

301A/301B/301C/301D/301E

Clamp Meter

Calibration Manual

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is two years and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

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Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

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Introduction

The Fluke 301A/301B/301C/301D/301E Clamp Meter (the Product or Clamp) measures ac and dc voltage, ac and dc current, resistance, continuity, diode, capacitance, and frequency. All illustrations show the 301B unless otherwise specified.

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.

+1-425-446-5500

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Safety Information

Warning

Read Safety Information before you use the Product.

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 hazardous 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.

Static Awareness

Semiconductors and integrated circuits can be damaged by electrostatic discharge during handling. This notice explains how to minimize damage to these components.

1. Understand the problem.
2. Learn the guidelines for proper handling.
3. Use the proper procedures, packaging, and bench techniques.

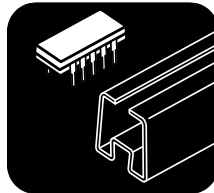
Follow these practices to minimize damage to static sensitive parts.

Warning

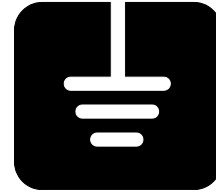
To prevent electric shock or personal injury. De-energize the product and all active circuits before opening a product enclosure, touching or handling any PCBs or components.



- Minimize handling.
- Handle static-sensitive parts by non-conductive edges.
- Do not slide static-sensitive components over any surface.
- When removing plug-in assemblies, handle only by non-conductive edges.
- Never touch open-edge connectors except at a static-free work station.



- Keep parts in the original containers until ready for use.
- Use static shielding containers for handling and transport.
- Avoid plastic, vinyl, and polystyrene foam in the work area.



- Handle static-sensitive parts only at a static-free work station.
- Put shorting strips on the edge of the connector to help protect installed static-sensitive parts.
- Use anti-static type solder extraction tools only.
- Use grounded-tip soldering irons only.

Specifications

Complete specifications are in the Users Manual online at www.Fluke.com. Safety specifications are in the Safety Information that shipped with the Product.

Maintenance

⚠ Caution

To prevent possible damage to the Product or to equipment under test, do not use abrasive cleansers.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

Battery Replacement

⚠⚠ Warning

To prevent possible explosion, fire, or personal injury, replace the batteries when the low battery indicator (⎓) shows to prevent incorrect measurements.

