BECKMAN

CIRCUITMATE™
Autoranging Digital Multimeters
MODEL DM73 and MODEL DM77

Operator's Manual

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Autoranging Digital Multimeters
Operator's Manual
for the
MODEL DM73 and MODEL DM77

BECKMAN ELECTRONICS TECHNOLOGIES • BREA, CALIFORNIA 92621

Beckman Instruments, Inc. Fullerton, CA 92634
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WARRANTY

NINETY-DAY LIMITED WARRANTY

Circuitmate™ Digital Multimeters are warranted in entirety against any defects of material or workmanship which develop for any reason whatsoever, except abuse, within a period of 90 days following the date of purchase of the multimeter by the original purchaser. This warranty is extended by Beckman Instruments, Inc. (Beckman), only to the original purchaser or original user of the multimeter, who must, as a CONDITION PRECEDENT TO WARRANTY COVERAGE AND PERFORMANCE THEREUNDER BY BECKMAN, complete and return the Warranty Registration Card, received on purchase of the multimeter.

In the event a defect develops during the warranty period, Beckman will, at Beckman's election, repair or replace the multimeter with a new or reconditioned model of equivalent quality. In order to obtain performance of any obligation of Beckman under the warranty, the original purchaser or original user must return the defective multimeter, postage prepaid, along with a handling charge of $3.00* to:

Beckman Instruments, Inc.
630 Puente Street
Brea, CA 92621
Attention: Customer Service

or to any other Beckman Service Center.

In the event of replacement with a new or reconditioned model, the replacement unit will continue the warranty period of the original multimeter. Replacement units will be returned by air, typically with only two (2) working days' turnaround at the Service Center.

ANY IMPLIED WARRANTIES ARISING OUT OF THE SALE OF A CIRCUITMATE MULTIMETER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE ABOVE-STATED 90-DAY PERIOD. BECKMAN SHALL NOT BE LIABLE FOR LOSS OF USE OF THE MULTIMETER OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, OR ECONOMIC LOSS, OR FOR ANY CLAIM OR CLAIMS FOR SUCH DAMAGE, EXPENSES, OR ECONOMIC LOSS.

Some states do not allow limitations on how long implied warranties last or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

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

BECKMAN INSTRUMENTS, INC.
Fullerton, California

*Prices are subject to change without notice.

CONTENTS

The Circuitmate™ Model DM73 and Model DM77 are completely portable, 3½-digit multimeters with an autoranging feature for fast and easy operation. These multimeters are designed for use by technicians, servicemen, and hobbyists who expect accuracy, reliability, and easy operation. The models are equipped with either four functions (Model DM73) or seven functions (Model DM77), with autoranging and an easy-to-use rotary selector switch (Model DM77).

These multimeters include all of the following features as standard:

1. 3½-digit LCD display
2. Autoranging
3. Overload Protection
4. DC Volts
5. AC Volts
6. Resistance
7. Dual Voltage Resistance (Model DM77)
8. DC Amps (Model DM77)
9. AC Amps (Model DM77)
10. 10 Amps AC and DC (Model DM77)
11. Continuity Beeper
12. Display Hold (Model DM73)
13. Low Battery Voltage Indicator
14. Single Function Selector Switch.

In addition, the Circuitmate Model DM73 is designed in an ultra-compact, pen-style case for convenient carrying and use.

EASE OF USE

A single switch selects the function, and the autoranging feature will automatically adjust the display to the proper range. The liquid crystal display is easy-to-read, both indoors and outdoors, even in direct sunlight. The touch hold feature (Model DM73) makes reading the display easy and convenient.

OVERLOAD PROTECTION
All inputs are protected against overload conditions up to the maximum rating shown in the specifications.

IN-CIRCUIT RESISTANCE MEASUREMENTS
Each Circuitmate model offers low voltage resistance measurements for accurate in-circuit resistance measurements. Test voltages are less than 0.45V (Model DM73) or 0.4V (Model DM77).

AUDIBLE CONTINUITY BEEPER
Continuity checks are easy with the audible beeper feature.

BATTERY LIFE
The standard batteries provide up to 100 hours (Model DM73) or 300 hours (Model DM77) of continuous operation.

LOW BATTERY INDICATOR
The digital display indicates "BATT" to warn the user to replace the batteries.

COMPLETE AND READY TO USE
Multimeters are shipped with battery and fuse installed. Remove the multimeter from the box and it is ready to use. Also included with each multimeter is a spare fuse (Model DM77), probe set, and a complete operator's manual.

This section contains paragraphs that describe the following: unpacking and inspection, installation, controls, indicators, connectors, and initial checkout procedure.

2.1 UNPACKING AND INSPECTION

Remove the multimeter from the shipping container. The box should contain the following items:

1. Multimeter
2. Probe set
3. Operator's manual
4. Batteries (installed)
5. Model DM77 also includes two fuses (one installed and one spare inside the case).

Account for and inspect all of the above items. If any of the items are damaged or are missing, immediately return the complete package to the place of purchase for an exchange.

NOTICE

Retain the shipping container for use if the multimeter must be returned for exchange or repair.

2.2 MULTIMETER FAMILIARIZATION

This section is designed to familiarize the user with the controls, indicators, connectors, and other features of the multimeter. It is HIGHLY RECOMMENDED that the user become familiar with the controls, indicators, and connectors shown and described in Figure 1, Figure 2, and Figure 3 before operating the multimeter.

1. *Digital Display*
   A 3½-digit display (maximum reading 1999) with automatic decimal point placement, automatic polarity indication, over-range indication, and low-battery indication.
2. *Power Switch*

