FLUKE®

# 1630-2/1630-2 FC

Earth Ground Clamp

Users Manual

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# *Table of Contents*


| Title | Page |
|---|---|
| Introduction | 1 |
| How to Contact Fluke | 1 |
| Safety Information | 2 |
| Before You Start | 2 |
| Power On/Off | 2 |
| Self-Calibration | 3 |
| Display Features and Controls | 4 |
| Setup | 6 |
| Log Interval | 6 |
| Alarm Threshold | 7 |
| Time/Clock | 8 |
| Clamp Settings | 8 |
| Backlight Auto-Off | 8 |
| Power Auto-Off | 9 |
| Firmware Version | 9 |
| How to Use the Clamp | 10 |
| Ground Resistance Measurements | 10 |
| AC Leakage Current Measurement | 13 |

Logging Measurements . . . . . 14
Hold . . . . . 14
Filter . . . . . 14
Fluke Connect Wireless System . . . . . 15
Radio Frequency Data . . . . . 15
Fluke Connect® App . . . . . 15
Memory . . . . . 17
View Memory . . . . . 17
Clear Memory . . . . . 17
Maintenance . . . . . 18
Clamp Care . . . . . 18
Battery Replacement . . . . . 18
Product Disposal . . . . . 19
Parts and Accessories . . . . . 19
Electrical Specifications . . . . . 24
General Specifications . . . . . 24
Ground Loop Resistance . . . . . 25
AC Leakage Current mA . . . . . 25

## Introduction

The Fluke 1630-2/1630-2 FC Earth Ground Clamp (the Product or Clamp) is a handheld, battery-operated clamp that measures the ground resistance without auxiliary ground rods and AC leakage current. The Clamp is used in multi-grounded systems without disconnecting the ground under test.

The Clamp supports these applications:

- Earth resistance and AC leakage current tests of high voltage pylons, buildings, cell phone substations, and RF transmitters
- Inspection of lightning protection systems

The 1630-2 FC supports the Fluke Connect® Wireless System (may not be available in all regions). Fluke Connect is a system that wirelessly connects your Clamp with an app on your smartphone or tablet. The app shows the ground resistance measurements on your smartphone or tablet display. You can save these measurements and images to Fluke Connect® Cloud storage and share with your team. For more information, see *Fluke Connect Wireless System* on page 15.

Your shipment includes:

- 1630-2 or 1630-2 FC Earth Ground Clamp
- AA alkaline batteries, IEC LR6 (x4, installed)
- Resistance test/check loop
- Safety Information and Quick Reference Guide (go to www.fluke.com to download the *1630-2/1630-2 FC Users Manual*).
- Carrying Case

## How to Contact Fluke

Fluke Corporation operates worldwide. For local contact information, go to our website: www.fluke.com

To register your product, or to view, print, or download the latest manual or manual supplement, go to our website: www.fluke.com/productinfo.

## Safety Information

General Safety Information is in the printed Safety Information document that ships with the Product and at www.fluke.com. More specific safety information is listed where applicable.

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

## Before You Start

This section is information to know before you use the Clamp.

**⚠⚠ Warning**

**To prevent possible electrical shock, fire, or personal injury:**

- **For optimal readings, make sure the conductor is positioned between the alignment marks on the jaws.**
- **Make sure the jaws are perpendicular to the conductor.**
- **Do not use the HOLD function to measure unknown potentials. When HOLD is turned on, the display does not change when a different potential is measured.**
- **Replace the batteries as soon as the low battery indicator appears.**

### Power On/Off

The Clamp has a power on/off button:

1. Push and hold ⏻ >2 s to turn on the Clamp.
2. Push and hold ⏻ >2 s to turn off the Clamp.

If Auto-Off Power is turned on, the Clamp turns off after 20 minutes of no use. See *Power Auto-Off* on page 9 for more information about how to set this feature.

## *Self-Calibration*

When you turn on the Clamp, it self-calibrates for best accuracy.

To start the self-calibration:

1. Open and inspect the Clamp jaws. Make sure the surfaces fit together and are clean.
2. Close the Clamp.
3. Do not attach the Clamp to a conductor or open the jaws during self-calibration.
4. Push ⏻ to turn on the Clamp. The display shows the self-calibration screen. See Figure 1.




**Figure 1. Self-Calibration Screen**

5. Wait 5 seconds for self-calibration to finish before you take measurements.

When the self-calibration is good, the display shows the resistance measurement screen and is ready to use.

