

Agilent U2741A USB Modular 5.5 Digits Digital Multimeter

Service Guide



Agilent Technologies

Notices

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Safety Notices

CAUTION

















A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

Safety Symbols

The following symbols on the instrument and in the documentation indicate precautions which must be taken to maintain safe operation of the instrument.

	Direct current (DC)		Off (supply)
	Alternating current (AC)		On (supply)
	Both direct and alternating current		Caution, risk of electric shock
	Three-phase alternating current		Caution, risk of danger (refer to this manual for specific Warning or Caution information)
	Earth (ground) terminal		Caution, hot surface
	Protective conductor terminal		Out position of a bi-stable push control
	Frame or chassis terminal		In position of a bi-stable push control
	Equipotentiality	CAT II 300 V	Category II 300 V overvoltage protection
	Equipment protected throughout by double insulation or reinforced insulation		

General Safety Information

WARNING

- **Do not use the device if it is damaged. Before you use the device, inspect the casing. Look for cracks or missing plastic. Do not operate the device around explosive gas, vapor, or dust.**
 - **Always use the device with the cables provided.**
 - **Observe all markings on the device before establishing any connection.**
 - **Turn off the device and application system power before connecting to the I/O terminals.**
 - **When servicing the device, use only the specified replacement parts.**
 - **Do not operate the device with the cover removed or loosened.**
 - **Use only the power adapter provided by the manufacturer to avoid any unexpected hazards.**
-

CAUTION

- If the device is used in a manner not specified by the manufacturer, the device protection may be impaired.
 - Always use dry cloth to clean the device. Do not use ethyl alcohol or any other volatile liquid to clean the device.
 - Do not permit any blockage of the ventilation holes of the device.
-

Environmental Conditions

This instrument is designed for indoor use and in an area with low condensation. The table below shows the general environmental requirements for this instrument.





Environmental conditions	Requirements
Operating temperature	0 °C to 50 °C
Operating humidity	20% to 85% RH non-condensing
Storage temperature	–20 °C to 70 °C
Storage humidity	5% to 90% RH non-condensing

CAUTION

The U2741A USB modular digital multimeter complies with the following safety and EMC requirements.

- IEC 61010-1:2001/EN61010-1:2001 (2nd Edition)
- Canada: CAN/CSA-C22.2 No. 61010-1-04
- USA: ANSI/UL 61010-1:2004
- IEC 61326-2002/EN 61326:1997+A1:1998+A2:2001+A3:2003
- Canada: ICES-001:2004
- Australia/New Zealand: AS/NZS CISPR11:2004

Regulatory Markings

	<p>The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.</p>		<p>The C-tick mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.</p>
<p>ICES/NMB-001</p>	<p>ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.</p>		<p>This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.</p>
	<p>The CSA mark is a registered trademark of the Canadian Standards Association.</p>		

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a "Monitoring and Control Instrument" product.

The affixed product label is as shown below.



Do not dispose in domestic household waste

To return this unwanted instrument, contact your nearest Agilent Technologies, or visit:

www.agilent.com/environment/product

for more information.

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Contents



1 Specifications

Product Specifications 2

Product Specifications

DC specifications ^[1]

Table 1-1 DC accuracy \pm

Function	Range	Input impedance	Test current /Burden voltage, shunt resistance	Accuracy (% of reading + % of range)	Temperature coefficient 0 °C to 18 °C 28 °C to 55 °C
Voltage ^[2]	100.000 mV	10 M Ω	–	0.015 + 0.008	0.002 + 0.0008
	1.00000 V	10 M Ω	–	0.015 + 0.005	0.001 + 0.0005
	10.0000 V	10 M Ω	–	0.018 + 0.005	0.002 + 0.0005
	100.000 V	10 M Ω	–	0.018 + 0.005	0.002 + 0.0005
	300.000 V	10 M Ω	–	0.018 + 0.005	0.0015 + 0.0005
Current ^[3]	10.0000 mA	–	<0.2 V, 10 Ω	0.06 + 0.015	0.005 + 0.0025
	100.000 mA	–	<0.2 V, 1 Ω	0.06 + 0.005	0.008 + 0.002
	1.00000 A	–	<0.3 V, 0.1 Ω	0.15 + 0.007	0.005 + 0.002
	2.00000 A	–	<0.8 V, 0.1 Ω	0.15 + 0.007	0.005 + 0.002
Resistance ^[4]	100.000 Ω	–	1.0 mA	0.03 + 0.008	0.006 + 0.0008
	1.00000 k Ω	–	1.0 mA	0.03 + 0.005	0.006 + 0.0005
	10.0000 k Ω	–	100 μ A	0.03 + 0.005	0.006 + 0.0005
	100.000 k Ω	–	10.0 μ A	0.03 + 0.005	0.006 + 0.0005
	1.00000 M Ω	–	1 μ A	0.06 + 0.005	0.01 + 0.0005
	10.0000 M Ω	–	225 nA	0.25 + 0.005	0.025 + 0.0005
	100.000 M Ω	–	225 nA	2.0 + 0.005	0.3 + 0.0005
Diode test ^[5]	1.0000 V	–	1.00 mA	0.015 + 0.03	0.005 + 0.0005
Continuity Test ^[6]	1.0000 k Ω	–	1.00 mA	0.05 + 0.03	0.005 + 0.0005

