3. The display should indicate between 00.0 Ω and 00.5 Ω. If the display reads OL, replace the fuse and test again. If the display reads another value, further servicing is required.
4. To test F1, move the probe from the **A** input terminal to the **mA/μA** input terminal.
5. The display should read between 0.995 kΩ and 1.005 kΩ. If the display reads OL, replace the fuse and test again. If the display reads another value, further servicing is required.

⚠⚠Warning

To avoid electrical shock or personal injury:

- **Remove the test leads and any input signals before replacing the battery or fuses.**
- **Install ONLY specified replacement fuses with the amperage, voltage, and speed ratings shown in Table 17.**

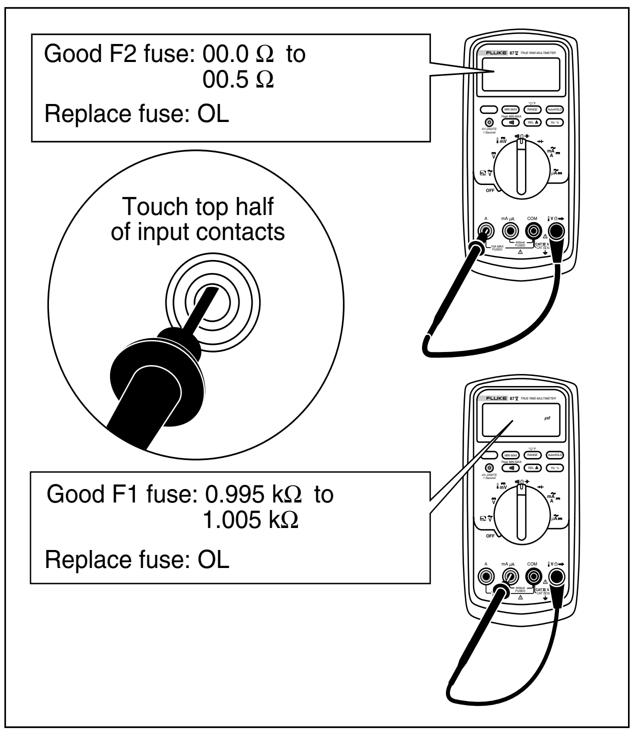

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Figure 4. Testing the Current Input Fuses

Replacing the Fuses

To replace the fuse(s), perform the following procedure.

1. To open the Meter, refer to “Opening the Meter Case”. See Figure 2.
2. Grasp the fuse in the center with needle nose pliers. Pull straight up on the fuse to remove it from the fuse clips.
3. Install ONLY specified replacement fuses with the amperage, voltage, and speed ratings shown in Table 17.
4. To close the Meter, refer to “Reassembling the Meter Case”.

Required Equipment

Required equipment for the performance tests is listed in Table 13. If the recommended models are not available, equipment with equivalent specifications may be used.

Warning

- **To avoid shock or injury, do not perform the verification tests or calibration adjustment procedures described in this manual unless you are qualified to do so.**
- **Repairs or servicing should be performed only by qualified personnel.**

Table 13. Required Equipment

Equipment	Required Characteristics	Recommended Model
Calibrator	AC Voltage Range: 0 - 1000 V ac Accuracy: ± 0.12 % Frequency Range: 60 - 20000 Hz Accuracy: ± 3 % DC Voltage Range: 0 - 1000 V dc Accuracy: ± 0.012 % Current Range: 350 µA - 2 A Accuracy: AC (60 Hz to 1 kHz): ± 0.25 % DC: ± 0.05 % Frequency Source: 19.999 kHz - 199.99 kHz Accuracy: ± 0.0025 % Amplitude: 150 mV to 6V rms Accuracy: ± 5 % Range: 1 Ω - 100 MΩ Accuracy: 0.065 %	Fluke 5500A Multi-Product Calibrator or equivalent
TC Adapter Accessory	K-type	Fluke 80 AK
K-type Thermocouple	K-type, mini-plug on both ends	

Performance Tests

The following performance tests verify the complete operability of the Meter and check the accuracy of each Meter function against the Meter's specifications. Performance tests should be performed annually to ensure that the Meter is within accuracy specifications.

Accuracy specifications are valid for a period of one year after calibration adjustment, when measured at an operating temperature of 18 °C to 28 °C and at a maximum of 90 % relative humidity.