If the self-calibration fails, the display shows the calibration error screen in the resistance measurement mode. See Figure 2.

To continue, turn off the Clamp and repeat the self-calibration. If the error persists, see *How to Contact Fluke* on page 1.

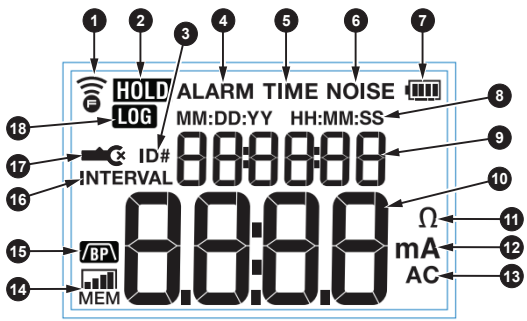



**Figure 2. Calibration Error Screen**

## Display Features and Controls

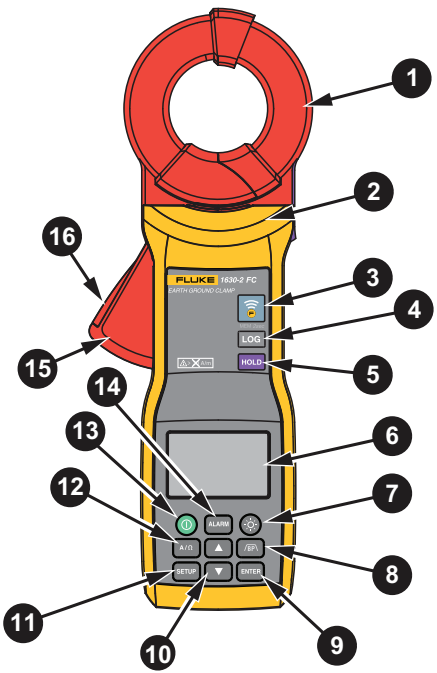
See Table 1 and Table 2 for the display features and button controls.

**Table 1. Display Features**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Fluke Connect® | 10 | Measurement value or custom setting |
| 2 | Hold | 11 | Ohms function |
| 3 | ID# | 12 | Current in mA or A |
| 4 | Alarm | 13 | Current type is AC |
| 5 | Set Time | 14 | Memory in use |
| 6 | Indicator for noise in ground electrode/rod | 15 | Filter is on (bandwidth 40 Hz to 70 Hz) |
| 7 | Battery | 16 | Logging Interval settings |
| 8 | Date/Time format | 17 | Jaws open |
| 9 | Date/Time/ID number | 18 | Setting or explore for LOG |

**Table 2. Controls**




| Item | Description |
|---|---|
| 1 | Jaw |
| 2 | Tactile barrier |
| 3 | Fluke Connect® (radio) on/off |
| 4 | Record measurements |
| 5 | Hold the displayed value |
| 6 | LCD |
| 7 | Backlight |
| 8 | Filter on/off |
| 9 | Enter |
| 10 | Value increment/decrement |
| 11 | Change Clamp settings |
| 12 | Select type of measurement |
| 13 | Power on/off |
| 14 | Alarm |
| 15 | Jaw trigger |
| 16 | Jaw trigger lock |

## Setup

Push SETUP to change these settings:

- Log interval
- Alarm threshold
- Time
- Clamp settings

### Log Interval

The time interval for data logging is the time between measurements.

To set the log interval:

1. Push SETUP until **LOG INTERVAL** shows in the display. See Figure 3.

   The interval is shown in minutes:seconds format and is adjustable from 00:00 to 59:59.

2. Push ENTER to enable the change mode. The digits start to blink.

3. Push ▲ / ▼ to increment/decrement the interval by 1 second.

4. After you select the value, push ENTER until the digits stop blinking.

5. Push A/Ω to go back to the measurement mode.




**Figure 3. Log Interval**

## Alarm Threshold

In alarm mode, the display shows **ALARM** and the beeper sounds when the measurement is outside the set threshold. The Clamp compares the reading with the high and low values. If the reading is larger than the high value, the Clamp beeps and shows **HI--** on the display. If the reading is less than the low value, the Clamp beeps and **LO--** shows on the display.

To set the alarm threshold:

1. Push SETUP until **ALARM** shows in the display. See Figure 4.
2. Push ENTER to select the type as **Amps HI**, **Amps LO**, **Ohms LO**, or **Ohms HI**.
3. Push ▲ / ▼ to increment/decrement the value.
4. Push ENTER to confirm the current input and move to the next setting.
5. Push A/Ω to go back to the measurement mode.

