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**FLUKE®**

# 772/773

## Milliamp Process Clamp Meter

### Calibration Manual



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## **Introduction**

### **Warning**

**To prevent electrical shock or personal injury, do not do the calibration verification tests or calibration procedures in this manual unless you are qualified.**

**The data in this manual is for qualified personnel only.**

This manual tells you about verification and adjustment procedures for the 772/773 Milliamp Process Clamp Meter (referred to in this manual as the Meter). The Meter features closed-case calibration to use with reference sources. It measures the reference signals, calculates the correction factors, and keeps them in memory. Calibration adjustment is required after a repair, or if the Meter fails a performance test.

This manual explains:

- Precautions and Safety Information
- Specifications
- Basic Maintenance
- Calibration/Verification Procedure
- Replaceable Parts and Accessories

For complete use instructions, refer to the *772/773 Instruction Sheet*.

## Safety Information

In this manual, a **Warning** identifies conditions and procedures that are hazardous to the user. A **Caution** identifies conditions and procedures that could cause Meter damage, equipment under test damage, or permanent loss of data.

### Warning

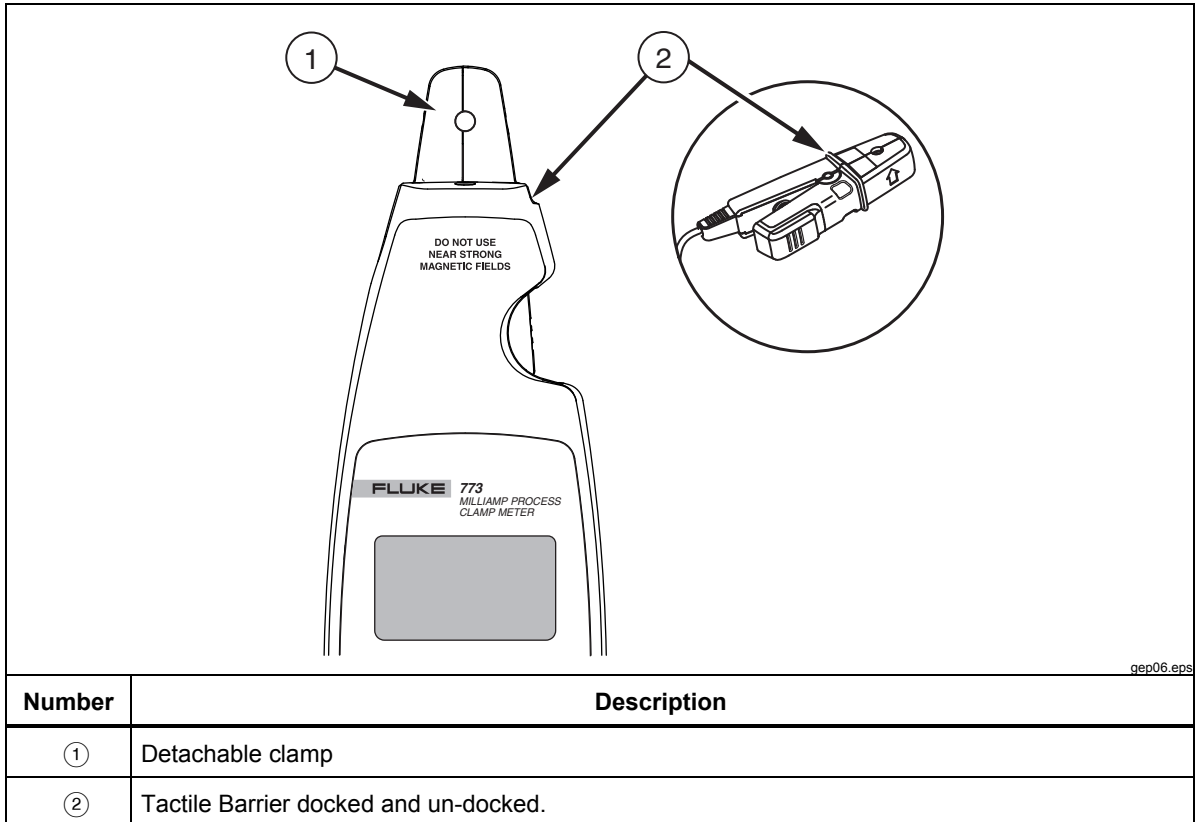
To prevent electrical shock or personal injury, and to prevent damage to the Meter, follow these guidelines:

- Read this manual before use and follow all safety instructions.
- Use the Meter only as this manual recommends. To use the Meter incorrectly, compromises the safety features of the Meter.
- Examine the case before you use the Meter. Look for cracks, missing plastic or missing pieces of the clamp and cable. Do not use if the clamp or Meter is damaged.
- Do not use on voltages >33 V ac rms, 47 V ac peak, or 70 V dc.
- Do not use to measure ac current.
- Do not use to measure ac voltage.
- Do not work alone.
- Use maximum precautions when you work near bare conductors or bus bars. If you touch the conductor, you can receive an electrical shock.
- To prevent incorrect indications that can cause electrical shock and injury, replace the batteries when the low-battery indicator () appears.
- Follow local and national safety codes. You must use protective equipment to prevent an electrical shock and arc blast injury where hazardous live conductors are exposed.

- When you measure, keep your fingers behind the Tactile Barrier. See Figure 1.
- Do not use with a non-insulated conductor.
- Do not use near strong magnetic fields.
- Remove test leads before you open the case.

