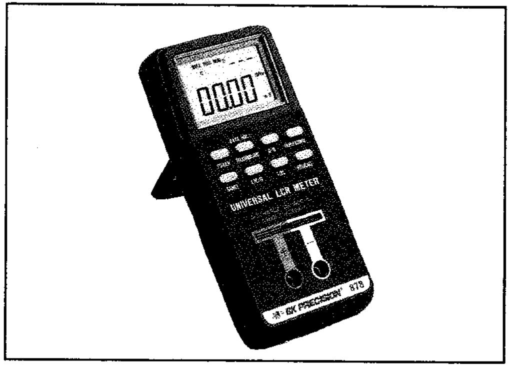
INSTRUCTION MANUAL



B+K PRECISION®

MODEL 878

UNIVERSAL LCR METER

B+K PRECISION®

TEST INSTRUMENT SAFETY

CAUTION

- Always discharge any capacitors that are to be measured and observe polarity markings on polarized capacitors.
- Never apply a voltage to the input jacks of the instrument.

Instruction Manual
For

B+K PRECISION®

MODEL 878
UNIVERSAL LCR METER

B+K PRECISION®

22820 Savi Ranch Parkway
Yorba Linda, California 92887

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INTRODUCTION

The **B+K Precision** Model 878 UNIVERSAL LCR Meter is a handheld portable test instrument used for measuring inductance, capacitance and resistance. The full 4–digit display reads values to 9999 on each range. The dual display feature permits simultaneous measurement of inductance and Q or capacitance and D (Dissipation Factor).

The instrument is autoranging, or manual ranging may be selected. A test frequency of 1kHz or 120 Hz may be selected on all applicable ranges. The smart instrument prompts when calibration is needed and the dual display shows whether to calibrate with an open or short. Calibration is as simple as pressing the **CAL** key; test lead capacitance, inductance or resistance is zeroed out.

Components can be measured in the series or parallel mode as desired; the more standard method is automatically selected first but can be overridden.

The Model 878 offers three useful modes for sorting components.

The MAX/MIN/AVG mode can be initiated at the beginning of a batch test. As each component of the batch is measured, the instrument recalculates the average value and stores any new maximum or minimum value. At the end of the batch test, the maximum, minimum and average values for the batch test can be recalled from memory.

The RELATIVE mode allows a reference component of the desired value to become zero. All subsequent values of a batch are measured as plus or minus with respect to the reference component.

The TOLERANCE mode allows a reference component of the desired value to become standard. The dual display shows the value of the component and the percent difference from the standard. Limits of 1%, 5% or 10% can be selected; a beeper will sound if the component under test exceeds the preset limit.

The highly versatile Model 878 can perform virtually all the functions of most bench type LCR bridges. With a basic accuracy of 0.7%, this economical LCR meter may be adequately subsituted for a more expensive LCR bridge in many situations. The meter may be powered from an AC adapter (supplied) or from a 9 volt battery. An auto power off feature automatically shuts off the meter after 5 minutes of inactivity and thus prolongs battery life. The auto power off feature can be overridden when desired.

The instrument has applications in electronic engineering labs, production facilities, service shops, and schools. It can be used to check tolerance, sort values, select precision values, measure unmarked and unknown inductors, capacitors or resistors, and measure capacitance, inductance, or resistance of cables, switches, circuit board foils, etc.

GENERAL SPECIFICATIONS

Parameters Measured

L, C, R, D and Q

Measured Circuit Mode

Parallel Mode (for Resistance and Capacitance); **Series Mode** (for Inductance).

Alternate Mode (Series Mode for Resistance and Capacitance, Parallel Mode for Inductance) is also available through simple key operation.

Display

4 Digit Max LCD Display for L, C, R; Max L, C, R Display 9999; Max Display 1999 for C @ 10 mF (120 Hz), 1mF (1KHz)

3 Digit LCD Display for D/Q, Max Display 999 (Auto Range).

Input Measurement Terminals

2 terminals with sockets

Ranging Mode

Auto and Manual

Test Frequency

1 KHz and 120 Hz

Frequency Accuracy

± 0.01% (1KHz = 1008.06 Hz; 120 Hz = 122.07 Hz)

Measurement Rate

1 measurement per second (Nominal)

Test Signal Level

0.9 Vrms (approximately)

Response Time

Approximately 1 second per DUT (Device Under Test) in Manual Range

Temperature Coefficient

0.05 x (Specified Accuracy) /° C (0° C - <18° C or 28° C to 50° C)

Operating Temperature

0° C to 40° C (32° F to 104° F);0 to 70 % R.H.

Storage Temperature

-20° C to +50° C (-4° F to 122° F); 0 to 80% R.H.

Power Requirements

Battery 9 Volt (Alkaline preferred) or External DC Adapter: DC 12V min to 15V max.

Low Battery Indication

6.8 V (Approximately)

Power Consumption

Approximately 40 mA; 0.3 mA @ Auto Power Off (Sleep Mode)

Protective Fuse

0.1 A, 250 VAC, Fast Blow

Auto Power Off Time

Approximately 5 minutes

Dimensions

7.56" L (192 mm) x 3.54" W (90mm) x 1.46" H (37mm)

Weight

13.76 Ounces (390 grams) including Battery

Accessories Included

AC Power Adapter

Test Leads (1 Pair)

Spare Fuse (1)

Instruction Manual

Please visit www.bkprecision.com for calibration information

INDUCTANCE, Q MEASUREMENT

Accuracy @ 23°C ± 5°C; <75% R.H.

TABLE 1

TEST FREQUENCY @ 120 Hz

RANGE	MAX DISPLAY	Lx ACCURACY	DF (DF <0.5) ACCURACY	REMARKS
10000 H	9999 H	± (5% + (Lx/10000) % +5 counts)	± (10% + 100/Lx +5 counts)	After Open Cal.
1000 H	999.9 H	± (1% + (Lx/10000) % +5 counts)	± (2% + 100/Lx +5 counts)	After Open Cal.
100 H	99.99 H	± (0.7% + (Lx/10000) % +5 counts)	± (1.2% + 100/Lx +5 counts)	
10 H	9.999 H	± (0.7% + (Lx/10000) % +5 counts)	± (1.2% + 100/Lx +5 counts)	
1 H	999.9 mH	± (0.7% + (Lx/10000) % +5 counts)	± (1.2% + 100/Lx +5 counts)	
100 mH	99.99 mH	± (1% + (Lx/10000) % +5 counts)	± (3% + 100/Lx +5 counts)	After Short Cal.
10 mH	9.999 mH	± (2% + (Lx/10000) % +5 counts)	± (10% + 100/Lx +5 counts)	After Short Cal.

TABLE 2
TEST FREQUENCY @ 1 KHz

RANGE	MAX DISPLAY	Lx ACCURACY	DF (DF <0.5) ACCURACY	REMARKS
1000 H	999.9 H	± (5% + (Lx/10000) % +5 counts)	± (10% + 100/Lx +5 counts)	After Open Cal.
100 H	99.99 H	± (1% + (Lx/10000) % +5 counts)	± (1.2% + 100/Lx +5 counts)	After Open Cal.
10 H	9.999 H	± (0.7% + (Lx/10000) % +5 counts)	± (1.2% + 100/Lx +5 counts)	
1 H	999.9 mH	± (0.7% + (Lx/10000) % +5 counts)	± (1.2% + 100/Lx +5 counts)	
100 mH	99.99 mH	± (0.7% + (Lx/10000) % +5 counts)	± (1.2% + 100/Lx +5 counts)	
10 mH	9.999 mH	± (1.2% + (Lx/10000) % +5 counts)	± (5% + 100/Lx +5 counts)	After Short Cal.
1 mH	999.9 µH	± (2% + (Lx/10000) % +5 counts)	± (10% + 100/Lx +5 counts)	After Short Cal.