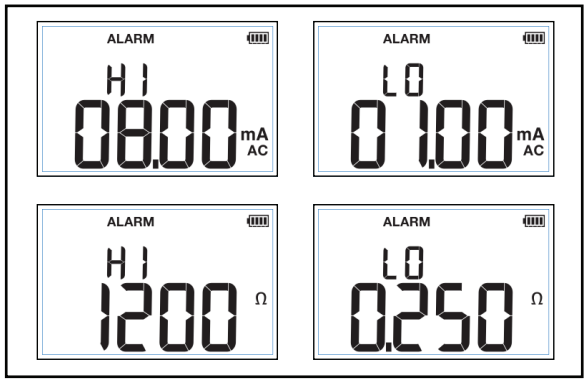



**Figure 4. Alarm Functions**

## Time/Clock

The Clamp has a time setting that is used as a timestamp for logged data.

To check or adjust the time setting:

1. Push SETUP until **TIME** shows in the display. See Figure 5.
2. Push ENTER until the digit you want to change starts to blink.
3. Push ▲ / ▼ to increment/decrement the value of the blinking digit.
4. After you select the value, push ENTER until the digits stop blinking.
5. Push A/Ω to go back to the measurement mode.

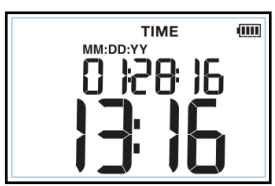



**Figure 5. Time Setting**

## Clamp Settings

The Clamp has a Setup menu for these subfunctions:

- Backlight auto-off
- Power auto-off
- Firmware version

## Backlight Auto-Off

A backlight on the display improves visibility in dim light. To conserve battery power, turn off the backlight.

To change the backlight option:

1. Push SETUP until **bL:** shows on the display. See Figure 6.
2. Push ▲ / ▼ to toggle the setting between on and off.

   The display updates to show the current setting:

   - On: backlight turns off after 2 minutes
   - Off: backlight does not turn off

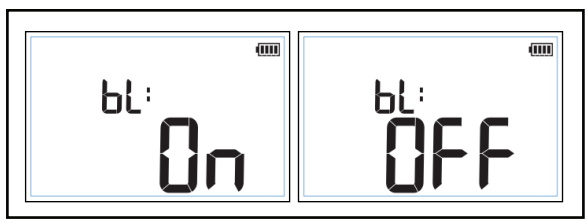



**Figure 6. Backlight Setting**

3. Push ENTER to confirm the current input and move to the next setting.
4. Push A/Ω to go back to the measurement mode.

## _Power Auto-Off_

To save battery power, you can set the clamp to automatically turn off the power after 20 minutes of no use.

To change the Auto-Off option:

1. Push SETUP until bL: shows on the display.
2. Push ENTER until AP: shows on the display. See Figure 7.
3. Push ▲ / ▼ to toggle the setting between on and off.

   The display updates to show the current setting:

   - On: Clamp turns off after 20 minutes
   - Off: Clamp does not turn off

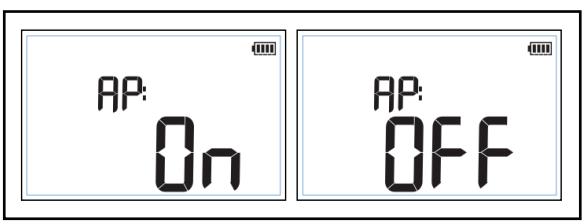



**Figure 7. Auto-Off Power Setting**

4. Push ENTER to confirm the current input and move to the next setting.
5. Push A/Ω to go back to the measurement mode.

## _Firmware Version_

To view the firmware version for the Clamp:

1. Push SETUP until bL: shows on the display.
2. Push ENTER until ver: and the version number shows on the display. See Figure 8.

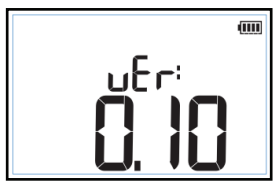



**Figure 8. Firmware Version**

3. Push A/Ω to go back to the measurement mode.

## How to Use the Clamp

This section is about how to set up the Clamp for Earth resistance tests, AC leakage current measurements, and the Fluke Connect® Wireless System.

The Clamp includes a trigger lock on the trigger. Push the jaw trigger lock and trigger together to open the jaw.