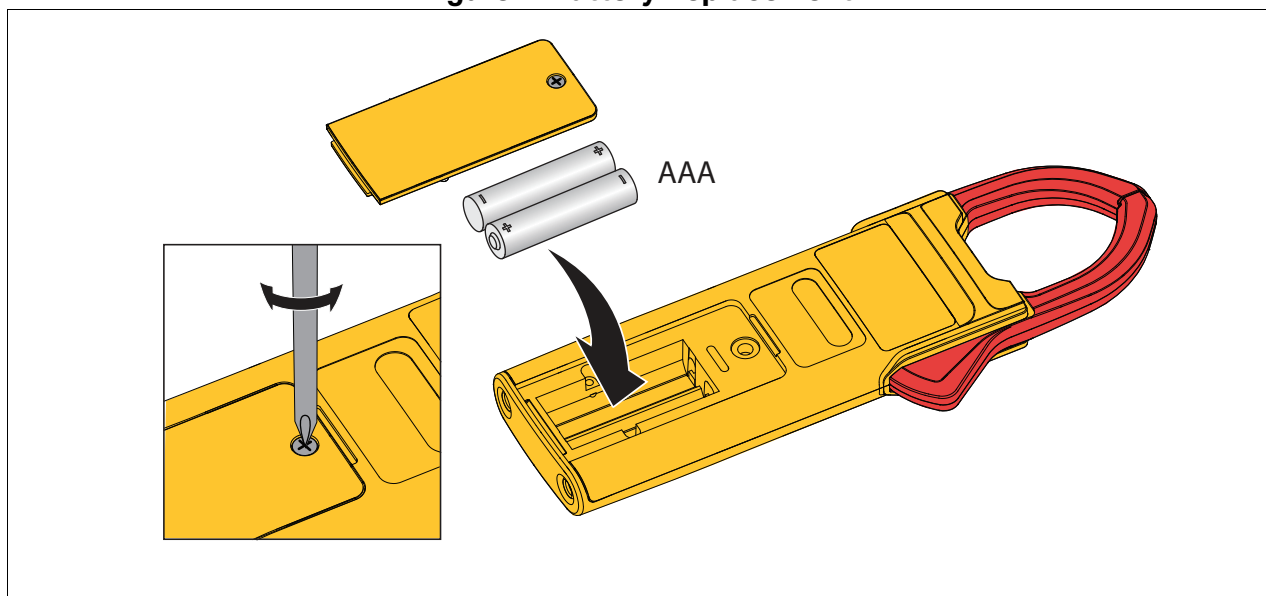
⚠ Caution

To prevent possible damage to the Product or to equipment under test:

- **Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.**
- **Be sure that the battery polarity is correct to prevent battery leakage.**

Figure 1 shows how to replace the battery.

Figure 1. Battery Replacement



To replace the batteries:

1. Turn off the Product.
2. Turn over the Product to access the battery compartment door screw.
3. Use a flat-head screwdriver to loosen the battery compartment door screw and lift off the battery compartment door.
4. Replace the two AAA batteries. Make sure to use the correct polarity when you put the batteries into the battery compartment door.
5. Reattach the battery compartment door.
6. Tighten the battery compartment door screw.

Jaw Maintenance

If the Product does not work properly:

1. Inspect the jaw mating surface for cleanliness. If any foreign material (including rust) is present, the jaw will not close properly and measurement errors will result.
2. Open the jaws and wipe the clamp metal ends with a non-flammable oil and cloth.

User-Replaceable Parts

[Table 1](#) is a list of the user-replaceable parts. To order parts, see [Contact Fluke](#).

Table 1. User-Replaceable Parts

Item	Quantity	Fluke Part Number
Battery AAA 1.5 V	1	5128983
Battery Door	1	5336951
TL75, Test Lead with 2 Caps	1	4306653

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.

Required Equipment

[Table 2](#) is a list of the equipment that is necessary for the performance tests and calibration adjustment.

Table 2. Equipment Requirements

Equipment	Required Characteristics	Recommended Model
Calibrator	4.5-digit resolution	5560A or equivalent
Wired Coil	25 turns	COIL3KA
Transconductance Amplifier	100 A	52120A

Performance Tests

Warning

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

The performance tests verify the full operation of the Product and measure the accuracy of each function against the Product specifications. If the Product fails a part of the test, calibration adjustment and/or repair is necessary. See [Calibration Adjustment](#).

Before you do the performance tests:

1. Make sure that you have the necessary equipment. See [Table 2](#).
2. Make sure the Product batteries are charged or replace them if necessary. See [Battery Replacement](#).
3. Warm up the Calibrator as necessary. Refer to its specifications.
4. Let the temperature of the DUT (device under test) become stable to room temperature.

