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This manual, with enclosed "Manual Changes" sheet, applies to HP Model 5381A Frequency Changes having serial number prefixes as listed on the "Manual Changes" sheet.

**NEWER INSTRUMENTS**

For additional information about serial numbers, see INSTRUMENT IDENTIFICATION in Section I.  
This manual applies directly to HP Model 5381A Frequency Counters having serial numbers prefixed 1624A. With changes described in Section IV, this manual also applies to instruments with serial numbers prefixed 1548A, 1532A, 1520A, and 1404A.

**SERIAL NUMBERS: 1624A**

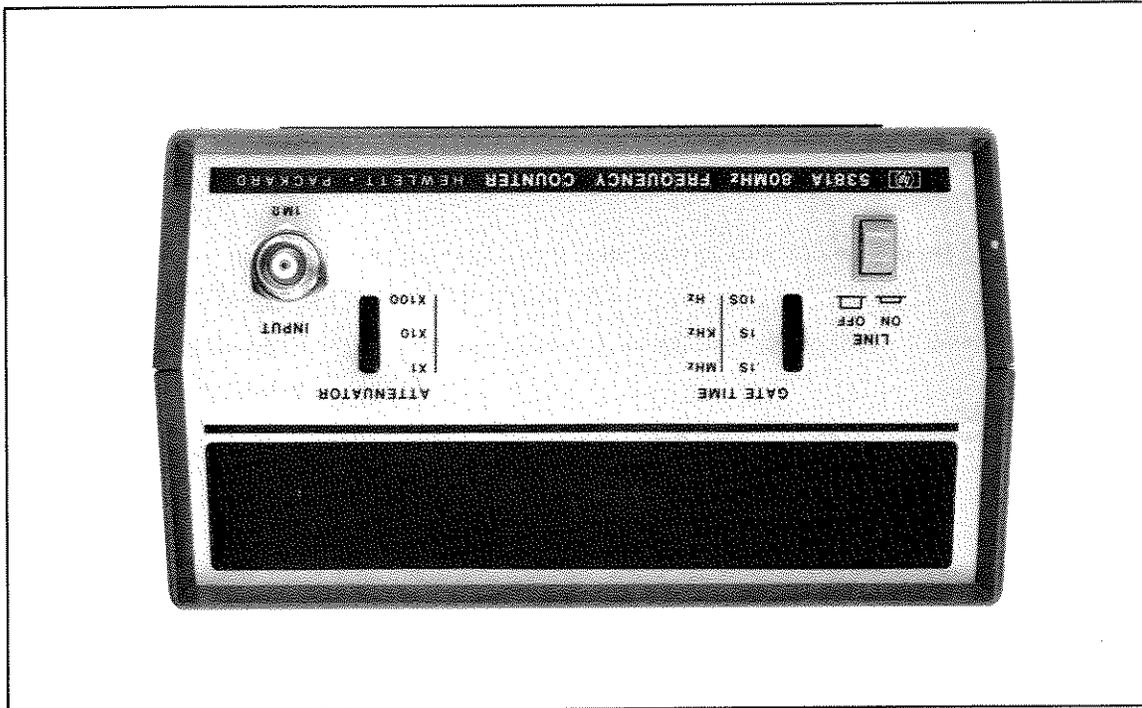
**5381A**

**FREQUENCY COUNTER**

**OPERATING AND SERVICE MANUAL**



Figure 1-1. Model 5381A Frequency Counter



1-8. Table 1-1 lists all specifications of the frequency counter.

### 1-7. SPECIFICATIONS

1-6. Hewlett-Packard uses a two-section, nine-digit serial number (0000A0000) mounted on the rear panel to identify the instrument. The first four digits are the serial prefix and the last five digits refer to the specific instrument. If the serial prefix on your instrument differs from that listed on the title page of this manual, there are differences between the manual and your instrument. Any lower prefixes are documented in Section IV of this manual and higher serial prefixes are covered by a manual change sheet included with the manual.

