Application Note

NOVOSENSE

Sensor Signal Conditioning Chip Evaluation Kit NSx2860(X)_9260(X) Single Calibration System User Guide

AN-12-0036

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ABSTRACT

The calibration system is designed to help customers quickly verify the NSx2860(X)/9260(X) series signal conditioning ASIC at the lab level. This document is used to guide the user on how to use this calibration system.

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1.System Overview

The NSx2860(X)/9260(X) calibration kit (Ordering part number: NSX2860_EVM) contains a 24V DC power supply, an USB-485 cable and an EVA board.

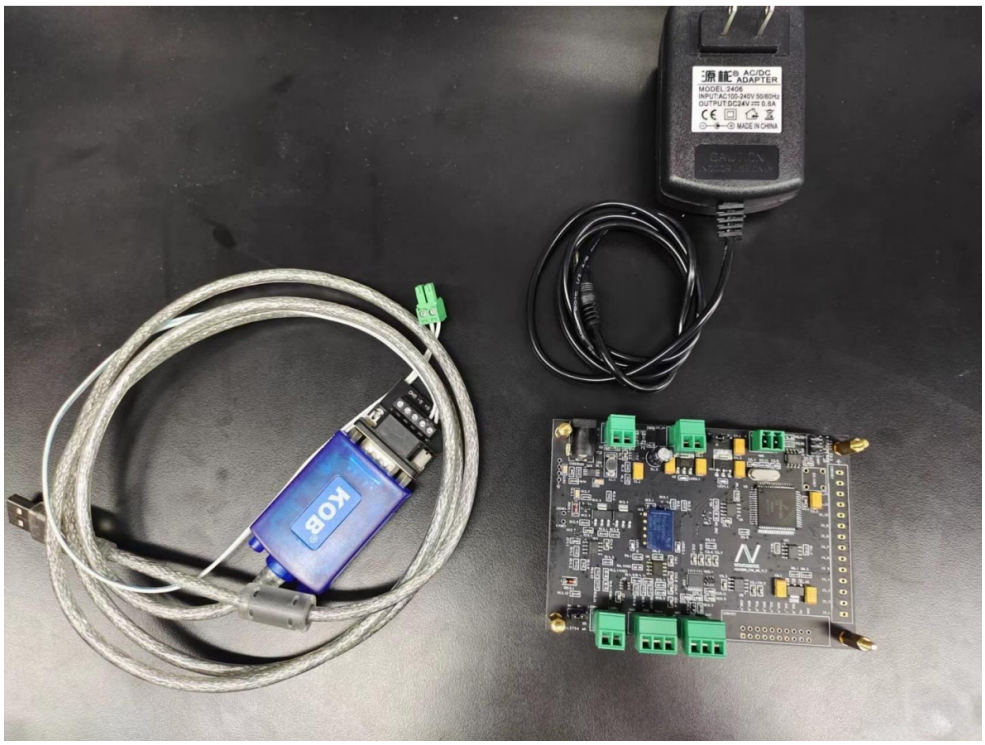


Figure1.1 NSx2860(X)/9260(X) Calibration Kit

The system connection is shown in the figure below.

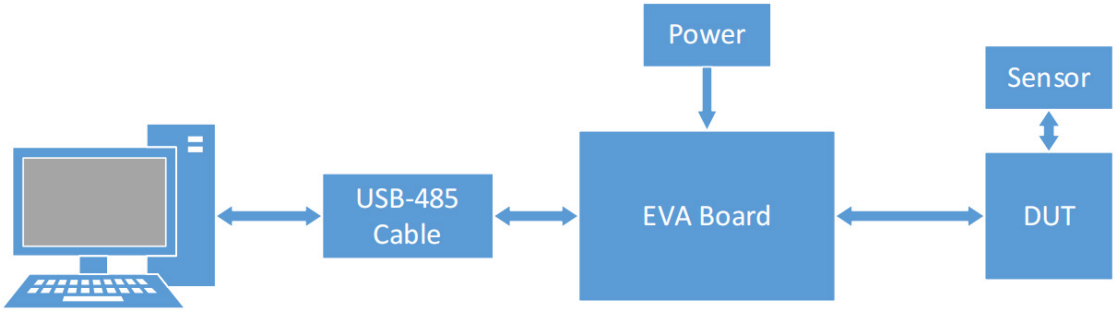


Figure1.2 System Connection Diagram

Since there are so many different types of DUT boards, users need to apply separately for the required DUT board.

The DUT ordering part number includes chip type, package type and output type. For example, NSA2860_S-SOP16_4-20mA_DUT or NSC9260_SSOP16_0-5V_DUT is a valid ordering part number.