To perform the following tests, it is not necessary to open the case. No adjustments are necessary. Make the required connections, apply the designated inputs, and determine if the reading on the Meter display falls within the acceptable range indicated.

Note

If the Meter fails any of these tests, it needs calibration adjustment or repair.

Basic Operability Tests

Refer to the following sections to test the basic operability of the Meter.

Testing the Fuses

Refer to “Testing Fuses (F1 and F2)”.

Testing the Display

Turn the Meter on while holding down (AutoHOLD) to view all segments of the display. Compare the display with the appropriate examples in Figure 5 and Table 14.

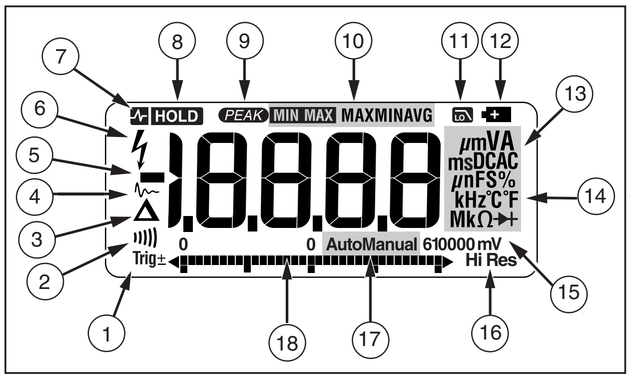

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Figure 5. Display Features

Table 14. Display Features

Number	Feature	Indication
1	±	Polarity indicator for the analog bar graph.
	Trig±	Positive or negative slope indicator for Hz/duty cycle triggering.
2	)))))	The continuity beeper is on.
3	Δ	Relative (REL) mode is active.
4	∿	Smoothing is active.
5	-	Indicates negative readings. In relative mode, this sign indicates that the present input is less than the stored reference.
6	ϟ	Indicates the presence of a high voltage input. Appears if the input voltage is 30 V or greater (ac or dc). Also appears in low pass filter mode. Also appears in cal, Hz, and duty cycle modes.
7	HOLD	AutoHOLD is active.
8	HOLD	Display Hold is active.
9	PEAK	Indicates the Meter is in Peak Min Max mode and the response time is 250 µs
10	MIN MAX MAX MIN AVG	Indicators for minimum-maximum recording mode.
11	LO	Low pass filter mode.

Table 14. Display Features (cont.)

Number	Feature	Indication
⑫		The battery is low. ⚠⚠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.
⑬	**A, µA, mA**	Amperes (amps), Microamp, Milliamp
	V, mV	Volts, Millivolts
	µF, nF	Microfarad, Nanofarad
	nS	Nanosiemens
	%	Percent. Used for duty cycle measurements.
	Ω, MΩ, kΩ	Ohm, Megohm, Kilohm
	Hz, kHz	Hertz, Kilohertz
	AC DC	Alternating current, direct current
⑭	**°C, °F**	Degrees Celsius, Degrees Fahrenheit
⑮	**610000 mV**	Displays selected range
⑯	**HiRes**	The Meter is in high resolution (Hi Res) mode. HiRes=19,999
⑰	**Auto**	The Meter is in autorange mode and automatically selects the range with the best resolution.
	Manual	The Meter is in manual range mode.
⑱		The number of segments is relative to the full-scale value of the selected range. In normal operation 0 (zero) is on the left. The polarity indicator at the left of the graph indicates the polarity of the input. The graph does not operate with the capacitance, frequency counter functions, temperature, or peak min max. For more information, see “Bar Graph”. The bar graph also has a zoom function, as described under "Zoom Mode".
--	OL	Overload condition is detected.

Error Messages	
bAtt	Replace the battery immediately.
diSC	In the capacitance function, too much electrical charge is present on the capacitor being tested.
EEPr Err	Invalid EEPROM data. Have Meter serviced.
CAL Err	Invalid calibration data. Calibrate Meter.
LEAd	⚠Test lead alert. Displayed when the test leads are in the **A** or **mA**/**µA** terminal and the selected rotary switch position does not correspond to the terminal being used.

Testing the Pushbuttons

To test the pushbuttons

1. Turn the Meter rotary knob to $\tilde{V}$.
2. Press each button and note that the meter responds with a beep for each button press.
3. Press and hold MIN MAX a second time to exit MIN MAX mode.

