TECHNICAL MANUAL

OPERATOR'S, UNIT AND INTERMEDIATE DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

TEST SET, COUNTER, ELECTRONIC TS-4274/G (NSN 6625-01-150-8116)

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 MARCH 1988

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

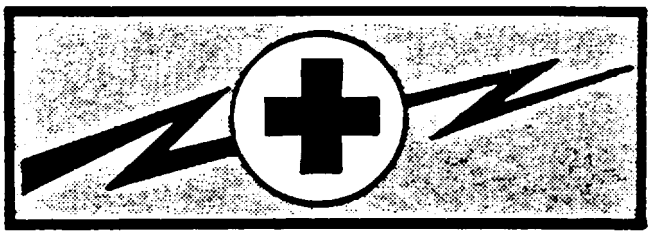
1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION



WARNING

HIGH VOLTAGE
is used in the operation of this equipment

DEATH ON CONTACT
may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must be warned about dangerous areas.

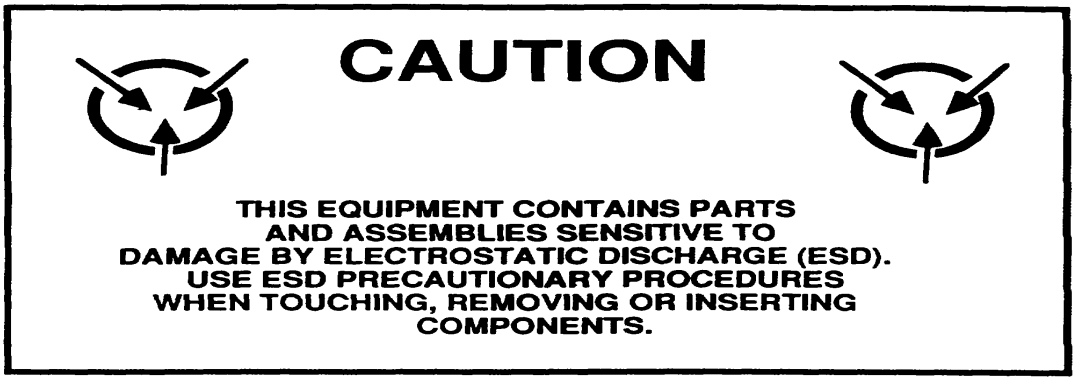
Be careful not to contact high-voltage connections of 115-volt ac input when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term "LOW VOLTAGE" Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration refer to FM 21-11.



ESD
CLASS 1

NOTE

The symbol for static sensitive devices in military inventory is as depicted in the caution block above.

GENERAL HANDLING PROCEDURES FOR ESDS ITEMS

- •USE WRIST GROUND STRAPS OR MANUAL
- •KEEP ESDS ITEMS IN PROTECTIVE COVERING
- •GROUND ALL ELECTRICAL TOOLS AND TEST EQUIPMENT
- •PERIODICALLY CHECK CONTINUITY AND RESISTANCE GROUNDING PROCEDURESOF GROUNDING SYSTEM
- •USEONLY METALIZED SOLDER SUCKER HANDLING WHEN NOT IN USE•ESDS ITEMS ONLY IN PROTECTED AREAS

MANUAL GROUNDING PROCEDURES

- •MAKE CERTAIN EQUIPMENT IS POWERED DOWN
- •TOUCH GROUND PRIOR TO REMOVING ESDS ITEMS
- •TOUCH PACKAGE OF REPLACEMENT ESDS ITEM TO GROUND BEFORE OPENING
- •TOUCH GROUND PRIOR TO INSERTING REPLACEMENT ESDS ITEMS

ESD PROTECTIVE PACKAGING AND LABELING

- •INTIMATE COVERING OF ANTISTATIC MATERIAL WITH AN OUTER WRAP OF EITHER TYPE 1 ALUMINIZED MATERIAL OR CONDUCTIVE PLASTIC FILM OR HYBRID LAMINATED BAGS HAVING AN INTERIOR OF ANTISTATIC MATERIAL WITH AN OUTER METALIZED LAYER
- •LABEL WITH SENSITIVE ELECTRONIC SYMBOL AND CAUTION NOTE

CAUTION

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of the components contain internal gate protection circuits that are partially effective, but sound maintenance practice and the cost of equipment failure in time and money dictate careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

CAUTION

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

STEP 1 Turn off and/or disconnect all power and signal source and loads used with the unit.

STEP 2 Place the unit on grounded conductive work surfaces.

STEP 3 Ground the repair operator using a conductive wrist strap or other device using a 1-M series resistor to protect

STEP 4 Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

STEP 5 All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.

STEP 6 When these devices and assemblies are removed from the unit, they should be placed in the conductive work surface or in conductive containers.

STEP 7 When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.

STEP 8 Do not handle these device unnecessarily or remove from their packages until actually used or tested.

Technical Manual

No. 11-6625-3196-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 March 1988

OPERATOR'S, UNIT AND INTERMEDIATE DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

TEST SET, COUNTER, ELECTRONIC TS-4274/G (NSN 6625-01-150-8116)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or 2028-2 located in back of this manual direct to: Commander, US Army Communication-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5000.

In either case, a reply will be furnished direct to you.

TABLE OF CONTENTS

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications, the format has not been structured to consider levels of maintenance.

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TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

Section 0 INTRODUCTION

0-1. SCOPE.

This manual contains instructions for the operation and maintenance of Test Set, Counter, Electronic TS-4274/G. Throughout this manual, Test Set, Counter, Electronic TS4274/G is referred to as either the Instrument, Frequency Counter, or HP 5314A.

0-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

0-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

a.Report of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750 as contained in Maintenance Management Update.

b.Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy) as prescribed in AR 735-1102/DLAR 4140.55/NAVMATINST 4355.73B/AFR 400-54/MCO 4430.3H.

c.Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (SF 361) as prescribed in AR 55-38/ NAVSUPINST 4610.33C/ AFR 75-18/ MCO P4610.19D/ DLAR 4500.15.

0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your Frequency Counter needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency report). Mail it to us at Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, NJ 07703-5000. We'll send you a reply.

0-5. ADMINISTRATIVE STORAGE.

Refer to TM 740-90-1 for administrative storage procedures.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

0-7. WARRANTY INFORMATION.

The HP 5314A is warranted by Hewlett-Packard Company for one year (Except battery is not warranted). Warranty starts on the date of shipment to the original buyer. Report all defects in material or workmanship to your supervisor who will take appropriate action.

0-8. SAFETY CONSIDERATIONS.

This product is a Safety Class I instrument; that is, one provided with a protective earth terminal. Before operating or servicing the Frequency Counter, personnel should familiarize themselves with both the safety markings on the equipment and the safety information presented at the beginning of this manual.

0-9. TOOLS AND TEST EQUIPMENT CROSS REFERENCE.

The following is a cross-reference of test equipment from table 1-3 to Appendix B MAC test equipment.

Table 1-3 Model Number/Name	Appendix B MAC Tool Number/Name
HP 3314A Test Oscillator	HP 652A Test Oscillator
HP 8656B Signal Generator	HP 8640B Signal Generator
HP 10100C 50 Termination	TEK 011-0049-01 50Q Termination
HP 3466A Digital Voltmeter	HP 3490A Digital Voltmeter
HP 1741A Oscilloscope	TEK 5440 Mainframe
	TEK 5A48 Plug-in
	TEK 5B42 Plug-in
	TEK 5S14N Plug-in
	TEK P6056 Probe
HP 3312 Function Generator	HP214B Pulse Generator
	HP 400EL Voltmeter
	HP 355D Attenuator

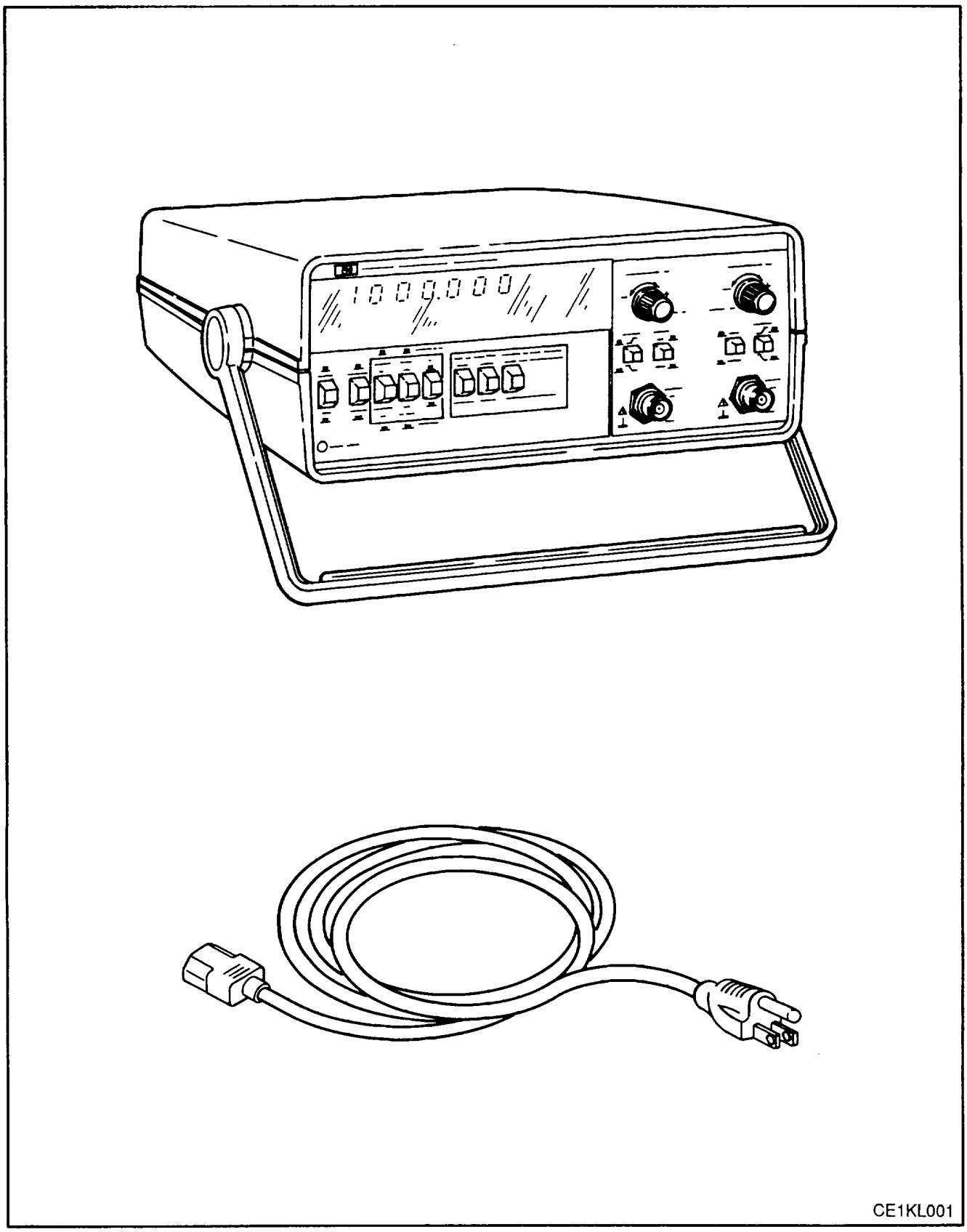


Figure 1-1. Model 5314A and Equipment Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual provides information pertaining to the installation, operation, testing, adjustment, and maintenance of the HP Model 5314A Universal Counter. *Figure 1-1* shows the HP 5314A with the supplied equipment.

1-3. This operating and service manual is divided into eight sections, each covering a particular topic for the operation and service of the HP 5314A. The eight sections are listed here:

Section	Topic
I	General Information
II	Installation
III	Operation
IV	Performance Tests
V	Adjustments
VI	Deleted
VII	Deleted
VIII	Service

1-4. SPECIFICATIONS

1-5. Instrument specifications are listed in *Table 1-1.* These specifications are the performance standards or limits against which the instrument may be tested.

1-6. SAFETY CONSIDERATIONS

1-7. The HP 5314A Universal Counter is a Safety Class I instrument, 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 HP 5314A in safe operating condition.

1-8. DELETED

1-9. Deleted
1-10. Deleted

1-11. DELETED

1-12. Deleted

Table 1-1 Specifications

INPUT CHARACTERISTICS

Range:
Channel A10 Hz to 100 MHz
Channel B10 Hz to 2.5 MHz

Sensitivity:
Channel A:
25 mV rms to 100 MHz
75 mV peak-to-peak minimum pulse with 5 ns
Channel B:
25 mV rms to 2.5 MHz
75 mV peak-to-peak minimum pulse width of 50 ns

Coupling: AC

Impedance: 1 Mn NOMINAL shunted by less than 30 pF

Attenuator: X1 or X20 **NOMINAL** (A Channel only)

Trigger Level:
Continuously variable +350 mV times attenuator setting around average value os signal.

Slope: Independent selection of + or - slope

Channel Input: Selectable SEPARATE or COMMON A

Damage Level:
X1DC to 100 kHz350V (DC + peak AC)
100 kHz to 5 MHz2.5 x 107C x Hz Product
Above 5 MHz5V rms
X20:DC to 1 MHz350V (DC + Peak AC)
1 MHz to 50 MHz2.5 x 108V x Hz Product
Above 50 MHz5V rms

FREQUENCY (A)

Range:
10 Hz to 10 MHz direct count
1 MHz to 100 MHz prescaled by 10

LSD Displayed: Direct count 0.1 Hz, 1 Hz, 10 Hz switch selectable. Prescaled 10 Hz, 100 Hz, 1 kHz switch selectable.

Resolution: ± LSD

Accuracy: ± LSD + (time base error) x FREQ

PERIOD (A)

Range: 10 Hz to 2.5 MHz

LSD Displayed:
100 ns / N for N=1 to 1000 in decade steps of N

Resolution:
± LSD ± 1.4 x Trigger Error

Accuracy
± LSD ± 1.4 x Trigger Error / N
± (time base error) x PER

TIME INTERVAL (A TO B)

Range: 250 ns to 1 s

LSD Displayed: 100 ns

Resolution: ± LSD ± START Trigger Error ± STOP Trigger Error

Accuracy: + LSD ± START Trigger Error ± STOP Trigger Error ± (time base error) x TI
Time Interval measurements require an arming signal for both the START and STOP Channels.
(See Paragraph 3-11.)

RATIO

Range:
10 Hz to 10 MHz Channel A
10 Hz to 2.5 MHz Channel B

LSD Displayed:
1 part in A x N in decade steps of N for N=1 to 1000

Resolution:
± LSD ± (B Trigger Error x FREQUENCY A)/N

Accuracy:
± 1 count of A ± (B Trigger Error x FREQUENCY A)/N

TOTALIZE (A)

Range: 10 Hz to 10 MHz

Resolution: ± 1 count of input

GENERAL

Check: Counts internal 10 MHz Oscillator

Display: 7-digit amber LED display with gate and overflow indication.

Maximum Sample Rate: 5 readings per second.

Operating Temperature: 0° to 50°C

Power Requirement:
115V, +10%, -25%; 230V, -17%, +9%;48-6 Hz; 10 VA maximum.

Weight: 2.0 kg (4.4 lbs.)

Dimension: 238 mm wide x 98 mm high x 276 mm long (93/8 X 33f8 X 107/8 in.)

TIME BASE

Frequency: 10 MHz

Aging Rate: <3 parts in 107 per month

Temperature: <+1 part in 105, 0° to 50°C

Line Voltage: <+1 part in 107 for +10% variation.

Battery

Type: Recharageable lead-acid (sealed)

Capacity: TYPICALLY 8 hour 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.

Battery Voltage Sensor: Automatically shuts instrument off when low battery condition exists.

Line Failure Protection: Instrument automatically switches to batteries in case of line failure.

Weight: A3 adds 1.5 kg (3.3 lbs.) to weight of instrument.

WARRANTY

ALL COMPONENTS WITHIN, EXCEPT THE BATTERY, ARE WARRANTED FOR ONE FULL YEAR. BATTERY BT1, (HP PART NO. 1420-0253 IS NOT WARRANTED

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 standard of frequency and time.

Trigger Error:

$$\frac{\sqrt{(80\ \mu V)\ 2 + en2}}{\text{Input Slew Rate at Trigger Point (pV/s) (rms)}}$$

Where en is the rms noise of the input for a 100 MHz bandwidth on Channel A and a 10 MHz bandwidth on Channel B

LSD: Least Significant Digit.

1-13. Deleted

1-14. Deleted

1-15. DESCRIPTION

1-16. The HP 5314A is a 100 MHz/100 ns Universal Counter. It features a seven-digit, seven-segment LED display with overflow indication, seven function performance, and full input signal conditioning.

1-17. The seven functions are: Frequency, Single-Shot Period, Period Average, Time Interval, Totalize, Ratio, and Self Check. This is accomplished by a single LSI integrated circuit. The input signal is AC coupled and can be conditioned as follows: slope selection, trigger level, and attenuation.

1-18. DELETED

1-19. Deleted

1-20. EQUIPMENT SUPPLIED

1-21. *Table 1-2* lists the only equipment supplied with the HP 5314A.

Table 1-2. Equipment Supplied

DESCRIPTION	HP PART NO.
Detachable Power Cord 229 cm (712 feet long)	8120-1378

1-22. RECOMMENDED TEST EQUIPMENT

1-23. The test equipment listed in *Table 1-3* is recommended for use during performance tests, adjustments, and troubleshooting. Substitute test equipment may be used if it meets the required characteristics listed in the table.

Table 1-3. Recommended Test Equipment

Instrument Type	Required Characteristics	HP Model No. Recommended
Test Oscillator	10 MHz, 25 mV rms	3314A
Signal Generator	100 MHz, 25 mV rms	8656B
50-ohm Termination	100 MHz bandwidth	10100C
Digital Voltmeter	10 volts	3466A
Oscilloscope (100 MHz)	V: 5 mV H: 50 ns	1741A
Function Generator	2.5 MHz, 25 mV rms	3312A

SECTION II

INSTALLATION

2-1. INTRODUCTION

2-2. This section provides all information necessary to install the HP 5314A. Covered in this section are initial inspection, preparation for use, field installation of options, operating environment, and repackaging for shipment.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the shipment has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the next higher level of maintenance.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. The HP 5314A requires a power source of 115V, +10%, -25%; 230V, -17%, +9%; 4866 Hz; 10 VA maximum. Power consumption is 10 watts maximum.

2-8. Line Voltage Selection

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the instrument is set to the voltage of the power source. The voltage at which the unit has been factory set, is indicated on the rear panel label.

2-9. Line voltage selection is determined by the position of the line voltage selector switch located inside the instrument on the A2 (05314-60002) power supply assembly. Line voltage is preset at the factor for 115V (86V to 126V) or 230V (172V to 252V) as ordered by the customer. If changing of the line voltage becomes necessary, follow the procedure in *Table 2-1.*

Table 2-1. Line Voltage Changing Procedure

WARNING

THE POWER CORD SHOULD BE REMOVED FROM THE REAR OF THE HP 5314A BEFORE STARTING THIS PROCEDURE.

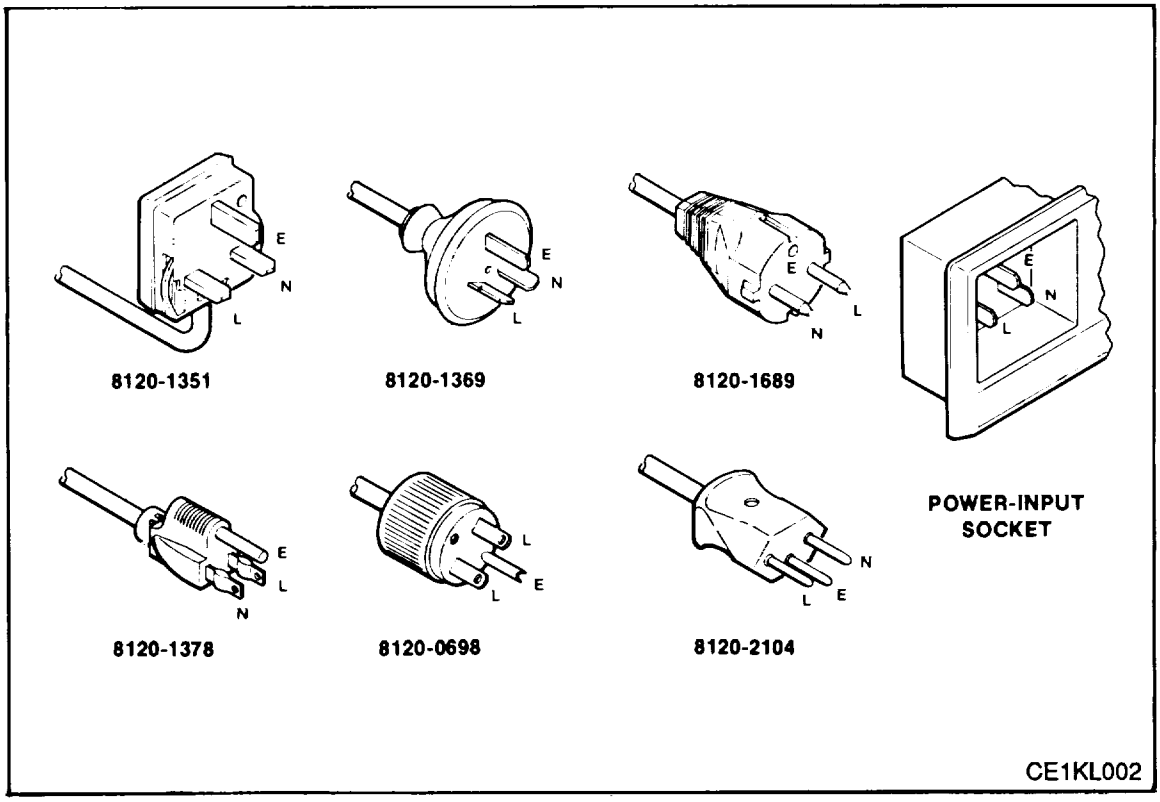
1. Turn the HP 5314A upside down and remove the four screws near the corners of the cabinet bottom.
2. Holding the top and bottom covers together, turn the HP 5314A right side up and carefully lift the top cover. This exposes the line voltage selector switch located on the A2 (05314-60002) power supply assembly (large pc assembly located in the rear of the cabinet).
3. The two-position switch may now be properly set to match the input voltage (115 for 86V to 126V input or 230 for 172V to 252V input).
4. Replace the top cover and carefully turn the unit upside down. Replace and tighten the four screws, one in each corner, of the cabinet bottom.

NOTE

The line voltage selector switch automatically selects the correct line input fuse configuration (the two fuses are located on the A2 assembly and are in series for 230V selection, and in parallel for 115V selection).

2-10. Power Cable

2-11.The HP 5314A is shipped with a three-wire power cable. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to *Figure 2-1* for the part numbers of the power cable and plug configurations available.



