Production Test Document for ISL26104AV28EV1Z Evaluation Board

Version 1, November 14, 2012

By Jerome Johnston, Applications Engineer

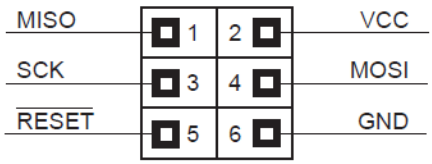
Introduction

The purpose of this document is to provide the necessary information to program and test the **ISL26104AV28EV1Z** evaluation board in production. The document also includes a segment on troubleshooting boards that fail to pass the production test.

Required Test Equipment

The following is a list of equipment and software will be needed to program the uC and test the board in production. Additional equipment may be needed for troubleshooting defective boards.

1. Personal computer (Windows XP or greater) with the following software:
    a. Atmel AVR Studio 4 (this software has a utility to program the flash memory of the microcontroller (uC) on the evaluation board): **AvrStudio4Setup.exe**
    b. The HEX file of the latest version of the uC software: **ISL26104AV28EV1Z_uC_Code_Rev7_Y12M11D12**
    c. The Evaluation Board GUI software, Version 3: **ISL261XX_Installer_v3.exe**
2. Power Supply, Agilent E36231A, or similar. This should be an adjustable linear supply capable of providing 5.0 volts. It should not be a switching supply as these output higher noise levels.
3. Voltmeter, Fluke 175, 177, 179, or similar. Capable of measuring 0 to 10 V to 3 digits behind the decimal; 2.500 volts.
4. Power leads, typically banana plug to banana plug, 18 to 24 inches long. Three each, each a different color such as Black, Red, and Blue.
5. Atmel programmer model AVRISP mkII. The uC on the evaluation board will be programmed through the six pin "In System Programming" port on the board. Any programmer that supports this port may be used but the procedure below would need to be adapted accordingly.



6. USB cable Type A to Type B, two each. One is to connect the AVRISP mkII programmer to the PC. Another is to connect the evaluation board to the PC.
7. A pdf file of the schematics for the **ISL26104AV28EV1Z** board.
   The file name is **ISL26104AV28EV1Z Rev B Schematics.pdf**

If the boards are not functional the following equipment may be needed for troubleshooting.

1. Oscilloscope, Tektronix 2465B, or similar. Note that the scope should be an analog scope. If a digital oscilloscope is used it may not trigger properly when the ISL26104 analog to digital converter chip is configured to output low frequency sample rates.

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Setting up the PC

The PC must have the following software and/or files installed in order to program and test the evaluation board:

Note that all of the necessary software should be available in a ZIP file on a CD, a USB flash stick, or via email provided with this test procedure.

1. Atmel Studio 4. This software should be installed as a program to be run under the Windows operating system. This software has utility that is used to program the flash memory in the microcontroller on the evaluation board.
   a. The HEX file which is to be flashed into the microcontroller:
      ISL26104AV28EV1Z_uC_Code_Rev7_Y12M11D12
      This file should be placed in a folder on the PC that can be found later.

2. The Intersil Evaluation Board GUI software, Version 3: **ISL261XX_Installer_v3.exe**
   This software should be installed as a program to be run under the Windows operating system. After installation, the menu in the operating system should have a folder titled Intersil. The program will be run later by clicking on Intersil=>ISL261XX=>ISL261XX Evaluation Software.

Flash Programming Procedure

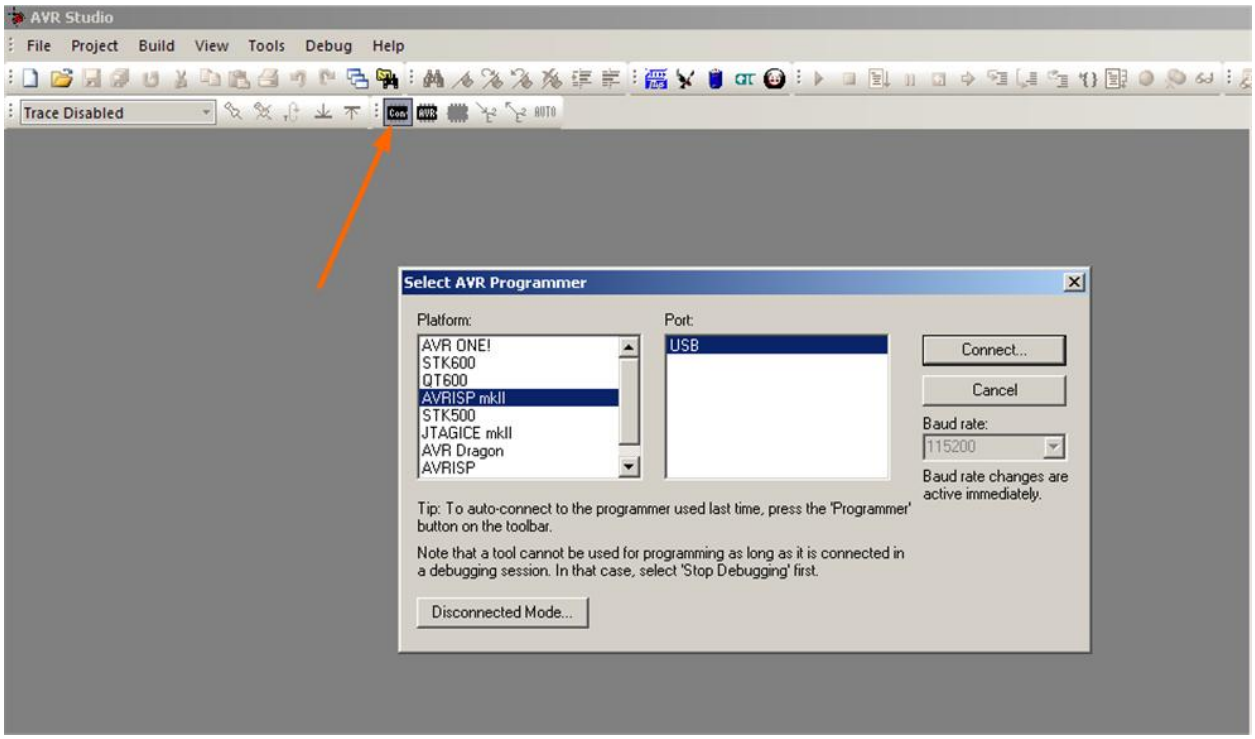
The evaluation board includes an Atmel AT90USB162 uC (microcontroller) on the board. This microcontroller provides the USB interface to the PC. The portion of the board that includes the microcontroller is powered by the USB

connection. There is no indication that the uC portion of the board is properly powered until the memory of the uC is flashed (programmed). If the uC has been programmed it will reset and light the LEDs in the uC section of the board when power is applied via the USB connection.