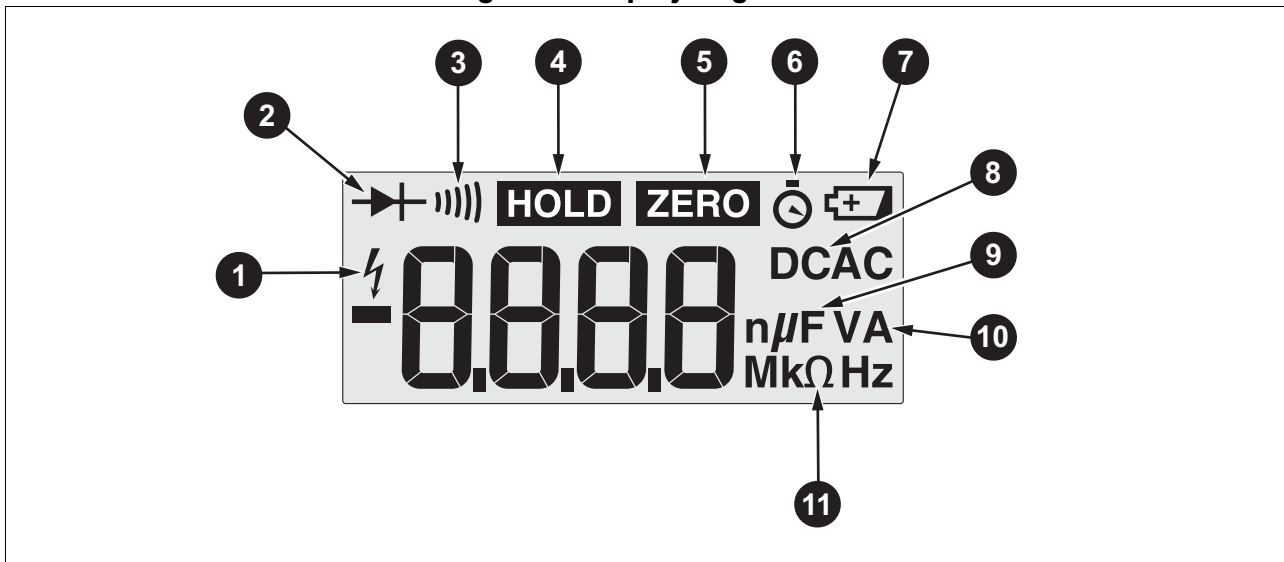
Display and Firmware Version

To verify that all segments of the display function:

1. With the Product off, push and hold .
2. Turn the Product on.
3. All display segments are shown. See [Figure 2](#).

If segments of the display are missing, repair is necessary. See [Contact Fluke](#).

Figure 2. Display Segments



When **HOLD** is released, the firmware current version shows, for example, **r013. F301** designates the model number.

Backlight

To verify that the backlight functions:

1. With the Product on, long push . The backlight comes on.
2. Long push again to turn off the backlight.
3. If the backlight does not function correctly, repair is necessary. See [Contact Fluke](#).

Button Test

To verify that the buttons function, turn on the Product and push each button separately. Each button push causes the Product to beep. When you push **HOLD**, **HOLD** shows on the display. If the buttons do nothing, repair is necessary. See [Contact Fluke](#).

Current

To do the A AC, A DC, and A ac Hz tests:

1. For test points <20, connect a single-wire short between the 20 A and AUX LO jacks on the Calibrator.
2. For test points >20 A, connect the Calibrator NORMAL HI and LO terminals to the INPUT HI and LO terminals of the 52120A and connect the COIL3KA to the 52120A HIGH CURRENT OUTPUT terminals.

To do the A dc tests:

1. Set the DUT to $\bar{\bar{A}}$.
2. Place the DUT on a flat surface away from any metal.

3. On the DUT, push to zero the dc current function.
4. Place the DUT around the wire used to create the short and keep the wire in the jaw center. Make sure the jaws are tightly closed.

Or,

1. Place the DUT around the center conductor of the coil. The small jaw size of the clamp meter ensures a tight fit around the coil.
2. Set the Calibrator to the necessary dc current output (single-wire) or to the necessary voltage output (52120A/COIL3KA).
3. Push **OPERATE** on the Calibrator and on the 52120A (if in use) and verify the measurement on the display of the DUT is within the readout limits for the test.

To do the A ac or A ac Hz tests:

1. Set the DUT to $\tilde{A}$ and push  to change the function to Hz.
2. On the 52120A, set LCOMP to ON.
3. Place the DUT around the wire used to create the short and keep the wire in the jaw center. Make sure the jaws are tightly closed.

