

OPERATING AND SERVICE MANUAL

FREQUENCY COUNTER

5381A

SERIAL NUMBERS: 1624A

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.

For additional information about serial numbers, see INSTRUMENT IDENTIFICATION in Section I.

NEWER INSTRUMENTS

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.

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

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

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

1-3. INSTRUMENT DESCRIPTION

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 I-1 for all counter specifications.

1-5. INSTRUMENT IDENTIFICATION

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.

1-7. SPECIFICATIONS

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

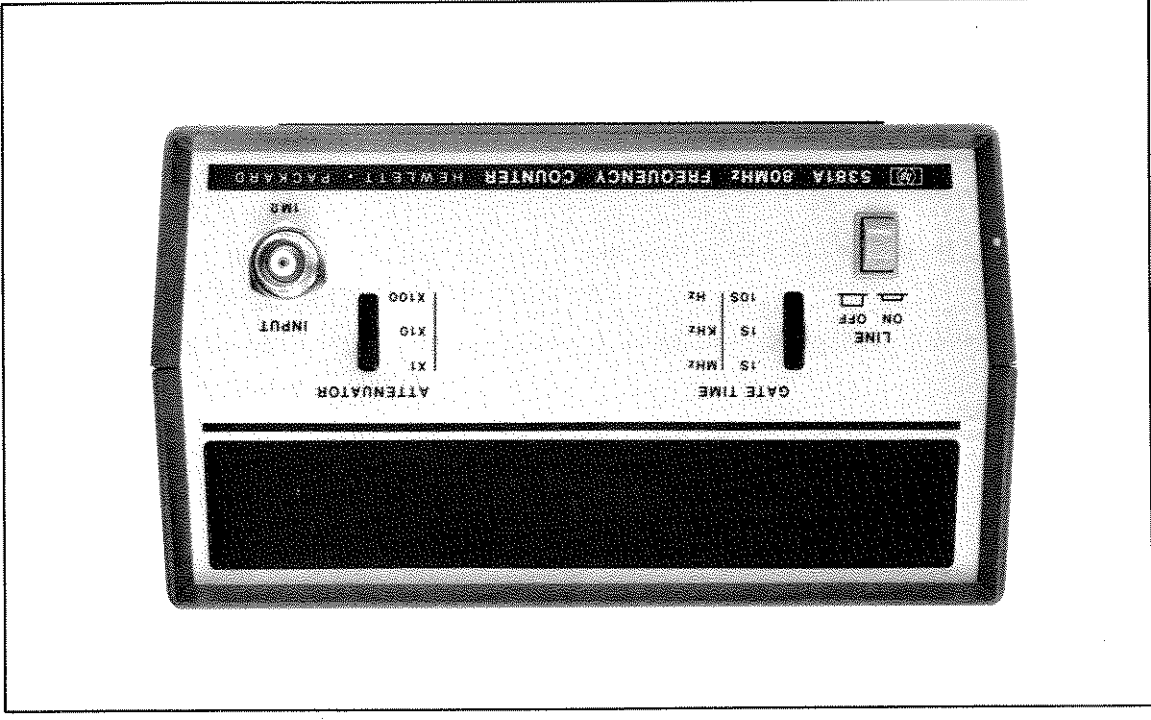


Figure 1-1. Model 5381A Frequency Counter

<p>Frequency Range: 10 Hz to 80 MHz Display: 7 Digit (LED's) Input Impedance: 1 MΩ, <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>Maximum Input Levels:</p> <table border="1"> <tr> <td>Attenuator "x1"</td> <td>DC to 40 Hz 40 Hz to 100 KHz 100 KHz to 5 MHz >5 MHz</td> <td>200 V (dc + Peak ac) 250 V rms 2.5 x 10⁷ V Hz 5 V rms</td> </tr> <tr> <td>Attenuator "x10"</td> <td>DC to 40 Hz 40 Hz to 1 MHz 1 MHz to 50 MHz 50 MHz to 80 MHz</td> <td>200 V (dc + Peak ac) 250 V rms 2.5 x 10⁸ V Hz 5 V rms</td> </tr> </table>		Attenuator "x1"	DC to 40 Hz 40 Hz to 100 KHz 100 KHz to 5 MHz >5 MHz	200 V (dc + Peak ac) 250 V rms 2.5 x 10 ⁷ V Hz 5 V rms	Attenuator "x10"	DC to 40 Hz 40 Hz to 1 MHz 1 MHz to 50 MHz 50 MHz to 80 MHz	200 V (dc + Peak ac) 250 V rms 2.5 x 10 ⁸ V Hz 5 V rms
