

MISUMI

Linear motor actuator

E-RAM Series

DA60 Driver User Manual

Ver1.0

Thank you for purchasing our linear motor actuator.

This user manual is a supplement to the manufacturer's catalog, and its purpose is to provide users with more detailed and convenient usage instructions. We have attempted to ensure the accuracy and completeness of the content. Nevertheless, we recommend that users use the manufacturer's catalog as a guide.

Please take the time to read this manual carefully before use. Please keep it in a safe place so that you can view it whenever necessary.

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1. Driver Overview

1.1 Manufacturer Information

Driver manufacturer: Servotronix

Manufacturer's official website:<https://www.servotronix.cn/en>

The manufacturer model number table is as follows.

Misumi model number	Servotronix model number
DA60	CDHD-0062AAP1

1.2 Safety precautions

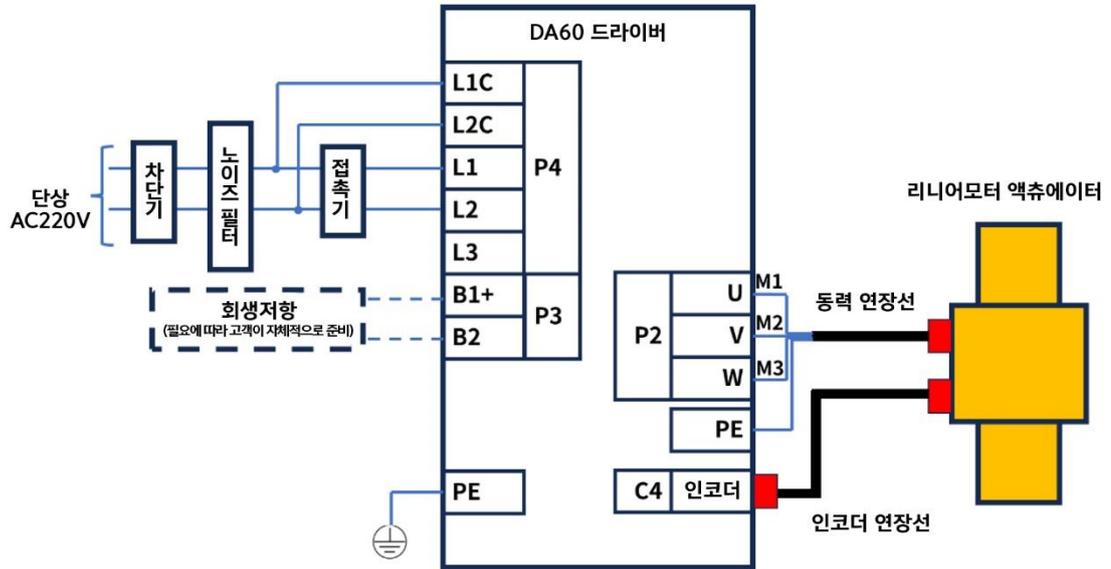
Before installation, please be sure to download and read all relevant materials from the manufacturer's website carefully, and use and operate the product exactly as required to ensure safety and accuracy.

Please use caution as improper handling may result in personal injury and/or equipment damage.

2. final

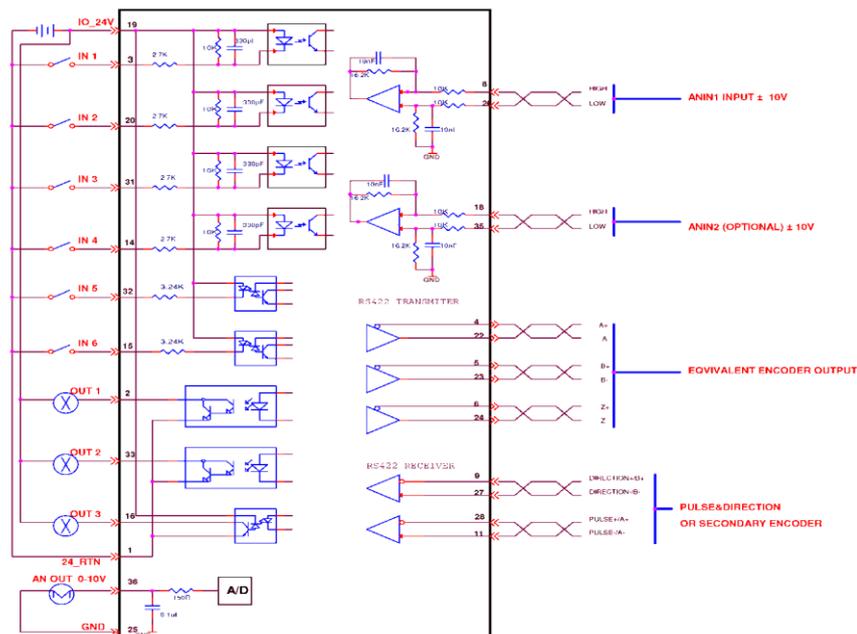
2.1 Main circuit

Driver rated input current 6A, maximum current 18A

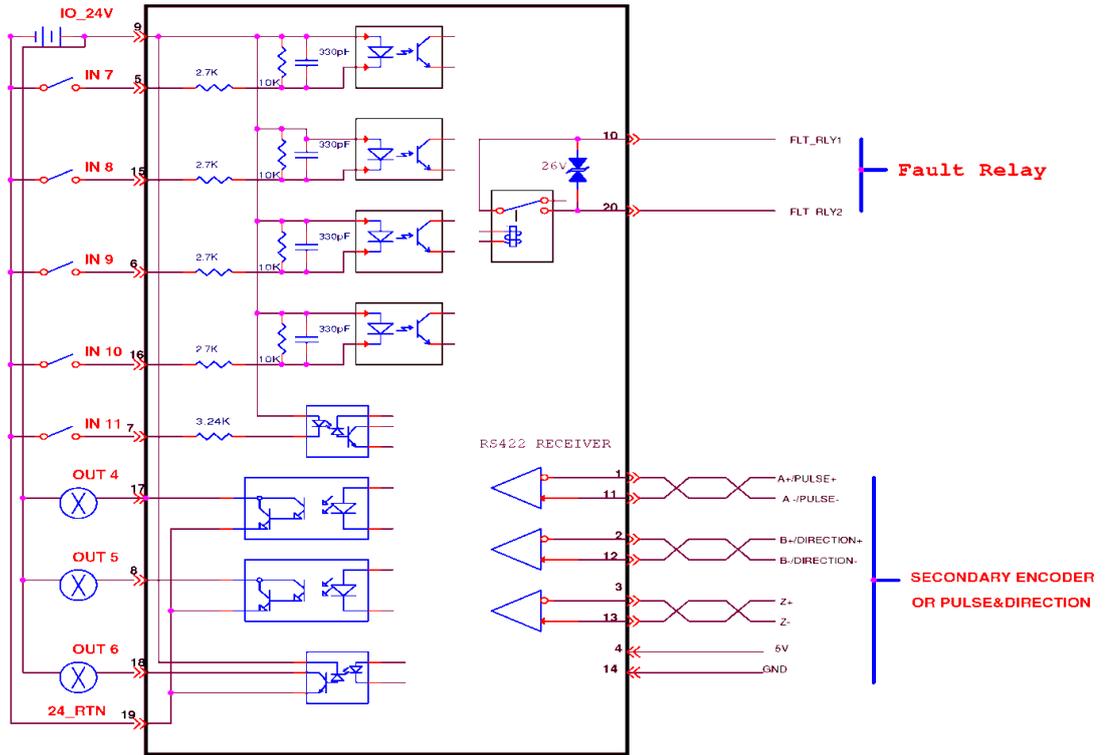


2.2 Control circuit

● C2 interface



● C3 interface



3. Debugging

3.1 Software download and installation

● software download

Download from the manufacturer's website.