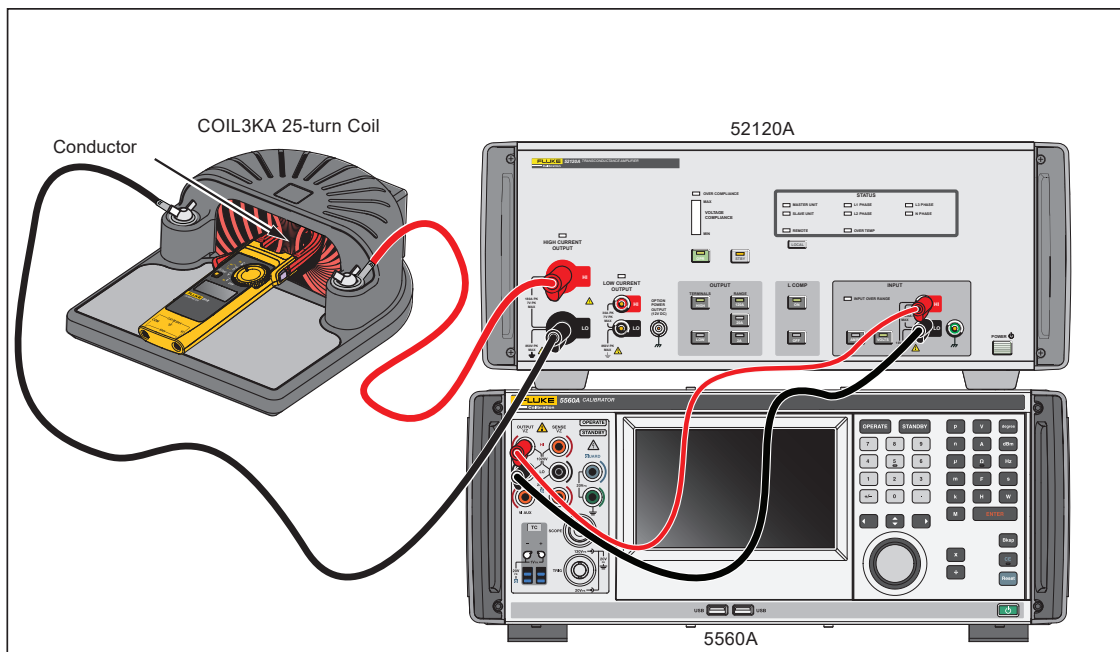
Or,

1. Place the DUT around the center conductor of the coil. The small jaw size of the clamp meter ensures a tight fit around the coil.
2. Set the Calibrator to the necessary ac current output (single-wire) or to the necessary voltage and frequency output (52120A/COIL3KA).
3. Push **OPERATE** on the Calibrator and on the 52120A (if in use) and verify the measurement on the display of the DUT is within the readout limits for the test.

