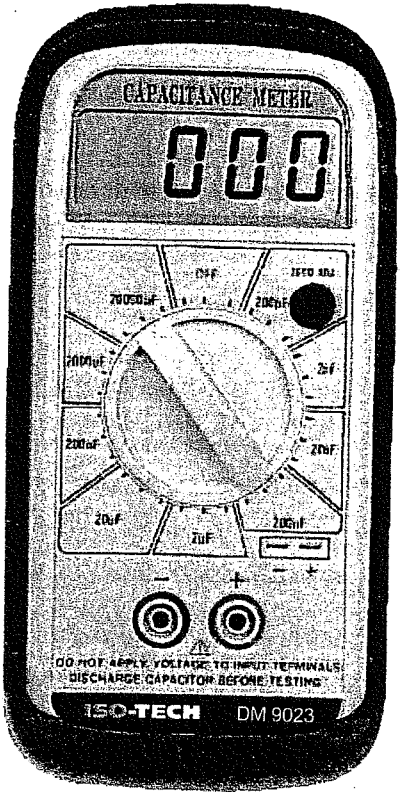
ISO-TECH

Instruction Manual

Capacitance Meter

DM 9023

EN



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1. GENERAL

1–1 Introduction

This Digital Capacitance Meter give a direct reading of capacitance on a 3 1/2 digits LCD display. Nine ranges give precision readings from 0.1 pF to 20,000 uF, which includes virtually all capacitors used 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, switch or PCB LAYOUT capacitance. Its battery operation, light weight, and small size make it a truly portable instrument.

1–2 Features

* Large LCD display, clear read–out even in bright conditions.
* Low power consumption..
* High accuracy in measuring
* LSI–circuit use provides high reliability and durability.
* Uses rotary ranges switch for easy operation.
* Low battery voltage indicator.
* Fast sampling rate.

2. SPECIFICATIONS

2–1 General Specifications

Display	18 mm (0.7") LCD (Liquid Crystal Display), Max. indication 1999.
Range	9 Ranges with full scale values from 200 pF to 20,000 uF..

Overload Indication	Indication of " 1"
Zero adjust:	Front panel Adjustment control. This is limited to approx. 20 pF.
Out–of–Range indication	Indication of " 1" .
Sampling rate	0.5 second .
Operating Temperature	0 °C to 50 °C (32 °F to 122 °F).
Operating Humidity	Less than 80% RH.
Power Supply	DC 9V battery.
Battery Life	Approximately 200 hours on alkaline or 100 hours on carbon zinc battery with normal usage. (Typical consumption current 3 to 4 mA on 200 pF to 200 uF range).
Dimension	185 x 87 x 39 mm (7.3 x 3.4 x 1.5 inch).
Weight:	290 g/0.64 LB (including battery).
Standard Accessories	Test alligator clips (red & black)……1 Pair. Spare Fuse (0.2A) ……1 PC. Instruction Manual……1 PC. Battery……1 PC.

2-2 Electrical Specifications

Normal range	Max. In-range Display	Resolution	Test Frequency
200 pF	199.9 pF	0.1 pF	800 Hz
2 nF	1.999 nF	1 pF	800 Hz
20 nF	19.99 nF	10 pF	800 Hz
200 nF	199.9 nF	100 pF	800 Hz
2 uF	1.999 uF	1000 pF	800 Hz
20 uF	19.99 uF	0.01 uF	80 Hz
200 uF	199.9 uF	0.1 uF	8 Hz
2,000 uF	1,999 uF	1 uF	8 Hz
20,000 uF	19,990 uF	10 uF	8 Hz

pF = picofarad (10^{-12})
nF = nanofarad (10^{-9})
uF = microfarad (10^{-6})

Accuracy (23 ± 5 °C)	* 1 % of full scale ± 1 d on 200 pF to 2000 uF ranges. * 2 % of full scale ± 2 d on 20,000 uF ranges.
Excitation Voltage	2.8 volts peak, maximum. POSITIVE input terminal's voltage is always higher than NEGATIVE terminal.
Protection	The Meter is protected against damage from charged capacitors (more than DC 50 volt) by the fuse (0.2A).

