

**FLUKE®**  
**77,75,73,70**  
**23,21**  
*Series III Multimeters*

*Calibration Information*

 **Warning**

**These service instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing unless you are qualified to do so.**

***Introduction***

This document contains specifications, general maintenance information, and performance tests for the Fluke 70, 73, 75, 77, 21, and 23 Series III Multimeters (collectively called the Series III Meters).

***Specifications***

Accuracy is specified for a period of one year after calibration, at 18°C to 28°C (64°F to 82°F) with relative humidity to 90%. AC conversions are ac-coupled, average responding, and calibrated to the RMS value of a sine wave input. Refer to Table 1 for product specifications.

Accuracy specifications are given as:

$$\pm([\% \text{ of reading}] + [\text{number of least significant digits}])$$

**Table 1. Specifications**

Maximum Voltage Between any Terminal and Earth Ground:	Rated Voltage
Display	
Digital:	3,200 counts, updates 2.5/sec
Analog:	31 segments, updates 25/sec
Response Time of Digital Display:	
V ac:	< 2 s
V dc:	< 1 s
Ω:	< 1 s to 320 kΩ, < 2 s to 3.2 MΩ, < 10 s to 32 MΩ
Operating Temperature:	0°C to 50°C
Storage Temperature:	-40°C to 60°C
Temperature Coefficient:	0.1 x (specified accuracy)/°C (<18°C or >28°C)
Electromagnetic Compatibility in RF field of 3 V/m on all functions except MΩ	
77, 75, 23, 21:	Total accuracy = Specified accuracy
70:	Total accuracy = Specified accuracy plus +2.0%
73:	Total accuracy =+2.5%
MΩ accuracy:	
70:	Total accuracy = Specified accuracy plus +5.4%
73:	Total accuracy = +2.9%
77, 75, 23, 21:	MΩ is not specified
Relative Humidity except 32 MΩ Range:	0% to 90% (0°C to 35°C)
32 MΩ Range only:	0% to 70% (35°C to 50°C) 0% to 80% (0°C to 35°C) 0% to 70% (35°C to 50°C)
Altitude	
Operating:	2000 meters
Storage:	12,000 meters
Battery Type:	9 V, NEDA 1604 or 6F22 or 006P, or NEDA 1604A or 6LR61
Battery Life:	2000 hrs typical with alkaline 1600 hrs typical with carbon zinc
Continuity Beeper:	4096 Hz
Shock, Vibration:	per MIL-T-PRF 28800F Class III, Sinusoidal, Non Operating
Size (H x W x L)	
70/73:(without holster)	2.8 cm x 7.5 cm x 16.6 cm (1.12 in x 2.95 in x 6.55 in)
77/75/23/21:	3.7 cm x 8.9 - 7.8 cm x 19 cm (1.5 in x 3.5 - 3.1 in x 7.49 in)
Weight	
70/73:	340 g (12.0 oz)
77/75/23/21:	365 g (12.9 oz)
Safety	
70/73:	600 V CAT II per ANSI/ISA S82.01-1994, EN 61010-1: 1993, CSA C22.2 No 1010.1-92, UL 3111-1.
21/75:	600 V CAT III
23/77:	600 V CAT III and 1000 V CAT II per ANSI/ISA S82.01-1994, EN 61010-1: 1993, CSA C22.2 No 1010.1-92, UL 3111-1.
EMC Regulations:	EN 61326-1: 1997
Certifications/Listings:	CSA UL pending and TÜV pending



Table 1. Specifications (cont.)

Function	Range	Accuracy
$\bar{V}$	3.200 V, 32.00 V, 320.0 V 600 V 1000 V (23/77)	$\pm(0.3\%+1)$ $\pm(0.4\%+1)$ $\pm(0.4\%+1)$
$m\bar{V}$	320.0 mV	$\pm(0.3\%+1)$
$\tilde{V}$ (45 to 500 Hz, 3.2V range. Other ranges 45 to 1 kHz)	3.200 V, 32.00 V, 320.0 V, 600 V 1000 V (23,77)	$\pm(2\%+2)$ $\pm(2\%+2)$ $\pm(2\%+2)$
$\Omega$ 21/70/73/75	320.0 $\Omega$ 3200 $\Omega$ , 32.00 k $\Omega$ , 320.0 k $\Omega$ , 3.200 M $\Omega$ 32.00 M $\Omega$	$\pm(0.5\%+2)$ $\pm(0.5\%+1)$ $\pm(0.5\%+1)$ $\pm(2\%+1)$
23/77	320.0 $\Omega$ 3200 $\Omega$ , 32.00 k $\Omega$ , 320.0 k $\Omega$ , 3.200 M $\Omega$ 32.00 M $\Omega$	$\pm(0.5\%+3)$ $\pm(0.5\%+1)$ $\pm(0.5\%+1)$ $\pm(2\%+1)$
$\rightarrow \text{    }$	2.0 V	$\pm(1\% \text{ typical})$

