and 100,000 seconds after 9 digits.

3-12. T.L. A-B (Time Interval A (start)-to-B (stop)) Mode

3-11. The Period A mode allows single period measurements to be made with periods of 100,000 seconds (28 minutes) to 10.0 nanoseconds into INPUT A. Select the appropriate input signal conditioning and Trigger Level/Sensitivity.

3-10. PER A (Period A Mode)

3-17. T.I. DELAY (Holdoff) Mode

3-18. The T.I. DELAY mode of operation is similar to T.I. A→B, but with the following additional control: The front panel GATE TIME control inserts a variable delay (from 500 μ s nominal to >20 ms between the START (INPUT A) event and the enabling of the STOP (INPUT B) event. Potential STOP events are ignored during the specified delay or holdoff. The amount of delay time may be continuously measured and displayed by simultaneously pressing the T.I. A→B, T.I. DELAY, and Blue shift keys. Figure 3-2 illustrates the T.I. DELAY function.

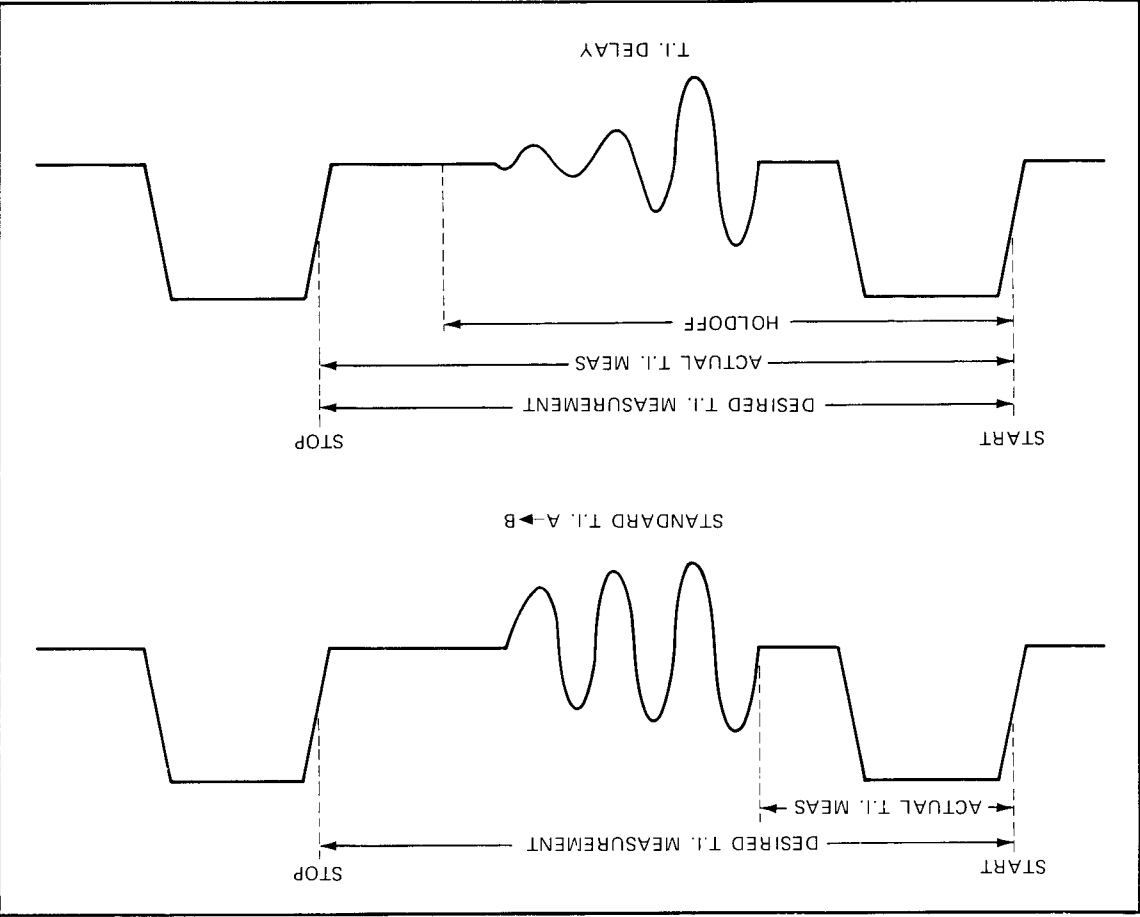


Figure 3-2. Timing of Time Interval Delay Mode

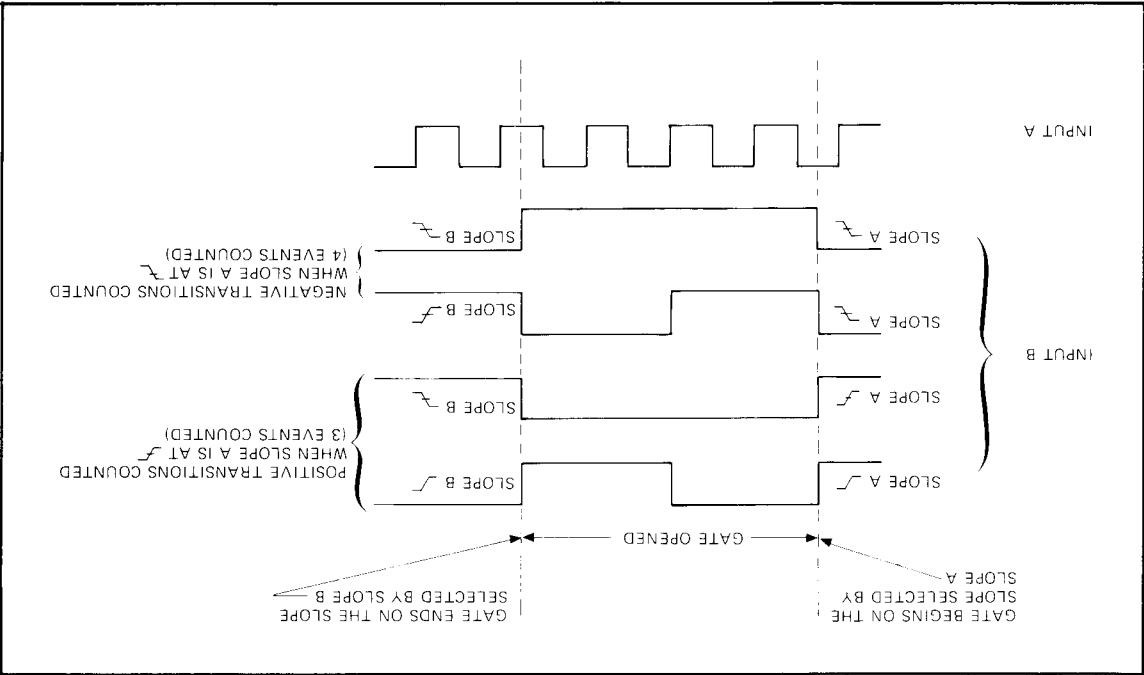
3-19. RATIO A/B

3-20. The RATIO A/B mode of operation measures and displays the frequency ratio of signals on INPUT A to signals on INPUT B. The GATE TIME control determines the resolution by selecting the number of cycles of the INPUT B signal over which the ratio A/B is measured. Increasing the gate time (towards MAX) or increasing the frequency of INPUT B results in an increased resolution of the measurement. Frequencies up to 100 MHz on both channels are allowed.

3-24. The 5315 has a measurement function, frequency-A-Armed-By-B, Averaged, for frequency averaging. Called "A ARMED BY B", this function allows the 5315 to average together multiple frequency measurements. To do this, a sampling signal synchronized with and of pulse width less than the signal bursts must be applied to the Channel B input. This signal performs two functions: one, it tells the 5315 when to count the incoming bursts and when to ignore the dead time between bursts; and two, it opens the 5315 gate. The measurement interval is set from the front panels and its length determines the number of bursts to be averaged. *Figure 3-4* shows an example of function A-Armed-By-B. In this example, 1 MHz bursts, 10 μ s wide, at a 10 kHz repetition rate are applied to Channel A input. A sampling signal of equal repetition rate and shorter pulse width is applied to Channel B. This sampling signal must be synchronized with the Channel A frequency burst signal. When the first burst occurs, the sampling signal at Channel B opens the gate, and tells the 5315 to begin counting the events at Channel A. If the gate is still open and another burst occurs, the 5315 will add these "new" events to the previous events counted. This will continue until the measurement interval runs out. On the next sampling pulse, after the gate closes, the 5315 will compute the average frequency of the signal during the burst (in this example 1 MHz). A final sampling pulse **must** occur after the measurement interval ends to terminate the measurement. The events that occurred during this final pulse are not averaged in the displayed amount.

3-23. A-ARMED-BY-B Mode

Figure 3-3. Timing of Totalize A by B Mode



3-22. A BY B (A gated by B) is a totalize mode of operation (see *Figure 3-3*), in which events on INPUT A (up to 100 MHz) are counted for a duration determined by INPUT B. The gate is "OPENED" on the slope of Input B selected by the Channel A Slope switch, and "CLOSED" on the slope of Input B selected by the Channel B Slope switch. This allows any one of four discrete gate durations from a given signal on Input B. The Channel A slope switch also determines which slope of the events signal is counted on INPUT A. A BY B is a single-shot mode of operation. The RESET button must be pressed to clear the display and allow the initiation of a new measurement.

3-21. A BY B (Gated Totalize)

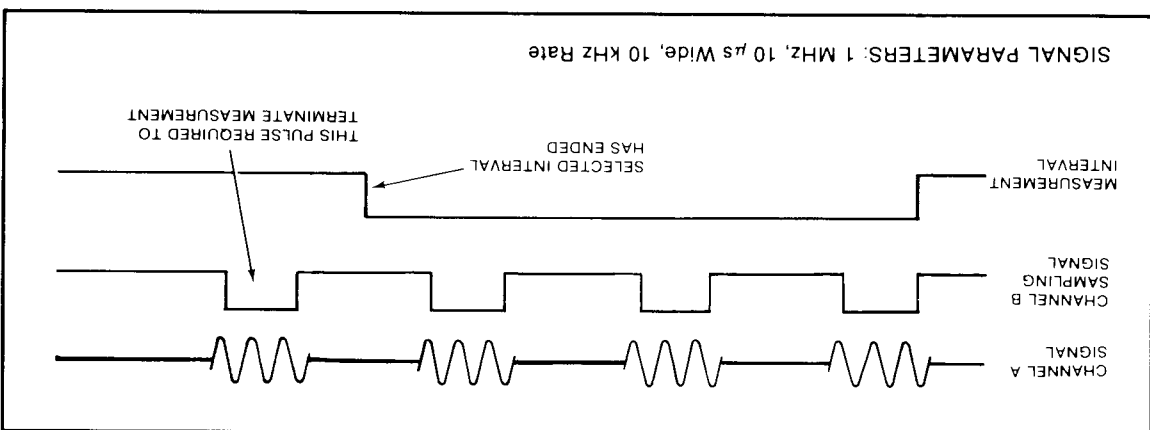


Figure 3-4. A ARMED BY B

3-25. The length of the measurement interval and signal repetition rate determine how many given number of averages. The main limit is that no more than 100 million "events" can be counted (either input signal cycles or time base counts). In the case of Figure 3-4, each burst contains 10 "events", with 10 thousand occurring in 1 second for 100 thousand "events" per second. Since 100 million events is the limit, the 5315 could average for 1000 seconds before the events counter would overflow. And, since the measurement interval determines the number of averages, a 1000-second measurement interval would be necessary before the events count or time base count would overflow. This, of course, is longer than that obtainable from the 5315 (maximum measurement interval of about 10 seconds). A specific case where the 5315 would overflow would be a 50 MHz signal pulsed for 200 ns at a 2 MHz rate. In this case 10 "events" occur during each burst, with 2 million bursts per second, or 20 million "events" in 1-second. So, the 5315 would overflow in 5 seconds, thus the gate time must be less than 5 seconds, and 10 million bursts would be averaged. If the 100 million events limit is exceeded the displayed answer will be inaccurate.

3-26. A ARMED BY B has two modes (two different measurement interval ranges) and is not labeled on the front panel. For a measurement interval range of 500 μ s-30 ms, press T.L. DELAY and RATIO A/B together. The measurement interval may be displayed by selecting the GATE TIME mode for the LONG interval or by pressing T.L. A-B, T.L. DELAY, and Blue Shift key simultaneously for the SHORT interval. For a measurement interval range of 60 ms to 10 seconds, press FREQ A and TOT STOP together. The Channel A Trigger Slope is set by the front panel Channel A Slope switch. The sampling signal enable slope (begin counting) is determined by the Blue Shift key. In the OUT position the counting will be enabled on the sampling signal positive slope. In the IN position, the counting will be enabled on the sampling signal negative slope. The gate will also be opened on the same slope as determined by the Blue Shift key. The disable slope is determined by the Channel B front panel slope switch. The measurement interval is controlled, as normal, by the front panel GATE TIME control. The gate will close once the selected time has passed. There is no problem if the gate should close in the middle of counting a burst. The following limits do exist in this mode:

1. 200 ns minimum dead time between bursts.
2. 100 ns minimum burst width.
3. The enable slope can only be negative when using the short measurement interval (500 μ s-30 ms).

Resolution increases with the square root of the number of samples averaged, N.

$$\text{Resolution} \sim \frac{(10^{-7}) \times (\text{INPUT FREQ})}{(\text{Sampling Signal Width}) \times (\sqrt{N})} \text{ Hz}$$

$$N \sim \frac{\text{Measurement Interval}}{\text{Gate signal repetition rate}}$$

3-32. The Check mode applies 10 MHz from the internal (or external for 5315B) reference oscillator to the MRC. It is used to verify the basic operation of the counter, GATE light and GATE TIME control.

3-31. CHECK (Mode)

3-30. Totalize STOP/START is a manually gated, totalize mode of operation. Pressing the blue shift key (IN position) opens the main gate, allowing INPUT A events to be counted. Pressing the shift key again (OUT position) closes the gate, stopping the count. The count is continuously displayed, and cumulative from gate cycle to gate cycle. The RESET button clears the counter and resets the display to zero.

3-29. TOT STOP/START (Totalize Start-Stop Mode)

The Trigger Lights for INPUT A and INPUT B are inoperative and extinguished when functions FREQ C or GATE TIME are selected. This is normal. However, pressing either Channel A or B Slope switches will reset the counter.

NOTE

Set the GATE TIME control to MIN (but not hold). Set the SENS C control to MIN. Slowly move the SENS C control in a clockwise direction (toward MAX) until the counter begins to gate. This represents the optimum trigger sensitivity. To increase the displayed resolution, move the GATE TIME control toward MAX. Pressing either slope switch will reset the counter.

If the amplitude of the signal exceeds the 1V rms dynamic range, the measurement may be incorrect.

NOTE

3-28. To make a frequency measurement on a CW signal in the range of 50 MHz to 1 GHz, select FREQ C function and connect the signal to INPUT C.

3-27. FREQ C (Frequency C Mode, Option 003)

With a 10 μ s sample pulse width, accuracy can be as good as 100 Hz if enough events are averaged.

$$\text{Ultimate accuracy} = \frac{10^{-9}}{\text{measurement interval}} \times (\text{input FREQ})$$

Accuracy: The actual measurement interval is shorter than the correct value by about 1 nanosecond. With short sample pulse widths and large N values the displayed answer will not be perfectly accurate:

$$\text{resolution} = \frac{100 \times 10^{-9}}{10 \times 10^{-6}} \times \frac{\sqrt{10000}}{10^6} = 100 \text{ Hz (100 times better)}$$

but with average N = 10000 (1 second measurement interval):

$$\text{resolution} = \frac{100 \times 10^{-9}}{1 \times 10^6} \times \frac{\sqrt{1}}{10^6} = 10^4 \text{ or } 10 \text{ kHz resolution}$$

From Figure 3-4, the sampling signal is 10 μ s wide at a 10 kHz repetition rate with a measurement interval of 1-second. With a single-shot measurement:

3-33. Display Check (Mode)

3-34. The Display Check mode is unlabeled; it cycles the display through a routine that exercises all digits and most annunciators. With the POWER switch to ON, and all function switches to the "OUT" position, a rolling display, corresponding to Table 3-1, will result.

Table 3-1. Display Check

All Displays										OVFL	ERROR	—	Hz	S	GATE	dp1	dp2	dp3
00000000 0										•						•		
1111111-1										•		•					•	
2222222 2										•				•				
3333333-3										•				•				
4444444 4										•				•				
5555555-5										•	•			•				
6666666 6										•				•				
7777777-7										•				•				
8888888 8										•						•		
9999999-9										•							•	
BLANK										•								

3-35. FRONT AND REAR PANEL FEATURES AND CONTROLS

3-36. The following paragraphs describe the features and controls of the function selection, signal conditioning, and display sections of the front panel. Front and rear panel controls are individually located and described in Figures 3-7 and 3-8).

NOTE

Except RESET all front panel key switches "latch" in and stay when pushed. A second push releases latched keys. The six keys between RESET and the blue "shift" key are interconnected so that pushing one will release another latched key.

3-37. FUNCTION SELECTION CONTROLS

3-38. The function (mode) selection section of the front panel contains the POWER (Stby/On), Reset keys, Function Mode keys group (within the border outline), and Gate Time/Delay control.

3-39. The POWER key sets the 5315A/B either to ON or STBY (Standby). In the ON position (in power is supplied to entire instrument. In the STBY position (OUT) unregulated DC is supplied only to battery-pack charging circuits (Option 002). The RESET key clears and updates the display for continuous measurement modes, and resets the counter in totalize modes.

3-40. Each of the keys within the outlined function group can select one of two functions: With the blue shift key in the "OUT" position, the other six keys select the function labeled above (i.e., FREQ A, T.I. A—B, etc.). With the shift key in the "IN" position, the keys select the function labeled in blue below (i.e., PER A, T.I. AVG A—B, etc.).

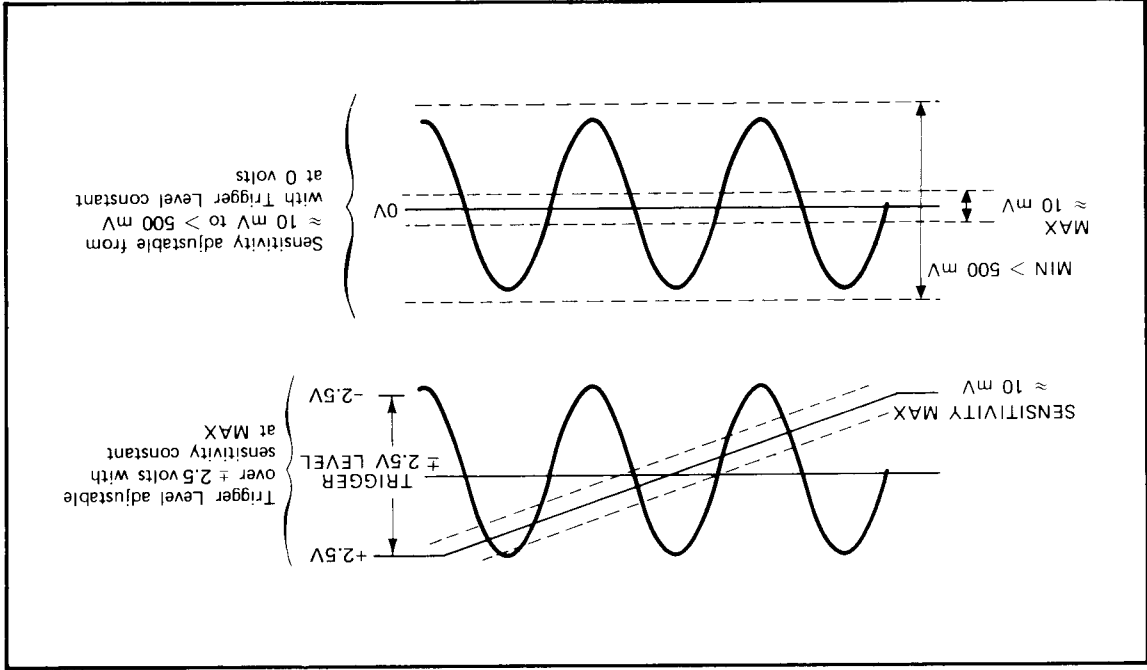


Figure 3-5. Trigger Level/Sensitivity Controls

3-46. The Trigger Level/Sensitivity controls provided for each channel operate as follows: With the TRIGGER LEVEL/SENSITIVITY key "out", the LEVEL/SENS control adjusts the trigger level (over a range of ± 2.5 volts DC in ATTN X1, or ± 50 volt DC in ATTN X20). With the TRIGGER LEVEL/SENSITIVITY key "in", the LEVEL/SENS control adjusts the input sensitivity from MAX (10 mV) up to 10 MHz, 25 mV up to 100 MHz) with control fully clockwise to MIN (greater than 500 mV) with control fully counterclockwise (see Figure 3-5).

3-45. TRIGGER LEVEL/SENSITIVITY CONTROLS

3-44. A low pass filter for Channel A input is provided. With the FILTER NORM key "in" frequencies above 100 kHz are effectively attenuated. With the FILTER NORM key "out" there is no filtering.

3-43. A full complement of signal conditioning controls are provided for each channel (A and B) input (see Figure 3-6). These controls allow the selection of Attenuation (X1, X20), Slope (positive or negative) and input coupling (AC or DC). The SEP/COM A switch allows the selection of separate Channel A and B inputs in the SEP position. The COM A position disconnects the Channel B input BNC, and connects both Channel A and Channel B input amplifiers to the Channel A input.

3-42. SIGNAL CONDITIONING CONTROLS

3-41. The GATE TIME/DELAY control determines the amount of gate time per measurement, and it is continuously adjustable over a range of 50 ms to 10 seconds. The selected gate time may be displayed by pressing the GATE TIME function key, and the blue shift key. In the T.L. DELAY mode of operation the control determines the amount of time the Start Channel is held off or "delayed" (see paragraph 3-17). The amount of "delay" may be displayed by pressing the T.L. DELAY key, and the blue shift key simultaneously. In the T.L. A-B mode of operation, the GATE TIME/DELAY control determines the sample rate.

Figure 3-6. 5315A/B Front End Block Diagram

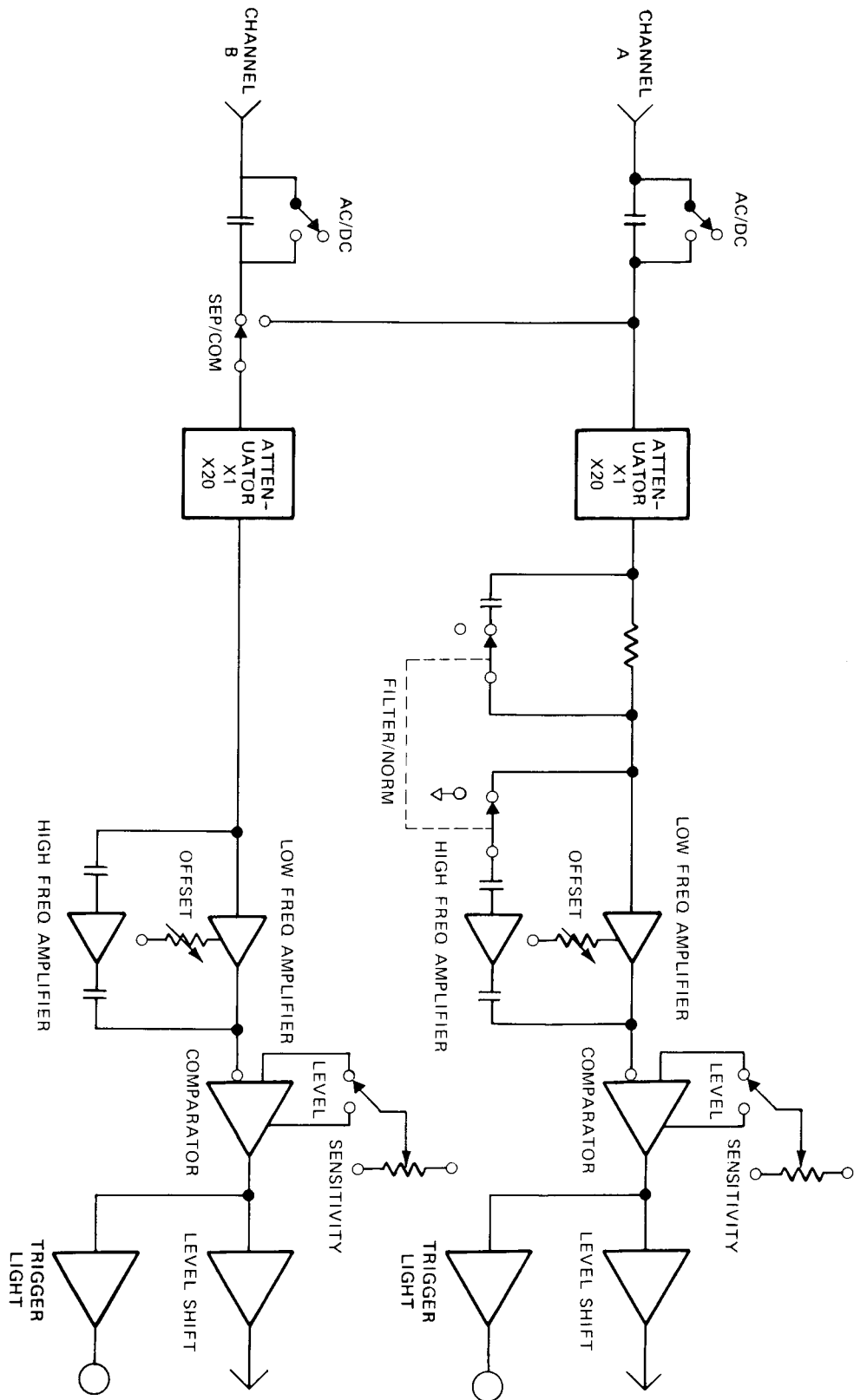
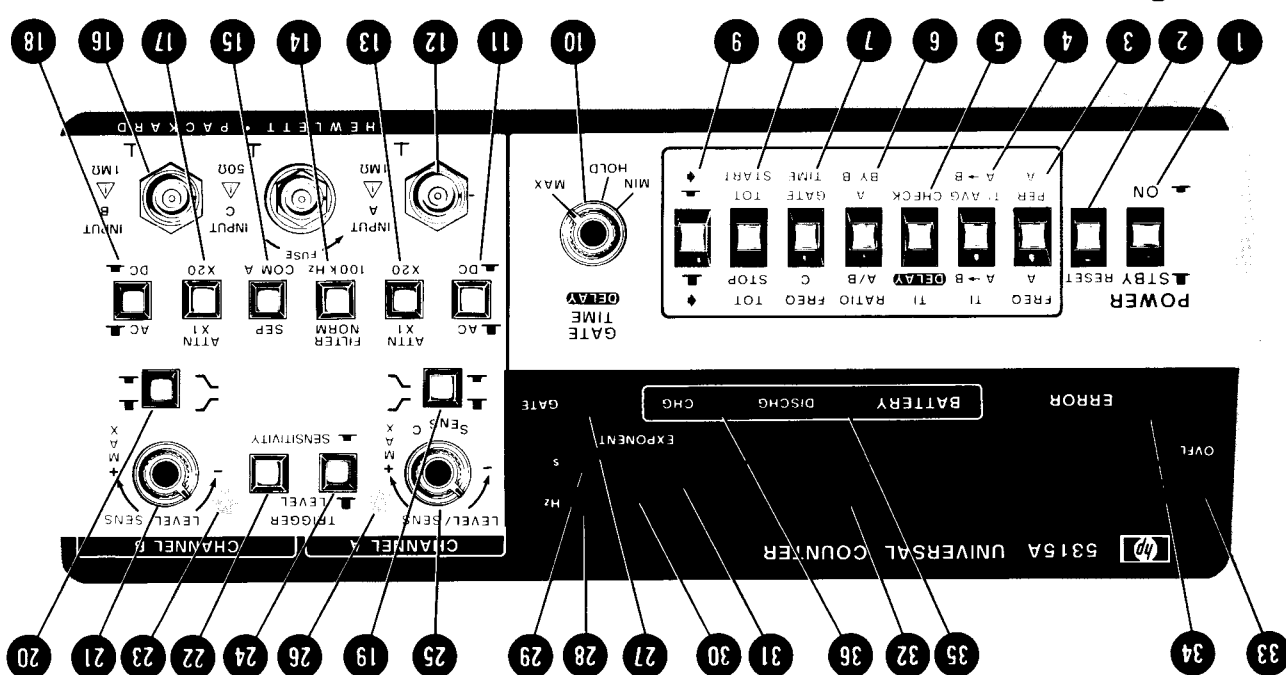


Figure 3-7. Front Panel Features



NOTE

This switch, when depressed (IN), maintains oven in standby mode. The switch only operates this way with the battery (Option 002) and oven reference oscillator (Option 004) installed.

T.I. A-B. Selects Time Interval mode of operation (with SHIFT key out) measuring time differences from Start signal on INPUT A to Stop signal on INPUT B (when in SEP).

T.I. DELAY. Selects Time Interval mode of operation (with SHIFT key out), measuring time differences from Start signal on INPUT A to Stop signal on INPUT B (when in SEP).

RATIO A/B. Selects Ratio mode of operation (with SHIFT key out), measuring the ratio of the signal frequency at INPUT A to the signal frequency at INPUT B.

FREQ C. Enables the Frequency C INPUT (Option 003) module (with the SHIFT key out).

GATE TIME. Continuously measures and displays the gate time determined by the GATE TIME control (with SHIFT key in).

STBY/ON. Supplies power to entire counter in the ON position. Supplies power to the Battery-Pack (Option 002) in the STBY (Standby) position, and to Option 004 for crystal oven power.

RESET. Clears and updates display in continuous measurement modes, resets counter to zero in totalize modes.

FREQ A. Selects Frequency modes of operation (with SHIFT key out), for signals on Input A.

PER A. Selects Period mode of operation (with SHIFT key in), for signal on Input A.

operation of MRC, display and GATE TIME control, microcomputer, etc.

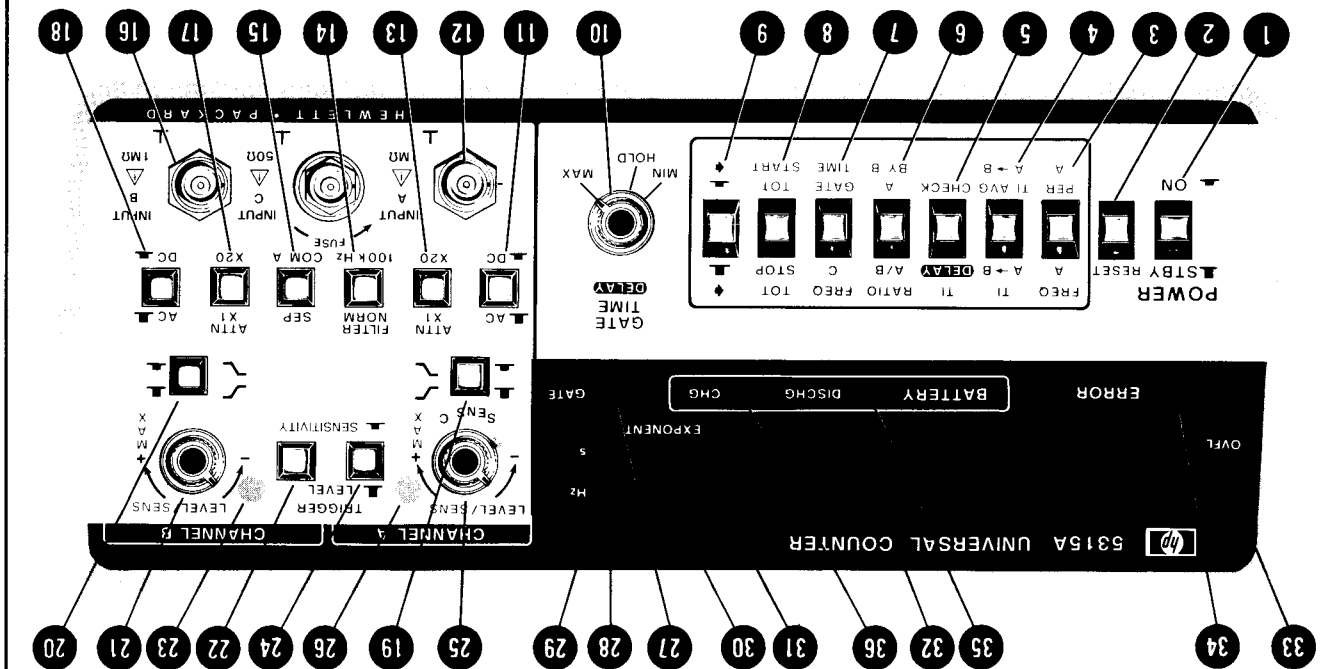
CHECK. Applies 10 MHz from reference oscillator to MRC (with SHIFT key in), to verify operation of MRC, display and GATE TIME control, microcomputer, etc.

RATIO A/B. Selects Ratio mode of operation (with SHIFT key out), measuring the ratio of the signal frequency at INPUT A to the signal frequency at INPUT B.

A BY B. Selects a "gated" totalize mode of operation (with SHIFT key in), in which the signal frequency of INPUT A is totalized for a gate duration determined by the signal on INPUT B.

FREQ C. Enables the Frequency C INPUT (Option 003) module (with the SHIFT key out).

GATE TIME. Continuously measures and displays the gate time determined by the GATE TIME control (with SHIFT key in).



NOTE

The trigger lights are disabled and extinguished when either FREQ C or GATE TIME is selected.

TOT, STOP/START. Selects Totalize mode of operation, manually controlled by the SHIFT key. With the SHIFT key in, totalizing of signal frequency on INPUT A starts. With the SHIFT key out, totalized accumulation stops and holds. RESET must be pressed to zero the display.

SHIFT. Used in conjunction with six dual purpose function keys (3, 4, 5, 6, 7, 8) to select the function labeled above or below the key. With the SHIFT key out, functions labeled below the keys are enabled. With the SHIFT key in, functions labeled above the keys are enabled.

GATE TIME/DELAY. For FREQUENCY, PERIOD, RATIO AND T.L. AVERAGE modes, provides continuously variable measurement time from, nominally, 50 ms to 10 s (minimum = 1 period of the input signal). For T.L. mode, varies the time between measurements. For T.L. DELAY mode, provides continuously variable delay time between START and STOP enable.

