RIGOL

Performance Verification Guide

DM3068 Digital Multimeter

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RIGOL Technologies, Inc.

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Safety Requirement

General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injury or damage to the instrument and any product connected to it. To prevent potential hazards, please use the instrument only specified by this manual.

Use Proper Power Cord.
Only the power cord designed for the instrument and authorized for use within the local country could be used.

Ground the Instrument.
The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of the power cord to the Protective Earth terminal before connecting any inputs or outputs.

Connect the Probe Correctly.
If a probe is used, do not connect the ground lead to high voltage since it has isobaric electric potential as the ground.

Observe All Terminal Ratings.
To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting the instrument.

Use Proper Overvoltage Protection.
Make sure that no overvoltage (such as that caused by a thunderstorm) can reach the product, or else the operator might be exposed to the danger of electrical shock.

Do Not Operate Without Covers.
Do not operate the instrument with covers or panels removed.

Do Not Insert Anything Into the Holes of Fan.
Do not insert anything into the holes of the fan to avoid damaging the instrument.

Use Proper Fuse.
Please use the specified fuses.

Avoid Circuit or Wire Exposure.
Do not touch exposed junctions and components when the unit is powered.

Do Not Operate With Suspected Failures.

If you suspect damage occurs to the instrument, have it inspected by **RIGOL** authorized personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by **RIGOL** authorized personnel.

Keep Well Ventilation.

Inadequate ventilation may cause an increase of instrument temperature which would cause damage to the instrument. So please keep the instrument well ventilated and inspect the intake and fan regularly.

Do Not Operate in Wet Conditions.

In order to avoid short circuiting to the interior of the device or electric shock, please do not operate the instrument in a humid environment.

Do Not Operate in an Explosive Atmosphere.

In order to avoid damage to the device or personal injuries, it is important to operate the device away from an explosive atmosphere.

Keep Product Surfaces Clean and Dry.

To avoid the influence of dust and/or moisture in the air, please keep the surface of the device clean and dry.

Electrostatic Prevention.

Operate the instrument in an electrostatic discharge protective environment to avoid damage induced by static discharges. Always ground both the internal and external conductors of cables to release static before making connections.

Proper Use of Battery.

If a battery is supplied, it must not be exposed to high temperature or in contact with fire. Keep it out of the reach of children. Improper change of battery (note: lithium battery) may cause explosion. Use **RIGOL** specified battery only.

Handling Safety.

Please handle with care during transportation to avoid damage to buttons, knob interfaces and other parts on the panels.

The disturbance tests of all models conform to the P/F values of A based on the standard of EN 61326: 1997+A1+A2+A3 instead of P/F values of B.

Input Terminal Protection Limit

The protection limits are defined for the input terminals.

1. Main input (HI and LO) terminals

The **HI** and **LO** input terminals are used for voltage, resistance, capacitance, continuity, frequency and diode measurements. Two protection limits are defined for these terminals.

1) **HI-LO** protection limit: 1000VDC or 750VAC; this is also the maximum measurable voltage. The limit can be expressed as up to 1000Vpk.
2) **LO**-ground protection limit: the LO input terminal can safely float to 500Vpk at most relative to the ground.

Since the protection limit of the **HI** input terminal is up to 1000Vpk relative to the ground, the sum of the "floating" voltage and measured voltage cannot exceed 1000Vpk.

2. Sampling (HI Sense and LO Sense/200mA) terminals

The **HI Sense** and **LO Sense/200mA** terminals are used for 4-wire resistance measurement. Two protection limits are defined for these terminals.

1) **HI Sense**-**LO Sense/200mA** protection limit: 200Vpk.
2) **LO Sense/200mA**-**LO** protection limits: 0.5Vpk. The current input fuse on the rear panel provides up to 500mA protection limit for the current passing through the **LO Sense/200mA** terminal.

3. Current input (10A and **Sense/200mA) terminals**

The **10A** and **LO** terminals are used for the current measurements of 2A and 10A ranges respectively. The internal fuse of the multimeter provides 10A protection limit for the current passing through the 10A terminal. The **LO Sense/200mA** and **LO** terminals are used for current measurements ranging from 200uA to 200mA. The current input fuse on the rear panel provides up to 500mA protection limit for the current passing through the **LO Sense/200mA** terminal.

NOTE:

In order to prevent the fuse from blowing out and protect the multimeter, please use the current input terminals according to the following requirements.

1) Do not connect the **10A** and **LO Sense/200mA** input terminals to the current measurement circuit at the same time.
2) Only use the **10A** and **LO** terminals for measurements when the AC+DC RMS value of the current under measurement is within 200mA and 10A.
3) When making current measurement, select a proper current input terminal according to the estimated current magnitude before connecting the multimeter to AC power supply.
4) The current input into the **10A** terminal cannot exceed 13.5A; otherwise, the internal fuse of the multimeter will be burned out. The current input into the **LO Sense/200mA** terminal cannot exceed 650mA; otherwise, the current input fuse on the rear panel may be burned out.

IEC II Overvoltage Protection

In order to avoid the danger of electric shock, DM3068 provides overvoltage protection for line-voltage mains connections meeting both of the following conditions.

1. The HI and LO input terminals are connected to the mains under Measurement Category II conditions defined below.
2. The mains are limited to a maximum line voltage of 300VAC.

WARNING: IEC II includes electrical devices connected to mains through an outlet from the branch circuit. Such devices include most small appliances, test equipments and other devices inserted into a branch socket.

