INSTRUCTION MANUAL

B+K PRECISION®

MODEL 830A

Autoranging CAPACITANCE METER

INTRODUCTION

The B & K Precision Model 830A Autoranging Capacitance Meter gives a direct reading of capacitance on a 3-½ digit crystal display. The autoranging feature automatically selects the range with the highest resolution. Ten full scale ranges of 199.9 picofarads to 199.9 millifarads include virtually all capacitors used in electronics equipment. A selectable hold feature prevents the range from resetting when a capacitor is removed, for faster batch testing of large value capacitors. The instrument has application in electronic engineering labs, production, service shops, and schools. It can be used to check tolerance, sort values, select precision values, measure unmarked capacitors, select matched sets, and measure cable or switch capacitance. Its battery operation, light weight, and small size make it a truly portable instrument.

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OPTIONAL ACCESSORIES

BE-12 AC/DC ADAPTOR
Allows for operation from AC line voltage. Output is 9VDC/300mA with center pin positive.

TL-830 CLIP LEAD SET
Designed to interface with Model 830A. Enables quick connection to capacitor to be tested.

LG29B CARRYING CASE
Offers convenience and protection while transporting the instrument. Sturdy grained leatherette construction, rugged snap fasteners, and handle. Cover swings away to permit use of meter while in carrying case. Storage for test leads and manual.

SPECIFICATIONS

CAPACITANCE

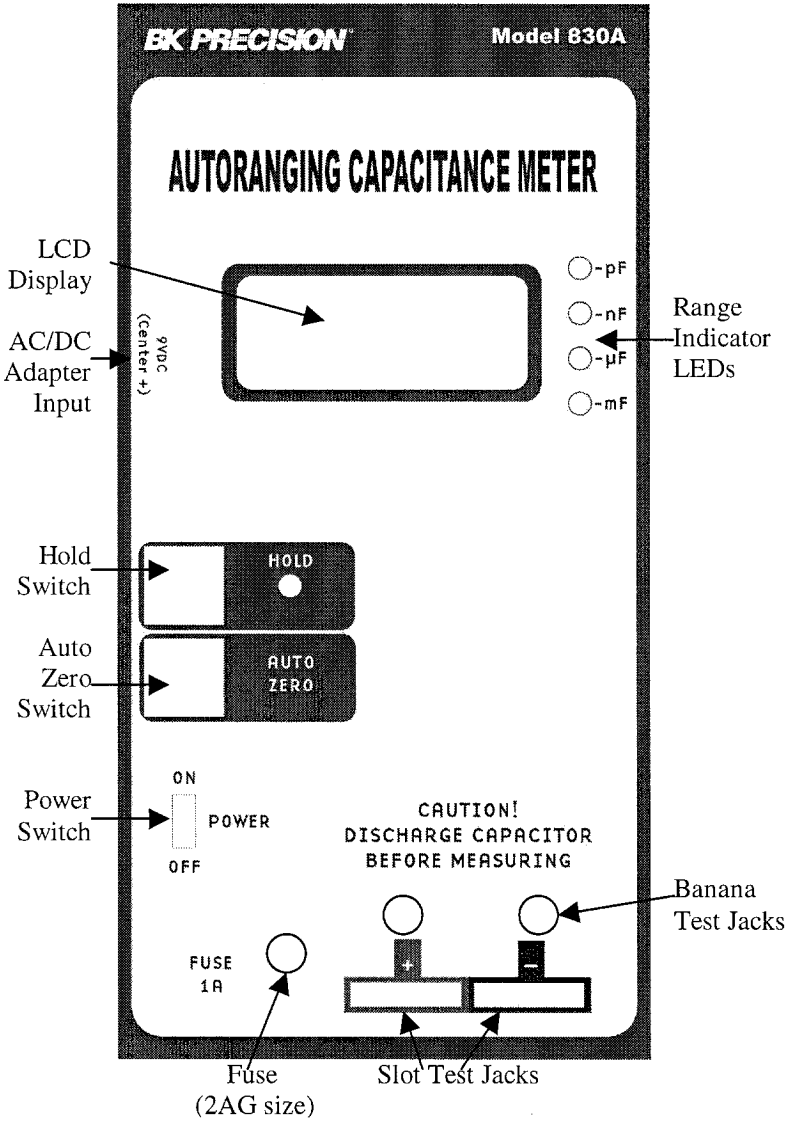
Range:	10 ranges, fully automatic with range hold. Full scale value from 199.9 pF to 199.9 mF.
Resolution:	0.05% of full scale on all ranges.
Accuracy:	<u>10% to Full Scale</u> 0.2% of reading, ±0.5 pF, ± 1 digit to 19.99 µF. 1.0% of reading, ± 1 digit from 20 µF to 199.9 mF. <u>0-10% of Full Scale</u> Add 0.1% of full scale up to 19.99 µF (including 199.9 pF range). Add 0.5% of full scale from 19.99 µF to 199.9 mF.
Reading Update Time:	<1.0 second to 25 mF, increasing to 8 seconds at 200 mF.
Auto Zero:	Can compensate up to 2000 pF of test lead capacitance.

