76

True RMS Multimeter

Service

PN 103926
Date September 1995

FLUKE ®

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OPERATOR SAFETY INFORMATION

This meter has been designed and tested according to IEC Publication 1010-1. Follow all safety and operating instructions to ensure that the meter is used safely and is kept in good operating condition.

- Never use the meter if the meter or test leads look damaged.
- Always turn off power to the circuit before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Never measure resistance in a circuit when power is applied to the circuit.
- Never touch the probes to a voltage source when the test leads are plugged into the 10A or 40 mA input jack.
- To avoid damage or injury, never use the meter on unprotected circuits that exceed 14000 volt-amps.
- Never apply more than 600V dc or ac rms (sine) between any input jack and earth ground.
- Always be careful when working with voltages above 60V dc or 30V ac rms. Such voltages pose a shock hazard.
- Always keep your fingers behind the finger guards on the probe when making measurements.
- Always use a high voltage probe to measure voltage if the peak voltage might exceed 600V.

SYMBOLS MARKED ON EQUIPMENT

DANGER - High voltage.

Attention - refer to the manual. This symbol indicates that information about usage of a feature is contained in the manual.

Fuse information.

USE THE PROPER FUSE

To avoid fire hazard, use only a fuse identical in type, voltage rating, and current rating as specified on the case bottom fuse rating label.

DO NOT OPERATE DISASSEMBLED METER

Always operate the meter with case top and bottom properly assembled.

Access procedures and the warnings for such procedures are contained in this Service Manual. Service procedures are for qualified service personnel only.

DO NOT ATTEMPT TO OPERATE IF PROTECTION MAY BE IMPAIRED

If the meter appears damaged or operates abnormally, protection may be impaired. Do not attempt to operate it. When in doubt, have the meter serviced.

Chapter 1
Introduction and Specifications

Title	Page

Introduction 1-1.

This service manual provides information on maintaining, troubleshooting, and repairing the Fluke 76 Multimeter. The manual also provides specifications, theory of operation, calibration routines, testing and troubleshooting procedures, parts replacement information, and schematic diagrams.

A meter under warranty will be promptly repaired or replaced (at Fluke's option) and returned at no charge. See the registration card for warranty terms. If the warranty has expired, the meter will be repaired and returned for a fixed fee. Contact the nearest Service Center for information and prices. A list of U.S. and International Service Centers is included at the end of Section 4 of this manual.

Organization of the Service Manual 1-2.

The following descriptions for the various sections serve to introduce the manual:

- Section 1. Introduction and Specifications

  This section describes both use of the Service Manual and application of special terminology (conventions) to describe the meter's circuitry. A complete set of specifications appears at the end of this section.

- Section 2. Theory of Operation

  This section first categorizes instrument circuitry into functional blocks, with a description of each block's role in overall operation. A detailed circuit description is then given for each block. These descriptions explain operation to the component level and support the troubleshooting and repair procedures defined in Section 3.

- Section 3. Maintenance

  This section provides complete maintenance information ranging from general maintenance, cleaning instructions, and detailed troubleshooting to repair procedures involving component-level adjustments. Troubleshooting and repair procedures rely heavily on both the Theory of Operation presented in Section 2 and the Schematic Diagrams shown in Section 5.

- Section 4. List of Replaceable Parts

  The section includes parts lists for all standard assemblies. Information on how and where to order parts is also provided.

- Section 5. Schematic Diagrams

  This section provides schematic diagrams for all assemblies. A list of mnemonic definitions is also included to aid in identifying signal name abbreviations.

Conventions 1-3.

Throughout the manual, certain notational conventions are used. A summary of these conventions follows:

- Printed Circuit Assembly

  The term "pca" is used to represent a printed circuit board and its attached parts.

- Circuit Nodes

  Individual pins or connections on a component are specified by a dash (-) following the component reference designator. For example, pin 19 of U30 would be U30-19.

- User Notation

Generally, function switch positions to select, input terminals to use, and display notation to be read are presented in this manual as they are seen on the multimeter.

Special terms (mnemonics) used in text descriptions of multimeter circuitry correspond to terms used on the schematic diagrams in Section 5.

Specifications 1-4.

Specifications for Fluke Model 76 are presented in Table 1-1 on the following page.

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 and true rms responding.

Accuracy Specifications are given as:

± ([% of reading] + number of least significant digits)

Table 1-1. Specifications

Display:	Digital: 4000 counts, updates 4/sec Analog: 63 segments, updates 40/sec Frequency: 9,999 counts Capacitance: 9,999 counts
Response Time of Digital Display:	Vac <1.5s (for upscale only) Vdc <1s Ω <1s to 40 kΩ, <2s to 4 MΩ, <10s to 40 MΩ
Operating Temperature:	0°C to 55°C
Storage temperature:	-40°C to 60°C
Temperature Coefficient:	0.1 x (specified accuracy)/ °C (<18°C or> 28°C)
Relative Humidity:	90% (0°C to 30°C) 75% (30°C to 40°C) 45% (40°C to 50°C) 35% (50°C to 55°C)
Altitude:	Operating: 2,000 meters
Storage:	12,000 meters
Battery type:	9v, NEDA 1604A or IEC 6LR61
Battery Life:	500 hrs typical with alkaline
Continuity Beeper:	4096 Hz
Vibration:	Per MIL-T28800E, Class III Sinusoidal, Non Operating
Drop:	ANSI/ISA-S82.01-1994 and EN61010-1, 1993 1 meter drop to hardwood on concrete
Enclosure:	Conforms to IP-40 Per IEC-529
Size (HxWxL):	2.8 cm x 7.5 cm x 16.6 cm (1.12 in x 2.95 in x 6.55 in)
Weight:	12 oz (340g)
EMC:	EN 50081-1, EN 50082-1
Surge Protection:	6 KV peak per IEC 1010-1, 1990-09 and ANSI/IEEE C62.41-1991
Safety:	600V AC, 600V DC maximum voltage between any terminal and earth ground. Complies with IEC-1010-1, 1990-09 and ANSI/ISA-S82.01-94 for use in overvoltage category III locations, ≤600V, UL3111, CSA/CAN C22.2 No. 1010.1-92 and EN61010 part 1-1993.
Certifications:	CE and CSA UL and TUV pending

Table 1-1. Specifications (cont)

Function	Range	Resolution	Accuracy	Burden Voltage (Typical)
Ṽ	400.0 mV	0.1 mV	±(1.9%+4)†	Not Applicable
(45 Hz to 1 kHz)	4.000V	0.001V	±(1.9%+2)†	
	40.00V	0.01V	±(1.5%+2)†	
	400.0V	0.1V	±(1.5%+2)†	
	600V	1V	±(1.5%+2)†	
V⎓	4.000V	0.001V	±(0.3%+1)	Not Applicable
	40.00V	0.01V	±(0.3%+1)	
	400.0V	0.1V	±(0.3%+1)	
	600V	1V	±(0.3%+1)	
mV⎓	40.00 mV*	0.01 mV	±(0.3%+5)	Not Applicable
	400.0 mV	0.1 mV	±(0.3%+1)	
Ω	400.0Ω	0.1Ω	±(0.4%+2)	Not Applicable
	4.000 kΩ	0.001 kΩ	±(0.4%+1)	
	40.00 kΩ	0.01 kΩ	±(0.4%+1)	
	400.0 kΩ	0.1 kΩ	±(0.4%+1)	
	4.000 MΩ	0.001 MΩ	±(0.4%+1)	
	40.00 MΩ	0.01 MΩ	±(1%+3)	
Capacitance	99.99 nF	0.01 nF	±(1.9%+2)**	Not Applicable
	999.9 nF	0.1 nF	±(1.9%+2)**	
	9.999 µF	0.001 µF	±(1.9%+2)**	
	99.99 µF	0.01 µF	±(1.9%+2)**	
	999.9 µF	0.1 µF	±(1.9%+2)**	
	9999 µF	1 µF	±10% Typical	
)))	400Ω	0.1Ω	5% Typical	Not Applicable
40Ω	40Ω*	0.01Ω	5% Typical	Not Applicable
(Lo-Ohms)	400Ω	0.1Ω	5% Typical	
	8 kΩ	1Ω	10% Typical	
Diode Test	2.450V	0.001V	±2% Typical	Not Applicable
Ã	4.000 mA	0.001 mA	±(1.5%+4)†	11 mV/mA
(45 Hz to 1 kHz)	40.00 mA	0.01 mA	±(1.5%+2)†	11 mV/mA
	4A	0.001A	±(1.5%+4)†	0.03 V/A
	10.00A***	0.01A	±(1.5%+2)†	0.03 V/A
A⎓	4.000 mA	0.001 mA	±(0.5%+5)	11 mV/mA
	40.00 mA	0.01 mA	±(0.5%+2)	11 mV/mA
	4A	0.001A	±(0.5%+5)	0.03 V/A
	10.00A***	0.01A	±(0.5%+2)	0.03 V/A
Frequency‡	99.99	0.01 Hz	±(0.01%+1)	Not Applicable
(1 Hz to 20 kHz)	999.9	0.1 Hz	±(0.01%+1)	
	9.999 kHz	0.001 kHz	±(0.01%+1)	
	20.00 kHz	0.01 kHz	±(0.01%+1)	

* In 40Ω and 40 mV ranges, thermals may introduce additional errors. Maximum accuracy is obtained when both probe tips are maintained at the same temperature.
** With film capacitor or better and residual (open lead reading) subtracted from measurement. This meter uses a dc-type measurement technique.
*** 10A continuous, 20A for 30 seconds.
† From 5% to 100% of specified range.
‡ For rectangular waveforms 25% ≤ duty cycle ≤ 75% . VAC ≤ 1 kHz.

Table 1-1. Specifications (cont)

Frequency Counter Sensitivity and Trigger Level		
Input Range*	**Minimum Sensitivity (RMS Sine Wave)**	
	500 Hz to 20 kHz	**1.0 Hz to 500 Hz****
400 mV ac	Not Applicable	Not Applicable
4V ac	0.3V	0.7V
40V ac	3V	7V
400V ac	30V	70V
600V ac	300V	Not Applicable

* Maximum input for specified accuracy = 10 x Range or 600V.
** Display rattle for sine waves below 500 Hz = 5 counts.

Function	Overload Protection*	Input Impedance (Nominal)	Common Mode Rejection Ratio (1 KΩ Unbalance)		Normal Mode Rejection
$\overline{V}$	600V dc 600V ac rms (sine)	>10 MΩ, <100 pF	>120 dB at dc, 50 Hz, or 60 Hz		>60 dB at 50 Hz or 60 Hz
$\overline{mV}$	600V dc 600V ac rms (sine)	10 MΩ, <100 pF	>120 dB at dc, 50 Hz, or 60 Hz		>60 dB at 50 Hz or 60 Hz
$\tilde{V}$	600V dc 600V ac rms (sine)	>10 MΩ, <100 pF (ac-coupled)	>60 dB, dc to 60 Hz		
Ω		**Open Circuit Test Voltage**	**Full Scale Voltage**		**Short Circuit Current**
			< 4.0 MΩ	<40 MΩ	
	600V dc, 600V rms (sine)	<1.3V dc	<450 mV dc	<1.3V dc	<500 uA
Diode Test —▶|—	600V dc, 600V rms (sine)	<3.1V dc	2.45V dc		800 uA typical

*10^7 V-Hz max.

Chapter 2
Theory of Operation

Title	Page

Introduction 2-1.

This section describes the theory of operation for the Fluke 76 multimeter.

Functional block descriptions present an overview of circuit operation followed by circuit descriptions, which detail the major circuit functions. Schematic diagrams are provided in Section 5.

Functional Block Description 2-2.

The instrument is partitioned into analog and digital sections. (See Figure 2-1 Block Diagram.) The integrated multimeter chip (U4) performs both analog and digital functions, which are explained in more detail below.

The analog section of U4 contains the a/d converter, active filter, frequency comparator, analog signal routing, range switching, and power supply functions.

The digital section of U4 executes software functions, formats data for the display, drives the display, and controls most analog and digital logic functions. The push button initiates various operating modes for the meter. Output from the digital section can be viewed on the liquid crystal display (LCD) and is audible through the beeper.

