Servo Commissioning Software Flexem Servo Configuration

4.0.6

User Manual

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Preface

Overview

Thank you for choosing Flexem product. This manual provides a detailed introduction to the configuration methods of Flexem Servo Configuration (hereafter referred to as “FSC”) as a guide for users to Commission Flexem servo drivers.

The content provided in this manual only serves as general guidance and does not guarantee coverage of all usage scenarios for all product models. Due to reasons such as version upgrades, different device models and configuration files, the content provided in the manual may not match the actual device interface used by the user. Please refer to the actual information displayed on the user's device interface. The manual will not provide a detailed explanation of the differences caused by the aforementioned situations.

For the purpose of functional introduction and configuration examples, the manual may use IP addresses, URLs, domain names, etc. Unless otherwise specified, the aforementioned content is for illustration only and does not represent any actual significance.

Target Reader

This document is mainly intended for readers who are interested in Commissioning Flexem Servo drivers via FSC. It includes mechanical engineer, electrical engineer, etc. This document assumes that readers have a certain level of knowledge in the following areas:

- Principles of automatic control
- Basic electrical knowledge
- Principles of servo system
- Sensor application

Format Convention

This manual follows the following content formatting conventions:

Content	Description
Bold	Bold represents the names and contents of various controls on the software interface. For example, "Select **Window/Current Window Properties** from the menu bar to enter the **Modify Window** page, and select the **Timer** tab."
/	When describing the operation steps on the software interface, slash is used to isolate the clicked objects(menu item, sub-menu, button, etc.). For example, “Select **Component/Switch/Bit Set** from

Content	Description
	the menu bar, and create a new bit set switch component".
Italic	Variables, must be replaced by actual values accordingly. For example, "Enter 'ftp://the IP of HMI' in the browser address bar, and press Enter to enter the file directory interface of the HMI."

This manual follows the icon formatting conventions below.

Icon	Description
	Tips, operation tips for users to solve problems.
	Description, supplementary and explanatory information for the main text.
	Caution, reminders for operation precautions, improper operation may cause potential device damage or data loss.
	Warning, the content following this icon requires special attention, otherwise it may result in personal injury.

Get Help

If you have any problem during use, please call the service hotline at 4008-033-022.

Please visit https://www.flexem.cn/download to obtain more documents.

Contact information

Address: 9th Floor of INNO Center Building A, No. 386 Guo'an Road, Yangpu District, Shanghai

Postcode: 200043

Website: https://www.flexem.cn

1 Product Overview

1.1 Product Introduction

Flexem Servo Configuration is the Commissioning software of Flexem servo drivers. All Flexem servo drivers use this software for Commissioning. It features simple installation, a user-friendly interface, strong scalability, and convenient configuration.

1.2 Installation

1.2.1 Installation Environment Requirement

1.2.1.1 Hardware Environment Requirement

To ensure the smooth operation of FSC, it is recommended that the PC used to install FSC meets the following minimum hardware configuration requirements.

Hardware	Minimum configuration
CPU	Dual-core, 2.4 GHz frequency
Memory	8GB
Installation path disk	50GB
USB interface	One USB interface

1.2.1.2 Software Environment Requirement

Operating system: Windows (64-bit, Win7 SP1 or above)

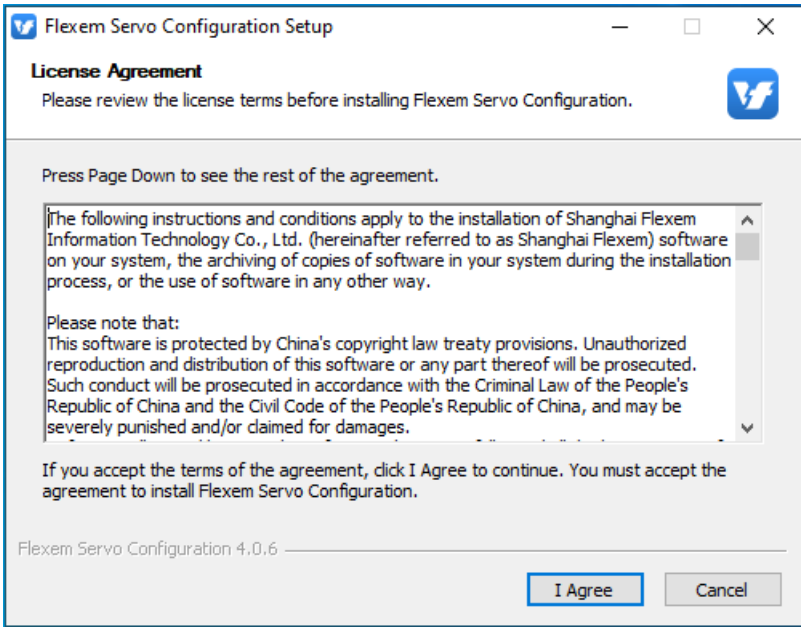
1.2.2 Get the Software

Please ask the Flexem technical support engineer for the installation file.

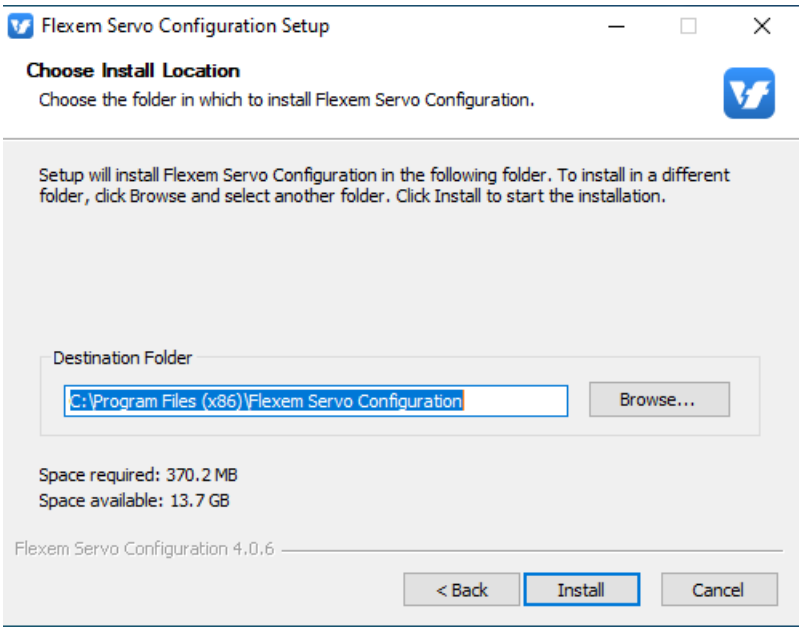
1.2.3 Installation Steps

Step 1. Double click the Flexem-Servo-Configuration-Installer application.

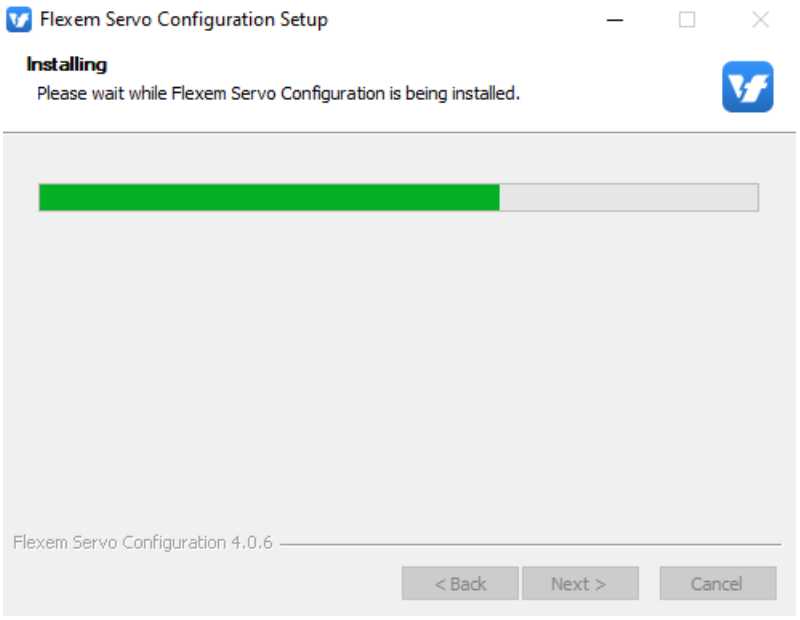
Step 2. Click **I Agree** for license protocol and continue installation.



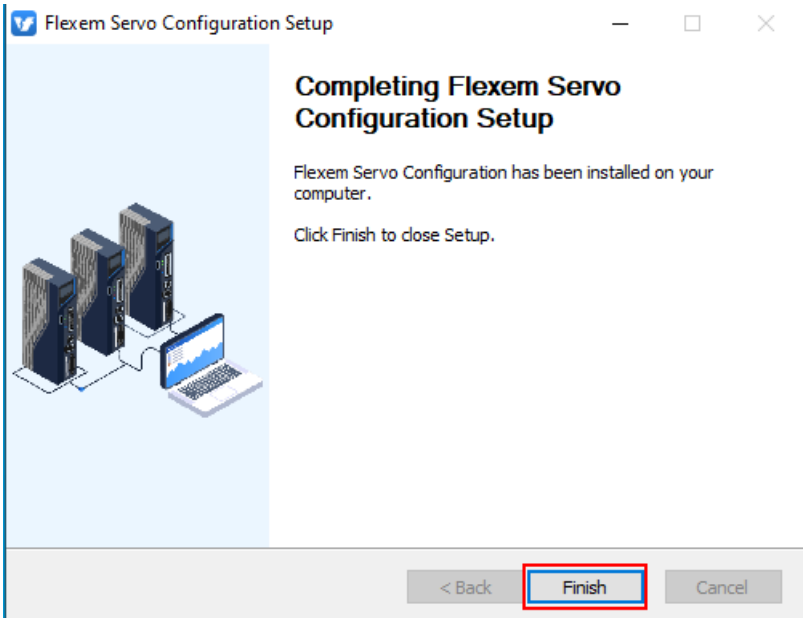
Step 3. Select installation path and click **Inatall**.



Step4. Wait for installation.

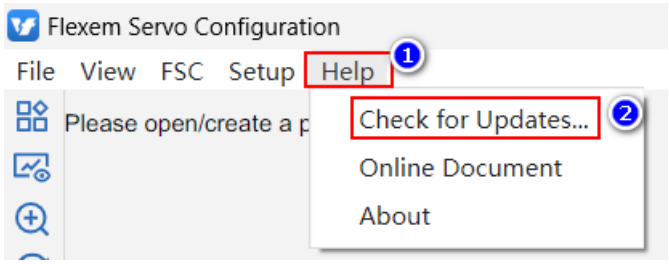


Step 4. Complete installation, automatically generate desktop shortcut, double click the  icon to start the software.



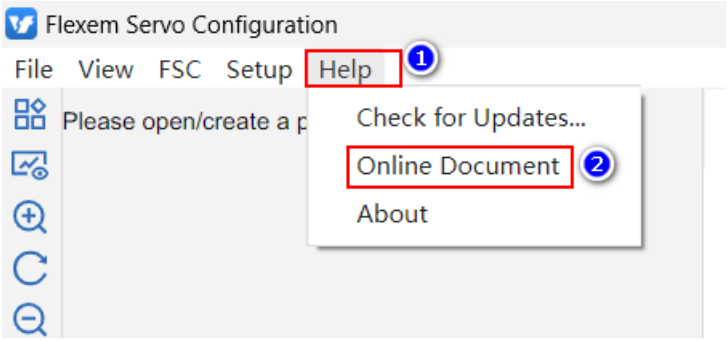
1.3 Update Online

Select "**Help/Check for Updates**" in the menu bar, FSC will automatically check if there is a new version of the software in the cloud server, if there is a new version of the software, you can update the software version, otherwise it will prompt "You are currently using the latest version" .



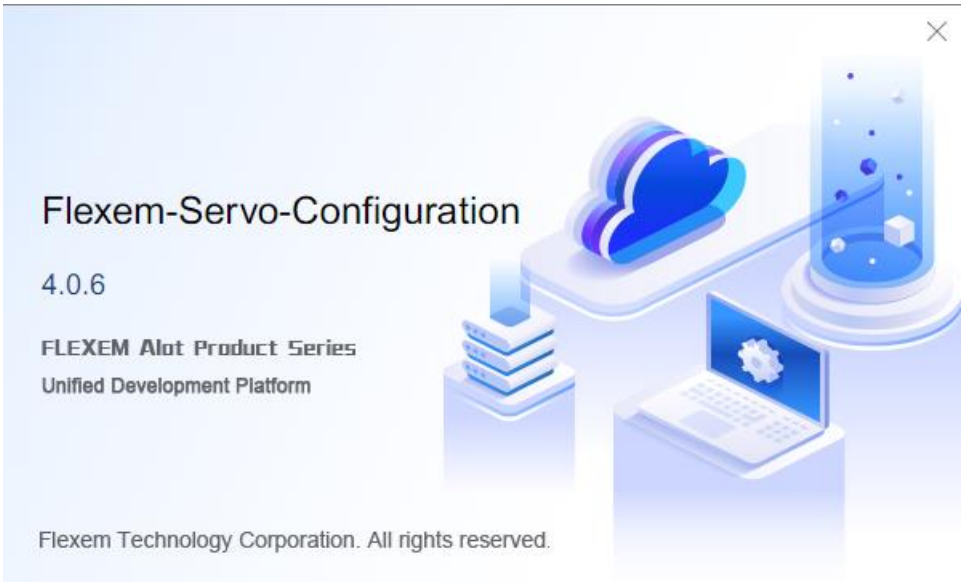
1.4 Help Document

Select **Help/Online Document** in the menu bar to download FSC help document and getting the configuration method for FSC.



1.5 Version Information

Select **Help/About** in the menu bar to view the current software version information.



2 Quick Start

Connect the driver to a PC to realize the function of reading and writing the parameters of the driver through the FSC software on the PC.

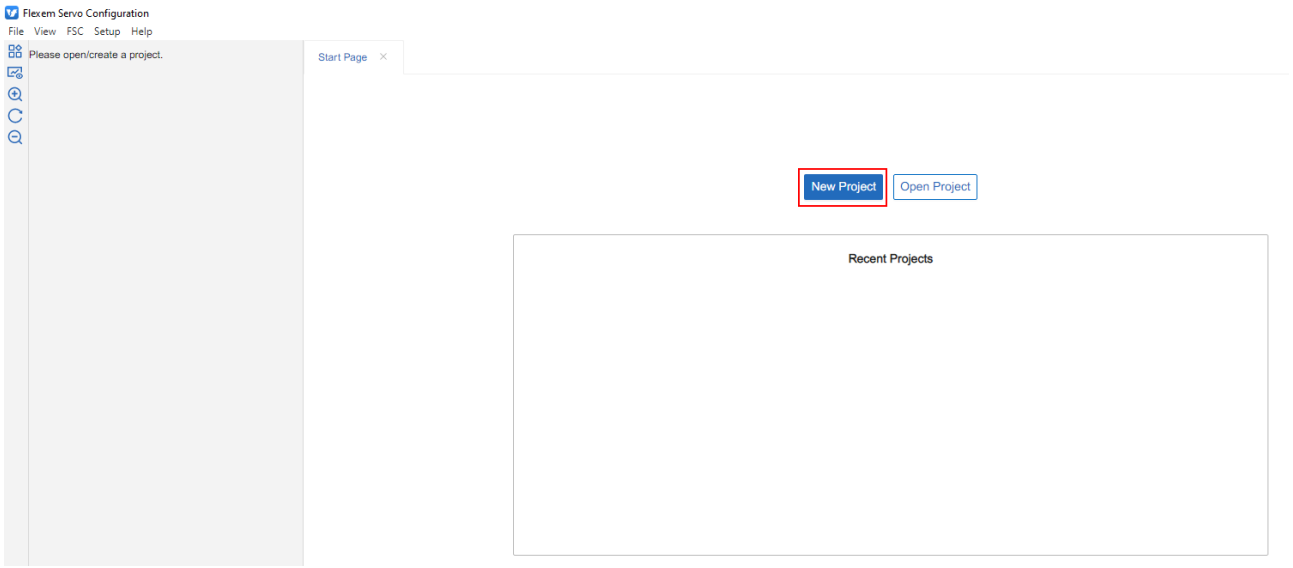
2.1 Hardware Preparation

Communication cable: USB Type-C data cable.

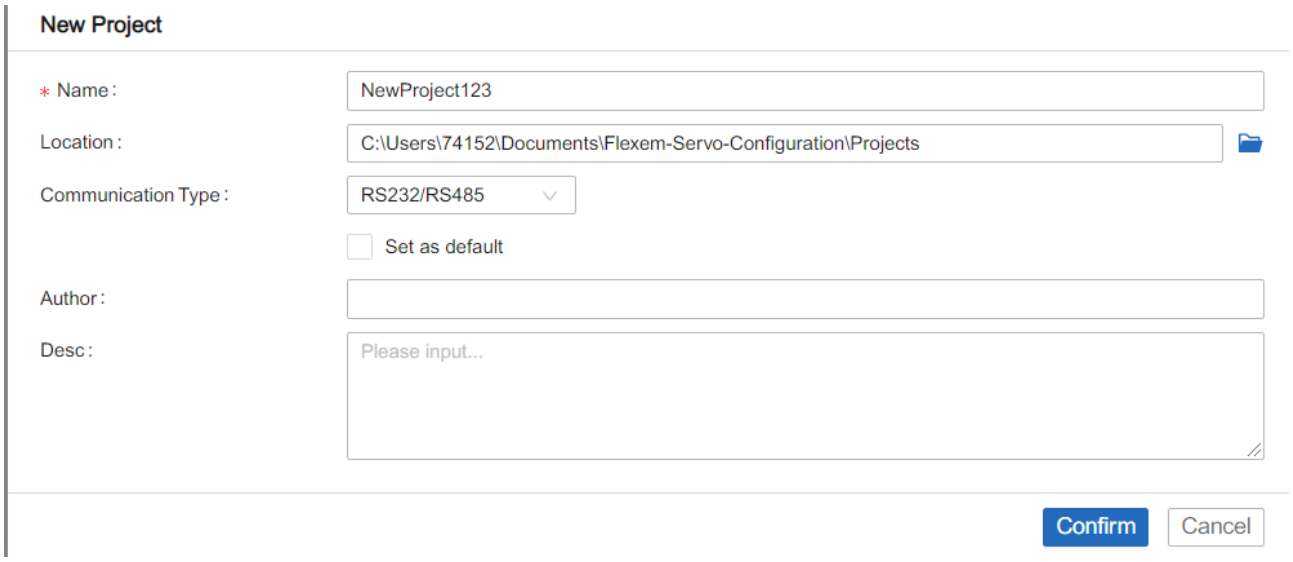
Hardware Connection: The Type-C end of the data cable is connected to the USB Type C interface of the driver(CN2), and the other end is connected to the USB interface of the PC.

2.2 Connection Steps

Step 1. Open the servo commissioning software, clikc **New Project.**

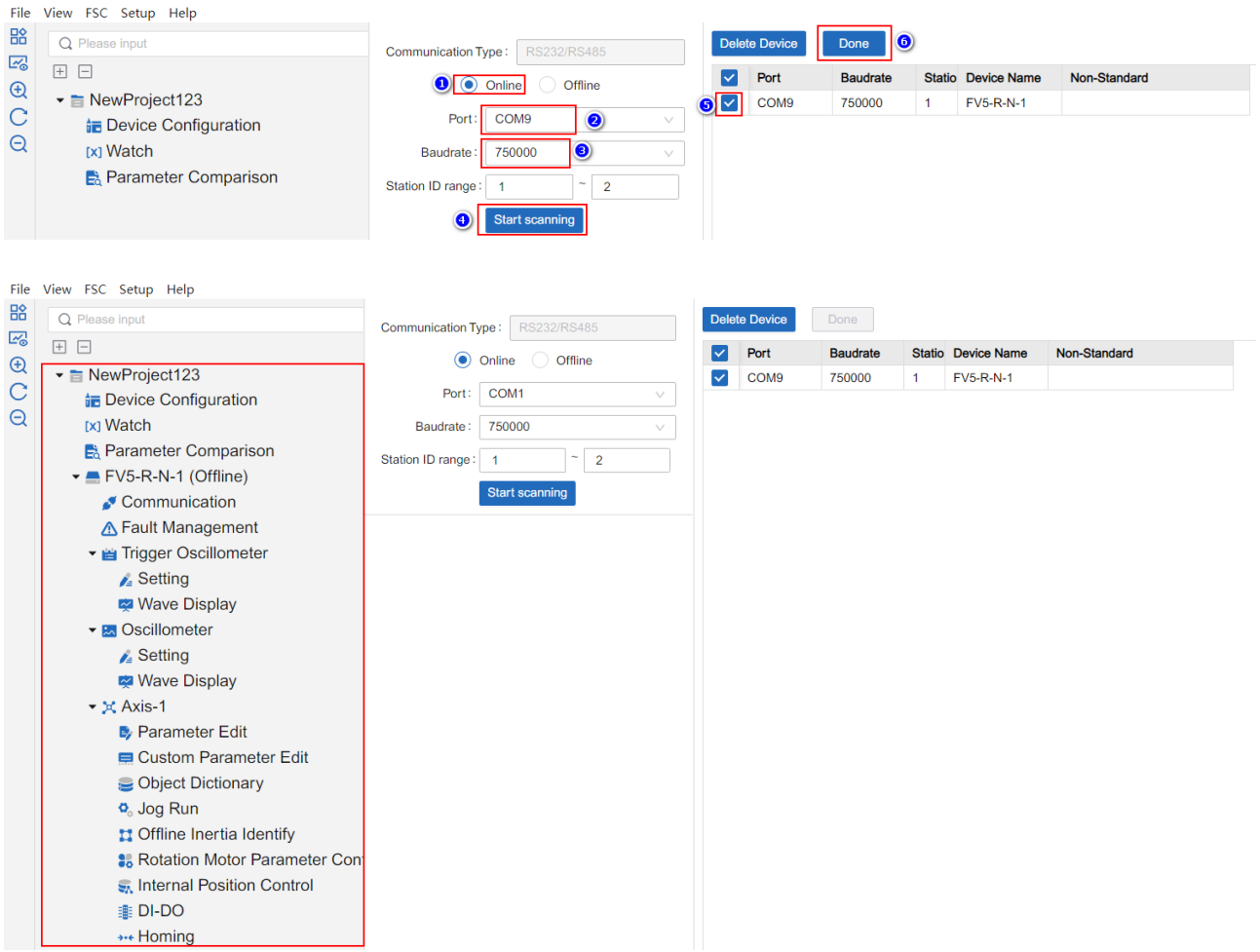


Step 2. Edit relevant information in the pop-up window, specify the **Name, Location** and other information of the new project, click **Confirm**.



Step 3. Click **Online**, select **Port**, Select **Baudrate**, set **Station ID range**.

Step 4. Click **Start scanning,** the scanned device information will be displayed on the right side, check the the device and click **Done**, the device will be displayed in the **Project Outline** on the left side.



Please see the table below for the detailed configuration methods.

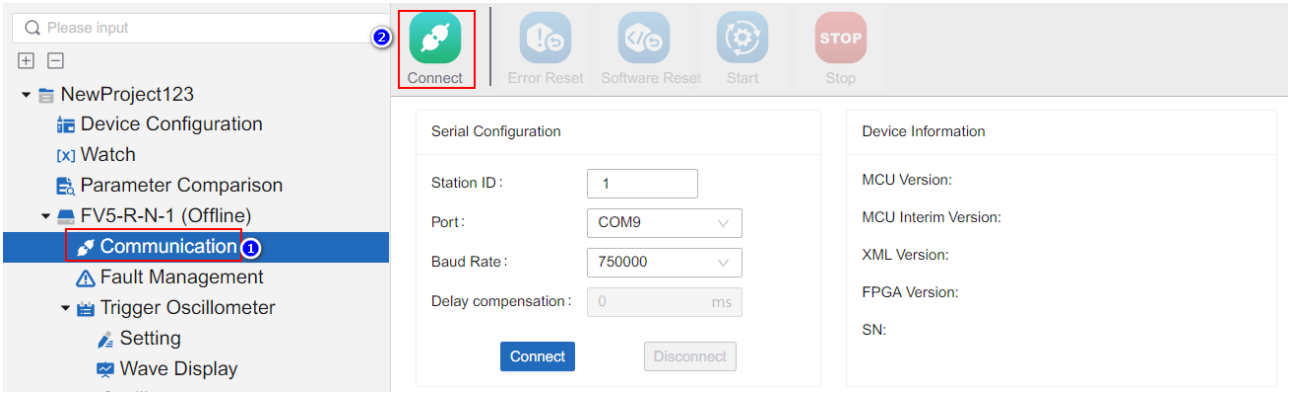
Parameter	Description
Online	driver scanning configuration for communication connection.
Offline	Add driver setting for non-communication connection.
Port	Select according to actual serial port number
Baud rate	The default baud rate for the FV5 driver is 750,000. Parameter P08.0A can be used to modify the communication baud rate of the driver.
Station ID range	The default station ID for the FV5 driver is 1, and it can be modified using parameter P08.00.
Delete Device	Delete the selected device information
Done	Add device to this project

2.3 Communication Connection

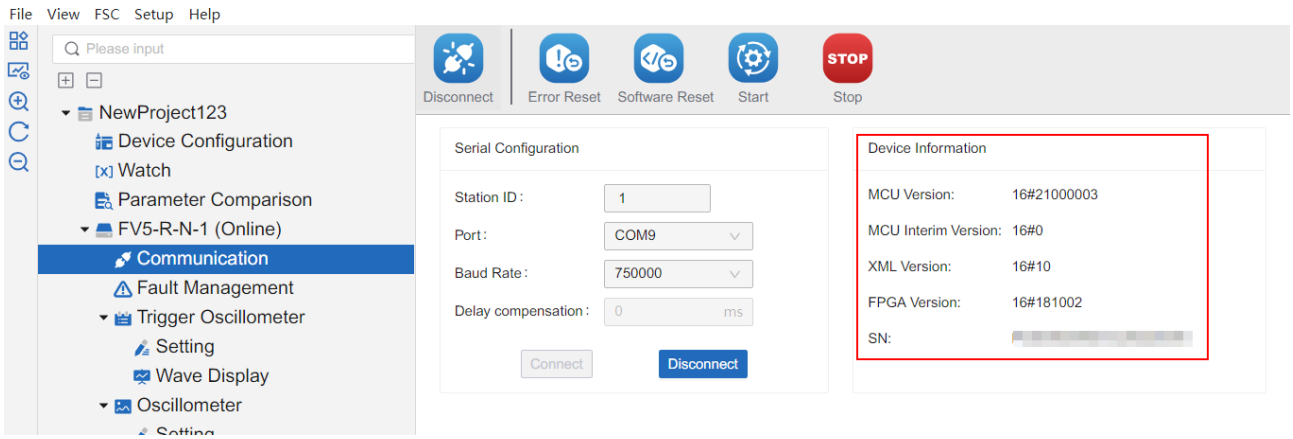
Connect the servo driver to the PC commissioning software to enable normal communication, allowing the commissioning software to read and write driver parameters.

Step 1. Select **Communication**, click the 

icon or **Serial Port Configuration/Communication Connection**. After successful communication, the driver status will switch to **online**, displaying the current device information. The status of the current servo will be shown in the upper right corner of the interface.



After successful communication, you can read and write parameters for the servo driver and view its status. The **device information** is shown in the figure below:



2.4 Disconnection

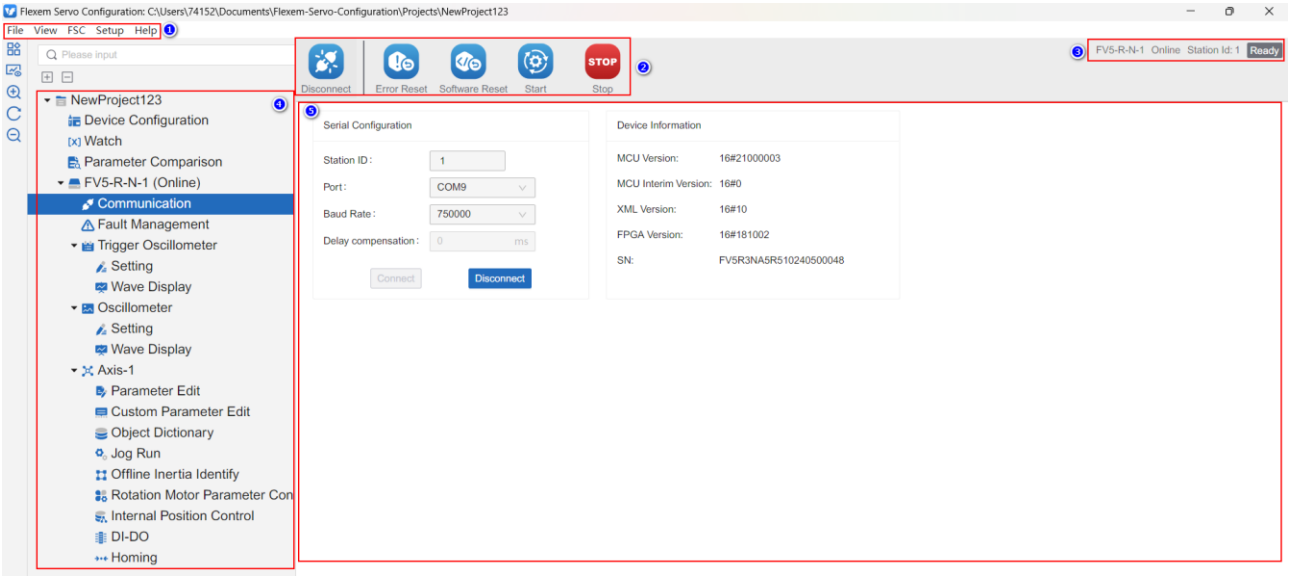
Click  icon or **Disconnect** to disconnect software and servo device. The disconnected device will show an offline status, release current communication port, the interface will display as follows:

2.5 Software Reset

Use the  button to restart the software part of the current servo device. In situations where it is inconvenient to operate the power control, the **software reset** can be used to achieve a power-off effect (not applicable in all situations).

2.6 Interface Introduction

The commissioning interface is mainly divided into four areas: menu bar, status bar, project outline, and operation display area.



Please see the table below for detailed description of each area.

SN	Area	Description
①	Menu bar	Provide access to the configuration of various functions, allowing users to switch based on their actual needs.
②	Common operation	Include disconnect, error reset, software reset, and stop.
③	Status bar	Display servo model, offline, online, station number, servo ready, servo running, alarm, etc.
④	Project outline	Display servo information and function directory
⑤	Operation display area	Display configuration devices, parameter monitoring, parameter file comparison, oscilloscope data acquisition curves, parameter read/write, IOG operation, inertia identification, motor parameter settings, operation control commissioning, and DI-DO status monitoring, etc.

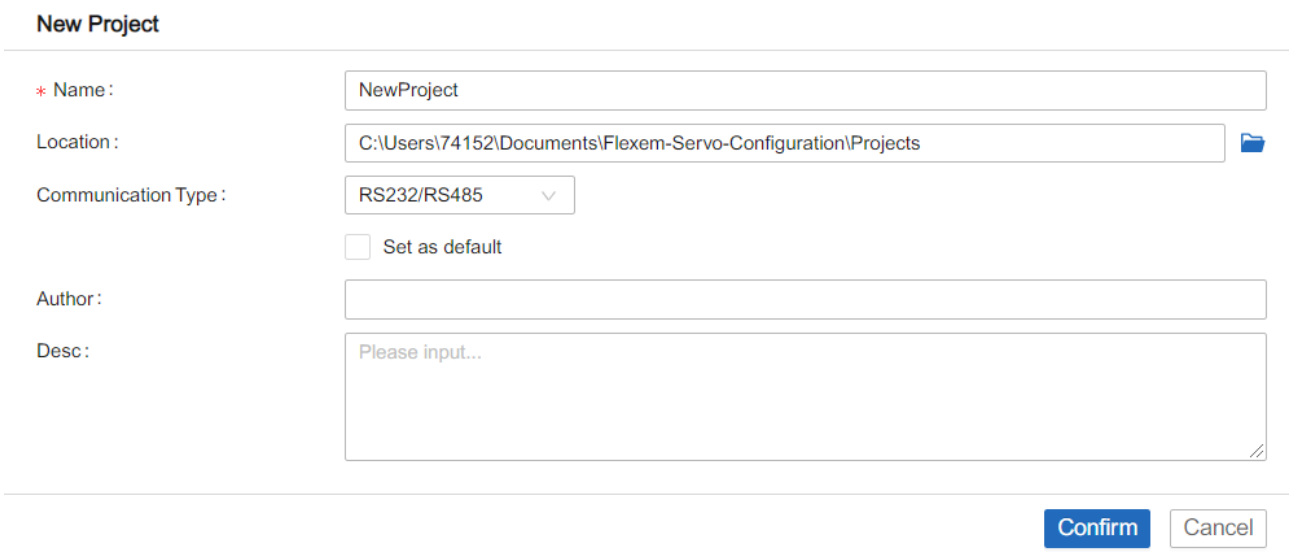
3 File

3.1 New Project

A project is the program and hardware configuration information of servo operation, it defines the control functions of the servo. The steps to create a new project are as follows:

Step 1. Select **File/New Project** in the menu bar (shortcut "Ctrl+N").

Step 2. Edit relevant information in the pop-up window, click **Confirm**.



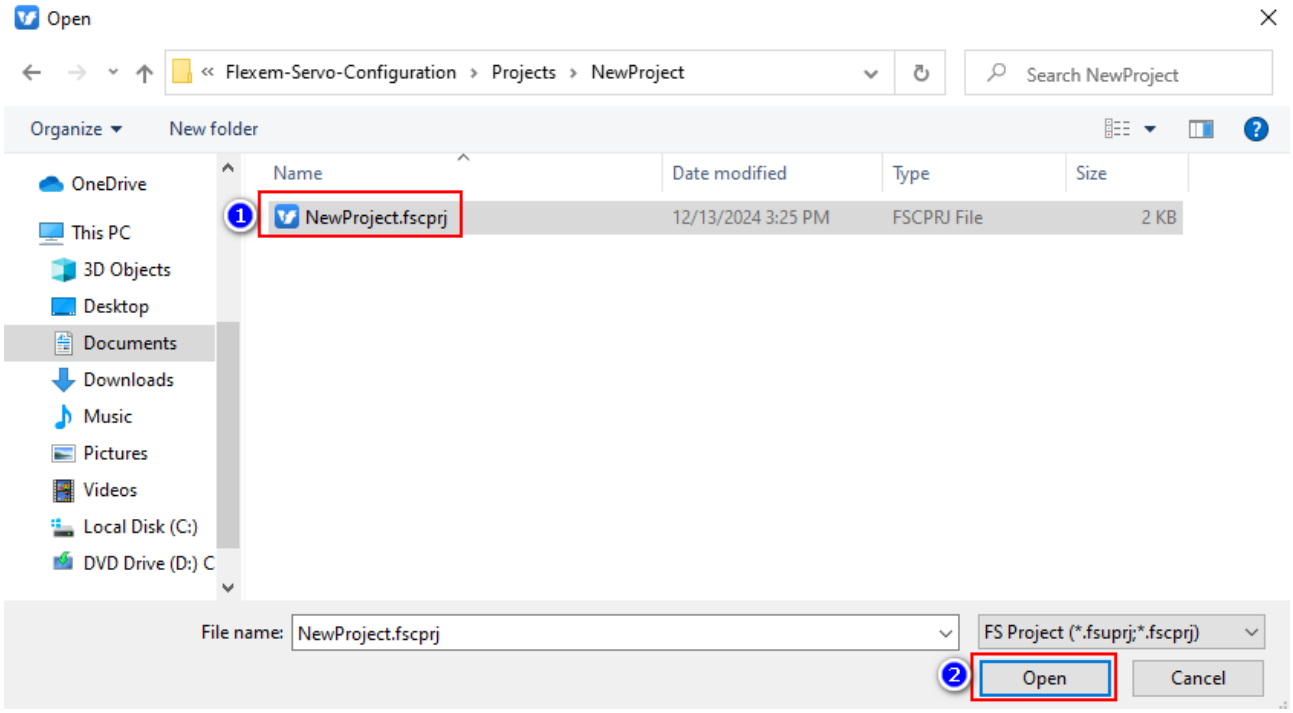
Please see the table below for detailed configuration.

Parameter	Description
Name	No more than 64 characters. Supports Chinese, English, numbers, and the special character "_" only.
Location	The location where project file is saved.
Communication type	Select "RS232/RS485".
Author	Author of the project.
Description	Description information of the project.

3.2 Open Project

Step 1. Select **File/Open Project** in the menu bar (shortcut "Ctrl+O").

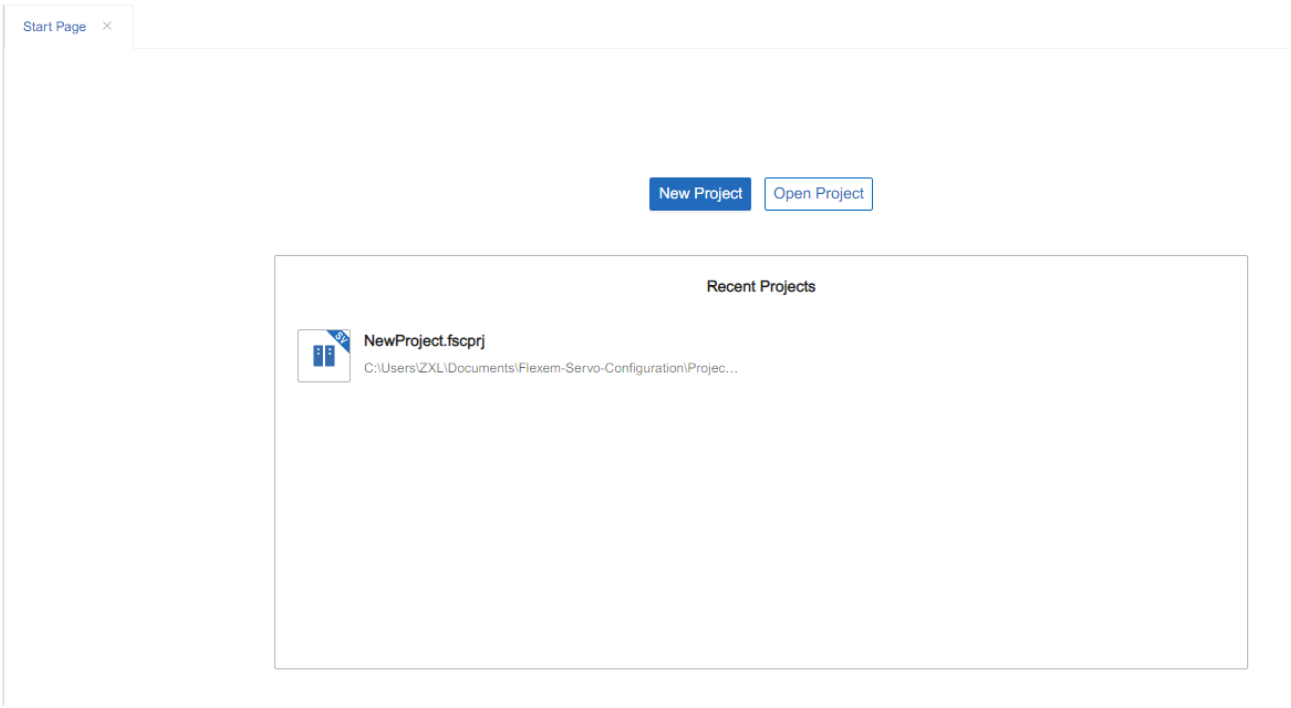
Step 2. In the pop-up dialog window, open the directory where the project file is located, select the file with the .fsuprj extension, and click **Open**.