2-12. Bench Operation

2-13. The HP 5314A has an adjustable handle, and two rubber strips located at the rear of the cabinet bottom, for convenience in bench operation. By pulling out the ends of the handle and adjusting it, the front of the HP 5314A may be raised for easier viewing of the front panel. The two rubber strips on the cabinet bottom keep the HP 5314A from sliding on smooth-surface benches.

2-14. INSTALLATION OF A3

2-15. For installation of battery, refer to Table 2-3. Field installation should be performed by qualified personnel only.

2-16. OPERATING ENVIRONMENT

2-17. In order for the HP 5314A to meet the specifications listed in *Table 1-1,* the operating environment must be within the following limits:

Temperature	0° to +55°C
Humidity.....	<80% relative
Altitude.....	15,000 feet

2-18. STORAGE AND SHIPMENT

2-19. Environment

2-20. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature	-40°C to +75°C
Humidity.....	<95% relative
Altitude.....	<50,000 feet

2-21. Packaging

2-22. Deleted

2-23. OTHER PACKAGING. The following general instructions should be used for repackaging with available materials.

a. Wrap the instrument in heavy paper or plastic.
b. Use a strong shipping container. A doublewall carton made of 250 pound test material is adequate.
c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.
d. Seal the shipping container securely.
e. Mark the shipping container FRAGILE to assure careful handling.

Table 2-2. Option 001 Installation Instructions
Table Deleted

Table 2-3. A3 Installation Instructions

NOTE
Installation of the battery pack should be performed by qualified personnel only.

A3 consists of the following parts:

HP Part Number	Qty.	Description
05314-60003	1	Battery Charger Assembly
1420-0253	1	6V Lead-Acid Battery
05314-00002	1	Battery Bracket
2420-0001	1	6-32 x 1/" Machine Screw

1. Turn off the HP 5314A and remove the AC power cord.

2. Turn the HP 5314A upside down and remove the four screws near the corners of the cabinet bottom.

3. Holding the top and bottom covers together, turn the HP 5314A rightside up and carefully lift the top cover.

4. Remove the front two black plastic spacers and washers (located 1 1/2" behind the combination front panel and A1 assembly). Discard the washers only.

5. Assemble the battery and battery hold-down bracket, matching the polarity of the battery with that shown on the hold-down bracket.

6. Dress all A1-A2 interconnect cables to lay across the lower left corner of the cabinet bottom.

7. Install the battery pack and A3 assembly as follows:

   a. Locate the two spacer studs in the front of the cabinet bottom (approximately 1 1/2" behind the combination front panel Al assembly).

   b. Mount the battery pack and bracket so the two spacer studs go through the two large holes on the bracket, and the battery posts (+ and -) are pointing toward the A2 assembly (rear of the cabinet).

   c. Locate the A3 assembly (05314-60003). Lay the assembly on a flat surface (component side up) and dress the two cables (red and black) so they point straight up (perpendicular from the assembly).

   d. Install the A3 assembly (05314-600031, component-side up, into A2J1 (the 6-pin plastic board connector on the A2 power supply assembly).

   e. Install a 12" 6-32 screw through the board assembly/battery mounting bracket and secure them to the cabinet bottom.

NOTE
Make sure the HP 5314A power switch is in the STBY position!

   f. Connect the red cable to the (+) post of the battery pack.

   g. Connect the black cable to the (-) post of the battery pack.

   h. Install the two black plastic spacers (without washers) onto the front spacer studs.

   i. Installation of A3 is now complete. IMMEDIATELY proceed to step 4 of Table 5-4, Battery Cutoff Voltage Adjustment.

SECTION III.

OPERATION

3-1. INTRODUCTION

3-2. This section provides complete operating information needed for the HP 5314A Universal Counter. This section includes a description of all front panel controls, connectors and indicators, operating instructions, operator's checks, and operator's maintenance.

3-3. OPERATING CHARACTERISTICS

3-4. The following paragraphs describe the operating ranges and resolution for frequency, period, time interval, ratio A/B, totalize A, and self-check functions.

3-5. Frequency Measurements

3-6. All frequency measurements are made through the A channel input. The frequency range is 10 Hz to 10 MHz direct count and 10 Hz to 100 MHz prescaled by 10, with a minimum input level of 25 mV rms or 75 mV p-p (with a minimum pulse width of 5 ns) times the attenuator setting. The resolution is 0.1 Hz for frequencies up to 10 MHz. With frequencies above 10 MHz (prescale mode), the resolution is 10 Hz. See *Figure 3-3* for a typical frequency measurement setup.

3-7. Period Measurements

3-8. All period measurements are made through the A channel input. The signal can be a sine wave, square wave, or a wave form with components faster than 10 Hz. The period range is 100 ms to 400 ns (10 Hz to 2.5 MHz). The sensitivity is 25 mV rms or 75 mV p-p. The resolution is 100 ns. See *Figure 3-4* for a typical period measurement setup.

3-9. Time Interval Measurements

3-10. The counter measures time intervals from Channel A to Channel B; that is, Channel A starts the measurement and Channel B stops the measurement. Time between points on a single waveform can be measured by connecting the input signal to CHANNEL A jack and placing the Input Amplifier Control switch to COM A. Under these conditions, the slope and level controls of Channel A and Channel B allow variable triggering on either the + or - slope. With the Input Amplifier Control switch set to SEP, measurements can be made between points on separate waveforms. The time interval range is 250 ns to 1 s. The sensitivity is 25 mV rms (75 mV p-p). The resolution is 100 ns. See *Figures 3-5* and 3-6 for typical time interval measurement setups.

3-11. INITIATING A MEASUREMENT. The HP 5314A does not internally arm itself in time interval. Both Channels A and B **must** be externally armed before a time interval measurement can be initiated, see *Figure 3-1.* Each channel is armed by the first positive or negative edge (corresponding to the slope selection setting) of the input signal. Channel A is armed first. Channel B ignores all input edges until Channel A is armed. Once Channel A is armed, the first positive or negative edge (corresponding to the slope selection setting) arms Channel B. Until Channel B is armed, Channel A ignores any further input edges. Once Channel B is armed, the next slope selected edge in Channel A starts the time interval measurement, and the next slope selected edge in Channel B stops the time interval measurement.

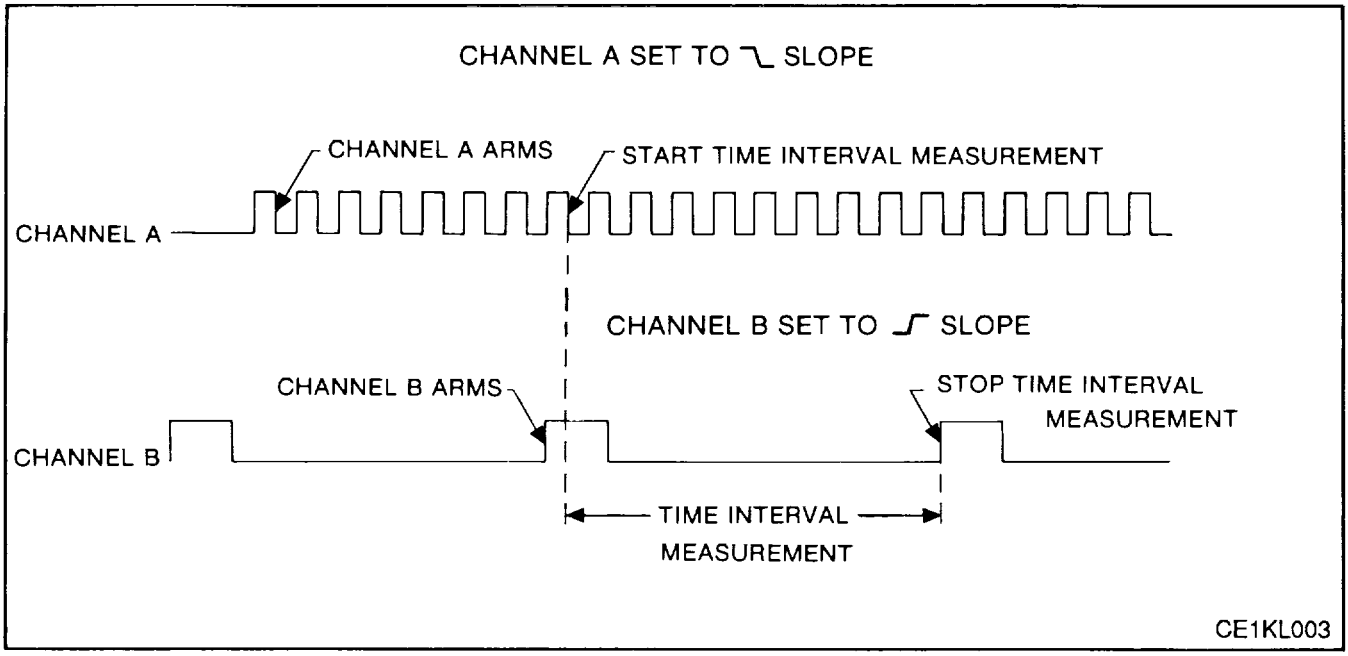


Figure 3-1. Time Interval Measurement Routine

3-12. Ratio A to B Measurements

3-13. The ratio between two frequencies (FA/FB) is measured by connecting one signal to Channel A and the other to Channel B. Channel A operates in the range of 10 Hz to 10 MHz. Channel B operates in the range of 10 Hz to 2.5 MHz. If the higher frequency is connected to Channel A, the ratio will be greater than one. The answer for a ratio measurement is a unitless figure. See Figure 3-7 for a typical ratio measurement setup.

3-14. Totalize A Measurements

3-15. The HP 5314A can totalize directly from 10 Hz to 10MHz with a resolution of 1 count. Input frequencies between 10 Hz and 100 MHz may be totalized in the prescale mode (see Figure 3-8) with a resolution of 10 Hz. The HOLD switch may be used to latch the display. However, the counter continues to increment and when the HOLD is released, the updated count is displayed. See Figure 3-8 for a typical totalize measurement setup.

3-16. Self-Check

3-17. The HP 5314A contains a built in self-check function. The self-check mode programs the unit to make a frequency measurement on its internal 10 MHz time base. For details concerning self-check, see Figure 3-9, Operator's Checks.

3-18. PANEL FEATURES

3-19. Front panel features of the HP Model 5314A are described in Figure 3-2, Front Panel Controls and Connectors. Contained in Figure 3-2 is a description of each of the controls and connectors. Description numbers match the numbers on the illustration.

3-20. OPERATING INSTRUCTIONS

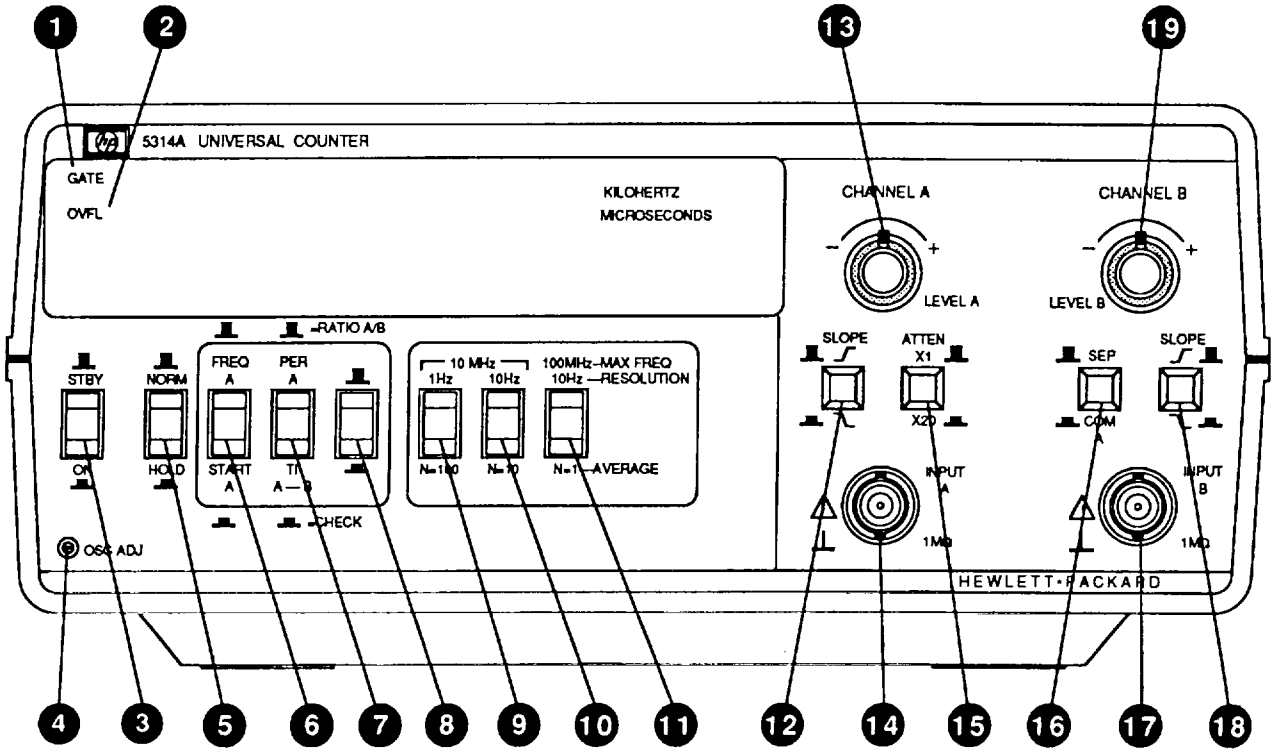
3-21. General operating procedures with the HP Model 5314A Universal Counter connected in typical measurement setups are shown in *Figures* 3-3, 3-4, 3-5, 3-6, 3-7, and 3-8. Many other applications are possible but not shown because the general operating procedure is the same. Description numbers match the numbers on the illustration.

3-22. OPERATOR'S MAINTENANCE

3-23. There is no operator's maintenance for the HP 5314A.

3-24. Power/Warm-Up

3-25. The HP 5314A has two a position power switch, STBY and ON. For HP 5314A models with A3, it is important that the instrument be connected to the power source in the STBY mode when not in use. This supplies power to the battery charging circuitry.



(1)	GATE	The gate light, when lit, indicates the main gate is open and a measurement is in progress.
(2)	OVERFLOW	LED annunciator which lights when one or more of the most significant digits (digits left-most from the decimal point) are not displayed. However, the counter continues to count correctly although the digits are only correct to the extent of the time base.
(3)	STBY/ON	Supplies power to the entire instrument in the ON position. Supplies power only to A3 battery charging circuit in the STBY position.
(4)	OSC ADJ	Front panel window allowing access to the oscillator frequency - adjustment capacitor (A1C2).
(5)	NORM/HOLD	In HOLD, switch IN, the measurement (except for totalize) in progress is stopped, the main counter is reset, and the HP 5314A is held ready to make a new measurement. The latches are not updated so the last complete measurement is displayed. When switched back to NORM, a new measurement is initiated. In totalize, when placed in HOLD, the display is held but the counters continue to increment. When the HOLD is released, the display is updated and resumes counting.
(6)	FREQ A START A	With this switch IN, the HP 5314A is placed in either frequency or totalize (START) mode as determined by the position of the blue shift key (8).
(7)	PER A T.I. A→B	With this switch IN, the HP 5314A is placed in either period or time interval mode as determined by the position of the blue shift (8).

Figure 3-2. *Front Panel Controls and Connectors*

NOTE

There are two additional functions which are selected using combinations of switches 6 and 7. These two functions are Self-Check and Ratio A to B. For self-check mode, place both function switches 6 and 7 in the IN position. The instrument is now making a frequency measurement on the internal 10 MHz time base. Activating switches 9 and 10 causes 10 MHz to be displayed. Activating switch 11 causes 100 MHz to be displayed. Resolution selection switches can now be checked for proper operation. For Ratio A to B, place both function switches 6 and 7 in the OUT position. For more details on Ratio K to B, refer to paragraph 3-12 and *Figure 3-7.*

8 SHIFT KEY IN/OUT position determines the function selected by keys 6 and 7. IN position selects the bottom row functions. OUT position selects the upper row functions.

NOTE

The following three switches 9 10 11 are dual purpose. Depending on the function selected (Frequency, Period, Ratio, etc.) the switches either represent the resolution and bandwidth (gate time) or the sample size (N samples).

9 1 Hz/N=100 In frequency (10 Hz to 10 MHz), this switch, when IN, gives a display with a 1 Hz resolution (1 second gate time). For frequencies between 10 MHz and 100 MHz, see the explanation for switch 11. In period, this switch, when IN, causes the HP 5314A to measure 100 periods and display the average value in microseconds. In ratio, this switch when IN, causes the HP 5314A to make 100 measurements and display the average ratio. This switch does not improve accuracy beyond 100 nanoseconds for time interval measurements!

10 10 Hz/N=10 In frequency (10 Hz to 10 MHz), this switch, when IN, gives a display with a 10 Hz resolution (100 millisecond gate time). For frequencies between 10 MHz and 100 MHz, see the explanation for switch 11. In period, this switch, when IN, causes the HP 5314A to measure 10 periods and display the average value in microseconds. In ratio, this switch, when IN, causes the HP 5314A to make 10 measurements and display the average ratio. This switch does not improve accuracy beyond 100 nanoseconds for time interval measurements!

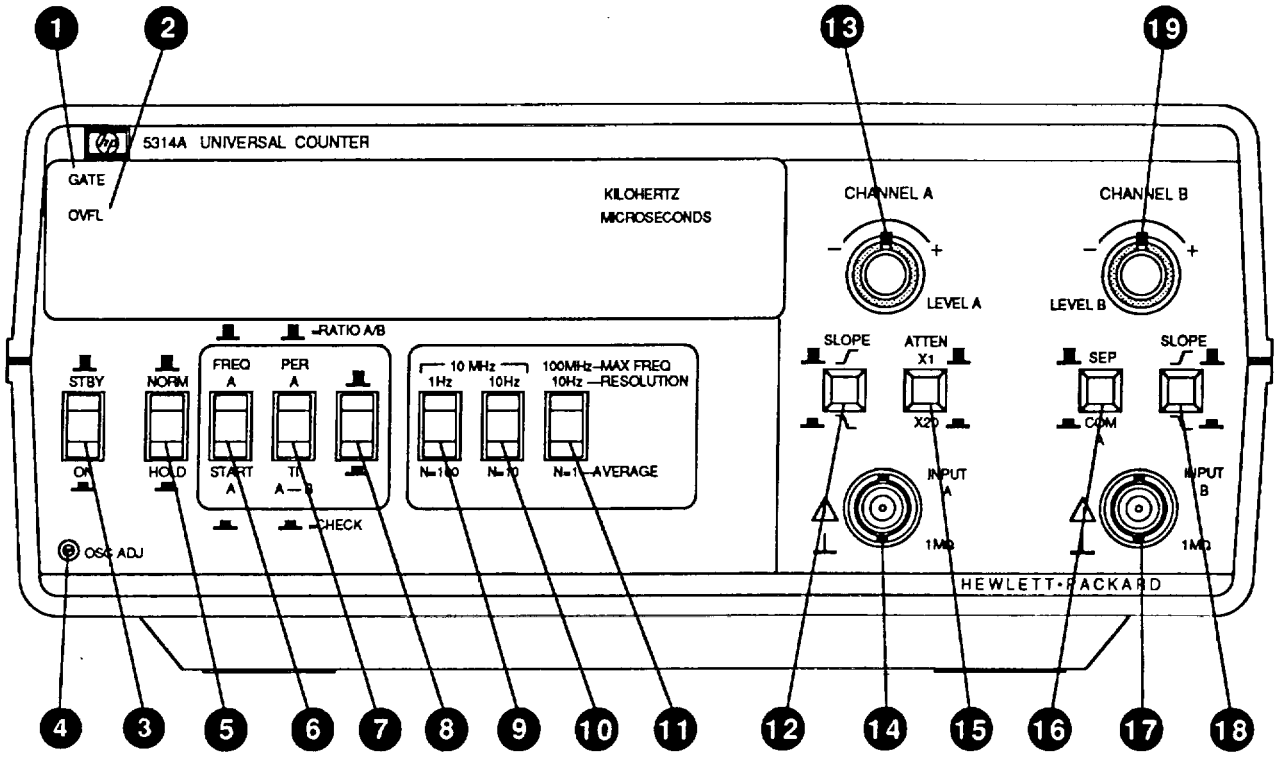
NOTE

There is another resolution available using switches 9 and 10 in addition to the two resolutions called out on the front panel. It is 0.1 Hz/N=1000. This is generated when switches 9 10 and 11 are in the OUT position. In frequency (10Hlz to 10 MHz), with these three switches out, the HP 5314A gives a display with 0.1 Hz resolution (10 second gate time). For frequencies between 10 MHz and 100 MHz, see the explanation for switch 11. In period, with these three switches out, the HP 5314A measures 1000 periods and displays the average value in microseconds. In ratio, with these three switches out, the HP 5314A makes 1000 measurements and displays the average ratio. This switch combination does not improve accuracy beyond 100 nanoseconds for time interval measurements.

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

11	10 Hz/N=1	This switch, when IN, reroutes the Channel A input signal through a divide- by-10 prescaler circuit (when FREQ A/START A switch 6 is in). This switch MUST be used for frequencies between 10 MHz an 100 MHz. In frequency, this switch, when IN, prescales the input signal by 10 and gives a display with a 10 Hz resolution (prescale by 10 with a 1-second gate time). This switch and switch 9 (1 Hz/N=100) IN prescales the input and gives a display with a 100 Hz resolution (prescale by 10with a 100-millisecond gate time). This switch and switch 10 (10 Hz/N=10) IN prescales the input and gives a display with a 1 kHz resolution iprescale by 10 with a 10-millisecond gate time). In Period, this switch IN causes the HP 5314A to measure 1 period and display the value in microseconds (this switch is used for single-shot period measurements). In Ratio, this switch IN causes the HP 5314A to make 1 measurement and display the ratio (this switch is used for single-shot ratio measurements). In Time Interval, this switch should be pressed. This programs the HP 5314A to make single-shot time interval measurements. In Start, the HP 5314A counts the input directly (10 Hz to 10 MHz) and displays in units. With this switch IN, the input is prescaled by 10 and the display is in kilo units. This switch MUST be used in START A for signals above 10 MHz.
12	SLOPE	This switch setting determines which slope of the Channel A input signal will be used as the triggering slope.
13	LEVEL A	LEVEL control used in conjunction with the attenuator switch 15, to select the relative voltage at which triggering occurs. Approximately +350 millivolts is the amount varied. The input amplifiers are ac coupled. The actual dc level of the trigger point is unknown.
14	INPUT A	BNC connector for the A channel signal input. The input impedance is 1 Meg. For more information on the input signal, refer to *Table 1-1,* Specifications.
15	ATTN	Channel A input signal attenuator switch. Used in conjunction with the LEVEL control to set the trigger point. The input signal is not affected in X1 position. Input signal amplitude is reduced by a factor of 20 in the X20 position.
16	SEP/COM A	Input amplifier control switch. a. SEP - Allows independent operation of A and B channels. b. COM A - Operationally connects Channels A and B in parallel. Used for single source time interval measurements. Channel B input jack is not active. The input impedance remains the same as in SEP.
17	INPUT B	BNC connector for the B channel signal input. The input impedance is 1 Meg. For more information on the input signal, refer to *Table 1-1,* Specifications.
18	SLOPE	This switch setting determines which slope of the Channel B input signal will be used as the triggering slope.
19	LEVEL B	LEVEL control used to select the relative voltage at which triggering occurs. When switch 16 is in SEP, the trigger voltage varies approximately +350 mV. When switch 16 is in COM A, the trigger voltage varies approximately +350 mV times the attenuator (switch 15) setting. The input amplifiers are ac coupled. The actual dc level of the triggering point is unknown.