Attenuator "x1"	DC to 40 Hz 40 Hz to 100 KHz 100 KHz to 5 MHz >5 MHz	200 V (dc + Peak ac) 250 V rms 2.5 x 10 ⁷ V Hz 5 V rms					
Attenuator "x10"	DC to 40 Hz 40 Hz to 1 MHz 1 MHz to 50 MHz 50 MHz to 80 MHz	200 V (dc + Peak ac) 250 V rms 2.5 x 10 ⁸ V Hz 5 V rms					
<p>Accuracy: ±1 Count ± Time Base Accuracy 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: <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. Weight: Net: 4.75 lb (2.2 kg) Shipping: 6 lb (2.8 kg) 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: <0.1 ppm per month Temperature: <±1 ppm between 0°C and 40°C Line Voltage: <±0.1 ppm for ±10% line (power) variation</p>							

Table 1-1. Specifications

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°F (-40°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).

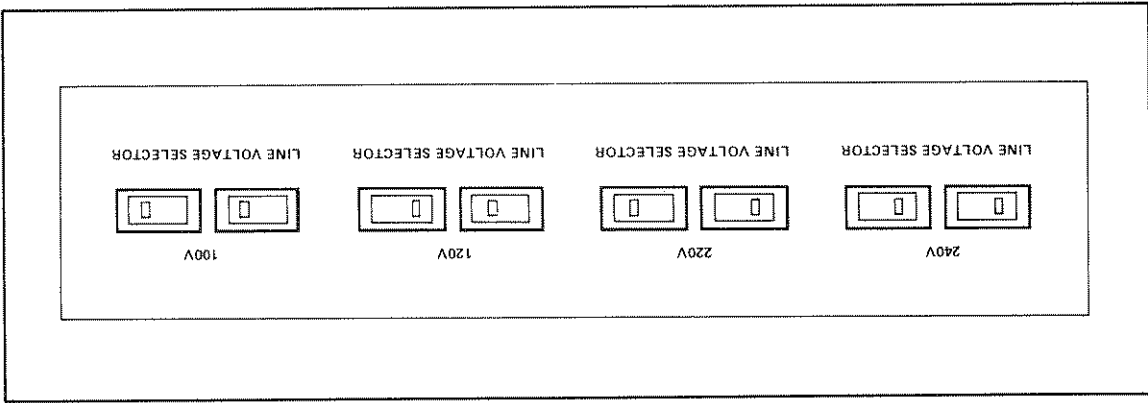


Figure 2-1. Line Voltage Selector Settings

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 (10³) 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 (10²) for a total of 10⁵. 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
 10³ if GATE TIME is 10s
 10⁶ if GATE TIME is 10s

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

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 by the following formula:

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

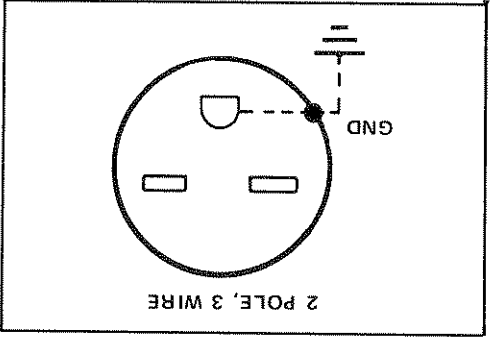
2-12. Figures 2-3 and 2-4 describe the operation of each panel control, connector, and indicator measurements with the counter, and how to optimize noise rejection with the ATTENUATOR. The following paragraphs describe proper cable and cable termination use, how to make ratio

