FLUKE®

377/377 FC/378/378 FC

Clamp Meter

Calibration Manual

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Introduction

⚠⚠ Warning

Read *Safety Information* before you use the Product.

This manual explains the Performance Tests for the 377/377 FC/378/378 FC Clamp Meter (the Product, the Jaw, or the device under test (DUT)). See the 377/377 FC/378/378 FC *Users Manual* for usage information.

Contact Fluke

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

To register your product, view, print, or download the latest manual or manual supplement, go to our website.

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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.

Specifications

Complete specifications are at www.fluke.com. See the *377/377 FC / 378/378 FC Product Specifications*.

Performance Tests

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, do not perform the performance test procedures unless the Product is fully assembled.

Fluke recommends a 1-year cycle for the Performance Tests. If the Product fails any test, return the Product to a Fluke Service Center or Authorized Service Partner. See *Contact Fluke* for more information.

Table 1 lists the standard equipment for the Performance Tests. Table 2 lists performance tests and readout limits to verify the complete operation of the Product and to check the accuracy of each function against the Product specifications.

Table 1. Standard Equipment

Equipment	Required Characteristics	Recommended Model
Calibrator (the Calibrator)	4.5-digit resolution	Fluke 55xxA or similar model
Transconductance Amplifier	100 A	Fluke 52120A
Wired Coil (the Coil)	25-turn	52120A/COIL3KA
Wired Coil (the Coil)	50-turn	52120A/COIL6KA
Test Leads	NA	PN 2070140

Performance Test Procedures

Before you start a performance test procedure:

- Read the documentation for all the test equipment used in a procedure.
- Warm up and stabilize all test equipment in an environment of 23 °C ±5 °C.

All procedures refer to the performance tests and the readout limits in Table 2.

AC Voltage

To verify ac voltage:

1. Connect the test leads to the V Ω and COM input terminals on the bottom of the device under test (DUT).
2. Connect the other end of the test leads to the NORMAL output HI and LO terminals on the Calibrator.
3. Set the DUT to $\widetilde{V}$.
4. On the Calibrator:
   a. Set the desired voltage and frequency at the NORMAL output terminals.

⚠ Caution

To prevent damage to the DUT, verify the applied voltage to the DUT does not exceed the rating of the DUT insulation and the interconnection wiring.

b. Push OPR to activate the Calibrator output and apply the voltage to the DUT.

5. On the DUT, verify the measurement on the display is within the readout limits for the test.

DC Voltage

To verify dc voltage:

1. Connect the test leads to the V Ω and COM input terminals on the bottom of the DUT.
2. Connect the other end of the test leads to the NORMAL output HI and LO terminals on the Calibrator.
3. Set the DUT to mV V⎓.
4. On the Calibrator:
   a. Set the desired voltage at the NORMAL output terminals.

⚠ Caution

To prevent damage to the DUT, verify the applied voltage to the DUT does not exceed the rating of the DUT insulation and the interconnection wiring.

   b. Push OPR to activate the calibrator output and apply the voltage to the DUT.
5. On the DUT, verify the measurement on the display is within the readout limits for the test.
6. To verify mV voltage, push [ ] on the DUT to go to mV mode.
7. On the Calibrator:
   a. Set the desired voltage at the NORMAL output terminals.
   b. Push OPR to activate the calibrator output and apply the voltage to the DUT.
8. On the DUT, verify the measurement on the display is within the readout limits for the test.

Resistance/Capacitance

To verify resistance and capacitance:

1. Connect the test leads to the V Ω and COM input terminals on the bottom of the DUT.
2. Connect the other end of the test leads to the NORMAL output HI and LO terminals on the Calibrator.
3. Set the DUT to ⊣⊢ Ω to verify resistance.
4. Set the Calibrator to the desired resistance output.

5. On the DUT, verify the measurement on the display is within the readout limits for the test.
6. To verify capacitance, push [ ] on the DUT to go to capacitance mode.
7. Set the Calibrator to the desired capacitance output.
8. On the DUT, verify the measurement on the display is within the readout limits for this test.

