

RIGOL

Calibration Guide

DG1000Z Series Function/Arbitrary Waveform Generator

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RIGOL Technologies, Inc.

Guaranty and Declaration

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Document Overview

This manual gives a detailed introduction of the calibration notices and calibration process of DG1000Z.

Subjects in this Manual:

Chapter 1 Calibration Notices

This chapter gives a detailed introduction of the recommended calibration interval, calibration safety, the method to stop the calibration and the related information, the method to acquire the calibration service, the recommended test devices and the notices during the test.

Chapter 2 Calibration Process

This chapter gives a detailed introduction of the calibration interface and the calibration process of each calibration item of DG1000Z.

Format Conventions in this Manual:

1. Button

The front-panel key is denoted by the format of “Text Box + Button Name (Bold)” in the manual, for example, **Utility** denotes the “Utility” key.

2. Menu

The menu is denoted by the format of “Character Shading + Menu Word (Bold)” in the manual, for example, **System** denotes the “System” menu item under **Utility**.

3. Operation Step

The next step of the operation is denoted by an arrow “→” in the manual. For example, **Utility** → **System** denotes pressing **Utility** at the front panel and then pressing **System**.

Content Conventions in this Manual:

DG1000Z series function/arbitrary waveform generator includes the following models. Unless otherwise noted in this manual, DG1062Z is taken as an example to introduce the calibration notices and calibration process of DG1000Z series.

Model	Number of Channels	Max. Output Frequency
DG1062Z	2	60MHz
DG1032Z	2	30MHz

Contents

Guaranty and Declaration	I
Document Overview.....	II
Chapter 1 Calibration Notices.....	1-1
Calibration Interval	1-1
Calibration Safety	1-1
To Stop the Calibration.....	1-1
To Acquire the Calibration Service	1-2
Recommended Test Devices	1-2
Test Notices	1-2
Chapter 2 Calibration Process	2-1
Frequency Accuracy Calibration.....	2-3
Amplitude (AC Amplitude) Calibration	2-4
Low-frequency Flatness Calibration	2-5
Offset (Output Offset) Calibration.....	2-6
Inner Load Calibration	2-7
High-frequency Flatness Calibration.....	2-9

Chapter 1 Calibration Notices

Calibration Interval

Regular calibration can ensure the performance specifications of DG1000Z. You are recommended to calibrate the instrument at a one-year calibration interval. You can select a proper calibration interval according to your requirement of performance accuracy. However, the calibration interval cannot exceed 2 years; otherwise, the specifications cannot be guaranteed.

You are recommended to perform a complete calibration at the selected calibration interval to ensure that the instrument will remain within specifications before the next calibration.

Calibration Safety

You need to input the correct password before calibration each time you want to calibrate the instrument. The password is used to prevent accidental or unauthorized calibration of the instrument.

Press **Utility** → **Test/Cal** → **Manual Cal**, input the correct password using the numeric keyboard. Then, press **OK** to enter the calibration interface.

The calibration password is "123456". The password is stored in the non-volatile memory and will not change at power-off or remote interface reset.

You are allowed to modify the calibration password. Press **Utility** → **Test Cal** → **Password Modify**, press **Old**, **New** and **Confirm** in turn, input the corresponding password and then press **OK** to finish the password modification.

To Stop the Calibration

You can power off the instrument to stop the calibration at any time during the calibration. The calibration data stored will not be cleared when the calibration is stopped and you do not need to calibrate the items already calibrated again in the next calibration.



CAUTION

If the calibration is stopped when the instrument is writing the new calibration constants into the Flash, you may lose all the calibration constants and you need to perform the calibration again.

To Acquire the Calibration Service

Improper calibration may result in output accuracy reduction and even output error. **RIGOL** does not recommend manual calibration by users. If calibration is required, please contact **RIGOL** customer service department or the local distributor.

Recommended Test Devices

It is recommended that you use the test devices listed in the table below or other test devices whose performance specifications satisfy the "Performance Requirement" listed in the table below for calibration.