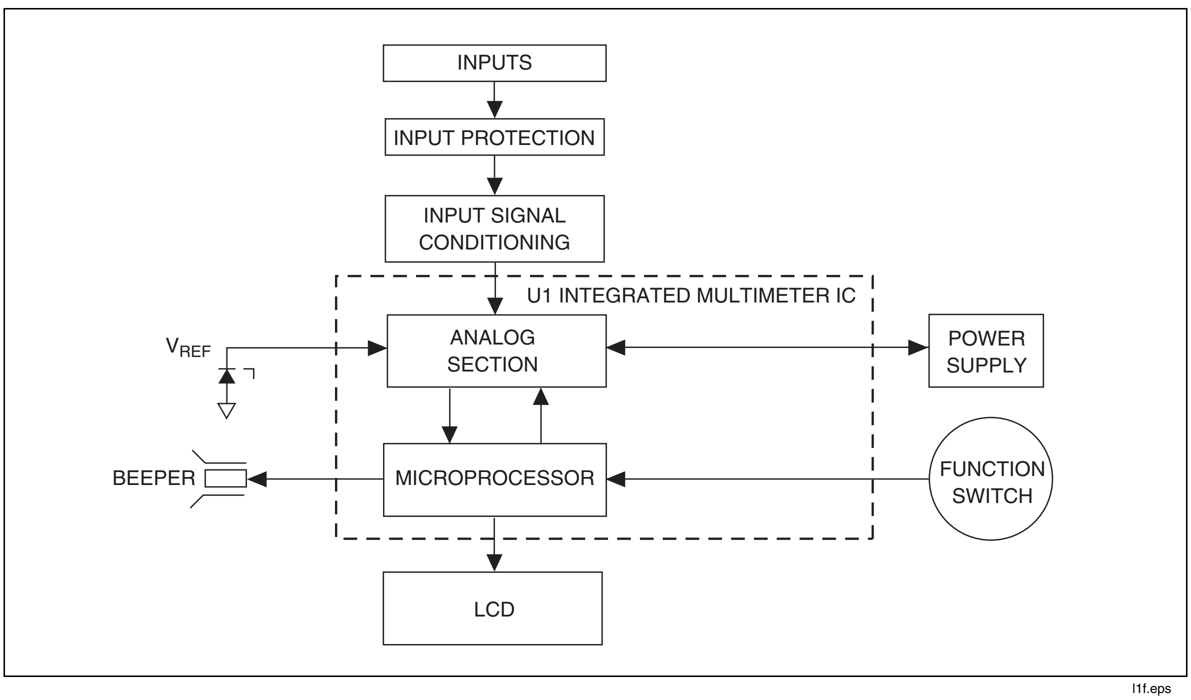


Figure 2-1. Block Diagram

Circuit Descriptions 2-3.

The following paragraphs discuss the functional blocks in Figure 2-1. Consult the schematic diagrams, located in Section 5, for additional circuit details not provided in this section.

Input Overload Protection 2-4.

The VΩ▶| input is protected from overload by a network consisting of three metal-oxide varistors (RV1, RV2 and RV3) and five current-limiting resistors (R1, R2, R8, R12 and RT1). The presence of an extremely high energy signal causes R1 (500Ω, 2W), a fusible resistor, to open. Thermistor RT1 rises to a high impedance during a sustained voltage overload in the Ohms, or continuity mode. Transistors Q1 and Q2 form a voltage clamp network. This clamp limits the overload current to U4 at 10 mA during Ohms and continuity overloads. Power supply regulation and system operation are maintained during any of these overloads.

The mA input is protected from overloads by F1 (1A/600V), while F2 (15A/600V) protects the A input. Milliamp shunt resistor R5 is protected from overload currents below the F1 fusing level by the U1 and CR1 diode clamp network.

Rotary Knob Switch 2-5.

Input signals are routed from the overload protection circuits to a double-sided switch wafer. This switch wafer provides the necessary connections to implement signal conditioning and function-encoding for U4.

Input Signal Conditioning Circuits 2-6.

Each input signal is routed through signal conditioning circuitry before reaching multimeter chip U4. Incoming signals received through the VΩ▶| input are routed to precision resistor network Z1. This divider network precisely scales the input for the various voltage ranges and provides precision reference resistors that are used for the Ohms and capacitance functions.

Input divider Z1 is used in two modes, series and parallel. In volts functions, a series mode provides four divider ratios. In the Ohms function, a parallel mode provides five reference resistors. During the following discussion, refer to schematic and signal flow diagrams in Section 5.

Volts Functions 2-7.

In volts functions, signal flow for input divider Z1 begins with a voltage that appears at the VΩ▶| input. (See Figure 2-2, 4V Range Simplified Schematic.) This input is connected to the high end of the 9.996 MΩ resistor (Z1-1) through R1, R8, R12, and RT1. If the AC volts function is selected, dc blocking capacitor C1 is also connected in series. In AC the signal is routed to U2 through the AC buffer in U4. If the DC volts function is selected, C1 is shorted by S1 (contacts 6 and 7).

Internal switches connect the 9.996 MΩ and 1.1111 MΩ resistors (Z1-2 and -3). The low end of the 1.1111 MΩ resistor (Z1-7) is connected to the COM input through S1 contacts 11 and 12. This produces the divide-by-10 ratio needed for the 400 mV ac, 4V ac, and 4V dc ranges. The 400 mVac and 4Vac ranges require frequency compensation, which is supplied by C20 (not shown in Figure 2-2.)

For the 40V range, internal switches connect the Z1-4 (101.01 kΩ) resistor to provide a divide-by-100 ratio. In the 400V range, Z1-5 (10.01 kΩ) produces a divide-by-1,000 ratio. And in the 600V range, the Z1-6 (1.0001 kΩ) resistor provides a divide-by-10,000 ratio.

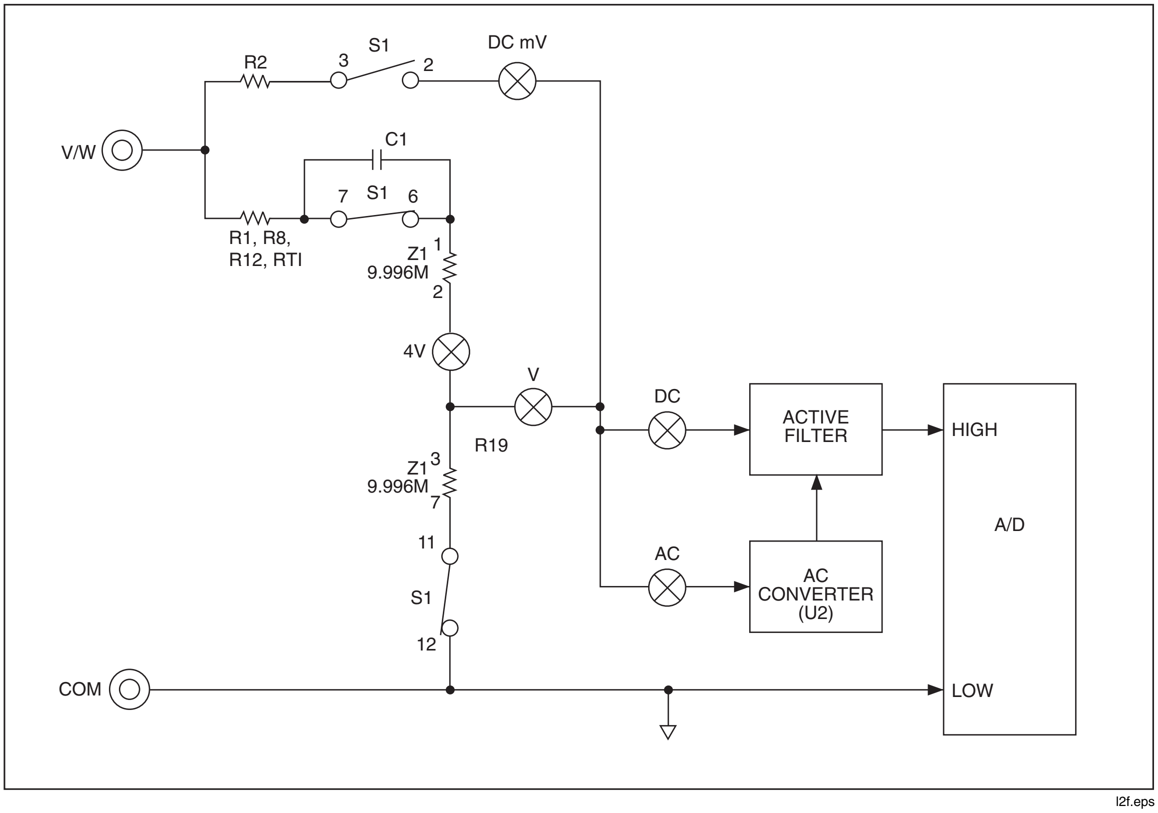


Figure 2-2. 4V Range Simplified Schematic

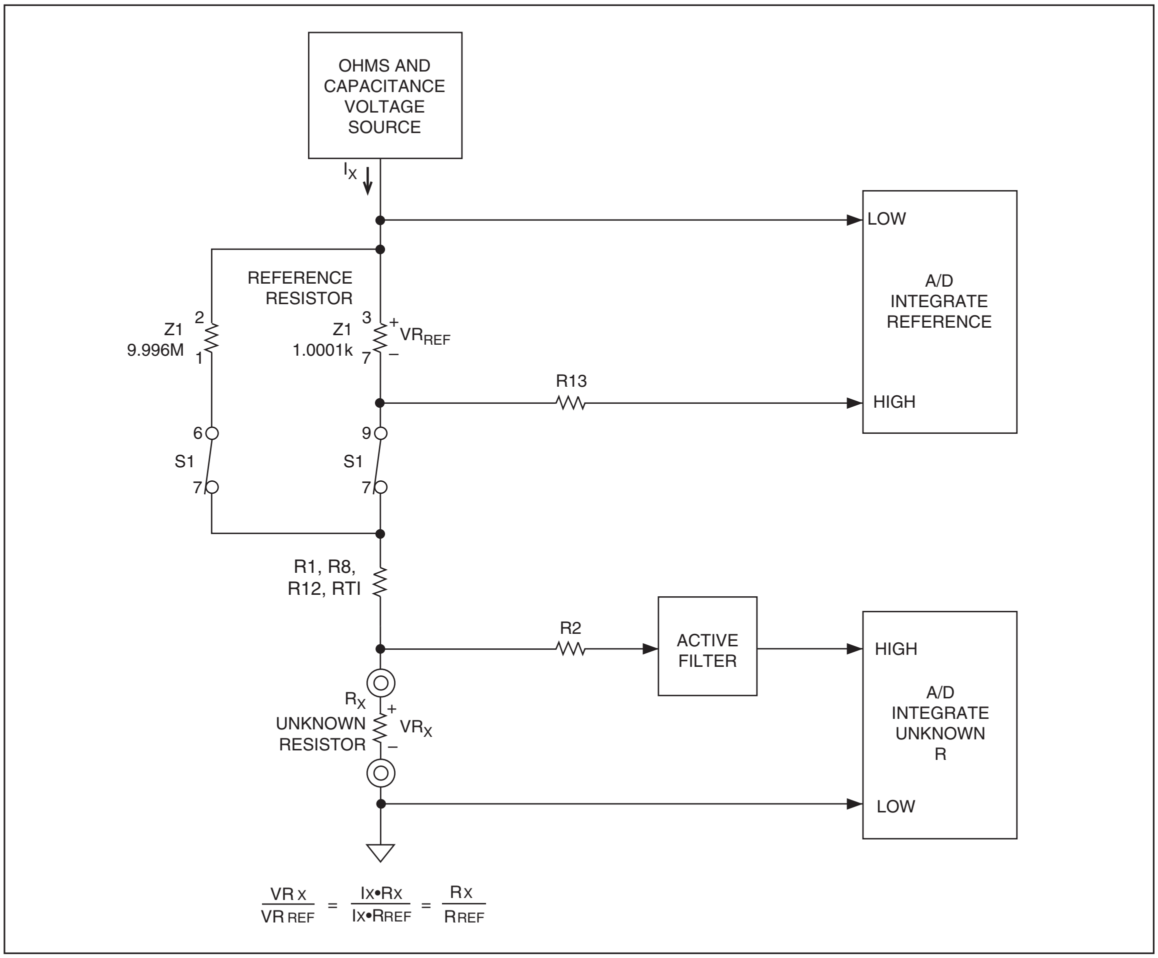
Ohms Functions 2-8.

When the 400 Ohm range is selected, internal switches connect the resistor Z1-2 (9.996 MΩ) to resistor Z1-6 (1.0001 kΩ). (See Figure 2-3, 400 Ohm Range Simplified Schematic.) Then through switch contacts S1 6, 7, and 9, these resistors form a reference resistor of 1 kΩ.

The source voltage is connected internally at both V0 and V4 of U4. The current is routed through two parallel resistor's Z1-6 and Z1-2 (1.0001 kΩ and 9.996 MΩ, into S1 at contacts 6 and 9. The signal then travels out of S1 at contact 7, through R1, R8, R12 and RT1 and to the VΩ⯈⊢ input. The signal then goes through the unknown resistance, and back to the COM input. The same current flows through the unknown resistance and the reference resistor. The voltage dropped across the unknown resistance is sensed from the VΩ⯈⊢ input jack through R2 and S1 (contacts 2 and 3) to OVS of U4.