You can directly enter the project file directory, double-click on the file with the .fsuprj extension to open the project directly.

3.3 View Start Page

Select **File/View Start Page** in the menu bar to enter the **start page** interface and view current projects. Click **New Project** to create a new project; click **Open Project** to open specific project.



3.4 Close Project

Close the current project without exiting the program, for switching projects. The steps are as follows:

Select **File/Close Project** in the menu bar to close current project and return to **start page**.

3.5 Save Project

Select **File/Save Project** in the menu bar (shortcut “Ctrl+S”) to save current project.

3.6 Exit

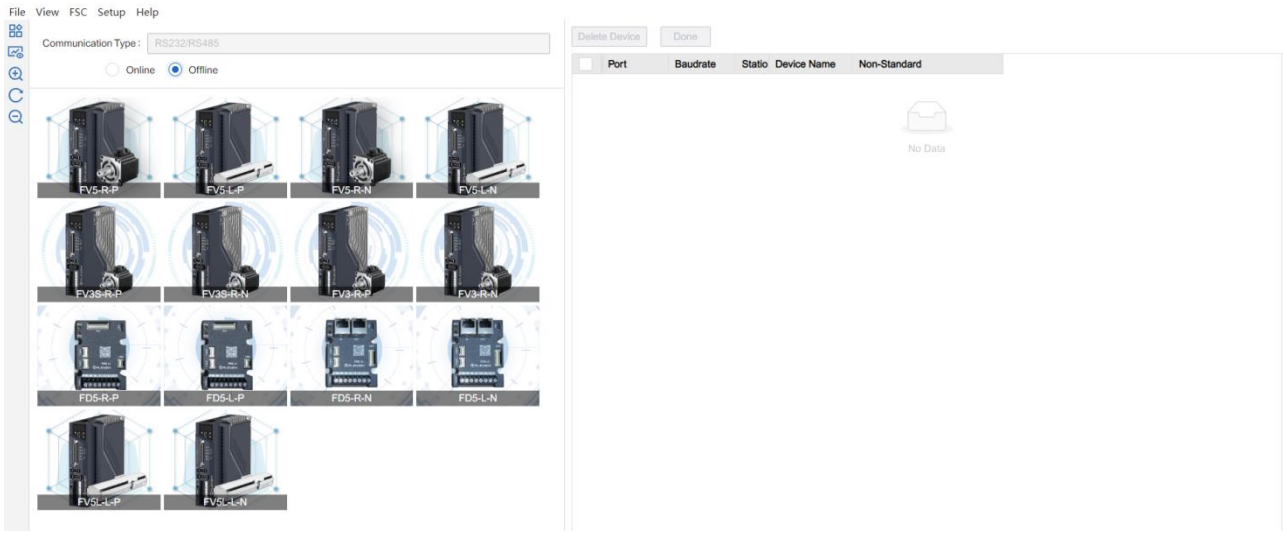
Select **File/Exit** (Shortcut “Alt+X”) in the menu bar to close the current project and exit the FSC software.

4 View

View is used to adjust the software interface layout and can restore the default workspace layout.

4.1 Full Screen

Select **View/Full Screen** (shortcut “F11”) in the menu bar to enter full screen view as shown in the figure below. Select **View/Full Screen** in the menu bar to exit full screen view.

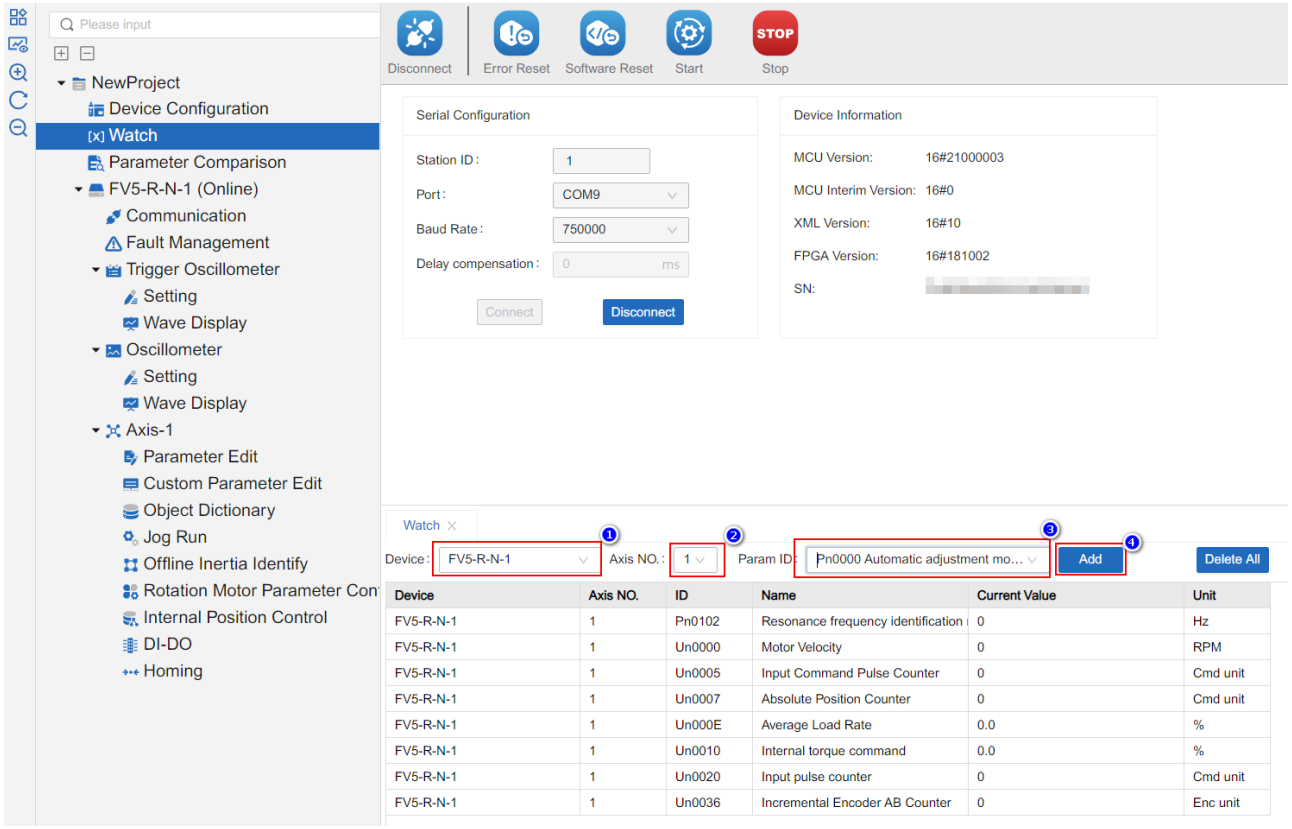


4.2 Watch

In the online watch status, users can watch real time information of specific parameters. The steps are as follows:

Step 1. In online watch status click **Watch**.

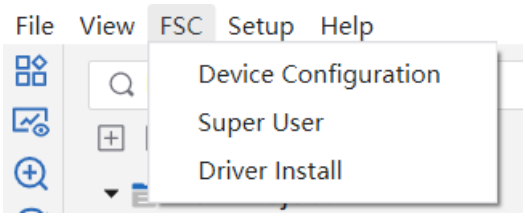
Step 2. In the pop-up watch list, select the **device**, **axis number**, **and parameter number (can be entered)**, click **Add**, then you can view the current status information of the watched parameters.



Device	Axis NO.	ID	Name	Current Value	Unit
FV5-R-N-1	1	Pn0102	Resonance frequency identification	0	Hz
FV5-R-N-1	1	Un0000	Motor Velocity	0	RPM
FV5-R-N-1	1	Un0005	Input Command Pulse Counter	0	Cmd unit
FV5-R-N-1	1	Un0007	Absolute Position Counter	0	Cmd unit
FV5-R-N-1	1	Un000E	Average Load Rate	0.0	%
FV5-R-N-1	1	Un0010	Internal torque command	0.0	%
FV5-R-N-1	1	Un0020	Input pulse counter	0	Cmd unit
FV5-R-N-1	1	Un0036	Incremental Encoder AB Counter	0	Enc unit

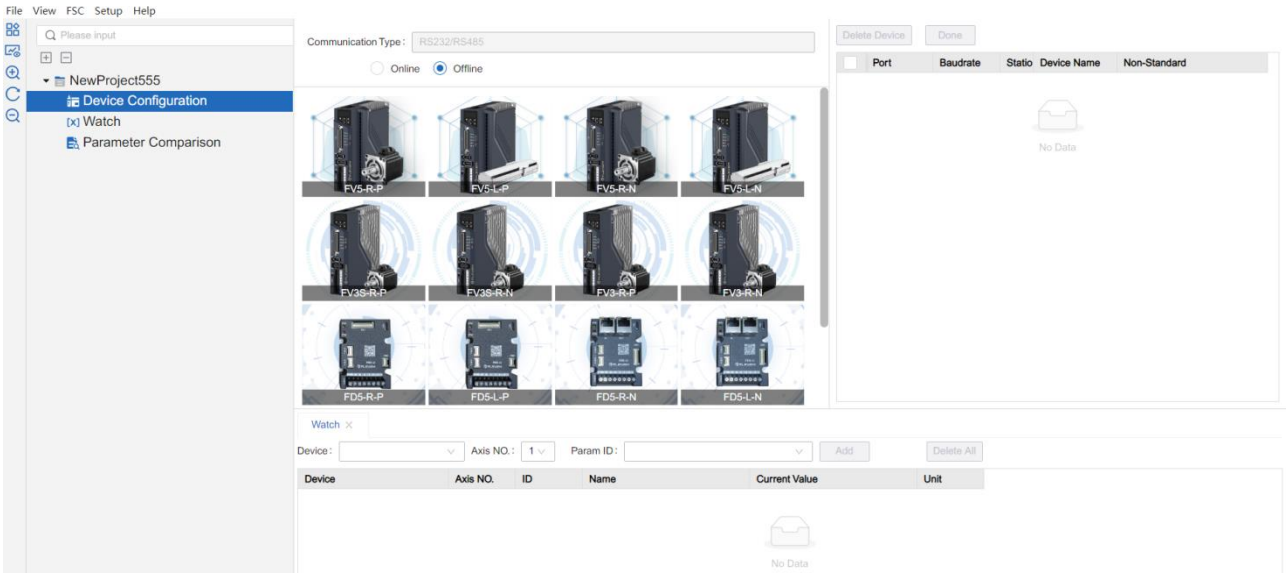
5 FSC

FSC is used for the configuration of device and system. There are three shortcuts: **Device Configuration, Super User, Driver Install**.



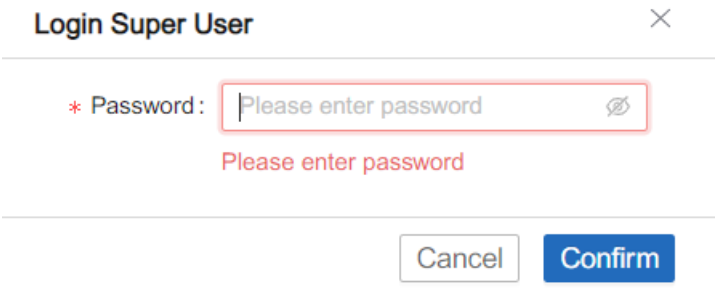
5.1 Device Configuration

Select **FSC/Device Configuration** to jump to the **device configuration** interface for configuring device information:



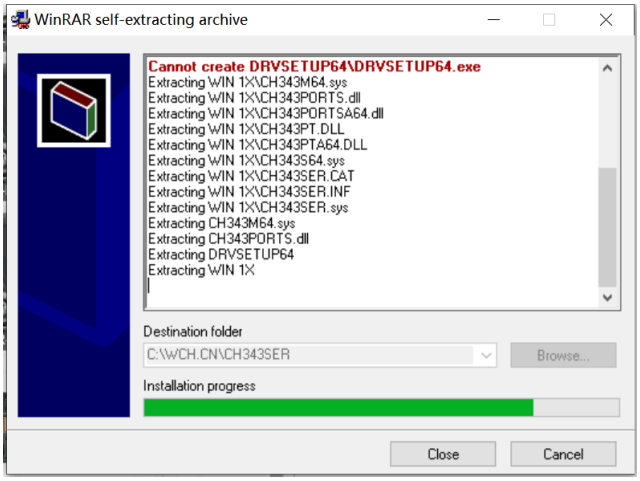
5.2 Super User

Select **FSC/Super User**, the super user login window will pop up. It is used for device version updates and upgrades (permission password must be got from Flexem technical support engineer):

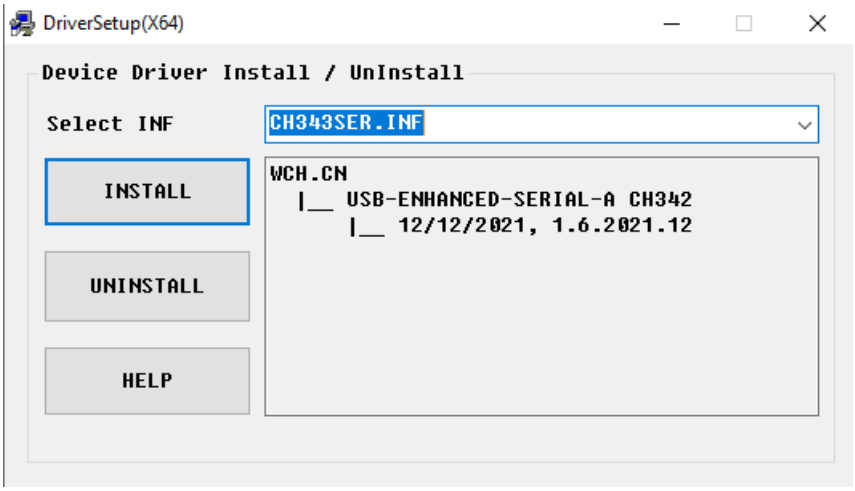


5.3 Driver Install

Select **FSC/Driver Install**, the software automatically detects the current driver installation package



If there is a driver update, select **Install**:



If the driver is successfully installed, the prompt window will pop up.

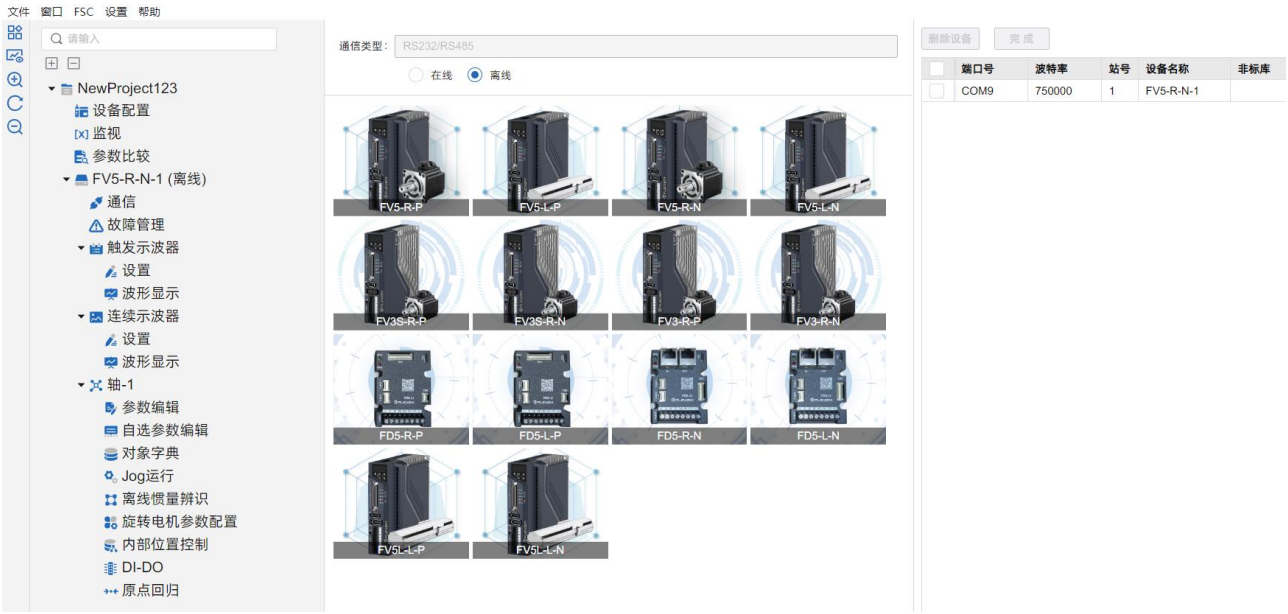
6 Setup

Setup is used to configure the operating parameters of FSC to meet the personalized needs of users.

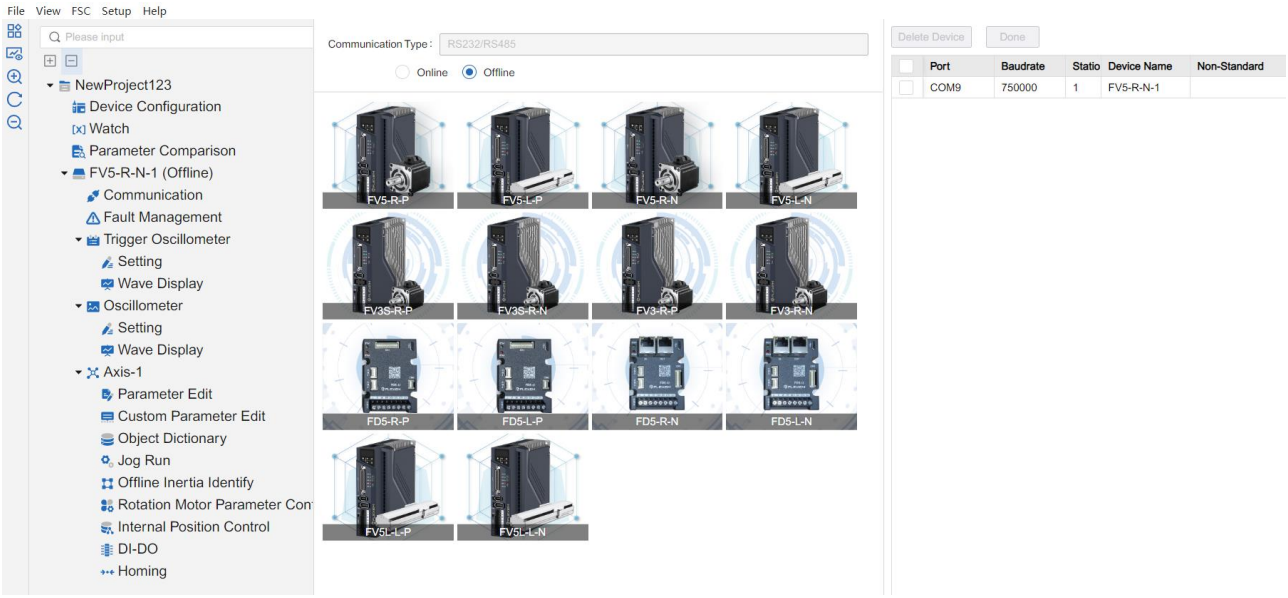
6.1 Switch Language

Select **Setup/Switch Language/English** in the menu bar, click **Confirm** in the pop-up dialog window to switch the system interface language into English. Select **Setup/Switch Language/Chinese,** click **Confirm** in the pop-up dialog box to switch the system interface language into Chinese.

The Chinese interface is as follows:



The English interface is as follows:



6.2 Zoom in

Select **Setup/Zoom In** in the menu bar, to Zoom in the interface.

6.3 Zoom out

Select **Setup/Zoom Out** in the menu bar, to Zoom out the interface.

6.4 Zoom reset

Select **Setup/Zoom Reset** in the menu bar, to reset the interface zoom setting.

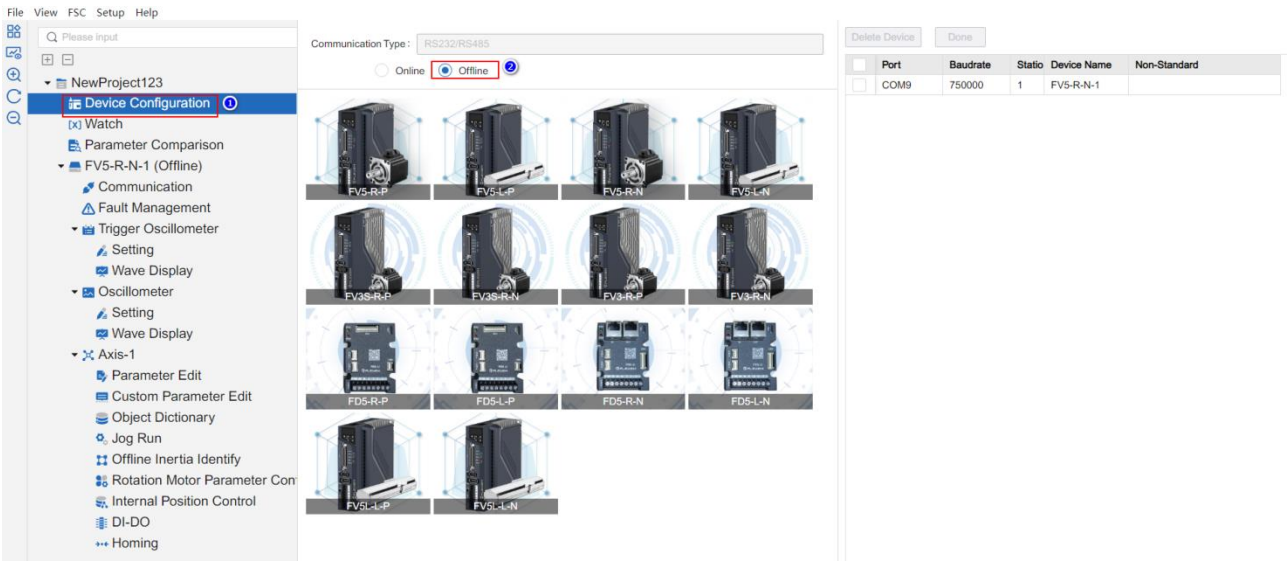
7 Device Configuration

Device configuration configures the servo driver hardware model.

7.1 Offline Configuration

The steps are as follows:

Step 1. Click **Device Configuration**, click **Offline**.



Please see the table below for detailed configuration.

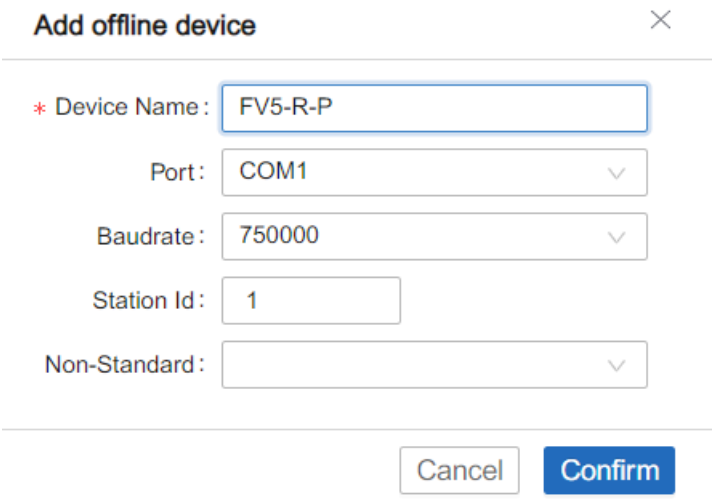
Parameter	Description
Model	◆ FV5-R-P：FV5 rotary pulse servo driver ◆ FV5-L-P：FV5 linear pulse servo driver ◆ FV5-R-N：FV5 rotary EtherCAT bus servo driver ◆ FV5-L-N：FV5 linear EtherCAT bus servo driver ◆ FV3S-R-P：FV3S rotary pulse servo driver ◆ FV3S-R-N：FV3S rotary EtherCAT bus servo driver ◆ FV3-R-P：FV3 rotary pulse servo driver ◆ FV3-R-N：FV3S rotary EtherCAT bus servo driver ◆ FD5-R-P：FD5 low voltage rotary pulse servo driver ◆ FD5-L-P：FD5 low voltage linear pulse servo driver ◆ FD5-R-N：FD5 low voltage rotary EtherCAT bus servo driver ◆ FD5-L-N：FD5 low voltage linear EtherCAT bus servo driver ◆ FV5L-L-P: FV5L gantry linear pulse servo driver ◆ FV5L-L-N: FV5L gantry linear EtherCAT bus servo driver

Create a new driver model based on the type of motor used with the servo driver. For example, if using FV5-E3-PA3R0 with a linear motor, the new project model should be FV5-L-P; if used with a rotary motor, the new project model should be FV5-R-P.

Step 2. Double click the  icon to select the driver model you need to configure.

Step 3. Configure **Add offline device** to add the device to the device list.

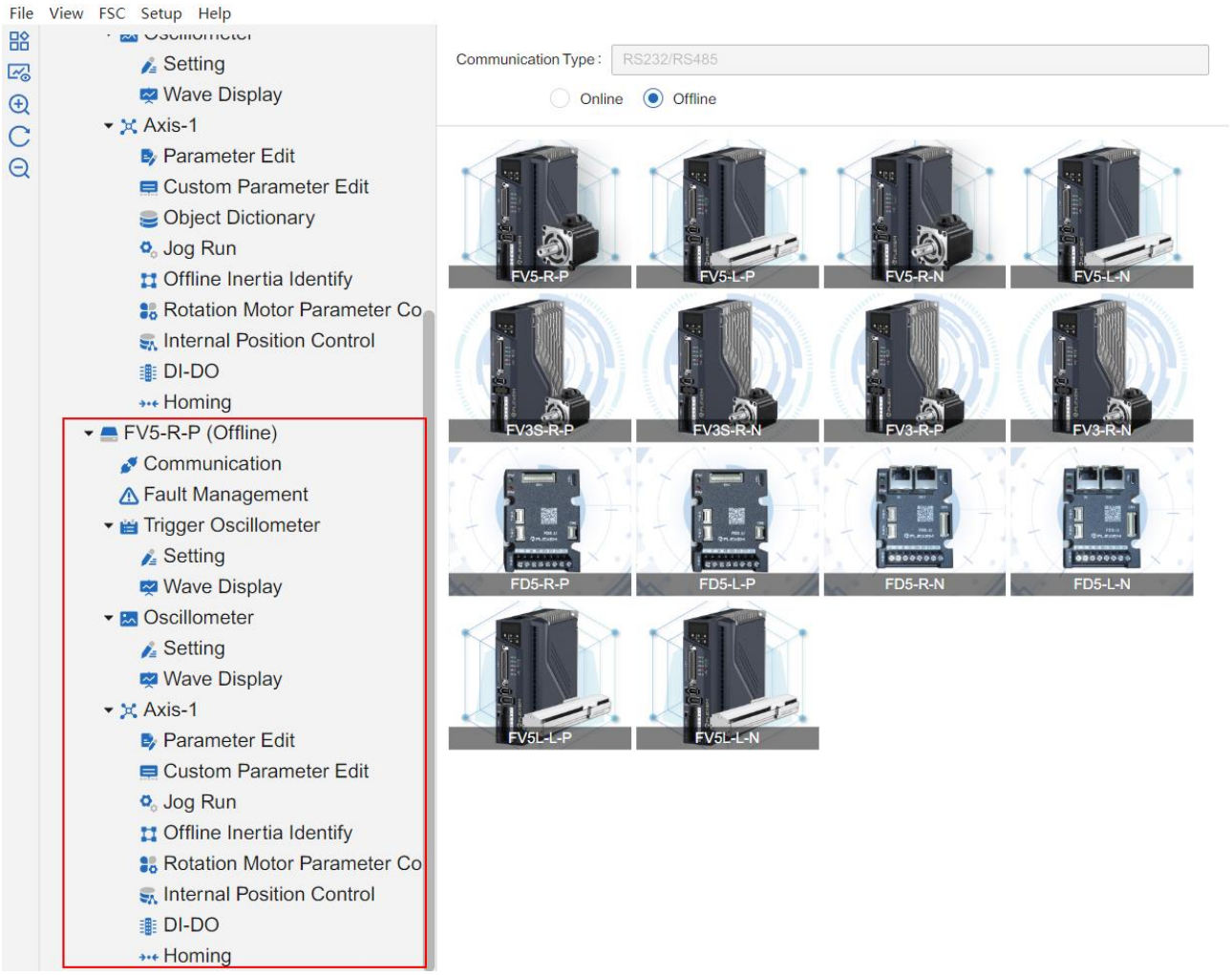
1) Change **Device Name**
2) Select **Port** number
3) Select **Baudrate**
4) Set the **Station ID**



Please see the table below for detailed configuration.

Parameter	Description
Device Name	Change based on actual situation.
Port	Set based on the actual serial port.
Baudrate	The default baudrate for the FV5 driver is 750,000. Parameter P08.0A can be used to change the communication baud rate of the driver.
Station ID	Change based on actual situation.

Step 4. Check the device, click **Done** to add this device to the project.

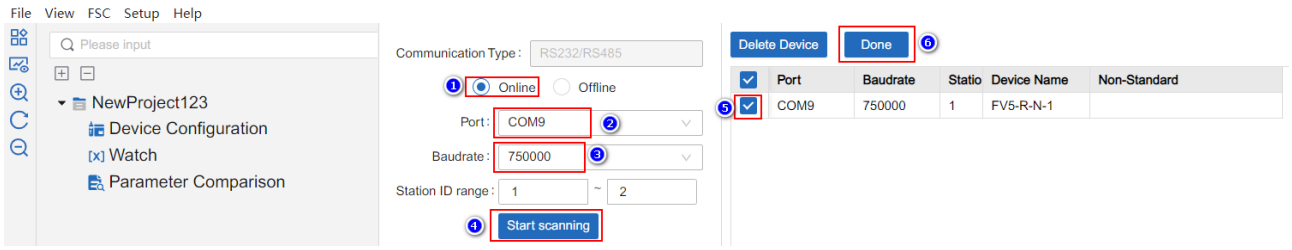


7.2 Online Configuration

The steps are as follows:

Step 1. **Click Online**, select **Port**, select **Baudrate**, set **Station ID range**.

Step 2. Click **Start scanning,** the scanned device information will be displayed on the right side, check the the device and click **Done**, the device will be displayed in the **Project Outline** on the left side.



Please see the table below for detailed configuration.

Parameter	Description
Online	driver scanning configuration for communication connection
Port	Set based on the actual serial port.
Baudrate	The default baudrate for the FV5 driver is 750,000. Parameter P08.0A can be used to change the communication baud rate of the driver.
Station ID range	The default station ID for the FV5 driver is 1, and it can be modified using parameter P08.00.

7.3 Delete Device

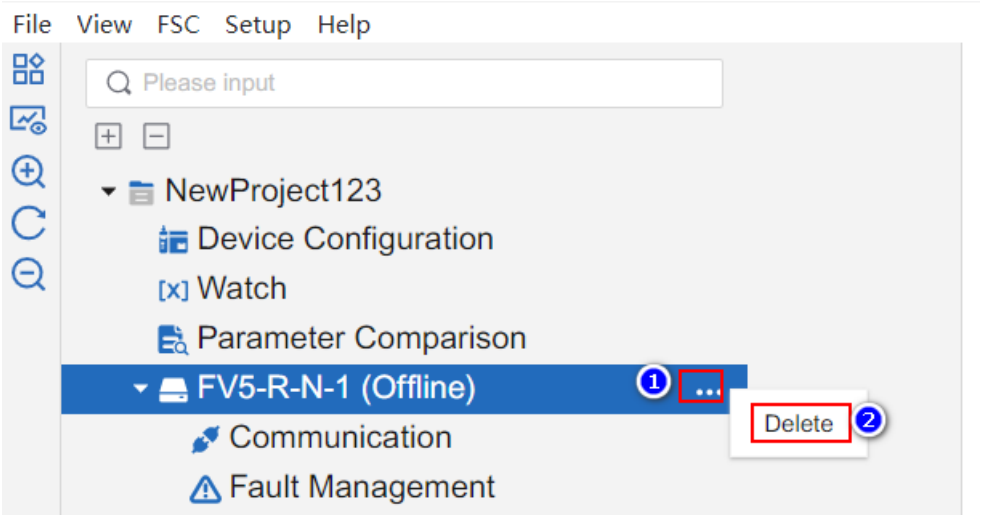
Delete the configured device information in display.

7.3.1 Delete Device from Project Outline

The steps are as follows:

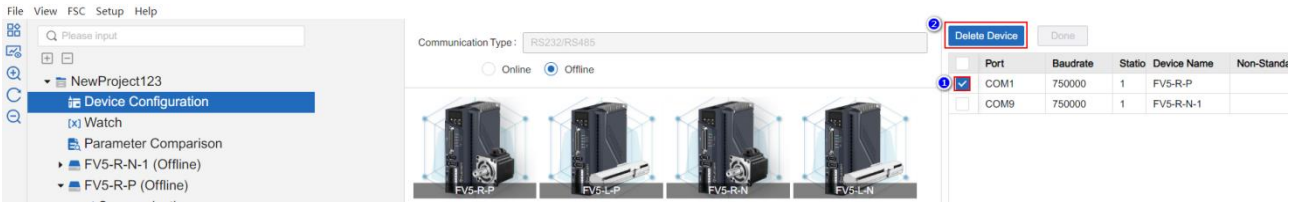
Step 1. Project Outline/New Project, delete the device to be deleted

Step 2. Hover the cursor to the driver, click the ••• icon, click **Delete**.

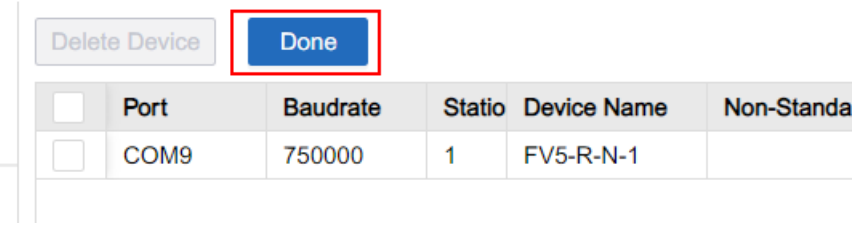


7.3.2 Delete Device from Model List

Step 1. Check the device you need to delete, click **Delete Device.**



Step 2. Click **Done** , the device is deleted from project outline.



8 Parameter Comparison

Compare all values, differing values, and identical values of two project files. The steps are as follows:

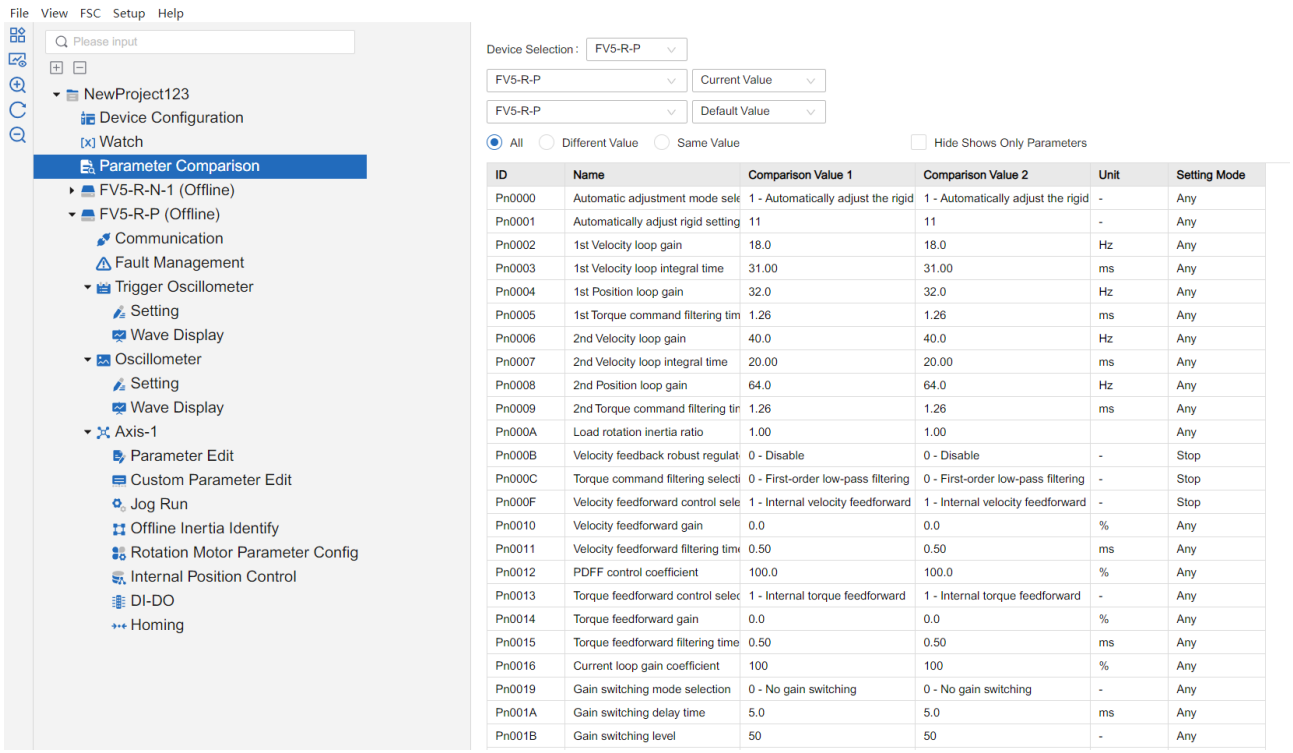
Step 1: Use the drop-down menu of **Device Selection** to select the current or other models.

Step 2. Select **Current Device File** or **Formula File**.

Step 3. For the Current Device File, you can select the **current value, set value, or factory value**. For **Formula File**, you need to click **Load Formula** to load the local file.

Step 4. You can choose to compare **All**, **Different Values**, or **Same Valuea** between the two files, and you can select to **Hide Shows Only Parameters**.

Step 5. Display the comparison results.



Please see the table below for detailed configuration.