1.1.Hardware Introduction

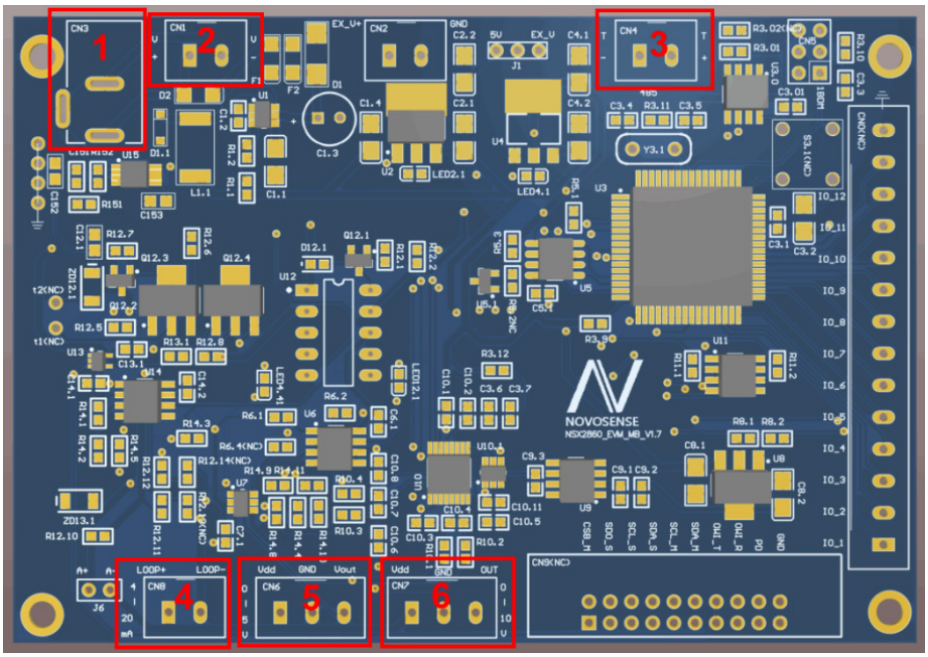


Figure1.3 NSx2860(X)/9260(X) EVA board Top Side

The description of these connectors in the figure is shown below.

1: Power supply option 1 - 24V DC jack.

2: Power supply option 2 - 24V 2Pin terminal pitch=3.81mm.

3: RS485 connector. Pay attention to the positive and negative pin order.

It should be noticed that never connect 24V power supply to this connector by mistake, otherwise the EVA board will be damaged.

4: 4-20mA connector. The pin order from left to right is Loop+, Loop- respectively.

5: 0-5V connector. The pin order from left to right is VDD, GND, VOUT respectively. This VDD pin is 5V supply.

6: 0-10V connector. The pin order from left to right is VDD, GND, VOUT respectively. This VDD pin is 24V supply.

Note: If you connect a 0-5V output type DUT, you need to remove these 2 resistors (R14.6 and R14.7) on the bottom side of the EVA

board. Otherwise, it will affect the output voltage accuracy.

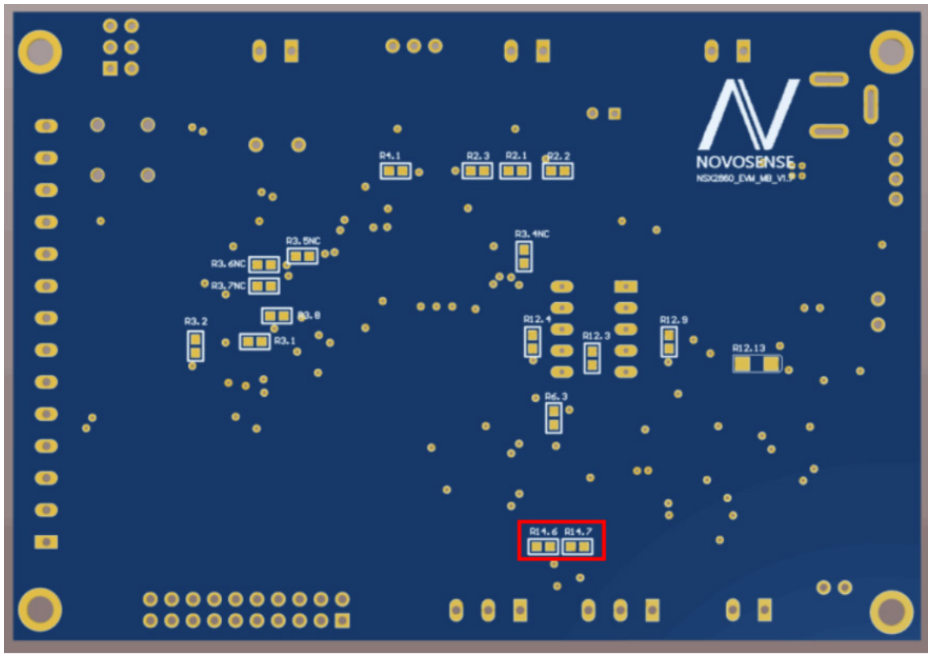


Figure 1.4 NSx2860(X)/9260(X) EVA board Bottom Side

1.2.Function Software and Driver Installation

1.2.1.Software Installation

Double click the “setup.exe” to start installation.