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



NOTE

See *Table 1-1* for the specifications on all input signals concerning bandwidth, accuracy, and amplitude.

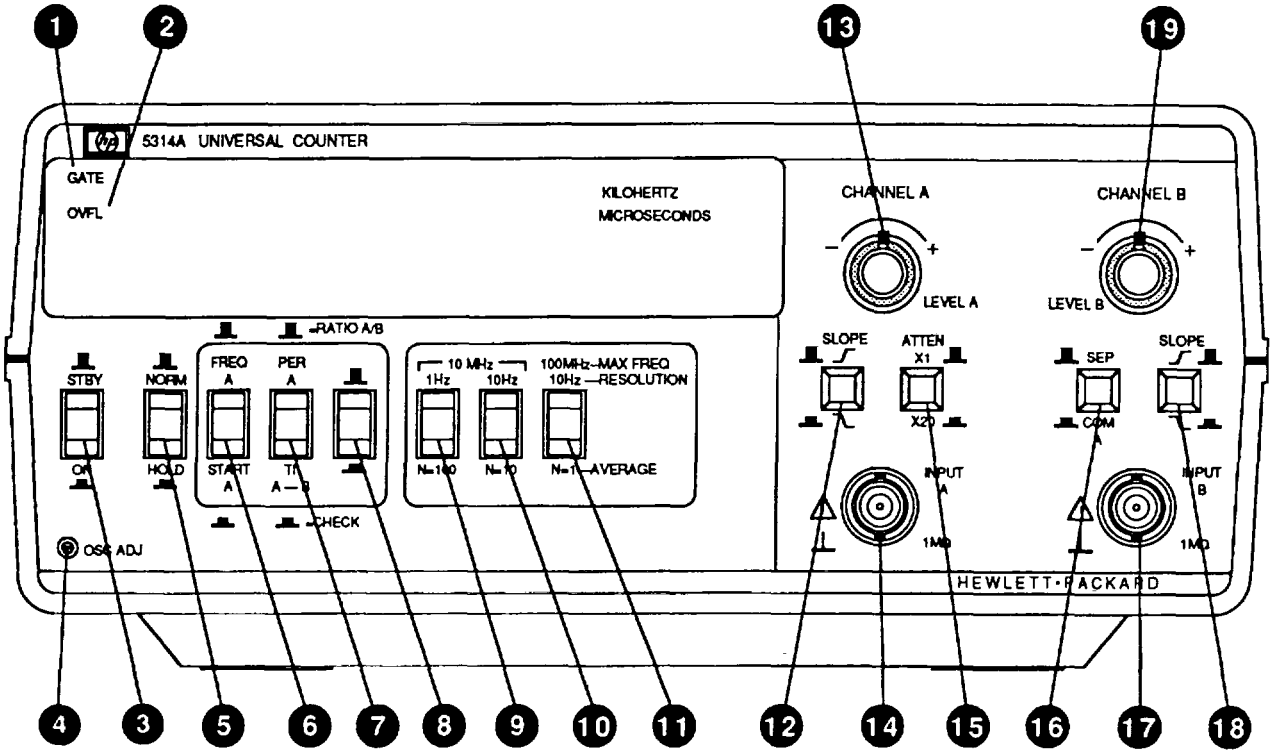
1. Set line switch (3) to the ON position.
2. Set COM A/SEP switch (16) to SEP position.
3. Connect the input signal to INPUT A jack (14).
4. Press FREQ A/START A switch (6) IN. Be sure the blue shift key (8) is in the OUT position. This selects the top function of switch (6).
5. Set SLOPE (12), ATTN (15) and LEVEL A (13) to desired positions; see *Table* 1-1, Specifications, for details.
6. Select either 1 Hz (9) or 10 Hz (10) resolution for frequencies between 10 Hz and 10 MHz. NOTE: 10 Hz (11) may also be used. For frequencies higher than 10 MHz, the 100 MHz/10 Hz switch (11) must be pressed IN.

NOTE

The following three resolutions are available with the HP 5314A but are not printed on the front panel.

A. For 0.1 Hz resolution (10 second gate time) on frequencies from 10 Hz to 10 MHz, place all three resolution switches (9) (10) (11) in the OUT position.
B. For 100 Hz resolution (0.1 second gate time) on frequencies to 100 MHz, place switches (9) and (11) in the IN position.
C. For 1 kHz resolution (0.01 second gate time) on frequencies to 100 MHz, place switches (10) and (11) in the IN position.

Figure 3-3. Frequency Measurement Setup

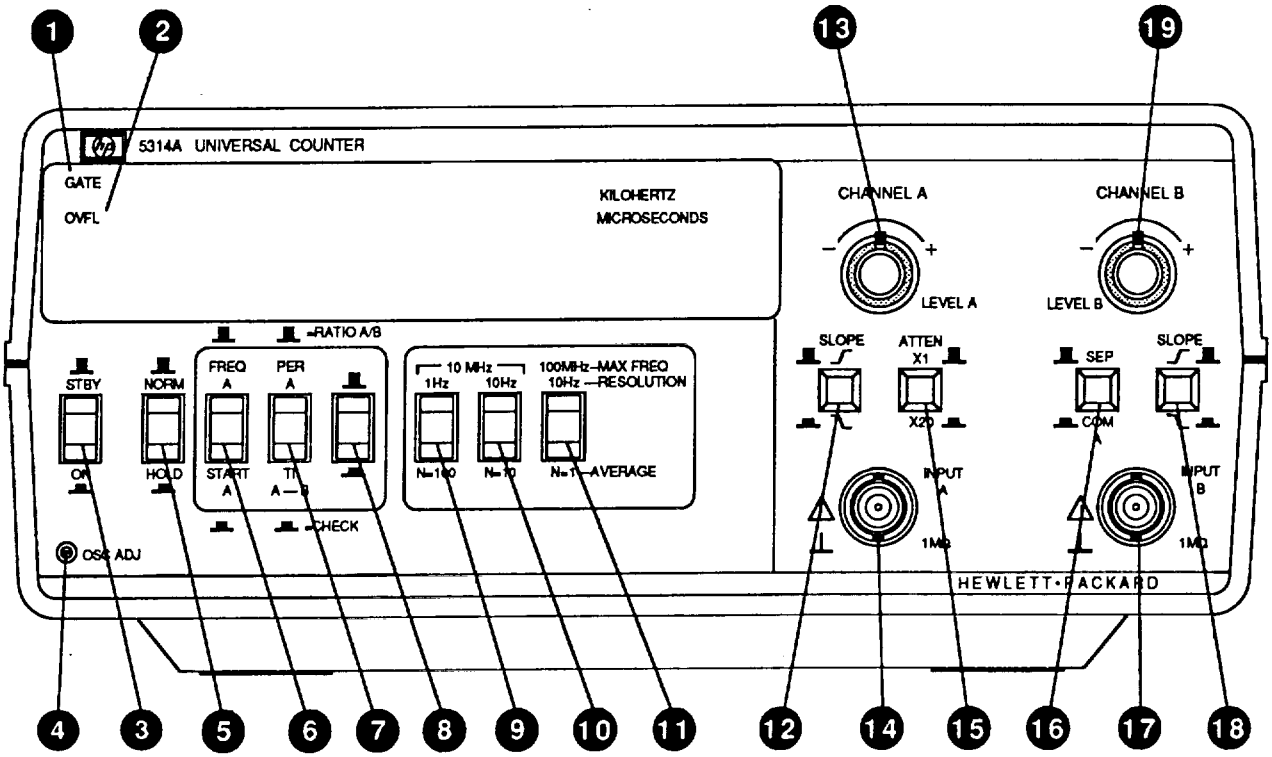


NOTE

See *Table* 1-1 for the specifications on all input signals concerning bandwidth, accuracy, and amplitude.

1. Set line switch (3) to the ON position.
2. Set COM A/SEP switch (16) to SEP position.
3. Connect the input signal to INPUT A jack (14).
4. Press PER A/T.I. A→B switch (7) IN. Make sure the blue shift key (8) is in the OUT position. This selects the top function of switch (7).
5. Set SLOPE (12) ATTN (15) and LEVEL A (13) to desired positions; see *Table* 1-1, Specifications, for details.
6. Press desired sample size switch ((9) (10) and (11)). For an explanation of the sample size switches (9) (10) and (11), see *Figure 3-2.*

Figure 3-4. Period Measurement Setup

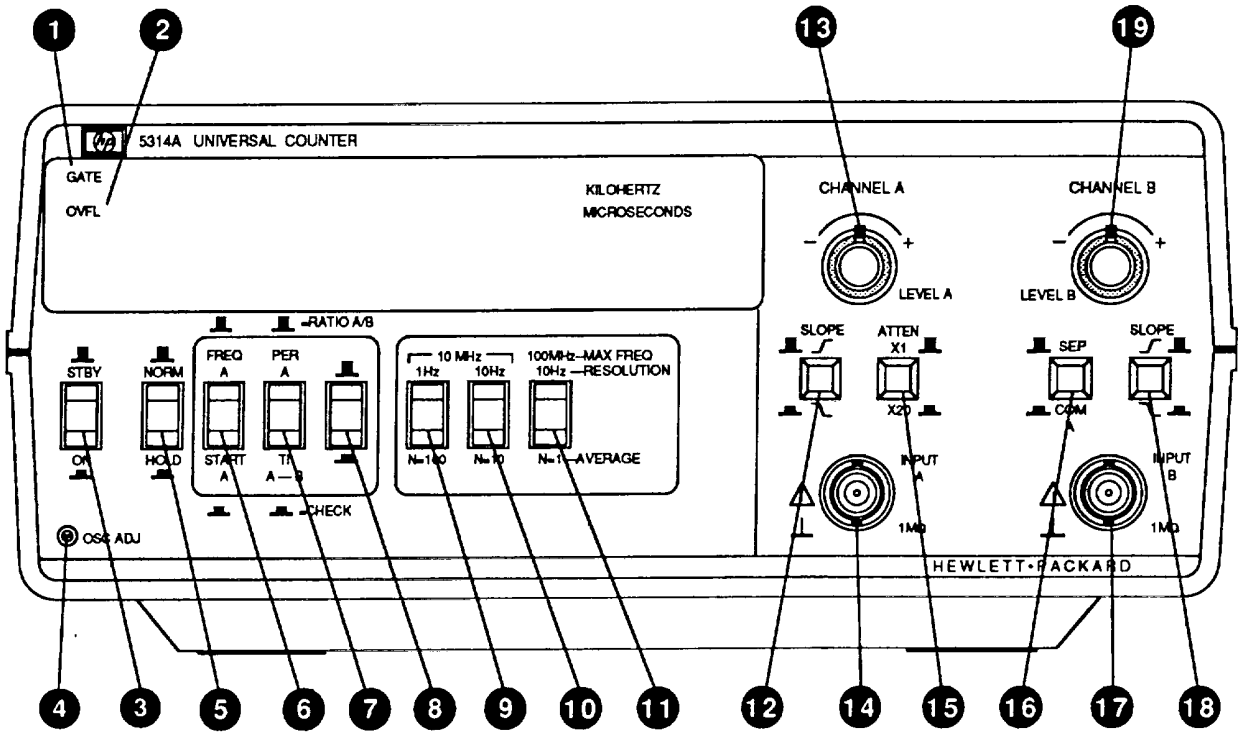


NOTE

See *Table* 1-1 for the specifications on all input signals concerning bandwidth, accuracy, and amplitude. See paragraph 3-11 for time interval arming characteristics.

1. Set line switch (3) to the ON position.
2. Set COM A/SEP switch (16) to COM A position.
3. Connect the input signal to the INPUT A jack (14).
4. Press PER A/T.I. A→B switch (7) IN. Press the blue shift key (8) IN position). This selects the bottom function of switch (7).
5. Set SLOPE switches (12) and (18), ATTN switch (15) and LEVEL A and B controls (13) and (14) to desired positions; see *Table 1,* Specifications, for details.
6. Press resolution switch (11) iN=1) IN. This places the HP 5314A into single-shot mode. All time interval measurements made with the HP 5314A should be single-shot.

Figure 3-5. One-Source Time Interval Measurement Setup

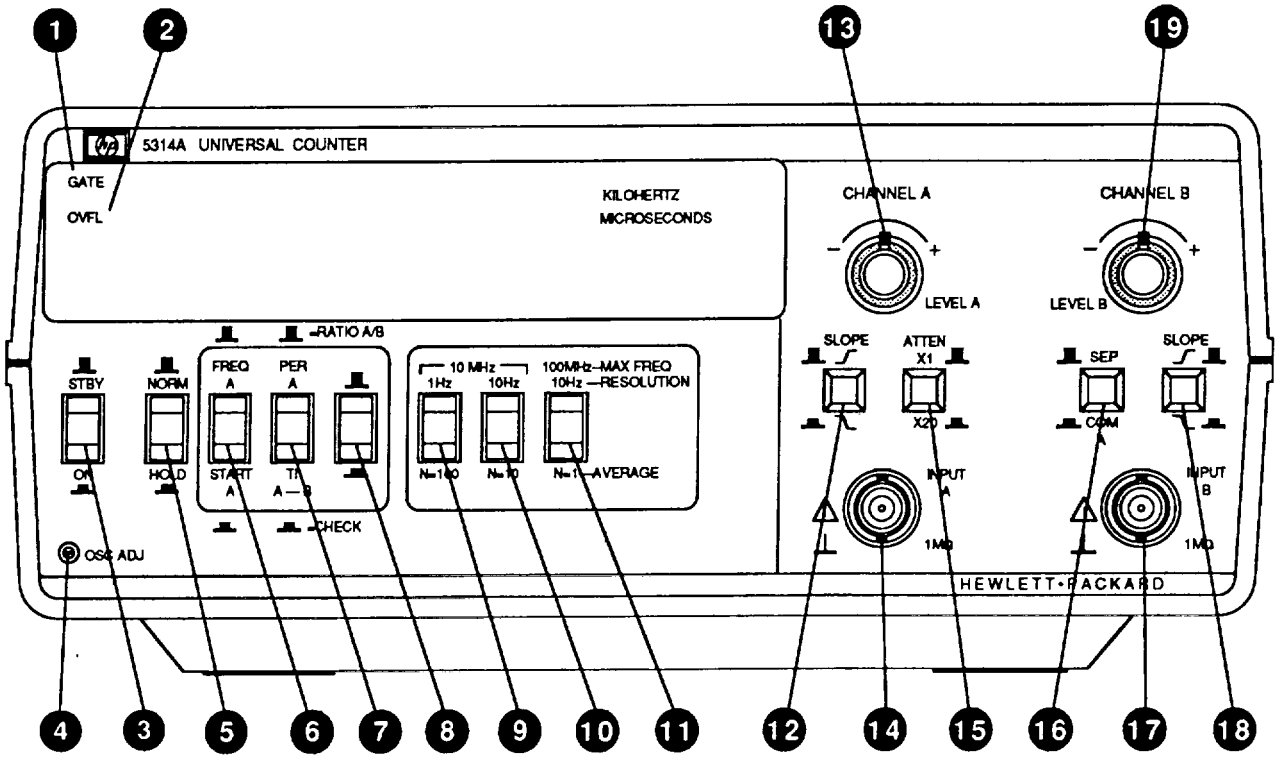


NOTE

See *Table 1-1* for specifications on all input signals concerning bandwidth, accuracy, and amplitude. See paragraph 3-11 for time interval arming characteristics.

1. Set line switch (3) to the ON position.
2. Set COM A/SEP switch (16) to SEP position.
3. Press PER A/T.I. A→B switch (7) IN. Press the blue shift key (8) (IN position). This selects the bottom function of switch (7).
4. Connect the start time-interval signal to the INPUT A jack. (14). Connect the stop time- interval signal to the INPUT B jack (17) .
5. Set SLOPE switches (12) and (18) , ATTN switch (15) , and LEVEL A and B controls (13) and (19) to desired positions; see *Table* 1-1, Specifications, for details.
6. Press resolution switch (11) (N=1) IN. This places the HP 5314A into single-shot mode. All time interval measurements made with the HP 5314A should be single-shot.

Figure 3-6. Two-Source Time Interval Measurement Setup

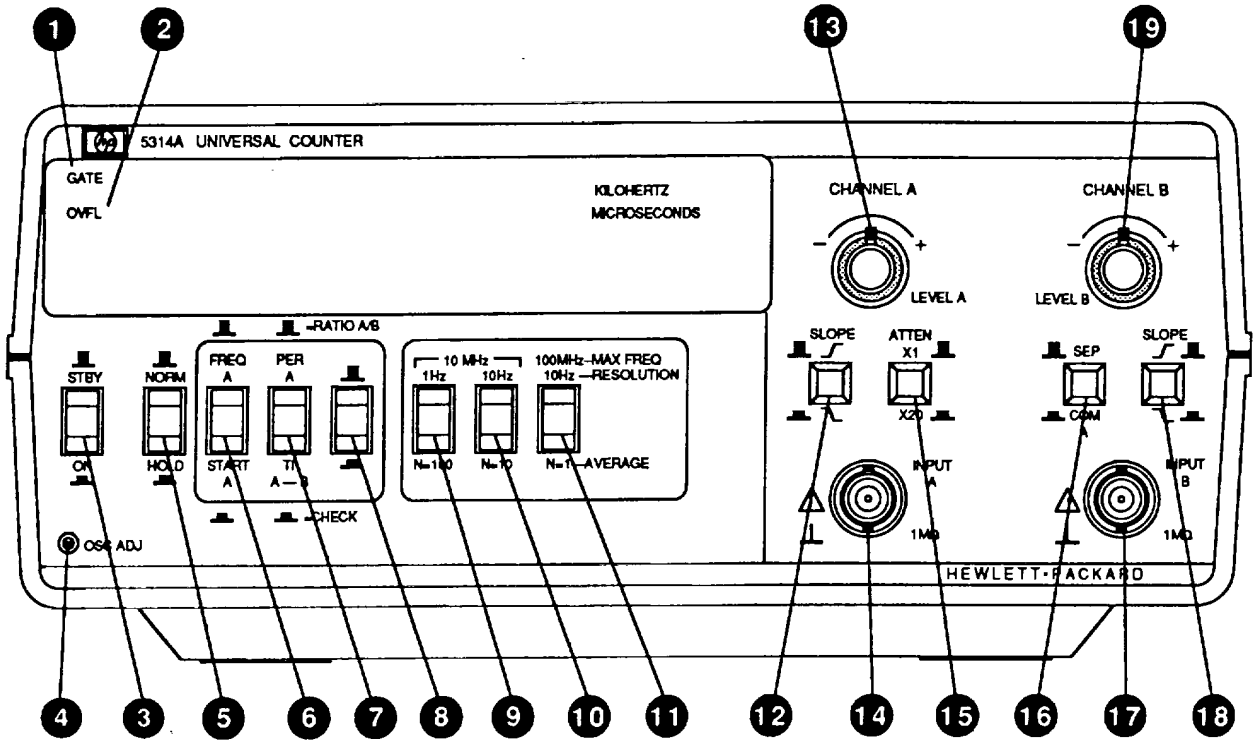


NOTE

See Table 1-1 for specifications on all input signals concerning bandwidth, accuracy, and amplitude.

1. Set line switch (3) to the ON position.
2. Set COM A/SEP switch (16) to SEP position.
3. Place the two function switches (6) and (7) in the OUT position. This places the HP 5314A in the Ratio A to B function.
4. Connect the higher frequency signal to the INPUT A jack (14). Connect the lower frequency signal to the INPUT B jack (17) (the higher frequency can be input to INPUT B if it is below
5. Set SLOPE switches (12) and (18), ATTN switch (15), and LEVEL A and B controls (13) and (19) to desired positions; see *Table* 1-1, Specifications, for details.
6. Press the desired sample size switch (9), (10), (11). For an explanation of the sample size switches, see Figure 3-2, (9) (10) and (11).

Figure 3-7. Ratio Measurement Setup

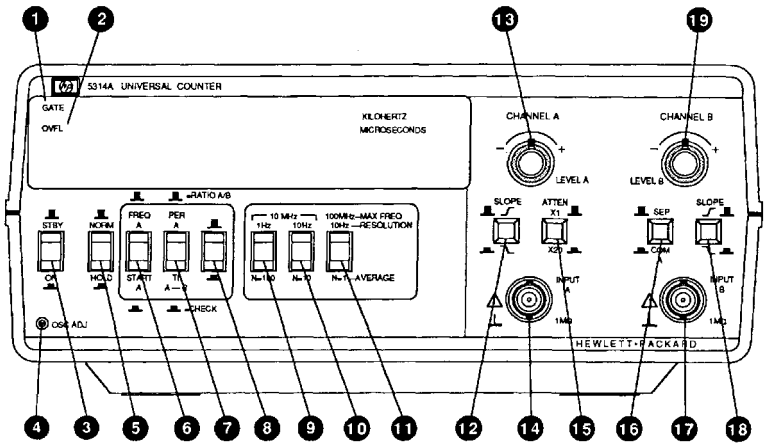


NOTE

See Table 1-1 for specifications on all input signals concerning bandwidth, accuracy, and amplitude.

1. Set line switch (3) to the ON position.
2. Set COM A/SEP switch (16) to SEP position.
3. Press the FREQ A/START A switch (6) IN.
4. Press the blue shift key (8) (IN position). This selects the bottom function of switch (6).
5. Set SLOPE (12), ATTN (15), and LEVEL A (13) to desired positions; see Table 1-1, Specifications, for details.
6. Connect the input signal to INPUT A jack (14). For input frequencies higher than 10 MHz, the 100 MHz/10 Hz resolution switch (11) (prescale by 10) MUST be pressed (IN position).

Figure 3-8. Totalize Measurement Setup



NOTE

This operator's check checks for proper operation of the counter chip A1U2, the function and resolution switches, and the display. This procedure does not check the operation of the two input amplifiers. See *Figure 4-1,* Operation Verification, for a more complete operational check.

1. Set the line switch **3** to the ON position.
2. Depress both function switches **6** and **7** IN position). This places the HP 5314A in the self-check mode.
3. Place resolution switch **9** (1 Hz/N=100) in the IN position. The HP 5314A should display

   ϕϕϕϕ.ϕϕϕ

   with the overflow LED **2** ON and the instrument gating once every second.
4. Place resolution switch **10** (10 Hz/N=10) in the IN position. The HP 5314A should display

   1ϕϕ ϕϕ.ϕϕϕ

   with the overflow LED OFF and a 100-millisecond gate time.
5. Place resolution switch 11 (10 Hz/N=1) in the IN position. The HP 5314A should display

   ϕϕϕϕϕ.ϕϕ

   with the overflow LED **2** ON and a 1-second gate time.
6. Place both resolution switches **9** and **11** in the IN position. The HP 5314A should display

   1ϕϕϕϕϕ.ϕ

   with the overflow LED **2** OFF and a 100-millisecond gate time.
7. Place both resolution switches **10** and **11** in the IN position. The HP 5314A should display

   1ϕϕϕϕϕ.

   with a 10-millisecond gate time.