Testing Meter Accuracy

Perform the accuracy test steps in Table 15.

Table 15. Accuracy Tests

Step	Test Function	Range	5500A Output	Display Reading
1	$\tilde{V}$ AC Volts	600 mV	330 mV, 60 Hz	327.3 to 332.7
2		600 mV	600 mV, 13 kHz	586.0 to 614.0
3		6 V	3.3 V, 60 Hz	3.275 to 3.325
4		6 V	3.3 V, 20 kHz	3.214 to 3.386
5		60 V	33 V, 60 Hz	32.75 to 33.25
6		60 V	33 V, 20 kHz	32.14 to 33.86
7		600 V	330 V, 60 Hz	327.5 to 332.5
8		600 V	330 V, 2.5 kHz	323.0 to 337.0
9		1000 V	500 V, 60 Hz	494 to 506
10		1000 V	1000 V, 1 kHz	986 to 1014
11	$\tilde{V}$ Hz AC Volts Frequency	600 mV	150 mV, 99.95 kHz	99.93 to 99.97
12		600 mV	150 mV, 199.50 kHz	199.48 to 199.52
13	Sensitivity	6 V	0.7 V, 99.95 kHz	99.93 to 99.97
14		60 V	7 V, 99.95 kHz	99.93 to 99.97
15	$\overline{V}$ Hz Trigger level	6 V	3.4 V, 1 kHz Sq. Wave	999.8 to 1000.2
16	$\overline{V}$ Hz Duty Cycle	6 V	5 V, 1 kHz, DC offset 2.5 V Sq. Wave	49.7 % to 50.3 %
17	$\overline{V}$ DC Volts	6V	3.3 V dc	3.297 to 3.303
18		60 V	33 V dc	32.97 to 33.03
19		600 V	330 V dc	329.7 to 330.3
20		1000 V	1000 V dc	998 to 1002
21	m$\overline{V}$ DC Volts	600 mV	33 mV dc	32.9 to 33.1
22		600 mV	330 mV dc	329.6 to 330.4
23	Ω Ohms	600 Ω	330 Ω (Use 2 wire Comp)[1]	329.1 to 330.9
24		6 kΩ	3.3 kΩ (Use 2 wire Comp) [1]	3.292 to 3.308
25		60 kΩ	33 kΩ	32.92 to 33.08
26		600 kΩ	330 kΩ	327.9 to 332.1
27		6 MΩ	3.3 MΩ	3.279 to 3.321
28		50 MΩ	30 MΩ	29.67 to 30.33

Table 15. Accuracy Tests (cont.)

Step	Test Function	Range	5500A Output	Display Reading
29	nS Conductance	60 nS	Open input	-0.10 to 0.10
30		60 nS	100 MΩ	9.80 to 10.20
31	Diode	6 V	3.0 V dc	2.939 to 3.061
32	Ã AC Amps	6 A	3.0 A, 60 Hz	2.968 to 3.032
33	A⎓ DC Amps	6 A	3.0 A	2.990 to 3.010
34	mÃ AC Milliamps	60 mA	33 mA, 60 Hz	32.65 to 33.35
35		400 mA	330 mA, 60 Hz	326.5 to 333.5
36	mA⎓ DC Milliamp	60 mA	33 mA	32.89 to 33.11
37		400 mA	330 mA	329.1 to 330.9
38	µÃ AC Microamps	600 µA	330 µA, 60 Hz	326.5 to 333.5
39		6000 µA	3300 µA, 60 Hz	3265 to 3335
40	µA⎓ DC Microamps	600 µA	330 µA	328.9 to 331.1
41		6000 µA	3300 µA	3291 to 3309
42	Capacitance	10 nf	Open input[2]	0.21 to 0.31
43		100 nf	5 nf[5]	4.7 to 5.3
44		100 µf	9.5 µf	9.2 to 9.8
45	Ṽ Low Pass Filter	1000 V	400 V, 400 Hz	372 to 408
46		1000 V	400 V, 800 Hz[4]	226 to 340[4]
47	V⎓ Peak Min/Max	6 V	8 Vpp, 2 kHz Sq. Wave, DC offset 2 V	Max = 5.896 to 6.104
48				Min = -1.898 to -2.102
49	mV⎓ Temperature [3]		0 °C	-1.0 to 1.0
50			100 °C	98.0 to 102.0
51	Backlight		Press backlight button	Backlight comes on
52			Press backlight button	Backlight Intensifies
53			Press backlight button	Backlight off