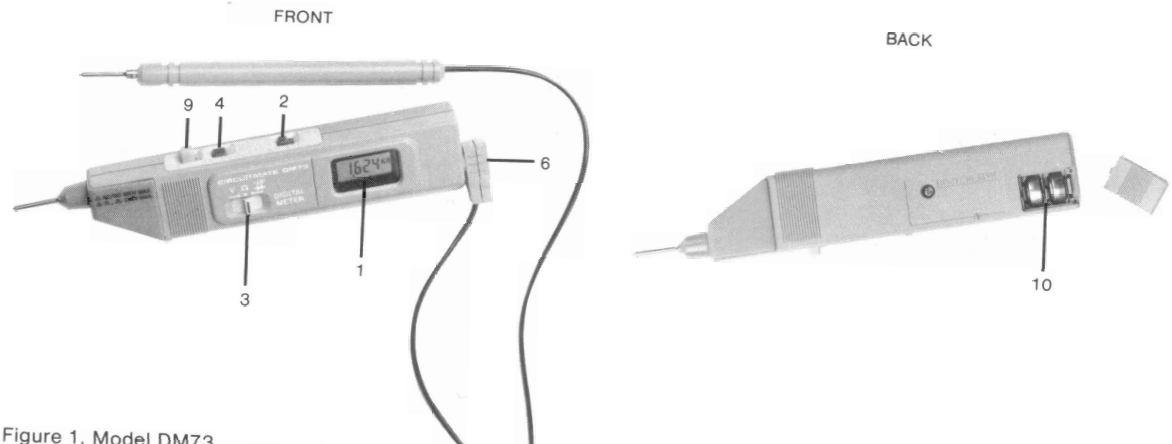

Figure 1. Model DM73

FRONT

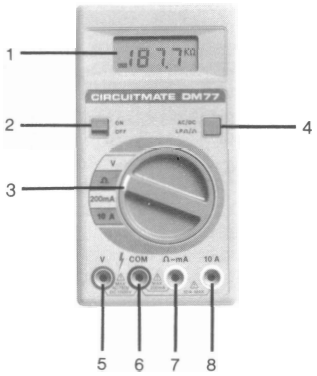

Figure 2. Model DM77

BACK

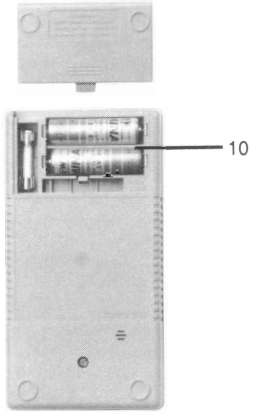

Figure 3. Model DM77

3. *Function Selector Switch*
   A three-position switch (Model DM73) or a single rotary switch (Model DM77) selects the function. The auto-ranging feature automatically adjusts the meter to the proper range for the display. Model DM73 may be set for volts, ohms, or continuity. The Model DM77 may be set for volts, ohms,and two current ranges. The selected function is indicated in the LCD display.
4. *Mode Switch*
   The mode switch is used to select AC or DC mode as well as low or high-voltage mode for resistance tests on the Model DM77. The mode is indicated on the LCD display by showing "AC" or "LPΩ." In the DC mode and the high-voltage mode (Model DM77), the display remains blank.
5. *V Input Connector (Model DM77)*
   Banana jack connector used as the high input for all voltage measurements.
6. *COM Input Connector*
   Banana jack connector used as the common or low input for all measurements.
7. *ΩmA Input Connector (Model DM77)*
   Banana jack connector used for all resistance measurements and 200mA current range measurements.
8. *10A Input Connector (Model DM77)*
   Banana jack connector used for continuous current measurements from zero to ten amperes. Inputs beyond this maximum may cause damage to the multimeter.
9. *Display Hold Button (Model DM73)*
   Depress the Display Hold button to freeze the data shown by the display. Press again to release the display for further measurements. A "DH" is shown in the display when the Display Hold feature is activated.
10. *Battery Compartment*
    Model DM73 uses two 1.5V button batteries, type SR-44 or LR-44. Model DM77 uses two 1.5V batteries, type AA.

2.3 INITIAL CHECKOUT

Before placing the multimeter into use, a simple checkout procedure will ensure that it is working properly. The only equipment required is the test leads.

2.3.1 MODEL DM73

1. Be certain that the batteries are properly installed (see Paragraph 5.2.2).
2. Insert the test lead into the common terminal on the end of the meter.
3. Set the power switch to the "ON" position.
4. Set the function switch to the "V" position.
5. Press the mode switch to select the DC mode. DC is the default mode and, therefore, shows no indicator in the display.
6. Touch the test lead and the meter probe together. The display will indicate zero ±2 digits.
7. With the probes still touching, depress the Display Hold button. The display will freeze, and the "DH" should be showing. Depress the Data Hold button again to release the display.
8. Press the mode switch to select AC. The display will indicate "AC."
9. Touch the test lead and the meter probe together. The display will indicate zero ±2 digits.
10. Set the function switch to the "Ω" position. The display will indicate "1000" with the number "1" blinking.
11. Touch the test lead and the meter probe together. The display will indicate zero ±2 digits.
12. Set the function switch to the "  " position. The meter will beep when the test lead and the meter probe are touched together.

2.3.2 MODEL DM77

1. Be certain that the batteries and fuse are properly installed (see Paragraphs 5.2.2 and 5.2.3).
2. Insert the black test lead into the COM input connector and the red test lead into the V input connector.
3. Set the power switch to the "ON" position.
4. Set the function switch to the "V" position.
5. Press the mode switch to select the DC mode. DC is the default mode and, therefore, shows no indicator in the display.
6. Touch the red and black test leads together. The display will indicate zero ±2 digits.

7. Press the mode switch to select the AC mode. The display will indicate "AC."
8. Touch the red and black test leads together. The display will indicate zero ±2 digits.
9. Insert the red test lead into the ΩmA input connector.
10. Set the function switch to the "Ω" position. The display will indicate "1000" with the number 1 blinking.
11. Touch the red and black test leads together. The display will indicate zero ±2 digits.
12. Press the mode switch to select low voltage resistance. The "LPΩ" indicator will appear in the display.
13. Set the function switch to the 200mA position. The display will indicate zero ±2 digits.
14. Set the function switch to the 10A position. The display will indicate zero ±2 digits.
15. The decimal position in the display is selected automatically and may be checked as follows:

FUNCTION	MODE	TEST LEADS	DISPLAY
V	DC	Shorted	00.0±2D
V	AC	Shorted	.000±2D
Ω	Ω	Shorted	00.0±2D
Ω	LPΩ	Shorted	.000±2D
200mA	DC and AC	— —	00.0±2D
10A	DC and AC	— —	0.00±2D

16. The meter will beep in the following situations: continuity, overload warning (for 200mA function only), when operating the function switch and the mode switch, and when the decimal point automatically changes up in the volt function.

This section of the manual describes the various operating modes of the multimeter, as well as a summary of warnings and precautions.

3.1 WARNINGS AND PRECAUTIONS

The following warnings and precautions are intended to protect the user from injury and the multimeter from damage.