The a/d converter senses the voltage drop across the 1 kΩ reference resistor through the low (RRS of U4 through R13) and high (V0 and V4) points. These two voltages are used by the a/d converter to perform a ratiometric measurement. Since the same current flows through the reference and unknown resistors, the ratio of the resistance values is the same as the ratio of the voltage drops across them.

For the 4 kΩ range, the 10.010 kΩ resistor (Z1-5) used in parallel with the 9.996 MΩ resistor (Z1-2) forms a 10 kΩ reference resistor. For the 40 kΩ range, 101.01 kΩ (Z1-4) and 9.996 MΩ form a 100 kΩ reference resistor. And for the 400 kΩ range, 1.1111 MΩ (Z1-3) and 9.996 MΩ provide a 1 MΩ reference resistor. The 4 MΩ and 40 MΩ ranges use the 9.996 MΩ resistor alone.



$$\frac{VR_X}{VR_{REF}} = \frac{I_X \bullet R_X}{I_X \bullet R_{REF}} = \frac{R_X}{R_{REF}}$$

Figure 2-3. 400 Ohm Range Simplified Schematic

Current Functions 2-9.

Input current through R5+R6 (for mA) or R6 (for amps) develops a voltage that is proportional to the input. The dc voltage is routed to the active filter and a/d converter inside U4. Ac voltage is routed to the ac buffer, ac converter (U2), active filter, and a/d converter. The 4 mA dc and 4A dc ranges use the a/d converter is 40 mV range. The mA ac and 4A ac ranges use the (x10) ac buffer range. 4

Continuity, Low Ohms and Diode Test Functions 2-10.

Q13 provides the source current for the continuity, low Ohms and diode test functions. Inputs are sensed through R2. R2 and R62 form a 10:1 divider for measuring voltages in diode test and the 8 kΩ range of low Ohms. The continuity function is the 400 Ohm range of low Ohms, and uses a comparator to turn on the beeper when the input is ≤20 Ohms. Low Ohms makes voltage measurements of the input to provide the higher resolution readings of the 40 Ohm range. Diode test also makes voltage measurements of the input. A single beep sounds when the input is ≤ 0.75V; a continuous tone sounds for inputs ≤ 60 mV.

Analog Section of Integrated Multimeter IC (U4) 2-11.

The a/d converter, autorange switching, frequency comparator, and most of the remaining analog circuitry are contained in the analog section of U4. Peripherals to this U4 analog section include the crystal clock, the system reference voltage, the ac converter, and the filter and amplifier resistors and capacitors.

U4 uses the dual-rate, dual-slope a/d converter circuit shown in Figure 2-4, A/D Converter. For most measurements, the basic a/d conversion cycle is 25 ms, for a rate of 40 measurements per second. A single conversion at this rate is called a minor cycle sample. Each minor cycle sample is used to provide updates at a rate of 40 per second for the fast response bar graph display, and fast autoranging.

Eight minor cycle samples are necessary to accumulate data for displaying a full-resolution (4000-count full scale) measurement on the digital display. A 40 ms autozero phase occurs following every eight-sample sequence. Therefore, each digital display update requires 240 ms, approximating four updates per second.

Basic a/d conversion elements and waveforms are illustrated in Figure 2-4, A/D Converter. A voltage level proportional to the unknown input signal charges integrator capacitor C11 for an exact amount of time. This capacitor is then discharged by a reference voltage of opposite polarity. The discharge time, which is proportional to the level of the unknown input signal, is measured by the digital circuits in U4 and sent to the display.

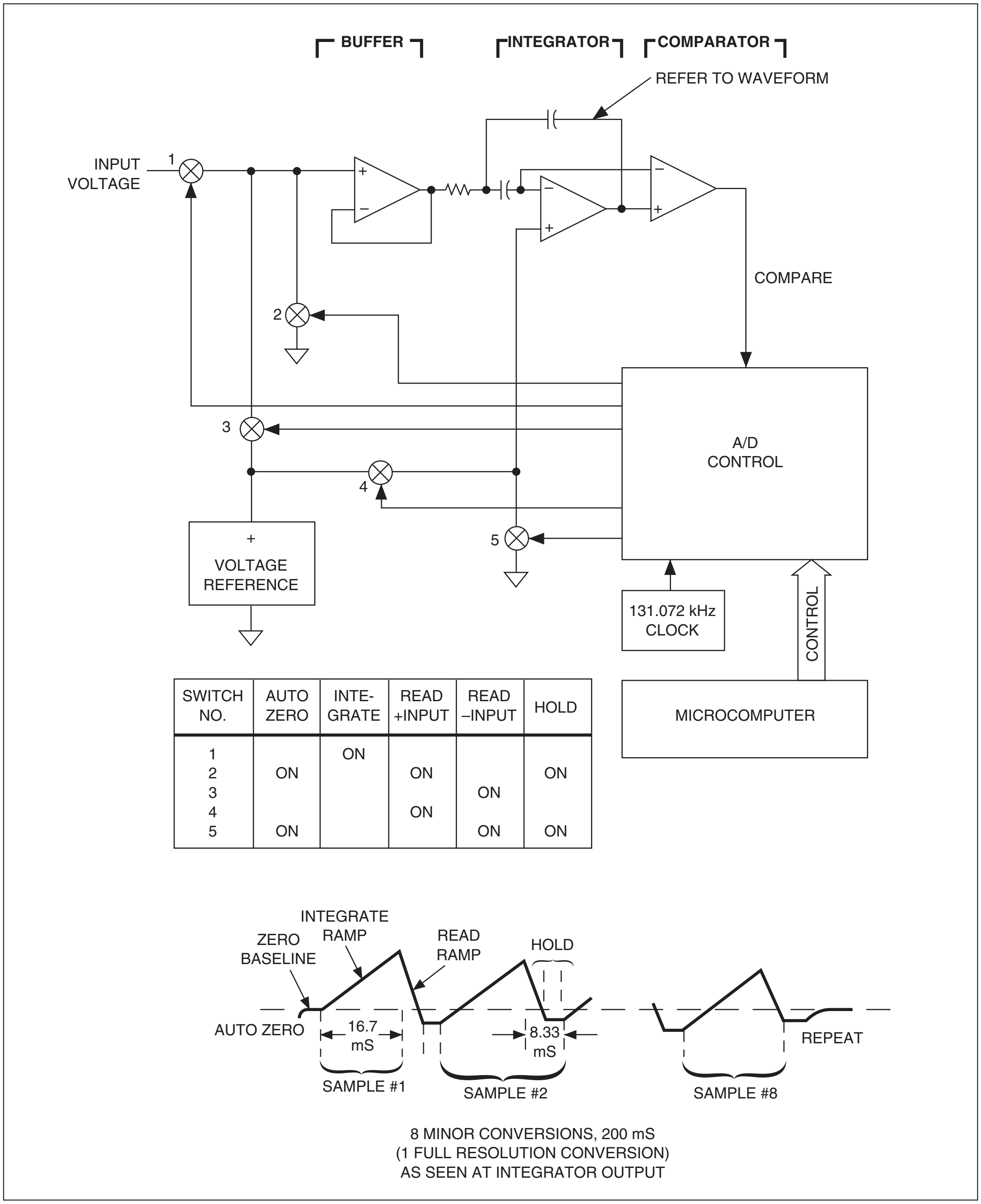
Basic timing for the a/d converter is defined as a series of eight integrate and read (de-integrate) cycles, followed by a 40 ms autozero phase. However, the 40 MΩ, capacitance, overload recovery, autoranging, and Touch Hold® modes all require variations from the basic timing.

Capacitance Measurements 2-12.

Refer to Figure 2-5, 100 nF Range Simplified Schematic. Capacitance measurements to 10,000 µF are made by measuring the charge required to change the voltage across the unknown capacitor from zero to the system reference voltage. This technique is referred to as a ballistic type of measurement, the configuration of which is the same as for Ohms. The unknown capacitor is discharged through the 1.0001k Ohm resistor of Z1, then charged during the a/d converter integrate cycle through the appropriate Z1 resistor. The voltage drop across the Z1 resistor is integrated by the a/d converter. During the a/d read cycle, the charge is held on the capacitor, and a count is accumulated. The microcomputer calculates a display value from the latched count, the capacitor is discharged, and the cycle repeats.

Frequency Measurements 2-13.

A voltage comparator is used for both signal detection in frequency mode and threshold detection in continuity mode. In frequency mode, digital pulses from the voltage comparator are routed to the counter. Pressing the range push button while in frequency mode causes a range change in the primary function (ac volts) that may change the sensitivity.



SWITCH NO.	AUTO ZERO	INTE-GRATE	READ +INPUT	READ –INPUT	HOLD
1		ON			
2	ON		ON		ON
3				ON	
4			ON		
5	ON			ON	ON

l4f.eps

Figure 2-4. A/D Converter

Microcomputer Control 2-14.

A microcomputer, integrated within U4, controls the various instrument functions and drives the display. The position of the rotary switch, S1, is decoded by the microcomputer from the three inputs F0, F1, and F2. All function modes, input ranging, signal routing, active filter enable, a/d timing and mode are controlled by the microcomputer.

The Touch Hold mode is a secondary software function. This means that the microcomputer performs a different control algorithm on the data. When the Touch Hold function is selected, the microcomputer does not allow a full resolution conversion to be completed unless the input signal is stable. When a stable reading occurs, the conversion is completed, and the microcomputer generates and freezes the corresponding display. The microcomputer now waits for a change in the signal to exceed a certain threshold, then begins watching for a stable reading again. Note that a reading is forced when the Touch Hold function is first selected. Also, open test lead signals generally do not update the display.

The SMOOTHING™ mode is another secondary software function. In the Smoothing function, the equivalent of eight readings are averaged, resulting in a more stable display of noisy input signals.

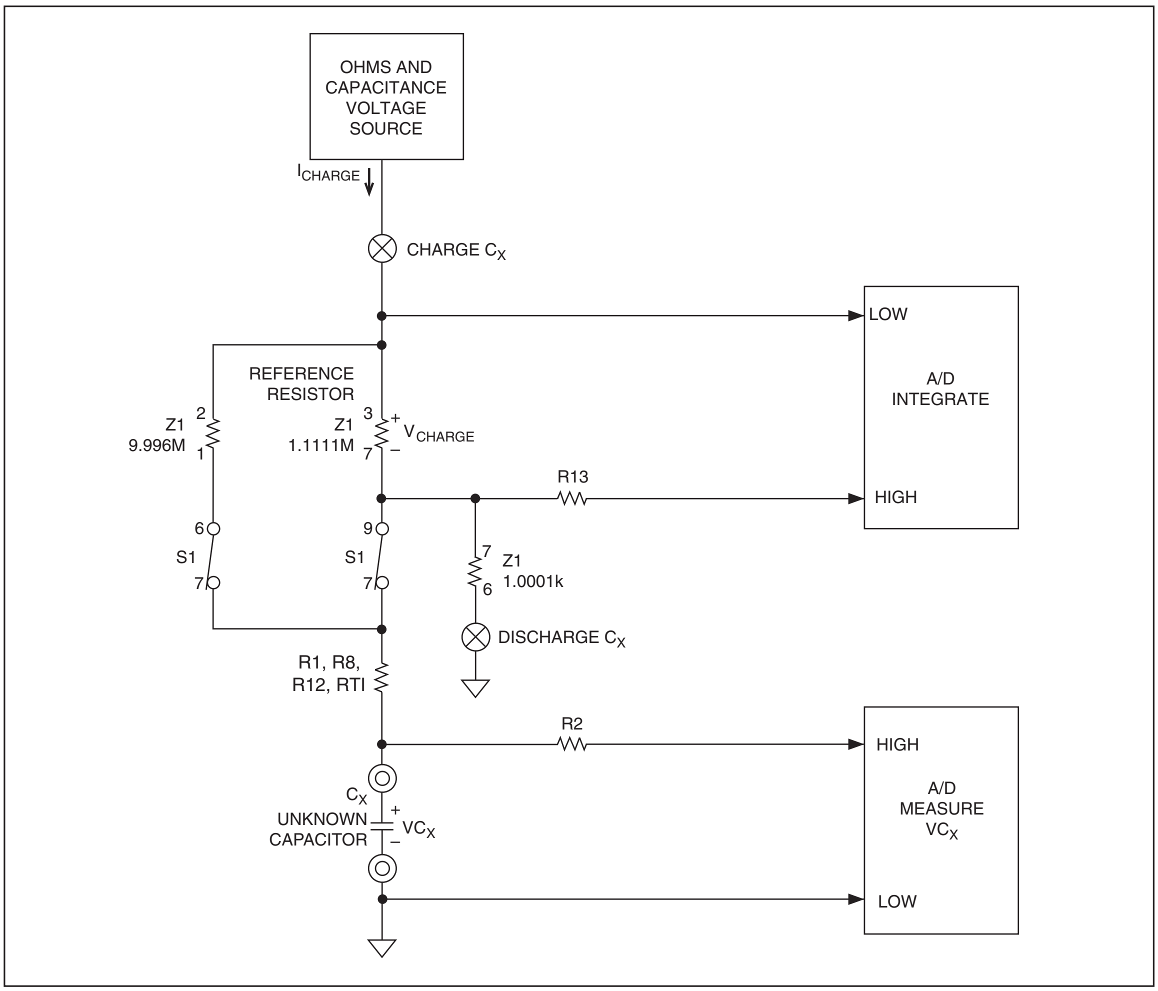


Figure 2-5. 100 nF Range Simplified Schematic

Peripherals to U4 2-15.