**⚠ Caution**

To prevent damage to the Meter, do not open it. Do not use a solvent to clean the Meter, and do not put the Meter in water.



**Figure 1. Tactile Barrier**

## Symbols

Table 1 refers to the symbols that are on the Meter or in this manual.

**Table 1. Symbols**

|                                                                                   |                                                                                                            |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
|  | Do not apply around, or remove from HAZARDOUS LIVE conductors.                                             |
|  | Dangerous. Important data. See Users Manual.                                                               |
|  | Risk of Electrical Shock.                                                                                  |
|  | Equipment protected by double or reinforced insulation.                                                    |
|  | Battery                                                                                                    |
|  | Low Battery                                                                                                |
|  | Confirms with relevant European Union directives.                                                          |
|  | DC (Direct Current)                                                                                        |
|  | Do not dispose of this the product as unsorted municipal waste. Go to Fluke's web site for recycling data. |
|  | Conforms to relevant Australian standards.                                                                 |
|  | Conforms to relevant Canadian and US standards.                                                            |

## Specifications

### Electrical Specifications

#### DC Current Measurement

With Jaw

Ranges ..... 0-20.99 mA; 21-100 mA  
Resolution..... 0.01 mA; 0.1 mA  
Accuracy..... 0.2 % + 5 counts; 1 % + 5 counts

In Circuit

Range ..... 0-24 mA  
Resolution..... 0.01 mA  
Accuracy..... 0.2 % + 2 counts

Current Source

Range ..... 0-24 mA  
Resolution..... 0.01 mA  
Accuracy..... 0.2 % + 2 counts  
mA Drive..... 24 mA into 1000  $\Omega$

Current Simulate

Range ..... 0-24 mA  
Resolution..... 0.01 mA  
Accuracy..... 0.2 % + 2 counts  
Maximum Voltage ..... 50 V

#### DC Voltage Measurement (773)

Range ..... 0-30 V  
Resolution..... 0.01 V  
Accuracy..... 0.2 % + 2 counts

### **DC Voltage Source (773)**

Range ..... 0-10 V  
Resolution ..... 0.01 V  
Accuracy ..... 0.2 % + 2 counts  
mA Drive ..... 2 mA max all conditions

### **mA DC IN/OUT (773)**

Sourcing range ..... 0-24 mA  
Sourcing resolution ..... 0.01 mA  
Sourcing accuracy ..... 0.2 % + 2 counts  
Measurement range ..... 0-24 mA  
Measurement resolution 0.01 mA  
Measurement accuracy ..... 1 % FS

### **Scaled mA DC Current Output to mA Current Input from the Jaw (773)**

Range ..... 0-24 mA  
Resolution ..... 0.01 mA  
Accuracy ..... 1 % FS

## **General Specifications**

Response speed ..... 2 times per second  
DC Loop Power ..... 24 V  
Influence of Earth's Field ..... < 0.20 mA  
Batteries ..... 4 1.5 V, Alkaline, IEC LR6  
Working hours ..... 12 hours @ 12 mA sourced into 500  $\Omega$

### **Mechanical Specifications**

Size (H X W X L) ..... 43.7 mm x 70 mm x 246.2 mm  
Weight ..... 410 g

### **Environmental Specifications**

Operating Temperature ..... -10 ~ 50 °C  
Storage Temperature ..... -25 ~ 60 °C  
Operating Humidity ..... <90 % RH @ <30 °C ; <75 % RH @ 30 ~ 50 °C  
Operating Altitude ..... 0 ~ 2000 m  
IP Rating ..... IP 40  
Vibration Requirements ..... Random 2 g, 5 to 500 Hz  
Drop Test Requirements ..... 1 meter drop test (except the jaw)  
EMI, RFI, EMC ..... Meets all applicable requirements in EN61326-1  
Note: For current measurement w/jaw, add 1 mA to specification for  
EMC field strengths of 1 V/m up to 3 V/m.  
Temperature Coefficients ..... 0.1(/ °C X Specified accuracy for Temperature < 18 °C or > 28 °C)

### **Standards and Agency Approval Specifications**

All products certified to the following:  
EN / IEC 61010-1, EN / IEC 61010-2-032  
Agency Approvals:   

### **Other Specifications**

Power Requirements ..... Four AA batteries, Alkaline, IEC LR6  
Automatic Time-out (Power) ..... After 15 minutes  $\pm$ 1 minutes  
Automatic Time-out (Backlight) ..... After 2 minutes  $\pm$ 10 seconds  
Automatic Time-out (Measurement Spotlight) ..... After 2 minutes  $\pm$ 10 seconds

## **Basic Maintenance**

### **⚠ ⚠ Warning**

To prevent electrical shock or personal injury, repairs or servicing not included in this manual must be done only by qualified personnel.

### **How to Clean the Meter**

### **⚠ ⚠ Warning**

To prevent electrical shock or personal injury, remove test leads before you clean the Meter.

### **⚠ Caution**

To prevent damage to the Meter, do not use aromatic hydrocarbons or chlorinated solvents when you clean the Meter. These solutions react with the plastics used in the Meter.

Clean the instrument case with a damp cloth and mild detergent.

## **Battery Replacement**

### **⚠ ⚠ Warning**

To prevent incorrect Meter indications that could cause possible electrical shock or personal injury, replace the batteries when the low battery indicator () appears.