Overrange Indication:	"01"

GENERAL

Display:	3-½ digit, 0.5" LCD with low battery indicator.
Front Panel Controls:	POWER ON-OFF switch, HOLD switch, and AUTO ZERO.
Power Source:	9VDC alkaline battery provided with unit. Option to use 9VDC/300 mA adapter with center plug positive.
Battery Life:	20 hours typical with alkaline batteries.
Operating Temperature:	+15° to +35° C; usable at reduced accuracy 0° to +50° C.
Dimensions:	7.5" x 4.0" x 2.0"
Weight:	1 lb.

Figure 1
OPERATING CONTROLS



OPERATING INSTRUCTIONS

WARNING

1. Never apply voltage to the test jacks; serious internal damage may result.
2. Fully discharge any capacitors before measurement.
3. Observe polarity when connecting polarized capacitors.

PREPARATION

The 830A is shipped with a 9V alkaline battery.

PROCEDURE

1. Set the POWER switch to the ON position.
2. Zero the meter. Press the AUTO ZERO switch and the display should read 00.0 ± 1 digit. If test leads are to be used, connect them to the "+" and "-" jacks before zeroing the meter. *Do not short the leads together*, this will cause an overrange condition.
3. a. For all capacitors with leads, insert the capacitor leads directly into the slotted capacitor test socket.
   b. For capacitors which do not have leads, plug test leads into the "+" and "-" jacks and clip the test leads to the capacitor terminals.
4. Read the capacitance value directly from the LCD display and its accompanying unit indicator LED. For example, when the µF unit indicator is lighted and the LCD display reads 47.3, the value is 47.3 microfarads.
   a. A conversion chart is provided on the last page of these instructions for convenience and accuracy in converting nanofarads and millifarads into picofarad and microfarad values.
   b. The meter always starts on the lowest range (200 pF full scale) and automatically ranges upward to the range that will give maximum resolution. The display reads "01" until the proper range is reached. For values below 25 mF the reading will appear in less than one second. The time required for the first reading increase with capacitance value to about 8 seconds for a 200 mF capacitor.
   c. Measurement of a group of similar value capacitors (especially large values over 200 µF) is faster if the HOLD switch is pressed before the first capacitor is removed.

The meter then locks on that particular range and reading. Subsequent measurements do not require the automatic upranging sequence before a reading is obtained. Press the HOLD switch again after the next similar capacitor is installed.

5. If the LO BAT indication appears in the display continuously, the batteries are nearing discharge. The instrument may be operated for 1 – 2 hours after the LO BAT indication first appears before accuracy is affected. Replace low batteries as applicable. See the SERVICING section of this manual for battery replacement procedures.

CONSIDERATIONS

1. Recheck zero each time measurements are started in the AUTO mode, making sure that the reading is as close to 00.0 as possible.
2. The LCD display indicates 01 when the unit is autoranging to prevent erroneous readings from being displayed.
3. A shorted capacitor will cause the meter to overrange. It will range upward through all ranges, then display 01 on the LCD display and the mF LED will be on.
4. An open capacitor will read a few picofarads.
5. The spring-tensioned slot type capacitor test socket speeds testing. It accepts a wide variety of capacitor lengths, lead dimensions, and lead dress. This eliminates the time spent searching for a socket with correct spacing or accurately bending lead dress to match a socket.
6. I test leads are to be used, select test leads that are terminated in banana plus on one end and alligator clips on the other. Use short leads to minimize cable capacitance. The meter will zero out 2000 pF maximum of test lead capacitance. Color coded test leads, one red and one black, simplify proper polarity connections.
7. When measuring an assortment of capacitors, where some will require test leads and some will not, leave the test leads connected to the meter throughout the measurements. Otherwise, it is necessary to zero out the test lead capacitance when test leads are connected, and rezero when that are removed.
8. The meter is protected against damage from charged capacitors by the fuse. If the fuse blows, the meter will read zero for all capacitors checked (a few pF on the 200 pF range). To remove the fuse, push and turn the cap counter-clockwise. Replace the fuse only with a 1 Amp, type 2AG fuse.
9. To conserve battery life, turn the POWER switch off when not actually making measurements.
10. The optional accessory Adapter is for use when an AC outlet is available.
11. Remove discharged disposable batteries immediately to prevent leakage.
12. The 830A applies a maximum of 4 volts to the capacitor being measured. On some ranges, only 0.2 volt is applied. There is no danger of exceeding the voltage rating of any capacitor, or of retaining a dangerous voltage on the capacitor when it is removed from the meter.
13. Capacitors, especially electrolytic, often have notoriously wide tolerances. Do not be surprised if the measured value is up to 100% greater that the value marked on the capacitor, unless it is a close tolerance type. However, values are seldom drastically below rated value.
14. A handy reference table, located on the inside read cover of the manual, summarizes typical characteristics for various types of capacitors.
15. To measure cable capacitance, it is best to measure a short precise length, such as 3 feet, and calculate the total capacitance of a longer cable.
16. Capacitor leakage causes the measured value to be high. The relative effects of capacitor leakage on each range are summarized in the following table.

