Application Note

NOVOSENSE

NSA2302 EVAL SYSTEM USER GUIDE

AN-12-0040

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NOVOSENSE

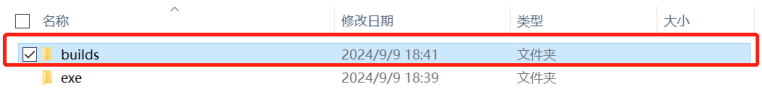
ABSTRACT

NSA2302 evaluation system is designed to help customers quickly validate the NSA2302 signal conditioning chip at the laboratory level.

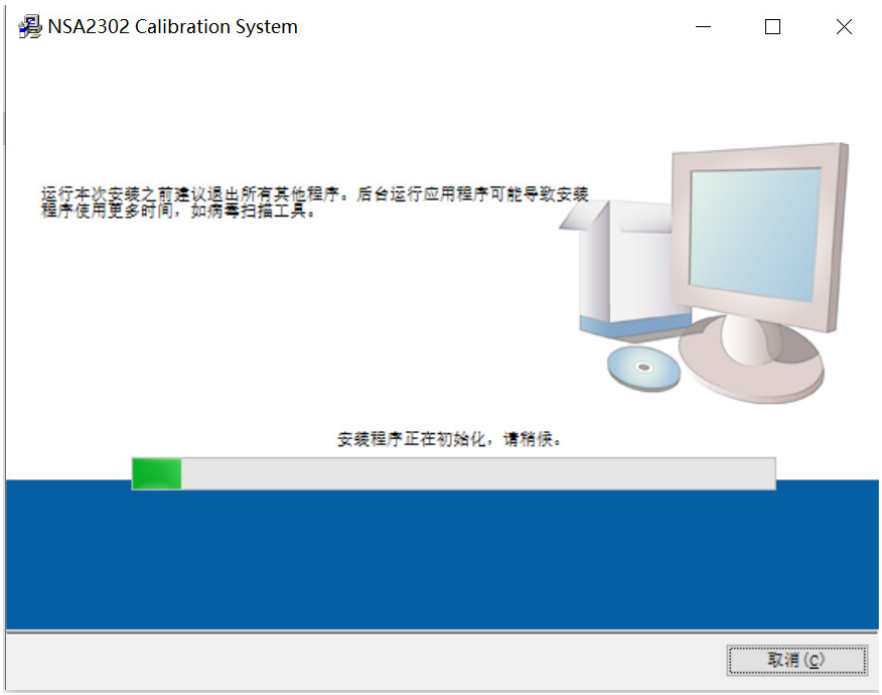
INDEX

1.NSA2302 Calibration System Installation Process

(1)Open the folder(builds\NSA2302 Calibration System\NSA2302 Calibration System_V1.0_install\Volume)

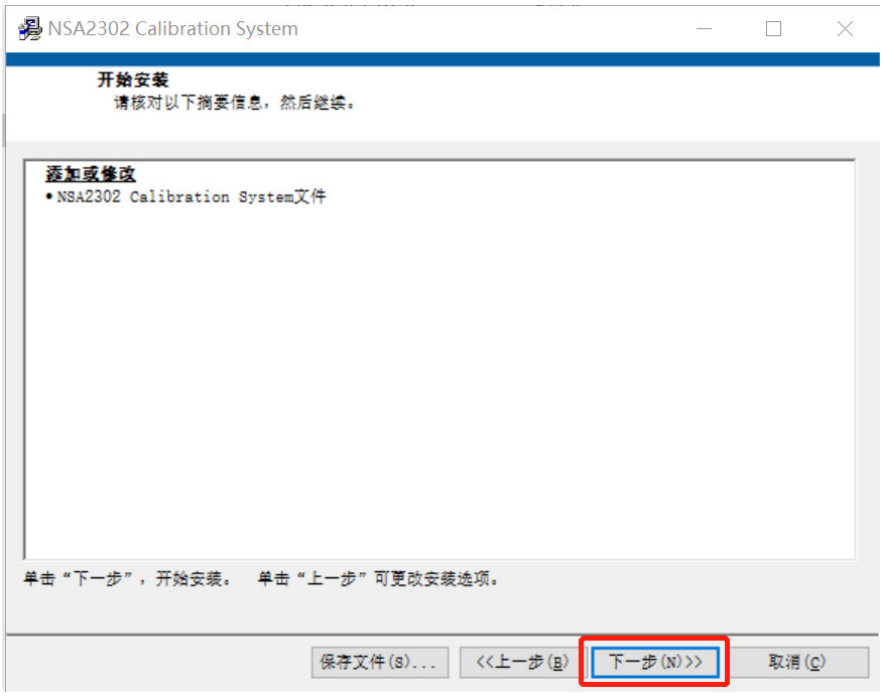


(2)Click setup

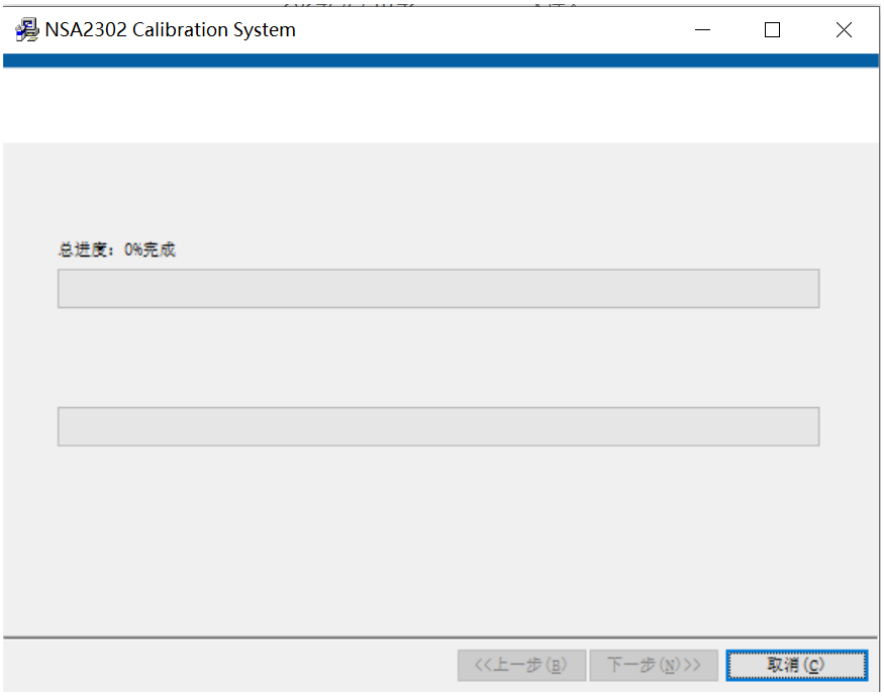


(3)Follow the process in the figure, select the installation path, and click Next