Table 3. Current Performance Tests

Calibrator Output	52120A Range	Res.	Spec.	Counts	301 Model					Lower Limit	Upper Limit
					A	B	C	D	E		
A ac											
10 A @ 50 Hz	NA	0.01	2.00 %	10	●	●	●	●	●	9.7	10.3
A ac (w/COIL3KA)											
40 A @ 50 Hz (1.6 V @ 50 Hz)	2	0.01	2.00 %	10	●	●	●	●	●	39.1	40.9
100 A @ 50 Hz (0.4 V @ 50 Hz)	20	0.1	2.00 %	5	●	●	●	●	●	97.5	102.5
400 A @ 50 Hz (1.6 V @ 50 Hz)	20	0.1	2.00 %	5	●					391.5	408.5
600 A @ 50 Hz (0.24 V @ 50 Hz)	120	0.1	2.00 %	5		●	●	●	●	587.5	612.5
700 A @ 50 Hz (0.28 V @ 50 Hz)	120	1	2.00 %	5			●		●	681	719
975 A @ 50 Hz (0.39 V @ 50 Hz)	120	1	2.00 %	5			●		●	951	1000
A ac, Hz (No Coil)											
45 Hz @ 10 A	NA	0.1	0.10 %	3	●	●	●	●	●	44.7	45.3
400 Hz @ 10 A	NA	0.1	0.10 %	3	●	●	●	●	●	399.3	400.7
A ac, Hz (w/COIL3KA)											
45 Hz @ 400 A (1.6 V @ 45 Hz)	20	0.1	0.10 %	3	●	●	●	●	●	44.7	45.3
400 Hz @ 400 A (1.6 V @ 45 Hz)	20	0.1	0.10 %	3	●	●	●	●	●	399.3	400.7
A Dc (No Coi)											
10 A	NA	0.01	2.00 %	10				●	●	9.7	10.3
A dc (w/COIL3KA)											
-800 A (-0.32 V)	120	1	2.00 %	5					●	-821	-779
-300 A (-1.2 V)	20	0.1	2.00 %	5				●	●	-306.5	-293.5
-30 A (-1.2 V)	2	0.01	2.00 %	10				●	●	-30.7	-29.3
60 A (0.24 V)	20	0.01	2.00 %	10				●	●	58.7	61.3
100 A (0.4 V)	20	0.1	2.00 %	5				●	●	97.5	102.5
600 A (0.24 V)	120	0.1	2.00 %	5				●	●	587.5	612.5
700 V (0.28 V)	120	1	2.00 %	5					●	681	719
975 V (0.39 V)	120	1	2.00 %	5					●	951	1000

Figure 3. AC Current Test Connections



AC Volts

To verify ac voltage:

1. Connect the test leads to the **VΩ** 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 $\tilde{V}$.
4. On the Calibrator:
 - a. Set the necessary voltage and frequency at the NORMAL output terminals.
 - b. Push **OPERATE** to activate the Calibrator output and apply the voltage to the DUT.
5. On the DUT, make sure the measurement on the display is within the readout limits for the test.

DC Volts

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 $\overline{\overline{V}}$.
4. On the Calibrator:
 - a. Set the desired voltage at the NORMAL output terminals.
 - b. Push **OPERATE** to activate the Calibrator output and apply the voltage to the DUT.
5. On the DUT, make sure the measurement on the display is within the readout limits for the test.

Resistance/Capacitance/Diode

To verify resistance, capacitance, and diode:

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 $\overline{\overline{\Omega}}$.
4. Set the Calibrator to the necessary resistance output.
5. On the DUT, make sure 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.
9. To verify the diode, push  on the DUT to go to diode mode.
10. Set the Calibrator to the desired voltage output.
11. On the DUT, verify the measurement on the display is within the readout limits for this test.