NOTE:
1. DF (Dissipation Factor) is the reciprocal of Q (Quality Factor).
2. The above specifications are based upon the measurement performed at the test socket.
3. DUT (Device Under Test) and the Test Leads are to be properly shielded to GND (DC "-") if necessary.
4. Lx = counts of displayed L value, e.g. : L = 88.88 H then Lx = 8888.

CAPACITANCE, DF MEASUREMENT

Accuracy @ 23°C ± 5°C; <75% R.H.

TABLE 3

TEST FREQUENCY @ 120 Hz

RANGE	MAX DISPLAY	Cx ACCURACY	DF ACCURACY	REMARKS
10 mF	9.99 mF (Note 3)	± (5% + 5 counts)(DF <0.1)	± (10% + 100/Cx +5 counts)(DF <0.1)	After Short Cal.
1000 µF	999.9 µF	± (1% + 5 counts)(DF <0.1)	± (2% + 100/Cx +5 counts)(DF <0.1)	After Short Cal.
100 µF	99.99 µF	± (0.7% + 3 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	
10 µF	9.999 µF	± (0.7% + 3 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	
1000 nF	999.9 nF	± (0.7% + 3 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	
100 nF	99.99 nF	± (0.7% + 5 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	After Open Cal.
10 nF	9.999 nF	± (1% + 5 counts)(DF <0.1)	± (2% + 100/Cx +5 counts)(DF <0.1)	After Open Cal.

TABLE 4
TEST FREQUENCY @ 1 KHz

RANGE	MAX DISPLAY	Cx ACCURACY	DF ACCURACY	REMARKS
1000 µF	0.999 mF (Note 3)	± (5% + 5 counts)(DF <0.1)	± (10% + 100/Cx +5 counts)(DF <0.1)	After Short Cal.
100 µF	99.99 µF	± (1% + 5 counts)(DF <0.1)	± (2% + 100/Cx +5 counts)(DF <0.1)	After Short Cal.
10 µF	9.999 µF	± (0.7% + 3 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	
1000 nF	999.9 nF	± (0.7% + 3 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	
100 nF	99.99 nF	± (0.7% + 3 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	
10 nF	9.999 nF	± (0.7% + 5 counts)(DF <0.5)	± (0.7% + 100/Cx +5 counts)(DF <0.5)	After Open Cal.
1000 pF	999.9 pF	± (1% + 5 counts)(DF <0.1)	± (2% + 100/Cx +5 counts)(DF <0.1)	After Open Cal.

NOTE:

1. The specification is based on the measurement performed at the test socket.
2. DUT and Test Leads are to be properly shielded to GND (DC "-") if necessary.
3. This reading can be extended to display 1999, but accuracy is not specified.
4. Cx = counts of displayed C value, e.g. C = 88.88 µF, then Cx = 8888.

RESISTANCE MEASUREMENT

Accuracy @ 23˚C ± 5˚C; <75% R.H.

TABLE 5

RANGE	MAX DISPLAY	TEST FREQUENCY @ 120 Hz ACCURACY	TEST FREQUENCY @ 1 KHz ACCURACY	REMARKS
10 MΩ	9.999 MΩ	± (2.0% + 8 counts)	± (2.0% + 8 counts)	After Open Cal.
1 MΩ	999.9 KΩ	± (0.5% + 5 counts)	± (0.5% + 5 counts)	After Open Cal.
100KΩ	99.99 KΩ	± (0.5% + 3 counts)	± (0.5% + 3 counts)	
10 KΩ	9.999 KΩ	± (0.5% + 3 counts)	± (0.5% + 3 counts)	
1KΩ	999.9 Ω	± (0.5% + 3 counts)	± (0.5% + 3 counts)	
100 Ω	99.99 Ω	± (0.8% + 5 counts)	± (0.8% + 5 counts)	After Short Cal.
10 Ω	9.999 Ω	± (1.2%+40 counts)	± (1.2%+40 counts)	After Short Cal.

NOTE:
1. This specification is based on the measurement performed at the Test Socket.
2. DUT and Test Leads are to be properly shielded to GND (DC "-") if necessary.
3. This specification is based on internal power (Battery) operation.

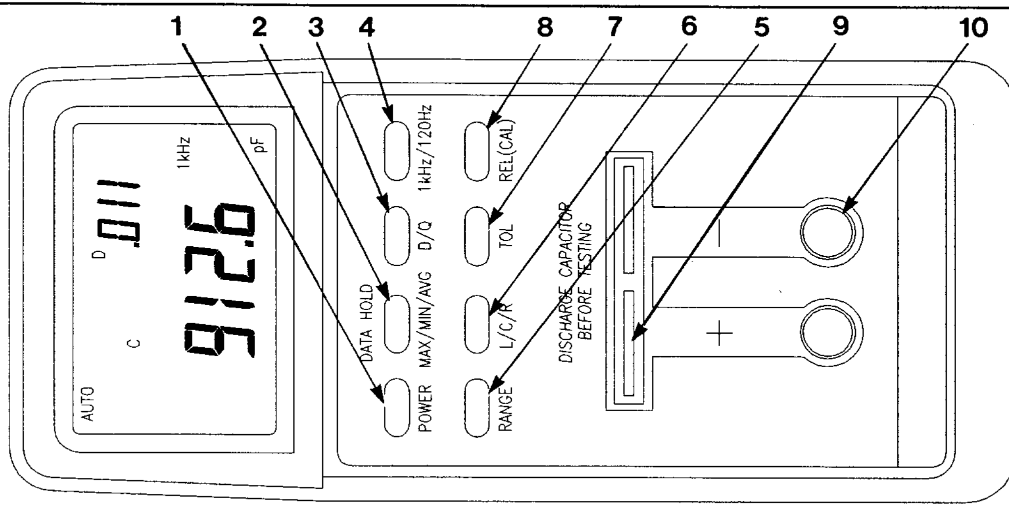


Figure 1. Controls and Indicators

FRONT PANEL CONTROLS

Refer to Figure 1.

1. **POWER KEY.** Turns the meter **ON** and **OFF.**
2. **DATA HOLD, MAX/MIN/AVG KEY.** Pressing the key alternately enables and disables the data hold which freezes the present reading on the display. Holding the key for 1 second initiates MAX/MIN/AVG memory. Each additional press sequences through MAX read, MIN read, AVG read and continue memory. Holding the key for 1 second again exits the MAX/MIN/AVG mode.

NOTE:

The **MAX/MIN/AVG** mode is also referred to as the **RECORD** mode.

3. **D/Q KEY.** Selects D (Dissipation Factor) or Q (Quality Factor). Used to select the alternate measurement mode. D=1/Q, conversely Q=1\D.
4. **1kHz/120Hz KEY.** Selects test frequency of 1 kHz or 120 Hz on all applicable ranges.
5. **RANGE KEY.** The first press of the key selects the manual ranging mode, but remains in the same range as previously selected during autoranging operation. Each additional press of the key advances to the next higher range. At the highest range, the next press of the key advances to the lowest range.

   Holding the key for 1 second exits to AUTO ranging.
6. **L/C/R KEY.** Sequences through measurement modes of L (inductance), C (capacitance) and R (resistance).
7. **TOL (tolerance) KEY.** Sequences through selections of tolerance mode; 1% limit, 5% limit and 10% limit. Holding key for 1 second exits the tolerance mode.
8. **REL (CAL) KEY.** When CAL prompt is displayed, pressing the key initiates calibration. When a value is displayed, pressing the key initiates the relative mode where the displayed value becomes zero and all subsequent measurements are relative to the initially displayed value. Press the key again to exit the relative mode.
9. **COMPONENT INPUT JACK.** Slotted clips permit axial lead and PC mount components to be inserted for measurement.
10. **TEST LEAD INPUT JACKS.** Accepts standard test leads for connection to component under test. The short test leads supplied with the unit are recommended for best performance.
11. **EXTERNAL POWER INPUT JACK.** Connector for AC adapter.