First connect a USB cable from the USB connector on the evaluation board to the PC that will be used for testing. If the PC is powered up, then the USB cable should supply power to the uC portion of the evaluation board. Once the main USB cable is connected to the PC then connect the Atmel AVRISP mkII programmer to the PC with a USB cable. Then connect the flat cable header connector on the output side of the AVRISP mkII programmer to the six pin programming header (labeled J1 on the board) on the uC side of the evaluation board. Pin 1 of the connector is marked with a small triangle. Be certain that the connector is connected with the proper orientation.

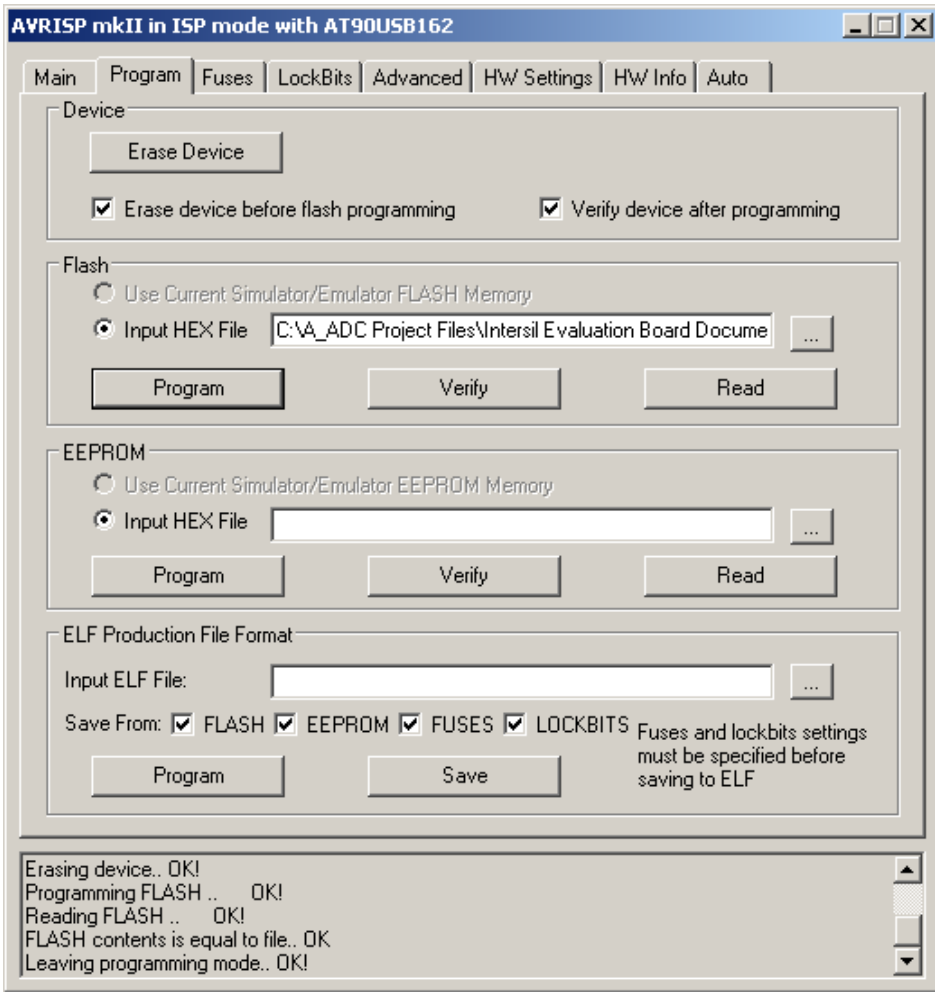
Go to Start=>**All Programs**=> **Atmel AVR Tools** => **AVR Studio 4** and run the **AVR Studio 4** software. Open the software to the main GUI page as shown below. Then click on the button pointed to by the red arrow. This should cause the **Select AVR Programmer** window should open (shown open in the figure below).

In the **Select AVR Programmer** window, choose the AVRISP mkII and the USB options as highlighted in the figure (this assumes the AVISP mkII programmer is being used). Then use the mouse and click on the **Connect** button in this window.



When the **Connect** button is clicked the following window will open.

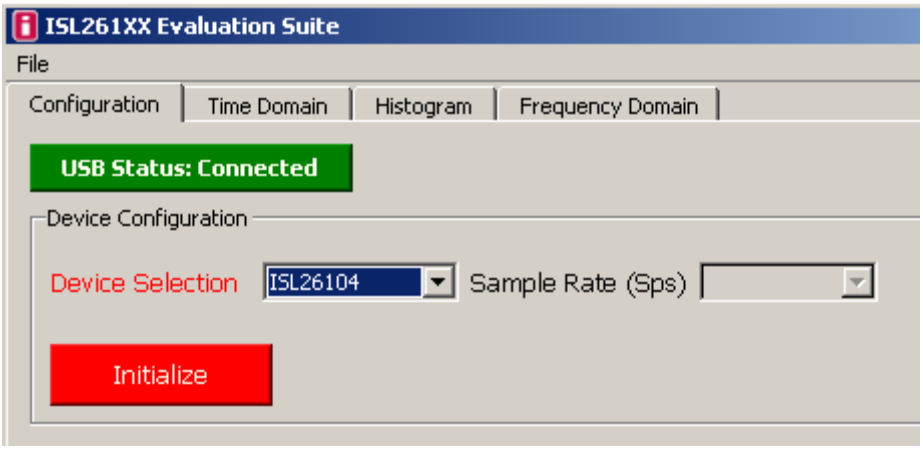
Make sure there is a check mark in the **Device** section each of the boxes labeled '**Erase device before flash programming**' and '**Verify device after programming**'.