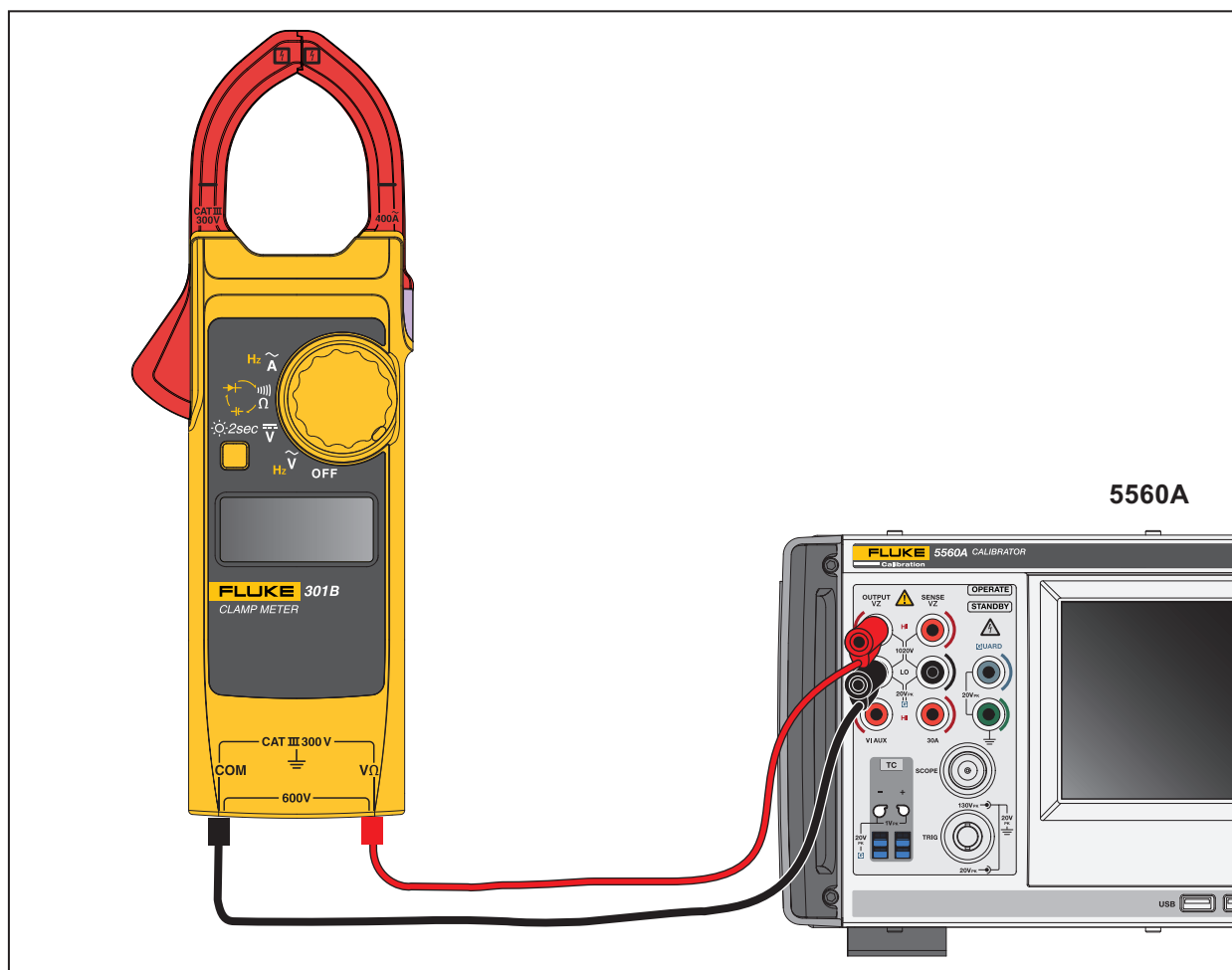
Table 4. Volts and Ohms Performance Tests

