RIGOL

Calibration Guide

DG1000 Series Dual-Channel Function/Arbitrary Waveform Generator

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Document Overview

This manual guides users to correctly calibrate **RIGOL** DG1000 series dual-channel function/arbitrary waveform generator.

Main topics in this manual:

- Calibration Instruction
- Testing Devices and Notice
- Calibration Process
- To Save the Calibration Data
- To Restore Initial Calibration Value
- Calibration Prompting Messages

Format Conventions in this Manual:

Front Panel Key: denoted by "Text Box + Key Name (Bold)", for example, **Utility**.
Menu Softkey: denoted by "Character Shading + Menu Word (Bold)", for example, **I/O**.
Operation Step: denoted by an arrow "→", for example, **Utility** → **I/O**.

Content Conventions in this Manual:

DG1000 series dual-channel function/arbitrary waveform generator includes two models (DG1022 and DG1022A). The introductions in this manual are applicable to all the models of the DG1000 series unless otherwise noted.

Model	Channels	Max. Frequency	Sample Rate
DG1022	2	20 MHz	100 MSa/s
DG1022A	2	25 MHz	100 MSa/s

Contents

Chapter 1 Calibration Instruction

1.1 Calibration Time Interval

Regular calibration should be performed on your instrument according to your measurement accuracy requirement. A one-year calibration time interval can fulfill most of your applications; a calibration time interval longer than one year can not ensure the accuracy.

1.2 Recommended Adjustments

No matter how long is your calibration time interval, **RIGOL** recommends that you perform complete readjustment within the calibration time limit, which can ensure the performance of the signal generator until the next calibration.

1.3 Calibration Time

The signal generator can perform auto calibration under the control of the PC. A complete calibration and verification test under the control of the PC takes about 30 minutes if the instrument has already been warmed up (refer to "**Testing Notice**"). It takes about 2.5 hours if you use the recommended testing instruments to adjust the instrument manually. Note that this manual only introduces manual calibration.

1.4 Calibration Security

The calibration password is used to prevent accidental and unauthorized calibration of the signal generator. The instrument is encrypted when you use it for the first time and you need to enter the correct password to decrypt the signal generator to perform calibration.

Press **Utility** → **Test/Cal** → **PassWd** to input the correct password and the system displays "**The instrument now is UNSECURED**". At this point, **SecOn** switches to **SecOff** as shown in the figure below.

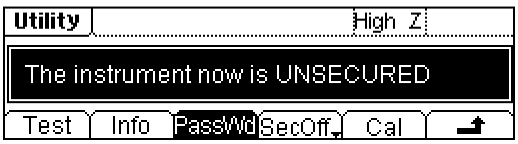

Figure 1-1 Input the Calibration Password

The password is set to “12345” when the signal generator is deliveried from the factory. This password is stored in the non-volatile memory and will not change at power-off or after remote interface reset.

1.5 Basic Calibration/Adjustment Procedures

The recommended procedures of instrument calibration are presented below. This is only a general description of a complete calibration and detailed operations will be presented in “**Calibration Process**”.

1. Read the “**Testing Notice**”.

2. Decrypt the signal generator (refer to “**Calibration Security**”).

3. Press **Test/Cal** (refer to Figure 1-1) to enter the calibration starting menu.

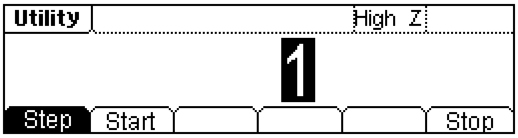

Figure 1-2 Calibration Starting

Table 1-1 Calibration Starting Menu

Menu	Description
Step	Select the step of the calibration operation to be performed.
Start	Start to perform the calibration step.
Stop	Stop the calibration step and return to the previous menu.

4. Select **Step** and use the knob or keyboard to input the calibration step (refer to Table 3-1) and the default is “1”. If only the specified N step of the calibration is needed, input the desired calibration step.

5. Select **Start** to open the calibration parameter setting menu.

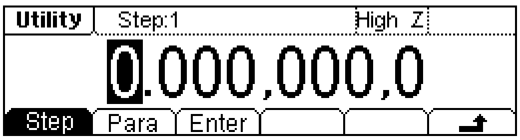

Figure 1-3 Calibration Parameter Setting

Table 1-2 Calibration Parameter Setting Menu

Menu	Description
Step	Select the step of the calibration operation to be performed.
Para	Press this key and input the measured value.
Enter	Finish the value input of the current step and enter the next step.

6. The signal generator displays the parameters currently need to be calibrated together with their default output signal values. To finish a step of calibration, you only need to read the reading on the testing instrument and press **Para** to input the reading. Then, the signal generator will adjust automatically.

7. Press **Enter** and the instrument enters the next calibration step automatically.

Tip

Select ⮥ in the "Calibration Parameter Setting" menu to cancel the current calibration. Select **Stop** in the "Calibration Starting" menu to stop the calibration. The instrument will be encrypted automatically after the calibration finishes.

1.6 To Stop the Calibration

You may need to stop the calibration during the calibration process. Thus you can power off the instrument or press any of the other function keys at the panel to stop the calibration at any time.

You need to perform the calibration again if the instrument is powered off during the calibration. The calibration data will be stored in the internal memory if you press any of the other function keys to stop the calibration and you can re-enter the calibration interface to execute other calibration steps. The signal generator will store the calibration constants to the Flash only after you execute the "**To Save the Calibration Data**" operation.