Figure 3-9. Operator's Check

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The two procedures in this section test the instrument's electrical performance using the specifications of *Table* 1-1 as performance standards. The first test is an operation verification which checks all major functions of the HP 5314A. The second test is the full performance test which checks all specifications.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for the complete test and operation verification is listed in *Table 1-2.* Any equipment which satisfies the critical specifications given in the table may be substituted for the recommended model.

4-5. OPERATION VERIFICATION

4-6. The abbreviated checks given in *Table 4-1* can be performed to give a high degree of confidence that the HP 5314A is operating properly without performing the complete performance test. The operation verification should be used for incoming QA, routine maintenance, and after instrument repair.

4-7. PERFORMANCE TEST

4-8. The performance test is given in *Table 4-2.* The performance test verifies all specifications listed in *Table 1-1.* Depending on the use and environmental conditions, the instrument should be checked-using the performance test at least once a year.

4-9. TEST RECORD

4-10. Results of the operation verification may be tabulated on the operation verification test card located at the end of *Table 4-1.* Results of the performance tests may be tabulated on the performance check test card located at the end of *Table 4-2.*

Table 4-1. Operation Verification

I. SELF TEST

Perform the self test procedure per *Figure* 3-9. Mark the results on the test card.

II. FREQUENCY RESPONSE AND SENSITIVITY

A. CHANNEL A

Specification: 10 Hz-100 MHz, 25 mV rms

1. Set the HP 5314A front panel controls as follows:

FUNCTION	FREQ A
RESOLUTION	1 Hz
BOTH SLOPES	*f*
BOTH LEVELS	Midrange
ATTN	X1
SEP/COM A	SEP

2. Connect an HP 3314A test oscillator to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Set the HP 3314A for 500 Hz and 5 MHz at 25 mV rms (-70 mV p-p). Replace the HP 3314A with an HP 8656A signal generator. Press resolution switch 10 Hz prescale (N=1). Set the HP 8656A for 50 MHz and 100 MHz at 25 mV rms (-70 mV p-p). The counter should display the specified frequencies. Mark the results on the test card.

Table 4-1. Operation Verification (Continued)

B. CHANNEL B

Specification: 10 Hz-2.5 MHz, 25 mV rms

1. Repeat step Al. Set the HP 5314A SEP/COM A switch to COM A. Set both function switches FREQ A and PER A OUT.
2. Connect an HP 3314A to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Set the HP 3314A for 500 Hz and 2.5 MHz at 25 mV rms ,(-70 mV p-p). The HP 5314A should display "1.00" at both specified frequencies. Mark the results on the test card.

III. PERIOD

Specification: 10 Hz-2.5 MHz, 25 mV rms

A. Repeat Test II, Step A1. Set the HP 5314A function switch PER A IN (make sure the HP 5314A blue key is OUT).

B. Connect an HP 3314A to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Set the HP 3314A for 500 Hz and 2.5 MHz at 25 mV rms (~70 mV p-p). The HP 5314A should display 2 milliseconds and 0.400 microseconds, respectively. Mark the results on the test card.

IV. TIME INTERVAL

Specification: 250 ns-1 s, 25 mV rms

A. Set the HP 5314A front panel controls as follows:

FUNCTION.....TI A→B
RESOLUTION ..... N=1
BLUE key ..... IN
CHANNEL A SLOPE ..... *f*
ATTN.....X1
SEP/COM A ..... COM A
CHANNEL B SLOPE ..... *f*
BOTH LEVELS..... Midrange

B. Connect an HP 3314A to the HP5314A INPUT A with a cable and 50-ohm feedthrough. Set the HP 3314A for 1 MHz at 100 mV rms (~285 mV p-p). The HP 5314A should display 0.5 microseconds ±100 nanoseconds. Mark the results on the test card.

V. RATIO

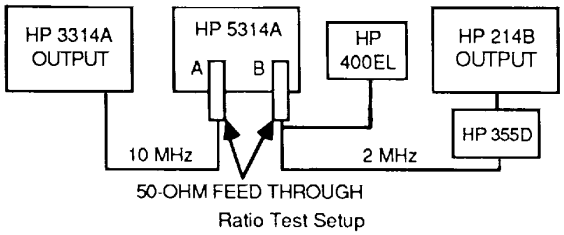
Specifications:

Channel A: 10 Hz-10 MHz, 25 mV rms
Channel B: 10 Hz-2.5 MHz, 25 mV rms

A. Set the HP 5314A front panel controls as follows:

FUNCTION..... RATIO A/B
RESOLUTION ..... N=100
BOTH SLOPES ..... *f*
BOTH LEVELS..... Midrange
ATTN.....X1
SEP/COM A .....SEP

B. Connect the HP 5314A, HP 3314A, HP 214B, HP 355D, and HP 400EL as shown as shown in the following diagram:



Ratio Test Setup

C. Set the HP 3314A for 10 MHz at 25 mV rms. Set the HP 214B Pulse Generator, and HP 355D to 2MHz at 25 mV rms (square wave). The HP 5314A should display 5.00. Mark the results on the test card.

OPERATION VERIFICATION TEST CARD

HEWLETT-PACKARD MODEL 5314A UNIVERSAL COUNTER

Test *Performed by* _____

Serial No._____

Date _____

DESCRIPTION	CHECK
I. SELF-CHECK	_____
II. FREQUENCY RESPONSE AND SENSITIVITY	
Channel A: 500 Hz, 5 MHz, 50 MHz 100 MHz	_____
Channel B: 500 Hz, 2.5 MHz	_____
III. PERIOD	
2 milliseconds	_____
0.400 milliseconds	_____
IV. TIME INTERVAL AND TIME INTERVAL AVERAGE	
Time Interval: 0.5 milliseconds at 100 mV (-285 mV p-p)	_____
V. RATIO A/B	
Ratio A/B as per Test V, step c	_____

Table 4-2. In-Cabinet Performance Test

I. SELF TEST

Perform the self test procedure per *Figure* 3-9. Mark the results on the test card.

II. FREQUENCY RESPONSE AND SENSITIVITY

A. CHANNEL A

Specification: 10 Hz-100 MHz, 25 mV rms

1. Set the HP 5314A front panel controls as follows:

FUNCTION.....FREQ A
RESOLUTION.....1 Hz
BOTH SLOPES.....*f*
ATTN.....X1
SEP/COM A.....SEP
BOTH LEVELS.....Midrange

2. Connect an HP 3314A to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Vary the HP 3314A from 10 Hz to 10 MHz, maintaining a 25 mV rms signal level. The counter should display the correct frequencies. Mark the results on the test card.
3. Connect an HP 8656A signal generator to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Press the prescaled 10 Hz (N=1) resolution switch I N. Vary the HP 8656A signal generator from 10 MHz to 100 MHz, maintaining a 25 mV rms signal level. The counter should display the correct frequencies. Mark the results on the test card.

B. CHANNEL B

Specification: 10 Hz-2.5 MHz, 25 mV rms

1. Repeat step Al. Set the HP 5314A SEP/COM A switch to COM A. Set all three function switches OUT.
2. Connect an HP 3314A to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Vary the HP 3314A from 10 Hz to 2.5 MHz, maintaining a 25 mV rms signal level. The counter should display "1.00" throughout the specified frequencies. Mark the results on the test card.

III. PERIOD

Specification: 10 Hz-2.5 MHz, 25 mV rms

A. Repeat Test II, Step Al. Set the HP 5314A function switch PER A IN (FREQ A switch OUT). Make sure the HP 5314A blue key is OUT.
B. Connect an HP 3314A to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Vary the HP 3314A from 10 Hz to 2.5 MHz maintaining a 25 mV rms signal level. The counter should display the correct period of all frequencies in this range. Mark the results on the test card.

IV. TIME INTERVAL

Specification: 250 ns-1 s, 25 mV rms

A. Set the HP 5314A front panel controls as follows:

FUNCTION.....TI A-B
BLUE key.....IN
RESOLUTION.....N=1
CHANNEL A SLOPE.....F
CHANNEL B SLOPE.....F
ATTN.....X1
SEP/COM A.....COM A
BOTH LEVELS.....Midrange

B. Connect an HP 3314A to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Set the HP 3314A for 1 MHz at 100 mV rms (-285 mV p-p). The HP 5314A should display 0.5 microseconds +100 nanoseconds. Mark the results on the test card.

Table 4-2. In-Cabinet Performance Test (Continued)

V. RATIO

Specifications:

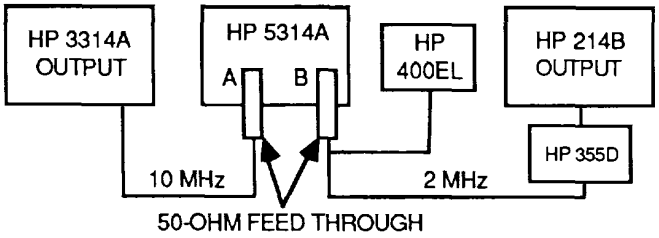
Channel A: 10 Hz-10 MHz, 25 mV rms

Channel B: 10 Hz-2.5 MHz, 25 mV rms

A. Set the HP 5314A front panel controls as follows:

FUNCTION..... RATIO A/B
RESOLUTION ..... N=100
BOTH SLOPES ..... *f*
BOTH LEVELS..... Midrange
ATTN.....X1
SEP/COM A .....SEP

B. Connect the HP 5314A, HP 3314A, HP 214B, HP 355D, and HP 400EL as shown as shown in the following diagram:



C. Set the HP 3314A for 10 MHz at 25 mV rms. Set the HP 214B Pulse Generator, and HP 355D to 2MHz at 25 mV rms (square wave). The HP 5314A should display 5.00. Mark the results on the test card.

VI. TOTALIZE

Specification: 10 Hz-10 MHz, 25 mV rms

A. Set the HP 5314A front panel controls as follows:

NORM/HOLD .....NORM
FUNCTION.....START A
BLUE key ..... IN
RESOLUTION .....1 Hz
BOTH SLOPES ..... *f*
ATTN.....X1
SEP/COM A .....SEP
BOTH LEVELS..... Midrange

B. Set the HP 3314A to 10 Hz at 25 mV rms. Connect the HP 3314A to the HP 5314A INPUT A with a cable and 50-ohm feedthrough. Observe the HP 5314A display upcounting at a 10 Hz rate. Press the NORM/HOLD switch IN. Notice the display stops upcounting. Release the NORM/HOLD switch (OUT position). Notice the updated display and a resume in counting. Set the HP 3314A to 10 MHz at 25 mV rms. The HP 5314A display should be counting with the OVFL indicator lit. Mark the results on the test card.

PERFORMANCE TEST RECORD

HEWLETT-PACKARD MODEL 5314A
UNIVERSAL COUNTER

Serial Number: _____
Test Performed By: _____
Date: _____
Notes: _____

Repair/Work Order No. _____
Temperature: _____
Relative Humidity: _____
Post Calibration Test: ☐
Pre Calibration Test: ☐

PARA. NO.	TEST	CORRECT DISPLAY	RESULTS		
			PASS	FAIL	
I.	**SELF-TEST**				
	Resolution,				
	1 Hz/N = 100	0000.000			
	10 Hz/N = 10	10000.00			
	10 Hz/N = 1	00000.00			
	100 Hz	100000.0			
	1 kHz	100000.			
II.	**FREQUENCY RESPONSE AND SENSITIVITY**				
	CHANNEL A:				
	10 Hz — 10 MHz @ 25 mV rms	Stable Count			
	10 MHz — 100 MHz @ 25 mV rms	Stable Count			
	CHANNEL B:				
	10 Hz — 2.5 MHz @ 25 mV rms	1.00			
III.	**PERIOD**				
	10 Hz — 2.5 MHz @ 25 mV rms	Correct Period			
			MINIMUM	**ACTUAL**	**MAXIMUM**
IV.	**TIME INTERVAL**				
	Time Interval 0.5 microseconds @ 100 mV rms - 285 mV p-p	0.5 μs	.400		.600
			PASS	**FAIL**	
V.	**RATIO**				
	Ratio A/B	5.00			
VI.	**TOTALIZE**				
	Totalize A:				
	10 Hz Up Count	10 Hz Up Count Rate			
	Up Count Stops	Stable Count			
	Display Update/Resume Count	Updated Display 10 Hz Up Count Rate			
	Display Update	Count with OVFL			

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes the two adjustments that may be made to the HP 5314A. First, the power transformer primary is switchable to allow selection of two different nominal line voltages and second, the time base oscillator frequency is adjustable. The HP 5314A top cover must be removed to change the power transformer primary (line voltage change) as directed in *Table 5-1.* The time base oscillator frequency may be adjusted via an adjustment window located in the lower left-hand corner of the front panel. Two methods for adjusting the time base frequency are given in *Table 5-2.* The first method uses an external input, with the HP 5314A in frequency mode. The second method compares (using an oscilloscope) the buffered internal 10 MHz time base with an external house standard.

5-3. Table 5-4 describes how to adjust the automatic battery charger's cutoff voltage. Adjustments require access to the inside of the HP 5314A.

5-4. EQUIPMENT REQUIRED

5-5. The test equipment required for the adjustment procedures is listed in *Table 1-3,* Recommended Test Equipment. Substitute equipment may be used if it meets or exceeds the critical specifications.

5-6. ADJUSTMENT LOCATIONS

5-7. Adjustment locations and Replaceable Parts are identified in the component locators in Section VIII, and in the top internal view of the HP 5314A as shown in Figure 8-7.

5-8. SAFETY CONSIDERATIONS

5-9. This section contains warnings and cautions that must be followed for your protection and to avoid damage to the equipment.

WARNING

MA1NTENANCE DESCRIBED HEREIN IS PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT, AND PROTECTIVE COVERS REMOVED. SUCH MA1NTENANCE SHOULD BE PER- FORMED ONLY BY SERVICE-TRA1NED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED (FOR EXAMPLE, FIRE AND ELECTRICAL SHOCK). WHERE MA1NTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER SHOULD BE REMOVED.

BEFORE ANY REPA1R IS COMPLETED, ENSURE THAT ALL SAFETY FEATURES ARE INTACT AND FUNCTIONING, AND THAT ALL NECESSARY PARTS ARE CONNECTED TO THEIR PROTECTIVE GROUNDING MEANS.

Table 5-1. Input Line Voltage Adjustment

WARNING

THE POWER CORD SHOULD BE REMOVED FROM THE REAR OF THE HP 5314A BEFORE STARTING THIS ADJUSTMENT PROCEDURE.

1. Turn the HP 5314A upside down and remove the four screws near the corners of the cabinet bottom.
2. Holding the top and bottom covers together, turn the HP 5314A right-side up and carefully lift the top cover. This exposes the line voltage selector switch located on the A2 (05314-60002) power supply assembly (large pc assembly located in the rear of the cabinet).
3. The two position switch may now be properly set to match the input voltage **(**115 for 86V to 126V input or **230** for 172V to 252V input) (fig. 8-7).
4. Replace the top cover and carefully turn the unit upside down. Replace and tighten the four screws, one in each corner, of the cabinet bottom.

NOTE

The line voltage selector switch automatically selects the correct line input fuse configuration (the two fuses are located on the A2 assembly and are in series for 230V operation and in parallel for 115V operation).

Table 5-2. Time Base Frequency Adjustment

NOTE

If this adjustment is to be considered valid, the HP 5314A must have a half-hour warm-up and the line voltage must be within +5% to -10%.

METHOD #1

1. Apply an external signal of known frequency (i.e., house standard) and suitable amplitude (minimum 25 mV rms) to the Channel A input of the HP 5314A.
2. Set the HP 5314A front panel controls as follows:

ON/OFF .....ON
NORM/HOLD ..... NORM
FUNCTION.....FREQ A
BLUE Key ..... OUT
RESOLUTION .....1 Hz
CHANNEL A
LEVEL A.....0V (center position
SLOPE .....+ (UP
ATTN.....X1
CHANNEL B
LEVEL B.....0V (center position
SLOPE .....+ (UP
SEP/COM A .....SEP

The approximate input frequency should be in the display with an update once a second.

3. Locate the OSC ADJ window in the lower left-hand corner of the front panel. Insert a plastic tuning wand through the window and turn the adjustor ,(A1C2); slowly until the display shows the input frequency. The internal time base frequency is now correctly adjusted.

Table 5-2. Time Base Adjustment (Continued)

METHOD #2

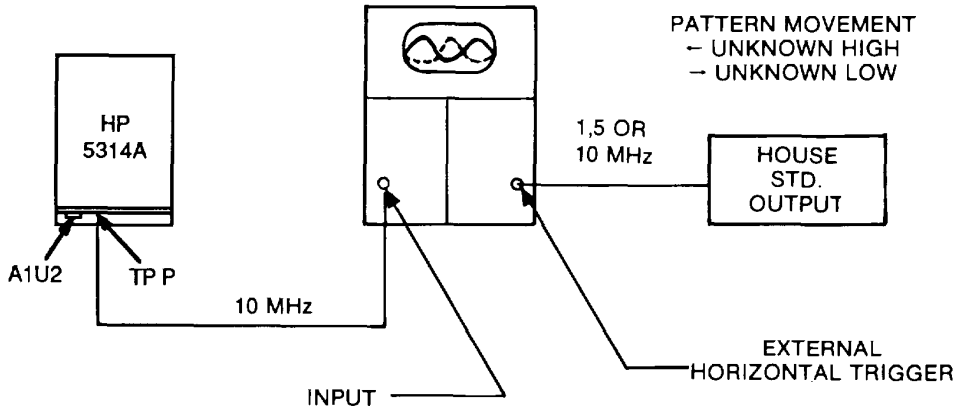
The second method requires access to the inside of the HP 5314A. However, it accomplishes a more accurate adjustment of the time base frequency than Method #1.

NOTE

The power cord should be remove while performing the first four steps.

1. Turn the HP 5314A upside down and remove the four screws near the corners of the cabinet bottom.
2. Holding the top and bottom covers together, turn the HP 5314A right-side up and carefully lift the top cover.
3. Carefully grasp the combination front panel and Al board assembly and lift until it clears the grooves. Remove front panel by removing two knobs and two connector nuts.
4. Place A1 Assembly into bottom cover. Press the power switch to turn on the HP 5314A.
5. Install the line cord and the HP 5314A should come on (the unit will be on already if it contains the optional battery pack and the battery is charged).
6. Connect an oscilloscope to TP P of the Al assembly (test point located near pin 40 of IC U2). This is the buffered 10 MHz internal oscillator.
7. Connect a house-standard signal to the EXT trigger input of an oscilloscope. Refer to the diagram below.

   Every few months, the oscillator should be checked to a house standard. When adjustment is required, use the oscilloscope method shown below. Using the appropriate sweep speed, adjust the oscillator until the movement of the pattern is stopped.



Oscillator Adjustment Interconnections

8. Set the controls of the oscilloscope as follows:
   COUPLING.....AC
   INPUT IMPEDANCE..... 1 Meg
   HORIZONTAL TRIGGER ..... EXT
   TIME BASE .....0.1 us/div.
9. Adjust the vertical gain for a full screen waveform. The waveform should be moving either to the left or to the right.
10. Adjust A1C2 {variable capacitor located in the lower left-hand corner of the A1 assembly) until the waveform is stationary. The accuracy of the frequency adjustment can be determined by referring to the table at the top of the next page.

Table 5-2. Time Base Adjustment (Continued)

Movement	SWEEP SPEED			NOTES
	1 μscm	01 μs/cm	0.01 μs/cm	
1 cm/s 1 cm/10 s cm/100 s	1 x 10-6 1 X 10-7 1 x 10-8	1 x 10-7 1 X 10-8 1 X 10-9	1 x 10-8 1 X 10-9 1 X 10-10	TIME SCOPE TRACE MOVEMENT WITH SECOND HAND OR WATCH OR CLOCK

The time base frequency adjustment is now complete. Install front panel. Mount the combination front panel/A1 assembly back into the cabinet bottom. Making sure the cables are properly routed, replace the top cover. Turn the HP 5314A upside down. Install and tighten the four screws, one in each corner, in the cabinet bottom.

Table 5-3. Option 001 Adjustment

Table Deleted

Table 5-4. Charger Cutoff Voltage Adjustment

This adjustment sets the voltage at which the 0.5 amp charging current to the battery is terminated. It is preset at the factory and normally requires no further adjustment. However. readjustment is necessary after a repair to the A3 assembly or after field installation of A3.

1. Remove the power cord from the rear of the HP 5314A.
2. Turn the HP 5314A upside down and remove the four screws near the corners of the cabinet bottom.
3. Holding the top and bottom covers together, turn the HP 5314A right-side up and carefully lift the top cover.
4. Disconnect the red and black cables from the battery.
5. Insert the line cord and turn the HP 5314A ON.
6. Connect a low voltage power supply to the A3 assembly charger cables (positive lead to red cable and negative lead to black cable).
7. Turn the pot on the A3 assembly (A3R12 Figure 8-10) fully clockwise.
8. Adjust the power supply to 0 volts, then increase it to +7.5 volts +5 millivolts.
9. Connect a voltmeter between ground and A3U1(7).
10. Turn the pot (A3R12) counterclockwise slowly until the voltage rises above 5 volts (typically 9-13 volts).
11. Disconnect the low voltage power supply from the red and black cables.
12. Turn the HP 5314A to STBY and remove the line cord.
13. Connect the red and black charger cable to the positive and negative posts of the battery, respectively.
14. Replace the handle and top cover.
15. Turn the unit upside down. Install and tighten the four screws (one in each corner) of the cabinet bottom. Adjustment of the A3 assembly is now complete.

SECTION VI
REPLACEABLE PARTS

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6-1/(6-2 Blank)

SECTION VII
MANUAL CHANGES

Deleted

7-1/(7-2 Blank)

SECTION VIII
SERVICE

WARNING

LINE VOLTAGE IS EXPOSED WITHIN THE HP 5314A EVEN WHEN THE POWER SWITCH IS IN THE STBY POSITION. REMOVAL OF THE POWER CORD IS REQUIRED TO FULLY UNPOWER THE INSTRUMENT.

8-1. INTRODUCTION

8-2. This section contains information needed to service the HP Model 5314A. The information includes: theory of operation, troubleshooting, recommended test equipment, schematic diagram notes, safety considerations, fuse replacement, block diagram theory, detailed circuit theory, service aids, block diagrams, component locators, and schematic diagrams.