DC Current (Jaw with Calibrator, 52120A, and Coil)

To verify dc current measurement with the Jaw:

1. Connect the Calibrator.
   - For test points <20 A, use a single-wire short between the 20 A and AUX LO jacks on the Calibrator.
   - For test points from 20 A to 100 A:
     - Use a single-wire short between the HIGH CURRENT OUTPUT HI and LO jacks of the 52120A.
     - Connect the Calibrator's NORMAL HI and LO terminals to the INPUT HI and LO terminals of the 52120A.
   - For test points >100 A:
     - Connect the Coil to the 52120A.
     - Connect the Calibrator's NORMAL HI and LO terminals to the INPUT HI and LO terminals of the 52120A.
2. Set the DUT to ZERO ⎓ A.
3. Place the DUT on a flat surface away from any metal.
4. On the DUT, push [ ] to zero the dc current function.
5. Place the DUT around the wire used to create the short so that the wire touches the yellow part at the tip of the closed jaw of the DUT. See Figure 1.

   Or,

   Place the DUT around the center conductor of the Coil so that the yellow part at the tip of the DUT touches the center wires of the Coil and the jaw of the DUT remains completely closed. See Figure 2.

   Calibration accuracy to specifications is guaranteed only with proper clamp alignment.

Figure 1. Wire Placement with DUT

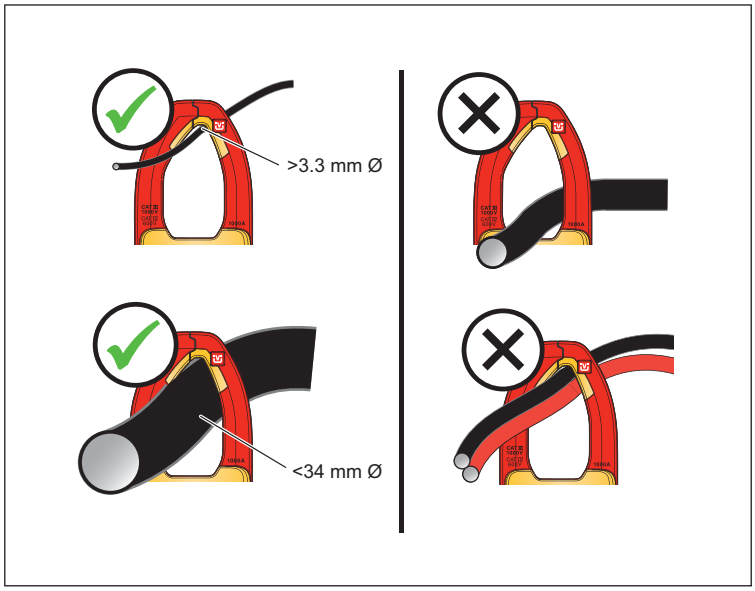
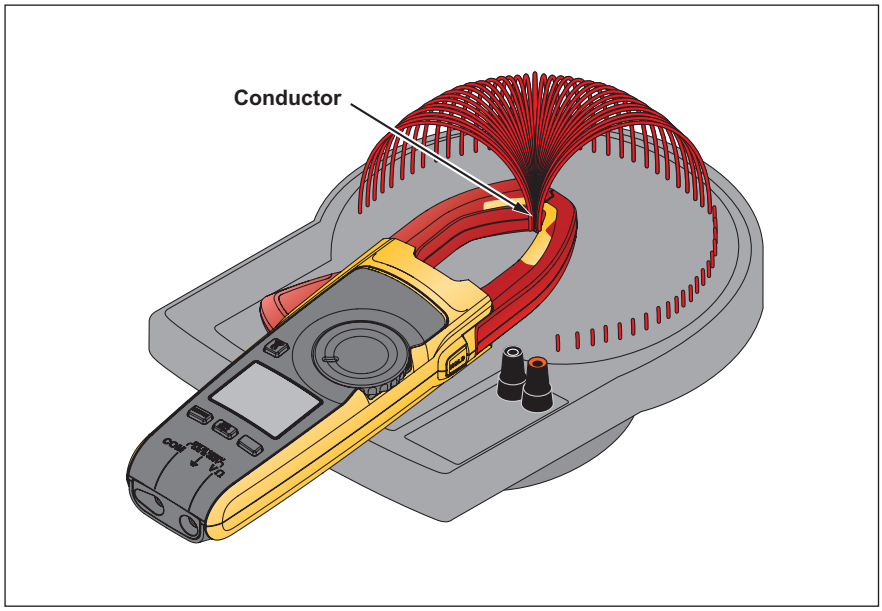


Figure 2. DUT Placement with Coil



6. Set the Calibrator to the desired dc current output.
7. Put the 52120A in standby mode.
8. On the Calibrator, push OPR.
9. On the 52120A, push OPR to activate the output and apply the current to the DUT.
10. On the DUT, verify the measurement on the display is within the readout limits for the test.