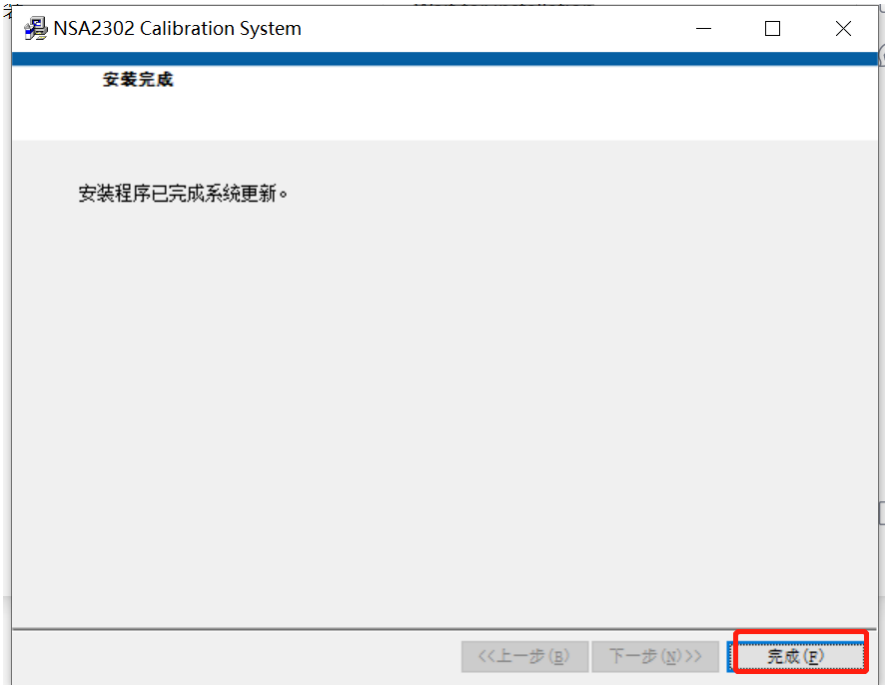
(4)Click Next



Wait for installation



(3)Click finish, and the software is installed completely



2.NSA2302 Evaluation Board Hardware

As shown in Figure 1.1, it is the hardware of NSA2302 evaluation board.

Red Box:24V Power Port.

Green Box:485 Communication Port.

Blue Box: Output Port

Yellow Box: IIC Port

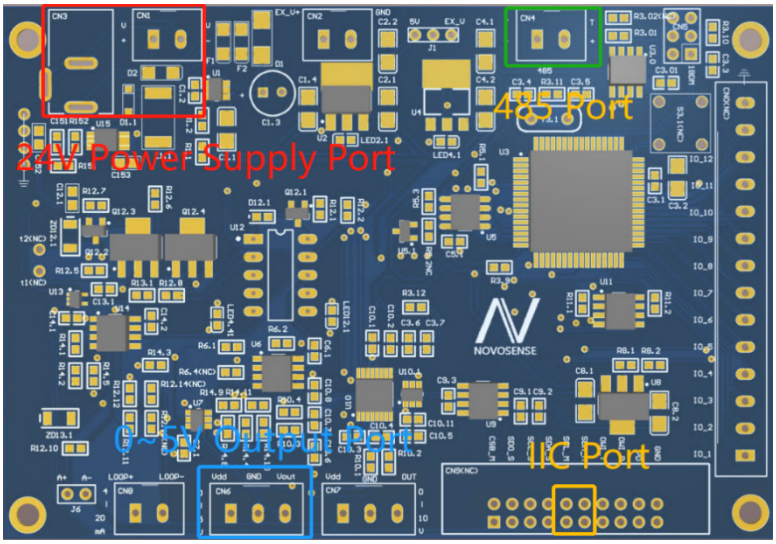


Figure 1.1 The Hardware of EVAL Board

According to the different output modes of NSA2302, the NSA2302 evaluation board and DUT can be connected in two ways:

As shown in Figure 1.2 for analog output:

(1)The VDD of the NSA2302 evaluation board is connected to the VDD of the DUT.

(2)The GND of the evaluation board is connected to the GND of the DUT.

(3)The Vout of the evaluation board is connected to the Vout of the DUT

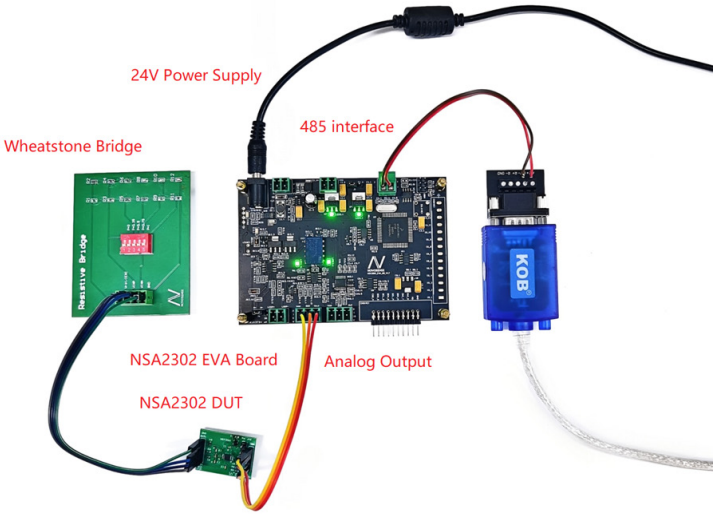


Figure 1.2 Hardware Connection (Analog output)

As shown in Figure 1.3 for digital output:

(1)The VDD of the NSA2302 evaluation board is connected to the VDD of the DUT.

(2)The GND of the evaluation board is connected to the GND of the DUT.

(3)The SCL_M of the evaluation board is connected to the SCL of the DUT.

(4)The SDA_M of the evaluation board is connected to the SDA of the DUT.

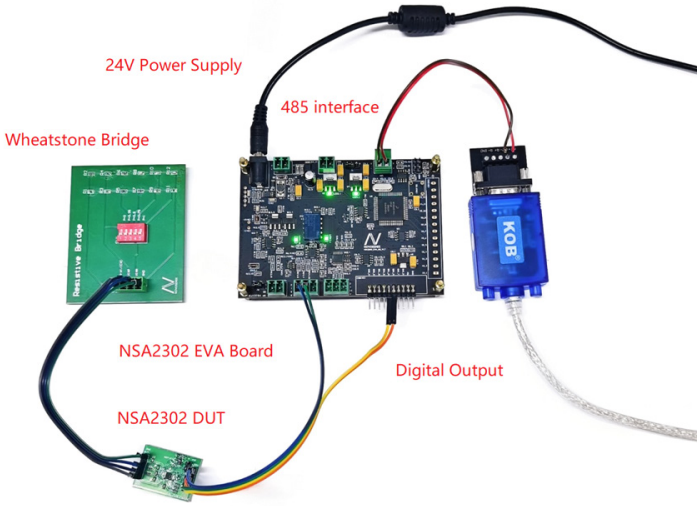


Figure 1.3 Hardware Connection (Digital Output)

3.The Software of NSA2302 Eval System

3.1.The Introduction of main interface

Figure 2.1 shows the main interface of the NSA2302 evaluation system.