3.1.1 WARNINGS

1. Users should not attempt to measure voltages or currents that may exceed the ratings of the meters.
2. Use extreme caution when working near high-voltage sources. This includes any voltage measurements requiring the use of the two highest VAC or VDC ranges.
3. To avoid electrical shock hazard and/or damage to the multimeter, do not measure voltages that might exceed the maximum voltages rating above earth ground.
4. Before each use of the multimeter, inspect test leads, connectors, and probes for cracks, breaks, or crazes in the insulation. If any defects are found, replace the item immediately.
5. To avoid electrical shock hazard, do not touch test leads, tips, or the circuit being tested while power is applied to the circuit.

3.1.2 PRECAUTIONS

1. Exceeding the maximum input overload limits can damage the multimeter.
2. When making current measurements, make sure that the multimeter is connected in series with the load in which the current is to be measured. NEVER connect the multimeter ACROSS a voltage source. To do so can result in either blowing the overload protection fuse or damaging the device being tested.

3.2 OVERRANGE INDICATION

The Series 70 Multimeters are equipped with automatic overrange indication. This indication, in the form of a flashing "1" or "– 1", will appear in the display whenever resistance measurements exceed 2 MΩ (DM73 and DM77)

or current measurements on the 200 mA scale exceed 200 mA (DM77).

3.3 VOLTAGE MEASUREMENTS

3.3.1 DC VOLTAGE

1. Connect the red test lead to V input connector (Model DM77). Connect the black test lead to COM input connector.
2. Set function switch to the "V" position.
3. Press the mode switch to select the DC mode. The DC mode is the default mode and therefore there is no indicator in the display.
4. Turn off power to device or circuit being tested and discharge all capacitors.

WARNING

To avoid electrical shock hazard and/or damage to the multimeter, do not attempt to measure voltages that might exceed the maximum voltage rating (DM77, 1000VDC and DM73, 500VDC).

5. Connect the test leads to device or circuit being measured.
6. Turn on power to device or circuit being measured. Voltage value will appear on digital display along with the voltage polarity.
7. Turn off power to device or circuit being tested and discharge all capacitors before disconnecting test leads from device or circuit being tested.

3.3.2 AC VOLTAGE

1. Connect the red test lead to "V" input connector (Model DM77). Connect the black test lead to COM input connector.
2. Set function switch to the "V" position.
3. Press the mode switch to select the AC mode. The AC indicator will show in the display.

4. Turn off power to device or circuit being tested and discharge all capacitors.

WARNING

To avoid electrical shock hazard and/or damage to the multimeter, do not attempt to measure voltage that might exceed the maximum voltage rating (DM77, 600VAC and DM73, 500VAC).

5. Connect test leads to device or circuit being measured.
6. Turn on power to device or circuit being measured. Voltage value will appear on digital display.
7. Turn off power to device or circuit being tested and discharge all capacitors before disconnecting test leads from device or circuit being tested.

3.4 CURRENT MEASUREMENTS (Model DM77)

3.4.1 DC CURRENT

1. Connect the red test lead to the ΩmA input connector for current measurements up to 200mA. For current measurements up to ten amperes, connect red test lead to the 10A input connector. Connect black test lead to COM input connector.
2. Set function switch to the 200mA or 10A position. If the magnitude of current is not known, set switch to highest range and reduce setting until satisfactory reading is obtained. When the 10A input connector is used, the function switch should be placed in the 10A position.
3. Press the mode switch to select the DC mode. The DC mode is the default mode and therefore there is no indicator in the display.
4. Turn off power to device or circuit being tested and discharge all capacitors.
5. Open circuit in which current is to be measured. Securely connect test leads in series with the load in which current is to be measured.
6. Turn on power to circuit being tested.

7. Read current value on digital display.
8. Turn off all power to circuit being tested and discharge all capacitors.
9. Disconnect test leads from circuit and reconnect circuit that was being tested.

3.4.2 AC CURRENT

1. Connect red test lead to ΩmA input connector for measurements up to 200mA. For current measurements up to ten amperes, connect red test lead to 10A input connector. Connect black test lead to COM input connector.

NOTE

When using the 10A input connector for current measurements, the test lead jack must be fully depressed into the input connector.

2. Set function switch to desired 200mA or 10A position. If the magnitude of current is not known, set switch to highest range and reduce setting until satisfactory reading is obtained. When the 10A input connector is used, the function switch should be placed in the 10A position.
3. Press the mode switch to select the AC mode. The AC indicator will show in the display.
4. Turn off power to device or circuit being tested and discharge all capacitors.
5. Open circuit in which current is to be measured. Securely connect test leads in series with the load in which the current is to be measured.
6. Turn on power to circuit being tested.
7. Read current value on digital display.
8. Turn off all power to circuit being tested and discharge all capacitors.
9. Disconnect test leads from circuit and reconnect circuit that was being tested.

3.5 RESISTANCE MEASUREMENTS

1. Connect red test lead to ΩmA input connector (Model DM77). Connect black test lead to COM input connector.
2. Set function switch to the ohm position.
3. Select either low or high voltage resistance by pressing the mode switch (Model DM77). The low voltage mode indicates "LPΩ" in the display.
4. The display will read 1000KΩ and the 1 will be blinking.
5. If the resistance being measured is connected to a circuit, turn off power to circuit being tested and discharge all capacitors.
6. Connect test leads to circuit being measured. When measuring high resistance be careful not to contact adjacent points, even if insulated. Some insulators have a relatively low insulation resistance, which can cause the measured resistance to be lower than the presumed resistance.
7. Read resistance value on digital display. If a high resistance value is shunted by a large value of capacitance, allow the digital display to stabilize.

3.6 CONTINUITY CHECKS

Both Circuitmate Models DM73 and DM77 have a continuity beeper feature. This feature is particularly useful to circuit and cable tracing.

3.6.1 CONTINUITY CHECKS

1. Place the function switch in the "  " position (Model DM73) or the Ω position (Model DM77).
2. Connect the red test lead to the ΩmA input connector (Model DM77). Connect the black test lead to the COM input connector. With the test leads separated or measuring out-of-range resistance, the Model DM77 will display the blinking 1 overload indicator.
3. Place one test lead probe at one end of cable or circuit to be tested. Use the other test lead to trace the circuit or cable until the circuit is complete. When continuity is established the meter will beep.

3.7 DISPLAY HOLD (Model DM73)

The display reading may be "frozen" for easy reading by depressing the Display Hold button. Pressing a second time releases the display.

Specifications are subject to change without notice.