8-3. THEORY OF OPERATION

8-4. There are two theorys of operation. The first is a block theory. That is, an overview of the HP 5314A is presented. The block theory is assembled to follow the block diagrams in *Figures 8-2* through *8-5.* The second is a detailed theory. It describes in detail, the circuit operation of all assemblies, both standard and optional. All reference is made to the schematic diagrams in *Figures 8-8* through *8-10.*

8-5. TROUBLESHOOTING

8-6. Troubleshooting for the HP 5314A is performed by selectively isolating and verifying the proper operation of the various circuit sections. This is accomplished in an indicated sequence, through a series of five test procedures, keyed to the troubleshooting block diagram in *Figure 8-6.*

8-7. RECOMMENDED TEST EQUIPMENT

8-8. Test equipment and test equipment accessories required to maintain the HP 5314A are listed in *Table 1-3.* Equipment other than that listed may be used if it meets the listed critical specifications.

8-9. SCHEMATIC DIAGRAM NOTES

8-10. *Figure 8-1* shows the symbols used on the schematic diagrams. *Figure 8-1* also shows the method of assigning reference designators, assembly numbers, and subassembly numbers.

8-11. Reference Designations

8-12. Assemblies such as printed circuit boards are assigned numbers in sequence, A1, A2, etc., as shown in *Table 8-1.* As shown in *Figure 8-1,* subassemblies within an assembly are given a subordinate A number. For example, rectifier subassembly Al, has the complete designator A25A1. For individual components, the complete designator is determined by adding the assembly number and subassembly number, if any. For example, CR1 on the rectifier assembly is designated A25A1CR1.

Table 8-1. Assembly Designations

Reference Designations	Description	HP Part Number
A1	Counter Assembly	05314-60005
A2	Power Supply Assembly	05314-60002
A3	Battery Charger Assembly	05314-60003

8-13. Identification Markings on Printed Circuit Boards

8-14. HP printed circuit boards (see *Figure 8-1)* have four identification numbers; an assembly part number, a series number, a revision letter, and a production code. The assembly part number has 10 digits (such as 05314-60005) and is the primary identification. All assemblies with the same part number are interchangeable. When a production change is made on an assembly that makes it incompatible with previous assemblies, a change in part number is required. The series number (such as 1828A) is used to document minor electrical changes. As changes are made, the series number is incremented. When replacement boards are ordered, you may receive a replacement with a different series number. If there is a difference between the series number marked on the board and the schematic in this manual, a minor electrical difference exists.

8-15. Revision letters (A, B, etc.) denote changes in printed circuit layout. For example, if a capacitor type is changed (electrical value may remain the same) and requires different spacing for its leads, the printed circuit board layout is changed and the revision letter is incremented to the next letter. When a revision letter changes, the series number is also usually changed. The production code is the four-digit, seven-segment number used for production purposes.

8-16. SAFETY CONSIDERATIONS

8-17. Although the HP 5314A has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to insure safe operation and to retain the HP 5314A in safe operating condition (also see Sections II, III,V).

WARNING

ANY INTERRUPTION OF THE PROTECTIVE (GROUNDING) CONDUCTOR (INSIDE OR OUTSIDE THE UNIT) OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO MAKE THE UNIT DANGEROUS.

8-18. Any adjustment, maintenance, and repair of the opened HP 5314A under voltage should be avoided as much as possible, and when inevitable, should be carried out only by a skilled person who is aware of the hazard involved. Capacitors inside the HP 5314A may still be charged even if the unit has been disconnected from its source of power.

WARNING

LINE VOLTAGE IS EXPOSED WITHIN THE HP 5314A EVEN WHEN THE POWER SWITCH IS IN STBY. REMOVAL OF THE POWER CORD IS NECESSARY TO FULLY UNPOWER THE UNIT.

8-19. 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. Whenever it is likely that this protection has been impaired, the HP 5314A must be made inoperative and be secured against any unintended operation.

8-19a. A3 REPLACEMENT

8-1 9b. Refer to Table 2-3 for installation instructions.

8-20. FUSE REPLACEMENT

8-21. There are two fuses in the standard HP 5314A. These are the line input fuses located on the A2 power supply assembly (Figure 8-9). There is an additional third fuse on the A3 Circuit Card Assembly (Figure 8-10). Instructions for changing these three fuses are given in the following paragraphs.

8-22. Line Input Fuse Replacement

CAUTION

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

8-23. The following instructions are given for line fuse replacement:

1. Turn the HP 5314A OFF and remove the line input power cord.
2. Turn the HP 5314A upside down and remove the four screws near the corners of the cabinet bottom.
3. Holding the top and bottom covers together, turn the HP 5314A right-side up and carefully lift the top cover. This exposes the two line input fuses located on the A2 assembly (assembly in the rear of the instrument).
4. Remove and replace the defective fuse with a 0.06 Amp fast-blow type fuse.
5. Replace the top cover and carefully turn the unit upside down. Replace and tighten the four screws, one in each corner of the cabinet bottom.

8-24. A3 Fuse Replacement

8-25. HP 5214A instruments with A3 contain a 3 Amp fuse in addition to the two line input fuses. This fuse is located on the A3 assembly. This fuse protects the battery pack from damage in case of a possible short circuit. The following instructions are given for A3 fuse replacement.

1. Turn the HP 5314A OFF and remove the line input power cord.
2. Turn the HP 5314A upside down and remove the four screws from the cabinet bottom.
3. Holding the top and bottom covers together, turn the HP 5314A right-side up and carefully lift the top cover. This exposes the A3 assembly.
4. Remove and replace the defective fuse with a 3 Amp fast-blow type fuse.
5. Replace the top cover and carefully turn the unit upside down. Replace and tighten the four screws, one in each corner of the cabinet bottom.

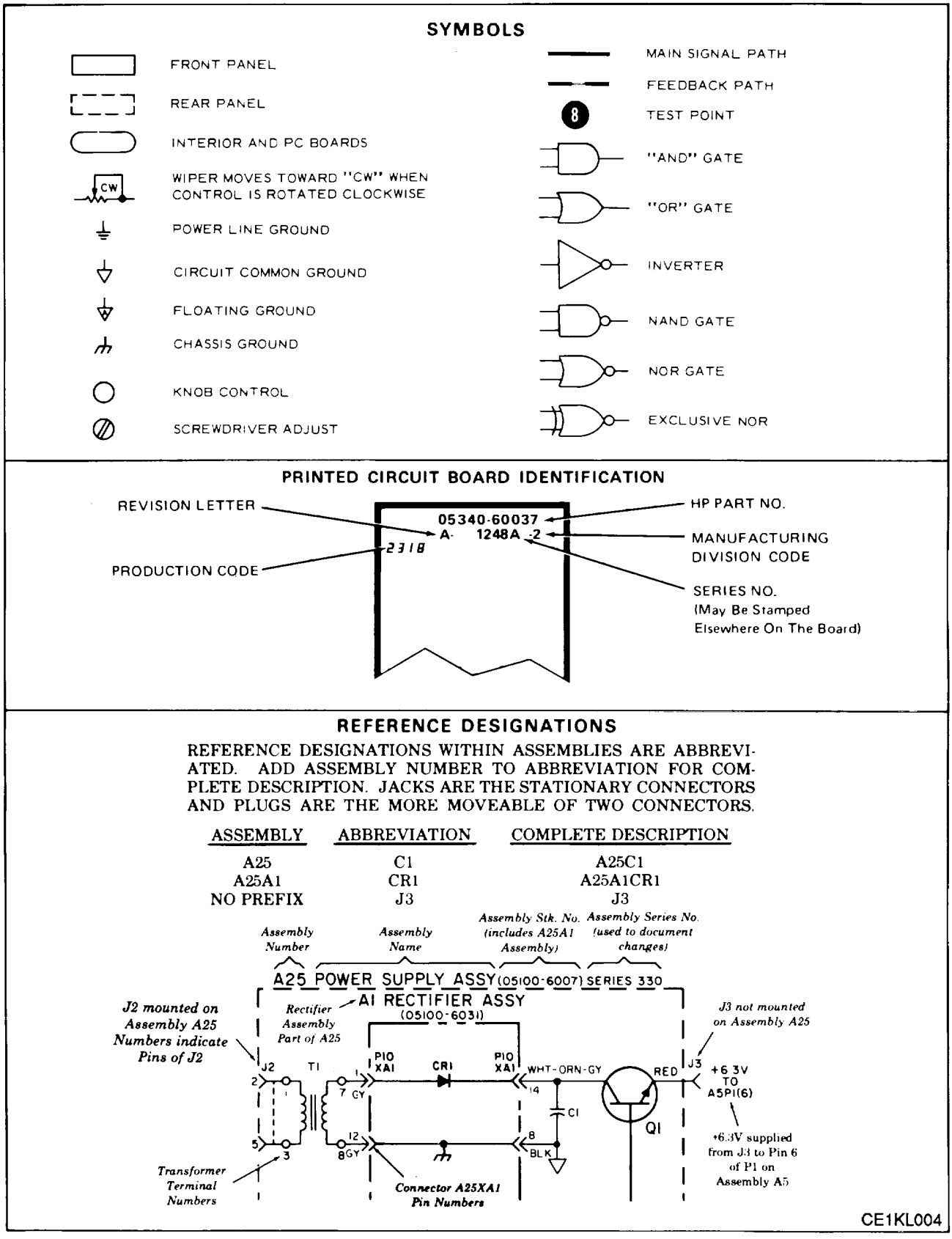


Figure 8-1. Schematic Diagram Notes

8-26. THEORY OF OPERATION

8-27. Introduction

8-28. The HP 5314A is a multifunction counter using a single LSI integrated circuit. The theory of operation is organized such that a block diagram is shown along with the block theory, immediately followed by the detailed theory. The block theory is structured to follow the block diagram. The detailed theory is referenced to the schematic diagrams found at the end of this section. There are four block diagrams, shown in *Figure 8-2* through *8-5,* as follows:

1. The HP 5314A overall block diagram.
2. The LSI counter chip (A1U2).
3. The power supply.
4. The A3 battery pack charger.

8-29. HP 5314A Overall Block Theory of Operation

8-30. The A and B input amplifiers condition the measured input signals and insure the subsequent digital circuits receive pulses of uniform rise and fall time. The signal on Channel B is applied directly to the counter IC. Channel A is similar to Channel B except a signal path through a +10 prescaler is also provided. The output of the counter drives the display through segment and digit drive lines. The digit drive lines are also used in conjunction with the front panel switches to select the proper function, range, and decimal point location. The power supply delivers +5 volts to the circuits and provides unregulated voltage to the battery charger connector for use with A3.

8-31. Detailed Al Assembly Theory

8-32. INPUT AMPLIFIERS. The signal is applied through a BNC input connector (J1) through coupling capacitor C19. The compensated attenuator is made of R27, R25, and C18, and allows selection of X1 or X20 through the use of switch SW10. The network made u p of R22, R23, C16, and diodes CR7 and CR6 make up the protection circuitry. The high input impedance is accomplished by the impedance converter made up of Q7 and Q8, and their associated biasing resistors. The signal is now amplified to an acceptable level by the first two stages of U5. The first stage provides a trigger level adjustment by allowing the reference level input to be shifted by approximately +400 mV using R29. The second stage of U5 provides some peaking at high frequencies to compensate for the roll off at the input impedance converter. The final stage of U5 is a Schmitt trigger which takes the amplified analog signal and digitizes it. The signal out of the impedance converter of Channel A goes to the amplifier U5, and can be switched into Channel B by using SW11 the SEP/COM A (separate/common A) switch.

8-33. Channel B is similar to Channel A with a few exceptions. A signal applied to Channel B is supplied with no attenuation through the protection circuitry made of R36, R35, C26, CR9, and CR8. The impedance converter is made up of Q9 and Q10 and their associated bias resistors. The Channel B signal is then amplified by the 3 stages of U6. The first stage provides an adjustable trigger level by setting R38. The second stage, rather than being peaked, is rolled off above 10 MHz as the Channel B is usable only to 2.5 MHz. The last stage is the Schmitt trigger without the high frequency compensation. The digital signal out of the Schmitt trigger must be translated to be compatible with TTL circuitry which follows. This is done by Q4 and Q3. The slope selection is done by U4C in conjunction with switch SW12. The Channel B signal is then applied to U2.

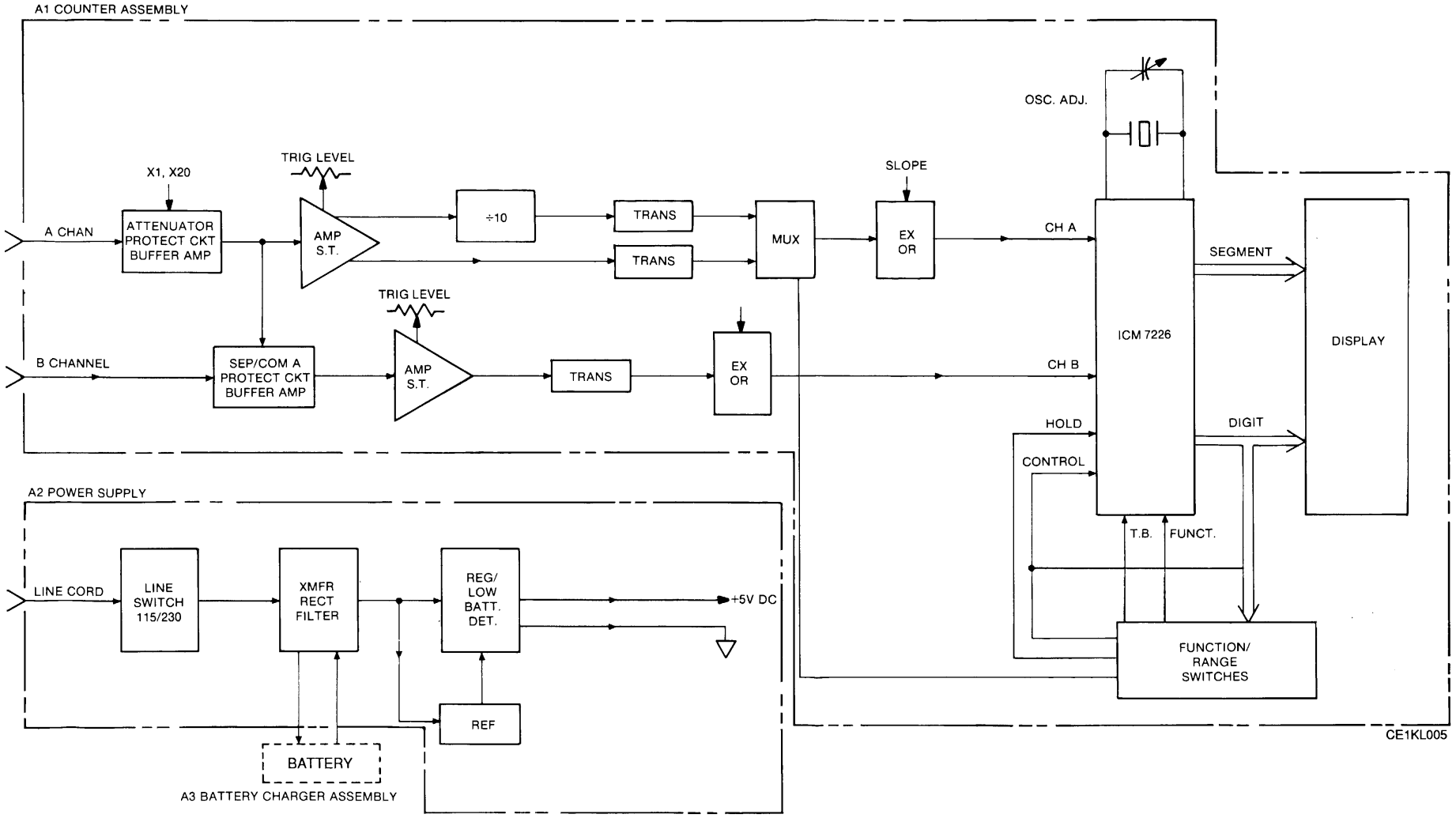


Figure 8-2. HP 5314A Overall Block Diagram

8-34. CHANNEL A PRESCALE SELECT CIRCUIT. The output of the Channel A amplifier goes to the input of U2 by taking one of two paths selected by the front panel switches. The first path is through the level translator Q5 and Q6. The multiplexer (U1C) selects the input on pin 13. The slope selection is made in U4 in conjunction with switch SW9. The signal is then applied to U2.

8-35 This is the normal signal path for most functions. When frequency A is selected and the 100 MHz/10Hz max frequency/resolution button is pushed, then the multiplexer (U1) directs the signal on pin 14 through the slope select logic and on to U2. This signal has come from amplifier U5 through a÷10 prescale decade and a level translator Q1 and Q2. Therefore anytime the FREQ A button is pushed in conjunction with the 100 MHz/10 MHz button, the prescaler will be switched. The other sections of the U1 multiplexer provides proper location of the decimal point when in the prescale mode.

8-36 LSI COUNTER CHIP. Integrated circuit A1U2 provides the circuitry to implement a full universal counter. The functions that can be performed are FREQUENCY, PERIOD, TIME INTERVAL, START A (TOTALIZE), RATIO A/B and CHECK. U2 also contains the logic to strobe the data into the display.

8-37 Function, Range, Control Inputs. In order to set the proper function and range, it is necessary to connect the proper digit drive line to the function or range input of U2. Since the digit drive lines are strobed consecutively starting from the most significant digit to the least significant digit, it is where the pulse occurs in time, which determines what function or range the instruments is in. As an example, connecting digit driver D0 to the function input causes U2 to be set up to measure frequency on Channel A. Connecting the same digit drive line to the range input sets the gate time to 0.01 seconds. A third input to U2 is called control and selects additional modes of operation. The operation of the function, range, and control inputs are shown in *Table 8-2.*

8-38 Display Strobe. The display consists of 7-segment common anode display digits with an overflow LED indicetor. Each digit has a decimal point with the most significant digit's decimal point used as a gate indicator.

8-39. In order to light a particular digit it is necessary to pull the anode of the digit high and sink current in the appropriate cathodes to light the desired number in the digit. Therefore, it is possible to tie all the corresponding segments (cathodes) together as the anode determines which digit is being addressed. U2 first addresses the most significant digit and strobes in the proper number, then the next MSD will be addressed and the proper number strobed in and so on. A complete display strobe cycle is executed in 2 milliseconds or at a 500 Hz rate. The overflow is driven from the eighth unused digit.

Table 8-2. Function/Range versus Digit Drive

Digit	Function	Range Gate Time/N	Control
D0	FREQUENCY	0.001 s/1	EXT OSC Enable
D1	RATION A/B	0.1 s/10	1 MHz REF Select
D2	CHECK	1 s/100	EXT Decimal Pt. Enable
D3	START A	- - -	BLANK Display
D4	TIME INTERVAL	- - -	- - -
D5	- - -	- - -	- - -
D6	- - -	- - -	- - -
D7	PERIOD	- - -	DISPLAY

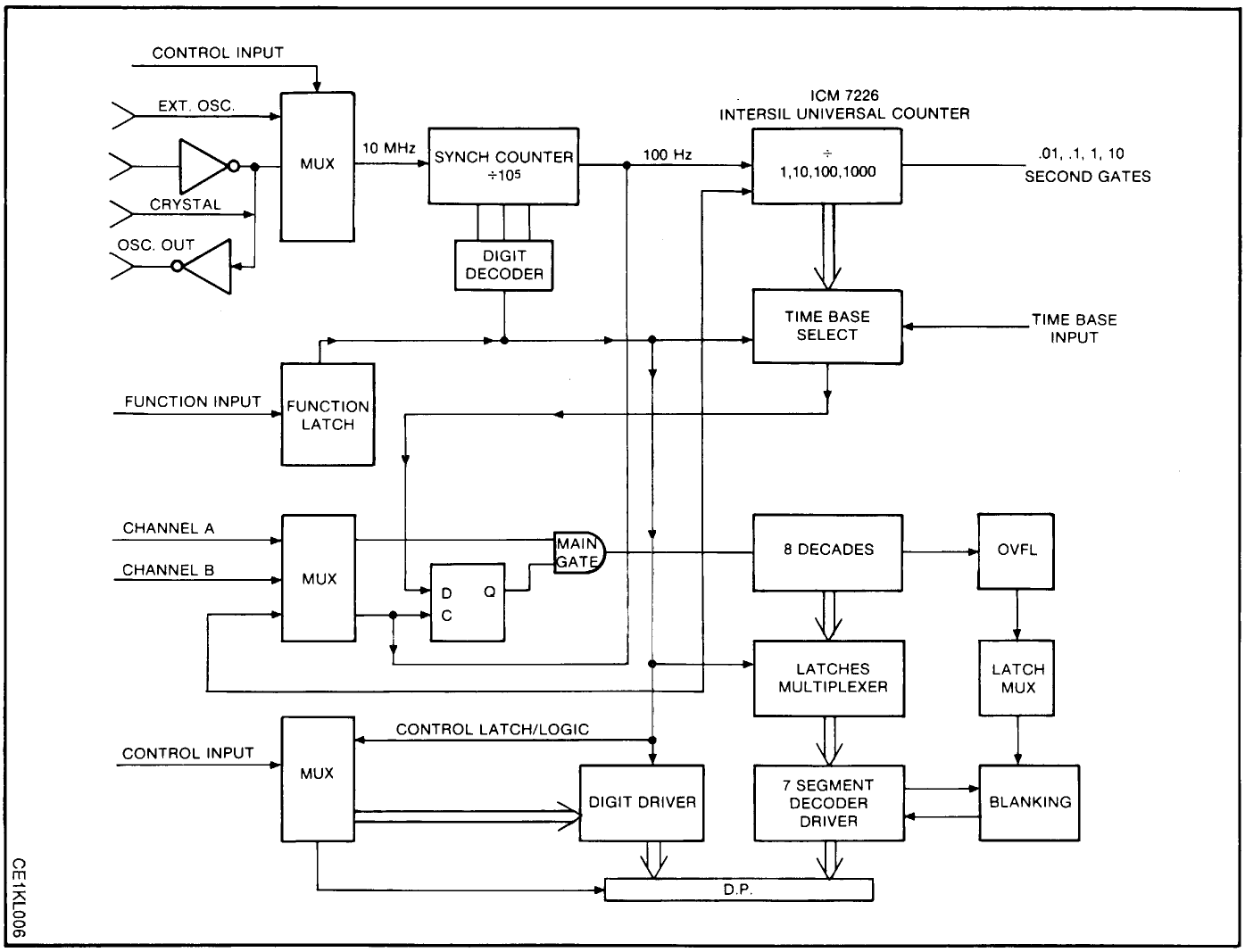


Figure 8-3. LSI Counter (A1U2) Block Diagram

8-40. Decimal Point Control. The circuitry in U2 determines the function, range, and control status and automatically positions the decimal point. The decimal point is strobed in exactly the same manner as the segments of the digits. When the prescaler decade is switched in, by selecting FREQ A and 100 MHz/10 Hz max. frequency/resolution, it is necessary to move the decimal point one-digit to the right. This is done by connecting digit D2 (EXT decimal point enable) to the control input through multiplexer U1. This allows pin 20 (EXT decimal point input) to be used to strobe the decimal point into the proper position.

