sense lines PB1, PB2 & PB3 with one switch from each strobe group per sense line. U2 pulls each strobe line to -2.5 V in sequence and monitors the sense lines. U2 can determine which switch is closed, debounce and handle multiple switch closures.

### Microprocessor & Support Circuits

U2 is the microprocessor and Y1 is the crystal used for the clock generator that is internal to U2. The 32.768-kHz oscillator is multiplied to above 1 MHz inside U2 when the Meter is not in sleep mode. This low oscillator frequency helps reduce the standby power required by U2 while the Meter is in sleep mode. C17, C18, C19, C25, C27 & C29 are power supply bypass capacitors.

R21 & C8 form the power on reset circuit that holds the RST* signal to U2 at logic low until C8 is charged to logic high on the way to 3.3 V (-2.5 V to +0.8 V).

U14 is an AND gate that allows the signal ODCMP from COMP_O (U1 pin 24) to gate the SMCLK signal from U2 back to the DCMP input of U2 to facilitate the measurement of duty cycle. When U2 sets SMCLK to logic high (+0.8 V), the ODCMP signal is counted by U2 and frequency is measured. When U2 drives SMCLK with an approximately 1-MHz clock, this signal appears at DCMP only when ODCMP is logic high (+0.8 V). The frequency of the signal ODCMP is measured directly while the multiple positive periods are measured referenced to the SMCLK. U2 uses the frequency of ODCMP and the accumulated time that the signal was high to compute both the positive and negative duty cycle.

### LCD

U11 is a liquid crystal display (LCD) with four back planes that are multiplexed by U2 with the COM0-3 signals. Only 34 of the possible 40 segment drivers of U2 are connected to U11 and not all combinations of segments and back planes are used.

R20, R25, R26, R27, R41 & RT2 form a temperature-compensated voltage divider used to generate the four voltage levels used by the display multiplexer internal to U2. As the temperature of the Meter is increased, U11 requires less total voltage to maintain the desired contrast ratio. RT1 is a negative temperature coefficient device, so as the temperature increases the total current through R27 increases and the voltage across R20, R25 & R26 decreases, thereby maintaining the display contrast ratio. The opposite occurs as the temperature lowers.

### Backlight

DS3, R14, R46, R50, R96, R99, Q4, Q8 & Q17 form the backlight and backlight control circuit. The microprocessor holds the backlight off or can turn it on with two levels of intensity available. When the BKLT and HIBEAM signals from U2 are at logic low (-2.5 V), Q4, Q8 & Q17 are off, allowing no current to flow through DS3. When U2 drives BKLT to logic high (+0.8 V), Q4 & Q8 are turned on. The current through DS3 is set by R50, R96 and Q8, and regulated by Q4, which adjusts the base current of Q8 to keep the voltage drop across R50 & R96 equal to the voltage drop across R46. When U2 drives HIBEAM to logic high (+0.8 V), Q17 is turned on and partially bypasses R96, thereby requiring more current through R50 to keep the voltage across R50, R96 and Q17 equal to the drop across R46 resulting in a brighter backlight.

### Beeper

LS1, R19, R44, R47, R108, C11, Q5 & U5 form the beeper and beeper control circuit. When the BPR signal from U2 is at logic low (-2.5 V), Q5 is off, which disconnects the negative power supply connection of U5 disabling the beeper oscillator and drive circuit. When the BPR signal from U2 is at logic high (+0.8 V), Q5 is on, which allows U5 to power up. Pin 2 of piezoelectric beeper LS1 is driven by the parallel combination of two U5 inverters and pin 1 of LS1 is driven by two more U5 inverters to supply enough current to the beeper and ensure adequate loudness. R108 allows for limiting beeper current if necessary due to future component changes. R44 in parallel with R47 & C11 set the frequency of the beeper oscillator (note that the junction of R44, R47 & C11 operates at voltages beyond the power supply values). The remaining two U5 inverters are used in series to form the non-inverting buffer portion of the oscillator.

# Troubleshooting

Refer to the “Theory of Operation” and “Schematics” sections to assist in troubleshooting the Meter.

## Restoration Actions

Refer to “Performance Tests”.

# Basic Maintenance

**⚠⚠Warning**

**To avoid possible electric shock or personal injury:**

- **Remove the test leads and any input signals before opening the case or replacing the battery or fuses.**
- **Repairs or servicing covered in this manual should be performed only by qualified personnel.**

## Cleaning the Meter

**⚠⚠Warning**

**To avoid possible electric shock, personal injury, or damage to the meter, never allow water inside the case.**

**⚠Caution**

**To avoid damaging the Meter, never apply abrasives, solvents, aromatic hydrocarbons, chlorinated solvents, or methanol-based fluids to the Meter.**

Periodically wipe the Meter case with Fluke “MeterCleaner” or a damp cloth and mild detergent.

Dirt or moisture in the **A** or **mA µA** input terminals can affect readings and can falsely activate the Input Alert feature without the test leads being inserted. Such contamination may be dislodged by turning the Meter over and, with all test leads removed, gently tapping on the case.