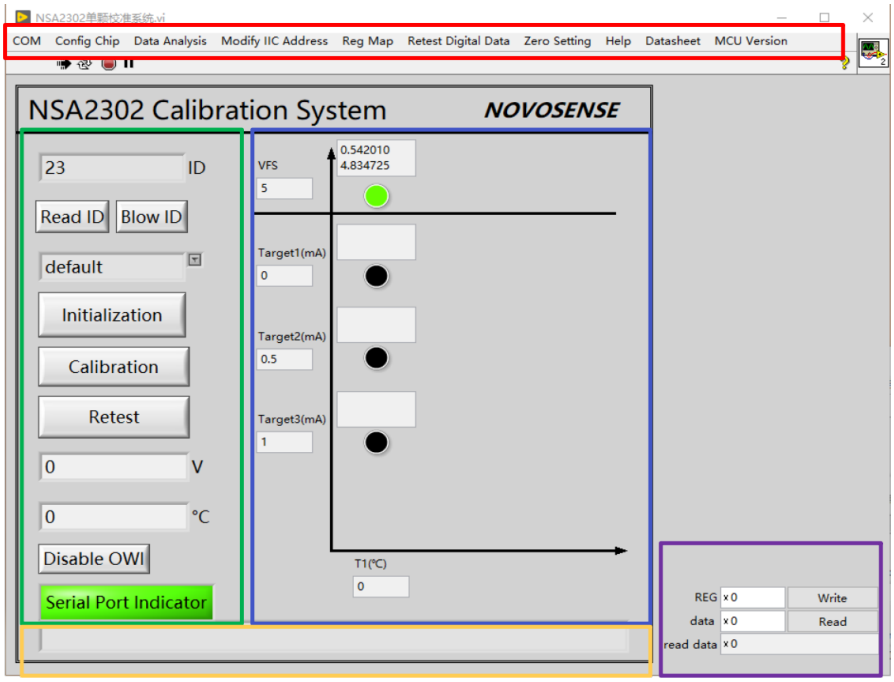


Figure 2.1 Main Interface of NSA2302 Evaluation System

1.Red Box:

(1)Com: 485 Serial port communication configuration buttons. For detail refer to 3.1.

(2)Config Chip: Provides basic parameter configuration for the chip. For detail refer to 3.2.

(3)Data analysis: Displays calibration raw data and calibration coefficients. For detail refer to 3.3.

(4)Modify IIC address: Modify NSA2302 IIC address. For detail refer to 3.4.

(5)Read Reg: Read and configure chip registers. For detail refer to 3.5.

(6)Retest Digital data: Digital output data can be collected. For detail refer to 3.6.

(7)Zero Setting: Chip support factory zero. For detail refer to 3.7.

(8)Version: Display current software version number and MCU version number. For detail refer to 3.8.

2.Green Box:

(1)Read ID: It is used to read the current chip ID number and is displayed in the ID display box on the top.

(2)Blow ID: It is used to write an ID number for each chip. The number is incremented by 1 automatically.

(3)The configuration file drop-down list: Before initializing the chip, manually select the name of the configuration file named in the configuration chip.

(4)Initialization: the parameters in the configuration chip are burned to the chip, and the data will not be lost after the chip is powered off.

(5)Calibration: Call the original data collected to calculate the corresponding coefficient, and burn the chip, the data will not be lost after the chip power off.

(6)Retest: Test the calibrated output, the output will be displayed in the display box below the retest button.

(7)Disable OWI: Disable OWI communication (If OWI is disabled, the product will not be able to communicate).

3.Blue Box:

(1)VFS: Capture reference Voltage, the black button will light up when the collection is over.

(2)Raw data collection button. After clicking the black button, two lines of data will be displayed in the display box above each button (above the first is the raw data of pressure, and the next is the temperature data. After the collection is finished, the black button will light up.

Note:

1. When the lighted button is clicked again, the button will revert to black, and the previously collected data will be cleared.

2, the horizontal axis represents different temperature points, and the vertical axis represents the output target value corresponding to different pressure points.

4.Yellow Box: Display the process of calibration.

5.Purple Box: Supports reading and writing of a single register.

4.The Description of calibration process

4.1.COM

The Com configuration interface is shown in Figure 3.1. The configuration is as follows:

COM: 485 Communication Port

Communication Mode: Support OWI、IIC、3Wire-SPI、4Wire-SPI

Output Mode: Support 0~5V Output Mode、4~20ma Output Mode、IIC Output Mode、SPI Output Mode.

After the configuration is complete, directly click X in the upper right corner to close the COM interface and return to the main interface.

As shown in Figure 3.1. Take OWI communication, 0 ~ 5V output as an example

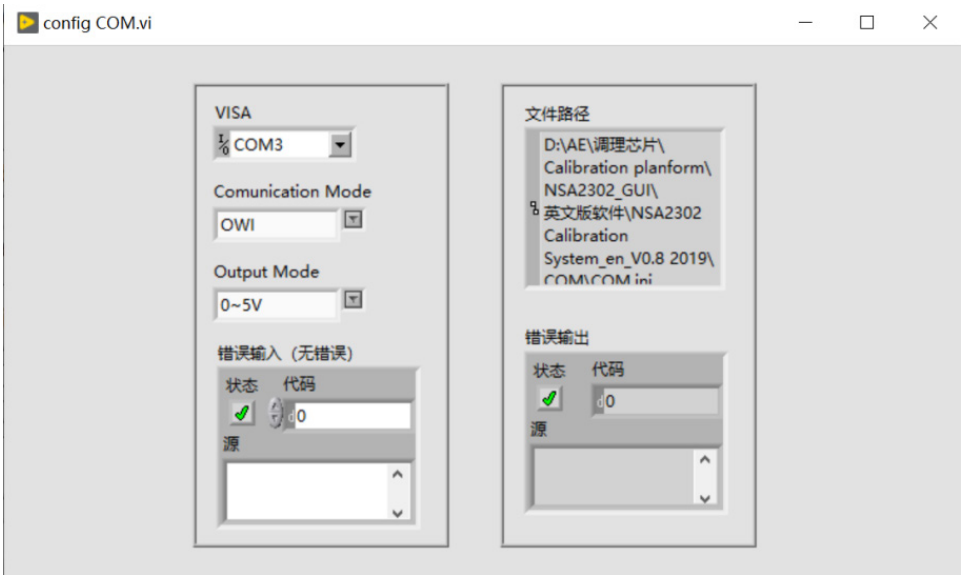


Figure 3.1 COM configuration interface

If the configuration of the COM port is correct, the serial port indicator on the main interface will be turned on, as shown in figure3.2. If the COM port is incorrectly configured or an error occurs during calibration, this indicator is turned off.