HOLD. Single measurement with minimum gate time. Requires pushing RESET key to initiate new measurement.

AC/DC. Selects AC or DC coupling for corresponding input signal except in the COM A mode. In the COM A mode, Channel A determines coupling.

INPUT A, B. Input BNC's for channels A and B.

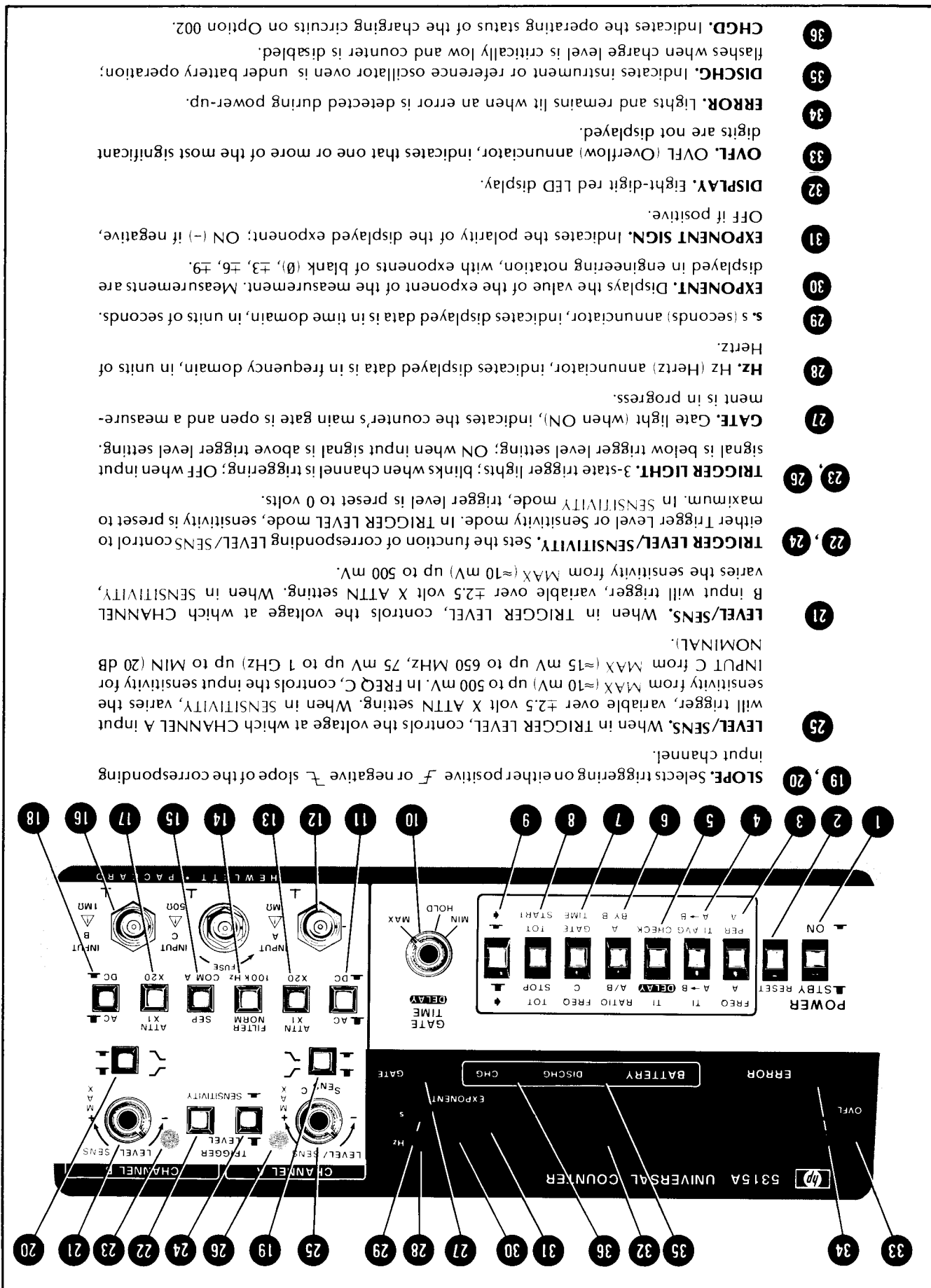
ATTN, X1/X20. Selects attenuation of signal on corresponding input channels. X1 position connects input signal directly to input amplifiers; X20 position attenuates input signal by a factor of 20 (nominal).

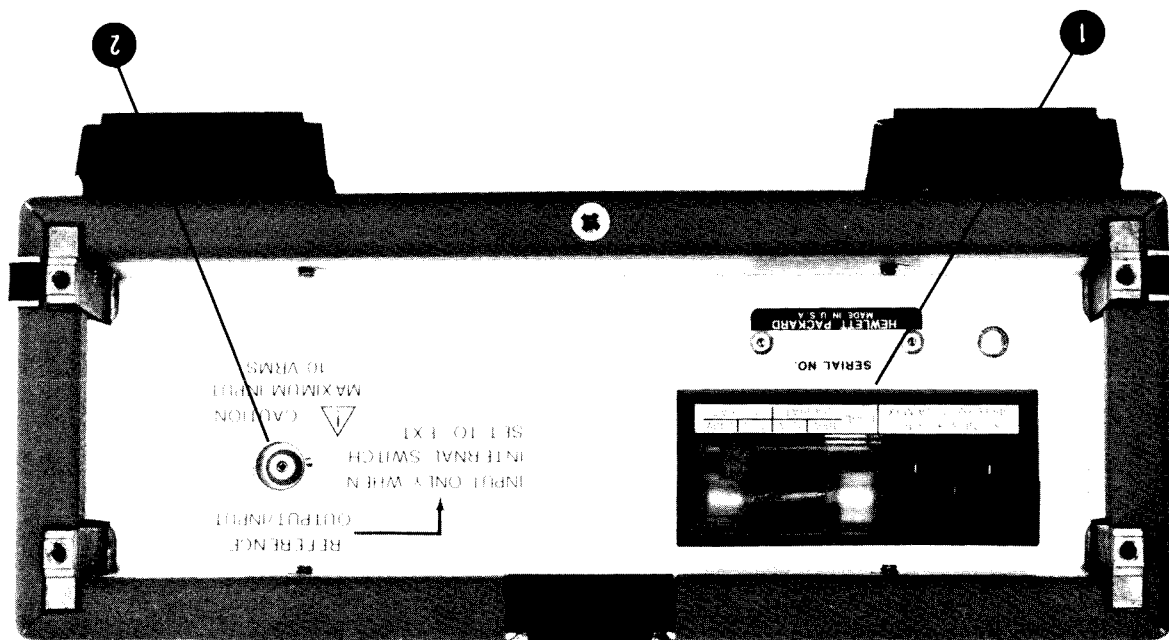
FILTER, NORM/100 KHZ. Inserts a low pass filter configuration into the INPUT A channel, attenuating frequencies above 100 KHz.

SEP/COM A. Input amplifier control, selects independent operation of inputs A and B in SEP (separate) position. In COM A (Common A) position, the signal at input A is also applied to input B, with the B input BNC disconnected from input circuitry. Input B coupling is the same as input A.

Figure 3-7. Front Panel Features (Continued)

Figure 3-7. Front Panel Features (Continued)





1 AC power input module permits operation from 100, 120, 220, or 240 volts AC. The number visible in the window indicates nominal line voltage to which instrument must be connected (see Figure 2-2). Protective grounding conductor connects to the instrument through this module.

WARNING

ANY INTERRUPTION OF THE PROTECTIVE (GROUNDING) CONDUCTOR INSIDE OR OUTSIDE THE INSTRUMENT OR DISCONNECTING OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO MAKE THE INSTRUMENT DANGEROUS. (See Section II.)

2 REFERENCE OUTPUT/INPUT jack (J8). Allows 5315B (only) to be operated with an external frequency standard of 10 MHz with drive of 1 volt rms across 500Ω, when INT/EXT switch A1S3 (located on A1 Motherboard) is in the EXT position. With A1S3 in INT, the internal 10 MHz standard operates the counter, and is output for external use through J8.

Figure 3-8. 5315B Rear Panel Features

3-47. DISPLAY

3-48. The 5315A/B counter display has nine, seven-bar LED's, providing eight digits of resolution and a one-digit exponent. All measurements are displayed in scientific notation (i.e., exponents of blank, ± 3 , ± 6 , or ± 9) with automatic decimal point location. Annunciators for indicating the measurement units Hz, for Hertz, and s, for seconds are provided. The OVL annunciator indicates that the left-most significant digits have overflowed the display. The GATE annunciator indicates the counter has been triggered and a measurement is in progress. The ERROR annunciator indicates a failure during power-up self-check. Battery annunciators DISCHG and CHG (on Models 5315A only) are active only when Option 002 is installed.

3-49. OPERATING INSTRUCTIONS

WARNING

BEFORE THE INSTRUMENT IS SWITCHED ON, ALL PROTECTIVE EARTH TERMINALS, EXTENSION CORDS, AUTOTRANSFORMERS, AND DEVICES CONNECTED TO IT SHOULD BE CONNECTED TO A PROTECTIVE EARTH GROUNDED SOCKET. ANY INTERRUPTION OF THE PROTECTIVE EARTH GROUNDING WILL CAUSE A POTENTIAL SHOCK HAZARD THAT COULD RESULT IN PERSONAL INJURY.

WARNING

ONLY FUSES WITH THE REQUIRED RATED CURRENT AND SPECIFIED TYPE SHOULD BE USED. DO NOT USE REPAIRED FUSES OR SHORT CIRCUITED FUSE-HOLDERS. TO DO SO COULD CAUSE A SHOCK OR FIRE HAZARD.

CAUTION

Before the instrument is turned on, it must be set to the voltage of the power source, or damage to the instrument could result.

3-50. OPERATOR'S CHECKS

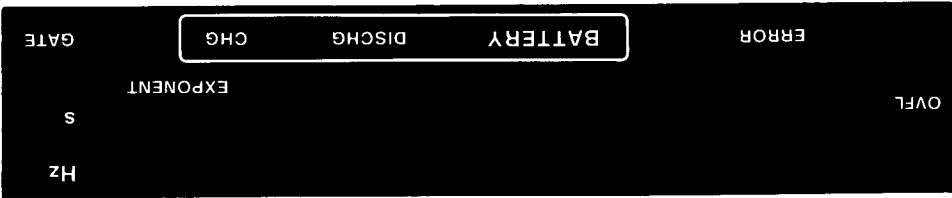
3-51. A procedure for verifying the basic operation of the 5315A/B is provided in *Figure 3-9*. This check utilizes the instrument self-calibration cycle and visual verification of front panel controls by front panel indicators. No additional equipment is required.

NOTE

This check is not intended to verify the accuracy or performance specifications of the instrument.

3-52. POWER-UP SELF CHECK

3-53. When the 5315A/B is turned on, a power-up reset and self-check cycle is automatically initiated. This is approximately a 2-second cycle, indicated by the following display:



3-54. During this cycle, the microcomputer performs a check sum of the internal program in ROM and a bit pattern written into RAM. Additionally, a partial check of the MRC and I/O ports is performed. Any failure during the cycle will produce a numbered error message, momentarily displayed, and will latch the ERROR annunciator ON. Refer to Error Messages, paragraph 3-55.

NOTE

During the power-up self-check routine the ERROR state is undefined. Therefore, the ERROR annunciator may or may not be lit.

3-55. ERROR MESSAGES

3-56. Failures during the power-up self-check routine will result in a (momentary) display of a numbered error message. In addition, the ERROR annunciator will light and remain lit until the error is cleared and the instrument restarted. There are three numbered Error Messages:

ERROR MESSAGE

- E1 Possible Failure in Microcomputer
- E2 Possible Failure in I/O Ports
- E3 Possible Failure in MRC or No Oscillator Signal

3-57. If the ERROR annunciator is lit, verify the error number (1, 2, or 3) by repeating the power-up self-check, and refer to Section VIII, Troubleshooting. Power-up self-check is initiated when the POWER switch is changed from STBY to ON.

Figure 3-9. Operator's Check

The Display Check routine is an unlabeled function, used to verify the operation, digits and most annunciators within the Display assembly.

NOTE

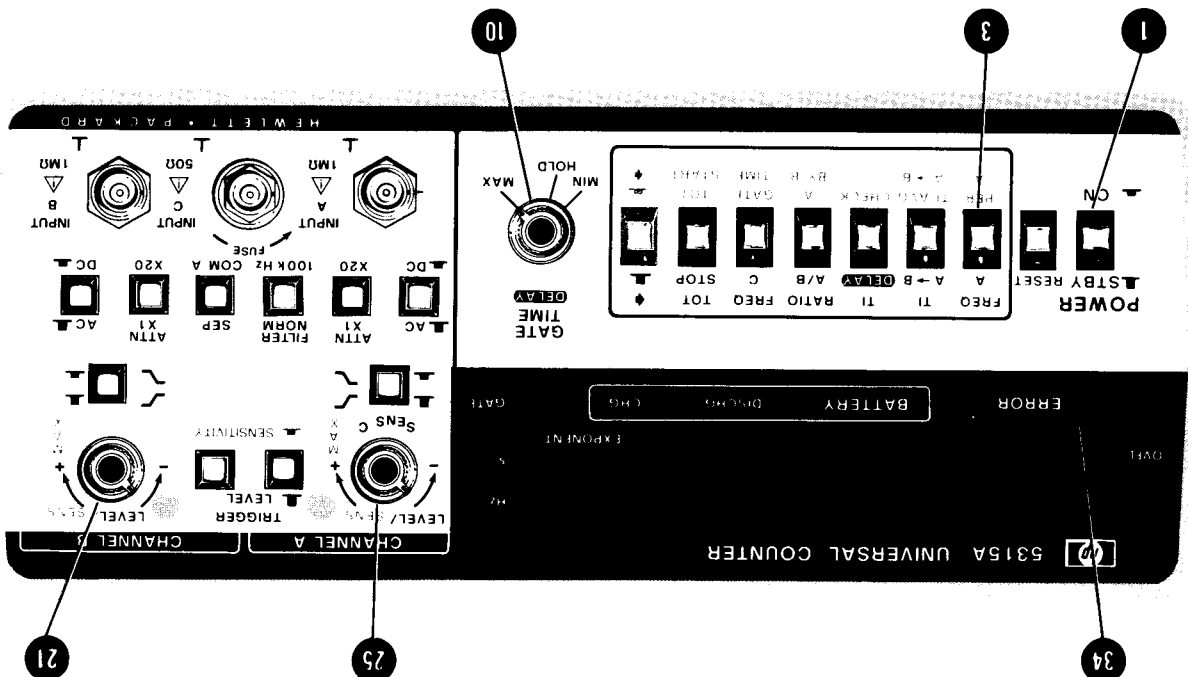
4. Verify Display Check routine by placing all function select switches in the OUT position. This may be accomplished by pressing any gray multi-function switch partially in, thereby releasing the function switch that is locked in. Observe the cycling of the display from all zeros to all one's, two's, three's, . . . etc., to all blank. Refer to paragraph 3-33.
- When the instrument is first turned on, the microcomputer performs a self-check. If, during power-up self-check, an error is detected, a numbered error message will flash momentarily and the Error annunciator 34 will light and remain lit. Verify the error number by repeating power-up self-check and refer to paragraph 3-59 Error Messages.

NOTE

1. Press FREQ A/PER A switch 3, and adjust LEVEL/SENS controls 21 25 fully ccw. Set all other switches to the OUT position.
2. Adjust GATE TIME control 10 to minimum.
3. Set POWER switch 1 to the ON position and observe the power-up self-check. Verify all segments of the display; decimal point after MSD; and the OVFL, Hz, S, and GATE annunciators light momentarily, followed by a display of 000. The ERROR annunciator may or may not light. Verify both trigger lights are lit.

Before switching on the instrument, ensure that the power transformer primary is matched to the available line voltage, the correct fuse is installed and the safety precautions are taken. Refer to Power Requirement, Line Voltage Selection, Power Cables, and associated warnings and cautions in Section II of this manual.

CAUTION



3-58. MEASUREMENT PROCEDURES

3-59. Figures 3-13 through 3-27 show general operating procedures with the HP Model 5315A/B Universal Counter in typical measurement setups. Description numbers match the locator illustrations. The following paragraphs provide recommended operating guidelines to assist in making the most accurate measurement possible.

3-60. Frequency, Period, and Ratio Measurements

1. For cw sine wave or symmetrical waveforms (triangle, square, etc.) use AC coupling and the sensitivity mode.

2. For asymmetrical waveforms (pulse trains, TTL, ECL signals, ramps, etc.) use a combination of DC coupling, Trigger Level, and fixed attenuator. AC coupling these types of signals tends to distort them slightly, due to the charging of the capacitor. More important, the position of the signal on the zero preset trigger level is determined by the average DC level of the input. Depending on the pulse width and duty cycle, this DC average may be low enough to allow the base line noise to trigger the counter, producing extra counts (see Figure 3-10.) DC coupling fixes the DC level of the input signal, which allows the adjustable Trigger Level to be positioned at the optimum point. Set the Trigger Level control to the approximate center of the triggering range indicated by the trigger light (see Figure 3-11).

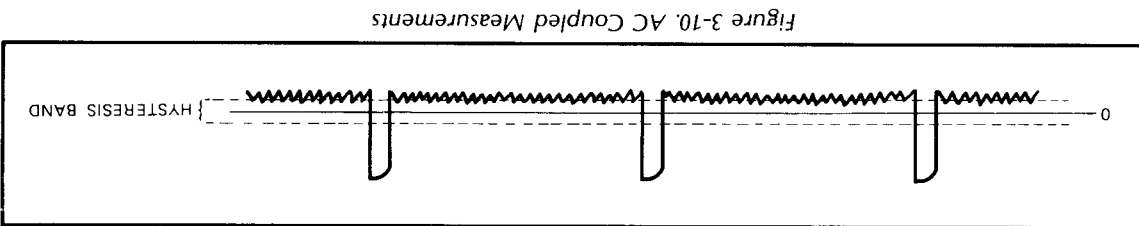


Figure 3-10. AC Coupled Measurements

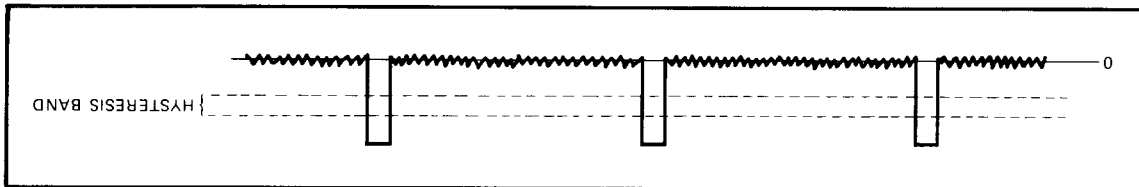


Figure 3-11. DC Coupled Measurements

3. When input loading is a problem (i.e., 1 MΩ load or cable capacitance) or when a more convenient method of probing is desirable, use a 10:1 Scope Probe. A probe is recommended for all logic applications.

4. For sine wave measurements 100 kHz and below, always use the low pass filter, selectable on the front panel. Normally the input signal is integrated over the entire 100 MHz bandwidth. Use of the filter effectively removes noise and harmonics (above 100 kHz) that may affect the correct measurement.

WARNING

WHEN MEASURING POWER LINE FREQUENCIES, BE EXTREMELY CAREFUL AND ALWAYS USE A STEP-DOWN ISOLATION TRANSFORMER (WITH ABOUT 10V OUTPUT). THE COUNTER'S PANEL IS TYPICALLY AT SIGNAL GROUND, SO NEVER TRY TO MEASURE THE 50 OR 60 HZ LINE WITHOUT AN ISOLATION TRANSFORMER.

5. Be very careful with input levels at higher frequencies (greater than 5 MHz). The counter front end can withstand only 6 volts rms at these frequencies.

3-72. The 5315A Option 004 consumes less power than the 5315B Option 004 and is compatible with battery operation. The 5315B Option 004, however, offers the greatest accuracy. Option 004 is available only for HP Models 5315A/B having serial numbers prefixed 2120A and above.

3-71. Option 004 is an oven stabilized oscillator for the 5315A/B which results in greater measurement accuracy. The oven oscillator generates a higher stability 10 MHz signal over the full operating temperature range than achieved by a standard or Option 001 time base.

3-70. Oven Contained Time Base OPTION 004

3-69. Option 003 extends the frequency counting range of the 5315A/B from 100 MHz (in Channel A to 1 GHz (in Channel C). The input sensitivity and gate time are adjustable by front panel controls. See Table 1-1 for complete specifications of Option 003.

3-68. C Channel OPTION 003

3-67. Option 002 provides for battery operation of HP Model 5315A. The option includes the battery, and circuitry required for recharging. The operation of the battery charger circuitry is monitored by front panel BATTERY indicators. See paragraph 8-79 for a complete description of battery operation and indicators. This option is available for Model 5315A only.

3-66. Battery and Charger OPTION 002

3-65. Option 001 provides a temperature-compensated-crystal-oscillator (TCXO) providing higher accuracy than the Standard Time base. The TCXO is a 10 MHz oscillator, capable of making minor frequency corrections to compensate for offsets due to temperature variations.

3-64. Temperature Compensated Time Base OPTION 001

3-63. The operating characteristics of the 5315A/B are affected by the addition of any of the options described in the following paragraphs. Only one time base (Option 001 or 004) can be used in an instrument. The time base option replaces the standard time base.

3-62. OPTIONS

1. To ensure waveform fidelity during T.L. measurements, always use DC coupling.
2. Measurements of pulse width, and time between pulses, are more conveniently made in the COM A (common) position.
3. Measuring extremely fast rise times is not recommended because of the difficulty of setting precise trigger levels.
4. T.L. Average measurements of synchronous frequencies (any 10 MHz, or harmonic of, with stability similar or better than the internal clock) are not recommended because of a possible lock-up condition.
5. In general, use the GATE TIME control to vary the amount of resolution displayed. This control does not affect accuracy. It basically trades off longer measurement time for more resolution.

3-61. Time Interval Measurements

3-73. Offset/Normalizer OPTION 006

3-74. Option 006 allows the operator to mathematically manipulate the 5315B display. Option 006 is described in its own installation and service manual, HP Part Number 05315-90011. This option is available for Model 5315B only.

3-75. OPERATOR'S MAINTENANCE

3-76. The only maintenance the operator should normally perform is the replacement of the primary power fuse on a standard 5315B. This fuse is located within the Line Module Assembly. For instructions on changing the fuse, refer to Section II, Line Voltage Selection.

CAUTION

Make sure that only fuses with the required rated current and of the slow-blow type are used for replacement. The use of re-paired fuses and the short-circuiting of fuse-holders must be avoided.

3-77. When Option 003 C Channel is installed, the operator may be required to replace the input BNC fuse. This is a 1/8A fuse (HP Part No. 2110-0301) which is located within the INPUT C BNC connector (see *Figure 3-12*, for details). To replace the fuse, disconnect the power cord, unscrew the special BNC barrel (P/N 05305-60205) and, with needle-nose pliers, remove and replace the fuse. Reinstall the BNC barrel, and tighten using a BNC cable connector. Be careful not to overtighten.

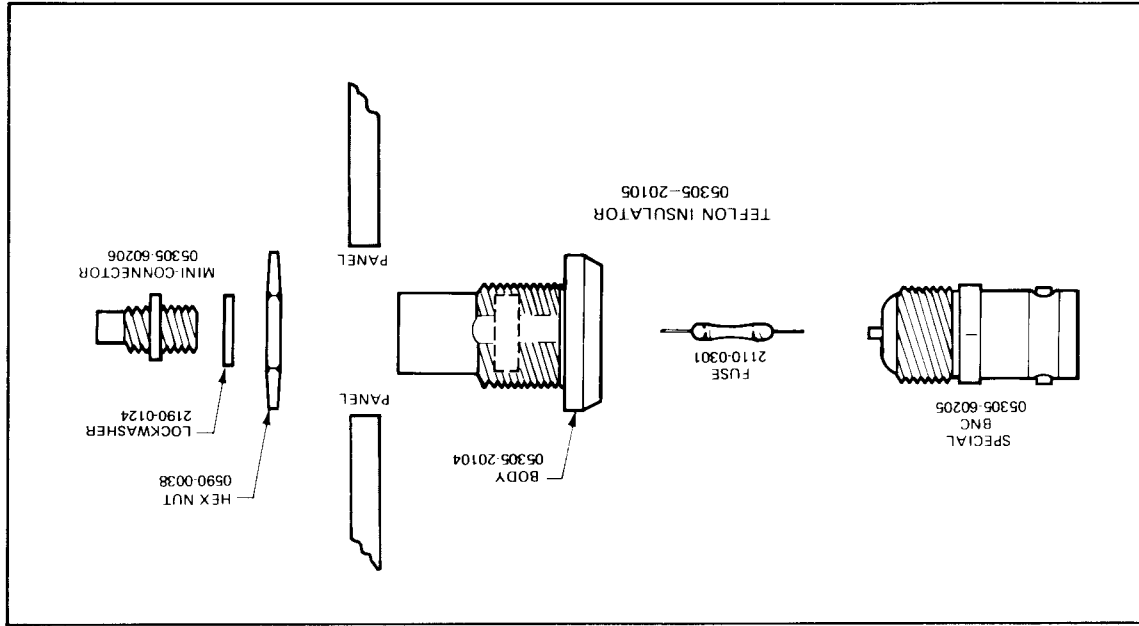


Figure 3-12. Details of Input Connector J1 and Fuse Mounting

3-81. The Option 004 time base oven is supplied power whenever line (Mains) power is connected to the instrument. For a 5315A with both Options 002 and 004 installed, the oven receives standby power from the battery when the FREQ A/PER A switch is depressed.

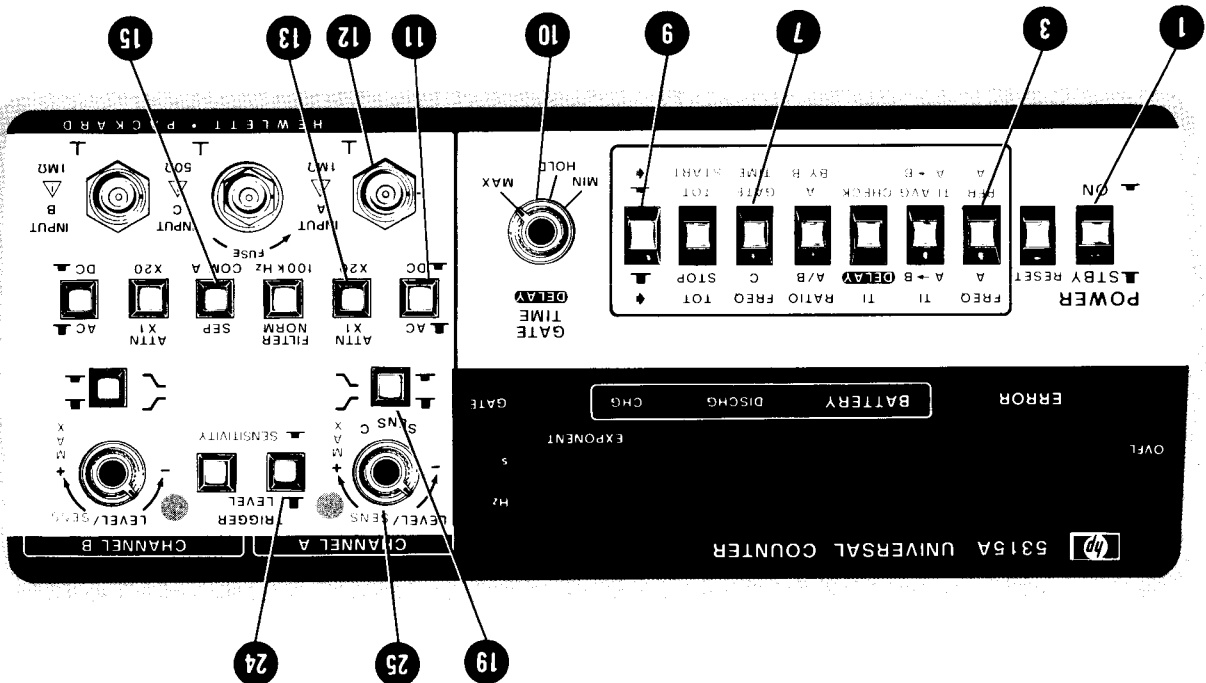
**POWER IS ALWAYS PRESENT AT THE STBY/ON (LINE) SWITCH
AND TRANSFORMER, AND UNREGULATED DC IS PRESENT
WHENEVER THE LINE CORD IS ATTACHED. UNPLUGGING THE
POWER CORD IS NECESSARY TO REMOVE ALL POWER FROM
THE INSTRUMENT.**

WARNING

3-80. The 5315A/B has a two-position power switch, STBY and ON. For 5315A models with Option 002, it is important that the instrument remain connected to the power source in the STBY mode when not in use. This supplies power to the battery charging circuitry.

3-79. The HP Model 5315A/B requires a power source of 100, 120, 220, or 240V AC, +5%, -10%, 48 to 66 Hz single phase. The selection of line voltage and input power fuse is described in Section II, paragraph 2-5, Preparation for Use.

3-78. POWER/WARM UP



NOTE

For specifications concerning bandwidth, accuracy, and amplitude on input signals, refer to Table 1-1.

1. Set POWER switch 1 to the ON position.
2. Set SEP/COM A switch 15 to SEP position.
3. Connect the input signal to INPUT A jack 12.
4. Press FREQ A/PER A switch 3, and set the Blue SHIFT key 9 in the out position for FREQ A, or the in position for Period A.
5. Set AC/DC 11, ATTN 13 and Slope 19 switches to appropriate positions.
6. Set GATE TIME control 10 to min.
7. Set TRIGGER LEVEL/SENSITIVITY switch 24 to SENSITIVITY position, and LEVEL/SENS control 25 fully ccw. This sets the trigger level at 0 volts (nominally) and sensitivity to minimum.
8. Adjust the LEVEL/SENS control 25 in a clockwise direction until a stable reading is obtained.
9. Adjust the GATE TIME control 10 for desired resolution. The gate time may be displayed by pressing the GATE TIME switch 7 and the Blue SHIFT key 9.

Figure 3-13. Frequency A/Period A Measurements

Figure 3-14. Time Interval Measurement

The first measurement is not displayed until the gate time delay is up. For slow sample rates, use HOLD and the RESET switch.

NOTE

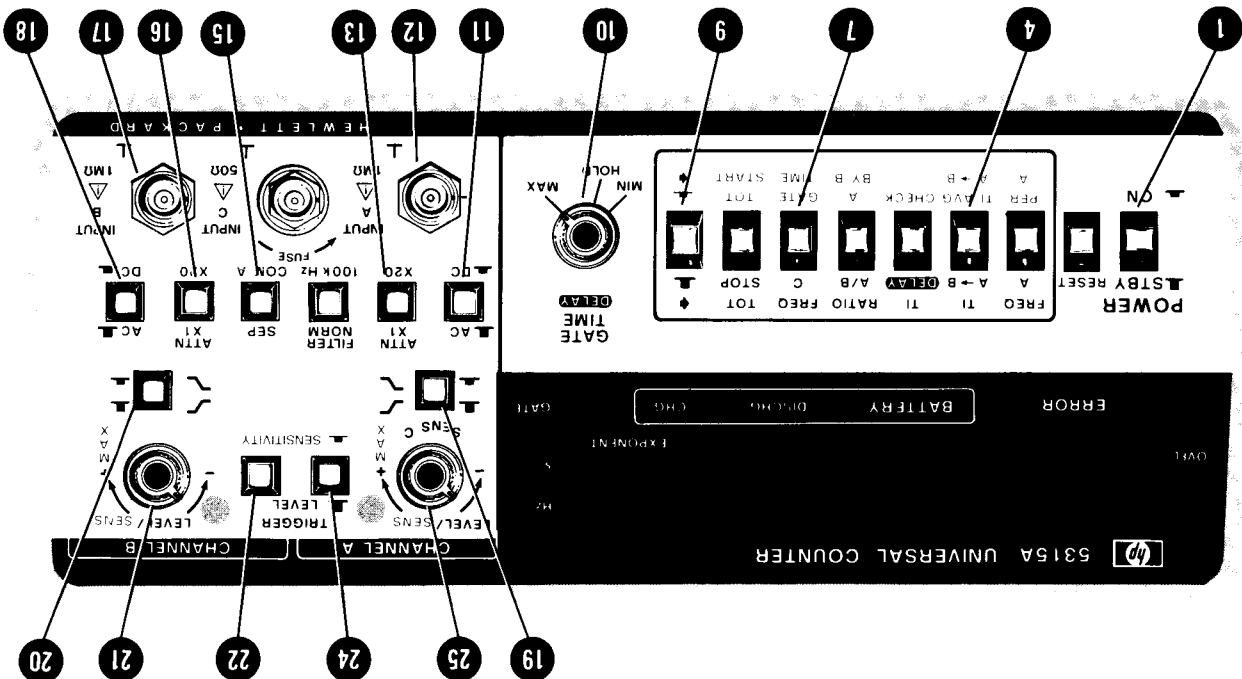
8. Adjust the GATE TIME control **10** for the desired sample rate, variable nominally from 50 ms to 10 s. The selected gate time may be displayed by pressing the GATE TIME switch **7** and the Blue SHIFT key **9**.
 7. Adjust the LEVEL/SENS controls **21** **25** for optimum triggering, usually the middle of the range over which the trigger light flashes.
 6. Set TRIGGER LEVEL/SENSITIVITY switches **22** **24** to TRIGGER LEVEL position. This sets the sensitivity to maximum (typically ≤ 10 mV for frequencies ≤ 10 MHz) and allows variable selection of trigger levels.
- When the SEP/COM A switch is set to COM A, only the CHANNEL A AC/DC switch **11** is effective. However, all Attenuator, Slope, and LEVEL/SENS controls are effective.