### Ground Resistance Measurements

The Clamp generates a voltage to the system under test and the induced current in the system is measured by the Clamp. The Clamp uses Ohm's Law (R=U/I) to automatically calculate the resistance measurement.

To check the Clamp before ground resistance measurements:

1. Position the Jaw on the Standard Loop Resistance. See Figure 9.

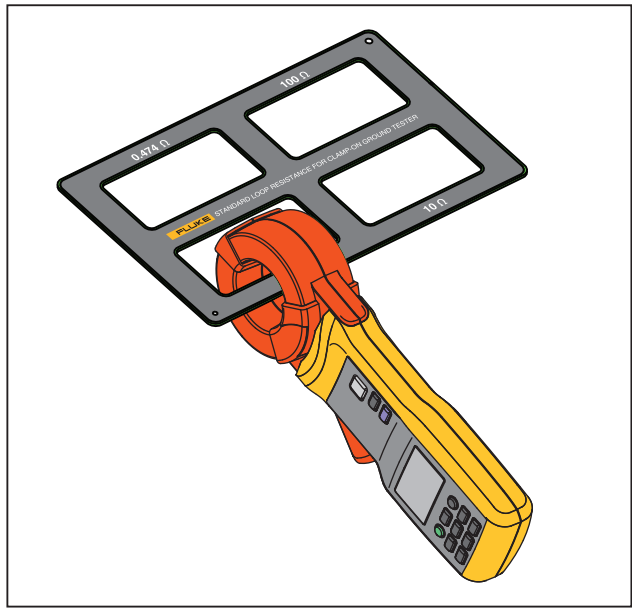



**Figure 9. Standard Loop Resistance**

2. Verify that the display reading is within specification, see Table 3.
   - If the reading is not within specification, clean the heads of the Jaw and repeat step 1 and step 2.
   - If the reading is within specification, remove the Jaw from the Standard Loop Resistance. The Clamp is ready for a ground resistance measurement.

**Table 3. Display Reading Specifications**

| Input (Ω) | Minimum | Maximum |
|---|---|---|
| 0.474 | 0.417 | 0.531 |
| 0.500 | 0.443 | 0.558 |
| 10.00 | 9.75 | 10.25 |
| 100.0 | 98.0 | 102.0 |

For ground resistance measurements:

1. Open the jaw and make sure the jaw is free of dust, dirt, or any foreign substances.
2. Turn on the Clamp.
3. Push A/Ω to select the Ω function.
4. Attach the Clamp to the electrode or ground rod to be measured.
5. Read the value of $R_g$ (ground resistance) from the display. Figure 10 illustrates the ground resistance measurement principles.

*Note*

- *If >3 A is found in the ground rod, NOISE shows on the display and the Clamp beeps. When noise is present, the Clamp reading is not valid.*
- *If the jaw assembly is opened during measurement, shows on the display.*

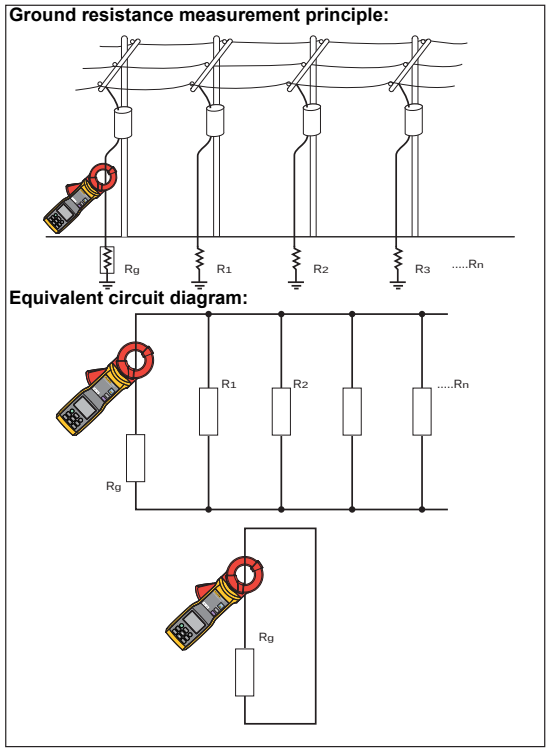



**Figure 10. Ground Resistance Measurement Principles**

## AC Leakage Current Measurement

Based on the electromagnetic induction principle, the Clamp has a ring-shape current transformer comprised of a metal core and coil winding. The current transformer senses the magnetic field produced by the current or by the vector sum of the currents flowing in the conductor under test. The current transformer then produces a current proportional to the current flowing in the conductor.