To prevent electrical shock, remove test leads before changing the batteries.

To replace the batteries, see Figure 2:

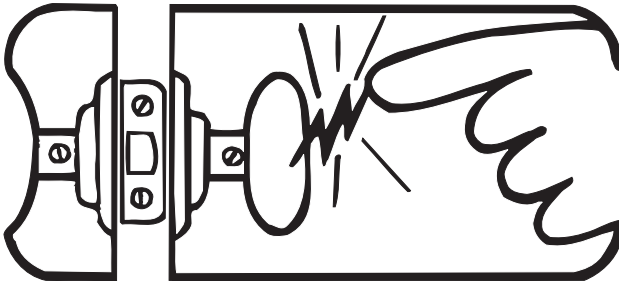
1. Turn the Meter off.
2. Use a flat-head screwdriver to loosen the battery compartment door screws, and remove the door from the case bottom.
3. Remove the batteries.
4. Replace the batteries with four new AA batteries.
5. Reattach the battery compartment door to the case bottom and tighten the screws.



# static awareness



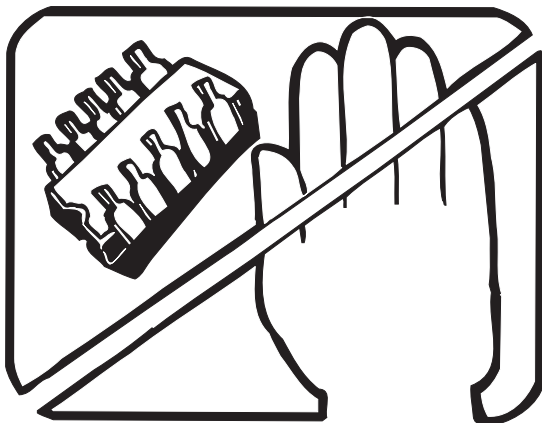
A Message From  
Fluke Corporation



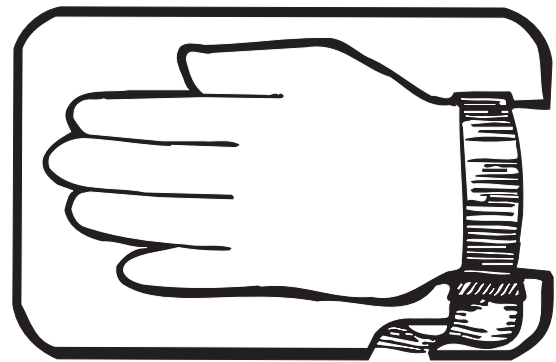
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, packaging, and bench techniques that are recommended.

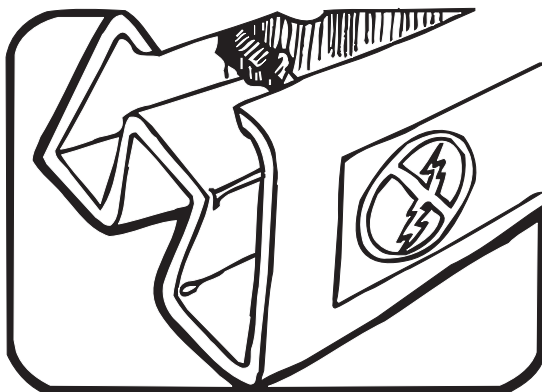
The following practices should be followed to minimize damage to S.S. (static sensitive) devices.



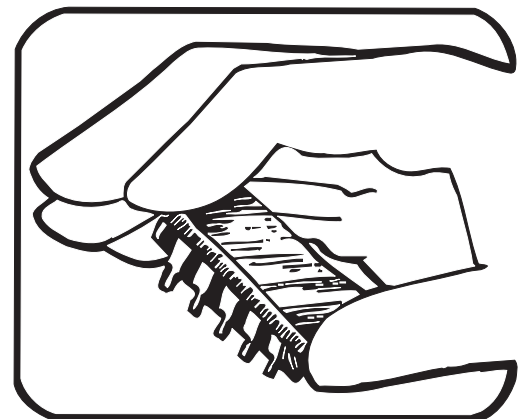
1. MINIMIZE HANDLING



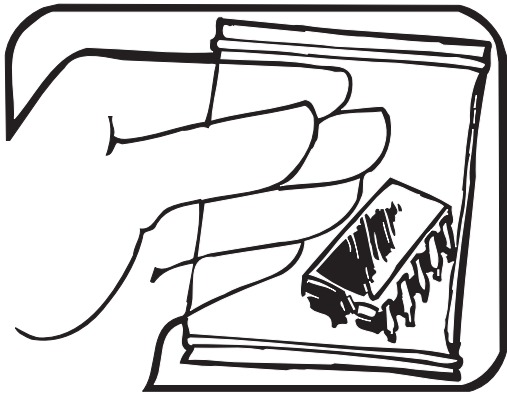
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



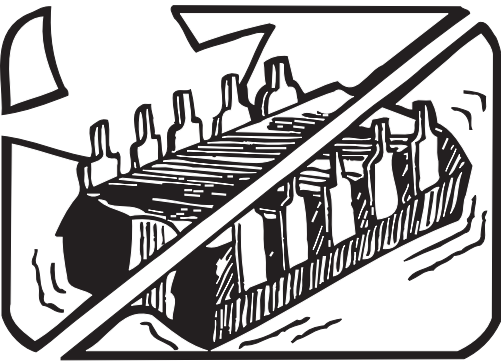
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