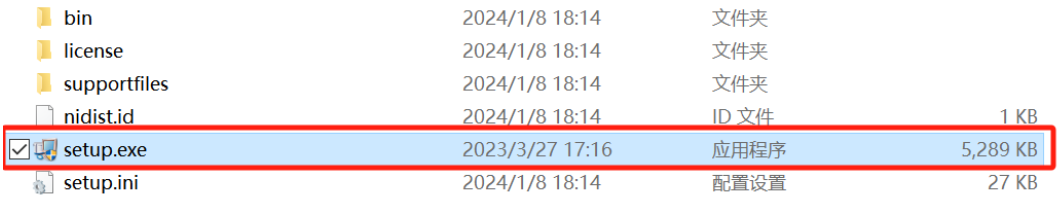


Figure 1.5 NSx2860(X)/9260(X) Calibration Program Files

After selecting the program installation directory, click “Next” to continue.
It is recommended not to install the program on the system disk (Disk C:\).

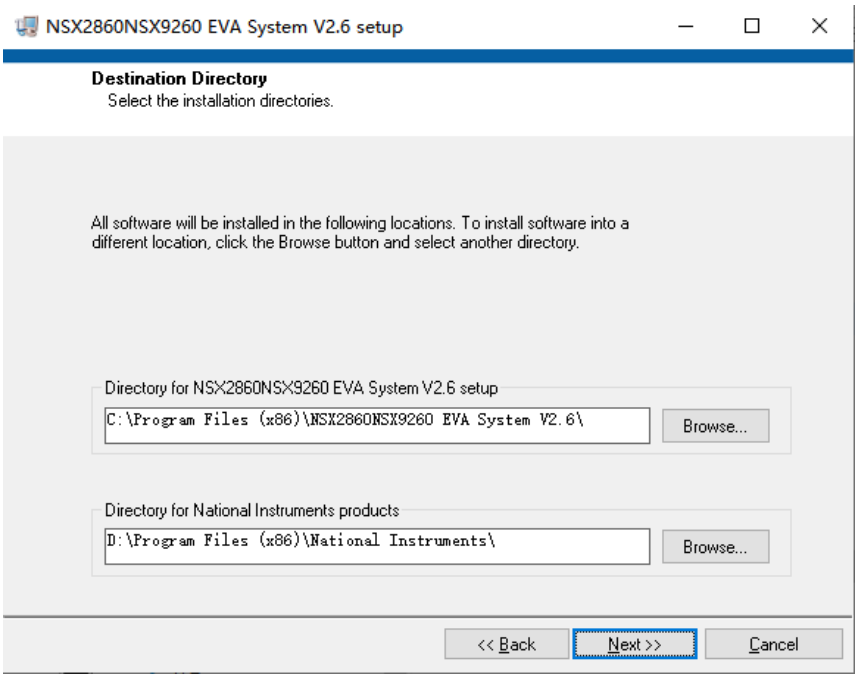


Figure 1.6 Installation Directory Selection

At this step, if you already have NI VISA 17.0 or higher version installed on your computer, it will prompt "Cannot install". Ignore this prompt, it will not affect the installation and use of the program. Click “Next” to continue.

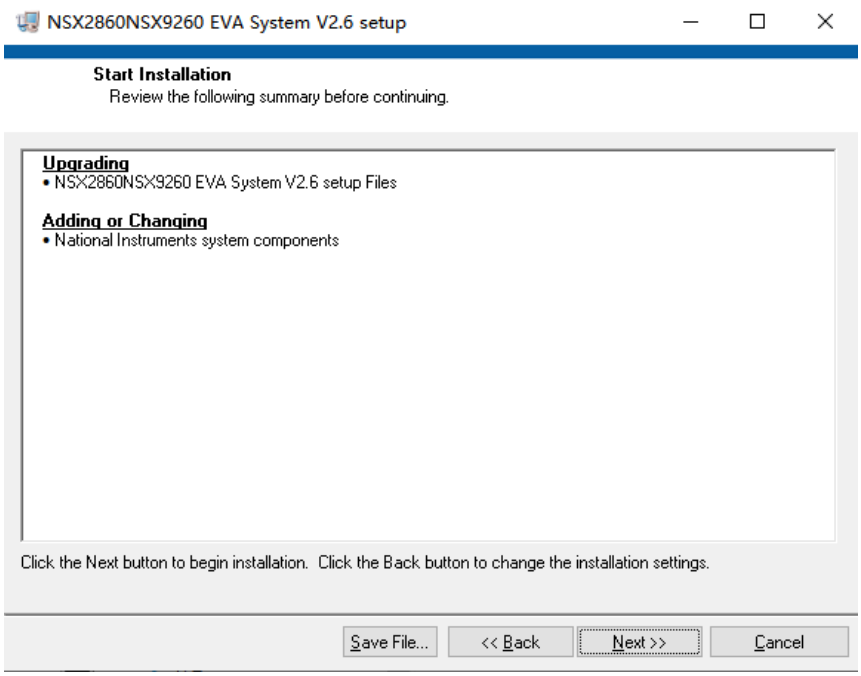


Figure 1.7 Components to be installed

Wait for the program installation to be completed.

