



SIA CALIBRATION

FOR THE SIA

Always allow a 30-minute warm-up period prior to performing system calibrations.

The purpose of this document is to help determine when a user calibration is required, how to perform a calibration and what each calibration does.

The SIA contains separate hardware sections, or measurement engines, to perform different measurements. There are several internal tables that contain information about various path lengths and circuit variations. The information contained in these tables is accessed every time a measurement is performed. The SIA circuitry may change over time due to temperature changes or aging of components and the calibration tables may become outdated. The SIA has the ability to self-calibrate, but the user must initiate this operation.

This calibration procedure contains several steps that need to be performed in order.

Equipment required

- *WAVECREST* SIA
- *WAVECREST* supplied, matched-length SMA cable pair. 2 cables total
- *WAVECREST* supplied hard line jumpers for the clock recovery option if installed. 2 jumpers total.
- Optional for user convenience on multi-channel systems: 2 quick disconnect SMA adapters. Use only if they are in good working order. Connect one adapter to the end of each cable that will connect to the inputs of all channels.

Time required to perform ALL steps

- Varies due to number of channels and required noise floor levels
- Approximately 10 minutes for a two channel system
- Additional time for extra channels

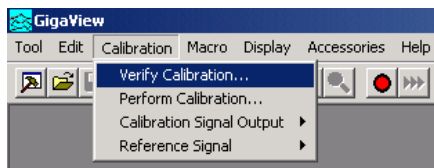
STEP 1 - Verify operation of SIA to determine if a calibration is needed

- This verification does NOT change any calibration values, it only checks them and suggests whether or not a calibration be performed.
- As the next step after verification, a calibration may need to be performed.

Time required for this step

- ~20 seconds

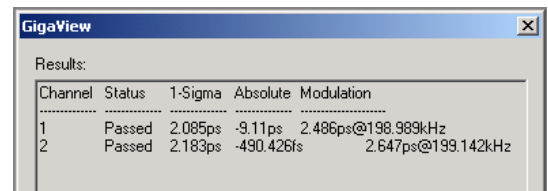
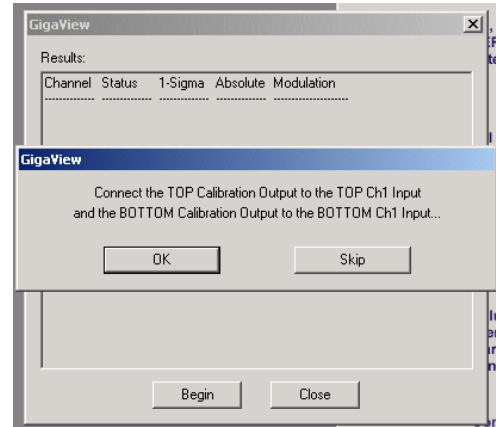
When using the Calibration pull down menu, select Verify Calibration as shown in this figure.



After selecting Verify Calibration, a pop up menu will appear.

Press Begin and another menu will appear with directions to follow for verification (See figure to the right). Using the *WAVECREST* supplied, matched length SMA cable pair, connect between the calibration outputs and the channel input specified in the pop-up window. A pop-up box will be displayed for each channel in the system. You will have to move the cables to the next channel following the on screen instructions. Pressing Skip will not test that channel and will advance to the next channel.

After completion of the verification, the results window will display pass/fail results and values for the simple tests that were performed (See figure to the right). If any channel fails, calibration is recommended. Or, if the values shown are higher than the values you expect to see in your measurements, you may want to continue with calibration. The verification measures the SIA 900MHz calibration output using the Histogram and High Frequency Modulation tools. It checks the 1-sigma and mean of a period histogram and looks at the magnitude of periodic components from an FFT. A calibration is recommended and a note will appear in the Results window if the 1-sigma or any single accumulated frequency component is greater than 3ps or the absolute mean is +/-30ps from its expected value.