4.1 GENERAL SPECIFICATIONS

OPERATING TEMPERATURE RANGE
0°C to +40°C

STORAGE TEMPERATURE RANGE
−20°C to +60°C with battery removed

DISPLAY
3½-digit liquid crystal display (LCD) with a maximum reading of 1999

POWER
DM73 – Two 1.5-volt, button batteries, Type LR-44 or SR-44
DM77 – Two standard 1.5-volt, AA batteries

BATTERY LIFE (Typical)
DM73 – 100 hours (with SR-44 batteries)
DM77 – 300 hours

MEASUREMENT RATE
Two measurements per second

DIMENSIONS
DM73 – 5.25 inches (13.3 cm) long x 0.90 inches (2.3 cm) wide x 0.63 inches (1.6 cm) high
DM77 – 6.30 inches (16.0 cm) long x 3.35 inches (8.5 cm) wide x 1.5 inches (2.9 cm) high

WEIGHT (including batteries)
DM73 – 1.9 ounces (55 grams)
DM77 – 8.4 ounces (239 grams)

STANDARD ACCESSORIES
1. Batteries (installed)
2. Spare fuse (Model DM77)
3. Test lead set
4. Operator's manual

4.2 ELECTRICAL SPECIFICATIONS

Accuracy at 18°C to 28°C, 80% maximum relative humidity.

4.2.1 DC VOLTS

	DM73		DM77	
	RANGE	ACCURACY	RANGE	ACCURACY
	2.000V	±0.5% reading + 4 digits	200.0mV	±0.5% reading + 4 digits
	20.00V	±0.7% reading + 4 digits	2.000V	±0.7% reading + 4 digits
	200.0V	±0.7% reading + 4 digits	20.00V	±0.7% reading + 4 digits
	500V	±1.0% reading + 4 digits	200.0V	±0.7% reading + 4 digits
			1000V	±1.0% reading + 4 digits
Input Impedance	12MΩ (2V range) 11MΩ (All other ranges)		>100MΩ (200mV range) 10.5MΩ (All other ranges)	
Overload Protection	700 VDC (60 seconds) or DC + AC peak maximum		1100 VDC (60 seconds) or DC + AC peak maximum	

4.2.2 AC VOLTS

	DM73		DM77	
	40Hz to 500Hz		40Hz to 500Hz	
	RANGE	ACCURACY	RANGE	ACCURACY
	2.000V	±1.0% reading + 8 digits	2.000V	±1.0% reading + 8 digits
	20.00V	±1.0% reading + 8 digits	20.00V	±1.0% reading + 8 digits
	200.0V	±1.0% reading + 8 digits	200.0V	±1.0% reading + 8 digits
	500V	±1.0% reading + 8 digits	600V	±1.2% reading + 8 digits
Input Impedance	12MΩ (2V range) 11MΩ (All other ranges)		10.5MΩ (All ranges)	
Overload Protection	700 VDC (60 seconds) or DC + AC peak maximum		1100 VDC (60 seconds) or DC + AC peak maximum	

4.2.3 RESISTANCE

	DM73			DM77		
	RANGE	OPEN CIRCUIT VOLTAGE	ACCURACY	RANGE	OPEN CIRCUIT VOLTAGE	ACCURACY
	2.000KΩ	<0.45V	±0.7% rdg + 4 digits	200.0Ω	1.5V ±0.2V	±0.8% rdg + 5 digits
	20.00KΩ	<0.45V	±0.7% rdg + 4 digits	2.000KΩ	0.65V±10%	±0.8% rdg + 5 digits
	200.0KΩ	<0.45V	±0.7% rdg + 4 digits	20.00KΩ	0.65V±10%	±0.8% rdg + 5 digits
	2MΩ	<0.45V	±1.2% rdg + 4 digits	200.0KΩ	0.65V±10%	±0.8% rdg + 5 digits
				2MΩ	0.65V±10%	±1.8% rdg + 10 digits
Overload Protection	250V AC or DC, maximum, one minute			250V AC or DC, maximum, 0.5A Fuse		

4.2.4 LOW VOLTAGE RESISTANCE (Model DM77 only)

DM77		
RANGE	OPEN CIRCUIT VOLTAGE	ACCURACY
2.000KΩ	<0.4V	±1.0% reading + 10 digits
20.00KΩ	<0.4V	±1.0% reading + 10 digits
200.0KΩ	<0.4V	±1.0% reading + 10 digits
2MΩ	<0.4V	±2.0% reading + 10 digits
Overload Protection: 250V AC or DC, maximum, 0.5A Fuse		

4.2.5 CURRENT (Model DM77 only)

	DC		AC (40Hz to 500Hz)	
	RANGE	ACCURACY	RANGE	ACCURACY
	200.0mA	±1.5% reading + 4 digits	200.0mA	±2.0% reading + 8 digits
	10.00A	±1.7% reading + 4 digits	10.0A	±2.2% reading + 8 digits
Overload Protection	0.5A/250V Fuse (200 mA range), 12A maximum, 60 seconds (10A range)		0.5A/250V Fuse (200 mA range), 12A maximum, 60 seconds (10A range)	

This section of the manual describes maintenance procedures, calibration, and troubleshooting. In addition, a general statement on service policy is included. Any questions regarding warranty repair or instrument servicing should be directed to Beckman Instruments, Inc., at (714) 993-8852.

5.1 WARRANTY STATEMENT

The warranty statement for the Circuitmate Multimeters appears on the inside front cover of this manual. Read it carefully before requesting warranty repairs.

5.1.1 CIRCUITMATE WARRANTY REPLACEMENT

Any multimeter claimed to be defective should be returned to Beckman Instruments, Inc., with a $3.00 handling fee from within the Continental U.S.A.; $12.00 from elsewhere.* Follow the shipping instructions of Paragraph 5.1.3.

Warranty replacement will be made typically within two working days after receipt of defective unit.

*Prices subject to change without notice.

5.1.2 NON-WARRANTY REPAIRS

Any out-of-warranty multimeter that is defective, but repairable may be returned to Beckman Instruments, Inc., for an estimate of the cost of repair. After subsequent receipt of a purchase order or cash for the estimated cost of repair, non-warranty repairs are typically made in two days. All non-warranty repairs carry a 90-day warranty. Contact any authorized Beckman Service Center or Beckman Instruments, Inc., for the current non-warranty rates.