In addition to input overload protection and input signal conditioning circuits, other devices peripheral to U4 are needed to support the meter's features. The active filter and a/d converter circuits require off-chip resistors and capacitors. Digital drive and levelshifting circuits are needed for the beeper drive. A voltage reference is generated separate from U4, and some discrete resistors and transistors support the power supply.

AC Buffer 2-16.

The ac buffer can be configured for an ac gain of 1 or 10. R14 and R15 provide for the X10 gain. C5 blocks any dc gain and provides a driven guard voltage. The ac buffer drives the frequency comparator and the ac converter (U2).

AC Converter 2-17.

The ac converter (U2) is a monolithic true rms-to-dc converter. The signal to the converter comes from the ac buffer. The signal is first attenuated by the voltage divider (R10 and R11). This provides an input signal range of zero to 200 mV ac. The converter's output range is zero to -200 mV DC. R34 is used to calibrate the ac gain of the Fluke Model 76. The converter output goes to the active filter in U4. The microprocessor in U4 multiplies the A-D reading by two to give a zero to 4000 count display.

Active Filter 2-18.

The active filter uses components R17, R18, C8, and C9. The active filter is a second order low-pass filter with two poles at 5.9 Hz in normal mode. It filters input signal noise and ac ripple from the ac converter, yielding stable a/d converter readings. The microcomputer can disable the filter completely or enable the filter fast response mode by shorting R17 and R18 with internal IC switches.

A/D Converter 2-19.

Precision resistor network Z1-8, 9, and 10 connects to the three a/d buffer/integrator range resistors. Z1-8 connects to 190 kΩ for the 1V range (de-integrate). Z1-9 connects to 166 kΩ for the 400 mV range, and Z1-10 connects to 16 kΩ for the 40 mV range. Z1-11 is the summing node of the integrator circuit. The autozero capacitor (C10) stores op amp and comparator offsets. The integrator capacitor is C11.

The system reference voltage (1.23V) is generated by VR1 and R44. The 1.000V reference voltage for the a/d converter is supplied through U4-1 (REFI). This voltage is adjusted by R21, the dc calibration potentiometer in conjunction with R19 and R20. In addition to generating the a/d reference, the VR1 voltage is used for power supply reference, voltage comparator offset generation, and the Ohms and capacitance source voltage.

Beeper 2-20.

Devices Q9, Q11, R57, R63, and R64 make up the beeper drive circuit.

Power Supply 2-21.

The power supply consists of two regulators, one shunt and one series, which set Vdd at +3.0V and Vss at -3.2V for all battery voltages down to 6.5V. The shunt (common) regulator sets |Vdgnd - Vss| (Vdgnd = COM = 0V) and consists of an op amp and current shunt devices integrated on U4. Resistors R37 and R38 provide voltage division. The series (Vdd) regulator, which sets |Vdd-Vdgnd|, is made up of another on-chip op amp, along with devices Q3, R24, and R25. Q3 is the series regulator element, and R24 and R25 are for voltage sensing. Capacitors C14 and C21 provide circuit compensation and power supply decoupling for the shunt and series regulators, respectively. Q10 provides base drive for Q3 at turn on. Voltage level information is presented in Table 2-1

Display 2-22.

The liquid-crystal display (LCD) operates under control of the microcomputer. Segments are driven by the computer and displayed on the LCD. Both digital readings and an analog bar-graph display are presented in conjunction with annunciators and decimal points. Refer to the Fluke 76 User Manual for information about the display.

Table 2-1. Typical Voltage Levels and Tolerance (Referred to Common)

Voltage Level	Tolerance
VDD	3.0 ± 0.2
VSS	-3.2 ± 0.2
VBT-	-6.1 (battery at full 9V charge)
	-3.2 (battery at low charge of 6.5V)
REFH	1.23 ± 0.04
PS0	1.23 ± 0.15
PS1	0 ± 0.15
VOA	2.2 to 1.7 (referenced from VSS)
VOB	1.07 to .85(referenced from VSS)

Chapter 3
Maintenance

Title		Page

Warning

These service instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than that contained in the Users or Service manual unless you are qualified to do so.

Introduction 3-1.

This section contains maintenance information for the Fluke 76 meter and includes performance tests, calibration, general maintenance procedures, and troubleshooting. For operator maintenance, refer to the Users Manual (P/N 106275).

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 in Section 1 of this manual.

Recommended Equipment 3-2.

Test equipment recommended for the performance tests and calibration is listed in Table 3-1. If the recommended equipment is not available, instruments with equivalent specifications may be used.

Table 3-1. Recommended Test Equipment

Equipment	Minimum Specifications	Recommended Model
DMM Calibrator plus Transconductance or Power Amplifier	DC Voltage: 0-600V Accuracy: .05% AC Voltage: 0-600V Accuracy: 0.2% Frequency: 45 Hz-20 kHz DC mA: 0-35 mA DCA: 0-10A Accuracy: 0.1% AC mA: 0-35 mA ACA: 0-10A Accuracy: 0.3% Frequency: 45 Hz-1 kHz	Fluke Models (5100B, 5101B, 5102B, 5700A) + 5220A or Fluke Models 5500A, 5700A + 5725A
Function Generator	Sinewave voltage: 0-1V rms Frequency: 1 Hz-20 kHz Frequency Accuracy: 002%	Philips 5190X
Decade Resistor	Resistance 0-35 MΩ: Accuracy: .05%	General Resistance RDS-77B
Decade Capacitor	Capacitance: 100 pF-1.1 uF Accuracy: 0.5%	GenRad 1412-BC

Operator maintenance 3-3.

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 contamination with oil from the fingers, handle the pca 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.

Case Disassembly 3-4.

Use the following procedure to disassemble the case:

1. Set the function switch to OFF and disconnect the test leads if they are installed.
2. Remove the four Phillips screws from the bottom case.
3. Turn the meter face up, grasp the top case, and pull the top case from the meter.

Battery Replacement 3-5.

The meter is powered by a single 9V battery (NEDA 1604, 6F22, or 006P).

Refer to Figure 3-1, and use the following procedure to replace the battery:

1. Remove the top case as described under Case Disassembly.
2. Lift the battery from the case bottom and install the new battery.
3. Reinstall the top case and the four Phillips screws into the bottom case.

Fuse Test 3-6.

Use the following procedure to test the internal fuses of the meter.

1. Turn the rotary selector switch to the Ω ⊣(position.
2. Plug a test lead into the VΩ→⊢ input terminal, and touch the probe to the 10A input terminal.
3. The display should indicate between 0.1 and 0.5 Ohms. This tests F2 (15A, 600V). If the display reads OL (overload), replace the fuse and test again. If the display reads any other value, further servicing is required.
4. Move the probe from the 10A input terminal to the 40 mA input terminal.
5. The display should read between 10 Ohms and 12 Ohms. This procedure tests F1 (1A, 600V). If the display reads a high resistance or OL (overload), replace the fuse and test again. If the display reads any other value, further servicing is required.

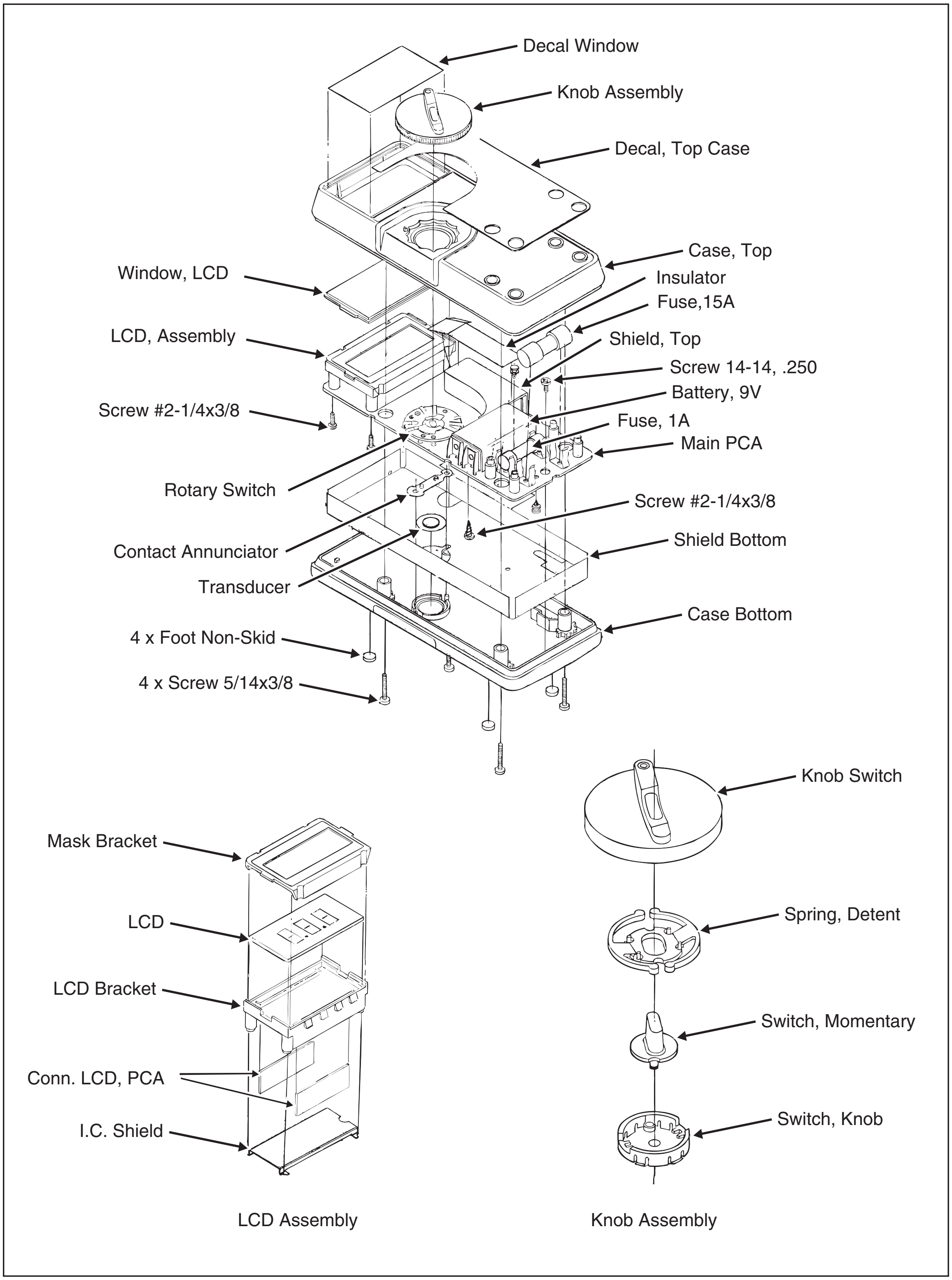


Figure 3-1. Assembly Details

Fuse Replacement 3-7.

Refer to Figure 3-1, and use the following procedure to examine or replace the meter's fuses:

1. Remove the top case.
2. Remove the defective fuse by gently prying one end of the fuse loose and sliding the fuse out of the fuse bracket.
3. Install a new fuse of the same size and rating. Make sure the new fuse is centered in the fuse holder.
4. Ensure that the case top rotary switch and circuit board switch are in the OFF position.
5. Reinstall the top case and the four Phillips screws into the bottom case.

PCA Removal 3-8.

1. The 15A fuse, F2, must be removed to access the screw that holds the pca to the case bottom (refer to Fuse Replacement, above).
2. Carefully pull back the bottom shield tab on the top shield as shown in Figure 3-2. Be sure not to crease the tab.

