

MiSUMi

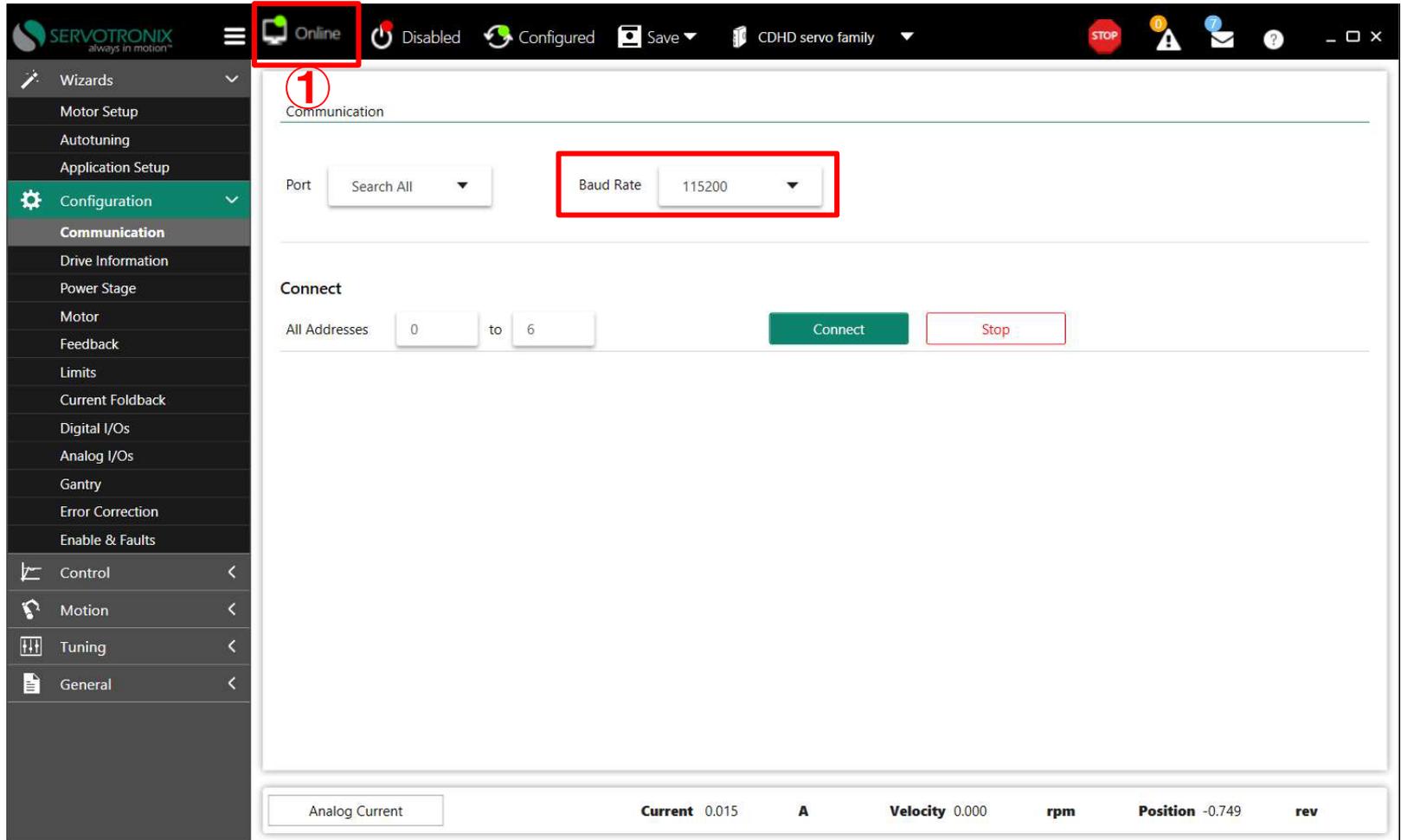
Linear Motor Actuator

SetUp Manual

Rev.1

2024-04-24
IM Division
Motion Unit Team

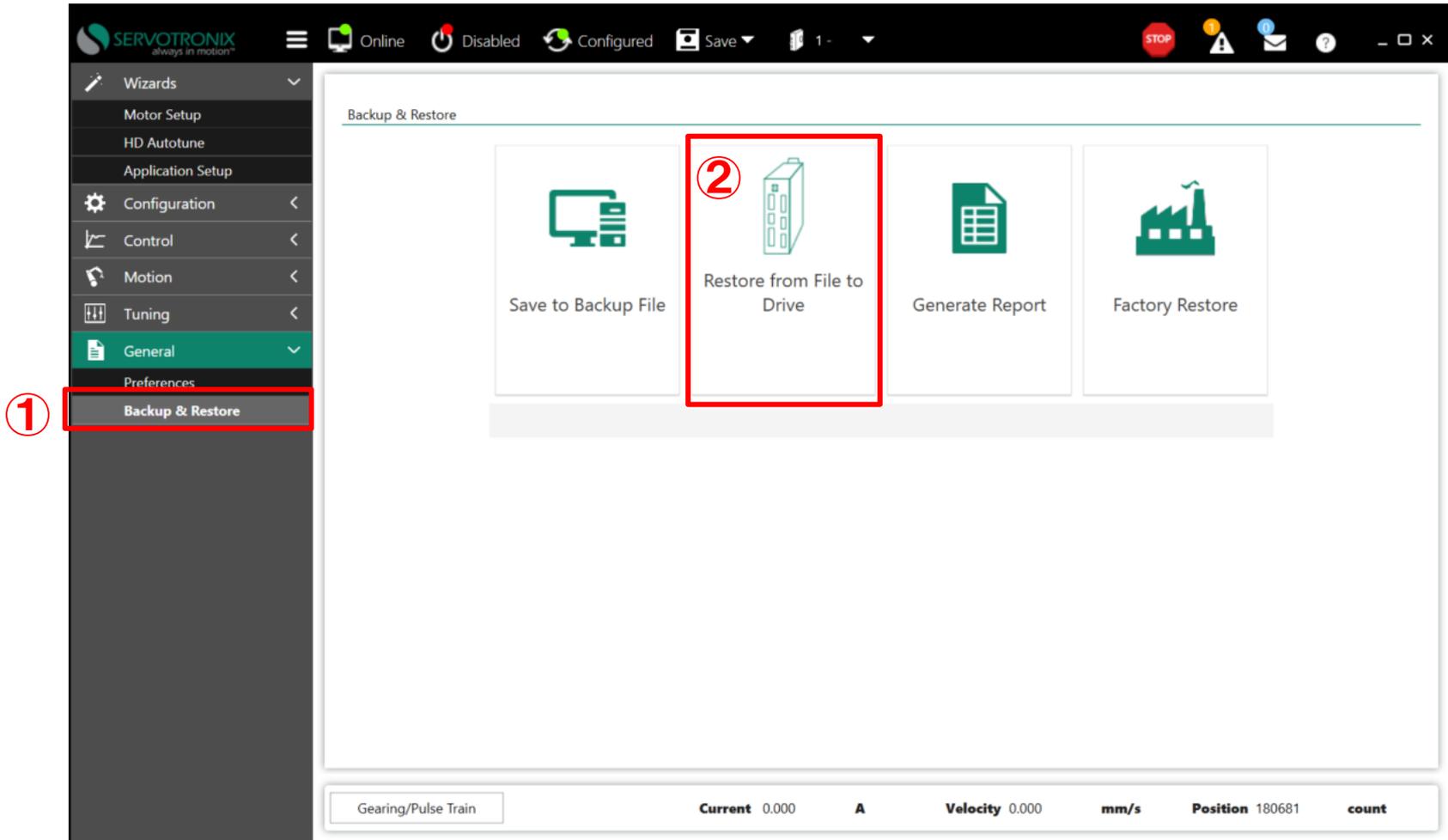
- ① 드라이브 전원을 켜고 Offline→Online으로 변경되는지 확인
- ※ Offline→Online으로 변경 안될 경우 연결된 시리얼포트 확인 및 Baud Rate값이 동일한지 확인



The screenshot displays the SERVOTRONIX software interface. The top status bar shows the system is 'Online'. The left sidebar is expanded to 'Configuration', with 'Communication' selected. The main window shows the 'Communication' configuration page. A red box highlights the 'Online' status in the top bar. Another red box highlights the 'Baud Rate' dropdown menu, which is currently set to '115200'. Below the communication settings, there is a 'Connect' section with 'All Addresses' set from 0 to 6, and 'Connect' and 'Stop' buttons. At the bottom, a status bar displays 'Analog Current', 'Current 0.015 A', 'Velocity 0.000 rpm', and 'Position -0.749 rev'.