Download link:<http://m.servotronix.com.cn/col.jsp?id=197>

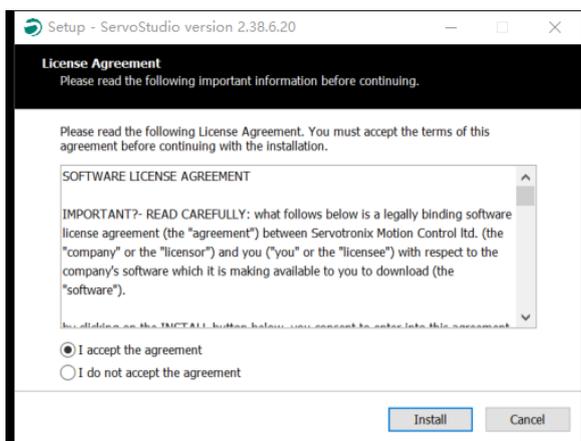
All software versions ServoStudioSetup_2_38_6_20 and higher are available.



● Software installation

 ServoStudioSetup_2_38_6_20.exe Double-click to complete the installation,

 ServoStudio.exe Double click to open the software and you are ready to use it.

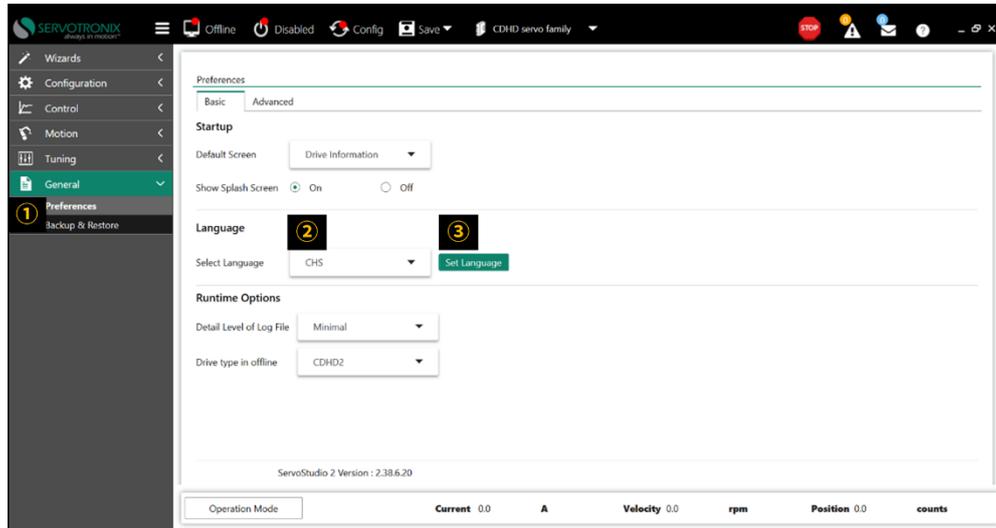


3.2 Language settings

① Click <Preferences>, and ② you can change it to <ENG> or <CHS>. If you want to change the language, select the language you want to change, and click ③<Set Language>.

If you close the program and turn it back on, it will change to the set language.

! When selecting a language, CHS represents Chinese and ENG represents English.



3.3 Communication between computer and driver

● final

Connect the computer to driver ①<C1 port> with a communication cable, then turn on the driver.

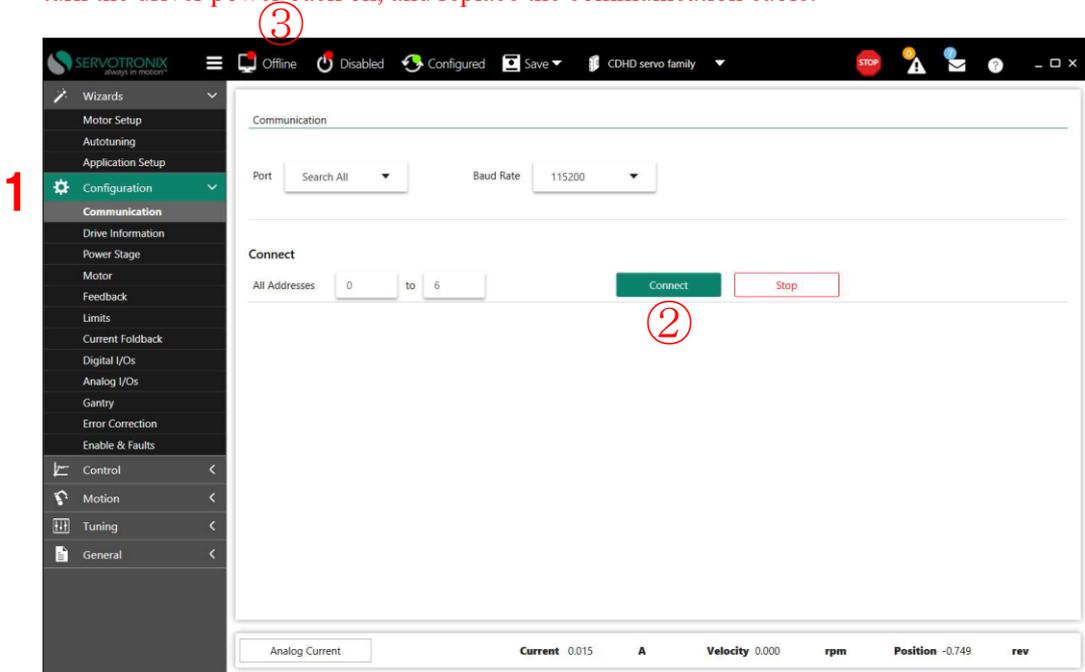
! Before turning on the power, be sure to check that all wiring is correct.



● communication

- 1 If communication is successful by clicking <Communication> and clicking ②<Connect>, ③<Disconnected> will appear.  Online changes to .

! If communication is not possible, reconnect the communication cable, reboot the computer, turn the driver power back on, and replace the communication cable.



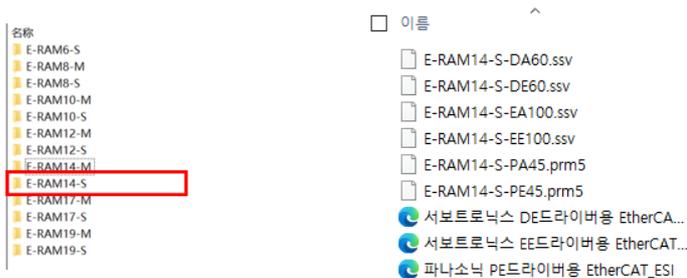
3.4 Importing motor parameters

● Download parameter pack

You can download the parameter pack from the MISUMI website or request it from MISUMI customer service staff.

Select the parameter pack according to the model number of the actuator you purchased.

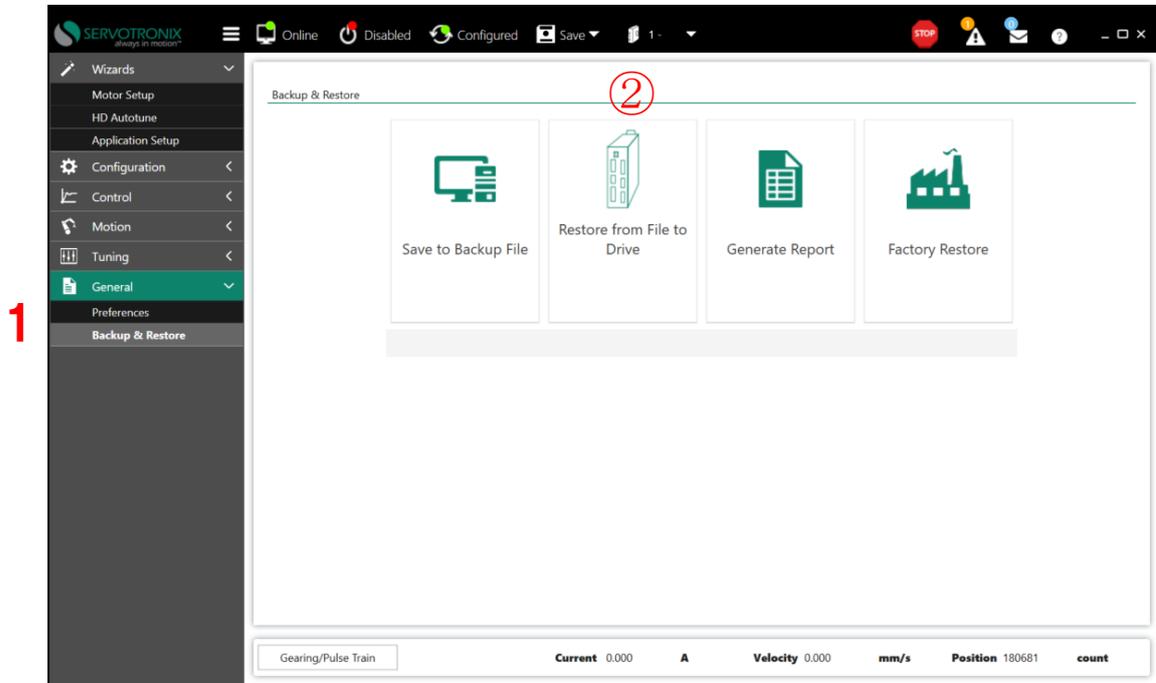
Example: If the model number of the linear motor actuator is E-RAM14-S-600-DA60-C3, the corresponding parameter pack is E-RAM14-S-DA60.