5.1.3 SHIPPING INSTRUCTIONS

A multimeter returned for calibration or repair should be shipped with the following information or items: company name, customer's name, address, telephone number, proof of purchase (warranty repairs), a description of the problem encountered or service required, and the appropriate service charge.

Service charges should be remitted in either the form of a check, money order, or purchase order made payable to Beckman Instruments, Inc.

A multimeter should be shipped with transportation charges prepaid to the following address:

Beckman Instruments, Inc.
630 Puente Street
Brea, CA 92621
Attention: Customer Service

A multimeter will be returned to the customer with transportation charges paid by Beckman Instruments, Inc.

5.2 MAINTENANCE PROCEDURES

Regular operator maintenance of the multimeter consists of: cleaning case and window, battery replacement, and fuse replacement. All other repairs should be performed by the Beckman Service Center or other qualified instrument service personnel.

5.2.1 CLEANING CASE AND WINDOW

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These chemicals will react with plastics used in construction of the case.

The front panel case should be cleaned with a mild solution of detergent and water. Apply sparingly with a soft cloth and allow to dry completely before using.

5.2.2 BATTERY REPLACEMENT

WARNING

To prevent electrical shock hazard, turn off the multimeter and disconnect test leads before removing the back cover.

1. After disconnecting test leads and turning off the multimeter, open battery compartment by twisting a small screwdriver in the battery cover slot (Model DM73) or by pressing down on the cover and sliding in the direction of the window (Model DM77).

CAUTION

Failure to turn off the multimeter before installing the battery could result in damage to the battery if it is connected to the battery terminal incorrectly.

2. The batteries are located in the battery compartment shown in Figures 1 and 3. Remove batteries from multimeter and replace with a standard 1.5 volt size SR-44 or LR-44 button battery (Model DM73) or standard 1.5 volt size AA battery (Model DM77).
3. Replace the back cover.

5.2.3 FUSE REPLACEMENT (Model DM77)

WARNING

To prevent electrical shock hazard, turn off the multimeter and disconnect test leads before removing the back cover.

1. The fuse is located in the battery compartment. Remove old fuse and replace with spare fuse.

WARNING

To prevent fire, use 0.5A/250V fuse.

2. Replace the battery cover.

5.3 CALIBRATION

In order to maintain the specifications described in this manual, it is recommended that the multimeter be calibrated once each year and/or after it is repaired.

5.3.1 CALIBRATION OF MODEL DM73

1. Perform the calibration of an ambient temperature of 23 ±2°C and a relative humidity of 80% or less.
2. Remove test lead and probe. (Figure 4)
3. Remove the single screw on the side of the meter. (Figure 5)
4. Gently separate the two halves of the meter case.
5. Set the meter function to volts and the mode to DC.
6. With the DC calibrator at 1.7 volts DC, the meter should read between 1.699 and 1.701. Using a small flat-tipped screwdriver, adjust resistor TR (3.3KΩ) as shown in Figure 6 until the meter reads within the proper range.
7. Disconnect the DC calibrator from the multimeter.
8. Replace the cover and secure with the screw.

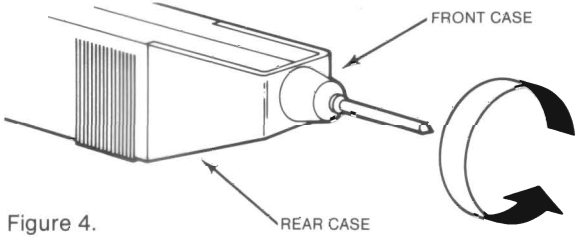

Figure 4.

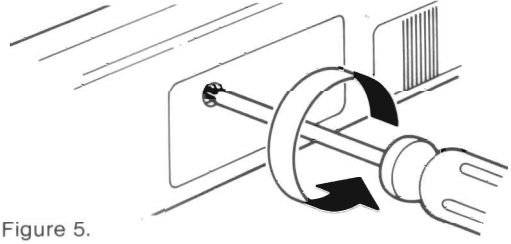

Figure 5.

5.3.2 CALIBRATION OF MODEL DM77

1. Perform the calibration at an ambient temperature of 23 ±2°C and a relative humidity of 80% or less.
2. Set the meter function switch to volts and the mode to DC.
3. Obtain access to interior of meter as follows:
   a. Remove the single screw in the back cover.
   b. Note setting of meter function switch.
   c. Using pliers with the jaws padded with a soft cloth, grasp the rib on the front face of the dial of the meter function switch. Pull outward, pulling the switch dial off the shaft.
   d. Remove battery cover and batteries.
   e. Remove front cover by pulling upward and outward to free it at the two top slots.
   f. Lift printed circuit assembly out gently, being careful not to break the continuity speaker wires.
4. With the DC calibrator at 170.0mV, the meter should read 170.0. Using a small flat-tipped screwdriver, adjust resistor TR3 (see Figure 8) as required.
5. With the DC calibrator at 1.700V, the meter should read between 1.699 and 1.701. Adjust resistor TR1 (see Figure 8) as required.
6. Set the meter mode to AC.
7. With the AC calibrator at 1.700V, the meter should read between 1.698 and 1.702. Adjust resistor TR2 (see Figure 8) as required.
8. Reassemble meter in reverse order. If beeper has inadvertently come loose, press it back into place. In pressing function switch dial onto shaft, make sure dial is set in same position as during its removal.