Function	Range	Accuracy	Typical Burden Voltage
$\tilde{A}$ (45 Hz to 1 kHz) (73/75/77/23/21)	32.00 mA, 320.0 mA 10.00 A *	$\pm(2.5\%+2)$ $\pm(2.5\%+2)$	6 mV/mA 50 mV/A
$\bar{A}$ (73/75/77/23/21)	32.00 mA, 320.0 mA 10.00 A *	$\pm(1.5\%+2)$ $\pm(1.5\%+2)$	6 mV/mA 50 mV/A

\* 10 A continuous, 20 A for 30 seconds maximum.

Table 1. Specifications (cont.)

Function	Input Impedance (Nominal)		
$\bar{V}$ , $m\bar{V}$ , $\tilde{V}$	>10 M $\Omega$ , <50 pF		
	<b>Common Mode Rejection Ratio (1 k<math>\Omega</math> Unbalanced)</b>	<b>Normal Mode Rejection</b>	
$\bar{V}$ , $m\bar{V}$	>120 dB at dc, 50 Hz, or 60 Hz	>60 dB at 50 Hz or 60 Hz	
$\tilde{V}$	>60 dB dc to 60 Hz		
	<b>Open Circuit Test Voltage</b>	<b>Full Scale Voltage</b>	
		<b>To 3.2 M<math>\Omega</math></b>	<b>32 M<math>\Omega</math></b>
$\Omega$	<3.1 V dc <2.8 V dc (typical)	<440 mV dc <420 mV dc (typical)	<1.4 V dc <1.3 V dc (typical)
$\rightarrow \vdash \parallel$ )	<3.1 V dc	2.0 V dc	
	<b>Typical Short Circuit Current</b>		
$\Omega$	70/73/21/75:	77/23:	
	400 $\mu$ A	300 $\mu$ A	
$\rightarrow \vdash \parallel$ )	500 $\mu$ A	400 $\mu$ A	
$\rightarrow \vdash$	<b>V<sub>F</sub></b>	<b>Typical Test Current</b>	
		70/73/21/75:	23/77:
	0.0 V	0.5 mA	0.4 mA
	0.6 V	0.4 mA	0.3 mA
	1.2 V	0.3 mA	0.2 mA
	2.0 V	0.1 mA	0.1 mA

## **PCA Access and General Maintenance**

### **⚠ Warning**

**To avoid electrical shock, remove the test leads before opening the case, and close the case before operating the meter. To prevent fire, install fuses with the rating shown on the back of the meter.**

### **Caution**

**To avoid contaminating the pca with oil from the fingers, handle it by the edges or wear gloves. Pca contamination may not cause immediate instrument failure in controlled environments. Failures typically show up when contaminated units are operated in humid areas.**

Use the following procedure for removing the pca (printed circuit assembly) from its case:

1. Set the function switch to OFF, and disconnect test leads if they are installed.
2. Remove the four Phillips screws from the bottom cover.
3. Turn the meter face up, grasp the top cover, and pull the top cover from the meter. For most models, this will best be accomplished by first lifting up the top cover at the input terminal end, followed by the display end.
4. Some Series III Meters have a fuse on the lower portion of the pca. This fuse must be removed to access the screw that holds the pca to the case bottom.
5. The pca may now be removed from the bottom cover.

## **Display Access**

### **Caution**

**Do not handle the conductive edges of the LCD interconnects. If contaminated, clean with alcohol.**

Refer to Figure 1 or 2 depending on the model.