Parameter	**Description**
Device Selection	Select driver model.
File Selection	Current device file: driver model of the **selected device**. Formula File: driver parameter files saved in history

Parameter	Description
Current Device File	**Current value**: current value of driver parameters. **Setpoint**: pre-set value of driver parameters. **Default value**: default value of driver parameters.
Load Formula	Select the directory of the historically saved parameter file.
Parameter display interface	**All**: all the parameters in two files **Different Value**: parameters with different values in two files **Same Value**: parameters with same values in two files
Hide Shows Only Parameters	Parameters of which the driver parameter is set to display only

9 Fault Management

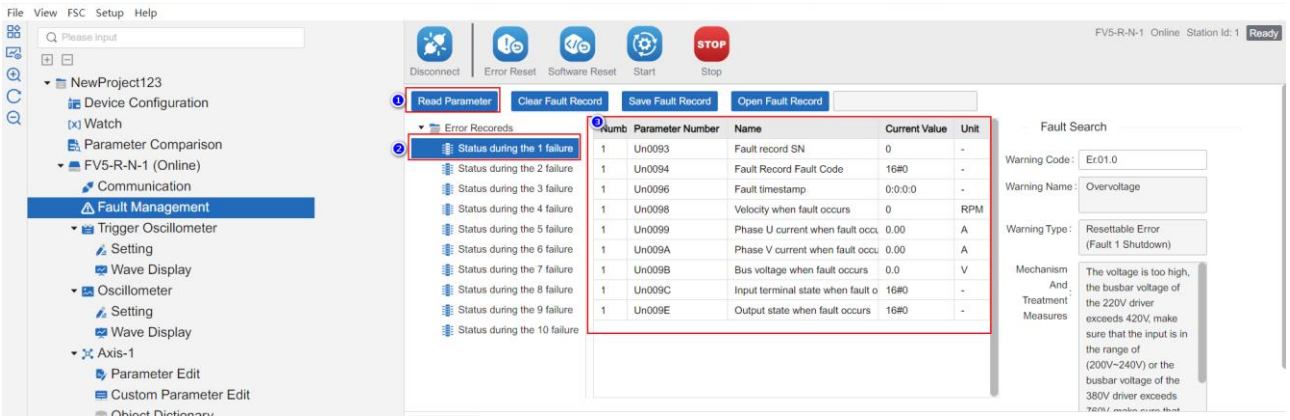
Query historical Fault codes and parameter at the time of the Fault. The Fault query function allows you to search for Fault handling measures, clear Fault records, save Fault record files, and open existing Fault record files.

9.1 History Fault Status Query

Step 1. Click **Read parameter** (read the most recent 10 Fault records of the driver).

Step 2. Select the Fault record to be queried.

Step 3. Display information of the queried Fault, including **the Fault Code, Fault timestamp, Velocity when fault occurs, Phase U current when fault occurs, Phase V current when fault occurs, Bus voltage when fault occurs, Input terminal state when fault occurs, and Output state when fault occurs**.



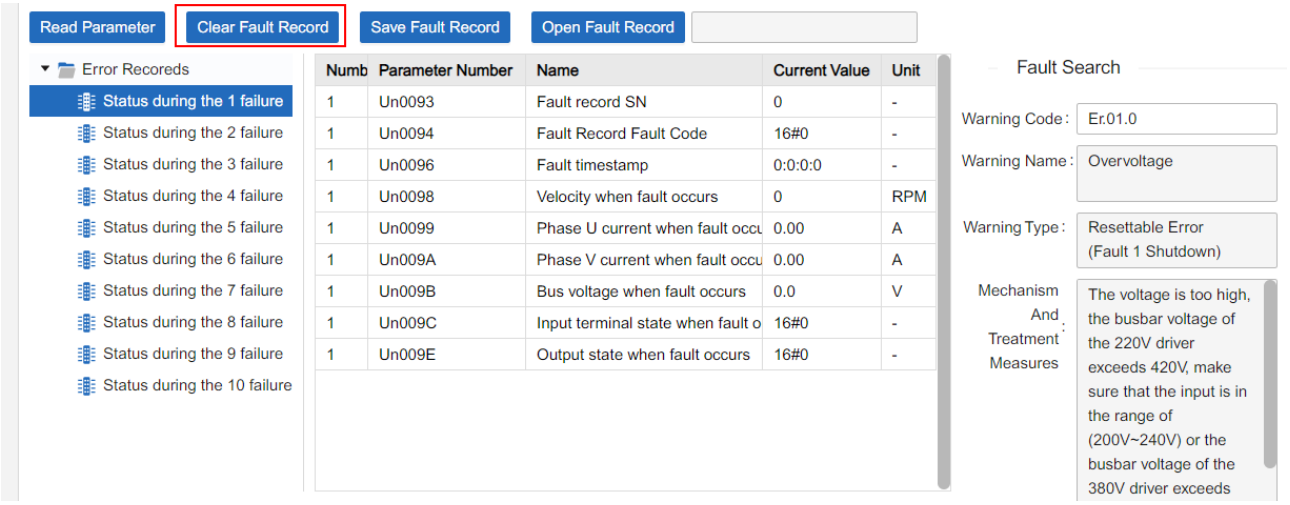
Please see the table below for detailed monitoring parameters.

Parameter	Name
Un0093	Fault record SN
Un0094	Fault record code
Un0096	Fault timestamp
Un0098	Velocity when fault occurs
Un0099	Phase U current when fault occurs
Un009A	Phase V current when fault occurs

Parameter	Name
Un009B	Bus voltage when fault occurs
Un009C	Input terminal state when fault occurs
Un009E	Output state when fault occurs

9.2 Clear Fault Record

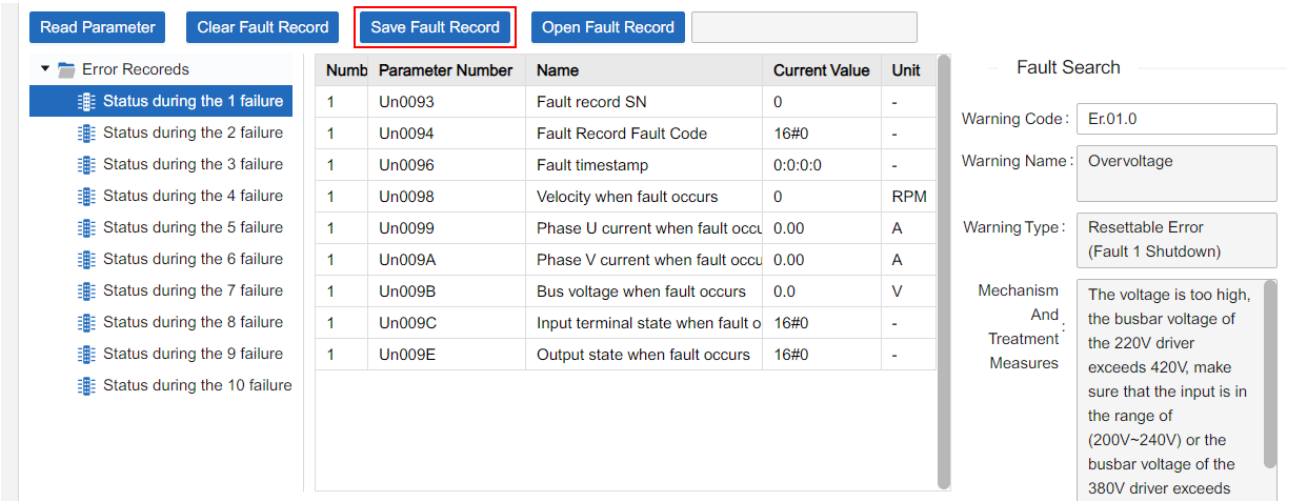
Click **Clear Fault Record** to clear all Fault records saved by the driver.



Once the records are cleared, they cannot be recovered. Please proceed with caution.

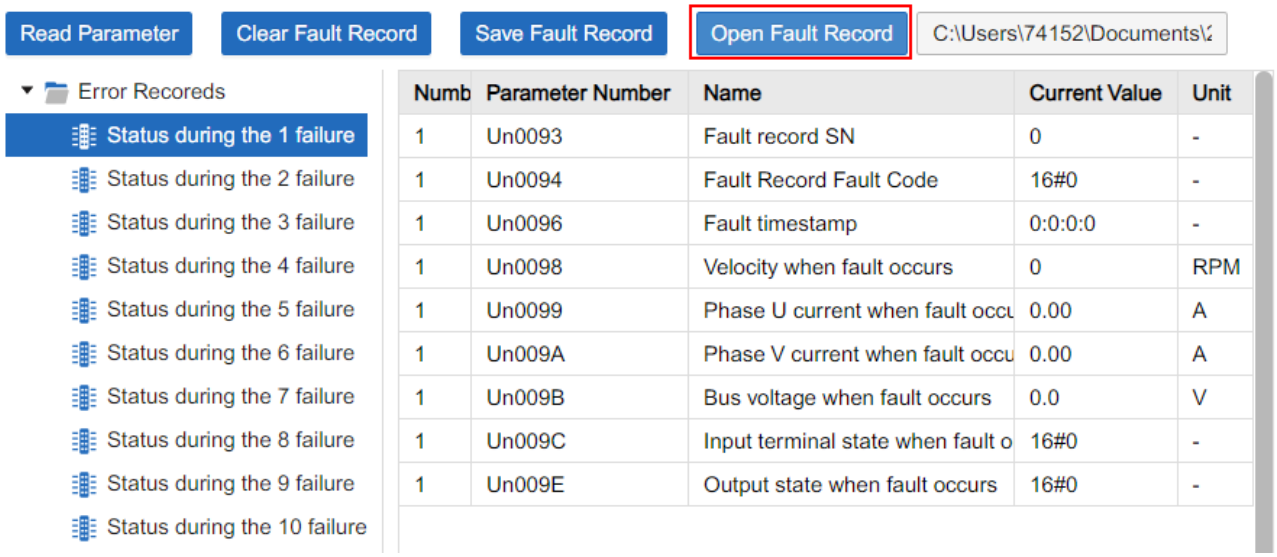
9.3 Save Fault Record

Click **Save Fault Record**, the Fault record is saved to the local .



9.4 Open Fault Record

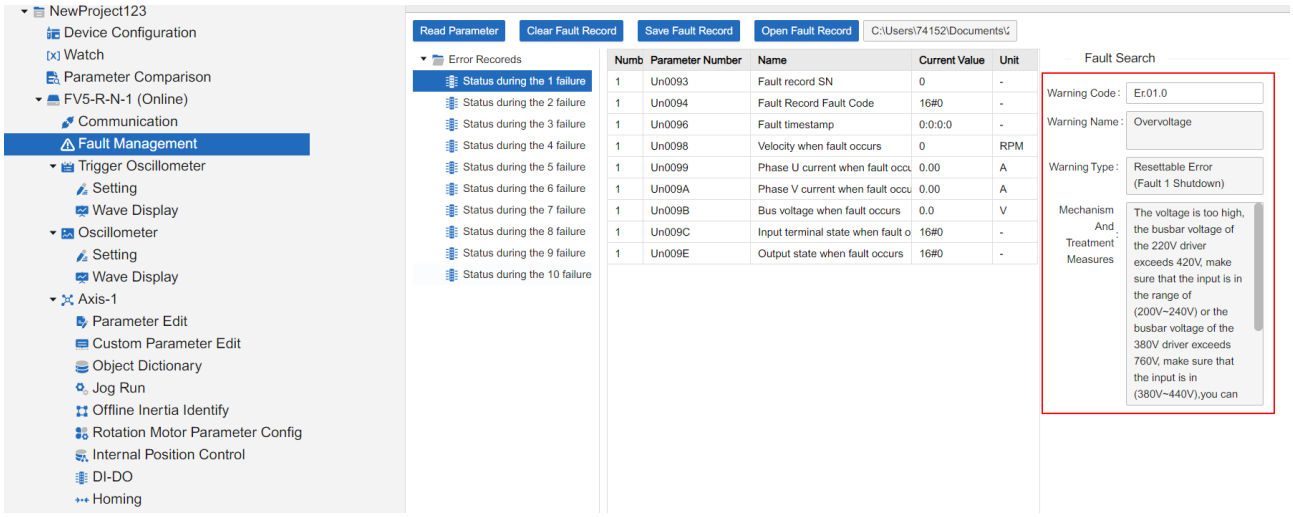
Step 1. Click **Open Fault Record**.



Step 2. Select the fault record file, to open the fault record.

9.5 Fault Query

Select the warning code to query the meaning of the warning code, warning type, mechanism and treatment measures.


NewProject123
Device Configuration
Watch
Parameter Comparison
FV5-R-N-1 (Online)
Communication
Fault Management
Trigger Oscillometer
Setting
Wave Display
Oscillometer
Setting
Wave Display
Axis-1
Parameter Edit
Custom Parameter Edit
Object Dictionary
Jog Run
Offline Inertia Identify
Rotation Motor Parameter Config
Internal Position Control
DI-DO
Homing
Read Parameter
Clear Fault Record
Save Fault Record
Open Fault Record
C:\Users\74152\Documents\
Error Recoreds
Status during the 1 failure
Status during the 2 failure
Status during the 3 failure
Status during the 4 failure
Status during the 5 failure
Status during the 6 failure
Status during the 7 failure
Status during the 8 failure
Status during the 9 failure
Status during the 10 failure
Numb Parameter Number Name Current Value Unit
1 Un0093 Fault record SN 0 -
1 Un0094 Fault Record Fault Code 16#0 -
1 Un0096 Fault timestamp 0:0:0:0 -
1 Un0098 Velocity when fault occurs 0 RPM
1 Un0099 Phase U current when fault occu 0.00 A
1 Un009A Phase V current when fault occu 0.00 A
1 Un009B Bus voltage when fault occurs 0.0 V
1 Un009C Input terminal state when fault o 16#0 -
1 Un009E Output state when fault occurs 16#0 -
Fault Search
Warning Code: Er.01.0
Warning Name: Overvoltage
Warning Type: Resettable Error (Fault 1 Shutdown)
Mechanism And Treatment Measures:
The voltage is too high, the busbar voltage of the 220V driver exceeds 420V, make sure that the input is in the range of (200V~240V) or the busbar voltage of the 380V driver exceeds 760V, make sure that the input is in (380V~440V),you can

10 Trigger Oscilloscope

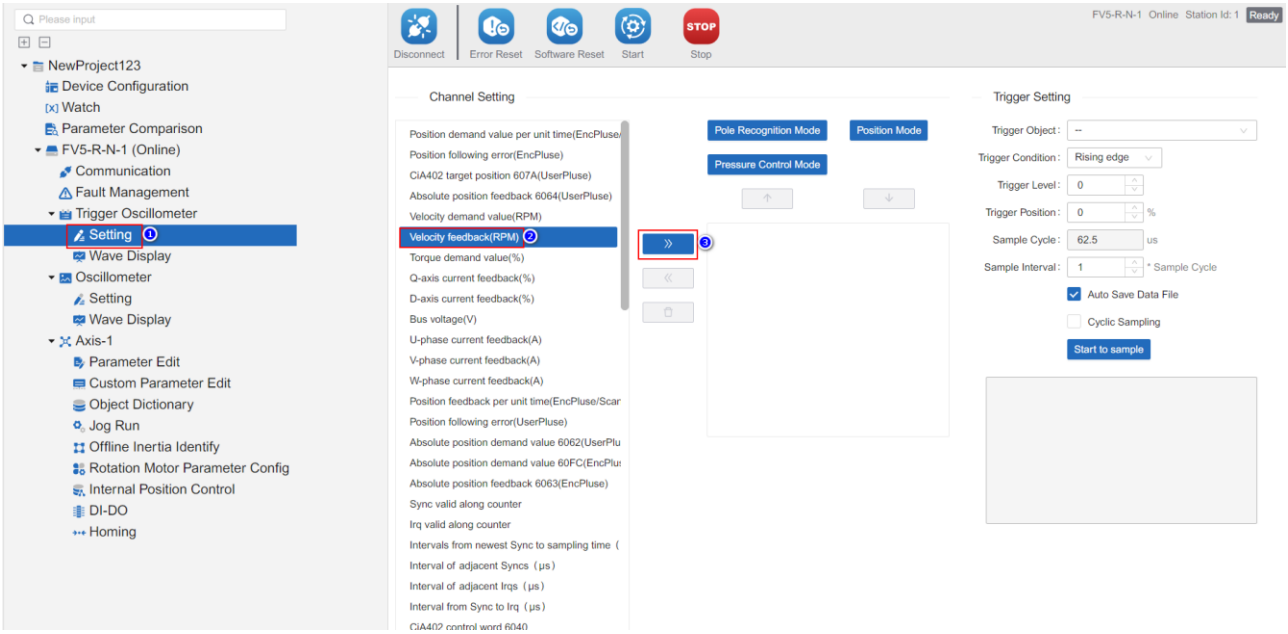
The trigger oscilloscope visually displays the motor's operating parameters (such as speed feedback, etc.) in the form of graphs or data tables. Users can customize the sampling channels and sampling methods.

10.1 Setting

The **Setting** module is used to customize the sampling channels and define the sampling methods for each channel.

10.1.1 Channel Setting

Step 1. In the **Project Outline** control, select **Setting,** choose the channel (e.g., speed feedback, multiple channels can be selected), and click the » icon to move the selected channel to the list of chosen channels.



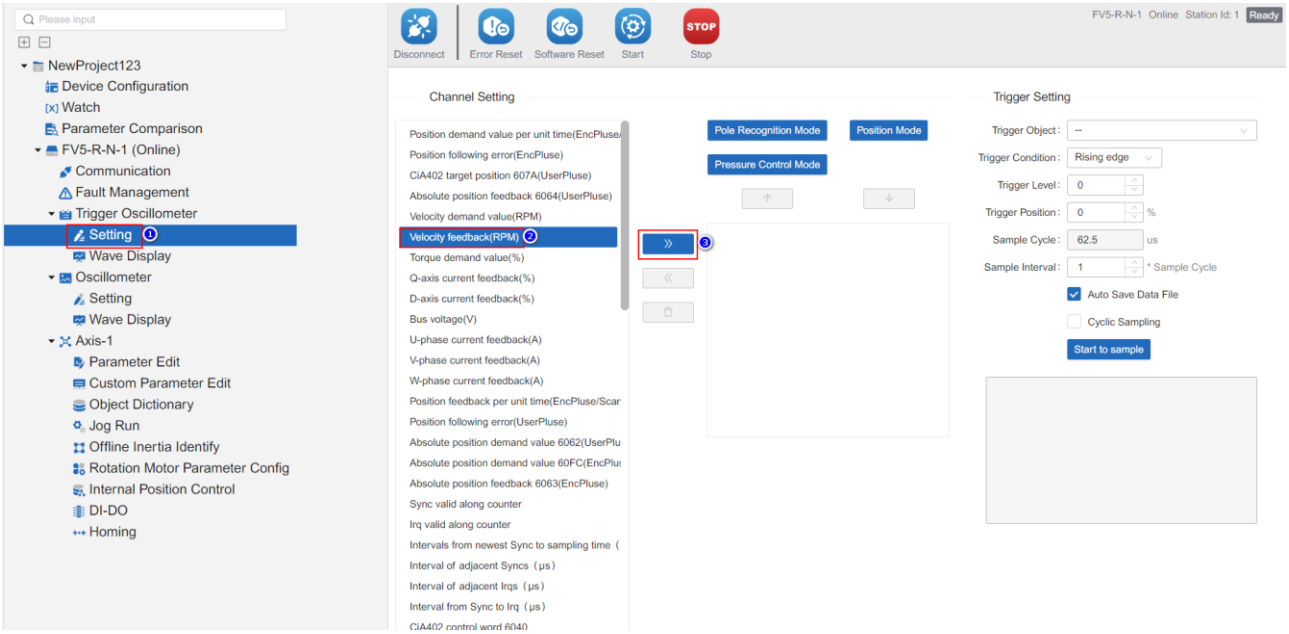
Please see the table below for detailed configuration.

Parameter	Description
»	Add the selected channels to the list of the selected channels.
«	In the list of the selected channels, select the channel and click this button to remove it.
↑	Move the selected channel up in the channel list.
↓	Move the selected channel down in the channel list.

Parameter	Description
	Click this button to delete all channels in the list of the selected channels.
Position Mode	Click **Position Mode** to move the commonly used channels related to position mode to the list of the selected channels.
Pole Recognition Mode	Click **Pole Recognition Mode** to move the commonly used channels related to pole recognition mode to the list of the selected channels.

10.1.2 Trigger Setting

Step 1. Configure channel trigger setting.



Please see the table below for detailed configuration.

Parameter	Description
Trigger Object	Select the trigger object according to the actual situation.
Trigger Condition	◆ Rising edge: Trigger sampling at the moment when the trigger object value equals the trigger level during the rising edge. ◆ Falling edge: Trigger sampling at the moment when the trigger object value equals the trigger level during the falling edge. ◆ Edge transition: Trigger sampling at the moment when the trigger object value equals the trigger level during the rising edge or falling edge. ◆ Equal: Trigger sampling when the value of the trigger object equals the trigger level.
Trigger	The current value of the trigger object at the time of the trigger condition.

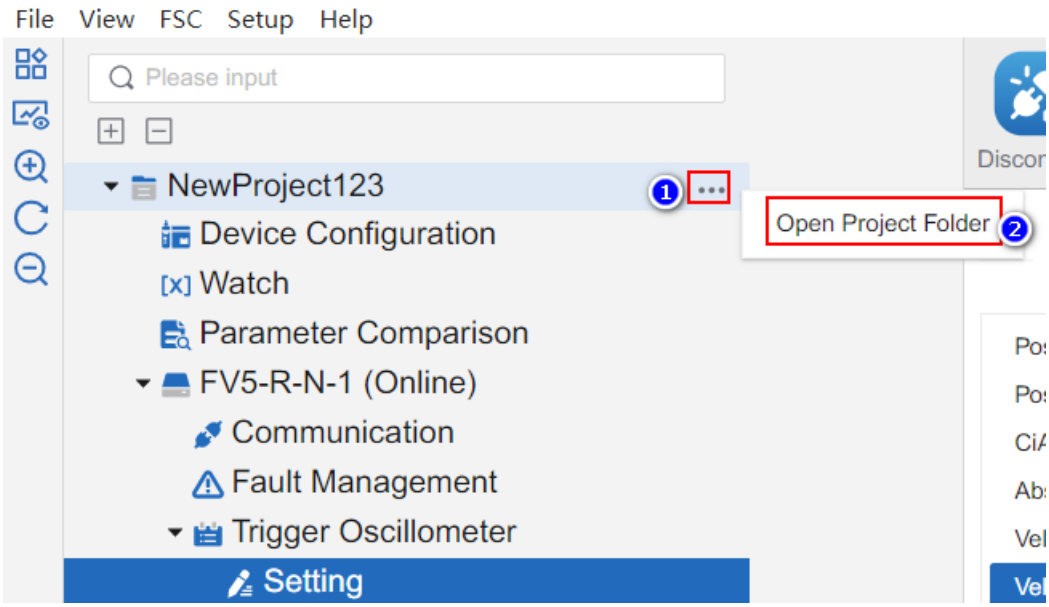
Parameter	Description
Level	
Trigger Position	The position of the trigger object in the waveform interface at the time of the trigger condition.
Sample Cycle	The default is 62.5 microseconds.
Sample Interval	The time interval between two samples, it is an integer multiple of the sampling cycle.
Auto Save Data File	FSC folder under project directory
Cyclic Sampling	Repeated triggering, which means that the next sampling will overwrite the previous sampling result.

Step 2. Click **Start to sample** to start data sampling.

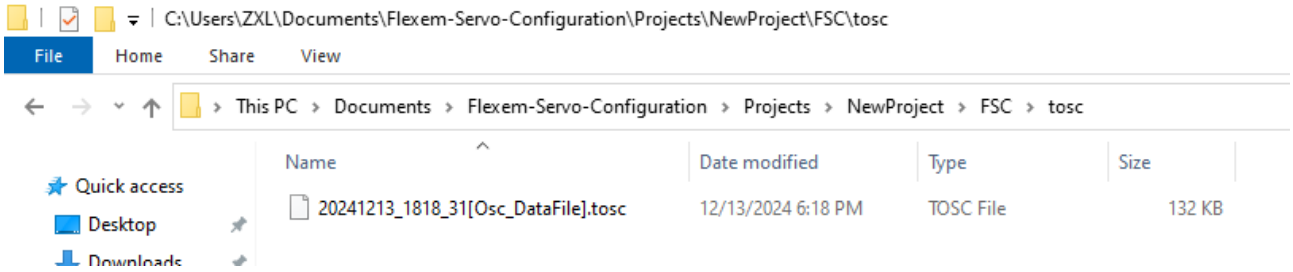
10.1.3 Trigger Oscilloscope Auto Save Data File

When **Auto Save Data File** is enabled , the file will saved to the file path which is the FSC folder under the project directory.

Step 1. Hover the cursor to the project , click ••• icon, click **Open project folder**.

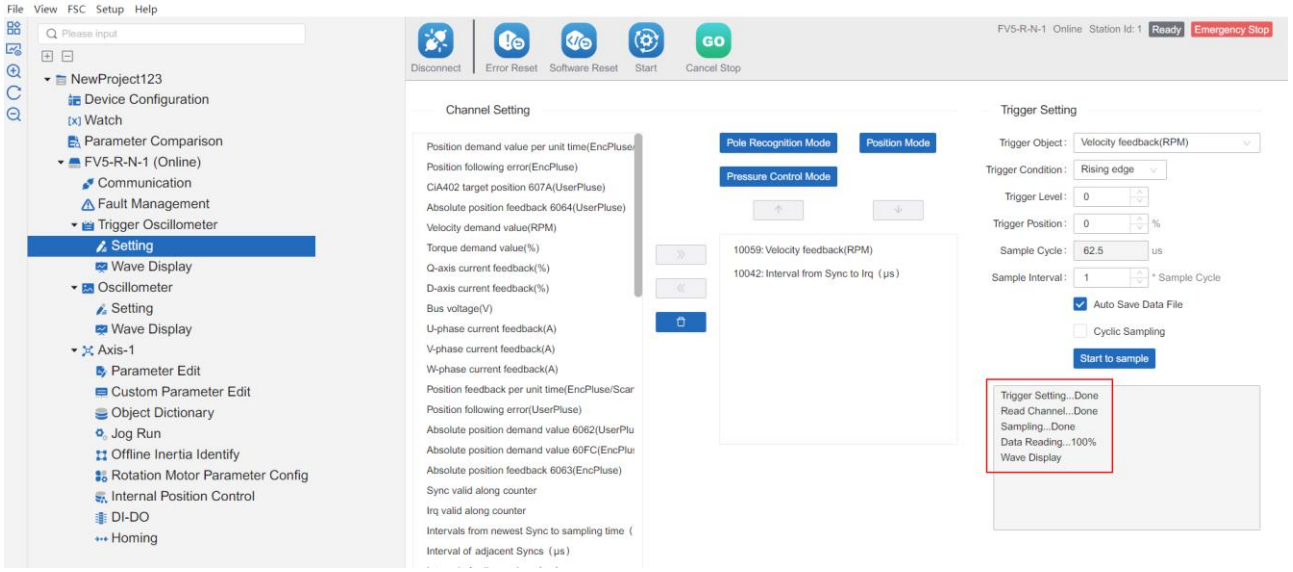


Step 2. Select directory ..**FSC\tosc** to view the files.



10.1.4 Data Collection Progress Display

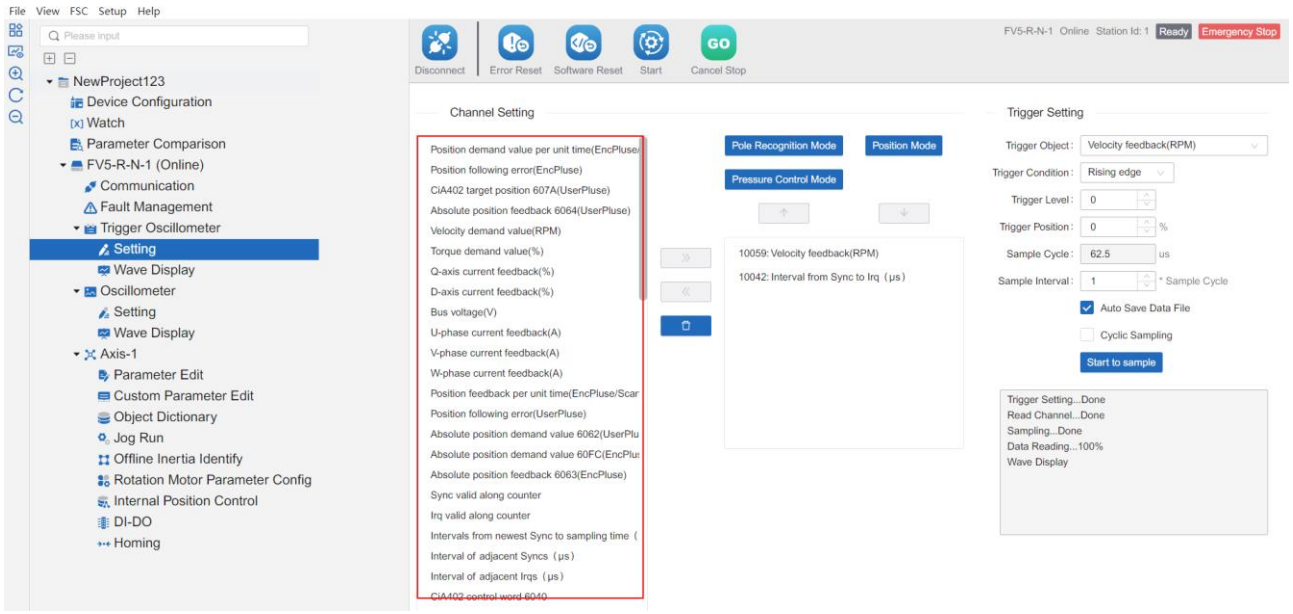
It displays the progress of current trigger sampling, data reading, and waveform.



10.2 Operating Instruction

10.2.1 Channel Setting

Display the configurable channel parameters.

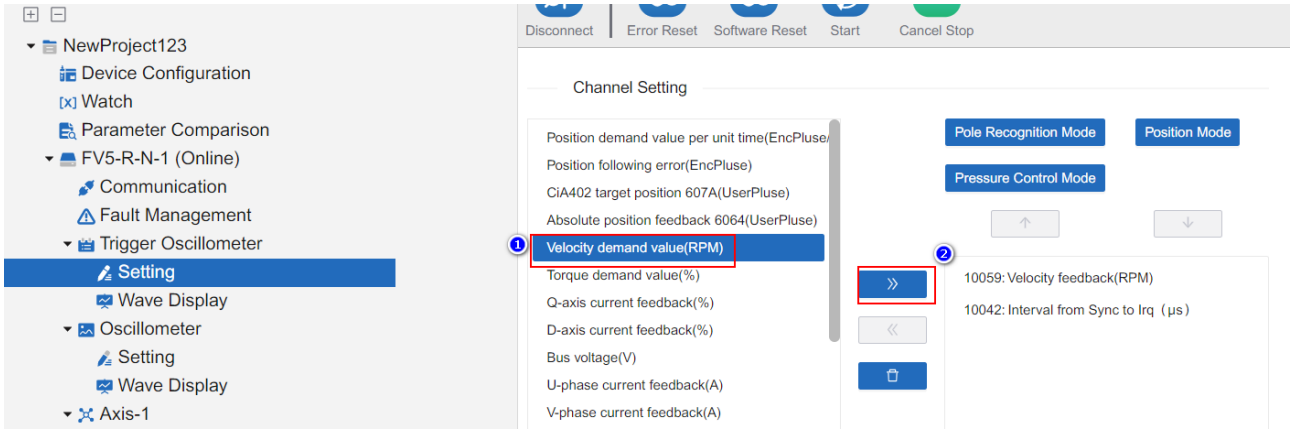


10.2.2 Select and Add

Method 1:

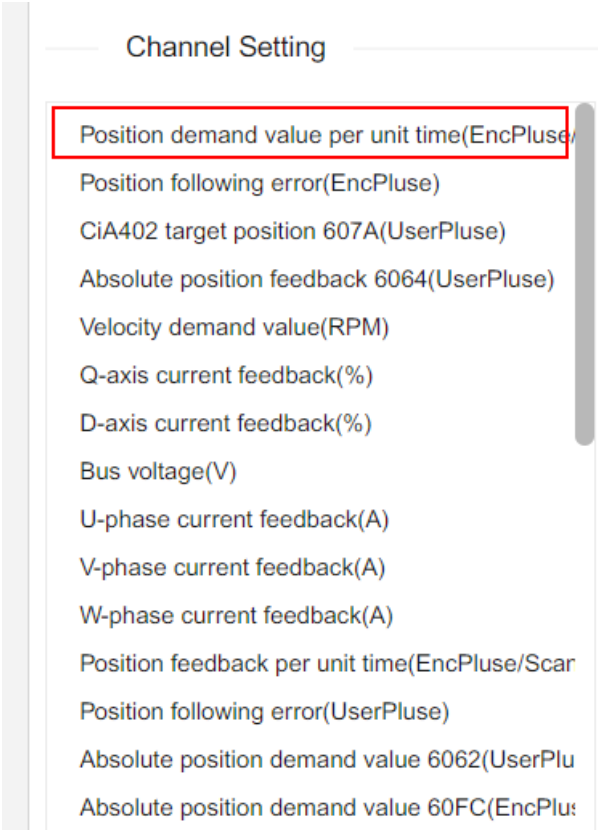
Step 1. Click to select the channel parameter to be added.

Step 2. Click the add button  .



Method 2:

Double click the channel to be added.

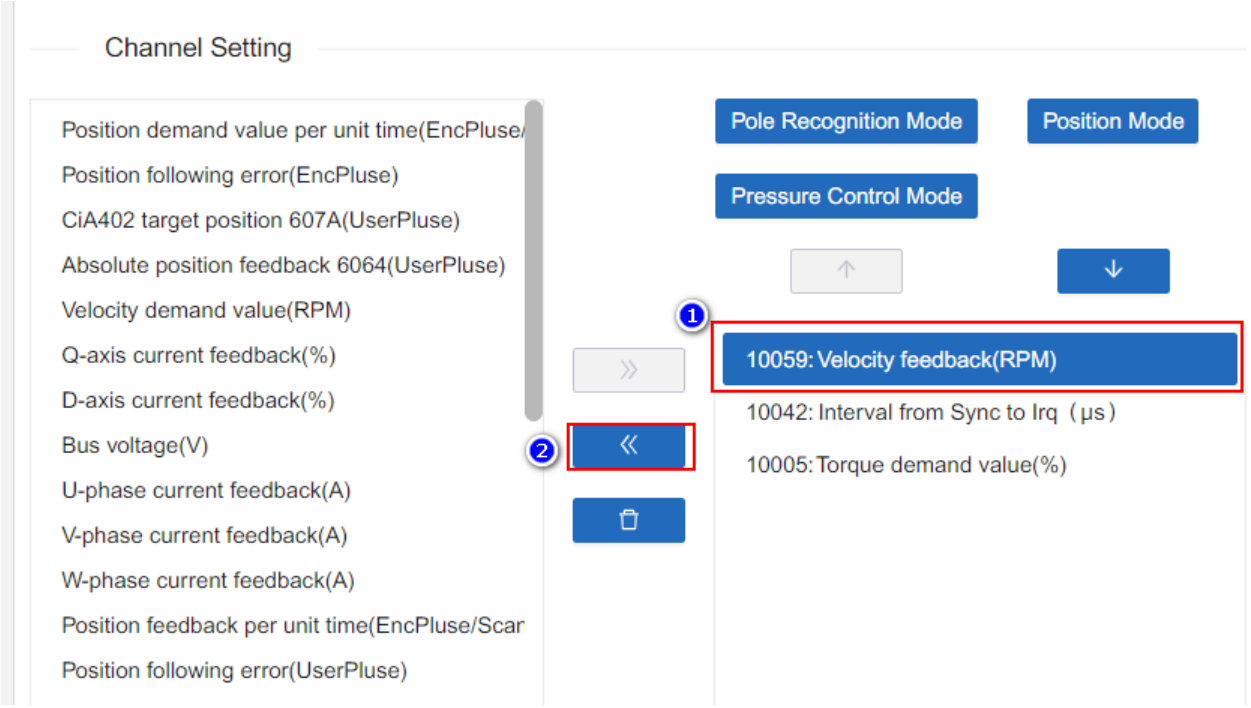


10.2.3 Select and Remove

Method 1:

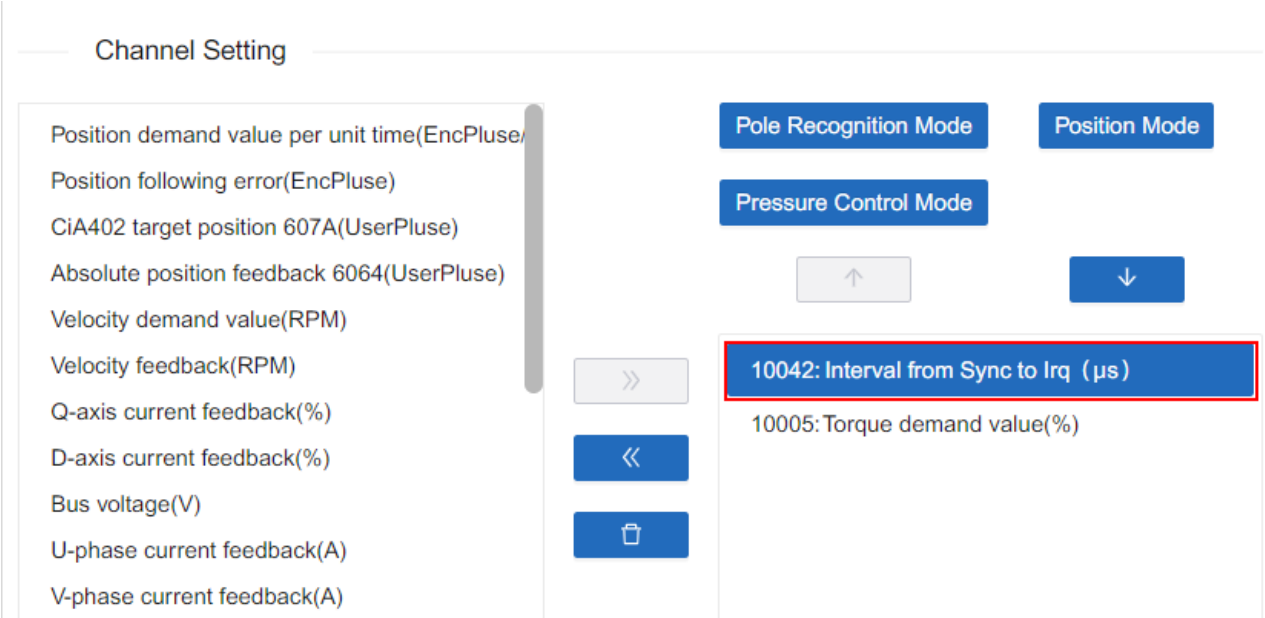
Step 1. Click to select the channel parameter to be removed.