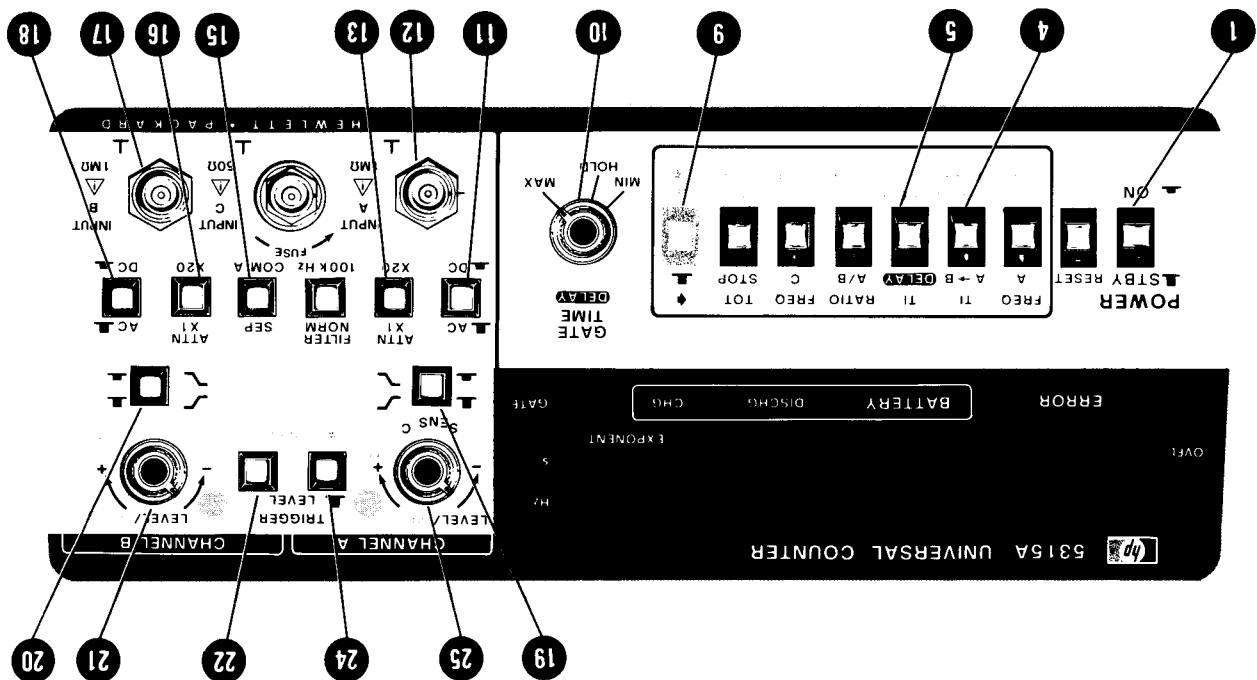
NOTE

5. Set AC/DC **11**, ATTN **13**, **16**, and Slope **19** **20** switches to desired positions.
4. Press T.I. A-B switch **4**, and ensure the Blue SHIFT key **9** is in the out position, to select time interval function.
3. If the Start and Stop signals are from separate sources, connect the Start signal to INPUT A jack **12**, the Stop signal to INPUT B jack **17**, and set the SEP/COM A switch **15** to SEP position. If the Start and Stop signals are from a common source, connect to INPUT A jack **12** and set the SEP/COM A switch **15** to COM A position.
2. Set GATE TIME control **10** to min.
1. Set POWER switch **1** to the ON position.

For specifications concerning bandwidth, accuracy, and amplitude on input signals, refer to Table 1-1.

NOTE





NOTE

For specifications concerning bandwidth, accuracy, and amplitude on input signals, refer to Table 1-1.

1. Set POWER switch **1** to the ON position.

2. If the Start and Stop signals are from separate sources, connect the Start signal to INPUT A jack **12**, the Stop signal to INPUT B jack **17**, and set the SEP/COM A switch **15** to SEP position. If the Start and Stop signals are from a common source, connect to INPUT A jack **12** and set the SEP/COM A switch **15** to COM A position.

3. Press T.I. DELAY switch **5**, and ensure the Blue **9** key is in the out position, to select time interval function.

4. Set AC/DC **11**, ATTN **13**, and Slope **16**, and Slope **19** switches to desired positions.

NOTE

When the SEP/COM A switch is set to COM A, only Channel A AC/DC switch **11** is effective. However, all ATTENUATOR, SLOPE, and LEVEL/ controls are effective.

5. Set TRIGGER LEVEL/ controls **22** to TRIGGER LEVEL position. This sets the sensitivity to maximum (typically ≤ 10 mV) and allows variable selection of trigger levels.
6. Adjust the LEVEL/ controls **21** for optimum triggering (i.e., the middle of the range over which the trigger light flashes).

7. Adjust the GATE TIME/DELAY control **10**, for the desired holdoff, (variable normally from 500 μ s to 20 ms) between the Start on Channel A and the enabling of Stop on Channel B. Inputs during the delay time are ignored. The selected delay time may be displayed by pressing T.I. A-B **4**, T.I. DELAY **5** and Blue **9** key **9** to their in positions.

Figure 3-15. Time Interval Delay Measurement

Figure 3-16. Time Interval Average A-B

The T.I. Average A-B mode of operation will measure time intervals from 10⁵ seconds down to 0 ns, with up to 1 ns resolution. A display of up to “-” 1 or 2 ns, indicating a negative time interval is possible (ie., Channel B event occurred before Channel A event).

NOTE

7. Adjust the GATE TIME control (10) for the desired resolution. The selected gate time may be displayed by setting the **TRIGGER** switch (7) and the Blue Shift key (9) to the “in” position.
6. Adjust the LEVEL/ATTEN controls (21) (25) for optimum triggering (ie., the middle of the range over which the trigger light flashes).
5. Set TRIGGER LEVEL/ATTEN switches (22) (24) to TRIGGER LEVEL position. This sets the sensitivity to maximum (≤ 10 mV) and allows variable selection of trigger levels.

When the SEP/COM A switch is set to COM A, only the Channel A AC/DC switch (11) is effective. However, all ATTENUATOR, SLOPE, and LEVEL/ATTEN controls are effective.

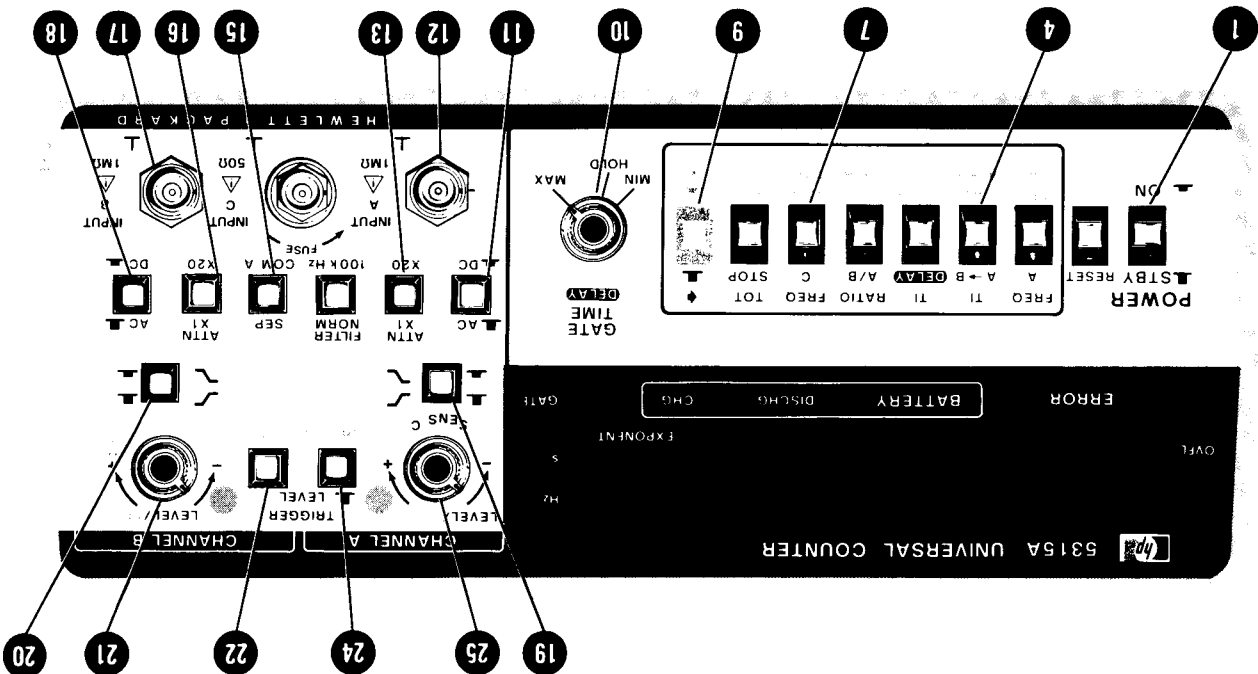
NOTE

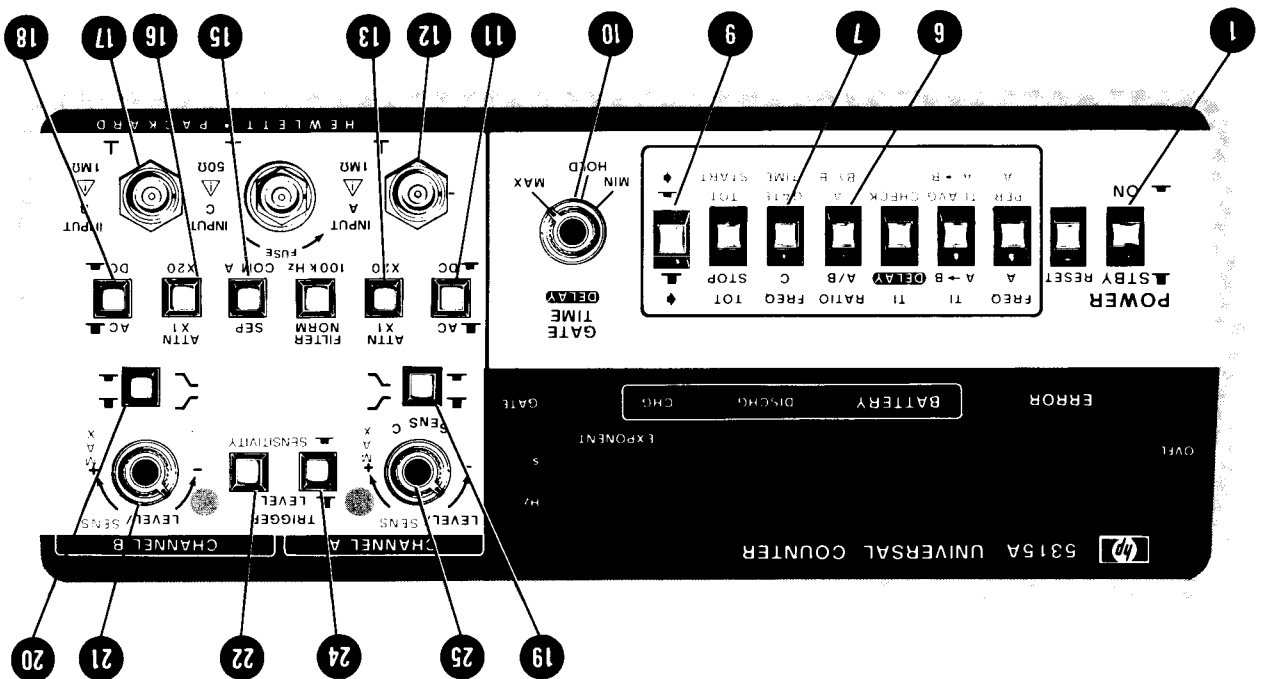
4. Set AC/DC (11) (18), ATTN (13) (16), and Slope (19) (20) switches to desired positions.
3. Press T.I. A-B switch (4), and the Blue Shift key (9), to select time interval average function.
2. If the Start and Stop signals are from separate sources, connect the Start signal to INPUT A jack (12), the Stop signal to INPUT B jack (17), and set the SEP/COM A switch (15) to SEP position. If the Start and Stop signals are from a common source, connect to INPUT A jack (12) and set the SEP/COM A switch (15) to COM A position.

There must be at least 200 ns between the Stop pulse and the next Start pulse. When measuring the time interval between the same polarity slope of two pulses from a single source, the T.I. A-B mode should be used.

NOTE

1. Set POWER switch (1) to the ON position.
- For specifications concerning bandwidth, accuracy, and amplitude on input signals, refer to Table 1-1.

NOTE



NOTE

For specifications concerning bandwidth, accuracy, and amplitude on input signals, refer to Table 1-1.

1. Set POWER switch **1** to the ON position.
2. Set SEP/COM A switch **15** to SEP position.
3. Connect the input signals to INPUT A **12** and INPUT B **13**. Connecting the higher frequency signal to INPUT A and lower frequency signal to INPUT B ensures that the counter meets its ratio accuracy specifications. Also, the ratio will always be greater than one.
4. Select RATIO A/B **6**, and ensure the Blue SHIFT key **9** is in the out position.
5. Set AC/DC **11**, ATTN **13**, and Slope **19**, **20** switches to desired positions.
6. Set TRIGGER LEVEL/SENSITIVITY switches **22**, **24** to SENSITIVITY position and LEVEL/SENS controls **21**, **25** fully ccw. This sets the trigger level at 0 volts (nominally) and sensitivity to minimum (>500 mV).
7. Adjust each LEVEL/SENS control **21**, **25** in a clockwise direction slightly beyond the point the corresponding trigger light flashes. If signals are less than 250 mV rms, the SENS controls may be fully cw.
8. Adjust the GATE TIME control **10** for desired resolution. The selected gate time, variable nominally from 50 ms to 10 s, may be displayed by pressing the GATE TIME switch **7** and the Blue SHIFT key **9**.

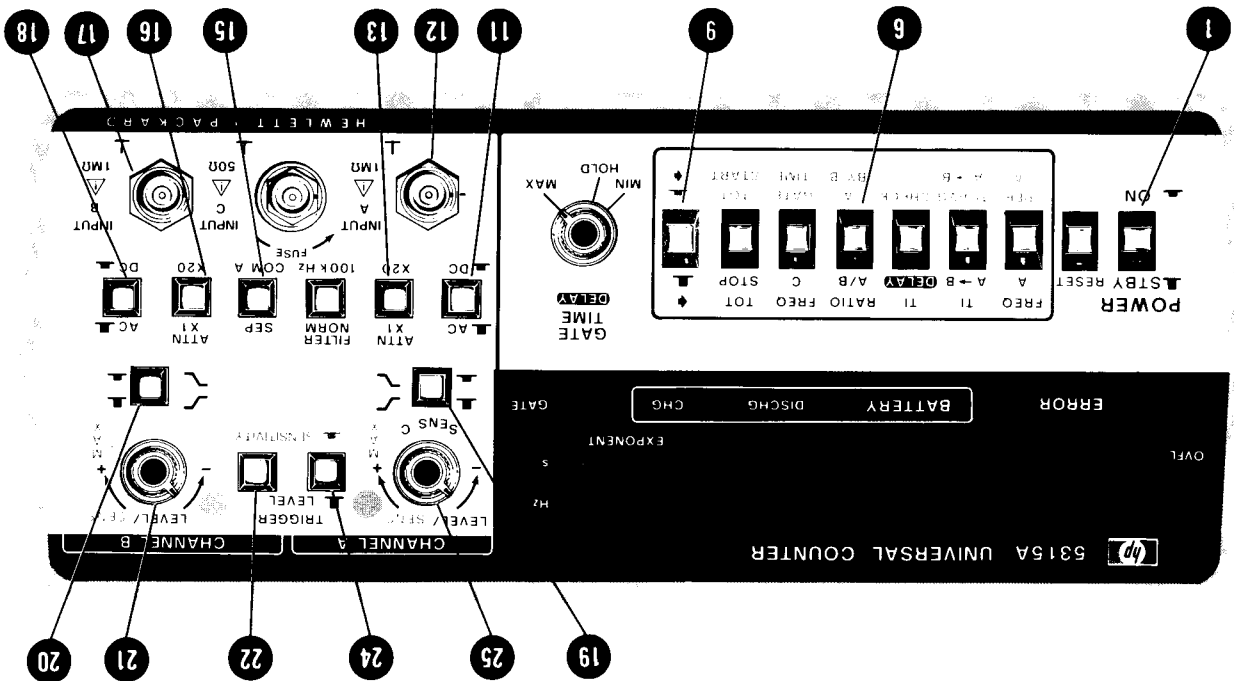
Figure 3-17. Ratio A/B Measurements

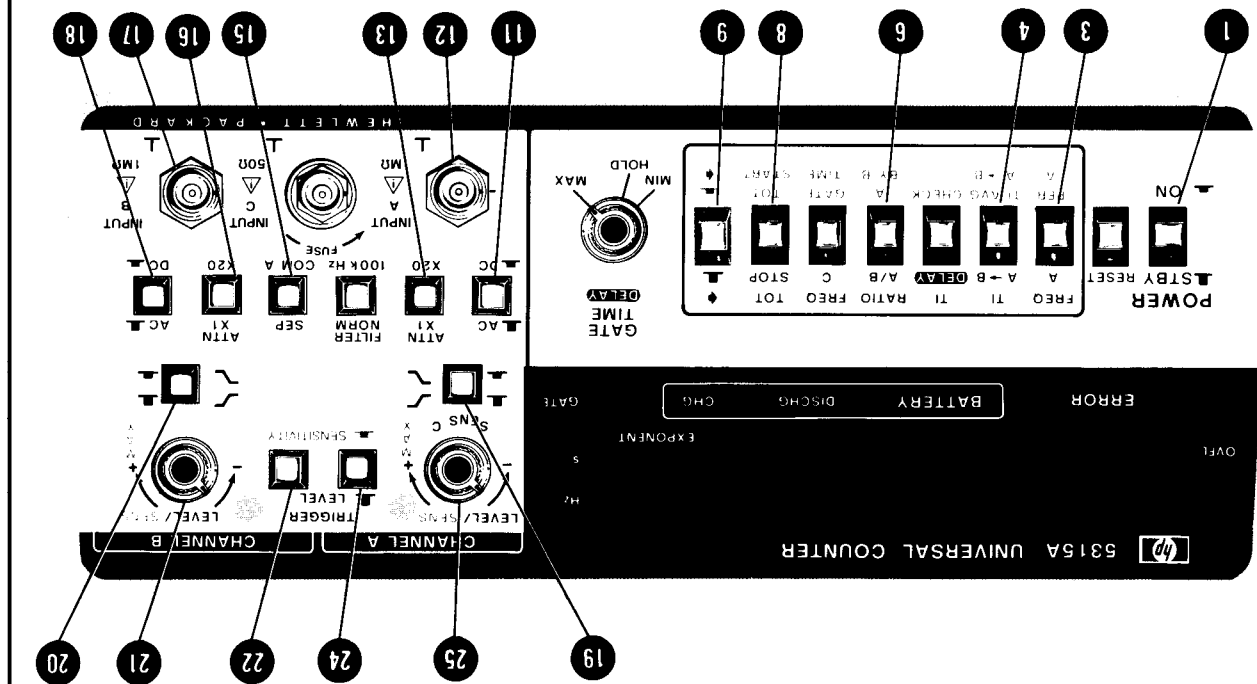
This mode will totalize inputs on Channel A for the time between two events on Channel B. The Gate will open on the A Slope setting and close on the B Slope setting. Reset is required to make a new measurement.

4. Press **↵** B switch **6** and the Blue SHIFT key **9** to select the totalize A BY B function.
5. Set AC/DC **11** , ATTN **18** , and Slope **19** **20** switches to desired positions.
6. Set TRIGGER LEVEL/SENSITIVITY switches **22** **24** to SENSITIVITY position and LEVEL/SENS (500 mV).
7. Adjust each LEVEL/SENS **21** **25** in a clockwise direction slightly beyond the point the corresponding trigger light flashes. If signals are less than 250 mV rms, the LEVEL/SENS controls may be fully cw.
8. This function operates in a Single Shot mode. The RESET key must be pressed to initiate a new measurement.

1. Set POWER switch **1** to the ON position.
2. Set SEP/COM A switch **15** to SEP position.
3. Connect the signal, either sine wave or pulses, to be totalized to INPUT A jack **12** and the gate control signal to INPUT B jack **17**.

NOTE





1. Set POWER switch **1** to the ON position.
2. Set SEP/COM A switch **15** to SEP position.
3. Connect the frequency burst signal to be averaged to INPUT A jack **12** and the sampling signal to INPUT B jack **17**. The sampling signal must be synchronized with, and of pulse width less than the burst.

NOTE

This mode will average together multiple frequency bursts and display the average frequency of the signal within the burst. Due to the complexity of this function it is recommended that the user thoroughly read paragraph 3-23 before attempting to use this function.

4. Press T.I. DELAY, CHECK switch **4** and RATIO A/B, A BY B switch **6** together for a gate time of 500 μ s-30 ms or FREQ A, PER A switch **3** and TOT STOP, TOT STAK switch **8** for a gate time of 60 ms-10 s.

5. Set AC/DC **11**, ATTN **13**, **16** to the desired positions.
6. Set the Blue Shift key **9** for the desired sampling/measurement interval enable slope: OUT for a positive enable slope, IN for a negative enable slope (negative slope only using SHORT measurement interval).

7. Set the A Channel SLOPE switch **19** to the desired trigger slope. Set the B Channel SLOPE switch **20** for the desired disable slope.
8. Set the TRIGGER/SENSITIVITY switches **22**, **24** to SENSITIVITY position and LEVEL/SENS controls **21**, **25** fully ccw. This sets the trigger level at 0 volts (nominally) and sensitivity to minimum (500 mV).
9. Adjust each LEVEL/SENS **21**, **25** in a clockwise direction slightly beyond the point the corresponding trigger light flashes. If the signals are less than 250 mV, the LEVEL/SENS controls may be fully cw.

Figure 3-19. FREQ A Armed by B Measurements

Figure 3-20. Totalize Measurement

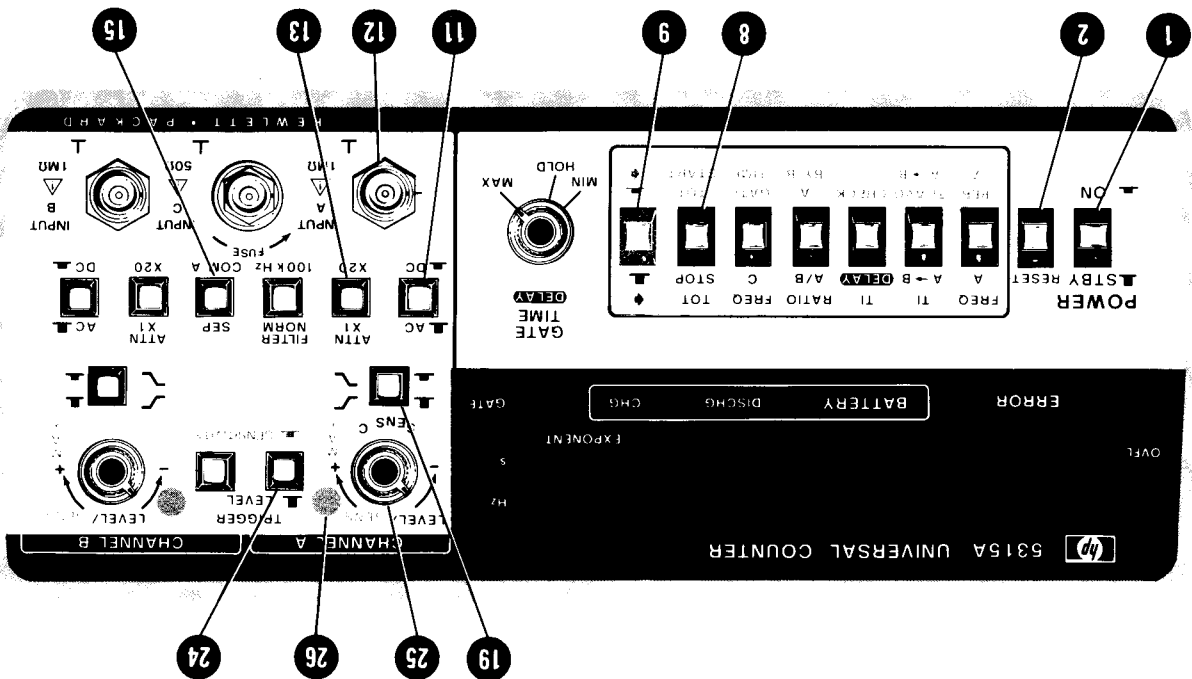
1. Set POWER switch **1** to the ON position.
 2. Set SEP/COM A switch **15** to SEP position.
 3. Connect the signal to be totalized to INPUT A jack **12**.
- This mode will totalize inputs on Channel A for the period of time manually selected on front panel switches.
4. Press TOT switch **8** and ensure the Blue SHIFT key **9** is in the out position.
 5. Set AC/DC **11**, ATTN **13** and Slope **19** switches to desired positions.
 6. Set TRIGGER LEVEL/SENSITIVITY switch **24** to SENSITIVITY position and LEVEL/SENS **25** fully ccw. This sets the trigger level at 0 volts (nominally) and sensitivity to minimum (500 mV).
 7. Adjust the LEVEL/SENS control **25** in a clockwise direction slightly beyond the point the Channel A trigger light **26** flashes.
 8. Press RESET **2** to clear display.
 9. Press Blue SHIFT key **9** IN to START totalize measurement, and press again (out position) to STOP totalize. Repeat this procedure to accumulate count, press RESET **2** to clear display and enable a new measurement.

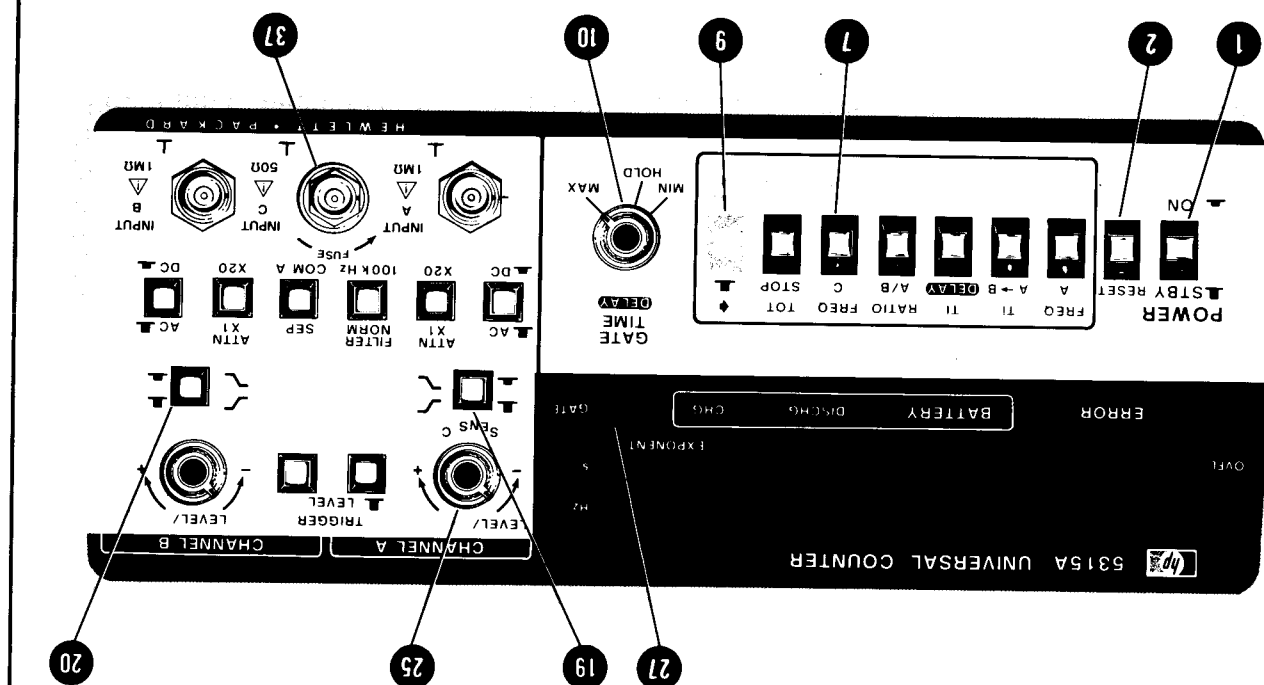
NOTE

1. Set POWER switch **1** to the ON position.
2. Set SEP/COM A switch **15** to SEP position.
3. Connect the signal to be totalized to INPUT A jack **12**.

For specifications concerning bandwidth, accuracy, and amplitude on input signals, refer to Table 1-1.

NOTE





NOTE

For specifications concerning bandwidth, accuracy, and amplitude on input signals, refer to Table 1-1.

1. Set POWER switch **1** to ON position.

2. Set GATE TIME control **10** to MIN.

3. Select FREQ C and be sure that the blue SHIFT key is in the OUT position.

CAUTION

Be sure that the Input C signal does not exceed 1 V rms into 50 ohms.

4. Connect the input signal to INPUT C jack **37**.

NOTE

The INPUT Connector is a special fused BNC. The in-line fuse within the connector is accessible from the front panel. Refer to the Operator's Maintenance section, paragraph 3-77, for replacement of fuse.

5. Set control **25** to min. Slowly rotate the control in a cw direction until the GATE light **27** just turns on.

6. Adjust the GATE TIME control **10** for the desired resolution. The actual gate time may be displayed by pressing the function switch **7** and the Blue key **9**. Moving the GATE TIME control **10** fully ccw into detent will HOLD the measurement display. In HOLD, single-shot measurements with minimum gate time can be made by pressing the RESET **2** key.

NOTE

The only controls active in FREQ C function mode are GATE TIME **10**, RESET **2**, and SENS C **25**. However, pressing either Channel A **19** or B **20** scope switches will reset the counter. All other controls have no effect.

Figure 3-21. Frequency C Measurement (Option 003)

SECTION IV PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedure in this section tests the electrical performance of the 5315A/B using the specifications in *Table 1-1* as the performance standards. The complete performance tests are given in *Tables 4-1* and *4-2*. All tests can be performed without access to the inside of the instrument.

4-3. Each test procedure found in this section is complete in itself. If the procedures are performed in order, any changes to the 5315A/B setup are printed in bold type. This makes it possible to do a single test out of sequence, yet the highest efficiency is achieved if all tests are performed.

4-4. OPERATIONAL VERIFICATION

4-5. The abbreviated checks given in *Table 4-1* can be performed to give a high degree of confidence that the 5315A/B is operating properly without performing the complete performance tests. The operational verification should be useful for incoming QA, routine maintenance, and after instrument repair. *Table 4-1* consists of the following:

- I. Self-Check
- II. Channel A Frequency Response/Sensitivity
- III. Channel B Frequency Response/Sensitivity and Ratio A/B
- IV. Time Interval and Time Interval Average
- V. Totalize

4-6. PERFORMANCE TESTS

4-7. The performance tests consist of all the tests given in this section as listed below and in *Table 4-2*. These tests verify the specifications in *Table 1-1*. All tests can be performed without access to the interior of the instrument.

- I. Display Test
- II. Self-Check
- III. Gate Time
- IV. Channel A Frequency Response/Sensitivity
- V. Channel B Frequency Response/Sensitivity and Ratio A/B
- VI. Period A
- VII. A By B
- VIII. Time Interval and Time Interval Average
- IX. Totalize
- X. Time Interval Delay
- XI. Channel C Frequency Response/Sensitivity

4-8. EQUIPMENT REQUIRED

4-9. Equipment required for the complete test and operational verification is listed in *Table 1-4*. Any equipment which satisfies the critical specification given in the table may be substituted for recommended model numbers.

4-10. TEST RECORD

4-11. Results of the operational verification and performance test may be tabulated on the test cards located at the end of each procedure.