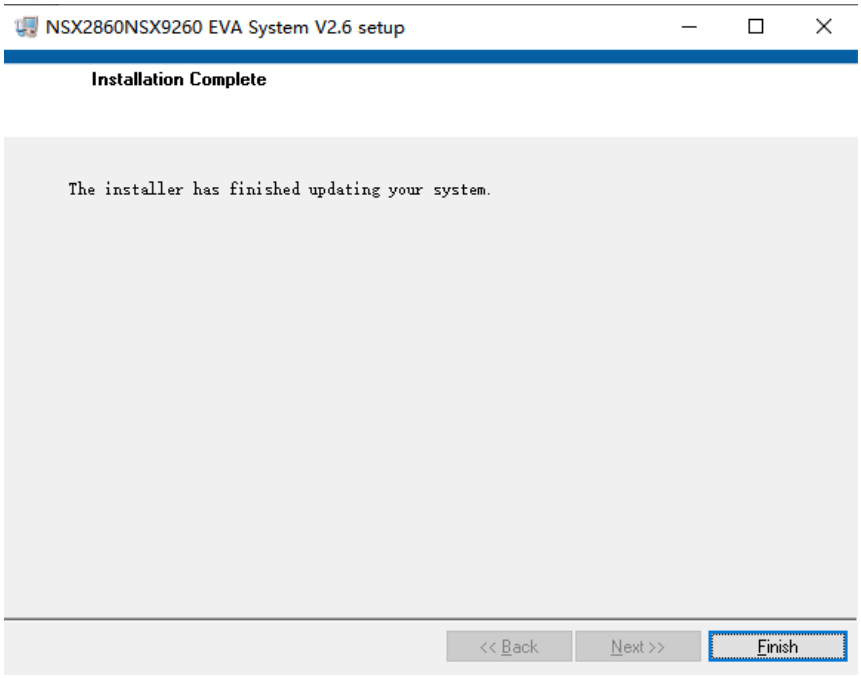


Figure 1.8 Installation Finished

1.2.2.Serial COM Driver

After the USB-485 cable is plugged into the computer, the system will automatically install its driver. After successful installation, the system device manager will show this serial device as shown in the figure below.

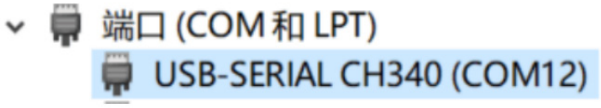


Figure 1.9 Serial COM Device in Device Manager

If the system does not successfully install the driver automatically, manually install the driver in the subfolder "CH" in the RS485 driver folder.

Figure 1.10. Serial COM Driver Files

1.3.Software GUI

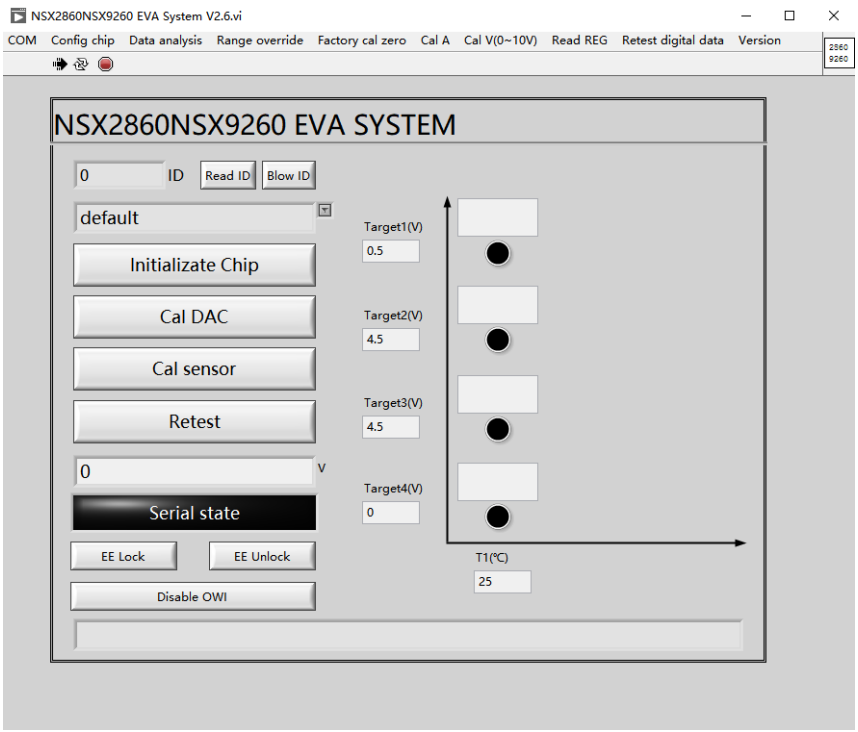


Figure1.11. NSx2860/9260 EVA System GUI

At the top of the software interface are the function menus. Each menu contains a separate function. Some of them are not necessary in the calibration process.

“COM”: Configure serial port. Refer to chapter 2.1 for detailed information.

“Config chip”: Configure chip basic registers. Refer to chapter 2.3 for detailed information .

“Data analysis”: Display raw data and calibration coefficients for analysis.

“Range override”: Adjust scale coefficients of a calibrated product for a new input range.