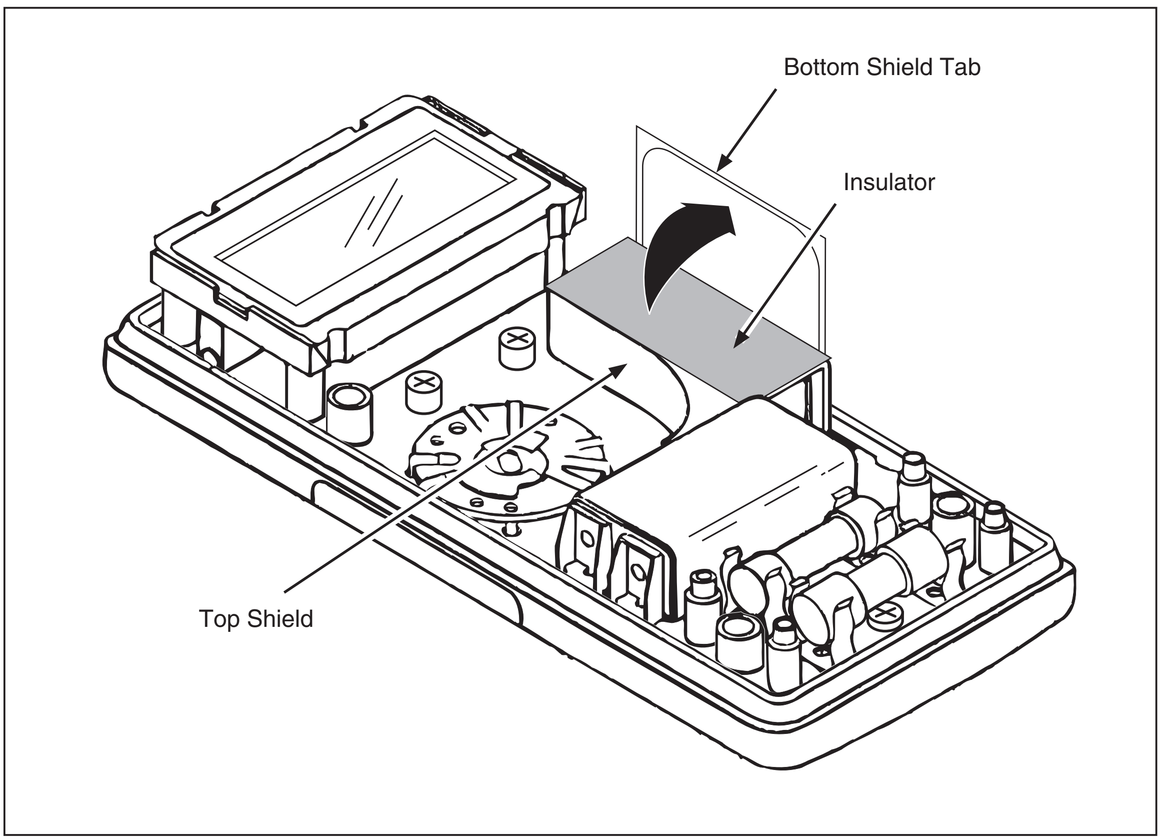


Figure 3-2. PCA Removal

3. The pca may now be removed from the bottom case.

Note

When reinstalling the pca, be sure to hold the bottom shield tab back, then insert the pca and re-adhere the bottom shiled tab to the top shield.

If the insulator on the top shield is damaged during removal of the pca, order and replace the insulator as shown in Figure 3-3.

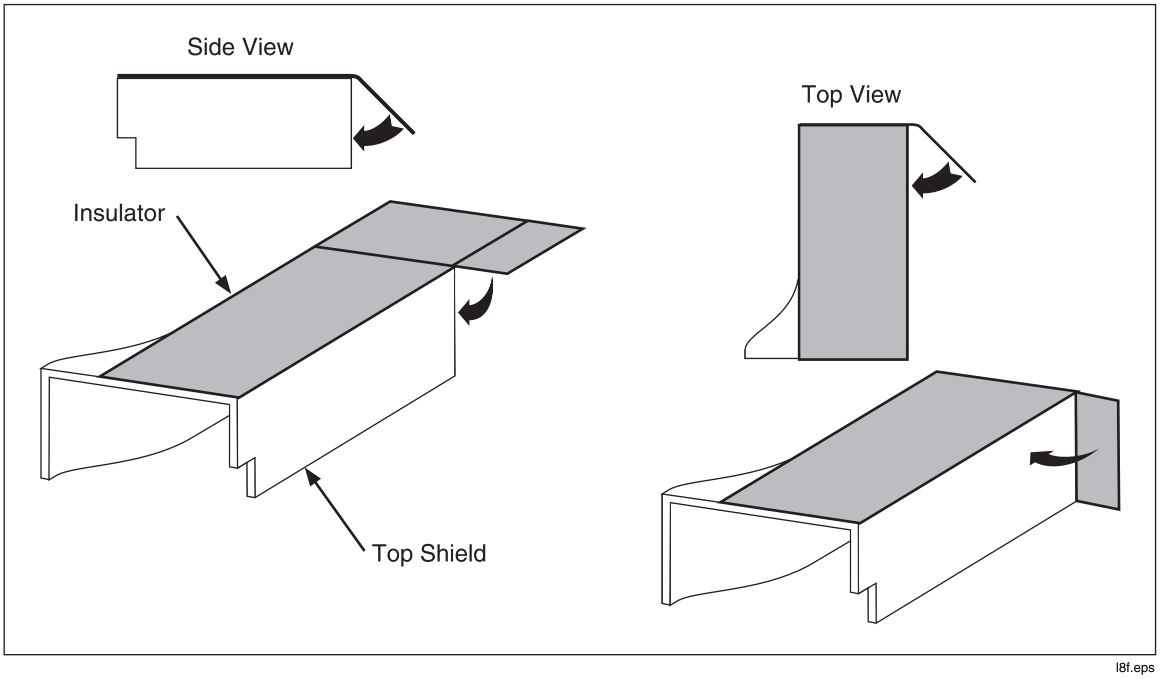


Figure 3-3. Top Shield Instulator Replacement

Display Access 3-9.

Caution

To prevent contamination, do not handle the conductive edges of the LCD interconnects. If they are contaminated, clean them with alcohol.

Refer to Figure 3-1.

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
4. Bracket, and gently pry the bracket loose from the snaps.
5. Turn the bracket upside down to remove the LCD.
6. Before installing a new LCD, make sure that all connector contact Points are clean.

Cleaning 3-10.

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 the instruments.

Do not allow the LCD to get wet. Remove the display assembly before washing the pca and do not reinstall it 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 3-11.

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

In the performance tests, the Fluke 76 meter is referred to as the unit under test (UUT).

Setup 3-12.

1. Allow the UUT to stabilize to room temperature 23°C ± 5°C (73°F ± 9°F).
2. Check the fuses and battery, and replace them if necessary. (Refer to the battery and fuse replacement procedures in this section.)

Warning

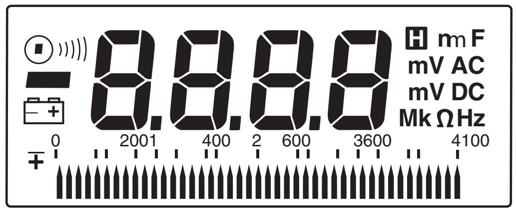
To prevent fire, install fuses in accordance with the rating shown on the back of the meter.

Warning

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

Display Test 3-13.

To test the display, turn the UUT on and check whether all display segments come on as indicated in Figure 3-4.



l9f.eps

Figure 3-4. Display

DC Voltage Test 3-14.

1. Set the UUT function switch to V DC and connect the DC Voltage Calibrator output to the VΩ⟶ and COM input terminals of the UUT.
2. Referring to Table 3-2, set the DC Voltage Calibrator for the output indicated in steps 1 through 4 only. Verify that the UUT display reading is within the limits shown.
3. Reset the source to 0V.

Table 3-2. DC Voltage Test

Step	Input		Display Reading
	Range	Voltage	
1	4V	short	0 to ± .001 V DC
2	4V	+3.5V	3.488 to 3.512V DC
3	4V	-3.5V	-3.488 to -3.512V DC (and within 2 counts of +3.5V reading)
4	40V	+35V	34.88 to 35.12V DC
5	400V	+350V	348.8 to 351.2V DC
6	600V	+600V	597 to 603V DC

mV DC Test 3-15.

1. Set the UUT function switch to mV DC, and connect the DC Voltage Calibrator output to the VΩ⟶ and COM input terminals of the UUT.

Note

For autorange, press and hold the push button for 1 second.

2. Referring to Table 3-3, set the DC Voltage Calibrator to the voltage indicated in the steps. Verify that the UUT display reading is within the limits shown.
3. Reset the source to 0V.

Table 3-3. mV DC Voltage Test

Step	Input		Display Reading
	Range	Voltage	
1	400 MV	+350 MV	348.8 To 351.2 MV DC
2	40 MV	SHORT	0 To ± .05 MV DC
3	40 MV	+35 MV	34.84 To 35.16 MV DC
4	40 mV	-35 mV	-34.84 to -35.16 mV DC

AC Voltage Test 3-16.

Warning

Injury hazard. Connect the ground/common/low side of the AC calibrator to common on the UUT.

1. Set the UUT function switch to V AC, and connect the AC Calibrator to the VΩ→⊢ and COM input terminals.
2. Set the AC Calibrator for the output given in Table 3-4, and verify that the UUT display reading is within the limits shown.

Note

When the input is open in the V AC function, it is normal for the 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 3-4. AC Voltage Test

Step	Input			Display Reading
	Range	Voltage	Freq.	
1	400 mV	20 mV	100 Hz	19.2 to 20.8 mV AC
2	400 mV	350 mV	100 Hz	343.0 to 357.0 mV AC
3	400 mV	350 mV	1 kHz	343.0 to 357.0 mV AC
4	4V	200 mV	100 Hz	.194 to .206V AC
5	4V	3.5V	100 Hz	3.432 to 3.569V AC
6	4V	3.5V	1 kHz	3.432 to 3.569V AC
7	40V	35V	1 kHz	34.46 to 35.55V AC
8	400V	350V	1 kHz	344.6 to 355.5V AC
9	600V	600V	1 kHz	589 to 611V AC

Frequency Test 3-17.

1. Set the UUT function switch to Hz and connect the Function Generator output to the VΩ→⊢ and COM input terminals of the UUT.
2. Referring to Table 3-5, set the Function Generator for the output indicated in the steps. Verify that the UUT display reading is within the limits shown.

Table 3-5. Frequency Test

Step	Input			Display Reading
	Range	Voltage	Freq.	
1	4V	300 mV	800 Hz	799.8 Hz to 800.2 Hz

Ohms Test 3-18.

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 3-6, set the Decade Resistor or Ohms Calibrator to the resistance value indicated in steps 1 through 7. Verify that the display reading is within the limits shown.

Table 3-6. Resistance Test

Step	Range	Input Resistance	Display Reading
1	400Ω	short	0 to 0.2Ω
Decades of 1:			
2	400Ω	100Ω	99.4 to 100.6Ω (plus 0 reading)
3	4 kΩ	1 kΩ	.995 to 1.005 kΩ
4	40 kΩ	10 kΩ	9.95 to 10.05 kΩ
5	400 kΩ	100 kΩ	99.5 to 100.5 kΩ
6	4 MΩ	1 MΩ	.995 to 1.005 MΩ
7	40 MΩ	10 MΩ	9.87 to 10.13 MΩ
Decades of 1.9:			
2	400Ω	190Ω	189.0 to 191.0Ω (plus 0 reading)
3	4 kΩ	1.9 kΩ	1.891 to 1.909 kΩ
4	40 kΩ	19 kΩ	18.91 to 19.09 kΩ
5	400 kΩ	190 kΩ	189.1 to 190.9 kΩ
6	4 MΩ	1.9 MΩ	1.891 to 1.909 MΩ
7	40 MΩ	19 MΩ	18.78 to 19.22 MΩ
Decades of 3.5:			
2	400Ω	350Ω	348.4 to 351.6Ω (plus 0 reading)
3	4 kΩ	3.5 kΩ	3.485 to 3.515 kΩ
4	40 kΩ	35 kΩ	34.85 to 35.15 kΩ
5	400 kΩ	350 kΩ	348.5 to 351.5 kΩ
6	4 MΩ	3.5 MΩ	3.485 to 3.515 MΩ
7	40 MΩ	35 MΩ	34.62 to 35.38 MΩ

Capacitance Test 3-19.

1. Set the UUT function switch to Ω ⊣⊢ and connect the Decade Capacitor output to the VΩ→⊢ and COM input terminals of the UUT.

Note

To enter capacitance, press and hold the push button for 2 seconds.

2. Referring to Table 3-7, set the Decade Capacitor for the output indicated in the steps. Verify that the UUT display reading is within the limits shown.

Table 3-7. Capacitance Test

Step	Input		Display Readings
	Range	Capacitance	
1	100 nF	open, no test leads	0 to 0.50 nF
2	1000 nF	open, no test leads	0 to 0.5 n
3	1000 nF	800 nF	784.6 to 815.4 nF
4*	10 µF	1.1 µF	1.077 to 1.123 µF
* Conducting performance tests of the 400Ω, 4kΩ, 40kΩ and 10µF ranges verifies that the discrete and integrated circuitry needed to support the other capacitance ranges are working within specifications. Therefore, these tests indirectly verify that the meter will meet specification in the 10µF, 100µF, 1000µF, and 10,000µF ranges.			

Continuity Test 3-20.