Table 4-1. Operational Verification

The following tests will be performed:	
I.	SELF-CHECK
II.	CHANNEL A FREQUENCY RESPONSE/SENSITIVITY
III.	CHANNEL B FREQUENCY RESPONSE/SENSITIVITY AND RATIO A/B
IV.	TIME INTERVAL AND TIME INTERVAL AVERAGE
V.	TOTALIZE
1. SELF-CHECK	
a.	Set-Up:
	POWER SWITCH ON (IN)
	FUNCTION SELECT T.I. DELAY/CHECK IN
b.	Verify the 5315A/B displays 10 MHz, with display resolution controlled by the Gate Time control knob. Resolution should increase with gate time.
c.	Record the results on the test card (PASS/FAIL).
II. CHANNEL A FREQUENCY RESPONSE/SENSITIVITY	
a.	Specifications: 0.1 Hz to 100 MHz.
	Set-Up:
1.	10 mV rms, sine wave 0.1 Hz-10 MHz, dc coupled.
2.	10 mV rms, sine wave 30 Hz-10 MHz, ac coupled.
3.	25 mV rms, sine wave 10-100 MHz, ac or dc coupled.
b.	Set-Up:
	FUNCTION SELECT (Blue Shift Key)
	ON (IN)
	POWER SWITCH
	FUNCTION SELECT
	T.I. DELAY/CHECK IN
b.	Verify the 5315A/B displays 10 MHz, with display resolution controlled by the Gate Time control knob. Resolution should increase with gate time.
c.	Record the results on the test card (PASS/FAIL).
III. CHANNEL B FREQUENCY RESPONSE/SENSITIVITY AND RATIO A/B	
a.	Specifications: 0.1 Hz to 100 MHz.
	Set-Up:
1.	10 mV rms, sine wave 0.1 Hz-10 MHz, dc coupled.
2.	10 mV rms, sine wave 30 Hz-10 MHz, ac coupled.
3.	25 mV rms, sine wave 10-100 MHz, ac or dc coupled.
b.	Set-Up:
	FUNCTION SELECT (Blue Shift Key)
	OUT
	GATE TIME/DELAY control fully CCW, but not in HOLD
	CHANNELS A&B TRIG LVL/SENS controls MAX (CW)
	CHANNELS A&B TRIGGER LEVEL/SENSITIVITY SENS (IN)
	CHANNELS A&B SLOPES POS (OUT)
	CHANNELS A&B AC/DC DC (IN)
	CHANNELS A&B ATTN X1/X20 X1 (OUT)
	FILTER NORM/100 kHz FILTER NORM (OUT)
	SEP/COM A SEP (OUT)
c.	Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC connector.
d.	Set the HP 3325A for 1 Hz, then 10 MHz at 10 mV rms. Verify the 5315A/B displays correct frequencies.
e.	Replace the HP 3325A with an HP 8654A Signal Generator. Set the HP 8654A to 50 MHz and then 100 MHz at 25 mV rms. Verify the 5315A/B displays the correct frequencies.
f.	Record the results on the test card (PASS/FAIL).
III. CHANNEL B FREQUENCY RESPONSE/SENSITIVITY AND RATIO A/B	
a.	Specifications: 0.1 Hz to 100 MHz.
	Set-Up:
1.	10 mV rms, sine wave 0.1 Hz-10 MHz, dc coupled.
2.	10 mV rms, sine wave 30 Hz-10 MHz, ac coupled.
3.	25 mV rms, sine wave 10-100 MHz, ac or dc coupled.
b.	Set-Up:
	FUNCTION SELECT (Blue Shift Key)
	OUT
	GATE TIME/DELAY control fully CCW, but not in HOLD
	CHANNELS A&B TRIG LVL/SENS controls MAX (CW)
	CHANNELS A&B TRIGGER LEVEL/SENSITIVITY SENS (IN)
	CHANNELS A&B SLOPES POS (OUT)
	CHANNELS A&B AC/DC DC (IN)
	CHANNELS A&B ATTN X1/X20 X1 (OUT)
	FILTER NORM/100 kHz FILTER NORM (OUT)
	SEP/COM A SEP (OUT)
c.	Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC connector.
d.	Set the HP 3325A for 1 Hz, then 10 MHz at 10 mV rms. Verify the 5315A/B displays correct frequencies.
e.	Replace the HP 3325A with an HP 8654A Signal Generator. Set the HP 8654A to 50 MHz and then 100 MHz at 25 mV rms. Verify the 5315A/B displays the correct frequencies.
f.	Record the results on the test card (PASS/FAIL).
III. CHANNEL B FREQUENCY RESPONSE/SENSITIVITY AND RATIO A/B	
a.	Specifications: 0.1 Hz to 100 MHz.
	Set-Up:
1.	10 mV rms, sine wave 0.1 Hz-10 MHz, dc coupled.
2.	10 mV rms, sine wave 30 Hz-10 MHz, ac coupled.
3.	25 mV rms, sine wave 10-100 MHz, ac or dc coupled.
b.	Set-Up:
	FUNCTION SELECT (Blue Shift Key)
	OUT
	GATE TIME/DELAY control fully CCW, but not in HOLD
	CHANNELS A&B TRIG LVL/SENS controls MAX (CW)
	CHANNELS A&B TRIGGER LEVEL/SENSITIVITY SENS (IN)
	CHANNELS A&B SLOPES POS (OUT)
	CHANNELS A&B AC/DC DC (IN)
	CHANNELS A&B ATTN X1/X20 X1 (OUT)
	FILTER NORM/100 kHz FILTER NORM (OUT)
	SEP/COM A SEP (OUT)
c.	Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel B Input BNC. Connect the HP 3325A front panel SYNC OUT, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.

Table 4-1. Operational Verification (Continued)

- IV. TIME INTERVAL AND TIME INTERVAL AVERAGE**
- Specifications:
 - Time Interval 100 ns to 10⁵ seconds.
 - Time Interval Average 0 ns to 10⁵ seconds.
 - Set-Up:
 - FUNCTION SELECT** T1-A-B/T1-AVG A-B
 GATE TIME/DELAY control fully CCW, but not in HOLD
 CHANNELS A&B TRIG LVL/SENS controls MAX (CW)
 CHANNEL A SLOPE POS (OUT)
 CHANNEL B SLOPE NEG (IN)
 CHANNEL A&B AC/DC DC (IN)
 CHANNEL A ATTEN X1/X20 X1 (OUT)
 FILTER NORM/100 kHz FILTER NORM (OUT)
SEP/COM A **COM A (IN)**
 - Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.
 - Set the HP 3325A to 500.013 kHz square wave at 300 mV p-p. The 5315A/B display should read 1.0 E-6s ± 1 count.
 - Press Function Set (Blue Shift Key) IN. The 5315A/B display should read 1.000 E-6s ± 5 ns.
 - Change the Channel B Slope to Positive (OUT). The display should read either 2.000 E-6s ± 5 ns or 0. E-9s ± 5 ns.
 - Change the Channel A Slope to Negative (IN). The 5315A/B display should read 1.000 E-6s ± 5 ns.
 - Change the Channel B Slope to Negative (IN). The 5315A/B display should read 0. E-9 ± 5 ns or 2.000 E-6s ± 5 ns.
 - Record the results on the test card (PASS/FAIL).

V. TOTALIZE

- Specification: 0 to 100 MHz.
- Set-Up:
- FUNCTION SELECT** TOT STOP/TOT START
 GATE TIME/DELAY control fully CCW, but not in HOLD
 CHANNELS A&B TRIG LVL/SENS controls MAX (CW)
 CHANNELS A&B SLOPES POS (OUT)
 CHANNELS A&B AC/DC DC (IN)
 CHANNELS A&B ATTEN X1/X20 X1 (OUT)
 FILTER NORM/200 kHz FILTER NORM (OUT)
SEP/COM A **SEP (OUT)**
- Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.
- Set the HP 3325A to 1 Hz at 100 mV rms. The 5315A/B display should read 0.
- Press the Function Set (Blue Shift Key) IN. Verify the 5315A/B is counting at a 1-count/second rate. The trigger LED will also flash at this rate.
- Release the Function Set (Blue Shift Key). The 5315A/B should display the total number of pulses counted. The GATE light should be off.
- Record the results on the test card (PASS/FAIL).

OPERATIONAL VERIFICATION TEST CARD

HEWLETT-PACKARD MODEL 5315A/B Test Performed By _____	
UNIVERSAL COUNTER	
Serial Number _____	Date _____
DESCRIPTION	
CHECK	
I. SELF-CHECK	
II. CHANNEL A FREQUENCY RESPONSE/SENSITIVITY	
III. CHANNEL B FREQUENCY RESPONSE/SENSITIVITY/RATIO	
IV. TIME INTERVAL AND TIME INTERVAL AVERAGE	
V. TOTALIZE	

Table 4-2. 5315A/B In-Cabinet Performance Test

The following tests will be included:

- I. DISPLAY TEST
- II. SELF-CHECK
- III. GATE TIME
- IV. CHANNEL A FREQUENCY RESPONSE/SENSITIVITY
- V. CHANNEL B FREQUENCY RESPONSE/SENSITIVITY AND RATIO A/B
- VI. PERIOD A
- VII. A BY B
- VIII. TIME INTERVAL AND TIME INTERVAL AVERAGE
- IX. TOTALIZE
- X. TIME INTERVAL DELAY
- XI. CHANNEL C FREQUENCY RESPONSE/SENSITIVITY

- a. Turn the 5315A/B power ON. Place all FUNCTION SELECT switches in the OUT position, including the Function Set (Blue Shift Key).
- b. Refer to paragraph 3-33 and verify that rolling display is correct.
- c. Record the results on the test card (PASS/FAIL).

II. SELF-CHECK

Set-Up:

FUNCTION SELECT (Blue Shift Key) IN
T.I. DELAY/CHECK

- b. Verify the 5315A/B displays 10 MHz, with display resolution controlled by the GATE TIME control knob. The resolution should increase with Gate Time.
- c. Record results on the test card (PASS/FAIL).

III. CHANNEL A FREQUENCY RESPONSE AND SENSITIVITY

a. Specifications: 0.1 Hz to 100 MHz.

1. 10 mV rms, sine wave 0.1 Hz-10 MHz, dc coupled.
2. 10 mV rms, sine wave 30 Hz-10 MHz, ac coupled.
3. 25 mV rms, sine wave 10-100 MHz, ac and dc coupled.

Set-Up:

FUNCTION SELECT (Blue Shift Key) OUT
FREQ A/PER A
CHANNELS A&B TRIG LVL/SENS controls fully CCW, but not in HOLD
CHANNELS A&B TRIGGER LEVEL/SENSITIVITY SENS (IN)
CHANNELS A&B SLOPES POS (OUT)
CHANNELS A&B AC/DC DC (IN)
CHANNELS A&B ATTN X1/X20 X1 (OUT)
FILTER NORM/100 KHz FILTER NORM (OUT)
SEP/COM A SEP (OUT)

- c. Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.

- d. Set the HP 3325A to the following frequencies at 10 mV rms: 0.1 Hz, 30 Hz, 100 Hz, 30 Hz, 100 Hz, 30 Hz, 100 Hz, 500 KHz, and 10 MHz. Verify the 5315A/B displays the proper frequencies. The 5315A/B should correctly display all frequencies in this range. (For the range of 0.1 Hz to 0.141 Hz, the OVFL light will be ON and the most significant digit "1" will not be displayed).
- f. Set the Channel A AC/DC switch to AC (OUT). While maintaining a 10 mV amplitude, set the 3325A to 30 Hz, 100 Hz, 500 KHz, and 10 MHz. Verify the 5315A/B displays the proper frequencies. Set the HP 3325A to 30 Hz at 5 mV rms. Increase the amplitude of the input signal until the 5315A/B displays a stable count of 30 Hz.
- h. Record on the test card the minimum amplitude at which the 5315A/B displays a stable count (VALUE).
- i. Set Channel A to DC coupled (IN).

- d. Record the results on the test card (PASS/FAIL).
- c. Connect an HP 8654A to 5315A/B Channel A Input BNC with a 50-ohm feedthrough. Set the HP 8654A to 10 MHz and 100 mV rms. The 5315A/B should display: 100 ns at 10 MHz and 10 ns at 100 MHz.
- b. Set-Up:
- a. Specification: 10 ns-10⁵ seconds.
- FUNCTION SELECT** **FREQ A/PER A**
FUNCTION SET (Blue Shift Key) **IN**
 GATE TIME/DELAY control fully CCW, but not in HOLD
 CHANNELS A&B TRIG LVL/SENS controls MAX (CW)
 CHANNELS A&B TRIGGER LEVEL/SENSITIVITY SENS (IN)
 CHANNELS A&B SLOPES POS (OUT)
 CHANNELS A&B AC/DC AC (OUT)
 CHANNEL A ATTN X1/X20 X1 (OUT)
 FILTER NORM/100 KHz FILTER NORM (OUT)
 SEP/COM A SEP (OUT)

V. PERIOD A

- i. Record the results on the test card (PASS/FAIL).
- h. While maintaining a 25 mV amplitude, set the HP 8654A to 50 MHz, 75 MHz, and 100 MHz. The 5315A/B should display a stable ratio from 1.000000 to 1.0000000 throughout this frequency range.
- g. Set Channel B to DC coupled (IN).
- f. Replace the HP 3325A with an HP 8654A Signal Generator. Connect the HP 8654A front panel RF OUT, through a 50-ohm feedthrough, to the 5315A/B Channel B Input BNC. Connect the HP 8654A rear panel AUX OUT, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.
- e. Change Channel B to AC coupled (OUT). Maintaining the 10 mV rms amplitude, set the HP 3325A to 30 Hz, 100 Hz, 500 KHz, and 10 MHz. Verify the 5315A/B displays: 1. to 1.000000.
- d. Set the HP 3325A to 10 Hz, 30 Hz, and 10 MHz at 10 mV rms. The 5315A/B should display a stable ratio of 1. to 1.000000 throughout the frequency range.
- c. Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough to the 5315A/B Channel B Input BNC. Connect the HP 3325A front panel SYNC OUT, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.
- b. Set-Up:
- FUNCTION SELECT** **RATIO A/B — A BY B**
FUNCTION SET (Blue Shift Key) OUT
 GATE TIME/DELAY control fully CCW, but not in HOLD
 CHANNELS A&B TRIG LVL/SENS controls MAX (CW)
 CHANNELS A&B TRIGGER LEVEL/SENSITIVITY SENS (IN)
 CHANNELS A&B SLOPES POS (OUT)
 CHANNELS A&B AC/DC DC (IN)
 CHANNEL A ATTN X1/X20 X1 (OUT)
 FILTER NORM/100 KHz FILTER NORM (OUT)
 SEP/COM A SEP (OUT)

IV. CHANNEL B FREQUENCY RESPONSE/SENSITIVITY AND RATIO A/B

- i. Record on the test card the minimum amplitude at which the 5315A/B displays a stable count (VALUE).
- k. Set the HP 8654A to 100 MHz to 5 mV rms. Increase the amplitude of the HP 8654A until the 5315A/B displays a stable count of 100 MHz.
- j. Replace the 3325A with the HP 8654A Signal Generator. Set the 8654A to 50 MHz, 75 MHz, and 100 MHz. Maintain an amplitude of 25 mV rms. The 5315A/B should correctly display all frequencies in this range.

Table 4-2. 5315A/B In-Cabinet Performance Test (Continued)

Table 4-2. 5315A/B In-Cabinet Performance Test (Continued)

VI. A BY B	
a.	Set-Up:
FUNCTION SELECT IN RATIO A/B — A BY B FUNCTION SET (Blue Shift Key) fully CCW, but not in HOLD GATE TIME/DELAY control MAX (CW) CHANNELS A&B TRIG LVL/SENS controls SENS (IN) CHANNELS A&B SLOPES POS (OUT) CHANNELS A&B AC/DC CHANNELS A&B ATTN X1/X20 FILTER NORM/100 kHz FILTER NORM (OUT) SEP/COM A SEP (OUT)	
b.	Connect the HP 3325A rear panel 1 MHz REF OUT, through a 50-ohm feedthrough to the Channel A Input BNC.
c.	Set the HP 3325A Synthesizer/Function Generator to 10 kHz square wave at 1.00 mV p-p. Connect the output of the HP 3325A to the CHANNEL B input BNC through a 50-ohm feedthrough.
d.	Verify the Channel A and B Trigger lights are flashing.
e.	Press the 5315A/B front panel RESET. The 5315A/B should display 100.000 ±1 count.
f.	Record the results on the test card (PASS/FAIL).
VII. TIME INTERVAL AND TIME INTERVAL AVERAGE	
a.	Specifications:
1.	Time Interval: 100 ns to 10e5 seconds.
2.	Time Interval Average: 0 ns to 10e5 seconds.
b.	Set-Up:
FUNCTION SELECT T.L. A-B/T.L. AVG A-B OUT FUNCTION SET (Blue Shift Key) fully CCW, but not in HOLD GATE TIME/DELAY control MAX (CW) CHANNELS A&B TRIG LVL/SENS controls SENS (IN) CHANNELS A&B SLOPES POS (OUT) CHANNEL B SLOPE CHANNELS A&B AC/DC CHANNELS A&B FILTER NORM/100 kHz FILTER NORM (OUT) SEP/COM A COM A (IN)	
c.	Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.
d.	Set the HP 3325A to 500.013 kHz square wave at 300 mV p-p. The 5315A/B should display 1.0 E-6s ±1 count.
e.	Press Function Set (Blue Shift Key) IN. The 5315A/B should display 1.000 E-6s ±5 ns.
f.	Change the Channel B Slope to Positive (OUT). The 5315A/B should display either 2.000 E-6s ±5 ns or 0. E-9s ±5 ns.
g.	Change the Channel A Slope to Negative (IN). The 5315A/B should display 1.000 E-6s ±5 ns.
h.	Change the Channel B Slope to Negative (IN). The 5315A/B should display 0. E-9 ±5 ns, or 2.000 E-6s ±5 ns.
i.	Record the results on the test card (PASS/FAIL).

Table 4-2. 5315A/B In-Cabinet Performance Test (Continued)

VIII. TOTALIZE	
a.	Specification: 0 to 100 MHz.
b.	Set-Up:
FUNCTION SELECT FUNCTION SET (Blue Shift Key) OUT TOT STOP/TOT START fully CCW, but not in HOLD CHANNELS A&B TRIG LVL/SENS controls MAX (CW) CHANNELS A&B TRIGGER LEVEL/SENSITIVITY SENS (IN) CHANNELS A&B SLOPES POS (OUT) CHANNELS A&B AC/DC DC (IN) CHANNELS A&B ATTN X1/X20 X1 (OUT) FILTER NORM/100 kHz FILTER NORM (OUT) SEP/COM A SEP (OUT)	
c.	Connect an HP 3325A Synthesizer/Function Generator, through a 50-ohm feedthrough, to the 5315A/B Channel A Input BNC.
d.	Set the HP 3325A to 1 Hz at 100 mV rms. The 5315A/B should display 0.
e.	Press the Function Set (Blue Shift Key) IN. Verify the 5315A/B is counting at a 1 count/second rate. The trigger LED will also flash at this rate.
f.	Release the Function Set (Blue Shift Key) OUT. The 5315A/B should display the total number of pulses counted. The GATE light should be OFF.
g.	Record the results on the test card (PASS/FAIL).
IX. GATE TIME	
a.	Set the Function Select to FREQ C/GATE TIME, and the Function Set (Blue Shift Key) IN. Vary Gate time pot from Min (CCW but not HOLD) to MAX (CW). The 5315A/B should display: 60 ms to 10 seconds nominal
b.	Set the Gate Time control to HOLD (detent). The 5315A/B should stop gating and hold the last measurement. The Gate Light should be OFF.
c.	Record the results on the test card (PASS/FAIL).
X. TIME INTERVAL DELAY	
a.	Specification:
b.	Set-Up: Variable delay: 500 μ s to 30 ms (nominal) between Channel A START and the enabling of Channel B STOP.
c.	Record the results on the test card (PASS/FAIL).
X. TIME INTERVAL DELAY	
a.	Specification:
b.	Set-Up: Variable delay: 500 μ s to 30 ms (nominal) between Channel A START and the enabling of Channel B STOP.
c.	Record the results on the test card (PASS/FAIL).
d.	Set the HP 3325A to 250 Hz at 100 mV rms. Verify the Channels A and B Trigger Lights are flashing. The 5315A/B should display: 2 E-3.
e.	Slowly increase the GATE TIME control CW. The 5315A/B should jump from 2 E-3s to 6 E-3s and continue to increase in 4 ms steps to greater than 20 ms.
g.	Record the results on the test card (PASS/FAIL).

Table 4-2. 5315A/B In-Cabinet Performance Test (Continued)

XI. CHANNEL C FREQUENCY RESPONSE AND SENSITIVITY

a. Specifications:

- | | |
|----|--------------------------------------|
| 1. | 15 mV rms (-23.5 dBm), 50-650 MHz. |
| 2. | 75 mV rms (-9.5 dBm), 650 MHz-1 GHz. |

b. Set the 5315A/B front panel controls as follows:

FUNCTION SELECT **FREQ C/GATE TIME (IN)**
FUNCTION SET (Blue Shift Key) **(OUT)**
GATE TIME/DELAY control **fully CCW, but not in HOLD**
CHANNEL A TRIGGER LVL/SENS C **fully CW**

- c. Connect the HP 8660C/86602A Synthesized Signal Generator, the HP 436A Power Meter, and the 5315A/B as shown in *Figure 4-1*.
- d. Set the HP 8660C Signal Generator to 50 MHz. Set output level for -23.5 dBm on the HP 436A Power Meter. Verify the 5315A/B gates and displays the 50 MHz. Repeat for 150 MHz, 350 MHz, and 650 MHz.
- e. Increase the HP 8660C/86602A output level for -9.5 dBm on the HP 436A Power Meter. Verify the 5315A/B gates and displays the proper frequency. Repeat for 900 MHz and 1000 MHz.
- f. Record the results on the test card (PASS/FAIL).

PERFORMANCE TEST CARD

HEWLETT-PACKARD MODEL 5315A/B
UNIVERSAL COUNTER
Test Performed By _____
Serial Number _____
Date _____

DESCRIPTION	CHECK
-------------	-------

- | | |
|--|-------|
| I. DISPLAY TEST (PASS/FAIL) | _____ |
| II. SELF CHECK (PASS/FAIL) | _____ |
| III. CHANNEL A FREQUENCY RESPONSE AND SENSITIVITY | _____ |
| 30 Hz-10 mV sensitivity specification (VALUE) | _____ |
| 100 MHz-10 mV sensitivity specification (VALUE) | _____ |
| IV. CHANNEL B FREQUENCY RESPONSE/SENSITIVITY AND RATIO A/B (PASS/FAIL) | _____ |
| V. PERIOD A (PASS/FAIL) | _____ |
| VI. A BY B (PASS/FAIL) | _____ |
| VII. TIME INTERVAL AND TIME INTERVAL AVERAGE (PASS/FAIL) | _____ |
| VIII. TOTALIZE (PASS/FAIL) | _____ |
| IX. GATE TIME (PASS/FAIL) | _____ |
| X. TIME INTERVAL DELAY (PASS/FAIL) | _____ |
| XI. CHANNEL C FREQUENCY RESPONSE/SENSITIVITY (PASS/FAIL) | _____ |

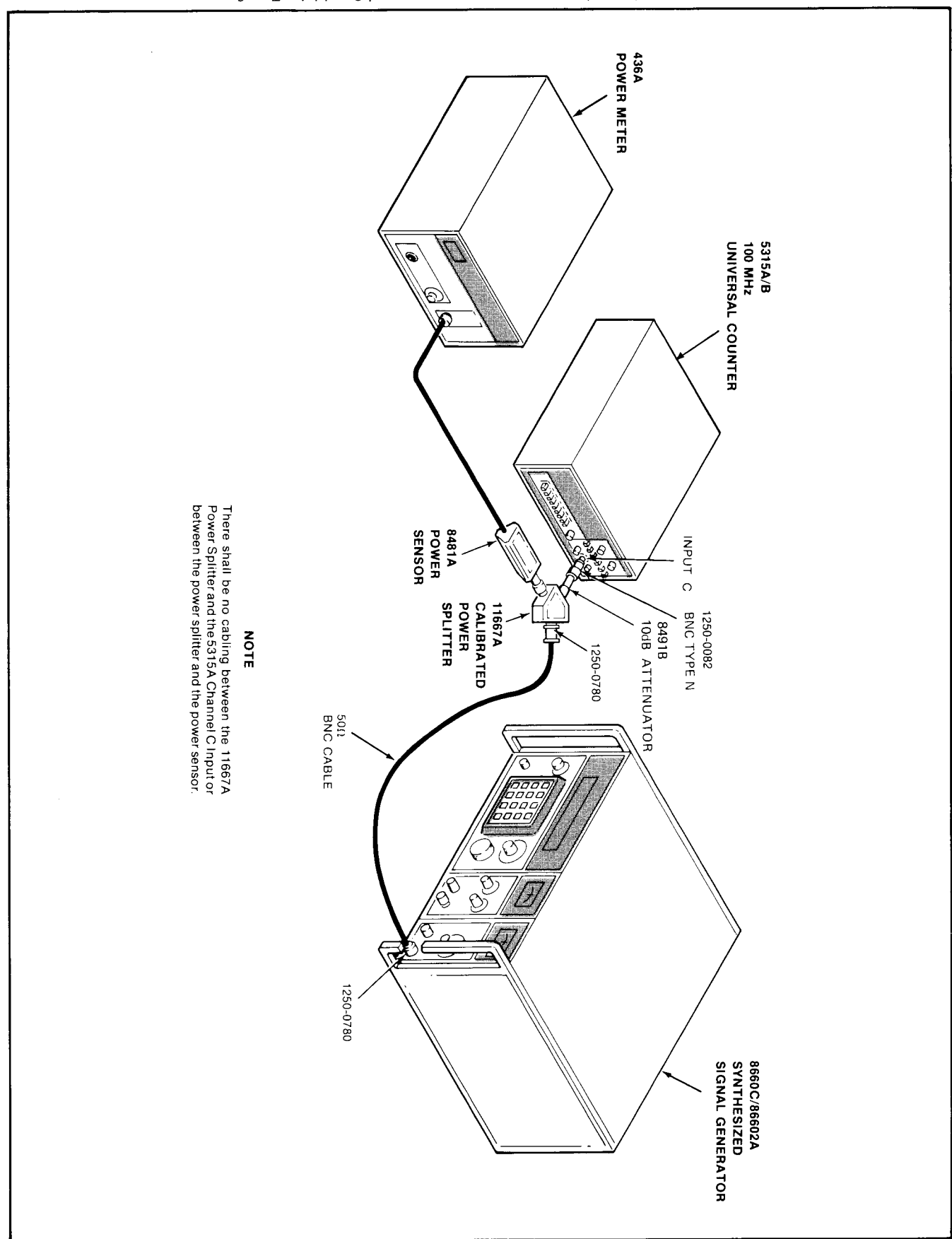


Figure 4-1. Channel C Frequency Response and Sensitivity Test Setup

SECTION V ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes the adjustments required to maintain the 5315A/B operating characteristics within specifications. Adjustments should be made when required, such as after a performance test failure or when components are replaced that may affect an adjustment.

5-3. *Table 5-1* is a list of all adjustable components in the 5315A/B and indicates the order in which adjustments should be performed.

5-4. EQUIPMENT REQUIRED

5-5. The test equipment required for the adjustment procedures is listed in *Table 5-1, Recommended Test Equipment*. Substitute instruments may be used if they meet the critical specifications.

5-6. FACTORY SELECTED COMPONENTS

5-7. Factory selected components are shown on schematics with an asterisk by the reference designator. *Table 5-2* lists selected components, possible values and basis for selection.

5-8. ADJUSTMENT LOCATIONS

5-9. *Figures 5-1* through 5-5 illustrate the location of all adjustments and test points used in the 5315A/B adjustment procedures.

WARNING

MAINTENANCE DESCRIBED HEREIN IS PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT, AND PROTECTIVE COVERS REMOVED. SUCH MAINTENANCE SHOULD BE PERFORMED ONLY BY SERVICE-TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED (FOR EXAMPLE, FIRE AND ELECTRICAL SHOCK). WHERE MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER SHOULD BE REMOVED.

BEFORE ANY REPAIR IS COMPLETED, ENSURE THAT ALL SAFETY FEATURES ARE INTACT AND FUNCTIONING, AND THAT ALL NECESSARY PARTS ARE CONNECTED TO THEIR PROTECTIVE GROUNDING MEANS.

- 5-12. Use the following procedure to change the power transformer primary line voltage switch setting in the 5315A.
- a. Disconnect the power cable from the rear panel of the 5315A.
 - b. Turn the 5315A upside down and remove the four screws near the corners of the cabinet bottom.
 - c. Holding the top and bottom covers together, turn the 5315A right side up and carefully lift the top cover off.
 - d. Refer to *Figure 5-7* which shows the line fuse holder and the line voltage selection switches. Both switch indicators must be set to the line voltage selection marks to match the available line voltage.

5-11. 5315A Voltage Selector

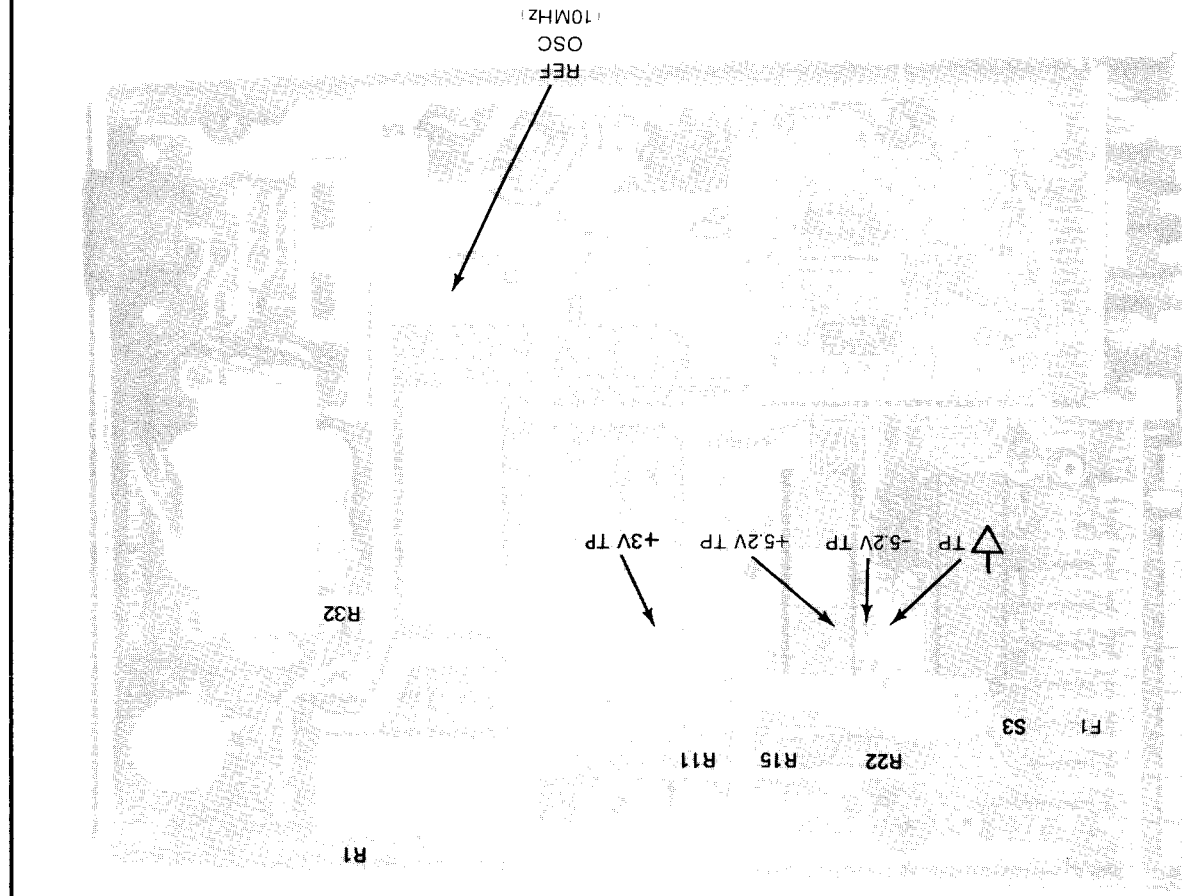
5-10. ADJUSTMENT PROCEDURES

Component	Service Sheet Figure No.	Range of Values	Basis For Selection
A13C2	8-14 and 8-16	22 pF nom (15-33 pF)	Selects the capacitor value that gives an output as close as possible to 10 MHz with A13C1 and A13C3 centered.

Table 5-2. Factory Selected Components

Procedure	Adjustment	Comments
1. 5315A (Only) Power Transformer Primary Line Voltage Selection	A1S3	Set to match available line voltage
2. Power Supply Adjustments	A1R15 A1R11(5315A); A1R12(5315B)	for +5V for +3V for -5.2V
3. Input Offset Adjustment	A4R32 R1	Channel A Channel B
4. Local Oscillator Adjustment	A13C1 A13C3	Fine Frequency Coarse Frequency
5. Option 001 Adjust	Part of A7Y1	Freq Adj
6. Option 002 Adjust	A6R14, A6R15	Adjustment of 500 mA charger
7. Option 003 Adjust	L, HY, H, CL	A3/A4 assembly must be removed prior to adjustment
8. Option 004 Adjust (5315A)	A14R1	+5V Adj
9. Option 004 Adjust (5315B)	P/O A15Y1	Freq Adj

Table 5-1. Adjustments



HP 5315A

220V	240V	120V	100V
FUSE	FUSE	FUSE	FUSE
125	125	250	250
mA	mA	mA	mA

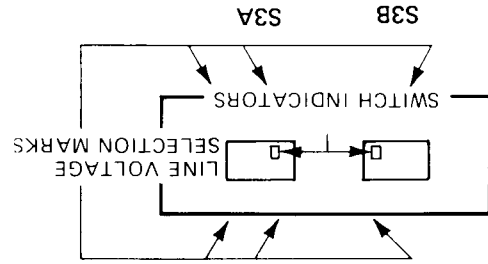


Figure 5-1. 5315A Adjustment Component Locations

- a. Connect an oscilloscope to Pin 5 of A4P2.
 - b. Using a 50Ω feedthrough, connect a 10 MHz sine wave to Channel A input BNC.
 - c. Set the appropriate Trigger Level/Sensitivity switch to SEHS with the control fully clockwise.
 - d. Adjust oscilloscope for stable display and then decrease amplitude of 10 MHz sine wave to the minimum allowable (typically 10 mV rms) to maintain display.
 - e. Adjust A4R32 for 50-50 duty cycle of the oscilloscope display.
 - f. Reconnect oscilloscope to Pin 6 of P2 and 10 MHz sine wave to Channel B input BNC.
 - g. Repeat steps c and d.
 - h. Adjust A4R1 for 50-50 duty cycle of the oscilloscope display.
 - i. This completes the input offset adjustments.
- 5-16. The input offset adjustments are made to the A4 assembly as follows. Refer to *Figures 5-1* or *5-2*.

5-15. Input Offset Adjustments

- a. Connect a DMM to TP +5 and adjust A1R15 for +5V dc ± 0.01 V dc.
 - b. Connect a DMM to TP +3 and adjust A1R11 (5315A) or A1R12 (5315B) for +2.85V dc ± 0.01 V dc.
 - c. Connect a DMM to TP -5.2 and adjust A1R22 for -5.2V dc ± 0.01 V dc.
- 5-14. The 5315A/B produces three regulated dc supply voltages which should be adjusted in the following order. Refer to *Figures 5-1* or *5-2*.

