

RIGOL

Calibration Guide

DM3058/DM3058E Digital Multimeter

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RIGOL Technologies, Inc.**

Guaranty and Declaration

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Contact Us

If you have any problem or requirement when using our products or this manual, please contact **RIGOL**.

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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.

Safety Terms and Symbols

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

**WARNING**

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

**CAUTION**

Caution statements indicate 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 die folgenden Sicherheitshinweise sorgfältig um Personenschäden oder Schäden am Gerät und an damit verbundenen weiteren Geräten zu vermeiden. Zur Vermeidung von Gefahren, nutzen Sie bitte das Gerät nur so, wie in diesem Handbuch angegeben.

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 eines Tastkopfes.

Die Erdungsklemmen der Sonden sind auf dem gleichen Spannungspegel des Instruments geerdet. Schließen Sie 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. Andernfalls besteht für den Anwender die Gefahr eines Stromschlages.

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 des Akkus.

Wenn eine Batterie verwendet wird, vermeiden Sie hohe Temperaturen bzw. Feuer ausgesetzt werden. Bewahren Sie es außerhalb der Reichweite von Kindern auf. Unsachgemäße Änderung der Batterie (Anmerkung: Lithium-Batterie) kann zu einer Explosion führen. Verwenden Sie nur von **RIGOL** angegebenen Akkus.

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 introduces how to perform user calibration of **RIGOL** DM3058/DM3058E digital multimeter. For the operation methods mentioned during the calibration process, please refer to the User's Guide of this product.

The Main topics of this manual:

Chapter 1 Calibration Overview

This chapter introduces the calibration interval, calibration notices and the preparations before the calibration.

Chapter 2 Calibration

This chapter introduces how to calibrate DM3058/DM3058E digital multimeter.

Contents

Guaranty and Declaration	I
Safety Requirement	II
General Safety Summary	II
Safety Terms and Symbols	IV
Allgemeine Sicherheits Informationen.....	V
Sicherheits Begriffe und Symbole	VII
Document Overview.....	VIII
Chapter 1 Calibration Overview.....	1-1
Calibration Interval	1-1
Calibration Notices.....	1-1
Calibration Protection.....	1-1
Calibration Devices	1-2
Test Conditions	1-2
Input Connection.....	1-3
Chapter 2 Calibration	2-1
Calibration Explanation	2-1
DC Voltage, DC Current and Resistance Calibrations.....	2-1
AC Voltage and AC Current Calibrations	2-3
Frequency Calibration	2-4
Capacitance Calibration.....	2-5

Chapter 1 Calibration Overview

Calibration Interval

Periodic calibration is required by the multimeter. The calibration interval depends on the requirement on the measurement accuracy.

For applications that require relatively higher measurement accuracy, the recommended calibration interval is 90 days; for most of the situations, a 1-year calibration interval is acceptable.

The accuracy specification can only be guaranteed when periodic calibration is performed.

No matter in which kind of application environment, calibration intervals longer than 1 year are not recommended.

Calibration Notices

No matter which kind of calibration interval do you select, it is recommended that you perform a complete re-calibration when the calibration interval expires to ensure that the accuracy of DM3058/DM3058E is within the specification within the next calibration interval.

If no re-calibration is performed, the instrument might not be within the test limits even though the instrument passes the performance verification test.

Calibration Protection

The calibration protection function is used to prevent accidental or unauthorized calibration operation. DM3058/DM3058E is in safety protection state when leaving factory. Before calibrating the multimeter, you need to input the correct calibration password to unlock the safety protection.

The calibration password can include numbers (0 to 9) and English uppercase letters (A to Z) and cannot exceed 10 characters. Users can modify the calibration password. Before modifying the calibration password, you need to input the correct original password. After the new password is saved, the password will not be lost at power-off or factory reset.

The default calibration password is "DMCAL".