- [1] Specifications are based on 30 minutes warm-up time, NPLC 20 digit resolution, and calibration temperature 18 °C to 28 °C. For NPLC 0 and 0.025, add 0.01% of range.
- [2] 20% over range on all ranges except 300 VDC. Input protection up to 300 VDC.
- [3] Input protected with externally accessible 2 A, 250 V fast blown fuse.
- [4] Specifications are for 4-wire ohm or 2-wire ohms using null function in AMM software. If without null function in AMM software, add 0.2 Ω additional error. Input protection up to 300 VDC. Specifications apply for NPLC ≥ 1 .
- [5] Specifications are for the voltage measured at the input terminals only.
- [6] Continuity threshold is fixed at less than 10 Ω .

DC current settling considerations

Switching current from >1 A to lower current measurement may cause an additional error of approximately 0.3% of reading due to self-heating, and will generally dissipate within a minute.

AC specifications ^[1]

Table 1-2 AC accuracy for voltage

Function	Range	Accuracy input (% of reading + % of range) Frequency (Hz)			
		20 ~ 45	45 ~ 10k	10k ~ 30k	30k ~ 100k ^[3]
Voltage ^[2]	100.000 mVrms	1 + 0.1	0.2 + 0.1	1.5 + 0.3	5.0 + 0.3
	1.00000 V	1 + 0.1	0.2 + 0.1	1.0 + 0.1	3.0 + 0.2
	10.0000 V	1 + 0.1	0.3 + 0.1	1.0 + 0.1	3.0 + 0.2
	100.000 V	1 + 0.1	0.3 + 0.1	1.0 + 0.1	3.0 + 0.2
	250.000 V ^[4]	1 + 0.1	0.3 + 0.1	1.0 + 0.1	3.0 + 0.2

- [1] Specifications are based on 30 minutes warm-up time and calibration temperature 18 °C to 28 °C. In manual range, the settling time is 2.6 seconds while in autorange, the first measurement accuracy is <1%.
- [2] Specifications are for sinewave inputs more than 5% of range. 20% over range on all ranges except 250 VAC. Maximum crest factor of 5 at full scale. Input impedance is 1 M Ω in parallel with capacitance less than 120 pF, AC couple with up to 300 VDC.

1 Specifications

^[3] Additional error to be added as frequency more than 30 kHz and signal input less than 10% of range. 30 kHz to 100 kHz: 0.003% of full scale per kHz.

^[4] Input signal has to be more than 50 Vrms.

Table 1-3 Temperature coefficient for voltage

	Range	Frequency (Hz)			
		20 ~ 45	45 ~ 10k	10k ~ 30k	30k ~ 100k
Temperature coefficient	100.000 mVrms, 1.00000 V, 10.0000 V, 100.000 V, 250.000 V	0.02 + 0.02	0.02 + 0.02	0.05 + 0.02	0.1 + 0.02

Table 1-4 AC accuracy for current ^[1]

Function	Range	Burden voltage/ Current shunt	Accuracy input (% of reading + % of range) Frequency (Hz)		
			20 ~ 45	45 ~ 1k	1k ~ 10k
Current ^[2]	10.0000 mA	<0.2 V, 10 Ω	1.5 + 0.1	0.5 + 0.1	2 + 0.2
	100.000 mA	<0.2 V, 1 Ω	1.5 + 0.1	0.5 + 0.1	2 + 0.2
	1.00000 A	<0.3 V, 0.1 Ω	1.5 + 0.1	0.5 + 0.1	2 + 0.2
	2.00000 A	<0.8 V, 0.1 Ω	1.5 + 0.1	0.5 + 0.1	2 + 0.2

^[1] In manual range, the settling time is 2.6 seconds while in autorange, the first measurement accuracy is <1%

^[2] Input protected with externally accessible 2 A, 250 V fast blown fuse.