DM3068 may be used to make measurements with the HI and LO inputs connected to mains in such devices (up to 300VAC), or to the branch socket. However, the HI and LO inputs of DM3068 cannot be connected to mains of permanently installed electrical devices such as a main circuit-breaker panel, sub-panel disconnected box or wired motors. Voltages beyond the protection limit of DM3068 may occur on such devices and circuits.

NOTE: Voltages above 300VAC may be measured only in circuits that are isolated from mains. However, a transient overvoltage is also present in such circuits. DM3068 was designed to safely withstand occasional transient overvoltage up to 2500Vpk. Do not use this device to measure circuits whose transient overvoltage may exceed this level.

Safety Terms and Symbols

Terms Used in this Manual. These terms may appear in this manual:

WARNING
Warning statements indicate the conditions or practices that could result in injury or loss of life.

CAUTION
Caution statements indicate the conditions or practices that could result in damage to this product or other property.

Terms Used on the Product. These terms may appear on the product:

DANGER It calls attention to an operation, if not correctly performed, could result in injury or hazard immediately.

WARNING It calls attention to an operation, if not correctly performed, could result in potential injury or hazard.

CAUTION It calls attention to an operation, if not correctly performed, could result in damage to the product or other devices connected to the product.

Symbols Used on the Product. These symbols may appear on the product:

Hazardous Voltage

Safety Warning

Protective Earth Terminal

Chassis Ground

Test Ground

Allgemeine Sicherheits Informationen

Überprüfen Sie diefolgenden Sicherheitshinweise sorgfältigumPersonenschädenoderSchäden am Gerätundan damit verbundenen weiteren Gerätenzu vermeiden. Zur Vermeidung vonGefahren, nutzen Sie bitte das Gerät nur so, wiein diesem Handbuchangegeben.

Um Feuer oder Verletzungen zu vermeiden, verwenden Sie ein ordnungsgemäßes Netzkabel.

Verwenden Sie für dieses Gerät nur das für ihr Land zugelassene und genehmigte Netzkabel.

Erden des Gerätes.

Das Gerät ist durch den Schutzleiter im Netzkabel geerdet. Um Gefahren durch elektrischen Schlag zu vermeiden, ist es unerlässlich, die Erdung durchzuführen. Erst dann dürfen weitere Ein- oder Ausgänge verbunden werden.

Anschluss einesTastkopfes.

Die Erdungsklemmen der Sonden sindauf dem gleichen Spannungspegel des Instruments geerdet. SchließenSie die Erdungsklemmen an keine hohe Spannung an.

Beachten Sie alle Anschlüsse.

Zur Vermeidung von Feuer oder Stromschlag, beachten Sie alle Bemerkungen und Markierungen auf dem Instrument. Befolgen Sie die Bedienungsanleitung für weitere Informationen, bevor Sie weitere Anschlüsse an das Instrument legen.

Verwenden Sie einen geeigneten Überspannungsschutz.

Stellen Sie sicher, daß keinerlei Überspannung (wie z.B. durch Gewitter verursacht) das Gerät erreichen kann. Andernfallsbestehtfür den Anwender die GefahreinesStromschlages.

Nicht ohne Abdeckung einschalten.

Betreiben Sie das Gerät nicht mit entfernten Gehäuse-Abdeckungen.

Betreiben Sie das Gerät nicht geöffnet.

Der Betrieb mit offenen oder entfernten Gehäuseteilen ist nicht zulässig. Nichts in entsprechende Öffnungen stecken (Lüfter z.B.)

Passende Sicherung verwenden.

Setzen Sie nur die spezifikationsgemäßen Sicherungen ein.

Vermeiden Sie ungeschützte Verbindungen.

Berühren Sie keine unisolierten Verbindungen oder Baugruppen, während das Gerät in Betrieb ist.

Betreiben Sie das Gerät nicht im Fehlerfall.

Wenn Sie am Gerät einen Defekt vermuten, sorgen Sie dafür, bevor Sie das Gerät wieder betreiben,

dass eine Untersuchung durch **RIGOL** autorisiertem Personal durchgeführt wird. Jedwede Wartung, Einstellarbeiten oder Austausch von Teilen am Gerät, sowie am Zubehör dürfen nur von **RIGOL** autorisiertem Personal durchgeführt werden.

Belüftung sicherstellen.

Unzureichende Belüftung kann zu Temperaturanstiegen und somit zu thermischen Schäden am Gerät führen. Stellen Sie deswegen die Belüftung sicher und kontrollieren regelmäßig Lüfter und Belüftungsöffnungen.

Nicht in feuchter Umgebung betreiben.

Zur Vermeidung von Kurzschluß im Geräteinneren und Stromschlag betreiben Sie das Gerät bitte niemals in feuchter Umgebung.

Nicht in explosiver Atmosphäre betreiben.

Zur Vermeidung von Personen- und Sachschäden ist es unumgänglich, das Gerät ausschließlich fernab jedweder explosiven Atmosphäre zu betreiben.

Geräteoberflächen sauber und trocken halten.

Um den Einfluß von Staub und Feuchtigkeit aus der Luft auszuschließen, halten Sie bitte die Geräteoberflächen sauber und trocken.

Schutz gegen elektrostatische Entladung (ESD).

Sorgen Sie für eine elektrostatisch geschützte Umgebung, um somit Schäden und Funktionsstörungen durch ESD zu vermeiden. Erden Sie vor dem Anschluß immer Innen- und Außenleiter der Verbindungsleitung, um statische Aufladung zu entladen.

Die richtige Verwendung desAkku.