For an AC leakage current measurement test:

1. Open the jaw and make sure the jaw is free of dust, dirt, or any foreign substances.
2. Turn on the Clamp.
3. Push A/Ω to select the **A** function.
4. Attach the Clamp to the electrode, conductor, or ground rod for measurement. Figure 11 shows several connection types for an AC leakage current measurement.
5. Read the value of the leakage current on the display.

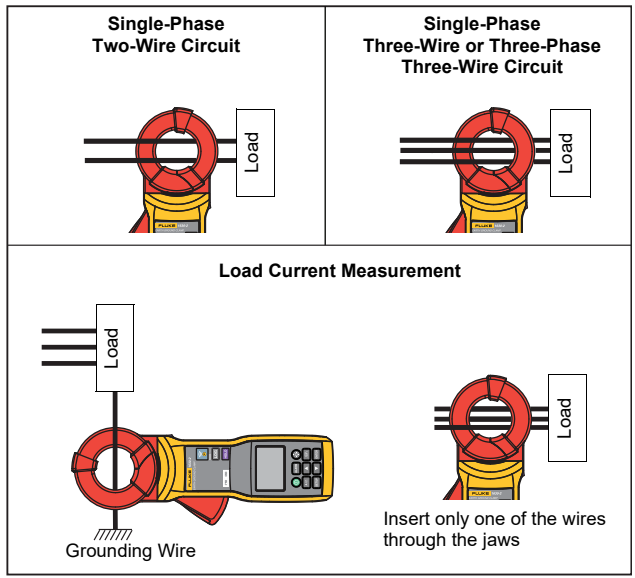



**Figure 11. AC Leakage Current Measurement**

## Logging Measurements

The Clamp records data over time and saves >2000 measurements in memory at the set logging interval.

To start logging measurements, push LOG. The display shows MEM to indicate that measurement logging is in progress See Figure 12.




**Figure 12. Logging Measurements**

Measurements are recorded at the sampling interval you specified. See *Log Interval* on page 6 for more information.

Logging stops when:

- Clamp memory is full
- Clamp detects a low battery
- You push LOG again

*Note*

*If the sampling interval is set at 0 seconds, only one data point is recorded. To record the next data point, press LOG again. The memory location is also displayed for about 1 second.*

## Hold

Push HOLD to freeze the measurement value on the display.

Push HOLD again to continue and take measurements.

## Filter

Push BP to toggle the filter on and off in the leakage current measurement mode. When BP shows on the display, the clamp can isolate the 50/60 Hz fundamental frequency from the harmonics.

## Fluke Connect Wireless System

The 1630-2 FC supports the Fluke Connect® Wireless System (may not be available in all regions). Fluke Connect® uses low-power 802.15.4 wireless radio technology to connect the Clamp with an app on your smartphone or tablet. The wireless radio does not cause interference with meter measurements.

The app shows measurements from the connected Clamp on your smartphone or tablet display, saves to Fluke Connect Cloud™ storage, and shares the information with your team.

### Radio Frequency Data

*Note*

*Changes or modifications to the wireless radio not expressly approved by Fluke Corporation could void the user's authority to operate the equipment.*

For complete information about radio frequency data, go to www.fluke.com/manuals and search for "*Radio Frequency Data Class B*".

### Fluke Connect® App

The Fluke Connect® app works with Apple and Android mobile products. The app is available for download to your smart device from the Apple App Store and Google Play Store.

To use Fluke Connect:

1. Turn on the Clamp. See Figure 13.
2. Press to activate the radio on the Clamp. shows on the display.
3. On your smartphone, go to **Settings** > **Bluetooth**.

   Verify that Bluetooth is turned on.
4. Go to the Fluke Connect App and in the list of connected Fluke tools, select **1630-2FC**.

   You can now take, save, and share measurements with the app. Go to https://www.fluke.com/en-us/products/fluke-software/connect for more information about how to use the app.