“Factory cal zero”: Modify the zero point of a calibrated product.

“Cal A”: Calibrate the 4~20mA measurement ammeter on the EVA board.

“Cal V(0~10V)”: Calibrate the 0~10V measurement voltmeter on the EVA board.

“All REG”: Read or write all registers of the chip.

“Retest digital data”: Get the digital data of retest.

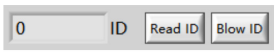
“Version”: Get the EVA board MCU version and software version.

Only the “COM” an “Config chip” menus are necessary for the calibration flow, the other menus are just some auxiliary functions.

The voltmeter and ammeter on the EVA board are calibrated at the factory, so it is recommended not to perform “Cal A” and

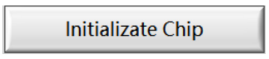
“Cal V(0~10V)” operations.

Start program.
Stop program.



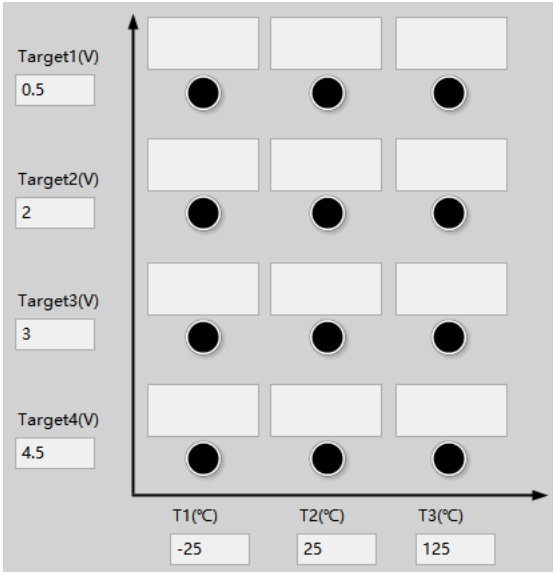
“Read ID”: Enter communication mode and get current ID stored in the configuration file.
“Blow ID”: Add 1 to the read ID, then program it into chip’s EEPROM and write to configuration file.

Select the desired initialization register configuration file. Users can add different configuration files depending on the needs of
different projects. The file directory is “xxxx\NSX2860NSX9260 EVA System V2.6\ConfigFile”.



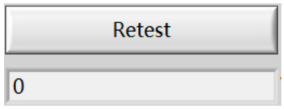
Click this button to start initializing registers and program them into the EEPROM according to the selected “xxxx.ini” file.

Click this button to start calibrating DAC, then store raw data and calculated coefficients into data file.

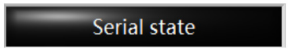


Click the black circular button on the right side to capture raw data at different pressures and temperatures.
This input matrix size will change depending on the configured calibration mode. A maximum of 4 pressure points and 3 temperature points are supported.

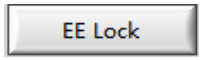
Click this button to start calibration, then store calculated coefficients into data file.



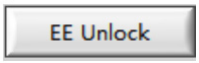
After the product has been calibrated, click the "Retest" button to retest it. The results of the retest are displayed in the box below.



This is the display bar of serial port status. If the serial port is configured correctly and there is no problem with the device, this status bar will turn green.



When the chip is in communication mode, click this button to lock the EEPROM. After this operation, EEPROM can not be program any more until it is unlocked.



When the chip is in communication mode, click this button to unlock the EEPROM.

When the chip is in communication mode, click this button to disable OWI communication mode. It will take effect at next power on.

This is the status bar of the software. It will show the status of the current operation or give feedback on the result of the operation.

2.Calibration Flow

The following is a detailed description of the calibration process using the NSA2860 0-5V output, 3P1T calibration mode as an example.

2.1.Serial Port Configuration

After running the software, the serial port configuration interface will pop up automatically, as shown in the following figure2.1