Step 2. Click the remove button « .



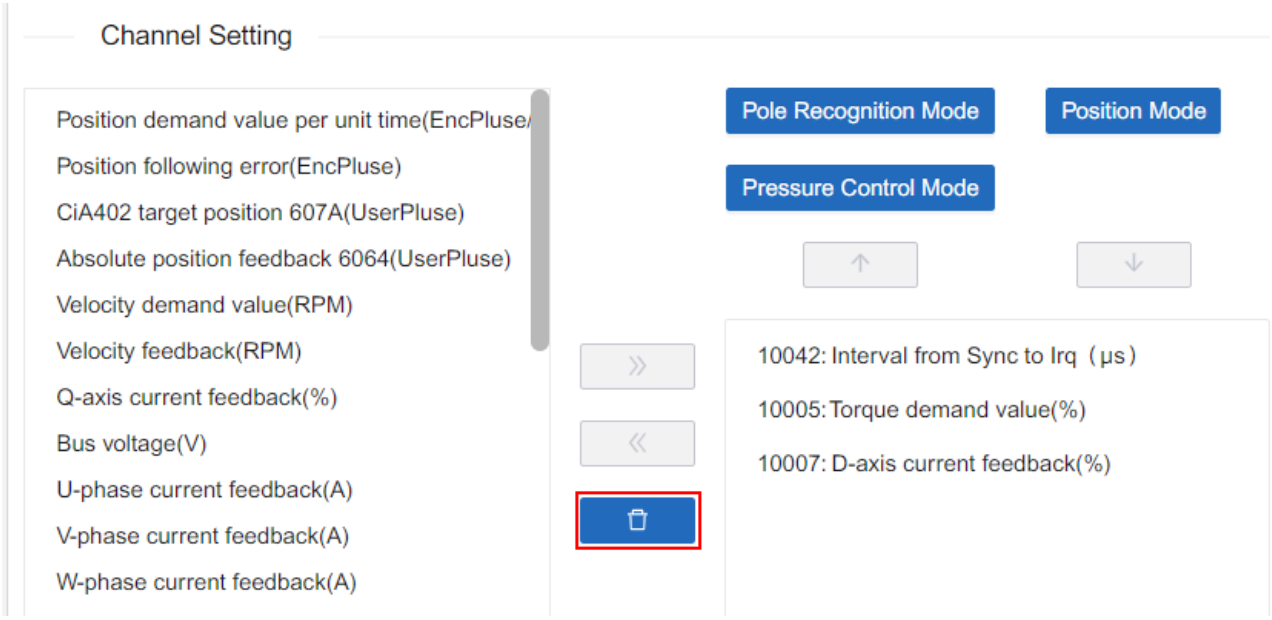
Method 2:

Double click the channel to be removed.



10.2.4 Clear

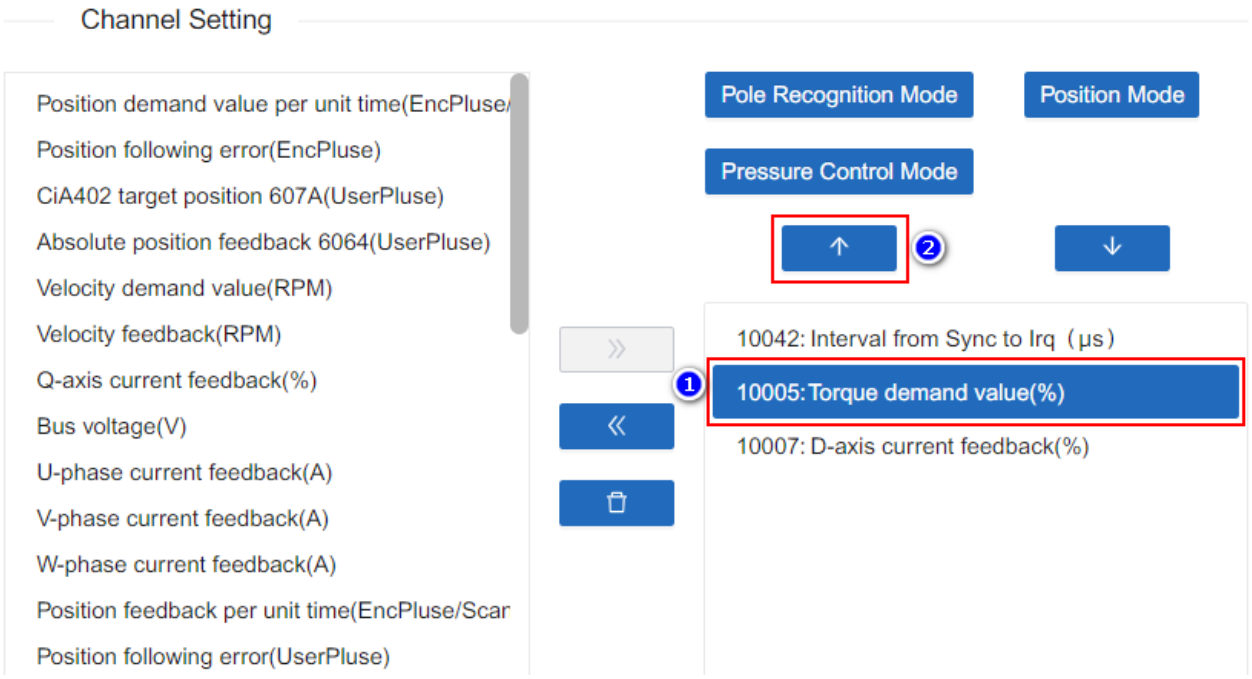
Click clear button  to clear all the selected channel parameters.



10.2.5 Select and Move Up

Step 1. Click to select the channel parameter to be moved up.

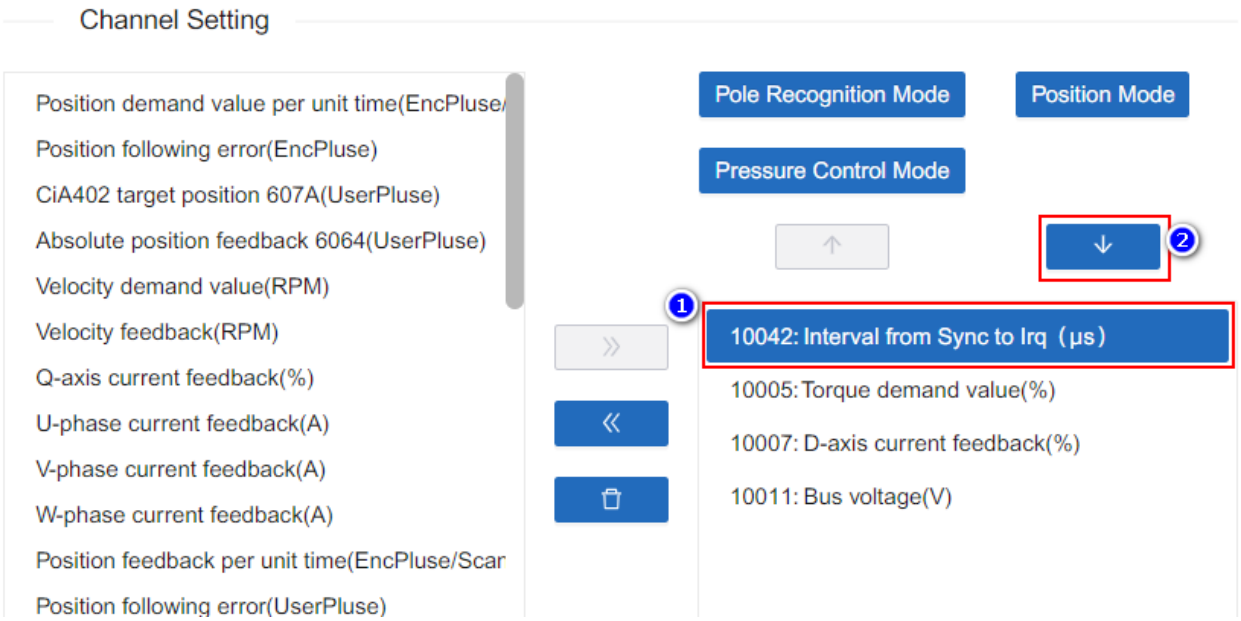
Step 2. Click the move up button  .



10.2.6 Select and Move Down

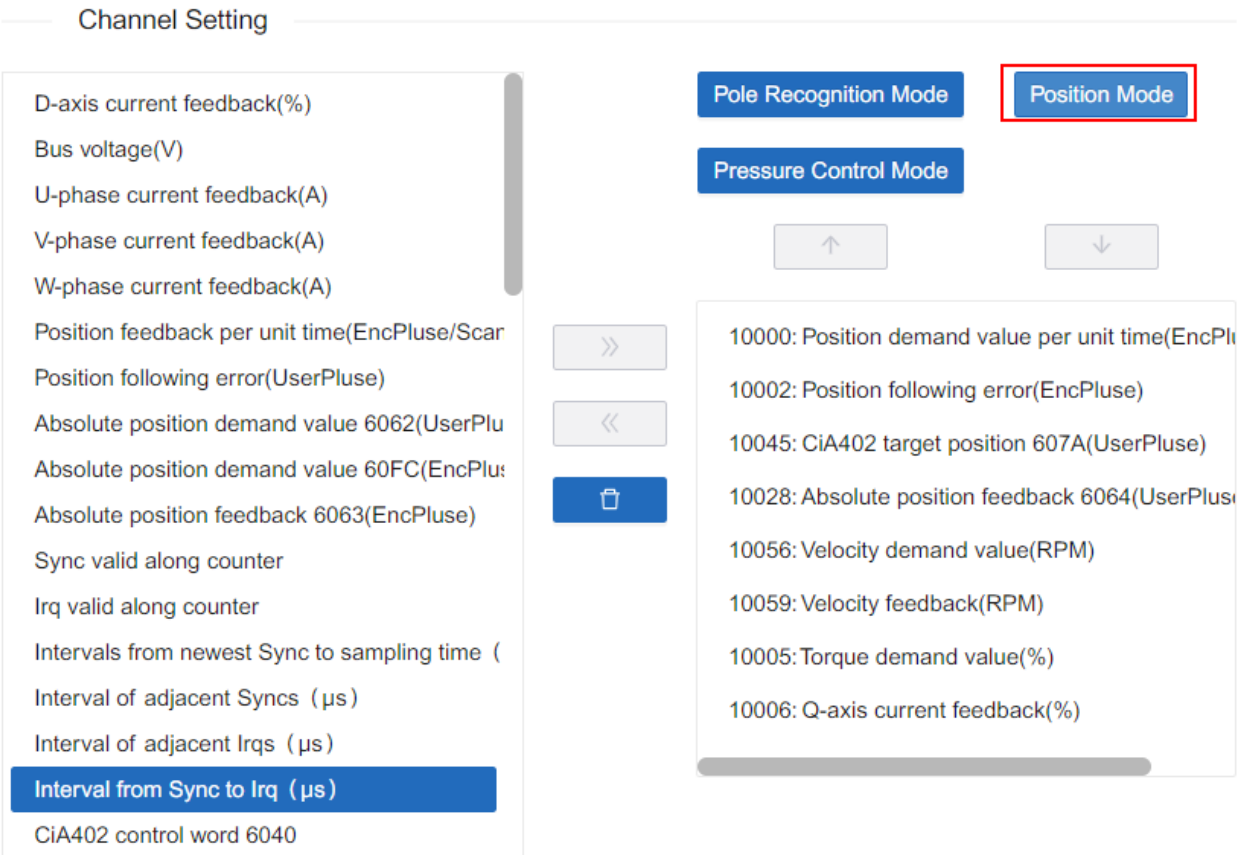
Step 1. Click to select the channel parameter to be moved down.

Step 2. Click the move down button  .



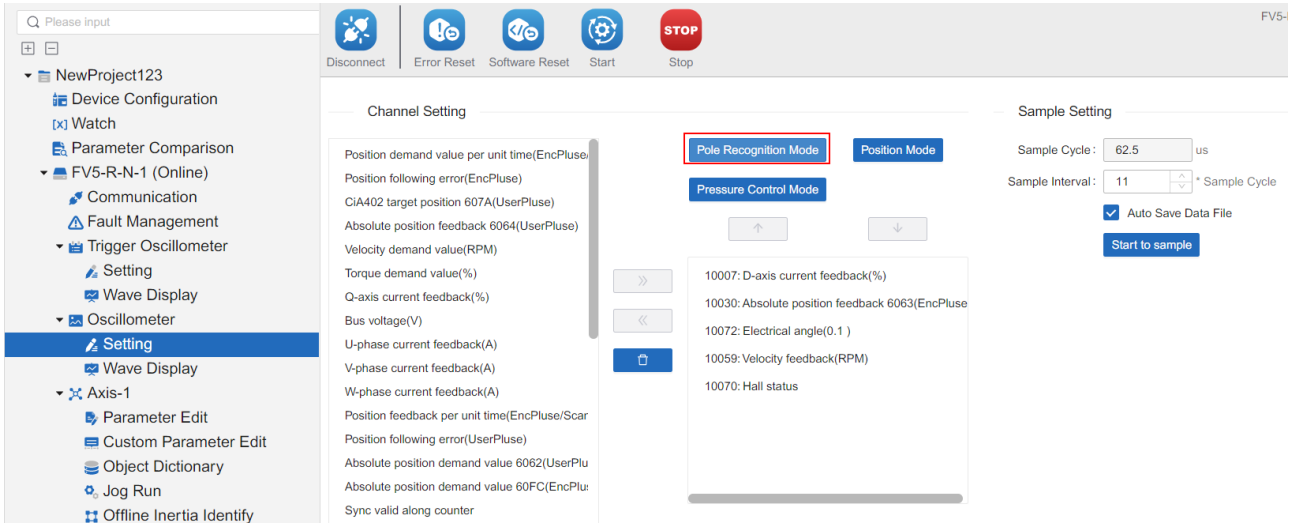
10.2.7 Shortcut for Position Mode Channel Parameter Configuration

Commonly used position mode channel parameters can be called by clicking **Position Mode**.



10.2.8 Shortcut for Pole Recognition Mode Channel Parameter Configuration

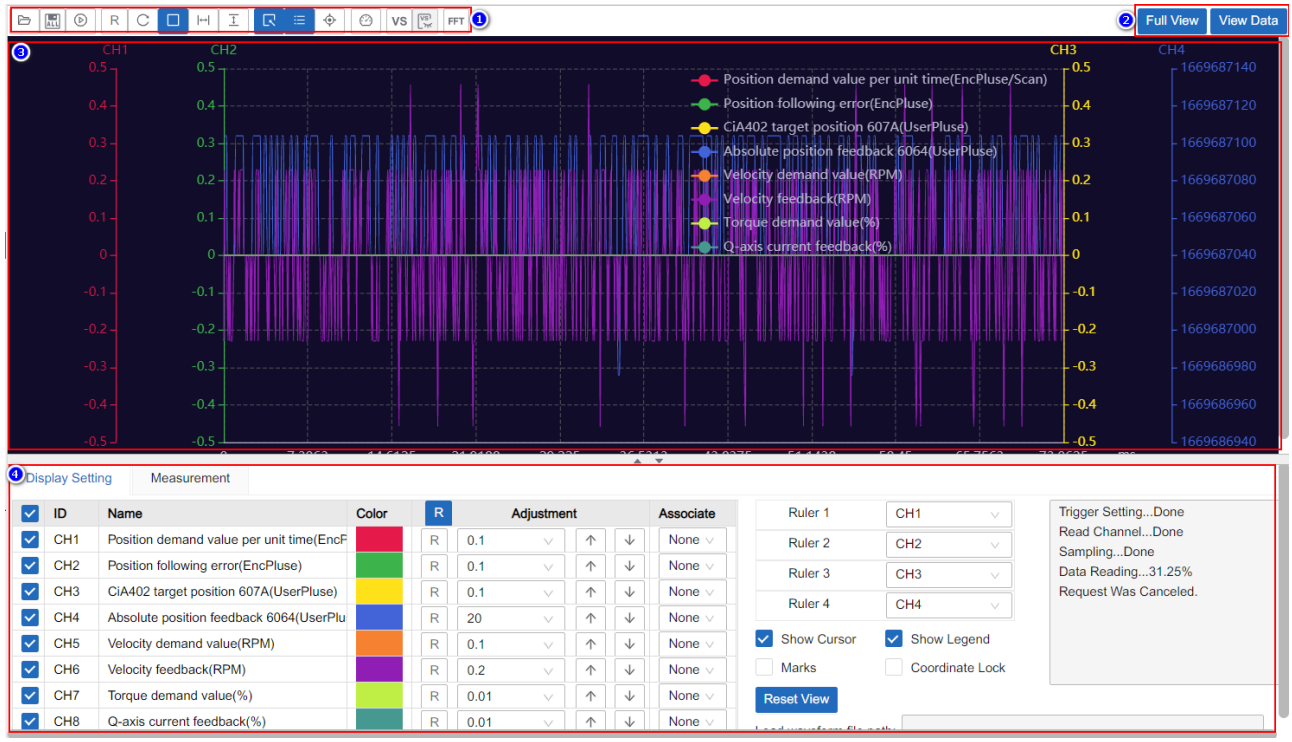
Commonly used pole recognition mode channel parameters can be called by clicking **Pole Recognition Mode**.



10.3 Waveform Display

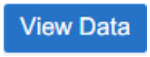
Display the waveform curve and data collected by trigger oscilloscope .

10.3.1 Interface Introduction



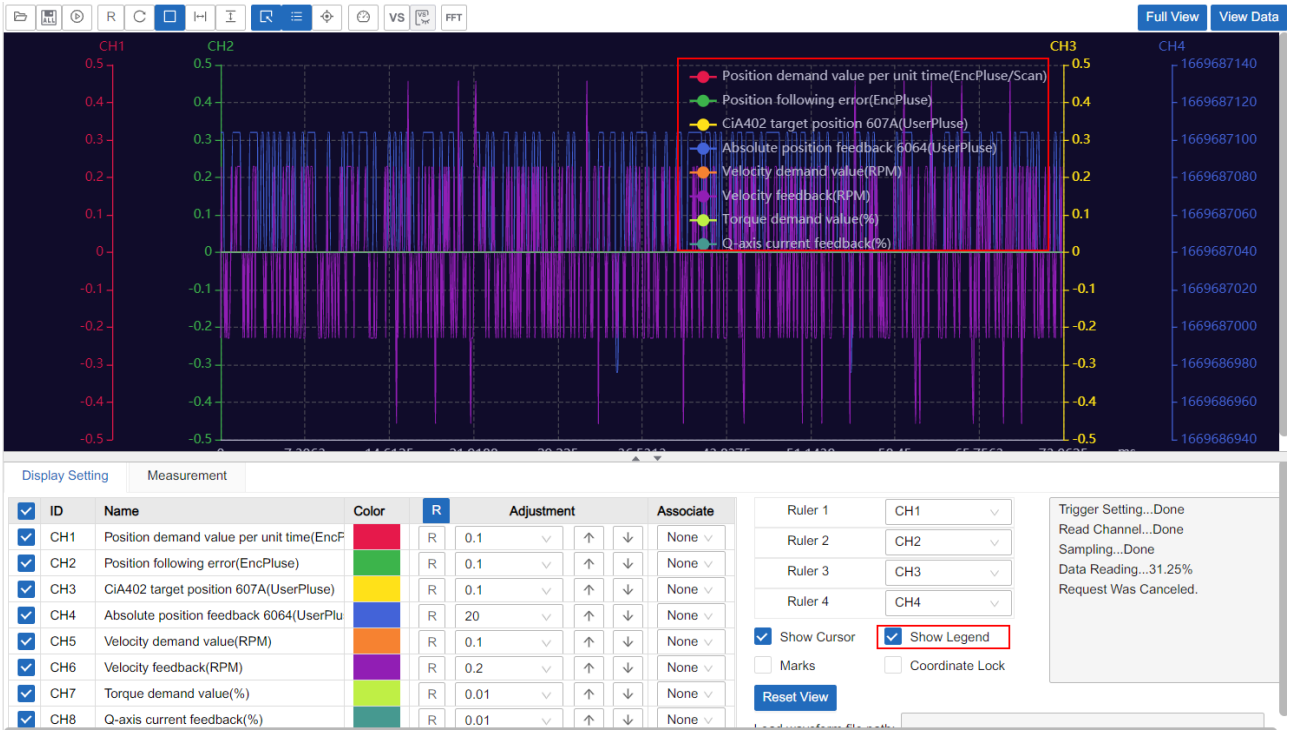
Please see detailed description of each area:

SN	Area	Icon	Description
①	Toolbar		Load file: load .tosc file from specified address
			Save Data File: save current wave data to specified address.
			Sample switch: used to start sampling and stop sampling
			Reset Zoom: reset the wave interface to the original status
			X and Y axes scaling: scale the wave in X axis and Y axis at the same time
			X axis scaling: scale the wave in X axis while locking the Y scale
			Y axis scaling: scale the wave in Y axis while locking the X scale
			Show Cursor: Follows the mouse, marks the curve cursor, and displays the current data value.
			Show Legend: display channel information in the upper right corner of the wave interface
			Marks: mark each collection point on the curve
			Horizontal Measurement: Display the measure line vertically to compare X-axis data. Vertical Measurement: Display the measure line horizontally to compare X-axis data.
			Waveform Comparison: Waveforms with the same **channel selection** and **trigger settings** can be imported for comparison.

SN	Area	Icon	Description
			Hide waveform in comparison: Hide imported wave curve
			Waveform data FFT calculation, analyzing amplitude-frequency characteristics.
②	View Switch		Full View: Hide **Display Setting** and **Measurement** to display the full wave graph.
③			Display data: Waveform curves switch to data tables, showing data at sampling time for each channel
④	Display Curve		Display the wave curve for the collected data
⑤	Display Setting and Measurement		Display Setting: Channel display selection, **color** modification, **adjust** channels, **reset** settings, move curve **up**, move curve **down**, **channel association** selection, **waveform display ruler** selection, **cursor** selection, **display legend** selection, **mark** selection, **coordinate locking** selection, **reset view** selection, **load waveform file path** display, **data collection** progress display. Measurement: Data points, differentials, average value, root mean square value, minimum value, maximum value, enable selection, measurement type selection.

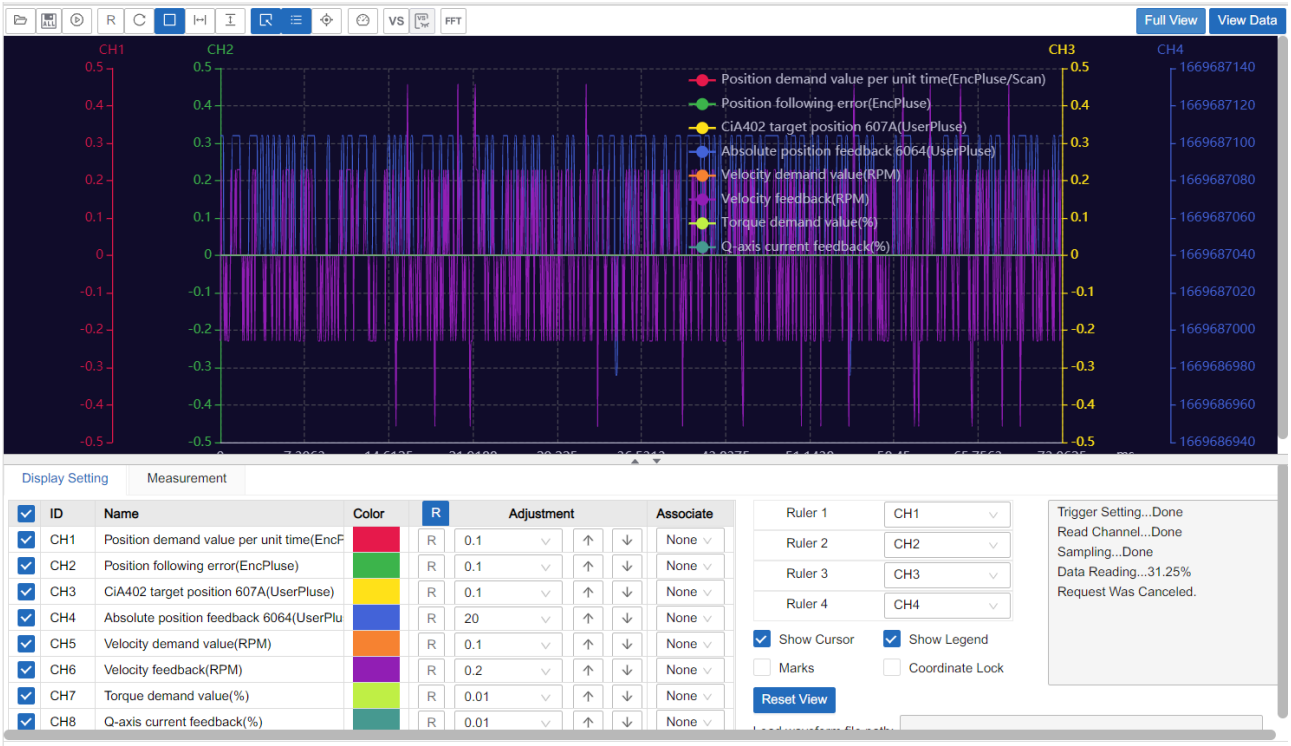
10.3.2 Show Legend

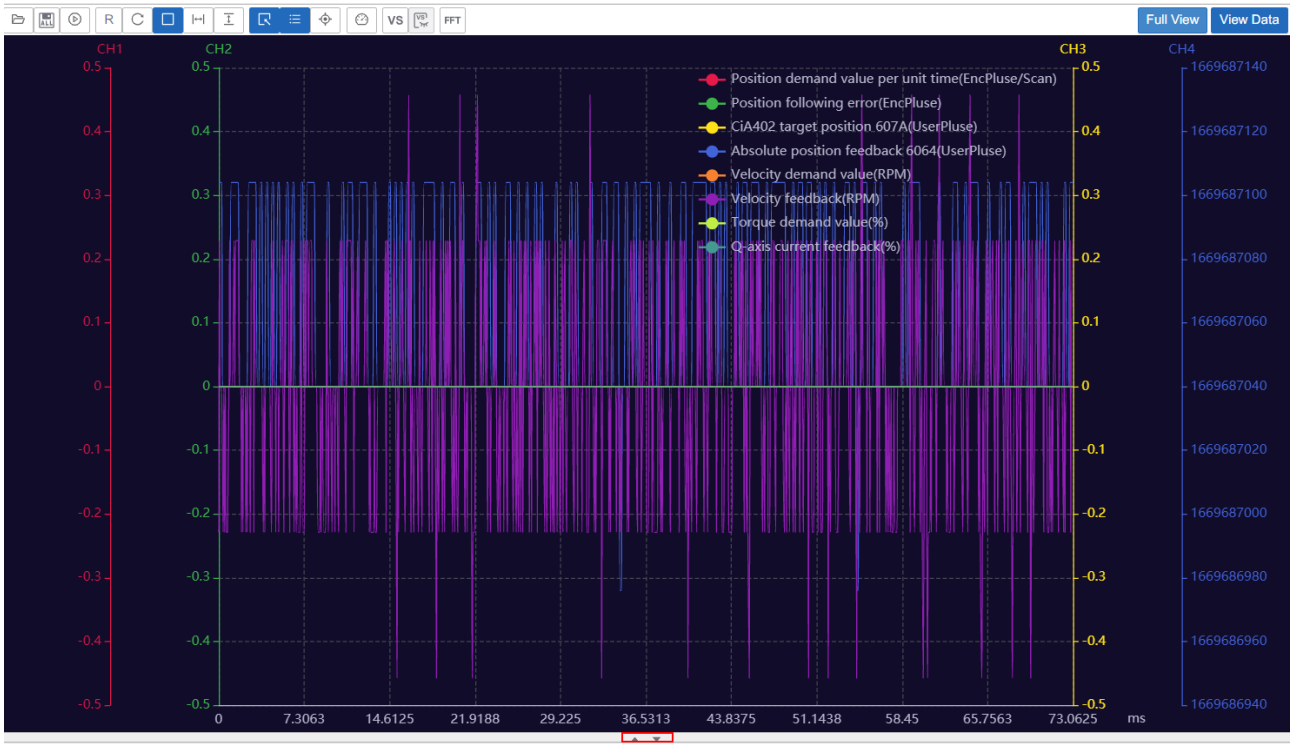
Display channel information in the upper right corner of the wave display interface.



10.3.3 Normal View

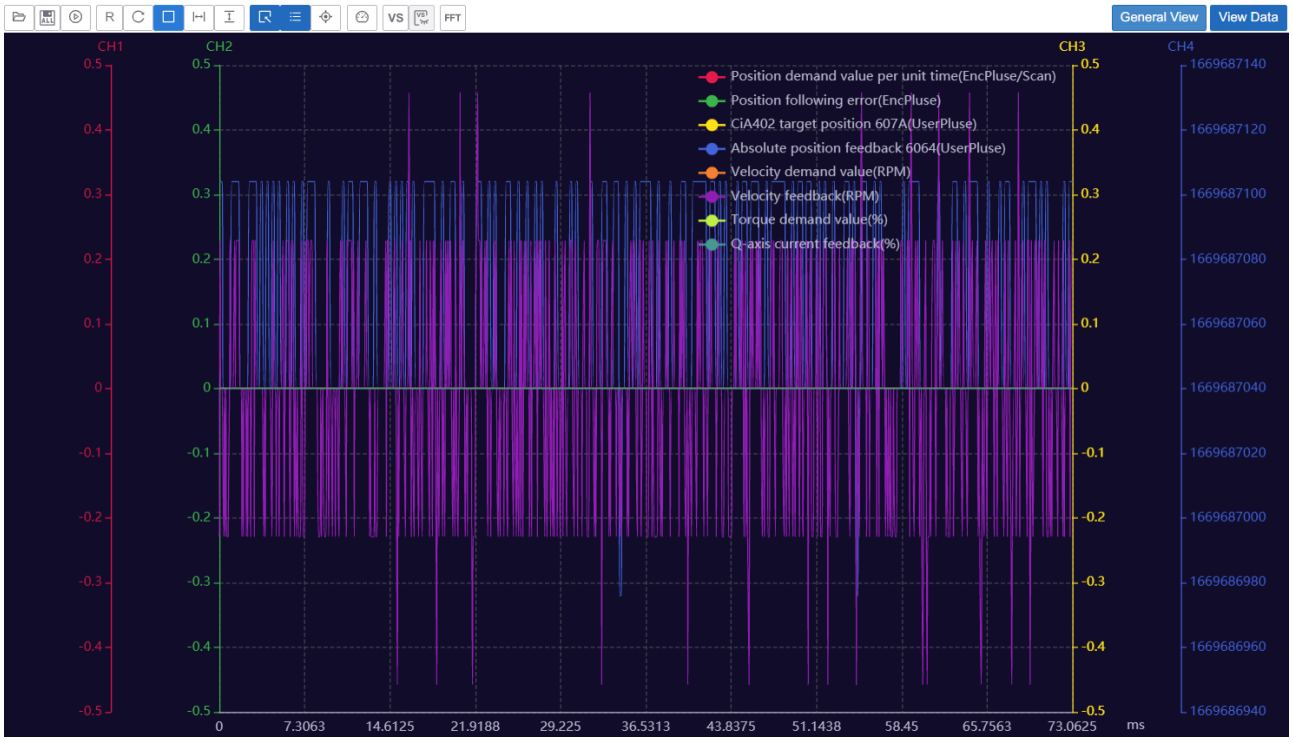
Display the **Display Setting** and **Measurement** interface, or the **display and hide** button of this interface.





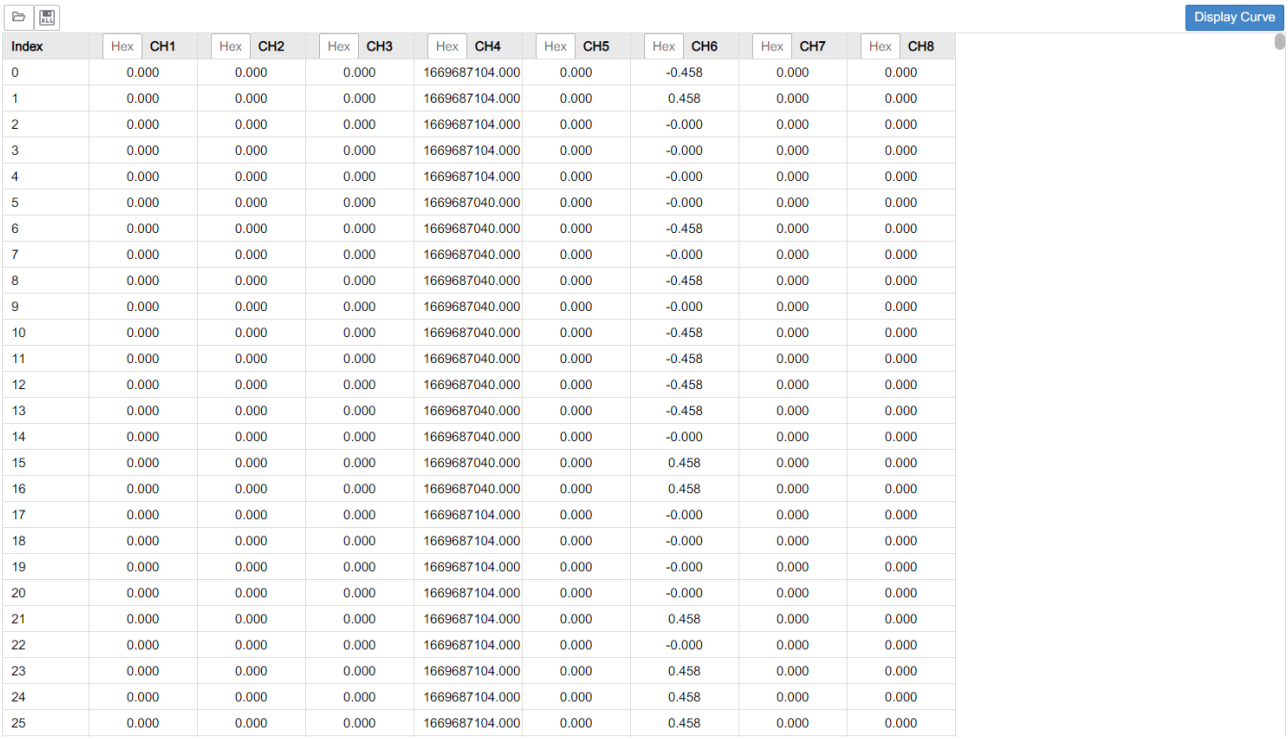
10.3.4 Full View

Hide **Display Setting** and **Measurement** to show the waveform in full view.



10.3.5 View data

Click **View Data**, the waveform curve is switched to data table, showing data for each channel at sampling time.



Display Curve

Index	Hex CH1	Hex CH2	Hex CH3	Hex CH4	Hex CH5	Hex CH6	Hex CH7	Hex CH8
0	0.000	0.000	0.000	1669687104.000	0.000	-0.458	0.000	0.000
1	0.000	0.000	0.000	1669687104.000	0.000	0.458	0.000	0.000
2	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
3	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
4	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
5	0.000	0.000	0.000	1669687040.000	0.000	-0.000	0.000	0.000
6	0.000	0.000	0.000	1669687040.000	0.000	-0.458	0.000	0.000
7	0.000	0.000	0.000	1669687040.000	0.000	-0.000	0.000	0.000
8	0.000	0.000	0.000	1669687040.000	0.000	-0.458	0.000	0.000
9	0.000	0.000	0.000	1669687040.000	0.000	-0.000	0.000	0.000
10	0.000	0.000	0.000	1669687040.000	0.000	-0.458	0.000	0.000
11	0.000	0.000	0.000	1669687040.000	0.000	-0.458	0.000	0.000
12	0.000	0.000	0.000	1669687040.000	0.000	-0.458	0.000	0.000
13	0.000	0.000	0.000	1669687040.000	0.000	-0.458	0.000	0.000
14	0.000	0.000	0.000	1669687040.000	0.000	-0.000	0.000	0.000
15	0.000	0.000	0.000	1669687040.000	0.000	0.458	0.000	0.000
16	0.000	0.000	0.000	1669687040.000	0.000	0.458	0.000	0.000
17	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
18	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
19	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
20	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
21	0.000	0.000	0.000	1669687104.000	0.000	0.458	0.000	0.000
22	0.000	0.000	0.000	1669687104.000	0.000	-0.000	0.000	0.000
23	0.000	0.000	0.000	1669687104.000	0.000	0.458	0.000	0.000
24	0.000	0.000	0.000	1669687104.000	0.000	0.458	0.000	0.000
25	0.000	0.000	0.000	1669687104.000	0.000	0.458	0.000	0.000

10.3.6 Display Setting

The steps are as follows:

Step 1. Check the channel ID to be displayed.

Step 2. Select the **color** to display the channel.

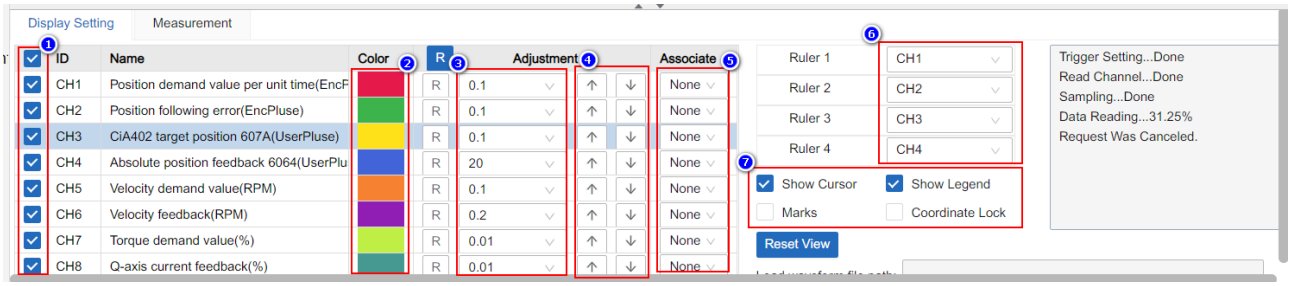
Step 3. **Adjust** the scale of the ruler.

Step 4. Move the curve up and down to the proper position.

Step5. Select whether to associate another channel.