Frequency specifications ^[1]

Table 1-5 Temperature coefficient for current

	Range	Frequency (Hz)		
		20 ~ 45	45 ~ 10k	10k ~ 30k
Temperature coefficient	10.0000 mA, 100.000 mA, 1.00000 A, 2.0000 A	0.02 + 0.02	0.02 + 0.02	0.02 + 0.02

Table 1-6 Frequency accuracy

Functions	Range	Accuracy (% of reading + % of range)	Minimum input frequency	Temperature coefficient (%)
Frequency	20 to 300 kHz	0.0200 +0.003	1 Hz	0.005

Table 1-7 Frequency sensitivity for AC voltage

Functions	Input range	Minimum sensitivity (RMS sinewave) Frequency (Hz)	
		20 ~ 100k	100 ~ 300k
AC Voltage	100 mV ^[2]	20 mV	20 mV
	1 V	100 mV	120 mV
	10 V	1 V	1.2 V
	100 V	10 V	20 V
	250 V	100 V	120 V

^[1] Frequency measurement can only be done in autorange mode. Specifications are for 30 minutes warm-up, using 1 second aperture. Measuring method is using reciprocal counting technique with AC coupled input at AC voltage function. Gate time of 0.1 second or 1 second.

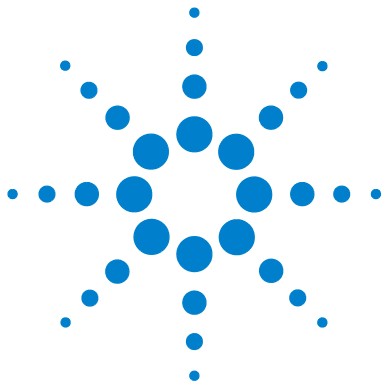
^[2] Only applicable for square wave measurement.

1 Specifications

Temperature specifications

Table 1-8 Temperature accuracy

Function	Thermistor type	Range	Accuracy	Temperature coefficient
Temperature	5 k Ω thermistor	-80.0 °C to 150.0 °C -112 °F to 302 °F	Probe accuracy + 0.2 °C	0.002 °C



2 Performance Test Calibration

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This chapter contains performance test and calibration procedures. The performance tests procedures allow you to verify that the multimeter is operating within its published specifications.



Calibration Overview

WARNING

SHOCK HAZARD. Only service trained personnels who are aware of the hazards involved should perform the procedure in this chapter. To avoid electrical shock and personal injury, make sure to read and follow all test equipments safety instructions.

NOTE

Make sure you have read “[Test Considerations](#)” on page 12 before calibrating the instrument.

Closed - case electronic calibration

The instrument features a closed-case electronic calibration. No internal mechanical adjustments are required. The instrument calculates the correction factors based upon the input reference value that you set. The new correction factors are stored in nonvolatile memory until the next calibration adjustment is performed. The nonvolatile EEPROM calibration memory does not change when power has been off or after a remote interface reset.

Agilent technologies calibration services

When your instrument is due for calibration, contact your local Agilent Service Center for a low-cost recalibration. The U2741A is supported on automated calibration systems, which allows Agilent to provide this service at competitive prices.

Calibration interval

A one year interval is adequate for most applications. Accuracy specifications are warranted only if adjustment is made at regular calibration intervals. Accuracy specifications are not warranted beyond the one year calibration interval. Agilent does not recommend extending calibration intervals beyond two years for any application.

Time required for calibration

The U2741A can be automatically calibrated under computer control. With computer control, you can perform the complete calibration procedure and performance verification tests in less than 30 minutes once the instrument is warmed-up (see “[Test Considerations](#)” on page 12). Refer to the *U2741A Programmer's Reference Guide* for more information.

Recommended Test Equipment

The test equipment recommended for the performance verification and adjustment procedures is listed below. If the exact instrument is not available, substitute with a calibration standards of an equivalent accuracy.

A suggested alternate method would be to use the Agilent 3458A 8½ -digits digital multimeter to measure less accurate yet stable sources. The output value measured from the source can be entered into the instrument as the target calibration value.

Table 2-1 Recommended test equipment

Application	Recommended equipment	Recommended accuracy requirements
Zero Calibration	Shorting Plug - Dual banana plug with copper wire short between the two terminals	
DC Voltage	Fluke 5520A	<1/5 instrument 1 year spec
DC Current	Fluke 5520A	<1/5 instrument 1 year spec
Resistance	Fluke 5520A	<1/5 instrument 1 year spec
AC Voltage	Fluke 5520A	<1/5 instrument 1 year spec
AC Current	Fluke 5520A	<1/5 instrument 1 year spec
Frequency	Fluke 5520A	<1/5 instrument 1 year spec

Self-Calibration

The self-calibration performs an internal self-alignment routine to optimize the signal path that affects measurement sensitivity, offset and trigger parameters. It is advisable for you to run self-calibration for the following situation:

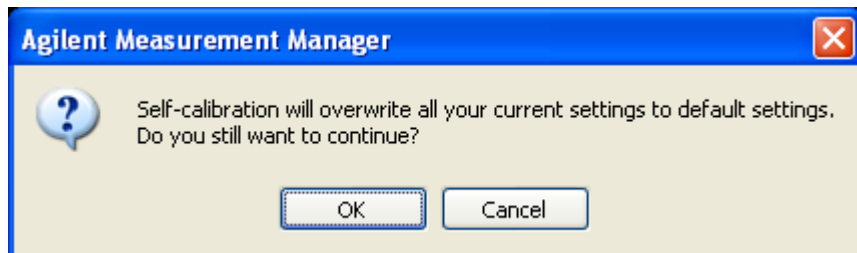
- Every 12 months or after 2000 hours of operation.
- If the ambient temperature is higher than 10 °C from the calibration temperature.
- To maximize the measurement accuracy.
- When you experience abnormal operation.
- To verify proper operation after repair.

NOTE

Disconnect all probe and meter connections to the input terminal of the instrument.

To start self-calibration, perform the following:

- 1 Click **Tools > Self-Calibration**.
- 2 Click **Ok** when the message is shown.



- 3 Wait for a few minutes for the self-calibration process to be completed.
- 4 Click **Close** when the self-calibration is completed.

Test Considerations

Errors may be induced by AC signals present on the input leads during the verification tests. Long test leads can also act as an antenna causing pick-up of AC signals.

For optimum performance, all procedures should comply with the following recommendations:

- Ensure that the calibration ambient temperature is stable and in between 18 °C and 28 °C. Ideally the calibration should be performed at 23 °C \pm 1 °C.
- Ensure that the ambient relative humidity is less than 80%.
- Allow a one hour warm-up period with a Shorting Plug connected to the HI and LO input terminals.
- Use shielded twisted pair Teflon-insulated cables to reduce settling and noise errors. Keep the input cables as short as possible.
- Connect the input cable shields to the ground. Except where noted in the procedures, connect the calibrator LO source to the ground at the calibrator. It is important that the LO to the ground connection be made at only one place in the circuit to avoid ground loops.

As the instrument is capable of making very accurate measurements, you must take special care to ensure that the calibration standards and test procedures used do not introduce additional errors. Ideally, the standards used to verify and adjust the instrument should be an order of magnitude more accurate than each instrument range full-scale error specification.

For the DC voltage, DC current and resistance gain verification measurements, you should ensure the calibrator's "0" output is correct. You will need to set the offset for each range of the measuring function being verified.

Input connections

Test connections to the instrument are best accomplished using the dual banana plug with a copper wire short between two terminals for low-thermal offset measurement. Shielded, twisted-pair, Teflon interconnect cables of a minimum length are recommended between the calibrator and the multimeter. Cable shields should be earth ground referenced. This configuration is recommended for optimal noises and settling time performance during calibration.

Performance Verification Tests Overview

Use the Performance Verification Tests to verify the measurement performance of the instrument. The performance verification tests use the instrument's specifications listed in [Chapter 1](#), "Specifications".

You can perform four different levels of performance verification tests:

Quick verification

A selected verification test.

Performance verification tests

An extensive set of tests that are recommended as an acceptance test when you first receive the instrument or after performing adjustments.

Optional verification tests

Tests that are not performed with every calibration. Perform these tests to verify additional specifications or functions of the instrument.

Quick performance check

The quick performance check is an abbreviated performance test (specified by the letter **Q** in the performance verification tests). This test provides a simple method to achieve high confidence in the instrument's ability to functionally operate and meet specifications. These tests represent the absolute minimum set of performance checks recommended following any service activity. Auditing the instrument's performance for the quick check points (designated by a **Q**) verifies performance for "normal" accuracy drift mechanisms. This test does not check for abnormal component failures.

To do a quick performance check, carry out only the performance verification tests indicated in the following tables with the letter **Q**.

If the instrument fails the quick performance check, adjustment or repair is required.

Adjustment is recommended at every calibration interval. If adjustment is not made, you must establish a 'guard band', using no more than 80% of the specifications, as the verification limits.

NOTE

Make sure you have read [“Test Considerations”](#) on page 12 before doing the performance verification tests.

Performance Verification Tests

Zero offset verification

This test is used to check the zero offset performance of the instrument. Verification checks are only performed for those functions and ranges with unique offset calibration constants. Measurements are checked for each function and range as described in the procedure on the next page.

Zero offset verification test

- 1 Connect the Shorting Plug to the voltage HI and LO input terminals. (see “[Input connections](#)” on page 13). Leave the current inputs open.
- 2 Select each function and range in the order shown in the table below. Make a measurement and observe the result. Compare the measurement results to the appropriate test limits shown in [Table 2-2](#).

NOTE

Note that resistance measurements use the Null math function (Null reading taken with test leads connected together) to eliminate test lead resistance.