Wenneine Batterieverwendet wird, vermeiden Sie hohe Temperaturen bzw. Feuer ausgesetzt werden. Bewahren Sie es außerhalbder Reichweitevon Kindern auf. UnsachgemäßeÄnderung derBatterie (Anmerkung: Lithium-Batterie) kann zu einer Explosion führen. VerwendenSie nur von **RIGOL** angegebenenAkkus.

Sicherer Transport.

Transportieren Sie das Gerät sorgfältig (Verpackung!), um Schäden an Bedienelementen, Anschlüssen und anderen Teilen zu vermeiden.

Sicherheits Begriffe und Symbole

Begriffe in diesem Guide. Diese Begriffe können in diesem Handbuch auftauchen:

WARNING
Die Kennzeichnung WARNING beschreibt Gefahrenquellen die leibliche Schäden oder den Tod von Personen zur Folge haben können.

CAUTION
Die Kennzeichnung Caution (Vorsicht) beschreibt Gefahrenquellen die Schäden am Gerät hervorrufen können.

Begriffe auf dem Produkt. Diese Bedingungen können auf dem Produkt erscheinen:

DANGER	weist auf eine Verletzung oder Gefährdung hin, die sofort geschehen kann.
WARNING	weist auf eine Verletzung oder Gefährdung hin, die möglicherweise nicht sofort geschehen.
CAUTION	weist auf eine Verletzung oder Gefährdung hin und bedeutet, dass eine mögliche Beschädigung des Instruments oder anderer Gegenstände auftreten kann.

Symbole auf dem Produkt. Diese Symbole können auf dem Produkt erscheinen:

Gefährliche Spannung

Sicherheits-Hinweis

Schutz-erde

Gehäusemasse

Erde

Document Overview

This manual guides users to correctly test the performance specifications of **RIGOL** DM3068 digital multimeter. For the operation method of the instrument, please refer to the corresponding User's Guide.

Main contents in this manual:

Chapter 1 Test Overview
This chapter introduces the preparations of the performance verification test.

Chapter 2 Performance Verification Test
This chapter introduces the routine test methods of DM3068 performance verification test.

Appendix Test Record Form
In the appendix, a test record form is provided for recording the test results so as to determine whether each performance specification fulfills the requirement.

Contents

Chapter 1 Test Overview

Test Type

The performance tests are used to check the measurement performance of the multimeter. DM3068 supports self-test, quick test and routine test.

Self-Test

Self-test is a series of internal calibration tests which can be used to reliably determine the usability of the instrument. The self-test method is as follows.

Step 1: Turn on the multimeter.

Step 2: Press **Utility** → **T/C** → **Slftst** → **Run** to start the self-test. When abnormal situation occurs during the test, the beeper sounds. "PASS!" or "FAIL!" is displayed on the screen when the self-test finishes. If the instrument passes the self-test, it will be assumed that the hardware of the instrument is working normally (confidence level>90%).

In remote mode, you can use the ***TST?** command to start the self-test and query its result. The query returns "0" (the instrument passes the self-test) or "1" (the self-test fails). The whole self-test process lasts about 18 seconds and appropriate interface timeout period may need to be configured.

Step 3: The error messages during the self-test are stored in the error queue and you can view them through pressing **Utility** → **T/C** → **Error** (or sending the **SYSTem:ERRor?** comamnd) after the self-test finishes.

The table below lists the errors which may occur during the self-test.

Table 1-1 List of possible errors

Error Code	Error Message
601	ADC offset too noisy
602	ADC fullscale too noisy
603	ADC gain test failed
604	OHM Common Drive Test
605	DCV Common Drive Test
606	DCI Common Drive Test
607	DC 200V Zero Test
608	DC 1000V Zero Test
609	Input Leakage Test
610	Ohms 0.2uA and DC x1 Test
611	DCV Autozero Test

612	DCI Autozero Test
613	Precharge Offset Test.
614	DC 20V Gain Test
615	AC 200mV Zero Test
616	DC 200V Gain Test
617	DC x10 Gain Test
618	DC 1000V Gain Test
619	Low Current Shunt Test
620	High Current Shunt Test
621	Ohms 2uA Current Source Test
622	Ohms 10uA Current Source Test
623	Ohms 100uA Current Source Test
624	Ohms 1mA Current Source Test
625	AC Gain Test
626	Frequency counter Test
627	Capacitance Function Test
628	FPGA Configuration failed

NOTE

Although the multimeter automatically cuts off the connection with the input signal while performing self-test, the AC signals from the input terminal may still enter the multimeter and cause the failure of the self-test. So please do not start the self-test until you have disconnected all the input connections.

The multimeter that failed the self-test must be repaired and calibrated before it is put back into use.

Quick Test

Quick test is an easy way to inspect the functions and specifications of the multimeter with higher confidence level. It contains only a few test points and can evaluate the accuracy of the multimeter in normal use; however, it cannot detect abnormal element failures.

The quick test procedures are as follows.

Step 1: Run the test.

Step 2: Execute the test items marked with “Q” (the quick test items) in “**Chapter 2 Performance Verification Tests**”.

NOTE

The quick test is not applicable to the instruments with abnormalities in some certain functions. The multimeter that fails to pass the quick test must be calibrated or repaired before it is put back into use.

Routine Test

It is recommended that you perform routine test when you obtain the multimeter for the first time and please compare the routine test results with the values of 1 year "Allowable Error Range" in Table 2-1 to Table 2-6 in "**Chapter 2 Performance Verification Tests**". After that, you can verify the performance of the instrument at the end of each calibration interval. It is recommended that you calibrate the instrument at the end of each calibration interval.