AC Current (Jaw with Calibrator, 52120A, and Coil)

To verify ac current measurement with the Jaw:

1. Connect the Calibrator.
   - For test points <20 A, use a single-wire short between the 20 A and AUX LO jacks on the Calibrator.
   - For test points from 20 A to 120 A:
     - Use a single-wire short between the HIGH CURRENT OUTPUT HI and LO jacks of the 52120A.
     - Connect the Calibrator's NORMAL HI and LO terminals to the INPUT HI and LO terminals of the 52120A.
   - For test points >120 A:
     - Connect the Coil to the 52120A.
     - Connect the Calibrator's NORMAL HI and LO terminals to the INPUT HI and LO terminals of the 52120A.
   - On the 52120A, set LCOMP to ON.
   - Set the DUT to Hz FIELD SENSE V A.
2. Place the DUT around the wire used to create the short so that the wire touches the yellow part at the tip of the closed jaw of the DUT. See Figure 1.

   Or,

   Place the DUT around the center conductor of the Coil so that the yellow part at the tip of the DUT touches the center wires of the Coil and the jaw of the DUT remains completely closed. See Figure 2.

   Calibration accuracy to specifications is guaranteed only with proper clamp alignment.
3. Set the Calibrator to the desired ac current output.
4. Put the 52120A in standby mode.
5. On the Calibrator, push OPR.
6. On the 52120A, push OPR to activate the output and apply the current to the DUT.
7. On the DUT, verify the measurement on the display is within the readout limits for the test.

AC Current (iFlex Current with iFlex Current Probe with Calibrator, 52120A, and Coil)

The Product measures both ac and dc voltage. The iFlex current probe (the Probe) only measures ac voltage. For ac current performance tests from 120 A to 2500 A, use the Product with the Probe, the Calibrator, 52120A, and the Coil. The 52120A converts low voltage input from the Calibrator into an output current up to 120 A, then sources the current into the Coil to produce up to 2500 Amp-turns ac.

⚠ Caution

Read all safety Information before you use the 377/378, 52120A, and the Coil. High currents are used during this test.

To verify iFlex ac current with the Probe:

1. Connect one end of the test leads to the NORMAL output HI and LO terminals on the Calibrator.
2. Connect the other end of the test leads to the INPUT HI and LO terminals on the 52120A.
3. Connect the HI and LO terminals of the Coil to the HIGH CURRENT OUTPUT HI and LO terminals on the 52120A.
4. On the 52120A:
   a. Select VOLTS on the input selection.
   b. Set LCOMP to ON.
   c. Set the OUTPUT TERMINALS to HIGH and the OUTPUT RANGE to 20 A or 120 A as noted in Table 2 for each test point for iFlex Current Probe (with 52120A and Coil).
5. Connect the Probe to the DUT.
6. Center the Probe on the Coil equal distance from the conductor and the cable within the Coil.
7. Set the Calibrator to the desired voltage and frequency output.
8. On the DUT, verify the measurement on the display is within the readout limits for the test.

AC Current (iFlex Current with Calibrator AC Voltage Simulation)