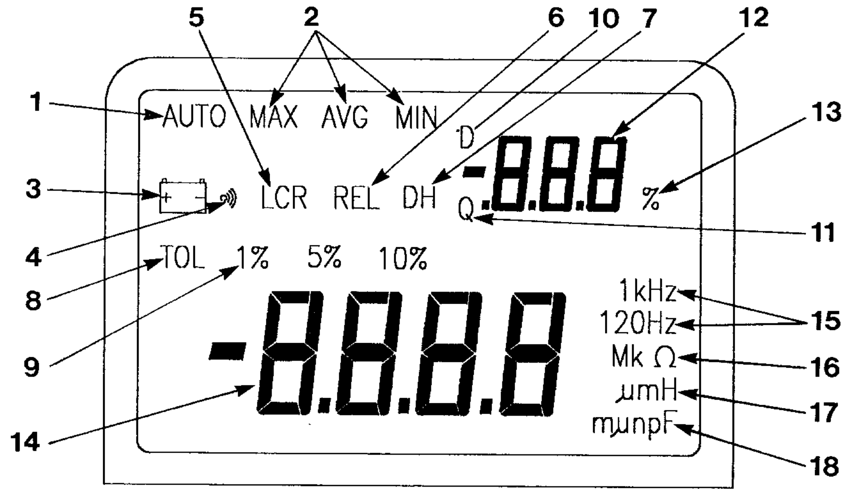


Figure 2a. Annunciators

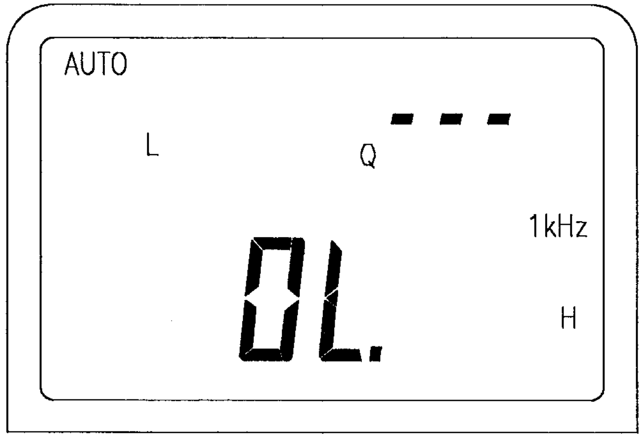


Figure 2b. Annunciators (con't)

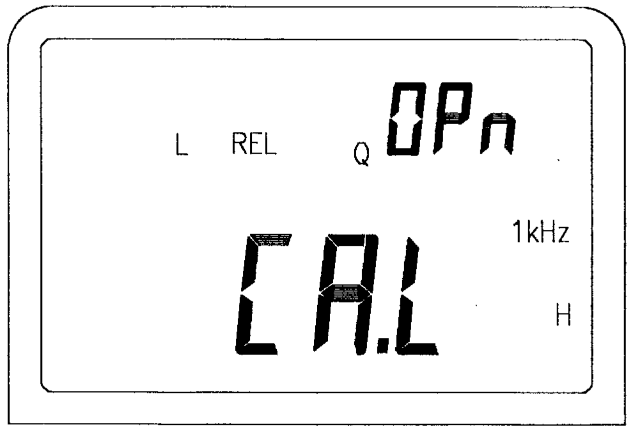


Figure 2c. Annunciators (con't)

ANNUNCIATORS

Refer to Figure 2.

1. **AUTO (Autoranging).** Indicates that the meter is in autoranging mode.
2. **MAX/MIN/AVG.** All three annunciators on indicates that the MAX/MIN/AVG memory is enabled.

   Only MAX on indicates that the MAX value from memory is displayed.

   Only MIN on indicates that the MIN value from memory is displayed.

   Only AVG on indicates that the AVG value from memory is displayed.
3. **SYMBOL.** Indicates low battery.
4. **SYMBOL.** Indicates that beeper is enabled for tolerance mode.
5. **L C R (inductance, capacitance, resistance).** Indicates measurement mode; L, C, or R.
6. **REL (Relative).** Indicates that relative mode is enabled and that the displayed value is relative to the reference value.
7. **DH (Data Hold).** Indicates that data hold is enabled and the last measurement value is latched into the display.
8. **TOL (Tolerance).** Indicates that tolerance mode is enabled.
9. **1%, 5%, 10%.** Indicates that tolerance mode limit of 1%, 5% or 10% is selected.
10. **D (Dissipation Factor).** Indicates that the secondary display reading is the value of D.
11. **Q (Quality Factor).** Indicates that the secondary display reading is the value of Q.
12. **Secondary Display.** 3–Digit display indicates value of D or Q for capacitance and inductance modes and percent for tolerance mode. The decimal point is automatically displayed. Minus sign (–) prefix is displayed for negative values.
    a. **Srt (Short).** Secondary display indicates Srt when calibration should be performed with the test leads shorted or shorting bar inserted.
    b. **OPn (Open).** Secondary display indicates OPn when calibration should be performed with the test leads open or removed.

c. **PAL (Parallel).** Indicates PAL when in the parallel mode of measurement, and parallel is the alternate mode.

d. **SEr (Series).** Indicates SEr when in the series mode of measurement and series is the alternate mode.

13. **%(Percent).** Indicates that the unit of measurement for the secondary display is in percent.

14. **Main Display.** 4–Digit display indicates value of component along with the appropriate decimal point. Minus sign (-) prefix is displayed for negative values.

a. **CAL (calibrate).** Main display indicates CAL when the meter must be calibrated.

b. **OL (overrange).** Value is greater than 9999 on the selected range. In Autoranging, value is greater than 9999 on the highest range.

c. **FUSE**. Main display indicates FUSE when the fuse is blown and must be replaced.

15. **1kHz, 120 Hz.** Indicates that the test frequency is 1kHz or 120 Hz.

16. **MkΩ**. Indicates that the unit of measurement for the main display is in (ohms), kΩ (kilohms) or MΩ (megohms).

17. **µmH.** Indicates that the unit of measurement for the main display is in H (henrys), mH (millihenry's) or µH (microhenrys).

18. **mµnpF**. Indicates that the unit of measurement for the main display is in pF (picofarads), nF (nanofarads), µF (microfarads) or mF (millifarads).

AUDIBLE SIGNALS

Each time a key is pressed the unit beeps once to confirm that the selection has been entered. For example, each time the range is changed by pressing the RANGE key, one beep is heard.

The unit does not beep when POWER is turned off. The unit beeps twice upon automatic power off.

In the MAX/MIN/AVG mode, the unit beeps once when each value is loaded into memory.

In the Tolerance mode, the unit beeps once when the measured value is within the preset percentage limit and three times when it exceeds the preset percentage limit.

The unit beeps continuously when the fuse is blown.

GENERAL INFORMATION

NOTE:

The meter is not intended for in-circuit measurements. Making in-circuit measurements with the meter will result in misleading indications of the component under test. This is partially because the meter generates an AC test signal and therefore biases other components in the circuit such as semi-conductors, and partially because the measurement may include other series or parallel components and not just that of the actual component under test. It is therefore strongly recommended that no in-circuit measurements be made.