3. FRONT PANEL DESCRIPTION

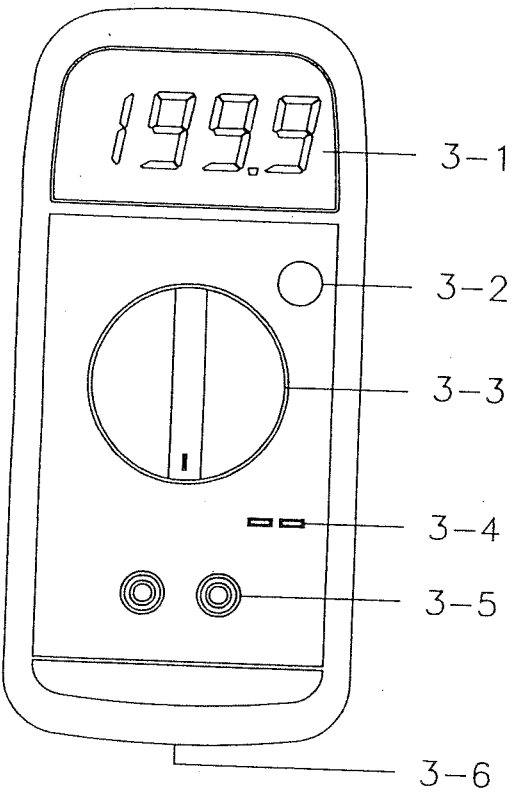

Fig. 1

3–1 Display	3 1/2 digits, decimal points "BAT" are displayed on LCD panel.
3–2 Zero Adjust Knob	Adjustment of the zero values are limited within approx. ± 20 pF.
3–3 Range/ Power off switch	The rotary switch is used to select the measuring ranges & shut power off for the meter. The range scale values are expressed as 1 count more than the maximum value of capacitance. Although the maximum display is 1999 counts in each case.
3–4 Measuring terminal 1	Direct measuring input socket for the tested capacitor.
3–5 Measuring terminal 2	Standard banana jack input connectors. Polarized for use with polarized capacitors.
3–6 Battery compartment/Cover	

4. OPERATING INSTRUCTION

4–1 Caution before measurement

1) Ensure Battery is correctly installed in the battery compartment.
2) Observe polarity when connecting polarized capacitors.
3) Fully discharge all capacitors, prior to measuring .
4) Never apply voltage to the test jacks, serious damage to the instrument may result.
5) Do not short circuit the test leads, as this will show an over range indication on all ranges, due to excessive drain on the battery.

4−2 Method of measurement

1) Select the range switch for the maximum expected capacitance.
2) Check the zero display: If your test range is 200 pF, 2 nF, 20 nF, Before connecting the capacitor under test (but after inserting any test leads or test fixtures).
3) Rotate the front−panel adjust knob for a zero display. This " ZERO ADJUSTMENT " is limited to approx. ± 20 pF.
4) Connect the capacitor under test to the "measuring terminal 1 or 2".
5) Read the display. The value is a direct reading in the electrical units (pF, nF, uF) indicated a the selected range switch. If DISPLAY indicates "1". This is an Out−of−Range measurement. If the display indicates one or more leading errors shift to the next lower range scale to improve the resolution of the measurement.

4−3 Consideration

1) If the capacitance value is unmarked, start with the 200 pF range and keep increasing until the over−range indication goes off and a reading is obtained.
2) A shorted capacitor will read over−range on all ranges. A shorted capacitor with low voltage leakage will read over−range, or a much higher value than normal. An open capacitor will read zero on all ranges (possibly a few pF on the 200 pF range).
3) Measurement of very low capacitance should be performed using extremely short leads in order to avoid introducing any stray capacitance.
4) When using the optional test leads, remember that the leads introduce a measurable capacitance to the measurement.

As a first approximation, the test lead capacitance may be measured by opening the leads at the tips, recording the open circuit value and subtracting that value (if the value is negative than adding) from the display results, However, in order for this correction to be valid, the succeeding capacitor measurement must be made with all other measurement conditions exactly the same.

5) Capacitors, especially electrolytic, often have notoriously wide tolerances. Do not be surprised if the measured value is greater than the value marked on the capacitor, unless it is a close tolerance type. However, values are seldom drastically below the rated value.
6) The existence of a leaky capacitance may be detected if the value changes significantly as the scales are changed. The effect of the internal leaky resistance is minimized on the lower range scales.

5. MAINTENANCE

5-1 Replacement of Battery

1) When the left corner of LCD display show "BAT" It is necessary to replace the battery.
2) Slide the " Battery Cover " (3-6, Fig 1), away from the instrument and remove the battery.
3) Replace with a 9V battery and reinstall the cover.

5-2 Replacement of Fuse

1) This instrument is provided with a 0.2A fuse (5 mm dia. x 20 mm) to protect against charged capacitor (more than 50 Volt) being connect to the test input terminal.
2) To replace the fuse, slide the " Battery Cover " (3-6, Fig. 1), the fuse is located near the right side of the battery compartment.