Table 2-2 Zero offset verification test

Input	Function ^[1]	Range	Quick check	Error from nominal 1 year
Open	DC Current	10 mA	0	±1.5 µA
Open		100 mA		±5 µA
Open		1 A		±70 µA
Open		2 A		±140 µA

Table 2-2 Zero offset verification test

Input	Function ^[1]	Range	Quick check	Error from nominal 1 year
Short	DC Volts	100 mV		±8 µV
Short		1 V	Q	±50 µV
Short		10 V		±0.5 mV
Short		100 V		±5 mV
Short		300 V		±15 mV
Short	2-Wire Ohms and 4-Wire Ohms	100 Ω		±8 mΩ ^[2]
Short		1 kΩ		±50 mΩ ^[2]
Short		10 kΩ	Q	±500 mΩ ^[2]
Short		100 kΩ		±5 Ω
Short		1 MΩ		±50 Ω
Short		10 MΩ		±500 Ω
Short		100 MΩ		±5 kΩ

^[1] Select NPLC 20 digit resolution.

^[2] The specifications are for 2-wire or 4-wire ohms using the null function in AMM software. Add 0.2 Ω error if null function is not used in AMM software.

Q = Quick performance verification test points

Gain verification

This test checks the full-scale reading accuracy of the instrument. Verification checks are performed only for those functions and ranges with unique gain calibration constants.

DC voltage gain verification test

DC voltage configuration:

```
(CONFigure[:VOLTage][:DC] [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>])
```

- 1 Connect the calibrator to the front panel HI and LO input terminals.
- 2 Select each function and range based on the input voltage as shown in [Table 2-3](#).
- 3 Make a measurement and observe the result. Compare the measurement results with the appropriate test limits as shown in [Table 2-3](#). (Be certain to allow for appropriate source settling when using the Fluke 5520A.)

Table 2-3 DC voltage gain verification

Input	Function ^[1]	Range	Quick check	Error from nominal 1 year
100 mV	DC Voltage	100 mV		±23 µV
-100 mV		100 mV		±23 µV
1 V		1 V	Q	±0.2 mV
-1 V		1 V		±0.2 mV
10 V		10 V		±2.3 mV
100 V		100 V	Q	±23 mV
300 V		300 V		±69 mV

^[1] Select NPLC 20 digit resolution.

Q = Quick performance verification test points

CAUTION

Set the calibrator output to 0 V before disconnecting it from the multimeter input terminals

DC current gain verification test

DC current configuration:

```
(CONFigure:CURRENT[:DC] [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>])
```

- 1 Connect the calibrator to the front panel current HI and LO input connectors.
- 2 Select each function and range based on the input current in [Table 2-4](#).
- 3 Make a measurement and observe the result. Compare the measurement results with the appropriate test limits shown in [Table 2-4](#). (Be certain to allow for appropriate source settling time when using the Fluke 5520A.)

Table 2-4 DC current gain verification

Input	Function ^[1]	Range	Quick check	Error from nominal 1 year
10 mA	DC Current	10 mA	Q	± 7.5 µA
100 mA		100 mA		± 65 µA
1 A		1 A		±1.57 mA
2 A		2 A	Q	±3.14 mA

^[1] Select NPLC 20 digit resolution.

Q = Quick performance verification test points

Ohms gain verification test

2-wire ohms configuration:

```
(CONFigure:RESistance [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>])
```

4-wire ohms configuration:

```
(CONFigure:FRESistance [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>])
```

- 1 Select the **Ohms** function.
- 2 Select each range in the order based on the input resistance in [Table 2-5](#). Compare the measurement results with the appropriate test limits shown in the following table. (Be certain to allow for appropriate source settling.)

Table 2-5 Ohms gain verification test

Input	Function ^[1]	Range	Quick check	Error from nominal 1 year
100 Ω	2-Wire Ohms and 4-Wire Ohms	100 Ω		±38 mΩ ^[2]
1 kΩ		1 kΩ	Q	±350 mΩ ^[2]
10 kΩ		10 kΩ		±35 Ω ^[2]
100 kΩ		100 kΩ		±35 Ω
1 MΩ		1 MΩ		±650 Ω
10 MΩ		10 MΩ	Q	±25.5 kΩ
100 MΩ		100 MΩ		±2.005 mΩ

^[1] Select NPLC 20 digit resolution.

^[2] The specifications are for 2-wire or 4-wire ohms using the null function in AMM software. Add 0.2 Ω error if null function is not used in AMM software.

Q = Quick performance verification test points

Frequency gain verification test

Frequency configuration:

```
(CONFigure:FREQuency [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>])
```

- 1 Select the **Frequency** function.
- 2 Select each range in the order based on the input voltage and frequency indicated in [Table 2-6](#). Compare the measurement results with the appropriate test limits shown in the [Table 2-6](#). (Be certain to allow for appropriate source settling.)