Note

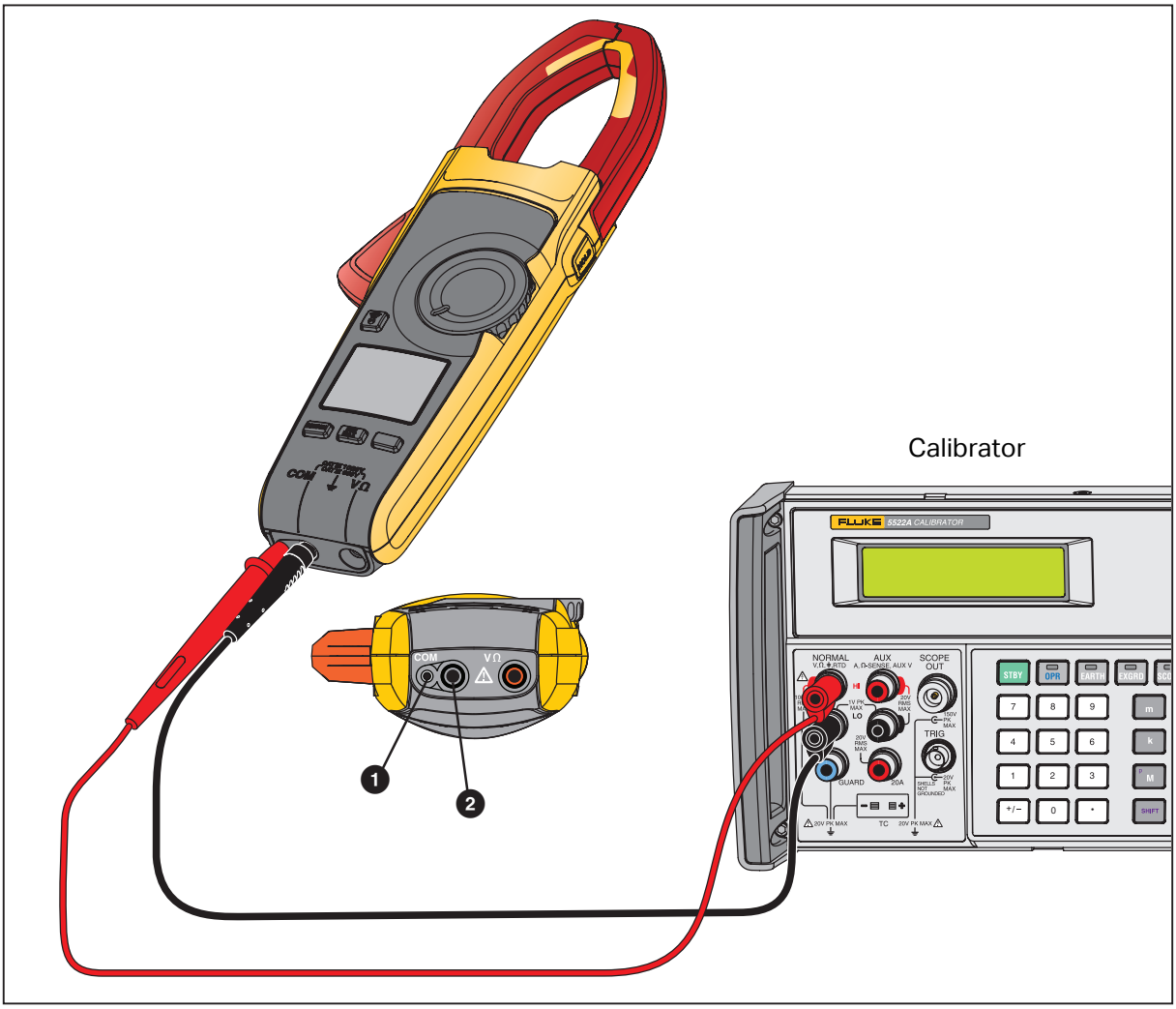
If the Probe is not available with the DUT for calibration, use the Calibrator to source voltage to simulate ac current up to 2500 A.

To verify ac current measurement without the Probe, use the ac voltage simulation from the Calibrator:

1. Connect the NORMAL output HI terminal of the Calibrator to the iFlex 2 mm jack flexible probe input terminal ❶ on the DUT. See Figure 3.

2. Connect the Calibrator NORMAL output LO terminal to the black COM jack ❷ on the DUT. See Figure 3.

Figure 3. iFlex Current Probe Connections



3. Set the DUT to iFlex Hz.
4. Set the Calibrator to the desired voltage and frequency output.
5. On the DUT, verify the measurement on the display is within the readout limits for the test.

Performance Tests and Readout Limits

Table 2 lists performance tests and readout limits to verify the complete operation of the Product and to check the accuracy of each function against the Product specifications.