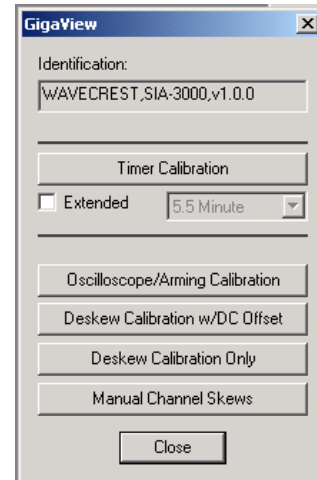
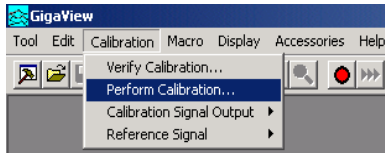
Passing values do not necessarily reflect actual SIA noise floors. These values only reflect the measurement of the calibration signal. If the values pass, it is still possible that a calibration will improve accuracy or noise floors. The verification just ensures that the instrument will meet basic specifications.

In some cases, this calibration verification may be too simplistic with coarse values. If a more thorough verification is desired, check with *WAVECREST* for additional procedures.

Press "Close" when finished with calibration verification and continue with STEP 2 below if any channel does not pass verification.

There are five distinct user calibrations—three are required and need to be performed in order (two are optional):

- ❑ Click on Perform Calibration to access the calibration dialog box.



STEP 2 - Timer Calibration (timing engine calibration)

This calibration mode affects all other calibrations and should be performed first.

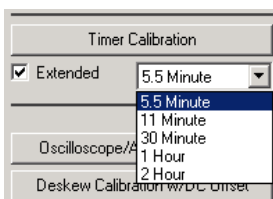
This step affects these measured values:

- RJ noise floor, longer cal duration may reduce noise floor further.
- Relative accuracy of all time measurements

Time required for this step

- User selectable, 5.5 minutes to 2 hours

The Timer calibration characterizes the internal ramps that provide the fine accuracy and resolution for time measurements. The calibration data is stored in the instrument and used each time a measurement is taken. This calibration should be performed whenever the SIA has been off for a long period of time or if it is moved to a significantly different operating environment (>5°C). Users should allow a for 30 minute warm-up period prior to performing any calibrations or testing.



Longer calibrations will lower the noise floor of the SIA. The “Extended” check box will allow the user to select increased time periods for the Timer Calibration.

Note: performing a short length cal immediately after a longer cal will result in the loss of the earlier cal as the entire contents of the internal tables is replaced with each cal.

No front panel connections are necessary for the Timer Calibration. The elapsed time is shown in the Status Bar on the lower right of the screen.

STEP 3 - Oscilloscope/Arming Calibration (amplitude and timing engine cal)

This calibrates the Oscilloscope function and the Arming Circuitry. Always perform this calibration *after* the Timer Calibration. Additionally, if “Deskew Calibration w/DC Offset” fails, you should run this step prior to Deskew.

This step affects these measured values:

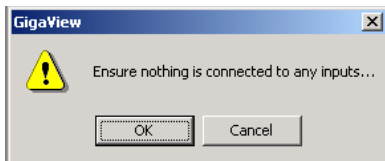
- Arm Delay settings, may reduce ambiguous measurements
- Oscilloscope delay settings, will remove ‘steps’ in scope view

Time required for this step

- Approximately 2 minutes

Additional equipment required

- None
- Ensure nothing is connected to the channel inputs.



STEP 4a - Deskew Calibration with DC Offset (amplitude and timing engine calibration)

This step affects these measured values:

- Absolute measured values
- Internal channel skews
- Channel to channel skew
- DC voltage offset

Approximate time required for this step

- 1.5 minutes for a two channel system
- + 45 seconds for each additional channel

