Application Note

NOVOSENSE

NSx2860(X)/NSx9260(X) MUL CAL SYSTEM Capacitive-Resistive Analog Output Pressure Conditioning Multiple Calibration Systemuser guide

AN-12-0042

Author:Di.Zhai

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ABSTRACT

The NSx2860(X)/NSx9260(X) MUL CAL SYSTEM Capacitive-Resistive Analog Output Pressure Conditioning Multiple Calibration System is a comprehensive evaluation platform for the 2860 and 9260 series of pressure conditioning chips, including NSA2860; NSC2860; NSA2860X; NSC2860X; NSA9260; NSC9260; NSA9260X; NSC9260X. This system aims to assist customers in the batch processing of pressure conditioning chips during mass production testing.

INDEX

1.System Overview

The NSx2860(X)/NSx9260(X) MUL CAL SYSTEM Capacitive-Resistive Analog Output Pressure Conditioning Multiple Calibration System is a comprehensive evaluation platform for the 2860 and 9260 series of pressure conditioning chips, including NSA2860; NSC2860; NSA2860X; NSC2860X; NSA9260; NSC9260; NSA9260X; NSC9260X. This system aims to assist customers in the batch processing of pressure conditioning chips during mass production testing. Capable of handling up to 32 channels, it facilitates the initialization, calibration, and testing of various pressure sensor of 0-5V, 0-10V or 4-20mA output mode. Additionally, NOVOSENSE offers comprehensive host computer software that integrates seamlessly with the system, ensuring smooth operation and efficient verification.

1.1.Hardware Introduction

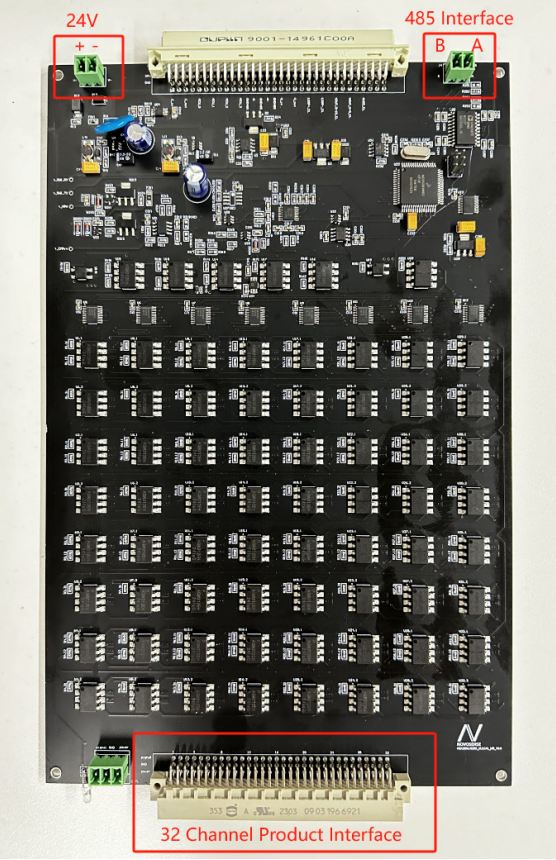

Figure1.1 NSx2860/9260 evaluation board Top View

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

24V: Connect to 24V DC power supply.

485 Interface: Connect to the RS485 converter. 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 evaluation board will be damaged.

32 Channel Product Interface: The device features 3 rows with 32 terminals per row. The pins on the top layer are defined as signal, the middle layer as GND, and the bottom layer as VDD.