Table 2. Performance Test and Readout Limits

Test (Switch Position)	Calibrator Output	52120A Range	Readout Limit	
			Low	High
~V AC Volts	30 V @ 20 Hz	NA	29.2 V	30.8 V
	30 V @ 55 Hz			
	30 V @ 500 Hz			
	570 V @ 45 Hz	NA	563.8 V	576.2 V
	570 V @ 55 Hz			
	570 V @ 500 Hz			
	1000 V @ 45 Hz	NA	985 V	1015 V
	1000 V @ 55 Hz			
	1000 V @ 500 Hz			
mV ⎓V DC Volts	-570 V	NA	-576.2 V	-563.8 V
	-300 V		-303.5 V	-296.5 V
	-50 V		-51.0 V	-49.0 V
	0 V		-0.5 V	0.5 V
	50 V		49.0 V	51.0 V
	300 V		296.5 V	303.5 V
	570 V		563.8 V	576.2 V
	-1000 V		-1015 V	-985 V
	1000 V		985 V	1015 V
	0 mV		-0.5 mV	0.5 mV
	500 mV		494.5 mV	505.5 mV
	-500 mV		-505.5 mV	-494.5 mV
Ω Resistance	0 Ω	NA	-0.5 Ω	0.5 Ω
	10 Ω		9.4 Ω	10.6 Ω
	570 Ω		563.8 Ω	576.2 Ω
	5700 Ω		5638 Ω	5762 Ω
	57 kΩ		56.38 kΩ	57.62 kΩ
Ω Capacitance	10 µF	NA	9.5 µF	10.5 µF
	90 µF		88.7 µF	91.3 µF
	950 µF		937 µF	964 µF
⎓A DC Amps: Jaw (with Calibrator short)	10 A	NA	9.3 A	10.7 A
	-10 A	NA	-10.7 A	-9.3 A

Table 2. Performance Test and Readout Limits (cont.)

Test (Switch Position)	Calibrator Output	52120A Range	Readout Limit	
			Low	High
⎓ Ã DC Amps: Jaw (with 52120A and 25-turn coil)	**using 52120A/COIL3KA**			
	-975 A (-0.39 V dc)	120 A	-995.0 A	-955.0 A
	-450 A (-1.80 V dc)	20 A	-510.5 A	-489.5 A
	975 A (0.39 V dc)	120 A	955.0 A	995.0 A
	450 A (1.80 V dc)	20 A	489.5 A	510.5 A
~ Ã AC Amps: Jaw (with Calibrator short)[X]	10 A @ 45 Hz	NA	9.3 A	10.7 A
	10 A @ 55 Hz			
	10 A @ 65 Hz			
~ Ã AC Amps: Jaw (with 52120A and 25-turn coil)	**using 52120A/COIL3KA**			
	450 A @ 45 Hz (1.8 V @ 45 Hz)	20 A	440.5 A	459.5 A
	450 A @ 55 Hz (1.8 V @ 55 Hz)			
	450 A @ 65 Hz (1.8 V @ 65 Hz)			
	975 A @ 45 Hz (0.39 V @ 45 Hz)	120 A	955.0 A	995.0 A
	975 A @ 55 Hz (0.39 V @ 55 Hz)			
	975 A @ 65 Hz (0.39 V @ 65 Hz)			
~ Ã AC Current Frequency	45 Hz @ 95 A	20 A	44.275 Hz	45.725 Hz
	66 Hz @ 450 A	20 A	65.17 Hz	66.83 Hz
	440 Hz @ 150 A	120 A	437.3 Hz	442.7 Hz
iFlex Ã ~ Hz iFlex Current Probe (with ac voltage simulation)	1.05 mV @ 35 Hz	NA	48.0 A	52.0 A
	3 mV @ 100 Hz			
	15 mV @ 500 Hz			
	11.4 mV @ 20 Hz		921.0 A	979.0 A
	57 mV @ 100 Hz			
	285 mV @ 500 Hz			
	29.4 mV @ 20 Hz		2372 A	2528 A
	147 mV @ 100 Hz			
	735 mV @ 250 Hz			
iFlex AC Current Frequency with simulation	20 Hz @ 1250 A[2]	NA	19.4 Hz	20.6 Hz
	100 Hz @ 1250 A[2]		99.0 Hz	101.0 Hz
	500 Hz @ 1250 A[2]		497.0 Hz	503.0 Hz

Table 2. Performance Test and Readout Limits (cont.)