1. Remove the four Phillips screws from the back side of the pca.
2. Remove the LCD mounting bracket.
3. Insert a small screwdriver under the edges of the display holding bracket, and gently pry the bracket loose from the snaps.
4. Turn the bracket upside down to remove the LCD.
5. Before installing a new LCD, make sure that all connector contact points are clean.

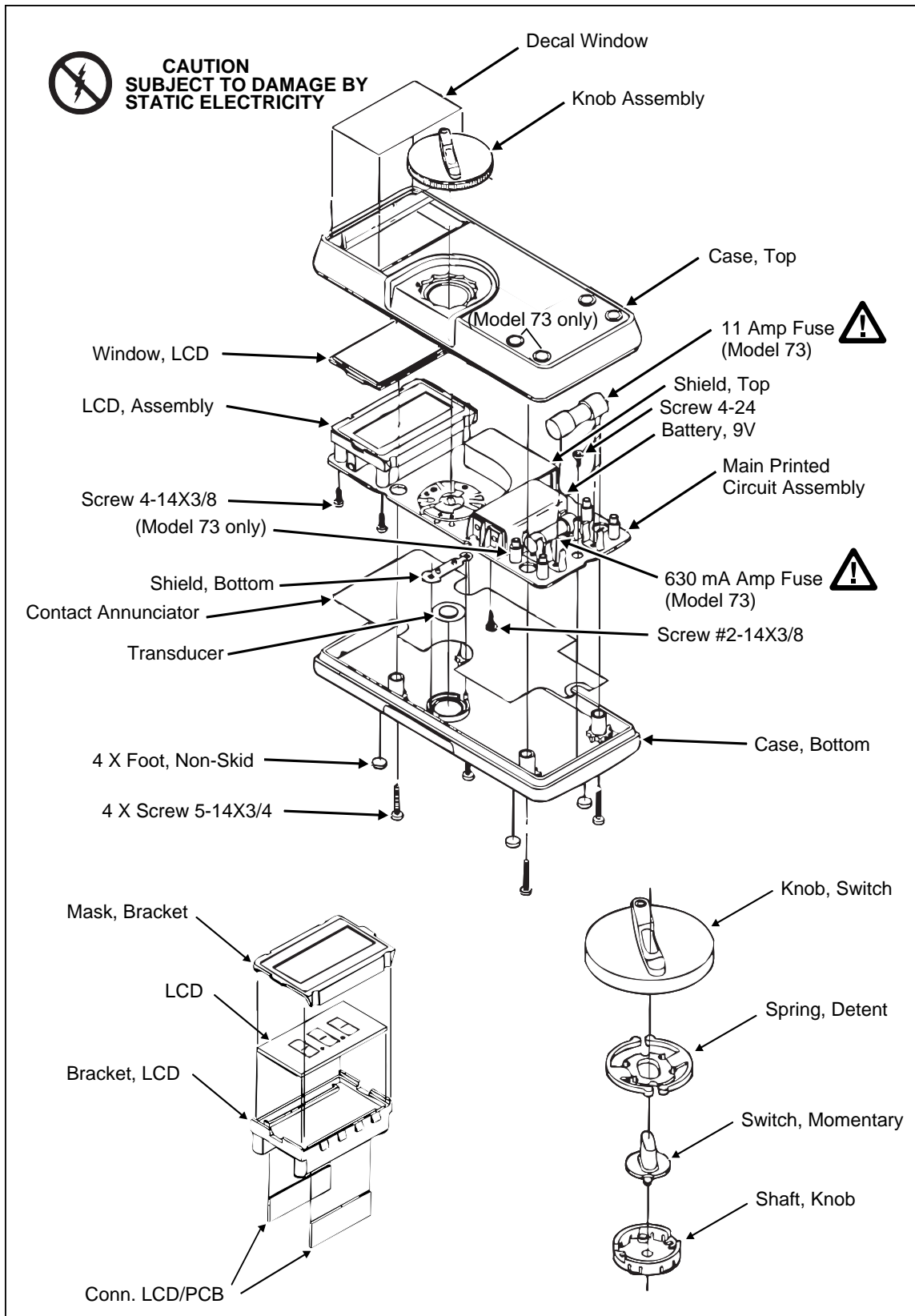


Figure 1. 70/73 Assembly Details

pm3f.eps