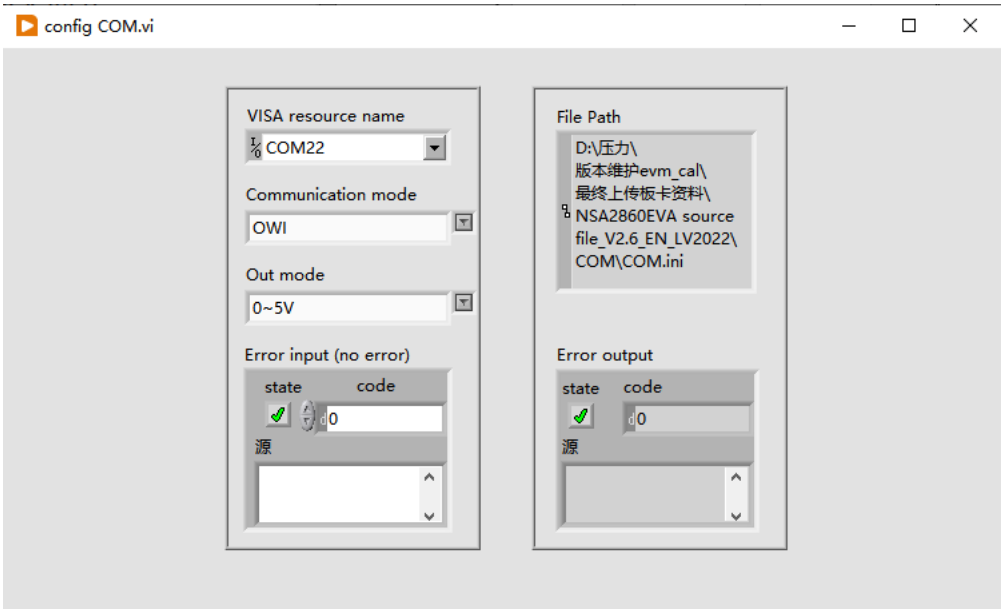


Figure 2.1 Serial Port Configuration

Under this interface, it is needed to configure the serial port number to which the EVA board is connected, the communication mode and output type of the DUT. After the configuration is finished, click the “X” button in the upper right corner to close the
interface.
If the serial port is configured correctly, this serial port status bar will turn green.

2.2.Read ID and Write ID

At first, click the “Read ID” button. It will make the chip to enter communication mode and get current ID stored in the configuration file.
Then click the “Blow ID” button. It will add 1 to the read ID, then program it into chip’s EEPROM and write to configuration file.

2.3.Chip Initialization

Click the “Config Chip” menu to go to the chip configuration screen.
The left side is the register configuration section. Please refer to the details of each register in the datasheet for how to choose the
configuration of this section.
The upper part on the right side is the calibration-related configuration section. Here you need to select the calibration mode and
its corresponding target output values and temperatures according to the needs of the product. The calibration algorithm is recommended to choose the fitting algorithm.
Once you have configured each configuration, click the “Save” button on the right to save the configuration to the file.

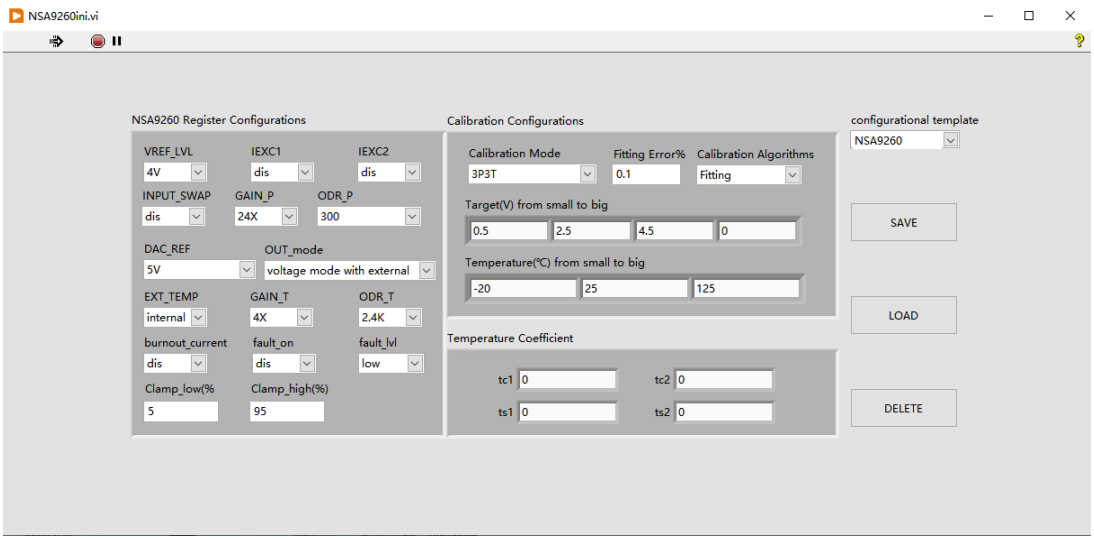


Figure 2.2 Chip Configuration

The above configuration will be saved in the “xxxx.ini” file in the directory “xxxx\NSX2860NSX9260 EVA System V2.6\Config-File”.
So, another way to modify the configuration is to modify this “xxxx.ini” file directly. The contents of this “xxxx.ini” file is shown in
Figure14 below. You can copy or create new “xxxx.ini” files under this directory for different projects.

```
[REG]
A1 = 0
A2 = 0
A3 = 0
A4 = 3
A5 = 196
A6 = 64
A7 = 26
A8 = 26

[Calibration Configurations]
Calibration Mode = "3P1T"
Fitting Error = 0.100000
target1 = 0.500000
target2 = 2.500000
target3 = 4.500000
target4 = 0.000000
T1 = 25.000000
T2 = 25.000000
T3 = 125.000000
Clamp_low = 5.000000
Clamp_high = 95.000000
Calibration Algorithms = "Fitting"

[Temperature Coefficient]
tc1 = 1.000000
tc2 = 3.000000
ts1 = 2.000000
ts2 = 4.000000
```

Figure 2.3 Chip Configuration

The register values are in decimal format.

The “Temperature Coefficient” here are here are experience coefficients for certain special applications, which want higher order

temperature compensation without actually calibrating at multiple temperatures. This requires a high degree of consistency in the temperature characteristics of the sensor.