Table 1-1 Recommended Test Devices

Device	Performance Requirement	Recommended
Digital Multimeter	6 ¹ / ₂ digits	RIGOL DM3068
Frequency Counter	>10MHz Accuracy: 0.1ppm	Agilent 53131A
Power Meter	-30dBm to +20dBm Accuracy: ±0.02dB Resolution: 0.01dB	Agilent E4418B
Connecting Wire	BNC (m) - Dual banana plug (m)	--
Connecting Wire	BNC (m) - BNC (m)	--
Power Sensor	-30dBm to +20dBm	Agilent N8482A
Power Sensor Connecting Wire	Used to connect the power meter and power sensor	--
50Ω Load	50Ω/1W	--

Test Notices

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

- 1) Make sure the environment temperature is stable and between 18°C and 28°C. Ideally, the calibration should be performed at 23°C ±1°C.
- 2) Make sure the environment relative humidity is less than 80%.
- 3) Make sure that the instrument has been warmed up for at least 30 minutes before the calibration.
- 4) Keep the test cables as short as possible and make sure that the impedance of the cable is consistent with the requirement.

Chapter 2 Calibration Process

Warm DG1000Z up for at least 30 minutes. Press **Utility** → **Test/Cal** → **Manual Cal** and input the correct password using the numeric keyboard. Then, press **OK** to enter the calibration interface as shown in the figure below.

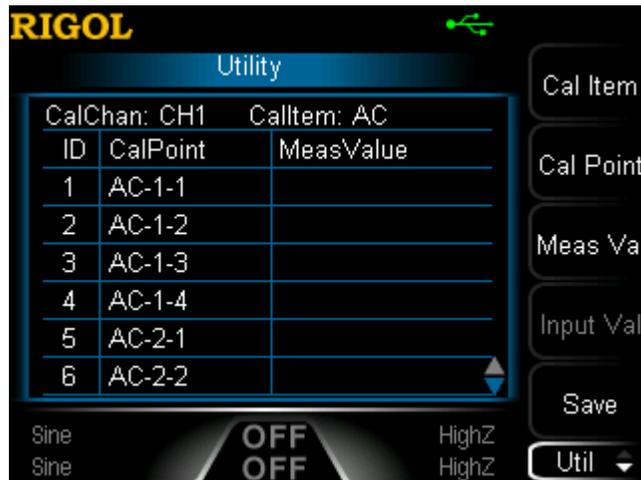


Figure 2-1 Calibration Interface

1. Cal Item

Press this softkey to select the desired calibration item. The calibration items of DG1000Z manual calibration are listed in the table below. You can select one or more calibration items, but it is recommended to perform a complete calibration.

Table 2-1 Calibration Items

No.	Item
1	Amplitude (AC amplitude)
2	Low-frequency Flatness
3	High-frequency Flatness
4	Inner Load
5	Offset (output offset)
6	Frequency Accuracy

Note: To acquire higher calibration accuracy, pay attention to the following points during the calibration process.

- Perform the frequency accuracy calibration before performing the amplitude calibration.
- Perform the frequency accuracy calibration and amplitude calibration before performing the flatness calibrations (include the low-frequency flatness and high-frequency flatness).

- Perform the amplitude calibration before performing the inner load calibration or offset calibration.
- Perform the inner load calibration before performing the high-frequency flatness calibration.

2. Cal Point

Press this softkey and the specified calibration point in the ID column is highlighted (not applicable to the “Freq Accuracy” calibration item). At this point, you can rotate the knob to select the current calibration point.

Note: Users cannot set the current calibration point for the inner load calibration at will. For the detailed calibration method, refer to “**Inner Load Calibration**”.

3. Meas Val

Press this softkey after selecting a calibration point (not applicable to the “Freq Accuracy” calibration item). The MeasValue column of the corresponding point becomes editable. At this point, use the numeric keyboard or the knob and direction keys to input the measurement value.

4. Input Val

After selecting a calibration point and inputting the measurement value (not applicable to the “Freq Accuracy” calibration item), press this softkey to write the measurement value into the system and finish the calibration of the point selected.