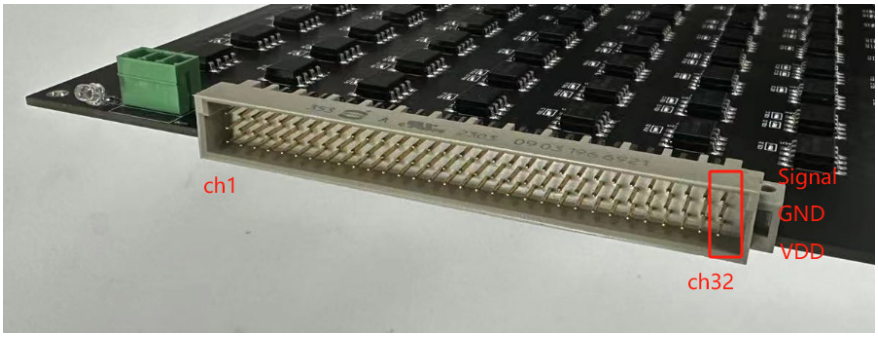

Figure 1.2 NSx2860/9260 MUL CAL SYSTEM 32 Channel Product Interface

1.2.Functional Software and Driver Installation

1.2.1.Software Installation

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

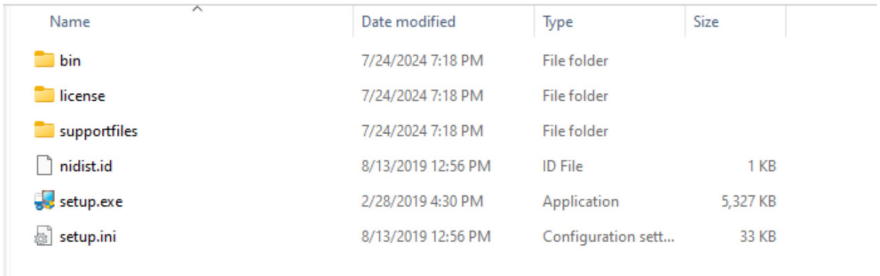

Figure 1.3 NSx2860/9260 MUL CAL SYSTEM Calibration Program Files

After selecting the program installation directory, click “Next” to continue.

It is recommended not to install the program on the system disk (Disk C:\).