The B+K Model 878 Universal LCR Meter has a dual LCD display (Main Display and a Secondary Display) which simultaneously displays both the measured inductance and the Q (Quality Factor) of the inductor or the measured capacitance and the D (Dissipation Factor) of the capacitor.When measuring resistance the Q and D are not displayed because a resistor is not a reactive component and therefore the Q and D are not applicable.

CAUTION

1. *To avoid personal electrical shock or permanent damage to the meter fully discharge any capacitor before attempting a capacitance measurement.*
2. *Observe polarity when connecting polarized capacitors.*
3. *Never apply a voltage to the test terminals of the meter, serious internal damage may result.*
4. *Avoid measurements in the presence of a strong magnetic field such as near large electric motors or transformers.*

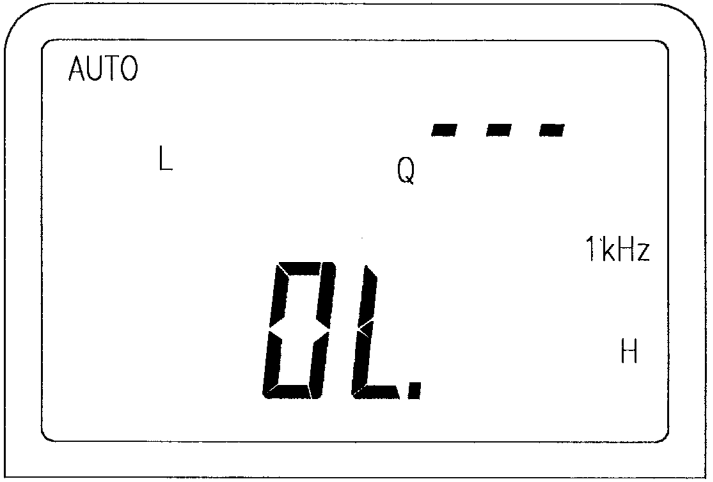


Figure 3. Display upon Power-Up

POWER UP

The meter may be powered internally by a 9 volt battery or externally by using the AC adapter (supplied) that plugs into the side of the meter. No battery is supplied with the meter. If battery operation is desired, install a 9-volt battery as described in the MAINTENANCE section of this manual. It is not necessary to install a battery when the AC Adapter is used. When the external AC adapter is used the internal battery is bypassed.

NOTE:

It is recommended that the AC adapter be used whenever possible to conserve battery life.

When the meter is first turned ON it automatically defaults to the **AUTO** (Autoranging) mode for inductance (**L**) measurement at a test frequency of **1kHz**. The LCD will display: **AUTO**, **L**, **Q**, ---, **OL**, **1kHz**, and **H** (highest inductance range in Henrys).

Pressing the **L/C/R** key once will cause the meter to cycle to the capacitance mode of measurement and the LCD will display: **AUTO**, **C**, a value will be displayed for the dissipation factor, **D**, and a value will be displayed for capacitance, **1kHz**, and **pF** (lowest capacitance range in picofarads).

Pressing the **L/C/R** key a second time will cause the meter to cycle to the resistance mode of measurement and the LCD will display: **AUTO**, **R**, **OL**, **1kHz**, and **MΩ** (highest resistance range in megohms). While in the resistance measurement mode the **Q** (Quality Factor) and **D** (Dissipation Factor) are not displayed because a resistor does not have these properties.

By pressing the **RANGE** key at any selected mode of measurement (L, C or R) the meter goes into the **Manual Ranging Mode** of measurement. The user can then manually select the most appropriate range and resolution for a given component under test.

The meter has a built in **Auto Power Off** feature that turns the meter off (Sleep Mode) after approximately 5 minutes. This feature may be disabled by performing either of the following procedures:

1. By holding down any key while simultaneously pressing the **POWER** key during power up (two beeps will be heard indicating that the Auto Power Off feature is disabled).

2. Plugging in the external AC adapter. By plugging in the AC adapter the meter will remain ON indefinitely until the user turns the power off.

MEASURING INDUCTANCE

Autoranging Mode

The autoranging mode is the fastest method to obtain the approximate value of an inductor. On some ranges, autoranging is not as accurate as the manual ranging mode because no calibration is performed.

NOTE:

When the meter is first turned ON it automatically defaults to the **AUTO** (Autoranging) mode for inductance (L) measurement at a test frequency of **1kHz**. The LCD will display: **AUTO, L, Q, – – –, OL., 1kHz, and H.**

1. Press the **POWER** Key to turn the meter ON.
2. Select 1kHz (default) or 120Hz (by pressing **1kHz/120Hz** key) test frequency as appropriate for the inductor to be measured. Refer to the "Considerations"paragraph for the rationale for selecting 120Hz or 1kHz as the test frequency.
3. Insert inductor leads directly into the meter's test slots or use test leads if necessary.
4. Read the measured inductance value on the main LCD display and the **Q** of the inductor on the secondary LCD display.

   An open inductor will indicate **OL** on the display at the highest range (H).

   A shorted inductor will indicate a low value on the lowest range.

Manual Ranging Mode

The manual ranging mode gives the optimum accuracy. On those ranges requiring calibration before measurement, the unit does not permit measurement until the calibration has been performed.

NOTE:

When the meter is first turned ON, it automatically defaults to the **AUTO** (Autoranging) mode for inductance (L) measurement at a test frequency of **1kHz**. The LCD will display: **AUTO, L, Q, – – –, OL., 1kHz,** and **H.**

1. Press the **POWER** Key to turn the meter ON if the meter is not already ON.
2. Select 1kHz (default) or 120Hz (by pressing **1kHz/120Hz** key) test frequency as appropriate for the inductor to be measured. See the "Considerations" paragraph for the rationale on selecting either 1kHz or 120Hz as the test frequency.
3. Press the **RANGE** key to go into the manual ranging mode of measurement. The LCD will display: **L, REL** (flashing), **Q, OPn, 1kHz, CA.L,** and **H** (the highest inductance measurement in Henrys).

NOTE:

When the **RANGE** key is first pressed the meter goes into the manual ranging mode of measurement displaying the highest range for inductance measurement in Henrys (H) on the main display. Each consecutive press of the **RANGE** key yields a scrolling effect from the highest range to the lowest range and then sequentially back up to the highest range. There are seven inductance ranges covered by the meter.

4. Press the **RANGE** key sequentially until the desired inductance measurement range is reached. (Refer to Tables A and B.)
5. Connect any test leads that will be needed for measurement to the (+) and (–) jacks of the meter.
6. If **CAL** is displayed on the main display while on the desired range, check the secondary display and follow its instructions. If **OPn** is displayed, press the **CAL** key with test leads open (or no test leads were connected in step 5). If **Srt** is displayed, short the test leads together (or insert shorting bar if no test leads used in step 5) before pressing the **CAL** key. **CAL** will disappear from the main display.

7. Insert inductor leads directly into the meter's test slots or use test leads if necessary.
8. Read the measured inductance value on the main display and the **Q** (Quality Factor) of the inductor on the secondary display.

An open inductor will indicate **OL** on the main display and the decimal point (depending upon the range selected) will move.

A shorted inductor may indicate random values on both the main and secondary displays.

TABLE A (1kHz)

RANGE	DISPLAY		
	Units	Main Display	Secondary Display
1000 H	H	CA.L	OPn
1000 µH	µH	CA.L	Srt
10 mH	mH	.CAL	Srt
100 mH	mH	O.L	---
1000 mH	mH	OL.	---
10 H	H	.OL	---
100 H	H	C.AL	OPn

TABLE B (120Hz)

RANGE	DISPLAY		
	Units	Main Display	Secondary Display
10000 H	H	CAL	OPn
10 mH	mH	.CAL	Srt
100 mH	mH	C.AL	Srt
1000 mH	mH	OL.	---
10 H	H	.OL	---
100 H	H	O.L	---
1000 H	H	CA.L	OPn

Considerations

1. Test Leads. When making measurements it is recommended that the component under test be plugged into the test slots and that the test leads remain unplugged whenever possible.