5. Save

Press this softkey to save the current calibration data.

6. Default

Press this softkey to restore the calibration values to the factory calibration values.

The calibration method of each calibration item is introduced in detail in the following part of this chapter.



CAUTION

You are recommended to calibrate each item following the sequence below.

Frequency Accuracy Calibration

1. Make sure that DG1000Z has been warmed up for at least 30 minutes. Use a dual-BNC connecting wire to connect the channel output terminal of DG1000Z (take CH1 as an example, the calibration method is also applicable to CH2) and the signal input terminal of the frequency counter, as shown in the figure below.

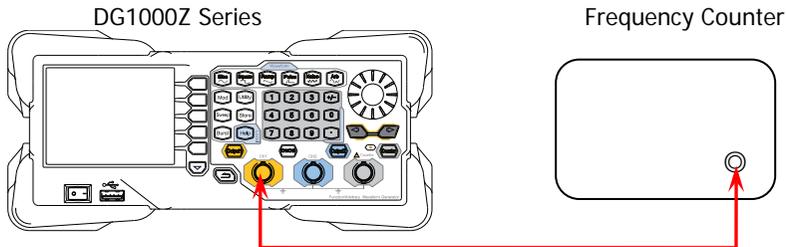


Figure 2-2 Connect DG1000Z and the Frequency Counter

2. Press **Output1** corresponding to CH1 on the front panel of DG1000Z to turn on the channel output.
3. Set the input impedance of the frequency counter to HighZ.
4. Enter the DG1000Z calibration interface and press **Cal Item** to select **Freq Accuracy**.
5. Press **Start** according to the prompt message on the calibration interface to start the frequency accuracy calibration (the calibration frequency is 10MHz).
6. Observe the measurement value of the frequency counter. If the current measurement value is less than 10MHz, press **UpWard Adjust** to increase the DG1000Z output frequency and if the current measurement value is greater than 10MHz, press **DnWard Adjust** to reduce the DG1000Z output frequency until the absolute value of the difference between the measurement value of the frequency counter and 10MHz is less than 1Hz.
7. Press **Save** and the frequency accuracy calibration is finished.

Amplitude (AC Amplitude) Calibration

1. Make sure that DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal of DG1000Z (take CH1 as an example, the calibration method is also applicable to CH2) and the voltage input terminals of the digital multimeter using a BNC-Dual banana plug connecting wire, as shown in the figure below.

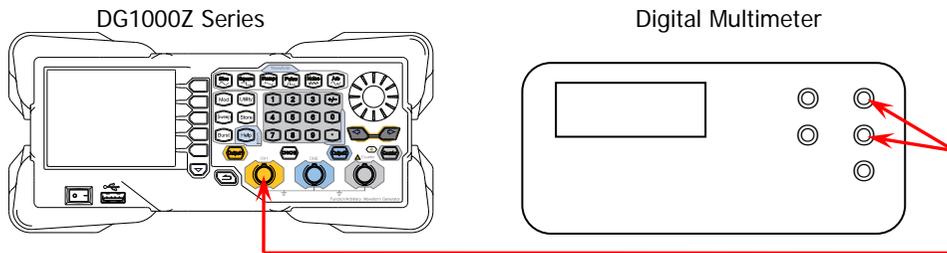


Figure 2-3 Connect DG1000Z and the Digital Multimeter

2. Press **Output1** corresponding to CH1 on the front panel of DG1000Z to turn on the channel output.
3. Turn on the digital multimeter, select the ACV measurement function and set the range to "Auto".
4. Enter the DG1000Z calibration interface and press **Cal Item** to select **Ampl** (the default calibration item).
5. Press **Cal Point** and the cursor switches to the first calibration point in the ID column.
6. Press **Meas Val** and the MeasValue column of the point selected becomes editable. At this point, use the numeric keyboard or the knob and direction keys to input the current measurement value of the digital multimeter.
7. Press **Input Val** to write the measurement value into the system and finish the calibration of the point selected. The cursor switches to the ID column.
8. Use the knob to select the next calibration point. Repeat steps 6 and 7 to measure the amplitude (AC amplitude) of this calibration point until finishing the calibration of all the calibration points.
9. Press **Save** and the amplitude (AC amplitude) calibration is finished.