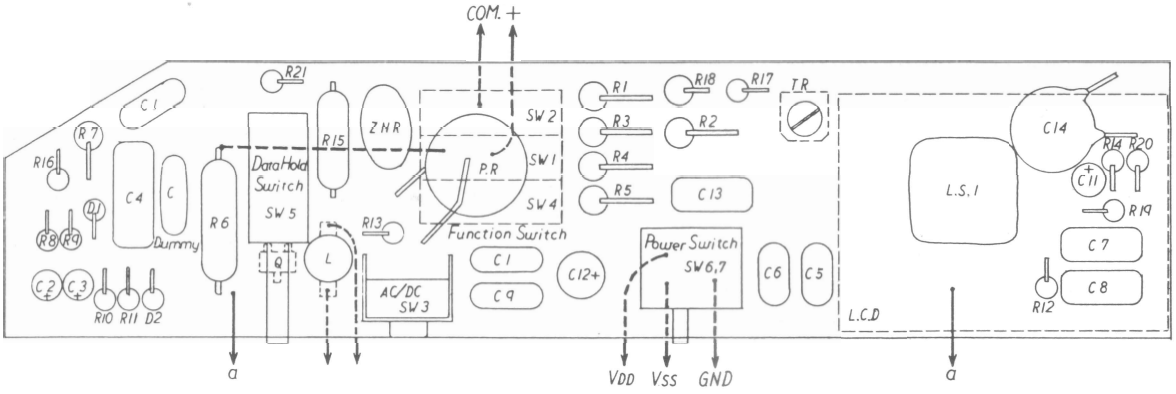

Figure 6. Components Locator for Model DM73

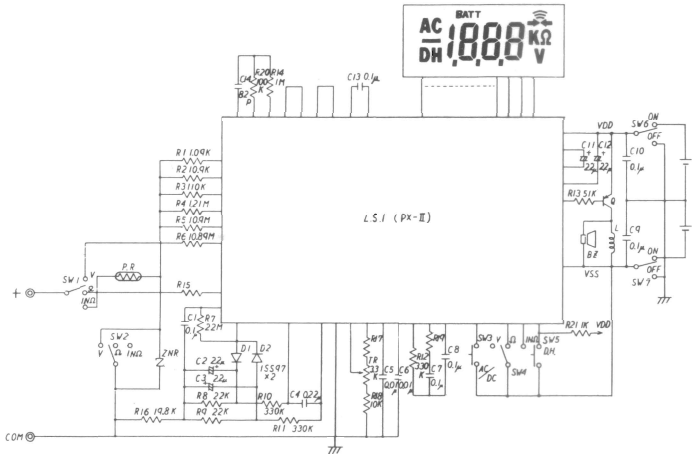

Figure 7. Schematic Wiring Diagram of Model DM73

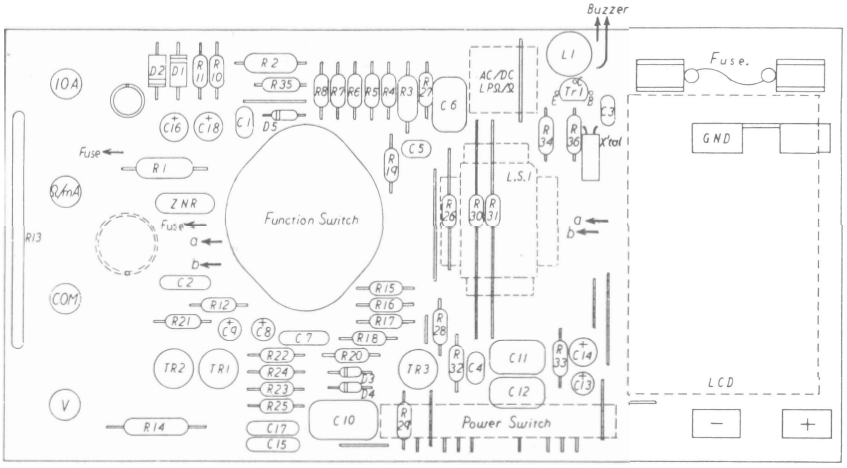

Figure 8. Parts Locator for Model DM77

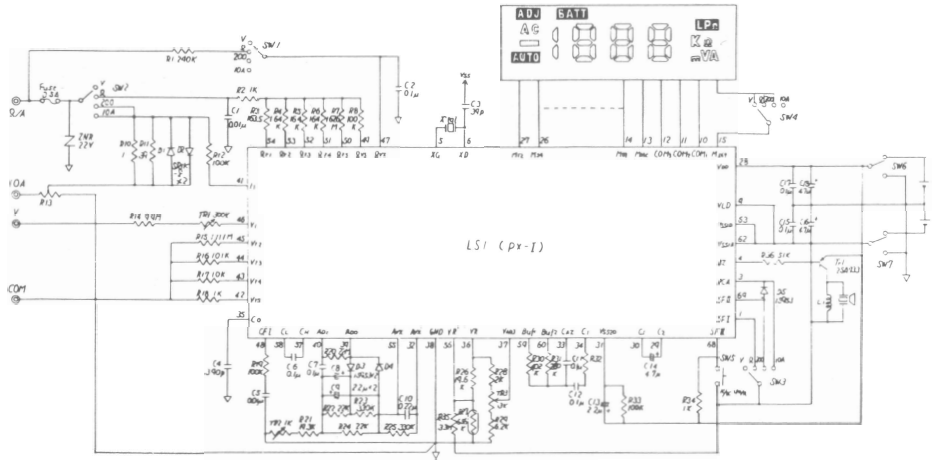

Figure 9. Schematic Wiring Diagram of Model DM77

5.4 MULTIMETER STORAGE

WARNING

If multimeter is to be stored at temperature above 122°F (50°C), remove the battery.

5.5 PARTS LIST FOR DM73

Part No.	Description
* 3003-000-100	Resistor, 22MΩ ¼W Carbon R7
* 3003-010-100	Resistor, 470-1KΩ ⅛W Carbon R19
* 3003-010-101	Resistor, 1KΩ ⅛W Carbon R21
3003-010-102	Resistor, 51KΩ ⅛W Carbon R13
3003-010-103	Resistor, 82-115KΩ ⅛W Carbon R20
* 3003-010-104	Resistor, 330KΩ ⅛W Carbon R10,R11
* 3003-010-105	Resistor, 1MΩ ⅛W Carbon R14
* 3003-050-200	Resistor, 0-1KΩ ⅛W Metal R17
3003-050-201	Resistor, 1.09KΩ ⅛W Metal R1
* 3003-050-202	Resistor, 5-10KΩ ⅛W Metal R18
3003-050-203	Resistor, 10.9KΩ ⅛W Metal R2
3003-050-204	Resistor, 19.6-20.0KΩ ⅛W Metal R16
* 3003-050-205	Resistor, 22KΩ ⅛W Metal R8,R9
* 3003-050-206	Resistor, 110KΩ ⅛W Metal R3
* 3003-050-207	Resistor, 240K, 270K, 300KΩ ½W Metal R15
* 3003-050-208	Resistor, 330KΩ ⅛W Metal R12
3003-050-209	Resistor, 1.21MΩ ⅛W Metal R4
3003-050-210	Resistor, 10.9MΩ ¼W Metal R5
3003-050-211	Resistor, 10.89MΩ ¼W Metal R6
3003-080-100	Varistor, ERZ-C05DK220 ZNR
3003-080-101	Thermistor, ERP-F4B-ON401A PR
* 3003-090-100	Resistor, Variable 3.3KΩ TR
3003-100-100	Capacitor, 82pF Ceramic C14
* 3003-100-101	Capacitor, 0.1μF Ceramic C1,C9,C10

*Part commonly available from local sources of electronic supplies, and *not* available from Beckman Instruments, Inc. Parts listed *without* asterisk notation (*) are available from Beckman's Customer Service Department.