Test (Switch Position)	Calibrator Output		52120A Range	Readout Limit	
				Low	High
	using 52120A/COIL3KA	using 52120A/COIL6KA			
iFlex Current Probe (with 52120A and Coil)[3]	0.6 V @ 10 Hz[1]	0.30 V @ 10 Hz[1]	20 A	145.0 A	155.0 A
	0.6 V @ 55 Hz[1]	0.30 V @ 55 Hz[1]			
	0.6 V @ 500 Hz[1]	0.30 V @ 500 Hz[1]			
	0.38 V @ 10 Hz[2]	0.19 V @ 10 Hz[2]	120 A	921.0 A	979.0 A
	0.38 V @ 55 Hz[2]	0.19 V @ 55 Hz[2]			
	0.38 V @ 500 Hz[2]	0.19 V @ 500 Hz[2]			
	0.96 V @ 10 Hz[2]	0.48 V @ 10 Hz[2]		2323.0 A	2477.0 A
	0.96 V @ 55 Hz[2]	0.48 V @ 55 Hz[2]			
	0.96 V @ 250 Hz[2]	0.48 V @ 250 Hz[2]			

[1] 52120A: Use HIGH CURRENT OUTPUT terminals. Under OUTPUT on the front panel, select TERMINALS HIGH and RANGE 20A.

[2] 52120A: Use HIGH CURRENT OUTPUT terminals. Under OUTPUT on the front panel, select TERMINALS HIGH and RANGE 120A.

[3] 52120A: Select L COMP ON.

Maintenance

If the Product is used appropriately it does not require special maintenance or repair. In case of repair, go to www.fluke.com for contact information of Fluke Service Centers worldwide.

⚠⚠ Warning

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

- **Remove the input signals before you clean the Product.**
- **Repair the Product before use if the battery leaks. Battery leakage may create a shock hazard or damage the Product.**
- **Use only specified replacement parts.**
- **Have an approved technician repair the Product.**
- **Remove the batteries if the Product is not used for an extended period of time, or if stored in temperatures above 50 °C. If the batteries are not removed, battery leakage may result.**

Maintenance Mode

In Maintenance Mode you can check:

- LCD segments
- Firmware version
- Battery status annunciators
- Fluke Connect LED
- Backlight

To enter Maintenance Mode:

1. Turn off the Clamp.
2. Push and hold HOLD as you turn the control knob to $\widetilde{V}$.
3. The Clamp goes into the option mode.
4. Push [ ] until ոrЯt ոrШd shows on the display.
5. Push [MIN MAX].

   All LCD segments turn on and the backlight turns off.
6. Release HOLD.

   All LCD segments continue to show on the display.
7. Press HOLD again to show the firmware version.

8. Continue to press HOLD to cycle through:
   - Empty battery annunciator
   - 25 % battery annunciator
   - 50 % battery annunciator
   - 75 % battery annunciator
   - Blue LED + live battery annunciator (for FC model only, step is skipped for non-FC model)
   - White backlight + live battery annunciator
   - Green backlight + live battery annunciator
9. Press HOLD again to show CAL on the display.
10. Press HOLD again to loop back to show all LCD segments (see step 6).

To exit maintenance mode, turn off the Meter.

How to Clean the Case

Wipe the case with a damp cloth and mild detergent.

⚠ Caution

Do not use abrasives, isopropyl alcohol, or solvents to clean the case or lens/window.

Battery Replacement

⚠⚠ Warning

To prevent personal injury and for safe operation of the Product:

- **The battery door must be closed and locked before you operate the Product.**
- **Remove all probes, test leads, and accessories before the battery door is opened.**
- **Replace the batteries when the low battery indicator shows to prevent incorrect measurements.**
- **When batteries are changed, ensure that the calibration seal in the battery compartment is not damaged. If damaged, the Product may not be safe to use. Return the Product to Fluke for replacement of the seal.**

