

## ACCESSORIES SUPPLIED

BC-18 AC Adapter/Charger (Domestic)  
or BC-19 AC Adapter/Charger (European).

Instruction Manual.

Composite (Schematic Diagram and Parts List).



6470 West Cortland Street  
Chicago, Illinois 60635

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## INSTRUCTION MANUAL



**100 MHz  
FREQUENCY  
COUNTER**



## WARRANTY INFORMATION

### WARRANTY SERVICE INSTRUCTIONS (For U.S.A. and its Overseas Territories)

1. Refer to the MAINTENANCE section of your **B&K-Precision** instruction manual for adjustments that may be applicable.
2. If the above-mentioned does not correct the problem you are experiencing with your unit, pack it securely (preferably in the original carton or double-packed). Enclose a letter describing the problem and include your name and address. Deliver to, or ship PREPAID (UPS preferred in U.S.A.) to the nearest **B & K-Precision** authorized service agency (see list enclosed with unit).

If your list of authorized **B & K-Precision** service agencies has been misplaced, contact your distributor for the name of your nearest service agency, or write to:

**B & K-Precision**, Factory Service Department  
Maxtec International Corporation  
6470 West Cortland Street  
Chicago, Illinois 60635  
Tel (312) 889-1448

Also use this address for technical inquiries  
and replacement parts orders.

### LIMITED ONE-YEAR WARRANTY

MAXTEC INTERNATIONAL CORPORATION warrants to the original purchaser that its **B & K-Precision** product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

MAXTEC will, without charge, repair or replace, at its option, defective product or component parts upon delivery to an authorized **B & K-Precision** service contractor or the factory service department, accompanied by proof of the purchase date in the form of a sales receipt.

To obtain warranty coverage in the U.S.A., this product must be registered by completing and mailing the enclosed warranty registration card to MAXTEC, **B & K-Precision**, 6470 West Cortland Street, Chicago, Illinois 60635 within fifteen (15) days from the date of purchase.

**Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. It is void if the serial number is altered, defaced or removed.**

MAXTEC shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have other rights which vary from state to state.

For your convenience we suggest you contact your **B & K-Precision** distributor, who may be authorized to make repairs or can refer you to the nearest service contractor. If warranty service cannot be obtained locally, please send the unit to **B & K-Precision** Service Department, 6470 West Cortland Street, Chicago, Illinois 60635, properly packaged to avoid damage in shipment.

**B & K-Precision** Test Instruments warrants products sold only in the U.S.A. and its overseas territories. In other countries, each distributor warrants the **B & K-Precision** products which it sells.

# SPECIFICATIONS

SPECIFICATIONS (cont.)

**OPERATING MODE** Frequency measurement, one second gate.

**FEATURES** 8 digits, leading zero blanking, low-pass filter, BNC input connector.

## FREQUENCY CHARACTERISTICS

**Range:** 5 Hz to 100 MHz.

**Accuracy:**  $\pm$ Time base accuracy  $\pm 1$  count.

**Resolution:** 1 Hz.

**Display:** Input signal frequency; values under 1 MHz read in Hz, values over 1 MHz read in MHz, with decimal point.

## INPUT CHARACTERISTICS

**Impedance:** 1 M $\Omega$  resistance, shunted by < 40 pF capacitance.

**Connector:** BNC.

**Coupling:** AC.

**Sinewave Sensitivity:** 30 mV rms, 5 Hz to 30 MHz;  
50 mV rms, 30 MHz to 80 MHz;  
100 mV rms, 80 MHz to 100 MHz.

**Filter:** Switch selectable low-pass filter, cutoff frequency of 100 kHz.

**Maximum Input:** See Fig. 1.

## TIME BASE CHARACTERISTICS

**Type:** Crystal oscillator.

**Frequency:** 2.097152 MHz.

**Stability:**  $\pm 0.1$  ppm.

**Temperature Stability:** Better than  $\pm 0.001\%$  ( $\pm 10$  ppm) from 0°C to 50°C.

**Maximum Aging Rate:**  $\pm 10$  ppm/year.

## DISPLAY CHARACTERISTICS

**Display:** Eight 0.43" LED's.

**Overflow Indication:** OVERflow indicator (top left corner of display) lights when count exceeds 99.999999 MHz.

**Display Update Time:** 1.16 second.

**Low Battery Indication:** All digits flash for battery voltage under 7.0 V.

## GENERAL

**Power:** AC Operation: BC-18 (120 V) or BC-19 (220 V) AC Adapter/Charger supplied; batteries not required.  
Portable Operation: Six AA cells, Alkaline or Ni-Cad; user installed.