8-41. REFERENCE OSCILLATOR. The oscillator is made up of the 10 MHz crystal Y1 and the trimmer capacitors C2, C4, and C5, and bias resistor R6. The active elements are internal to U2. The buffered oscillator is brought out on pin 38 and is connected to the EXT OSC input on pin 33. It is therefore necessary to program the control input to the EXT oscillator input mode by connecting D0 to the control input. This is done through isolation diode CR4. If the temperature compensated crystal oscillator is used, the jumper between pins 33 and 38 is removed and the TCXO output is connected between ground and pin 33, EXT OSC input.

8-42. GATE LAMP. The gate lamp is used to give an indication that the counter is in the process of making a measurement. The gate lamp is on whenever the gate is open and the counting decades are accumulating pulses. When making measurements where the gate is only open for a short time such as time interval or single-shot period measurements, the gate signal is not on long enough to light the gate indicator. Therefore, the reset pulse is also connected to the gate indicator to provide an indication that measurements are being made. The reset pulse occurs about 140 milliseconds after the measurement is over.

8-43. POWER, HOLD, FUNCTION, AND RANGE SWITCHES. Switch SW1 connects unregulated voltage from the power supply board back to the regulator on the power supply board. Switch SW2 in the normal (NORM) position applies ground to the hold input pin 39 of U2. When SW2 is depressed, a positive voltage generated by CR3 and C1 is applied to the hold input. This terminates any measurement in progress and holds the previous reading in the display. Upon releasing the hold button, a new measurement will begin. Switches SW3, 4, and 5 connect the proper digit drive lines to the function input. Switch SW5 acts like a shift key allowing switches SW3 and SW4 to select two functions. When both SW3 and SW4 are in or out the functions CHECK or RATIO A/B are respectively selected. In this situation the shift key SW5 has no affect.

8-44. Switches SW6, 7, and 8 select the proper digit drive line to be connected to the range input. SW8 provides the special function of connecting ground to U3 (-10 prescaler) only when SW3 is also in. This same line is also applied to the multiplexers as the control signal. Switches SW6, 7, and 8 are connected to provide more range positions than those shown on the front panel. The useful switch positions are shown below in *Table 8-3.*

Table 8-3. Useful Resolution Switch Positions (Shaded buttons indicate IN)

Switch Position			Prescale	Freq Gate Time	Freq. Res.	No. of Avg.
SW6	SW7	SW8				
□	□	□	OFF	10 s	0.1 Hz	N=1000
■	□	□	OFF	1 s	1 Hz	N=100
□	■	□	OFF	0.1 s	10 Hz	N=10
□	□	■	ON	1 s	10 Hz	n=1
■	□	■	ON	0.1 s	100 Hz	n=1
□	■	■	ON	0.01 s	1 kHz	n=1

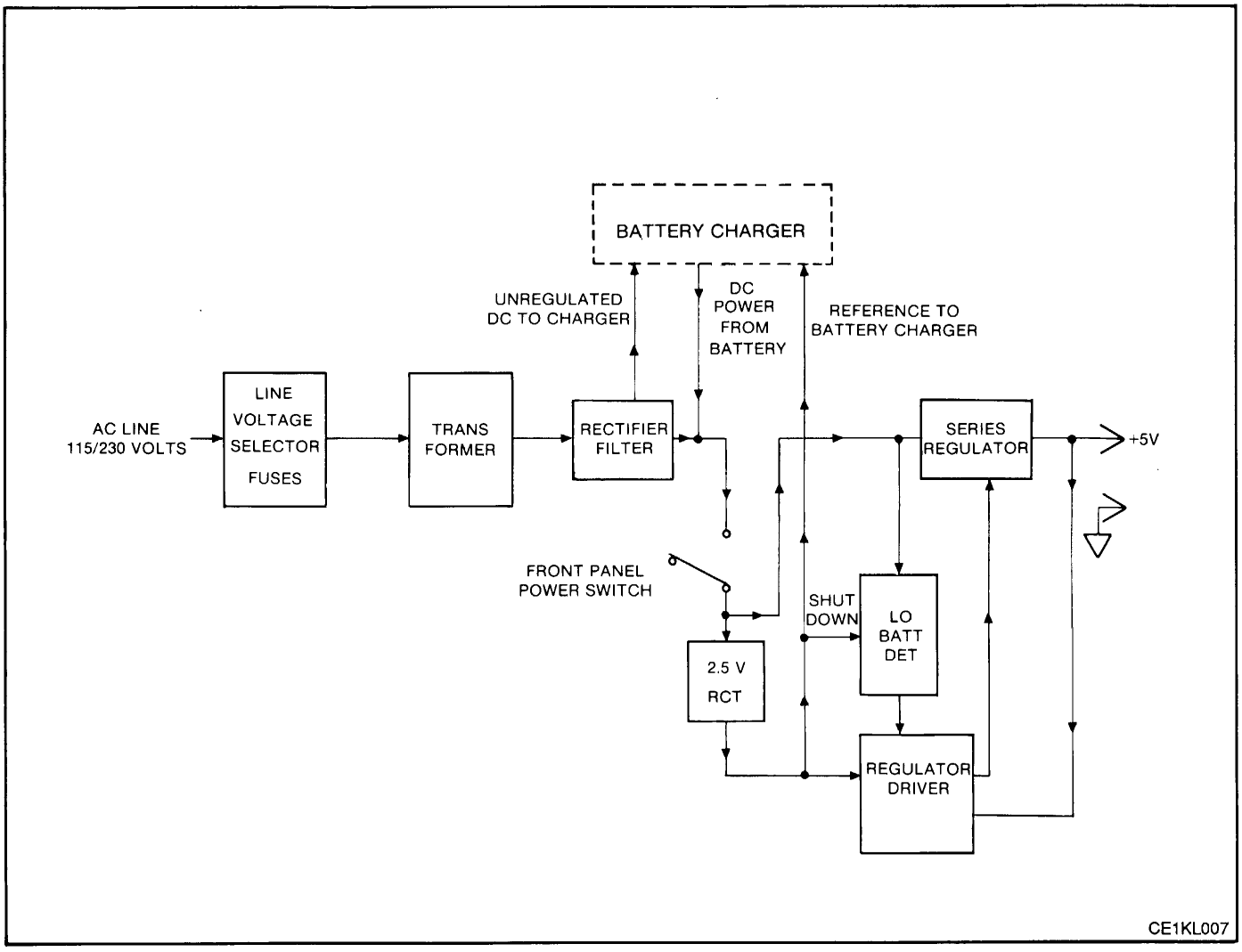


Figure 8-4. HP 5314A Power Supply Block Diagram

8-45. Power Supply Block Theory

8-46. The power supply contains circuitry to operate the instrument when the front panel STBY switch is pushed to ON, or charge the battery when in standby (STBY) . Input line voltages can range from 86 to 126 volts in the 115V position of the power selector switch and 172V to 252 in the 230- volt position. The outputs provided by the power supply are regulated +5 volts at 0.5 amps, unregulated +8 to +10 volts for charging the battery and +2.5V reference to be used by the battery charger.

8-47. Detailed A2 Assembly Theory

8-48. Line power is applied to the primary side of T1 power transformer through the line selector switch and fuses F1 and F2. The line selector switch configures the dual primary for 115-volt or 230- volt operation by connecting the windings in parallel or series, respectively. The fuses need not be changed when the line voltage selector switch is changed. The secondary of the power transformer contains a full wave rectifier and filter made up of CR2, CR1, and C1. The unregulated dc at this point is supplied to the battery charger board. The dc also passes through two isolation diodes CR5 and CR6.

8-49. These diodes keep current from coming back out of the battery and into the charger circuitry. The dc line is broken at this point by the standby (STBY) switch located on the Al assembly. When the switch is ON, power is supplied to the 2.5 volt regulator U1, the output regulator driver and series pass transistor, and the low voltage detector. The regulated +5 volts output is generated using a conventional series pass linear regulator. The output voltage is divided-by-2 using R7 and R8. Under normal conditions this will produce 2.5 volts at the output of the divider which is applied to an operational amplifier U2 pin 2. This voltage is compared with the 2.5 volts generated by the reference U1. The output of the opamp will control the current in Q1 which controls the series pass transistor Q2. The other half of U2 is used as a low battery detector. When the HP 5314A is operating under battery power, an attenuated version of the battery voltage is present on U2 pin 6. This voltage is compared with the 2.5 volt reference which is applied to pin 5 of U2. When the battery voltage is high, the output of U2 is low and CR4 is reversed biased. When the battery voltage gets low, indicating low capacity, pin 7 of U2 will go high. This pulls pin 2 of U2 high and turns off the output transistor Q2. Positive feedback is applied around the low battery detector to provide hysteresis. This ensures that once the detector has shut the HP 5314A off, it will stay off. Capacitor C5 delays the 2.5-volt reference on pin 5 ensuring that when the instrument is turned on, it comes on then shuts down if necessary.

8-50. A3 Battery Charger Block Theory

8-51. The battery charger has circuitry that supplies 10 mA to the battery whenever the instrument has line power coming in. If the instrument is in the standby position, the battery is charged at a 0.5 amp rate until it is fully charged. When the battery is fully charged, a circuit detects this and discontinues the 0.5 amp current and resumes the 10 mA float current. See *Table 8-4* for power switch operation.

Table 8-4. Power Switch Operation

AC Line Cord	Power Switch	Battery-Pack Operation
Connected	STBY	Two-step battery charging cycle active.
Connected	ON	Counter operates from ac power; charge circuitry provides a 10 mA trickle charge to battery to maintain charge level.
Disconnected	STBY	None.
Disconnected	ON	Counter operates from battery power; Auto-Shut Down circuitry operative.

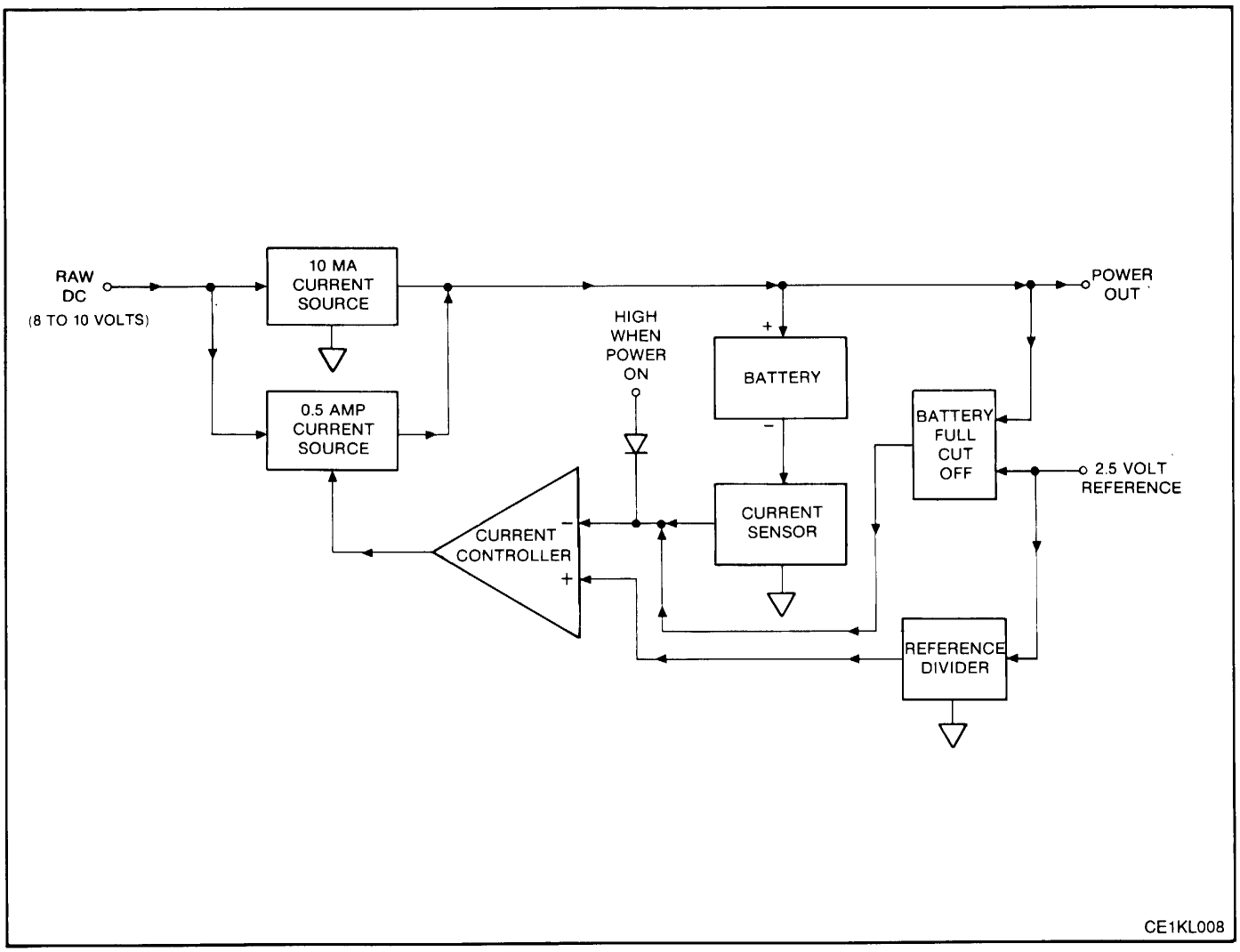


Figure 8-5. HP 5214A A3 Battery Pack Block Diagram

8-52. Detailed A3 Assembly Theory

8-53. Power comes on to this board at pin 1. The components R1, R2, Q1, and Q2 provide continuous 10 mA to the battery from the collector of Q1. R13 is the current sensor and R4 is used to isolate the sensor from pin 2 of the IC. The 2.5-volt reference comes on to the board at pin 5 and is divided down to 50 mV by R10 and R6 (50 mV is the voltage developed by the current sensor). The OP amp (consisting of pins 1, 2, and 3), in conjunction with Q3, Q4, R3, and R5, is used to control the 0.5 amp used to charge the battery.

8-54. CR2 is used so the battery does not power this circuitry when the instrument is unplugged. CR1 is used so that power only leaves the board at pin 2. When the instrument is on, pin 3 goes high which discontinues the 0.5 amp current used to charge the battery. In the standard HP 5314A, the 2.5-volt reference is turned off when the switch is in STBY, so power is provided through CR4 to the reference input at pin 4 needed.

8-55. The remaining components comprise the circuit to shut off the 0.5 amp current when the battery has a full charge. R9 and R11 and the 2 K.Q potentiometer (R12) comprise the voltage divider to determine the correct voltage where the 0.5 amps should be discontinued. CR7 and the 33 KQ thermistor are used to track the temperature changes inside the instrument. R7 pulls pin 7 to approximately 60 mV above ground when the opamp goes low. When the battery is not fully charged, pin 7 will be low (because the voltage at pin 5 will be less than 2.5-volt reference at pin 6). The 2 KQ pot is adjusted so that the full charge cutoff happens when there is 7.5 volts across the battery at room temperature. Now the thermistor and CR8 are out of the circuit, which causes pin 5 to go even higher. Pin 7 will not go low now until pin 5 goes below 2.5 volts. This will happen when approximately 7.05 volts is across the battery. CR5, CR6, and R8 are used to insure that the previously described circuitry has no affect on pin 2 of the IC. (Recall that pin 2 is sensing 50 mV and pin 7 goes down to 60 mV.)

8-56. TROUBLESHOOTING TEST PROCEDURES

NOTE

It will be necessary to remove top cover and front panel to access troubleshooting test points.

8-57. The following test procedures are designed to effectively verify the proper operation of isolated subsections of the HP 5314A. Refer to the troubleshooting block diagram in *Figure 8-6* to determine the circuits tested by each procedure. Although each procedure may be performed independently, it is recommended that they be performed in the numerical sequence as given in *Table 8-5.*

8-58. Throughout the five troubleshooting test procedures, alphabetical test points from D to S are referenced. These test points appear on the Al schematic diagram in *Figure 8-8.* They are enveloped within black circles located at various points throughout the schematic diagram. *Table 8-5* lists the test points and the signals present at each.

Table 8-5. Block Diagram Sections versus Test Procedures

Figure 8-6 Sections	Test Procedure				
	1	2	3	4	5
A	X	X	X	X	X
B		X		X	X
C			X		X
D				X	X

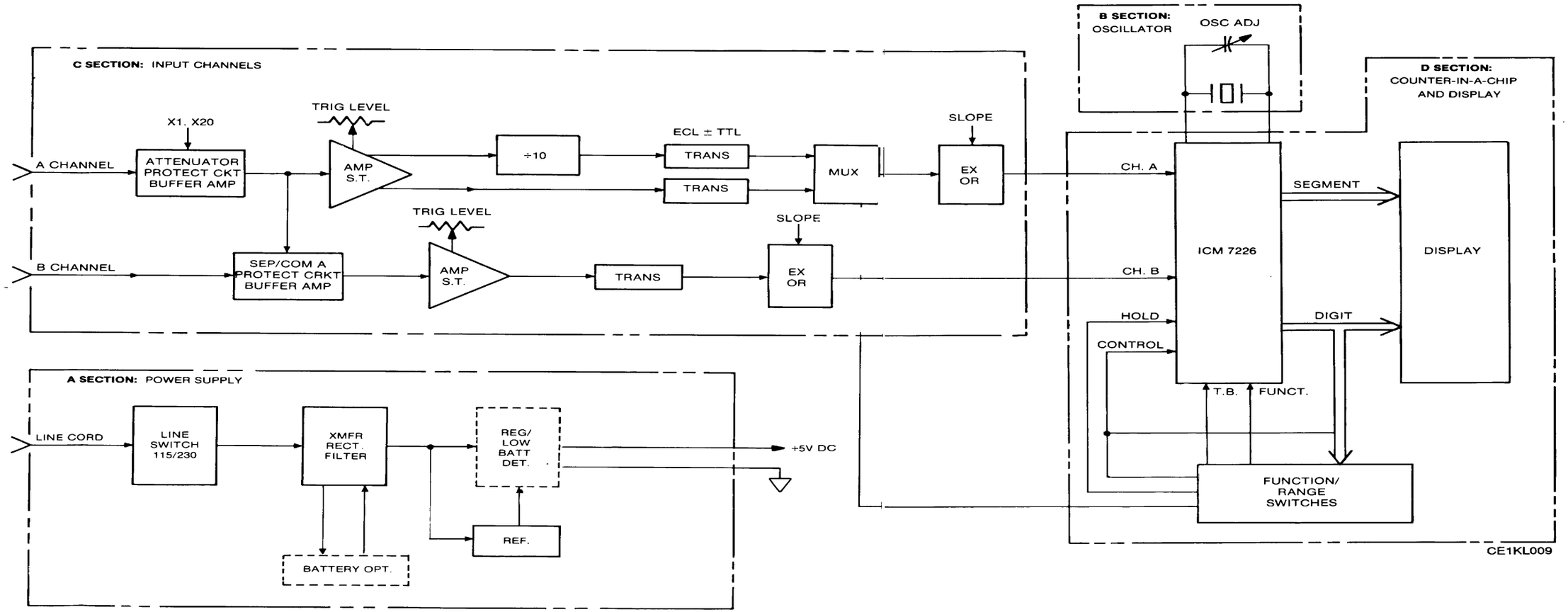


Figure 8-6. HP 5314A Troubleshooting Block Diagram

Table 8-6. A1 Test Point Signal Descriptions

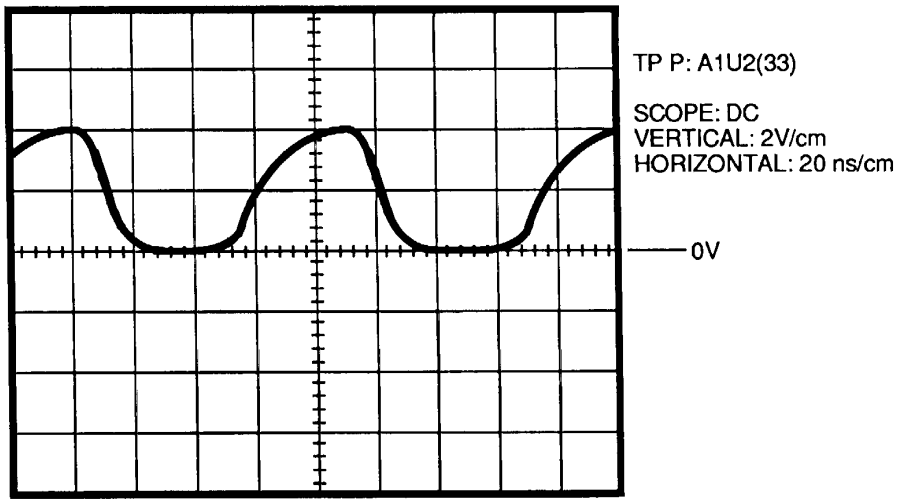
Test Point	Description
TPD:	Channel A Input to wideband amplifier-collector of A1Q7
TP E&F:	Channel A Schmitt trigger outputs A1U5(15, 14)
TP G:	Channel A Input to Counter-in-a-chip A1U2(401
TP H:	Channel B Input to wideband amplifier-collector of A1Q9
TP J&K:	Channel B Schmitt trigger outputs A1U6(15, 14)
TP L:	Channel B Input to Counter-in-a-chip A1U2(2)
TP M:	"FUNCTION" input to A1U2(4)
TP N:	"TIME BASE" input to A1U2(21)
TP P:	"EXT OSC INPUT" A1U2(33)
TP Q:	"CONTROL" input A1U2(1)
TP R:	"OVFL" output A1U2(22)
TP S:	+5 Volts
TP T:	⏚(GND)

8-59. Procedure #1: Testing of 5314A Power Supply

8-60. To verify proper operation of the HP 5314A power supply, check Test Point S on the A1 motherboard. It should be +5V +75 mV. This is the only supply voltage in the HP 5314A, and it is not adjustable.

8-61. Procedure #2: Testing of 5314A Reference Oscillator

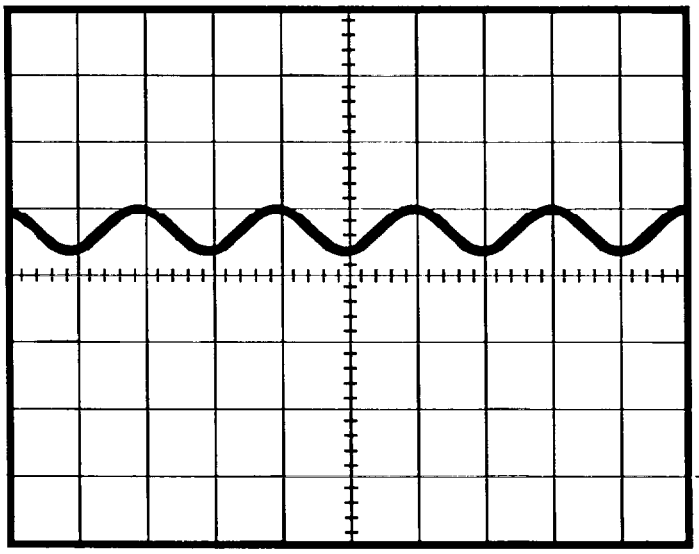
8-62. Check for the presence of the 10 MHz Reference Oscillator at Test Point P, A1U2(33); see following figure for a typical waveform:



If the 10 MHz reference oscillator is not present, check AIY1, R6, C2, C5, and U2.