### 1-5. INSTRUMENT IDENTIFICATION

1-4. The HP Model 5381A Frequency Counter (see Figure 1-1) is a direct-counting frequency counter that has a range of 10 Hz to 80 MHz. Seven display digits are provided. Front-panel controls allow a selection of gate times and attenuation factors of the input signal. A rear-panel connector and associated selector switch allow connection of an external time base oscillator. This feature also allows ratio measurements to be made by the counter. Refer to Table 1-1 for all counter specifications.

### 1-3. INSTRUMENT DESCRIPTION

1-2. This section of the manual gives a description of the instrument, instrument identification information, and complete specifications.

### 1-1. INTRODUCTION

## GENERAL INFORMATION

### SECTION I

Table 1-1. Specifications

<p>Frequency Range: 10 Hz to 80 MHz                  Display: 7 Digit (LED's)                  Input Impedance: 1 MΩ, &lt;50 pF                  Sensitivity: 25 mV (rms Sinewave) 30 Hz to 20 MHz                  50 mV (rms Sinewave) 10 Hz to 80 MHz                  Input Attenuator: Three Position (x1, x10, x100)</p>	
<p>Attenuator "x1"</p>	<p>DC to 40 Hz                  40 Hz to 100 kHz                  100 kHz to 5 MHz                  &gt;5 MHz</p>
<p>Attenuator "x10"</p>	<p>DC to 40 Hz                  40 Hz to 1 MHz                  1 MHz to 50 MHz                  50 MHz to 80 MHz</p>
<p>Attenuator "x100"</p>	<p>DC to 40 Hz                  40 Hz to 1 MHz                  1 MHz to 50 MHz                  50 MHz to 80 MHz</p>
<p>Accuracy: ±1 Count ± Time Base Accuracy</p>	<p>Gate Times: Manually Selected, 1 second, 1 second, 10 seconds                  Resolution: 10 Hz at 0.1 second gate time                  1 Hz at 1 second gate time                  0.1 Hz at 10 second gate time</p>
<p>Time Base:                  Internal                  Frequency: 1 MHz Crystal                  Aging: &lt;0.3 ppm/Month                  Temperature: ±10 ppm 0°C to 40°C                  Line Voltage: ±1 ppm for 10% line variation</p>	
<p>External Input                  Frequency Range: 10 kHz to 2 MHz                  Sensitivity: TTL Level or 2.5 V rms Sinewave                  Maximum Input: 25 V rms dc to 2 MHz</p>	
<p>Accessories Available:                  10851A Rack Mounting Kit for mounting one HP Model 5381A,                  5382A, 5383A or similar instrument in the center of a standard                  48.26 cm (19.00 inches) long by 8.89 cm (3.5 inches) high.                  10852A Rack Mounting Kit for side by side mounting of two HP                  Model 5381A, 5382A, 5383A or similar instruments. Standard panel                  size 48.26 cm (19.00 inches) long by 8.89 cm (3.5 inches) high.                  Operating Temperature: 0°C to 40°C</p>	
<p>Power Requirements: 100, 120, 220, 240V rms (48 Hz to 440 Hz) (+5%-10%) 30 VA max.</p>	
<p>Weight: Net 4.75 lb (2.2 kg) Shipping: 6 lb (2.8 kg)</p>	
<p>Dimensions: 89 mm H x 160 mm W x 248 mm D (3.5 in. x 6.25 in. x 9.75 in.)</p>	
<p>OPTION 001 TCXO                  Frequency: 10 MHz (Temperature Compensated Crystal Oscillator)                  Aging: &lt;0.1 ppm per month                  Temperature: &lt;±1 ppm between 0°C and 40°C                  Line Voltage: &lt;±0.1 ppm for ±10% line (power) variation</p>	

## SECTION II INSTALLATION AND OPERATION

### 2-1. INTRODUCTION

2-2. This section of the manual provides information about unpacking, inspecting, storing, and shipping the frequency counter and gives instructions for operating the counter. Descriptions of all controls, connectors, and indicators are included.

### 2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, ask the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage such as scratches, dents, broken switches, etc. If the instrument is damaged or fails to meet performance tests, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately. Performance check procedures are located in Section III, and Sales and Service Offices are listed at the back of this manual. Retain the shipping carton and the padding material for the carrier's inspection. The Sales and Service Office will arrange for the repair or replacement of the instrument without waiting for the claim against the carrier to be settled.