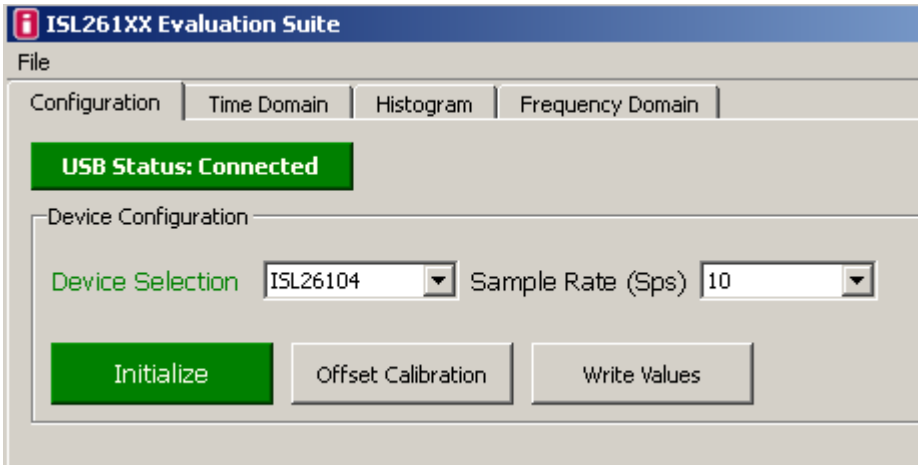
The next step is to program the flash. In the sub-window titled **Flash** click the **Input HEX file** radio button. Then find the folder that holds the hex file to be programmed into the uC flash memory. Once the file is located, click on the **Program** button. The uC flash should be programmed and the text window at the bottom of the screen should confirm that the device has been flashed. Make sure the window includes the line that says **Flash contents is equal to the file. Ok**

If the board has been successfully programmed, LED1, LED2 and LED3 in the uC section of the board should be lighted.

Run the ISL261XX Evaluation software. If the USB connection on the board is connected to a USB port on the PC, the board should be detected and the **USB Status: Connected** button should turn green.

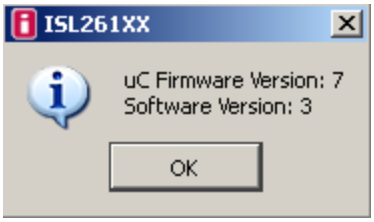


Use the pull down menu titled **Device Selection** to choose the ISL26104. Then click the **Initialize** button.



The top portion of the screen should be as shown in the figure above. Now click on the selection **File**=>**About** at the top of the window.

A small window should open and reveal the software version.



Verify that the **uC Firmware Version: 7** is the code flashed into the uC. The window should also reveal that the GUI software version is **Software Version: 3**.

You can then click the **OK** button in the window and close it and the shrink the GUI window until needed when the next board is programmed.

Once the board has been programmed unplug the 6-pin header connector from the programmer and then unplug the USB cable going to the PC.

Then mark the back of the board with some type of stamp or sticker that will provide an indication that the board has successfully been programmed. The board will then be set aside until all boards in the manufacturing batch have had their microcontroller programmed.

Repeat the instructions for the **Flash Programming Procedure** for each evaluation board to be programmed. After all boards have been programmed, proceed with the remainder of the test procedure.

Procedure to Test the Board

The following assumes that the uC on the board has been properly programmed. This is necessary for the GUI software to function as it sends commands to the microcontroller on the evaluation board via the USB connection. The microcontroller then communicates with the analog-to-digital converter (ADC) portion of the board and sends data from the ADC back to the PC over the USB cable.

The board has several header connectors that have shorting jumpers. Certain headers must be populated with shorting shunts for the board to work properly.

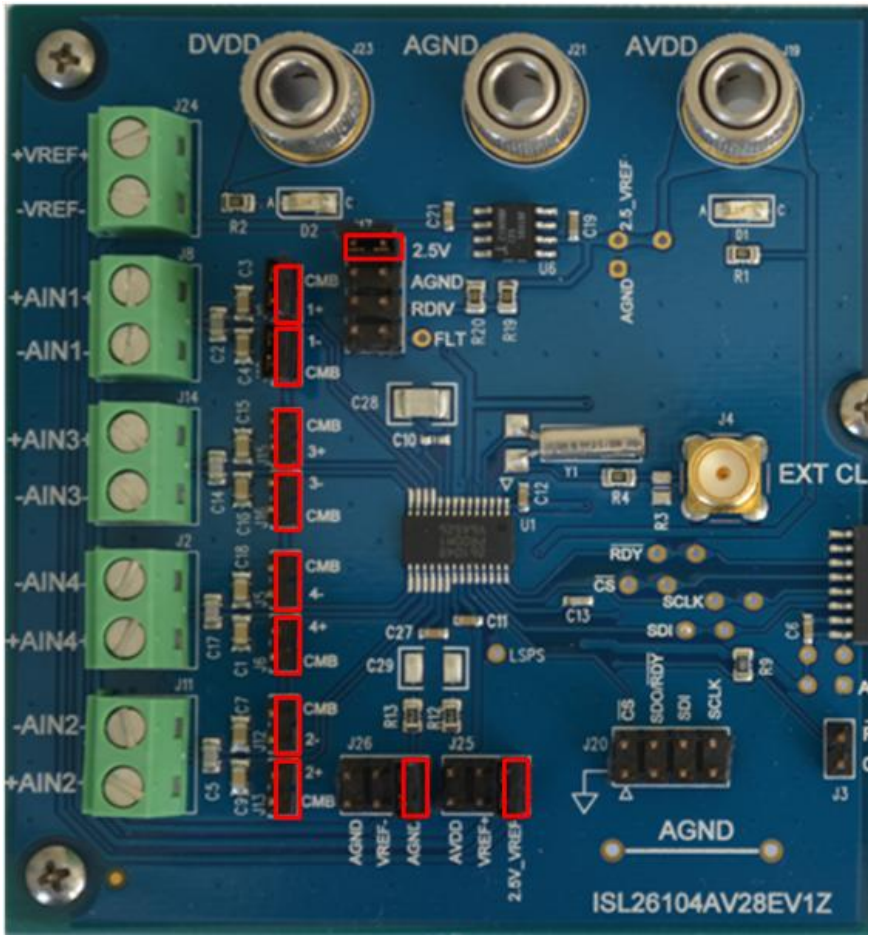
The initial jumper configuration for testing is indicated in the figure below. Place shunts on the header positions indicated by a red rectangular outline.

Header J17 is connected with the 2.5V reference selected as the common mode voltage.