Calibrator Output	52120A Range	Res.	Spec.	Counts	301 Model					Lower Limit	Upper Limit
					A	B	C	D	E		
V ac											
10 V @ 45 Hz	NA	0.1	1.50 %	5	•	•	•	•	•	9.4	10.7
10 V @ 50 Hz		0.1	1.50 %	5	•	•	•	•	•	9.4	10.7
10 V @ 400 Hz		0.1	1.50 %	5	•	•	•	•	•	9.4	10.7
20 V @ 45 Hz		0.1	1.50 %	5	•	•	•	•	•	19.2	20.8
500 V @ 50 Hz		0.1	1.50 %	5	•	•	•	•	•	492.0	508.0
500 V @ 400 Hz		0.1	1.50 %	5	•	•	•	•	•	492.0	508.0
594 V @ 400 Hz		0.1	1.50 %	5	•	•	•	•	•	584.6	603.4
Hz (V ac)											
1 Hz @ 10 V	NA	0.001	0.10 %	3	•	•	•	•	•	0.996	1.004
9 Hz @ 10 V		0.001	0.10 %	3	•	•	•	•	•	8.988	9.012
15 Hz @ 10 V		0.01	0.10 %	3	•	•	•	•	•	14.96	15.05
900 Hz @ 10 V		0.1	0.10 %	3	•	•	•	•	•	898.8	901.2
1.5 kHz @ 10 V		0.001	0.10 %	3	•	•	•	•	•	1.496	1.505
90 kHz @ 10 V		0.01	0.10 %	3	•	•	•	•	•	89.88	90.12
V dc											
-500 V	NA	0.1	1.00 %	5	•	•	•	•	•	-505.5	-494.5
-10 V		0.1	1.00 %	5	•	•	•	•	•	-10.6	-9.4
-6 V		0.1	1.00 %	5	•	•	•	•	•	-6.56	-5.44
6 V		0.1	1.00 %	5	•	•	•	•	•	5.44	6.56
10 V		0.1	1.00 %	5	•	•	•	•	•	9.4	10.6
500 V		0.1	1.00 %	5	•	•	•	•	•	494.5	505.5
594 V		0.1	1.00 %	5	•	•	•	•	•	587.56	600.44
Ohm											
0 Ω	NA	0.1	1.00 %	5	•	•	•	•	•	-0.5	0.5
10 Ω		0.1	1.00 %	5	•	•	•	•	•	9.4	10.6
300 Ω		0.1	1.00 %	5	•	•	•	•	•	296.5	303.5
3 kΩ		0.001	1.00 %	5	•	•	•	•	•	2.965	3.035
30 kΩ		0.01	1.00 %	5	•	•	•	•	•	29.65	30.35

Table 4. Volts and Ohms Performance Tests (cont.)

Calibrator Output	52120A Range	Res.	Spec.	Counts	301 Model					Lower Limit	Upper Limit
					A	B	C	D	E		
Capacitance											
0.050 μF	NA	0.001	2.00 %	5	•	•	•	•	•	0.044	0.056
0.500 μF		0.001	2.00 %	5	•	•	•	•	•	0.485	0.515
5.000 μF		0.001	2.00 %	5	•	•	•	•	•	4.895	5.105
90.00 μF		0.01	2.00 %	5	•	•	•	•	•	85.45	94.55
500.00 μF		0.1	2.00 %	5	•	•	•	•	•	474.5	525.5
Diode											
0.7 V	NA	0.001	10.00 %	-	•	•	•	•	•	0.630	0.770

Figure 4. Volts and Ohms Performance Test Connections



Calibration Adjustment

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

Should the Product fail any of the performance tests, do the calibration adjustment procedure.

For information about damage by electrostatic discharge, see [Static Awareness](#).

To do the calibration adjustment:

1. Remove the Product battery door. See [Battery Replacement](#).
2. Apply 3.0 V across the battery contacts on the PCA. Note the polarity in [Figure 5](#).
3. Turn the rotary switch to the function to **OFF**.
4. Remove the calibration seal.
5. While shorting across the CAL keypad on the PCA, turn the rotary switch to the function to adjust. See [Figure 5](#).
6. When CAL shows on the display, remove the short.

This puts the Product into calibration mode.

7. When the real value shows on the display, apply the correct input signals from [Table 5](#) to the Product. For each function, the calibration step shown on the display will advance.
8. After each step, push  on the front to confirm the calibration step, store the value, and go to the next step.
9. Set the Calibrator to Standby after you complete adjustment of each function.

Note

*If any calibration point is missing, **Err** is shown on the display.*

After you push , wait until the calibration step number advances before you change the Calibrator source. Some adjustment steps can take several seconds to execute before the Product goes to the next step.

10. When calibration adjustment is complete, remove the 3.0 V supply.

The Product exits the calibration mode automatically.