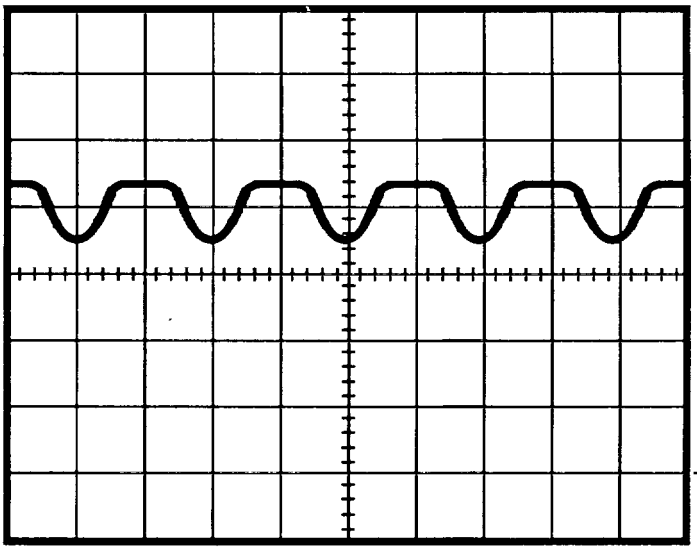
8-63. Procedure #3: Testing Input Channels

8-64. To verify proper operation of the HP 5314A input channels, apply a 10MHz signal at 100mV rms (~280mV p-p) to INPUT A, then to INPUT B. Check that the proper waveform exists at TP G [A1 U4(6)] and at TP L [A1 U4(8)]. If they are not present, trace back the signal. The following eight illustrations show the signal which should be present at the corresponding test points.



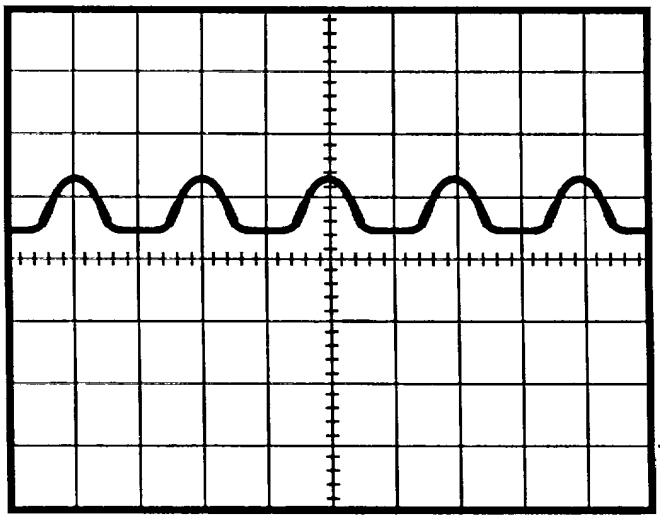
TP D: Collector of A1Q7

SCOPE: DC
VERTICAL: 0.5V/cm
HORIZONTAL: 50 ns/cm



TP E: A1U5(15)

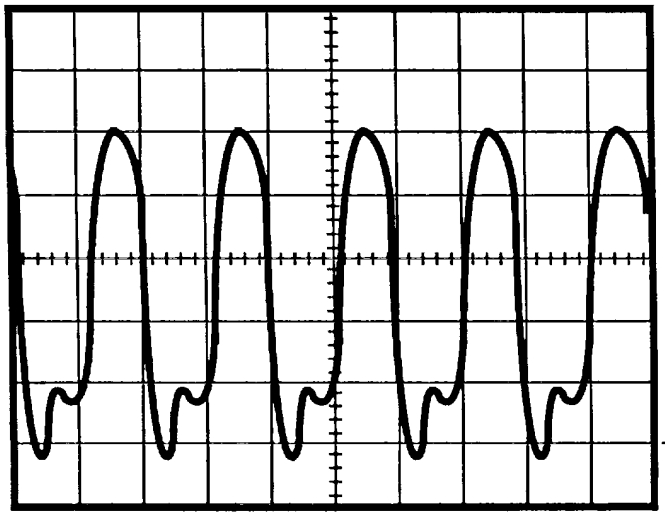
SCOPE: DC
VERTICAL: 1V/cm
HORIZONTAL: 50 ns/cm



TP F: A1U5(14)

SCOPE: DC
VERTICAL: 1V/cm
HORIZONTAL: 50 ns/cm

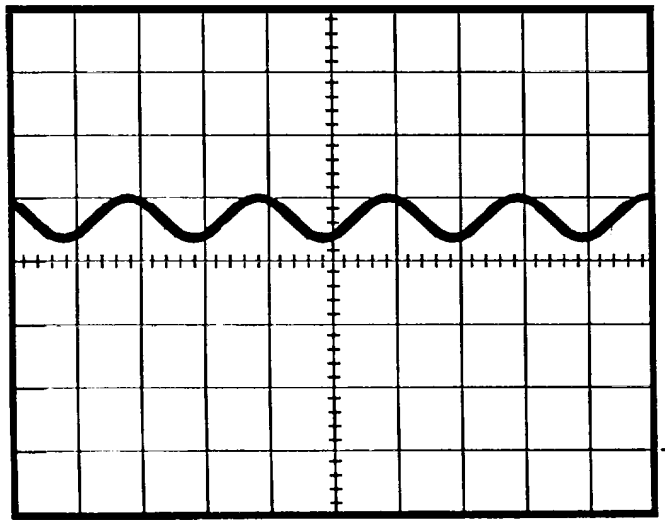
0V



TP G: A1U4(6)

SCOPE: DC
VERTICAL: 1V/cm
HORIZONTAL: 50 ns/cm

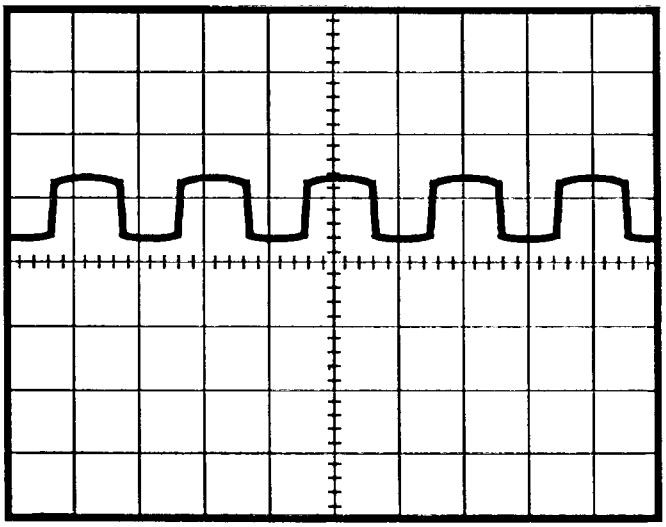
0V



TP H: Collector of A1Q9

SCOPE: DC
VERTICAL: 0.5V/cm
HORIZONTAL: 50 ns/cm

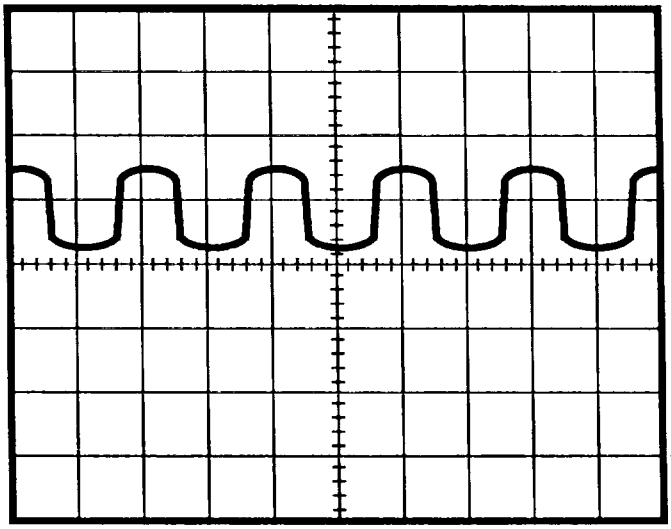
0V



TP J: A1U6(15)

SCOPE: DC
VERTICAL: 1V/cm
HORIZONTAL: 50 ns/cm

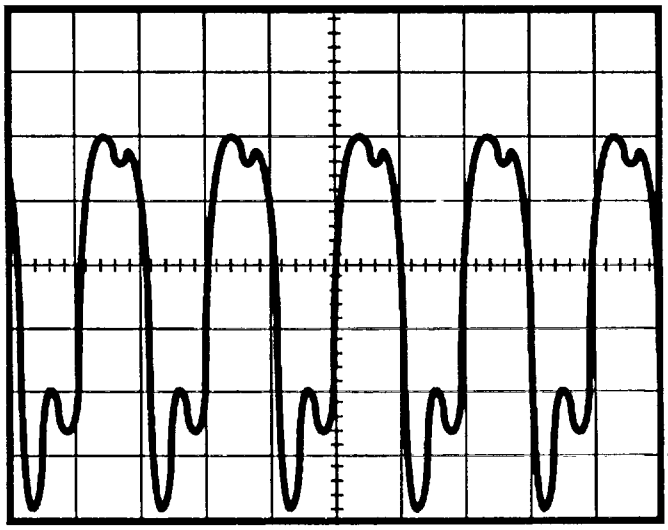
0V



TP K: A1U6(14)

SCOPE: DC
VERTICAL: 1V/cm
HORIZONTAL: 50 ns/cm

0V



TP L: A1U4(8)

SCOPE: DC
VERTICAL: 1V/cm
HORIZONTAL: 50 ns/cm

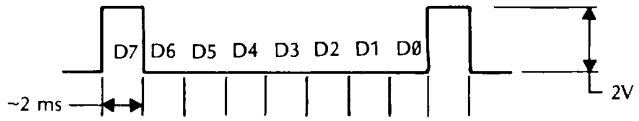
0V

8-65. Procedure #4: Testing of ICM 7226 [Counter-in-a-Chip] and Display

8-66. To verify the proper operation of A1U2 (counter-in-a-chip) and the displays and the front panel switches, set the 5314A to SELF-CHECK mode; set resolution to 10Hz (N=10). The display should be +1 count with "GATE" light blinking as follows:

If counter fails to pass this test, check Digit Driver lines from A1 U2 as follows.

Connect Oscilloscope channel A input to A1U2(22)(TP"R") and adjust time base so that the total period of pulses occupy eight centimeters on the display as shown.



Connect Oscilloscope channel B input to A1U2(4)(TP"M"). Set the following front panel functions and verify the correct response.

FUNCTION	CORRECT RESPONSE
FREQ A	D0
RATIO	D1
SELF CHECK	D2
START A	D3
TIME INTERVAL	D4
PERIOD	D7

Connect Oscilloscope channel B input to Al U2(20)(TP"M"). Set all front panel buttons to OUT except power and FREQ A. Press the following front panel push buttons and verify the correct response.

PUSH BUTTONS IN	CORRECT RESPONSE
N=10, N=1	D0
N=100, N=1	D1
N=1	D2
ALL OUT	D3

Connect Oscilloscope channel B input to the following Al U2 pin numbers and verify the correct response.

A1U2 PIN NUMBER	CORRECT RESPONSE
30	D0
29	D1
28	D2
27	D3
26	D4
24	D5
23	D6
22	D7

8-67. Procedure #5: 20 MHz Mode

8-68. Apply a 20 MHz signal at 100 mV rms (-280 mV p-p) to the HP 5314A INPUT A with a 50-ohm feedthrough. Set the HP 5314A to FREQ A mode, with a resolution of 10 Hz (N=1), ATTN X1/X20 in X1, and LEVEL A about midrange. Verify that counter counts 20 MHz +1 count.

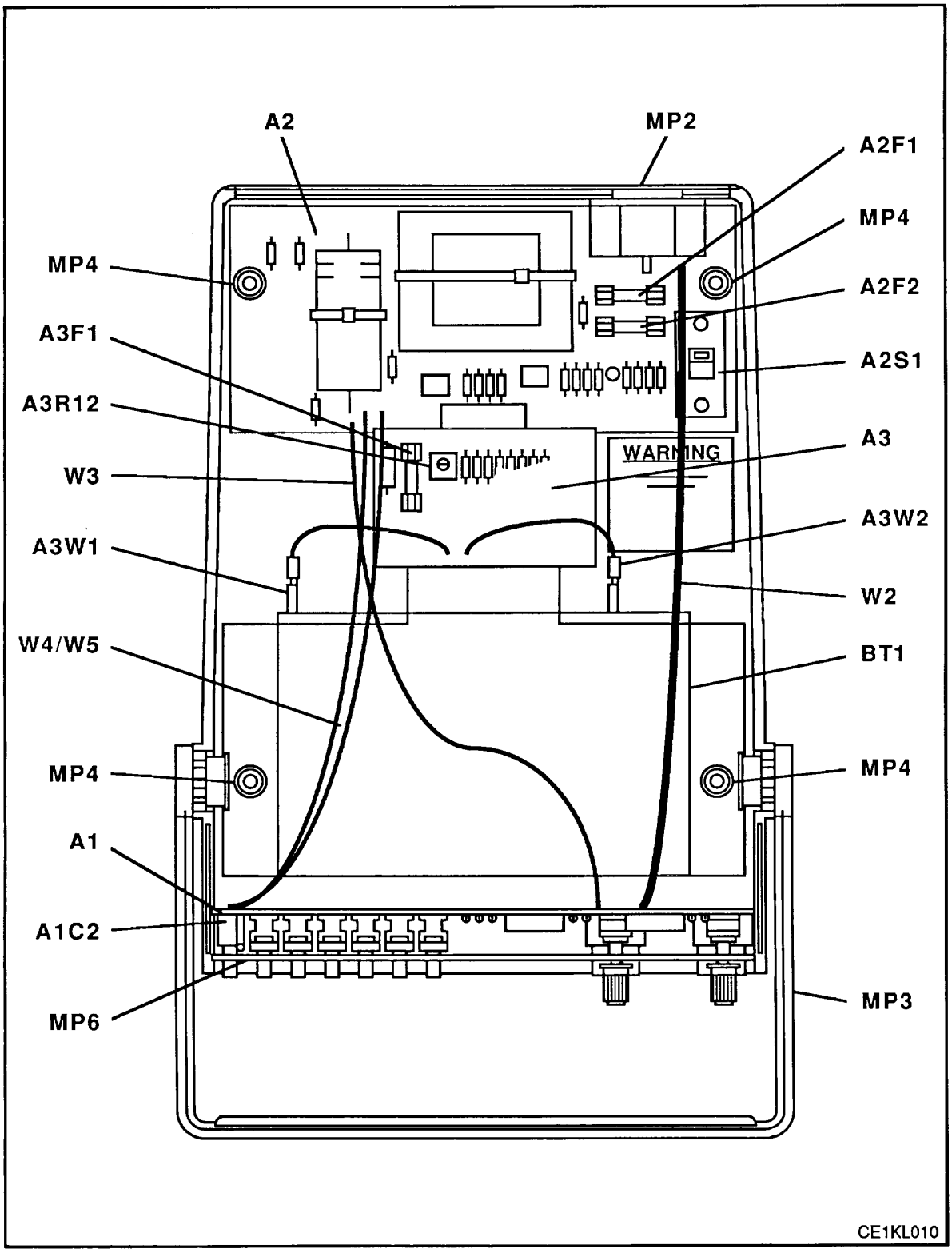
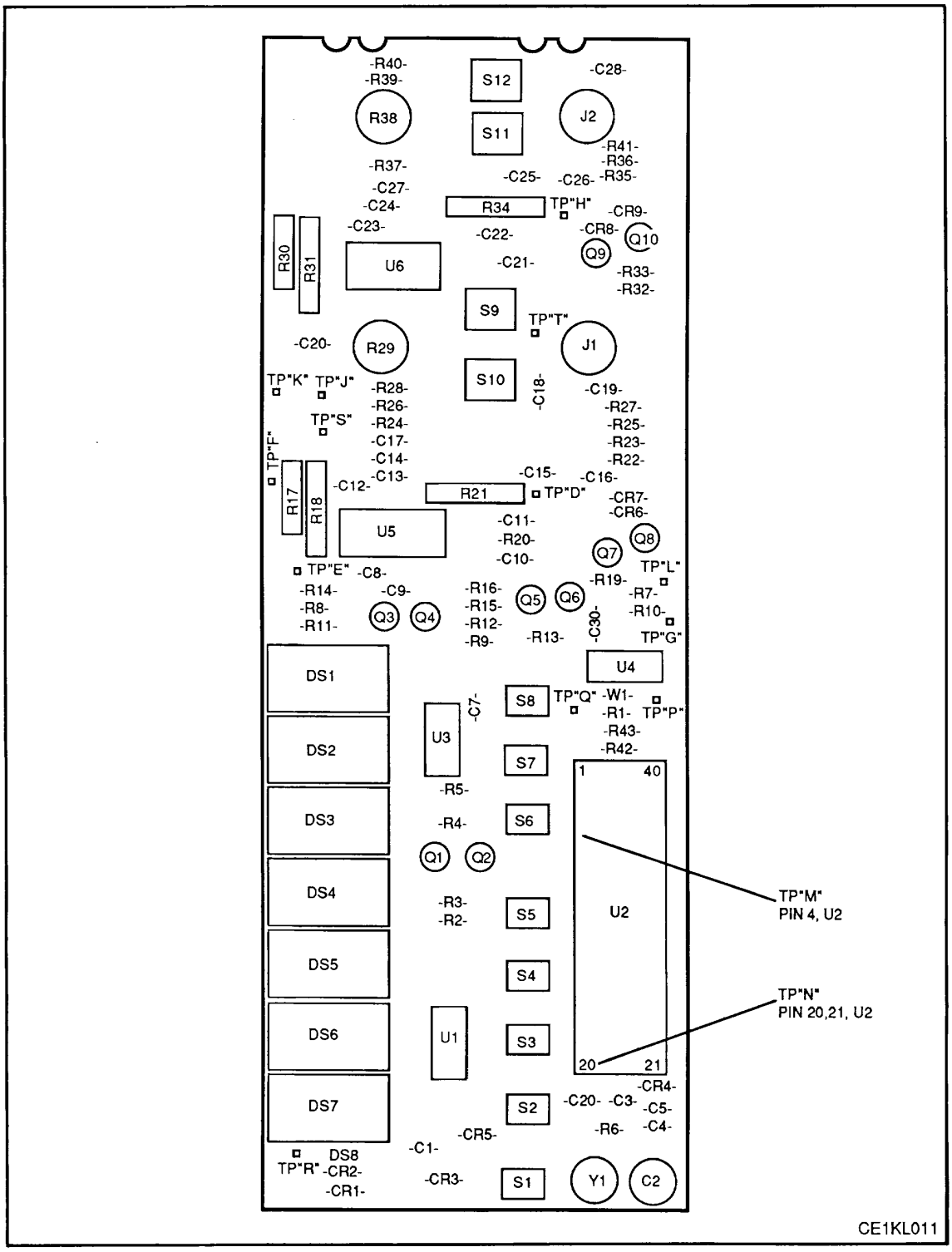


Figure 8-7. Top Internal View



Part of Figure 8-8. A1 Counter Assembly Component Locator

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS
C1-C33
CR1-CR9
DS1-DS8
J1, J2
Q1-Q10
R1-R41
S1-S12
U1-U6
W1-W5
Y1

Table of Active Elements

REFERENCE DESIGNATIONS	HP PART NUMBER	MFG PART NUMBER
CR1-CR9	1901-0040	1901-0040
DS1-DS7	1990-0658	5082-7621
DS8	1990-0487	5082-4584
Q1-Q7, Q9,	1853-0481	1853-0481
Q8, Q10	1855-0267	2N5245
U1	1820-1470	SN74LS157N
U2	1820-2187	1820-2187
U3	1820-1383	MC10138L
U4	1820-0694	SN74LS86N
U5, U6	1820-1224	MC10216P
Y1	0410-1188	0410-1188