Additional equipment required

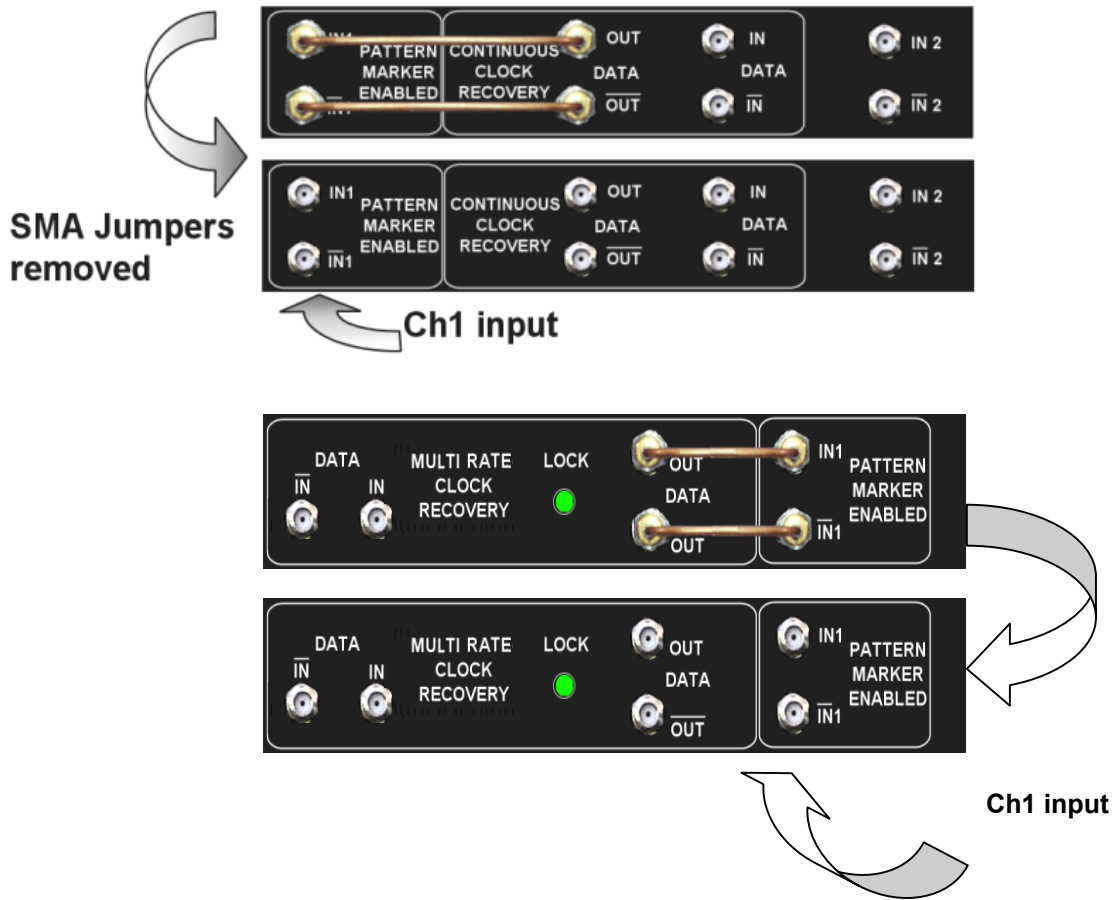
- *WAVECREST* supplied matched length SMA cable pair. 2 cables total.
- *WAVECREST* supplied SMA Jumpers (only for Clock Recovery Option)

This calibration compensates for DC offsets and then automatically performs a “Deskew Calibration”. This ensures less than 10ps skew between all channels at the input connectors. This does not calibrate to the end of the cables used, only internal paths.

- Select “Deskew Calibration w/DC Offset”.
- A dialog window appears informing you how to connect the calibration cables (use provided matched cables).
- Follow the onscreen instructions to complete the calibration.
- Note polarity of connections, as this will change as you proceed through the cal.

For the Clock Recovery Option:

- If the Clock Recovery option is installed, the calibration will prompt for the SMA jumpers to be removed. The following figure shows removal of the SMA Jumpers.



The final instructions will prompt to reconnect the jumpers, follow the on-screen directions for specific connections.

Upon completion of this step, you may close the calibration dialog box and resume using the SIA; it is not necessary to continue with further calibrations. The SIA is now ready to make measurements. Refer to the SIA User's Guide for a description of the features and measurement tools on the instrument.

STEP 4b (optional) - Deskew Calibration (*do not perform if Deskew Calibration with DC Offset has been performed in previous step*)

This step affects these measured values:

- Absolute measured values
- Internal channel skews
- Channel to channel skew

Approximate time required for this step

- 1.2 minutes for a two channel system
- + 45 seconds for each additional channel

Additional equipment required

- *WAVECREST* supplied matched length SMA cable pair. 2 cables total.

This calibration only deskews between channels. Calibrating the internal signal paths to the channel input connectors is an option. This does not calibrate to the end of the cables used. The DC offset calibration is not performed.

You do not need to perform this calibration if you have already performed "Deskew Calibration with DC Offset".

- Select "Deskew Calibration".
- A dialog window appears informing the user to connect the calibration cables (use provided matched cables).
- Follow the onscreen instructions to complete the calibration.
- Note polarity of connections, as this will change as you proceed through the calibration.