Thoroughly clean the terminals as follows:

1. Turn the Meter off and remove all test leads.
2. Soak a clean swab with isopropyl alcohol and work the swab around in each input terminal to remove contaminates.

## Opening the Meter Case

**⚠Caution**

**To avoid unintended circuit shorting, always place the uncovered Meter assembly on a protective surface. When the case of the Meter is open, circuit connections are exposed.**

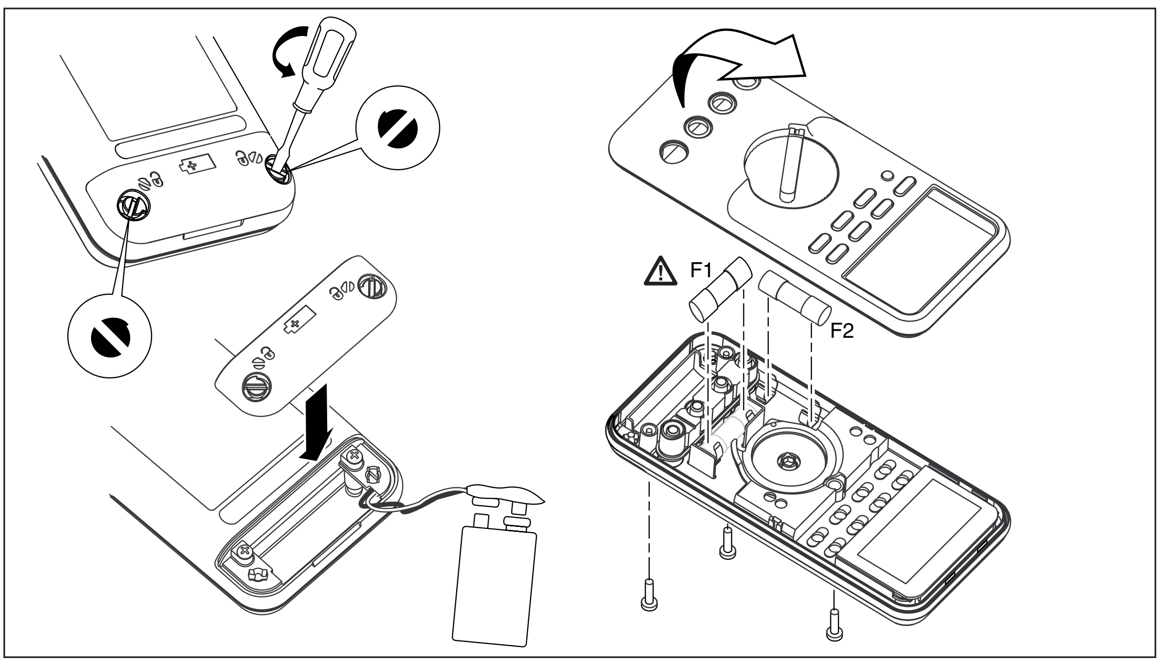
To open the Meter case, refer to Figure 2 and do the following:

1. Disconnect test leads from any live source, turn the rotary knob to **OFF**, and remove the test leads from the front terminals.
2. Remove the battery door by using a flat-blade screwdriver to turn the battery door screws 1/4-turn counterclockwise.
3. The case bottom is secured to the case top by three screws and two internal snaps (at the LCD end). Using a Phillips-head screwdriver, remove the three screws.

**⚠Caution**

**To avoid damaging the Meter, the gasket that is sealed to the bottom case, and is between the two case halves, must remain with the case bottom. The case top lifts away from the gasket easily. Do not damage the gasket or attempt to separate the case bottom from the gasket.**

4. Hold the Meter display side up.
5. Pushing up from the inside of the battery compartment, disengage the case top from the gasket.
6. Gently unsnap the case top at the display end, see Figure 2.