**Dimensions (HWD):** 2 x 6.5 x 6.75"  
(5 x 16.5 x 17.1 cm).

**Weight:** Approx. 24 oz. (680 g), with batteries.

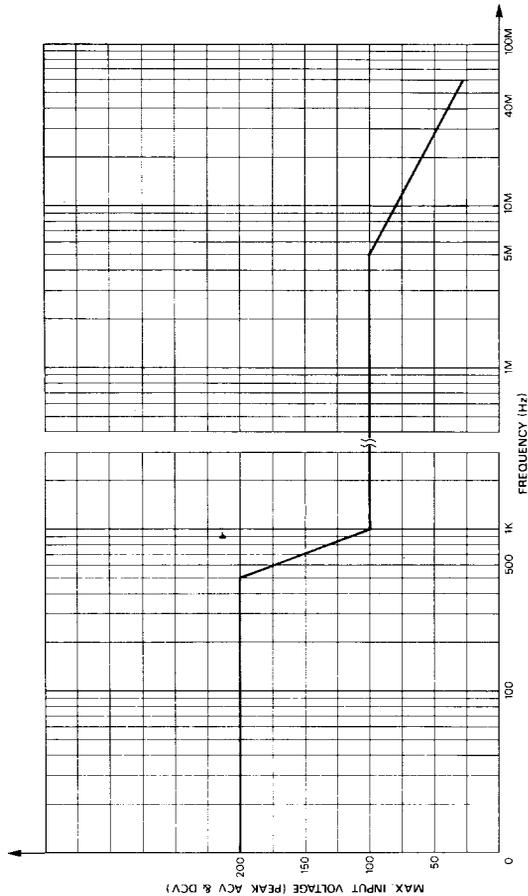


Fig. 1. Maximum input protection derating curve.

Refer to Fig. 2.

1. **POWER Switch.** 3-position slide switch (OFF-ON-LPF). Counter is on in either ON or LPF position. ON setting applies signal directly to counter; LPF setting routes signal through a low-pass filter with a cutoff point of approximately 100 kHz.
2. **Input Jack.** Input for all frequency measurements; female BNC connector terminated in 1 megohm input resistance, shunted by  $< 40$  pF capacitance.
3. **Display.** Eight-digit display used for all frequency readings.
4. **OVERflow Indicator.** Lights whenever the range of the display (99.999999 MHz) is exceeded. Most significant digit is not displayed.

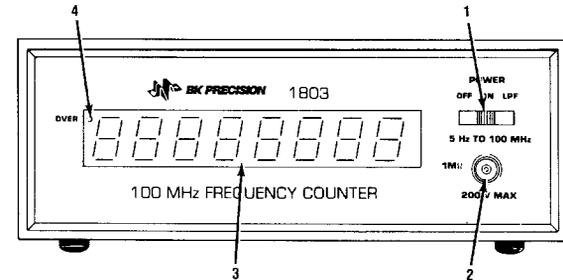


Fig. 2. Controls and indicators.

## OPERATING INSTRUCTIONS

### FREQUENCY MEASUREMENTS

Note: some operating conditions may pose an electrical shock hazard. Know and observe the precautions described in the "TEST INSTRUMENT SAFETY" section.

1. Install proper batteries, or connect the unit to the supplied BC-18 or BC-19 AC Adapter/Charger, or to an appropriate dc source; see "MAINTENANCE".
2. Set the POWER switch to ON (center position), and apply the signal to be measured to the input jack.

#### CAUTION

A. To prevent damage to the unit, do not apply input voltage higher than the limits listed in the SPECIFICATIONS section.