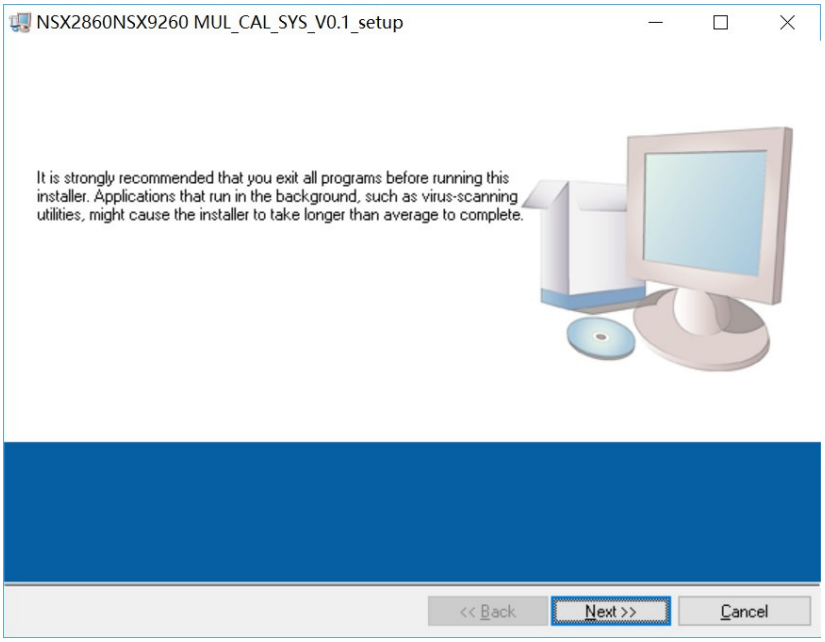

Figure 1.4 NSx2860/9260 MUL CAL SYSTEM Calibration Program Installer

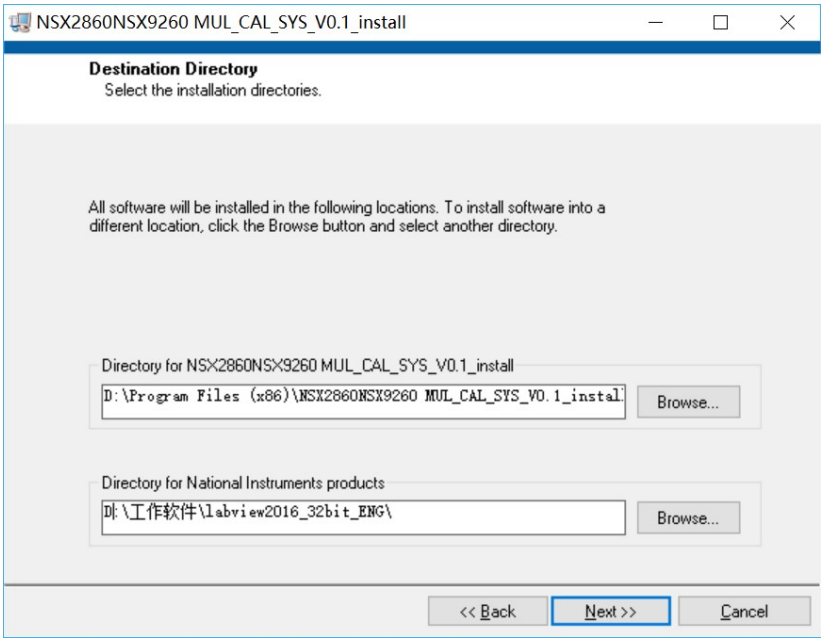

Figure 1.5 Installation Directory Selection

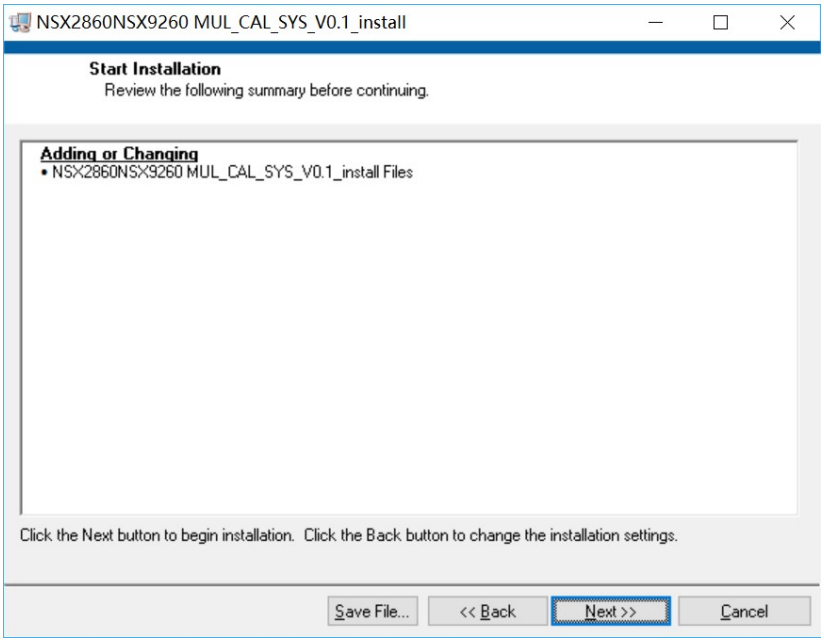

Figure 1.6 Components to be installed

Wait for the program installation to be completed.

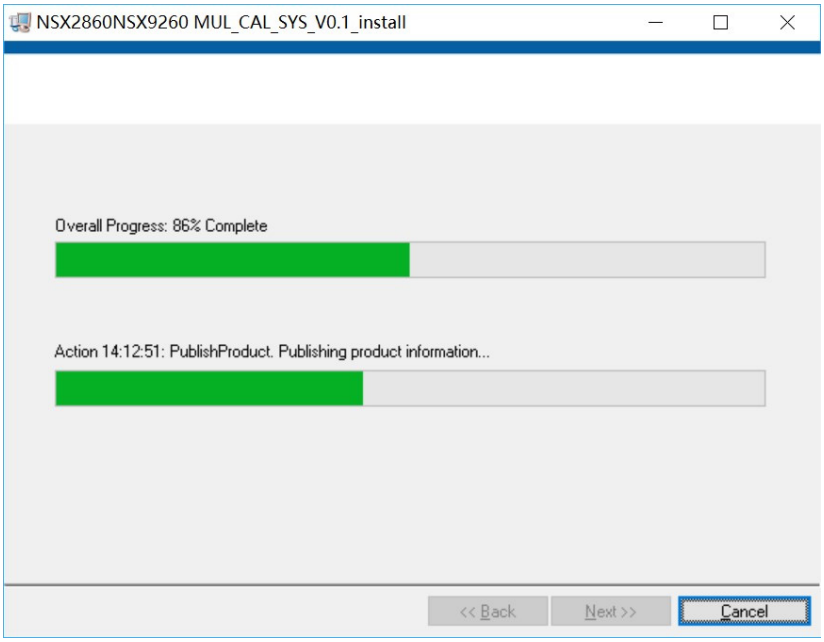

Figure 1.7 Installation Progress

After installation, you can click “Finish” to complete the process. If a computer restart is required, you will be prompted to do so.

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.

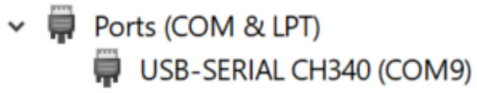

Figure 1.8 Serial COM Device in Device Manager

If the system does not successfully install the driver automatically, manually install the driver in the subfolder “RS485_Driver_CH” in the RS485 driver folder.