5-13. Power Supply Adjustments

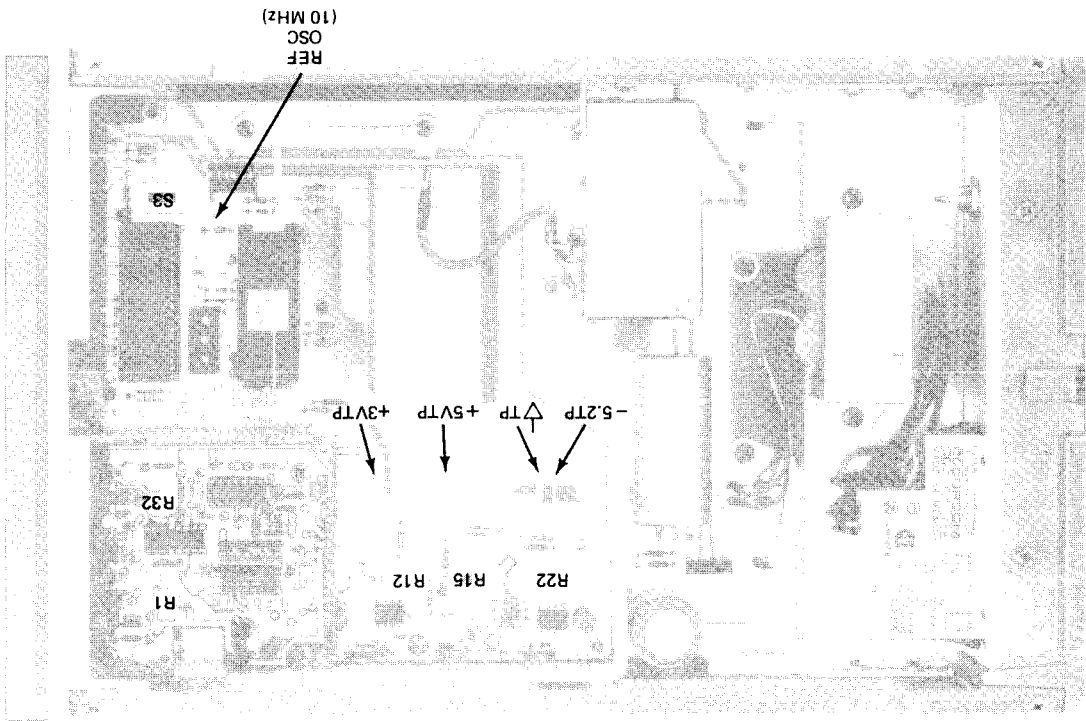
Check the line fuse, F1. It must correspond to the line voltage selected. Refer to the specifications in Section I for the correct value fuse.

CAUTION

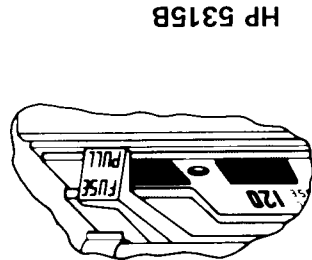
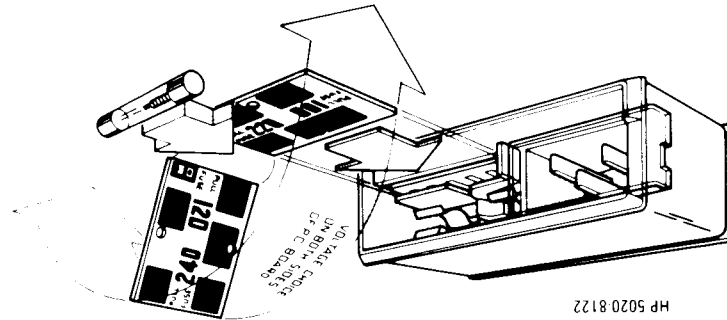
- e. Set the line voltage switches to appropriate positions for the available line voltage.

The possible line voltage ranges are listed in Section I, Specifications. Refer to this list to decide where the selection switches should be set.

NOTE



PC BOARD PART NUMBER IS
HP 5020 8122



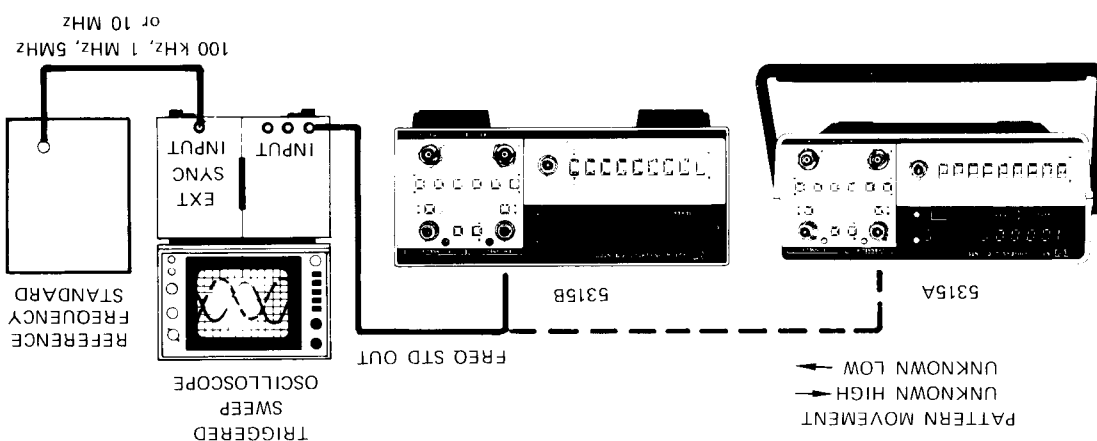
- SELECTION OF OPERATING VOLTAGE
1. Open cover door and rotate fuse pull to left.
 2. Select operating voltage by orienting PC board to position desired voltage on top left side. Push board firmly into module slot.
 3. Rotate fuse pull back into normal position and re insert fuse in holders, using cautions to select correct fuse value.

HP 5315B

Figure 5-2. 5315B Adjustment Component Locations

- Connect reference frequency standard to the external SYNC input of the oscilloscope.
- Connect Channel A input of oscilloscope to the A1 REF OSC test point in the 5315A. The 5315A may be connected via the REFERENCE OUTPUT/INPUT BNC on the rear panel.
- Adjust oscillator frequency for minimum sideways movement of the 10 MHz display signal with ADJ on the TCXO. See *Figure 5-3*.

5-21. ADJUSTMENT OF OPTION 001 (FOR OPERATION AT 25°C)



5-20. Two procedures are given for the adjustment of Option 001 (TCXO). If the operation of the counter will be solely at 25°C (78°F), adjust the frequency of the oscillator as close to 10 MHz as possible using the first procedure given. If the operation of the counter will be over the full temperature range (0°C to 40°C), then the oscillator must be offset by the marked amount in order to keep the oscillator frequency within the manufacturer's temperature specification. To adjust the oscillator to the offset frequency, use the second procedure.

5-19. Option 001 Oscillator Adjustment (TCXO)

The most accurate and stable adjustment will be attained by allowing at least a one hour warmup of the 5315A/B with the covers in place. This allows the instruments internal temperature to stabilize. Perform the adjustment immediately upon removing the cover.

NOTE

- Connect a known reference frequency (≥ 1 MHz) to Channel A input. See *Table 1-1* Specifications, for maximum input requirements and range.
 - Press function key GATE TIME and insure the Blue Shift key is in the IN position.
 - Adjust the GATE TIME control for ≈ 1 second gate.
 - Press function key FREQ A and insure that the Blue Shift key is in the OUT position.
 - Adjust A13C1 (FINE) and if necessary A13C3 (COARSE) for the most accurate display of the reference frequency. Refer to A13C2 in *Table 5-2* if the reference frequency cannot be set on the display.
- 5-18. Every few months, the reference oscillator should be checked to a known or house frequency standard. When adjustment is required, use the following method. Refer to *Figure 5-3*.

5-17. Standard Oscillator Adjustment

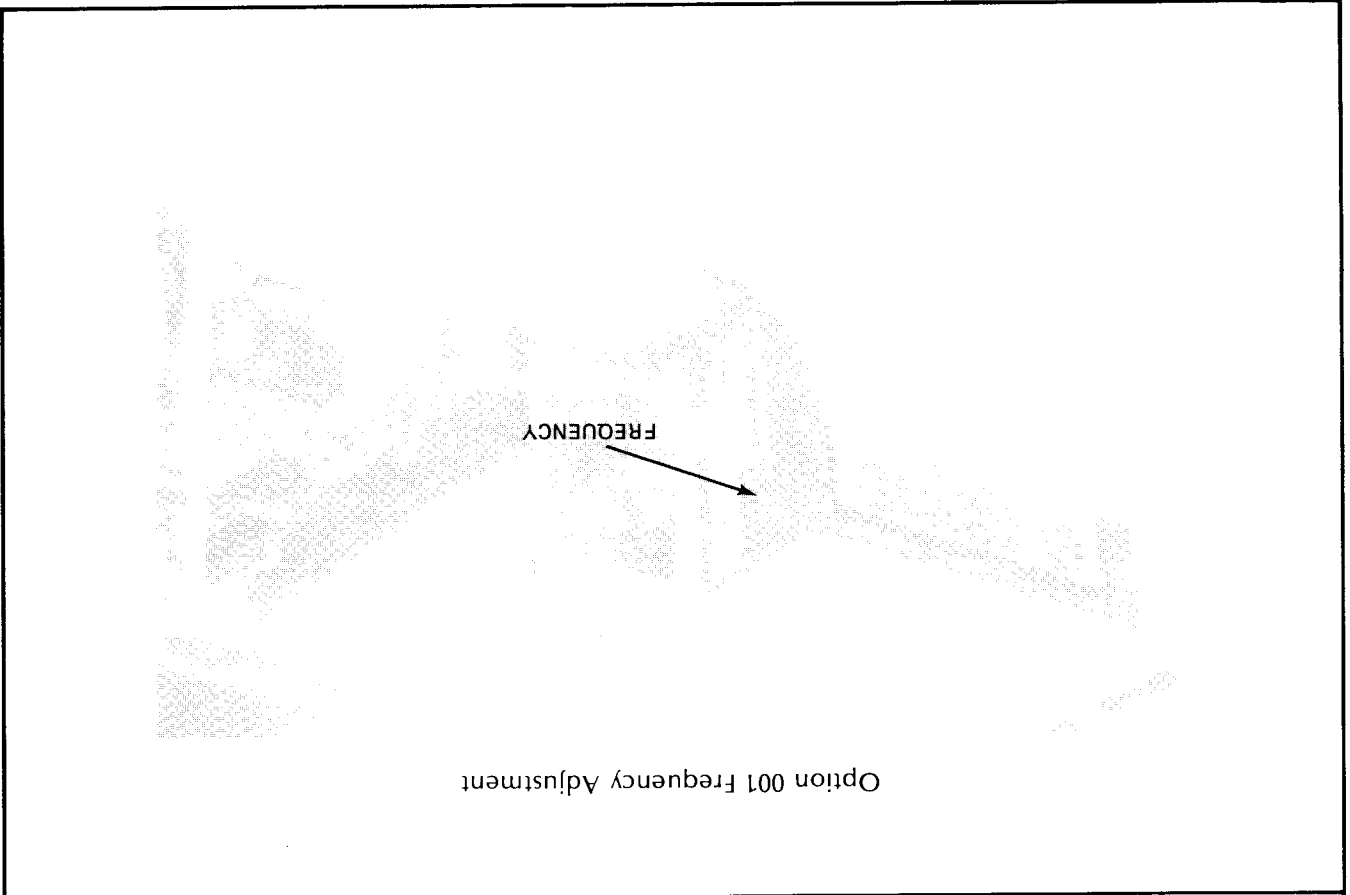
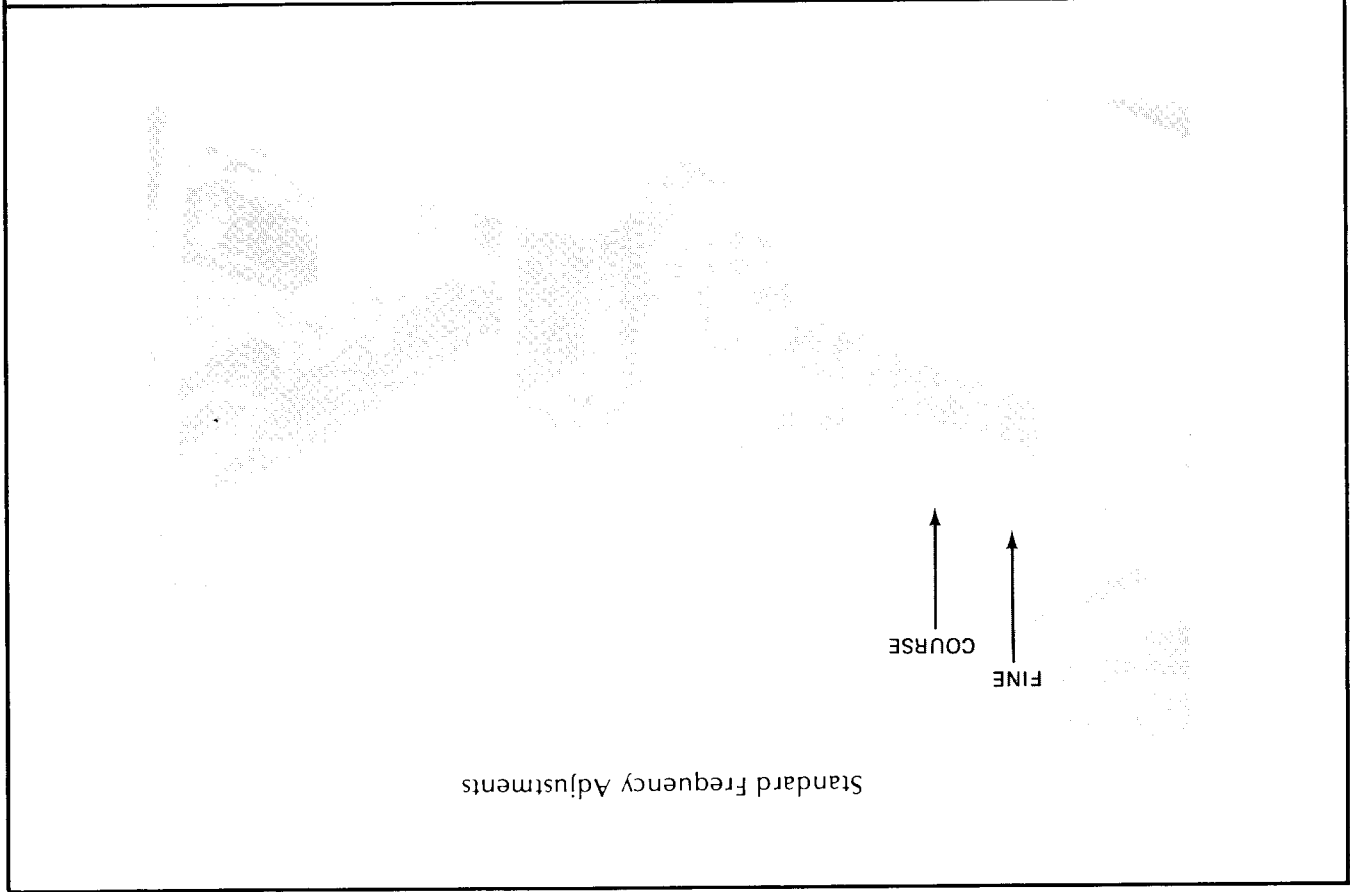
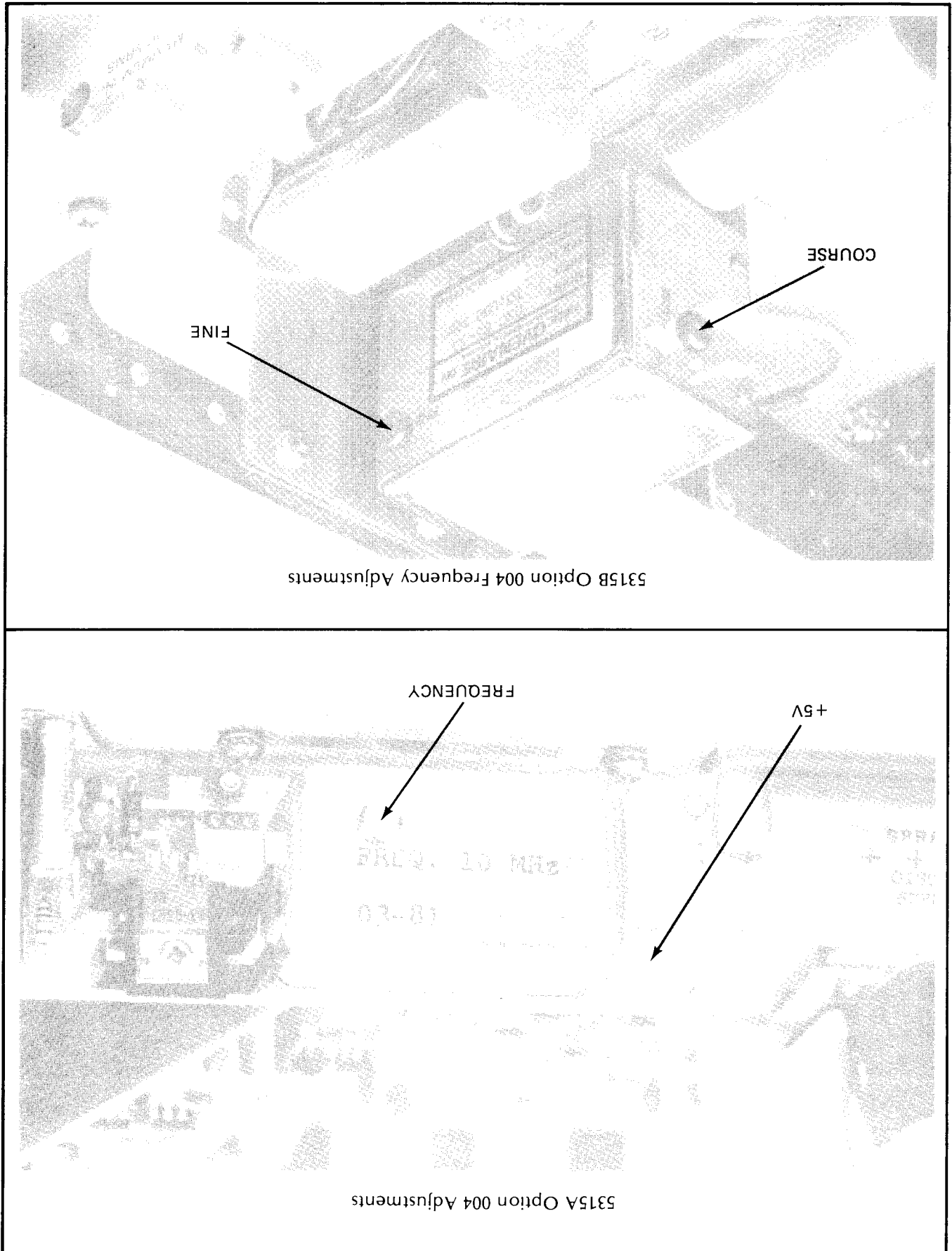


Figure 5-3. Reference Oscillator Adjustment Locations (Standard and Option 001)

Figure 5-3. Reference Oscillator Adjustment Locations (Option 004)



5-26. The following battery charger adjustment procedure applies to the Model 5315A with serial numbers prefixed 2120A and above. Refer to Figure 5-4.

5-25. Option 002 Battery Charger Adjustment

By timing the horizontal movement (in cm per second), the drift rate (compared to the reference standard) can be determined by using the sweep speed table shown for TCXO adjustment.

NOTE

- e. Adjust the oscillator frequency for a stationary or minimum horizontal movement of the waveform displayed on the oscilloscope.
- d. If adjustment is required, remove the dust cap screw if necessary. The 5315A has only one adjustment while the 5315B has FINE and COARSE adjustments. The COARSE adjustment should be used only when the FINE adjustment does not have sufficient range.
- c. Connect the oscilloscope's Channel A input to the REF OSC test point on A1 motherboard of the 5315A. Connect the oscilloscope to the REFERENCE OUTPUT/INPUT BNC on the rear panel of the 5315B.
- b. Connect the test equipment as shown in the Option 001 (TCXO) adjustment setup.
- a. On the 5315A only, verify setting of +5V regulator on oscillator assembly. If necessary, adjust A14R1 (+5V ADJUST) for 5.000V dc ± 0.025 V dc monitored at the +5V pin of the oven module.
- method. Refer to Figure 5-3.

5-24. Initially (to maintain specified accuracy) oven oscillators may require frequent adjustment until they have undergone an aging process. To adjust the 5315A Option 004, the instruments top and bottom cover must be removed. Allow at least one hour of warmup for oven internal temperature to stabilize before attempting adjustment. After adjustment is made, allow a fifteen minute settling period and then verify setting. When adjustment is required, use the following

5-23. Option 004 Oven Contained Oscillator Adjustment (5315A/B)

- c. Adjust the oscillator frequency (via ADJ) for 10 MHz, $\pm$ the offset marked on the TCXO label. For example, if +3.6 Hz is marked on the label, adjust the oscillator for a frequency of 10.0000036 MHz at 25°C. Refer to Figure 5-3.
- b. Connect the Channel A input of the 5345A to the Option 001 oscillator signal at A1 "REF OSC" test point. The 5315B may be connected via the REFERENCE OUTPUT/INPUT BNC on the rear panel.
- a. Connect a reference frequency to the EXT FREQ STD INPUT of a high resolution frequency counter (reciprocal taking) such as an HP 5345A.

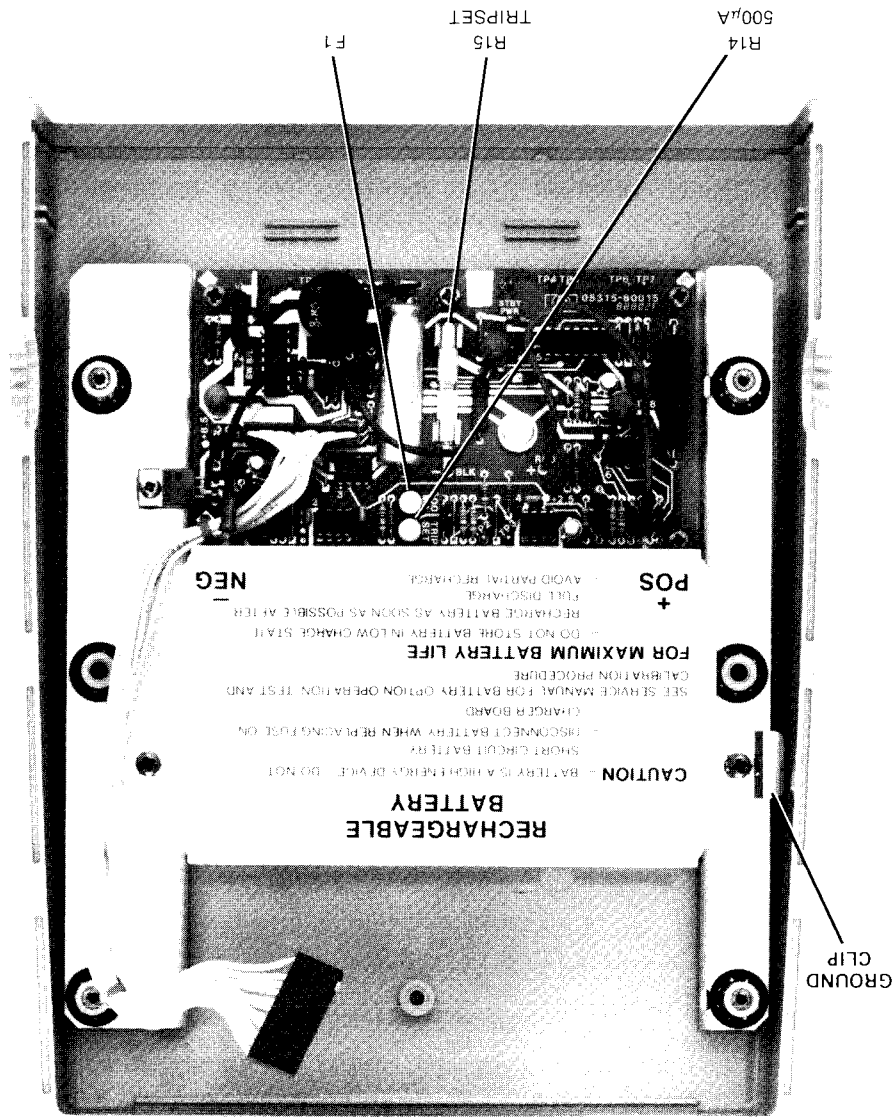
5-22. ADJUSTMENT OF OPTION 001 (OPERATION OVER 0°C to 40°C RANGE)

For example, if the trace moves 1 centimeter in 10 seconds and the sweep speed is 0.01 μ s/cm, the oscillator signal is within 1×10^{-9} of the reference frequency.

Movement	SWEEP SPEED			NOTES
	1 μ s/cm	0.1 μ s/cm	0.01 μ s/cm	
1 cm/s	1 $\times 10^{-6}$	1 $\times 10^{-7}$	1 $\times 10^{-8}$	TIME SCOPE TRACE MOVEMENT WITH SECOND HAND OR WATCH OR CLOCK
1 cm/10 s	1 $\times 10^{-7}$	1 $\times 10^{-8}$	1 $\times 10^{-9}$	
1 cm/100 s	1 $\times 10^{-8}$	1 $\times 10^{-9}$	1 $\times 10^{-10}$	

- d. By timing the sideways movement (in CM per second), the approximate offset can be determined based on the oscilloscope sweep speed as shown in the following:

Figure 5-4. Option 002 Battery Charger Adjustment Locations



- a. Disconnect the power cable from the 5315A.
- b. Disconnect the battery from A6 (05315-60015) battery charger assembly board.
- c. Connect cable W4 between A1J4 and A6J1.
- d. Connect the DVM positive lead to W2 (red wire) and negative lead to the ground test point on the battery charger assembly board.
- e. Connect the power cable to 5315A; set the STBY/ON switch to STBY.
- f. Set the TRIP SET adjustment A6R15 fully ccw. Connect a jumper clip between A6TP2 and the ground test point.

CAUTION

Shorting the test points in the next step will cause A6R38 (a large 12Ω resistor) to heat up. Avoid physical contact with this component. Do not leave shorting clip in place for an extended period of time.

- g. Connect A6TP6 to A6TP7 with a shorting clip.
- h. Set the 500 mA adjustment A6R14 for a DVM reading of 7.71 volts.
- i. Rotate the TRIP SET control A6R15 slowly clockwise until the charging LED (CHGD) just lights. This sets the comparator high trip point.

NOTE

Due to hysteresis of approximately 500 mV in the charge comparator circuit, it is not possible to obtain correct setting by “rocking” the TRIP SET adjustment. The trip point is attainable only by cw rotation of the control. To verify the setting, or to repeat above adjustment, it is necessary to rotate the adjustment slightly ccw from the trip point, and then to reduce the charge voltage below the hysteresis limit. This can be readily accomplished by switching the 5315A power switch to ON, then back to STBY (out).

- j. Connect the negative lead of the DVM to W3 (black wire). Adjust the 500 mA control until the DVM reads 5.00 volts. (This sets the 500 mA charge current.)
- k. Disconnect the shorting clip between A6TP6 and A6TP7.
- l. Set STBY/ON switch to the ON position. Connect A6TP4 and A6TP5 together with a shorting clip. The DVM should read between 1.9 and 2.4 volts. (This verifies operation of the 10 mA current regulator.)
- m. Remove all shorting clips and jumper wires. Turn the instrument off and disconnect the power cable. Disconnect all the test equipment.
- n. Reconnect the charger board red and black wires to the battery observing proper polarity. Be sure that the wire clips are fully engaged.
- o. Replace the top cover. Be sure that the four black spacers (MP4) are in place. As the cover is being positioned, be sure that the leads of the cable assembly W4 will not be pinched between the cover and rear spacer.

- a. Remove the AC power cord.
- b. Remove the instrument top cover (MP 12) by removing the screw which secures the carrying handle (MP 11) at rear of instrument. Slide the cover backward until free.
- c. Remove the gray trim strip (MP 16) from top of the instrument front frame (MP 17).
- d. Remove the four screws which secure the front panel (MP 12). The front feet of the instrument must be removed to access the two screws on the frame bottom.

5-31. 5315B A3/A4 REMOVE/REPLACE PROCEDURE

- a. Remove the AC power cord.
- b. Remove the instrument top cover (MP 12) by removing the four screws accessible from the cabinet bottom.
- c. Remove the LEVEL/SENS and GATE TIME control knobs.
- d. Remove the three screws which secure the motherboard to cabinet bottom. Remove the handle (MP 3) and the four black spacers (MP 4) and lift the entire instrument straight up and out.
- e. Turn the instrument upside-down and carefully remove the brass SMC connector from the A9 INPUT C BNC assembly.
- f. Remove the front panel hex nuts on the CHANNEL A and B BNC's, the three control hex nuts and the 1/4" hex nut on the back side of the display board. Pull the front panel (MP 6) straight out and off.
- g. Remove the four screws securing the A4 Input Amplifier. Remove the A3/A4 assembly by gently lifting on the rear edge of A4, until the pins come free of motherboard connector A15.
- h. Reconnect the brass SMC connector to the INPUT C BNC assembly, loosely replace the front panel and set the instrument into the cabinet bottom.
- i. Replace the AC power cord, and refer to the OPTION 003 Adjustment Procedure.
- j. Replacement is the reversal of this procedure.

5-30. 5315A A3/A4 REMOVE/REPLACE PROCEDURE

5-29. Access to the OPTION 003 test points and adjustments on A9 requires the removal of the A3/A4 Input Switch/Amplifier assembly. To remove and replace the A3/A4 assembly in a 5315A or 5315B, refer to the appropriate procedure that follows.

5-28. The following procedure describes the adjustments required to maintain the OPTION 003 operating characteristics within specifications. Adjustments should be made when required, such as after a performance test failure, or when components are replaced that may affect an adjustment.

5-27. Option 003 1 GHz Channel C Adjustment

NOTE:

The following two steps only apply to instruments with serial numbers prefixed 1812A through 2032A.

- e. Remove the two screws which secure the support bracket, on the left side of A1 motherboard, to the instrument side frame.
- f. Remove the two screws and bracket which secure the A1 power supply heat sink to the instrument side frame.
- g. Remove the two screws at the rear edge of A1 motherboard.
- h. Disconnect the three power transformer secondary wires (BLU, BLU, WHT-BLU) from the A1 motherboard, by pulling the push-on connectors straight up and off the gold test pins. Remove the OSC OUT wire which connects J8 to A1 motherboard in the same manner.

NOTE

HP 5315B instruments with serial number 1832A00120 or lower do not have push-on connectors on the transformer secondary or EXT REF wires. Carefully solder the wires on these instruments to complete the procedure.

- i. Carefully pull the entire instrument straight forward, through the front frame, and clear of the cabinet.
- j. Remove the LEVEL/SENS and GATE TIME front panel control knobs.
- k. Remove the front panel hex nuts on CHANNEL A and B INPUT BNC's and the three control hex nuts.
- l. Remove the 1/4" hex nuts on the left side (back) of the A2 Display Assembly.
- m. Gently pull the front panel (MP 21) straight forward. Carefully remove the brass SMC connector from the A9 INPUT C BNC assembly. Pull the front panel clear. Note the spacer between the front panel and A2. On older instruments, the spacer is not attached to the front panel.
- n. Remove the four screws securing the A4 Input Amplifier Assembly. Remove the A3/A4 assembly by gently lifting on the rear edge of A4, until the pins come free of motherboard connector A1 J5.
- o. Reconnect the brass SMC connector to the INPUT C BNC assembly and loosely replace the front panel.
- p. Position the cabinet and A1 motherboard assembly side by side, with the cabinet facing to the rear. Route the three power transformer secondary wires through the cabinet side frame and reconnect to A1 motherboard test pins. Insure the wire colors match the pins as labeled.
- q. Carefully replace the AC power cord, and refer to the OPTION 003 Adjustment Procedure.
- r. Replacement is the reversal of this procedure. Be sure that the A1 motherboard fits into the grooves in the board guide.

5-32. OPTION 003 1 GHz CHANNEL C ADJUSTMENT PROCEDURE

5-33. To perform adjustments on OPTION 003, first follow the appropriate disassembly procedure for removal of the A3/A4 Input Switch/Amplifier Assembly. (Refer to Preliminary Disassembly Procedures.)

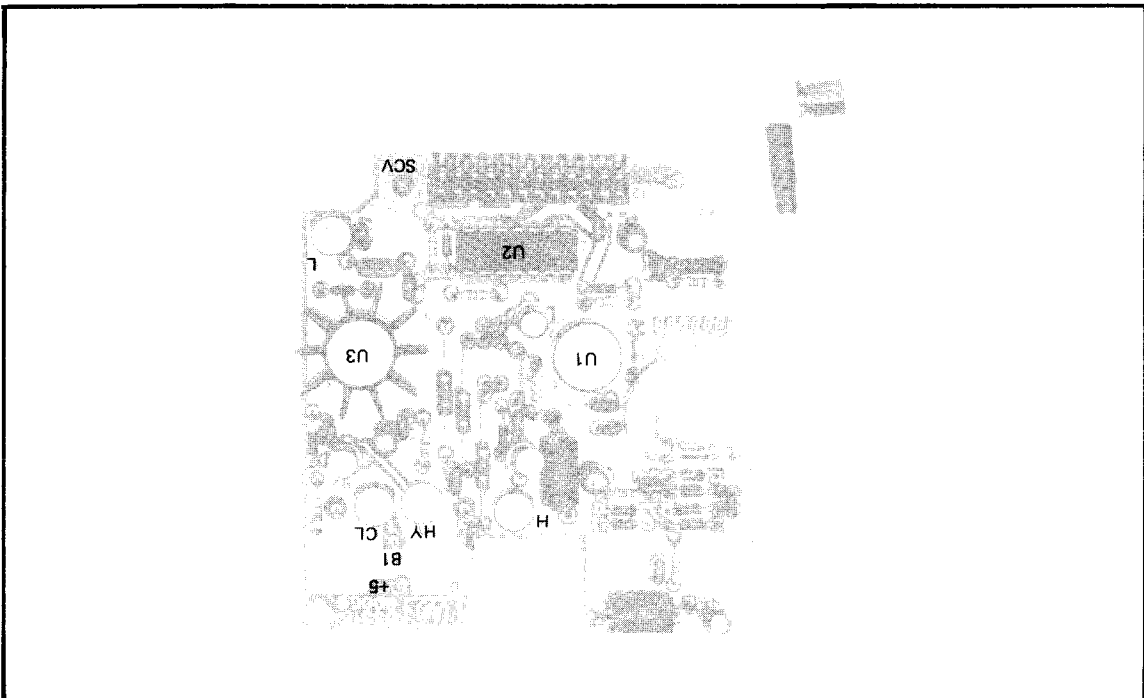


Figure 5-5. Option 003 Channel C Adjustment Locations

- Connect a jumper wire between TP marked SCV and the TP marked +5.
- Connect a 8660A signal generator to the C Channel input BNC. Set the 8660A for a frequency of 100.000 MHz, at an output level of 0.5V rms.
- Connect a 3465A Digital Voltmeter between A9 U2 (pin 8) and ground. Set the adjustment labeled "L" for a reading of $2.6V \pm 5$ mV on the voltmeter.