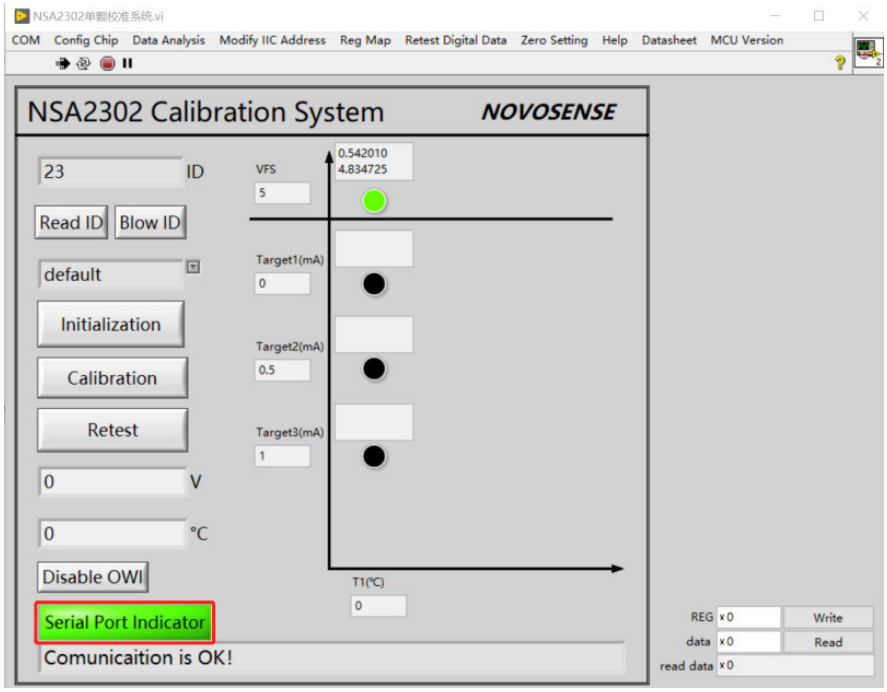


Figure 3.2 Main Interface of NSA2302 Evaluation System

4.2.Read and Write ID

Click the "Read ID" button, then you can hear the sound of the relay on the calibration board, if the communication is successfully established, the blue image below is shown the in-frame ID display box will display the current chip ID, and the red prompt box in the following figure will display communication Normal, and the current chip series is displayed.
If the communication fails, the alarm will blink, and the system connection needs to be checked.
If you need to write another ID number to the product, you can click the burn ID, and the software will be saved according to the current software installation directory, The ID data is automatically added by 1 and written to the current chip.

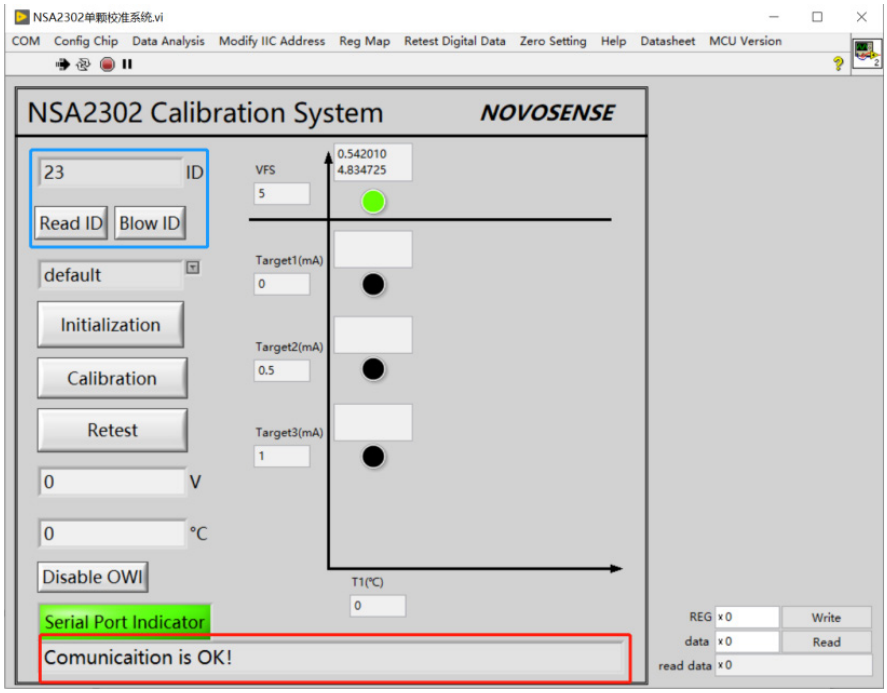


Figure 3.3 Main Interface of NSA2302 Evaluation System

4.3.Configuration Chip

Click the Config chip button in the toolbar, and the Config chip window pops up. The configuration interface is shown in figure 3.4

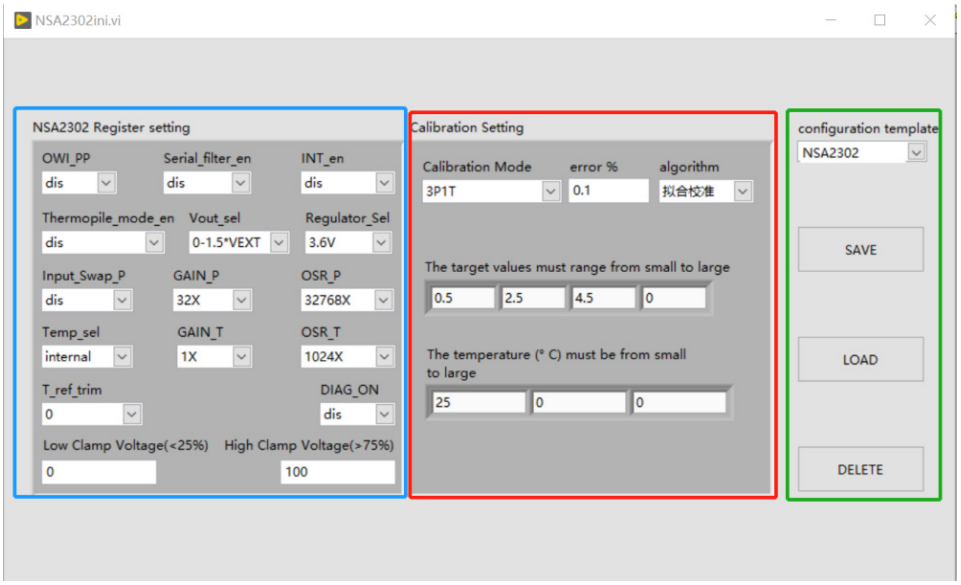


Figure 3.4 Configuration Interface

Blue Box: Configure basic chip functions and diagnostic functions. The meanings of each configuration are as follows:

(1)OWI_PP: Enable, Configure the OWI bus in Push-Pull mode. Dis, Configure the OWI bus as the Open Drain mode.

(2)Serial_filter_en: Enable, Enable the de-glitch filter on two pins of SCL/SDA.

(3)INT_en: Enable, the interrupt function is turned on and the SDO pin outputs an interrupt signal.

(4)Thermopile_mode_en: Enable, Enable thermopile mode, in which the sensor's negative VINN is forced to connect to 9*VEXT/16.