1. Set the UUT function switch to 40Ω ( )))).
2. Referring to Table 3-8, apply a short as indicated. Verify that the UUT display and beeper indicate as shown.

Table 3-8. Continuity Test

Step	Range	Input Resistance	Display Reading
1	400Ω	short	tone
2	400Ω	open	OL

DC and AC Current Test 3-21.

1. Set the UUT Function switch to amps.
2. Set the output of the Current Calibrator to standby and connect it to the 40 mA and Common input terminals of the UUT.
3. Set the Current Calibrator to the output shown in Table 3-9. Verify that the UUT display\reading is within the limits shown

Table 3-9. DC and AC mA Test

Step	Input			Display Reading
	Range	A	Freq.	
1	40 mA dc	+35 mA		34.80 to 35.20 DC
NOTE To enter AC mA, press and hold button for 2 seconds				
2	40 mA ac	35 mA	1 kHz	34.45 to 35.55A AC

4. Set the output of the Current Calibrator to standby and connect it to the 10A and Common input terminals of the UUT.
5. Return the UUT to A DC.
6. Set the Current Calibrator to the output shown in Table 3-10, and verify that the UUT display reading is within the limits shown.

Table 3-10. DC Amps Test

Step	Input		Display Reading
	Range	A	
2	10A dc	+10A	9.93 to 10.07 DC

Calibration 3-22.

Calibrate the meter once a year to ensure that it performs according to specifications. Calibration adjustment points are identified in Figure 3-5.

Use the following procedure to calibrate the Fluke 76:

1. Set the DC Voltage Calibrator to 0 volts.
2. Select the $\overline{\overline{V}}$ function on the meter.
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 +3.5V dc.
5. The UUT should display 3.500V dc ± 0.001. If necessary, remove the four case screws and top cover, and adjust R21 to obtain the proper display.
6. Set the UUT to the **V**~ function, and set the source for an output of 3.500V ac at 100 Hz.
7. The UUT should display 3.500V ac ± 0.002. If necessary, remove the four case screws and top cover and adjust R34 to obtain the proper display.

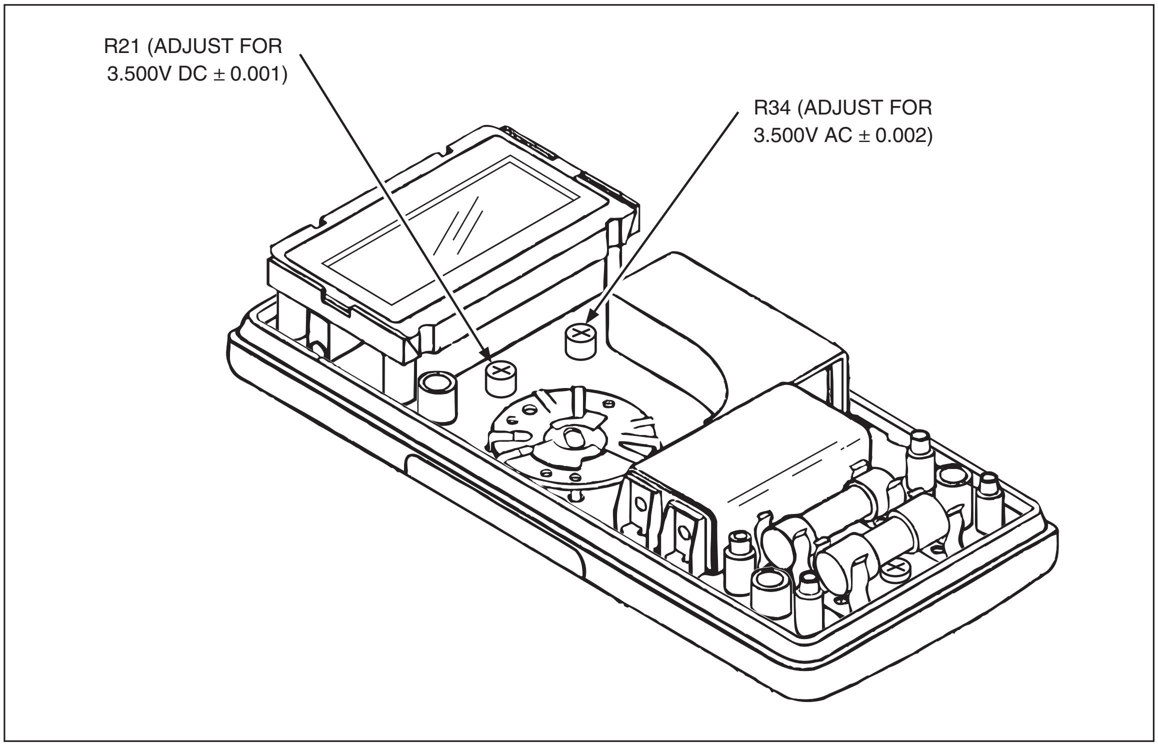


Figure 3-5. Calibration Adjustment Points

Troubleshooting 3-23.

The procedures provided in these paragraphs will help isolate problems with the meter. In these procedures, the meters are referred to as the unit under test (UUT).

When troubleshooting the Fluke 76 meter, use the precautions listed on the "Static Awareness Sheet" to prevent damage from static discharge.

Surface Mount Assemblies 3-24.

The 76 multimeter incorporates surface-mount technology (SMT) on the printed circuit assembly (pca). Surface-mount components are much smaller than their predecessors, with leads soldered directly to the surface of a circuit board; no plated through-holes are used. Unique servicing, troubleshooting, and repair techniques are required to support this technology. The information offered in the following paragraphs serves only as an introduction to SMT. We do not recommend that you attempt a repair based only on the information presented here.

Since sockets are seldom used with SMT, "shotgun" troubleshooting cannot be used; isolate a fault to the component level before replacing a part. Surface-mount assemblies are probed from the component side. The probes should contact only the pads in front of the component leads. With the close spacing involved, ordinary test probes can easily short two adjacent pins on an SMT IC.

Due to the limited space on the surface of the circuit board, component locations are not labeled. Therefore, this service manual is a vital source for component locations and values. Figures provided in Section 5 of this manual provide component location information. Also, remember that SMT components are not individually labeled; keep any new or removed component in a labeled package.

Surface-mount components are removed and replaced by reflowing all the solder connections at the same time. Special considerations are required.

- The de-solder tool should use regulated hot air to melt the solder; there should be no direct contact between the tool and the component.
- Rework surface-mount assemblies with wire solder rather than with solder paste. Multicore X38B, no-clean wire solder is recommended.
- A good connection with SMT requires only enough solder to make a positive metallic contact. Too much solder causes bridging, while too little solder can cause weak or open solder joints. With SMT, the anchoring effect of the through-holes is missing; solder provides the only means of mechanical fastening. Therefore, the pca must be especially clean to ensure a strong connection. An oxidized pca pad causes the solder to wick up the component lead, leaving little solder on the pad itself.

Power Supply Related Troubleshooting 3-25.

The two regulator circuits are interrelated; a malfunction in either the common regulator or the Vdd regulator may cause a problem in the other. Refer to Tables 3-11 and 3-12 for descriptions of power supply components and voltage levels. To isolate the problem regulator circuit, disconnect the battery, and drive Vdd - Vss = 6.2V with a power supply. This procedure tests the common regulator independently of the Vdd regulator.

Now check for Vdgnd - Vss = -3.2V ± 0.2V. If this test is successful, the problem lies with the Vdd regulator; refer to Vdd Regulator Troubleshooting later in this section. If this test is not successful, the problem lies with the common regulator; continue with the Common Regulator Troubleshooting below.

Note that if the common regulator works or has been repaired, check both supplies with the 9V battery supply.

Common (Shunt) Regulator Troubleshooting 3-26.

To troubleshoot the common regulator, connect the power supply so that Vdd, Vss, and DGND (digital ground) are supplied from an external power supply. This procedure overdrives the large on-chip shunt transistors; the bias current from the power supply ranges from 10 mA to 100 mA. Refer to the schematic for a diagram of the common regulator.

Table 3-11. Functional Description of Power Supply Components

Component	Function
Q10	Power supply startup device. Q10 provides Q8 base startup current. Q10 is always off during meter operations.
VR1	VR1 provides the system reference voltage. It is used for the a/d converter reference and as a reference for both power supply regulators
C14	Vdd regulator compensation and bypass.
C21	Common regulator compensation and Vss bypass.
C35	Battery bypass.
R24, R25	Vdd regulator voltage sensing resistors.
R37, R38	Common regulator voltage sensing resistors.
R44	Supplies bias current to VR1.

Table 3-12. Voltage Levels

VDD	3.0 ± 0.2
VSS	3.2 ± 0.2
VBT-	6.1 (battery at full 9V charge) 3.2 (battery at low charge of 6.0V)
REFH	1.23 ± 0.04
PS0	1.23 ± 0.15
PS1	0 ± 0.15
VOA	2.2 to 1.7 (referenced from VSS)
VOB	1.07 to .85 (referenced from VSS)

Make the following tests:

1. Check for +1.23V ± 40 mV (Vrefh) at the cathode of VR1. If Vrefh is not correct, check VR1, R19, R20, R21 and R44 carefully. If Vrefh is still incorrect, U4 is bad.
2. If Vrefh is correct, measure the voltage at U4 pin 6 (PS1). If Vps1 is not equal to 0V ± 0.15V, check R37 and R38. If Vps1 is still at an incorrect voltage, U4 is bad.
3. Check the bias generator circuit. With the exception of resistor R35 (620 kΩ), the bias generator (which sets the bias level for all U4 analog circuitry) is internal to U4. A problem with this circuit could cause the on-chip power supply op amps to fail. Measure the dc voltage between U4 pin 8 (Vbias) and DGND. If -0.2V < Vbias < +0.2V the bias generator is okay. If Vbias is not correct, check R35. If Vbias is still wrong, replace U4.
4. Measure the ac voltage between Vdgnd and Vss. If it is greater than 10 mV ac, check C21. (An open C21 causes common regulator instability.) The dc level may also be incorrect.
5. If the common regulator still does not work, circuitry internal to U4 is bad. Replace U4.

Vdd (Series) Regulator Troubleshooting 3-27.

If a problem still exists after the common regulator troubleshooting, continue with the following Vdd regulator troubleshooting. Often, a short or sneak current path causes power supply problems. Refer to the schematic for a diagram of the Vdd (Series) Regulator. Make the following tests:

1. Measure the dc operating current from the 9V battery. If the current is greater than 1.2 mA, a sneak current path exists. A sneak current path can be very difficult to find.
2. First, visually check for both solder bridges on U4 pins and other circuit board shorts.

Isolate the current path at the negative battery terminal (Vbt-). The components connected to Vbt- are C35, CR4, and R63. Remove these parts one at a time. Measure I(bat) after each removal to isolate the problem.

1. If the excess battery current stops after removing R63, either R63, R57, Q9, or Q11 may be bad.
2. If the extra current is still present with all parts removed, remove Q10 and check for excess battery current. If I(bat) is now correct, Q10 is bad. If I(bat) is still excessive, U4 is probably at fault.

If the power supply is not working but battery current is normal, perform the following tests.

1. If Vdd - Vss is low, a problem may exist with start-up device Q10. Check Q10 by momentarily connecting Vss to Vbt-. If both Vss and Vbt- now start up and operate correctly, check Q10 for an open.
2. Measure the ac voltage between Vdd and Vss. An unstable Vdd regulator can be caused by an open C14. If the voltage is greater than 10-mV ac, check C14. The dc level may also be incorrect.

For a final check of U4, remove the battery and supply Vdd = +3.0V, Vdgnd = 0, and Vss = -3.2V from an external power supply. Measure the voltage at U4 pin 7 (Vps0). If it does not equal 1.23V ± 0.15V, check R24 and R25 carefully. If Vps0 is still incorrect, U4 is bad.

Chapter 4
List of Replaceble Parts

Introduction 4-1.

This section contains an illustrated list of replaceable parts for the Fluke 76 True RMS Multimeter. Parts are listed by assembly; alphabetized by reference designator. Each assembly is accompanied by an illustration showing the location of each part and its reference designator. The parts lists give the following information:

- Reference designator
- An indication if the part is subject to damage by static discharge
- Description
- Fluke stock number
- Total quantity
- Any special notes (i.e., factory-selected part)

Caution

A * symbol indicates a device that may be damaged by static discharge.

How to Obtain Parts 4-2.

Electrical components may be ordered directly from the Fluke Corporation and its authorized representatives by using the part number under the heading FLUKE STOCK NO. In the U.S., order directly from the Fluke Parts Dept. by calling 1-800-526-4731. Parts price information is available from the Fluke Corporation or its representatives. Prices are also available in a Fluke Replacement Parts Catalog which is available upon request.

In the event that the part ordered have been replace by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt delivery of the correct part, include the following information when you place an order:

- Instrument model and serial number
- Part number and revision level of the pca containing the part
- Reference designator
- Fluke stock number
- Description (as given under the DESCRIPTION heading)
- Quantity

Manual Status Information 4-3.