ama12.eps

**Figure 2. Opening the Meter, Battery and Fuse Replacement**

## Accessing the PCA and Replacing the LCD

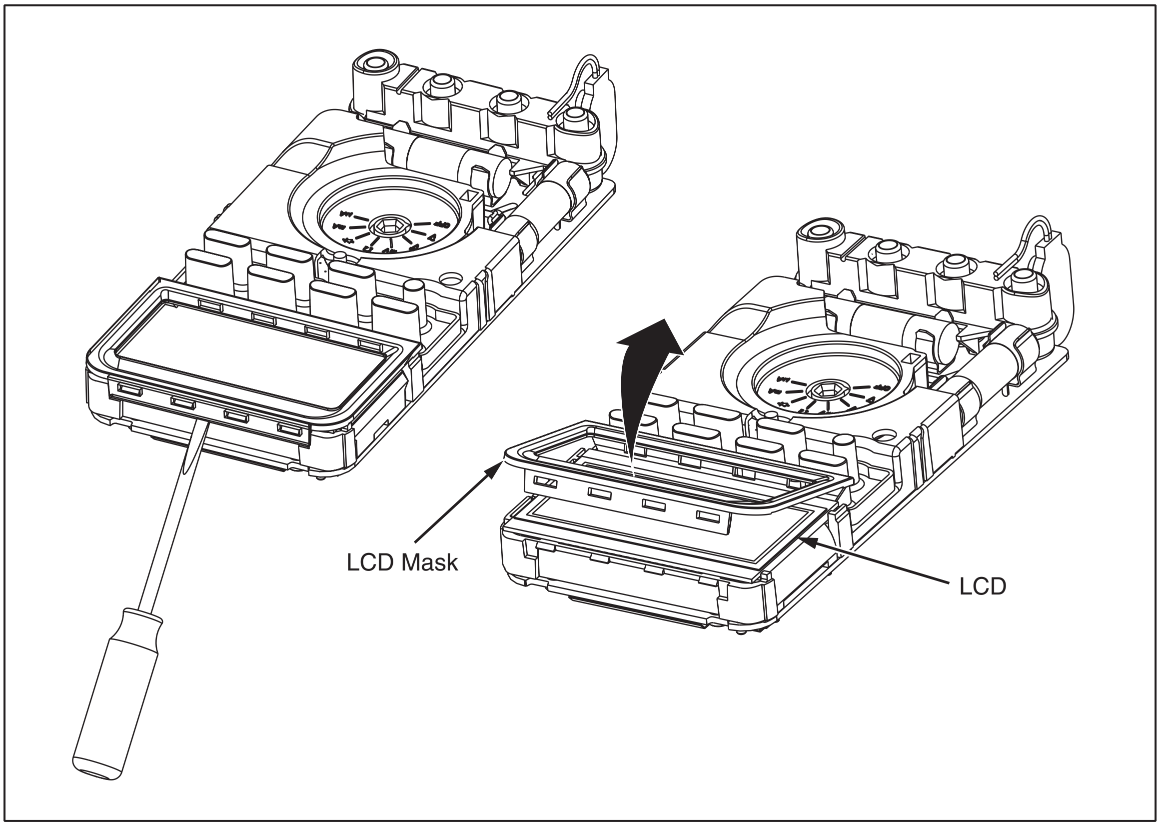
Once the case has been opened, the A1 Main PCA can easily be removed. The shields disconnect from the PCA as follows:

1. Remove the five Phillips-head screw securing the top and bottom shields to the PCA.
2. Remove the top shield assembly that also houses the LCD and lightpipe for the LCD backlight.
3. To access the LCD, unsnap the LCD mask using a small flat-blade screwdriver. The LCD may now be removed. Refer to Figure 3.

*Note*

*Two elastomeric connectors make electrical contact between the LCD and the PCA. These connectors usually stick to the LCD when it is removed. If the connectors are to be reused, do not handle them, as the electrical contact points might become contaminated. Use tweezers to remove these connectors.*

4. To reinstall the connectors, replace the LCD and LCD mask and lay the top shield face down. Install the elastomeric connector strips into the slots on the top shield.
5. Place the PCA onto the top shield so that the screw holes align.
6. Place the bottom shield onto the PCA and secure the assembly with five Phillips-head screws. Ensure that the shields are tightly attached. Properly fitted shields are required for the Meter to perform to specifications.




ama08f.eps

**Figure 3. Removing LCD Mask to Access LCD**

## Reassembling the Meter Case

To reassemble the Meter case:

1. Verify that the rotary knob and circuit board switch are in the **OFF** position, and that the gasket remains secured to the bottom case.
2. Place the PCA into the bottom case.
3. Place the case top on the case bottom.
4. To avoid damaging the battery wire, ensure the wire exits the middle of the battery compartment.
5. Properly seat the case gasket and snap the case halves together above the LCD end. See Figure 2.
6. Reinstall the three case screws and the battery door.
7. Secure the battery door by turning the screw 1/4-turn clockwise.
8. Go to “Performance Tests” later in this document, and perform the procedures described.

## Replacing the Battery

Replace the battery with a 9-V battery (NEDA A1604, 6F22, or 006P).

**⚠⚠Warning**

**To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator (+) appears. If the display shows “bAtt” the Meter will not function until the battery is replaced.**

Replace the battery as follows, refer to Figure 2:

1. Turn the rotary knob to **OFF** and remove the test leads from the terminals.
2. Remove the battery door by using a standard-blade screwdriver to turn the battery door screws one-quarter turn counterclockwise.
3. Remove the old battery and replace it with a new one.
4. Align the battery leads so that they not pinched between the battery door and the case bottom.
5. Secure the door by turning the screws one-quarter turn clockwise.

## Testing Fuses and Current Circuitry

If a test lead is plugged into the **mA/µA** or **A** terminal and the rotary knob is turned to a non-current function, the Meter chirps and flashes “LEAd” if the fuse associated with that current terminal is good. If the Meter does not chirp or flash “LEAd”, the fuse is bad and must be replaced. Refer to Table 17 for the appropriate replacement fuse.

Before measuring current, test the quality of the appropriate fuse and the current shunt using the following procedure. See Figure 4.

1. Turn the rotary knob to ))))Ω⊣⊢.
2. To test F2, insert a test lead into the **VΩ→⊢** input terminal and touch the probe to the **A** input terminal.

*Note*

*The input receptacles contain split contacts. Be sure to touch the probe to the half of the receptacle nearest the LCD.*