FLUKE®

707Ex

mA Calibrator

Calibration Information

⚠⚠ Warning

Read Safety Information before using the mA Calibrator.

Introduction

The *Calibration Information* for the 707Ex mA Calibrator (hereafter referred to as the mA Calibrator) provides the information necessary to verify the performance and adjust the calibration of the mA Calibrator.

This document includes the following:

- Contacting Fluke
- Specifications
- Safety Information
- Maintenance
- User-Replaceable Parts
- Recommended Test Equipment
- Performance Verification
- Calibration Adjustment

For complete operating instructions, refer to the *707Ex Users Manual* located on the CD that came with the mA Calibrator.

Warranty

This Fluke product comes with a 1-year warranty for material and workmanship. For warranty information, refer to the *707Ex Users Manual* that came with the mA Calibrator.

Contacting Fluke

To contact Fluke for product information, operating assistance, service, or to get the location of the nearest Fluke distributor or service center, call:

Address correspondence to:

Accuracy Specifications

Accuracy is specified for 1-year after calibration at operating temperatures of 18 °C to 28 °C and is given as:

± ([% of reading] + [counts])

MEASURE V dc:

Range: + 28 V max
Resolution: 1 mV
Input Impedance: 1 MΩ
Accuracy: ± (0.015 % of reading + 2 counts)

MEASURE mA dc:

Range: 20 mA (24 mA max)
Resolution: 1 µA
Accuracy: ± (0.015 % of reading + 2 counts)

SOURCE / SIMULATE mA dc:

Range: 0 mA to 20 mA (24 mA max)
Resolution: 1 µA
Accuracy: ± (0.015 % of reading + 2 counts)

Source Mode:

Compliance: To 700 Ω at 20 mA

Simulate Mode:

External loop voltage requirement: 24 V nominal, 28 V maximum, 12 V minimum

Loop Power:

Maximum Load: 700 Ω

Percent Display:

– 25 % to 125 % (4 to 20 mA mode)

Input/Output Protection:

Fused; not replaceable

General Specifications

Maximum voltage between any terminal and earth ground or between any two terminals:

28 V

Storage Temperature:

– 30 °C to 60 °C

Operating Temperature:

– 10 °C to 50 °C

Operating Altitude:

3000 meters maximum

Temperature Coefficient:

± 0.005 % of range per °C for temperatures of –10 °C to 18 °C and 28 °C to 50 °C

Relative Humidity:

95 % up to 30 °C
75 % up to 40 °C
45 % up to 50 °C

Vibration:

Random 2 g, 5 to 500 Hz

Shock:

1 meter drop test

Safety Compliance:

Complies with IEC 61010-1-95 CAT I, 28 V; CSA C22.2 No. 1010-92 NRTL; ANSI/ISA S82.02.01-1994; Ⓔx Directive 94/9/EG and FM APPROVED
NEC 500: Uo = 27.6 V, Io = 96.13 mA, Co = 76 nF, Lo = 2.5 mH, Ui = 30 V, Ii = 24 mA, Ci = 10 nF, Li = 0 mH

CE:

Complies with EN61010-1 and EN61326

Power Requirements:

Single 9 V battery
(See Table 2 in the User-Replaceable Parts section)

Battery Life (typical):

SOURCE mode: 18 hours; 12 mA into 500 Ω;
MEASURE / SIMULATE mode: 50 hours

Size:

69.85 mm (W) x 142.87 mm (L) x 50.80 mm (H)
[2.75 in (W) x 5.625 in (L) x 2.00 in (H)]

With red holster and Flex-Stand:
76.20 mm (W) x 158.75 mm (L) x 54.61mm (H)
[3.00 in (W) x 6.25 in (L) x 2.15 in (H)]

Weight:

0.28 kg (0.62 lb)

With red holster and Stand:

0.42 kg (0.93 lb)

Safety Information

In this manual a Warning identifies conditions and actions that pose hazards to the user. A Caution identifies conditions and actions that may damage the mA Calibrator or equipment under test. International symbols used in this manual are identified in the Symbols section.

Read the entire *707Ex Users Manual* and the *707Ex mA Calibrator CCD* (Concept Control Drawing) before using the mA Calibrator.