B. Connect the instrument ground lead only to zero volt points in the circuit under test. Attempting to "float" the unit may result in a shock hazard, since instrument ground is exposed at the front panel BNC connector.

C. If measuring ac line frequency, use a voltage divider or 10:1 probe to protect the counter input against unexpected voltage surges.

3. Frequency is given by the front panel display. Readings below 1 MHz are given in hertz; above 1 MHz, they are in megahertz. For example, 12 kHz is displayed as 12000, and 12 MHz is 12.000000.

## TEST INSTRUMENT SAFETY

#### WARNING

An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltages are even more dangerous. Observe the following safety precautions:

1. Never apply input voltages greater than those listed in the "SPECIFICATIONS" section. Personal injury or damage to the instrument may occur.
2. Be careful to avoid touching a high voltage point. Remember that ac line voltage may be present in equipment under test (for example, at on-off switch, fuses, transformer, etc.), any time the equipment is connected to an ac outlet, even if it is turned off. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.
3. When removing the cover for servicing or battery replacement, make sure that the input is disconnected from any high voltage.
4. Connect instrument ground only to zero volt points in the circuit under test. "Floating" the instrument can result in a shock hazard, since instrument ground is exposed at the front panel BNC connector.

4. Measurement interval, or "gate time", is one second. This is combined with an additional 0.16 second interval for internal latching and resetting, for a total of 1.16 seconds between display updates. Display resolution is 1 Hz at all frequencies; however, note comments concerning display instability in the "Considerations" section.
5. The OVERflow indicator lights whenever the range of the display (99.999999 MHz) is exceeded.
6. Sliding the POWER switch to "LPF" applies the input to a low-pass filter (cutoff frequency of approx. 100 kHz) before application to the counter, to minimize count errors in low frequency measurements, by reducing effects of high-frequency input noise.

### CONSIDERATIONS

#### Battery Operation

When using the unit on battery power, remember to turn it off between measurements. Fully charged Nickel-Cadmium batteries typically provide about 1-1/2 hours continuous operation before requiring recharge, and fresh Alkalines about 4 hours continuous operation before requiring replacement. Each of these times can be significantly increased by using the unit intermittently.

#### Display Instability

An uncertainty of  $\pm 1$  least significant digit is inherent in all digital measurements, and greater display uncertainties can result from other factors. For example,

### TEST INSTRUMENT SAFETY (cont.)

5. Use the time-proven "one hand in the pocket" technique while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.
6. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment; make certain such surfaces are not damp or wet.
7. Some equipment with a two-wire ac power cord, including some with a polarized power plug, is the "hot chassis" type. This includes most recent television receivers and audio equipment. A plastic or wooden cabinet insulates the chassis to protect the customer. When the cabinet is removed for servicing, a serious shock hazard exists if the chassis is touched. Additionally, in many test instruments, the ground lead is connected directly to earth ground via the third prong of the power plug. Equipment damage and/or personal injury may occur if a "hot chassis" is shorted to earth ground through the ground lead of such a test instrument. To make measurements in "hot chassis" equipment, always connect an isolation transformer between the ac outlet and the equipment under test. The **B&K-Precision** Model TR-110 Isolation Transformer, or Model 1653 or 1655 AC Power Supply is suitable for most applications. To be on the safe side, treat all two-wire ac powered equipment as "hot chassis" unless you are sure it has an isolated or earth ground chassis.
8. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.

**OPERATING INSTRUCTIONS (cont.)**

in low frequency measurements, high frequency noise on the input can cause mis-counting. Engaging the low-pass filter (LPF) helps avoid this problem. Also, uncertainty may be introduced by instability of the input frequency, usually common with LC-type oscillators.

**Use of 10:1 Probes**

An important consideration in any measurement is what effect, if any, the test equipment will have on the circuit being tested. For example, measurements in an oscillator circuit may alter the RC time constant and change the frequency, or loading may stall the oscillator. Frequency measurements should be taken at low impedance points if possible.