● Importing parameter packs

Operate in the following order:

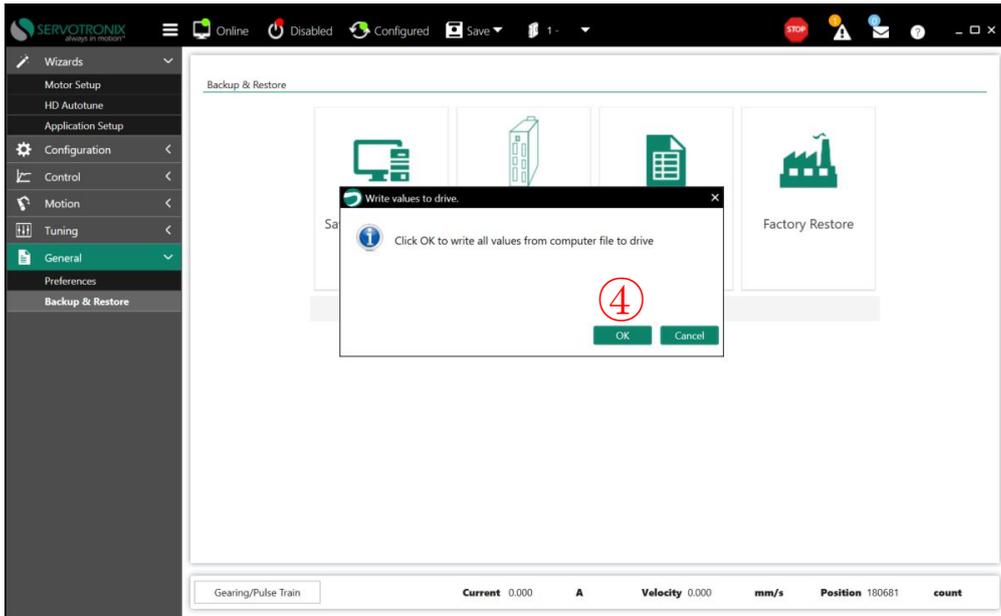
- 1 Click <Backup & Restore>, and click ②<Restore from File to Driver>.



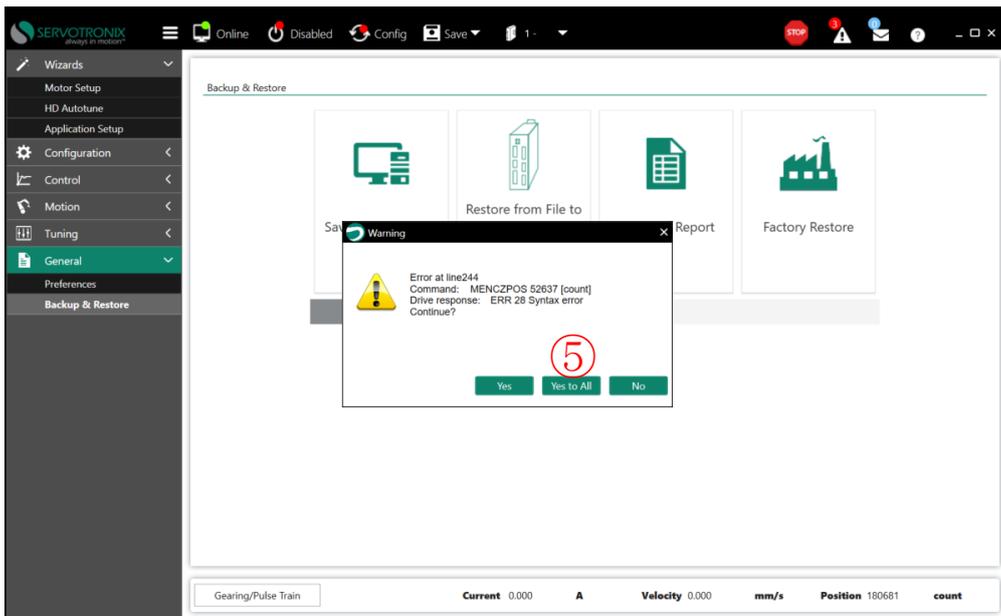
- 2 Double-click the locally saved parameter pack.

이름	수정한 날짜	유형
E-RAM14-S-DA60.ssv	2024-02-29 오후 6:57	SSV 파일

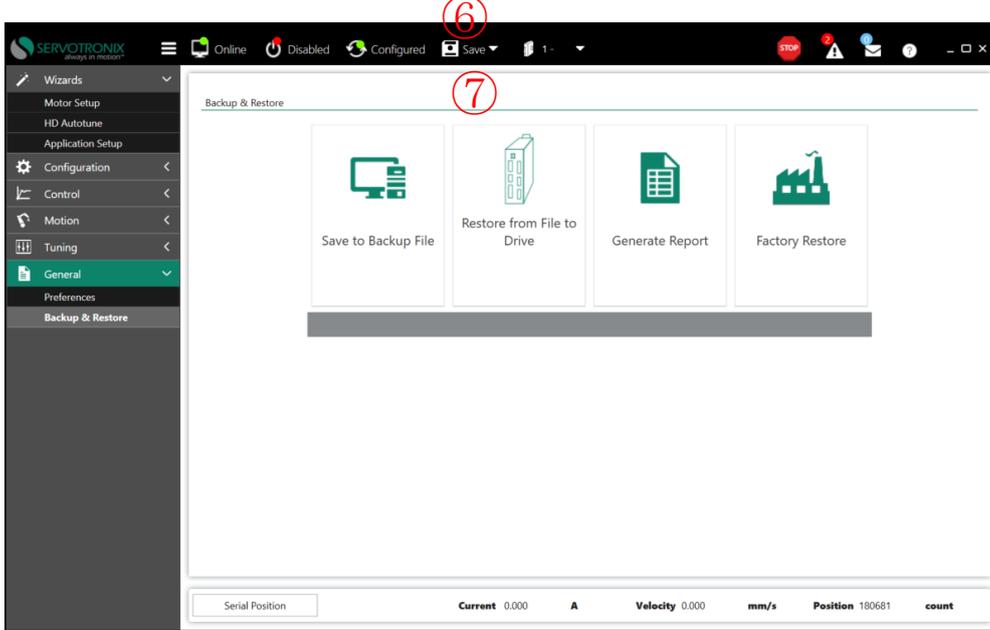
- ④ Click <Confirm>.



⑤ Click <All>.