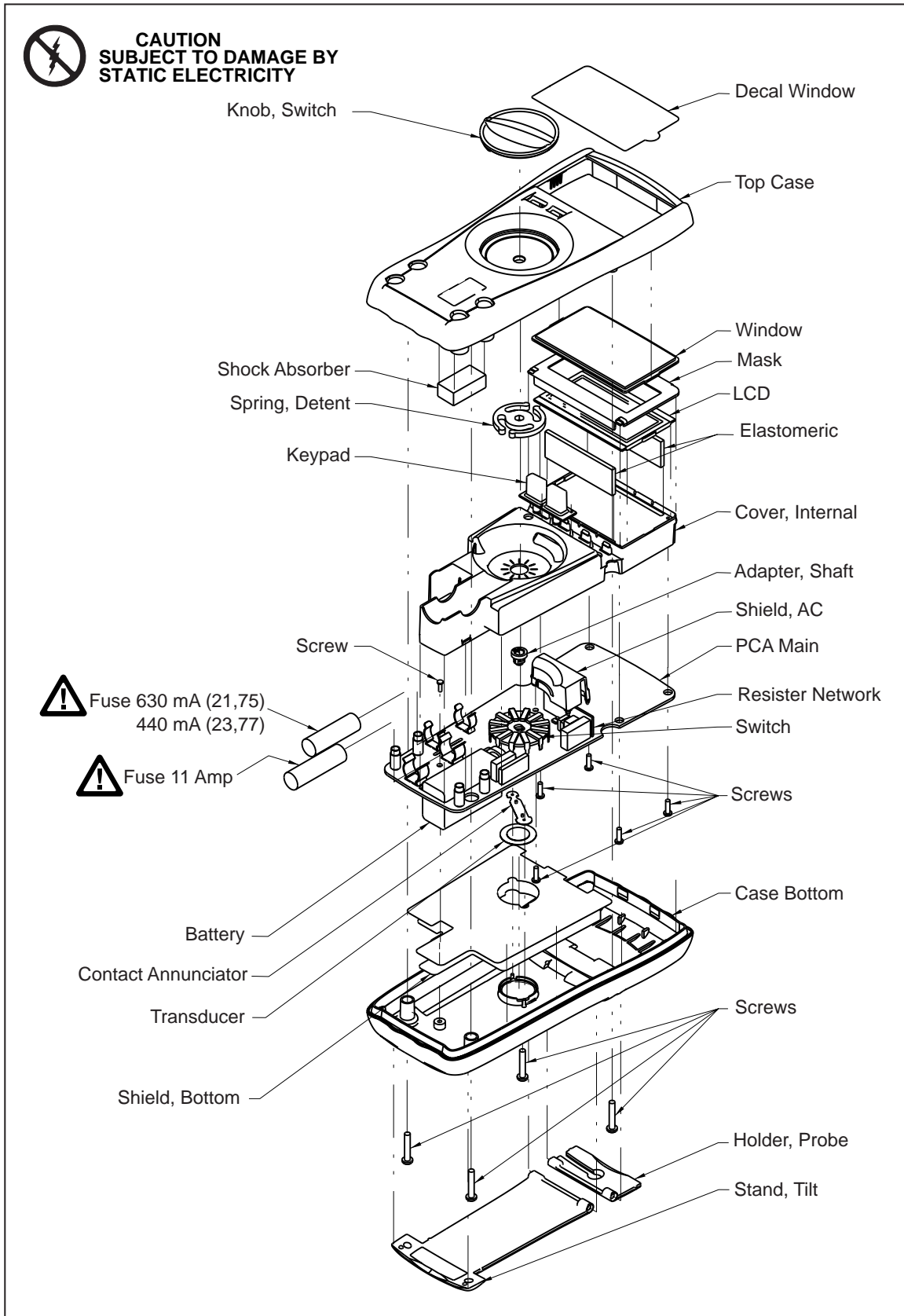


Figure 2. 77/75/23/21 Assembly Details

pm5f.eps

## Cleaning

### Caution

To avoid damaging the meter, do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastics used in instruments.

Do not allow the LCD to get wet. Remove the display assembly before washing the pca and do not install until the pca is completely dry.

Do not use detergent of any kind for cleaning the pca.

Do not remove lubricants from the switch when cleaning the pca.