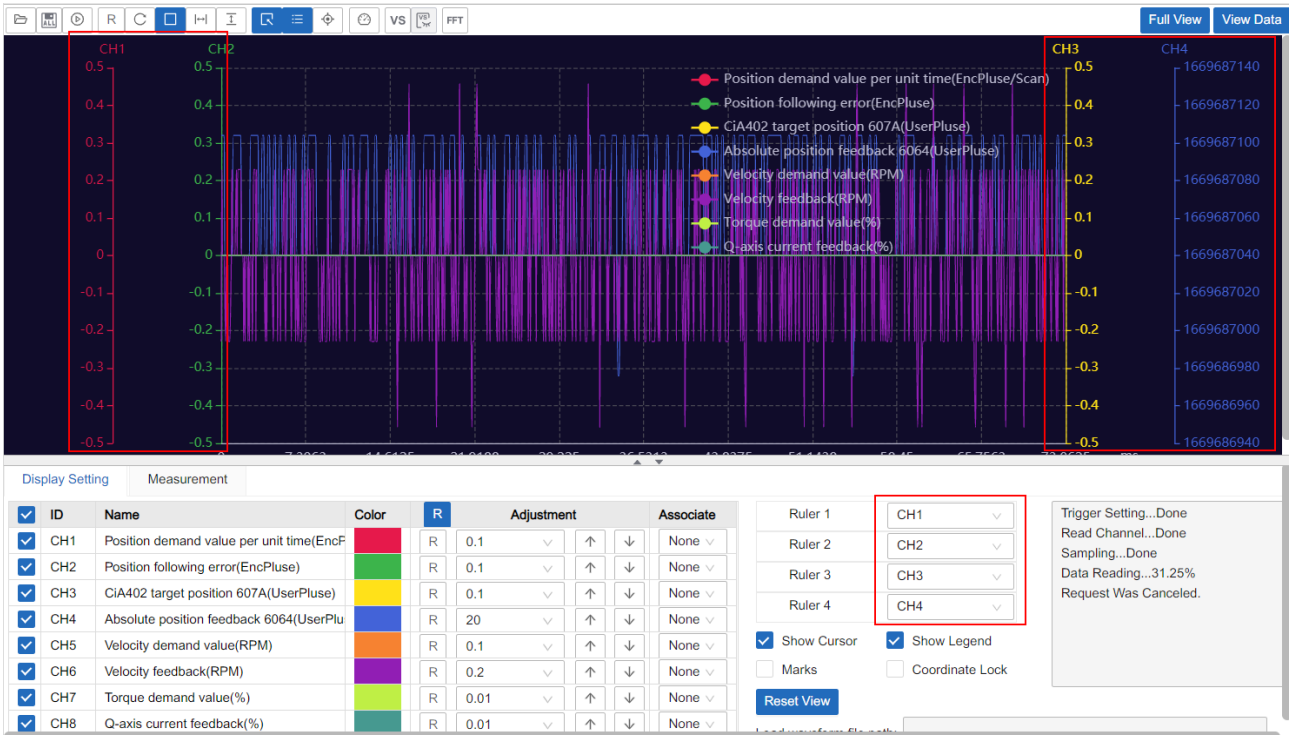
Step 6. Select **ruler ID** according the **channel ID** displayed

Step 7. Check or uncheck show cursor, show legend, mark, coordinate lock function according to the actual situation.



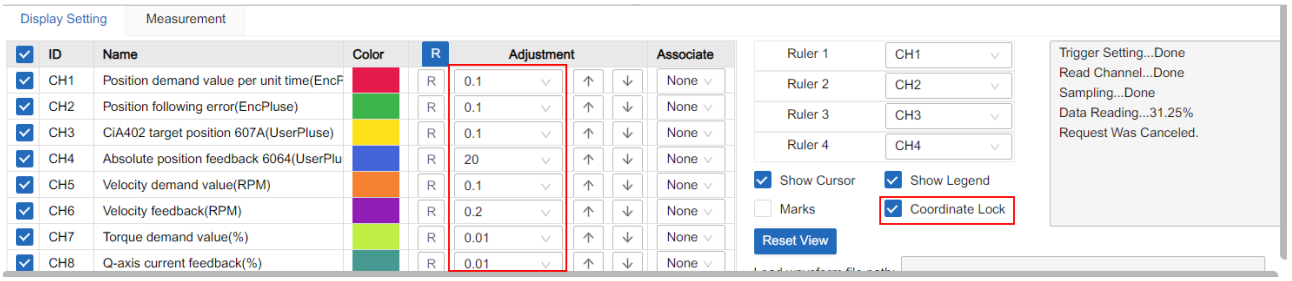
10.3.6.1 Ruler

The coordinate axes on the left and right sides of the waveform display interface.



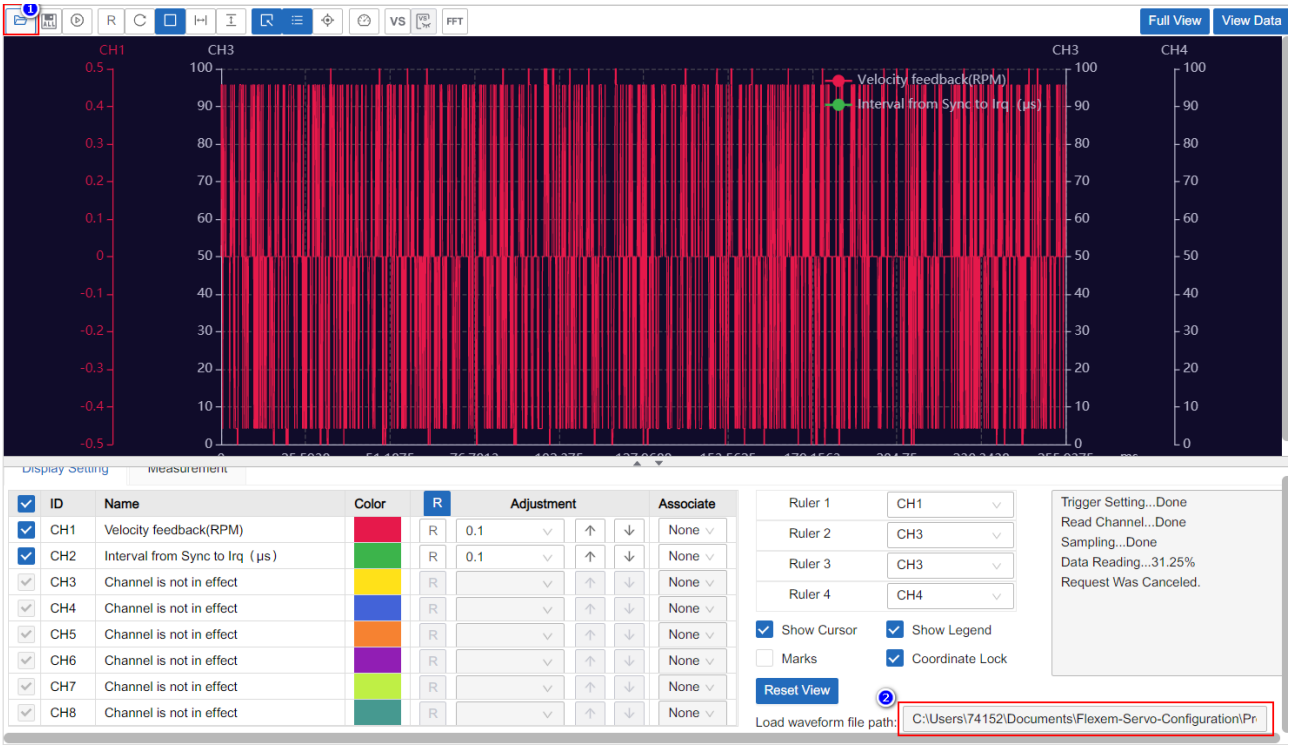
10.3.6.2 Coordinate Lock

Check **Coordinate Lock** to Lock the scale of the adjustment ruler.



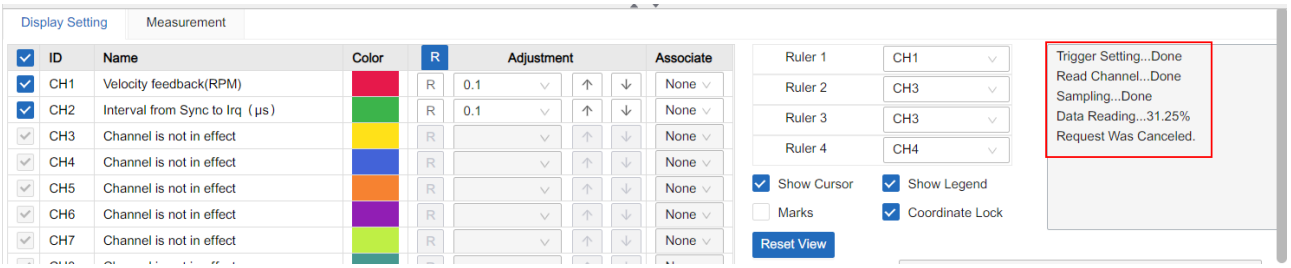
10.3.6.3 Load Waveform File Path

When click icon to open the waveform file, it display the local storage path of the loaded waveform file.



10.3.6.4 Data Collection Progress Display

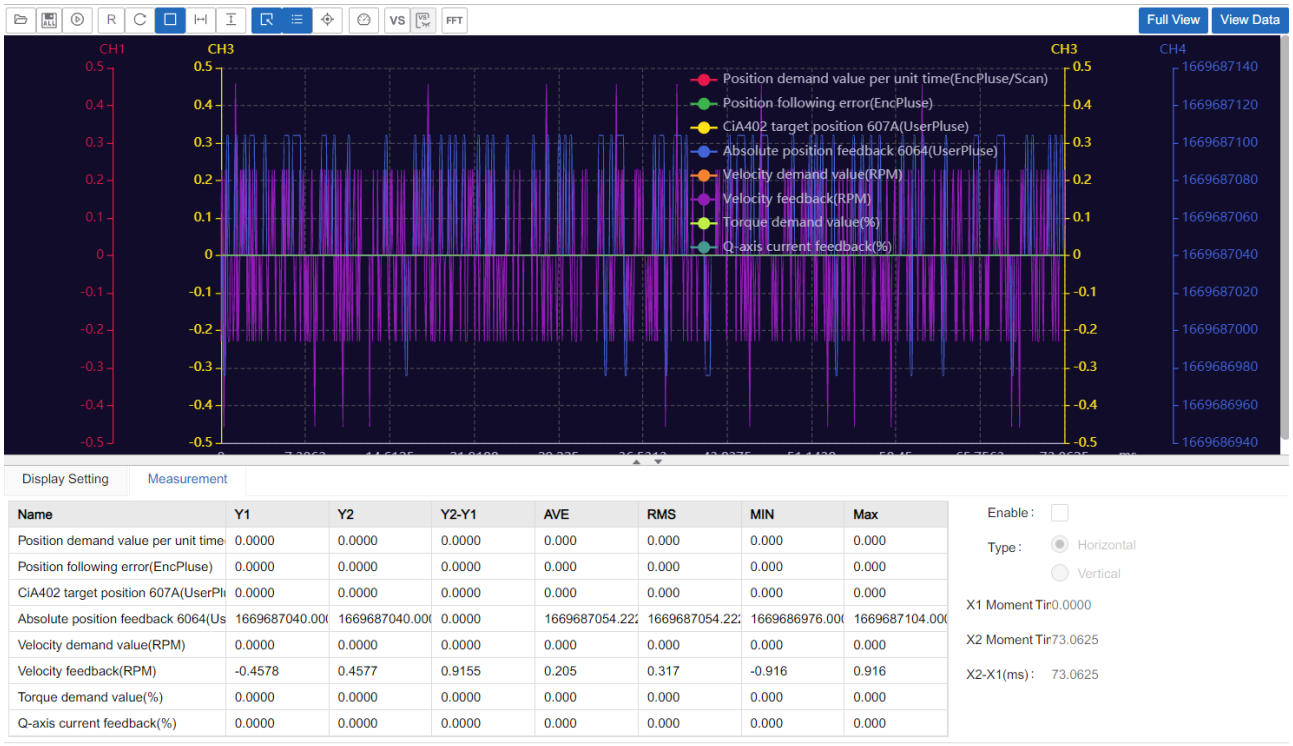
Display the current progress of trigger sampling, data reading, and waveform display.



10.3.6.5 Measurement

Measurement is divided into horizontal measurement and vertical measurement.

Horizontal Measurement: Display the measure line vertically to compare X-axis data, as shown in the figure below:

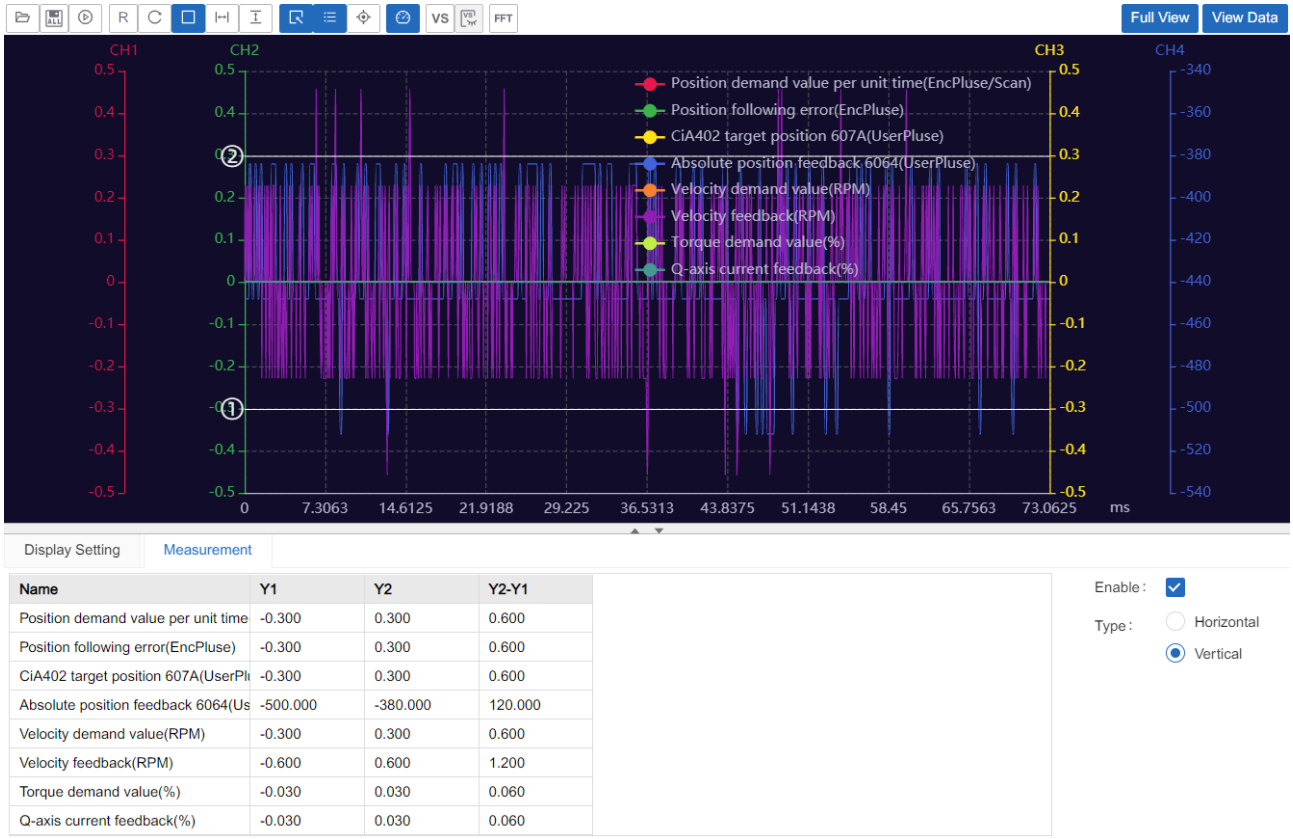


Name	Y1	Y2	Y2-Y1	AVE	RMS	MIN	Max
Position demand value per unit time	0.0000	0.0000	0.0000	0.000	0.000	0.000	0.000
Position following error(EncPluse)	0.0000	0.0000	0.0000	0.000	0.000	0.000	0.000
CiA402 target position 607A(UserPl	0.0000	0.0000	0.0000	0.000	0.000	0.000	0.000
Absolute position feedback 6064(Us	1669687040.00(	1669687040.00(	0.0000	1669687054.22	1669687054.22	1669686976.00(	1669687104.00(
Velocity demand value(RPM)	0.0000	0.0000	0.0000	0.000	0.000	0.000	0.000
Velocity feedback(RPM)	-0.4578	0.4577	0.9155	0.205	0.317	-0.916	0.916
Torque demand value(%)	0.0000	0.0000	0.0000	0.000	0.000	0.000	0.000
Q-axis current feedback(%)	0.0000	0.0000	0.0000	0.000	0.000	0.000	0.000

Please see the table below for detailed description.

Parameter	Description
X1	Horizontal measurement line 1
X2	Horizontal measurement line 2
X2-X1	Horizontal measurement line 2 - measurement line 1
AVE	Average value between measurement line 1 and measurement line 2
RMS	The square root of the mean value between Measurement Line 1 and Measurement Line 2.
MIN	Minimum value between Measurement Line 1 and Measurement Line 2.
Max	Maximum value between Measurement Line 1 and Measurement Line 2.

Vertical Measurement: Display the measure line horizontally to compare X-axis data, as shown in the figure below:



Name	Y1	Y2	Y2-Y1
Position demand value per unit time	-0.300	0.300	0.600
Position following error(EncPluse)	-0.300	0.300	0.600
CiA402 target position 607A(UserPl	-0.300	0.300	0.600
Absolute position feedback 6064(Us	-500.000	-380.000	120.000
Velocity demand value(RPM)	-0.300	0.300	0.600
Velocity feedback(RPM)	-0.600	0.600	1.200
Torque demand value(%)	-0.030	0.030	0.060
Q-axis current feedback(%)	-0.030	0.030	0.060

Please see the table below for detailed description.

Parameter	**Description**
Y1	Vertical measurement line 1
Y2	Vertical measurement line 2
Y2-Y1	Vertical measurement line 2 - measurement line 1

11 Oscillometer

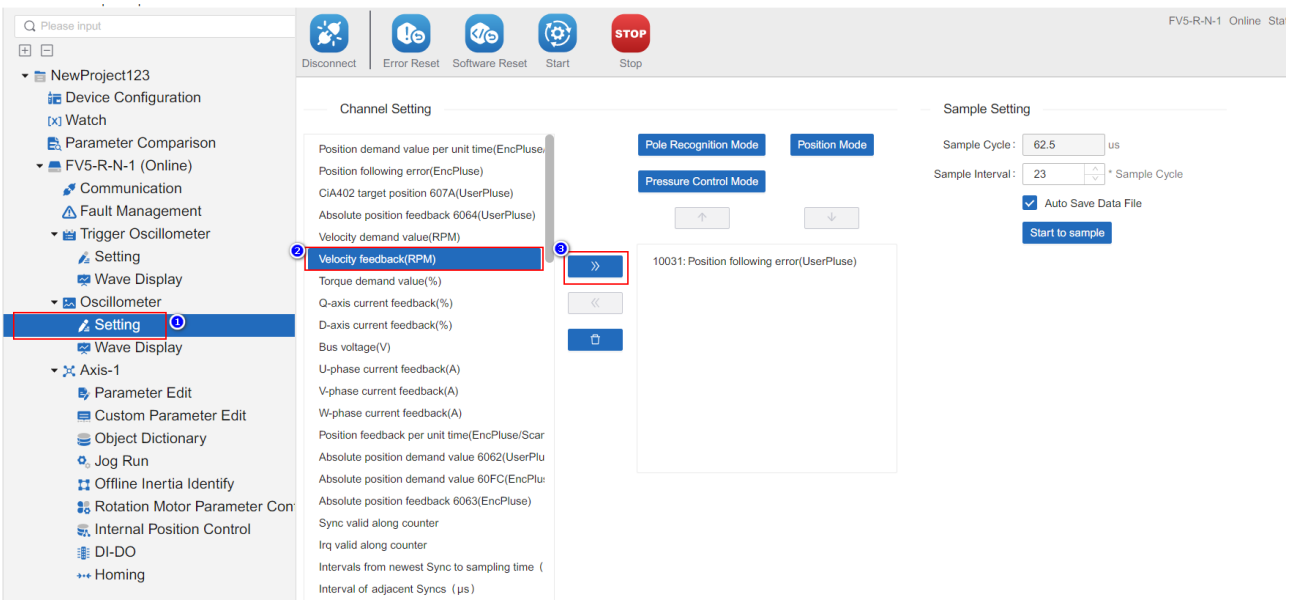
The oscillometer visually displays the operating parameters of the motor (such as speed feedback) in real time through curve graphs or data tables. Users can customize the sampling channels and methods.

11.1 Setting

The setting module is used to customize sampling channels and set the sampling methods for the channels.

11.1.1 Channel Setting

Step 1. In the **Project Outline** control, select **Setting**, choose the channel (e.g., **speed feedback**, multiple channels can be selected), and click the » icon to move the selected channel to the list of chosen channels.



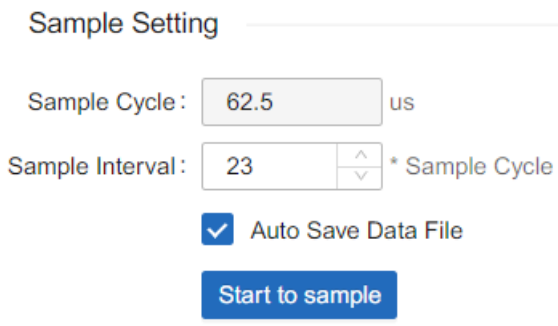
Please see the table below for detailed configuration.

Parameter	Description
»	Add the selected channels to the list of the selected channels.
«	In the list of chosen channels, select the channel and click this button to remove it.
↑	Move the selected channel up in the channel list.

Parameter	Description
	Move the selected channel down in the channel list.
	Click this button to delete all channels in the list of the selected channels.
Position Mode	Click **Position Mode** to move the commonly used channels related to position mode to the list of the selected channels.
Pole Recognition Mode	Click **Pole Recognition Mode** to move the commonly used channels related to pole recognition mode to the list of the selected channels.

11.1.2 Sample Setting

Step 1. Set **sample interval**



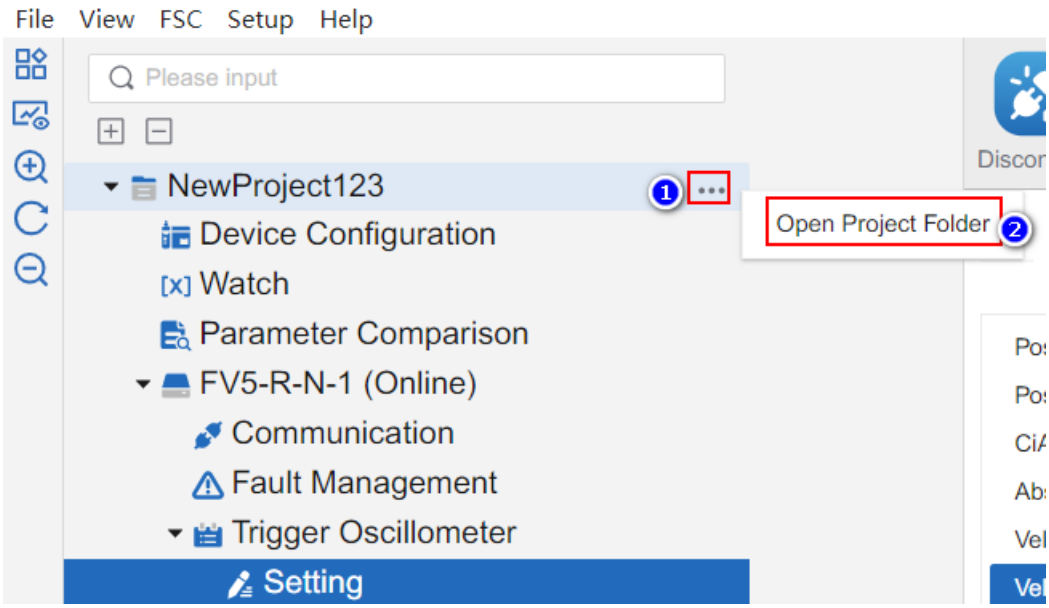
Please see the table below for detailed configuration.

Parameter	Description
Sample Cycle	The default is 62.5 microseconds.
Sample Interval	Sample interval = number of samples * sampling cycle, which is the time interval between adjacent sampling points.

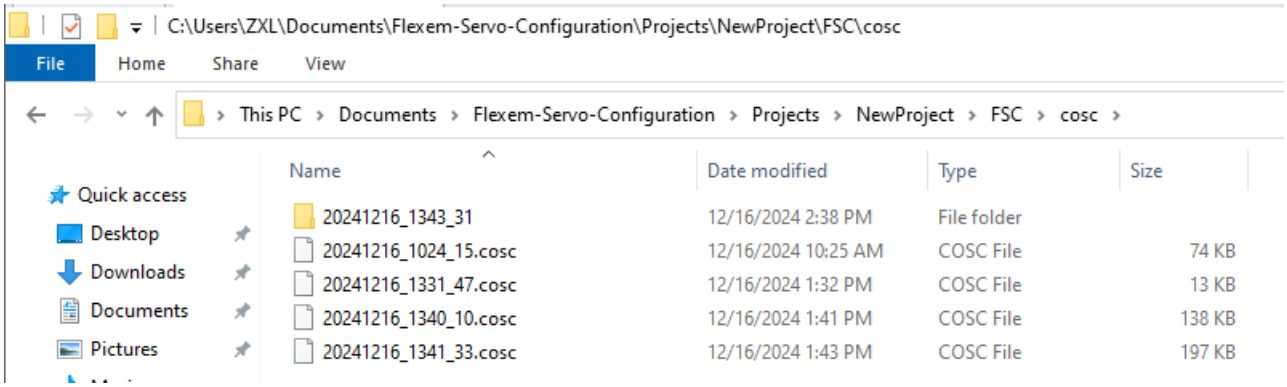
11.1.3 Oscillometer Auto Save Data File

The file path is located in the FSC folder under the project directory.

Step 1. Hover the cursor to the project, click  icon, click **Open project folder**.



Step 2. Select directory ...**FSC\cosc** to view the file.

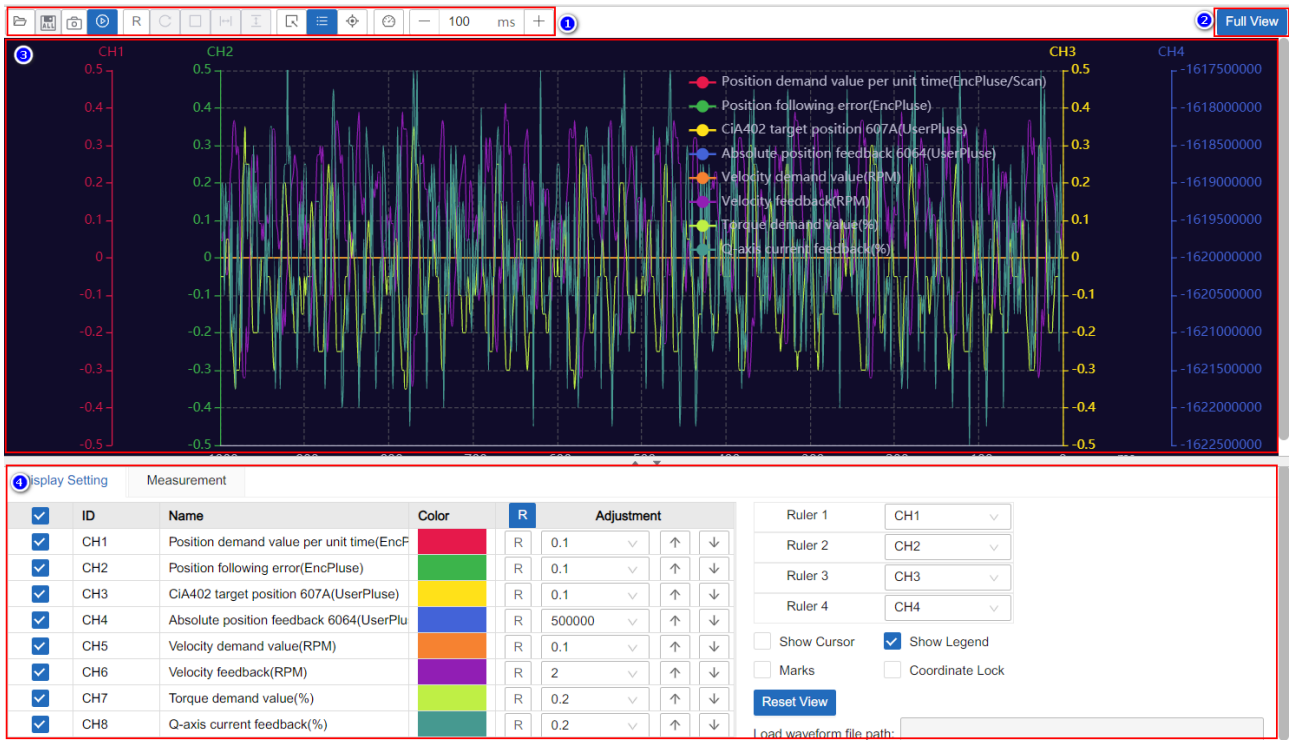


11.2 Operating Instruction

Refer to Operating Instruction.

11.3 Waveform Display

11.3.1 Interface Instruction



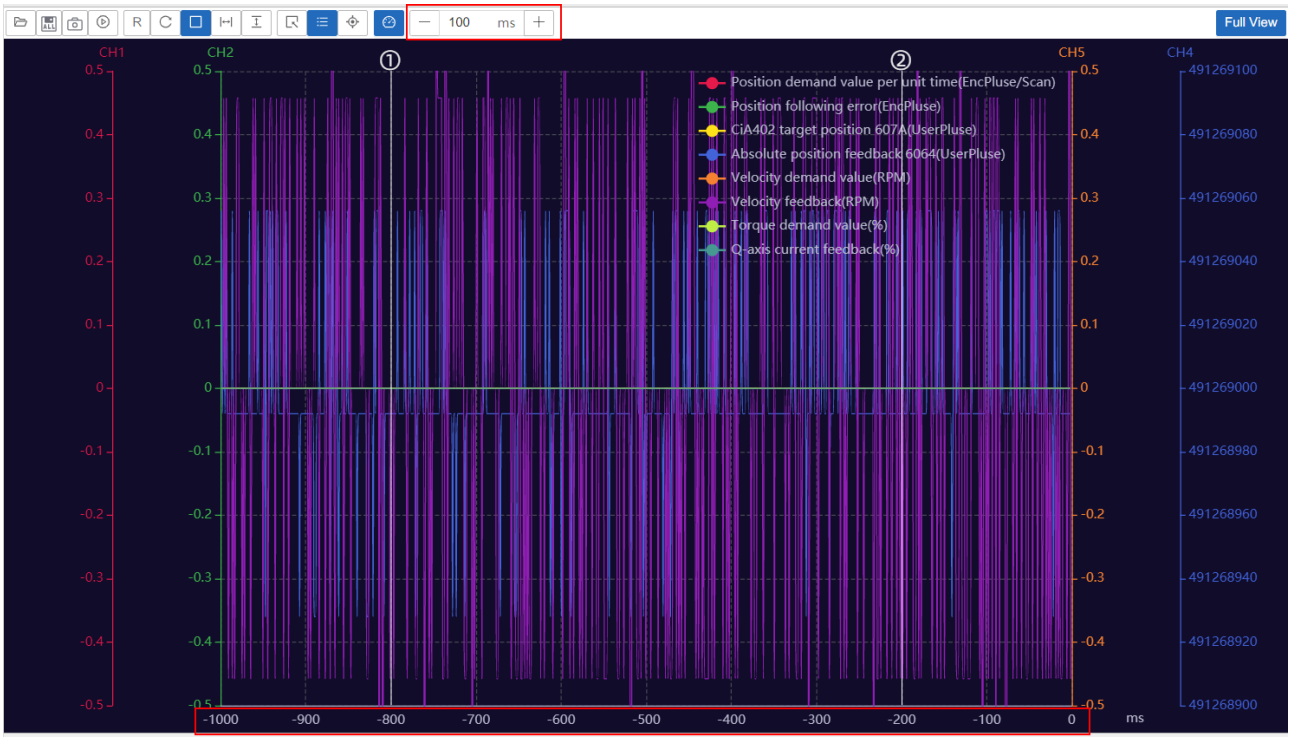
Please see the table below for detailed description of each area.

SN	Area	Icon	Description
①	Toolbar		Load file: load .tosc file from specified address
			Save Data File: save current wave data to specified address.
			Save Snapshot: The current waveform curve interface is saved in PNG format.
			Sample switch: used to start sampling and stop sampling
			Reset Zoom: reset the wave interface to the original status
			X and Y axes scaling: scale the wave in X axis and Y axis at the same time

SN	Area	Icon	Description
			X axis scaling: scale the wave in X axis while locking the Y scale
			Y axis scaling: scale the wave in Y axis while locking the X scale
			Show Cursor: Follows the mouse, marks the curve cursor, and displays the current data value.
			Show Legend: display channel information in the upper right corner of the wave interface
			Marks: mark each collection point on the curve
			Horizontal Measurement: Display the measure line horizontally Vertical Measurement: Display the measure line vertically
			Reduce the time interval.
			Increase the time interval.
②	View Switch		Full View: Hide **Display Setting** and **Measurement** to display the full wave.
③	Display Curve		Display the wave curve for the collected data
④	Display Setting and Measurement		Display Setting: Channel display selection, **color** modification, **adjust** channels, **reset** settings, move curve **up**, move curve **down**, **channel association** selection, **waveform display ruler** selection, **cursor** selection, **display legend** selection, **mark** selection, **coordinate locking** selection, **reset view** selection, **load waveform file path** display. Measurement: Data points, differentials, average value, root mean square value, minimum value, maximum value, enable selection, measurement type selection.

11.3.2 Adjust Time Interval

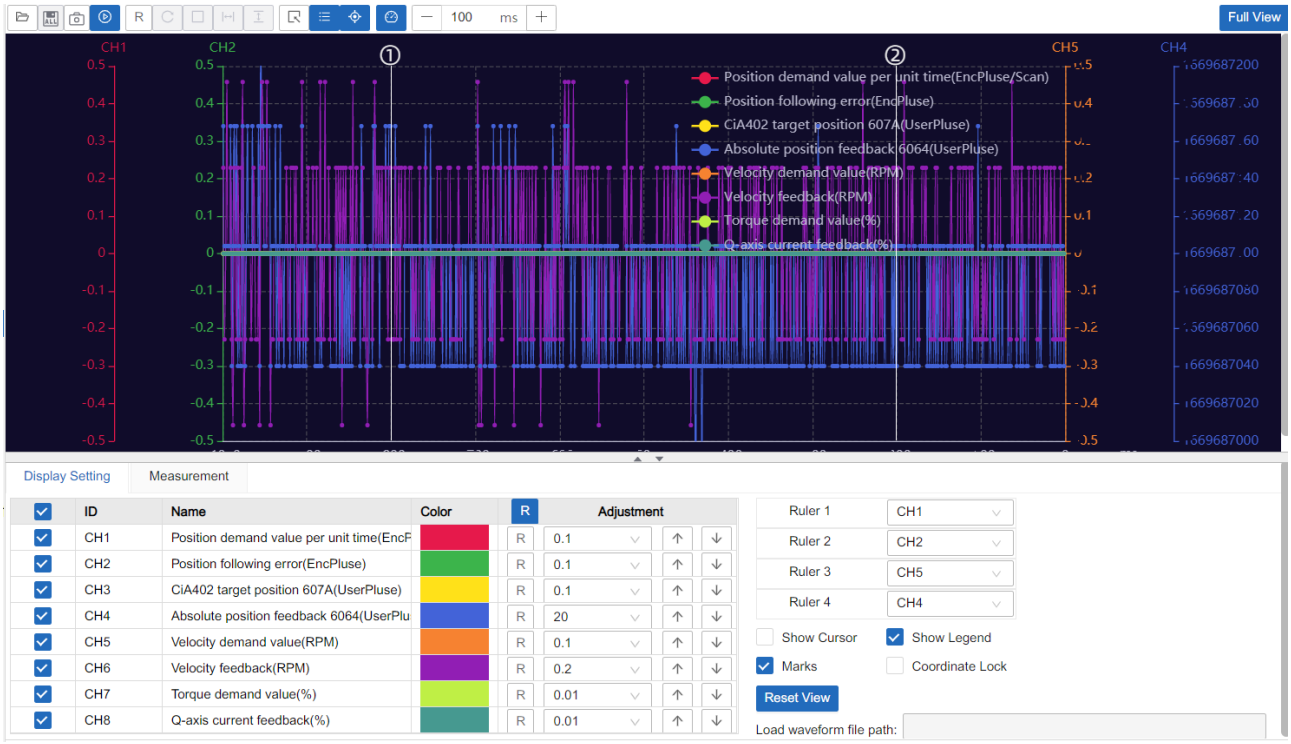
Time interval can be reduced by [−] and increased by [+].



11.3.3 Mark

Mark each collection point on the curve.

The overall marking is as follows:

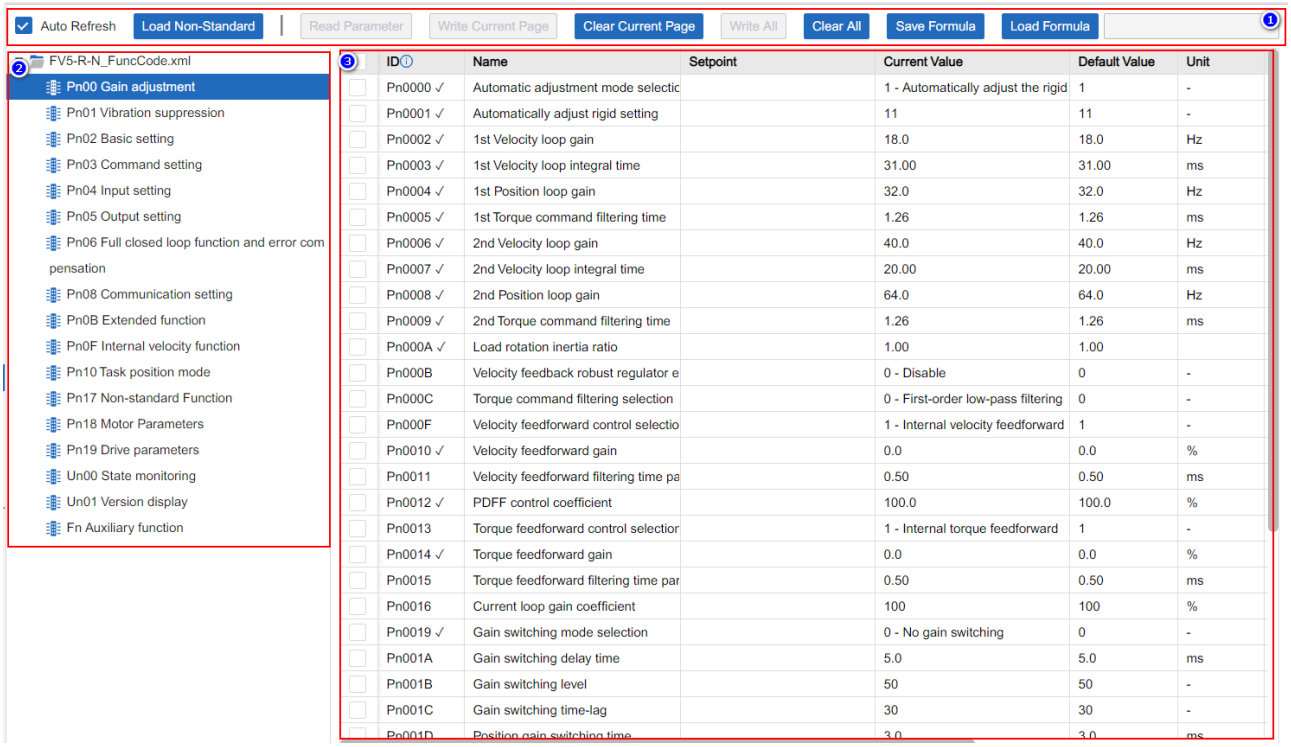


The zoomed-in curve with marked points is displayed as follows:

12 Parameter Edit

12.1 Interface Introduction

The system provides a user-friendly parameter configuration interface, as shown in the following figure.