A typical 1:1 probe used with this counter causes circuit loading of 1 MΩ and 100 pF and has a bandwidth of 10 MHz. This loading effect is generally insignificant in measurements at low impedance points and at frequencies below 10 MHz. However, the loading effect can change the frequency or amplitude during measurements in higher impedance circuits (over 1 kΩ) and at higher frequencies. The following **B&K-Precision** 10:1 probes can reduce circuit loading and increase bandwidth:

Probe	Loading Effect		10:1 Bandwidth
PR-37	10 MΩ	12.5 pF	100 MHz
PR-40	10 MΩ	18 pF	100 MHz
PR-45	10 MΩ	18 pF	150 MHz

Remember, a 10:1 probe also attenuates the input to the counter. Make certain that signal amplitude at the point of measurement is large enough to provide at least

the minimum required signal for the counter when attenuated 10:1. Also remember the reduced bandwidth of 10:1/direct probes in the direct setting.

**Cable Considerations**

Cable connections in rf measurements should be aimed at reducing standing waves and shunt cable capacitance, both of which can affect measurement accuracy. Standing waves can be minimized by matching impedances of signal source, cable, and termination. For example, for a 50 Ω source, use 50 Ω cable and terminate with a 50 Ω resistive load. Both standing waves and shunt cable capacitance can be reduced by keeping cable lengths short, under three feet (91 cm).

**Line Voltage Measurement**

**WARNING**

*Use caution in measuring the line frequency of an ac outlet. Connect the probe ground lead to earth ground, and **measure both sides of the line with the probe tip**. The neutral side will read zero and the hot side will provide the desired measurement. Do not touch either side of the line with the ground lead; that lead is exposed at the front panel BNC connector, and a possible shock hazard could result.*

Use a 10:1 probe when measuring line frequency, to guard against unexpected voltage surges and transients. Use of the input filter is also advisable because noise is usually present and can cause mis-counting.

**MAINTENANCE**

**WARNING**

*Disconnect the input from any high voltage before removing cover for any reason.*

**POWER SOURCE**

The Model 1803 can be powered by one of three sources: six user-installed size "AA" batteries (Alkaline or rechargeable Nickel Cadmium), the supplied **B&K-Precision** BC-18 (Domestic) or BC-19 (European) AC Adapter/Charger, which plugs into the jack located on the back panel, or an appropriate dc source (+7.0 to +10 V dc at 400 mA), plugged into the same back panel jack.

**CAUTION**

*Observe proper polarity when installing batteries. Improper polarity may result in instrument damage.*

**BATTERY REPLACEMENT/RECHARGING**

Flashing of the display indicates low battery voltage. Alkaline batteries in use should be replaced; Nickel Cadmium batteries should be recharged.

**Replacing Batteries**

To replace batteries, open top cover (held by four Phillips screws in bottom of unit), remove batteries from holder, and replace with six fresh "AA" cells, observing proper polarity. For Alkalines, set the NICAD/ALK

**MAINTENANCE (cont.)**

switch, at the rear of the main circuit board, to "ALK". This disconnects the batteries from the internal charging circuit at all times, and from the counter completely when the ac adapter (or external dc source) is plugged in.

**Recharging Batteries**

Whenever rechargeable Nickel Cadmium batteries are used, the NICAD/ALK switch inside the unit should be set to "NICAD". This connects the batteries to the internal charging circuit, which operates whenever the BC-18, BC-19, or external dc source is plugged into the back panel jack. Charging occurs regardless of whether the unit is on or off. With it off, a full charge requires about 15 to 16 hours, and typically provides 1-1/2 hours of continuous operation, using Nickel Cadmium batteries with a capacity of 500 mA-hr. The ac adapter may be connected indefinitely without damage to the batteries.

**CALIBRATION**

There is one calibration adjustment, the time base oscillator frequency. This adjustment (C17) is located in the left rear corner of the main circuit board, and is accessible through a hole in the bottom cover; case removal is not required. Calibration requires a 10 MHz standard with an accuracy of at least ±1 part in 10<sup>6</sup> (1 ppm).

1. Allow the unit to warm up for at least one hour.
2. Connect the standard frequency source to the input.
3. Using a screwdriver-type tool, adjust C17, through access hole, for a display of 10.000000 MHz.