Modify the password

You can use the direction keys at the front panel of DM3058/DM3058E to input the password. The up and down direction keys are used to select the character; press the up/down direction key to switch among "0 to 9", "A to Z" and "space". The left and right direction keys are used to move the cursor.

Press **Utility**; press **T/C** → **PSW** and input the original password; set **SecrOff** and input the new password. Check and make sure that the password is correct; then, press **SecrOff**; at this point, the new password is set.

Tip

Please remember the new password.

Calibration Devices

You are recommended to use the devices listed in Table 1-1 to calibrate DM3058/DM3058E digital multimeter. If you do not have these devices, please use other devices that can meet the "**Precision Requirement**" in the table below.

Table 1-1 Recommended Devices

Item	Recommended Device	Precision Requirement
Zero Point Calibration	None	Pure copper 4-terminal short-circuiter
DC Voltage	Fluke 5520A	<1/5 of the 1-year parameters of the instrument
DC Current	Fluke 5520A	<1/5 of the 1-year parameters of the instrument
Resistance	Fluke 5520A	<1/5 of the 1-year parameters of the instrument
AC Voltage	Fluke 5520A	<1/5 of the 1-year parameters of the instrument
AC Current	Fluke 5520A	<1/5 of the 1-year parameters of the instrument
Frequency	Fluke 5520A	<1/5 of the 1-year parameters of the instrument
Capacitance	Fluke 5520A	<1/5 of the 1-year parameters of the instrument

Test Conditions

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

1. Provide proper working voltage for the device.
2. Make sure the environment temperature is stable and between 18°C and 28°C. Ideally, the calibration should be performed at 23°C ± 2°C.
3. Make sure the environment relative humidity is lower than 80%.
4. Make sure that the instrument has been warmed up for more than 1 hour before the test or calibration.

5. Use copper connectors to reduce the effect of thermoelectric potential.
6. Use Teflon shielded twisted pair (as short as possible) to reduce the effect of external interference. When making capacitance verification and calibration, use coaxial cable 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 DM3058/DM3058E digital multimeter is a high-precision measuring instrument, special care should be paid during the verification and calibration to avoid causing additional error. Ideally, the accuracy of the standard source of the verification and calibration should be more than 5 times higher than the accuracy specification of the test instrument.

When performing the DC voltage, DC current and resistance gain calibrations, the "0" output of the calibrator must be correct. To reduce the error caused by the connecting cable, the connecting cable must be adequately warmed up (for about 5 minutes) each time when the connecting cable or the short-circuiter is re-connected.

Input Connection

For the zero point calibration, please use copper or copper alloy low thermoelectric potential 4-terminal short-circuiter. For the capacitance calibration, please use coaxial cable and connect its shielding layer with the LO terminal. For the calibrations of the other functions, please use Teflon shielded twisted pair (as short as possible) to connect the multimeter and calibrator; the HI and LO terminals must be connected with twisted pair; the HI-Sense and LO-Sense terminals must be connected with the twisted pair. The shielding layer of the cable must be connected to the reference ground. This kind of connection can reduce the effect of the thermoelectric potential and external interference.

Chapter 2 Calibration

Calibration Explanation

The DM3058/DM3058E calibration consists of user calibration and factory calibration. The calibration parameters acquired from the calibration performed by **RIGOL** factory or the **RIGOL** authorized third-party organizations are stored as the factory calibration parameters. The calibration parameters acquired by performing the calibration operations mentioned below are the user calibration parameters which will not overwrite the factory calibration parameters. You can select the desired type of calibration parameters or restore the user calibration parameters to the default values via the menus. After the user calibration parameters are saved, they will not be lost at power-off.

Press **Utility**; press **T/C** → **PSW** and input the correct password; set **SecrOff**. Then, press **Cal** to enter the calibration menu and execute the calibration to acquire the user calibration parameters. You can press **Default** under the calibration menu to restore the user calibration parameters to the default values. Press **On/Off** to select "On" and the multimeter will correct the measurement results according to user calibration parameters; press **On/Off** to select "Off" and the multimeter will use the factory calibration parameters.