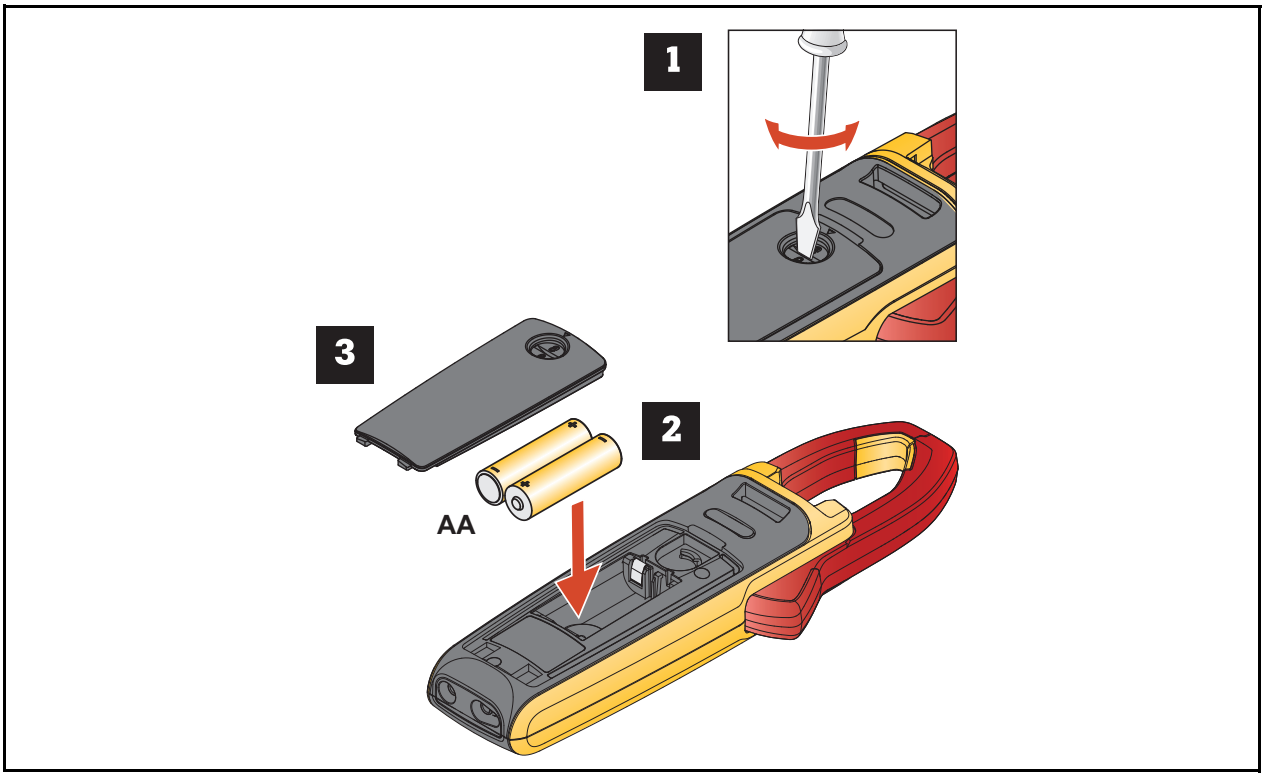
⚠ Caution

To prevent damage to the battery:

- **Repair the Product before use if the battery leaks.**
- **Do not expose battery to heat sources or high-temperature environments such as an unattended vehicle in the sun.**
- **Always operate in the specified temperature range.**
- **Do not incinerate the Product and/or battery.**

The Product ships with the batteries installed. To replace batteries, see Figure Figure 4.

Figure 4. Batteries



User Replaceable Parts

To maintain optimum performance, an authorized Fluke Calibration service center should service the Product every two years.

Contact your equipment distributor or authorized Fluke Calibration Service Center for any equipment performance failure or to schedule regular maintenance service. See *Contact Fluke* for more information.

Table Table 3 lists the replacement parts of the Product.

Table 3. Replacement Parts

Item/Description	Fluke Part or Model Number
Battery, AA 1.5 V (x2)	376756
Battery Door	5105034
Test Lead Set	TL75
Test Lead Set	TL175
Test Probe	TP175
Alligator Clip	AC285
Flexible Current Probe i2500-10	3676410
Flexible Current Probe i2500-18	3798105
Magnet Strap	669952
Strap (9-inch)	669960
Carry Case	5211830