Clean the instrument case with a mild detergent and water.

The pca may be washed with isopropyl alcohol or deionized water and a soft brush. Remove the display assembly and fuses before washing, and avoid washing the switch if possible. Dry the pca with clean dry air at low pressure, then bake it at 50°C for 24 hours.

## Performance Tests

The performance tests are recommended as a preventive maintenance tool to verify proper instrument operation. A one year calibration cycle is recommended to maintain the specifications given. Test equipment required for the performance tests and calibration is listed in Table 2. If the recommended equipment is not available, instruments with equivalent specifications may be used.

Table 2. Recommended Test Equipment

Instrument Type	Recommended Model
Multi-Product Calibrator	Fluke 5500A

Performance tests are recommended for incoming inspection, periodic maintenance, and for verifying the specifications. If the instrument fails any part of the test, calibration and/or repair is indicated.

In the performance tests, the Series III Meters are referred to as the unit under test (UUT).

### Initial Procedure

1. Allow the UUT to stabilize to room temperature  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$  ( $73^{\circ}\text{F} \pm 9^{\circ}\text{F}$ ).
2. Check the fuses and battery, and replace them if necessary.

### Warning

To prevent fire, install fuses in accordance with the rating shown on the back of the meter.

### Display Test (70/73 Series III only)

To test the display, turn the UUT on and check whether all display segments come on as indicated in Figure 3.

### Display Test (21/23/75/77 Series III only)

To test the display, press the range and hold buttons while turning the UUT on and check whether all display segments come on as indicated in Figure 4.



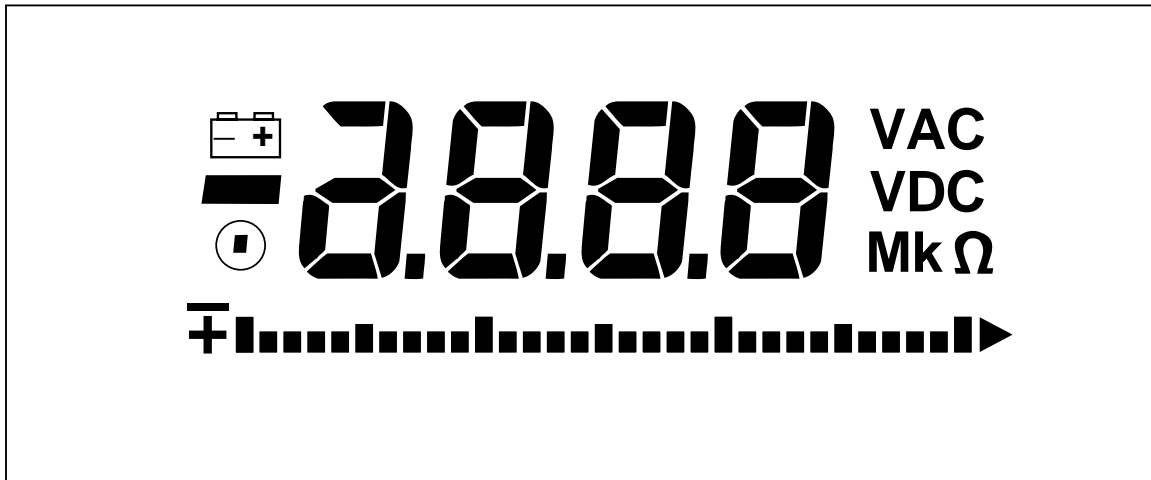


Figure 3. Display (70/73 display)