NOTE

The voltmeter must be a "floating" type.

- Reduce the 8660A output level to 0.5 mV rms. Connect the 3465A positive lead to TP "B1" and common lead to TP "B2". Set the adjustment labeled "HV" for a reading of $110 \text{ mV} \pm 1$ mV on the voltmeter.
- Increase the 8660A output level to 50 mV rms. Set the adjustment labeled "H" for a reading of $75 \text{ mV} \pm 1$ mV (differential between TP B1 and TP B2) on the voltmeter.
- Connect the 3465A positive lead to TP "C". Set the adjustment labeled "CL" for a reading of $37 \text{ mV} (+1 - 0)$. The counter display should read $100.0000 \text{ MHz} \pm \text{time base discrepancy} \pm 1$ count. (Note: For 5315B, connect EXT REF from 8660A to rear REFERENCE INPUT of counter and set motherboard FREQ STD select switch A1 S3 to EXT.
- Recheck steps d, e, and f to verify all voltages. Repeat steps until all adjustments are within tolerance.
- Set the 8660A output level to 75 mV rms at 900 MHz. Verify that the counter displays 900.000 MHz. This completes the adjustment.

SECTION VI REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. *Table 6-1* lists abbreviations used in the parts list and throughout the manual. *Table 6-2* lists all replaceable parts for the standard 5315A/B in reference designation order. *Tables 6-3, 6-4, and 6-5* list replaceable parts for Options 001, 002, and 003, respectively. *Tables 6-6 and 6-7* list parts for Option 004 (5315A and 5313B, respectively). *Table 6-8* contains the names and addresses that correspond with the manufacturer's code numbers. *Table 6-9* lists the 5315A/B hardware. *Figures 6-1 through 6-5* show Cabinet and Option parts.

6-3. ABBREVIATIONS

6-4. *Table 6-1* lists abbreviations used in the parts list, schematics, and throughout the manual. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviations forms are used with lower case and upper case letters.

6-5. REPLACEABLE PARTS

6-6. *Tables 6-2 through 6-7* are the lists of replaceable parts, and are organized as follows:

- a. Electrical assemblies and their components in alphanumerical order by reference designation.
- b. Chassis-mounted parts in alphanumerical order by reference designation.
- c. Miscellaneous parts.

6-7. The information given for each part consists of the following:

- a. The Hewlett-Packard part number.
- b. The part number check digit (CD).
- c. The total quantity (Qty) used in the instrument.
- d. The description of the part.
- e. A typical manufacturer of the part in a five-digit code.
- f. The manufacturer's number for the part.

6-8. The total quantity of each part used within an assembly is given only once at the first appearance of the part number in the list.

6-9. ORDERING INFORMATION

6-10. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-11. To order a part that is not listed in the replaceable parts table, include the instrument model number, serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

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ABBREVIATIONS

A	= assembly	DL	= delay line	L	= relay	T	= transformer
AT	= attenuator, isolator	DS	= annunciator, signaling device	K	= coil, inductor	TB	= terminal board
B	= fan, motor	F	= miscellaneous electrical part	MP	= miscellaneous mechanical part	TP	= test point
BAT	= battery	F	= fuse	ME	= metre	TC	= thermocouple
CP	= capacitor	FL	= filter	M	= magnetic		
CR	= diode, diode thyristor, varactor	H	= hardware	O	= transistor, SCR, triode thyristor	VR	= voltage regulator, breakdown diode
DC	= directional coupler	J	= electrical connector - stationary	R	= resistor	W	= cable, transmission path, wire
			= electrical connector - stationary	RT	= thermistor	X	= socket
			= port, jack	S	= switch	Y	= crystal unit-piezoelectric
				Z	= tuned cavity, tuned circuit		

ac

= alternating current

ADJ

= adjustment

ACCESS

= accessory

A/D

= analog-to-digital

AF

= audio frequency

AFC

= automatic frequency control

AGC

= automatic gain control

AL

= aluminum

ALC

= automatic level control

AM

= amplitude modulation

AMP

= amplifier

APC

= automatic phase control

ASSY

= assembly

AUX

= auxiliary

AVG

= average

AWG

= american wire gauge

BAL

= balance

BOD

= binary coded decimal

BO

= board

BE CU

= beryllium copper

BFO

= beat frequency oscillator

BH

= binder head

BKDN

= breakdown

BPF

= bandpass

BPF

= bandpass filter

BRS

= brass

BWS

= backward-wave oscillator

CAL

= calibrate

CCW

= counterclockwise

CER

= ceramic

CHAN

= channel

CM

= centimeter

COAX

= coaxial

COEF

= coefficient

COM

= common

COMP

= composition

COMPL

= complete

CONN

= connector

CP

= cathode-ray tube

CRT

= cathode-ray tube

CWL

= continuous wave

CW

= clockwise

D/A

= digital-to-analog

dB

= decibel

dBm

= decibel referred to 1 mW

DC

= direct current

deg

= degree (angle)

= degree (plane angle)

°C

= degree Celsius (centigrade)

°F

= degree Fahrenheit

DEPC

= deposited carbon

DET

= detector

diam

= diameter

DIA

= diameter : used in parts list

DIFF AMP

= differential amplifier

DPDT

= double-pole, double-throw

DSB

= double sideband

DTL

= diode transistor logic

DVM

= digital voltmeter

ECL

= emitter coupled logic

EMF

= electromotive force

EDP

= electronic data processing

ELECT

= electrolytic

ENCAP

= encapsulated

EXT

= external

F

= farad

FET

= field-effect transistor

FI/F

= flip-flop

FM

= that head

FOL H

= filariter head

FM

= frequency modulation

FP

= front panel

FREQ

= frequency

FSD

= fixed

G

= gram

GE

= germanium

GHz

= gigahertz

GL

= glass

GND

= grounded

H

= henry

H

= hour

HEX

= hexadecimal

N/C

= normally closed

NC

= no connection

NA

= nanampere

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6-12. DIRECT MAIL ORDER SYSTEM

6-13. Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are:

- Direct ordering and shipment from the HP Parts Center in Mountain View, California.
- No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing).
- Prepaid transportation (there is a small handling charge for each order).
- No invoices — to provide these advantages, a check or money order must accompany each order.

6-14. Mail order forms and specific ordering information is available through your local HP office. Addresses and phone numbers are located at the back of this manual.

6-15. SPECIAL PARTS REPLACEMENT CONSIDERATIONS

- 6-16. Certain mechanical parts and electrical components require special consideration.
- 5315B Transformer T1: If the power transformer, T1, must be replaced, order HP Part Number 05315-80001. This transformer assembly includes the connectors.
 - Front Panels: Eight front panels are available. The standard front panels have no opening for the Option 003 BNC connector. The following part numbers are valid for instruments with serial numbers prefixed 2120A and above.

5315A Standard	05315-00026
5315A Option 003	05315-00027
5315B Standard	05315-00028
5315B Option 003	05315-00029

For instrument with serial numbers prefixed 1812A through 2032A, the part numbers are:

5315A Standard	05315-00003
5315A Option 003	05315-00004
5315B Standard	05315-00007
5315B Option 003	05315-00008

NOTE

Any time a front panel is reinstalled, consideration should be given to panel alignment. The gate time control must have a backup spacer, either a hex nut or washers, to position the panel in the plane determined by the shoulders on the input BNC connectors.

- 5315B Side Struts: The left and right side struts differ slightly and should not be interchanged. The left strut has four drilled and tapped holes to facilitate the addition of Option 006 Offset/Normalizer. Viewed from the front, the undrilled right strut is HP Part Number 5020-8830 and the drilled left strut is HP Part Number 5020-8885.

- d. Function Switch Assembly A1S1: The function switches are one complete assembly. If any one section is found to be defective the complete block of switches must be replaced. Care should be taken when removing the switch assembly to avoid damage to the A1 Motherboard. The switch assembly is HP Part Number 3101-2297.
- e. Input Amplifier Assembly A3/A4: If either the Input Switch assembly A3, or the Input Amplifier assembly A4 is to be replaced, both must be replaced as one complete assembly by ordering HP Part Number 05315-60100. Do not attempt to separate the assemblies and replace only one.
- f. The two LSI integrated circuits used in the 5315A/B are available only from Hewlett-Packard. Although the Microcomputer A1U1 is not made by HP, the internal ROM is programmed specifically for the Model 5315A/B. The Multiple Register Counter is manufactured by and is available from Hewlett-Packard.
- g. A1 Motherboard: If the A1 Motherboard is to be replaced, order HP Part Number 05315-60013 for 5315A or 05315-60014 for the 5315B. This assembly will include the two LSI integrated circuits A1U1 and A1U2, the heat sink bracket MP1, the A5 Display Support Assembly, and for the 5315A only, the power transformer.
- h. Bottom Cover MP8: The replacement bottom cover (HP Part Number 5060-9963) does not include the information label. The label must be ordered separately under HP Part Number 7120-7489.
- i. A1 Motherboard Slide Rails: If any of the A1 Motherboard slide rails (0403-0373) are to be replaced, new retainers (0510-1152) should be used. Two are required for each rail. Note that the slide rails are not located directly opposite each other.

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	05315-60013	7	1	MOTHERBOARD ASSEMBLY FOR 5315A ONLY. SERIES 2120	28480	05315-60013
A1C1	0160-4557	0	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	56289	CAC04X7R104M050A
A1C2	0180-0562	1	5	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D33X6X0010K41
A1C3	0180-2814	0	1	CAPACITOR-FXD 22UF+-20% 10VDC TA	28480	0180-2814
A1C4	0180-0562	1	6	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D33X6X0010K41
A1C5	0160-3879	7	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3879
A1C6	0160-4554	7	2	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C7	0160-3879	7	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C8	0160-3879	7	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C9	0160-3879	7	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C10	0160-3879	7	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C11	0180-0562	1	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D33X6X0010K41
A1C12	0180-4554	7	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C13	0160-4557	0	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C14	0180-2820	0	0	CAPACITOR-FXD .01UF +-20% 50VDC TA	28480	0180-2820
A1C15	0160-3879	7	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C16	0180-0562	1	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D33X6X0010K41
A1C17	0180-2815	1	1	CAPACITOR-FXD 100UF+-20% 10VDC TA	28480	0180-2815
A1C18	0180-1735	2	1	CAPACITOR-FXD .02UF+-10% 35VDC TA	56289	1500224X9035A2
A1C19	0160-4497	7	1	CAPACITOR-FXD 0.02PF +-5% 200VDC CER 0+-30	28480	0160-4497
A1C20	0180-2891	3	1	CAPACITOR-FXD 4700UF+-100-10% 15VDC AL	28480	0180-2891
A1C21	0180-0562	1	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D33X6X0010K41
A1C22	0180-2820	0	0	CAPACITOR-FXD .02UF+-20% 35VDC TA	28480	0180-2820
A1C23	0160-4557	0	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C24	0160-4557	4	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C25	0180-2892	4	1	CAPACITOR-FXD 2200UF+-75-10% 16VDC AL	28480	0180-2892
A1C81	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1C82	1901-0050	3	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1C83	1901-0050	3	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1C84	1901-0050	3	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1C85	1901-0673	6	1	DIODE-PWR RECT 100V 5A SWS	0358	A154
A1C86	1901-0731	7	1	DIODE-PWR RECT 400V 1A	28480	1901-0731
A1C87	1906-0096	7	1	DIODE-FW BRDG 200V 2A	04713	MDA202
A1F1	2110-0201	0	1	FUSE .25A 250V TO 1.25X.25 UL	75915	313.250
A1J1	1251-4743	0	1	CONNECTOR-6C POWER,MALE	28480	1251-4743
A1J2	1251-4215	1	1	CONNECTOR-6 PIN, FEMALE	28480	1251-4215
A1J4	1251-5370	1	2	CONNECTOR-11 PIN,MALE	28480	1251-5370
A1J5	1251-5281	3	1	CONNECTOR-12 PIN,FEMALE	28480	1251-5281
A1J7	1251-5370	1	1	CONNECTOR-11 PIN,MALE	28480	1251-5370
A1J7	1200-0423	8	1	SOCKET-1C 16-CONT DIP DIP SLDR	28480	1200-0423
A1L1	9100-1637	4	1	INDUCTOR RF-GH-MD 120UH 5% .166DX.39SLC	28480	9100-1637
A1M1	05315-00091	7	1	HEAT SINK	28480	05315-00091
A1M2	1251-3768	7	38	HE POST (PART OF J3)	28480	1251-3768
A1Q1	1853-0363	0	1	TRANSISTOR PNP 5T PD=50W FT=20MHZ	03538	X45M281
A1Q1	0340-0864	6	3	INSULATOR-XSTR NYLON	28480	0340-0864
A1Q2	1854-0477	7	1	TRANSISTOR NPN 2N2222A ST 10-18 PD=500MW	04713	2N2222A
A1R1	0698-0084	6	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R2	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R3	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R4	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R5	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R6	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R7	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R8	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R9	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R10	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R11	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R12	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R13	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R14	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R15	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R16	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R17	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R18	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R19	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905
A1R20	0698-0084	3	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	2100-3905

See introduction to this section for ordering information
*Indicates factory selected value

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R21	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	CA-178-T0-316R-F
A1R22	0270-0568	1	3	RESISTOR 1RMK 100 10% C 10P ADJ 1-TBN	24546	2130-0568
A1R23	0277-0288	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	CA-178-T0-1001-F
A1R24	0257-0288	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	CA-178-T0-1001-F
A1S1	3101-2297	0	1	SWITCH-PB 9-STATION 10MM C-C SPACING	29480	3101-2297
A1S2	3101-0693	6	1	SWITCH-SL 2-PPDT STD 1.5A 250VAC PC PART OF A1R1	29480	3101-0693
A1I1	1820-2131	3	1	IC MISC	04713	MC3076P
A1U2	1826-0412	2	1	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	29480	1820-2312
A1U3	1826-0346	1	1	IC CP AMP GP DUAL 8-DIP-P PKG	27014	LM358N
A1U4	1826-0393	0	1	IC V RGLTR TO-220	27014	LM317T
A1U5	0340-0468	6	1	INSULATOR-XSTR NYLON	29480	0340-0468
A1U6	1826-0544	0	1	V REF 8-DIP-C	04713	MC1403U
A1U7	1826-0527	9	1	IC 33Z V RGLTR TO-220	27014	LM332T
A1X7	0340-0468	6	6	INSULATOR-XSTR NYLON	29480	0340-0468
A1XF1	2110-0269	0	2	FUSEHMD DR-CLIP TYPE.250-FUSE	29480	2110-0269
A1XU1	1200-0552	4	2	SOCKET-IC 40-CONT DIP-SLD8	29480	1200-0552
A1XU2	1200-0552	4	4	SOCKET-IC 40-CONT DIP-SLD8	29480	1200-0552
	0380-0770	6	4	STANDOFF-RVT-CN .187-IN-LG 6-32THD	00000	ORDCR BY DESCRIPTION
	0380-0906	7	6	STANDOFF-RVT-CN .1-IN-LG 6-32THD	00000	ORDCR BY DESCRIPTION
	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ 50	29480	1251-0600

Model 5315A/B
Replaceable Parts

Table 6-2. Replaceable Parts (Continued)

Reference	HP Part	Qty	Description	Mfr Code	Mfr Part Number
A1	05315-60014	1	MOTHERBOARD ASSEMBLY FOR 5315B ONLY.	28480	05315-60014
A1C1	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C2	0180-0562	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	28480	196D336X0010KAI
A1C3	0180-2698	8	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	28480	0180-2698
A1C4	0180-0562	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	52829	196D336X0010KAI
A1C5	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C6	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C7	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C8	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C9	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C10	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C11	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C12	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C13	0180-0562	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	52829	196D336X0010KAI
A1C14	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C15	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C16	0180-2816	2	CAPACITOR-FXD 68UF+-20% 10VDC TA	28480	0180-2816
A1C17	0180-2820	8	CAPACITOR-FXD .22UF+-20% 35VDC TA	28480	0180-2820
A1C18	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C19	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C20	0180-2820	8	CAPACITOR-FXD 100UF+-20% 10VDC TA	28480	0180-2820
A1C21	0180-1735	2	CAPACITOR-FXD .22UF+-10% 35VDC TA	52829	150D224X9035A2
A1C22	0160-4497	7	CAPACITOR-FXD 82PF +-5% 20VDC CER 0+-30	28480	0160-4497
A1C23	0180-2816	2	CAPACITOR-FXD 68UF+-20% 10VDC TA	28480	0180-2816
A1C24	0180-2820	8	CAPACITOR-FXD .22UF+-20% 35VDC TA	28480	0180-2820
A1C25	0180-2891	3	CAPACITOR-FXD 4700UF+-10% 15VDC AL	28480	0180-2891
A1C26	0180-2892	4	CAPACITOR-FXD 2200UF+-25% 10% 16VDC AL	28480	0180-2892
A1C27	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C28	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C29	0180-2815	1	CAPACITOR-FXD 100UF+-20% 10VDC TA	28480	0180-2815
A1C30	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C31	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C32	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C33	0180-0562	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	52829	196D336X0010KAI
A1C34	0180-0562	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	52829	196D336X0010KAI
A1C35	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C36	1251-5227	9	CONNECTOR-11 PIN, MALE	28480	1251-5227
A1C37	1200-0423	8	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0423
A1C38	9100-1637	4	INDUCTOR RF-CR-MB 120UH 5% 166DX, 3851 G	28480	9100-1637
A1C39	05315-00001	7	HEAT SINK	28480	05315-00001
A1C40	1251-3768	7	"E" POST (PART OF J3)	28480	1251-3768
A1C41	1853-0363	8	TRANSISTOR PNP SI PD=50W FT=20MHZ	03308	X454281
A1C42	0340-0468	6	INSULATOR-XSTR NPLDN	28480	0340-0468
A1C43	0340-0864	6	INSULATOR-XSTR THRM-CNDCT	28480	0340-0864
A1C44	1854-0477	7	TRANSISTOR NPN 2N2222A SI TO-18 PD=50MM	04713	2N2222A
A1C45	2100-3905	6	RESISTOR-VAR W/SW 500K 20% 10CM SPD1-NC	28480	2100-3905
A1C46	0698-0084	9	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CA-1/8-T0-2151-F
A1C47	0698-7218	5	RESISTOR 178 1% .05W F TC=0+-100	24546	CA-1/8-T0-178R-G
A1C48	0698-7218	5	RESISTOR 178 1% .05W F TC=0+-100	24546	CA-1/8-T0-178R-G
A1C49	0698-0082	7	RESISTOR 464 1% .125W F TC=0+-100	24546	CA-1/8-T0-464R-F
A1C50	0757-0199	3	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CA-1/8-T0-2152-F
A1C51	0698-3440	7	RESISTOR 196 1% .125W F TC=0+-100	24546	CA-1/8-T0-196R-F
A1C52	0698-3441	6	RESISTOR 23.7 1% .125W F TC=0+-100	03688	PMS5-1/8-T0-23R7-F
A1C53	0698-3442	9	RESISTOR 237 1% .125W F TC=0+-100	24546	CA-1/8-T0-237R-F
A1C54	0698-3443	0	RESISTOR 287 1% .125W F TC=0+-100	24546	CA-1/8-T0-287R-F
A1C55	2100-0568	1	RESISTOR-TMR 100 10% C T02-ADJ 1-TRN	28480	2100-0568
A1C56	0698-3444	9	RESISTOR 34.8 1% .125W F TC=0+-100	24546	CA-1/8-T0-34R-F
A1C57	0698-3445	3	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	CA-1/8-T0-196R-F
A1C58	2100-3252	6	RESISTOR-TMR 5K 10% C T0P-ADJ 1-TRN	28480	2100-3252
A1C59	0698-0084	9	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CA-1/8-T0-2151-F
A1C60	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	CA-1/8-T0-1001-F
A1C61	0698-3442	9	RESISTOR 237 1% .125W F TC=0+-100	24546	CA-1/8-T0-237R-F
A1C62	0757-0403	2	RESISTOR 121 1% .125W F TC=0+-100	24546	CA-1/8-T0-121R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R21	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-178-T0-316-F
A1R23	0757-0288	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-178-T0-100-F
A1R24	0757-0288	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-178-T0-100-F
A1S1	3101-2297	0	SWITCH-PB 9-POSITION 10MM C-C SPACING	28480	3101-2297
A1S2	3101-2334	6	SWITCH-SL DPDT SHUNT .50A 125VAC/DC PC	28480	3101-2334
A1TP1	1251-0600	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC SZ 50	28480	1251-0600
A1U1	1826-2312	3	IC	04713	MC3870P
A1U2	1826-2312	2	IC MISC	28480	1826-2312
A1U3	0340-0468	6	IC V RGLTR 10-220	27014	LM317T
A1U4	0340-0864	6	INSULATOR-XSTR NYLON	28480	0340-0468
A1U5	1826-0346	0	IC OP AMP GP DUAL 8-DIP-P PKG	27014	LM358N
A1U6	1826-0527	9	IC 337 V RGLTR TO-220	27014	LM337T
A1U6	0340-0468	6	INSULATOR-XSTR NYLON	28480	0340-0468
A1U6	0340-0864	6	INSULATOR-XSTR THRM-CNDCT	28480	0340-0864
A1XU1	1200-0552	4	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
A1XU2	1200-0552	4	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
A1XU2	0380-0745	6	STANDOFF-RVT-0N .187-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
A1XU2	0380-0770	7	STANDOFF-RVT-0N .075-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
A1XU2	1251-0600	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC SZ 50	28480	1251-0600

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2	05315-60012	6	DISPLAY ASSEMBLY, SERIES 1924	28480	05315-60012
A2C1	0180-2929	8	CAPACITOR FXD VALUE 10% 1000C 1A	28480	0180-2929
A2D50	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D51	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D52	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D53	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D54	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D55	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D56	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D57	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D58	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D59	1990-0730	3	DISPLAY-NUM-SEG 1-CHAR 3-H RED	28480	5082-7611
A2D510	1990-0517	4	LED-1AMP LUM-INT=3MCD IF=20MA-MAX BUR=5V	28480	5082-4655
A2D511	1990-0517	4	LED-1AMP LUM-INT=3MCD IF=20MA-MAX BUR=5V	28480	5082-4655
A2D512	1990-0517	4	LED-1AMP LUM-INT=3MCD IF=20MA-MAX BUR=5V	28480	5082-4655
A2D513	1990-0517	4	LED-1AMP LUM-INT=3MCD IF=20MA-MAX BUR=5V	28480	5082-4655
A2D514	1990-0517	4	LED-1AMP LUM-INT=3MCD IF=20MA-MAX BUR=5V	28480	5082-4655
A2D515	1990-0517	4	LED-1AMP LUM-INT=3MCD IF=20MA-MAX BUR=5V	28480	5082-4655
A2D516	1990-0517	4	LED-1AMP LUM-INT=3MCD IF=20MA-MAX BUR=5V	28480	5082-4655
A2J1A	1251-5344	9	CONNECTOR 7-PIN F POST TYPE	28480	1251-5344
A2L1	9100-1618	1	INDUCTOR RF-CH MID 5.6UH 10%	28480	9100-1618
A2R1	0757-0398	4	RESISTOR 25 1% 125W F TC=0+-100	24546	C4 1/8-10-75R0-F
A2R2	0757-0401	0	RESISTOR 100 1% 125W F TC=0+-100	24546	C4 1/8-10-101-F
A2R3	0698-3438	3	RESISTOR 147 1% 125W F TC=0+-100	24546	C4 1/8-10-147R-F
A2R4	0698-3442	9	RESISTOR 237 1% 125W F TC=0+-100	24546	C4 1/8-10-237R-F
A2U1	1820-1199	1	IC INV TTL LS HCX 1-TMP	01295	SN74LS04N
A2U2	1820-1688	3	IC DSD TTL LS BCD-10-7-SFC	01295	SN74LS247N
A2U3	1820-2132	4	IC DRV CMOS LED DRV	32293	ICM7218A
A2XD50	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD51	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD52	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD53	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD54	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD55	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD56	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD57	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XD58	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XU1	1200-0679	6	SOCKET-1C 14-CONT DIP DIP-SLDR	28480	1200-0679
A2XU2	1200-0679	8	SOCKET-1C 16-CONT DIP DIP-SLDR	28480	1200-0679
A2XU3	1200-0679	1	SOCKET-1C 28-CONT DIP DIP-SLDR	28480	1200-0679
	1251-3768	2	CONTACT-COMM D/M-POST-TYPE MALE DP5LDR	28480	1251-3768

See introduction to this section for ordering information
*Indicates factory selected value

*Indicates factory selected value

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Model 5315A/B
Replaceable Parts

Table 6-2. Replaceable Parts (Continued)

Reference	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4	05315-60004	6	INPUT AMPLIFIER BOARD ASSEMBLY (SERIES 1824)	28480	05315-60004
A4C1	0180-2815	1	CAPACITOR-FXD 100UF +-20% 10VDC TA	28480	0180-2815
A4C2	0160-3875	3	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A4C3	0180-2815	1	CAPACITOR-FXD 100UF +-20% 10VDC TA	28480	0180-2815
A4C4	0180-2815	1	CAPACITOR-FXD 100UF +-20% 10VDC TA	28480	0180-2815
A4C5	0160-3877	5	CAPACITOR-FXD 100UF +-20% 200VDC CER	28480	0160-3877
A4C6	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C7	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C8	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C9	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C10	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C11	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C12	0160-3875	3	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A4C13	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C14	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C15	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C16	0180-2662	6	CAPACITOR-FXD 10UF +-10% 10VDC TA	25088	D487C51A10K
A4C17	0160-3879	5	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3879
A4C18	0160-3877	5	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A4C19	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C20	0180-2662	6	CAPACITOR-FXD 10UF +-10% 10VDC TA	25088	D487C51A10K
A4C21	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C22	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C23	1901-0518	8	DIOBE-SM SIG SCHOTTKY	28480	1901-0518
A4C24	1901-0518	8	DIOBE-SM SIG SCHOTTKY	28480	1901-0518
A4P1	1251-3768	7	CONTACT-CONN U/M-POST-TYPE MALE D50 DB	28480	1251-3768
A4P2	1251-5282	4	CONNECTOR 12-PIN M POST TYPE	28480	1251-5282
A4Q1	1854-0345	8	TRANSISTOR NPN 2N5179 ST 10-72 PD=200MW	04713	2N5179
A4Q2	1855-0213	1	TRANSISTOR JFET DUAL N-CHAN D-MODE 10-78	04713	2N5179
A4Q3	1854-0345	8	TRANSISTOR NPN 2N5179 ST 10-72 PD=200MW	04713	2N5179
A4Q4	1855-0213	1	TRANSISTOR JFET DUAL N-CHAN D-MODE 10-78	04713	2N5179
A4R1	2100-1984	7	RESISTOR 18M 100 10% C 10P-ADJ 1-PIN	82PR100	C4 1/8-10-215R-F
A4R2	0698-3441	3	RESISTOR 215 1% .125W F TC=0+-100	24546	C4 1/8-10-511R-F
A4R3	0757-0416	4	RESISTOR 511 1% .125W F TC=0+-100	24546	C4 1/8-10-511R-F
A4R4	0757-0416	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4 1/8-10-511R-F
A4R5	0698-3449	6	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4 1/8-10-2872-F
A4R6	0698-7218	5	RESISTOR 178K 1% .125W F TC=0+-100	24546	C4 1/8-10-178R-F
A4R7	0698-7228	7	RESISTOR 464 1% .05W F TC=0+-100	24546	C3 1/8-10-464R-G
A4R8	0698-7228	7	RESISTOR 464 1% .05W F TC=0+-100	24546	C3 1/8-10-464R-G
A4R9	0698-7228	7	RESISTOR 464 1% .05W F TC=0+-100	24546	C3 1/8-10-464R-G
A4R10	0698-7229	4	RESISTOR 75 1% .05W F TC=0+-100	24546	C3 1/8-10-75R-G
A4R11	0698-3441	8	RESISTOR 215 1% .125W F TC=0+-100	24546	C4 1/8-10-215R-F
A4R12	0757-0417	8	RESISTOR 562 1% .125W F TC=0+-100	24546	C4 1/8-10-562R-F
A4R13	0698-7228	7	RESISTOR 464 1% .05W F TC=0+-100	24546	C3 1/8-10-464R-G
A4R14	0757-0416	0	RESISTOR 100 1% .125W F TC=0+-100	24546	C4 1/8-10-101 F
A4R15	0698-3449	6	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4 1/8-10-2872-F
A4R16	0757-0228	9	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4 1/8-10-178R-F
A4R17	1810-0219	3	NOT ASSIGNED	01121	208R221
A4R18	0698-7218	5	RESISTOR 178 1% .05W F TC=0+-100	24546	C3 1/8-10-178R-G
A4R19	1810-0203	5	NETWORK-RES 8-SIP220.0 OHM X 4	01121	208R221
A4R20	1810-0203	5	NETWORK-RES 8-SIP220.0 OHM X 4	01121	208R221
A4R21	0757-0439	4	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4 1/8-10-681R-F
A4R22	0757-0418	9	RESISTOR 619 1% .125W F TC=0+-100	24546	C4 1/8-10-619R-F
A4R23	0757-0418	9	RESISTOR 619 1% .125W F TC=0+-100	24546	C4 1/8-10-619R-F
A4R24	0757-0283	6	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4 1/8-10-201R-F
A4R25	0757-0416	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4 1/8-10-511R-F
A4R26	0757-0416	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4 1/8-10-511R-F
A4R27	0757-0421	4	RESISTOR 825 1% .125W F TC=0+-100	24546	C4 1/8-10-825R-F
A4R28	0698-3441	8	RESISTOR 215 1% .125W F TC=0+-100	24546	C4 1/8-10-215R-F
A4R29	0757-0439	4	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4 1/8-10-681R-F
A4R30	0757-0417	8	RESISTOR 562 1% .125W F TC=0+-100	24546	C4 1/8-10-562R-F
A4R31	0757-0421	4	RESISTOR 825 1% .125W F TC=0+-100	24546	C4 1/8-10-825R-F
A4R32	2100-1984	7	RESISTOR 18M 100 10% C 10P-ADJ 1-PIN	82PR100	C4 1/8-10-215R-F
A4R33	0757-0416	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4 1/8-10-511R-F
A4R34	0757-0283	6	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4 1/8-10-201R-F
A4T1	0360-0124	3	CONNECTOR-SCL CONF PIN .04-IN-BSC-57 RND	28480	0360-0124
A4U1	1858-0048	8	IC COMPARATOR HS DUAL 16-DIP-C DIP	01428	AM682AD1
A4U2	1826-0426	7	TRANSISTOR ARRAY 14-PIN PLTIC DIP	01428	CA3046
A4U3	1821-0001	4	TRANSISTOR ARRAY 14-PIN PLTIC DIP	01428	CA3046

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5	05315-60005	7	SUPPORT BOARD	28480	05315-60005
ASP1	1251-3768	7	CONTACT-CONN U/W POST-TYPE MALE DPSLDR	28480	1251-3768
ASP2	1251-3768	7	CONTACT-CONN U/W POST-TYPE MALE DPSLDR	28480	1251-3768
A13	05315-60016	0	REFERENCE OSCILLATOR ASSEMBLY (STANDARD) (SERIES 2120)	28480	05315-60016
A13C1	0121-0059	7	CAPACITOR-V 18MF-CER 2-8PF 350V PC-MTG	52763	304324 2/BPF NP0
A13C2*	0160-3825	3	CAPACITOR-FXD 22PF +-5% 200VDC CER 9+-30	28480	0160-3825
A13C3	0121-0105	4	CAPACITOR-V 18MF-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A13C4	0160-4554	7	CAPACITOR-FXD 101UF +-20% 50VDC CER	28480	0160-4554
A13C5	0160-4389	6	CAPACITOR-FXD 100PF +-5PF 200VDC CER	51642	200-200-NP0-101J
A13C6	0160-4481	9	CAPACITOR-FXD 270PF +-5% 100VDC CER	51642	150-100-NP0-271J
A13C7	0160-4554	7	CAPACITOR-FXD 101UF +-20% 50VDC CER	28480	0160-4554
A13L1	9140-0210	1	INDUCTOR RF-CH-MD 100UH 5% .166DX .385LG	28480	9140-0210
A13P1	1251-4510	9	CONNECTOR 6-PIN M POST TYPE	28480	1251-4510
A13Q1	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A13Q2	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A13R1	0757-0199	3	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-10-2152-F
A13R2	0698-3443	0	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-10-2152-F
A13R3	0698-3443	0	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-10-287P-F
A13R4	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-10-1001-F
A13R5	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-10-1001-F
A13R6	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-10-1001-F
A13Y1	0410-0423	2	CRYSTAL-QUARTZ 10.000 MHZ	28480	0410-0423
	1400-0957	7	BRACKET	28480	1400-0957