The Manual Status Information table that precedes the parts list, defines the assembly revision levels that are documented in the manual. Revision levels are printed on the component side of each pca.

Newer Instruments 4-4.

Changes and improvements made to the instrument are identified by incrementing the revision letter marked on the affected pca. These changes are documented in a manual supplement which, when applicable, is included with the manual.

Service Centers 4-5.

A list of service centers is located at the end of this section.

Note Ni-Cd

This instrument may contain a Nickel-Cadmium battery. Do not mix with the solid waste stream. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler. Contact your authorized Fluke service center for recycling information.

Warning

This instrument contains a fusible resistor (PN 107398). To ensure safety, use exact replacement only.

Manual Status Information

REF OR OPTION NO.	ASSEMBLY NAME	FLUKE PART NO.	REVISION LEVEL
A1	Main PCA	104064	B

Table 4-1. 76 Final Assembly

Reference Designator	Description	Fluke Stock No	Tot Qty	Notes
BT1	BATTERY,PRIMARY,ALKALINE,9V,0-200MA	614487	1	
C1	CAP,POLYES,0.01UF,+-10%,630V	107409	1	
F1	FUSE,.406X1.375,1A,600V,FAST	830828	1	
F2	FUSE,.406X1.5, 15A, 600V, FAST	820829	1	
H1	SCREW,PH,P,THD FORM,STL,4-24,.250	519116	1	
H2	SCREW,PH,P,THD FORM,STL,2-14,.375	821140	1	
H3	SCREW,PH,P,THD FORM,STL,4-14,.375	448456	4	
H7	SCREW,PH,P,THD FORM,STL,5-14,.750	733410	4	
J1-4	RECEPTACLE,INPUT	642959	4	
LS1	AF TRANSD,PIEZO,20 MM		1	2
MP1,MP2	CONTACT,600V,FUSE	659524	2	
MP3,MP4	600 VOLT FUSE CONTACT	707190	2	
MP6	CONTACT,BATTERY	642967	1	
MP7	CONTACT,BATTERY	654228	1	
MP9	SHIELD, TOP, PLATED	104106	1	
MP10	FOOT,NON-SKID	640565	4	
MP14	CASE,BOTTOM		1	2
MP15	SHIELD, BOTTOM		1	1, 2
MP17	CASE,TOP	103887	1	
MP18	WINDOW,LCD (FLUKE 76	103892	1	
MP19	BRACKET,LCD	646653	1	
MP20	MASK/BRACKET	885848	1	
MP21	CONN,ELASTOMERIC,LCD TO PWB,1.900 L	649632	2	
MP23	KNOB,SWITCH	885843	1	
MP24	SHAFT,KNOB	646661	1	
MP25	SPRING,DETENT	646679	1	
MP26	SHOCK ABSORBER	428441	1	
MP27	DECAL,CASE TOP	103884	1	
MP28	LABEL,WINDOW	844340	1	
MP31	HOLSTER & FLEXSTAND ASSY, YELLOW	890298	1	
MP32	TEST LEADS	855742	1	
MP54	SPACER,SNAP,NYL,.125	106416	2	
MP57	INSULATOR	104059	1	1, 3
MP58	SPACER, FOAM	104098	1	
MP 59	I.C. SHIELD	104163	1	
S1	SWITCH,ROTARY	885876	1	
S2	SWITCH,MOMENTARY, YELLOW	890280	1	
S4	CONTACT,ANNUNCIATOR		1	2
TM1	USERS MANUAL, INTERNATIONAL	106275	1	
TM2	PRINTED MATL,WARRANT CARD,FLUKE 70/20 SERIES	897806	1	
TM3	QUICK REFERENCE CARD	106278	1	

NOTES:

1. TO ENSURE SAFETY, THESE PARTS MUST BE INSTALLED.
2. NON-PROCURABLE, ORDER NEXT HIGHER ASSEMBLY PN 104067.
3. SEE FIGURE 3-3 TOP SHIELD INSULATOR REPLACEMENT.

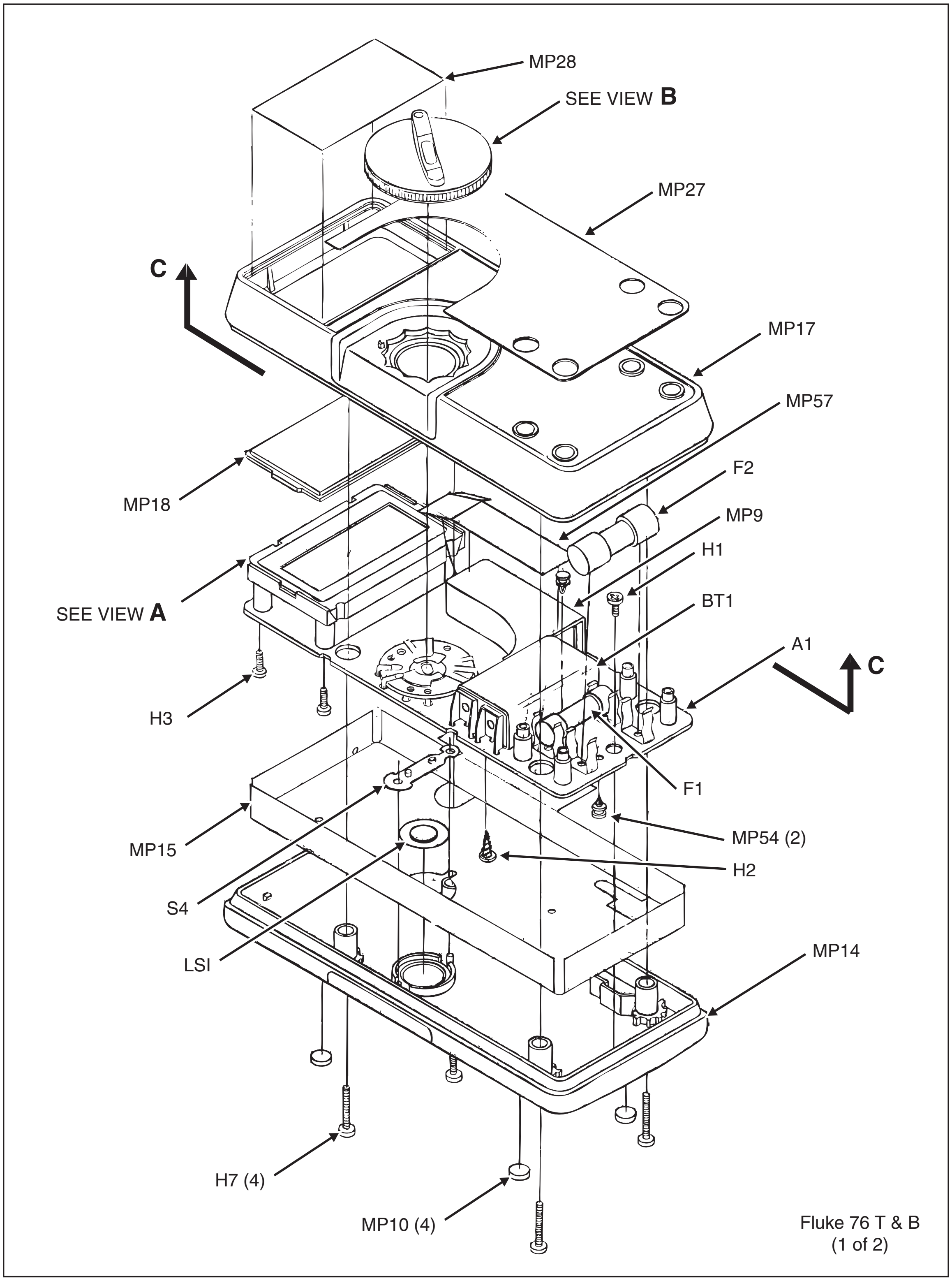


Figure 4-1. 76 Final Assembly

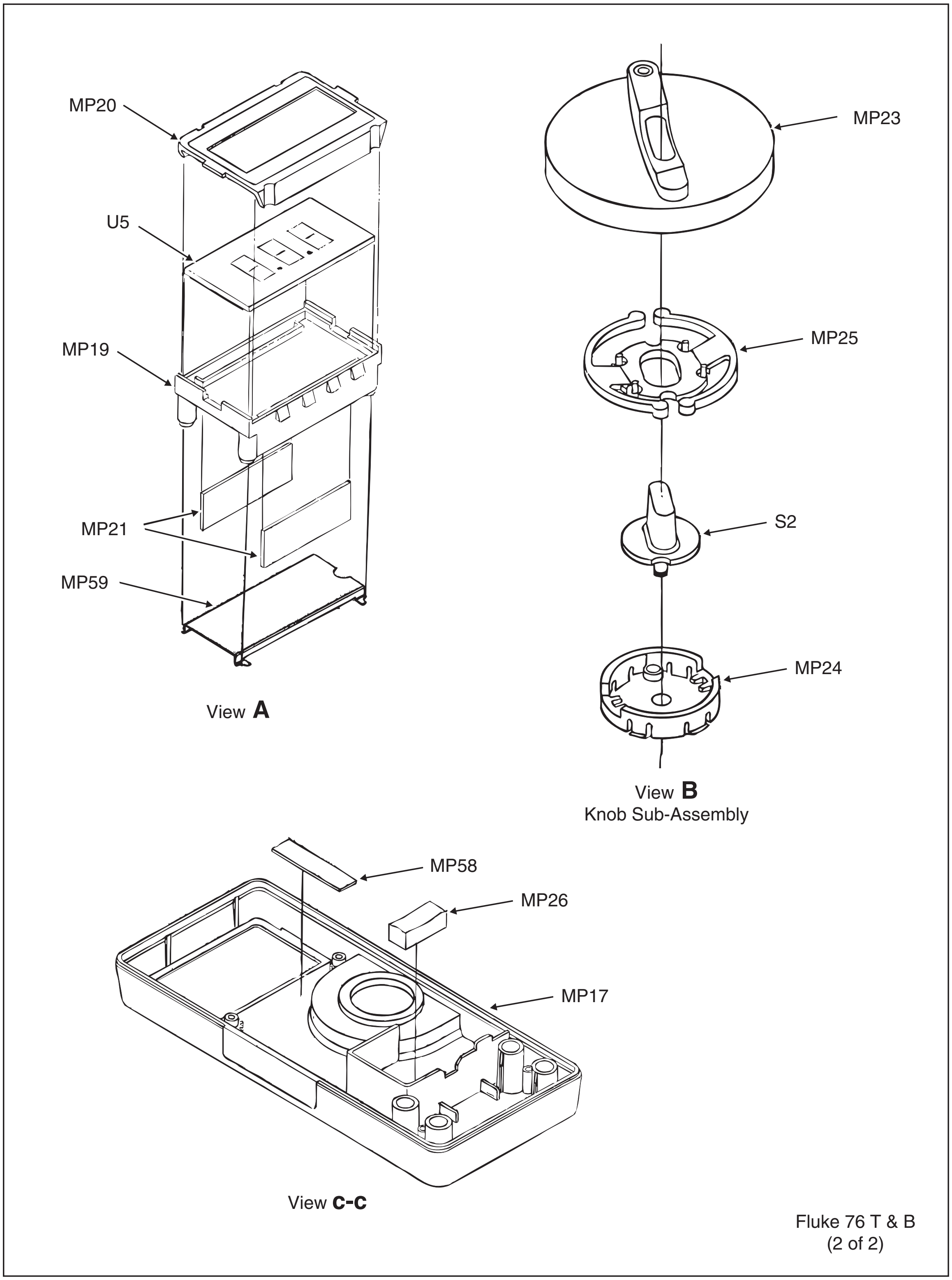


Figure 4-1. 76 Final Assembly (cont)