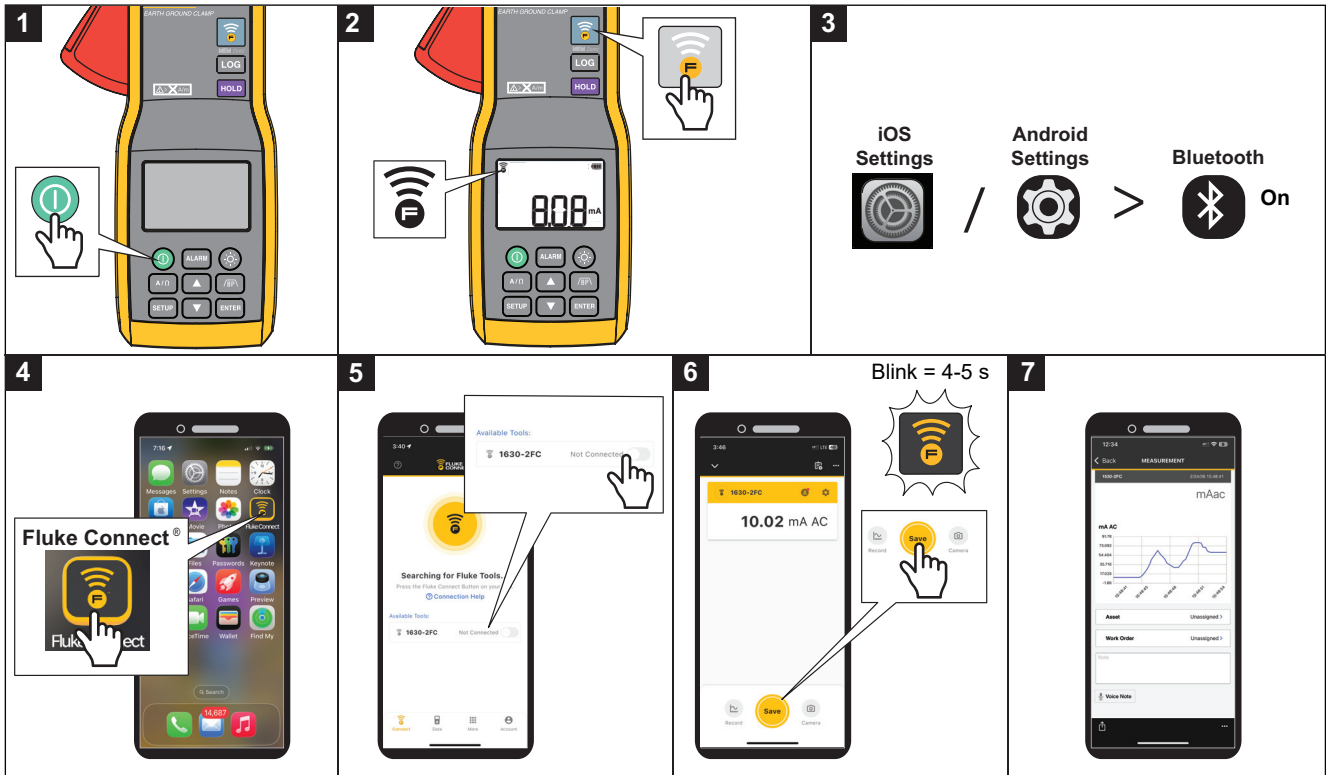



**Figure 13. Fluke Connect®**

# Memory

You can log >2000 measurements in the Clamp memory.

## View Memory

To view logged measurements in memory:

1. Push and hold LOG >2 s to go the view memory mode.

   The most recent logged measurement shows on the display with an ID#. See Figure 14.

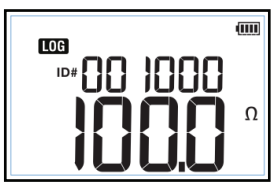



**Figure 14. Logged Measurements**

2. Press ▲ / ▼ to go to the next or previous ID# (memory location). The ID# rolls over when you reach the first or last record.
3. Push ENTER to toggle the display to show the time or date for the logged measurement. See Figure 15.

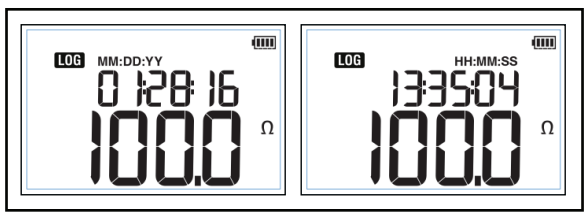



**Figure 15. Timestamp**

## Clear Memory

To clear the memory:

1. In measurement mode, simultaneously push and hold ▲ / ▼.
2. Push ENTER to confirm and finish the clear action.

   The clamp automatically goes back to measurement mode.