NOTE
The multimeter that passes the routine test must be tested again when the test time interval expires. The multimeter that fails to pass the routine test must be calibrated or repaired before it is put back into use.

Test Equipments

Table 1-2 lists the equipments recommended for the test. If you do not have such equipments, use other equipments that fulfill the "**Precision Requirements**" in the table.

Table 1-2 Recommended equipments

Items	Recommended Equipments	Precision Requirements
Zero Offset Test	None	Pure copper 4-terminal short-circuiter
DC Voltage	Fluke 5520A	<1/5 of the 24 hour specification of the instrument
DC Current	Fluke 5520A	<1/5 of the 24 hour specification of the instrument
Resistance	Fluke 5520A	<1/5 of the 24 hour specification of the instrument
AC Voltage	Fluke 5520A	<1/5 of the 24 hour specification of the instrument
AC Current	Fluke 5520A	<1/5 of the 24 hour specification of the instrument
Frequency	Fluke 5520A	<1/5 of the 24 hour specification of the instrument
Capacitance	Fluke 5520A	<1/5 of the 24 hour specification of the instrument

Test Conditions

For the best performance, all the test processes should fulfill the following recommendations.

1. Always operate the instrument under a proper voltage.
2. Make sure the ambient temperature during the test is stable and within 18°C and 28°C.
3. The relative humidity should be lower than 80%.
4. Warm up the instrument for at least 90 minutes before testing the instrument.
5. Use a copper connector to reduce its thermoelectric potential effect.
6. Use Teflon shielded twisted pair (as short as possible) in order to reduce the effect of external interference. In the process of capacitance test, a coaxial cable should be used to minimize the external interference and noise.
7. Ground the shield of the twisted pair and the shield of the coaxial cable. Unless otherwise noted, ground the LO terminal of the calibrator.

As DM3068 is a high-precision measuring instrument, special attention should be paid to the additional error caused by the calibration source and calibration operations. In ideal situation, the accuracy of the verification test and calibration standard source must be at least four times higher than that of the test instrument.

When performing the gain calibration for DC voltage, DC current and resistance, the “0” output of the calibrator must be correct. In order to reduce the errors caused by the connecting cables, adequate warm-up (about 5 minutes) must be done before each reconnection of the cables or short-circuiter.

Input Connections

To perform zero offset test, you must use a copper/copper alloy low thermoelectric potential 4-terminal short-circuiter. A coaxial cable whose shielding layer is connected to the LO terminal should be used for capacitance test. For other function verification tests, Teflon shielded twisted pairs (as short as possible) should be used to connect the multimeter and calibrator. The cables connecting the HI and LO terminals as well as the HI-Sense and LO-Sense terminals should be twisted together respectively. Besides, the shielding layers of the cables must be connected to the reference ground. This kind of connections can reduce the effect of thermoelectric potential and external interference.

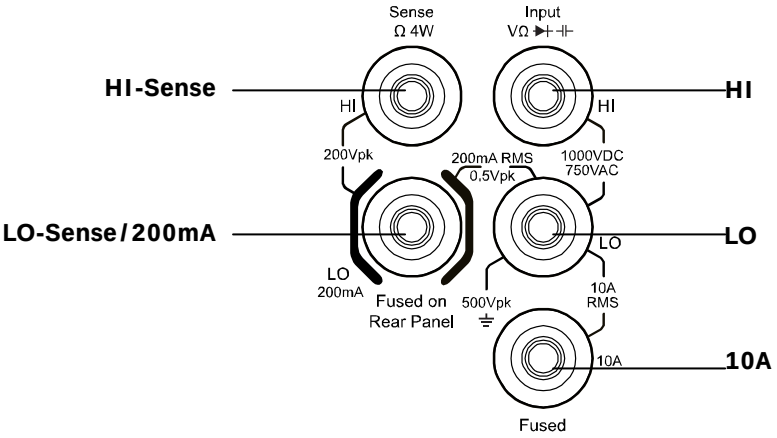

Figure 1-1 Input terminals

Test Result Record

Record and keep the test result of each test. In "**Appendix Test Record Form**" of this manual, a test result record form which lists all the test items and their corresponding performance limits as well as spaces for users to record the test results, is provided.

Tip:
It is recommended that users photocopy the test record form before each test and record the test results in the copy so that the form can be used repeatedly.

Specifications

The allowable error range of each test item, calculated based on the specification of DM3068, is provided in chapter 2. For the technical specifications of DM3068, refer to *DM3068 User's Guide* or *DM3068 Data Sheet* (can be downloaded from www.rigol.com).

Chapter 2 Performance Verification Test

This chapter introduces the routine test methods of DM3068 performance verification test and the quick test methods are also contained.

Zero Offset Test

The zero offset test inspects the meter's offset performance at the zero point. It is necessary only when a regular offset occurs to a function and range.

The zero offset test procedures are as follows.

1. Make sure you have carefully read the "**Test Conditions**".
2. Use a 4-terminal short-circuiter to short-circuit the HI-LO and Sense HI-LO terminals for DC voltage and resistance measurements (as shown in Figure 2-1). Open the circuits of both the 200mA and 10A current input terminals for current measurement.
3. Test the functions under different ranges specified in Table 2-1 one by one. Set the integration time to 100PLC. Unless otherwise noted, turn off all the math operations.
4. Compare the test results with the limits in the table.