Notice

If you stop the calibration when the signal generator is writing the calibration constant to the Flash, you may lost all the calibration constants and you need to perform all the calibrations again.

Chapter 2 Testing Devices and Notice

2.1 Testing Devices

The testing devices recommended to be used to perform the calibration are as shown in the table below. If you do not have the specified device, please use alternative testing devices with the same accuracy.

Table 2-1 Recommended Testing Devices

Device	**Specifications**	**Recommended Model**	**Usage[1]**
Oscilloscope	Bandwidth: 200 MHz Sample Rate: 2 GSa/s	**RIGOL** DS2000A	P, T
Digital Multimeter (DMM)	AC Volts (True-RMS, AC Coupled) Accuracy: ±0.06% (300 kHz) DC Volts Accuracy: 0.0015% Resistance Accuracy: 0.002%	**RIGOL** DM3068	P, T
Frequency Counter	Accuracy: 0.1 ppm	Agilent 53131A	P, T
Power Meter	Absolute Accuracy: ±0.02dB (log) or ±0.5% (linear) Relative Accuracy: ±0.04dB (log) or ±1.0% (linear)	Agilent E4418B	P, T

Note[1]: P = Performance Verification, T = Troubleshooting.

2.2 Testing Notice

To get the optimum effect, all the test steps must comply with the following advices:

1. Make sure the temperature of the environment is between 18℃ and 28℃. The calibration should be performed in 23℃±1℃ in ideal situation.
2. Make sure the relative humidity of the environment is lower than 80%.
3. Make sure the instrument has been working continuously for 1 hour.
4. The cable used in the test should be as short as possible and the impedance of the cable should meet the requirement.
5. Only use RG-58 or similar 50 Ω cables.

Chapter 3 Calibration Process

The calibration process contains 17 items (3.1 to 3.17). When the calibration begins, you must calibrate each item in sequence from 3.1 to 3.17 but you can start to calibrate from any steps in a single item.

Table 3-1 Calibration Steps Preview

Channel	Calibration Steps (DG1022)	Calibration Steps (DG1022A)	Name of the Calibration Items
CH1&CH2	1	1	Self-test
	2～3	2～3	Frequency (Internal Timebase) Adjustment
CH1	4～22	4～22	AC Amplitude (High-impedance) Adjustment
	23～35	23～35	Offset DAC
	36～57	36～57	Low Frequency Flatness Adjustment
	58～79	58～79	Output Impedance Adjustment
	80～89	80～91	0 dB Output Flatness Adjustment
	90～99	92～103	+10 dB Output Flatness Adjustment
	100～109	104～115	+20 dB Output Flatness Adjustment
CH2	304～319	304～319	AC Amplitude (High-impedance) Adjustment
	323～333	323～333	Offset DAC
	336～350	336～350	Low Frequency Flatness Adjustment
	355～373	355～373	Output Impedance Adjustment
	380～389	380～391	0 dB Output Flatness Adjustment
	390～399	392～403	+10 dB Output Flatness Adjustment
CH1&CH2	280～281	280～281	Frequency (External Timebase) Adjustment
	285～293	285～293	Phase Adjustment
	254	254	To Save the Calibration Data
	255	255	To Restore the Initial Calibration Value

3.1 Self-test

The first step of the calibration is self-test which is used to check whether the signal generator is working normally.

1. Press **Utility** → **Test/Cal** → **PassWd** and enter the password to decrypt the instrument. Then, press **Cal** → **Start** to perform the calibration from the first step.

   Table 3-2 Self-test Step

Step	Description
1	Perform self-test. The main output is disabled automatically during the self-test.

2. To continue the calibration, the instrument must be repaired if the self-test of the signal generator fails.

3.2 Frequency (Internal Timebase) Adjustment

The signal generator stores a frequency calibration constant to make sure that the output is 10 MHz.

1. Connect the frequency counter and the signal generator as shown in the figure below. Set the scale accuracy of the frequency counter to 0.1 ppm and its input impedance to 50 Ω (connect an external 50 Ω terminal if your frequency counter does not have a 50 Ω input impedance).

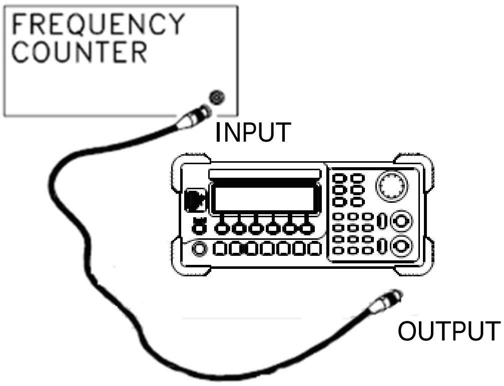

Figure 3-1 Frequency (Internal Timebase) Adjustment Connection

2. Use the frequency counter to measure the frequency of the output signal.

3. According to the steps in the table below, press **Para** and use the keyboard on the panel to input the measurement value in step 2.