   The meter will accept standard banana plug test leads when necessary to make test connections to the inductor. However, the short test leads supplied with the instrument should be used whenever possible. Longer test leads have more inductance and resistance. Test lead inductance becomes a significant potion of the measured value for small inductors and a few milliohm resistance becomes significant when measuring low Q inductors. Although the test lead inductance and resistance are zeroed out in the CAL steps, stray inductance from long test leads varies as the test leads are moved. Also, long test leads are more susceptible to radiated and induced magnetic fields which can affect the measurement.

2. Rationale for 1kHz or 120Hz Test Frequency. By default, the meter uses a test frequency of 1kHz during power up; however, the test frequency is user selectable and can be changed to 120Hz.

   Typically a 1kHz test signal is used to measure inductors that are used in audio and RF (radio frequency) circuits. This is because these components operate at higher frequencies and require that they be measured at a higher frequency of 1kHz. However, a 120Hz test signal is used to measure inductors that are used as filter chokes in power supplies that typically operate at 60 Hz AC with 120Hz filter frequencies.

   Generally, inductors below 2mH should be measured at 1kHz and inductors above 200H should be measured at 120Hz. The manufacturer's specification sheet usually specifies the appropriate test frequency.

3. DC Bias Considerations. Some inductors are intended to operate at a certain DC bias (mA or A of current) to achieve a certain inductance value. However, this meter cannot produce such a biasing scheme and external biasing should not be attempted because external power would be applied to the instrument and cause serious damage to the meter. Therefore, in certain cases the measured inductance reading will not agree with the manufacturer's specification sheet.

   For example: Measuring the inductance value of laminated-core inductors (such as power supply chokes) with any low-current instrument may yield misleading readings. This is due to the fact that laminated-core inductors are typically designed for relatively high DC levels, such as those encountered in practical applications. Therefore, an inductor rated at 6H at 100 mA may not produce this inductance value when measured at a much lower current.

4. Displaying D (1/Q). The secondary display normally reads the value of Q. It is possible to display the value of D if desired by pressing the D/Q key. D is the reciprocal of Q (D= 1/Q) and may be the specified parameter on some inductor data sheets or test procedures.

5. Data Hold. The inductance reading can be latched into the display by pressing the **DATA HOLD** key (**DH** will be displayed). This may be convenient when measuring difficult to access components. The test leads can be connected to the component and the **DATA HOLD** key pressed. Then the test leads can be removed and the reading will remain on the display. Return to normal operation by pressing the **DATA HOLD** key again.

6. Autoranging Range Advance. In the autoranging mode of measurement, the meter will automatically step to the next higher range if the value exceeds about 9400 counts. For values between 9400 and 9999 (regardless of decimal point), it will be necessary to use manual ranging to obtain the highest resolution. However, the extra digit of resolution is seldom needed and the next higher range will provide adequate accuracy.

7. Combining Autoranging and Manual Ranging Operation. Combining autoranging and manual ranging is a very convenient way to gain the advantage of both modes. Starting in the autoranging mode, insert or connect the inductor to be measured. The instrument quickly steps to the correct range for measurement. Next, press the **RANGE** key to switch to the manual ranging mode. The instrument will be on the correct range. The display will indicate whether a calibration needs to be performed to obtain optimum accuracy. If not, take the reading. If so, perform the calibration, then take the reading. This method combines the speed of autoranging and the accuracy of manual ranging and is very easy and simple to perform.

8. Series vs Parallel Measurement. The Model 878 normally measures inductance in the series equivalent mode. Since series is the normal mode, **SEr** is not displayed on the secondary display. The series mode gives the most accurate measurement in most cases. The series equivalent mode is essential for obtaining an accurate Q reading of low Q inductors. Where ohmic losses are most significant, the series equivalent mode is preferred. However, there are cases where the parallel equivalent mode may be more appropriate. For iron core inductors operating at higher frequencies where hysteresis and eddy currents become significant, measurement in the parallel equivalent mode is preferred. There is a fixed relationship between the series and parallel equivalent modes of measurement as shown in Table C. The Model 878 can store the measured parameters in memory and calculate the parallel equivalent value for display. The procedure is as follows:

1. Measure the inductor in the normal series equivalent mode so that the inductance value and **Q** value are displayed.
2. Press the **DATA HOLD** key. **DH** will appear on the display.
3. Hold the **D/Q** key for 1 second. **PAL** (parallel) will be displayed on the secondary display and the inductance value for the parallel equivalent mode will be displayed on the main display.
4. To exit the parallel mode, press the **D/Q** key, then the **DATA HOLD** key.

TABLE C

CIRCUIT MODE		DISSIPATION FACTOR	CONVERSION TO OTHER MODES
Lp Mode	 Lp Rp	$D = \frac{2\Pi f Lp}{Rp} \left(= \frac{1}{Q}\right)$	$Ls = \frac{1}{1+D^2} Lp$, $Rs = \frac{D^2}{1+D^2} Rp$
Ls Mode	Ls Rs 	$D = \frac{Rs}{2\Pi f Ls} \left(= \frac{1}{Q}\right)$	$Lp = (1+D^2)\, Ls$, $Rp = \frac{1+D^2}{D^2} Rs$

MEASUREMENT PARAMETER CONVERSION

Parameter values for a component measured in a parallel equivalent circuit and that measured in series equivalent circuit are different from each other. But the dissipation factor of a component always has the same dissipation factor at a given frequency for both parallel equivalent and series equivalent circuits. The equations in Table C show the relationship between parallel and series parameters of a component.

MEASURING CAPACITANCE

CAUTION

To avoid personal electrical shock or damage to the meter, discharge the capacitor before attempting a capacitance measurement and observe polarity markings on Polarized Capacitors.

Autoranging Mode

Autoranging is the fastest method to obtain the approximate value of a capacitor. On some ranges, autoranging is not as accurate as the manual ranging mode because no calibration is performed.

1. Press the **POWER** Key to turn the meter ON.

   NOTE:

   When the meter is first turned ON it automatically defaults to the **AUTO** (Autoranging) mode for inductance (**L**) measurement at a test frequency of **1kHz**. The LCD will display: **AUTO, L, Q, – – –, OL., 1kHz, and H**.

2. Press the **L/C/R** key once to measure capacitance. The LCD will display: **AUTO**, **C**, **D** (a value for the dissipation factor), **1kHz**, a value for the capacitance and **pF** (the lowest range in the capacitance measurement mode in picofarads).

3. Select 1kHz (default) or 120Hz (by pressing **1kHz/120Hz** key) test frequency as appropriate for the capacitor to be measured. Refer to the "Considerations" paragraph for the rationale on selecting either 1kHz or 120Hz as the test frequency.

4. Insert capacitor leads directly into the meter's test slots or use test leads if necessary.

5. Read the measured capacitance value on the main display and the D of the capacitor on the secondary display. The meter automatically selects the most appropriate range while in the AUTO mode of operation.

   An open capacitor will indicate random capacitance and dissipation factor values on the LCD display at the lowest range while in AUTO mode.

   A shorted capacitor will indicate random capacitance and dissipation factor values on the LCD display and will automatically select a measurement range.

Manual Ranging Mode

The manual ranging mode gives the optimum accuracy. On those ranges requiring calibration before measurement, the unit does not permit measurement until the calibration has been performed.