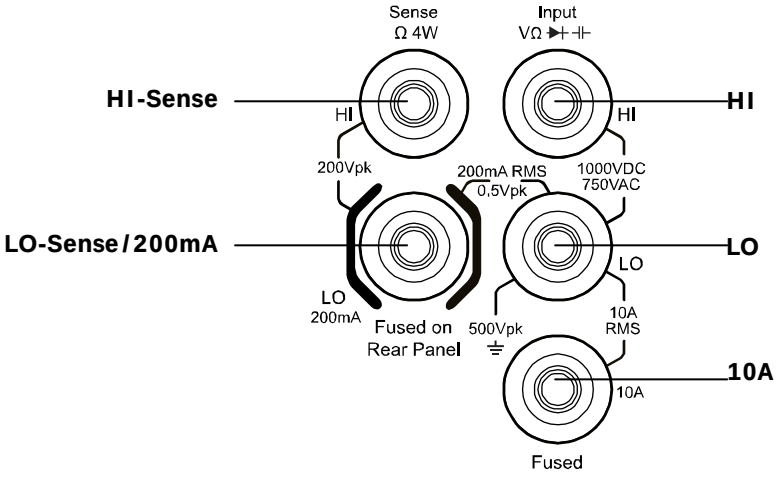

Figure 2-1 Zero offset test connection

Table 2-1 Zero offset test items

Function[1]	Range	Input signal	Quick Test[3]	Allowable Error Range		
				24 hours	90 days	1 year
DC Voltage	200.000mV	short	Q	±4μV	±5μV	±5μV
	2.00000V	short		±10μV	±12μV	±12μV
	20.0000V	short		±80μV	±100μV	±100μV
	200.000V	short	Q	±1.2mV	±1.2mV	±1.2mV
	1000.00V	short		±6mV	±10mV	±10mV
DC Current	200.000μA	open	Q	±24nA	±30nA	±30nA

	2.00000mA	open		±60nA	±60nA	±60nA
	20.0000mA	open	Q	±2.4μA	±3μA	±3μA
	200.000mA	open		±4μA	±6μA	±6μA
	2.00000A	open	Q	±400μA	±400μA	±400μA
	10.0000A	open		±1mA	±1mA	±1mA
Resistance[2]	200.000Ω	short		±6mΩ	±8mΩ	±8mΩ
	2.00000kΩ	short		±10mΩ	±20mΩ	±20mΩ
	20.0000kΩ	short	Q	±100mΩ	±200mΩ	±200mΩ
	200.000kΩ	short		±1Ω	±2Ω	±2Ω
	1.00000MΩ	short	Q	±10Ω	±10Ω	±10Ω
	10.0000MΩ	short		±100Ω	±100Ω	±100Ω
	100.000MΩ	short		±10kΩ	±10kΩ	±10kΩ

Note[1]: The integration time is set to 100PLC.

Note[2]: Specifications are for the 4-wire resistance function or the 2-wire resistance function using “REL” operation. If the 2-wire resistance function is used without "REL" operation, add 0.2Ω additional errors.

Note[3]: Q marks the optional quick test points.

Gain Test

The gain test inspects the accuracy of the multimeter under full range. It is necessary only when a regular gain offset occurs to a function and range.

1. The DC gain test procedures

(1) Make sure you have carefully read the "**Test Conditions**".

(2) Connect the input terminals of the multimeter with the calibrator.

(3) Test the functions under different ranges specified in Table 2-2 one by one. Set the integration time to 100PLC. Unless otherwise noted, turn off all the math operations.

(4) Input the signals specified in Table 2-2 using the calibrator and compare the test results with the limits in the table (make sure the output of the calibrator is built adequately).

Table 2-2 DC gain test items

Function[1]	Range	Test Signal	Quick Test[4]	Allowable Error Range		
				24 hours	90 days	1 year
DC Voltage	200.0000mV	200mV		±8μV	±11μV	±13μV
	200.0000mV	-200mV		±8μV	±11μV	±13μV
	2.000000V	2V	Q	±40μV	±52μV	±82μV
	2.000000V	-2V		±40μV	±52μV	±82μV
	20.00000V	20V	Q	±480μV	±700μV	±900μV
	20.00000V	-20V		±480μV	±700μV	±900μV
	200.0000V	200V	Q	±5.2mV	±9.2mV	±11.2mV
	200.0000V	-200V		±5.2mV	±9.2mV	±11.2mV
	1000.000V	1000V	Q	±26mV	±50mV	±65mV
	1000.000V	-1000V		±26mV	±50mV	±65mV

DC Current[2]	200.0000μA	200μA	Q	±44nA	±110nA	±130nA
	200.0000μA	-200μA	Q	±44nA	±110nA	±130nA
	2.000000mA	2mA		±200nA	±660nA	±1.06μA
	2.000000mA	-2mA		±200nA	±660nA	±1.06μA
	20.00000mA	20mA	Q	±3.8μA	±9μA	±13μA
	20.00000mA	-20mA	Q	±3.8μA	±9μA	±13μA
	200.0000mA	200mA		±24μA	±66μA	±106μA
	200.0000mA	-200mA		±24μA	±66μA	±106μA
	2.000000A	2A	Q	±1.4mA	±2mA	±2.4mA
	2.000000A	-2A		±1.4mA	±2mA	±2.4mA
	10.00000A	10A		±11mA	±13mA	±16mA
	10.00000A	-10A		±11mA	±13mA	±16mA
Resistance[3]	200.0000Ω	200Ω		±12mΩ	±24mΩ	±28mΩ
	2.000000kΩ	2kΩ		±50mΩ	±180mΩ	±220mΩ
	20.00000kΩ	20kΩ	Q	±500mΩ	±1.8Ω	±2.2Ω
	200.0000kΩ	200kΩ		±5Ω	±18Ω	±22Ω
	1.000000MΩ	1MΩ	Q	±30Ω	±110Ω	±130Ω
	10.00000MΩ	10MΩ		±1.6kΩ	±3.1kΩ	±4.1kΩ
	100.0000MΩ	100MΩ		±310kΩ	±810kΩ	±810kΩ

Note[1]: The integration time is set to 100PLC.