Table 3-3 Frequency (Internal Timebase) Adjustment Steps

Expected Value			**Description**
Step	Frequency	Amplitude	
2	<10 MHz	1 Vpp	Output frequency is slightly less than 10 MHz (e.g. 9,999,945.73 Hz)
3[1]	ENDSTEP_CAL_FREQ (Frequency adjustment finishes)		

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.3 CH1 AC Amplitude Adjustment

1. Connect the DMM and the signal generator as shown in the figure below.

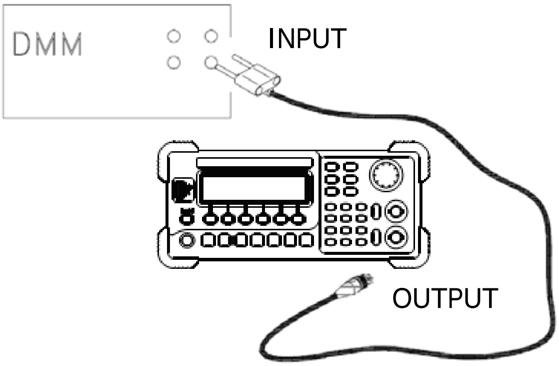

Figure 3-2 AC Amplitude Adjustment Connection

2. Use the DMM to measure the AC voltage output from the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-4 AC Amplitude Adjustment Steps

Expected Value			**Description**
Step	AC Voltage	Output Impedance	
4	0.021 Vpp (0.0074 Vrms)	HighZ	-30 dB output range
5	0.038 Vpp (0.0134 Vrms)	HighZ	-30 dB output range
6	0.055 Vpp (0.0194 Vrms)	HighZ	-30 dB output range
7	0.070 Vpp (0.0248 Vrms)	HighZ	-30 dB output range
8	0.13 Vpp (0.046 Vrms)	HighZ	-30 dB output range
9	0.19 Vpp (0.0672 Vrms)	HighZ	-30 dB output range
10	0.21 Vpp (0.0743 Vrms)	HighZ	-10 dB output range
11	0.40 Vpp (0.1414 Vrms)	HighZ	-10 dB output range
12	0.59 Vpp (0.2086 Vrms)	HighZ	-10 dB output range
13	0.61 Vpp (0.2157 Vrms)	HighZ	0 dB output range
14	1.26 Vpp (0.4455 Vrms)	HighZ	0 dB output range
15	1.9 Vpp (0.6719 Vrms)	HighZ	0 dB output range
16	2.1 Vpp (0.7426 Vrms)	HighZ	+10 dB output range
17	4 Vpp (1.414 Vrms)	HighZ	+10 dB output range
18	5.9 Vpp (2.086 Vrms)	HighZ	+10 dB output range
19	6.5 Vpp (2.298 Vrms)	HighZ	+20 dB output range
20	13.2 Vpp (4.667 Vrms)	HighZ	+20 dB output range

21	19.9 Vpp (7.036 Vrms)	HighZ	+20 dB output range
22[1]	ENDSTEP_CAL_ACAMPLITUDE (AC amplitude adjustment finishes)		

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.4 CH1 Offset DAC

Offset DAC is used to calibrate the DC offset of the main DAC output and needs to calibrate all the attenuation channels with high output impedance. The offset coefficient is obtained through two measurements (first measure the positive level output from the DAC and then measure the negative level output from the DAC). Thus, such testing steps always appear in pairs.

1. Connect the DMM and the signal generator as shown in the figure below.

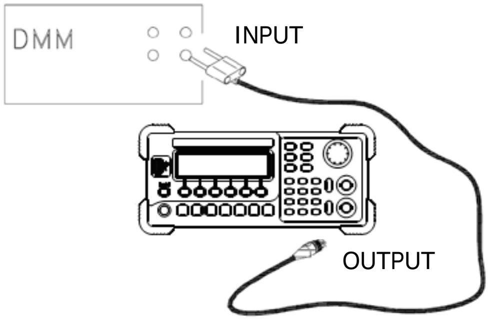

Figure 3-3 Offset DAC Connection

2. Use the DMM to measure the DC voltage output from the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-5 Offset DAC Steps

Expected Value			**Description**
Step	DC Voltage	Output Impedance	
23	+0.025 V	HighZ	-30 dB output range
24	-0.025 V	HighZ	-30 dB output range
25	+0.0625 V	HighZ	-20 dB output range
26	-0.0625 V	HighZ	-20 dB output range
27	+0.25 V	HighZ	-10 dB output range
28	-0.25 V	HighZ	-10 dB output range
29	+0.625 V	HighZ	0 dB output range
30	-0.625 V	HighZ	0 dB output range
31	+2.5 V	HighZ	+10 dB output range
32	-2.5 V	HighZ	+10 dB output range
33	+6.25 V	HighZ	+20 dB output range
34	-6.25 V	HighZ	+20 dB output range
35[1]	ENDSTEP_CAL_OFFSETDAC (Offset DAC finishes)		

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.5 CH1 Low Frequency Flatness Adjustment

Low frequency flatness adjustment is used to adjust the 3 attenuation channels (using elliptical filter, with low passband ripples, applicable to Sine and Square) and the other two amplification channels (using linear phase filter, applicable to Ramp, Noise and arbitrary waveforms) of the signal generator.