pm4f.eps

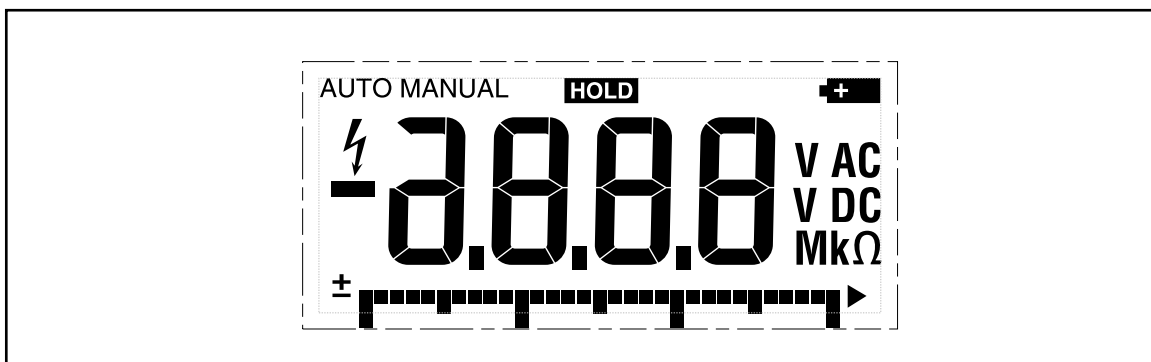


Figure 4. Display (21/23/75/77 display)

pm6f.eps

## DC Voltage Test

### Warning

**Connect the ground/common/low side of the DC calibrator to COM on the UUT.**

1. Set the UUT function switch to VDC, and connect the DC Voltage Calibrator output to the  $V\Omega$  and COM input terminals of the UUT.
2. Referring to Table 2, set the DC Voltage Calibrator for the output indicated in steps 1 through 5 only. Verify that the UUT display reading is within the limits shown.
3. Set the DC Voltage Calibrator for an output of +300 mV, and switch the UUT to the 300 mV function. Verify that the UUT display reading is within the limits shown in Table 3 (step 6).

**Table 3. DC Voltage Test**

Step	DC Input Voltage	Model	
		70, 73, 75, 21	77,23
1	+2.7V	2.691 to 2.709V DC	2.691 to 2.709V DC
2	+27V	26.91 to 27.09V DC	26.91 to 27.09V DC
3	+270V	269.1 to 270.9V DC	269.1 to 270.9V DC
4	+600V	597 to 603V DC	
5	+1000V	N/A	995 to 1005V DC
6*	+300 mV	299.0 to 301.0 mVDC	299.0 to 301.0V DC

\*300 mV function only

**AC Voltage Test**

**⚠ Warning**

**Connect the ground/common/low side of the AC calibrator to COM on the UUT.**

1. Set the UUT function switch to VAC, and connect the AC Voltage Calibrator to the **VΩ→** and COM input terminals.
2. Set the AC Voltage Calibrator for the output given in Table 4, verify that the UUT display reading is within the limits shown.

*Note*

*When the input is open in the VAC function, it is normal for the Series III Meters to read some counts on the display. This is due to ac pickup in the ac amplifier when the ac amplifier is unterminated.*

**Table 4. AC Voltage Test**

Input			Display Reading	
Step	Voltage	Frequency	70, 73, 75, 21	77,23
1	2.7V	100 Hz	2.644 to 2.756V AC	2.644 to 2.756V AC
2	2.7V	500 Hz	2.644 to 2.756V AC	2.644 to 2.756V AC
3	600V	100 Hz	586 to 614V AC	
4	600V	1 kHz	586 to 614V AC	
5	1000V	100 Hz	N/A	978 to 1022
6	1000V	1 kHz	N/A	978 to 1022

**Resistance Test**

1. Select the ohms function on the UUT.
2. Connect the Ohms Calibrator or Decade Resistor to the **VΩ→** and COM input terminals of the UUT.
3. Referring to Table 5, set the Ohms Calibrator or Decade Resistor to the resistance value indicated in steps 1 through 6. Verify that the display reading is within the limits shown.