11. Replace the batteries and battery door.

Figure 5. CAL Keyboard

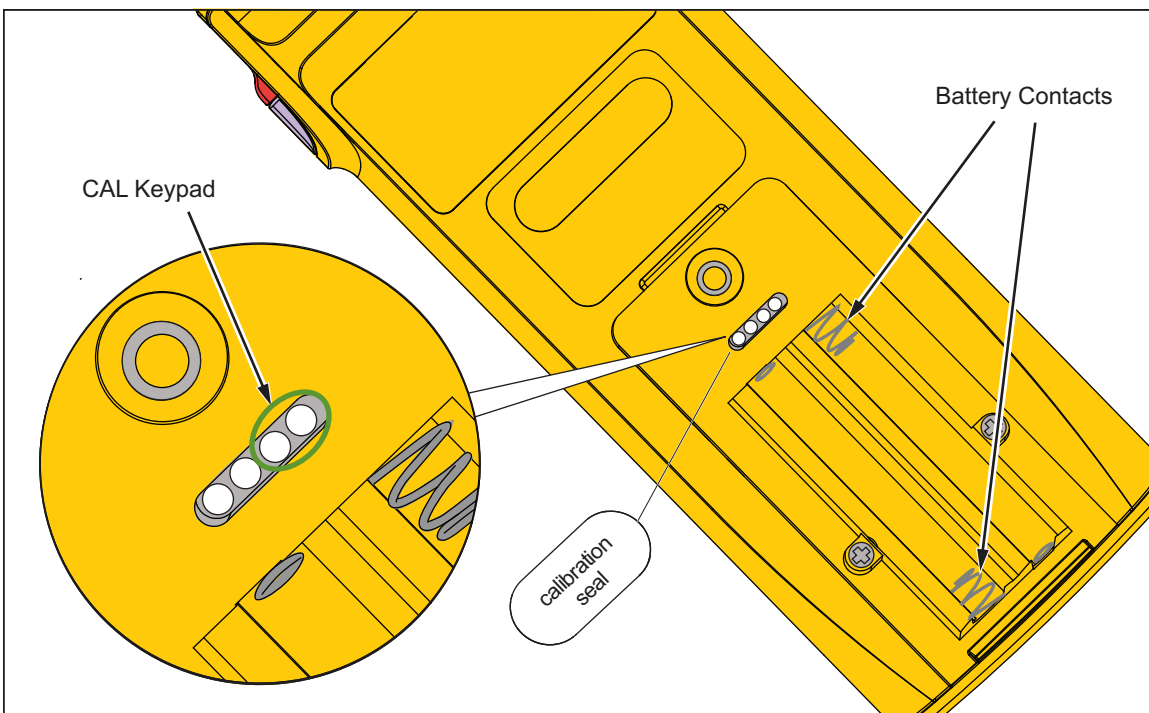


Table 5. Calibration Adjustment

RSOB Position	Value	Unit	Frequency or Amplitude	Calibration Step	301 Model				
					A	B	C	D	E
Wait for Self-Calibration until display shows MV									
	500.0	mV	0 Hz	C-1.1	●	●	●	●	●
	300.0	Ω		C-2.1	●	●	●	●	●
	50.00	kΩ		C-2.2	●	●	●	●	●
	100	nF		C-3.1	●	●	●	●	●
	50.00	μF		C-3.2	●	●	●	●	●
	30.00	A	60 Hz	C-4.1	●	●	●	●	●
	300.0	A		C-4.2	●	●	●	●	●
	800	A		C-4.3			●		●
	0.00	A	0 Hz	C-5.1				●	●
	30.00	A		C-5.2				●	●
	0.0	A		C-5.3				●	●
	300.0	A		C-5.4				●	●
	0	A		C-5.5					●
	800	A		C-5.6					●
$\bar{V}$	300.0	V	0 Hz	C-7.1	●	●	●	●	●
$\tilde{V}$	300.0	V	60 Hz	C-7.2	●	●	●	●	●