After configuring the above configuration file, click the “Initialize Chip” button to write the configuration to the chip.

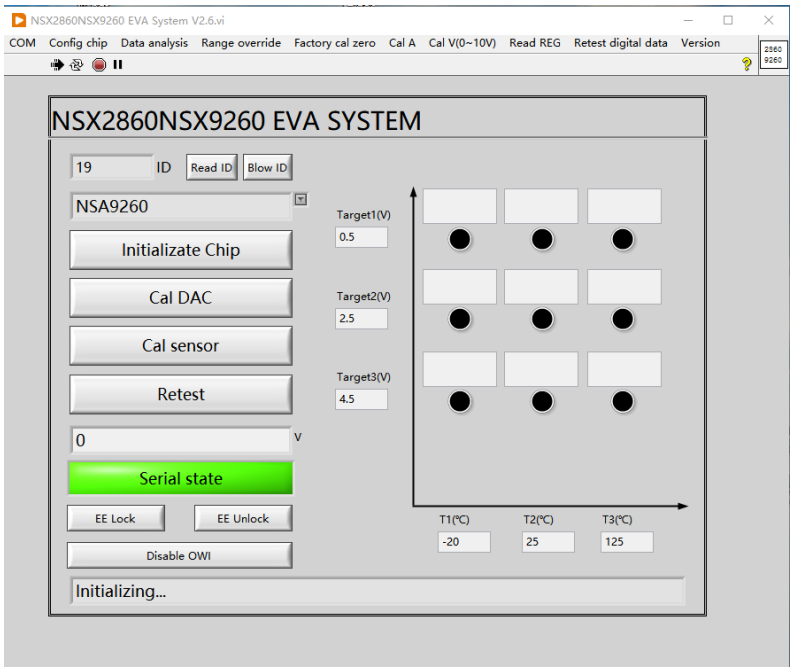


Figure 2.4 Initialization Completed

2.4.DAC Calibration

Click the "DAC Calibration" button and the program will automatically perform DAC calibration. After the calibration is completed, the interface is as shown below.

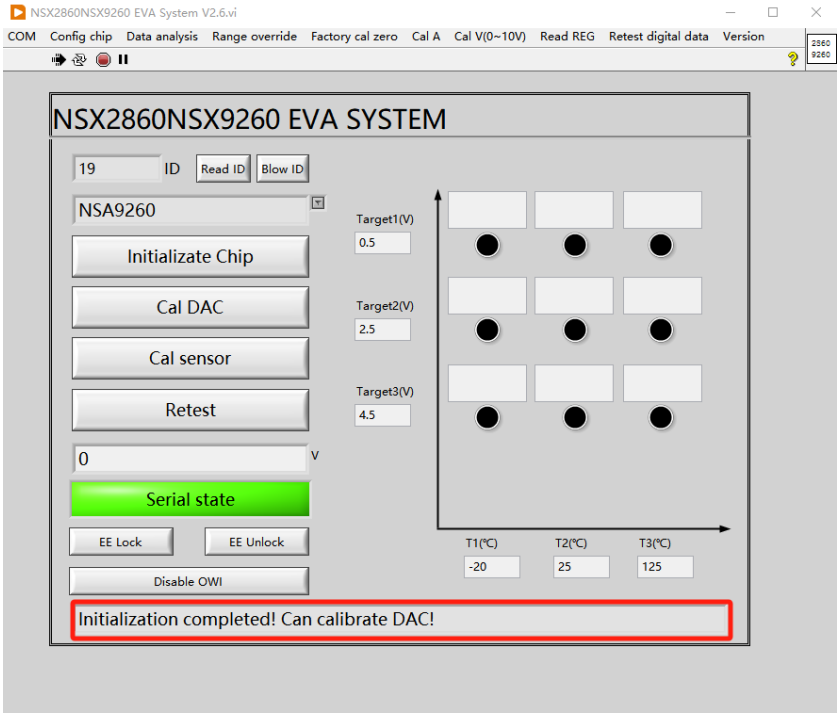


Figure 2.5 DAC Calibration Completed

2.5.Raw Data collection

Click the black circular button on the right side to capture raw data at different pressures and temperatures. Pressure raw data is displayed in normalized format. Temperature data is displayed in °C.