Place shunts on the following headers at the analog inputs:

Headers J9, J10, J15, J16, J5, J6, J12, and J13.

For the voltage reference input to the ADC on headers J25 and J26: the 2.5V_VREF option is selected on J25. The AGND option is selected on J26 (Note that there are two AGND selections on header J26, both are electrically the same). These enable to 2.5V voltage reference chip to be the voltage reference for the ADC.



DIP switch: **Switches S2-SW1, S2-SW2, S2-SW3 and S2-SW4 <u>cannot be</u> in the 'ON' position. These switches must be in the 'OFF' position.** With all four switches in the 'ON' position the board is in a test mode and will not function properly with the PC software GUI. If the test mode is selected LED3 will be illuminated if the USB plug is connected to power. When the test mode is activated the uC outputs a repeated stream of SCLKs to the isolator interface. This aids in troubleshooting if the board is not functional with the GUI software.

Adjust the Linear Power Supply

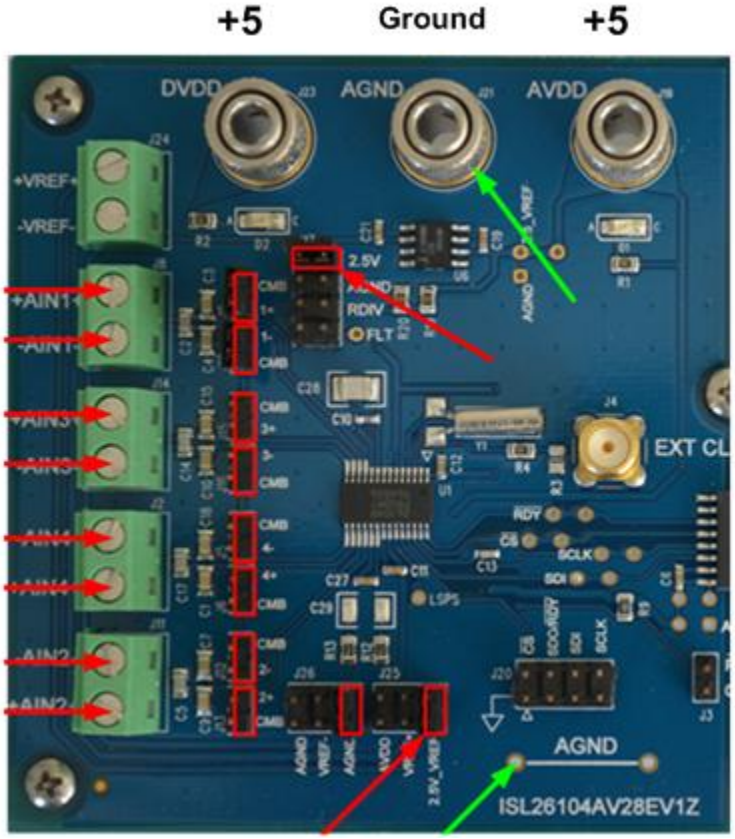
<u>Without the supply being connected to the board</u>, apply power to the linear supply. Use the voltmeter to measure the output from the power supply. Adjust the supply as close as possible to 5.0 (4.90 to 5.10) volts. Then shut off the power supply. Plug in the power leads, Red lead to +5 volt output, Black to (-) return line, Blue to +5 volt output.

Then connect the Red (+5 volt) lead from the power supply to the banana plug labeled AVDD.

Connect the Blue (+5 volt) lead from the power supply to the banana plug labeled DVDD.

Connect the Black (-) lead from the power supply to the banana plug labeled AGND.

Then activate the power supply. Red LEDs should light up to indicate that the AVDD and DVDD plugs are powered.



2.5 Volts at RED arrow points

Verify 5V at AVDD and DVDD

Set the voltmeter to measure DC volts with a range setting appropriate for measuring 5 volts.

Reference the minus lead (-) of the voltmeter to the AGND (connect the (-) meter probe to one of the AGND locations indicated by the green arrow in the figure below for all of the following measurements).

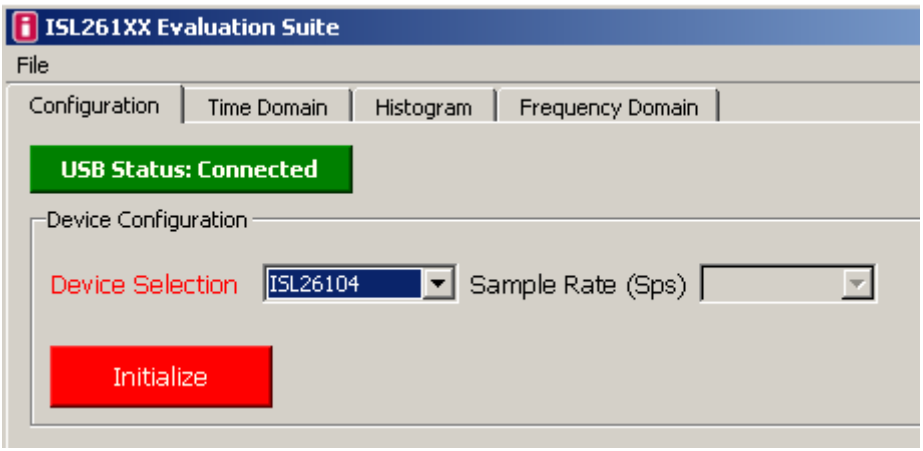
Connect the (+) lead of the voltmeter to AVDD banana plug receptacle. AVDD should be 5.0 volts (4.90 to 5.10 volts).

Then connect the (+) lead of the voltmeter to DVDD banana plug receptacle. DVDD should be 5.0 volts (4.90 to 5.10 volts).

Maintain the (-) lead of the voltmeter on AGND and verify that 2.5 volts at measured at the analog input terminal connections and on the header jumpers indicated by RED arrows.