Note[2]: For continuous currents greater than DC 7A or AC RMS 7A, close the circuit for 30s on and then open the circuit for 30s.

Note[3]: Specifications are for the 4-wire resistance function or the 2-wire resistance function using “REL” operation. If the 2-wire resistance function is used without "REL" operation, add 0.2Ω additional errors.

Note[4]: Q marks the optional quick test points.

2. The AC voltage gain test procedures

(1) Make sure you have carefully read the "**Test Conditions**".

(2) Connect the input terminals of the multimeter with the calibrator.

(3) Test the ranges specified in Table 2-3 one by one. Set the AC filter to "Slow" and turn off all the math operations.

(4) Input the signals specified in Table 2-3 using the calibrator and compare the test results with the limits in the table (make sure the output of the calibrator is built adequately).

Table 2-3 AC voltage gain test items

Range[1]	Test Signal	Input Frequency	Quick Test[2]	Allowable Error Range		
				24 hours	90 days	1 year
200.0000mV	200mV	10Hz		±760μV	±780μV	±780μV
	200mV	20kHz	Q	±140μV	±180μV	±200μV
	200mV	50kHz		±300μV	±320μV	±340μV
	200mV	100kHz		±1.26mV	±1.36mV	±1.36mV
	200mV	300kHz		±9mV	±9mV	±9mV
2.000000V	2V	10Hz		±7.4mV	±7.6mV	±7.6mV

	2V	20kHz	Q	±1.2mV	±1.6mV	±1.8mV
	2V	50kHz		±2.8mV	±3.2mV	±3.4mV
	2V	100kHz		±12.6mV	±13.6mV	±13.6mV
	2V	300kHz		±90mV	±90mV	±90mV
	100mV	1kHz		±440μV	±650μV	±660μV
20.00000V	20V	10Hz		±76mV	±78mV	±78mV
	20V	20kHz	Q	±16mV	±22mV	±24mV
	20V	50kHz		±30mV	±34mV	±40mV
	20V	100kHz		±126mV	±136mV	±136mV
	3.2V	300kHz		±228mV	±228mV	±228mV
200.0000V	200V	45Hz		±120mV	±200mV	±220mV
	200V	20kHz	Q	±120mV	±200mV	±220mV
	200V	50kHz		±280mV	±340mV	±400mV
	200V	100kHz		±1.26V	±1.36V	±1.36V
750.000V	320V	45Hz		±278mV	±449mV	±481mV
	320V	20kHz	Q	±278mV	±449mV	±481mV
	320V	50kHz		±620mV	±759mV	±855mV
	320V	100kHz		±2.36V	±2.52V	±2.52V
	750V	10kHz	Q	±450mV	±750mV	±825mV

Note[1]: The AC filter is set to "Slow".

Note[2]: Q marks the optional quick test points.

3. The AC current gain test procedures

(1) Make sure you have carefully read the "**Test Conditions**".

(2) Connect the input terminals of the multimeter with the calibrator.

(3) Test the ranges specified in Table 2-4. Set the AC filter to "Slow" and turn off all the math operations.

(4) Input the signals specified in Table 2-4 using the calibrator and compare the test results with the limits in the table (make sure the output of the calibrator is built adequately).

Table 2-4 AC current gain test items

Range[1]	Test Signal	Input Frequency	Quick Test[3]	Allowable Error Range		
				24 hours	90 days	1 year
200.0000μA	200μA	1kHz	Q	±420nA	±420nA	±420nA
	200μA	5kHz		±420nA	±420nA	±420nA
	200μA	10kHz		±2.1μA	±2.1μA	±2.1μA
2.000000mA	2mA	1kHz	Q	±3.2μA	±3.2μA	±3.2μA
	2mA	5kHz		±3.2μA	±3.2μA	±3.2μA
	2mA	10kHz		±9μA	±9μA	±9μA
20.00000mA	20mA	1kHz	Q	±42μA	±42μA	±42μA
	20mA	5kHz		±42μA	±42μA	±42μA
	20mA	10kHz		±210μA	±210μA	±210μA
200.0000mA	200mA	1kHz	Q	±280μA	±280μA	±280μA

	200mA	5kHz		±280μA	±280μA	±280μA
	200mA	10kHz		±900μA	±900μA	±900μA
	10mA	10kHz	Q	±520μA	±520μA	±520μA
2.000000A	2A	1kHz	Q	±4.2mA	±4.2mA	±4.2mA
	2A	5kHz		±4.2mA	±4.2mA	±4.2mA
10.00000A[2]	10A	1kHz		±23mA	±25mA	±25mA

Note[1]: The AC filter is set to "Slow".

Note[2]: For continuous currents greater than DC 7A or AC RMS 7A, close the circuit for 30 seconds and then open the circuit for 30 seconds.

Note[3]: Q marks the optional quick test points.

4. The frequency gain test procedures

(1) Make sure you have carefully read the "**Test Conditions**".

(2) Connect the input terminals of the multimeter with the calibrator.

(3) Select the range according to Table 2-5 and turn off all the math operations.

(4) Input the signals specified in Table 2-5 using the calibrator and compare the test results with the limits in the table (make sure the output of the calibrator is built adequately).