Part No.	Description
*3003-130-200	Capacitor, 0.01μF Polyester C5,C6
*3003-130-201	Capacitor, 0.1μF Polyester C7,C8,C13
*3003-130-202	Capacitor, 0.22μF Polyester C4
*3003-150-300	Capacitor, 2.2μF Tantalum C2,C3,C12
*3003-160-400	Capacitor, 2.2μF Aluminum C11
3003-200-100	Diode, 1SS97 D1,D2
3003-250-100	Transistor 2SB709-RID Q
3003-270-100	C-MOS LSI PX-II
3003-350-100	Coil 25mH L
3003-360-100	Buzzer CB18AB-40 BZ
3003-370-100	Battery Contact (+, −) AD-1144-016-0
3003-370-101	Battery Contact (GND) AD-1144-017-0
3003-370-102	Test Probe AD-1144-018-0
3003-370-103	UL Jack (Upper) AD-1144-019-0
3003-370-104	UL Jack (Lower) AD-1144-020-0
3003-370-105	Input Jack AD-1140-008-0
3003-370-106	Rubber Connector
3003-390-100	LCD LD-B7079-A
3003-400-100	Switch, Slide SLJA-13P02 SW1,2,4
3003-400-101	Switch, Key KHH-15951 SW3
3003-400-102	Switch, Push ESB 6039 SW5
3003-400-103	Switch, Slide SSJ 322 SW6,7
3003-420-100	Front Case W/Side Protector AD-1144-001-0
3003-420-101	Rear Case W/Side Protector AD-1144-002-0
3003-420-102	Battery Cover AD-1144-003-0
3003-420-103	Switch Panel AD-1144-004-0
3003-420-104	Side Protector (Left) AD-1144-005-0

*Part commonly available from local sources of electronic supplies, and *not* available from Beckman Instruments, Inc. Parts listed *without* asterisk notation (*) are available from Beckman's Customer Service Department.

Continued

Part No.	Description
3003-420-105	Side Protector (Right) AD-1144-006-0
3003-420-106	Function Switch Knob AD-1144-009-0
3003-420-107	Power Switch Knob AD-1144-010-0
3003-420-108	AC/DC Switch Knob AD-1144-011-0
3003-420-109	D.H. Switch Knob AD-1144-012-0
3003-420-110	LCD Cover AD-1144-013-0
3003-420-111	LCD Frame AD-1144-021-0
3003-450-100	Test Prod (+) AD-1144-007-0
3003-450-101	Test Prod Stay (+) AD-1144-008-0
3003-450-102	Prod Stay AD-1144-014-0
3003-450-103	Input Jack Stay AD-1144-015-0
3003-450-104	Shielding Sheet Rear Case AD-1144-023-0
3003-450-105	Test Pin AD-1144-024-0
3003-450-106	Rubber Spacer
3003-450-107	Spring Metal Washer
* 3003-450-108	Screw M2.6 x 4
* 3003-450-109	Screw M2.6 x 12

5.6 PARTS LIST FOR DM77

Part No.	Description
* 3003-000-100	Resistor, 22MΩ ¼W Carbon R20
* 3003-000-101	Resistor, 220-680Ω ¼W Carbon R32
* 3003-000-102	Resistor, 1KΩ ¼W Carbon R34
3003-000-103	Resistor, 51KΩ ¼W Carbon R36
* 3003-000-104	Resistor, 100KΩ ¼W Carbon R8,12,19,33
* 3003-000-105	Resistor, 330KΩ ¼W Carbon R23,25
* 3003-000-106	Resistor, 3.3MΩ ¼W Carbon R35
* 3003-050-212	Resistor, 1Ω ¼W Metal R10
3003-050-213	Resistor, 39Ω ¼W Metal R11
3003-050-214	Resistor, 163.5Ω ½W Metal R3
* 3003-050-215	Resistor, 1KΩ ¼W Metal R18
* 3003-050-216	Resistor, 1KΩ 1W Metal R2
3003-050-217	Resistor, 1.64KΩ ¼W Metal R4

*Part commonly available from local sources of electronic supplies, and *not* available from Beckman Instruments, Inc. Parts listed *without* asterisk notation (*) are available from Beckman's Customer Service Department.

Part No.	Description
*3003-050-218	Resistor, 2KΩ ¼W Metal R28
*3003-050-219	Resistor, 6.2KΩ ¼W Metal R29
*3003-050-220	Resistor, 6.56KΩ ¼W Metal R27
*3003-050-221	Resistor, 10KΩ ¼W Metal R17
*3003-050-222	Resistor, 16.4K ¼W Metal R5
*3003-050-223	Resistor, 19.3K ¼W Metal R21
*3003-050-224	Resistor, 19.6K ¼W Metal R26
*3003-050-225	Resistor, 22K ¼W Metal R22-R24
*3003-050-226	Resistor, 101K ¼W Metal R16
*3003-050-227	Resistor, 164K ¼W Metal R6
*3003-050-228	Resistor, 240KΩ 1W Metal R1
*3003-050-229	Resistor, 280KΩ ¼W Metal R31
*3003-050-230	Resistor, 402KΩ ¼W Metal R30
3003-050-231	Resistor, 1.111MΩ ⅛W Metal R15
3003-050-232	Resistor, 1.626MΩ ¼W Metal R7
*3003-050-233	Resistor, 9.9MΩ ¼W Metal R14
*3003-050-234	Resistor, 12MΩ Approx R13
3003-080-102	Varistor ERZ-C10-DK220 ZNR

Part No.	Description
*3003-090-101	Resistor, Variable 1KΩ TR2
*3003-090-102	Resistor, Variable 3KΩ TR3
*3003-090-103	Resistor, Variable 500KΩ TR1
*3003-100-101	Capacitor, 0.1μF Ceramic C2,7,15,17
*3003-100-102	Capacitor, 0.01μF Ceramic C1
3003-100-103	Capacitor, 39pF Ceramic C3
*3003-100-104	Capacitor, 390pF Ceramic C4
*3003-130-200	Capacitor, 0.01μF Polyester C5
*3003-130-201	Capacitor, 0.1μF Polyester C6,11,12
*3003-130-202	Capacitor, 0.22μF Polyester C10
*3003-160-400	Capacitor, 2.2μF Aluminum C8,9,13
*3003-160-401	Capacitor, 4.7μF Aluminum C14,16,18

*Part commonly available from local sources of electronic supplies, and *not* available from Beckman Instruments, Inc. Parts listed *without* asterisk notation (*) are available from Beckman's Customer Service Department.