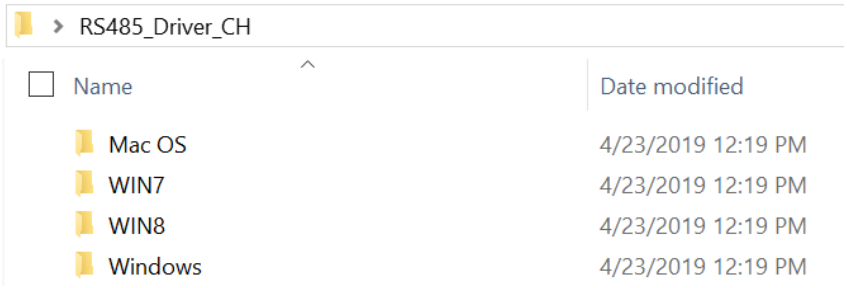

Figure 1.9. Serial COM Driver Files

1.3.Software GUI

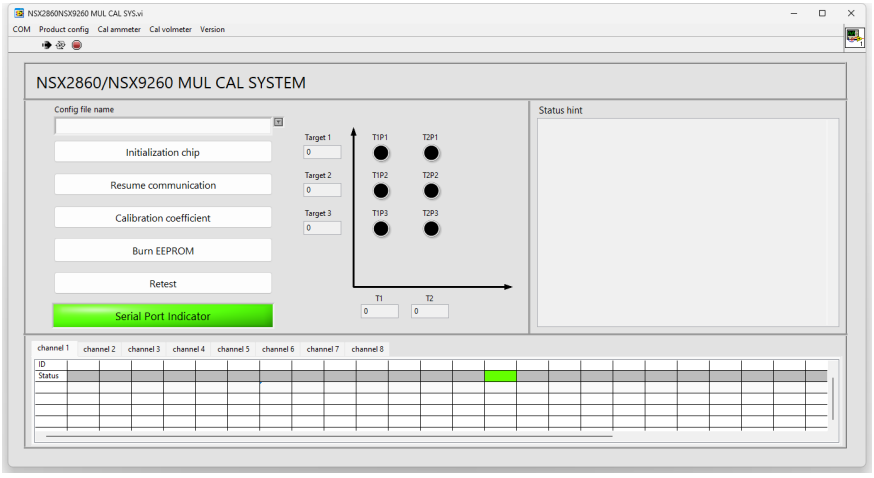

Figure1.11. NSx2860/ 9260 EVA System GUI

The software is used to complete the calibration process of the MUL CAL SYSTEM, with the following main functions:
Initialization chip: Prepares the software for calibration tasks.
Resume communication: resume chip operation.
Calibration coefficient: Executes the calibration process.
Burn EEPROM: Saves the calibration coefficients to the device.
Retest: Verifies the calibration results.

At the top of the software interface are the function menus. Each menu contains a separate function.
COM: Configure serial port. Refer to chapter 2.1 for detailed information.
Product config: Configure chip basic registers. Refer to chapter 2.2 for detailed information.
Cal ammeter: Calibrates the ammeter.
Cal volmeter: Calibrates the voltmeter.
Version: Displays the software version information.

Usage Example:
For instance, to calibrate the NSA9260 sensor, set up calibration at pressure points of 90kPa and 130kPa under normal temperature. The calibrated analog output values should be 0.5V and 4.5V, respectively, with the sensor output range spanning from 0 to 5V.