1. Connect the DMM and the signal generator as shown in the figure below. Set the DMM to measure the Vrms voltage value.

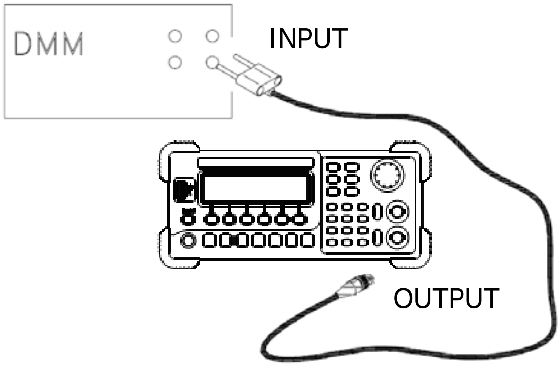

Figure 3-4 Low Frequency Flatness Adjustment Connection

2. Use the DMM to measure the Sine waveform output from the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-6 Low Frequency Flatness Adjustment Steps

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
36	Sine	HighZ	1 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
37	Sine	HighZ	100 Hz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
38	Sine	HighZ	10 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
39	Sine	HighZ	30 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
40	Sine	HighZ	60 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
41	Sine	HighZ	80 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter

42	Sine	HighZ	100 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
43	Sine	HighZ	1 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
44	Sine	HighZ	100 Hz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
45	Sine	HighZ	10 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
46	Sine	HighZ	30 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
47	Sine	HighZ	60 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
48	Sine	HighZ	80 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
49	Sine	HighZ	100 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
50	Sine	HighZ	1 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
51	Sine	HighZ	100 Hz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
52	Sine	HighZ	10 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
53	Sine	HighZ	30 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
54	Sine	HighZ	60 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
55	Sine	HighZ	80 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
56	Sine	HighZ	100 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
57[1]	ENDSTEP_CAL_LOWFREQFLAT (Low frequency flatness adjustment finishes)				

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.6 CH1 Output Impedance Adjustment

Output impedance adjustment is used to adjust the output impedance. The measurement of the output impedance constant uses the distortion filter of the signal generator and all the six attenuation/amplification channels of the signal generator.

1. Set the DMM to use AC voltage for measurement. The (CH1) output terminal of the signal generator is connected to the AC voltage intput terminal of the DMM via a 50 Ω impedance adapter. The connecting method is as shown in the figure below.

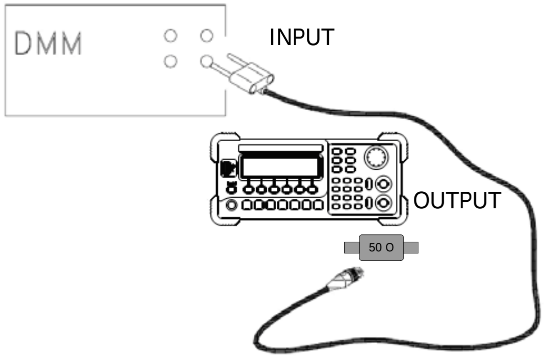

Figure 3-5 Output Impedance Adjustment Connection

2. Use the DMM to measure the output voltage of the signal generator according to each of the output measurements in Table 3-7. The internal resistance of the signal generator is obtained indirectly through the voltage measurement and the expected measurement value should be 50 Ω.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-7 Output Impedance Adjustment Steps

Step	Expected Value	Description (Signal Generator Output)
58	50 Ω	0.038 Vpp (0.0134 Vrms)
59	50 Ω	0.125 Vpp (0.0442 Vrms)
60	50 Ω	0.375 Vpp (0.1326 Vrms)
61	50 Ω	1 Vpp (0. 3536 Vrms)
62	50 Ω	1.5 Vpp (0. 5304 Vrms)
63	50 Ω	3 Vpp (1.060 Vrms)
64	50 Ω	4.5 Vpp (1.591 Vrms)
65	50 Ω	6.5 Vpp (2.298 Vrms)
66	50 Ω	11 Vpp (3.889 Vrms)

67	50 Ω	0 Vpp (0 Vrms)
68	50 Ω	17 Vpp (6.011 Vrms)
69	50 Ω	8.5 Vpp (3.005 Vrms)
70	50 Ω	5.5 Vpp (1.944 Vrms)
71	50 Ω	3.25 Vpp (1.149 Vrms)
72	50 Ω	2.25 Vpp (0.7956 Vrms)
73	50 Ω	1.5 Vpp (0.5304 Vrms)
74	50 Ω	0.75 Vpp (0.2652 Vrms)
75	50 Ω	0.5 Vpp (0.1768 Vrms)
76	50 Ω	0.187 Vpp (0.0661 Vrms)
77	50 Ω	0.0625 Vpp (0.0221 Vrms)
78	50 Ω	0.019 Vpp (0.0067 Vrms)
79[1]	ENDSTEP_CAL_IMPENDANCE (Output impedance adjustment finishes)	

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.7 CH1 0 dB Output Flatness Adjustment

1. Connect the power meter and the signal generator as shown in the figure below. Set the output impedance of the signal generator to 50 Ω.

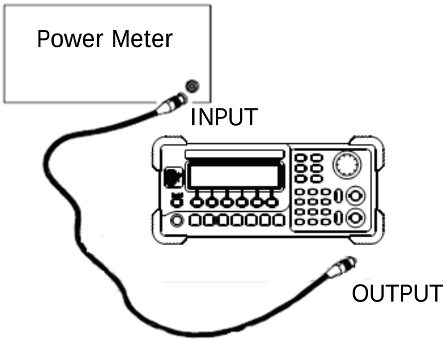

Figure 3-6 Output Flatness Adjustment Connection

2. Use the power meter to measure the amplitude (dBm) value of the output signal of the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-8 0 dB Output Flatness Adjustment Steps (DG1022)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
80	Sine	50 Ω	100 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
81	Sine	50 Ω	500 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
82	Sine	50 Ω	1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
83	Sine	50 Ω	5 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
84	Sine	50 Ω	10.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
85	Sine	50 Ω	11.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
86	Sine	50 Ω	15.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
87	Sine	50 Ω	18.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter

88	Sine	50 Ω	20.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
89[1]	ENDSTEP_CAL_0dBFLAT (0 dB output flatness adjustment finishes)				

Table 3-9 0 dB Output Flatness Adjustment Steps (DG1022A)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
80	Sine	50 Ω	100 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
81	Sine	50 Ω	500 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
82	Sine	50 Ω	1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
83	Sine	50 Ω	5 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
84	Sine	50 Ω	10.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
85	Sine	50 Ω	11.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
86	Sine	50 Ω	15.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
87	Sine	50 Ω	18.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
88	Sine	50 Ω	20.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
89	Sine	50 Ω	23.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
90	Sine	50 Ω	25.0 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
91[1]	ENDSTEP_CAL_0dBFLAT (0 dB output flatness adjustment finishes)				

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.8 CH1 +10 dB Output Flatness Adjustment

1. Connect the power meter and the signal generator as shown in Figure 3-6. Set the output impedance of the signal generator to 50 Ω.

2. Use the power meter to measure the amplitude (dBm) value of the output signal of the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-10 +10 dB Output Flatness Adjustment Steps (DG1022)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
90	Sine	50 Ω	100 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
91	Sine	50 Ω	500 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
92	Sine	50 Ω	1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
93	Sine	50 Ω	5 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
94	Sine	50 Ω	10.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
95	Sine	50 Ω	11.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
96	Sine	50 Ω	15.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
97	Sine	50 Ω	18.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
98	Sine	50 Ω	20.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
99[1]	ENDSTEP_CAL_10dBFLAT (+10 dB output flatness adjustment finishes)				

Table 3-11 +10 dB Output Flatness Adjustment Steps (DG1022A)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
92	Sine	50 Ω	100 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
93	Sine	50 Ω	500 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
94	Sine	50 Ω	1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter

95	Sine	50 Ω	5 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
96	Sine	50 Ω	10.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
97	Sine	50 Ω	11.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
98	Sine	50 Ω	15.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
99	Sine	50 Ω	18.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
100	Sine	50 Ω	20.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
101	Sine	50 Ω	23.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
102	Sine	50 Ω	25.0 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
103[1]	ENDSTEP_CAL_10dBFLAT (+10 dB output flatness adjustment finishes)				

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.9 CH1 +20 dB Output Flatness Adjustment

1. Connect the power meter and the signal generator as shown in Figure 3-6. Set the output impedance of the signal generator to 50 Ω.

2. Use the power meter to measure the amplitude (dBm) value of the output signal of the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-12 +20 dB Output Flatness Adjustment Steps (DG1022)

Output signal of the signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
100	Sine	50 Ω	100 kHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
101	Sine	50 Ω	500 kHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
102	Sine	50 Ω	1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
103	Sine	50 Ω	5 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
104	Sine	50 Ω	10.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
105	Sine	50 Ω	11.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
106	Sine	50 Ω	15.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
107	Sine	50 Ω	18.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
108	Sine	50 Ω	20.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
109[1]	ENDSTEP_CAL_20dBFLAT (+20 dB output flatness adjustment finishes)				

Table 3-13 +20 dB Output Flatness Adjustment Steps (DG1022A)

Output signal of the signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
104	Sine	50 Ω	100 kHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
105	Sine	50 Ω	500 kHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
106	Sine	50 Ω	1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter

107	Sine	50 Ω	5 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
108	Sine	50 Ω	10.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
109	Sine	50 Ω	11.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
110	Sine	50 Ω	15.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
111	Sine	50 Ω	18.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
112	Sine	50 Ω	20.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
113	Sine	50 Ω	23.1 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
114	Sine	50 Ω	25.0 MHz	17.96 dBm	Flatness for 20 dB, Linear Phase Filter
115[1]	ENDSTEP_CAL_20dBFLAT (+20 dB output flatness adjustment finishes)				

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.10 CH2 AC Amplitude Adjustment

1. Connect the DMM and the signal generator as shown in the figure below.

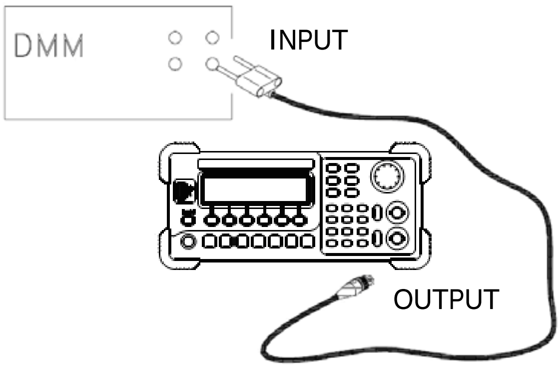

Figure 3-7 AC Amplitude Adjustment Connection

2. Use the DMM to measure the AC voltage output from the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-14 AC Amplitude Adjustment Steps