## Maintenance

**⚠⚠ Warning**

**To prevent a possible electrical shock, fire, or personal injury:**

- **Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.**
- **Repair the Product before use if the battery leaks.**
- **Use only specified replacement parts.**
- **Have an approved technician repair the Product.**
- **Remove the input signals before you clean the Product.**
- **Do not use the HOLD function to measure unknown potentials. When HOLD is turned on, the display does not change when a different potential is measured.**

### Clamp Care

**⚠ Caution**

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

Clean the case with a damp cloth and mild detergent. Do not use a solvent or cleaners with abrasives.

### Battery Replacement

**⚠⚠ Warning**

**To avoid false readings that could lead to possible electric shock or personal injury, replace the batteries as soon as the low battery indicator (▭) appears.**

To replace the battery:

1. Push and hold ⏻ >2 s to turn off the Clamp.
2. See Table 4 for details on how to replace the battery.

### *Product Disposal*

Dispose of the Product in a professional and environmentally sound manner:

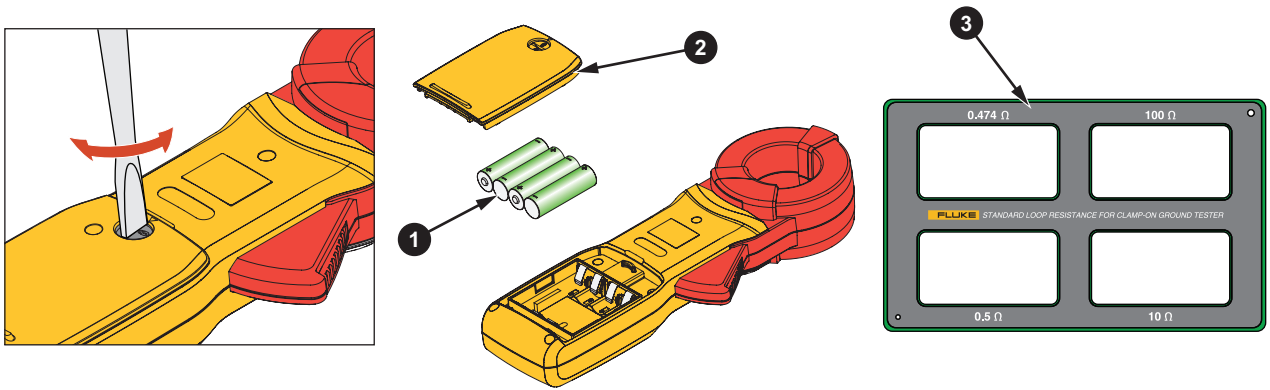
- Delete personal data on the Product before disposal.
- Remove batteries that are not integrated into the electrical system before disposal and dispose of batteries separately.
- If this Product has an integral battery, put the entire Product in the electrical waste.

## *Parts and Accessories*

Read this manual to make sure the Product is used correctly. If the Clamp does not turn on, check the battery.

Replacement parts and accessories are shown in Table 4. For more information about parts and accessories, see *How to Contact Fluke* on page 1.

**Table 4. Accessories and Replacement Parts**




| Item | Description | Fluke Part or Model Number |
|---|---|---|
| 1 | AA Alkaline Battery, IEC LR6 (requires 4) | 373756 |
| 2 | Battery Door Assembly | 4779851 |
| 3 | Standard Loop Resistance | 4799496 |

**Table 5. Operational Error for Ground Resistance Measurement**

| Parameter | Specification | Typical | Max[1] |
|---|---|---|---|
| Intrinsic uncertainty | IEC 61557-5 A<br>Reference conditions | 2.11 % | 4.90 % |
| Conductor Position | IEC 61557-5 E1<br>±30 ° | 0.00 % | 0.00 % |
| Battery Voltage | IEC 61557-5 E2<br>4.4 V to 6.4 V | 0.00 % | 0.00 % |
| Temperature | IEC 61557-5 E3<br>-10 °C to 50 °C | 4.75 % | 10.28 % |
| Series interference voltage | IEC 61557-5 E4<br>3 V rms 400 Hz, 60 Hz, 50 Hz, 16-2/3 Hz, and ±3 V dc | 2.45 % | 5.35 % |
| Uncertainty | IEC 61557-5 B | 8.26 % | 18.23 % |
| [1] Confidence level: 95 %. | | | |