Table 2-6 Frequency gain verification test

Voltage	Input frequency	Function ^[1]	Range	Quick check	Error from nominal 1 year
200 mVrms	1 kHz	Frequency	1 V	Q	±0.5 Hz
200 mVrms	10 kHz		1 V		±5.0 Hz

^[1] Select NPLC 20 digit resolution.

Q = Quick performance verification test points

AC voltage verification test

AC voltage configuration:

```
(CONFigure[:VOLtage]:AC [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>]])
```

1 Select the **AC Voltage** function.

Select each range in the order based on the indicated input voltage and frequency. Compare the measurement results with the appropriate test limits shown in [Table 2-7](#). (Be certain to allow for appropriate source settling.)

Table 2-7 AC volts verification test error

Voltage	Input frequency	Function ^[1]	Range	Quick check	Error from nominal 1 year
100 mV	45 Hz	AC Voltage	100 mV		±1.1 mV
100 mV	10 kHz		100 mV		±0.3 mV
100 mV	30 kHz		100 mV		±1.8 mV
100 mV	100 kHz		100 mV		±5.3 mV
1 V	45 Hz		1 V		±11 mV
1 V	1 kHz		1 V	Q	±3.0 mV
1 V	30 kHz		1 V		±11 mV
1 V	100 kHz		1 V		±32 mV
10 V	45 Hz		10 V		±110 mV
10 V	1 kHz		10 V	Q	±40 mV
10 V	30 kHz		10 V		±110 mV
10 V	100 kHz		10 V		±320 mV
100 V	45 Hz		100 V		±1.1 V
100 V	1 kHz		100 V	Q	±0.4 V
100 V	30 kHz		100 V		±1.1 V
100 V	100 kHz		100 V		±3.2 V
250 V	45 Hz		250 V		±2.75 V
250 V	1 kHz		250 V		±1 V
250 V	30 kHz		250 V		±2.75 V
250 V	100 kHz		250 V		±8 V

^[1] Select NPLC 20 digit resolution.

Q = Quick performance verification test points

CAUTION

Set the calibrator output to 0 V before disconnecting it from the multimeter input terminals.

AC current verification test

AC current configuration:

```
(CONFigure:CURRENT:AC [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF]])
```

- 1 Select the **AC Current** function.
- 2 Select each range in the order based on the input current and frequency. Compare the measurement results with the appropriate test limits shown in [Table 2-8](#). (Be certain to allow for appropriate source settling.)

Table 2-8 AC current verification test

Current	Input frequency	Function ^[1]	Range	Quick check	Error from nominal 1 year
10 mA	1 kHz	AC Current	10 mA		±60 µA
10 mA	10 kHz		10 mA		±220 µA
100 mA	1 kHz		100 mA	Q	±0.6 mA
100 mA	10 kHz		100 mA		±2.2 mA
1 A	1 kHz		1 A		±6 mA
1 A	10 kHz		1 A		±22 mA
2 A	1 kHz		2 A		±12 mA
2 A	10 kHz		2 A		±44 mA

^[1] Select NPLC 20 digit resolution.

Q = Quick performance verification test points

Optional AC voltage performance verification test

These tests are *not* intended to be performed with every calibration. They are provided as an aid for verifying additional instrument specifications.

AC voltage configuration:

```
(CONFigure[:VOLTage]:AC [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>])
```

- 1 Select the **AC Voltage** function.
- 2 Select each range in the order based on the input voltage and frequency. Compare the measurement results with the appropriate test limits shown in the [Table 2-9](#). (Be certain to allow for appropriate source settling.)

Table 2-9 Optional AC voltage performance verification test

Voltage	Input frequency	Function ^[1]	Range	Error from nominal 1 year
1 V	45 Hz	AC Voltage	1 V	±11mV
1 V	1 kHz		1 V	±3 mV
1 V	10 kHz		1 V	±3 mV
1 V	30 kHz		1 V	±11 mV
1 V	100 kHz		1 V	±32 mV
10 V	1 kHz		10 V	±40 mV
1 V	1 kHz		10 V	±13 mV

^[1] Select NPLC 20 digit resolution.

Q = Quick performance verification test points

Optional AC current performance verification test

These tests are *not* intended to be performed with every calibration. They are provided as an aid for verifying additional instrument specifications.

AC current configuration:

```
(CONFigure:CURRent:AC [<range|MIN|MAX|AUTO>
[,resolution|MIN|MAX|DEF>])
```

- 1 Select the **AC Current** function.
- 2 Select each range in the order based on the indicated input current and frequency. Compare the measurement results with the appropriate test limits shown in the [Table 2-10](#). (Be certain to allow for appropriate source settling.)