Expected Value			**Description**
Step	AC Voltage	Output Impedance	
304	0.021 Vpp (0.0074 Vrms)	HighZ	-30 dB output range
305	0.038 Vpp (0.0134 Vrms)	HighZ	-30 dB output range
306	0.055 Vpp (0.0194 Vrms)	HighZ	-30 dB output range
307	0.070 Vpp (0.0248 Vrms)	HighZ	-20 dB output range
308	0.13 Vpp (0.046 Vrms)	HighZ	-20 dB output range
309	0.19 Vpp (0.0672 Vrms)	HighZ	-20 dB output range
310	0.21 Vpp (0.0743 Vrms)	HighZ	-10 dB output range
311	0.40 Vpp (0.1414 Vrms)	HighZ	-10 dB output range
312	0.59 Vpp (0.2086 Vrms)	HighZ	-10 dB output range
313	0.61 Vpp (0.2157 Vrms)	HighZ	0 dB output range
314	1.26 Vpp (0.4455 Vrms)	HighZ	0 dB output range
315	1.9 Vpp (0.6719 Vrms)	HighZ	0 dB output range
316	2.1 Vpp (0.7426 Vrms)	HighZ	+10 dB output range
317	4 Vpp (1.414 Vrms)	HighZ	+10 dB output range
318	5.9 Vpp (2.086 Vrms)	HighZ	+10 dB output range
319[1]	ENDSTEP_CAL_ACAMPLITUDE (AC amplitude adjustment finishes)		

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.11 CH2 Offset DAC

Offset DAC is used to calibrate the DC offset of the main DAC output and needs to calibrate all the attenuation channels with high output impedance. The offset coefficient is obtained through two measurements (first measure the positive level output from the DAC and then measure the negative level output from the DAC). Thus, such testing steps always appear in pairs.

1. Connect the DMM and the signal generator as shown in the figure below.

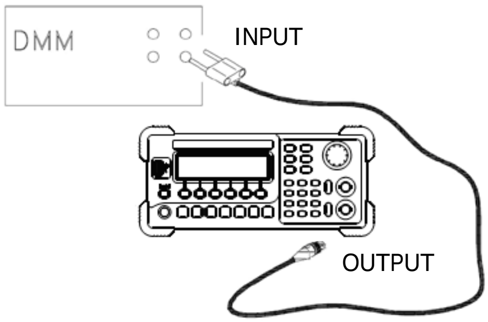

Figure 3-8 Offset DAC Connection

2. Use the DMM to measure the DC voltage output from the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-15 Offset DAC Steps

Expected Value			**Description**
Step	DC Level	Output Impedance	
323	+0.025 V	HighZ	-30 dB output range
324	-0.025 V	HighZ	-30 dB output range
325	+0.0625 V	HighZ	-20 dB output range
326	-0.0625 V	HighZ	-20 dB output range
327	+0.25 V	HighZ	-10 dB output range
328	-0.25 V	HighZ	-10 dB output range
329	+0.625 V	HighZ	0 dB output range
330	-0.625 V	HighZ	0 dB output range
331	+2.5 V	HighZ	+10 dB output range
332	-2.5 V	HighZ	+10 dB output range
333[1]	ENDSTEP_CAL_OFFSETDAC (Offset DAC finishes)		

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.12 CH2 Low Frequency Flatness Adjustment

Low frequency flatness adjustment is used to adjust the 3 attenuation channels (using elliptical filter, with low passband ripples, applicable to Sine and Square) and the other two amplification channels (using linear phase filter, applicable to Ramp, Noise and arbitrary waveforms) of the signal generator.

1. Connect the DMM and the signal generator as shown in the figure below. Set the DMM to measure the Vrms voltage value.

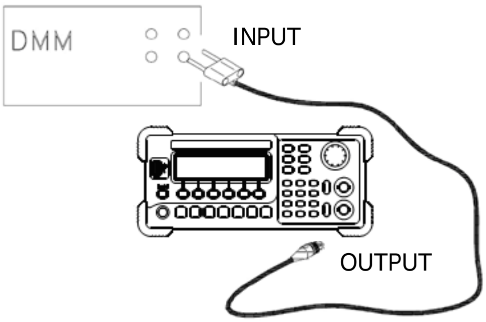

Figure 3-9 Low Frequency Flatness Adjustment Connection

2. Use the DMM to measure the Sine waveform output from the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-16 Low Frequency Flatness Adjustment Steps

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
336	Sine	HighZ	1 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
337	Sine	HighZ	100 Hz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
338	Sine	HighZ	10 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
339	Sine	HighZ	30 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
340	Sine	HighZ	60 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
341	Sine	HighZ	80 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
342	Sine	HighZ	100 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter

343	Sine	HighZ	1 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
344	Sine	HighZ	100 Hz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
345	Sine	HighZ	10 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
346	Sine	HighZ	30 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
347	Sine	HighZ	60 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
348	Sine	HighZ	80 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
349	Sine	HighZ	100 kHz	1.7 Vrms	Flatness for +10 dB, Linear Phase Filter
350[1]	ENDSTEP_CAL_LOWFREQFLAT (Low frequency flatness adjustment finishes)				

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.13 CH2 Output Impedance Adjustment

Output impedance adjustment is used to adjust the output impedance. The measurement of the output impedance constant uses the distortion filter and all the six attenuation/amplification channels of the signal generator.

1. Set the DMM to use AC voltage for measurement. The (CH2) output terminal of the signal generator is connected to the AC voltage intput terminal of the DMM via a 50 Ω impedance adapter. The connecting method is as shown in the figure below.