(5)Vout_sel: 1, Set the analog output to a fixed voltage output, the output range is 0~1.5*VEXT; 0, Set the analog output to output in proportion to the power supply voltage, and the output range is 0~VDD.

(6)Regular_sel: 1, the VEXT end output 2.4V reference voltage (suitable for 3.3V power supply). 0, the VEXT end output 3.6V parameter Test voltage (suitable for 5V power supply).

(7)Input_swap: Enable, exchange VINP and VINN inside the chip.

(8)GAIN_P: Enable, Configure the main channel gain.

0000	0001	0010	0011	0100	0101	0110	0111
1X	2X	4X	6X	8X	12X	16X	24X
1000	1001	1010	1011	1100	1101	1110	1111
32X	48X	64X	96X	128X	192X	256X	1X,disable buffer

(9)OSR_P: Oversampling when collecting sensor signals:

000	001	010	011	100	101	110	111
1024X	2048X	4096X	8192X	256X	512X	16384X	32768X

(10)Temp_sel: 1, enable the internal temperature sensor; 0, enable the external temperature sensor (There is a 6KΩ pull-down resistor between GND and GND).
(11)GAIN_T: Temperature channel gain configuration (external temperature sensors only).

0000	0001	0010	0011	0100	0101	0110	0111
1X	2X	4X	6X	8X	12X	16X	24X
1000	1001	1010	1011	1100	1101	1110	1111
32X	48X	64X	96X	128X	192X	256X	1X,disable buffer

(12)OSR_T: Oversampling when collecting Temperature signal:

000	001	010	011	100	101	110	111
1024X	2048X	4096X	8192X	256X	512X	16384X	32768X

(13)T_ref_trim: In the external temperature sensor mode, set the reference voltage of the external temperature sensor signal:

0000	0001	0010	0011	0100	0101	0110	0111
8/15*VEXT	9/15*VEXT	10/15*VEXT	11/15*VEXT	12/15*VEXT	13/15*VEXT	14/15*VEXT	VEXT
1000	1001	1010	1011	1100	1101	1110	1111
0	1/15*VEXT	2/15*VEXT	3/15*VEXT	4/15*VEXT	5/15*VEXT	6/15*VEXT	7/15*VEXT

(14)Diag_on: enable, Enable the diagnosis function.

(15)Low clamp (%): The percentage of the minimum output voltage to the DAC reference voltage; If the clamp is not set, enter 0.

(16)High clamp (%): The percentage of the maximum output voltage to the DAC reference voltage; If the clamp is not set, enter 100.

Note: For proportional output, the DAC reference voltage is VDD; The absolute output is 1.5*VEXT.

Read Box: Calibration mode Settings

(1)Calibration Mode: The chip supports multiple calibration modes; The chip supports at most second-order temperature coefficient calibration and third-order nonlinearity Calibration, so up to three temperature points can be collected, and four pressure data can be collected at each temperature point.

(2)Fitting Error: Input allowed error. Note that this error can only represent the error of the fitting algorithm, not the final voltage output value error; The value cannot be 0

(3)Calibration algorithm: Support two kinds of algorithm calibration: fitting and solving equations.

(4)Target value: Fill in the corresponding analog current or voltage output value at each pressure point.

(5)Temperature: Set the temperature point as required.

Green Box:

(1)Configuration template: Save the current configuration to a configuration file. The file name can be changed at will.

(2)Save: Save the current configurations to the configuration template file in the previous step.

(3)Load: Loads the configurations of the file corresponding to the current configuration template name.

(4)Deletes the configuration file corresponding to the current configuration template.

After all configurations are configured, click Save to close the screen and return to the main screen.

4.4.Initialize Chip

Perform the following two steps to initialize the chip.

(1)In the red box, select the configuration template and select the name of the configuration file NSA2302 saved in the previous step.

(2)Click the "initialize chip" button, write the configuration into the corresponding register of the chip.

After the write is complete, the EEPROM is automatically burned and written, and the test can continue after reading the ID even if the power is lost during the subsequent test. After the initialization is complete, the blue box in the image above will display: " NSA2302 initialization is complete!" If communication fails during initialization, an alarm flash.

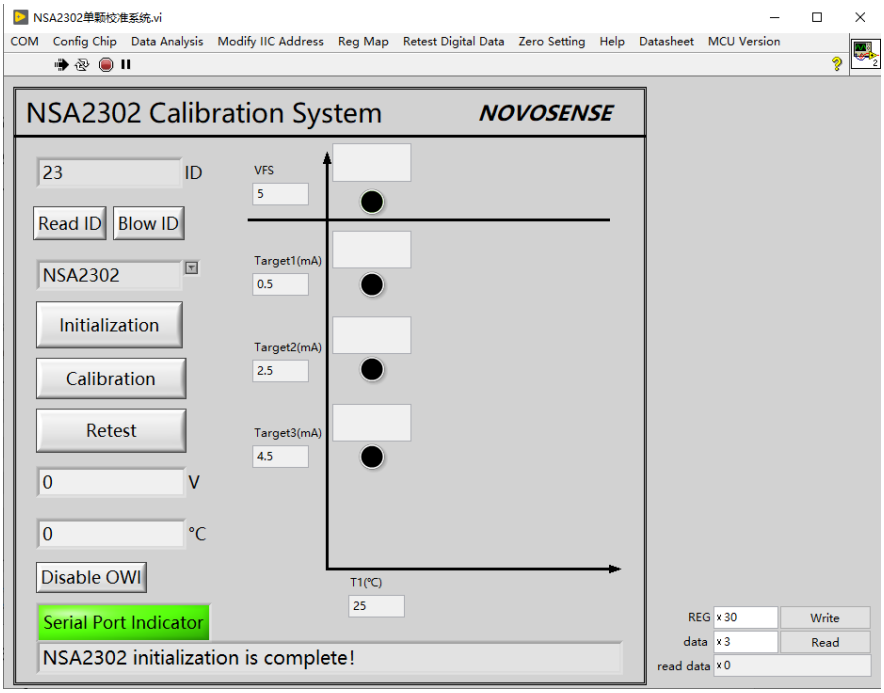


Figure 3.5 Main Interface of NSA2302 Evaluation System

4.5.Capture Pressure and Temperature Raw data

Take the 3P1T calibration mode as an example. Follow these three steps:

(1)Click the black button corresponding to the VFS value, click button 1.

(2)Change the pressure environment to zero pressure, click button 2.

(3)Change the pressure environment to the middle pressure and click button 3.

(4)Change the pressure environment to full pressure and click button4.

As shown in figure3.6. After the completion of each original data collection, the corresponding black button will be lit, and there are two raw data above each collection button: The upper data shows the normalized value of the original data of the pressure channel, and the lower data shows the actual temperature value.