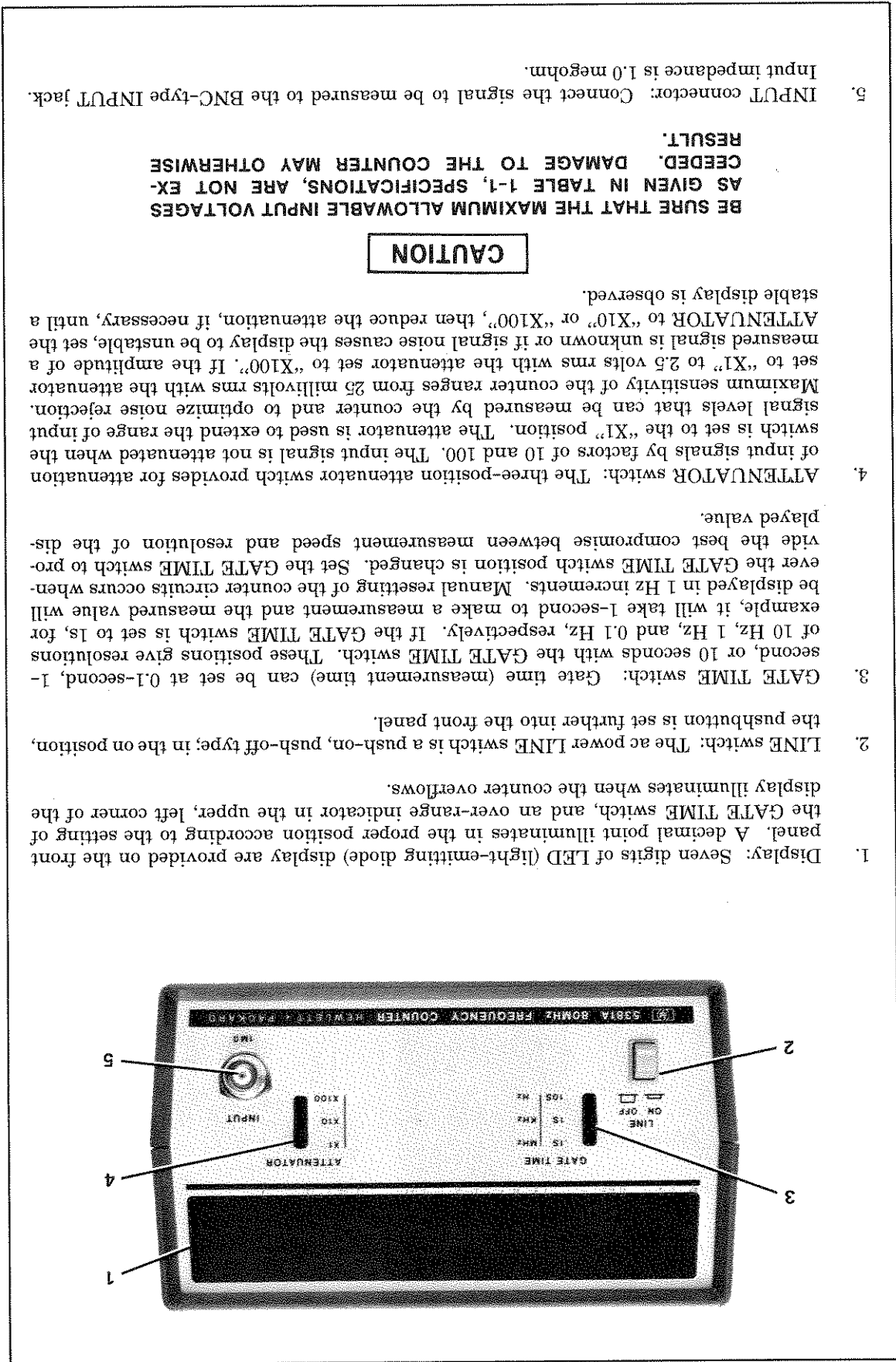
2-11. OPERATION

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





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.

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.

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.

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.

CAUTION

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.