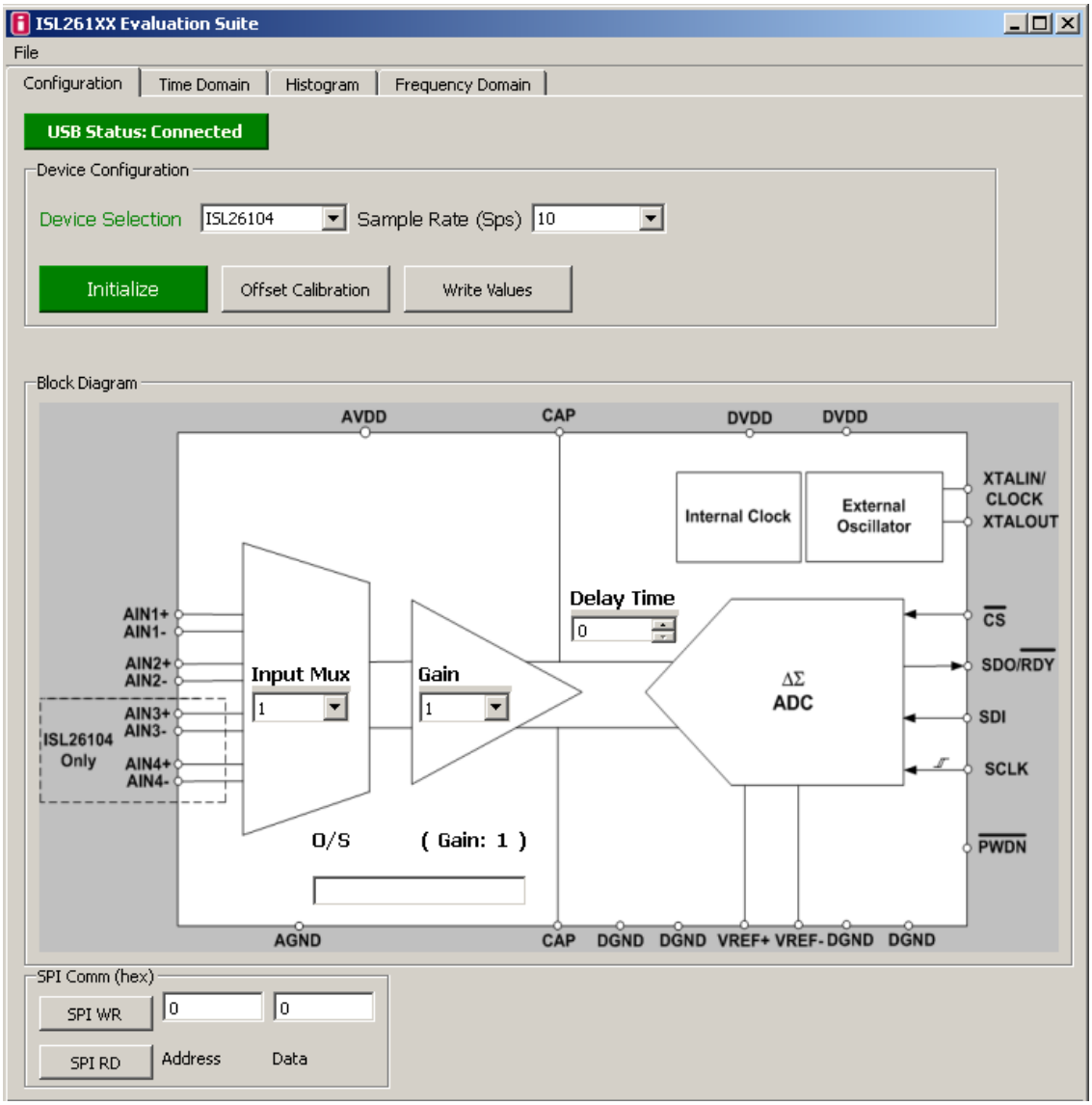
Performance Testing

Run the PC GUI software.