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

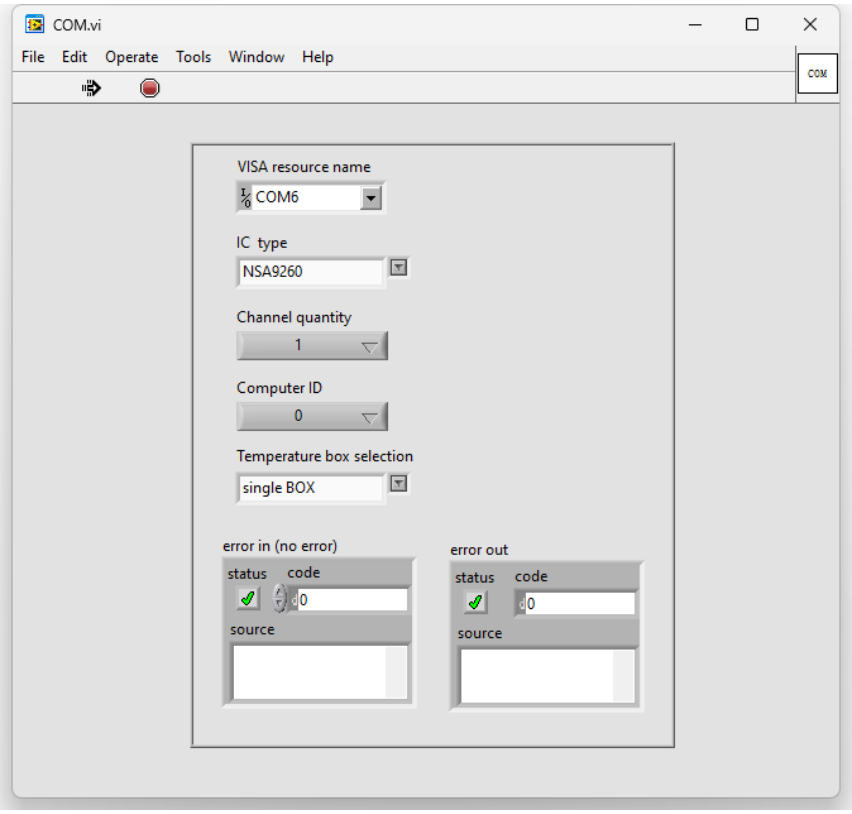

Figure 2.1 Serial Port Configuration

Under this interface, it is needed to configure the serial port number to which the 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.
VISA resource name: Select the COM port.
IC type: NSA2860(X), NSC2860(X), NSA9260(X), and NSC9260(X). Select the corresponding option based on the chip model, choose the 2860 option for 2860X, and choose the 9260 option for 9260X.
Channel quantity: Select between 1 to 8 channels, representing the number of cascades in the calibration system.
Computer ID: Range from 0 to 15; use different numbers to distinguish between multiple devices being calibrated simultaneously.
Temperature box selection: Choose between single temperature box calibration or multi-temperature box calibration.

2.2.Product Config

Click the “Product Config” menu to go to the chip configuration interface.

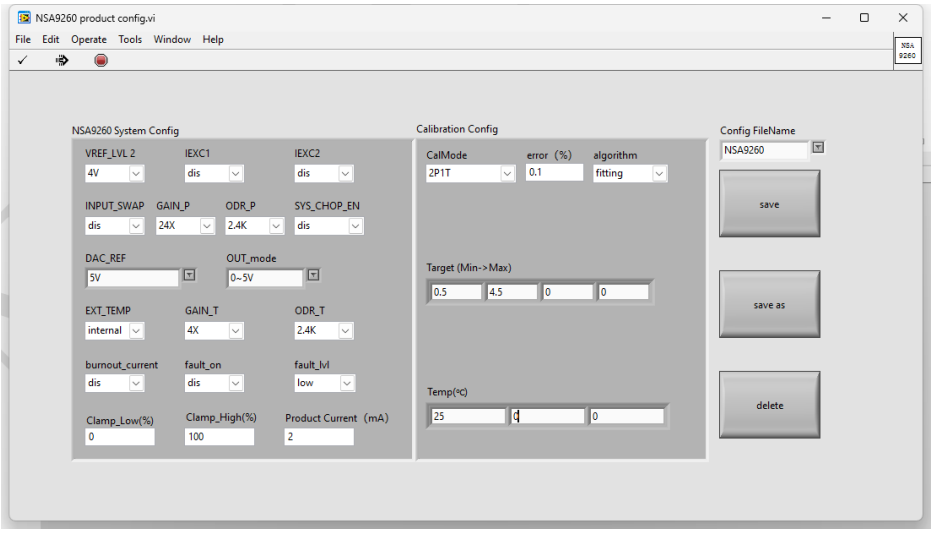

Figure 2.2 Chip Configuration

The left side is the system configuration section. Please refer to the details of each register in the datasheet for how to choose the
configuration of this section. The right side is the calibration-related configuration section.

System Config:
System configuration: refer to the datasheet of each chip series for details.
Clamp_Low (%): The percentage of the minimum output voltage relative to the DAC reference voltage. If clamping is not needed,
set this value to 0.
Clamp_High (%): The percentage of the maximum output voltage relative to the DAC reference voltage. If clamping is not needed,
set this value to 100.

Calibration Config:
CalMode: Select the calibration mode. NSx2860/NSx9260 supports multiple calibration modes, ranging from 2P1T to 4P3T. It can
perform up to second-order temperature coefficient calibration and third-order nonlinear calibration, allowing for the collection
of up to three temperature points, with four pressure data points recorded at each temperature point. In Figure 2.2, the 2P1T mode is selected.
Error (%): Set the permissible error range for the fitting algorithm, which does not include the final voltage or current output values.
Algorithm: Select the calibration algorithm. There are two options: fitting calibration and equation solving calibration. Equation
solving calibration supports piecewise calibration, while fitting calibration does not.
Target: Set the analog voltage output target values corresponding to the pressure points, which must be arranged in ascending
order. For example, when the external pressure is 90 kPa, the output voltage is 0.5 V; at 110 kPa, the output voltage is 2.5 V; and at
130 kPa, the output voltage is 4.5 V.
Temp(°C): Set the temperature points for calibration; Figure 2.2 indicates that calibration is performed only at room temperature
(25°C).
Output File Config:
Config FileName: Set the target file to save the current configuration. You can choose the file name freely, but it is recommended to name it in relation to the product series model for easy identification.
Save: Save the current configuration to the file specified in the previous step.
Save as: Save the current configuration under a new file name as a different command template.
Delete: Delete the configuration file associated with the current command template name.
Click save and close the window on the upper right-hand corner.