Please see the table below for detailed description of each area.

SN	Area	Description
①	Toolbar	It provides commonly used features, including auto-refresh, loading library files, reading parameters, and writing parameters.
②	Menu bar	It provides entry for configuring various parameter groups, allowing users to switch based on their actual needs.
③	Operation area	View, set and select parameters.

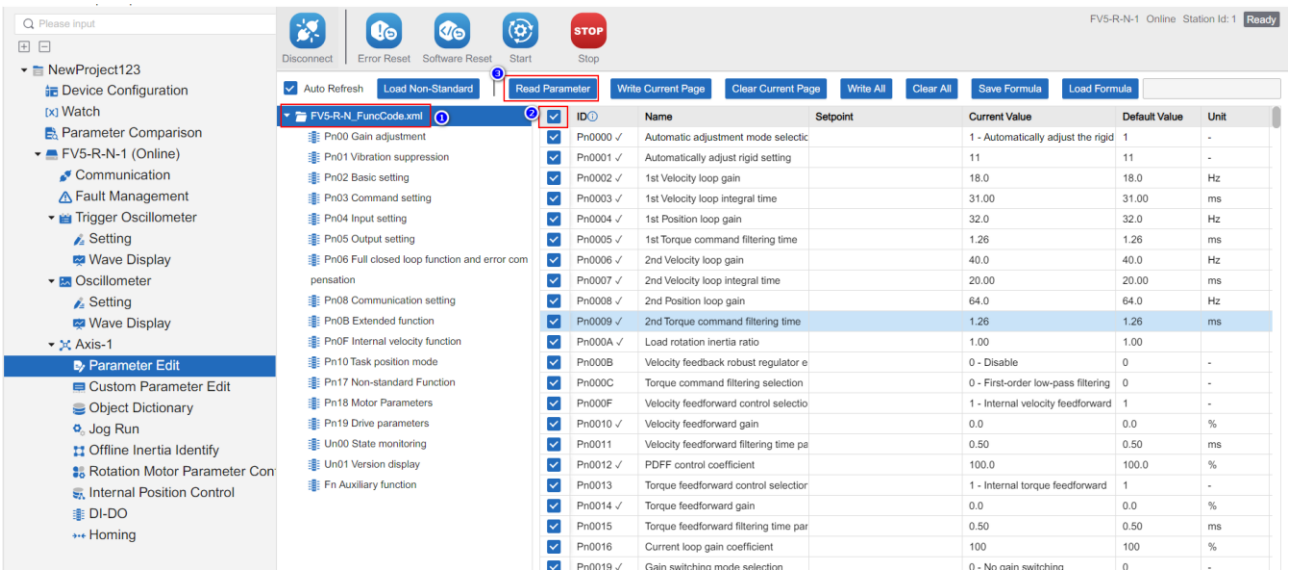
12.2 Main Operating Procedure

Step 1. Read parameter.

1) Click xml file (for example, FV5-R-N_FuncCode.xml).

2) Check  to select all parameters.

3) Click **Read Parameter** to read.

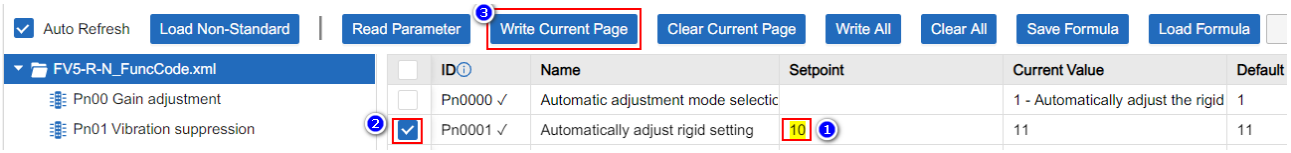


Step 2. Select the parameter that needs to be changed, and enter the setpoint.

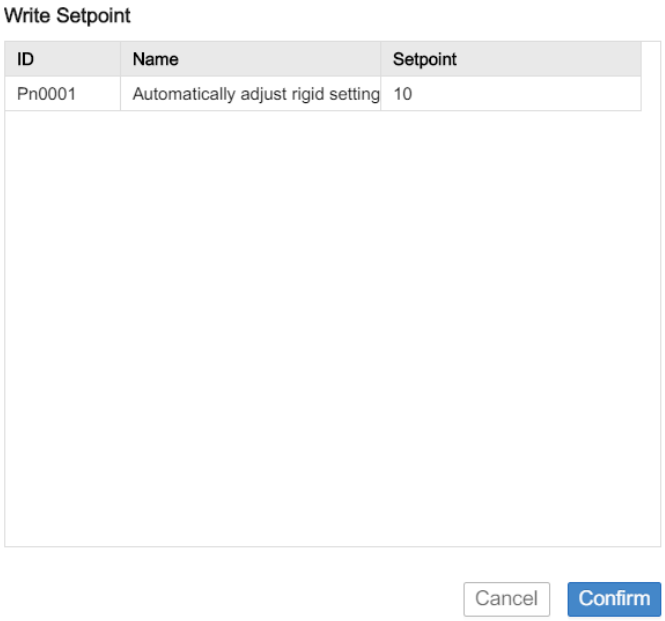
1) Change the setpoint of **Pn0001 automatically adjust rigid setting** to 10

2) Make sure the parameters to be written are checked.

3) Click **Write Current Page**.



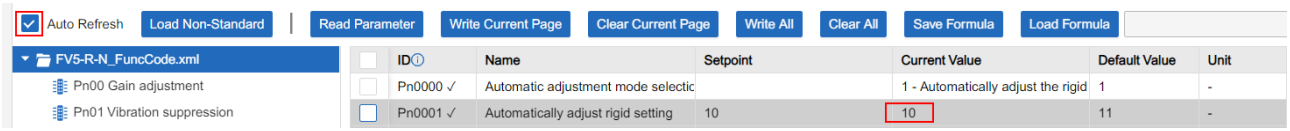
Step 3. Click **Confirm** to write the setpoint.



Step 4. Successfully written

1) The prompt window pop up in the bottom right corner of the interface indicates that **data writing is complete.**

2) After checking **Auto Refresh** or clicking **Read Parameters**, the current value will be updated to setpoint.



12.3 Toolbar

Please see the table below for detailed configuration.

Icon	Description
Auto Refresh	Auto refresh parameter in the **Parameter Edit** interface
Load Non-Standard	Load non-standard database (usually used for non-standard customized servo driver)
Read Parameter	Read parameters from servo driver

Icon	Description
Write Current Page	Write **setpoint** of the checked **ID** in **current page** to driver
Clear Current Page	Clear **setpoint** of the checked **ID** in **current page**
Write All	Operate on **all pages** to write the **set values** for parameters that are not empty into the driver.
Clear All	Clear **set values** in **all pages**
Save Formula	Save all checked **numbers** and their set values from **all pages**, and store them at the specified directory.
Load Formula	Open the formula file at the specified directory.

12.4 Operating Area

Please see the table below for detailed configuration.

Name	Description
ID	Driver function code parameter
Name	Driver function code parameter name
Setpoint	Set according to the actual situation
Current Value	Driver parameter current value
Default Value	Default factory value
Unit	Refer to the actual situation
Min	Minimum value of parameter setting
Max	Maximum value of parameter setting
Setting mode	Refer to the actual situation
Activate mode	Refer to the actual situation

13 Custom Parameter Edit

Users can select the parameters they need from the predefined parameter list for **parameter editing**. The specific steps are as follows:

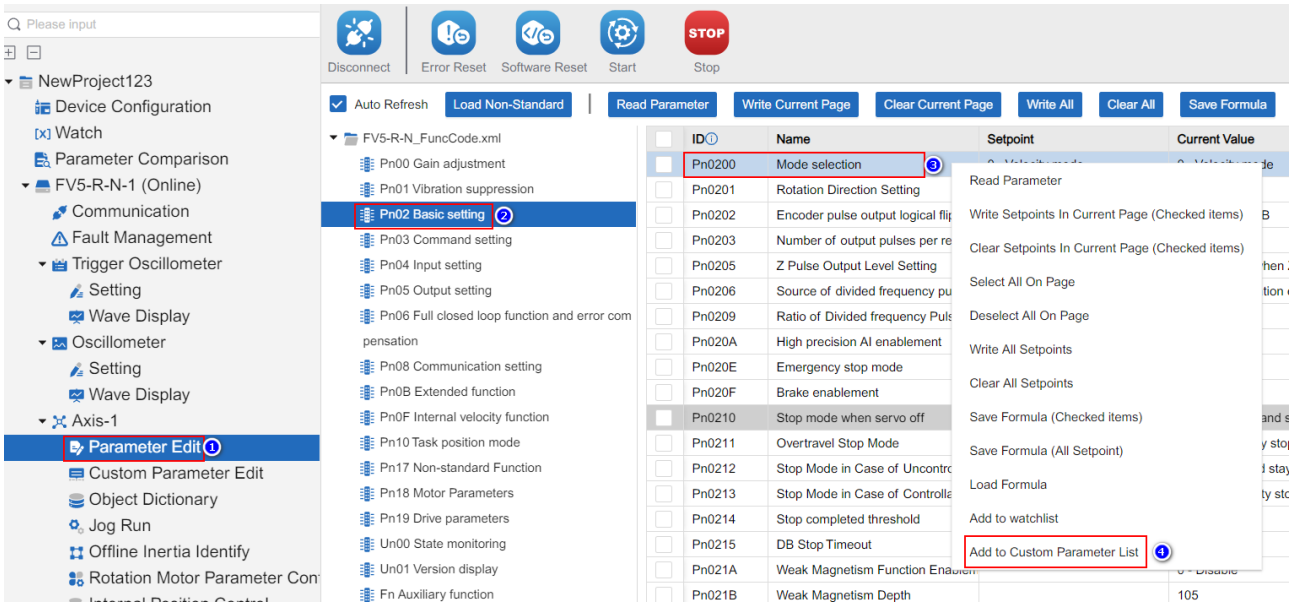
13.1 Add Parameter to Custom Parameter List

Step 1. Select **Parameter Edit**.

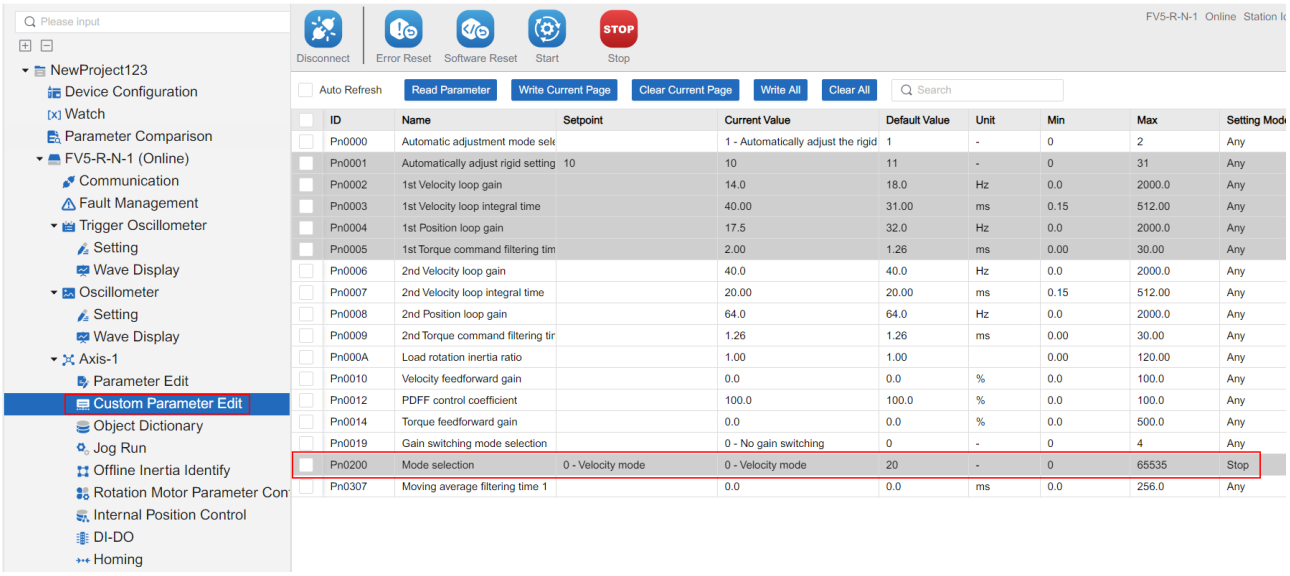
Step 2. Select parameter group, such as **Pn02 Basic setting**.

Step 3. Select the parameter to be added, such as **Pn0200**, right click.

Step 4. Select **Add to Custom Parameter List**.



Step 5. The added parameter information can be viewed and changed in **Custom Parameter Edit**.

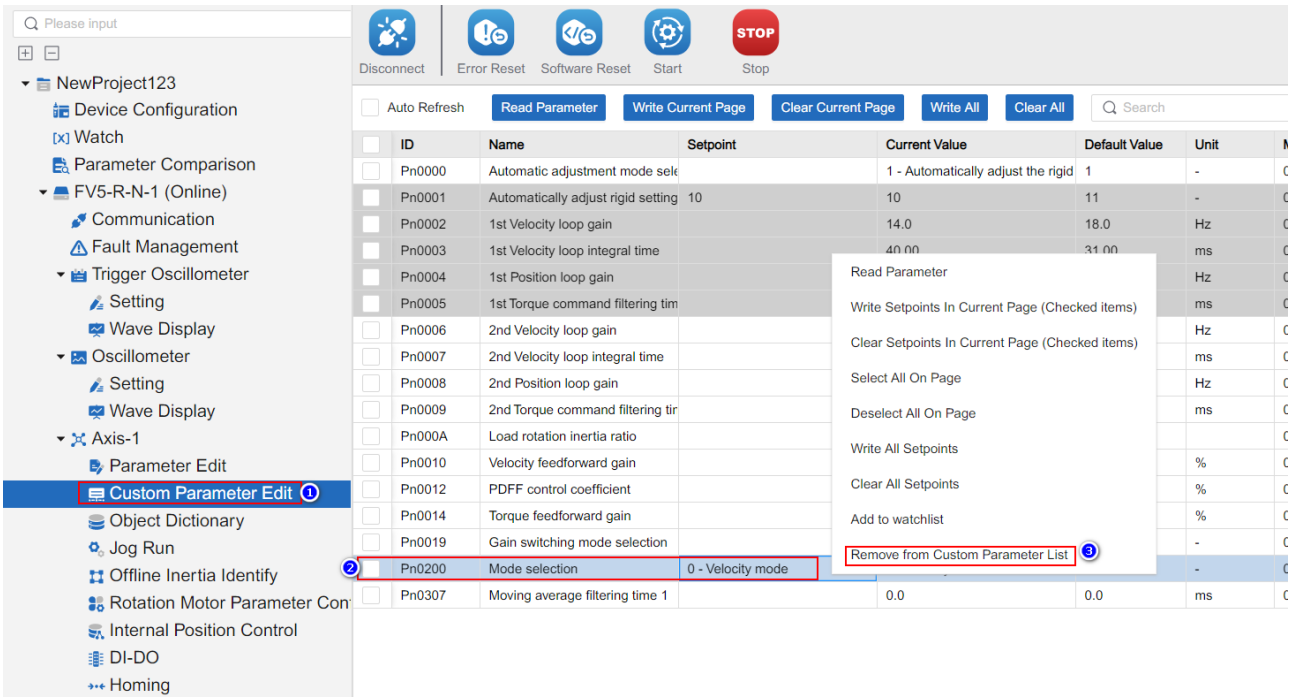


13.2 Remove Parameter from Custom Parameter List

Step 1. Select **Custom Parameter Edit**.

Step 2. Select the parameter to be deleted, such as **Pn0200**, right click.

Step 3. Select **Remove from Custom Parameter List**.



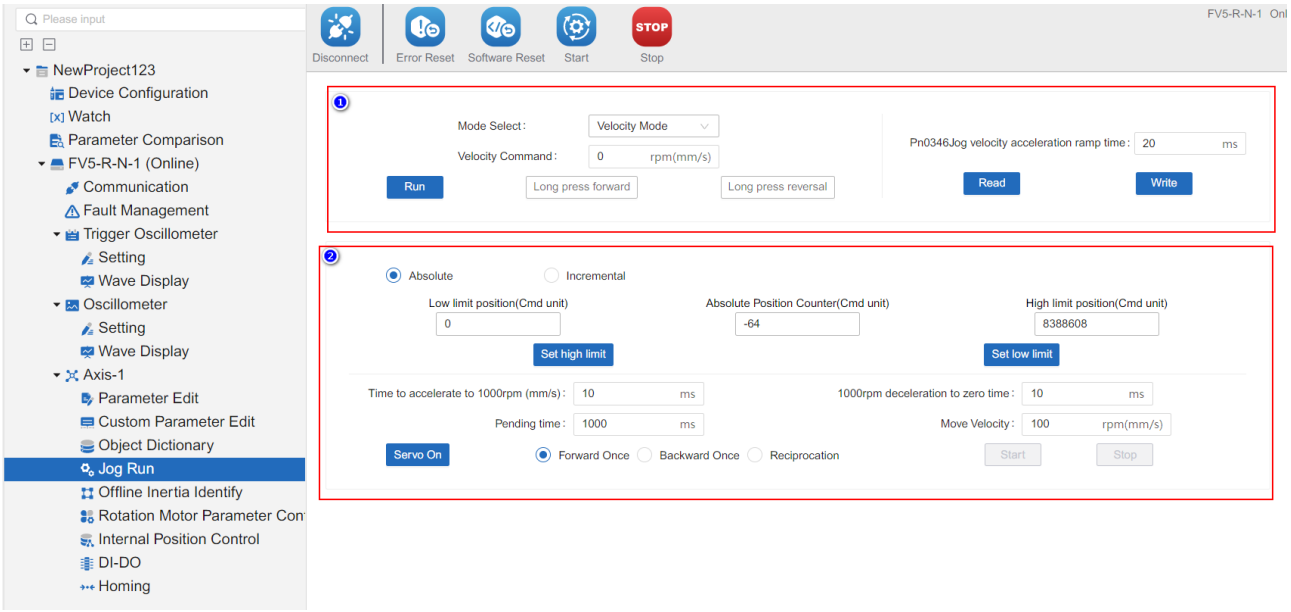
14 JOG Run

The JOG run uses a compact and intuitive interface, making it easy for users to perform jog operations on the servo.

14.1 Interface Introduction

OG run interface can be divided into the following two functional areas:

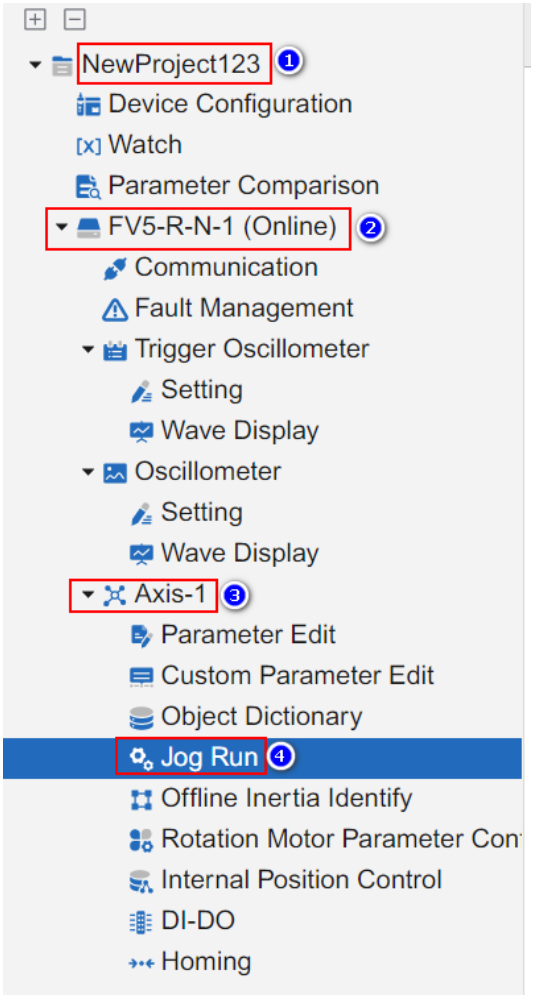
- Area ①: jog operation
- Area ②: Two-segment position operation.



14.2 Jog Operation

Jog operation allows you to choose between **Velocity Mode** or **Position Mode** to control the servo motor's actions. You can control the motor's running speed and acceleration time by setting the **Velocity Command** and the **jog velocity acceleration ramp time**. The operating method is as follows:

Step 1. Select **Current Project/Current File/Current Axis/JOG Run**.



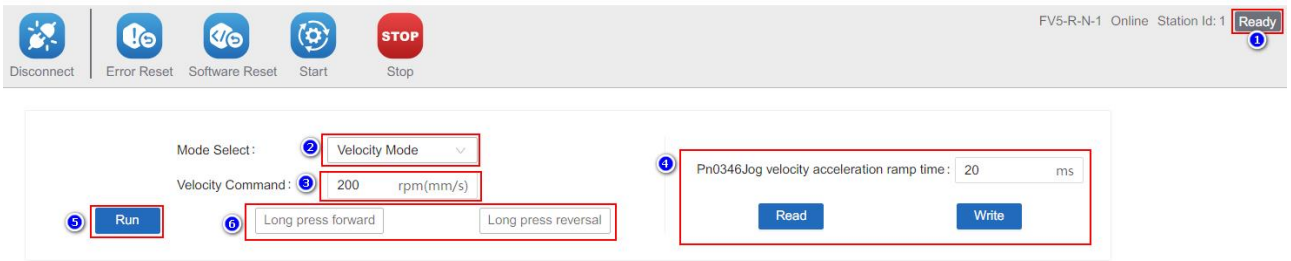
Step 2. Select **Velocity Mode** or **Position Mode**.

Step 3. Set the **Velocity Command** according to the running requirements. It is recommended to start with a lower speed for the initial trial run.

Step 4. **Read** Pn0346 Acceleration ramp time of jog velocity, set it according to the actual situation, and then select to **write** to the driver.

Step 5. When **Servo Ready**, click **Run** to enable the driver, long press **Long press forward** for forward rotation, and long press **Long press reversal** for reverse rotation.

Step 6. Click **Stop** when jog commissioning is finished.



Please see the table below for detailed configuration.

Feature	Description
Mode Select	◆ Velocity Mode ◆ Position Mode
Velocity Command	rpm: Revolutions per minute (for rotary motors) mm/s: Millimeters per second (for linear motors)
Run	Jog run enabled
Long press forward	Continue forward jog run
Long press reversal	Continue reverse jog run
Pn0346 Jog velocity acceleration ramp time	Pn0346 Acceleration Ramp Time of Jog Velocity: Rotary motor: The time taken for the jog speed to accelerate from 0 rpm to 1000 rpm. Linear motor: The time taken for the jog speed to accelerate from 0 mm/s to 1000 mm/s

14.3 Two-segment Position Operation

By setting the target position, the servo can operate in either **Absolute** mode or **Incremental** mode.

Please see the table below for detailed configuration.

Feature	Description
Low limit position(Cmd unit)	The maximum travel position for reverse operation, in command units.
Input Command Pulse Counter (Cmd unit)	Current absolute position in command units.
High limit position (Cmd unit)	The maximum travel position for forward operation, in command units.
Incremental Target Position (Cmd unit)	Relative position of the set operation, in command units.
Set low limit	Set the current absolute position data as the **low limit position**, in command units.
Set high limit	Set the current absolute position data as the **high limit position**, in command units.
Time to accelerate to 1000rpm	Set acceleration time

Feature	Description
(mm/s)	
Pending time	Set pending time during reciprocating operation.
1000rpm deceleration to zero time	Set deceleration time.
Move Velocity	Set according to the actual situation. Rotary motor unit: rpm. Linear motor unit: mm/s.
	Enable the driver, power on the motor.
	Start operation and interrupt the **Stop** command.
	Stop current operation.
Forward Once	Execute a forward operation command to the **high limit position**.
Backward Once	Execute a backward operation command to the **low target position**.
Reciprocation	Execute the operation command to move back and forth between the **forward target position** and the **backward target position**.

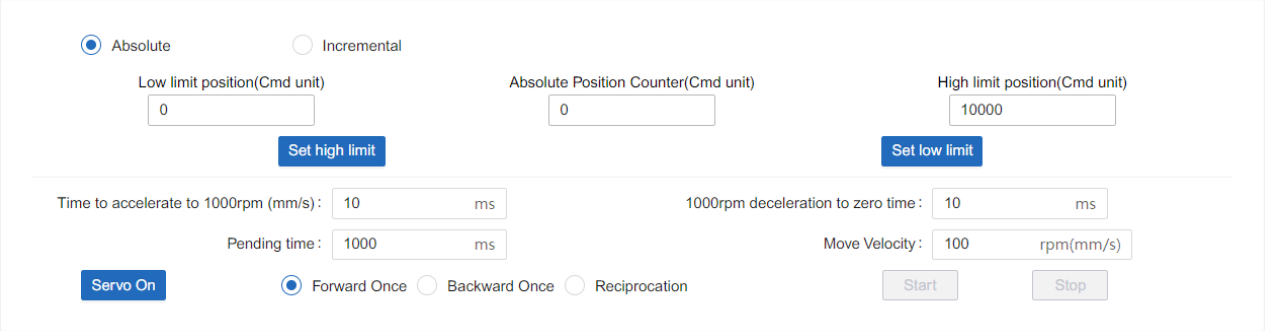
14.3.1 Absolute Mode

By setting the **low limit absolute position** and the **high limit absolute position**, control the motor for forward rotation, reverse rotation, and reciprocating operation.

14.3.1.1 Forward Once

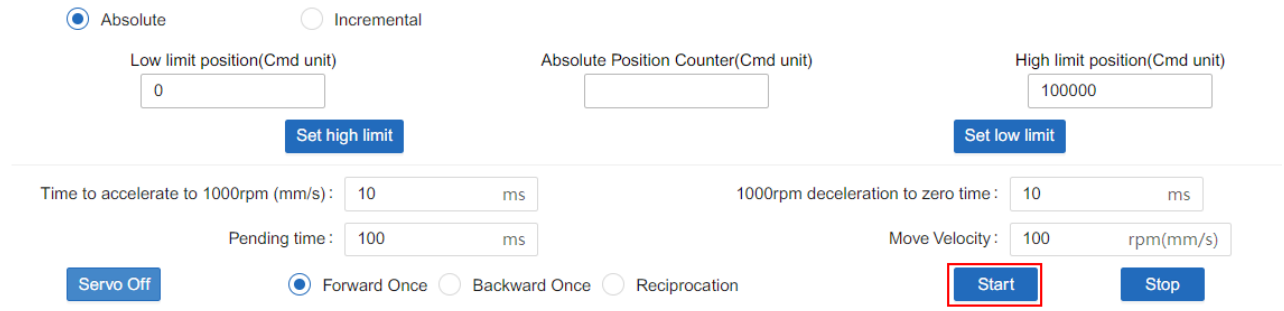
Execute a forward operation command to the **high limit position**.

Step 1. The configuration of **Low limit position**, **High limit position** and **Forward Once** are as follows.



Step 2. Click **Servo On** to enable the driver.

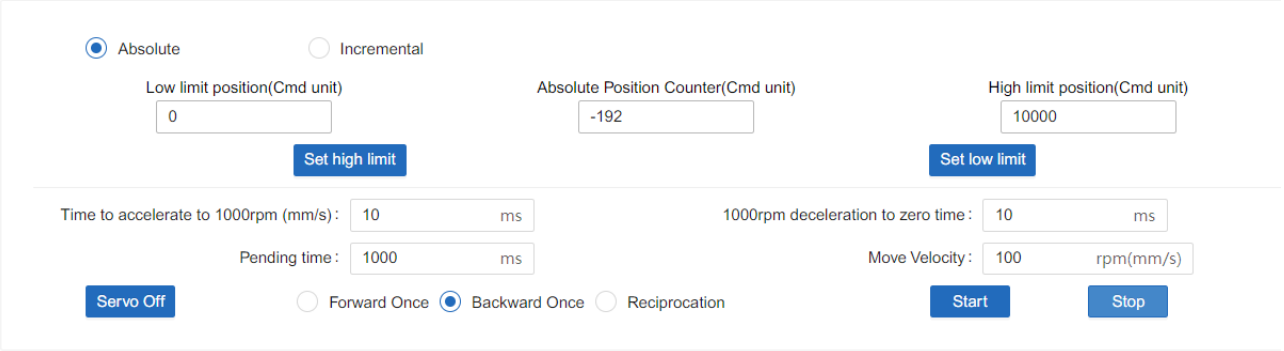
Step 3. Click **Start**, motor will execute a forward rotation command, operate to high limit position 1000 (Absolute position = high limit position)



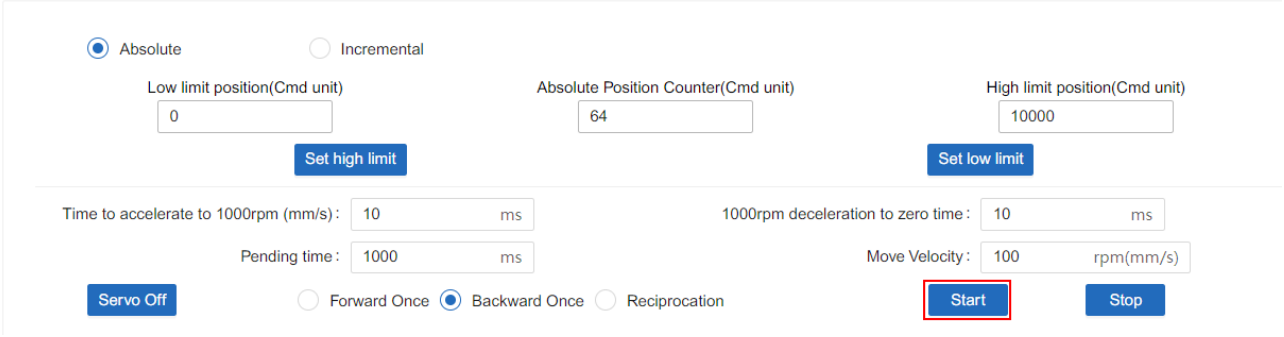
14.3.1.2 Backward Once

Execute a backward operation command to the **low limit position**.

Step 1. Select **Backward Once**



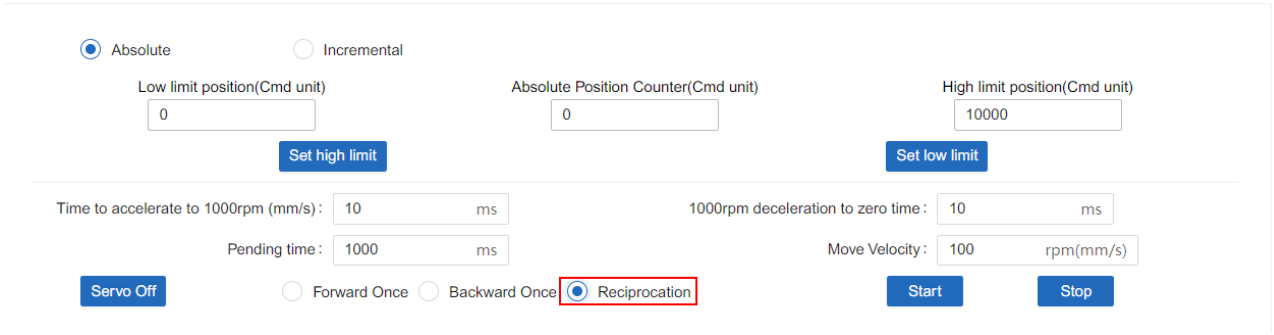
Step 2. Click **Start**, motor will execute a backward rotation command, operate to low limit position 0 (Absolute position = low limit position)



14.3.1.3 Reciprocation

Execute the command to move back and forth between the **low limit position** and the **high limit position**.

Step 1. Select **Reciprocation.**



Step 2. Click **Start**, the motor will run back and forth between the **high limit position** and the **low limit position**. As shown in the image above, the motor's absolute position will oscillate between position 0 and position 10,000.

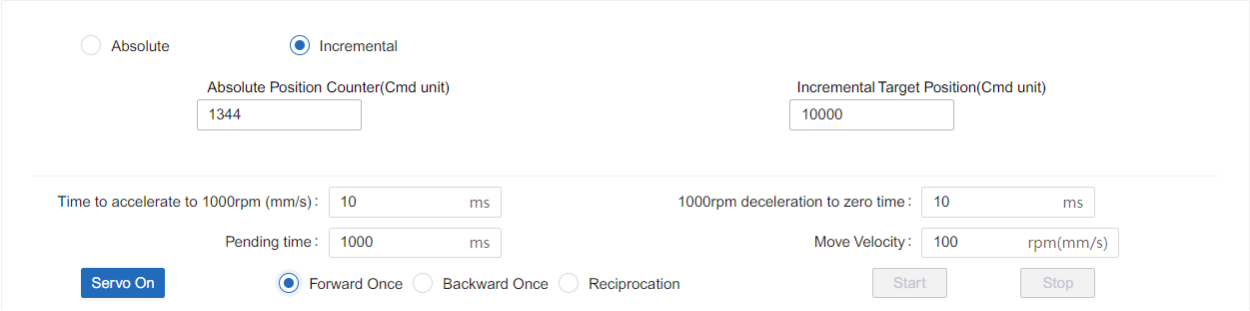
14.3.2 Incremental Mode

By setting the Incremental Target Position, control the motor for forward rotation, reverse rotation, and reciprocating operation. For detailed configuration methods, please refer to the section on absolute positions above.

14.3.2.1 Forward Once

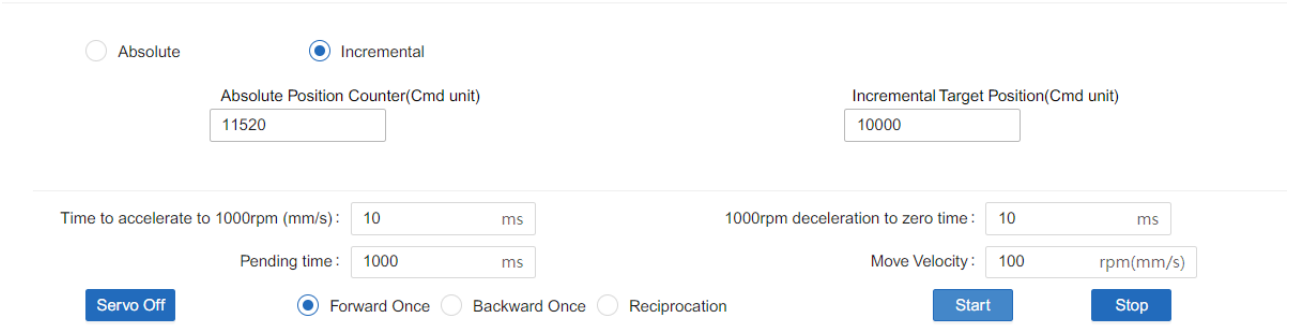
Execute a forward operation once, referencing the absolute position, and perform the command for **Incremental Target Position (Cmd unit)**.

Step 1. The configurations of **Incremental Target Position** and **Forward Once** are as follows:



Step 2. Click **Servo On** to enable driver.

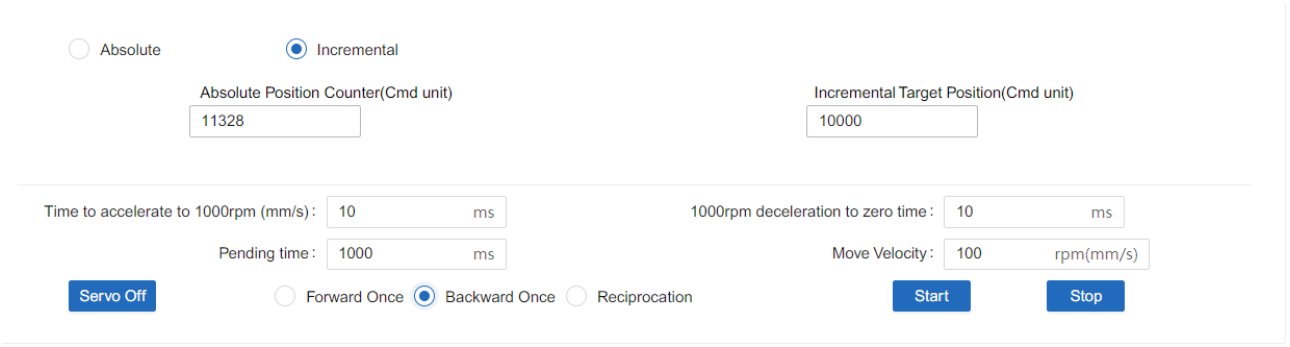
Step 3. Click **Start** to execute; after operation, absolute position = initial absolute position + incremental target position.