1. Or short test leads and use REL to offset test lead resistance.
2. Remove test leads from unit.
3. To ensure accurate measurement, the Meter and thermocouple adapter must be at the same temperature. After connecting the thermocouple adapter to the Meter allow for reading to stabalize before recording display reading.
4. The Meter accuracy is not specified at this input signal frequency with Low-pass filter selected. The display reading shown, check that the Low-pass filter is active and follows an expected roll-off curve.
5. Use REL to compensate for internal Meter and lead capacitance. The test leads must be disconnected from the calibrator before pushing REL.

Calibration Adjustment

The Meter features closed-case calibration adjustment using known reference sources. The Meter measures the applied reference source, calculates correction factors and stores the correction factors in nonvolatile memory.

The following sections present the features and Meter pushbutton functions that can be used during the Calibration Adjustment Procedure. Perform the Calibration Adjustment Procedure should the Meter fail any performance test listed in Table 15.

Calibration Adjustment Counter

The Meter contains a calibration adjustment counter. The counter is incremented each time a Calibration Adjustment Procedure is completed. The value in the counter can be recorded and used to show that no adjustments have been made during a calibration cycle.

Use the following steps to view the Meter's calibration counter.

1. While holding down (MIN MAX), turn the rotary knob from **OFF** to **VAC**. The Meter should display "ϟ **CAL**".
2. Press (AutoHOLD) once to see the calibration counter. For example "n001".
3. Turn the rotary knob to **OFF**.

Calibration Adjustment Password

To start the Calibration Adjustment Procedure, the correct 4-button password must be entered. The password can be changed or reset to the default as described in following paragraphs. The default password is "1234".

Changing the Password

Use the following steps to change the Meter's password:

1. While holding down (MIN MAX), turn the rotary knob from **OFF** to **VAC**. The Meter displays "ϟ **CAL**".
2. Press (AutoHOLD) once to see the calibration counter.
3. Press (AutoHOLD) again to start the password entry. The Meter displays "????".
4. The Meter buttons represent the digit indicated below when entering or changing the password:

   ( ) = 1 (MIN MAX) = 2 (RANGE) = 3 (AutoHOLD) = 4

   (☼) = 5 ()))) = 6 (REL Δ) = 7 (Hz %) = 8

   Press the 4 buttons to enter the old password. If changing the password for the first time, enter ( ) (1) (MIN MAX) (2) (RANGE) (3) (AutoHOLD) (4).

5. Press (RANGE) to change the password. The Meter displays "----" if the old password is correct. If the password is not correct, the Meter emits a double beep, displays "????" and the password must be entered again. Repeat step 4.
6. Press the 4 buttons of the new password.
7. Press (AutoHOLD) to store the new password.

Restoring the Default Password

If the calibration password is forgotten, the default password (1234) can be restored using the following steps.

1. While holding down MIN MAX, turn the rotary knob from **OFF** to **VAC**. The Meter displays "ϟ **CAL**".
2. Remove the Meter's top case. Leave the PCA in the bottom case. (See "Opening the Meter Case".)

⚠⚠Warning

To avoid electrical shock or personal injury, remove the test leads and any input signal before removing the Meter's top case.

3. Through an access hole provided in the top shield, short across the keypads on the PCA. See Figure 6. The Meter should beep. The default password is now restored.
4. Replace the Meter's top case and turn the rotary knob to **OFF**. (See "Reassembling the Meter Case).

