RIGOL

Calibration Guide

DS6000 Series Digital Oscilloscope

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RIGOL Technologies, Inc.

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Document Overview

This document is for users who want to calibrate the **RIGOL** DS6000 oscilloscope in its project mode. It is assumed that readers of this document are familiar with the front and rear structures and the operation method of the DS6000 oscilloscope. DS6000 includes two types of model: two-channel and four-channel, we will take the four-channel model as example in this document.

Calibration Notices

Calibration Preparations

- **RIGOL** DS6000 oscilloscope
- **RIGOL** DG5000 signal generator.
- BNC cable (see figure 1)
- BNC one-to-five cable (see figure 2)

Note: Make sure the instrument has been warmed up for 30 minutes before calibrating.

Figure 1 BNC Cable   Figure 2 BNC One-to-Five Cable

Project Mode

1. Start the oscilloscope.

2. Press **MENU** in the **TRIGGER** control area at the lower-right corner of the front panel, then press **Type** in the function menu and select "Edge".

3. Press **F7**, **F6**, **F7** and **UTIL** (**F7** and **F6** are defined as shown in figure 3 on the right) successively to enter the project mode and enter the second-page menu (see figure 4). (Following the operations above can return to the normal mode).

Figure 3   Figure 4

Note: By default, the oscilloscope enters the normal mode after restart.

Calibration Sequence

The calibration sequence is as shown in the figure below. It is recommended to calibrate the instrument following the **Thorn Calibration, Self-Calibration, Equivalent Calibration**, **Delay Calibration** sequence, wherein, thorn calibration, equivalent calibration and delay calibration must be performed in project mode.

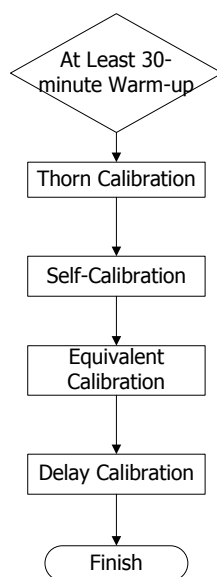Figure 5

To Resume Calibration

Select **ResumeCal** to restore the oscilloscope to its default parameters when the calibration fails or the oscilloscope fails to save the parameters.

Calibration Procedures

Thorn Calibration

Make sure the oscilloscope has been warmed up for 30 minutes before performing thorn calibration. Then, follow the steps below to calibrate the instrument.

1. Disconnect the signal connections of all the channels (including the external trigger channel).

2. Enter the second-page menu (Figure 4) in the project mode and select **ThornCal** to start the calibration.

3. It takes about 5 minutes (3 minutes for two-channel model) to finish the calibration. Restart the oscilloscope when the "Calibration finished, please restart the oscilloscope!" message is displayed.

Figure 6

4. Press **ACQ**, then press the menu key **Acquisition** to select "Normal" and the key **Mem Depth** to select "Auto".

5. Turn all the channels on and set all the channels to 200mV scale and observe whether there are evident thorns on the waveforms at 2ms, 5ms and 10ms horizontal scales. The normal waveform is as shown in figure 6. Calibrate again when evident thorns occur.
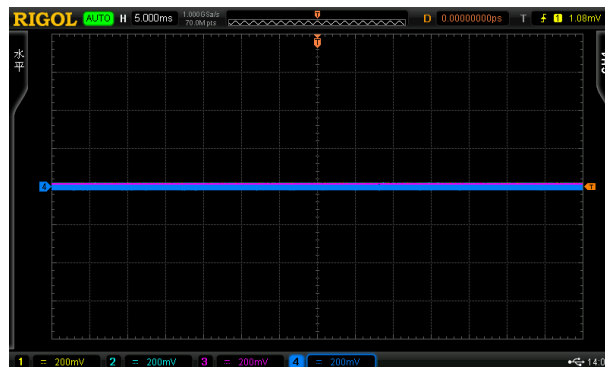
Self-Calibration (Vertical Calibration)

Make sure the oscilloscope has been warmed up for 30 minutes before performing self-calibration. Then, follow the steps below to calibrate the instrument.

1. Connect all the input channels and external trigger channel to the **[Trigout/Calibration]** connector at the rear panel using the **BNC One-to-Five Cable**.
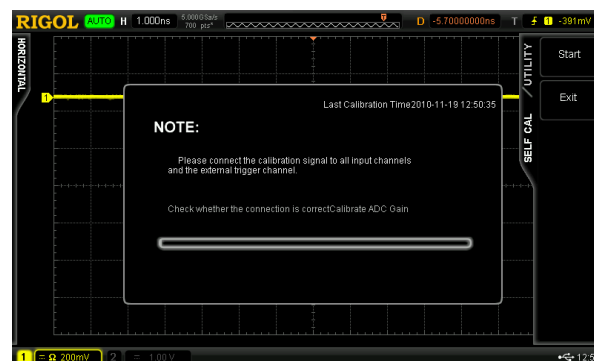
2. Press **UTIL** at the front panel and select **Self-Cal** in the first-page menu as shown in figure 7.

3. Press **Start** to perform self-calibration.

Figure 7

4. It takes about 20 minutes (15 minutes for two-channel model) to finish the calibration. Restart the oscilloscope when the "Calibration finished, please restart the oscilloscope!" message is displayed.

5. Press **ACQ**, then press the menu key **Acquisition** to select "Average" and the key **Averages** to set the number of averages to 16.