NOTE:

When the meter is first turned ON it automatically defaults to the **AUTO** (Autoranging) mode for inductance (L) measurement at a test frequency of **1kHz**. The LCD will display: **AUTO, L, Q, – – –, OL., 1kHz, and H.**

1. Press the **Power** key to turn the meter ON if the meter is not already ON.
2. Press the **L/C/R** key once for capacitance measurement mode.
3. Select 1kHz (default) or 120Hz (by pressing **1kHz/120Hz** key) test frequency as appropriate for the capacitor to be measured. See the "Considerations" paragraph for the rationale on selecting either 1kHz or 120Hz as the test frequency.

   Press the **RANGE** key to go into the manual ranging mode of measurement. The LCD will display: **C, REL** (flashing), **D, OPn, 1kHz, CA.L,** and **pF** (the lowest capacitance measurement in picofarads).

NOTE:

When the **RANGE** key is first pressed, the meter goes into the manual ranging mode of measurement displaying the lowest range for capacitance measurement on the main display. Each consecutive press of the **RANGE** key yields a scrolling effect from the lowest range to the highest range and then sequentially back down to the lowest range. There are 7 capacitance ranges on the meter.

4. Press the **RANGE** key sequentially until the desired capacitance measurement range is reached (refer to Tables D and E).
5. Connect any test leads that will be needed for the measurement to the (+) and (–) jacks of the meter.
6. If **CAL** is displayed on the main display while on the desired range, check the secondary display and follow its instructions. If **OPn** is displayed, press the **CAL** key with test leads open (or no test leads were connected in step 5). If **Srt** is displayed, short the test leads together (or insert shorting bar if no test leads were used in step 5) before pressing the **CAL** key. **CAL** will disappear from the main display.
7. Insert capacitor leads directly into the meter's test slots or use test leads if necessary.

8. Read the measured capacitance value on the main display and the D (Dissipation Factor) of the capacitor on the secondary display.

   An open capacitor will indicate 0000 on the main display and the decimal point (depending upon the range selected) will move accordingly.

A shorted capacitor may indicate random values on both the Main and Secondary displays.

TABLE D (1kHz)

RANGE	DISPLAY		
	Units	Main Display	Secondary Display
1000 pF	pF	CA.L	OPn
10 nF	nF	.CAL	OPn
100 nF	nF	00.00	– – –
1000 nF	nF	000.0	– – –
10 µF	µF	0.000	– – –
100 µF	µF	C.AL	Srt
1 mF	mF	.CAL	Srt

TABLE E (120Hz)

RANGE	DISPLAY		
	Units	Main Display	Secondary Display
10 nF	nF	.CAL	OPn
100 nF	nF	C.AL	OPn
1000 nF	nF	000.0	– – –
10 µF	µF	0.000	– – –
100 µF	µF	00.00	– – –
1000 µF	µF	CA.L	Srt
10 mF	mF	C.AL	Srt

Considerations

1. Test Leads. When making measurements it is strongly recommended that the component under test be plugged into the test slots and that the test leads remain unplugged whenever possible.

   The meter will accept standard banana plug test leads when necessary to make connections to the capacitor. However, the short test leads supplied with the instrument should be used whenever possible. Longer test leads have more stray capacitance. Although the test lead capacitance is zeroed out in the CAL steps, stray capacitance varies as the test leads are moved and may introduce error into small capacitance values. Also, long test leads are more susceptible to radiated and induced magnetic fields which can affect the measurement.

2. Test Frequency. By default, the meter uses a test frequency of 1 kHz during power up, however, the test frequency is user selectable and can be changed to 120 Hz. Generally, a 1kHz test signal is used to measure capacitors that are 0.01 µF or smaller, and a 120Hz test signal is used for capacitors that a 10 µF or larger.

   It is best to check with the manufacturers data sheet to determine the best test frequency for the device.

3. Charged Capacitors And Fuse. Always discharge any capacitor prior to making a measurement since a charged capacitor may seriously damage the meter.

   A protective fuse is used in series with the input terminals of the meter to protect it from overvoltage conditions (charged capacitors) or other externally applied voltage.

   If the fuse is blown, the main display will indicate **FUSE** and the beeper will sound continuously. The fuse must be replaced as instructed in the MAINTENANCE section before measurements can continue.

4. Effect Of High D On Accuracy. A low D (Dissipation Factor) reading is desirable. Electrolytic capacitors inherently have a higher dissipation factor due to their normally high internal leakage characteristics. If the D (Dissipation Factor) is excessive, the capacitance measurement accuracy may be degraded.

5. Displaying Q (1/D). The secondary display normally reads the value of D (dissipation factor). If desired, the reciprocal of D can be displayed by pressing the **D/Q** key. A Q annunciator will accompany the reading.

6. Data Hold. The capacitance reading can be latched into the display by pressing the **DATA HOLD** key (**DH** will be displayed). This may be convenient when measuring difficult to access components. The test leads can be connected to the capacitor and the **DATA HOLD** key pressed. Then the test leads can be removed and the reading will remain on the display. Return to normal operation by pressing the **DATA HOLD** key again.

7. Autoranging Range Advance. In the autoranging mode of measurement, the meter will automatically step to the next higher range if the value exceeds about 9400 counts. For values between 9400 and 9999 (regardless of decimal point), it will be necessary to use manual ranging to obtain the highest resolution. However, the extra digit of resolution is seldom needed and the next higher range will provide adequate accuracy.

8. Combining Autoranging and Manual Ranging Operation. Combining autoranging and manual ranging is a very convenient way to gain the advantage of both modes. Starting in the autoranging mode, insert or connect the capacitor to be measured. The instrument quickly steps to the correct range for measurement. Next, press the **RANGE** key to switch to the manual ranging mode. The meter will already be on the correct range. The display will indicate whether a calibration needs to be performed to obtain optimum accuracy. If not, take the reading. If so, perform the calibration, then take the reading. This method combines the speed of autoranging and the accuracy of manual ranging and is very easy and simple to use.

9. Measuring Capacitance Of Cables, Switches Or Other Parts. Measuring the capacitance of coaxial cables is very useful in determining the actual length of the cable. Most manufacturer's specifications list the amount of capacitance per foot of cable and therefore the length of the cable can be determined by measuring the capacitance of that cable.

   For example: A manufacturer's specification calls out a certain cable, to have a capacitance of 10 pF per foot. After measuring the cable a capacitance reading of 1.000 nF is displayed. Dividing 1000 pF (1.000 nF) by 10 pF per foot yields the length of the cable to be approximately 100 feet.

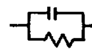
   Even if the manufacturer's specification is not known, the capacitance of a measured length of cable (such as 10 feet) can be used to determine the capacitance per foot. Do not use too short a length such as one foot, because any error becomes magnified in the total length calculations.

   Sometimes, the capacitance of switches, interconnect cables, circuit board foils, or other parts affecting stray capacitance can be critical to circuit design, or must be repeatable from one unit to another. The Model 878 can be used to measure such capacitance with resolution to 0.1pF if the measured points are open circuited.

10. Parallel vs Series Measurement. The Model 878 normally measures capacitance in the parallel equivalent mode. Since parallel is the normal mode, **PAL** is not displayed on the secondary display. Most capacitors should be measured in the parallel equivalent mode. Most capacitors have very low dissipation factor (high internal resistance) compared to the impedance of the capacitance. In these cases, the paralleled internal resistance has negligible impact upon the measurement. In large capacitors with higher dissipation factor, the lower internal resistance becomes a more significant factor and may be appropriate to be measured in the series equivalent mode. There is a fixed relationship between the parallel and series equivalent modes of measurement as shown in Table F. The Model 878 can store the measured parameters in memory and calculate the series equivalent value for display. The procedure is as follows:

1. Measure the capacitor in the normal parallel equivalent mode so that the capacitance and D value are displayed.
2. Press the **DATA HOLD** key. **DH** will appear on the display.
3. Hold the **D/Q** key for 1 second. **SEr** (series) will be displayed on the secondary display and the capacitance value for the series equivalent mode will be displayed on the main display.
4. To exit the series mode, press the **D/Q** key, then the **DATA HOLD** key.