Table 2-5 Frequency gain test items

Signal Effective Value	Signal Frequency	Quick Test[1]	Range	Allowable Error Range		
				24 hours	90 days	1 year
20mV	98Hz		200mV	±4.9mHz	±5.88mHz	±6.86mHz
200mV	500kHz	Q	2V	±25Hz	±30Hz	±35Hz

Note[1]: Q marks the optional quick test point.

5. The capacitance gain test procedures

(1) Make sure you have carefully read the "**Test Conditions**".

(2) Switch to the capacitance measurement function and select a range listed in Table 2-6.

(3) Connect one end of the shielded cable to the input terminal of the multimeter and leave the other end free; then, execute "REL" operation.

(4) Connect the other end of the shielded cable to the calibrator.

(5) Input the signals specified in Table 2-6 using the calibrator and compare the test results with the limits in the table (make sure the output of the calibrator is built adequately).

(6) Repeat steps (2), (3), (4) and (5) to finish the test.

Table 2-6 Capacitance test items

Range[1]	Test Signal	Quick Test[2]	Allowable Error Range
			1 year
2.000nF	2nF	Q	±90pF
20.00nF	20nF		±260pF
200.0nF	200nF		±2.6nF
2.000uF	2uF		±26nF
20.00uF	20uF		±260nF

200.0uF	200uF		±2.6μF
2.000mF	2mF		±26μF
20.00mF	20mF	Q	±260μF
100.0mF	100mF		±3.2mF

Note[1]: Specifications are obtained under "REL" operation.

Note[2]: Q marks the optional quick test points.

Appendix Test Record Form

Zero Offset

Function[1]	Range	Input Signal	Quick Test[3]	Allowable Error Range			Test Result		
				24 hours	90 days	1 year	24 hours	90 days	1 year
DC Voltage	200.0000mV	short	Q	±4μV	±5μV	±5μV			
	2.000000V	short		±10μV	±12μV	±12μV			
	20.00000V	short		±80μV	±100μV	±100μV			
	200.0000V	short	Q	±1.2mV	±1.2mV	±1.2mV			
	1000.000V	short		±6mV	±10mV	±10mV			
DC Current	200.0000μA	open	Q	±24nA	±30nA	±30nA			
	2.000000mA	open		±60nA	±60nA	±60nA			
	20.00000mA	open	Q	±2.4μA	±3μA	±3μA			
	200.0000mA	open		±4μA	±6μA	±6μA			
	2.000000A	open	Q	±400μA	±400μA	±400μA			
	10.00000A	open		±1mA	±1mA	±1mA			
Resistance[2]	200.0000Ω	short		±6mΩ	±8mΩ	±8mΩ			
	2.000000kΩ	short		±10mΩ	±20mΩ	±20mΩ			
	20.00000kΩ	short	Q	±100mΩ	±200mΩ	±200mΩ			
	200.0000kΩ	short		±1Ω	±2Ω	±2Ω			
	1.000000MΩ	short	Q	±10Ω	±10Ω	±10Ω			
	10.00000MΩ	short		±100Ω	±100Ω	±100Ω			
	100.0000MΩ	short		±10kΩ	±10kΩ	±10kΩ			

Note[1]: The integration time is set to 100PLC.

Note[2]: Specifications are for the 4-wire resistance function or the 2-wire resistance function using “REL” operation. If the 2-wire resistance function is used without "REL" operation, add 0.2 Ω additional errors.

Note[3]: Q marks the optional quick test points.

DC Gain

Function[1]	Range	Test Signal	Quick Test[4]	Allowable Error Range			Test Result		
				24 hours	90 days	1 year	24 hours	90 days	1 year
DC Voltage	200.0000mV	200mV		±8μV	±11μV	±13μV			
	200.0000mV	-200mV		±8μV	±11μV	±13μV			
	2.000000V	2V	Q	±40μV	±52μV	±82μV			
	2.000000V	-2V		±40μV	±52μV	±82μV			
	20.00000V	20V	Q	±480μV	±700μV	±900μV			
	20.00000V	-20V		±480μV	±700μV	±900μV			
	200.0000V	200V	Q	±5.2mV	±9.2mV	±11.2mV			
	200.0000V	-200V		±5.2mV	±9.2mV	±11.2mV			
	1000.000V	1000V	Q	±26mV	±50mV	±65mV			
	1000.000V	-1000V		±26mV	±50mV	±65mV			
DC Current[2]	200.0000μA	200μA	Q	±44nA	±110nA	±130nA			
	200.0000μA	-200μA	Q	±44nA	±110nA	±130nA			
	2.000000mA	2mA		±200nA	±660nA	±1.06μA			
	2.000000mA	-2mA		±200nA	±660nA	±1.06μA			
	20.00000mA	20mA	Q	±3.8μA	±9μA	±13μA			
	20.00000mA	-20mA	Q	±3.8μA	±9μA	±13μA			
	200.0000mA	200mA		±24μA	±66μA	±106μA			
	200.0000mA	-200mA		±24μA	±66μA	±106μA			
	2.000000A	2A	Q	±1.4mA	±2mA	±2.4mA			
	2.000000A	-2A		±1.4mA	±2mA	±2.4mA			
	10.00000A	10A		±11mA	±13mA	±16mA			
	10.00000A	-10A		±11mA	±13mA	±16mA			
Resistance[3]	200.0000Ω	200Ω		±12mΩ	±24mΩ	±28mΩ			
	2.000000kΩ	2kΩ		±50mΩ	±180mΩ	±220mΩ			
	20.00000kΩ	20kΩ	Q	±500mΩ	±1.8Ω	±2.2Ω			

	200.0000kΩ	200kΩ		±5Ω	±18Ω	±22Ω			
	1.000000MΩ	1MΩ	Q	±30Ω	±110Ω	±130Ω			
	10.00000MΩ	10MΩ		±1.6kΩ	±3.1kΩ	±4.1kΩ			
	100.0000MΩ	100MΩ		±310kΩ	±810kΩ	±810kΩ			

Note[1]: The integration time is set to 100PLC.