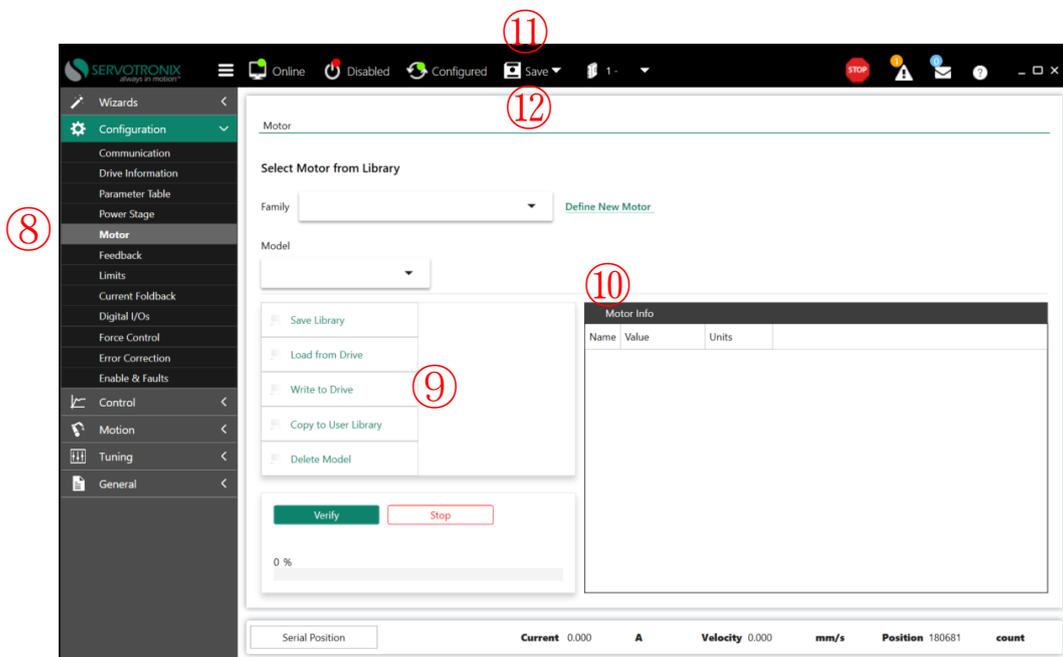


Click ⑥<Save>, and click ⑦<Save to Driver>.



Power off the driver, wait 5 seconds, and then power it back on to allow the computer to communicate with the driver.

Click ⑧<Motor>, click ⑨<Read from Driver>, check ⑩<Motor Information> to determine whether the parameters have been imported correctly, click ⑪<Save>, and click ⑫<Save as Driver>. do.



● motor inspection

First, push the slider on the actuator to the middle position.



1 Click <Motor>, and click ②<Inspect>.

1

The screenshot shows the 'Motor' configuration window in the SERVOTRONIX software. The 'Verify' button is circled with a red '2'. The 'Motor Info' table is as follows:

Name	Value	Units
Motor Type	2	
Motor Commutation Type	0	
Motor Name	Parker_R7_1S_D_1	
Motor Peak Current	29.698	A
Motor Continuous Current	6.505	A
Motor Pitch	40	mm
Motor Maximum Speed	1000	mm/s
Motor Inductance	6.1	mH
Motor Resistance	4	Ohm
Motor Poles	2	poles
Force Constant for Linear Motor	16.405	N/A
Mass of Linear Motor Without Load	2.000	Kg
Motor Encoder Resolution	10000	Lines per pltt
Feedback Type	2	
Motor Encoder Type	6	

At the bottom, the status bar shows: Serial Current, Current 0.023 A, Velocity 0.000 mm/s, Position -2.000 counts.

2 If you click <OK>, the actuator will move slightly and the inspection will be completed.

The screenshot shows the same Motor configuration window, but with a warning dialog box open. The dialog box contains the following text:

Warning

During motor setup there should be no load on motor. Verify by enable the drive and move the motor at 80% of motor continuous current. Click OK to continue.

The 'OK' button is circled with a red '3'. The 'Motor Info' table is as follows:

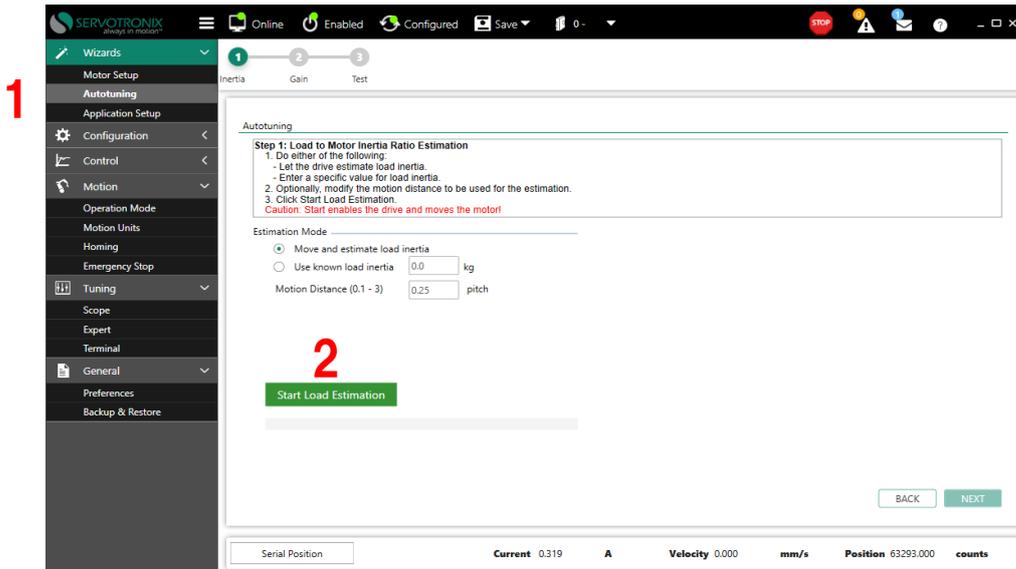
Name	Value	Units
Parker_Linear_D_1	2	
Motor Peak Current	29.698	A
Motor Continuous Current	6.505	A
Motor Maximum Speed	1000	mm/s
Motor Inductance	6.1	mH
Motor Resistance	4	Ohm
Motor Poles	2	poles
Motor Over-Temperature Mode	3	
Feedback Type	2	
Motor Encoder Type	6	
Motor Encoder Resolution	10000	Lines per pltt
Force Constant for Linear Motor	16.405	N/A
Mass of Linear Motor Without Load	2.000	Kg
Motor Pitch	40	mm

At the bottom, the status bar shows: Serial Current, Current 0.001 A, Velocity 0.000 mm/s, Position -88023.000 counts.

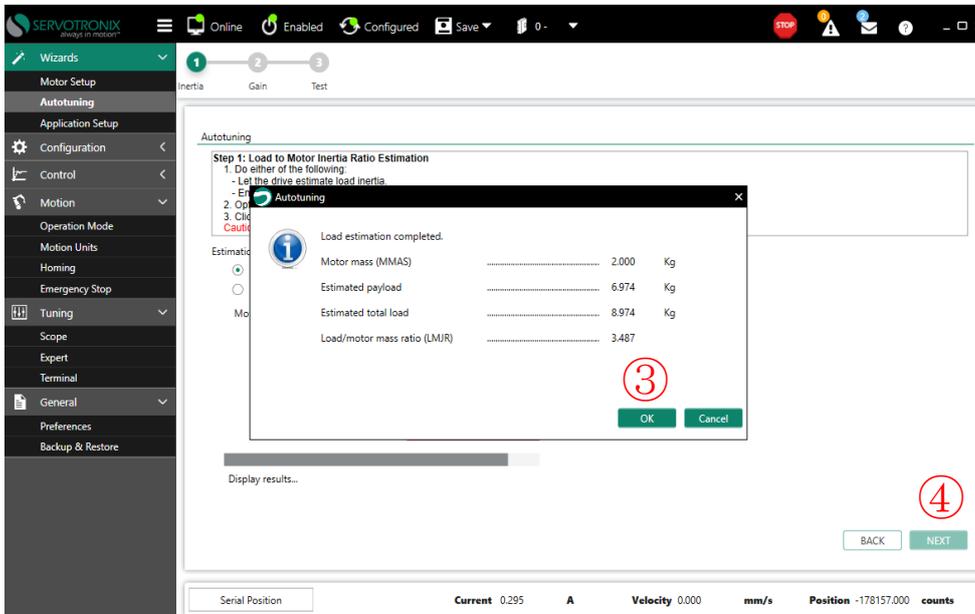
3.5 Commissioning

● auto tuning

1 Click <Auto Tuning>, and click ②<Start Load Estimation>.



2 Click <OK>, and click ④<Next>.



Depending on the actual usage situation, set ⑤<distance (encoder unit)>, ⑥<speed>, and ⑦<acceleration>.

⑧Click <Start Debugging> to allow the actuator to continue operating for a few minutes and then click ⑨<Next> when the settings are complete.