**Table 6. Operational Error for Leakage Current Measurement**

| Parameter | Specification | Typical | Max[1] |
|---|---|---|---|
| Intrinsic uncertainty | IEC 61557-13 A<br>Reference conditions | 0.06 % | 0.20 % |
| Conductor Position | IEC 61557-13 E1<br>±30° | 0.06 % | 0.20 % |
| Battery Voltage | IEC 61557-13 E2<br>4.4 V to 6.4 V | 0.07 % | 0.20 % |
| Temperature | IEC 61557-13 E3<br>-10 °C to 50 °C | 0.25 % | 0.47 % |
| Distortion | IEC 61557-13 E9 | 0.10 % | 0.25 % |
| Magnetic Field | IEC 61557-13 E11<br>(15 Hz to 400 Hz)<br>10A/m Class 3<br>30A/m Class 2 | <br><br>2.58 %<br>7.55 % | <br><br>4.87 %<br>13.45 % |
| Load Current | IEC 61557-13 E12<br>40 Arms max (50 Hz and 60 Hz) | 4.72 % | 9.02 % |

**Table 6. Operational Error for Leakage Current Measurement (cont.)**

| Parameter | Specification | Typical | Max[1] |
|---|---|---|---|
| Touch Current | IEC 61557-13 E13<br>CAT III 1000 V/ 60 Hz | 0.06 % | 0.20 % |
| Frequency | IEC 61557-13 E14<br>40 Hz to 1 kHz | 0.40 % | 0.95 % |
| Repeatability | IEC 61557-13 E15 | 0.06 % | 0.20 % |
| Uncertainty | IEC 61557-13 B<br>10 A/m Class 3<br>30 A/m Class 2 | <br>6.28 %<br>12.06 % | <br>10.32 %<br>18.87 % |
| [1] Accuracy guaranteed for 50 Hz and 60 Hz. Confidence level: 95 %. | | | |

## Electrical Specifications

Safety Specifications are in the Safety Specifications section of the *Safety Information* that ships with the Product or at www.fluke.com.

**Battery Life** ..... >15 hours in Ground Resistance measurement mode, with backlight turned off, and RF mode turned off

**Frequency Range**

- Filter OFF ..... 40 Hz to 1 kHz
- Filter ON ..... 40 Hz to 70 Hz

**LCD**

- Digital Reading ..... 9999 counts
- Refresh Rate ..... 4/second

**Reference Temperature** ..... 23 °C ±5 °C (73 °F ±9 °F)

**Temperature Coefficient** ..... 0.15 % x reading/ °C (<18 °C or >28 °C)

**Overload Indication** ..... OL

**Data Logging Capacity** ..... >2000 data points

**Data Logging Interval** ..... 1 second to 59 minutes and 59 seconds

## General Specifications

**Conductor Size** ..... 40 mm approximately

**Dimensions** ..... 283 mm x 105 mm x 48 mm

**Weight** ..... 880 g

## Ground Loop Resistance

Frequency of measurement: 3.333 kHz.

| Range | Accuracy [1] ± (% of reading + Ω) |
|---|---|
| 0.025 Ω to 0.249 Ω | 1.5 % + 0.020 Ω |
| 0.250 Ω to 0.999 Ω | 1.5 % + 0.050 Ω |
| 1.000 Ω to 9.999 Ω | 1.5 % + 0.100 Ω |
| 10.00 Ω to 49.99 Ω | 1.5 % + 0.30 Ω |
| 50.00 Ω to 99.99 Ω | 1.5 % + 0.50 Ω |
| 100.0 Ω to 199.9 Ω | 3.0 % + 1.0 Ω |
| 200.0 Ω to 399.9 Ω | 5.0 % + 5.0 Ω |
| 400 Ω to 599 Ω | 10.0 % + 10 Ω |
| 600 Ω to 1500 Ω | 20.00 % |

[1] Loop resistance with no inductance, conductor centered.

## AC Leakage Current mA

True rms, crest factor CF ≤3.

| Range | Resolution | Accuracy [1] ± (% of reading + mA) |
|---|---|---|
| 0.200 mA to 3.999 mA | 1 µA | 2.0 % + 0.05 mA |
| 4.00 mA to 39.99 mA | 10 µA | 2.0 % + 0.03 mA |
| 40.0 mA to 399.9 mA | 100 µA | 2.0 % + 0.3 mA |
| 0.400 A to 3.999 A | 1 mA | 2.0 % + 3 mA |
| 4.00 A to 39.99 A | 10 mA | 2.0 % + 30 mA |

[1] Applies to signal frequency:
- 40 Hz to 1 kHz with Filter set to OFF
- 40 Hz to 70 Hz with Filter set to ON