파라미터 Restore

- ①, ②를 순서대로 클릭

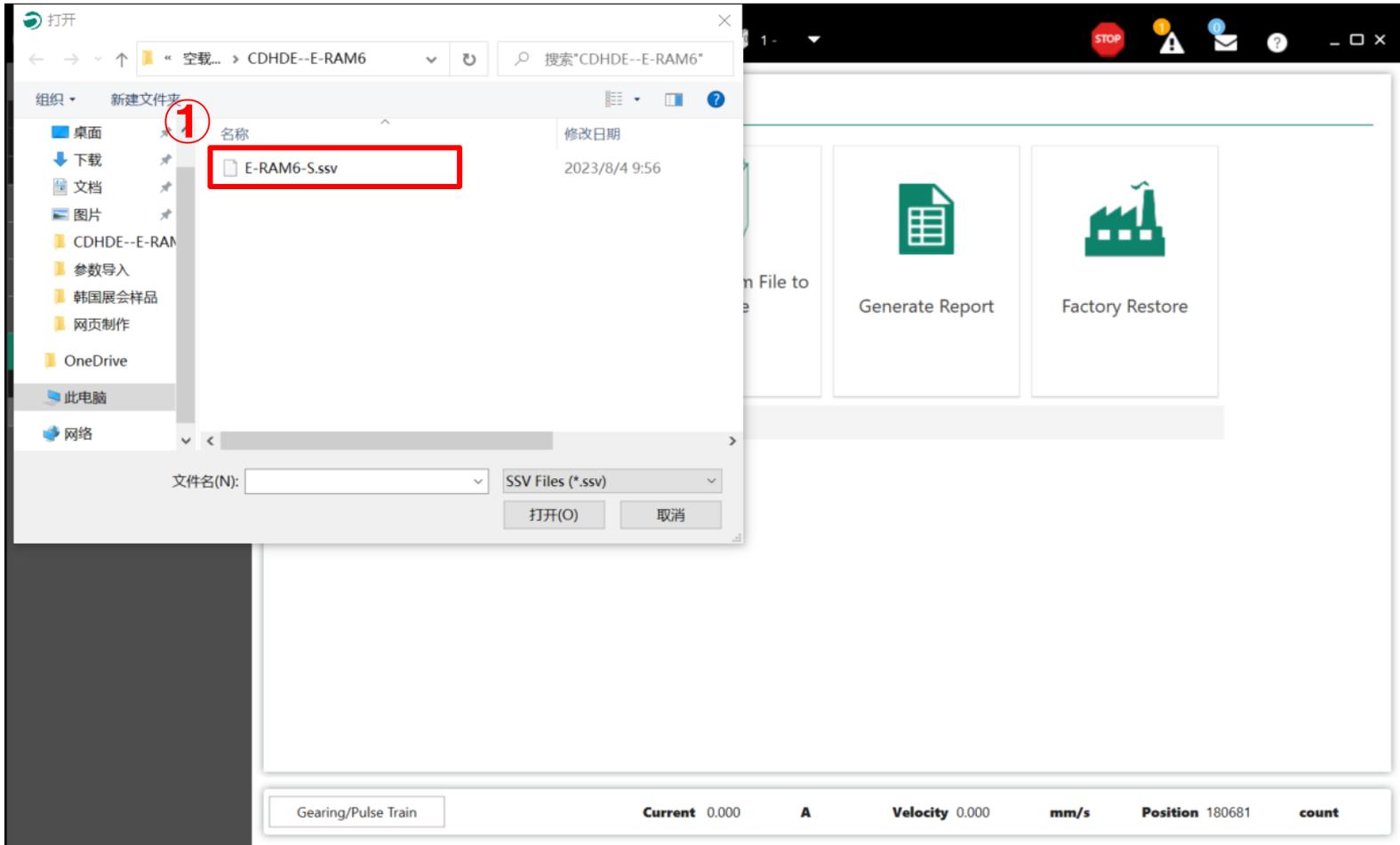


파라미터 Restore

- 제공된 ①기본 파라미터 파일을 선택