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
F1	2110-0318	0	FUSE .125A 250V TO 1.25X.15 IN	75915	315 125
F1	2110-0201	0	FUSE .125A 250V TO 1.25X.15 IN	75915	315 125
MP1	4040-1126	3	SHELL - TOP	28480	4040-1126
MP2	4040-1463	1	SHELL - BOTTOM	28480	4040-1463
MP3	5040-8058	5	HANDLE	28480	5040-8058
MP4	5040-8044	9	SPACER	28480	5040-8044
MP5	05315-40002	2	WINDUP	05315-40002	05315-40002
MP6	05315-00026	6	PANEL-FRONT EXCEPT OPTION 003	28480	05315-00026
MP7	5040-7223	4	FOOT	28480	5040-7223
T1	9100-4058	9	TRANSFORMER-POWER	28480	9100-4058
W1	8120-1378	1	CABLE ASSY 18AWG 3-CONDCT JGK-JKT	28480	8120-1378
MISCELLANEOUS PARTS					
	0370-1005	2	KNOB-BASE-PTR 3/8 JGK .125-IN-ID	28480	0370-1005
	0370-2486	5	PUSHBUTTON 230X.390X.397 IN H. JADE	28480	0370-2486
	0370-2917	7	PUSHBUTTON-WHITE	28480	0370-2917
	0370-2872	3	PUSHBUTTON-WHITE	28480	0370-2872
	7120-5370	0	LABEL-HANDLE	28480	7120-5370
	7120-7425	0	LABEL-5315A SERIAL	28480	7120-7425
	7120-7426	1	LABEL-5315A VOLTAGE	28480	7120-7426
	7120-7475	0	LABEL-5315A CAUTION	28480	7120-7475
	7120-7489	6	LABEL-INFO	28480	7120-7489
	5040-8816	3	BUTTONS - SQUARE	28480	5040-8816
5315A CHASSIS PARTS					
	75915	1	FUSE .125A 250V TO 1.25X.15 IN	75915	315 125
	28480	1	SHELL - TOP	28480	4040-1126
	28480	1	SHELL - BOTTOM	28480	4040-1463
	28480	1	HANDLE	28480	5040-8058
	28480	4	SPACER	28480	5040-8044
	05315-40002	2	WINDUP	05315-40002	05315-40002
	28480	1	PANEL-FRONT EXCEPT OPTION 003	28480	05315-00026
	28480	2	FOOT	28480	5040-7223
	28480	1	TRANSFORMER-POWER	28480	9100-4058
	28480	1	CABLE ASSY 18AWG 3-CONDCT JGK-JKT	28480	8120-1378
MISCELLANEOUS PARTS					
	0370-1005	3	KNOB-BASE-PTR 3/8 JGK .125-IN-ID	28480	0370-1005
	0370-2486	8	PUSHBUTTON 230X.390X.397 IN H. JADE	28480	0370-2486
	0370-2917	1	PUSHBUTTON-WHITE	28480	0370-2917
	0370-2872	1	PUSHBUTTON-WHITE	28480	0370-2872
	7120-5370	2	LABEL-HANDLE	28480	7120-5370
	7120-7425	1	LABEL-5315A SERIAL	28480	7120-7425
	7120-7426	1	LABEL-5315A VOLTAGE	28480	7120-7426
	7120-7475	1	LABEL-5315A CAUTION	28480	7120-7475
	7120-7489	1	LABEL-INFO	28480	7120-7489
	5040-8816	10	BUTTONS - SQUARE	28480	5040-8816

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
AR	0960-0443	1	LINE MODULE-FILTERFD	28480	0960-0443
F1	2110-0318	0	FUSE .125A 250V TD 1.25X.25 UL	75915	313.125
F1	2110-0201	0	FUSE .25A 250V TD 1.25X.25 UL	75915	313.250
J9	1250-0083	1	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
MP8	5060-9963	5	COVER-BOTTOM	28480	5060-9963
MP9	5040-7201	8	FOOT(STANDARD)	28480	5040-7201
MP10	1460-1345	5	FILL STAND SST	28480	1460-1345
MP11	5060-9802	1	STRAP-HANDLE	28480	5060-9802
	5040-7219	8	STRAP-HANDLE, CAP-FRONT	28480	5040-7219
	5040-7220	1	STRAP-HANDLE, CAP-REAR	28480	5040-7220
	5040-8816	3	BUTTONS (SQUARE)	28480	5040-8816
MP12	5001-0418	3	COVER-TOP	28480	5001-0418
MP13	05315-00025	5	PANEL-REAR	28480	05315-00025
MP14	5020-9814	9	FRAME-REAR	28480	5020-9814
MP15	05315-00010	8	SUPPORT-REAR	28480	05315-00010
MP16	5040-7203	0	TRIM-TOP 1/2	28480	5040-7203
MP17	5020-8813	8	FRAME-FRONT	28480	5020-8813
MP18	5001-0438	7	TRIM-SIDE	28480	5001-0438
MP19	5020-8830	9	SIDE STRUT-RIGHT	28480	5020-8830
MP20	05315-40003	3	WINDOW	28480	05315-40003
MP21	05315-00028	8	PANEL-FRONT (EXCEPT OPTION 003)	28480	05315-00028
MP28	5020-8885	4	SIDE STRUT-LEFT	28480	5020-8885
MP29	0403-0373	2	GUIDE PC BOARD	28480	0403-0373
T1	05315-80001	5	TRANSFORMER MODIFIED	28480	05315-80001
W1	8120-1378	1	CABLE ASSY 18 AWG 3-CONDCT JGK-JKT	28480	8120-1378
	0370-0606	7	BEZEL-PUSHBUTTON (SQUARE)	28480	0370-0606
	0370-0914	0	BEZEL-PUSHBUTTON (RECT)	28480	0370-0914
	0370-1005	2	KNOB-BASE-PTR 3/8 JGK .125-IN-ID	28480	0370-1005
	0370-2486	5	PUSHBUTTON .230X.390X.397 IN H JADE	28480	0370-2486
	0370-2917	7	PUSHBUTTON .230X.390X.397 IN H	28480	0370-2917
	0370-2872	3	PUSHBUTTON-WHITE	28480	0370-2872
	0370-2872	1	RETAINER-PUSH ON	28480	0370-2872
	0510-1152	8	NUT-SHMET-FLT 10-32 THD STL	28480	0510-1152
	0590-0639	2	BUTTONS SQUARE	28480	0590-0639
	5040-8816	3	LABEL-INFO POWER	28480	5040-8816
	7120-7872	1	LABEL-INFO	28480	7120-7872
	7120-7489	6		28480	7120-7489

See introduction to this section for ordering information
*Indicates factory selected value

Model 5315A/B
Replaceable Parts

Table 6-3. Option 001 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	05315-60007	9	TCXD ASSEMBLY-OPTION 001 (SERIES 1624)	28480	05315-60007
A7C1	0180-0562	1	CAPACITOR-FXD 33UF+-20% 18VDC 1A	56289	196D336X0010K A1
A7R1	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	04-1/8-T0-1001-F
A7R2	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	04-1/8-T0-316R-F
A7Y1	0960-0394	1	CRYSTAL OSCILLATOR -- TCXD	28480	0960-0394
		1	A7 MISCELLANEOUS PARTS		
		1	CONNECTOR 6-PIN M POST TYPE	28480	1251-4510
		2	BRACKET-R1ANG .475-LG X .183-LG .25-WD	28480	1460-0957

See introduction to this section for ordering information
*Indicates factory selected value

*Indicates factory selected value

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6	05315-60015	9	BATTERY CHARGER ASSEMBLY—OPTION 002 S315A ONLY; SERIES 2120	28480	05315-60015
A6C1	0180-2815	1	CAPACITOR-FXD 100UF+-20% 15VDC TA	28480	0180-2815
A6C2	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C3	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C4	0180-2821	6	CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A6C5	0160-4511	9	CAPACITOR-FXD 220PF +-5% 200VDC CER	51642	200-200-NP0-221J
A6C6	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C7	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C8	0160-0576	5	NOT ASSIGNED	28480	0160-0576
A6C9	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C10	0180-2686	4	CAPACITOR-FXD 470UF+100-10% 25VDC AL	00853	301ER471U025B
A6C11	0180-2821	9	CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A6C12	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C13	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C14	0180-2821	9	CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A6C15	0180-0562	1	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	1960335X60010K A1
A6C16	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C17	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A6C18	1901-0734	0	DIODE-PWR RECT 1N5818 30V 1A	04713	1N5818
A6C19	1901-0050	1	DIODE-PWR RECT 1N5818 30V 1A	04713	1N5818
A6C20	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C21	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C22	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C23	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C24	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C25	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C26	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C27	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C28	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C29	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C30	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C31	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C32	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C33	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C34	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C35	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C36	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C37	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C38	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C39	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C40	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C41	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C42	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C43	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C44	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C45	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C46	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050
A6C47	1901-0050	3	DIODE-SWITCHING 80V 200MA ZNS DO-35	28480	1901-0050

Table 6-4. Option 002 Replaceable Parts (Continued)

Reference Designation	HP Part Number	C	Qty	Description	Mfr Code	Mfr Part Number
A6R26	0757-0442	9	1	RESISTOR 10K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R27	0757-1093	8	1	RESISTOR 2K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-3001-F
A6R28	0757-0280	3	1	RESISTOR 1K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R29	0757-0472	5	1	RESISTOR 200K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-2003-F
A6R30	0698-3155	1	1	RESISTOR 4.64K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A6R31	0757-0199	3	1	RESISTOR 21.5K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A6R32	0698-3160	8	1	RESISTOR 31.6K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A6R33	0757-0442	9	1	RESISTOR 10K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R34	0757-0407	6	1	RESISTOR 200K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-2003-F
A6R35	0698-3156	2	1	RESISTOR 14.7K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A6R36	0757-0462	3	1	RESISTOR 75K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A6R37	0757-0447	4	1	RESISTOR 16.2K 1%, 125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R38	0811-3117	7	1	RESISTOR 12 1%, 7W PW TC=0+-20	28480	C4-1/8-T0-1622-F
A6R39	0837-0159	5	1	THERMISTOR-33K OHM	01295	TM 1/8 333K
A6TP1	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP2	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP3	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP4	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP5	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP6	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP7	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP8	1251-0600	0	0	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6U1	1826-0450	7	1	IC V RGLTR 14-DIP-P	01295	TL497CN
A6U2	1826-0346	0	1	IC OP AMP GP DUAL 8-DIP-P PKG	27014	LM358N
A6U3	1826-0544	0	1	V REF 8-DIP-C	04713	MC1403U
A6U4	1826-0412	1	2	IC COMPARATOR PRGN DUAL 8-DIP-P PKG	27014	LM339N
A6U5	1820-1600	9	1	IC SCHMITT-TRIG CMOS NAND QUAD 2-INP	01928	CD4093BE
A6U6	1826-0412	1	1	IC COMPARATOR PRGN DUAL 8-DIP-P PKG	27014	LM339N
A6XF1	2110-0269	0	2	FUSEHOLDER-CLIP TYPE, 25D-FUSE	28480	2110-0269
BT1	1420-0253	8	1	BATTERY 6V 5A-HR PB-ACID ODISC		
MP22	05315-00005	1	1	CLAMP-BATTERY		
MP23	05315-00006	2	1	DECK-BATTERY		
MP24	0510-0585	9	1	RETAINER-PUSH ON RND EXT .383-IN-DIA		
MP25	05315-00014	2	1	CLIP-GROUNDING		
W2	05315-60102	5	1	CABLE ASSEMBLY-LEAD (RED)		
W3	05315-60103	6	1	CABLE ASSEMBLY-LEAD (BLACK)		
W4	05315-60101	4	1	CABLE ASSEMBLY-BATTERY		

See introduction to this section for ordering information
*Indicates factory selected value

See introduction to this section for ordering information
*Indicates factory selected value

Reference	HP Part	Qty	Description	Mfr Code	Mfr Part Number
A9	05315-60009	1	FREQUENCY BOARD ASSEMBLY - OPTION 003	28480	05315-60009
A9C1	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C2	0160-2662	6	CAPACITOR-FXD .10UF+-10% 10VDC TA	25388	D4R76S1A10K
A9C3	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C4	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C5	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C6	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C7	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C8	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C9	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C10	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C11	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C12	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C13	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C14	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C15	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C16	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C17	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C18	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C19	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C20	0160-2662	6	CAPACITOR-FXD .10UF+-10% 10VDC TA	25388	D4R76S1A10K
A9C21	0160-0127	2	CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-0127
A9C22	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C23	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A9C81	1901-0535	9	DIOCE-SM SIG SCHOTTKY	28480	1901-0535
A9C82	1901-0535	9	DIOCE-SM SIG SCHOTTKY	28480	1901-0535
A9C83	1901-0050	4	DIOCE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A9C84	1901-0050	4	DIOCE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A9C85	1902-0041	3	DIOCE-ZNR 5.11V 5Z DO-35 PD=.4W	28480	1902-0041
A9C86	1901-0535	9	DIOCE-SM SIG SCHOTTKY	28480	1901-0535
A9C87	1901-0535	9	DIOCE-SM SIG SCHOTTKY	28480	1901-0535
A9C88	1902-0551	1	DIOCE-ZNR 6.19V 5Z DO-15 PD=1W TC=+.022%	28480	1902-0551
A9F1	2110-0301	1	FUSE .125A 125V .281X.093	28480	2110-0301
A9J1	05305-20105	2	INSULATOR-TFLON	28480	05305-20105
A9L2	9100-1788	6	CHOK-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK230 20/48
A9L3	9100-2272	3	INDUCTOR RF-CO-MD 4ZUH 10% .10SDX.26LG	28480	9100-2272
A9L4	9100-2272	5	INDUCTOR RF-CO-MD 4ZUH 10% .10SDX.26LG	28480	9100-2272
A9L5	9100-2272	5	INDUCTOR RF-CO-MD 4ZUH 10% .10SDX.26LG	28480	9100-2272
A9P1	1251-1556	7	CONNECTOR-SGL CONT SKT .018 IN POST TYPE	28480	1251-1556
A9Q1	1853-0281	9	TRANSISTOR PNP 2N297A SI TO-18 PD=400MW	04713	2N297A
A9Q2	1853-0420	2	TRANSISTOR J-FET 2N4391 N-CHAN B-MODE	01295	2N4391
A9Q3	1853-0420	2	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A9R1	0698-2234	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R2	0698-2234	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R3	0698-2234	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R4	0698-2234	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R5	0698-2234	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R6	0698-2258	3	RESISTOR 8.25K 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R7	0698-2196	3	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-10-21R5-G
A9R8	0698-2196	3	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-10-21R5-G
A9R9	2100-2061	3	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-10-21R5-G
A9R10	0698-2276	5	RESISTOR 46.4K 1% .05W F TC=0+-100	24546	C3-1/8-10-464R-G
A9R11	0698-2276	5	RESISTOR 46.4K 1% .05W F TC=0+-100	24546	C3-1/8-10-464R-G
A9R12	0698-2269	6	RESISTOR 3.7K 1% .05W F TC=0+-100	24546	C3-1/8-10-37R2-G
A9R13	0698-2243	6	RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-10-196R-G
A9R14	2100-2061	3	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R15	0698-2234	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R16	2100-2061	3	RESISTOR 200 10% C TOP-ADJ 1-TRN	27338	82PR200
A9R17	0698-2212	3	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-10-100R-G
A9R18	2100-2061	3	RESISTOR 200 10% C TOP-ADJ 1-TRN	27338	82PR200
A9R19	0698-2234	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-10-825R-G
A9R20	0698-2276	5	RESISTOR 46.4K 1% .05W F TC=0+-100	24546	C3-1/8-10-464R-G
A9U1	1826-0589	3	IC TO-8 PKG	28480	1826-0589
A9U3	1826-0138	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A9W1	05315-60104	7	CABLE ASSEMBLY-FREQUENCY C	28480	05315-60104
A9W2	05315-60106	9	CABLE ASSEMBLY-RESET	28480	05315-60106

Table 6-5. Option 003 Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP6	0360-0124	3	CONNECTOR-SGL CONT PIN .04-IN-BGC-S7 RND	28498	0360-0124
	1205-0375	1	HEAT SINK SGL TO-8-CS	05620	211-CR
	05305-60205	7	CONNECTOR-SPECIAL RNC	28480	05305-60205
	05305-20104	1	CONNECTOR-BODY	28490	05305-20104
	0590-0038	5	NUT-HEX-DBL-CHAM 1/2-32-1H6 .094-IN THK	00000	ORDER BY DESCRIPTION
	2190-0124	4	WASHER-LK INTL T NO. 10 .195-IN-ID	28490	2190-0124
	05305-60206	8	MINI-CONNECTOR	28480	05305-60206
	05315-00027	7	PANEL-FRONT	28480	05315-00027
	5315A CHASSIS PARTS				
	5315B CHASSIS PARTS				
MP21	05315-00029	9	PANEL-FRONT	28480	05315-00029
		1			

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-6. 5315A Option 004 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14	05315-60017	1	REFERENCE OSCILLATOR ASSEMBLY(OPT. 004) (SERIES 2120)	28480	05315-60017
A14C1	0160-4554	2	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A14C2	0160-4554	2	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A14C3	0180-6662	6	CAPACITOR-FXD .01UF +-10% 10VDC 1A	28480	0180-6662
A14C4	0180-0418	6	CAPACITOR-FXD .01UF +-20% 35VDC 1A	28480	0180-0418
A14C5	0160-4511	6	CAPACITOR-FXD .022PF +-5% 20VDC CER	28480	0160-4511
A14C81	1901-0731	7	DIODE-PWR RECT 400V 1A	28480	1901-0731
A14C82	1902-3059	0	DIODE-ZNR 3.8KV 5% DO-35 PD=.4W	28480	1902-3059
A14P1	1251-4510	9	NOT ASSIGNED	28480	1251-4510
A14P2	1251-4510	9	CONNECTOR-6 PIN, MALE	28480	1251-4510
A14Q1	1853-0363	8	TRANSISTOR PNP SI PD=50W FT=20MHZ	03508	X45H281
	0340-0468	6	INSULATOR-XSTR NYLON	28480	0340-0468
	0340-0864	6	INSULATOR-XSTR THRM-CNDCT	28480	0340-0864
A14Q2	1205-0219	0	HEAT SINK SGL TO-66-CS	28480	1205-0219
	1854-0477	7	TRANSISTOR NPN NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A14R1	2100-0568	1	RESISTOR-TMR 100 10% C TO2-AJT 1-TRN	28480	2100-0568
A14R2	0757-0401	0	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R3	1810-0374	1	NETWORK-RFS 8-STP1.0K OHM X 4	01121	208R102
A14R4	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R5	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R6	0757-0199	3	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A14U1	1820-0493	6	IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A14U2	1826-0544	0	U REF 8-DIP-C	04713	MC1403U
A14Y1	0960-0636	4	OSCILLATOR, OVEN	28480	0960-0636
	1400-0957	7	BRACKET-RECTANGULAR	28480	1400-0957

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-7. 5315B Option 004 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15	05315-60112	7	REFERENCE OSCILLATOR ASSEMBLY; OVEN	28480	05315-60112
A15C1	0160-4556	9	CAPACITOR-FXD 100PF +-2% 100VDC CER	14299	CAC02X2R102M100A
A15E1	9170-0029	3	CORE-SHIELDING BEAD	28480	9170-0029
A15E2	9170-0029	3	CORE-SHIELDING BEAD	28480	9170-0029
A15M1	05316-60103	7	CABIN ASSEMBLY-OSCILLATOR	28480	05316-60103
A15Y1	0960-0603	5	OSCILLATOR-OVEN	28480	0960-0603
A15A1	05315-60018	2	OVEN OSCILLATOR INTERCONNECT BOARD (SERIES 2120)	28480	05315-60018
A15A1C1	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15A1P1	1251-4510	9	CONNECTOR	28480	1251-4510
A15A1R1	0757-0401	0	RESISTOR 100 1% .125W F TC=0+-100	24546	04-1/8-10-101-F
	1400-0957	7	BRACKET-RANG .475-LG X .183-LG .25-W0	28480	1400-0957
	2360-0113	2	SCREW-MACH 6-32 .25-IN-LG PAN-HD-PN7I	06000	ORDER BY DESCRIPTION
			A15A1 MISCELLANEOUS PARTS		
			OVEN OSCILLATOR INTERCONNECT BOARD (SERIES 2120)	28480	05315-60018
			CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
			CONNECTOR	28480	1251-4510
			RESISTOR 100 1% .125W F TC=0+-100	24546	04-1/8-10-101-F
			BRACKET-RANG .475-LG X .183-LG .25-W0	28480	1400-0957
			SCREW-MACH 6-32 .25-IN-LG PAN-HD-PN7I	06000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	ANY SATISFACTORY SUPPLIER	PICKENS SC	29671
00853	SANGAMO ELEC CO S CAROLINA DIV	MILWAUKEE WI	53204
01121	ALLEN-BRADLEY CO	DALLAS TX	75222
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DENVER CO	80217
0139E	GATES ENERGY PRODUCTS INC	SOMERVILLE NJ	08876
0192B	RCA CORP SOLID STATE DIV	SAUGERTIES NY	12477
02114	FERROXCUBE CORP	SYRACUSE NY	13201
03508	GE CO SEMICONDUCTOR PROD DEPT	WHIPPANY NJ	07981
03888	KDI PYROFILM CORP	PHOENIX AZ	85062
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	WAKEFIELD MA	01880
05820	WAKEFIELD ENGINEERING INC	RALEIGH NC	27604
16299	CORNING GL WK ELEC CMPNT DIV	MINERAL WELLS TX	76067
19701	MEPCO/ELECTRA CORP	BRADFORD PA	16701
24546	CORNING GLASS WORKS (BRADFORD)	ISELIN NJ	08830
25088	SIEMENS CORP	SANTA CLARA CA	95051
27014	NATIONAL SEMICONDUCTOR CORP	PALO ALTO CA	94304
28480	HEWLETT-PACKARD CO CORPORATE HQ	CUPERTINO CA	95014
32293	INTERISIL INC	SUNNYVALE CA	94086
34335	ADVANCED MICRO DEVICES INC	CUPERTINO CA	94304
50522	MONSANTO CO ELEK SPECIAL PROD	STATE COLLEGE PA	16801
51642	CENTRE ENGINEERING INC	CAZENOVIA NY	13035
52763	STETTNER-TRUSH INC	NORTH ADAMS MA	01247
56289	SPRAGUE ELECTRIC CO	WILLIMANTIC CT	06226
72136	ELECTRO MOTIVE CORP SUB IEC	FULLERTON CA	92634
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	DES PLAINES IL	60016
75915	LITTELFUSE INC	COLUMBUS NE	68601
91637	DALE ELECTRONICS INC		

Table 6-8. Manufacturers Code List

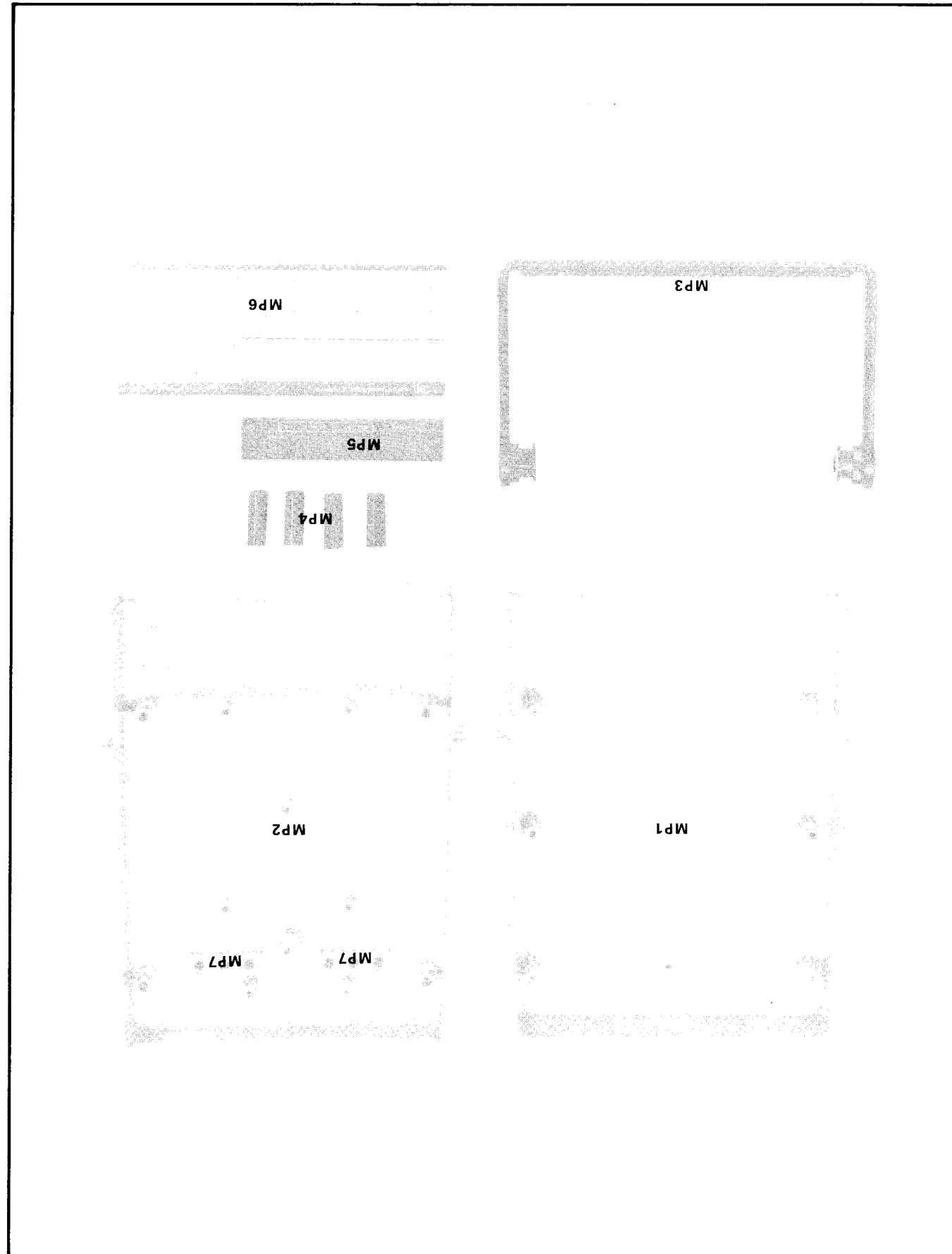


Figure 6-1. Model 5315A Mechanical Parts Layout

Figure 6-2. Model 5315B Mechanical Parts Layout

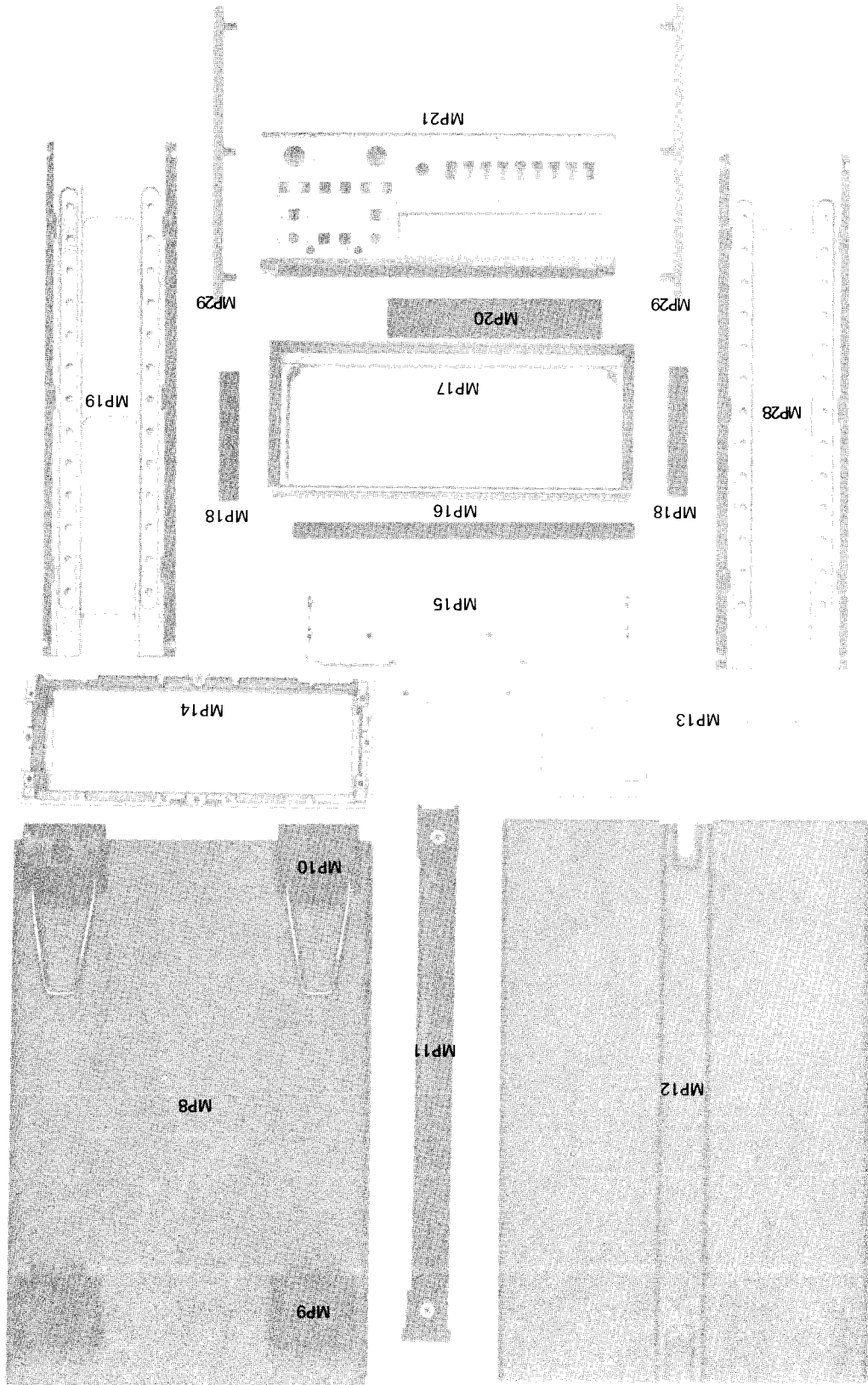


Figure 6-3. Option 002 Rechargeable Battery

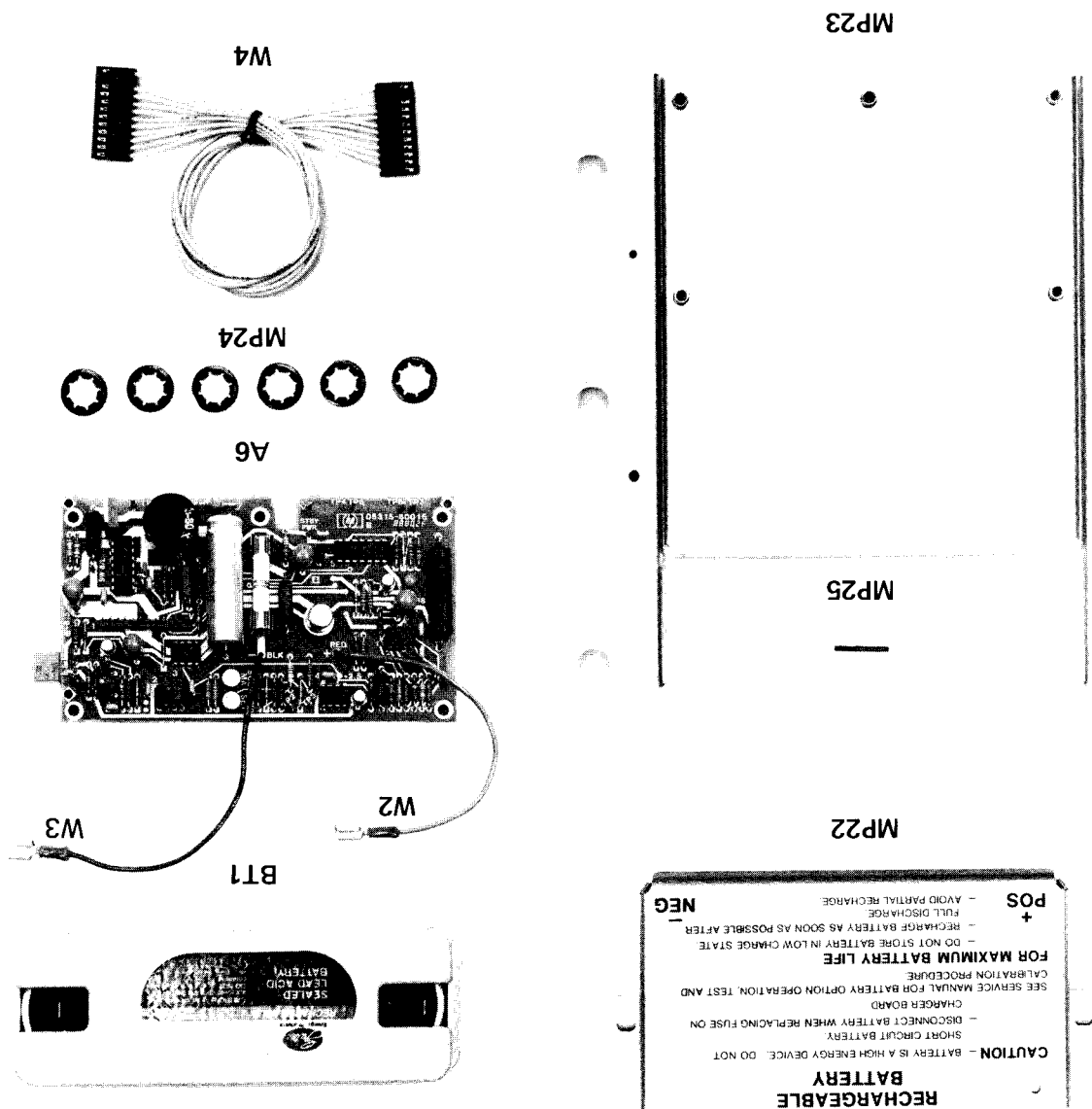
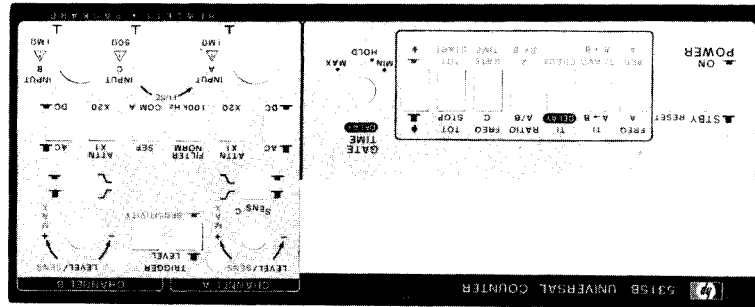
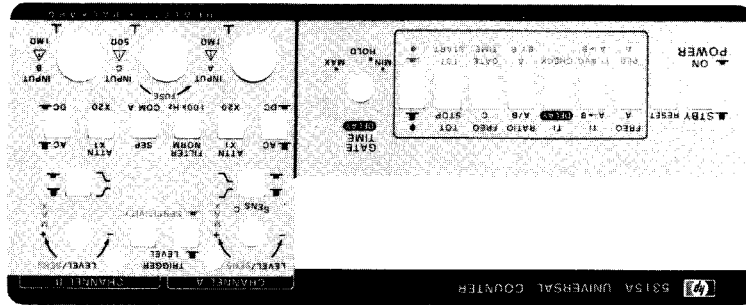


Figure 6-4. Option 003

MP27



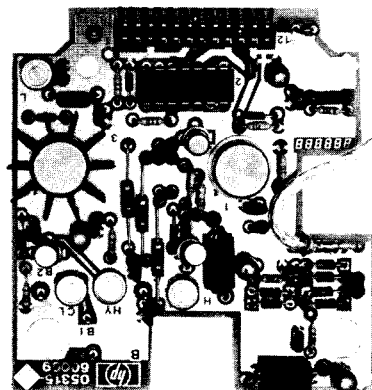
MP26



A9J1



A9
05315 - 60009



W2
05315 - 60106
(NOT REQUIRED FOR
INSTRUMENTS WITH
SERIAL PREFIX
1928A OR HIGHER)

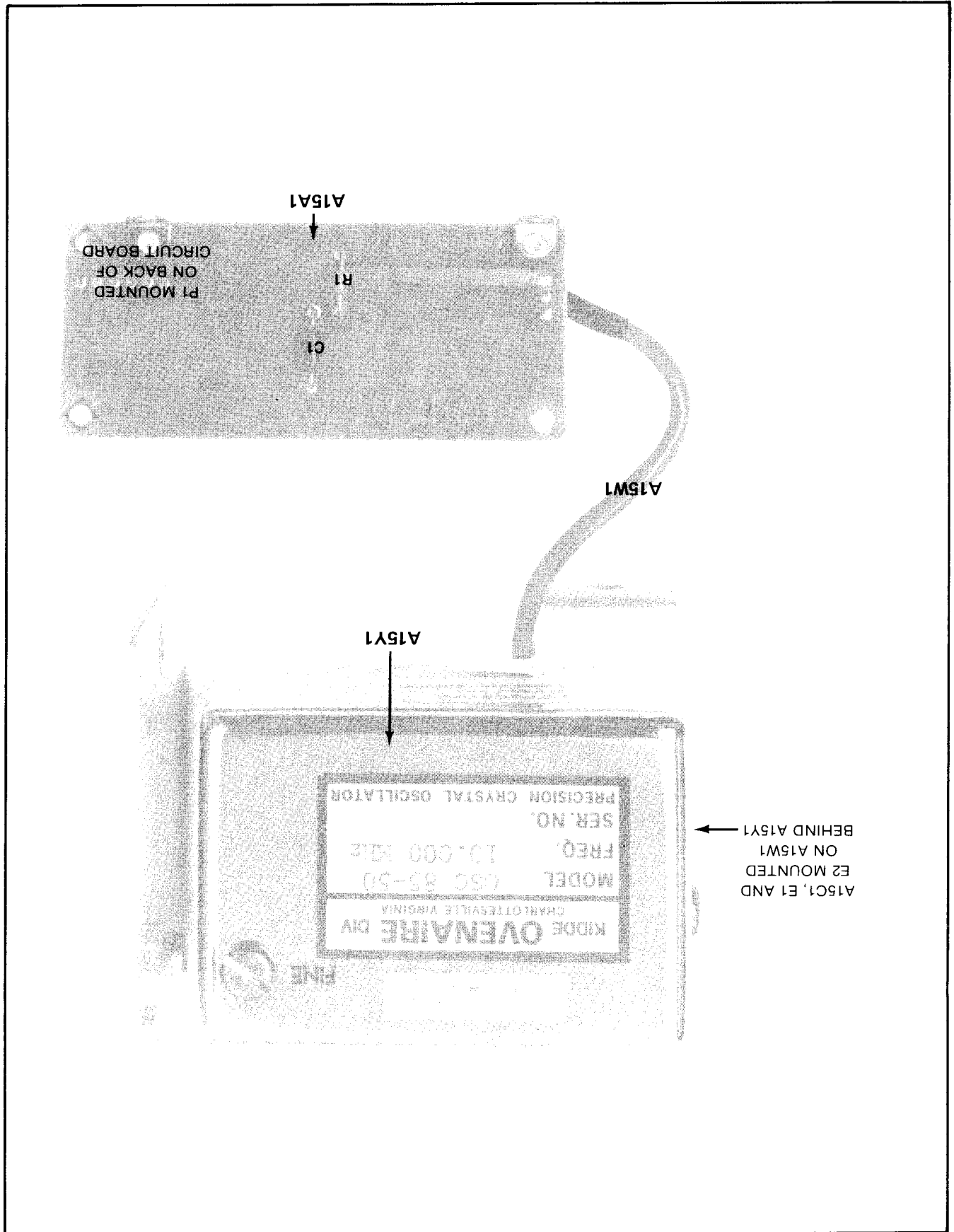


Figure 6-5. Option 004

**SECTION VII
MANUAL CHANGES**

7-1. INTRODUCTION

7-2. This section contains information necessary to adapt this manual to older instruments.