STEP 5 (Optional) - Manual Channel Skews

This step affects these measured values:

- Channel to channel skew

Time required for this step

- If delays are known, entering the values takes just seconds.
- If delays are unknown, other methods must be used to determine the cable's electrical length.

Additional equipment required

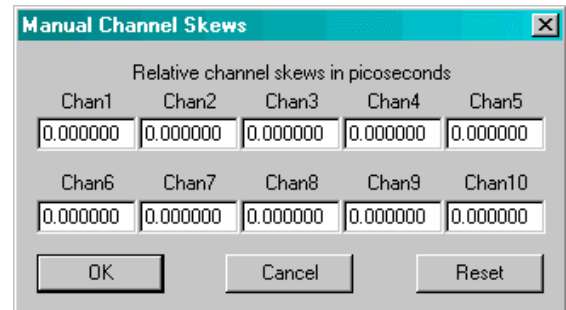
- None

This step is optional and allows fixed time-offsets to be added to or subtracted from a channel when a Channel-to-Channel measurement is made. This can be used to compensate for different cable delays between channels. *This will affect all channel-to-channel measurements or any measurement such as DataBus, Random Data w/ Bit Clock or any measurement using one channel as a "reference".* To clear these values, press "Reset". The values will also reset to zero if the instrument is powered down.

Only enter values here if the delay difference between channels is known. When using differential inputs, the cables connected to each pair of channel inputs must be a matched set.

The values entered are relative to one of the channels; one value will always be left at 0.0000.

- Select "Manual Channel Skews" (see Figure to the right).
- A dialog window appears allowing the user to enter relative channel skews. Enter values in picoseconds.



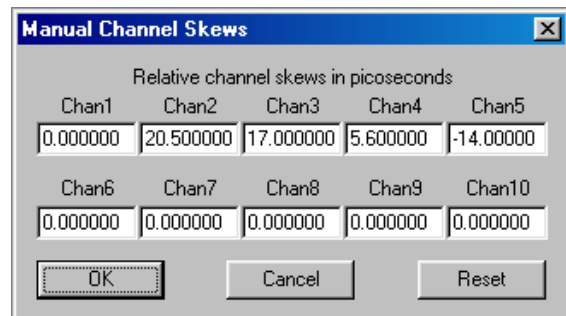
The screenshot shows a dialog box titled "Manual Channel Skews" with a close button (X) in the top right corner. The title bar is teal. The main area has a light gray background and contains the text "Relative channel skews in picoseconds" centered above a grid of ten input fields. The fields are arranged in two rows of five, labeled Chan1 through Chan10. All fields contain the value "0.000000". Below the grid are three buttons: "OK", "Cancel", and "Reset".

Chan1	Chan2	Chan3	Chan4	Chan5
0.000000	0.000000	0.000000	0.000000	0.000000
Chan6	Chan7	Chan8	Chan9	Chan10
0.000000	0.000000	0.000000	0.000000	0.000000

Manual Channel Skew setup

In the figure to the right, example values are shown. The values that are input are the differences between channels, not the absolute electrical length of a cable on that channel.

For instance, Channel 1 cable is 2.80ns. Channel 2 cable is 2.8205ns. So the value entered in "Channel 2" is the difference, 20.5ps. Note in this example, Channel 5 is 14ps shorter than Channel 1.



The screenshot shows the same "Manual Channel Skews" dialog box as above, but with example values entered in the input fields. The title bar is blue. The values are: Chan1: 0.000000, Chan2: 20.500000, Chan3: 17.000000, Chan4: 5.600000, Chan5: -14.000000, Chan6: 0.000000, Chan7: 0.000000, Chan8: 0.000000, Chan9: 0.000000, Chan10: 0.000000. The "OK" button is highlighted with a dashed border.

Chan1	Chan2	Chan3	Chan4	Chan5
0.000000	20.500000	17.000000	5.600000	-14.000000
Chan6	Chan7	Chan8	Chan9	Chan10
0.000000	0.000000	0.000000	0.000000	0.000000

Manual Channel Skews

The SIA is now ready to make measurements. Refer to the SIA User's Guide for a description of the features and measurement tools on the instrument.

FOR MORE INFORMATION CONTACT:

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