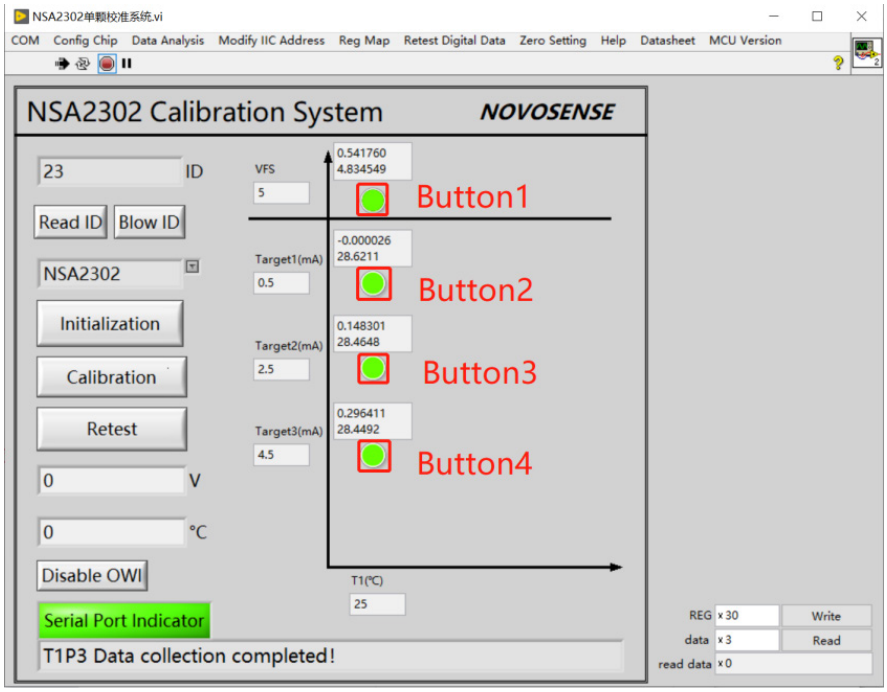


Figure 3.6 Main Interface of NSA2302 Evaluation System

4.6.Calibration Sensor

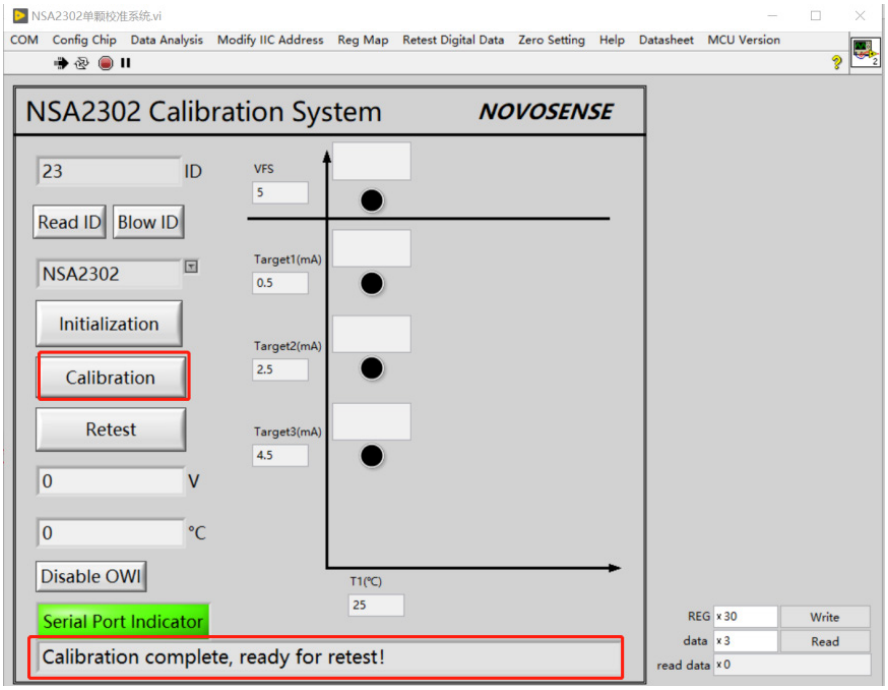


Figure 3.7 Main Interface of NSA2302 Evaluation System

After data collection is completed, click the sensor calibration button, and the software calculates each calibration coefficient according to the original data currently collected; If the calibration is successful, each calibration coefficient is written into the chip and EEPROM is burned; After the burn is completed, it will automatically reset, and whether the read burn value is consistent with the write value; And in the display box prompt " Calibration complete, ready for retest!"

4.7.Retest

Adjust the pressure environment to the full degree (corresponding to the output 4.5V), click the retest button in the red box, and then the button on the button the "Retest" character switches to "Stop" and displays the voltage value corresponding to the pressure point in the blue box. Change difference Pressure environment, confirm whether the output is within the allowable error range.

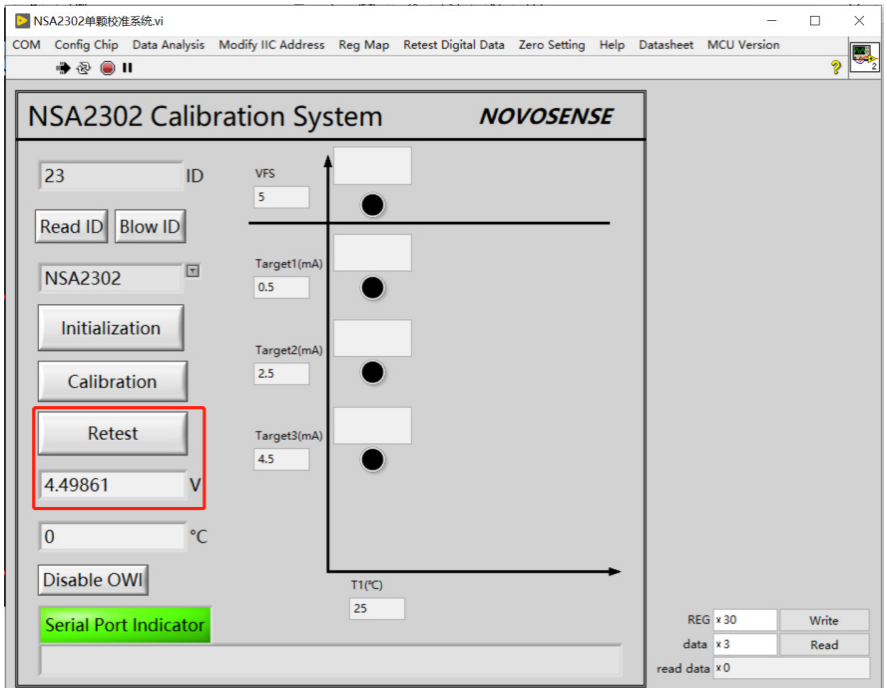


Figure 3.8 Main Interface of NSA2302 Evaluation system

After following the above steps, the calibration process is complete.