Low-frequency Flatness Calibration

1. Make sure that DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal of DG1000Z (take CH1 as an example, the calibration method is also applicable to CH2) and the voltage input terminals of the digital multimeter using a BNC-Dual banana plug connecting wire, as shown in Figure 2-3.
2. Press **Output1** corresponding to CH1 on the front panel of DG1000Z to turn on the channel output.
3. Turn on the digital multimeter, select the ACV measurement function and set the range to "Auto".
4. Enter the DG1000Z calibration interface and press **Cal Item** to select **Low Freq Flat**.
5. Press **Cal Point** and the cursor switches to the first calibration point in the ID column.
6. Press **Meas Val** and the MeasValue column of the point selected becomes editable. At this point, use the numeric keyboard or the knob and direction keys to input the current measurement value of the digital multimeter.
7. Press **Input Val** to write the measurement value into the system and finish the calibration of the point selected. The cursor switches to the ID column.
8. Use the knob to select the next calibration point. Repeat steps 6 and 7 to measure the low-frequency flatness of this calibration point until finishing the calibration of all the calibration points.
9. Press **Save** and the low-frequency flatness calibration is finished.

Offset (Output Offset) Calibration

1. Make sure that DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal of DG1000Z (take CH1 as an example, the calibration method is also applicable to CH2) and the voltage input terminals of the digital multimeter using a BNC-Dual banana plug connecting wire, as shown in Figure 2-3.
2. Press **Output1** corresponding to CH1 on the front panel of DG1000Z to turn on the channel output.
3. Turn on the digital multimeter, select the DCV measurement function and set the range to "Auto".
4. Enter the DG1000Z calibration interface and press **Cal Item** to select **Offset**.
5. Press **Cal Point** and the cursor switches to the first calibration point in the ID column.
6. Press **Meas Val** and the MeasValue column of the point selected becomes editable. At this point, use the numeric keyboard or the knob and direction keys to input the current measurement value of the digital multimeter.
7. Press **Input Val** to write the measurement value into the system and finish the calibration of the point selected. The cursor switches to the ID column.
8. Use the knob to select the next calibration point. Repeat steps 6 and 7 to measure the offset of this calibration point until finishing the calibration of all the calibration points.
9. Press **Save** and the offset (output offset) calibration is finished.

Inner Load Calibration

1. Make sure that DG1000Z has been warmed up for at least 30 minutes. Connect the channel output terminal of DG1000Z (take CH1 as an example, the calibration method is also applicable to CH2) and the voltage input terminals of the digital multimeter using a BNC-Dual banana plug connecting wire, as shown in Figure 2-3.
2. Press **Output1** corresponding to CH1 on the front panel of DG1000Z to turn on the channel output.
3. Turn on the digital multimeter, select the ACV measurement function and set the range to "Auto".
4. Enter the DG1000Z calibration interface and press **Cal Item** to select **Inner Load**.
5. Press **Cal Point** and the cursor switches to the first calibration point in the ID column.
6. You need to calibrate each calibration point twice (otherwise, you cannot select the next calibration point).
 - a) Calibration without 50Ω load:
Press **Meas Val** and the MeasValue column of the point selected becomes editable. At this point, use the numeric keyboard or the knob and direction keys to input the current measurement value of the digital multimeter. Press **Input Val** to write the measurement value into the system. At this point, "Please connect 50 ohm load." is displayed on the instrument screen and the cursor switches to the ID column. Please connect a 50Ω load between DG1000Z and the digital multimeter, as shown in the figure below.

