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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.

WARRANTY INFORMATION (cont.)

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.

ACCESSORIES SUPPLIED

120 V AC Adapter
or
220 V AC Adapter

Instruction Manual

Composite (Schematic Diagram and Parts List)

BK PRECISION®

6470 West Cortland Street
Chicago, Illinois 60635

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INSTRUCTION MANUAL

BK PRECISION® 1803A 1804

FREQUENCY COUNTERS

Model 1803A 100MHz
Model 1804 550MHz

BK PRECISION®

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SPECIFICATIONS

Unless otherwise stated, specifications apply to both Model 1803A and 1804

FREQUENCY CHARACTERISTICS

Range:	
1803A:	5 Hz to 100 MHz
1804 Direct:	5 Hz to 100 MHz
1804 Prescale:	10 MHz to 550 MHz
Accuracy:	
1.0 Sec Gate:	±Time base accuracy ±1 count
0.1 Sec Gate:	±Time base accuracy ±2 counts
Resolution:	
1803A:	
1.0 Sec Gate:	1 Hz
0.1 Sec Gate:	10 Hz
1804 Direct:	Same as 1803A
1804 Prescale:	
1.0 Sec Gate:	10 Hz
0.1 Sec Gate:	100 Hz
Display:	
1.0 Sec Gate:	Input signal frequency; values under 1 MHz read in Hz, values over 1 MHz read in MHz, with decimal point (leading zeroes blanked on Model 1803A and 1804 direct)
0.1 Sec Gate:	All values read in MHz

INPUT CHARACTERISTICS

Impedance:	
1803A:	1 MΩ resistance, shunted by 40 pF
1804 Direct:	Same as 1803A
1804 Prescale:	50 Ω
Connector:	BNC
Coupling:	AC
Sinewave Sensitivity:	
1803A:	30 mV rms, 5 Hz to 30 MHz 50 mV rms, 30 MHz to 80 MHz 100 mV rms, 80 MHz to 100 MHz
1804 Direct:	Same as 1803A
1804 Prescale:	50 mV rms, 10 MHz to 550 MHz

SPECIFICATIONS (cont.)

Filter:	Switch selectable low-pass filter, cutoff frequency of 100 kHz
Maximum Input:	
1803A:	See Fig. 1
1804 Direct:	See Fig. 1
1804 Prescale:	5 V rms

TIME BASE CHARACTERISTICS

Type:	Crystal oscillator
Frequency:	5.24288 MHz
Setability:	±0.1 ppm.
Temperature Stability:	Better than ±.001% (±10 ppm) from 0°C to 50°C.
Maximum Aging Rate:	±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:	1.0 second gate: 2.0 seconds 0.1 second gate: 0.2 second
Low Battery Indication:	Model 1803A Only: All digits flash for battery voltage under 7.0 V.

GENERAL

Power:	
AC Operation:	120 V, 60 Hz or 220 V, 50/60 Hz AC Adapter/Charger supplied
Battery Operation: (Model 1803A Only)	Six AA cells, Alkaline or Ni-Cad; user installed
Dimensions:	2 x 6.5 x 6.75" (50 x 165 x 171 mm)
Weight:	Approx. 24 oz. (680 g)

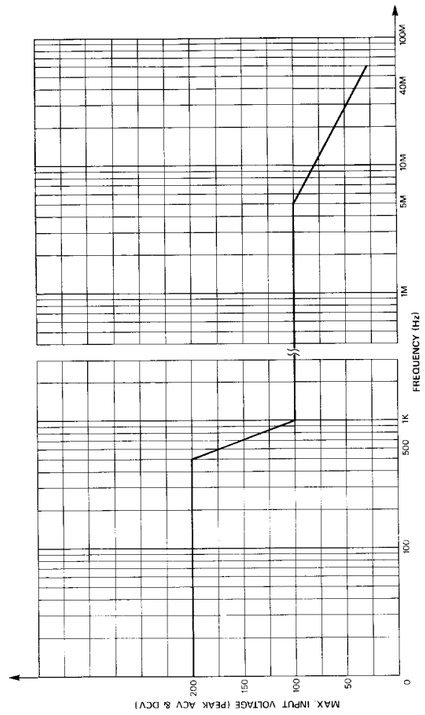

Fig. 1. Maximum input protection derating curve.