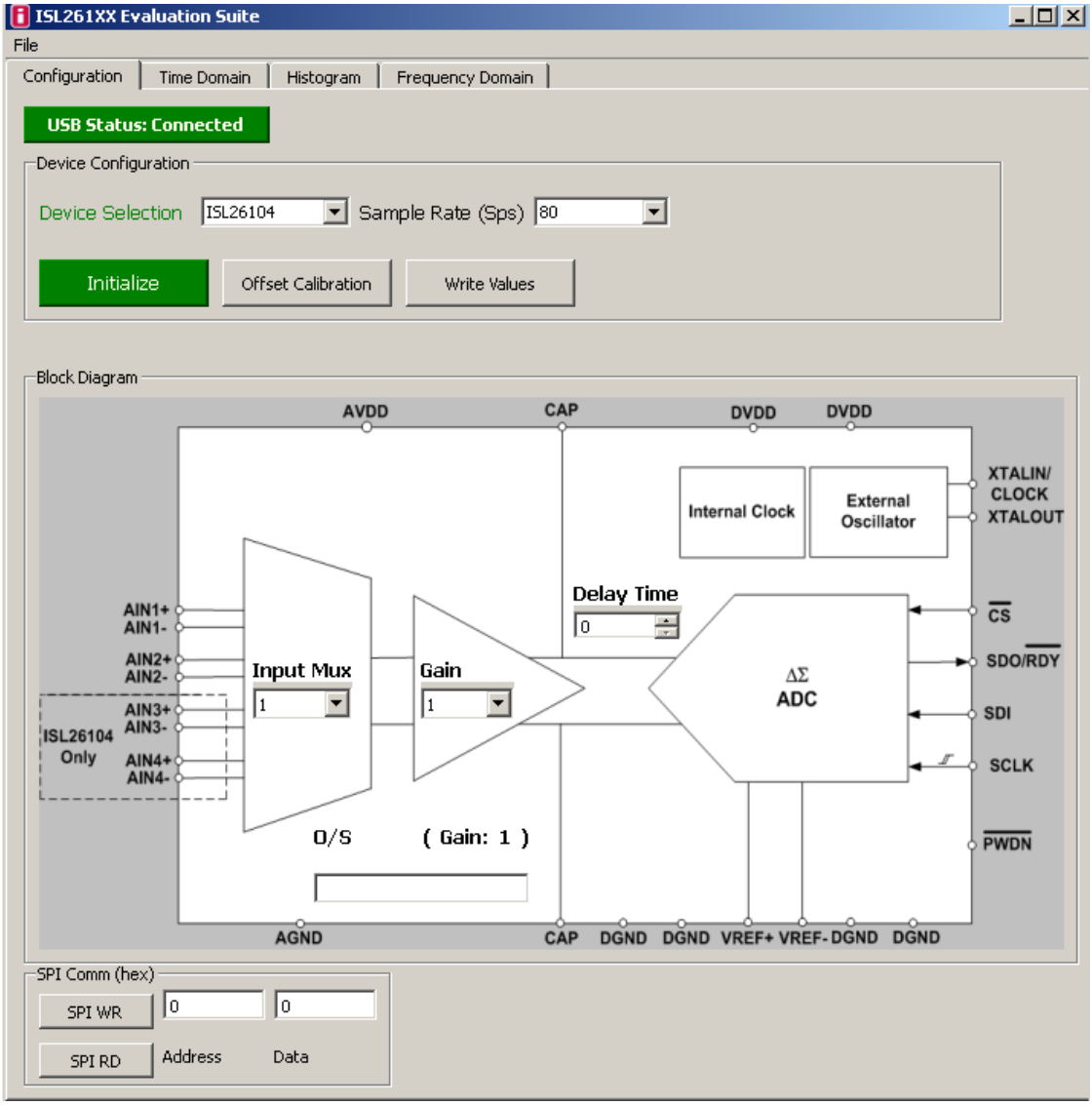


In the **Device Selection** window choose the ISL26104 and then click on the **Initialize** button.

The following screen should appear showing a block diagram of the ISL26104.

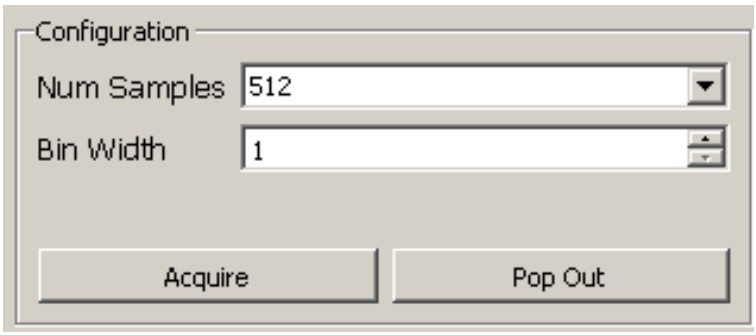


In the pull down menu labeled **Sample Rate (Sps),** select 80. Then click on the **Write Values** button. Clicking the **Write Values** button causes the GUI to communicate to the microcontroller on the evaluation board which then sends a command to the ISL26104 to configure its word rate to 80 Sps (sample per second).

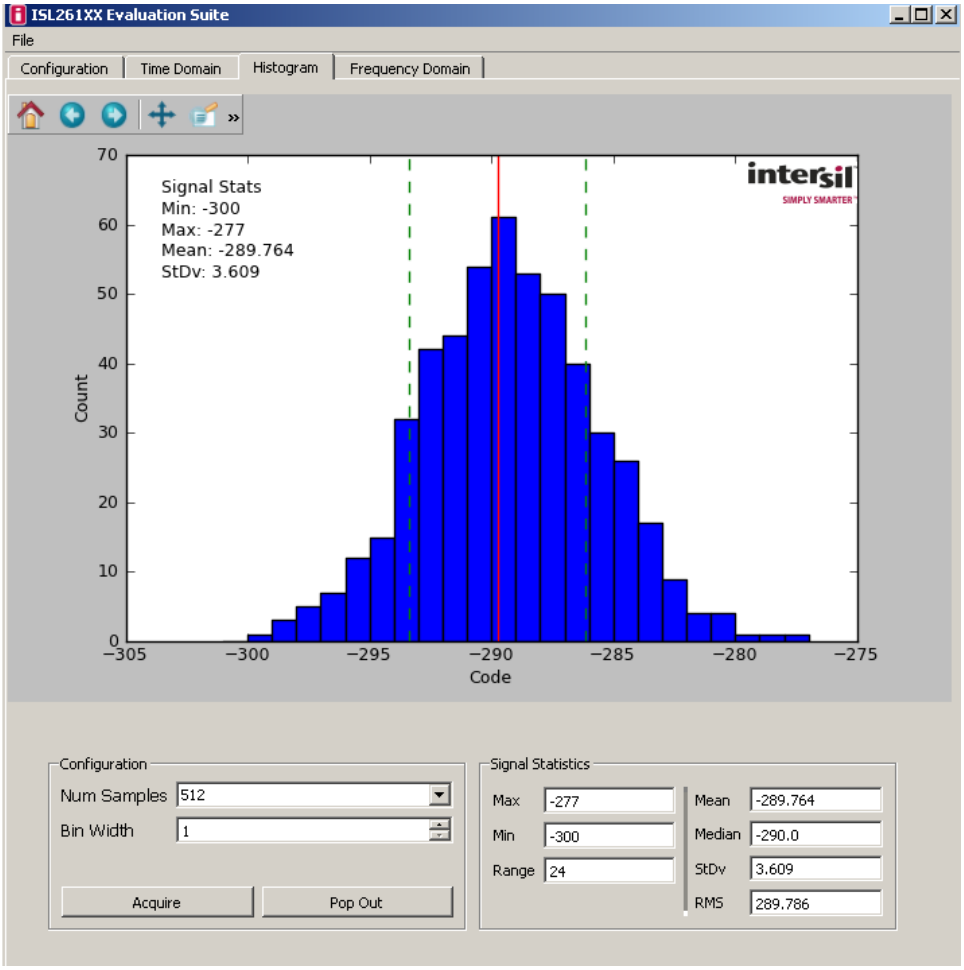


Then click on the **Histogram** menu selection at the top of the screen.

In the **Num Samples** window select 512. Then click **Acquire**.



The GUI software will collect 512 samples and compute the standard deviation (**StDv**) of this data.