! Distance unit 1=1 μ m, acceleration unit 10000=1G

Autotuning

Step 2: Gain Optimization
 1. Use Negative and Positive to bring the load to a position from which it can move in both directions.
 2. Click Start Tuning.
 3. If necessary, adjust Move Command settings.
 Caution: Start Tuning enables the drive and moves the motor repeatedly!

Manual Move

Speed (mm/s) 5

Negative Positive

Move Command

Distance (encoder count) 3072000 ⑤

Speed (mm/s) 10 ⑥

Acceleration (mm/s²) 1000 ⑦

Start Tuning ⑧

Parameters

Name	Initial Value	Limit Value	Selected Value
HD Global Gain	0.7	3.000	
HD Current Filter Damping	45.000	90.000	
HD Current Filter Low Pass Rise Time	16.150	0.100	
HD Proportional Gain	12.520	75.200	
HD Derivative-Integral Gain	6.260	75.200	
HD Integral Gain	2.250	75.200	
HD Global Gain	0.000	0.000	

BACK NEXT ⑨

Serial Current Current 0.007 A Velocity 0.000 mm/s Position -1139107.000 counts

⑩Click <Save>.

Autotuning

Alternating

Target Position 40000 counts

Cruise Velocity 100.00 mm/s

Acceleration 5900.00 mm/s²

Show Traces ICMD V

Move and Plot

Softer response Stiffer response

See Less

HD Global Gain 0.10 1.00 2

HD Derivative-Integral Gain 7.73 150

HD Torque Filter 0.01 13.23 25

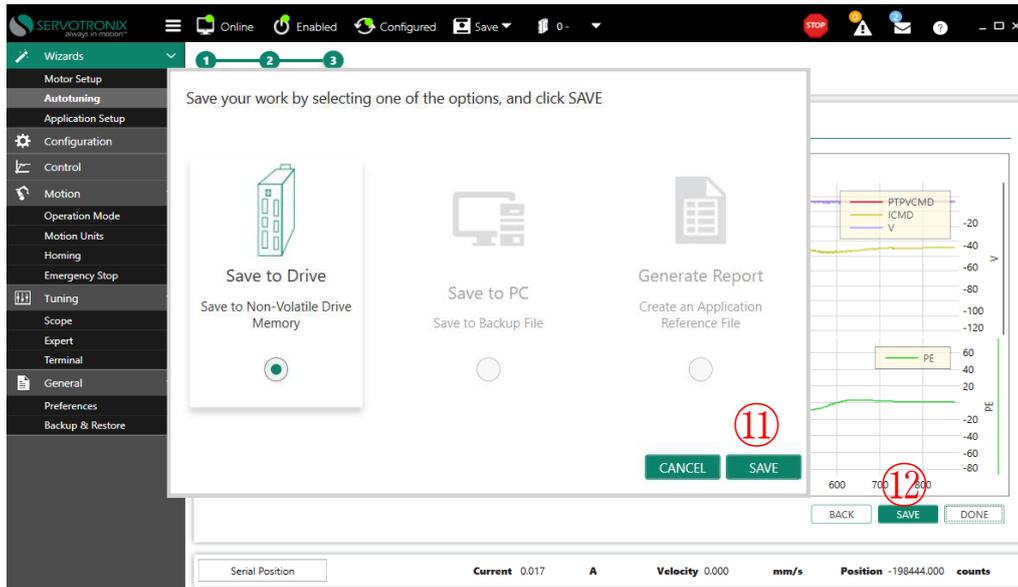
Position Command Moving 0.25 0.75 128

ICMD V PE

BACK SAVE ⑩ DONE

Serial Position Current 0.017 A Velocity 0.000 mm/s Position -198444.000 counts

Click ⑪<SAVE>, and click ⑫<Complete>.



● trial run

Click ①<Scope> and set ② to <Serial Position>,

③Set <Position>, <Velocity>, <Acc>, and <Dec>,

④Change the name in <Trigger Setup> to <V>, ⑤Change <Level> to <10>, ⑥Change <Pre-Points> to <10>.

⑦Select the variables to record in <Record Variables>.

! Confirm that the interface mode is <Serial/Pulse>, and refer to 3.6 for instructions.

! Position unit: 1counts=1 μ m Example) To move 10mm, enter 10000 counts.

! Common variables include:

PTPVCMD position command speed

PE position error

ICMD current command

V actual speed

The screenshot shows the SERVOTRONIX software interface. The sidebar menu on the left has 'Scope' highlighted with a red box and number 1. The main configuration area has 'Serial Position' selected in the 'Operation Mode' dropdown, highlighted with a red box and number 2. Below this, the 'Position' field is set to 50000 counts, Velocity to 100 mm/s, Acc to 5000.000 mm/s², and Dec to 5000.000 mm/s². A red box and number 3 highlights these fields. The 'Trigger Setup' section has 'Name' set to 'V' (red box 4), 'Level' set to 10 (red box 5), and 'Pre-Points' set to 10 (red box 6). The 'Record Variables' table has 'PTPVCMD' and 'PE' checked (red box 7).

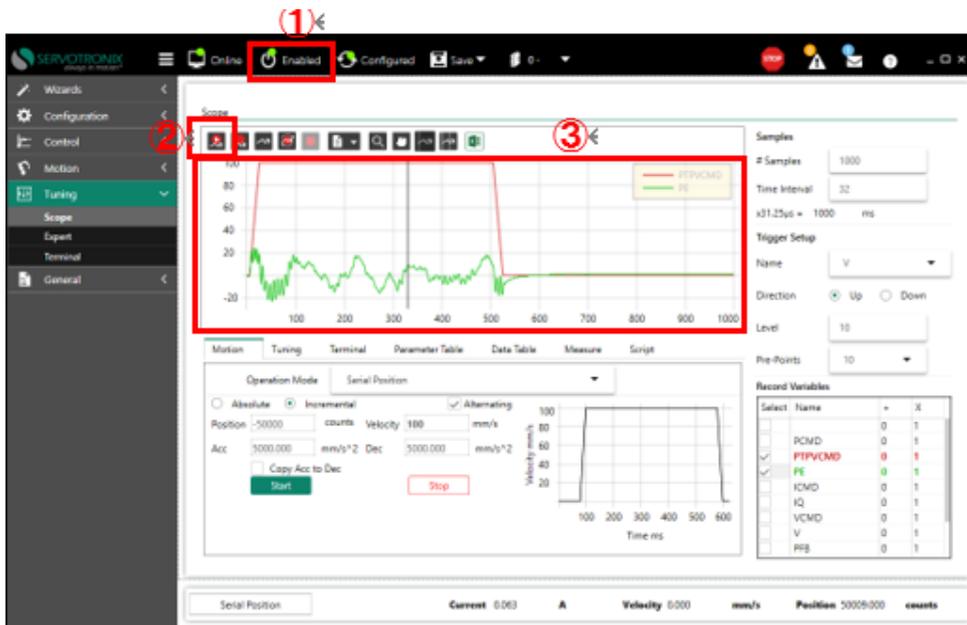
Select	Name	Y	X
<input type="checkbox"/>	PCMD	0	1
<input type="checkbox"/>	PE	0	1
<input checked="" type="checkbox"/>	PTPVCMD	0	1
<input type="checkbox"/>	ICMD	0	1
<input type="checkbox"/>	IQ	0	1
<input type="checkbox"/>	VCMD	0	1
<input type="checkbox"/>	V	0	1
<input type="checkbox"/>	PFB	0	1

● Waveform acquisition

- 1  When you click , the button changes to <Start> and then the driver is activated.
- ②  When you click , the actuator starts operating, and when operation is completed,
- ③ <Waveform display> is displayed.