5.The Introduction of Background File

The path of the background file is the same as the path of the software installation.
As show in Figure 4.1. There are three folders which can assist customers in product data analysis

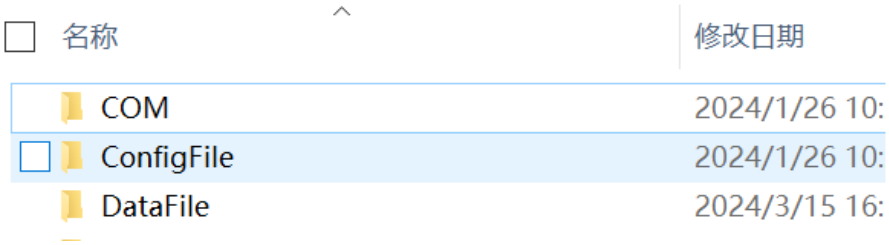


Figure 4.1 Background file

5.1.Data Analysis

Click the data analysis button, and the software automatically loads the original data and calibration coefficient of the current ID product; Such as during calibration, in case of abnormal situation, the data in the table can be analyzed; Or select all the data, right-click to export to excel, and send the data send to NOVOSENSE support staff.

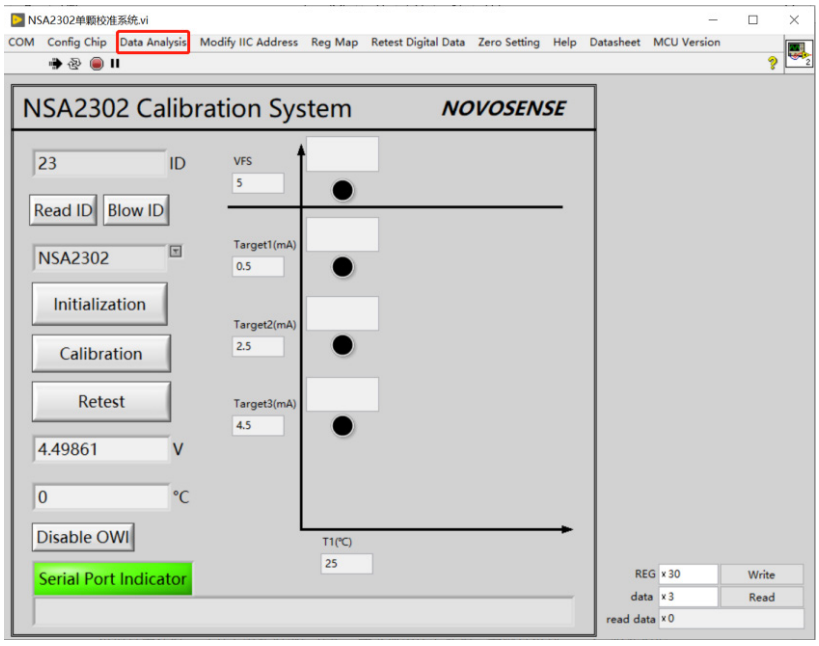
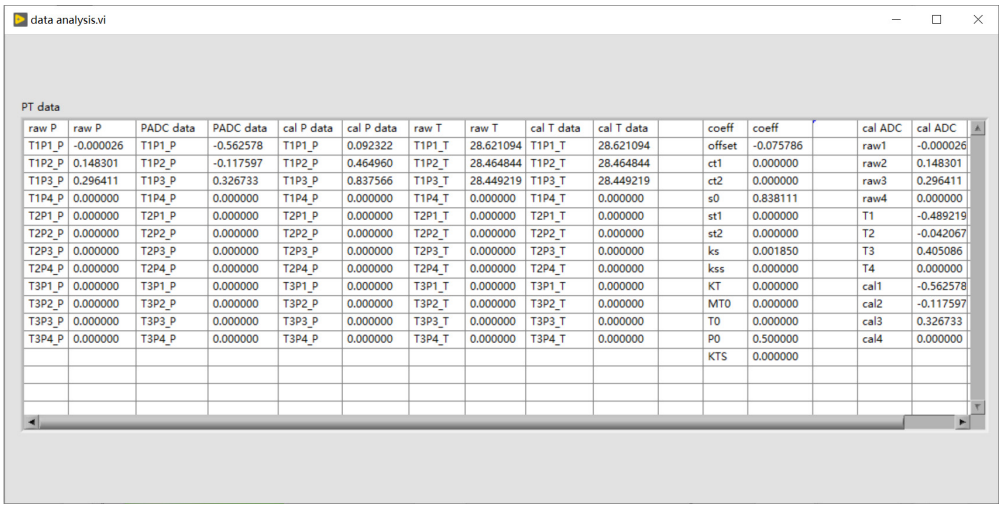


Figure 4.2 Main Interface of NSA2302 Evaluation System



raw P	raw P	PADC data	PADC data	cal P data	cal P data	raw T	raw T	cal T data	cal T data		coeff	coeff		cal ADC	cal ADC
T1P1_P	-0.000026	T1P1_P	-0.562578	T1P1_P	0.092322	T1P1_T	28.621094	T1P1_T	28.621094		offset	-0.075786		raw1	-0.000026
T1P2_P	0.148301	T1P2_P	-0.117597	T1P2_P	0.464960	T1P2_T	28.464844	T1P2_T	28.464844		ct1	0.000000		raw2	0.148301
T1P3_P	0.296411	T1P3_P	0.326733	T1P3_P	0.837566	T1P3_T	28.449219	T1P3_T	28.449219		ct2	0.000000		raw3	0.296411
T1P4_P	0.000000	T1P4_P	0.000000	T1P4_P	0.000000	T1P4_T	0.000000	T1P4_T	0.000000		s0	0.838111		raw4	0.000000
T2P1_P	0.000000	T2P1_P	0.000000	T2P1_P	0.000000	T2P1_T	0.000000	T2P1_T	0.000000		st1	0.000000		T1	-0.489219
T2P2_P	0.000000	T2P2_P	0.000000	T2P2_P	0.000000	T2P2_T	0.000000	T2P2_T	0.000000		st2	0.000000		T2	-0.042067
T2P3_P	0.000000	T2P3_P	0.000000	T2P3_P	0.000000	T2P3_T	0.000000	T2P3_T	0.000000		ks	0.001850		T3	0.405086
T2P4_P	0.000000	T2P4_P	0.000000	T2P4_P	0.000000	T2P4_T	0.000000	T2P4_T	0.000000		kss	0.000000		T4	0.000000
T3P1_P	0.000000	T3P1_P	0.000000	T3P1_P	0.000000	T3P1_T	0.000000	T3P1_T	0.000000		KT	0.000000		cal1	-0.562578
T3P2_P	0.000000	T3P2_P	0.000000	T3P2_P	0.000000	T3P2_T	0.000000	T3P2_T	0.000000		MT0	0.000000		cal2	-0.117597
T3P3_P	0.000000	T3P3_P	0.000000	T3P3_P	0.000000	T3P3_T	0.000000	T3P3_T	0.000000		T0	0.000000		cal3	0.326733
T3P4_P	0.000000	T3P4_P	0.000000	T3P4_P	0.000000	T3P4_T	0.000000	T3P4_T	0.000000		P0	0.500000		cal4	0.000000
											KTS	0.000000			