### 2-5. STORAGE AND SHIPMENT

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

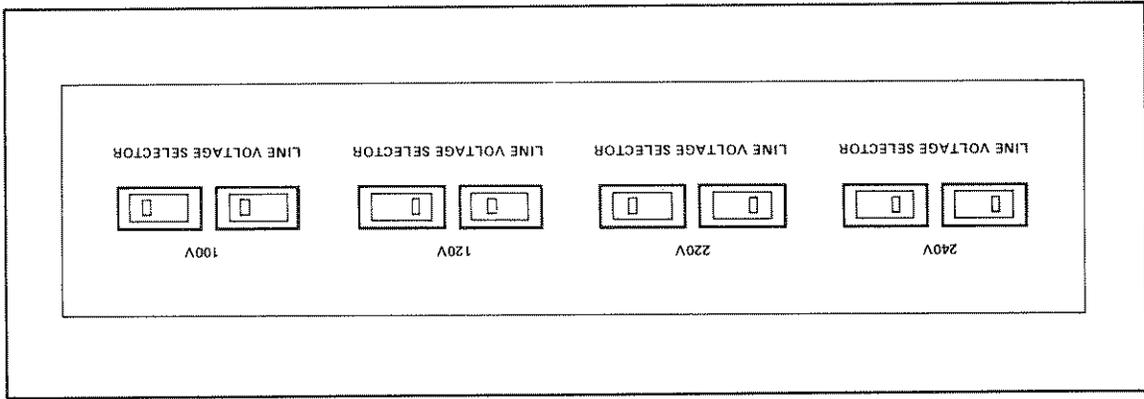
2-7. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

- a. Maximum altitude: 25,000 ft.
- b. Minimum temperature:  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ).
- c. Maximum temperature:  $+130^{\circ}\text{F}$  ( $+55^{\circ}\text{C}$ ).

### 2-8. LINE VOLTAGE SELECTION

2-9. The counter is supplied from the factory with the rear panel line voltage switches set for 120 volt, 48 to 440 Hz operation. If any other supply voltage is to be used, change the rear panel switch settings as follows:

- a. Using a small screwdriver, a pencil, or other suitable tool, align the notches of the LINE VOLTAGE SELECTOR switches with the markings on the rear panel that correspond to the desired operating voltage (see Figure 2-1).



2-19. The ATTENUATOR should usually be set to "X100", then reduced, one step at a time, until a stable display is obtained. If the signal contains a high percentage of amplitude modulation, however, the above procedure may cause counting of only a portion of the cycles of the carrier signal. In these cases, the ATTENUATOR should be set to "X1" (be sure that the input amplitude does not exceed the limits specified in Table 1-1), then increased to "X10" or "X100" if this is possible without causing the displayed value to change or become unstable.

2-18. A measured signal may have a large harmonic content or noise from other sources. The presence of either can cause inaccurate or unstable displays from the counter. Measurement errors from these sources can be minimized or eliminated by proper use of the ATTENUATOR switch.

**2-17. Optimizing Noise Rejection**

Note that in the above formula the term "X" changes by a factor of 1000 (10<sup>3</sup>) for each change in GATE TIME setting. GATE TIME, itself, changes "X" by a factor of 10, and the decimal point in the display shifts two places (10<sup>2</sup>) for a total of 10<sup>5</sup>. Note, also, that actual measurement time increases as the frequency applied to the OSCILLATOR-EXT IN connector decreases. If the frequency applied to the OSCILLATOR-EXT IN connector is 100 kHz, for example, and GATE TIME is set to 1s, actual measurement time will be 10 seconds.

where X = 1 if GATE TIME is 1s  
 10<sup>3</sup> if GATE TIME is 1ms  
 10<sup>6</sup> if GATE TIME is 1μs

$$\frac{\text{freq at INPUT}}{\text{Display Value}} = \frac{\text{freq at OSCILLATOR-EXT IN}}{X}$$

by the following formula:

2-16. The counter will measure the ratio between the frequencies of two signals if one of the signals is applied to the rear-panel OSCILLATOR-EXT IN connector and the other signal is applied to the front-panel INPUT connector. Be sure to refer to Table 1-1 for signal level and frequency limits. The displayed value represents the ratio of one frequency to the other as shown