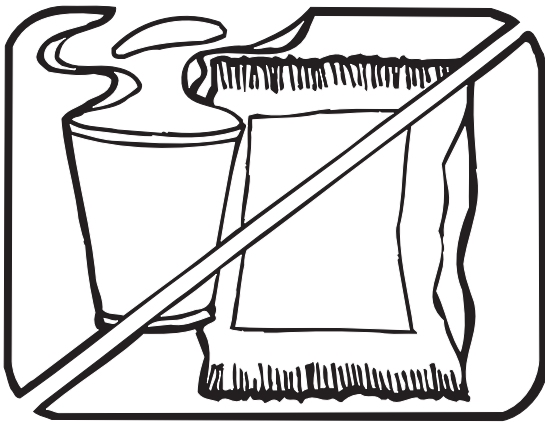
4. HANDLE S.S. DEVICES BY THE BODY.



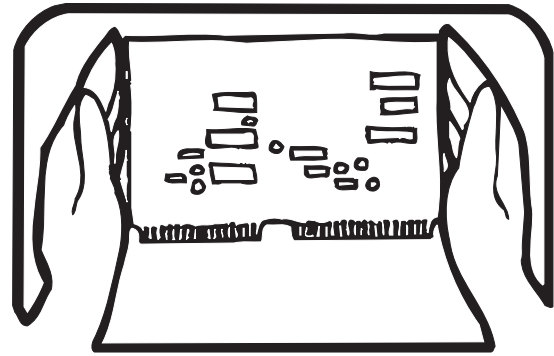
5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT.



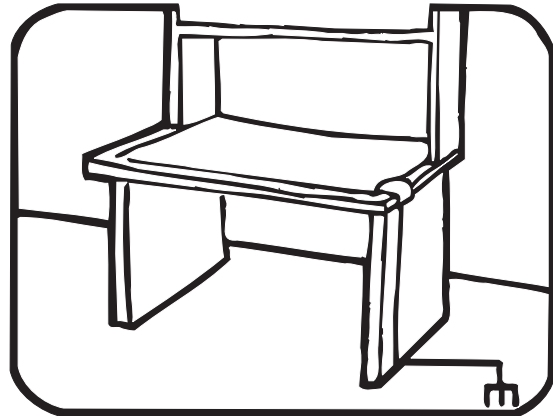
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE.



7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA.



8. WHEN REMOVING PLUG-IN ASSEMBLIES HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS PROTECT INSTALLED S.S. DEVICES.



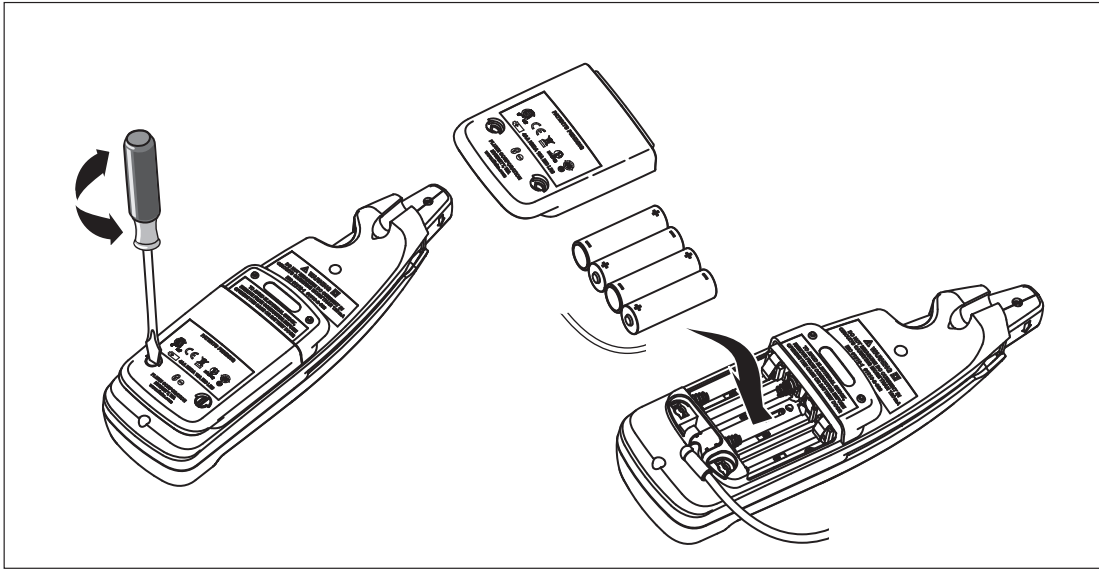
9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION.

10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

11. ONLY GROUNDED-TIP SOLDERING IRONS SHOULD BE USED.

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gep02.eps

Figure 2. Battery Replacement

## Performance Tests

### ⚠⚠ Warning

To prevent electrical shock, personal injury, or fire:

- Repairs or Meter servicing must be done only by qualified personnel.
- Do not do the verification tests or calibration adjustment in this manual unless qualified.

The tests that follow verify the functions of the Meter. If the Meter fails the verification tests, repair is necessary. For Meter servicing, see “How to Contact Fluke”.

### Required Equipment

Required equipment for the performance tests is in Table 2. If the recommended models are not available, equipment with equivalent specifications can be used.