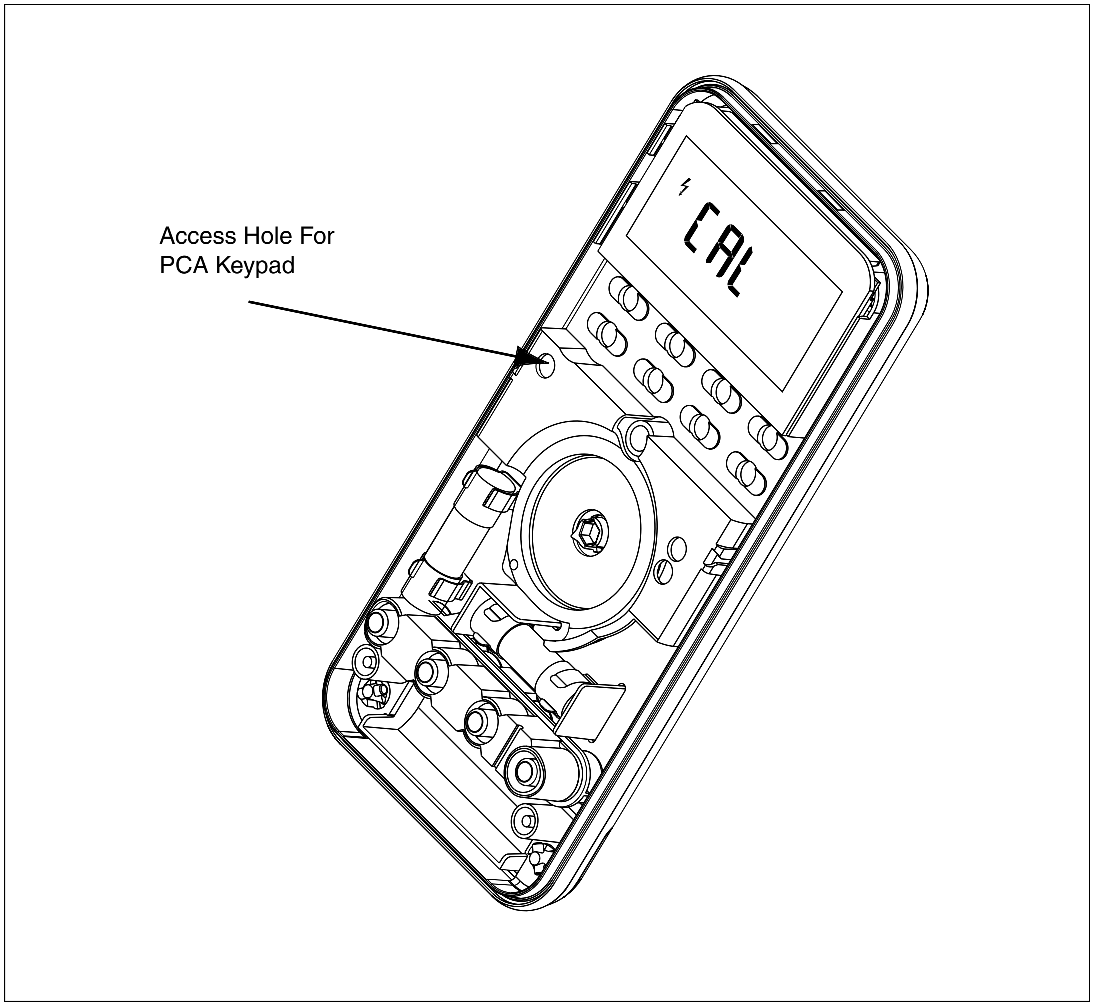

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Figure 6. Restoring the Default Password

Meter Buttons Used in the Calibration Steps

The Meter buttons behave as follows when performing the Calibration Adjustment Procedure. This may be of help determining why a calibration step is not accepted and for determining the input value without referring to Table 16.

	Press and hold to show the measured value. The measurement value is not calibrated so it may not match the input value. This is normal.
MIN MAX	Press and hold to display the required input amplitude.
Hz %	Press and hold to display the frequency of the required input.
AutoHOLD	Press to store the calibration value and advance to the next step. This button is also used to exit calibration mode after the calibration adjustment sequence is complete.

Calibration Adjustment Procedure

Use the following steps to adjust the Meter's calibration. If the Meter is turned off before completion of the adjustment procedure, the calibration constants are not changed.

1. While holding down (MIN MAX), turn the rotary knob from **OFF** to **VAC**. The Meter displays "**ϟ CAL**".
2. Press (AutoHOLD) once to see the calibration counter.
3. Press (AutoHOLD) again to start the password entry. The Meter displays "????".
4. Press 4 buttons to enter the password.
5. Press (AutoHOLD) to go to the first calibration step. The Meter displays "C-01" if the password is correct. If the password is not correct, the Meter emits a double beep, displays "????" and the password must be entered again. Repeat step 4.
6. Using Table 16, apply the input value listed for each calibration adjustment step. For each step, position the rotary switch and apply the input to the terminals as indicated in the table.
7. After each input value is applied, press (AutoHOLD) to accept the value and proceed to the next step (C-02 and so forth).