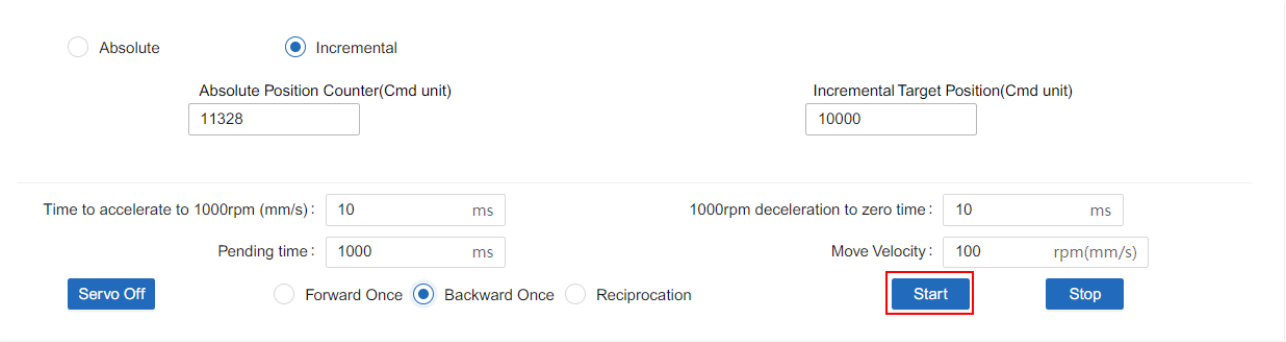
14.3.2.2 Backward Once

Execute a backward operation once, referencing the absolute position, and perform the command for **Incremental Target Position (Cmd unit)**.

Step 1. The configurations of **Incremental Target Position** and **Backward Once** are as follows:

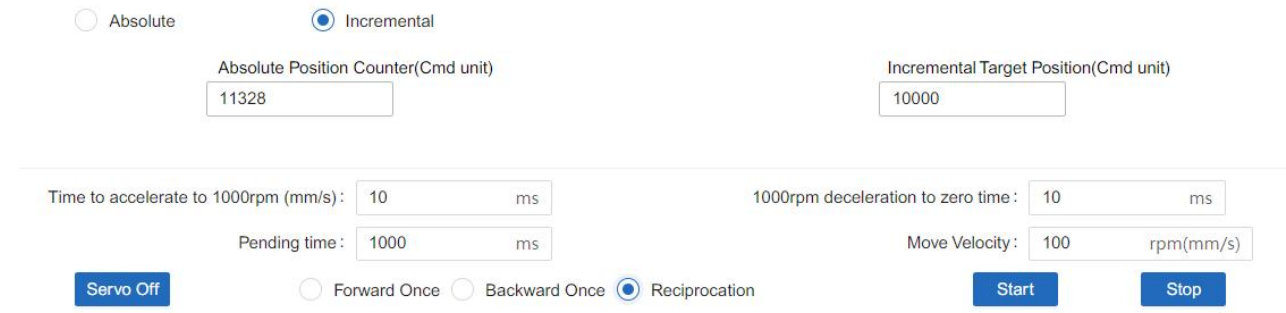


Step 2. Click **Start** to execute; after operation, absolute position = initial absolute position - incremental target position.



14.3.2.3 Reciprocation

Execute the command to run back and forth between (initial **absolute position** + **incremental target position**) and the initial **absolute position**.



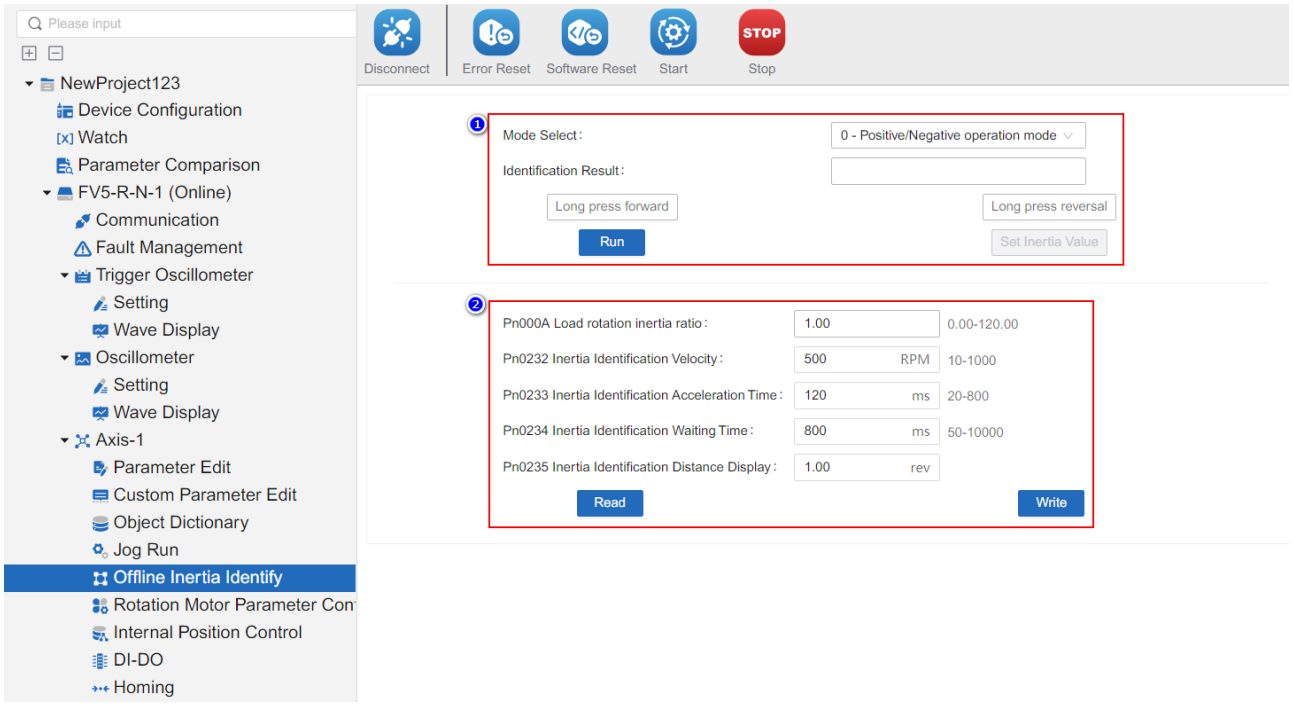
Click **Start**, he motor will run back and forth between (initial **absolute position** + **incremental target position**) and the i**nitial absolute position**. As shown in the image above, the motor's absolute position will oscillate between position 10,002 and position 2.

15 Offline Inertia Identification

The inertia identification interface allows you to set the operating mode and the forward and reverse rotation commissioning to identify the current rotational inertia ratio, facilitating quick inertia recognition and configuration.

15.1 Interface Introduction

The offline inertia identification interface is divided into 2 areas as shown in the figure below:

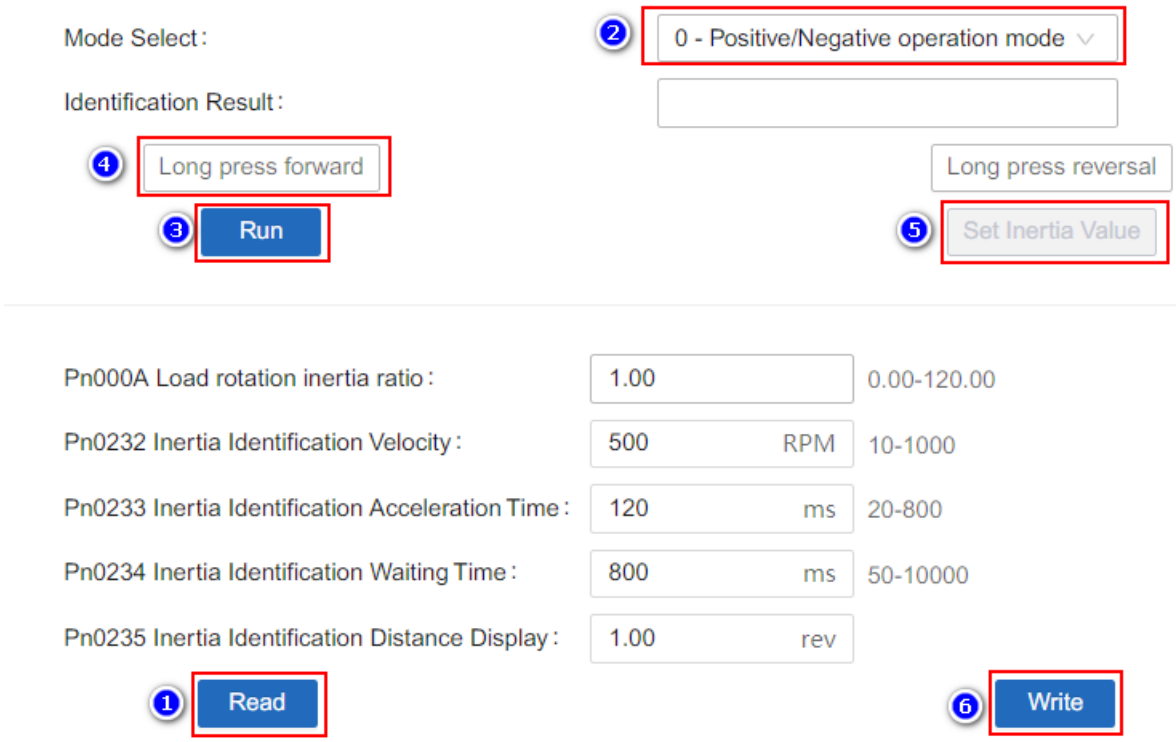


Please see the table below for detailed configuration description.

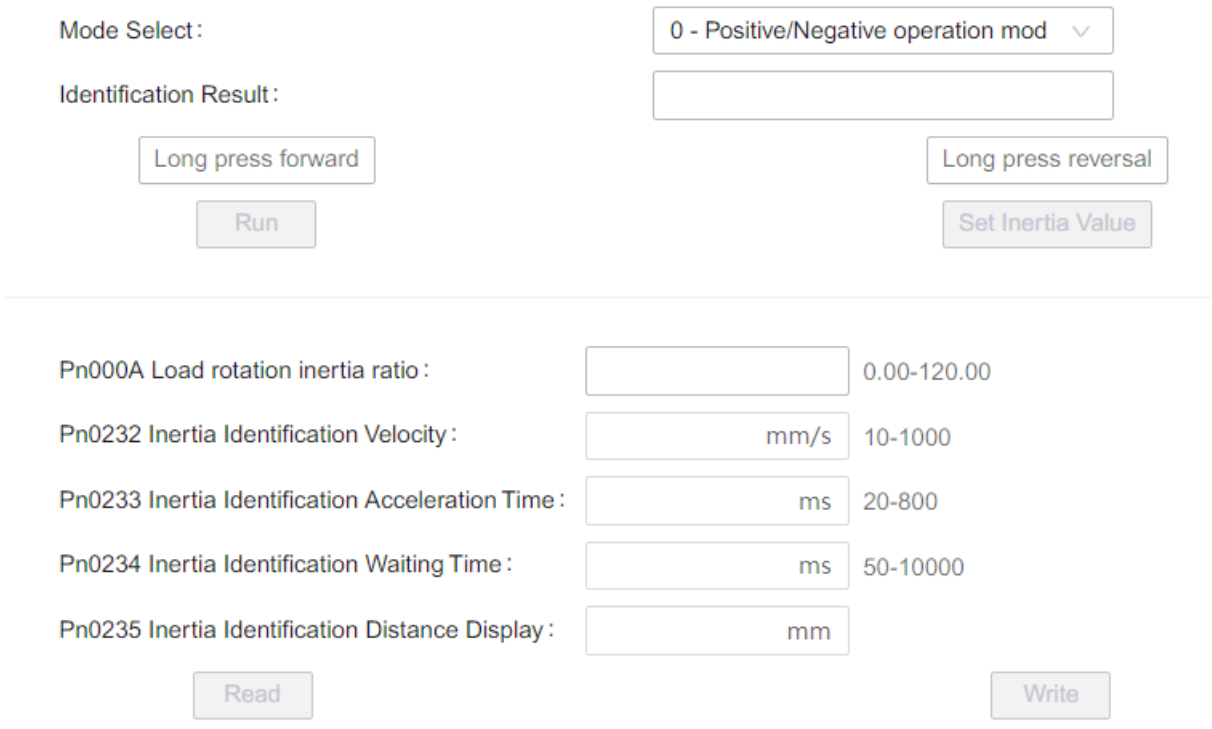
Function	Description
Area 1	Commissioning control area
Area 2	Reading, writing and displaying area of inertia associated parameters

15.2 Inertia Identification

Rotary servo:



Linear servo:



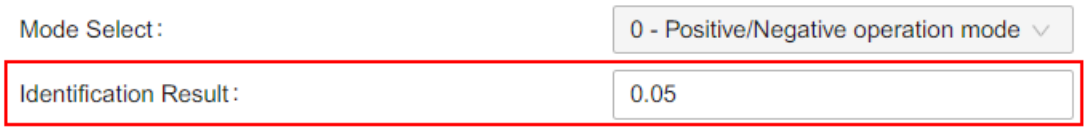
The commissioning steps for using the offline inertia identification interface are as follows (taking the rotary servo interface as an example):

Step 1:Click **Read** to read the parameters in Area 2 and set the identification parameters according to the actual situation.

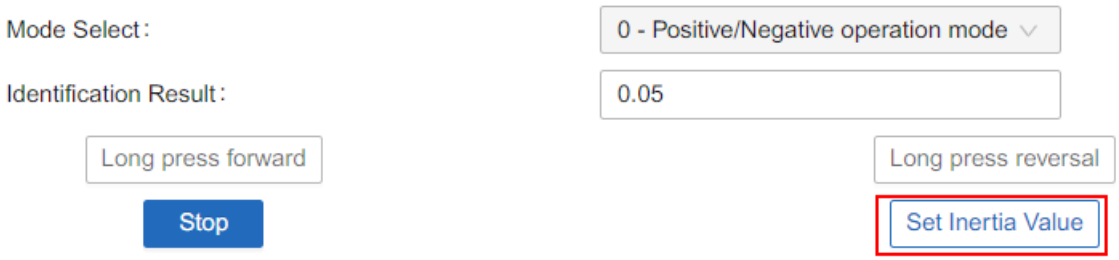
Step 2. Select the default mode **0 - positive/negative operation mode**. Try to position the load in the middle of the travel to ensure that the identification direction and distance do not cause a collision.

Step 3. Click **Run** to enable the driver, powering on the motor.

Step 4. Long press **Long press forward**, the motor rotate forward for 1 circle and then backward for 1 circle based on the identification speed, identification acceleration time, and identification waiting time. After the motor stops, the inertia identification results will be displayed at:



Step 5. Click **Set Inertia Value** to set the **identification Results** to Pn000A:



Please see the table below for detailed configuration.

Function	**Description**
Select Mode	0-Positive/negative operation mode: operate positively or negatively within the identification distance. 1-JOG mode: operate according to the jog command.
Run	Identification enable
Identification Result	Rotation inertia ratio of identification
Long press forward	**Positive/negative operation mode** Jog: rotate positively first and then negatively Long press: Repeat the action of rotating positively first and then negatively.

	JOG mode Jog: rotate positively upon one click Long press: Continue positive running action
Long press reversal	**Positive/negative operation mode** Jog: rotate negatively first and then positively Long press: Repeat the action of rotating negatively first and then positively. **JOG mode** Jog: rotate negatively upon one click Long press: Continue negative running action
Set Inertia Value	Set the **identification result** to Pn000A load rotation inertia ratio
Pn000A Load rotation inertia ratio	$\text{Load rotation inertia ratio} = \frac{\text{Total rotational inertia of mechanical load}}{\text{Rotational inertia of the motor}}$
Pn0232 Inertia Identification Velocity	Set according to the actual situation, associate with the identification distance (set speed to twice the initial speed value, i.e., 500 rpm * 2; change distance to twice the initial distance, i.e., 1 rev * 2), with a setting range of 10-1000. Rotary motor unit: rpm Linear motor unit: mm/s
Pn0233 Inertia Identification Acceleration Time	Set according to the actual situation, setting range 20-80, unit ms.
Pn0234 Inertia Identification Waiting Time	Set according to the actual situation, setting range 50-10000, unit ms.
Pn0235 Inertia Identification Distance Display	Display only, associated with identification speed Rotary motor unit: rpm Linear motor unit: mm/s
Read	Read the inertia-associated parameters in Area 2 of the driver interface.

Write	Write the inertia-associated parameters from Area 2 of the interface to the driver.

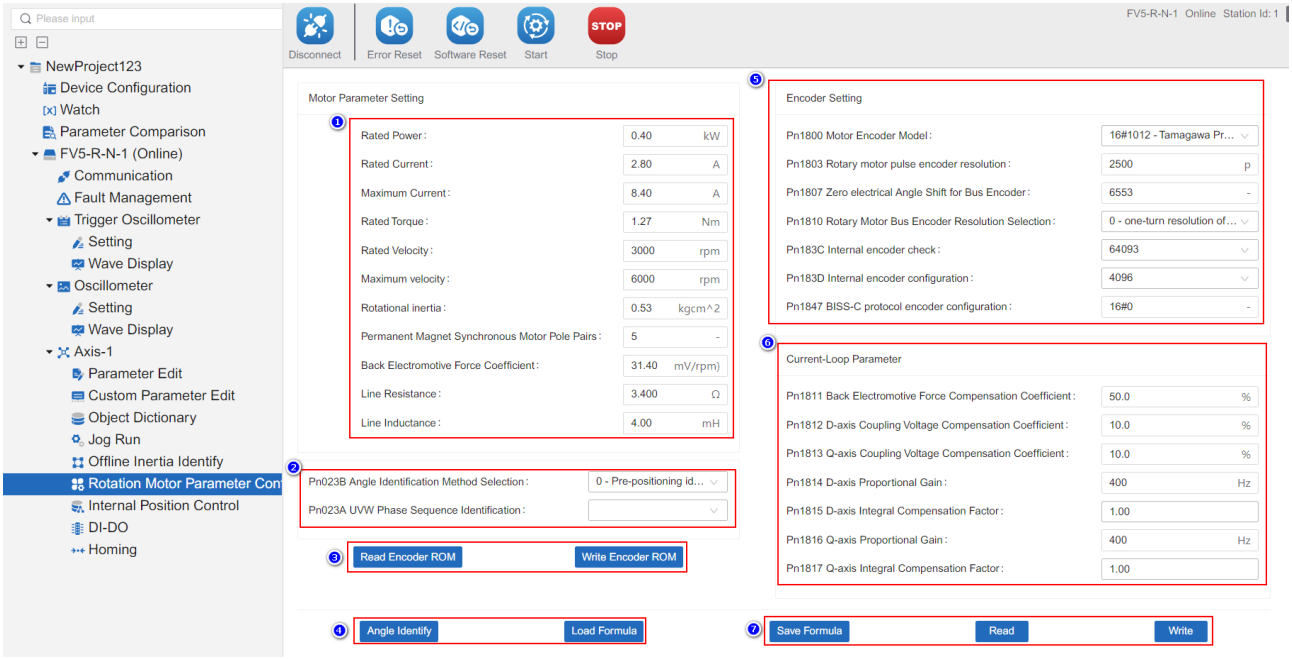
Rotate positively and then negatively based on the identification speed, acceleration time, waiting time, and identification distance.

Long press: Repeat the action of rotating positively and then negatively based on the identification speed, acceleration time, waiting time, and identification distance.

Pn0234 is the inertia identification waiting time, which is related to the start time of the **long press reversal**.

16 Motor Parameter Configuration

The **Rotation Motor Parameter Configuration** interface provides six functional areas for quick parameter operations.

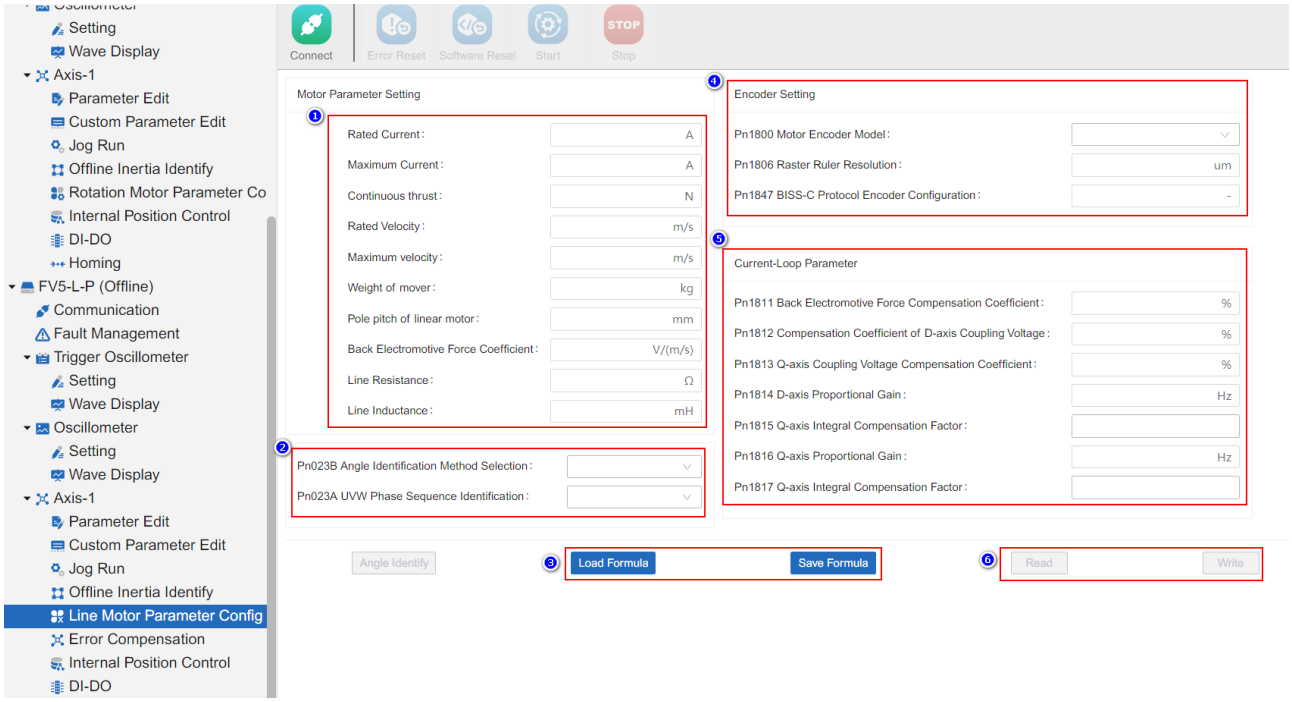


Please see the table below for detailed configuration.

Area	Function	Description
1	Motor parameter setting	**Rated Power** (Pn1820): Please set according to the actual situation, in units of kW. **Rated Current** (Pn1822): Set the rated current value of the motor, allowing for decimal input, in units of Arms. **Maximum Current** (Pn1824): Set the maximum current value of the motor, in units of Arms. **Rated Torque** (Pn1826): Please set according to the actual situation, in units of Nm. **Rated Velocity** (Pn182A): Rated velocity of the motor, please refer to the actual situation. **Maximum Velocity** (Pn182C): Maximum velocity of the motor, please refer to the actual situation. **Rotational Inertia** (Pn182E): Please set according to the actual situation, in units of kg*cm^2. **Permanent Magnet Synchronous Motor Pole Pairs**(Pn1830): Please set according to the actual situation.

		Back Electromotive Force Coefficient (Pn1834): Set the line back electromotive force, allowing for two decimal places. **Line Resistance**(Pn1831): Please set according to the actual situation. If the motor manufacturer provides phase resistance, the line resistance can be calculated as follows: Phase resistance * 2 = Line resistance. **Line Inductance** (Q-axis inductance Pn1832, D-axis inductance Pn1833): Please set according to the actual situation. If the motor manufacturer provides phase inductance, the line inductance can be calculated using the formula: Phase inductance * 2 = Line inductance.
2	Angle Identification	Angle identification Pn023B: Choose the identification method based on the actual situation of the motor. Normally, "3 - Micro-motion method 2" is sufficient.
3	Encoder ROM	Write the motor parameters to the motor encoder ROM.
4	Formula	Click **Save Formula** to save the configured motor parameters for future reference and duplication. Click **Load Formula** to open previously set parameters.
5	Encoder Setting	Motor encoder model: Select the settings based on the type of encoder. For example, for an ABZ encoder, set it to 0xA000.
6	Current-Loop Parameter	If the motor parameters are correct, you can use the default values.
7	Read and Write Parameters	Click **Write** to write the motor parameters to the driver. Click **Read** to read the motor parameters from the driver.

The **Linear Motor Parameter Configuration** interface provides six functional areas for quick parameter operations.



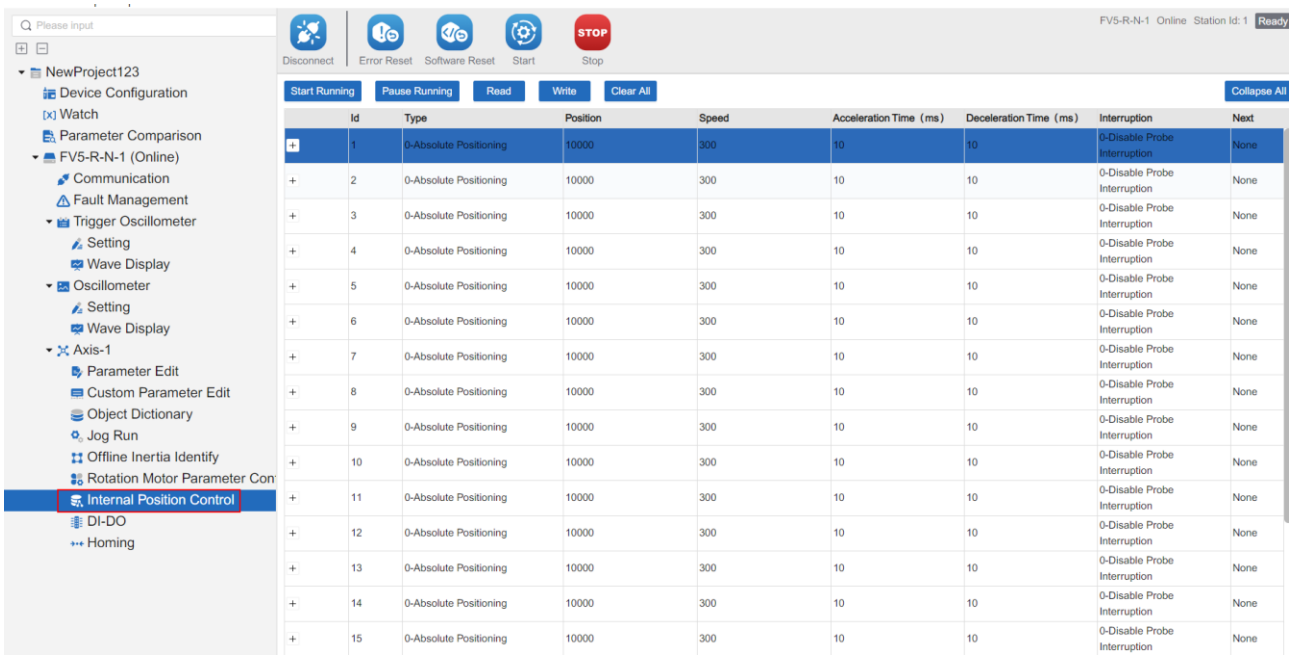
Please see the table below for detailed configuration.

Area	Function	Description
1	Motor parameter setting	**Rated Current** (Pn1822): Set the rated current value of the motor, allowing for decimal input, in units of Arms. If this parameter is set too high, it may burn out the linear motor; if set too low, it may lead to incorrect angle identification and abnormal operation. **Maximum Current** (Pn1824): Set the maximum current value of the motor, in units of Arms. It is suggested to set it to 3.5 times of the rated current. **Continuous Thrust** (Pn1826): The thrust of the linear motor can be set with decimal places, for example, 100.00, with a maximum value of 655.35, in units of N*m. If the value exceeds this limit, it can also be set to 655.35 and used normally. **Rated Velocity** (Pn182A): The rated speed of the linear motor should be set according to the actual situation. **Maximum Velocity** (Pn182C): The maximum speed of the linear motor should be set according to the actual situation. **Weight of Mover** (Pn1821): The unit is kg, and it can be set with up to three decimal places, allowing for precision down to grams. **Pole pitch of linear motor** (Pn1805): Represents the distance between the N-N poles of the linear motor, and can include up to two decimal places, for example, 32.00 mm.

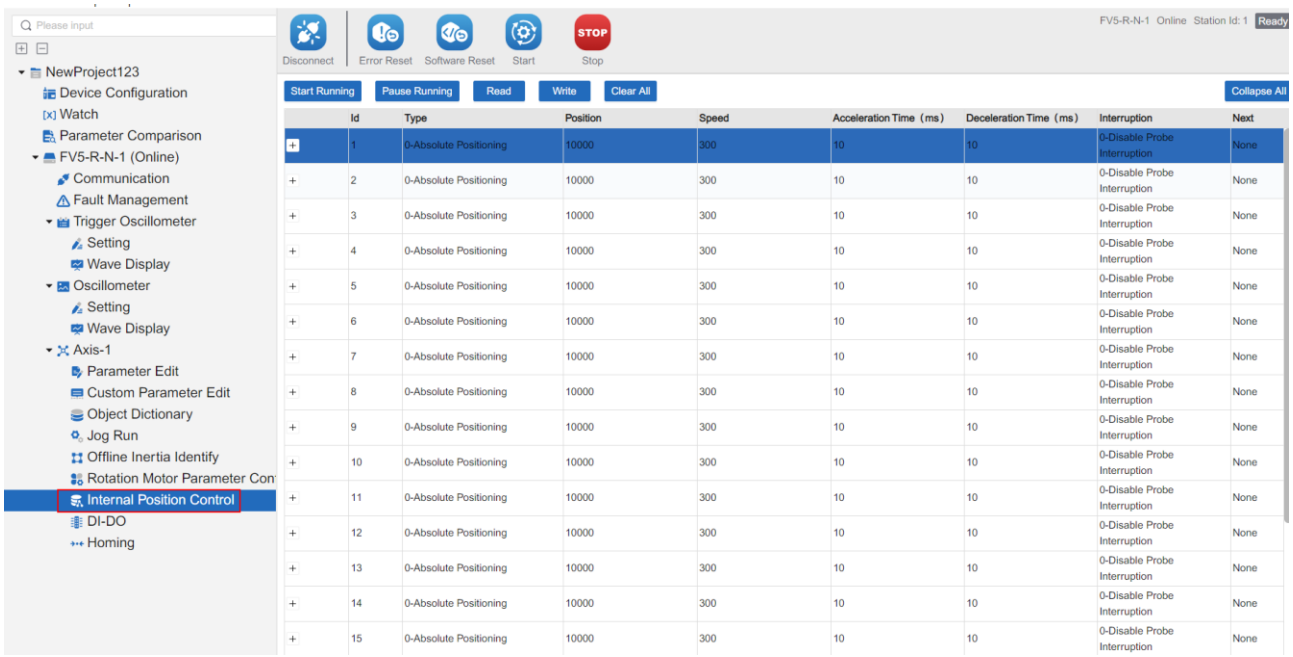
		Back Electromotive Force Coefficient (Pn1834): Set the line back electromotive force, allowing for two decimal places. **Line Resistance** (Pn1831): Please set according to the actual situation. If the motor manufacturer provides phase resistance, the line resistance can be calculated as follows: Phase resistance * 2 = Line resistance. **Line Inductance** (Q-axis inductance Pn1832, D-axis inductance Pn1833): Please set according to the actual situation. If the motor manufacturer provides phase inductance, the line inductance can be calculated using the formula: Phase inductance * 2 = Line inductance.
2	Angle identification	Angle identification Pn023B: Choose the identification method based on the actual situation of the motor. Normally, "3 - Micro-motion method 2" is sufficient.
3	Formula	Click **Save Formula** to save the configured motor parameters for future reference and duplication. Click **Load Formula** to open previously set parameters.
4	Encoder Setting	Raster Ruler Resolution: in μm and can include up to two decimal places. Motor Encoder Model: Select the settings based on the encoder type. For example, for an ABZ encoder, set it to 0xA000.
5	Current-Loop Parameter	If the motor parameters are correct, you can use the default values.
6	Read and Write Parameters	Click **Write** to write the motor parameters to the driver. Click **Read** to read the motor parameters from the driver.

17 Internal Position Control

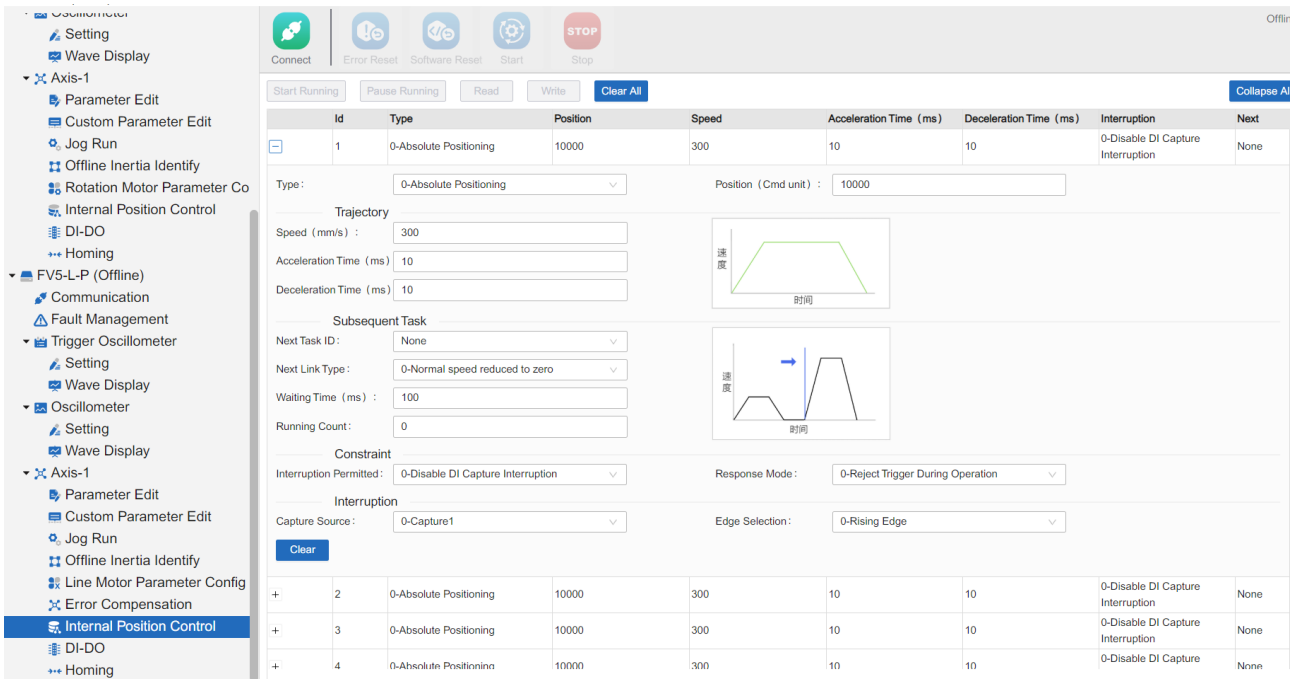
The internal position control (operation control) interface presents the usage principles and parameter setting methods in a combination of text and graphics.



Rotary servo:

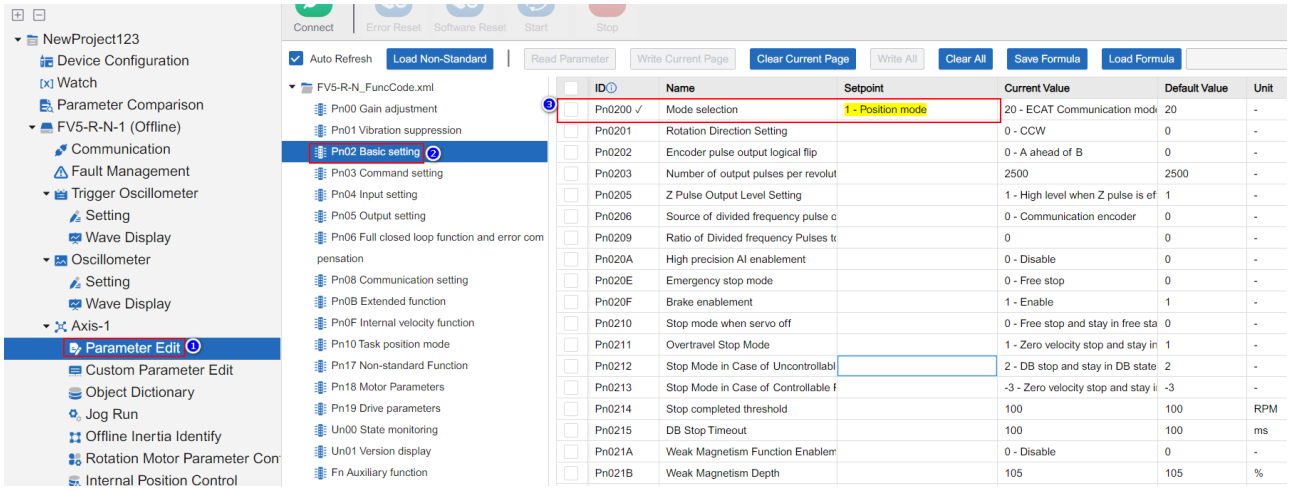


Linear servo:

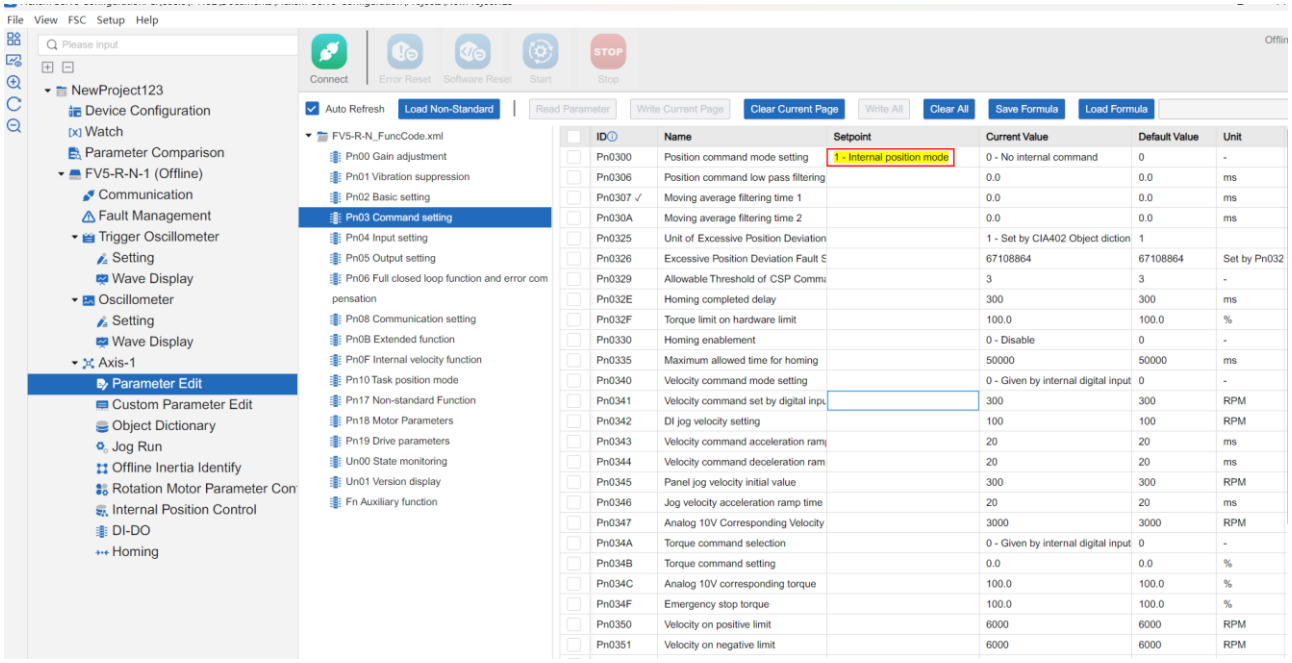


The commissioning steps for using **Internal Position Control** interface are as follows (taking the rotary servo interface as an example):

Step 1. Set control mode to **1-Position mode**



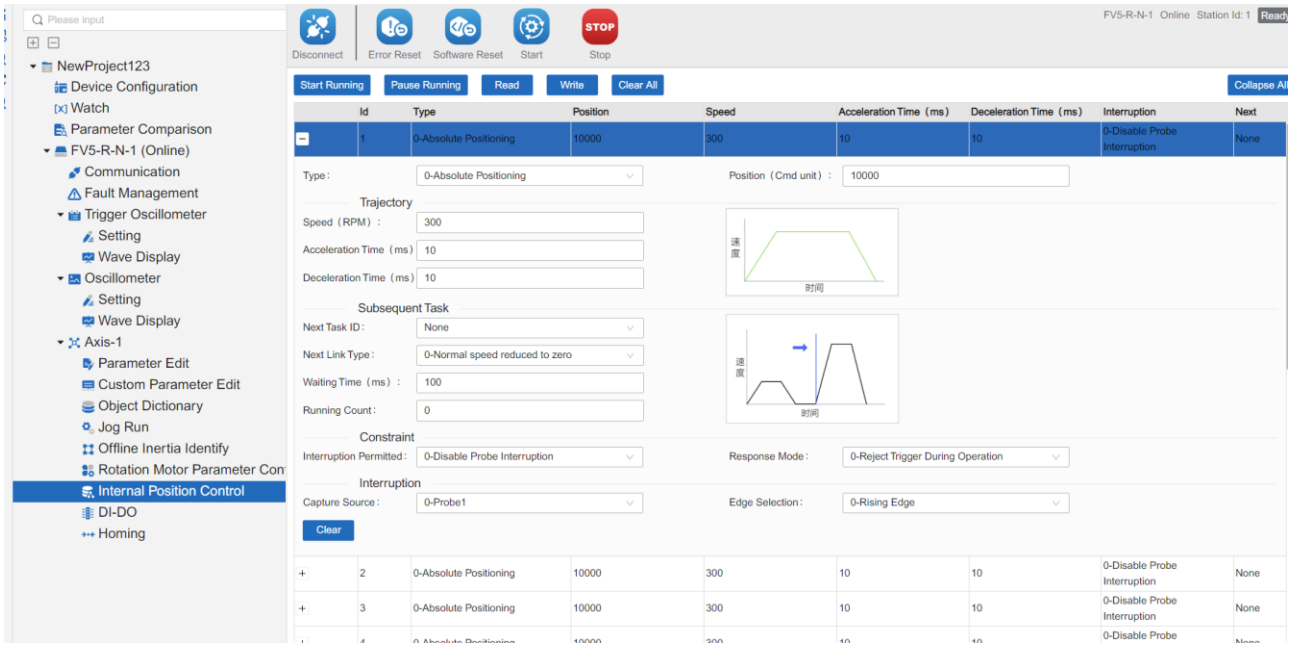
Step 2. Set position command mode as **1-Internal position mode.**



Step 3. Check ☑ to select the modified parameters and click **Write All**.