Table 2-10 Optional AC current performance verification test

Current	Input frequency	Function ^[1]	Range	Error from nominal 1 year
10 mA	20 Hz	AC Current	10 mA	±0.16 mA
10 mA	45 Hz		10 mA	±0.16 mA
10 mA	1 kHz		10 mA	±0.06 mA
10 mA	10 kHz		10 mA	±0.22 mA
1 A	1 kHz		1 A	±6 mA
100 mA	1 kHz		1 A	±1.5 mA

^[1] Select NPLC 20 digit resolution.

2 Performance Test Calibration



3 Service

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Types of Service Available

If your instrument fails during the warranty period, Agilent Technologies will repair or replace it under the terms of your warranty. After your warranty expires, Agilent offers repair services at competitive prices.

Extended service contracts

Many Agilent products are available with optional service contracts that extend the covered period after the standard warranty expires. If you have such a service contract and your instrument fails during the covered period, Agilent Technologies will repair or replace it in accordance with the contract.

Obtaining repair service (Worldwide)

To obtain service for your instrument (in-warranty, under service contract, or post-warranty), contact your nearest Agilent Technologies Service Center. They will arrange to have your unit repaired or replaced, and can provide warranty or repair-cost information where applicable.

To obtain warranty, service, or technical support information you can contact Agilent Technologies at one of the following telephone numbers:

United States: (800) 829-4444

Canada: (877) 894 4414

China: (800) 810 0189

Europe: 31 20 547 2111

Japan: (81) 426 56 7832

Korea: (080) 769 0800

Latin America: (305) 269 7500

Taiwan: 0800 047 866

Other Asia Pacific Countries: (65) 6375 8100

Or visit Agilent worldwide Web at:
www.agilent.com/find/assist

Or contact your Agilent Technologies Representative. Before shipping your instrument, ask the Agilent Technologies Service Center to provide shipping instructions, including what components to ship. Agilent recommends that you retain the original shipping carton for use in such shipments.

Repackaging for Shipment

If the unit is to be shipped to Agilent for service or repair, be sure to:

- Attach a tag to the unit identifying the owner and indicating the required service or repair. Include the model number and full serial number.
- Place the unit in its original container with appropriate packaging material for shipping.
- Secure the container with strong tape or metal bands.
- If the original shipping container is not available, place your unit in a container which will ensure at least 4 inches of compressible packaging material around all sides for the instrument. Use static-free packaging materials to avoid additional damage to your unit.

Agilent suggests that you always insure shipments.

Cleaning

Clean the outside of the instrument with a soft, lint-free, slightly dampened cloth. Do not use detergent. Disassembly is not required or recommended for cleaning.

Electrostatic Discharge (ESD) Precautions

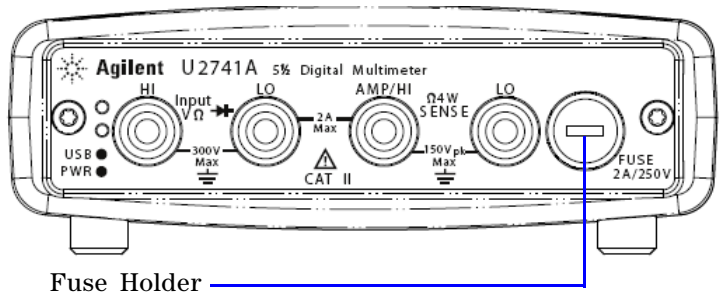
Almost all electrical components can be damaged by electrostatic discharge (ESD) during handling. Component damage can occur at electrostatic discharge voltages as low as 50 volts.

The following guidelines will help prevent ESD damage when servicing the modular DMM or any electronic device.

- Disassemble instruments *only* in a static-free work area.
- Use a conductive work area to dissipate static charge.
- Use a conductive wrist strap to dissipate static charge accumulation.
- Minimize handling.
- Keep replacement parts in original static-free packaging.
- Remove all plastic, styrofoam, vinyl, paper, and other static-generating materials from the immediate work area.
- Use *only* antistatic solder remover.

To Replace a Current Input Fuse

The current input terminal is fuse protected. The fuse 2 A, 250 Vac, is located in the fuse folder on the front panel as shown in figure below. If you determine that the fuse is faulty, remove the fuse holder and replace this fuse, order Agilent part number 2110-1422.



Troubleshooting the modular DMM

This section provides a brief check list of common failures. Before troubleshooting or repairing the modular DMM, make sure the failure is in the instrument rather than any external connections.

Unit is inoperative

- Verify that the AC/DC adapter is connected to the modular DMM.
- Verify that the front panel power indicator is lit.
- Verify that the USB cable is connected to the PC and the USB inlet in modular DMM.

Current input is inoperative

Verify that the front panel 2 A, 250 V current fuse is functional.