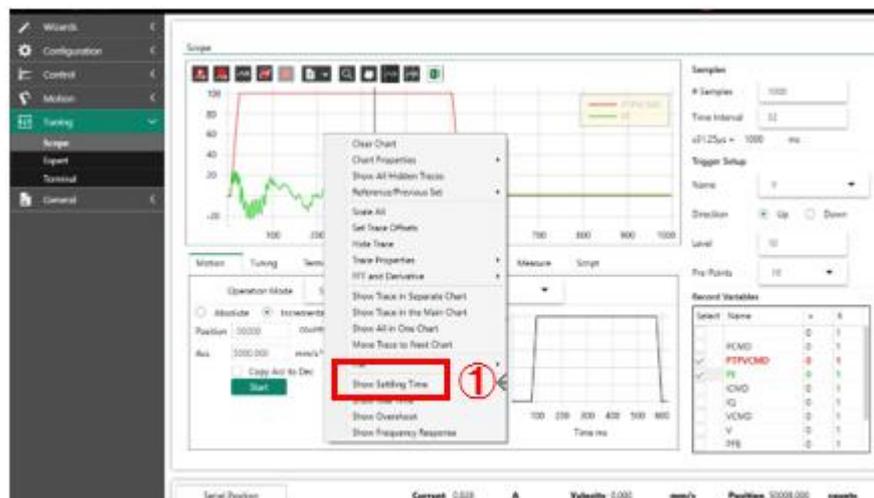
! It is normal for the actuator to emit an electromagnetic sound after activation.

! When you are finished driving, be sure to turn it off for safety reasons.



● Settling Time Analysis

Place the mouse at a random location on the oscillogram, right-click, and select ①<Show Settling Time>.



- ① Set <PVPVCMD> in <Command>, and select <PE> in ②<Response>.
- ③Set the position accuracy error (unit μm) in <Acceptable Range>, and click ④<Show>.
- ⑤The required settling time is displayed in <Setting Time>.

Example) If Acceptable Range is set to 5 and Setting Time is displayed as 95, it indicates that the position accuracy error is within $5\mu\text{m}$ and the required settling time is 0.095 seconds.

The screenshot displays a software interface with a 'Settling Time' dialog box. The dialog box contains the following fields and buttons:

- Command:** PVPVCMD (indicated by a red box and circled '1')
- Response:** PE (indicated by a red box and circled '2')
- Acceptable Range:** 5 (indicated by a red box and circled '3')
- Settling Time:** 5 (indicated by a red box and circled '5')
- Show:** A green button (indicated by a red box and circled '4')
- Stop:** A red button

The background interface includes a 'Scope' window with two traces: PVPVCMD (red) and PE (green). The PE trace shows a signal that stabilizes around 100. The 'Record Variables' table on the right lists various variables:

Select	Name	+	X
<input type="checkbox"/>	PVID	0	1
<input type="checkbox"/>	PVPVCMD	0	1
<input checked="" type="checkbox"/>	PE	0	1
<input type="checkbox"/>	ICMD	0	1
<input type="checkbox"/>	IQ	0	1
<input type="checkbox"/>	VCMD	0	1
<input type="checkbox"/>	V	0	1
<input type="checkbox"/>	PFB	0	1

At the bottom of the interface, there are status indicators: Serial Position, Current 0.028 A, Velocity 0.000 mm/s, and Position 50009.000 counts.

● Gain Tuning

In principle, debugging can be completed through <Auto Tuning>, and the stiffness can be fine-tuned to bring the actuator to the best condition.

! Debugging tips:

By adjusting the stiffness level, you can increase the responsiveness of the actuator or suppress module vibration and noise.

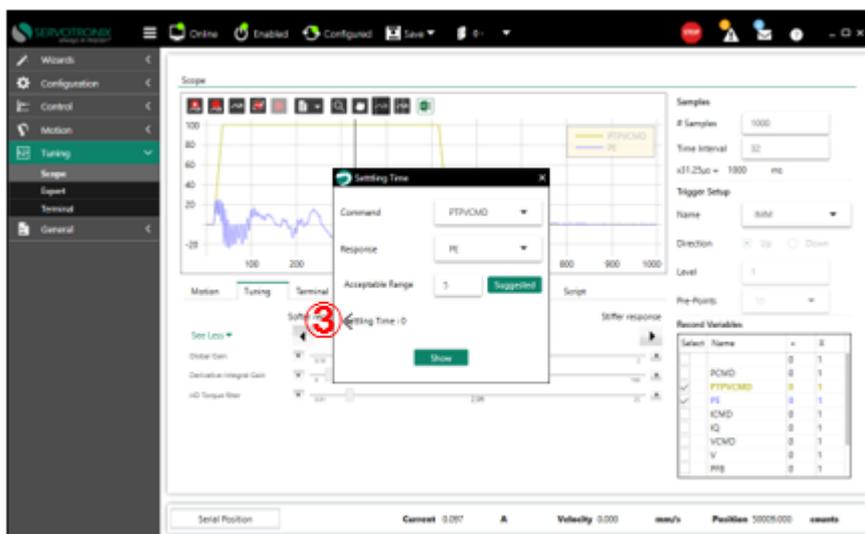
- 1 Click <Tuning> to set ②<Gain Level>.



● Check debugging results

After collecting the waveform again, the settling time is analyzed.

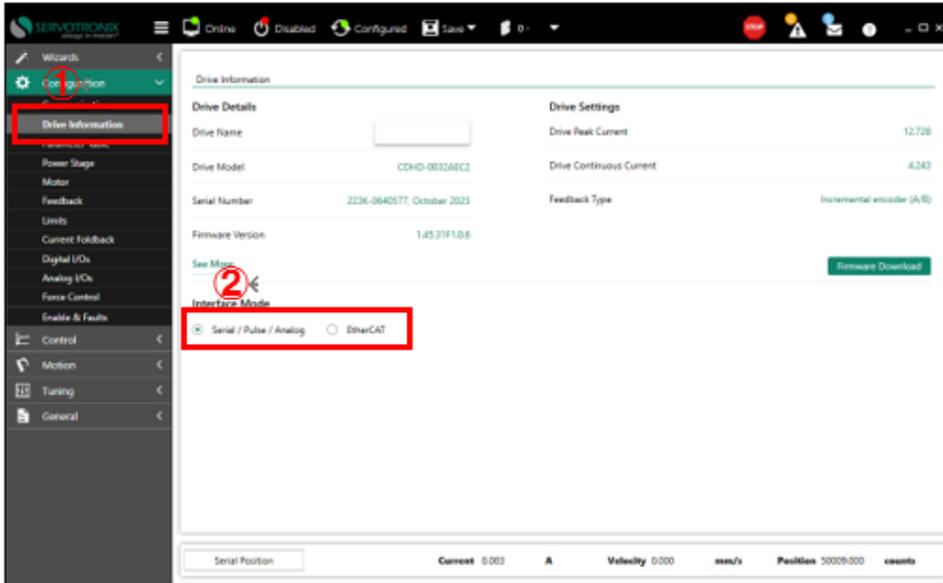
Example) After increasing the rigidity level, the positioning accuracy error is within 5 μm , and the required correction time has been changed from 0.095 seconds to 0 seconds.



3.6 Control

● Select mode

1 Click <Drive Information> and select ②<Interface Mode> as <Serial/Pulse>.

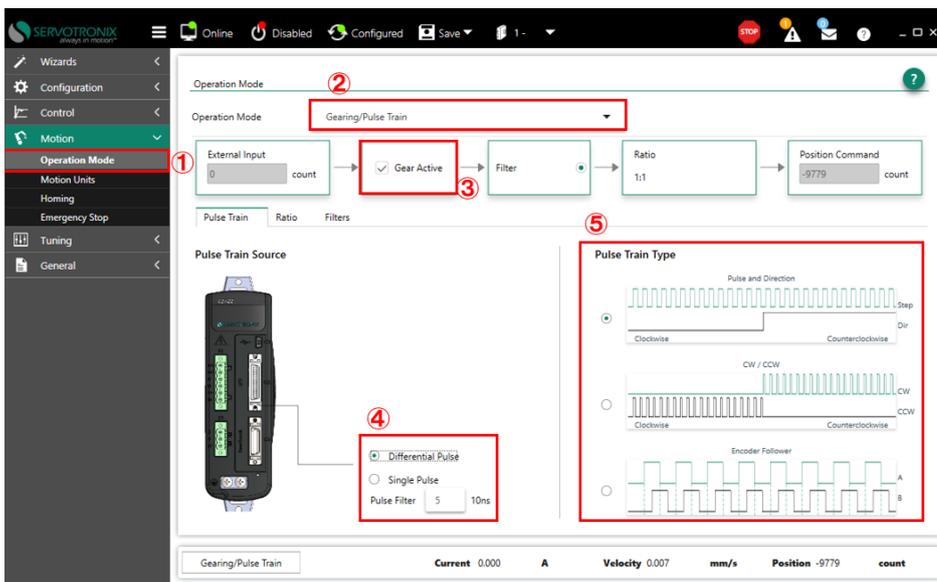


● Pulse mode settings

Click ①<Work Mode>, select ②<Electrical Device/Pulse Train>, and check ③<Electrical Enabled>.