DC Voltage, DC Current and Resistance Calibrations

The calibrations of the DC voltage, DC current and resistance measurement functions consist of the zero point calibration and gain calibration. You should first perform the zero point calibration and then perform the gain calibration.

The calibration procedures of the DC voltage, DC current and resistance measurement functions are similar. The introductions below illustrate the calibration procedures by taking the 4-wire 20 k Ω scale as an example.

1. Read the "**Calibration Devices**" and "**Test Conditions**".
2. Press **Ω** to select the 4-wire resistance measurement function. Set the range to 20 k Ω and the reading rate to "Slow".
3. Press **Utility**; press **T/C** → **PSW** and input the correct calibration password; set **SecrOff** and press **Cal** → **Enter**.
4. As shown in Figure 2-1, short-circuit the Input HI-LO terminal and Sense HI-LO terminal (namely the zero point calibration input) using a 4-terminal

short-circuiter. Press **Zero** to perform the zero point calibration. The zero point calibration parameters will be displayed in the **Cal 0** table after the zero point calibration finishes.

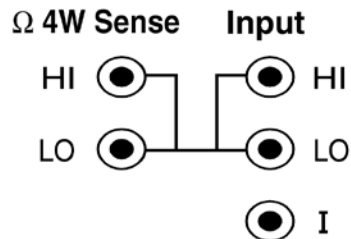


Figure 2-1 Short-circuit of the Input HI-LO and Sense HI-LO Terminals

- After the zero point calibration finishes, connect the Input HI-LO terminal and Sense HI-LO terminal with the corresponding output terminals of the calibrator. Set the output of the calibrator to 4-wire resistance 20 k Ω (namely the gain calibration input). Turn on the output of the calibrator and wait until the output of the calibrator becomes stable. Then, press **Gain** to perform the gain calibration. The gain calibration parameters will be displayed in the **Cal G** table after the gain calibration finishes.
- After the above calibrations finish, press **Save** to save the calibration parameters.

Note

Special care should be paid during the calibration process to avoid affecting the performance of the instrument. Please read the "**Test Conditions**" before performing the calibration.



Table 2-1 DC Voltage, DC Current and Resistance Calibration Inputs

Function	Range Scale	Zero Point Calibration Input ^[1]	Gain Calibration Input
DC Voltage	200.000 mV	short	200.000 mV
	2.00000 V	short	2.00000 V
	20.0000 V	short	20.0000 V
	200.000 V	short	200.000 V
	1000.00 V	short	1000.00 V
DC Current	200.000 μ A	open	200.000 μ A
	2.00000 mA	open	2.00000 mA
	20.0000 mA	open	20.0000 mA
	200.000 mA	open	200.000 mA
	2.00000 A	open	2.00000 A
	10.0000 A	open	10.0000 A
Resistance	200.000 Ω	short	200.000 Ω
	2.00000 k Ω	short	2.00000 k Ω
	20.0000 k Ω	short	20.0000 k Ω
	200.000 k Ω	short	200.000 k Ω
	2.00000 M Ω	short	2.00000 M Ω
	10.0000 M Ω	short	10.0000 M Ω

Note^[1]: Use the 4-terminal short-circuiter for short-circuit.

AC Voltage and AC Current Calibrations

The AC voltage and AC current calibrations consist of the half range calibration and gain calibration. You should first perform the half range calibration and then perform the gain calibration. The introductions below illustrate the calibration procedures by taking the AC voltage 200 mV scale as an example.

1. Read the "**Calibration Devices**" and "**Test Conditions**".
2. Press  to select the AC voltage measurement function. Set the range to the 200 mV scale and set the reading rate to "Slow".
3. Press ; press **T/C** \rightarrow **PSW** and input the correct calibration password; set **SecrOff** and press **Cal** \rightarrow **Enter**.
4. Connect the voltage output terminal of the calibrator with the HI-LO input terminal of the multimeter. Set the calibrator to output a 100 mV, 1 kHz sine waveform (namely the half range calibration output). Turn on the output of the calibrator and wait until the output of the calibrator becomes stable. Then, press **Middle** to perform the half range calibration; the half range calibration parameters will be displayed in the **Cal M** table after the half range calibration finishes.