RANGE	RANGE	RANGE
1 200.0 pF	4 200.0 nF	8 2000 µF
2 2000 pF	5 2.000 µF	9 20.00 mF
3 20.00 nF	6 20.00 µF	10 200.0 mF
	7 200.0 µF	
LEAKAGE EFFECT	**LEAKAGE EFFECT**	**LEAKAGE EFFECT**
1 nA = .1%	1 µA = .1%	10 µA = .1%
10 nA = 1%	10 µA = 1%	100 µA = 1%
100 nA = 10%	100 µA = 10%	1mA = 10%
% = percentage of full scale		

Added effects of leakage on readings

SERVICING

BATTERY REPLACEMENT

This instrument operates from one 9VDC alkaline battery and is installed at the factory. Subsequently, alkaline batteries must be replaced within 1 to 2 hours operating time after the LO BAT indicator of the LCD display appears. Low batteries should be removed immediately to prevent instrument damage from battery leakage.

1. Remove the battery cover by pressing down slightly and slide cover off.
2. Replace 9V battery and slide cover on.

Checkout of Autoranging

A quick check of autoranging may be performed by inserting a greater than 2000 µF capacitor between the "+" and "-" jacks. The display will read "01" and the 830A will step through its ranges, one at a time, until is locks up on the top range. As the 830A steps through its ranges, the associated LED lights and the decimal points shift.

CALIBRATION ADJUSTMENTS

The unit was carefully checked and calibrated at the factory prior to shipment. Readjustment is recommended only if repairs have been made in a circuit affecting calibration, or if you have reason to believe the unit may be out of calibration. Recalibration should be attempted only if you have the recommended test equipment and calibration standard capacitors. The accuracy of the instrument will be degraded if less accurate calibration standards are used. Very few instrument shops have standard capacitors of the precision required to calibrate this instrument. Your Model 830A Capacitance Meter will be adjusted to its original accuracy if returned to the B & K Precision factory service department for recalibration.

Test Equipment Required

Precision capacitors of known calibrated values must be used. The values should be between mid scale and 80% of full range, with the higher the better.

Procedure

Perform adjustments only in the sequence listed.

1. Make sure the LO BAT indicator is off. Replace battery if necessary.
2. Remove the top covers and lay in its side, leaving connections to the circuit board. Circuit boards should remain in the housing for calibration adjustments.
3. ZERO the meter.
4. Connect the 1000 pF (up to 1900 pF) precision capacitor and adjust R30 so the meter reads the exact value of the precision capacitor.
5. Connect the 1000 nF (up to 1900 nF) precision capacitor and adjust R23 so the meter reads the exact value of the precision capacitor.
6. Connect the 1000 µF (up to 1900 µF) precision capacitor and adjust R16 so the meter reads the exact value of the precision capacitor.
7. Connect the 100 mF (up to 190 mF) precision capacitor and adjust R9 so the meter reads the exact value of the precision capacitor.

BASIC TROUBLESHOOTING HINTS

Blown Fuse

If the front panel fuse is blown the meter will read a few pF for all value capacitors (will not uprange). In the HOLD mode, it will read zero or the last reading displayed.

Battery Inserted Backwards

The circuit is protected against short term reverse battery connections.

All Display Segments Lighted

If all segments including the LO BAT, "±", and decimal points come on, turn the unit off immediately. Otherwise, the LCD display will be *permanently* damaged. The BP signal is probably abnormal.

ADDITIONAL CAPACITANCE MEASUREMENT INFORMATION

Some class 2 monolithic ceramic capacitors with a "high K' (dielectric constant) have electrical properties that vary widely with applied AC and DC voltage, temperature, and frequency. Dielectric absorption is so high in some "high K" capacitors at the voltage and frequency applied by the capacitance meter that a large leakage current is present; reading may be 25% to 50% higher than that measured with a bridge type measurement system with an applied voltage of 0.5 or 1 Vrms at 1 kHz.

USEFUL CONVERSIONS

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

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