Select ④<Pulse Train Source> (differential pulse or single-ended pulse) according to the host computer,

⑤Select <Pulse Train Type>.

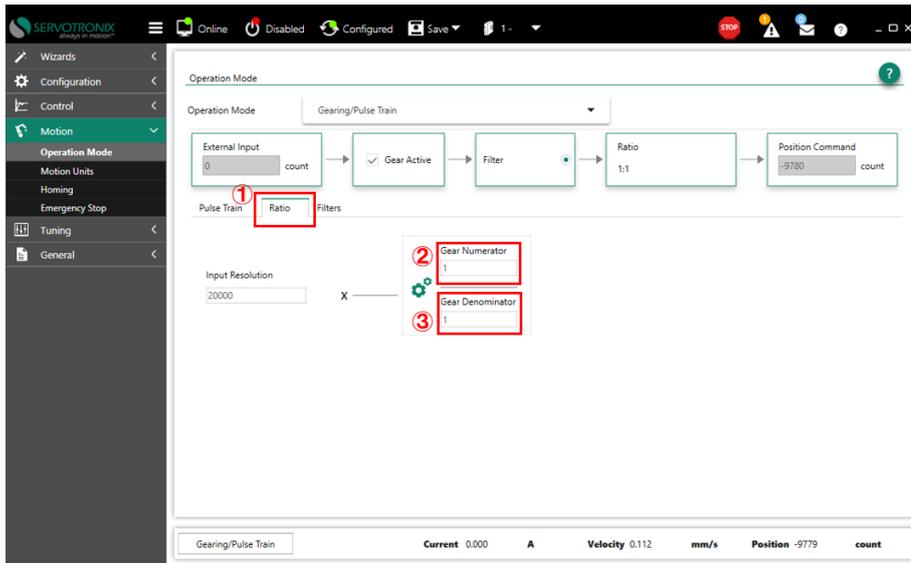


● Electronic gear ratio settings

Click ①<Ratio> to set ②<electronic gear numerator> and ③<electronic gear denominator>.

Formula: Actual travel distance = command pulse x (electronic gear numerator/electronic gear denominator) x 0.001mm

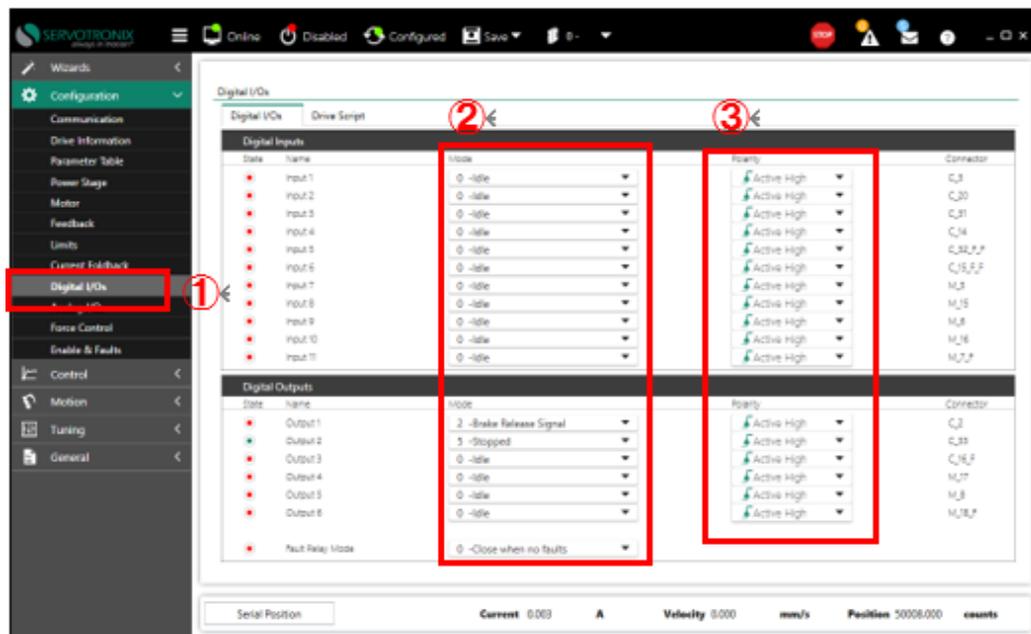
! Be sure to press the Enter key after setting the parameters.



● I/O settings

Click ①<Digital I/O> to set ②<Mode> and ③<Polarity>.

! Polarity <High level valid> is NPN mode.



● Change of driving direction

① Click <Tuning>, enter dir in ②<Terminal>, then press Enter to check ③<Result>.

③If <Result> is 0, enter dir 1 in ②<Terminal>.

③If <Result> is 1, enter dir 0 in ②<Terminal>.

②Enter mphase in <Terminal>, then press the Enter key to check ④<Result>.

④If <result> is less than 180, add 180 to this result,

④If <result> is greater than or equal to 180, 180 is subtracted from this result.

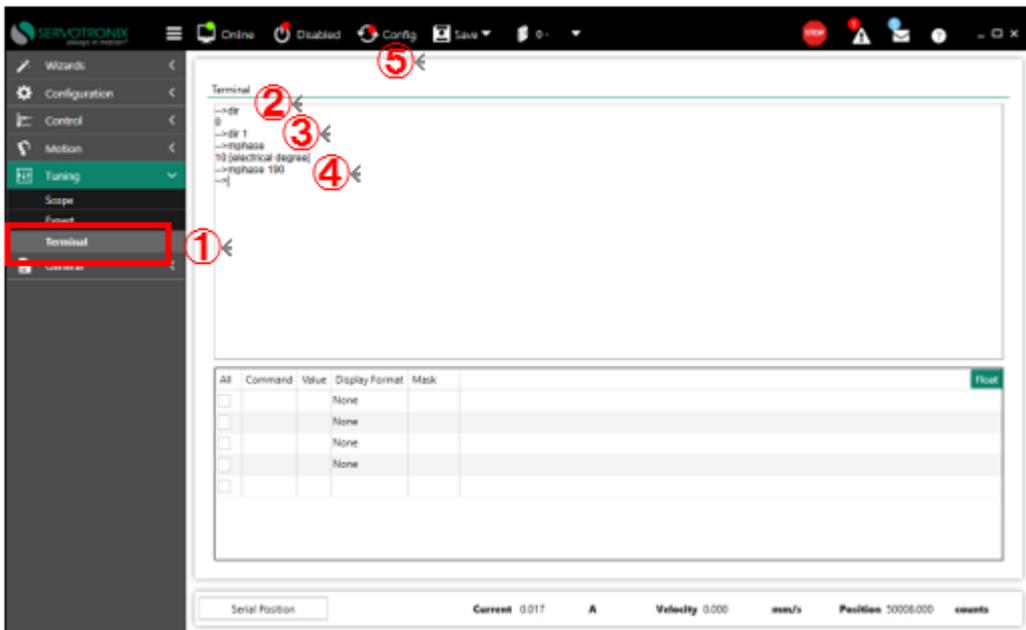
Example) If ④<result> is 0, enter mphase 180 in ②<dialog window>.

④If <result> is 210, enter mphase 30 in ②<dialog window>.

⑤Click <config>.

! Type dir or mphase, followed by a space, then a number. Otherwise, an error will occur.

! These two variables, dir and mphase, must be changed at the same time. Otherwise, motor runaway will occur.



● Power-on activation settings

① Click <Activation and Troubleshooting> and check ② <Automatically Activate after Power On>.

! If you do not control the driver's operation with a higher-level computer, remove <Automatic activation after power on> and set <Remote activation> in ② <Mode> in <Digital I/O> to Idle. Otherwise it cannot be activated.