Table 2. Required Equipment

| Equipment  | Minimum Required Characteristics                                                                                          | Recommended Model |
|------------|---------------------------------------------------------------------------------------------------------------------------|-------------------|
| Calibrator | DC milliamperes:<br>0-24.00 mA = $\pm 0.073$ %<br>24.0-100.0 mA = $\pm 0.375$ %<br>DC Volts:<br>0-30.00 V = $\pm 0.267$ % | Fluke 55xxA       |
| DMM        | DC Current:<br>0-24.00 mA = $\pm 0.375$ %<br>DC Volts:<br>0-10 V = $\pm 0.1$ %                                            | Fluke 88xxA       |
| Lab Supply | 6 Vdc $\pm 0.5$ V                                                                                                         | -                 |

### How to Test the Batteries

Prior to performing the following tests, check the batteries with a multimeter and replace as necessary. See “Battery Replacement”.

### How to Test the Display

1. Push and hold **HOLD** while powering on the Meter.
2. Compare the Meter display to Figure 3.
3. Examine all display segments for clarity and contrast.

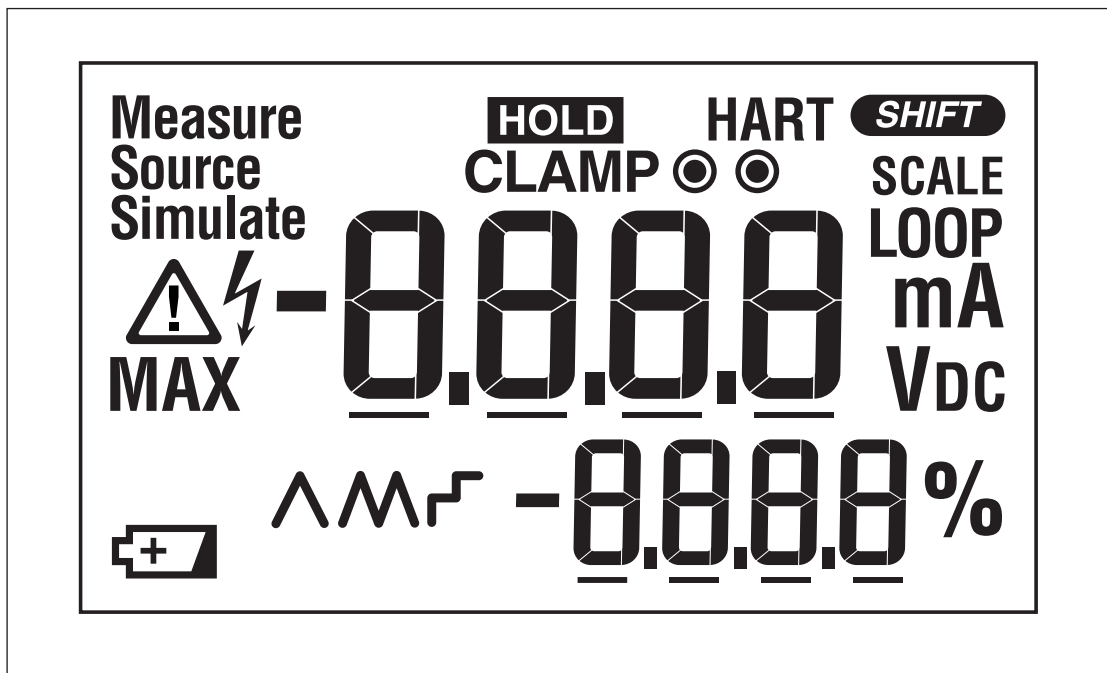


Figure 3. Display Test

gep07.eps

### Display Hold Test

#### ⚠ ⚠ Warning

Changes to the input signal will not register on the Meter display when in Display Hold Mode. To prevent electrical shock or personal injury, you must be aware of what mode the Meter is in.

Push **HOLD** to activate Display Hold mode. The display shows **HOLD** and the display freezes. Push **HOLD** a second time to exit and resume normal operation.

### Backlight Test

Push  to turn the backlight on and off. To extend battery life, the backlight automatically stops after 2 minutes.

### Measurement Spotlight LED Test

Push  to activate the Measurement Spotlight LED. To extend battery life, the light automatically stops after 2 minutes.

## Accuracy Tests

Accuracy specifications are valid for 1 year after calibration adjustment when measured at an operation temperature of 18 °C to 28 °C. Allow the Meter to stabilize at room temperature prior to performing the accuracy tests.

The following tables list the required performance test points for verifying Meter accuracy. Zero the Meter prior to completing each measurement point.

### **mA DC Clamp Measure Accuracy Tests**

| Step | Calibrator Output | UUT Meter Reading Limit |           |
|------|-------------------|-------------------------|-----------|
|      |                   | Low                     | High      |
| 1    | 4.00 mA           | 3.94 mA                 | 4.06 mA   |
| 2    | -4.00 mA          | -4.06 mA                | -3.94 mA  |
| 3    | 12.00 mA          | 11.03 mA                | 12.07 mA  |
| 4    | -12.00 mA         | -12.07 mA               | -11.03 mA |
| 5    | 20.00 mA          | 19.01 mA                | 20.09 mA  |
| 6    | -20.00 mA         | -20.09 mA               | -19.01 mA |
| 7    | 100.0 mA          | 98.5 mA                 | 101.5 mA  |
| 8    | -100.0 mA         | -101.5 mA               | -98.5 mA  |