⚠⚠ Warnings and Cautions

To avoid electric shock, injury, or damage to the mA Calibrator:

- **Use the mA Calibrator only as described in this Calibration Information, the Users Manual, and the Fluke 707Ex mA Calibrator CCD (Concept Control Drawing) or the protection provided by the mA Calibrator may be impaired.**
- **Inspect the mA Calibrator before use. Do not use it if it appears damaged.**
- **Check the test leads for continuity, damaged insulation, or exposed metal. Replace damaged test leads.**
- **Never apply more than 28 V between the input terminals, or between any terminal and earth ground.**
- **Applying more than 28 V to the input terminals invalidates the mA Calibrator's Ex Approval and may result in permanent damage to the unit so it can no longer be used.**
- **Use the proper terminals, mode, and range for your measuring or sourcing application.**
- **To prevent damage to the unit under test, put the mA Calibrator in the correct mode before connecting the test leads.**
- **When making connections, connect the COM test probe before the live test probe. When disconnecting, disconnect the live probe before the COM probe.**
- **Never use the mA Calibrator with the red holster removed.**
- **Never use the mA Calibrator with the case open. Opening the case violates Ex Approval.**
- **Make sure the battery door is closed before using the mA Calibrator.**
- **Replace the battery as soon as the (low battery) symbol appears to avoid false readings that can lead to electric shock.**
- **Remove test leads from the mA Calibrator before opening the battery door.**
- **This equipment is specified for use in measurement category I (CAT I) pollution degree 2 environments and should not be used in CAT II, CAT III, or CAT IV environments. Voltage transients should not exceed 300 V for the CAT I applications where this product is used. Measurement transients are defined in IEC1010-1 as 2 µs rise time with a 50 µs duration at 50 % of the maximum amplitude height.**
- **Measurement Category I (CAT I) is defined for measurements performed on circuits not directly connected to the mains.**

Faults and Damage

⚠⚠ Warning

Applying a voltage greater than 28 V to the input of the mA Calibrator invalidates its Ex Approval and may impair its safe operation in an Ex-hazardous area.

If there is any reason to suspect that the safe operation of the mA Calibrator has been affected, it must be immediately withdrawn from use, and precautionary measures must be taken to prevent any further use of the mA Calibrator in an Ex-hazardous area.

The safety features and integrity of the unit may be compromised by any of the following:

- External damage to the housing
- Internal damage to the mA Calibrator
- Exposure to excessive loads
- Incorrect storage of the unit
- Damage sustained in transit
- Correct certification is illegible
- Using the product with the red holster removed
- Functioning errors occur
- Permitted limitations are exceeded
- Functioning errors or obvious measurement inaccuracies occur which prevent further measurement by the mA Calibrator

Safety Regulations

The use of this 707Ex mA Calibrator meets the requirements of the regulations providing that the user observes and applies the requirements as laid down in the regulations and that improper and incorrect use of the unit is avoided.

- Use must be restricted to the specified application parameters.
- Do not open the mA Calibrator.
- Do not remove or install the battery within the Ex-hazardous area.
- Do not carry additional batteries within the Ex-hazardous area.
- Use only type-tested batteries. The use of any other battery will invalidate the Ex-certification and present a safety risk. Refer to Table 2.

- Do not use the mA Calibrator in an Ex-hazardous area unless it is completely and securely fitted in its accompanying red holster.
- After using the mA Calibrator in a non-intrinsically safe protected circuit, a rest time of 3 minutes minimum duration must occur before the mA Calibrator is taken into and/or used in an Ex-hazardous area.

Ex-Certification Data

- ATEX Certificate of Conformity: ZELM 02 ATEX 0120 X
- Certification: Ⓔx II 2 G EEx ia IIC T4
- Permitted for: Zone1, Equipment Group II, gas group C hazardous gases, vapor or mist, Temperature class T4.
- Factory Mutual, N.I. Class 1 Div. 2 Groups A-D
- Permitted for: Division 2 hazardous gases, vapor or mist, Gas Groups A-D

Symbols

International symbols used on the mA Calibrator and in this manual are explained below.

Symbol	Meaning
⏻	ON / OFF button.
⏚	Earth ground
⚠	Caution: Important information. Refer to instruction sheet
Ⓔx	Conforms to ATEX requirements
FM APPROVED	Conforms to Factory Mutual requirements
⧈	Double insulated
▬	Battery
C SP US	Conforms to relevant Canadian Standards Association directives. Certification # LR110460-2.
CE	Conforms to European Union requirements
⎓	Direct current

Maintenance

⚠⚠ Warning

To avoid electric shock, personal injury, or damage to the mA Calibrator:

- **Do not service this product. To maintain the integrity of the mA Calibrator in explosive atmospheres, return the mA Calibrator to Fluke for all repairs.**
- **Remove any input signals from the test probes prior to removing test leads from the mA Calibrator.**
- **When servicing the mA Calibrator, use only specified replacement parts described in Table 1.**
- **Use only the battery specified in Table 2.**
- **Do not allow water inside the case.**

Contact a Fluke Service Center before performing any maintenance procedure not described in the *707Ex Users Manual*. Refer to the Contacting Fluke section.