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

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

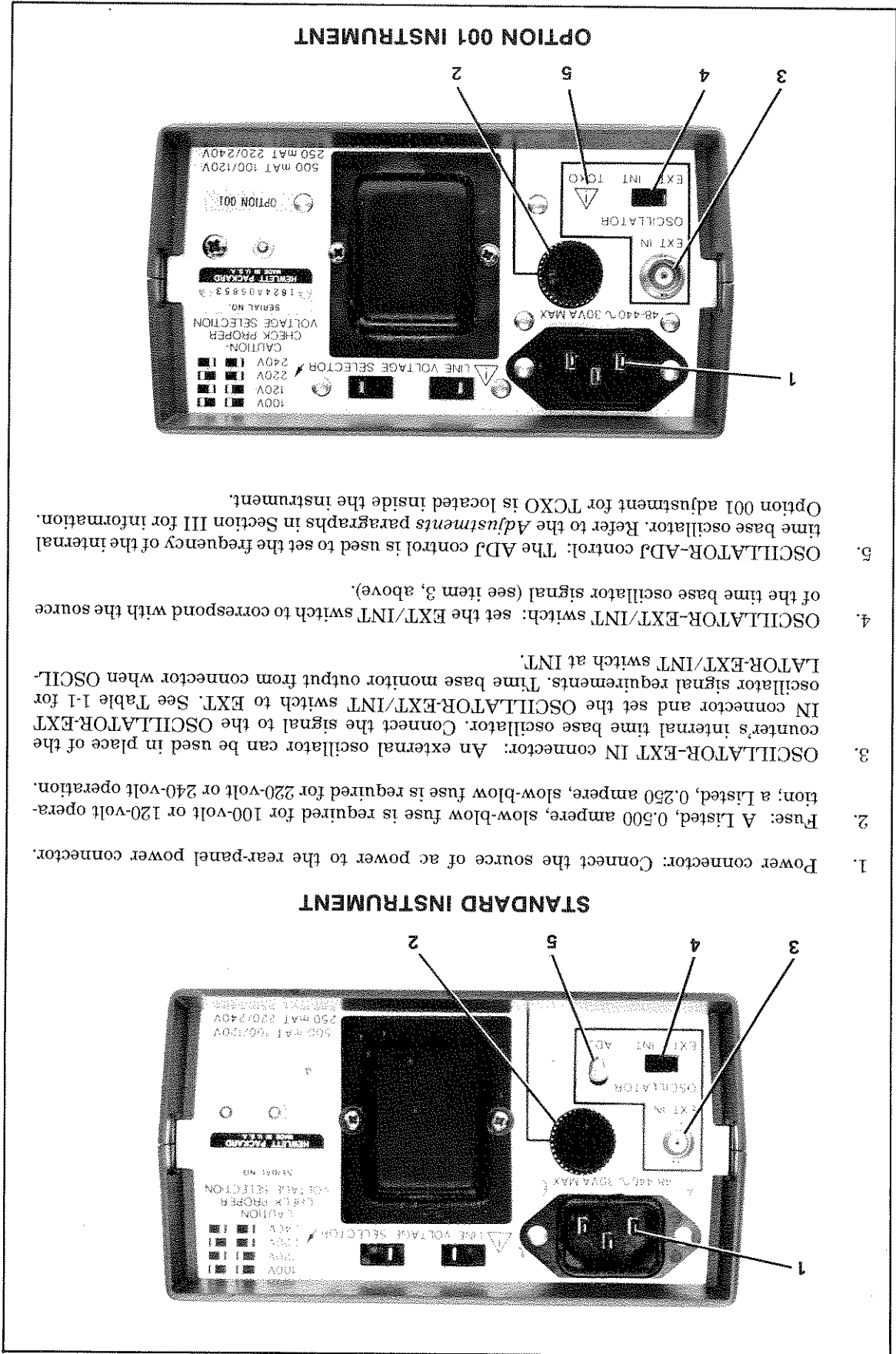


Figure 2-4. Rear-Panel Operating Controls and Connectors

1. Power connector: Connect the source of ac power to the rear-panel power connector.
2. Fuse: A Listed, 0.500 ampere, slow-blow fuse is required for 100-volt or 120-volt operation; a Listed, 0.250 ampere, slow-blow fuse is required for 220-volt or 240-volt operation.
3. OSCILLATOR-EXT IN connector: An external oscillator can be used in place of the counter's internal time base oscillator. Connect the signal to the OSCILLATOR-EXT IN connector and set the OSCILLATOR-EXT/INT switch to EXT. See Table 1-1 for oscillator signal requirements. Time base monitor output from connector when OSCILLATOR-EXT/INT switch at INT.
4. OSCILLATOR-EXT/INT switch: set the EXT/INT switch to correspond with the source of the time base oscillator signal (see item 3, above).
5. OSCILLATOR-ADJ control: The ADJ control is used to set the frequency of the internal time base oscillator. Refer to the *Adjustments* paragraphs in Section III for information. Option 001 adjustment for TCXO is located inside the instrument.

STANDARD INSTRUMENT

OPTION 001 INSTRUMENT