Note[2]: For continuous currents greater than DC 7A or AC RMS 7A, close the circuit for 30s and then open the circuit for 30s.

Note[3]: Specifications are for the 4-wire resistance function or the 2-wire resistance function using “REL” operation. If the 2-wire resistance function is used without "REL" operation, add 0.2 Ω additional errors.

Note[4]: Q marks the optional quick test points.

AC Voltage Gain

Range[1]	Test Signal	Input Frequency	Quick Test[2]	Allowable Error Range			Test Result		
				24 hours	90 days	1 year	24 hours	90 days	1 year
200.0000mV	200mV	10Hz		±760μV	±780μV	±780μV			
	200mV	20kHz	Q	±140μV	±180μV	±200μV			
	200mV	50kHz		±300μV	±320μV	±340μV			
	200mV	100kHz		±1.26mV	±1.36mV	±1.36mV			
	200mV	300kHz		±9mV	±9mV	±9mV			
2.000000V	2V	10Hz		±7.4mV	±7.6mV	±7.6mV			
	2V	20kHz	Q	±1.2mV	±1.6mV	±1.8mV			
	2V	50kHz		±2.8mV	±3.2mV	±3.4mV			
	2V	100kHz		±12.6mV	±13.6mV	±13.6mV			
	2V	300kHz		±90mV	±90mV	±90mV			
	100mV	1kHz		±440μV	±650μV	±660μV			
20.00000V	20V	10Hz		±76mV	±78mV	±78mV			
	20V	20kHz	Q	±16mV	±22mV	±24mV			
	20V	50kHz		±30mV	±34mV	±40mV			
	20V	100kHz		±126mV	±136mV	±136mV			
	3.2V	300kHz		±228mV	±228mV	±228mV			

200.0000V	200V	45Hz		±120mV	±200mV	±220mV			
	200V	20kHz	Q	±120mV	±200mV	±220mV			
	200V	50kHz		±280mV	±340mV	±400mV			
	200V	100kHz		±1.26V	±1.36V	±1.36V			
750.000V	320V	45Hz		±278mV	±449mV	±481mV			
	320V	20kHz	Q	±278mV	±449mV	±481mV			
	320V	50kHz		±620mV	±759mV	±855mV			
	320V	100kHz		±2.36V	±2.52V	±2.52V			
	750V	10kHz	Q	±450mV	±750mV	±825mV			

Note[1]: The AC filter is set to "Slow".

Note[2]: Q marks the optional quick test points.

AC Current Gain

Range[1]	Test Signal	Input Frequency	Quick Test[3]	Allowable Error Range			Test Result		
				24 hours	90 days	1 year	24 hours	90 days	1 year
200.0000μA	200μA	1kHz	Q	±420nA	±420nA	±420nA			
	200μA	5kHz		±420nA	±420nA	±420nA			
	200μA	10kHz		±2.1μA	±2.1μA	±2.1μA			
2.000000mA	2mA	1kHz	Q	±3.2μA	±3.2μA	±3.2μA			
	2mA	5kHz		±3.2μA	±3.2μA	±3.2μA			
	2mA	10kHz		±9μA	±9μA	±9μA			
20.00000mA	20mA	1kHz	Q	±42μA	±42μA	±42μA			
	20mA	5kHz		±42μA	±42μA	±42μA			
	20mA	10kHz		±210μA	±210μA	±210μA			
200.0000mA	200mA	1kHz	Q	±280μA	±280μA	±280μA			
	200mA	5kHz		±280μA	±280μA	±280μA			
	200mA	10kHz		±900μA	±900μA	±900μA			
	10mA	10kHz	Q	±520μA	±520μA	±520μA			
2.000000A	2A	1kHz	Q	±4.2mA	±4.2mA	±4.2mA			

	2A	5kHz		±4.2mA	±4.2mA	±4.2mA			
10.00000A[2]	10A	1kHz		±23mA	±25mA	±25mA			

Note[1]: The AC filter is set to "Slow".

Note[2]: For continuous currents greater than DC 7A or AC RMS 7A, close the circuit for 30 seconds and then open the circuit for 30 seconds.

Note[3]: Q marks the optional quick test points.

Frequency Gain

Signal Effective Value	Signal Frequency	Quick Test[1]	Range	Allowable Error Range			Test Result		
				24 hours	90 days	1 year	24 hours	90 days	1 year
20mV	98Hz		200mV	±4.9mHz	±5.88mHz	±6.86mHz			
200mV	500kHz	Q	2V	±25Hz	±30Hz	±35Hz			

Note[1]: Q marks the optional quick test point.

Capacitance Gain

Range[1]	Test Signal	Quick Test[2]	Allowable Error Range	Test Result
			1 year	1 year
2.000nF	2nF	Q	±90pF	
20.00nF	20nF		±260pF	
200.0nF	200nF		±2.6nF	
2.000uF	2uF		±26nF	
20.00uF	20uF		±260nF	
200.0uF	200uF		±2.6μF	
2.000mF	2mF		±26μF	
20.00mF	20mF	Q	±260μF	
100.0mF	100mF		±3.2mF	

Note[1]: Specifications are obtained under "REL" operation.

Note[2]: Q marks the optional quick test points.