2.3.Configuration

Config file name: Select a configuration template that has already been stored in the Product Config menu. After making your selection, the target value on the main interface, including the temperature and collection point, will be updated to synchronize with the state stored in the chosen configuration template.

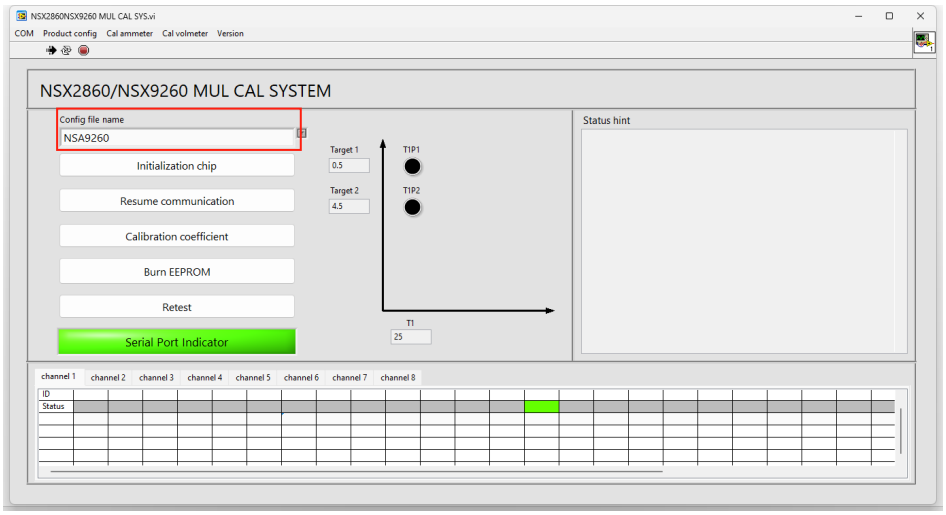

Figure 2.3 Choose Configuration template

2.4.Initialization

Click the “initialization chip” button to open the interface, which includes four buttons: Short circuit test, Write ID, Read ID, and Config chip.

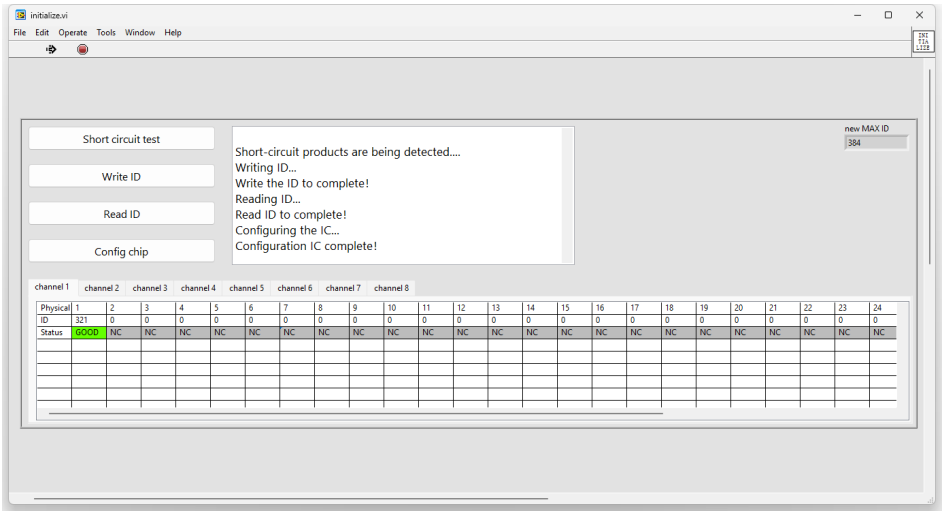

Figure 2.4 Initialization Interface

Short circuit test: Products are powered up in sequence to measure the current. If the current exceeds the limit, the product's calibration status will be marked as gray.
Write ID: Write unique IDs to all products. If the products to be calibrated do not have pre-assigned IDs, you must first click "Write ID". After clicking, the status information for writing can be displayed in the prompt interface on the right. Once the log output is complete, the ID numbers of each product will be displayed in the 'ID' row of the table below, and the communication status will be displayed in the "Status" row.
Read ID: Read the current IDs of all products. If the IDs have already been written and you do not want to reassign them, you may click "Read ID". After clicking, the status information for reading can be displayed in the prompt interface on the right. The ID numbers of each product will be displayed in the "ID" row of table below, and the communication status will be shown in the "Status" row.
Config chip: Write the registers to the chip according to the configuration file. After clicking, the calibration interface will display "Configuring the IC…". Once the process is complete, it will show "Configuration IC Complete!".