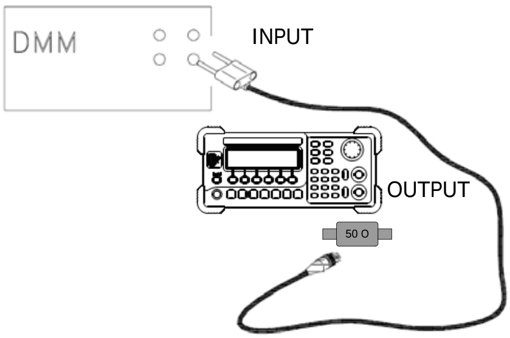

Figure 3-10 Output Impedance Adjustment Connection

2. Use the DMM to measure the output voltage of the signal generator according to each of the output measurements in Table 3-17. The internal resistance of the signal generator is obtained indirectly through the voltage measurement and the expected measurement value should be 50 Ω.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-17 Output Impedance Adjustment Steps

Step	Expected Value	Description (Signal Generator Output)
355	50 Ω	0.038 Vpp (0.0134 Vrms)
356	50 Ω	0.125 Vpp (0.0442 Vrms)
357	50 Ω	0.375 Vpp (0.1326 Vrms)
358	50 Ω	1 Vpp (0.3536 Vrms)
359	50 Ω	1.5 Vpp (0.5304 Vrms)
360	50 Ω	3 Vpp (1.060 Vrms)
361	50 Ω	4.5 Vpp (1.591 Vrms)
362	50 Ω	0 Vpp (0 Vrms)
363	50 Ω	2.25 Vpp (0.7956 Vrms)
364	50 Ω	1.5 Vpp (0.5304 Vrms)

365	50 Ω	0.75 Vpp (0.2652 Vrms)
366	50 Ω	0.5 Vpp (0.1768 Vrms)
367	50 Ω	0.187 Vpp (0.0661 Vrms)
368	50 Ω	0.0625 Vpp (0.0221 Vrms)
369	50 Ω	0.019 Vpp (0.0067 Vrms)
370	50 Ω	0 Vpp (0 Vrms)
371	50 Ω	2 Vpp (0.7072 Vrms)
372	50 Ω	2 Vpp (0.7072 Vrms)
373[1]	ENDSTEP_CAL_IMPENDANCE (Output impedance adjustment finishes)	

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.14 CH2 0 dB Output Flatness Adjustment

1. Connect the power meter and the signal generator as shown in the figure below. Set the output impedance of the signal generator to 50 Ω.

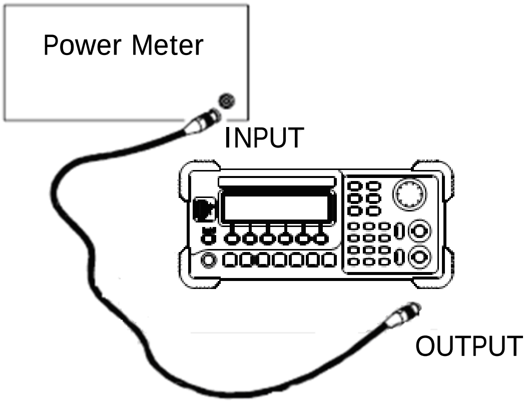

Figure 3-11 Output Flatness Adjustment Connection

2. Use the power meter to measure the amplitude (dBm) value of the output signal of the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-18 0 dB Output Flatness Adjustment Steps (DG1022)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
380	Sine	50 Ω	100 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
381	Sine	50 Ω	500 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
382	Sine	50 Ω	1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
383	Sine	50 Ω	5 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
384	Sine	50 Ω	10.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
385	Sine	50 Ω	11.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
386	Sine	50 Ω	15.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter

387	Sine	50 Ω	18.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
388	Sine	50 Ω	20.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
389[1]	ENDSTEP_CAL_ 0dBFLAT (0 dB output flatness adjustment finishes)				

Table 3-19 0 dB Output Flatness Adjustment Steps (DG1022A)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
380	Sine	50 Ω	100 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
381	Sine	50 Ω	500 kHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
382	Sine	50 Ω	1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
383	Sine	50 Ω	5 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
384	Sine	50 Ω	10.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
385	Sine	50 Ω	11.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
386	Sine	50 Ω	15.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
387	Sine	50 Ω	18.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
388	Sine	50 Ω	20.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
389	Sine	50 Ω	23.1 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
390	Sine	50 Ω	25.0 MHz	2 dBm	Flatness for 0 dB, Linear Phase Filter
391[1]	ENDSTEP_CAL_ 0dBFLAT (0 dB output flatness adjustment finishes)				

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.15 CH2 +10 dB Output Flatness Adjustment

1. Connect the power meter and the signal generator as shown in Figure 3-11. Set the output impedance of the signal generator to 50 Ω.

2. Use the power meter to measure the amplitude (dBm) value of the output signal of the signal generator.

3. Perform the measurements in sequence according to the steps in the table below, and select **Para** to input the measurement value at each step.

Table 3-20 +10 dB Output Flatness Adjustment Steps (DG1022)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
390	Sine	50 Ω	100 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
391	Sine	50 Ω	500 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
392	Sine	50 Ω	1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
393	Sine	50 Ω	5 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
394	Sine	50 Ω	10.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
395	Sine	50 Ω	11.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
396	Sine	50 Ω	15.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
397	Sine	50 Ω	18.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
398	Sine	50 Ω	20.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
399[1]	ENDSTEP_CAL_10dBFLAT (+10 dB output flatness adjustment finishes)				

Table 3-21 +10 dB Output Flatness Adjustment Steps (DG1022A)

Output Signal of the Signal Generator					**Description**
Step	Type	Output	Frequency	Amplitude	
392	Sine	50 Ω	100 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
393	Sine	50 Ω	500 kHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
394	Sine	50 Ω	1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter

395	Sine	50 Ω	5 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
396	Sine	50 Ω	10.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
397	Sine	50 Ω	11.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
398	Sine	50 Ω	15.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
399	Sine	50 Ω	18.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
400	Sine	50 Ω	20.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
401	Sine	50 Ω	23.1 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
402	Sine	50 Ω	25.0 MHz	12 dBm	Flatness for 10 dB, Linear Phase Filter
403[1]	ENDSTEP_CAL_10dBFLAT (+10 dB output flatness adjustment finishes)				

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.16 Frequency (External Timebase) Adjustment

1. Set the scale accuracy of the frequency counter to 0.1 ppm and its input impedance to 50 Ω (if your frequency counter does not have a 50 Ω input impedance, you need to connect an external 50 Ω terminal). The connecting method is as shown in the figure below. Connect the 10 MHz Out of the frequency counter with the 10 MHz In of the signal generator and the output terminal of the signal generator with the input terminal of the frequency counter.

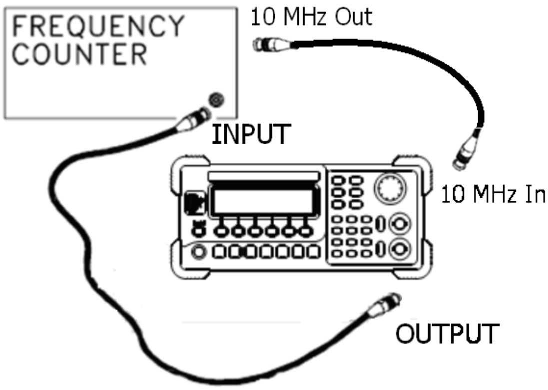

Figure 3-12 Frequency (External Timebase) Adjustment Connection

2. Use the frequency counter to measure the output frequency of the signal generator.

3. According to the steps in the table below, press **Para** and use the keyboard on the panel to input the measurement value in step 280.

Table 3-22 Frequency (External Timebase) Adjustment Steps

Expected Value			**Description**
Step	Frequency	Amplitude	
280	<10 MHz	1 Vpp	Output frequency is slightly less than 10 MHz (e.g. 9,999,945.73 Hz)
281[1]	ENDSTEP_CAL_FREQ (Frequency adjustment finishes)		

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

3.17 Phase Adjustment

1. Set the input impedance of the oscilloscope to 50 Ω (if your oscilloscope does not have a 50 Ω input impedance, use an external 50Ω adapter). Connect the two output terminals of the signal generator to two input channels of the oscilloscope correspondingly. The connecting method is as shown in the figure below.

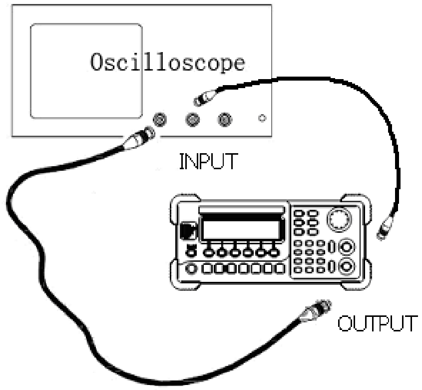

Figure 3-13 Phase Adjustment Connection

2. Enter the calibration interface (press **Utility** → **Test/Cal** → **PassWd** and enter the password to decrypt the signal generator. Then press **Cal** → **Step**). Perform the relative operations in sequence according to the steps in the table below, and select **Para** to input the measurement value (Dly1↑→2↑) at each step.

Table 3-23 Phase Adjustment Steps

Step	Description
285	Press **MENU** at the left of the DS2000A screen → "HORIZONTAL" and then select the corresponding delay measurement softkey. Read the measurement result (Dly1↑→2↑) at the bottom of the screen and input it into the signal generator (in s).
286	The same as 285.
287	The same as 285.
288	The same as 285.
289	The same as 285.
290	The same as 285.
291	The same as 285.
292	The same as 285.
293[1]	ENDSTEP_CAL_FREQ (Frequency adjustment finishes)

Note[1]: this step is only for display and you need not to input any value. Press **Enter** to enter the next step.

At this point, all the calibration operations are finished.

Chapter 4 To Save the Calibration Data

Table 4-1 To Save the Calibration Data

Step	Description
254	Perform this step to save the calibration data to the non-volatile memory of the instrument after finishing "**Calibration Process**".

Chapter 5 To Restore the Initial Calibration Value

Table 5-1 To Restore the Initial Calibration Value

Step	Description
255	The signal generator has an initial calibration value (empirical value, not factory default). Perform this step to restore the default calibration value. It is recommended that users perform the complete "**Calibration Process**" to get more accurate output.

Chapter 6 Calibration Prompting Messages

The following prompting messages may appear during the calibration.

1. **Performing Self-Test, Please wait...**
   The system needs some time to finish the self-test, so please wait patiently.

2. **Self-Test Passed.**
   This message is displayed if the system passes the self-test successfully.

3. **The instrument now is UNSECURED.**
   After the message is displayed to indicate that the correct password has been input, users can perform the calibration operation and at this point, the instrument is unsecured.

4. **Performing Calibration, Please wait....**
   The instrument enters the calibration execution menu to prepare to start the calibration, so please wait patiently.

5. **Incorrect secure code, please try again.**
   Users need to input the secure code to calibrate the signal generator. The entered secure code is incorrect and users need to enter the correct code.

6. **Please first complete step**.**
   If users want to finish the selected calibration step during the calibration of the instrument, they must start from step **.