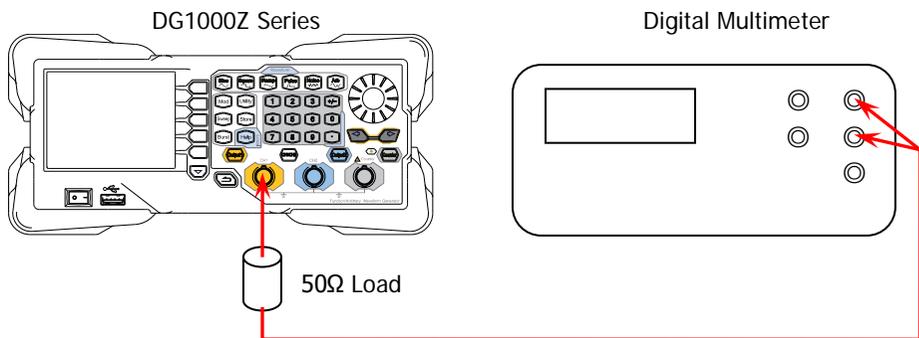


Figure 2-4 Connect DG1000Z and the Digital Multimeter via a 50Ω Load

- b) Calibration with 50Ω load:
Press **Meas Val** and the MeasValue column of the point selected becomes editable. At this point, use the numeric keyboard or the knob and direction keys to input the current measurement value of the digital multimeter. Press **Input Val** to write the measurement value into the system. At this point, "Please remove the 50 ohm load." is displayed on the instrument screen and the cursor switches to the ID column. Please remove the 50Ω load between DG1000Z and the digital multimeter and connect DG1000Z and the digital multimeter according to Figure 2-3.
7. Use the knob to select the next calibration point. Repeat step 6 to measure the inner load of this calibration point until finishing the calibration of all the calibration points.
8. Press **Save** and the inner load calibration is finished.

High-frequency Flatness Calibration

1. Make sure that DG1000Z has been warmed up for at least 30 minutes. Connect the power meter and power sensor; then connect the power sensor to the output terminal of DG1000Z (take CH1 as an example, the calibration method is also applicable to CH2), as shown in the figure below.

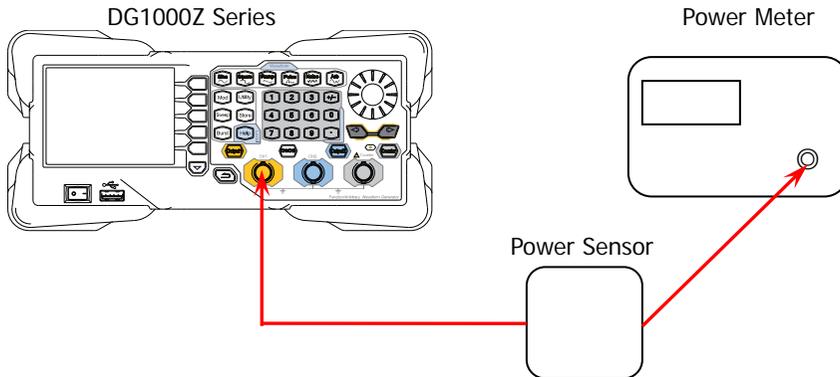


Figure 2-5 Connect G1000Z and the Power Meter

2. Press **Output1** corresponding to CH1 on the front panel of DG1000Z to turn on the channel output.
3. Turn on the power meter.
4. Enter the DG1000Z calibration interface and press **Cal Item** to select **High Freq Flat**.
5. Press **Cal Point** and the cursor switches to the first calibration point in the ID column.
6. The frequency of the first calibration point is 100kHz. Please set a proper frequency calibration factor on the power meter according to the ratio of the power sensor.
7. Press **Meas Val** and the MeasValue column of the point selected becomes editable. At this point, use the numeric keyboard or the knob and direction keys to input the current measurement value of the power meter.
8. Press **Input Val** to write the measurement value into the system and finish the calibration of the point selected. The cursor switches to the ID column.

9. Use the knob to select the next calibration point (for each calibration point, set a proper frequency calibration factor on the power meter). Repeat steps 7 and 8 to measure the high-frequency flatness of this calibration point until finishing the calibration of all the calibration points.
10. Press **Save** and the high-frequency flatness calibration is finished.