TABLE F

CIRCUIT MODE		DISSIPATION FACTOR	CONVERSION TO OTHER MODES
Cp Mode	 Cp Rp	$D = \frac{1}{2\Pi f Cp Rp} (= \frac{1}{Q})$	$Cs = (1 + D^2)\,Cp\,,\ Rs = \frac{D^2}{1 + D^2}\,Rp$
Cs Mode	Cs Rs 	$D = 2\Pi f Cs Rs\,(= \frac{1}{Q})$	$Cp = \frac{1}{1 + D^2}\,Cs\,,\ Rp = \frac{1 + D^2}{D^2}\,Rs$

MEASUREMENT PARAMETER CONVERSION

Parameter values for a component measured in a parallel equivalent circuit and a component measured in series equivalent circuit are different from each other. But, the dissipation factor of a component always has the same dissipation factor at a given frequency for both parallel equivalent and series equivalent circuits. The equations in Table F show the relationship between parallel and series parameters of a component.

MEASURING RESISTANCE

Autoranging Mode

Autoranging is the fastest method to obtain the approximate value of a resistor. On some ranges, autoranging is not as accurate as the manual ranging mode because no calibration is performed.

1. Press the **POWER** Key to turn the meter ON.

NOTE:

When the meter is first turned ON it automatically defaults to **AUTO** (Autoranging) mode for Inductance (L) measurement at a test frequency of **1kHz**. The LCD will display: **AUTO, L, Q, – – –, OL., 1kHz,** and **H**.

2. Press the **L/C/R** key twice to measure resistance. The LCD will display: **AUTO, R, 1kHz, OL,** and **M** (the highest range in the resistance measurement mode in Megohms).

3. Press the **1kHz/120Hz** key if the desired test frequency is to be 120Hz (instead of the default 1kHz).

4. Insert resistor leads directly into the meter's test slots or use test leads if necessary.

5. Read the measured resistance value on the main display.

   An open resistor will read **.OL** on the display while in AUTO mode of operation.

   A shorted resistor will indicate a very small resistance value on the LCD display.

Manual Ranging Mode

The manual ranging mode gives the optimum accuracy. On those ranges requiring calibration before measurement, the meter does not permit measurement until the calibration has been performed.

NOTE:

When the meter is first turned ON, it automatically defaults to the **AUTO** (Autoranging) mode for inductance (L) measurement at a test frequency of 1kHz. The LCD will display: **AUTO, L, Q, – – –, OL., 1kHz,** and **H.**

1. Press the **POWER** key to turn the meter ON if the meter is not already ON.
2. Press the **L/C/R** key twice to go into the resistance measurement mode.
3. Select 1kHz (default) or 120Hz (by pressing **1kHz/120Hz** key) test frequency. The test frequency is usually not significant for resistance measurements.
4. Press the **RANGE** key to go into the manual mode of measurement. The LCD will display: **R, REL** (flashing), **D, OPn, 1kHz, .CAL,** and **MΩ** (the highest resistance measurement in megohms).

NOTE:

When the **RANGE** key is first pressed, the meter goes into the manual ranging mode of measurement displaying the highest range for resistance measurement in megohms (MΩ) on the main display. Each consecutive press of the **RANGE** key yields a scrolling effect from the highest range (MΩ) to the lowest range (Ω) and then sequentially back up to the highest range. There are seven resistance ranges on the meter.

5. Press the **RANGE** key sequentially until the desired resistance measurement range is reached (refer to Table G).
6. Connect any test leads that will be needed for the measurement to the (+) and (–) jacks of the meter.
7. If **CAL** is displayed on the main display while on the desired range, check the secondary display and follow its instructions. If **OPn** is displayed, press the **CAL** key with test leads open (or no test leads were connected in step 6). If **Srt** is displayed, short the test leads together (or insert shorting bar if no test leads were used in step 6) before pressing the **CAL** key. **CAL** will disappear from the main display.

8. Insert resistor leads directly into the meter's test slots or use test leads if necessary.
9. Read the measured resistance value on the main display.

   An open resistor will indicate **OL** on the main display.

   A shorted resistor will indicate a very small resistance value on the display.

TABLE G

RANGE	DISPLAY		
	Units	Main Display	Secondary Display
10 MΩ	MΩ	.CAL	OPn
10 Ω	Ω	.CAL	Srt
100 Ω	Ω	C.AL	Srt
1000 Ω	Ω	OL.	---
10 kΩ	kΩ	.OL	---
100 kΩ	kΩ	O.L	---
1000 kΩ	kΩ	CA.L	OPn

Considerations

1. Test Leads. When making measurements, it is recommended that the component under test be plugged into the test slots and that the test leads remain unplugged whenever possible.

   The meter will accept standard banana plug test leads when necessary to make test connections to the resistor. However, the short test leads supplied with the instrument should be used whenever possible. Longer test leads have more resistance. On the 10 ohm range, the meter has 1 milliohm resolution and test lead resistance becomes significant to the measurement. Test lead resistance is zeroed out when the **CAL** key is pressed, thus accurate measurements may still be achieved.

2. Shielded Test Leads. Measurements on the 1000 kΩ (1MΩ) and 10 MΩ ranges tend to be unstable (digits keep changing several counts) when test leads are used. If resistors cannot be plugged directly into the test slots for these ranges, shielded test leads may reduce the instability. Connect the shield to the (–) test jack. It may also be helpful to use battery operation rather then the AC Adapter for measurements on the 1MΩ and 10MΩ ranges.

3. Data Hold. The resistance reading may be latched into the display by pressing the **DATA HOLD** key (**DH** will be displayed). This may be convenient when measuring difficult to access components. The test leads can be connected to the resistor and the **DATA HOLD** key pressed, then the test leads can be removed and the reading will remain on the display. Return to normal operation by pressing the **DATA HOLD** key again.

4. Autoranging Range Advance. In the autoranging mode of measurement, the meter will automatically step to the next higher range if the value exceeds about 9400 counts. For values between 9400 and 9999 (regardless of decimal point), it will be necessary to use manual ranging to obtain the highest resolution. However, the extra digit of resolution is seldom needed and the next higher range will provide adequate accuracy.

5. Combining Autoranging and Manual Ranging Operation. Combining autoranging and manual ranging is a very convenient way to gain the advantage of both modes. Starting in the autoranging mode, insert or connect the resistor to be measured. The meter quickly steps to the correct range for measurement. Next, press the **RANGE** key to switch to the manual ranging mode. The meter will already be on the correct range. The display will indicate whether a calibration needs to be performed to obtain optimum accuracy. If not, simply take the reading. If so, perform the calibration, then take the reading. This method combines the speed and simplicity of autoranging with the accuracy of manual ranging and is very easy to perform.

6. Parallel vs Series Mode. The Model 878 normally measures resistance in the parallel equivalent mode. For resistance measurements, results should be identical in parallel and series equivalent modes since no reactive element is involved. The instrument can be placed in the series mode if desired by the following procedure:

   1. Measure the resistance in the normal parallel mode so that the value is displayed.

   2. Press the **DATA HOLD** key. **DH** will be displayed.

   3. Hold the **D/Q** key for 1 second. **Ser** (series) will be displayed on the secondary display and the resistance value in the series mode will be displayed on the main display.

   4. To exit the series mode, press the **D/Q** key, then the **DATA HOLD** key.

SORTING COMPONENTS

For each sorting function selected, the meter must be in the manual mode of measurement prior to executing the selected function. A component of the batch can be tested in autoranging to determine the correct range setting if desired.