Step 4. Click **Confirm** to write the set value, the prompt message for successful writing is as follows.

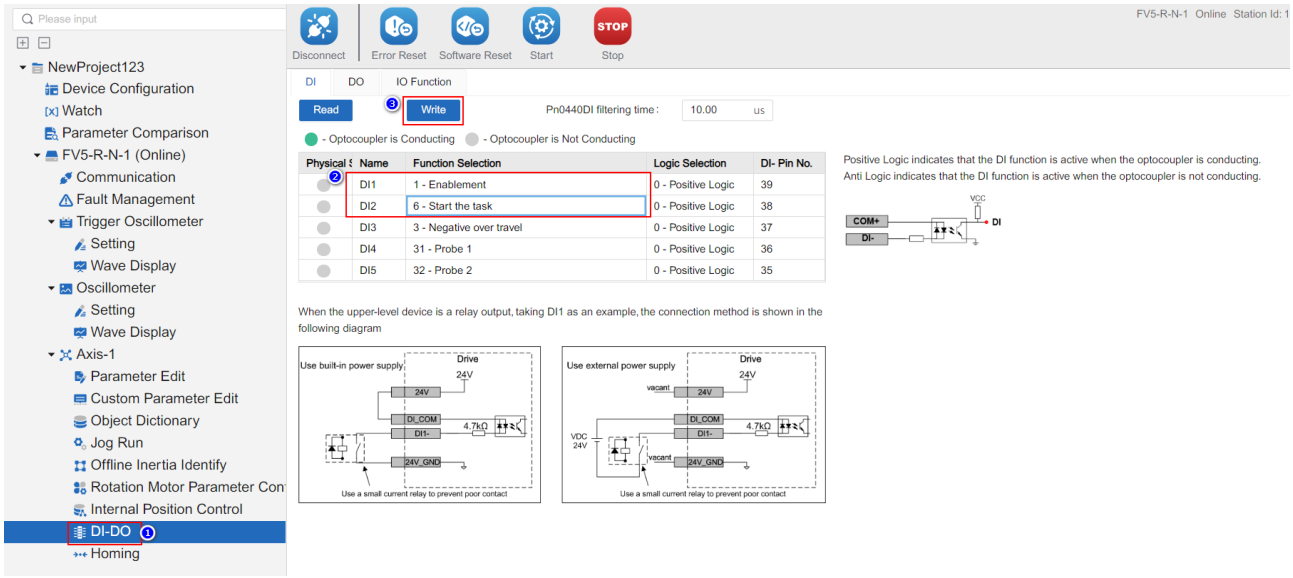
Step 5. Select Internal Position Control (operation control), click ⊞ to unfold parameter configuration interface.



Step 6. Select the **Type** as **0-Relative Positioning** (Pn100E bit0~3 positioning mode), set **Position (Cmd unit)** as 10000(Pn1008). Use default value for other parameters in this interface.

Step 7. Click **Write** to write the interface parameter configuration to the driver.

Step 8. Configure the Servo enabled terminal as DI1 and the internal position command trigger terminal as DI2, set through the DI-DO function interface.

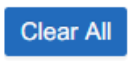


Step 9. DI1 enable the servo.

Step 10. DI2 starts the internal position command or can be triggered via a shortcut 

, and the motor operates to the specified position based on the speed setting.

Please see the table below for detailed configuration:

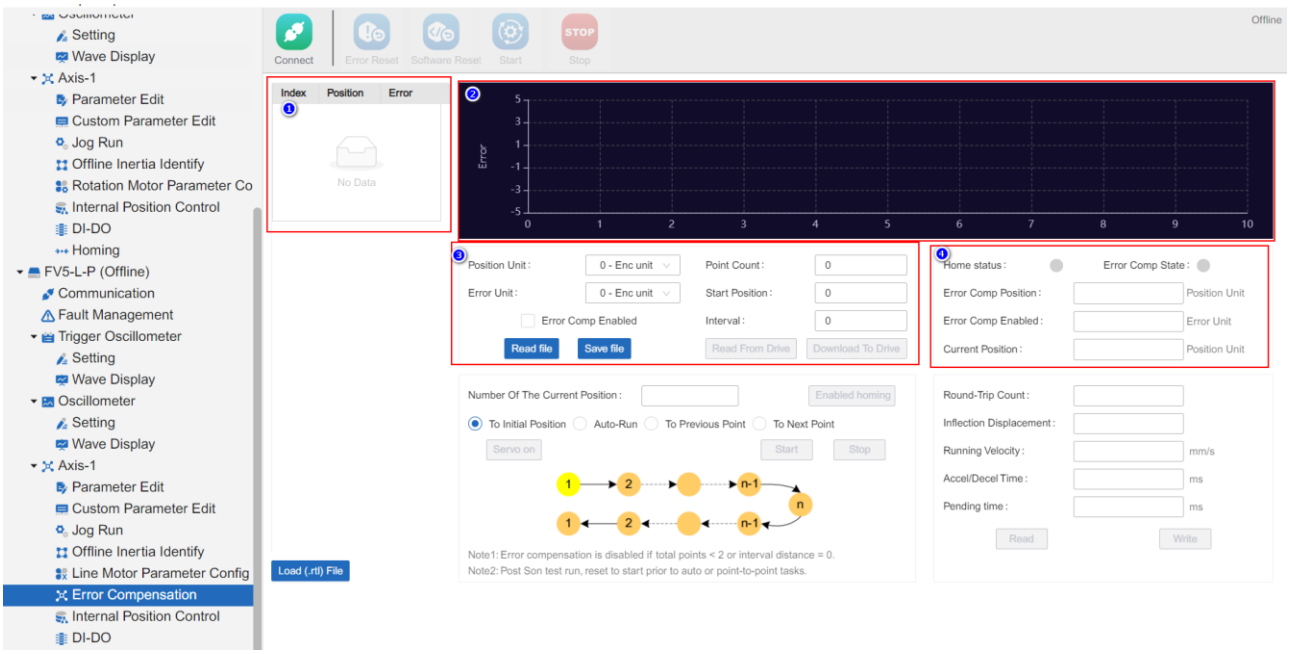
Name	Description
	Start running internal position command.
	Interrupt the running command to pause current operation.
	Read and display the parameters of the driver shown on the interface.
	Write all the set values from the interface to the driver.
	Restore all set values on the interface to their default values and write them to the driver.

Name	Description
Id	Segment number
Type	Positioning Type： ◆ 0: Absolute Positioning ◆ 1: Relative Positioning ◆ 2: Relative to Last Target Position (used in cases where the target operation is unexpectedly interrupted) ◆ 3: Relative to Probe Position ◆ 4: Absolute Positioning Forward (with Mode) ◆ 5: Absolute Positioning Reverse (with Mode) ◆ 6: Absolute Positioning Nearest (with Mode)
Position	Set the operating displacement, in command units.
Speed	Set operating speed in rpm or mm/s
Acceleration Time	Set acceleration time in ms
Deceleration Time	Set operating deceleration time in ms
Interruption Permitted	Set whether to run DI capture to interrupt the current state. 1- Enable Probe interruption (allow interruption) 0- Disable Probe interruption (not allow interruption)
Next Task ID	Set the ID for the next segment after the current operation ends.

18 Linear Motor Error Compensation

18.1 Interface Introduction

Run the servo commissioning software and select **Error Compensation** from the menu bar to enter the error compensation interface.



Please see the table below for detailed information of each area in this interface.

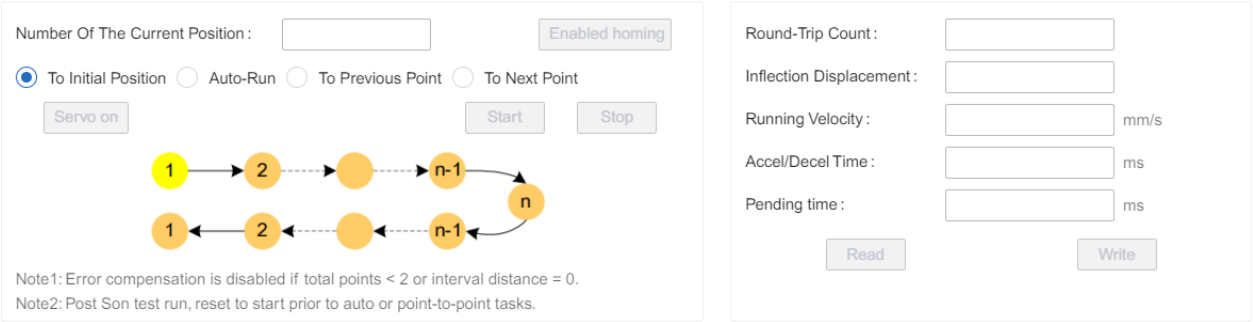
Area	Name	Description
1	Set error compensation value	Set the error compensation parameters for each position. The serial number is the position index, and the position is absolute position, automatically calculated based on the parameters setting. The error is the position's error compensation parameter, which can be set by the user manually. Typically, this data is obtained using a laser interferometer.
2	Error compensation chart	The horizontal axis represents the index corresponding to the position, while the vertical axis represents the error compensation value for the specified position.
3	Error compensation setting	Users can set the parameters for error compensation, where the position unit and error unit can be defined freely. The total number of points and intervals can be set according to the actual travel distance, with a maximum of 1,024 points in

Area	Name	Description
		total supported.
4	Error compensation status	When **Home Status** is green, it indicates that the starting position for error compensation has been determined. When the **Error Compensation State** is green, it indicates that the error compensation function has been enabled and the home has been confirmed. To enable error compensation, set P06.20 = 1 or check the **Error Compensation Enabled** option in Area 3. Note that this requires the system to be stopped for setup. **Error Compensation Enabled** displays the error position for the current location compensation.

18.2 Error Compensation Operation

The error compensation trial run function can only be used after the error compensation parameters have been set.

In the lower part of the error compensation interface is the **error compensation trial run** setting interface.



Step 1. Click **Servo on** to enable servo. Click **Servo off** to disable servo. Note that there should be no external enabling of the servo driver during the entire process.

Step 2. After enabling, click **Enabled homing**. The servo will enable the homing action. You need to set the homing parameters based on the actual situation before using enable homing. For example, the homing mode and speed for the FD5 series fully functional pulse servo driver are set by P03.31 to P03.33.

Step 3. Select **To Initial Position** and click **Start**. The motor will return to the origin position.

Step 4. Select **Auto-Run** and click **Start**. The motor will run back and forth according to the set number of position points and speed, and you can test it using a laser interferometer.

Step 5. Select **To Previous Point** or To **Next Point**, and click **Start**. The motor will then move to the previous or next point.

If the pulse frequency division function is used, after enabling the error compensation function, please set **Pn0206 pulse frequency output source selection** appropriately (without error compensation / with error compensation mode).

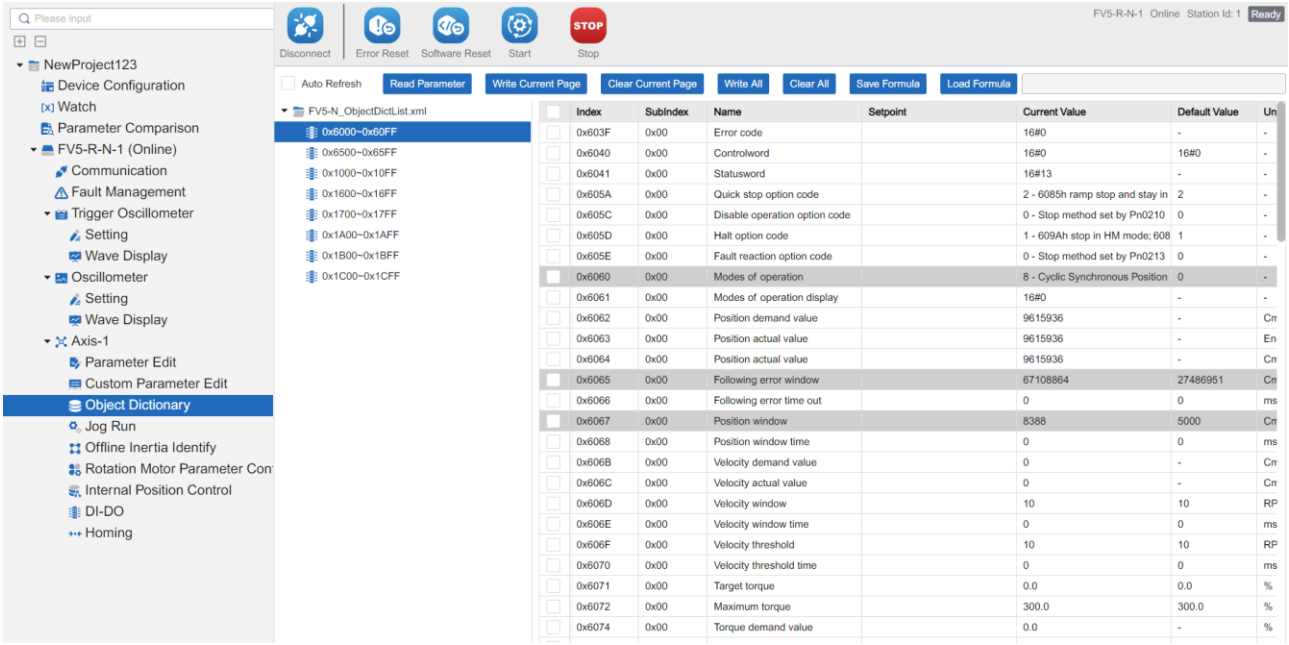
18.3 Error Compensation Home Setting

- Use the internal return-to-zero method for homing. After the homing is complete, the current position automatically calibrates the home position for error compensation.
- Use FunIn.21 to select the current position as the home for error compensation on the rising edge.

Use F0C=1 (Modbus address is 1F0C) to select the current position as the home for error compensation.

19 Object Dictionary

This interface is suitable for EtherCAT bus servos and displays the object dictionary separately. It includes communication object area parameters and manufacturer-defined area parameters. The real-time refresh function updates the current values in real time. After modifying the **object dictionary** on the master computer, you can use the object dictionary interface to view the servo modification status and **current values** in real time.

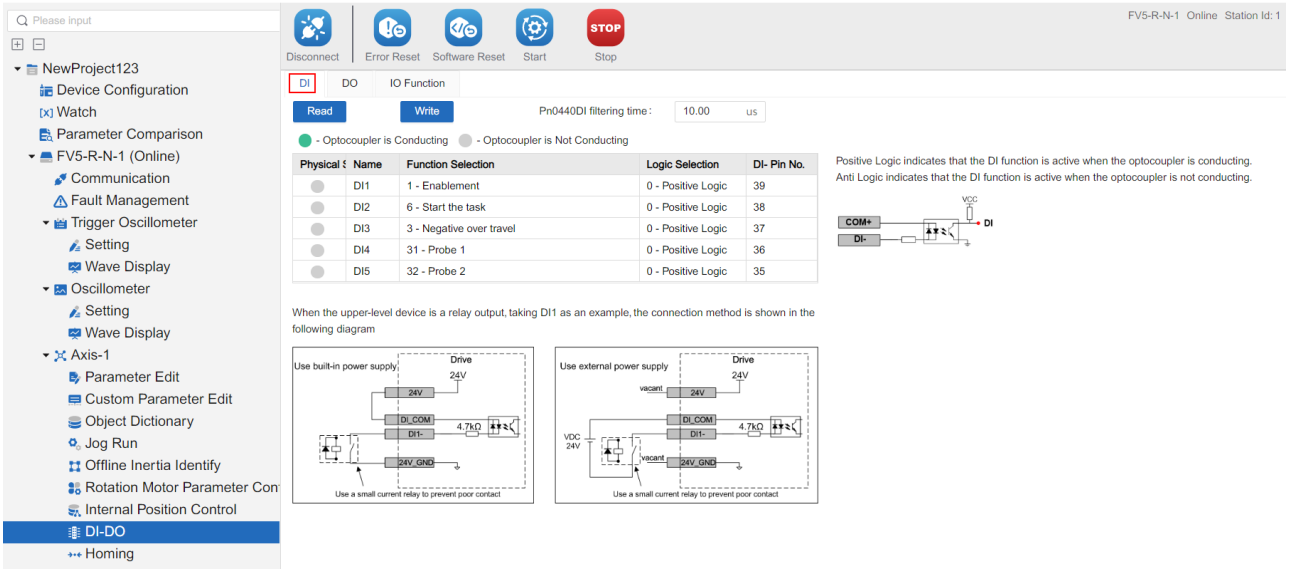


20 DI-DO

The DI-DO interface is used for quick setting and status viewing of IO functions, and it mainly consists of three functional areas: DI Function, DO Function, and IO Function. The specifics are introduced as follows:

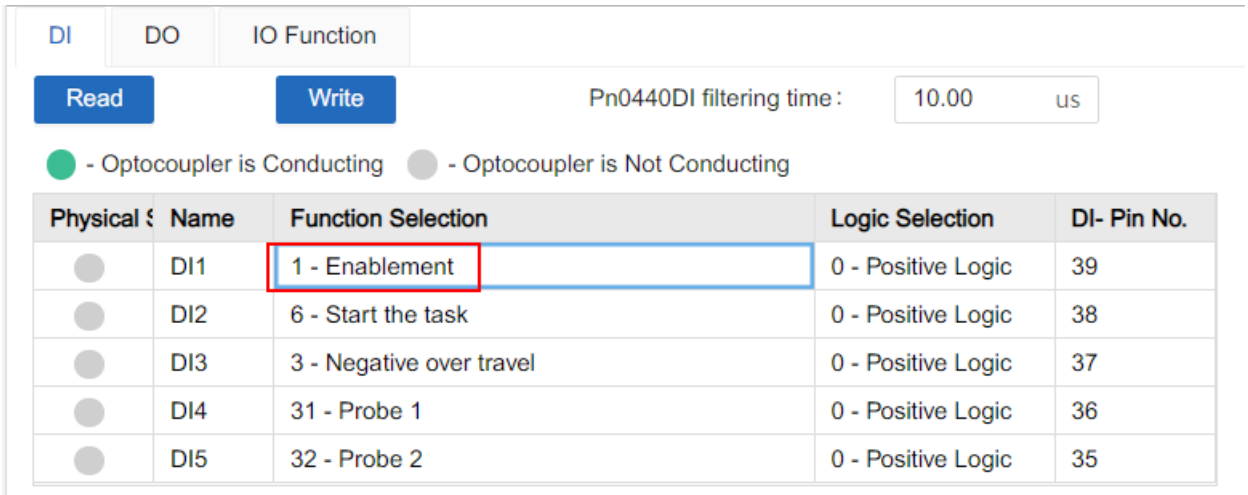
20.1 DI Function

The DI function interface facilitates the configuration of various DI functionalities and logic. It displays the physical pin numbers of each DI on the driver's CN1 signal port and the on/off status of the optocouplers, making it easier to use DI functions and conduct on-site commissioning.



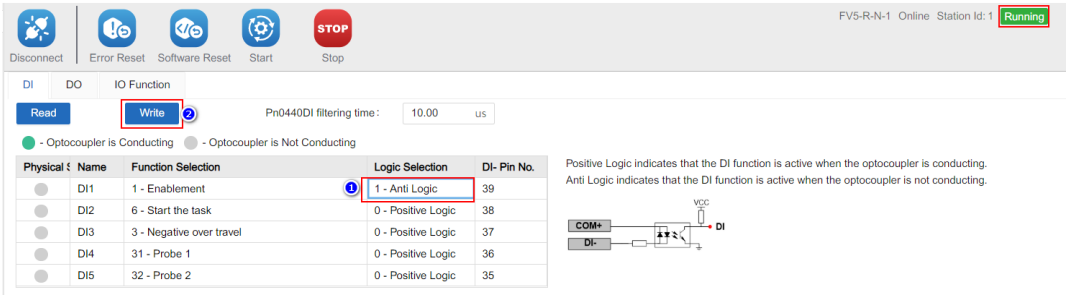
Take Enablement as an example, the steps are as follows:

Step 1. Configure DI1 as servo enablement function.

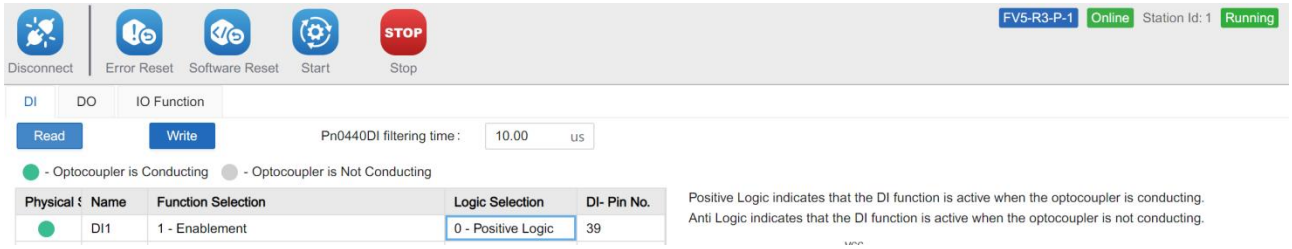


Step 2. Enable driver

Method 1: Logic Selection **1 - Anti Logic** (No external wiring needed for DI1). Click **Write**, and the servo status will show as **Servo Running**, indicating it is enabled. (Due to the inverted logic, the non-physical input makes the optocoupler conductive, while the physical state at this time is that **the optocoupler is in a non-conductive state**).



Method 2: By using external wiring, with the corresponding logic selection for the enablemment function set to **0 - Positive Logic**, the DI terminal is activated (the physical input makes the DI1 optocoupler conductive), and the servo status will display as **Servo Running**, indicating it is in an enabled state.



At this point, if the logic selection for the enablement function is changed to **1 - Anti Logic**, the servo status will display as **Ready**, indicating that the enablement state is disconnected.

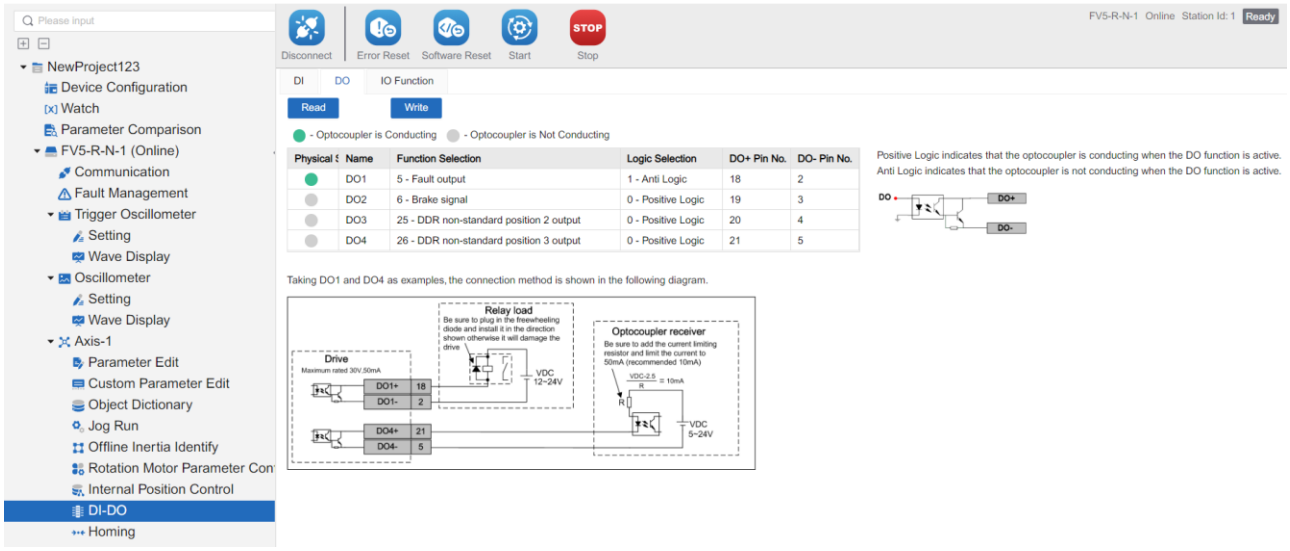
Please see the table below for the detailed configuration description.

Name	**Description**
Physical Status	The status of the driver's DI hardware optocoupler (related to external DI wiring). - Optocoupler is Conducting - Optocoupler is Not Conducting

Name	Description
Name	DI terminal numbers, such as **DI1**, **DI2** and so on
Function Selection	Configure according to actual needs. For example, if you need to set DI1 as a positive limit function, select the function corresponding to **DI1** as 2 - **Positive over travel**.
Logic Selection	Positive Logic: The DI function is active when the hardware optocoupler is conductive, and inactive when it is not conductive. Anti Logic: The DI function is inactive when the hardware optocoupler is conductive, and active when it is not conductive.
DI-Pin No.	The physical pin numbers of the DI terminals on the driver's CN1 signal port.

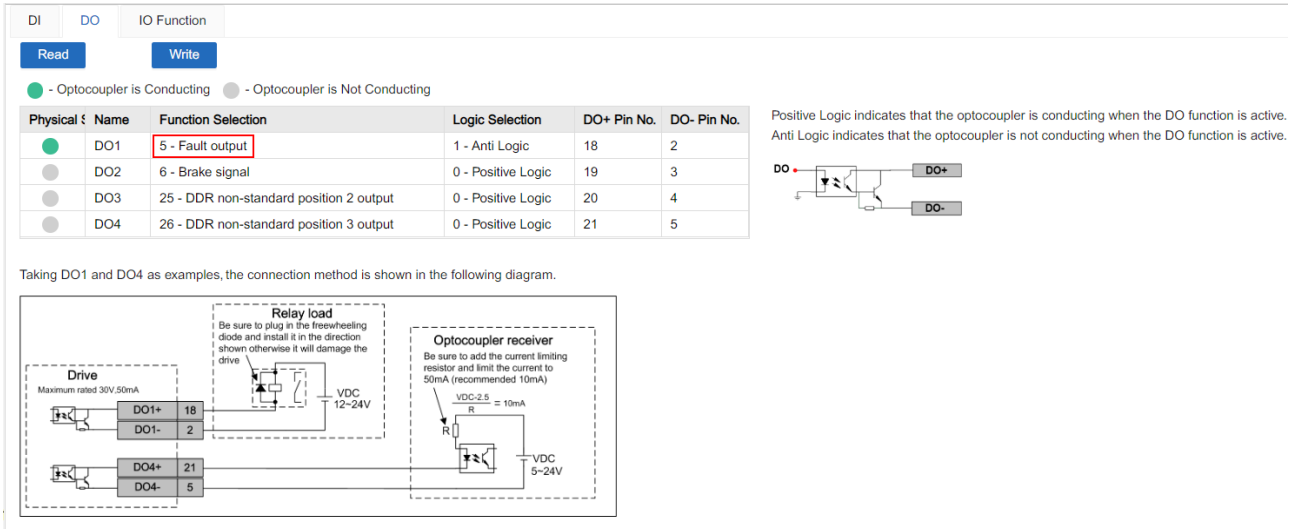
20.2 DO Function

The DO function interface facilitates the configuration of various DO functionalities and logic. It displays the physical pin numbers of each DO on the driver's CN1 signal port and the on/off status of the optocouplers, making it easier to use DO functions and conduct on-site commissioning.

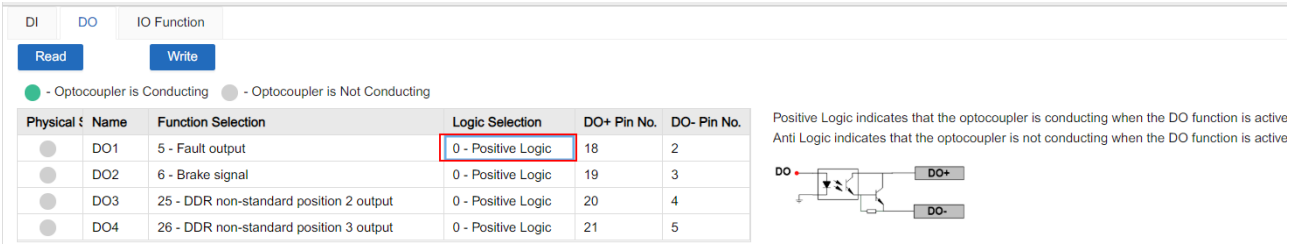


Take Fault output as an example, the steps are as follows:

Step 1. Configure DO1 as fault output alarm, select **5-Fault Output** for function selection.



Step 2. The requirement is to output a signal when the driver fails and not output a signal when it is not failing. With the logic selection set to **0 - Positive Logic**, when the driver is not failing, the physical status indicator will show ○, indicating that the DO1 **function is inactive** (the DO1 **optocoupler is not conductive**).



Step 3. If the requirement is for the driver to not output a signal when failing and to output a signal when not failing, the logic selection should be set to 1 - Anti Logic. When the driver is not failing, the physical status indicator will show ●, indicating that the DO1 **function is active** (the DO1 **optocoupler is conductive**).

Please see the table below for detailed configuration description:

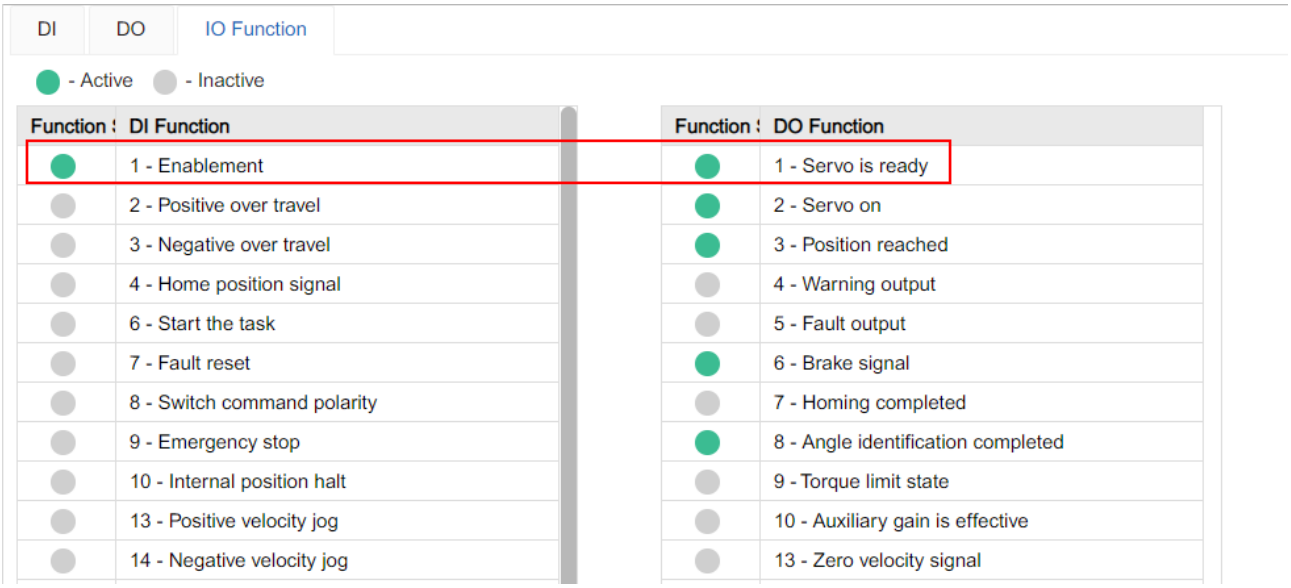
Name	**Description**
Physical Status	The status of the driver's DO hardware optocoupler (related to the current DO function state and logic selection). ● - Optocoupler is Conducting ○ - Optocoupler is Not Conducting
Name	DO terminal numbers, such as **DO1**, **DO** etc.
Function Selection	Configure according to actual needs. For example, if you need to set **DO1** as a fault output function, select the function corresponding to **DO1** as **5 - Fault Output**.

Name	Description
Logic Selection	Positive Logic: When DO function is valid, the hardware optocoupler is conductive; when invalid, not conductive. Anti Logic: When DO function is valid, the hardware optocoupler is not conductive; when invalid, it is conductive.
DO + Pin number	The physical pin numbers of the DO terminals on the driver's CN1 signal port (Positive).
DO - Pin number	The physical pin numbers of the DO terminals on the driver's CN1 signal port (Negative).

20.3 IO Function

It displays the current valid/invalid status of the DI/DO terminal functions.

When the driver's DI terminal is not wired and logic selection is set to **1 - Anti Logic** to enable the driver, the physical status shows ● (DI1 terminal optocoupler is not conductive), while the function status shows ● (the driver is enabled). The driver status displays **Running**.



Please see the table below for detailed configuration description:

Name	Description
Function Status	Validity status of current driver DI/DO functions. ● - Active ● - Inactive
DI Function	DI function list
DO Function	DO function list

21 Appendix - Terminology

Term	Description
DI	DI (Digital Input) converts the switching signals, which have only two statuses during the production process, into a format recognizable by the driver. For example, this includes the status of field limit switches.
DO	DO (Digital Output) converts the binary codes output by the driver into switching signals that can control the production process or display status. For example, this includes the control and status display of on/off indicator lights, motor start/stop, valve open/close, and relay on/off states.
EtherCAT	EtherCAT (Ethernet for Control Automation Technology) is an open architecture, Ethernet-based fieldbus system. The "CAT" in its name is an abbreviation for Control Automation Technology. EtherCAT is a deterministic industrial Ethernet, originally developed by Beckhoff Automation in Germany. EtherCAT has a short cycle time because the slave's microprocessor does not need to process Ethernet packets. All program data is processed by the hardware of the slave controller. This feature, combined with the functional principles of EtherCAT, allows it to become a high-performance distributed I/O system: exchanging program data for 1,000 distributed digital inputs/outputs takes only 30 µs, which is equivalent to transmitting 125 bytes of data over a 100 Mbit/s Ethernet. A system reading and writing to 100 servo axes can update at a rate of 10 kHz, with general update rates around 1 to 30 kHz. However, lower update rates can also be used to avoid too frequent direct memory access affecting the operation of the master station.
Modbus	Modbus is a serial communication protocol developed by Modicon (now Schneider Electric) in 1979 for communication with programmable logic controllers (PLCs). Modbus has become the de facto industry standard for communication protocols in the industrial field and is now a commonly used method for connecting industrial electronic devices. The main reasons why Modbus is more widely used than other communication protocols include: ◆ Publicly published and royalty-free ◆ Easy for deployment and maintenance ◆ For vendors, there are few restrictions on modifying local bits or bytes. Modbus allows multiple devices (approximately 240) to connect and communicate on the same network. For example, a device that measures temperature and humidity can send the results to a computer. In data acquisition and supervisory control systems(SCADA) , Modbus is commonly used to connect monitoring computers and remote terminal units (RTUs).

PDFF	PDFF (Pseudo-Derivative Feedback and Feedforward) introduces a feedforward gain in the speed loop PI controller. The setpoint of the system is passed through a feedforward channel and superimposed onto the control output of the system. This approach allows for an increase in integral gain without causing excessive overshoot. Additionally, the integral component can filter out many low-frequency interference signals, enhancing the system's responsiveness and disturbance resistance. As a result, the motor can achieve rapid positioning and improved tracking performance during operation.