2.5.Resume communication

Resume communication: If you are unsure of the current operation state of the product, click this button to resume chip operation.

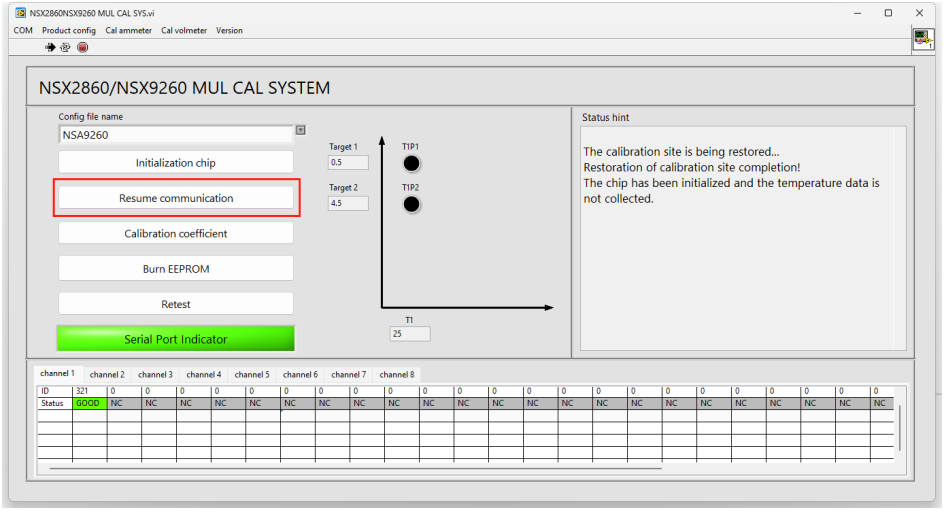

Figure 2.5 Resume chip operation

2.6.Collecting raw data

Change the pressure environment to 90 kPa. Click the T1P1 indicator button, and the indicator will turn on. The calibration status bar will show the status of T1P1 raw data reading. After the collection is complete, it will display “T1P1Collect Complete!”.
Change the pressure environment to 130 kPa. Click the T1P2 indicator button, and the indicator will turn on. The calibration status bar will show the status of T1P2 raw data reading. After the collection is complete, it will display “T1P2Collect Complete!”.

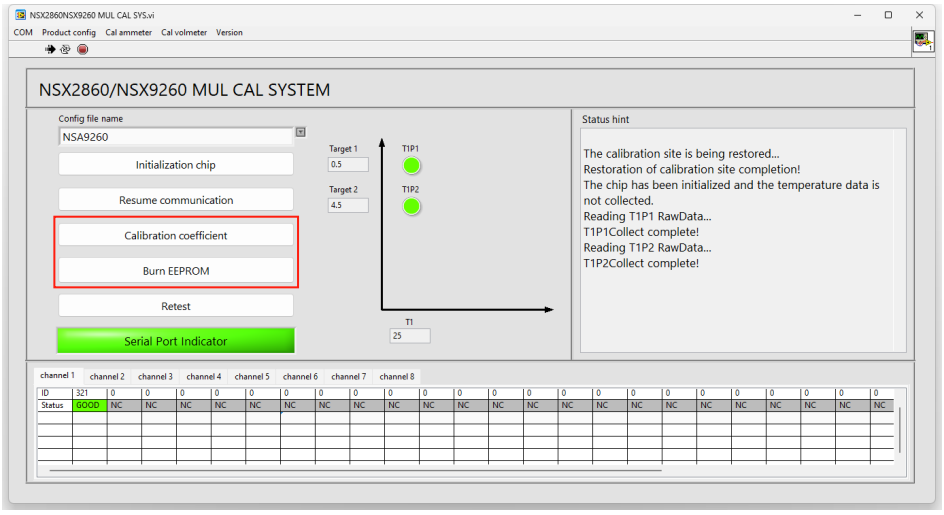

Figure 2.6 Collecting raw data

At this point, the whole calibration flow is completed.
If additional function such as locking the EEPROM is required, follow the descriptions in the following sections.