Table 5. Resistance Test

Step	Input Resistance	Display Reading	
		70, 73, 21, 75	23, 77
1	short	0.0 to 0.2 $\Omega$	0.0 to 0.3 $\Omega$
Decades of 1:			
2	100 $\Omega$	99.3 to 100.7 $\Omega$ (plus 0 reading)	99.2 to 100.8 $\Omega$ (plus 0 reading)
3	1k $\Omega$	994 to 1006 $\Omega$	994 to 1006 $\Omega$
4	10 k $\Omega$	9.94 to 10.06 k $\Omega$	9.994 to 10.06 k $\Omega$
5	100 k $\Omega$	99.4 to 100.6 k $\Omega$	99.94 to 100.6 k $\Omega$
6	1 M $\Omega$	.994 to 1.006 M $\Omega$	.994 to 1.006 M $\Omega$
7	10 M $\Omega$	9.79 to 10.21 M $\Omega$	9.79 to 10.21 M $\Omega$
Decades of 1.9:			
2	190 $\Omega$	188.8 to 191.2 $\Omega$ (plus 0 reading)	188.7 to 191.3 $\Omega$ (plus 0 reading)
3	1.9 k $\Omega$	1889 to 1911 $\Omega$	1889 to 1911 $\Omega$
4	19 k $\Omega$	18.89 to 19.11 k $\Omega$	18.89 to 19.11 k $\Omega$
5	190 k $\Omega$	188.9 to 191.1 k $\Omega$	188.9 to 191.1 k $\Omega$
6	1.9 M $\Omega$	1.889 to 1.911 M $\Omega$	1.889 to 1.911 M $\Omega$
7	19 M $\Omega$	18.61 to 19.39 M $\Omega$	18.61 to 19.39 M $\Omega$
Decades of 2.7:			
2	270 $\Omega$	268.4 to 271.6 $\Omega$ (plus 0 reading)	268.3 to 271.7 $\Omega$ (plus 0 reading)
3	2.7 k $\Omega$	2685 to 2715 $\Omega$	2685 to 2715 $\Omega$
4	27 k $\Omega$	26.85 to 27.15 k $\Omega$	26.85 to 27.15 k $\Omega$
5	270 k $\Omega$	268.5 to 271.5 k $\Omega$	268.5 to 271.5 k $\Omega$
6	2.7 M $\Omega$	2.685 to 2.715 M $\Omega$	2.685 to 2.715 M $\Omega$
7	27 M $\Omega$	26.45 to 27.55 M $\Omega$	26.45 to 27.55 M $\Omega$

### Diode Test

To test the Series III Meters, perform the following steps:

1. Set the UUT to the Diode Test function.

#### Note

*On Fluke 5100 series calibrators, activate the 50 $\Omega$  divider override. On Fluke 5500A calibrators, lock voltage to the 33V range.*

2. Apply an input from the DC Voltage Calibrator of +.090V dc to the **V $\Omega$ →** and COM input terminals of the UUT, and verify that the beeper is on.
3. Increase the DC Voltage Calibrator output to +.110V dc, and verify that the beeper is off.

### DC mA Test (73/75/21 & 77/23 Only)

1. Set the output of the DC Current Calibrator to zero, and connect it to the 300mA and COM input terminals of the UUT.
2. Set the DC Current Calibrator to the output shown in Table 5, and verify that the UUT display reading is within the limits shown.

**Table 5. DC mA Test**

Step	Input Current	Display Reading
1	+27 mA	26.57 to 27.43 DC
2	+200 mA	196.8 TO 203.2 DC

**DC Amps Test (21/23/73/75/77 Only)**

1. Set the DC Current Calibrator to standby and connect it to the 10A and COM input terminals of the UUT.
2. Apply current as indicated in Table 6, and verify that the display reading is within the limits shown.

**Table 6. DC Amps Test**

Step	Input Current	Display Reading
1	+10 dc	9.83 to 10.17 DC

**Calibration**

1. Set the DC Voltage Calibrator to zero, and set the UUT to the VDC function.
2. Remove the case top cover as previously described.
3. Connect the DC Voltage Calibrator to the **VΩ→** and COM input terminals of the UUT.
4. Set the DC Voltage Calibrator for an output of +3.000V dc, and adjust R8 for a display reading of +3.000V dc ± .001V.

**Replaceable Parts**

**Table 7. User Replaceable Parts**

Item	P/N	Description	Where Used			
			70	73	21,75	23,77
F1*	943121	Fuse, 44/100 A (fast acting), 1000 VAC/DC Min Interrupt Rating 10 kA				x
F2*	943118	Fuse, 11A (fast acting), 1000 VAC/DC Min Interrupt Rating 17 kA		x	x	x
F1*	740670	Fuse, 630 mA (fast acting), 250V Min Interrupt Rating 1500A or IEC 127-1		x	x	
	659128	Bottom Case Assembly			x	x
	659125	Case top Assembly			x	
	659133	Case top Assembly				x
	649241	Case Top Assembly		x		
	649233	Case Top Assembly	x			
	648748	Probe Holder			x	x
	648961	Tilt Stand			x	x

\*For safety, use exact replacement