### **mA DC Measure Accuracy Tests**

| Step | Calibrator Output | UUT Meter reading limit |           |
|------|-------------------|-------------------------|-----------|
|      |                   | Low                     | High      |
| 1    | 0.00 mA           | -0.02 mA                | 0.02 mA   |
| 2    | 4.00 mA           | 3.97 mA                 | 4.03 mA   |
| 3    | -4.00 mA          | -4.03 mA                | -3.97 mA  |
| 4    | 8.00 mA           | 7.96 mA                 | 8.04 mA   |
| 5    | -8.00 mA          | -8.04 mA                | -7.96 mA  |
| 6    | 12.00 mA          | 11.96 mA                | 12.04 mA  |
| 7    | -12.00 mA         | -12.04 mA               | -11.96 mA |
| 8    | 20.00 mA          | 19.94 mA                | 20.06 mA  |
| 9    | -20.00 mA         | -20.06 mA               | -19.94 mA |
| 10   | 24.00 mA          | 23.93 mA                | 24.07 mA  |
| 11   | -24.00 mA         | -24.07 mA               | -23.93 mA |

### Volts DC Measure Accuracy Tests

| Step | Calibrator Output | UUT Meter Reading Limit |          |
|------|-------------------|-------------------------|----------|
|      |                   | Low                     | High     |
| 1    | 0.00 V            | -0.02 V                 | 0.02 V   |
| 2    | 10.00 V           | 9.96 V                  | 10.04 V  |
| 3    | -10.00 V          | -10.04 V                | -9.96 V  |
| 4    | 20.00 V           | 19.94 V                 | 20.06 V  |
| 5    | -20.00 V          | -20.06 V                | -19.94 V |
| 6    | 30.00 V           | 29.92 V                 | 30.08 V  |
| 7    | -30.00 V          | -30.08 V                | -29.92 V |

### mA DC Source Accuracy Tests

| Step | UUT Meter Output | DMM Reading Limit |          |
|------|------------------|-------------------|----------|
|      |                  | Low               | High     |
| 1    | 0.00 mA          | -0.02 mA          | 0.02 mA  |
| 2    | 4.00 mA          | 3.97 mA           | 4.03 mA  |
| 3    | 8.00 mA          | 7.96 mA           | 8.04 mA  |
| 4    | 12.00 mA         | 11.96 mA          | 12.04 mA |
| 5    | 20.00 mA         | 19.94 mA          | 20.06 mA |
| 6    | 24.00 mA         | 23.93 mA          | 24.07 mA |

### Volts DC Source Accuracy Tests

| Step | UUT Meter Output | DMM Reading Limit |         |
|------|------------------|-------------------|---------|
|      |                  | Low               | High    |
| 1    | 0.00 V           | -0.02 V           | 0.02 V  |
| 2    | 2.50 V           | 2.47 V            | 2.53 V  |
| 3    | 5.00 V           | 4.97 V            | 5.03 V  |
| 4    | 7.50 V           | 7.46 V            | 7.54 V  |
| 5    | 10.00 V          | 9.96 V            | 10.04 V |

## Calibration Adjustment

The Meter features closed-case calibration adjustment with a known reference source. The Meter measures the applied reference source, calculates correction factors, and keeps the correction factors in nonvolatile memory.

Before you start calibration adjustment, let the Meter stabilize to room temperature.

To turn on Calibration mode:

1. Remove the batteries and substitute with a lab supply set to 6 V dc.
2. Open the battery door. The calibration button is usually hidden by the factory calibration seal.
3. Use a small probe and push the calibration button longer than 2 seconds. See Figure 4.