7-3. MANUAL CHANGES

7-4. To adapt this manual to your instrument, refer to the serial number tag on the instrument rear panel and *Table 7-1*. Make the manual changes as determined by the series number found under each assembly designation and opposite the serial number prefix.

7-5. For parts lists and schematics to be changed, refer to the appropriate tables and figures in Sections VI and VIII unless otherwise noted.

7-6. Be sure to use the appropriate notes as indicated in *Table 7-1*. They may effect your manual change.

7-7. If your instrument serial number prefix is not listed on the title page of this manual or in *Table 7-1* below, it may be documented in a yellow MANUAL CHANGES supplement. Manuals for these instruments are supplied with a manual change sheet containing the required information. Contact the nearest Hewlett-Packard Office if this supplement is missing.

Table 7-1. Manual Changes by Series Number

Serial Number Prefix	Assembly Designation														
	A11,2,4	A1-"A"/3,5	A1-"B"/3,5	A2	A3	A41	A5	A62	A63	A7	A8	A9	A133	A143	A153
1812A	1812	1812	1812	1812	1812	1812	1812	1812	1812	1812	1812	1812	1812	1812	1812
1824A	1824	1824	1824	1824	1824	1824	1824	1824	1824	1824	1824	1824	1824	1824	1824
1832A	1832	1824	1824	1832	1824	1824	1824	1812	1812	1824	1824	1824	1824	1824	1824
1908A	1920	1824	1824	1832	1824	1824	1824	1908	1908	1824	1824	1824	1824	1824	1824
1920A	1920	1824	1824	1832	1824	1824	1824	1908	1908	1824	1824	1824	1824	1824	1824
1928A	1928	1824	1824	1832	1824	1824	1824	1908	1908	1824	1824	1824	1824	1824	1824
1948A	1928	1824	1824	1948	1832	1824	1824	1908	1908	1824	1824	1824	1824	1824	1824
2024A	1928	1824	1824	1948	2024	1824	1824	1908	1908	1824	1824	1824	1824	1824	1824
2032A	1928	1824	1824	1924	2024	1824	1824	2032	2032	1824	1824	1824	1824	1824	1824
2120A	2120	1824	1824	1924	2024	1824	1824	2120	2120	1824	1824	1824	1824	1824	1824

1. A1 and A4 Assembly series numbers both must be 1812 or both must be greater than 1812 to be compatible.
2. The A1 and A6 assemblies are compatible with each other only when the series numbers are 1812 through 2032.
3. The assemblies indicated (A1-"A" or A1-"B", A6, and A13, A14 or A15) are compatible with each other only when the series numbers are 2120 and above.
4. Instruments with serial number prefixes 1812A through 1920A require the A1 Assembly jumper as shown in the Assembly Schematic in Section VIII.
5. A1-"A" is A1 Assembly of Model 5315A; A1-"B" is A1 Assembly of Model 5315B.

A1 ASSEMBLY

Series 1812

For A1 Assembly parts lists and schematics, use *Tables 7-3 and 7-4*, and *Figure 7-4*. A1 adjustment locations are shown in *Figure 7-1*.

NOTE

For A1U2, 1820-2312 is the recommended replacement. A1R29 and A1R30, however, must be installed if 1820-2312 is used. Refer to A1 Assembly information under Series 1920.

Series 1824

Include A1 Assembly information from Series 1812 and as follows:
A1C14 is a 0.2-1.5 pF variable capacitor connected across A1C9.
A1R5 and A1R6 are 178 ohms. A1R5 is connected from +3V to A1U2-pin 28; A1R6 is connected from +3V to A1U2-pin 30.

Series 1832

Include A1 Assembly information from Series 1812, 1824 and as follows:
A1C7 is not used (5315A only).
A1C30 and A1C31 are 0.1 μ F. A1C30 is connected from the upper ac input (A1CR7) to ground. A1C31 is connected from the lower ac input of A1CR7 to ground.
A1R27 is 1000 ohms. It is connected from the junction of A1CR6 and A1CR7 to ground.

Series 1920

Include A1 Assembly information from Series 1812, 1824, 1832 and as follows:
A1R29 is 23.7 ohms. It is connected from +3V to A1U2-pin 39.
A1R30 is 196 ohms. It is connected from A1U2-pin 39 to ground.
A1U2 is 1820-2312, CD1.

Series 1928

Include A1 Assembly information from Series 1812, 1824, 1832, 1920 and as follows:
A1C33 is 0.01 μ F. It is connected to A1U2-pin 39.
A1Q5 is not used.
A1R20 is not used. There is a direct connection from A1C26 to Q3-emitter.
A1R28 is 1000 ohms. It is connected from A1U3-pin 8 to ground.
A1U3B is connected in parallel with A1U3A, that is, pin 6 to pin 2, pin 5 to pin 3, and pin 7 to pin 1.
Show a connection from A1U1-pin 18 to J6-pin 1.
Show no connections from J6-pin 1 and J6-pin 11 to ground.
A1S1 is as shown in *Figure 7-2*. (This change is referenced to instrument serial number prefix 1948A rather than series number 1928).

Series 2120

Refer to other sections of this manual.

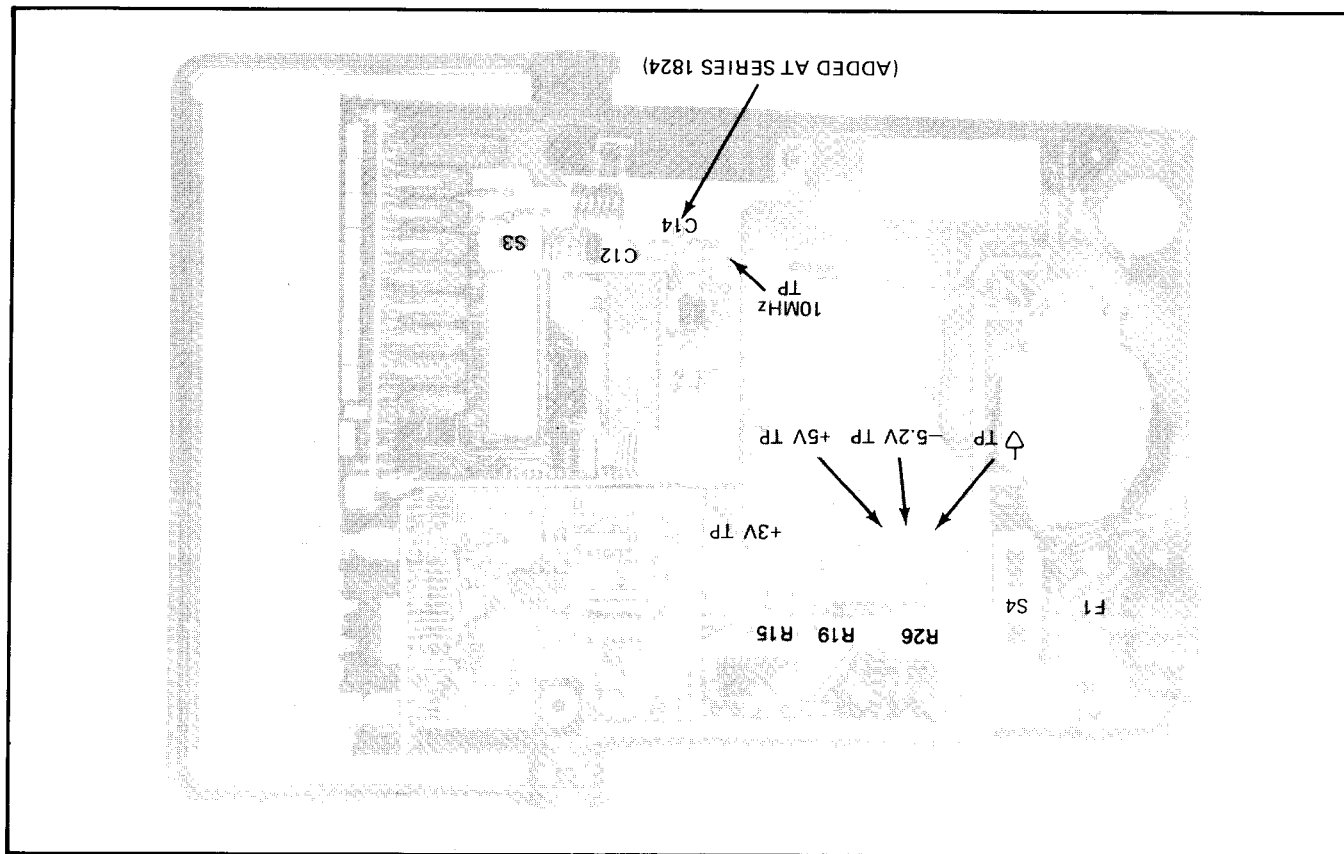


Figure 7-1. Adjustment Component Locator (A1 Assembly)
(A1 Assembly Series 1812 through 1928)

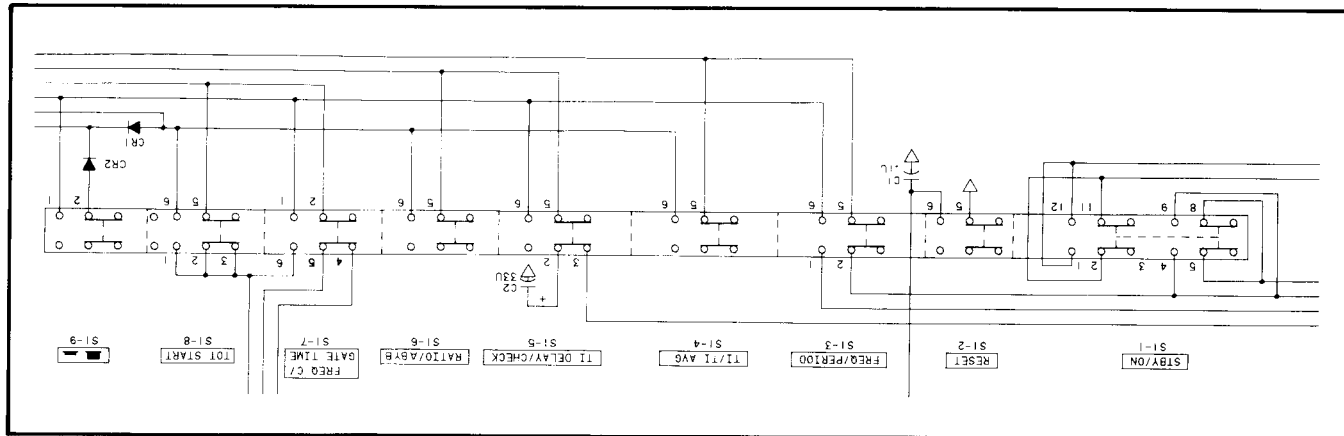


Figure 7-2. A1S1 Switch Assembly (A1 Assembly Series 1928)

A2 ASSEMBLY

Series 1812

For the A2 Assembly, use Table 6-2 and Figure 7-4 except:

A2 Assembly is 05315-60002

A2C1 is 68 pF

A2XU3 is 1200-0555, CD5

A2DS0 through A2DS8 are 1990-0658

A2DS9 is 1990-0668

A2DS10 through A2DS16 are 1990-0534

Series 1824
For the A2 Assembly, use Table 6-2 and Figure 7-4 except:
A2 Assembly is 05315-60002
A2C1 is 68 pF
A2XU3 is 1200-0555, CD5
A2DS0 through A2DS8 are 1990-0658
A2DS9 is 1990-0668
A2DS10 through A2DS16 are 1990-0534
Series 1924
Refer to other sections of this manual.

Series 1948
For A2 Assembly parts list and schematic, use Table 6-2 and Figure 7-4 except:
A2 is 05315-60002
A2DS0 through A2DS8 are 1990-0658
A2DS9 is 1990-0668
A2DS10 through A2DS16 are 1990-0534

A3 ASSEMBLY

Series 1812
A3C3 and A3C11 are 100 μ F
Series 1824
A3C3 and A3C11 are 100 μ F
Series 1832
A3C3 and A3C11 are 33 μ F
A3C8 is 68 pF connected to ground; A3R18 is not used
Series 2024
Refer to other sections of this manual

A4 ASSEMBLY

Series 1812
A4R6 and A4R19 are 90.0 ohm
A4R9 and A4R13 are not used
Series 1824
Refer to other sections of this manual

A6 ASSEMBLY

Series 1812
For the A6 Assembly, use Tables 7-2 and 7-5 and Figures 7-3 and 7-5.
Series 1908
For the A6 Assembly, use Tables 7-2 and 7-5 and Figures 7-3 and 7-5 except:
A6CR7 is 1901-0782, DIODE-SCHOOTKY 1N5821 30V 3A.
A6F1 is 2110-0447, 3A 125V FAST BLO .281 $\times$.093.
Series 2032
For the A6 Assembly, use Tables 7-2 and 7-5 and Figures 7-3 and 7-5 except:
A6CR7 is 1901-0782, 1N5821, SCHOTTKY DIODE 30V 3A.
A6F1 is 2110-0546, 5A FUSE.
Series 2120
Refer to other sections of this manual.

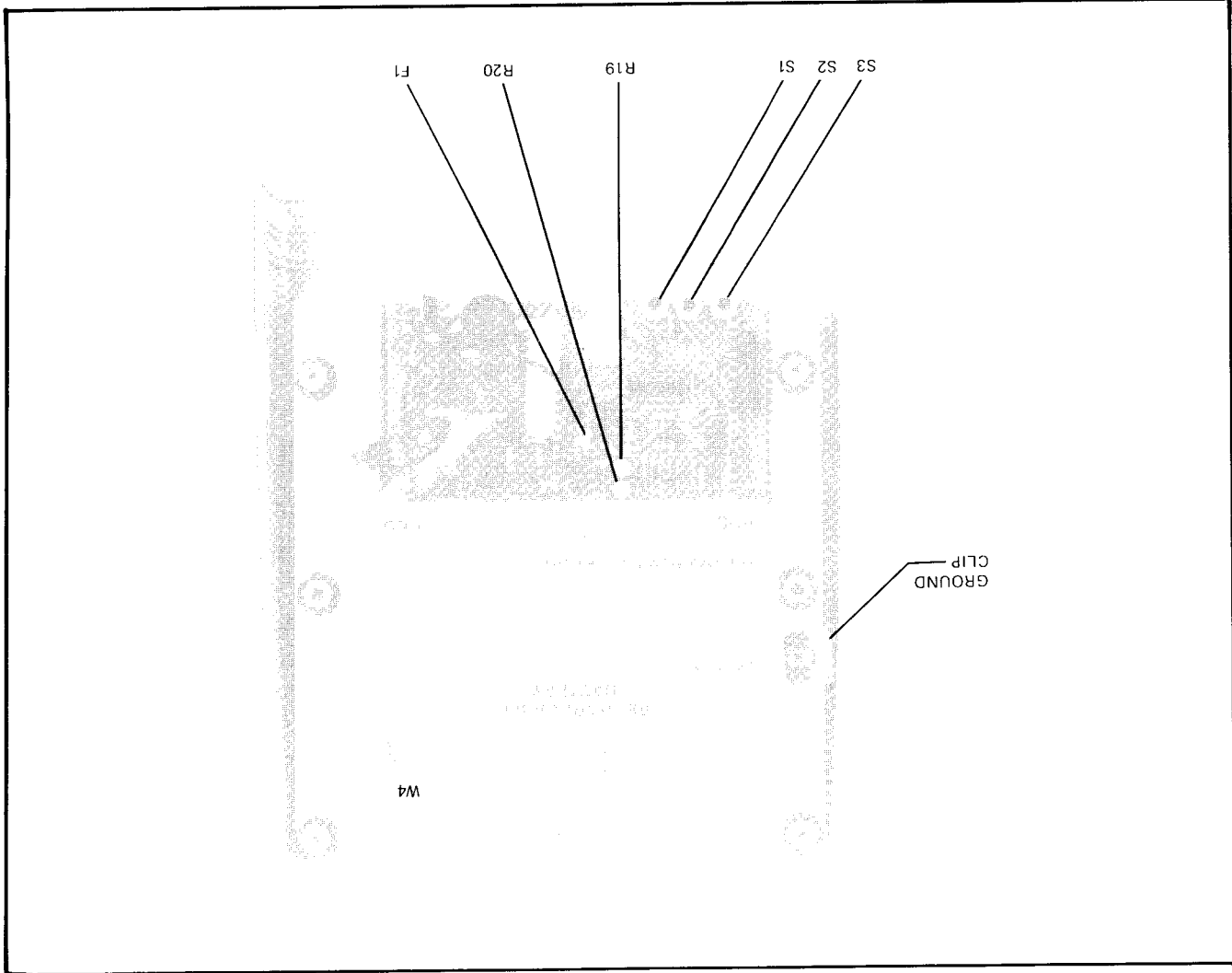


Figure 7-3. Option 002 Battery Charger Adjustment Locations
(A6 Assembly Series 1812 through 2032)

Table 7-2. A6 Adjustments (Series 1812 through 2032)

- a. Refer to Figure 7-3.
- b. Disconnect battery power cable from 5315A.
- c. Disconnect battery from A6 (05315-60006) battery charger assembly board.
- d. Connect cable W4 between A1J4 and A6J1.
- e. Connect DVM positive lead to A6W2 (red wire) and negative lead to a ground on battery charger assembly board (e.g., TP3).
- f. Connect power cable to 5315A; set STBY/ON switch to STBY position.
- g. Adjust A6R20 fully counterclockwise.
- h. Hold switch S3 down while adjusting A6R19 until DVM reads 7.71 volts; adjust A6R20 until charging LED (CHGD) turns on. Release switch S3.
- i. Connect DVM negative lead to A6W3 (black wire); short TP3 to TP7. Hold switch S3 down while adjusting A6R19 until DVM reads 6.00V.
- j. Set STBY/ON switch to the ON position. Hold switch S2 down; DVM should read $2.0 \pm 0.4/-0.1$ volts. Remove all shorts and turn instrument off.
- k. Disconnect all test equipment.

A7 ASSEMBLY

Series 1812

Refer to other sections of this manual.

Series 1824

Refer to other sections of this manual.

A9 ASSEMBLY

Series 1928

Refer to other sections of this manual.

A13, A14 AND A15 ASSEMBLIES

Series 2120

Refer to other sections of this manual.

Model 5315A/B
Replaceable Parts

Model 5315A/B
Replaceable Parts

Model 5315A/B
Replaceable Parts

See introduction to this section for ordering information
*Indicates factory selected value

Table 7-4. 5315B-A1 Assembly Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05315-60008	0	MOTHERBOARD ASSEMBLY (FOR 5315B ONLY) (SERIES 1812)	28480	05315-60008
A1C1	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	1A299	CAC04X7R104M050A
A1C2	0180-0562	1	CAPACITOR-FXD 33UF +-20% 10VDC TA	5A289	18AD336X010KAI
A1C3	0180-2698	8	CAPACITOR-FXD 4.7UF +-10% 35VDC TA	28480	0180-2698
A1C4	0180-0562	1	CAPACITOR-FXD 33UF +-20% 10VDC TA	5A289	18AD336X010KAI
A1C5	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C6	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C7	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C8	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C9*	0160-2150	5	CAPACITOR-FXD 33PF +-5% 30VDC MICA	28480	0160-2150
A1C10	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C11	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C12	0121-0061	1	CAPACITOR-V TRMR CER 5.5-18PF 350V	52763	304322 5.5/18PF NPO
A1C13	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C14	0160-2204	0	CAPACITOR-FXD 100PF +-5% 30VDC MICA	28480	0160-2204
A1C16	0140-0210	2	CAPACITOR-FXD 270PF +-5% 30VDC MICA	72136	DM15F227J10300WV1CR
A1C17	0180-0562	1	CAPACITOR-FXD 33UF +-20% 10VDC TA	5A289	18AD336X010KAI
A1C18	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C19	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	1A299	CAC04X7R104M050A
A1C20	0160-4554	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C21	0180-2820	8	CAPACITOR-FXD .22UF +-20% 35VDC TA	28480	0180-2820
A1C22	0160-3879	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C23	0180-2816	2	CAPACITOR-FXD .68UF +-20% 10VDC TA	28480	0180-2816
A1C24	0180-2815	1	CAPACITOR-FXD 100UF +-20% 10VDC TA	28480	0180-2815
A1C25	0140-0192	0	CAPACITOR-FXD 82PF +-5% 30VDC MICA	72136	DM15F620J0300WV1CR
A1C26	0180-1235	2	CAPACITOR-FXD .22UF +-10% 35VDC TA	5A289	150D224X9035A2
A1C27	0180-2891	3	CAPACITOR-FXD 4700UF +-100-18% 15VDC AL	28480	0180-2891
A1C28	0180-2816	8	CAPACITOR-FXD .68UF +-20% 10VDC TA	28480	0180-2816
A1C29	0180-2820	8	CAPACITOR-FXD .22UF +-20% 35VDC TA	28480	0180-2820
A1C30	0180-2820	8	CAPACITOR-FXD .22UF +-20% 35VDC TA	28480	0180-2820
A1C31	0180-2892	4	CAPACITOR-FXD 2200UF +-75-10% 16VDC AL	28480	0180-2892
A1C32	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C33	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C34	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C35	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C36	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C37	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C38	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C39	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C40	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C41	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C42	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C43	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1C44	1251-5370	1	CONNECTOR 11-PIN M POST TYPE	28480	1251-5370
A1C45	1251-5381	3	CONNECTOR 12-PIN F POST TYPE	28480	1251-5381
A1C46	1251-5370	1	CONNECTOR 11-PIN M POST TYPE	28480	1251-5370
A1C47	1251-4215	1	CONNECTOR 6-PIN F POST TYPE	28480	1251-4215
A1C48	NOT ASSIGNED	2	CONNECTOR 11-PIN M POST TYPE	28480	1251-5370
A1C49	1251-5381	3	CONNECTOR 12-PIN F POST TYPE	28480	1251-5381
A1C50	1251-5370	1	CONNECTOR 11-PIN M POST TYPE	28480	1251-5370
A1C51	1200-0423	8	SOCKET-16 16-CONT DIP DIP-SIDR	28480	1200-0423
A1C52	9140-0237	2	INDUCTOR RF-CH-MLD 2000H 5% .166DX.385L5	28480	9140-0237
A1C53	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C54	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C55	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C56	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C57	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C58	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C59	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C60	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C61	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C62	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C63	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C64	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C65	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C66	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C67	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C68	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C69	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C70	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C71	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C72	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C73	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C74	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C75	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C76	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C77	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C78	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C79	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C80	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C81	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C82	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C83	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C84	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C85	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C86	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C87	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C88	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C89	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C90	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C91	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C92	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C93	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C94	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C95	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C96	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C97	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C98	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C99	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C100	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C101	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C102	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C103	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C104	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C105	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C106	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C107	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C108	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C109	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C110	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C111	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C112	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C113	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C114	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C115	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C116	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C117	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C118	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C119	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C120	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C121	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C122	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C123	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C124	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C125	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C126	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C127	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C128	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C129	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C130	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C131	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C132	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C133	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C134	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C135	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C136	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C137	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C138	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C139	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C140	1854-0477	7	TRANSISTOR NPN 2N2222A SI 10-18 PD=500MW	04713	2N2222A
A1C141					

Model 5315V/8
Replaceable Parts

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Model 5315A/B
Replaceable Parts

Table 7-5. 5315A-A6 Assembly Replaceable Parts

Reference	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
AA	05315-60006	8	BATTERY CHARGER ASSEMBLY 5315A ONLY OPTION 002, SERIES 1812	29480	05315-60006
AA51	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	15292	CAC04X2R104M050A
AA52	0180-2815	1	CAPACITOR-FXD 100UF+-20% 10VDC TA	29480	0180-2815
AA53	0180-2921	2	CAPACITOR-FXD 27UF+-20% 35VDC TA	29480	0180-2821
AA54	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	29480	0160-0576
AA55	0160-0134	1	CAPACITOR-FXD 220PF +-5% 30VDC MICA	29480	0160-0134
AA56	0160-4557	0	CAPACITOR-FXD .1UF +-20% 50VDC CER	15299	CAC04X2R104M050A
AA57	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	29480	0160-0576
AA58	0180-2686	4	CAPACITOR-FXD 470UF+-10% 25VDC AI	00853	3016FR4710025R
AA59	0160-0576	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	29480	0160-0576
AA60	0180-2821	1	CAPACITOR-FXD 27UF+-20% 35VDC TA	29480	0180-2821
AA61	0180-0505	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA62	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA63	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA64	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA65	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA66	1901-0460	9	DIODE-STARATOR 30V 150MA DO-7	29480	1901-0460
AA67	1901-0676	1	DIODE-GEHOLTY 20V 5A	29480	1901-0676
AA68	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA69	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA70	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA71	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	29480	1901-0050
AA72	9140-0320	4	INDUCTOR 75UH 8% 7DX16LS	29480	9140-0320
AA73	1853-0363	8	TRANSISTOR PNP SI PD=50W FT=20MHZ	03508	X45H281
AA74	1854-0477	7	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
AA75	1854-0477	7	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
AA76	1853-0363	8	TRANSISTOR PNP SI PD=50W FT=20MHZ	03508	1853-0036
AA77	1853-0036	2	TRANSISTOR PNP SI PD=50W FT=20MHZ	03508	1853-0036
AA78	0757-0398	4	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-10-75R0-F
AA79	0698-3438	3	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-10-147R-F
AA80	0757-0276	7	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-10-61.9R-F
AA81	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-10-1K01-F
AA82	0757-0283	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K3-F
AA83	0698-8022	9	RESISTOR 6.8 1% .125W F TC=0+-100	24546	C4-1/8-10-6.8R-F
AA84	0757-0274	5	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-10-1.21K-F
AA85	0757-0290	5	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF401/8-10-6191-F
AA86	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA87	0757-0401	0	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-10-1003-F
AA88	0698-8022	9	RESISTOR 6.8 1% .125W F TC=0+-100	24546	C4-1/8-10-6.8R-F
AA89	0757-0274	5	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-10-1.21K-F
AA90	0757-0290	5	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF401/8-10-6191-F
AA91	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA92	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA93	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA94	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA95	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA96	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA97	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA98	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA99	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA00	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA01	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA02	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA03	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA04	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA05	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA06	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA07	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA08	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA09	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA10	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA11	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA12	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA13	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA14	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA15	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA16	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA17	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA18	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA19	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA20	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA21	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA22	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA23	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA24	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA25	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA26	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA27	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA28	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA29	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA30	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA31	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA32	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA33	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA34	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA35	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA36	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA37	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA38	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA39	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA40	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA41	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA42	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA43	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA44	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA45	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA46	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA47	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA48	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA49	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA50	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA51	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA52	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA53	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA54	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA55	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA56	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA57	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA58	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA59	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA60	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA61	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA62	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA63	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA64	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA65	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA66	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA67	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA68	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA69	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA70	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA71	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA72	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA73	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA74	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA75	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA76	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA77	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA78	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA79	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA80	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA81	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA82	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA83	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA84	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-10K2-F
AA85	0757-0441	6	RESISTOR 10K 1% .125W F TC=0+-100		

*Indicates factory selected value
See introduction to this section for ordering information

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R31	6698-3156	2	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-10-147-F
A6R32	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-10-100-F
A6R33	0757-0442	3	RESISTOR 25K 1% .125W F TC=0+-100	24546	C4-1/8-10-250-F
A6R34	0757-0447	4	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-10-162-F
A6R35	0757-0283	6	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-10-200-F
A6R36	0757-0407	6	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-10-201-F
A6R37	0811-3117	7	RESISTOR 12 1% 2W FV TC=0+-20	24480	0811-3117
A6R11	0837-0159	15	THERMISTOR 33K-OHM TC=+1%/C-DIG	01295	TM 1/8 333K
A6S1	3101-2351	7	SWITCH-PR SPST-NO MOM 1A 120VAC BLK-RTN	24480	3101-2351
A6S2	3101-2351	7	SWITCH-PR SPST-NO MOM 1A 120VAC BLK-RTN	24480	3101-2351
A6T1	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6T2	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6T3	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6T4	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6T5	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6T6	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6T7	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6T8	1251-0600	0	CONNECTOR-SGL GNDT PIN 1.14-MM-BSC-SZ 50	24480	1251-0600
A6U1	1426-0450	7	IC V REG1R 14-DIP-P	01295	TL497CN
A6U2	1426-0424	5	IC OP AMP GP 06AL 14-DIP-P PKG	04713	MC3405P
A6U3	1426-0467	6	V RFL PRGN 8 DIP-P	04713	MC1403P1
A6U4	1426-1600	9	IC SCHMITT-TRIG CMOS NAND GUAD 2-PIN	01295	CD4023BE
A6U5	1426-0412	1	IC COMPARATOR PRGN DUAL 8-DIP-P PKG	27014	LM339N
A6 MISCELLANEOUS PARTS					
TERMINAL-STUD FKD-TUR SWGRM-MTG					
28480	0360-0295	2		28480	0360-0295
5315A CHASSIS PARTS					
B11	1420-0253	8	BATTERY 6 V 5A-HR PB-ACID QDISC	0139E	0800-0011
MP22	05315-00005	1	CLAMP-BATTERY	28480	05315-00005
MP23	05315-00006	2	DECK-BATTERY	28480	05315-00006
MP24	0510-0585	6	RETAINER-PUSH ON	28480	0510-0585
MP25	0531353-00014	2	CLIP-GROUNDING	28480	05315-00014
MISCELLANEOUS PARTS					
W2	05315-60102	5	CABLE ASSEMBLY-LEAD, RED	28480	05315-60102
W3	05315-60103	6	CABLE ASSEMBLY-LEAD, BLACK	28480	05315-60103
W4	05315-60101	4	CABLE ASSEMBLY-BATTERY	28480	05315-60101

Table 7-5. 5315A-A6 Assembly Replaceable Parts (Continued)

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