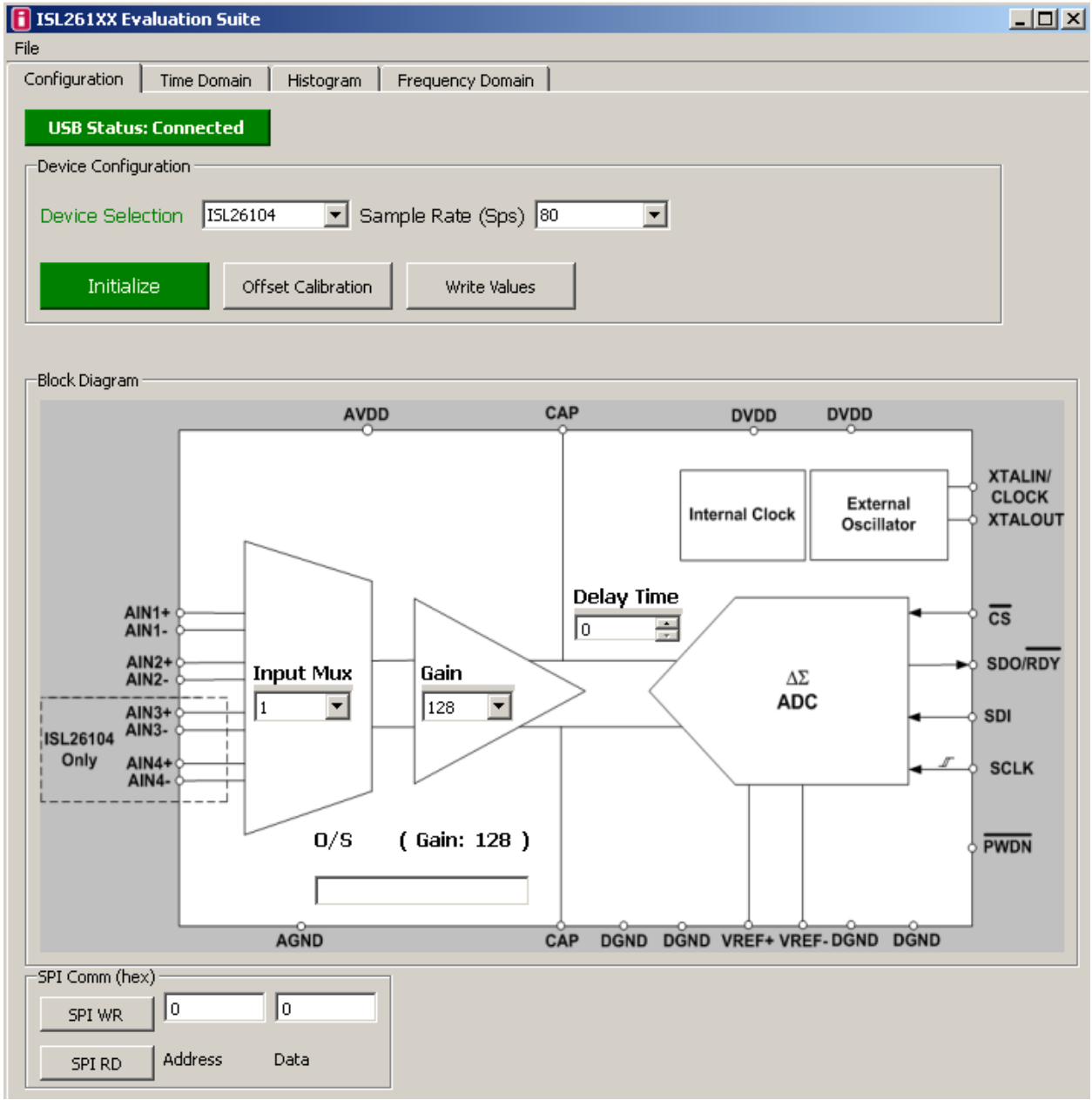


The **StDv** value should range between 3.1 and 4.3 with something near 3.7 being the most probable.

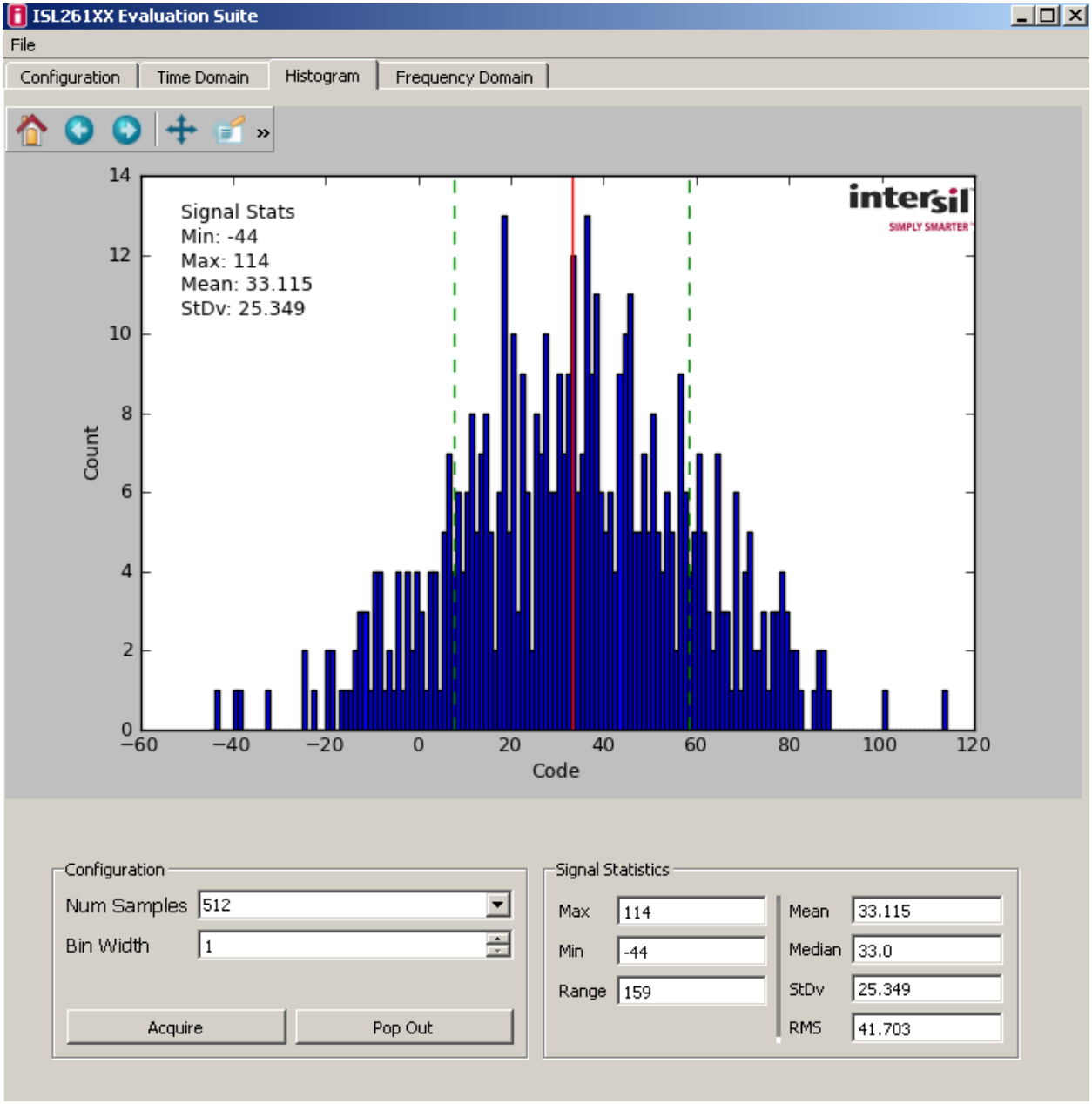
Verify that the shape of the data in the plot has the shape of a bell curve.