CONTROLS AND INDICATORS

1. **Input Jack (1803A), Direct Input Jack (1804).** Input jack for 5 Hz to 100 MHz frequency measurements.
2. **Prescale Input Jack (1804 only).** Input jack for 10 MHz to 550 MHz frequency measurements.
3. **Display.** Eight-digit display used for all frequency readings.
4. **OVERflow Indicator.** Lights whenever range of display is exceeded (99.999999 MHz). Most significant digit is not displayed.
5. **POWER/GATE TIME Switch.** 3-position slide switch (OFF-0.1S-1.0S). Power removed in OFF position. Power is on in 0.1S or 1.0S position. 0.1S position selects 0.1 second gate time (10 Hz resolution for direct input, 100 Hz resolution for prescale input). 1.0S position selects 1.0 second gate time (1 Hz resolution for direct input, 10 Hz resolution for prescale input).
6. **LPF Switch (1803A), INPUT SELECT Switch (1804).**

   For Model 1803A, 2-position slide switch. In OFF position, input is applied directly to counter. In ON position, input is routed through low-pass filter (approx. 100 kHz cutoff).

   For Model 1804, 3-position slide switch. In 550 MHz position, prescale input is applied to counter. In 100 MHz position, direct input is applied to counter. In LPF position, direct input is routed through low-pass filter (approx. 100 kHz cutoff).

Fig. 2. Controls and Indicators.

OPERATING INSTRUCTIONS

FREQUENCY MEASUREMENTS

WARNING

Some operating conditions may pose an electrical shock hazard. Know and observe the precautions described in the "Test Instrument Safety" section.

1. Connect the AC Adapter to an ac outlet and plug into the rear panel jack of the frequency counter. For Model 1803A only, it is also possible to operate from batteries or external dc power; see the "Battery Operation" paragraph.
2. Set the POWER/GATE TIME switch to 0.1S or 1.0S. Either position turns on the instrument.
   a. Use 0.1S for faster measurement of high frequency signals. The update time of the display is every 0.2 second. Resolution is 10 Hz for Model 1803A or the direct input of Model 1804, and 100 Hz when using the prescale input of Model 1804.
   b. Use 1.0S for measurement of low frequencies or where highest resolution is needed. The update time of the display is every 2 seconds. Resolution is 1 Hz for Model 1803A or the direct input of Model 1804, and 10 Hz for the prescale input of Model 1804.
3. Apply the signal to be measured to the input jack.
   a. For Model 1803A, apply 5 Hz to 100 MHz signals to the input jack.
   b. For Model 1804, apply 5 Hz to 100 MHz signals to the direct input jack and set the INPUT SELECT switch to the 100 MHz position; apply 10 MHz to 550 MHz signals to the prescale input jack and set the INPUT SELECT switch to the 550 MHz position. Signals between 10 MHz and 100 MHz may be applied to either the direct or prescale input; refer to the "Considerations" paragraph.

CAUTION

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

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.

If measuring ac line frequency, observe the precautions listed in the "Line Voltage Measurement" paragraph below.

4. Frequency is given by the front panel display. The decimal point is automatically positioned.
   a. With 1.0S gate time, 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.
   b. With 0.1S gate time, all readings are displayed in MHz, and with one less digit resolution. For example, 12 kHz is displayed as 0.01200, and 12 MHz is 12.00000.
   c. When using the prescale input of Model 1804, decimal points are automatically corrected as readings are displayed with one less digit resolution than in the examples above.
5. Measurement interval, or "gate time", is 1.0 second or 0.1 second. This is combined with an additional interval of equal time for internal latching and resetting, for a total of 2 seconds between display updates when 1.0S gate time is selected or 0.2 seconds when 0.1S gate time is selected.
6. The OVERflow indicator lights whenever the range of the display (99.999999 MHz) is exceeded.
7. Sliding the "LPF" switch to ON (Model 1803A) or the INPUT SELECT switch to LPF (Model 1804) routes the 5 Hz to 100 MHz input through a low-pass filter before application to the counter. This minimizes count errors in low frequency measurements by reducing effects of high-frequency input noise. Use the LPF position for measurements below 100 kHz.