Figure 4.3 Data Analysis Interface

5.2.Zero Setting

On the premise of adding the product module, click "Zero" after reading the ID, and the following interface will pop up:
Zero normalized target = target voltage at zero voltage/full scale VFS value

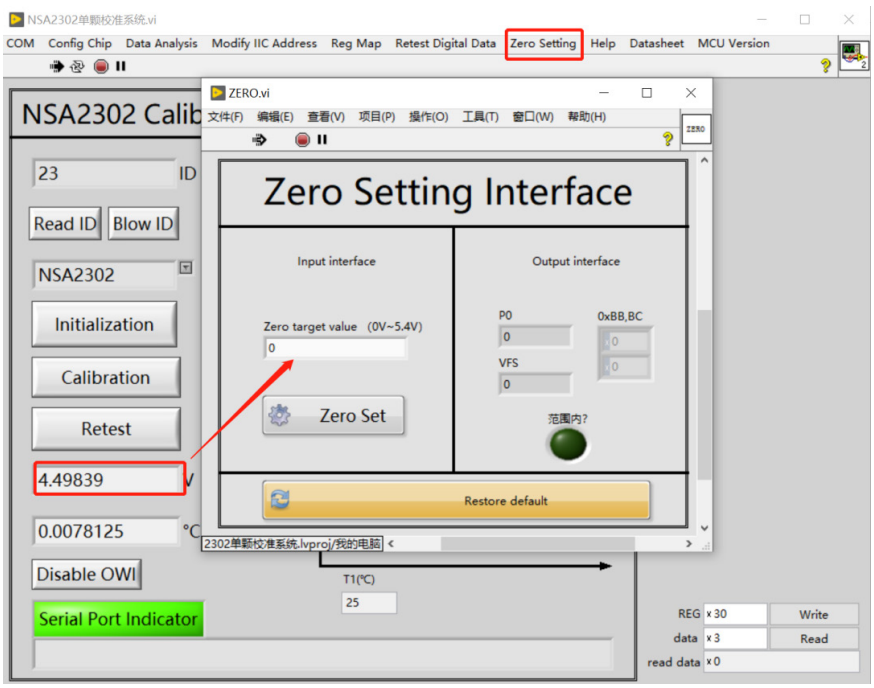


Figure 4.4 Zero Setting interface

5.3.Reg Map

On the premise of connecting the product module, click "Reg map" after reading the ID,
The value of all previous registers. The register table can be read, written, exported, and imported. Register meaning please refer to Datasheet. As shown in Figure 4.5.

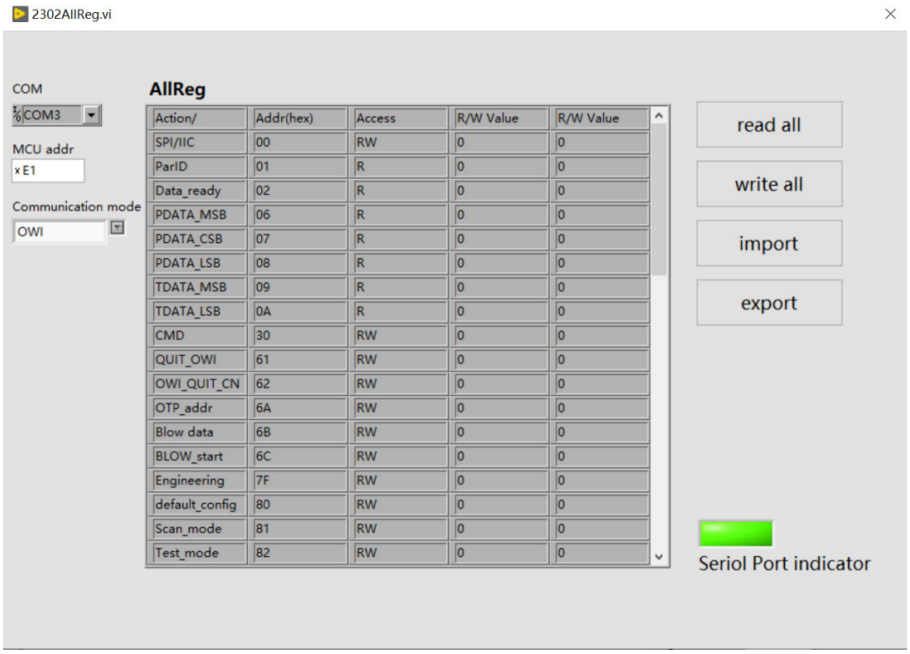


Figure 4.5 NSA2302 Reg Map Interface

5.4.Modify IIC Address

On the premise of connecting the product module, click "Modify IIC Address" after reading the ID. Customers can change the IIC address of NSA2302.

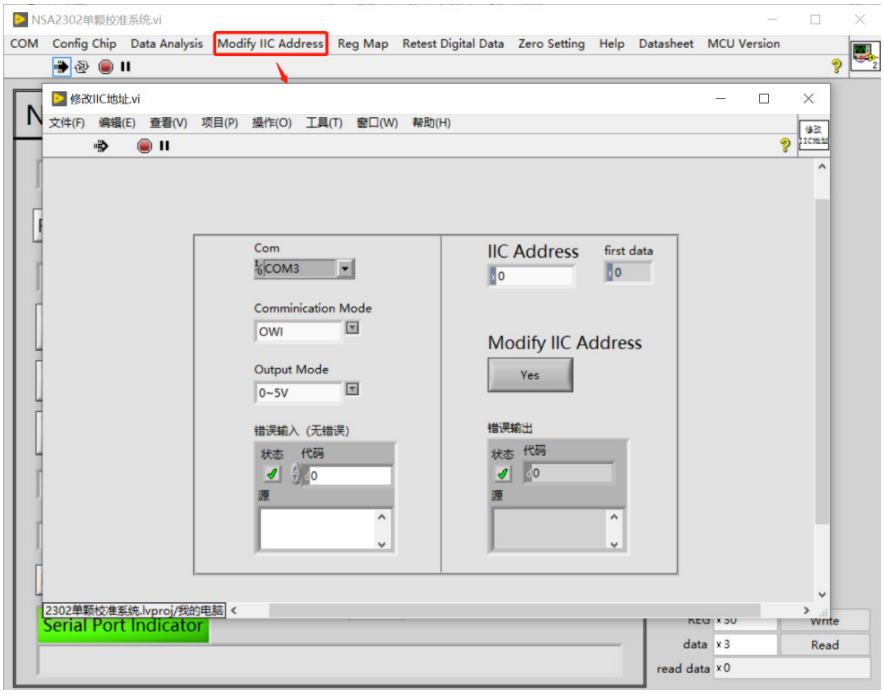


Figure 4.5 Modify IIC Address Interface

6.Ordering Information

Part Number	Description
NSA2302_EVM	NSA2302 Single Chip Evaluation Board

7.Revision History

Revision	Description	Author	Date
1.0	Initial Version	Weijie.Zhou	15/3/2023

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