Power supply problems

Check that the AC/DC adapter is function and make sure that its output voltage is 12 V.

Contact Agilent Technologies Service Centre to obtain technical assistance, if necessary.



4 Replacement Parts

To Order Replaceable Parts [36](#)

General Disassemble [37](#)

This section provides the information of the orderable replacement parts for U2741A USB modular digital multimeter. The parts available for replacement are listed in [Table 4-1](#) with the reference part numbers and the respective part names.



To Order Replaceable Parts

You can order the replacement parts from Agilent using the part number provided in the table below. To order replacement parts from Agilent, do the following:

- 1 Identify the Agilent part number of the required parts as shown in the replacement parts list.
- 2 Contact your nearest Agilent Sales Office or Service Center.
- 3 Provide the instrument's model number and serial number.

Table 4-1 List of replacement parts

Part number	Description
U2702-68301	L-Bracket Assembly
U2702-40004	Rubber Bumper
U2702-60202	Rear Panel Assembly
2110-1422	2 A 250 Vac Fuse
2110-0970	Front Panel Fuse Holder

General Disassemble

This chapter provides the step-by-step guide on how to dismantle the module and install the replacement assembly. To reassemble the module, follow the instructions in reverse order.

NOTE

The parts shown in the following figures are representative and may differ from what you have in your module.

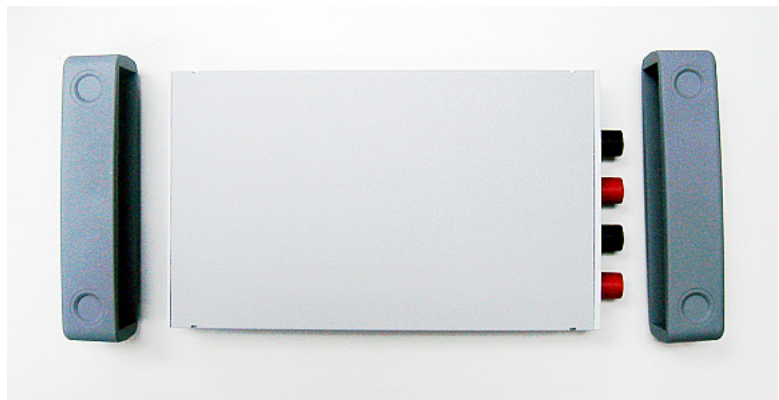
The removable assemblies include:

- Metal casing
- Rear metal casing
- Front metal casing, which is attached to the carrier board and measurement board
- Front and rear rubber bumper

Mechanical Disassemble

Follow the instructions in this section for the instrument disassembly process.

Step 1: Pull the rubber bumper out to unscrew the metal casing

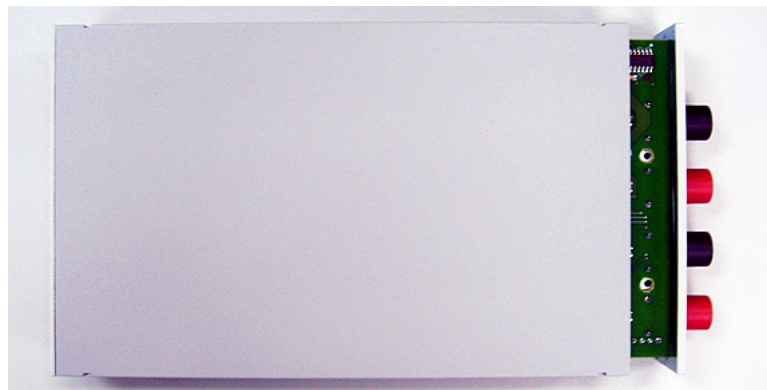


4 Replacement Parts

Step 2: Unscrew all the following indicated screws from the metal casing



Step 3: Gently pull the front metal piece out, which is attached to the carrier and measurement boards.



Step 4: Unscrew all the following indicated screws from the metal casing and remove the rear metal piece.



www.agilent.com

Contact us

To obtain service, warranty or technical assistance, contact us at the following phone or fax numbers:

United States:

(tel) 800 829 4444 (fax) 800 829 4433

Canada:

(tel) 877 894 4414 (fax) 800 746 4866

China:

(tel) 800 810 0189 (fax) 800 820 2816

Europe:

(tel) 31 20 547 2111

Japan:

(tel) (81) 426 56 7832 (fax) (81) 426 56
7840

Korea:

(tel) (080) 769 0800 (fax) (080) 769 0900

Latin America:

(tel) (305) 269 7500

Taiwan:

(tel) 0800 047 866 (fax) 0800 286 331

Other Asia Pacific Countries:

(tel) (65) 6375 8100 (fax) (65) 6755 0042

Or visit Agilent World Wide Web at:

www.agilent.com/find/assist

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