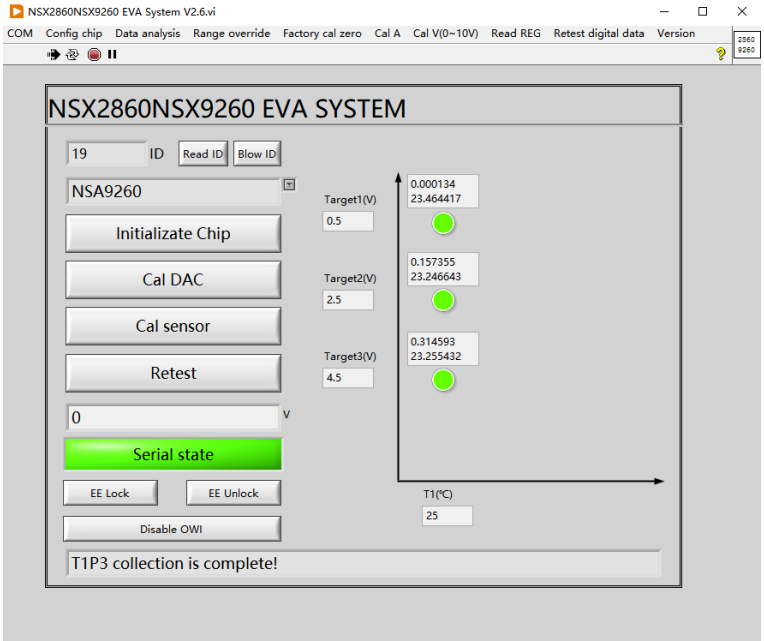


Figure 2.6 Raw Data Collection

2.6.Calibrate Coefficients

After all the raw data is collected, click the “Cal Coefficient” button. The program will automatically complete the calibration of the sensor and program the coefficients into the EEPROM and writes them to a local file.

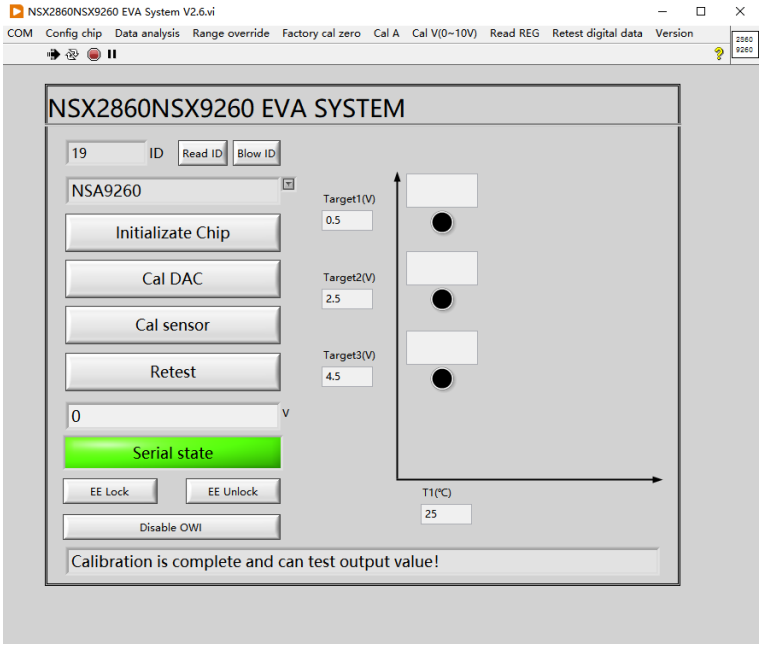


Figure 2.7 Calibration Completed

2.7.Retest

After calibration is complete, click the “Retest” button to test the output values at certain pressure and temperature.

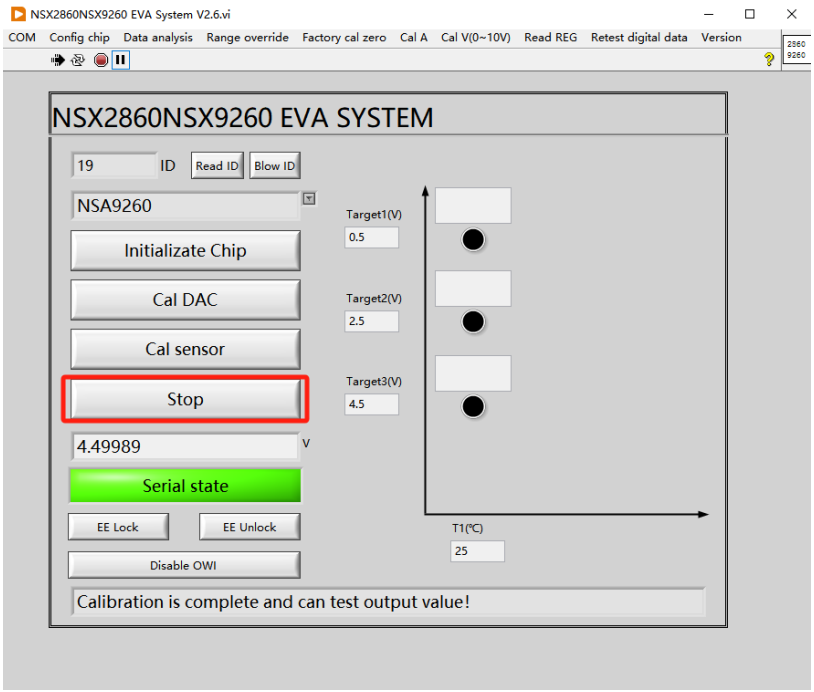


Figure 2.8 Retest

At this point, the whole calibration flow is completed.

If additional function such as locking the EEPROM or disabling the OWI is required, follow the descriptions in the previous sections.

3.Revision History

Revision	Description	Author	Date
1.0	Initial version	Feifei Sun	16/6/2023

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