Cleaning

⚠⚠ Warning

To avoid electrical shock, remove test leads and input signals before cleaning.

To clean the case, wipe it with a cloth lightly dampened with water and mild detergent.

⚠Caution

Do not use abrasives, solvents, or alcohol. These materials will damage the case.

Replacing the Battery

⚠⚠ Warning

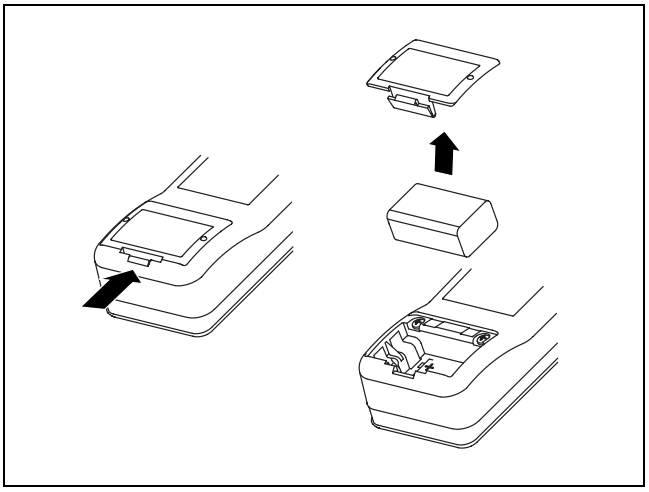
To avoid false readings, which could lead to electric shock or injury, replace the battery as soon as ▬ (low battery indicator) appears on the display.

Do not remove or install the battery within the Ex-hazardous area.

Use only a single 9 V alkaline battery, properly installed, to power the mA Calibrator. See Table 2.

To replace the battery (refer to Figure 1 and Table 2):

1. Remove the test probes from the input signal.
2. Press ⏻ to turn the mA Calibrator OFF.
3. Remove the test leads from the input terminals.
4. Remove the red holster.
5. Lift off the battery door on the back of the mA Calibrator as shown.
6. Remove the battery.
7. Insert the replacement battery and re-install the battery door. Make sure it is securely in place.
8. Return the mA Calibrator to its red holster.

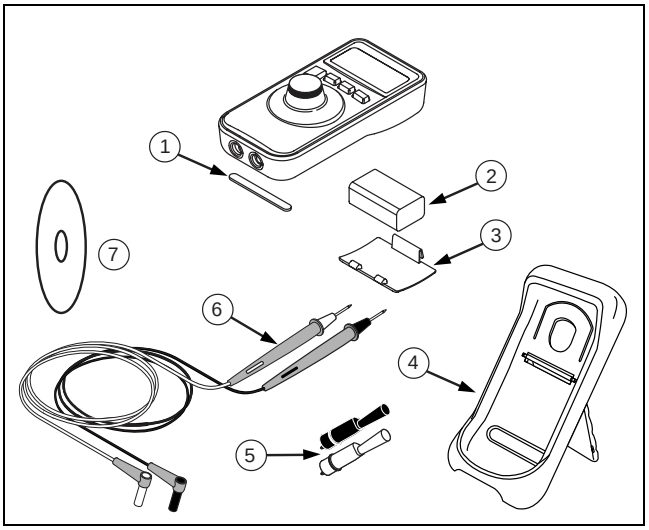


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Figure 1. Replacing the Battery

User-Replaceable Parts

User-replaceable parts and accessories are shown in Figure 2 and Table 1.



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Figure 2. User-Replaceable Parts

Table 1. User-Replaceable Parts

Item	Part Description	Fluke Part No.	Qty.
①	Non-skid foot	885884	1
②	Battery, 9 volt, Alkaline	822270 or see Table 2	1
③	Battery door	665106	1
④	Red holster, with bail	2040228	1
⑤	Alligator clips	AC72	1
⑥	Test lead set	TL75	1
⑦	Users Manual on CD	2053979	1

Table 2. Approved Batteries

Battery Description	Manufacturer	Type
Alkaline, 9 volt	Duracell	6LR61
Alkaline Ultra, 9 volt	Duracell	6LR61
Professional Alkaline Battery Procell, 9 volt	Duracell	6LR61
Alkaline Energizer, 9 volt	Eveready	6LR61
Alkaline Power Line Industrial Battery, 9 volt	Panasonic	6LR61
Alkaline, 9 volt	Daimon	6LR61

Recommended Test Equipment

A list of recommended equipment for the performance verification tests and calibration adjustment procedure is shown in Table 3.