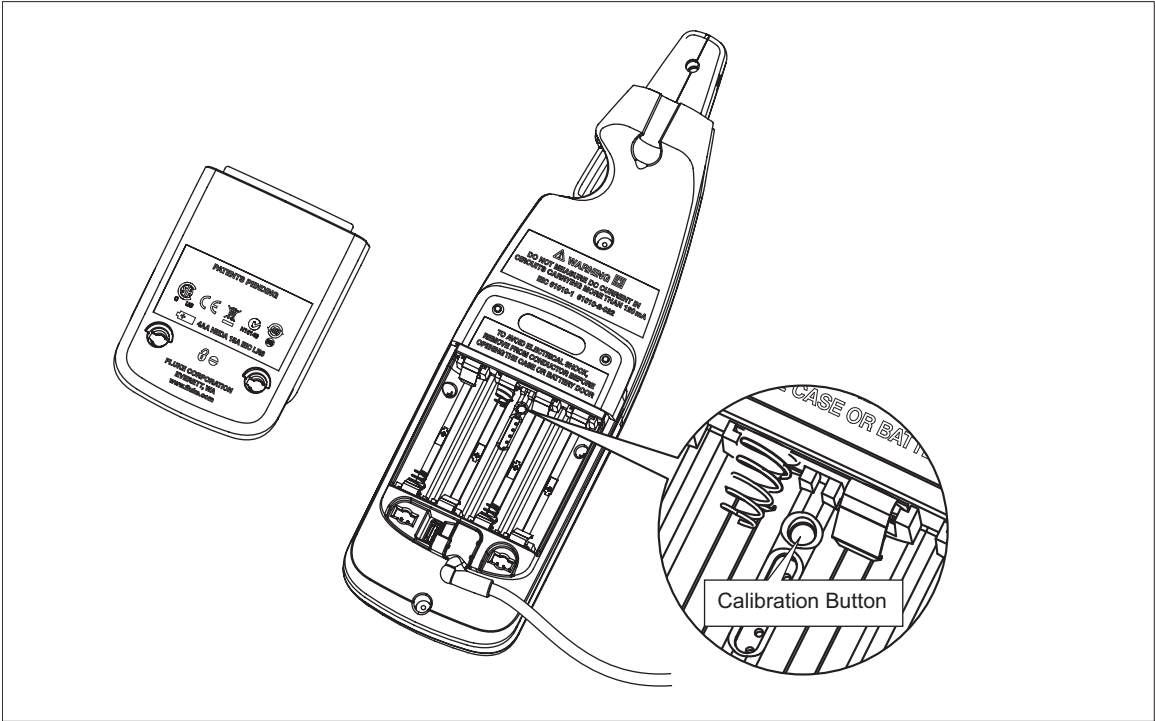


Figure 4. Accessing the Calibration Button

gep01.eps

There are five Meter functions to adjust:

1. Clamp measure
2. mA measure
3. Volt measure (773 only)
4. mA source
5. Volt source (773 only)

Table 3 shows the Meter buttons you use to select a function to be calibrated.

Table 3. Calibration Functions

| Button                                                                              | Calibration Function Description         |
|-------------------------------------------------------------------------------------|------------------------------------------|
|  | Engages mA function                      |
|  | Identifies V dc function                 |
|  | Identifies Clamp function                |
|  | Toggles between measure and source modes |

Table 4 shows the Meter buttons you use to adjust the Meters calibration.

**Table 4. Calibration Adjustments**

| Button                                                                                                                                                                 | Calibration Adjustment Description                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                       | A short button push (1 second) changes the Meter to the first calibration step<br>A long button push exits the Meters calibration mode |
| <br> | Adjust source output in large steps                                                                                                    |
| <br> | Adjust source output in small steps                                                                                                    |
|                                                                                       | Forward to subsequent calibration step                                                                                                 |

The Meter display shows the value in each adjustment step.

- In Measure mode, the shown value is the calibrator input.
- In Source mode, the shown value is the Meter output.

To exit Calibration mode:

Push the calibration button a second time to keep new calibration constants and exit calibration mode.

### **Calibration Error Messages**

The calibration error messages that the Meter can show are in Table 5. Steps to remove the messages are also shown in the table.

**Table 5. Error Messages**

| Error Message | Cause of Error                              | Removal Steps             |
|---------------|---------------------------------------------|---------------------------|
| <b>Cal</b>    | Meter not calibrated, use default parameter | Do all adjustments        |
| <b>Err</b>    | Code area checksum error                    | Meter repair is necessary |

### **mA DC Clamp Measure Adjustment Procedure**

To adjust the Clamp Measure function, use the Calibrator to apply the necessary Meter input and do the steps in Table 6.

**Table 6. Clamp Measure Adjustment Procedure**

| Step | Meter Display | Calibrator Output | Procedure                             |
|------|---------------|-------------------|---------------------------------------|
| 1    | 0.00 mA       | 0.00 mA           | Stop for 10 seconds, push <b>HOLD</b> |
| 2    | -20.00mA      | -20.00 mA         | Push <b>HOLD</b>                      |
| 3    | 0.00mA        | 0.00 mA           | Stop for 10 seconds, push Hold button |
| 4    | 20.00mA       | 20.00 mA          | Push <b>HOLD</b>                      |
| 5    | 0.00 mA       | 0.00 mA           | Stop for 10 seconds, push <b>HOLD</b> |
| 6    | -100.00mA     | -100.00 mA        | Push <b>HOLD</b>                      |
| 7    | 0.00mA        | 0.00 mA           | Stop for 10 seconds, push <b>HOLD</b> |
| 8    | 10.00mA       | 100.00 mA         | Push <b>HOLD</b>                      |
| 9    | Save          | --                | Push <b>HOLD</b>                      |

### **mA DC Measure Adjustment Procedure**

To adjust the mA Measure function, use the Calibrator to apply the necessary Meter input and do the steps in Table 7.

**Table 7. mA Measure Adjustment Procedure**

| Step | Meter Display | Calibrator Output | Procedure        |
|------|---------------|-------------------|------------------|
| 1    | -20.00 mA     | -20.00 mA         | Push <b>HOLD</b> |
| 2    | 0.00 mA       | 0.00 mA           | Push <b>HOLD</b> |
| 3    | 20.00 mA      | 20.00 mA          | Push <b>HOLD</b> |
| 4    | Save          | --                | Push <b>HOLD</b> |

### **Volts DC Measure Adjustment Procedure**

To adjust the Volt Measure function, use the Calibrator to apply the necessary Meter input and do the steps in Table 8.

**Table 8. Volt Measure Adjustment Procedure**

| Step | Meter Display | Calibrator Output | Procedure        |
|------|---------------|-------------------|------------------|
| 1    | -30.00V       | -30.00 V          | Push <b>HOLD</b> |
| 2    | 0.00V         | 0.00 V            | Push <b>HOLD</b> |
| 3    | 30.00V        | 30.00 V           | Push <b>HOLD</b> |
| 4    | Save          | --                | Push <b>HOLD</b> |

### **mA DC Source Adjust Procedure**

To adjust the mA Source function, use the Calibrator to apply the necessary Meter input and do the steps in Table 9.