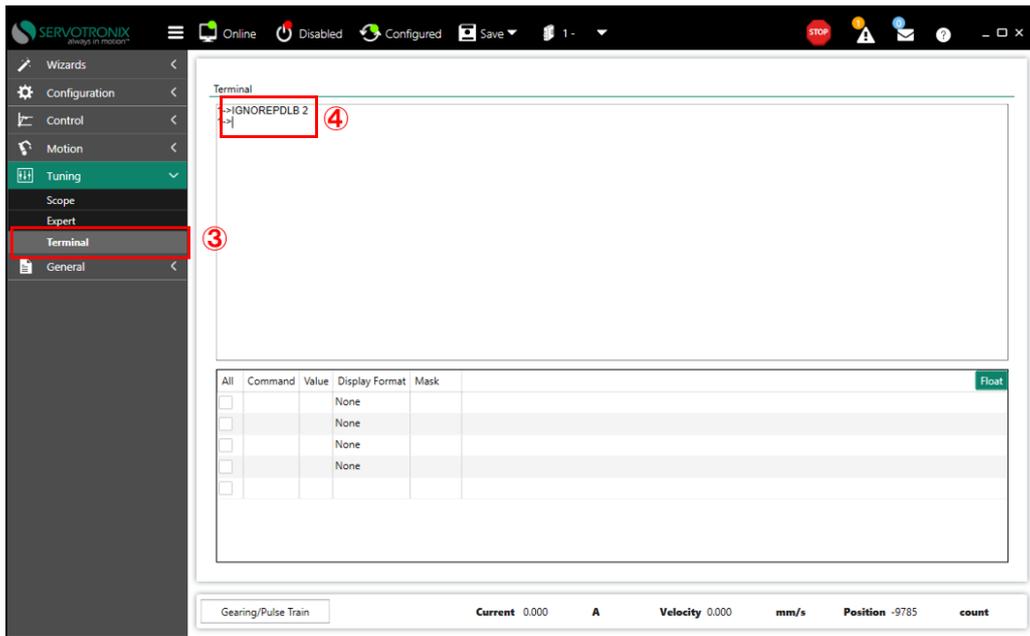
The screenshot shows the 'Enable & Faults' configuration window in the SERVOTRONIX software. The left sidebar has 'Enable & Faults' selected. The main area contains a logic diagram with 'Clear Fault', 'Software Enable', 'Remote Enable', 'Ready', and 'Active' blocks connected by 'And' gates. A red box highlights the 'Software Enable on Power-Up' checkbox, which is checked. Below the diagram is a 'Faults & Warnings' table:

Icon	Display	Fault Name	Description	Action Required
?		Drive Inactive		
?		No SW enable		
!	PF	Phase Find Required	Phase difference is required to initialize the commutation angle.	

At the bottom, the status bar shows: Gearing/Pulse Train, Current 0.000 A, Velocity 1.499 mm/s, Position -9779 count.

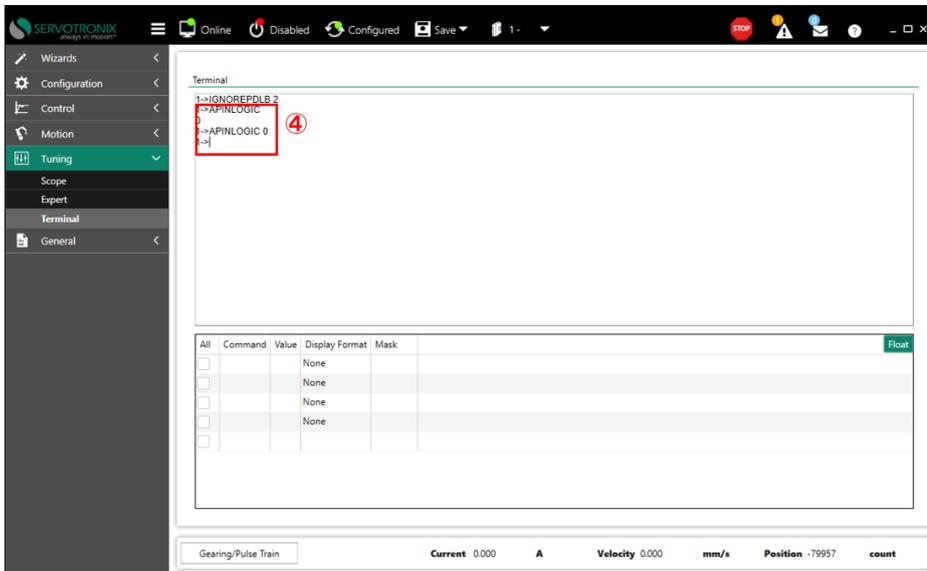
! When in differential pulse mode, the driver checks the level status of the differential pulse, and when the pulse line is not connected, the driver sounds the R25 alarm. The operation method to block the alarm is as follows.

③ Click <Terminal>, enter IGNOREPDLB 2 in ④ and press the Enter key.



! When the pulse train type is CW/CCW pulse mode, the driver's inability to receive pulses can be resolved as follows:

Enter APINLOGIC 0 (or 1) in ④ and press the Enter key.

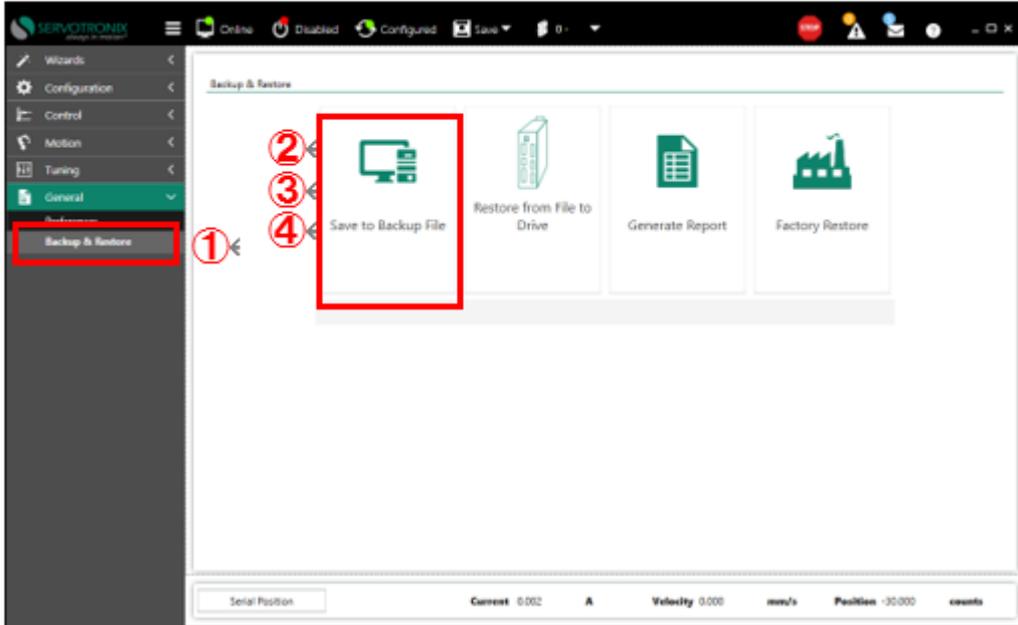


3.7 Parameter backup & parameter recovery

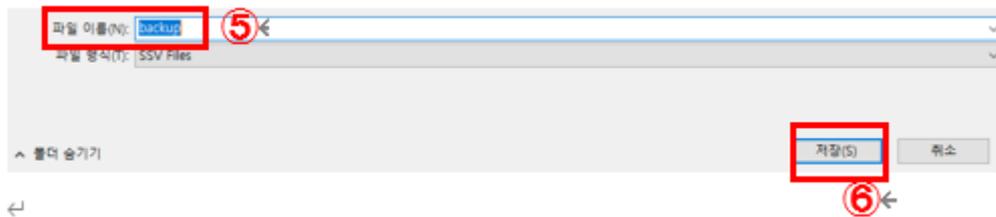
● Parameter backup

Click ①<Backup & Restore>, click ②<Save>, then click ③<Save to Driver>.

2 Click <Save to backup file>.



Enter the file name in ⑤ and click ⑥<Save>.



● Parameter recovery

For recovery method, please refer to <3.4 Importing Motor Parameters>.

The differences are as follows:

1. The parameter pack is changed to the saved parameter pack.
2. No need to do motor inspection.