Performance Verification

⚠⚠ Warning

To avoid electric shock, do not perform the verification tests unless the mA Calibrator is fully assembled.

Perform the following tests to check the accuracy of each of the mA Calibrator's functions against its specifications.

If the mA Calibrator fails any of these tests, calibration adjustment or repair is required.

Performance Verification Procedures

DC Current Source Mode

Test 1:

1. Turn the mA Calibrator on.
2. After the P.S. power timeout displays, the mA Calibrator should display 4.000 mA. If it is displaying 0.000 mA, turn the mA Calibrator off. Hold down MODE while turning the mA Calibrator on. Continue to hold MODE for 2 seconds. When the timeout display ends, the mA Calibrator should display 4.000 mA.
3. Connect the mA Calibrator's + terminal to the HP 3458A **I** input, and the **COM** terminal to the HP 3458A **LO** input.
4. Verify that the mA Calibrator's display shows **SOURCE** in the upper-left corner.
5. Set the HP 3458A to measure DC Amps (DCI).
6. Refer to Table 4 to verify the readings on the HP 3458A for the following tests. (No adjustment is necessary for test 1.)

Test 2:

1. Press 25% twice to select 12.000 mA.
2. Verify the readings.

Test 3:

1. Press 25% twice to select 20.000 mA.
2. Press and rotate the knob until 24.000 mA is displayed.
3. Verify the readings.

DC Current Measurement Mode

Tests 4-6:

1. Press the MODE key twice to put the mA Calibrator into the mA measurement mode.
2. The mA Calibrator's display should show **MEASURE** in the top right corner.
3. Disconnect the HP 3458A from the mA Calibrator.
4. Connect the test leads from the **red AUX** terminal of the Fluke 5520A to the HP 3458A **I** input.
5. Connect a test lead from the **black AUX** terminal of the Fluke 5520A to the **COM** terminal on the mA Calibrator.
6. Connect a test lead from the HP 3458A **LO** input to the mA Calibrator's + terminal.
7. Adjust the Fluke 5520A to output the value of test 4 in Table 4 as measured by the HP 3458A.
8. Verify the display readings on the mA Calibrator.
9. Repeat adjustment and reading for steps 5 and 6.

Table 3. Recommended Equipment

Equipment	Minimum Specification	Recommended Model or Equivalent
DC Calibrator	DC Voltage: 0 to 30 V Accuracy: ± 0.004 % +0.5 mV DC Current: 0 to 24 mA Accuracy: ± 0.004% +0.5 µA	Fluke 5520A Multi-Product Calibrator
Digital Multimeter	DC Current: 0 to 26 mA Accuracy: ± 0.004% +0.5 µA	HP 3458A
Flexible Test Leads		Fluke TL24

Table 4. DC Current Source / Current Measure / Voltage Measure Mode Tests

Test No.	707Ex mA Calibrator Output	Mode	HP 3458A Minimum	HP 3458A Maximum
1	4.000 mA	mA Source	3.9974 mA	4.0026 mA
2	12.000 mA	mA Source	11.9962 mA	12.0038 mA
3	24.000 mA	mA Source	23.9944 mA	24.0056 mA
Test No.	**5520A Calibrator Output**	**Mode**	**Fluke 707Ex Minimum**	**Fluke 707Ex Maximum**
4	4.000 mA	mA Measure	3.997 mA	4.003 mA
5	12.000 mA	mA Measure	11.996 mA	12.004 mA
6	24.000 mA	mA Measure	23.994 mA	24.006 mA
Test No.	**5520A Calibrator Output**	**Mode**	**Fluke 707Ex Minimum**	**Fluke 707Ex Maximum**
7	0.000 V	Volt Measure	-0.002 V	0.002 V
8	14.000 V	Volt Measure	13.995 V	14.005 V
9	28.000 V	Volt Measure	27.993 V	28.007 V

DC Voltage Measurement Mode

Tests 7-9:

1. Press MODE twice to get the mA Calibrator to **V MEASURE**. The mA Calibrator's display should read "**V**".
2. Connect the test leads from the **NORMAL** output terminals of the Fluke 5520A to the input terminals on the mA Calibrator (black to **COM** and red to **+**).
3. Set the Fluke 5520A to test 7 in Table 4 and verify the display reading on the mA Calibrator.
4. Repeat for tests 8 and 9.
5. The reading on the display should be within the minimum and maximum values shown in Table 4.
6. Set the 5520A output to 0 V (zero), and set output to **STANDBY**.
7. Turn the mA Calibrator **OFF** and disconnect the mA Calibrator from the 5520A.
8. The performance verification tests are now complete.
9. If the mA Calibrator failed any of these tests, calibration adjustment or repair is required.

Calibration Adjustment

Perform the following calibration adjustment procedure if the mA Calibrator fails the performance verification test.

Calibration Adjustment Counter

The mA Calibrator contains a calibration adjustment counter. The value in the calibration adjustment counter can be recorded and used to show that no adjustments have been made during a calibration cycle. When Fluke performs the calibration, the value of the calibration adjustment counter will be recorded on the calibration label.

To find the value in the calibration adjustment counter, hold down 25% while turning the unit on. The software revision will display for 2 seconds followed by the calibration counter for another 2 seconds.

Note

Make sure that the mA Calibrator has a new battery before starting the calibration procedure. Calibration will not function properly if the low battery indicator (+) is on.

Because the mA Calibrator incorporates several key hold start up features, entering the Adjust mode through the keypad requires an exact key hold sequence:

1. With the mA Calibrator off, hold down 25% and 0-100% and turn the mA Calibrator on.

   "**CAL**" appears on the main display and the calibration adjustment counter is displayed on the

secondary display. If the knob is not turned within 2 seconds, the unit returns to the normal operation mode.

2. The mA Calibrator adjustment procedure is password protected. At this point, a password is needed to go forward. "**PAS**" is displayed on the main display and "**000**" on the secondary display.

   Enter the password "**297**" as follows:

   1. Rotate the knob to add a 2 in the LCD of the secondary display push and release the knob.
   2. Rotate the knob to get 9 into the LCD, push and release.
   3. Rotate the knob to get a 7, push and release.

   If the password is correct, you'll be led through all the adjust modes (source, mA read, V read), otherwise the unit returns to normal operation. In the adjust mode, the main display will show "**1.000 mA**".

3. Connect the mA Calibrator **+** terminal to the HP 3458A **I** input, and the **COM** terminal to the HP 3458A LO input. The mA Calibrator will be in mA source cal and "**1.000 mA**" is displayed. On the secondary LCD, the last 3 digits from the knob value are shown. Adjust the mA output by tuning the knob until "**1.000 mA**" shows on the HP 3458A.
4. Press [0-100%], "**22.000 mA**" is displayed. Adjust the mA output by turning the knob until "**22.000 mA**" is shown on the HP 3458A.
5. Press [MODE] to go to mA measure adjust.
6. Disconnect the HP 3458A from the mA Calibrator.
7. Connect the test leads from the **AUX** terminals of the Fluke 5520A to the terminals on the mA Calibrator (black to **COM** and red to **+**).
8. The mA Calibrator will display "**MEASURE**" and 0.000 mA is displayed. On the secondary display, the last 3 digits of the A/D reading are shown. Set the 5520A to output 0.000 mA into the mA Calibrator. Press [0-100%].
9. After a moment, the mA Calibrator will display 24.000 mA. Set the 5520A to output 24.000 mA into the mA Calibrator.
10. Press [MODE] to go to V measure adjust.
11. Connect the test leads from the output **NORMAL** terminals of the Fluke 5520A to the input terminals on the mA Calibrator.
12. The mA Calibrator will display "**MEASURE**" and 0.000 V. The Secondary display will show the last 3 digits of the A/D reading. Set the 5520A to output 0.000 V into the mA Calibrator.
13. Press [0-100%]. After a moment, 25.000 V will display on the mA Calibrator. Set the 5520A to output 25.000 V into the mA Calibrator.
14. Press [MODE] to complete the adjustment. The calibration counter is incremented and the calibration data is stored. The calibration count will be on the main display and "**CAL**" on the secondary display for 2 seconds.

The calibration adjustment procedure is complete.

To see the value of the calibration counter without calibrating the unit, hold down [25%] at power up. The software revision number is displayed for 2 seconds followed by the calibration counter for 2 seconds.