6. SPECIAL TABLE

6–1 Useful conversions

Useful conversion

pF	nF	μF	FARAD
1,000	1.0	0.001	
10,000	10.0	0.01	
100,000	100.0	0.1	
1,000,000	1000.0	1.0	
	10,000	10.0	
	100,000	100.0	
	1,000,000	1000.0	0.001
		10,000	0.01

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

6-2 Typical Capacitor Characteristics

TYPE	VALUE	VOLTAGE	TEMPCO	DF	DA	LEAKAGE
Glass and Mica	0.5 pF - .01 uF	300 - 1 KV	± 140 + 25	.03 - 0.1%		10^11
Glass	10 pF - .01 uF	50 - 100	± 4500	1 - 3%		10^9
High K Glass	1 pF - .01 uF	100 - 2 KV	± 500 + 10	.05 - 0.2%	0.7%	10^9 - 10^11
Mica						
Ceramic						
COG	1 pF - 0.1 uF	50 - 600	0 ± 30	0.2%		10^6
COH	1 pF - .01 uF	50 - 600	0 ± 60	0.2%		10^8
COJ	1 pF - .01 uF	50 - 600	0 ± 120	0.2%		10^6
COK	1 pF - .01 uF	50 - 600	0 ± 250	0.2%		10^6
P3K	100 pF - .01 uF	50 - 600	-1500 ± 250	0.2%		10^6
S2L	3 - 200 pF	1 KV - 6 KV	-330 ± 500	0.6%		10^7
S3N	3 - 200 pF	1 KV - 6 KV	-3300 ± 2500	0.6%		10^7
U2J	1 pF - .01 uF	50 - 600	-1500 ± 250	0.2%		10^8
X5F	100 pF - .01 uF	50 - 600	-500 ± 2500	2%		10^4 - 10^10
X5U	100 pF - .01 uF	50 - 6 KV	± 2000	2%		10^4 - 10^10
X7R	10 pF - 2.2 uF	50 - 100	+1000 ± 3000	2.5%		10^8 - 10^9
Y5F	0.01 - 2.2 uF	3 - 50	± 2500	2-10%		10^5 - 10^8
Y5R	0.01 - 2.2 uF	3 - 50	± 3000	2-10%		10^5 - 10^6
Y5T	0.01 - 2.2 uF	3 - 50	+ 1000 ± 4000	2-10%		10^5 - 10^8
Y5V	470 pF - 4.7 uF	50 - 100	± 20,000	2.5%		10^9
Z5F	100 pF - .01 uF	50 - 6 KV	± 2000	2%		10^4 - 10^10
Z5P	0.001 - 0.1 uF	50 - 6 KV	+ 2500 ± 2500	2%		10^4 - 10^10
Z5R	0.005 - 0.1 uF	50 - 6 KV	+ 2500 ± 2500	2%		10^4 - 10^10
Z5U	0.001 - 4.7 uF	50 - 6 KV	± 10,000	2%		10^4 - 10^10
Z5V	0.001 - 0.1 uF	50 - 600	± 10,000	2%		10^4 - 10^10
Paper and Plastic						
Mylar	.001 - 10 uF	50 - 1600	+ 400 ± 200	0.5 - 1%	0.5%	10^9 - 10^11
Paper	.0005 - 100 uF	200 - 15 KV	0 ± 500	0.2 - 1%	2%	10^9 - 10^10
Parylene	.001 - 1 uF	30 100	0 ± 50 - 200	0.1 - 0.3%	0.1 - 1%	10^10 - 10^12
Polycarbonite	.001 - 25 uF	50 - 400	0 ± 100	0.1 - 0.5%	0.2%	10^10 - 10^11
Polystyrene	20 pF - 30 uF	30 - 600	-120 ± 30	0.01 - 0.1%	0.02%	10^11 - 10^12
Teflon	.001 - 1 uF	50 - 600	-200	0.1 - 0.2%	0.2%	10^11 - 10^12
Electrolytic						
Aluminum Foil	0.5 uF - 1 F	3 - 500	+ 10,000	3-50%	10%	0.1 - 10 uA
Tantalum Foil	0.1 - 10,000 uF	3 - 500	+ 2500	10-20%		0.1 - 1 uA
Solid Tantalum	1 - 1000 uF	3 - 125	+ 1000	1-12%	2%	0.1 - 10 uA

Remark :

TEMPCO = Temperature coefficient in ppm per ℃.

DF = Dissipation factor @1 KHz, except electrolytics @120 Hz, Mica @ 1 MHz

DA = Dielectric absorption.

LEAJAGE = ohms x uF, except electrolytics = uA per uFV.

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