Continued

Part No.	Description
3003-200-101	Diode, 1S953 D3,4,5
3003-230-100	Diode, SR1K-8 D1,2
3003-250-101	Transistor 2SA733 Tr1
3003-270-101	C-MOS LSI PX-I
3003-350-101	Coil 22mH L1
3003-360-101	Crystal KF-38G X-TAL
3003-360-102	Buzzer CB20AA
3003-370-107	Input Jack 1,2,3,4
3003-370-108	Fuse Clip 1,2
3003-370-109	Shield Contact of Rear Case
3003-370-110	Shield Contact Spring of Front Case
3003-370-111	Battery Contact (+,−) AD-1145-010-0
3003-370-112	Battery Contact (COM)
3003-370-113	Rubber Connector
3003-370-114	Rubber Spacer

Part No.	Description
3003-390-101	LCD SK-B7009 E
3003-400-104	Fuse 0.5A used Arc-Quenching Filler
3003-400-105	Switch, Key KHC-10901
3003-400-106	Switch, Slide A004-C SW6,7
3003-400-107	Switch, Rotary MSG-44 SW1,2,3,4
3003-420-112	Key Switch Knob AD-1145-007-0
3003-420-113	LCD Cover AD-1145-008-0
3003-420-114	LCD Frame
3003-420-115	Battery Cover AD-1145-003-0
3003-450-110	Screw M3X15 (+)
3003-450-111	Shielding Sheet of Ft Case AD-1145-011-0
3003-450-112	Shielding Sheet of RR Case AD-1145-012-0
3003-570-100	Front Case Assembly DM77
3003-570-101	Rear Case Assembly DM77

This section provides a description of the accessories that are available from Beckman for the Circuitmate Model DM77.

6.1 AC CURRENT CLAMP (CT-231)

This accessory extends the AC current measurement capability to 150 amperes without breaking the circuit under test. The 1000:1 current transformation allows direct reading in amperes when used with the 200mA AC current range of the multimeter.

6.1.1 AC CURRENT CLAMP SPECIFICATIONS

RANGE
10 to 150A RMS AC

FREQUENCY RANGE
30Hz to 1kHz

ACCURACY
±3% (50Hz to 150Hz)
±4% (150Hz to 1000Hz)
±6% (30Hz to 50Hz)

DIVISION RATIO
1000:1

CIRCUIT-TO-GROUND VOLTAGE
1000V RMS maximum

MAXIMUM CONDUCTOR SIZE
0.5 inch (11.4mm)

6.1.2 OPERATION WITH 150A AC CURRENT CLAMP

The CT-231 AC Current Clamp is connected to the ΩmA and COM input connectors of the multimeter in place of the standard test leads. The jaws of the current clamp are placed around one of the current-carrying conductors. With the multimeter in the 200mA ACA position, current is read directly in amperes.

6.2 AC CURRENT CLAMP (CT-234)

This accessory extends the AC current measurement to 200 amperes. The clamp-on design permits AC current measurements without breaking the circuit under test.

6.2.1 AC CURRENT CLAMP SPECIFICATIONS

CURRENT RANGE
0A to 200A RMS

FREQUENCY RANGE
50Hz to 2000Hz

TEMPERATURE RANGE
15°C to 35°C

ACCURACY*

	RANGE	
	2 AMP	20 AMP AND 200 AMP
60Hz	±4%	±4%
60Hz to 1000Hz	±7%	±6%
1000Hz to 2000Hz	±8%	±7%

*Percentage of fullscale with conductor centered.
Add DMM AC volt accuracy.

TEMPERATURE INFLUENCE
2-ampere range: Less than ±3% of full range error between 15°C and 35°C. 20-ampere and 200-ampere ranges: Less than ±0.5% of full range error between 15°C and 35°C.

CIRCUIT-TO-GROUND VOLTAGE
600V RMS maximum

MAXIMUM CONDUCTOR SIZE
1.37 inches (35mm)

6.2.2 OPERATION WITH CT-234 CURRENT CLAMP

1. Connect the leads to the V and COM inputs of the multimeter.
2. Set the function switch to the "V" position, and set the mode switch to "AC."
3. Snap the jaws of the current clamp around one of the current-carrying conductors. Make sure that the jaws are tightly clamped.
4. Center the conductor between the two closed jaws.

NOTICE

If the jaws of the Model CT-234 AC current clamp are clamped around both conductors (as in a power cord), opposing magnetic fields will cancel each other and cause the current clamp to be ineffective.

5. Read the value indicated on the multimeter. The current in amperes is ten times this value.

6.3 TEMPERATURE/VOLTAGE CONVERTER (TC-253)

The TC-253 converts K-type thermocouple voltages for use with the Model DM77. It interfaces between the DMM and any K-type thermocouple, such as the Beckman Models TP-254 and TP-255, or any probe using a standard K-type miniature or subminiature connector. The display reads in degrees C or F, which is switch-selectable.

6.3.1 TEMPERATURE/VOLTAGE CONVERTER SPECIFICATIONS

ACCURACY:* 22°C ±3°C Ambient

TEMPERATURE RANGE		ACCURACY
°C	°F	
−50° to −10°	−58° to +14°	1.2% rdg. +2.5°C or 4.5°F
−10° to +200°	+14° to +392°	0.5% rdg. +1.5°C or 2.7°F
+200° to +500°	+392° to +932°	0.7% rdg. +1.5°C or 2.7°F
+500° to +900°	+932° to +1652°	1.4% rdg. +1.5°C or 2.7°F

*For total measurement accuracy, include error due to meter and thermocouple.

6.3.2 OPERATION WITH TC-253 TEMPERATURE/VOLTAGE CONVERTER

1. Plug TC-253 into V and COM inputs of multimeter.
2. Plug in Type-K thermocouple connector at input, switch to °C or °F.
3. Set the function switch to the "V" position, and set the mode switch to "DC."
4. Read the display in degrees.

BECKMAN

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