**2-15. Ratio Measurements**

2-14. To prevent miscounting due to noise, shielded cables should be used to make measurements. More specifically, a coaxial cable with a 50-ohm characteristic impedance and BNC connectors at each end are recommended for most measurements. At higher frequencies the 50-ohm cable becomes an important factor. Whenever the measured source has a 50-ohm output impedance (this is the case with most test oscillators), a 50-ohm feedthrough termination should be used. On the other hand, in cases where minimal source loading is desirable, the 50-ohm feedthrough termination should be omitted from the circuit. At frequencies up to approximately 10 MHz, and at all but the lowest signal levels, a 10:1 divider probe can be used to further reduce source loading.

**2-13. Cable and Termination Requirements**

2-12. Figures 2-3 and 2-4 describe the operation of each panel control, connector, and indicator measurements with the counter, and how to optimize noise rejection with the ATTENUATOR. The following paragraphs describe proper cable and cable termination use, how to make ratio

**2-11. OPERATION**

b. Ensure that the correct fuse is installed. Use a Listed, 0.500 ampere, slow-blow fuse for 100-volt or 120-volt operation or a Listed, 0.250 ampere, slow-blow fuse for 220-volt or 240-volt operation.

2-10. If the counter is to be used in the USA with a 220-240 volt, 48-440 Hz power source, use a power cord with a Listed connector of the type shown in Figure 2-2.

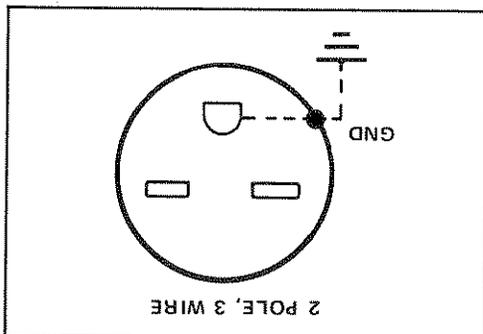


Figure 2-2. Power Cord Connector for 240-Volt Operation

Figure 2-3. Front Panel Operating Controls, Connectors, and Indicators

5. INPUT connector: Connect the signal to be measured to the BNC-type INPUT jack. Input impedance is 1.0 megohm.

**BE SURE THAT THE MAXIMUM ALLOWABLE INPUT VOLTAGES AS GIVEN IN TABLE 1-1, SPECIFICATIONS, ARE NOT EXCEEDED. DAMAGE TO THE COUNTER MAY OTHERWISE RESULT.**

**CAUTION**

4. ATTENUATOR switch: The three-position attenuator switch provides for attenuation of input signals by factors of 10 and 100. The input signal is not attenuated when the switch is set to the "X1" position. The attenuator is used to extend the range of input signal levels that can be measured by the counter and to optimize noise rejection. Maximum sensitivity of the counter ranges from 25 millivolts rms with the attenuator set to "X1" to 2.5 volts rms with the attenuator set to "X100". If the amplitude of a measured signal is unknown or if signal noise causes the display to be unstable, set the ATTENUATOR to "X10" or "X100", then reduce the attenuation, if necessary, until a stable display is observed.
3. GATE TIME switch: Gate time (measurement time) can be set at 0.1-second, 1-second, or 10 seconds with the GATE TIME switch. These positions give resolutions of 10 Hz, 1 Hz, and 0.1 Hz, respectively. If the GATE TIME switch is set to 1s, for example, it will take 1-second to make a measurement and the measured value will be displayed in 1 Hz increments. Manual resetting of the counter circuits occurs whenever the GATE TIME switch position is changed. Set the GATE TIME switch to provide the best compromise between measurement speed and resolution of the displayed value.
2. LINE switch: The ac power LINE switch is a push-on, push-off type; in the on position, the pushbutton is set further into the front panel.
1. Display: Seven digits of LED (light-emitting diode) display are provided on the front panel. A decimal point illuminates in the proper position according to the setting of the GATE TIME switch, and an over-range indicator in the upper, left corner of the display illuminates when the counter overflows.