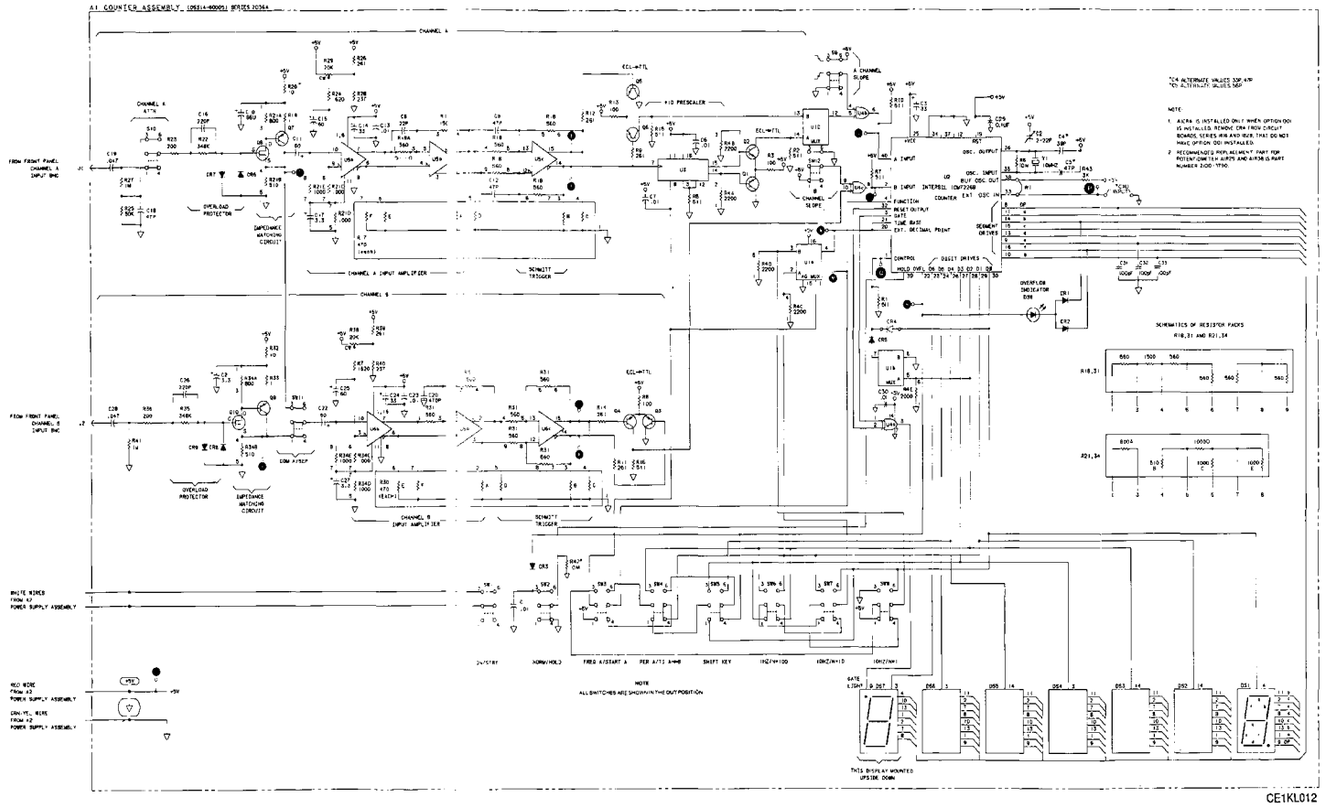
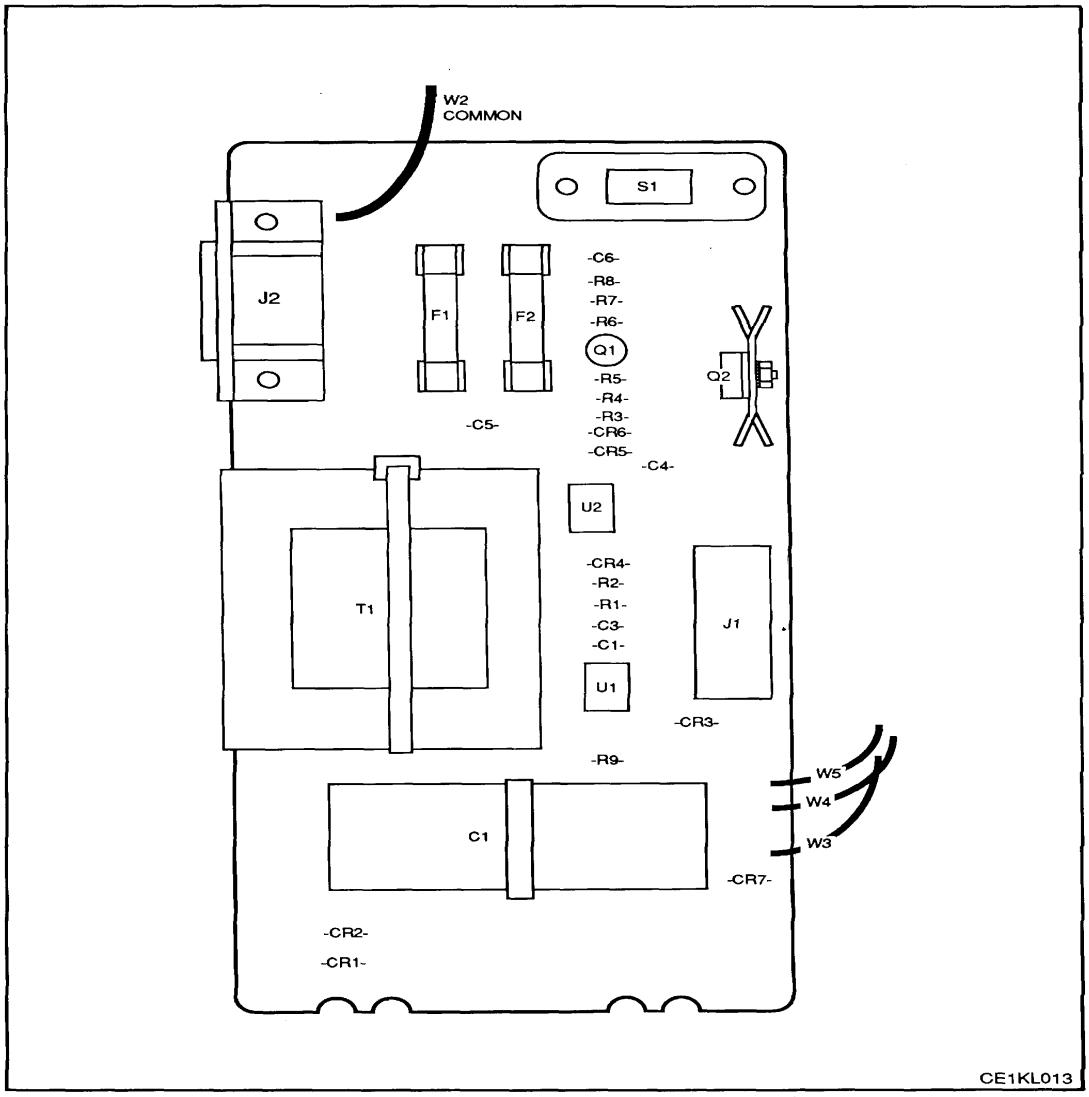
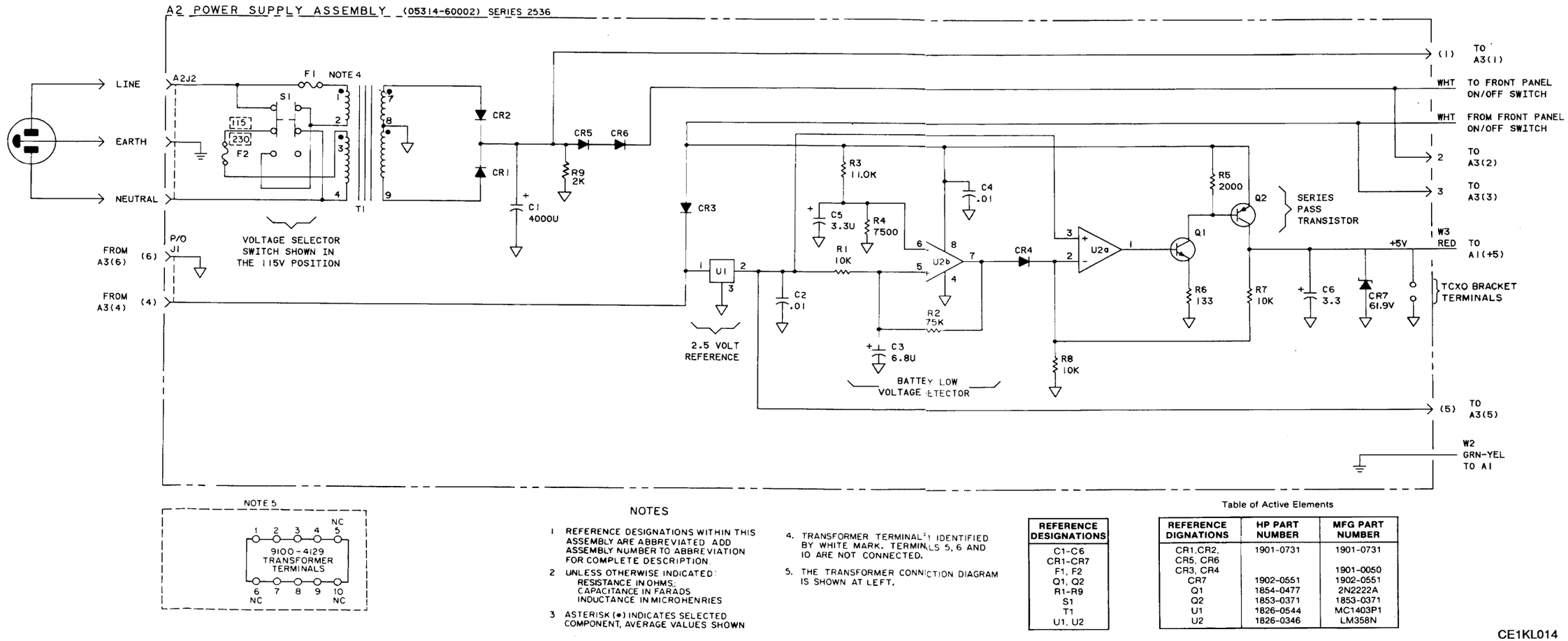


Figure 8-8. A1 Counter Assembly



Part of Figure 8-9. A2 Power Supply Assembly Component Locator



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN FARADS; INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. TRANSFORMER TERMINAL #1 IDENTIFIED BY WHITE MARK. TERMINALS 5, 6 AND 10 ARE NOT CONNECTED.
5. THE TRANSFORMER CONNICTION DIAGRAM IS SHOWN AT LEFT.

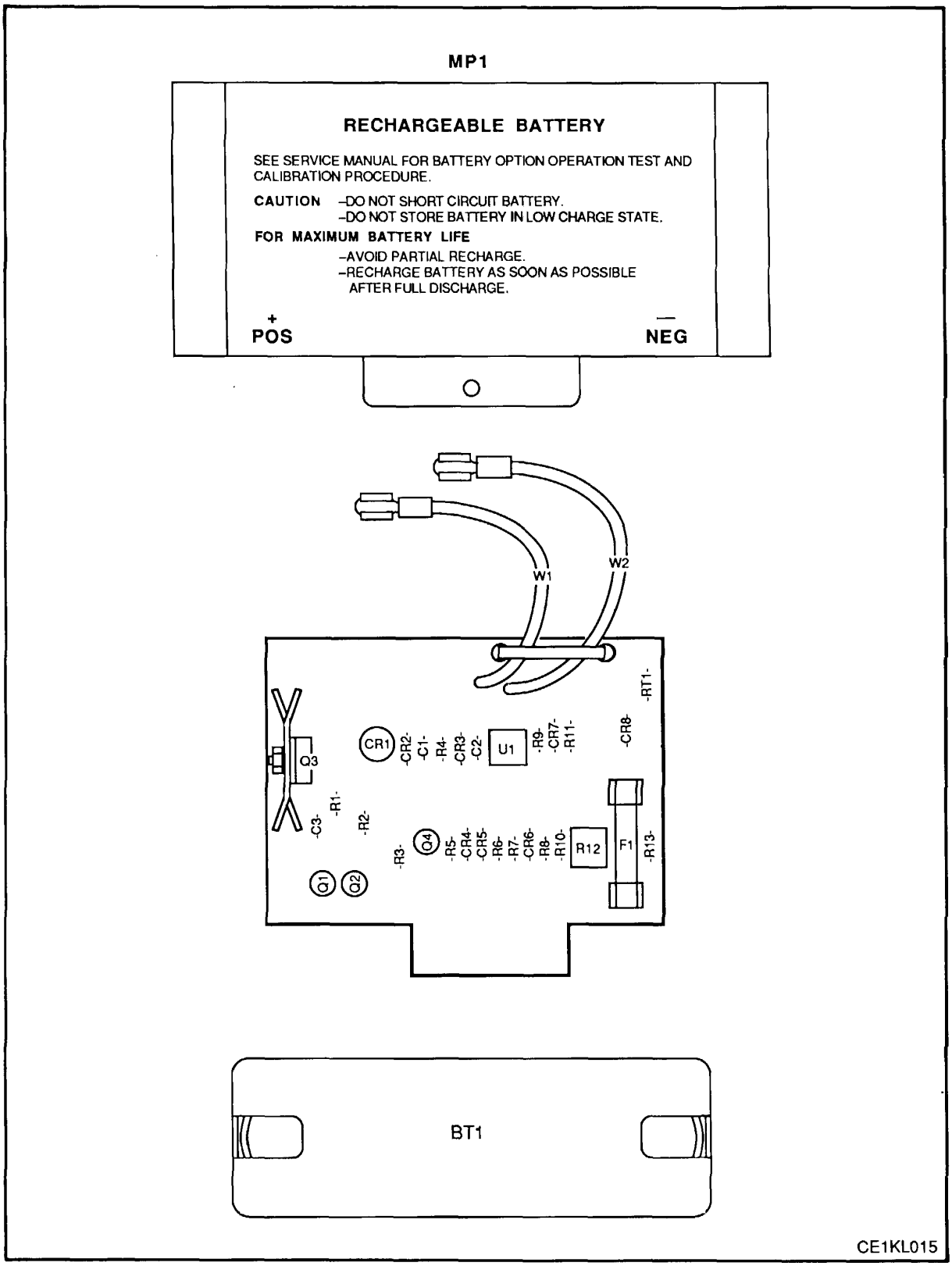
REFERENCE DESIGNATIONS
C1-C6
CR1-CR7
F1, F2
Q1, Q2
R1-R9
S1
T1
U1, U2

Table of Active Elements

REFERENCE DIGNATIONS	HP PART NUMBER	MFG PART NUMBER
CR1,CR2, CR5, CR6	1901-0731	1901-0731
CR3, CR4		1901-0050
CR7	1902-0551	1902-0551
Q1	1854-0477	2N2222A
Q2	1853-0371	1853-0371
U1	1826-0544	MC1403P1
U2	1826-0346	LM358N

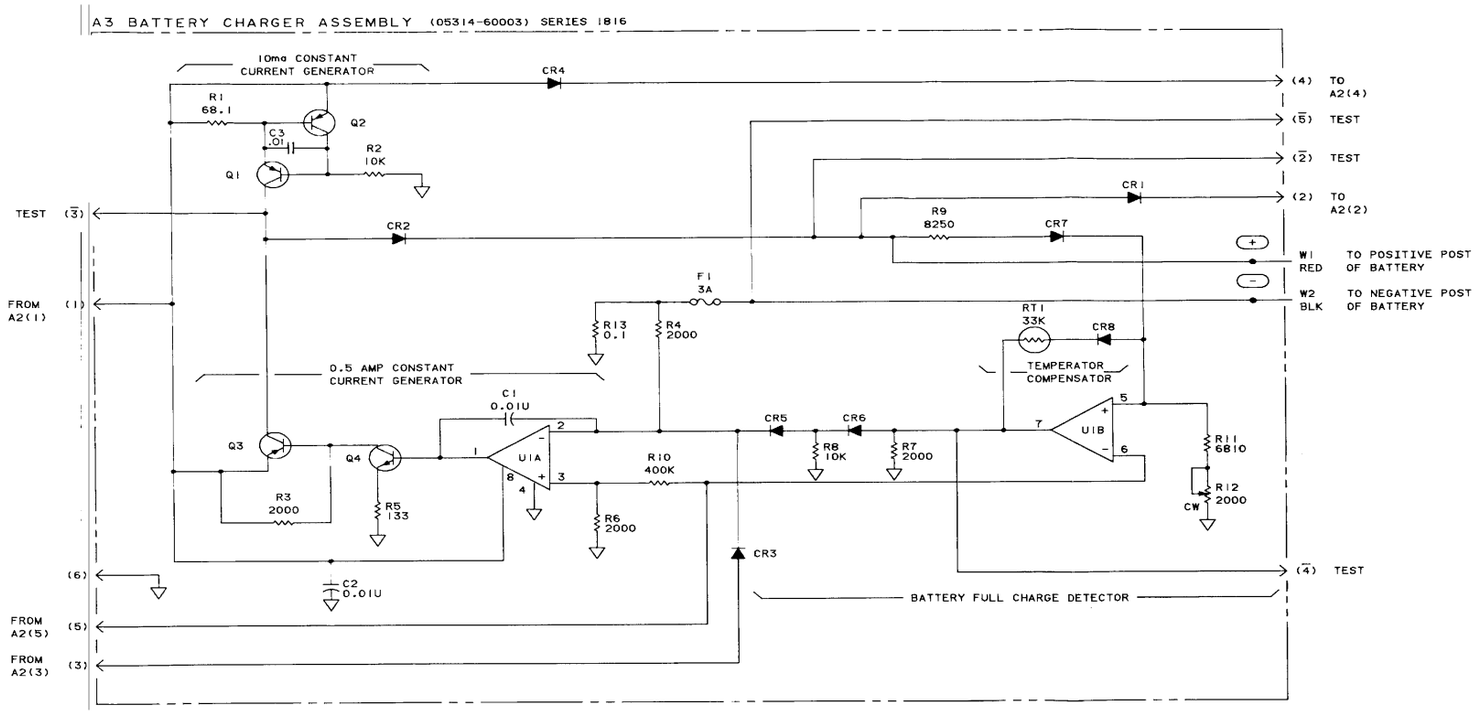
CE1KL014

Figure 8-9. A2 Power Supply Assembly



Part of Figure 8-10. A3 Battery Charger Component Locator

Part of Figure 8-10. A3 Battery Charger Component Locator



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN FARADS; INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

Table of Active Elements

REFERENCE DESIGNATIONS	HP PART NUMBER	MFG PART NUMBER
BT1	1420-0253	0800-0011
CR1	1901-0676	1901-0676
CR2	1901-1080	IN5817
CR3-CR6, CR8	1901-0040	1901-0040
CR7	1901-0460	1901-0460
Q1, Q2	1853-0016	1853-0016
Q3	1853-0371	1853-0371
Q4	1854-0477	2N2222A
U1	1826-0346	LM358N

REFERENCE DESIGNATIONS
BT1
C1, C2
CR1-CR8
F1
Q1-Q4
R1-R13
RT1
U1
W1,

CE1KL016

Figure 8-10. A3 Battery Charger Assembly

Figure 8-10. A3 Battery Charger Assembly

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, technical bulletins, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Discrepancy in shipment report (DISREP) ..... Form SF 361

Report of discrepancy (ROD) ..... Form SF 364

Quality deficiency report..... Form SF 368

Recommended changes to equipment technical publications ..... DA Form 2028-2

A-3. TECHNICAL MANUALS.

Unit and Intermediate direct support, and general support repair parts and special tools list,
Frequency Counter ..... TM 11-6625-3196-24P

Administrative storage procedures ..... TM 740-90-1

Procedures for destruction of electronics materiel to prevent enemy use (Electronics Command) ..... TM 750-244-2

A-4. MISCELLANEOUS.

The Army Maintenance Management System (TAMMS) ..... DA Pam 738-750

Consolidated index of Army publications and blank forms ..... DA Pam 25-30

First aid for soldiers ..... FM 21-11

APPENDIX B
MA1NTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. GENERAL.

a. This appendix provides a general explanation of all maintenance and repair functions authorized at various maintenance levels for the HP 5314A/002/115.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MA1NTENANCE FUNCTIONS. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i. e., to clean (includes decontaminate, when required), preserve, drain, paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. Maintain or regulate within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine the cause and corrections to be made or adjusted on instruments or test measuring and diagnostic equipment used in precision measurement . This consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service on other maintenance functions. Install may be the act of emplacing, seating, of fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, and/or replace) including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to identify troubles restore serviceable to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item or system.

j. Overhaul. That periodic maintenance effort (service/ action) prescribed to restore an item to a completely. serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR) . Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/ actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/ components.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the next higher assembly. End item group number shall be "00".

b. Column 2, Component/ Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2.

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn (s), the level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time and quality assurance/ quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

UNIT
C - Operator/Crew
O - Organizational Maintenance

INTERMEDIATE
F - Direct Support Maintenance
H - General Support Maintenance
L - Specialized Repair Activity

DEPOT
D - Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

SECTION II. MA1NTENANCE ALLOCATION CHART
FOR
COUNTER, ELECTRONIC HP5314A/002/115

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MA1NTENANCE FUNCTION	(4) MA1NTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
00	Counter, Electronic HP 5314A/002/115	Inspect	0.1					1	A
		Inspect			0.1			2	B
		Test	01						C
		Test			0.5			2-17	D
		Calibrate			0.5			2-17	E
		Repair	0.5					1	F
		Repair			1.0			2	G
0001	Power Supply CCA A2	Inspect			0.1			2	
		Test			0.5			2,4	
		Repair			0.5			2	H
0001	Battery Pack CCA A3	Inspect			0.1			2	
		Test			0.5			2,4	
		Repair			0.5			2	J

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS

FOR

Counter, Electronic HP 5314A/002/115

TOOL OR TEST EQUIPMENT REF CODE	MA1NTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	0	Tool Kit, TK-101/G	5180-00-064-5178	
2	H	Tool Kit, JTK-17	4931-01-073-3845	
3	H	Attenuator, Variable	5985-00-957-1860	HP 355D
4	H	Digital Voltmeter	6625-00-557-8305	HP 3490A
5	H	Voltmeter 7915906	6625-00-229-0457	HP 400EL
6	H	Pulse Generator MIS10355TYPE1	6625-01-103-9550	HP 214B
7	H	Signal Generator MIS28707TYPE1	4931-01-085-4229	HP 8640B
8	H	Oscillator, Test MIS10224	5963-00-113-2943	HP 652A
9	H	Oscillator, Quartz	4931-01-020-4514	HP 105A
10	H	Oscilloscope Mainframe MIS28706/1TYPE1	6625-01-046-3712	TEK 5440
11	H	Plug-In Oscilloscope MIS28706/3	4931-01-008-1480	TEK 5A48
12	H	Plug-In Oscilloscope MIS28706/4	4931-01-008-1479	TEK 5B42
13	H	Plug-In Oscilloscope MIS28706/5	4931-01-008-1478	TEK 5S14N
14	H	Probe,10:1 010-6056-03	6625-00-434-0605	TEK P6056
15	H	50 Ohm Termination (2 required)	5985-00-087-4954	TEK 011-0049-01
16	H	Adapter, Connector (BNC TEE) M55339/17-00274	5935-00-926-7523	UG-274
17	H	Power Supply	6625-00-150-6994	JF332BAF

SECTION IV. REMARKS
FOR

Counter, Electronic HP 5314A/002/115

REFERENCE CODE	REMARKS
A	External visual inspection.
B	Visual external and internal inspection for signs of damage, loose parts, or cables, ETC.
C	Perform operator check and observation of display messages.
D	Fault isolate to major assembly or cables.
E	Calibration performed using technical bulletin listed in TB 43-180.
F	Repair by replacement of knobs and power cable which are nonrepairable items.
G	Repair includes replacement of A1 Main CCA, A3BT1 Battery, and W1 Power Cable which are nonrepairable items.
H	Repair limited to replacement of fuses A2F1 and A2F2.
J	Repair limited to replacement of fuse A3F1.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with special list.

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter 10 Millimeters 0 01 Meters 0 3937 Inches
1 Meter 100 Centimeters 1000 Millimeters 39 37 Inches
1 Kilometer 1000 Meters 0 621 Miles

WEIGHTS

1 Gram 0 001 Kilograms 1000 Milligrams 0 035 Ounces
1 Kilogram 1000 Grams 2 2 Lb
1 Metric Ton 1000 Kilograms 1 Megagram 1 1 Short Tons

LIQUID MEASURE

1 Milliliter 0 001 Liters 0 0338 Fluid Ounces
1 Liter 1000 Milliliters 33 82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter 100 Sq Millimeters 0 155 Sq Inches
1 Sq Meter 10,000 Sq Centimeters 10 76 Sq Feet
1 Sq Kilometer 1,000,000 Sq Meters 0 0386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter 1000 Cu Millimeters 0 06 Cu Inches
1 Cu Meter 1,000,000 Cu Centimeters 35 31 Cu Feet

TEMPERATURE

5/9 (F 32) C
212 Fahrenheit is equivalent to 100 Celsius
90 Fahrenheit is equivalent to 32 2 Celsius
32 Fahrenheit is equivalent to 0 Celsius
9/5 C + 32 F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2 540
Feet	Meters	0 305
Yards	Meters	0 914
Miles	Kilometers	1 609
Square Inches	Square Centimeters	6 451
Square Feet	Square Meters	0 093
Square Yards	Square Meters	0 836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0 405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29 573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0 907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubit Feet	35.315
Cubic Meters	Cubic Yards	1,308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1 102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5825-270-10	23 Jul 81	Radio Frequency R-2176/FRN

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.