5. After the half range calibration finishes, set the calibrator to output a 200 mV, 1 kHz sine waveform (namely the gain calibration input). Turn on the output of the calibrator and wait until the output of the calibrator becomes stable. Then, press **Gain** to perform the gain calibration; the gain calibration parameters will be displayed in the **Cal G** table after the gain calibration finishes.
6. After the above calibrations finish, press **Save** to save the calibration parameters.

Table 2-2 AC Voltage and AC Current Calibration Inputs

Function	Range Scale	Half Range Calibration Input ^[1]	Gain Calibration Input
AC Voltage	200 mV	1 kHz/100 mV	1 kHz/200 mV
	2 V	1 kHz/1 V	1 kHz/2 V
	20 V	1 kHz/10 V	1 kHz/20 V
	200 V	1 kHz/100 V	1 kHz/200 V
	750 V	1 kHz/375 V	1 kHz/750 V
AC Current	20 mA	1 kHz/10 mA	1 kHz/20 mA
	200 mA	1 kHz/100 mA	1 kHz/200 mA
	2 A	1 kHz/1 A	1 kHz/2 A
	10 A	1 kHz/5 A	1 kHz/10 A

Frequency Calibration

For the frequency function, you only need to perform the gain calibration and the operation procedures are as follows.

1. Read the "**Calibration Devices**" and "**Test Conditions**".
2. Press **Freq** to select the frequency measurement function and set the range to the manual 2 V scale.
3. Press **Utility**; press **T/C** → **PSW** and input the correct calibration password; set **SecrOff** and press **Cal** → **Enter**.
4. Connect the voltage output terminal of the calibrator with the HI-LO input terminal of the multimeter. Set the calibrator to output a 2 V, 100 kHz sine waveform. Turn on the output of the calibrator and wait until the output of the calibrator becomes stable. Then, press **Gain** to perform the gain calibration; the gain calibration parameters will be displayed in the **Cal G** table after the gain calibration finishes.
5. After the gain calibration finishes, press **Save** to save the calibration parameters.

Capacitance Calibration

For the capacitance function, you need to perform the zero point calibration and gain calibration. The following introductions illustrate the calibration procedures by taking the capacitance 2 nF scale as an example.

1. Read the "**Calibration Devices**" and "**Test Conditions**".
2. Press **⊕** to select the capacitance measurement function and set the range to the manual 2 nF scale.
3. Press **Utility**; press **T/C** → **PSW** and input the correct calibration password; set **SecrOff** and press **Cal** → **Enter**.
4. Connect on end of the connecting cable to the HI-LO input terminal of the multimeter and leave the other end of the connecting cable unconnected; connect the shielding layer of the cable to the chassis ground. Press **Zero** to perform the zero point calibration; the zero point calibration parameters will be displayed in the **Cal 0** table after the zero point calibration finishes.
5. Connect the end of the test cable hang in the air with the output of the calibrator. Set the output of the calibrator to 2 nF. Turn on the output of the calibrator and wait until the output of the calibrator becomes stable. Then, press **Gain** to perform the gain calibration; the gain calibration parameters will be displayed in the **Cal G** table after the gain calibration finishes.
6. After the above calibrations finish, press **Save** to save the calibration parameters.

Table 2-3 Capacitance Calibration Inputs

Function	Range Scale	Zero Point Calibration Input	Gain Calibration Input
Capacitance	2 nF	Open	2 nF
	20 nF	Open	20 nF
	200 nF	Open	200 nF
	2 μF	Open	2 μF
	200 μF	Open	200 μF
	10000 μF	Open	10000 μF