**Table 9. mA Source Adjustment Procedure**

| Step | Meter LCD display | Action                                                  |
|------|-------------------|---------------------------------------------------------|
| 1    | 4.00 mA           | Adjust until Meter output is 4.00 mA, push <b>HOLD</b>  |
| 2    | 20.00 mA          | Adjust until Meter output is 20.00 mA, push <b>HOLD</b> |
| 4    | Save              | Push <b>HOLD</b>                                        |

### **Volts DC Source Adjust Procedure (773 Only)**

To adjust the Volt Source function, use the Calibrator to apply the necessary Meter input and do the steps in Table 10.

**Table 10. Volt Source Adjustment Procedure**

| Step | Meter LCD display | Action                                                 |
|------|-------------------|--------------------------------------------------------|
| 1    | 0.00 V            | Adjust until Meter output is 0.00 V, push <b>HOLD</b>  |
| 2    | 10.00 V           | Adjust until Meter output is 10.00 V, push <b>HOLD</b> |
| 4    | Save              | Push <b>HOLD</b>                                       |

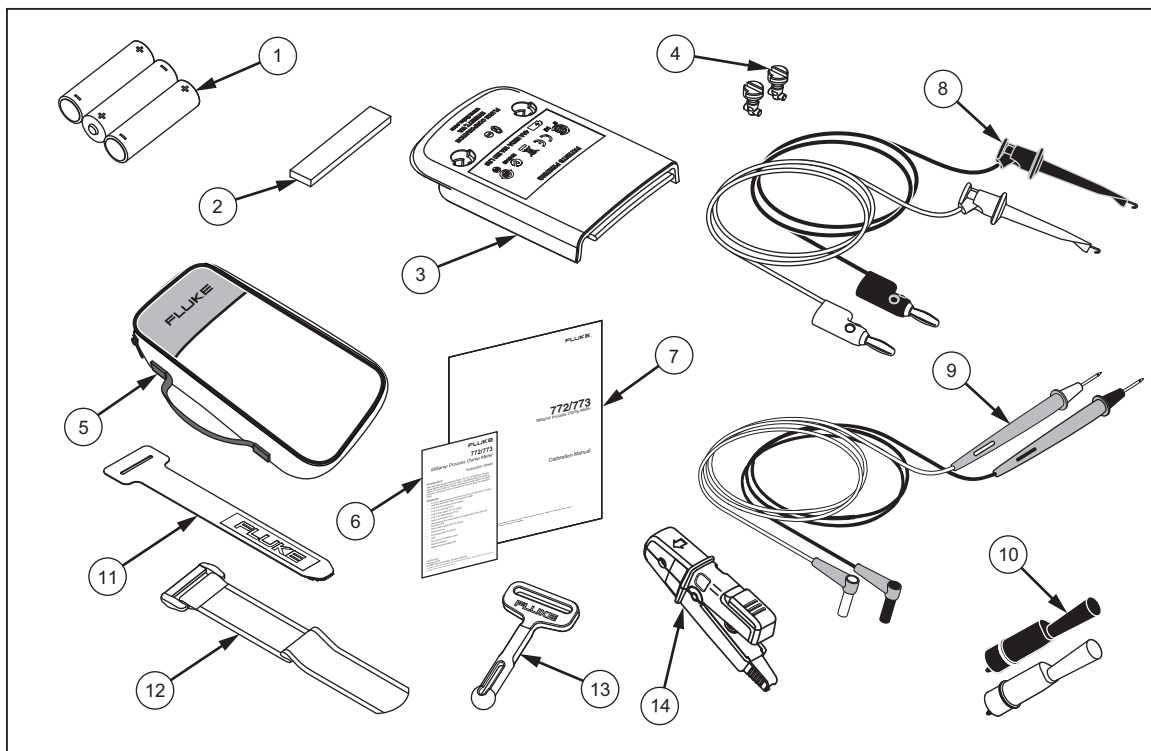


## **Replaceable Parts**

Table 11 and Figure 5 show all replaceable parts.

**Table 11. Replaceable Parts**

| <b>Item</b>                                                 | <b>Description</b>             | <b>Quantity</b> | <b>Part or Model Number</b> |
|-------------------------------------------------------------|--------------------------------|-----------------|-----------------------------|
| ①                                                           | AA Batteries, 1.5 V            | 4               | 376756                      |
| ②                                                           | Absorber                       | 1               | 3369914                     |
| ③                                                           | Battery door                   | 1               | 3350978                     |
| ④                                                           | Fastener                       | 2               | 948609                      |
| ⑤                                                           | Soft Carrying Case             | 1               | 3351060                     |
| ⑥                                                           | Instruction Sheet              | 1               | 3351049                     |
| ⑦                                                           | Calibration Manual             | 1               | 3362376                     |
| ⑧                                                           | TL940 Mini Hook with Test Lead | 1 Set           | 1616705                     |
| ⑨                                                           | TL75- Test Leads               | 1 Set           | 855742                      |
| ⑩                                                           | AC72 Detachable Clip           | 2               | 1670095                     |
| ⑪                                                           | Velcro Strip                   | 1               | 3031302                     |
| ⑫                                                           | TPAK, Strap 17 inches          | 1               | 669967                      |
| ⑬                                                           | Hanger                         | 1               | 337574                      |
| ⑭                                                           | *Jaw Assembly                  | 1 Set           | 3350957                     |
| *Re-calibration is required after jaw assembly is replaced. |                                |                 |                             |



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**Figure 5. Replaceable Parts**