Table 4-2. A1 Main PCA

Reference Designator		Description	Fluke Stock No	Tot Qty	Notes
C1		CAP,POLYES,0.01UF,+-10%,630V	107409	1	
C2,C4,C12,C30		CAP,CER,270PF,+-1%,50V,C0G,0805	944301	4	
C3		CAP,CER,75PF,+-5%,COG,0805	107638	1	
C5,C7		CAP,TA,15UF,+-20%,10V,3528	867593	2	
C6		CAP,TA,22UF,+-20%,6V,6032	876545	1	
C8,C9		CAP,POLYCA,0.027UF,+-10%,63V	720979	2	
C10		CAP,TA,0.47UF,+-20%,25V,3216	876180	1	
C11		CAP,POLYPR,0.022UF,+-10%,63V	821579	1	
C13,C19		CAP,CER,270PF,+-1%,50V,C0G,0805	944301	2	
C14,C21		CAP,TA,47UF,+-20%,10V,7343	867580	2	
C15,C16		CAP,CER,0.1UF,+-10%,25V,X7R,1206	747287	2	
C17,C18		CAP,CER,22PF,+-10%,50V,C0G,1206	740563	2	
C20		CAP,CER,3.3PF,+-0.25PF,1500V,C0J	904636	1	
C31,C33,C34		CAP,CER,0.01UF,+-10%,50V,X7R,1206	747261	3	
C35		CAP,TA,4.7UF,+-20%,10V,3528	867262	1	
CR1,CR4		DIODE,SI,100 PIV,1 AMP,SURFACE MOUNT	912451	2	
L1		FERRITE CHIP,60 OHM @100 MHZ,1806	944645	1	
Q1,Q2	*	TRANSISTOR,SI,NPN,SELECT IEBO,SOT-23	821637	2	
Q3,Q9,Q12	*	TRANSISTOR,SI,NPN,SMALL SIGNAL,SOT-23	742676	3	
Q4	*	TRANSISTOR,SI,NPN,SMALL SIGNAL,SOT-23	912469	1	
Q5	*	TRANSISTOR,SI,PNP,50V,0.2W,SOT-23	820910	1	
Q10	*	TRANSISTOR,SI,P-CHAN,SOT-23	832477	1	
Q11	*	TRANSISTOR,SI,PNP,SMALL SIGNAL,SOT-23	742684	1	
Q13	*	TRANSISTOR,SI,PNP,SELECT ICER,SOT-23	887179	1	
R1		RES,MF,450,+-10%,100PPM,FLMPRF,FUS	107398	1	1
R2		RES,CERM,1M,+-1%,2W,100PPM	876177	1	
R3		RES,CERM,1.5K,+-1%,.125W,100PPM,1206	810630	1	
R4,R17,R18,		RES,CERM,1M,+-1%,.125W,100PPM,1206	836387	4	
R23			836387		
R5		RES,WW,9.99,+-0.25%,1W,50PPM	876321	1	
R6		RES,WW,0.010,+-0.25%,1W,100PPM	877076	1	
R7		RES,CERM,1K,+-5%,.125W,200PPM,1206	745992	1	
R8,R12		RES,CERM,750,+-2%,2W,100PPM,MELF	107375	2	
R9,R59		RES,CERM,510,+-5%,.125W,200PPM,1206	746388	2	
R10,R11		RES,MF,51.1K,+-0.1%,0.1W,25PPM,0805	106382	2	
R13,R29,R60,		RES,CERM,100K,+-5%,.125W,200PPM,1206	740548	5	
R61,R64			740548		
R14		RES,MF,10K,+-0.1%,.125W,25PPM,1206	106366	1	
R15		RES,MF,90K,+-0.1%,.125W,25PPM,1206	106374	1	
R16		RES,CERM,510,+-5%,.125W,200PPM,1206	746388	1	
R19		RES,CERM,56.2K,+-1%,.125W,100PPM,1206	831305	1	
R20,R25,R37		RES,CERM,205K,+-1%,.125W,100PPM,1206	769836	3	
R21		RES,VAR,CERM,100K,+-25%	912493	1	
R22,R38		RES,CERM,536K,+-1%,.125W,100PPM,1206	845420	2	
R24		RES,CERM,280K,+-1%,.125W,100PPM,1206	886833	1	
R28		RES,CERM,68.1K,+-1%,.125W,100PPM,1206	851845	1	
R34		RES,VAR,CERM,100,+-25%,0.2W	106937	1	
R35		RES,CERM,620K,+-5%,.125W,200PPM,1206	811919	1	
R44		RES,CERM,82K,+-5%,.125W,200PPM,1206	811794	1	
R57		RES,CERM,33K,+-5%,.125W,200PPM,1206	746669	1	

Table 4-2. A1 Main PCA (cont)

Reference Designator		Description	Fluke Stock No	Tot Qty	Notes
R62		RES,CERM,107K,+-1%,.125W,100PPM,1206	875224	1	
R63		RES,CERM,2.2K,+-5%,.125W,200PPM,1206	746479	1	
RT1		THERMISTOR,POS,1.1K,+-20%,25 C	867192	1	
RV1		VARISTOR,910,+-10%,1.0MA	876193	1	
RV2		VARISTOR,910,+-10%,1.0MA	876193	1	
RV3		VARISTOR,910,+-10%,1.0MA	876193	1	
U1		DIODE,RECT,BRIDGE,BV=50V,IO=1A	912456	1	
U2	*	IC,BPLR,TRUE RMS TO DC CONVERTER,SOIC	868000	1	
U4	*	IC N-WELL 76TRMS,ASSEMBLY TESTED	103728	1	
U5	*	LCD,4.5 DIGIT,BAR GRAPH,MULTIPLEXED	875534	1	
VR1	*	IC, 1.23V,150 PPM T.C.,BANDGAP V. REF	634451	1	
Y1		CRYSTAL,131.072KHZ,30PPM,SURFACE MT	912464	1	
Z1		RNET,CERM,SIP,FLUKE 83 HI V DIVIDER	828152	1	

NOTES

1. FUSIBLE RESISTOR. TO ENSURE SAFETY, USE EXACT REPLACMENT ONLY.

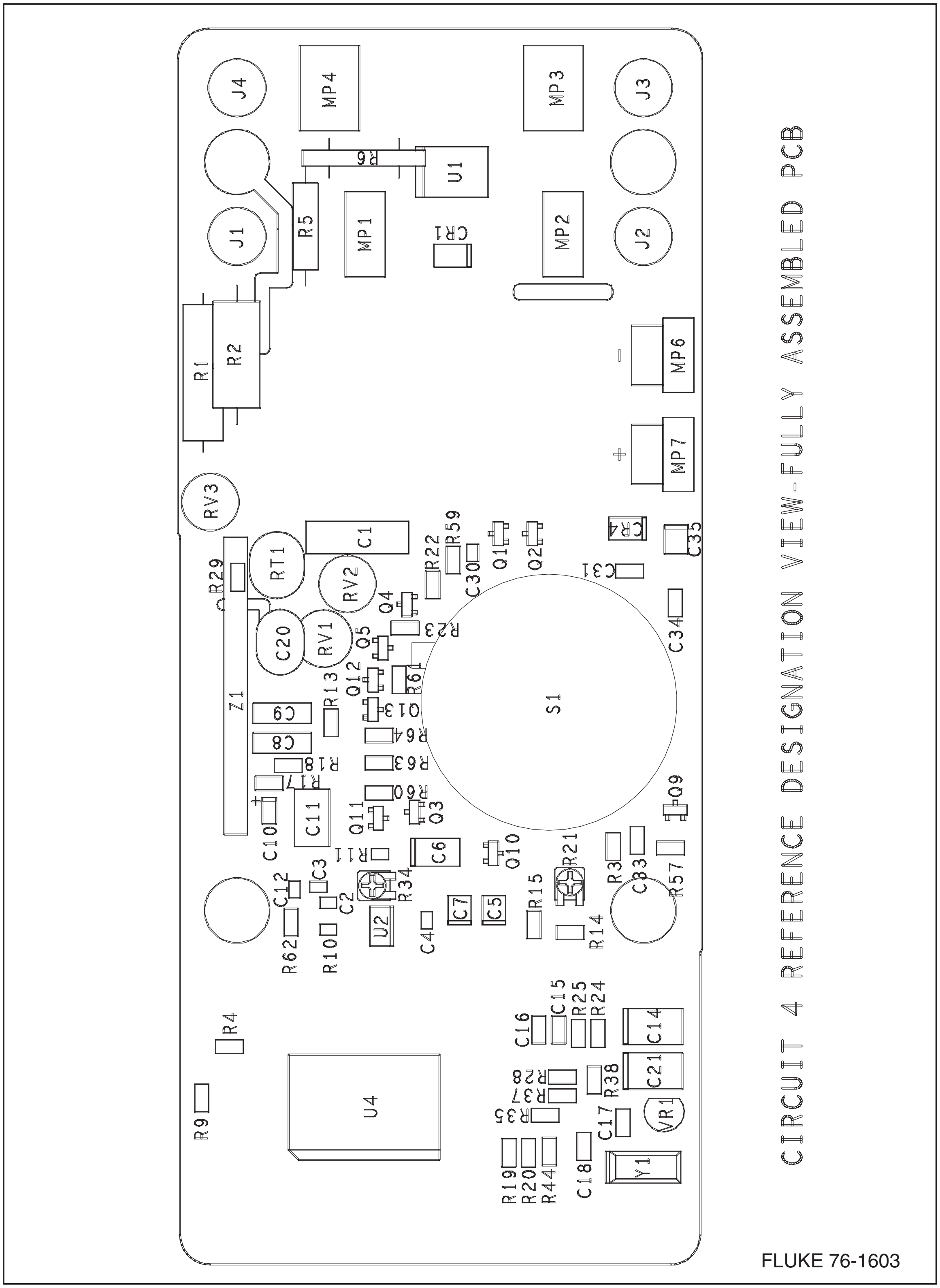


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Figure 4-2. A1 Main PCA

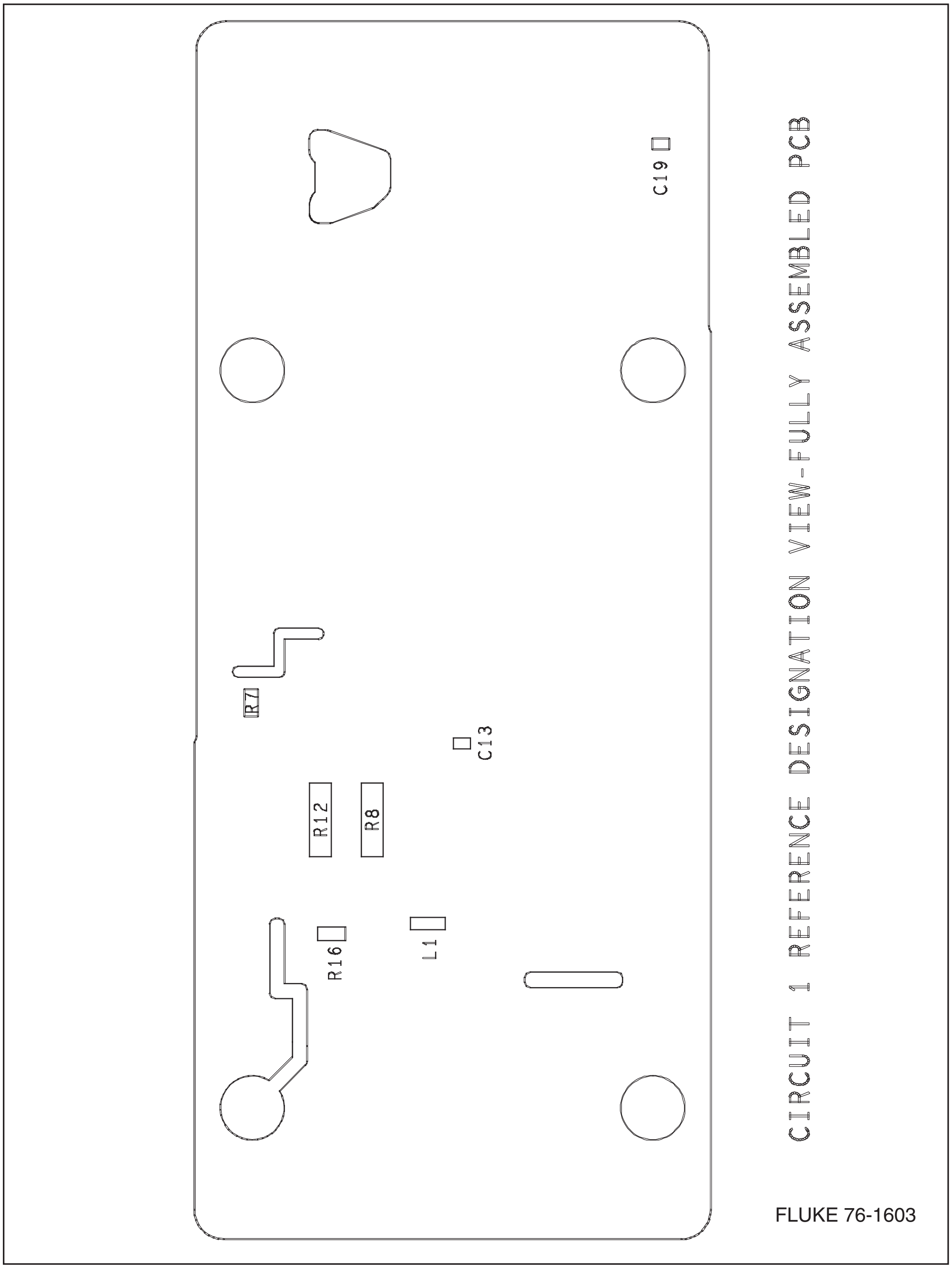

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Figure 4-2. A1 Main PCA (cont)

Chapter 5
Schematic Diagrams