Note

After pressing (AutoHOLD), wait until the step number advances before changing the calibrator source or turning the Meter rotary knob.

If the Meter rotary knob is not in the correct position, or if the measured value is not within the anticipated range of the input value, the Meter emits a double beep and will not continue to the next step.

Some adjustment steps take longer to execute than others (10 to 15 seconds). For these steps, the Meter will beep when the step is complete. Not all steps have this feature.

8. After the final step, the display shows "End" to indicate that the calibration adjustment is complete. Press (AutoHOLD) to go to meter mode.

Notes

Set the calibrator to Standby prior to changing the function switch position and or after completing adjustment of each function.

If the calibration adjustment procedure is not completed correctly, the Meter will not operate correctly.

Table 16. Calibration Adjustment Steps

Switch Position (Function)	Input Terminal	Calibration Adjustment Step	Input Value
$\tilde{V}$ (AC Volts)	V Ω ⊣▶⊢	C-01	600.0 mV, 60 Hz
		C-02	600.0 mV, 20 kHz
		C-03	6.000 V, 60 Hz
		C-04	6.000 V, 20 kHz
		C-05	60.00 V, 60 Hz
		C-06	60.00 V, 20 kHz
		C-07	600.0 V, 60 Hz
		C-08	600.0 V, 10 kHz
$\overline{\overline{V}}$ (DC Volts)		C-09	6.000 V, 0 Hz
		C-10	60.00 V, 0 Hz
		C-11	600.0 V, 0 Hz
m$\overline{\overline{V}}$ (DC Millivolts)		C-12	600.0 mV, 0 Hz
		C-13	60.00 mV, 0 Hz
Ω (Ohms)		C-14	600.0 Ω
		C-15	6.000 kΩ
		C-16	60.00 kΩ
		C-17	600.0 kΩ
		C-18	6.000 MΩ
		C-19	0.000 Ω
		C-20	50.0 MΩ
⊣▶⊢ (Diode Test)		C-21	3.000 V, 0 Hz
A, mA (Amps, milliamps)	A	C-22	6.000 A, 60 Hz
		C-23	6.000 A , 0 Hz
	mA /µA	C-24	60.00 mA, 60 Hz
		C-25	400.0 mA, 60 Hz
		C-26	60.00 mA, 0 Hz
		C-27	400.0 mA, 0 Hz
µA (Microamps)	mA /µA	C-28	600.0 µA, 60 Hz
		C-29	6000 µA, 60 Hz
		C-30	600.0 µA, 0 Hz
		C-31	6000 µA, 0 Hz

Service and Parts

Replacement parts are shown in Table 17, Table 18, and Figures 7 and 8. To order parts and accessories, refer to "Contacting Fluke".