2.7.Calibration & Burning EEPROM

By clicking on the “Calibration coefficient” button, the software will calculate the calibration coefficient of each product according to the original data collected. The calibration results of each product will be marked in the 'Status' row of the table. Then press “Burn EEPROM” button, if the calibration is successful, the calibration coefficients will be written to the chip and burned to EEPROM.

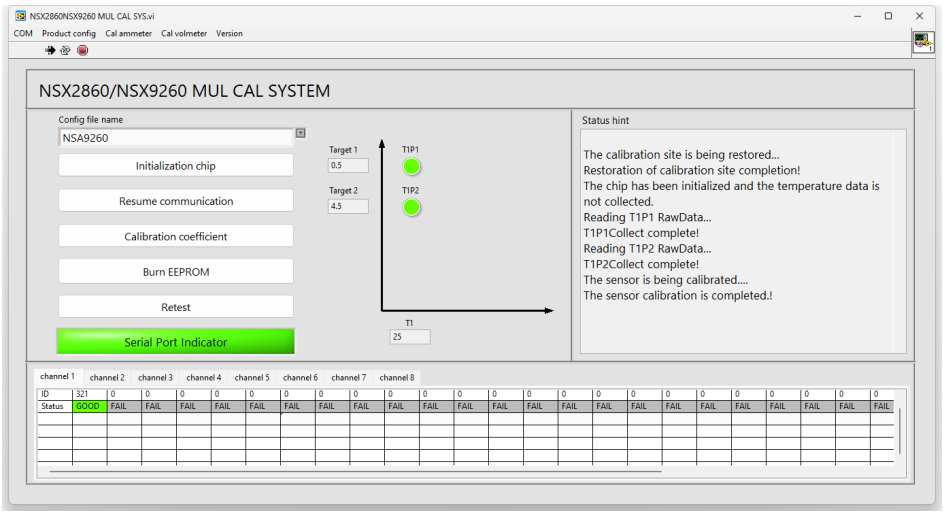

Figure 2.7 Calibration & Burning EEPROM

2.8.Confirm

Retest: Change the pressure environment, click the “Retest” button, and display the analog output value in the current pressure environment in the form.

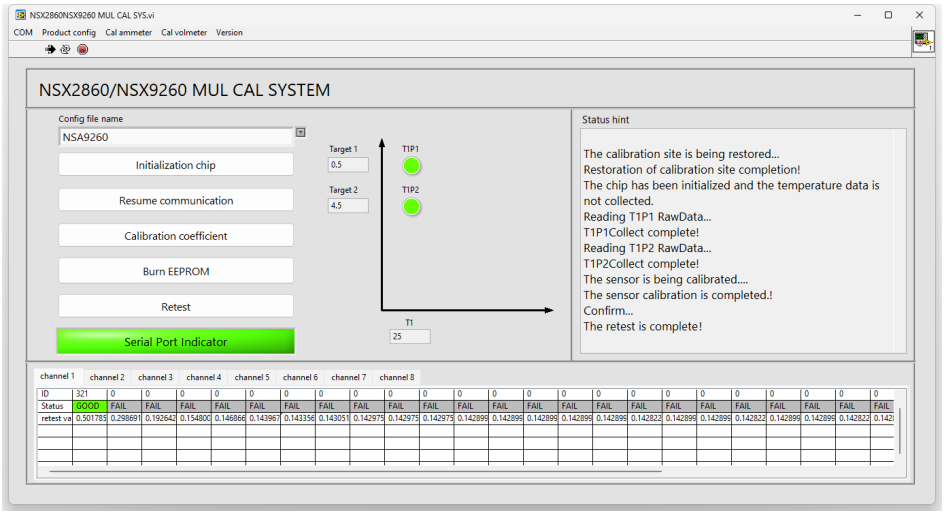

Figure 2.8 Retest Chip & Confirm

3.Config file path

The COM file save path:
D:\Program Files (x86)\NSX2860NSX9260 MUL_CAL_SYS_V0.1_setup\COM
The configuration file save path:
D:\Program Files (x86)\NSX2860NSX9260 MUL_CAL_SYS_V0.1_setup\ConfigFile
The calibration data preservation path:
D:\Program Files (x86)\NSX2860NSX9260 MUL_CAL_SYS_V0.1_setup\DataFile\0\channel1

Note:
If debug support is needed, please simply send the relevant files from the above path to NOVOSENSE.
please find folders based on the software installation directory.

4.Ordering Information

Part Number	Description
NSA2860_CAL32	NSx2860_9260 32-channel Calibration Board

5.Revision History

Revision	Description	Author	Date
1.0	Initial version	Di.Zhai	25/9/2024

Sales Contact: sales@novosns.com;Further Information: www.novosns.com