CONSIDERATIONS

Display Instability

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

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.

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-47	10 MΩ	12.5 pF	100 MHz
PR-46	10 MΩ	16 pF	250 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.

For Model 1804, use a 10:1 probe only with the direct input. Never use a 10:1 probe with the prescale input. The 10:1 ratio applies only when the input impedance is 1 MΩ. With the 50 Ω input impedance of the prescale input, the ratio will approach 200,000:1 and no useful signal level will reach the prescale input.

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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).

Direct Vs Prescale Input (Model 1804)

Frequencies below 10 MHz should be applied to the direct input. The input impedance is 1 MΩ, 40 pF and maximum resolution is given.

Frequencies above 100 MHz should be applied to the prescale input. The prescale input has 50 Ω input impedance and must be measured from a low impedance point. Do not use an external 50 Ω terminating resistor, and do not use a 10:1 probe.

Frequencies from 10 MHz to 100 MHz can be measured by applying the input to either the direct or prescale inputs. The prescale input is preferred for low impedance measurement points. There is one digit less resolution than when using the direct input, but this is sufficient for most measurements. Use the direct input for high impedance measurement points or when maximum resolution is required.

Battery Operation (Model 1803A Only)

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, and by using ac power rather than battery power whenever it is available.

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 connectors.
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 or 1604 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.

MAINTENANCE

WARNING

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

CALIBRATION

There are two calibration adjustments, the time base oscillator frequency (C17), and gate time correlation (R63). These adjustments are located in the left rear corner of the main circuit board. C17 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 10^6 (1 ppm).

1. Allow the unit to warm up for at least one hour.
2. Connect the standard frequency source to the input.
3. Select 1.0 second gate time. The display should read 10.000000 MHz. If readjustment is required, use a screwdriver-type tool and adjust C17 through access hole, for a display of 10.000000 MHz.
4. Select 0.1 second gate time. The display should read 10.00000 MHz. If readjustment is required, open the top cover and adjust R63 for a display of 10.00000 MHz.

POWER SOURCE

The Model 1804 is designed to operate from ac power only, using either the 120-volt or 220-volt ac adapter supplied with the unit.

The Model 1803A can be powered by one of three sources:

1. The 120-volt or 220-volt AC Adapter/Charger supplied with the unit, which plugs into the jack located on the back panel.
2. An external dc source (+7.0 to +10 V dc at 400 mA), which plugs into the same back panel jack.

3. Six user-installed "AA" cells (non-rechargeable Alkaline or rechargeable Nickel Cadmium type). Alkaline batteries will give about 4 hours continuous operation before replacement is required. Nickel Cadmium batteries will give about 1-1/2 hour continuous operation before recharging is required.

BATTERY INSTALLATION (Model 1803A Only)

CAUTION

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

Open the top cover (held by four Phillips screws in bottom of unit), and install six fresh "AA" cells, observing proper polarity. For Alkalines, set the NICAD/ALK switch (S3) at the rear of the main circuit board, to the right (referenced as viewed the front of the unit). 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. The internal NICAD/ALK switch should be set to "NICAD" (left) whenever rechargeable Nickel Cadmium batteries are used. This connects the batteries to the internal charging circuit, which operates whenever the ac adapter or external dc source is plugged into the back panel jack.

BATTERY REPLACEMENT (Model 1803A Only)

Flashing of the display indicates low battery voltage. Alkaline batteries in use should be replaced. Follow the steps listed above for "Battery Installation", except remove the old batteries first.

RECHARGING NI-CAD BATTERIES (Model 1803A Only)

Flashing of the display indicates that battery voltage is low and batteries need recharging. Recharge batteries by connecting the AC Adapter/Charger or an external dc source. Charging occurs regardless of whether the counter 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 when using Nickel Cadmium batteries with a capacity of 500 mA-hr. The ac adapter may be connected indefinitely without damage to the batteries.