If the components to be sorted have a value of approximately 10,000 counts where some values would be below 9999 counts and some values above 9999 counts, select the next higher range. Otherwise, values above 9999 counts will overrange (OL) and cannot be measured.

Max/Min/Avg Mode

The **MAX/MIN/AVG** mode can be initiated at the beginning of a batch test. As each component of the batch is measured, the instrument recalculates the average value and stores any new maximum or minimum value. At the end of the batch test, the maximum, minimum and average values for the batch can be recalled from memory.

1. Turn Power on.
2. Select L,C, or R as appropriate for the batch of components to be measured.
3. Select 1kHz or 120Hz test frequency as appropriate for the components to be measured.
4. Press the **RANGE** key to enter the manual mode of measurement.
5. Press the **RANGE** key repeatedly until the proper range has been selected for the component under test.
6. Connect any test leads that will be needed.
7. If **CAL** is displayed, perform the calibration.
8. Press the **MAX/MIN/AVG** key for 1 second.

   The LCD will display: **MAX, AVG, MIN**.

   The meter is now ready to measure and record component values in the MAX MIN AVG mode.
9. Insert the component to be measured and recorded into the test socket or connect to test leads.

   An audible beep will be heard after approximately 1 second indicating that the component has been measured and it's value stored in memory.

   The meter will display the current value of the inserted component on the main display.

10. Insert the next component to be measured and recorded into the Test Socket.

    An audible beep will be heard after approximately 1 second indicating that the component has been measured and it's value stored in memory.

11. Repeat this procedure as many times as needed to measure and record all component values.

12. When all components have been tested, press the **MAX/MIN/AVG** key to view the Maximum, Minimum or Average values of the previously measured and recorded components on the Main LCD display.

    Pressing the **MAX/MIN/AVG** key yields a scrolling affect, for example:

    Press once to view the MAXIMUM component value.

    Press again to view the MINIMUM component value.

    Press again to view the AVERAGE component value.

    Pressing the key again brings the annunciators back to the original MAX AVG MIN record mode.

13. To exit the MAX/MIN/AVG mode, hold the **MAX/MIN/AVG** key for 1 second.

Relative Mode

The **Relative** mode allows a reference component of the desired value to become zero. All subsequent values of a batch are measured as plus or minus with respect to the reference component.

1. Turn Power on.
2. Select L, C, or R as appropriate for the components to be measured.
3. Select 1kHz or 120Hz test frequency as appropriate for the components to be measured.
4. Press the **RANGE** key to enter the manual mode of measurement.
5. Press the **RANGE** key repeatedly until the proper range has been selected for the component under test.
6. Connect any test leads that will be needed.
7. If **CAL** is displayed, perform the calibration.
8. Insert the reference component of the desired value recorded into the test socket or connect to test leads.

   The meter will display the measured value on the main display.

9. Press the **REL** key to enter the Relative mode of measurement. The main display will now display 0000 (with appropriate decimal point).
10. Remove the reference component.
11. Insert another component for measurement. The value displayed will be the difference between the component under test and the reference value.
12. Repeat this procedure as many times as needed to measure each of the components to be tested relative to the reference value.
13. To exit the relative mode, hold the **REL** key for 1 second.

Tolerance Mode

The **Tolerance** mode allows a reference component of the desired value to become the standard. The dual display shows the value of the component and the percent difference from the standard. Limits of 1%, 5% or 10% can be selected; a beeper will sound if the component under test exceeds the preset limit.

1. Turn Power on.
2. Select L, C, or R as appropriate for the components to be measured.
3. Select 1kHz or 120Hz test frequency as appropriate for the components to be measured.
4. Press the **RANGE** key to enter the manual mode of measurement.
5. Press the **RANGE** key repeatedly until the proper range has been selected for the component under test.
6. Connect any test leads that will be needed.
7. If **CAL** is displayed, perform the calibration.
8. Insert the reference component of the desired value into the test socket or connect to test leads.

   The meter will display the measured value on the main display.
9. Press the **TOL** key to enter the tolerance mode of measurement. **TOL** will be displayed, and the beeper symbol will also be displayed.
10. Press the **TOL** key repeatedly to select a tolerance limit of 1%, 5% or 10% respectively. The selected tolerance limit is displayed

11. Remove the reference component and insert another component for measurement. If the newly inserted component is within the specified limit (1%, 5% or 10%) 1 beep will sound indicating that the new resistor is within the specified limit. If the newly inserted resistor is outside of the specified limit (1%, 5% or 10%) then 3 beeps will sound indicating that the limit has been exceeded. The value of the component will be displayed on the main display and the percentage difference from the reference component will be displayed on the secondary display.

12. Repeat this procedure as many times as needed to measure and view the component values and tolerance percentage.

13. To exit the relative mode, hold the **TOL** key for 1 second.

BATTERY INSTALLATION OR REPLACEMENT

The indication first appears when the battery is about 90% depleated. The meter may be operated for a short period, but the battery should be replaced as soon as posible. To prolong battery life, turn off power to the unit when not making measurements. For prolonged use, use the AC adapter.

To replace the battery use the following procedures:

1. Set the **POWER** switch to off.
2. Remove the 3-screws located at the back of the meter using a Phillips head screwdriver. Remove the rear case.
3. Remove the used battery and install a fresh 9 volt "transistor" battery (use Alkaline battery for extended life).
4. Replace rear case and screws.

FUSE REPLACEMENT

The fuse protects the meter from an accidental connection of a charged capacitor or a connection to an external voltage. When **FUSE** is displayed, check for blown fuse. The fuse is located in the battery compartment.

To replace the fuse use the following procedures:

1. Set the power switch to off.
2. Remove the 3-screws located at the back of the meter using a Phillips head screwdriver. Remove the rear case.
3. Carefully remove the blown fuse and replace only with original type 0.1A, 250 VAC, 5 x 20 mm fast acting fuse (B&K Part No. 194-029-9-001).
4. Replace rear case and screws.

WARRANTY SERVICE INSTRUCTIONS (FOR U.S.A. AND ITS OVERSEAS TERRITORIES)

To send in 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 the 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 agency, or write to:

B+K PRECISION CORPORATION

22820 Savi Ranch Parkway

Yorba Linda, California 92887

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

LIMITED ONE – YEAR WARRANTY

B+K PRECISION CORPORATION warrants to the original purchaser that its **B+K PRECISION** product, and the components thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

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

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

B+K PRECISION 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 meter to **B+K PRECISION CORPORATION 1031 Segovia Circle, Placentia, CA 92870-7137,** and please make certain that the meter is packaged properly 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.

USEFUL CONVERSIONS

INDUCTANCE

μH	mH	HENRY
0.001		
0.01		
0.1		
1.0	0.001	
10.0	0.01	
100.0	0.1	
1,000.0	1.0	0.001
10,000	10.0	0.01
100,000	100.0	0.1
1,000,000	1,000.0	1.0

μH= microHenry (10^{-6})
mH= milliHenry (10^{-3})
H = Henry (1.0)

CAPACITANCE

pF	nF	μF	mF	FARAD
1,000	1.0	0.001		
10,000	10.0	0.01		
100,000	100.0	0.1		
1,000,000	1,000.0	1.0	0.001	
	10,000	10.0	0.01	
	100,000	100.0	0.1	
	1,000,000	1,000.0	1.0	0.001
		10,000	10.0	0.01
		100,000	100.0	0.1
		1,000,000	1,000.0	1.0

pF= picofarads (10^{-12})
nF= nanofarads (10^{-9})
μF= microfarads (10^{-6})
mF= millifarads (10^{-3})