The **Mean** should be less than ±1000. If you have boards that fail this number when the **StDv** number is okay, and nothing can be found wrong with the setup configuration, contact the Intersil engineer responsible for the evaluation board.

If the board passes, click on the **Configuration** menu selection. Select a gain of 128 in the **Gain** pull down menu and click the **Write Values** button.



Then return to the **Histogram** screen. **Num Samples** should still be 512. Click the **Acquire** button.



The GUI software will collect 512 samples and compute the standard deviation (**StDv**) of this data.

If the jumpers are set properly, the result should give a value for **StDv** between 22 -29, nominally 24.

Verify that the shape of the data in the plot has a bell shaped curve.

The **Mean** should be less than ±100. If you have boards that fail this number when the **StDv** number is okay, and nothing can be found wrong with the setup configuration, contact the Intersil engineer responsible for the evaluation board.

In the example **StDv** is equal to 25.349.

If the **StDv** value is smaller or greater than the 22-29 range, repeat the test multiple times. If the number still remains outside the 22-29 range, the sample rate may have been set wrong, there is something is wrong with the board jumper connections, or there is a problem with the ADC chip. Also verify that the plot has the shape of a bell curve.

If the board passes all tests above, disconnect all of the power supply connections and the USB connector.

Place a stamp or sticker on the back of the board on the USB side of the board to provide a record that the board has passed the production test.

Prior to placing the board in an anti-static bag, remove jumpers so that the board will be shipped with jumpers ONLY in place where indicated in RED in the following image. The DIP switch positions should remain in the OFF position.



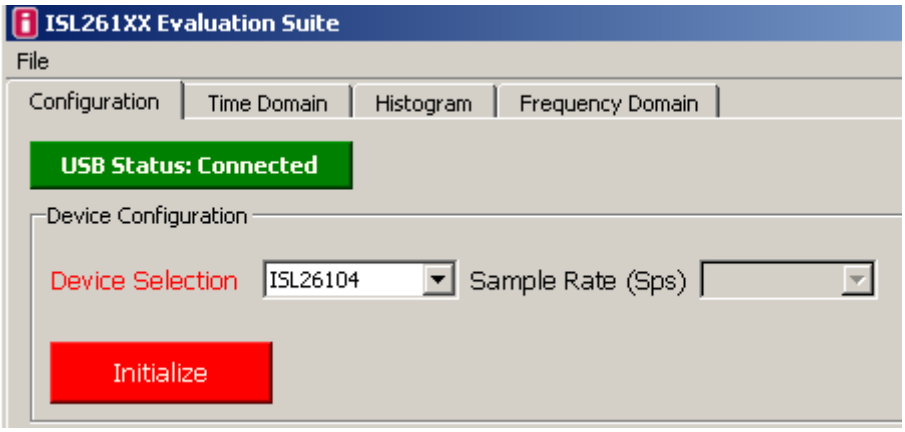
Jumper Positions on Finished Board

APPENDIX 1

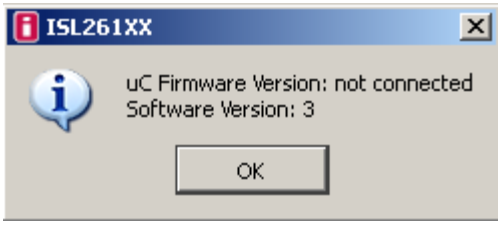
Troubleshooting Boards that Fail

There are several things that can go wrong with the board if it does not pass the tests listed above.

If the **Initialize** button stays RED after being clicked as shown below, the microcontroller may not have been programmed.



One can check the **File**=>**About** option to check.



If the **uC Firmware Version** says '**not connected'** this is an indication the uC has not been programmed.

If the **uC Firmware Version** is stated as version '7' this indicates that the GUI software is communicating with the microcontroller properly.

If the uC is programmed with the wrong .hex file, the Windows operating system may not recognize the board when plugged into the USB connector.

If during a test, the **Acquire** button is clicked but no data is captured this can indicate that the ADC section of the board is not powered properly. If this occurs first check that the AVDD and DVDD supply voltages are the correct magnitude and polarity.

If the AVDD and DVDD supplies are present and the **Acquire** function still does not work, try exiting the GUI software and restarting it. Occasionally it will lock up due to unknown circumstances.

If the GUI software still cannot acquire data from the board, then there is most likely a defective component on the board.

The microcontroller software includes a test mode to help troubleshoot the isolator interface.

The test mode is initiated by placing the quad DIP switch associated with the microcontroller all in the ON position. For test mode to be active the DIP switch should be configured as follows: **Switches S2-SW1, S2-SW2, S2-SW3 and S2-SW4 must be in the 'ON' position. Then push the RESET button on the microcontroller side of the board.**

If a RESET is activated with all four switches in the ON position the microcontroller will continue executing a special test program. While in test mode, the board will not function properly with the PC software GUI. While the test mode is executing, LED3 will be blinking if the USB plug is connected to power. Anytime the test is executing, the uC will output a repeated stream of square waves to the three isolators that convey signals to the ADC through the isolator interface. The purpose of this test mode is only to check that the signals communicate through the isolator chip. When the test mode is active, an oscilloscope can be used to examine the SCLK, CS/, and SDI signals on the each side of the isolation barrier to confirm proper operation of the isolator chip.

APPENDIX 2

USB VID and PID

The VID (vendor ID) for Intersil = 09AA) and PID (product ID) =201C for the evaluation board can be found by examining the Windows Systems Information under Components=>USB. It will be listed as a HID Compliant device with the VID and PID indicated as follows:

HID-compliant device HID\VID_09AA&PID_201C\6&2ADC8489&0&0000