Table 17. 87 V/AN Final Assembly

Reference Designator	Description	Part Number	Cage	Manufacturer's Part Number	Qty
A1	PCA Main Assembly	2174143	89536	2174143	1
AC72	Alligator Clip, Black	1670652	89536	1670652	1
AC72	Alligator Clip, Red	1670641	89536	1670641	1
BT1	Battery, 9 V	2139179	83740	522VP	1
BT2	Cable Assy, 9 V Battery Snap	2064217	89536	2064217	1
CR6	Lightpipe	2074057	89536	2074057	1
F1⚠	Fuse, 0.440 A, 1000 V, FAST	943121	0FB96	DMM-44/100	1
F2 ⚠	Fuse, 11 A, 1000 V, FAST	803293	0FB96	DMM-11	1
H2-4	Screw, Case	832246	89536	832246	3
H5-9	Screw, Bottom Shield	448456	89536	448456	5
J1-2	Elastomeric Connector	817460	89536	817460	2
MP2	Shield, Top	2073906	89536	2073906	1
MP4	Shield, Bottom	2074025	89536	2074025	1
MP5	Case Top (PAD XFER) with Window	2073992	89536	2073992	1
MP6	Case Bottom	2073871	89536	2073871	1
MP8	Knob, Switch (PAD XFER)	2100482	89536	2100482	1
MP9	Detent, Knob	822643	89536	822643	1
MP10-11	Foot, Non-Skid	824466	89536	824466	2
MP13	Shock Absorber	828541	89536	828541	1
MP14	O-Ring, Input Receptacle	831933	17506	5-143-N1472-70	1
MP15	Holster w/ Tilt Stand	2074033	89536	2074033	1
MP22	Battery Door	2073938	89536	2073938	1
MP27-MP30	Contact RSOB	1567683	89536	1567683	4
MP31	Mask, LCD (PAD XFER)	2073950	89536	2073950	1
MP41	Housing, RSOB	2073945	89536	2073945	1
MP390-391	Access Door Fastener	948609	89536	948609	2
NA	Tiltstand	2074040	89536	2074040	1
S2	Keypad	2105884	89536	2105884	1
TL75	Test Lead Set	855742	89536	855742	1
TM1 (not shown)	CD ROM, 87 V/AN	2153570	89536	2153570	1
TM2 (not shown)	_87 V/AN Users Manual_	2153581	89536	2153581	1
TM3 (not shown)	_87 V/AN Service Manual_ (this manual)	2153596	89536	2153596	1
U5	LCD, 4.5 DIGIT,TN, Transflective, Bar Graph, OSPR80	2065213	89536	2065213	1
80BK	Thermocouple Assembly, K-Type, Beaded, Molded Dual Banana Plug, Coiled	1273113	89536	1273113	1

⚠To ensure safety, use exact replacement only.

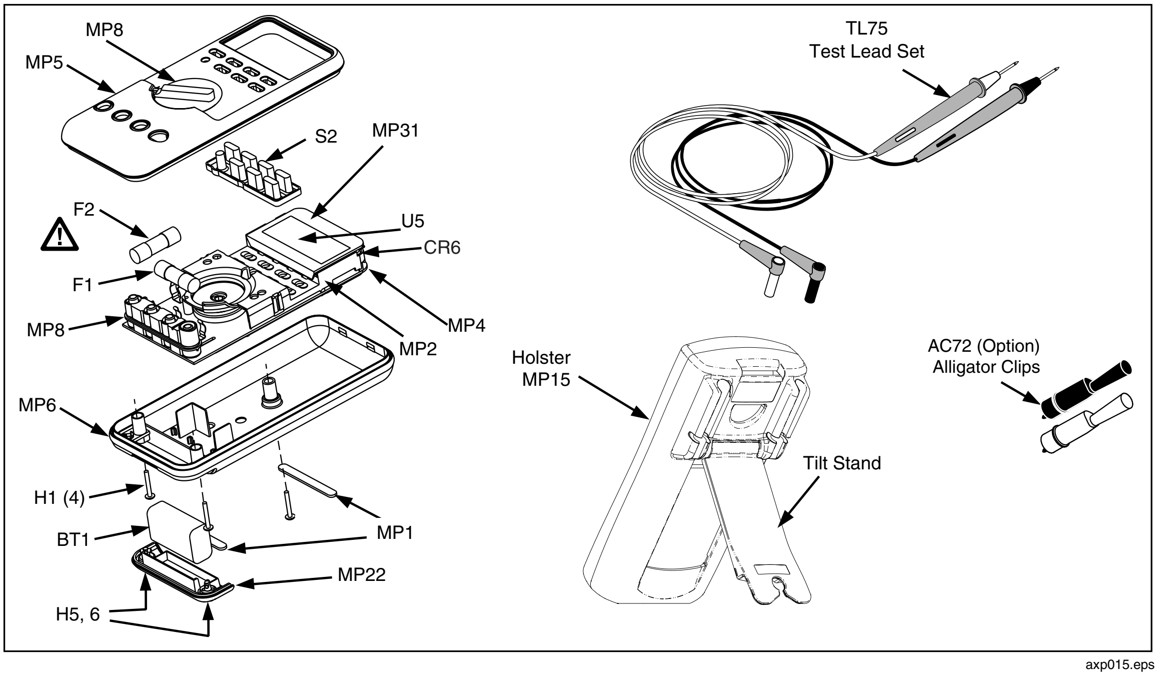

Figure 7. 87 V/AN Final Assembly