6. Disconnect the input signals of all the channels and observe the offset of the waveform of each channel at 2mV scale. Calibrate again if the offset exceeds 1div.

Equivalent Calibration

Make sure the oscilloscope has been warmed up for 30 minutes before performing equivalent calibration. Then, follow the steps below to calibrate the instrument.

1. Connect the **[Trig Out/Calibration]** connector of the oscilloscope to the input connector of CH1 using the **BNC Cable**, enter the project mode and select **EqualCal** (Figure 4) to start the calibration.

2. It takes about 4 minutes (3 minutes for two-channel model) to finish the calibration. Restart the oscilloscope when the "Calibration finished, please restart the oscilloscope!" message is displayed.

3. Press **UTIL** to enter the second-page menu, then press the menu key **AUXOutput** and select "Fast".

4. Press **CH1**, then press the menu key **Input** and set the input impedance of CH1 to 50Ω. Observe the jitter of the trigger position of the signal at 10ns and 2ns horizontal scales respectively. Calibrate again if the jitter is as shown in figure 8 or 9.
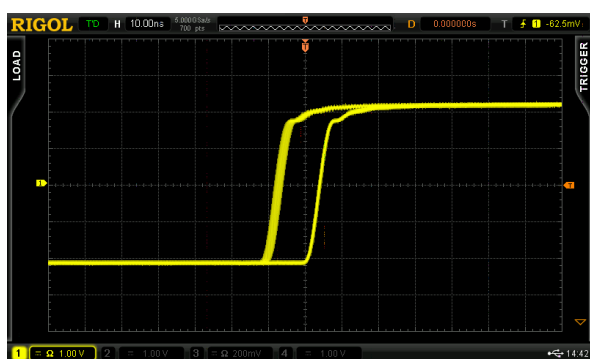

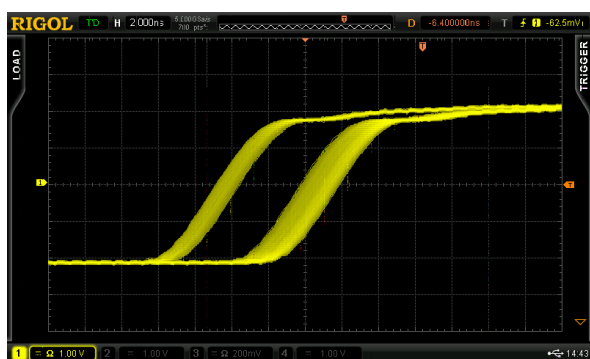Figure 8 Failed Waveform 1 of Equivalent Calibration

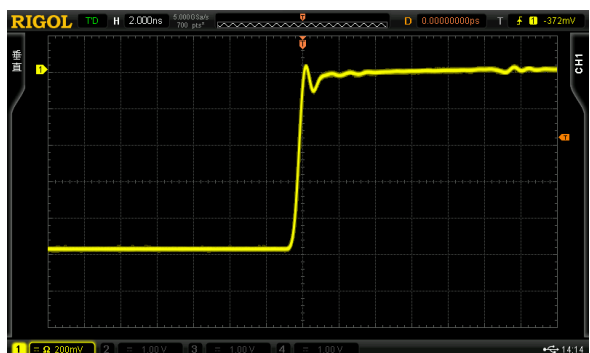Figure 9 Failed Waveform 2 of Equivalent Calibration

Figure 10 Normal Waveform of Equivalent Calibration

Delay Calibration

Make sure the oscilloscope has been warmed up for 30 minutes before performing delay calibration. Then, follow the steps below to calibrate the instrument.

1. Use the signal generator to generate a square waveform with 100kHz frequency, 10Vpp amplitude and 50Ω impedance.

2. Connect the signal outputted from the generator to all the input channels (except the external trigger channel) of the oscilloscope using the **BNC One-to-Five Cable**.

3. Enter the second-page menu (Figure 4) of the project mode and select **DelayCal** to start the calibration.

4. It takes about 2 minutes (1 minutes for two-channel model) to finish the calibration. Restart the oscilloscope when the "Calibration finished, please restart the oscilloscope!" message is displayed.

5. Set the timebase to the minimum scale (600MHz oscilloscope: 1ns scale; 1GHz oscilloscope: 500ps scale) and observe whether offset to the zero point of the waveform occurs in each channel. Calibrate again if offset to the zero point occurs.

6. Use the same timebase setting as step 5. Turn all the channels on, then turn any of the channels off and view whether other channels are affected and whether the waveforms jump. Perform delay calibration again if the waveforms jump. The normal waveform and failed waveform of the calibration are as shown in figure 11 and 12.
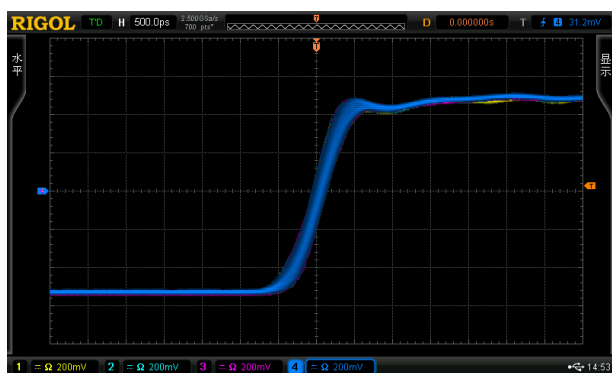

Figure 11 Normal Waveform of Delay Calibration

Figure 12 Failed Waveform of Delay Calibration

At this point, the calibration finishes.