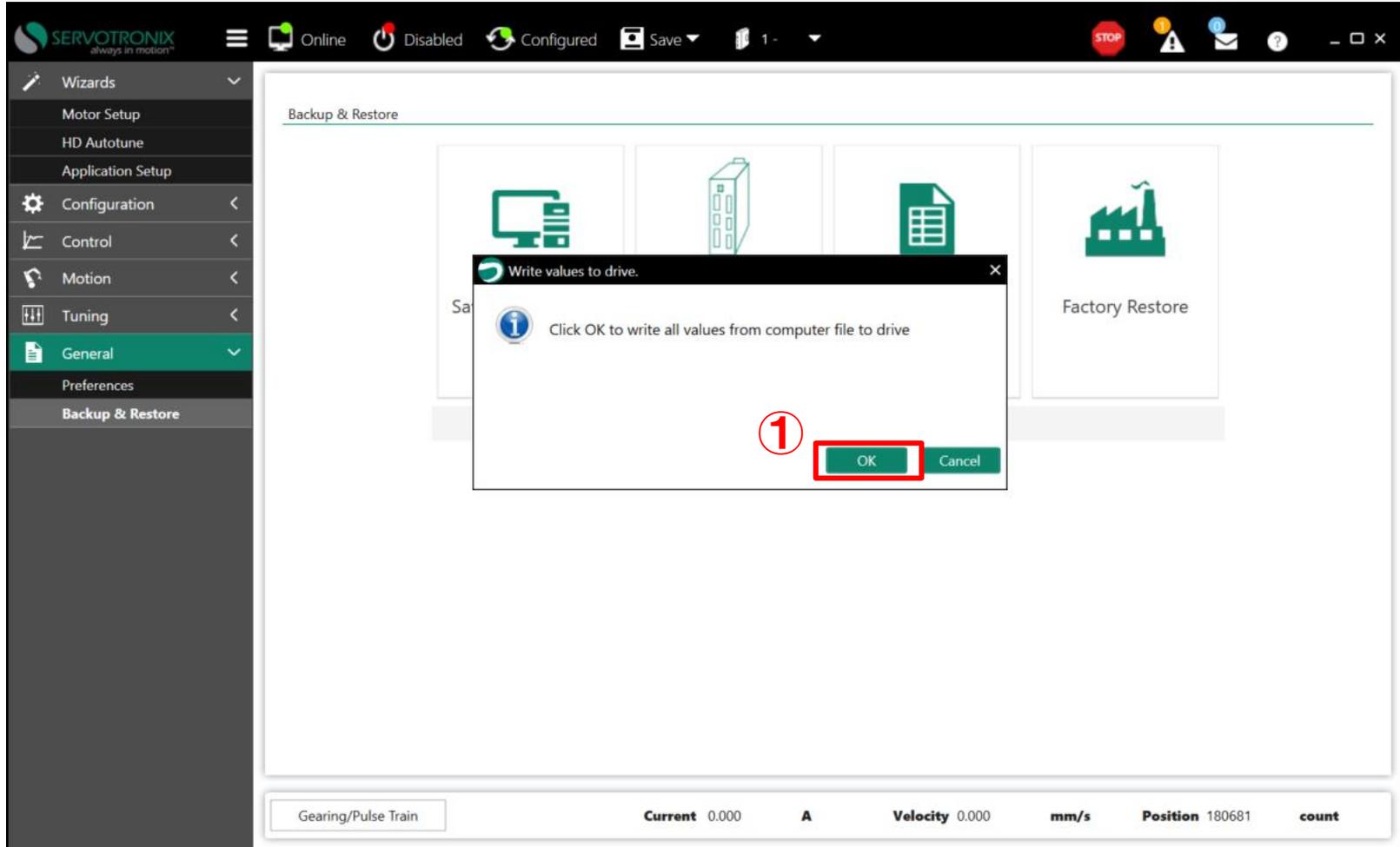
※ 아래 예시는 리니어모터AC : E-RAM6-S, 드라이브 : EA45 를 사용

※ 모터와 드라이브를 확인하고 형번에 맞는 파일을 선택하여 다운로드해야 모터 정상 동작



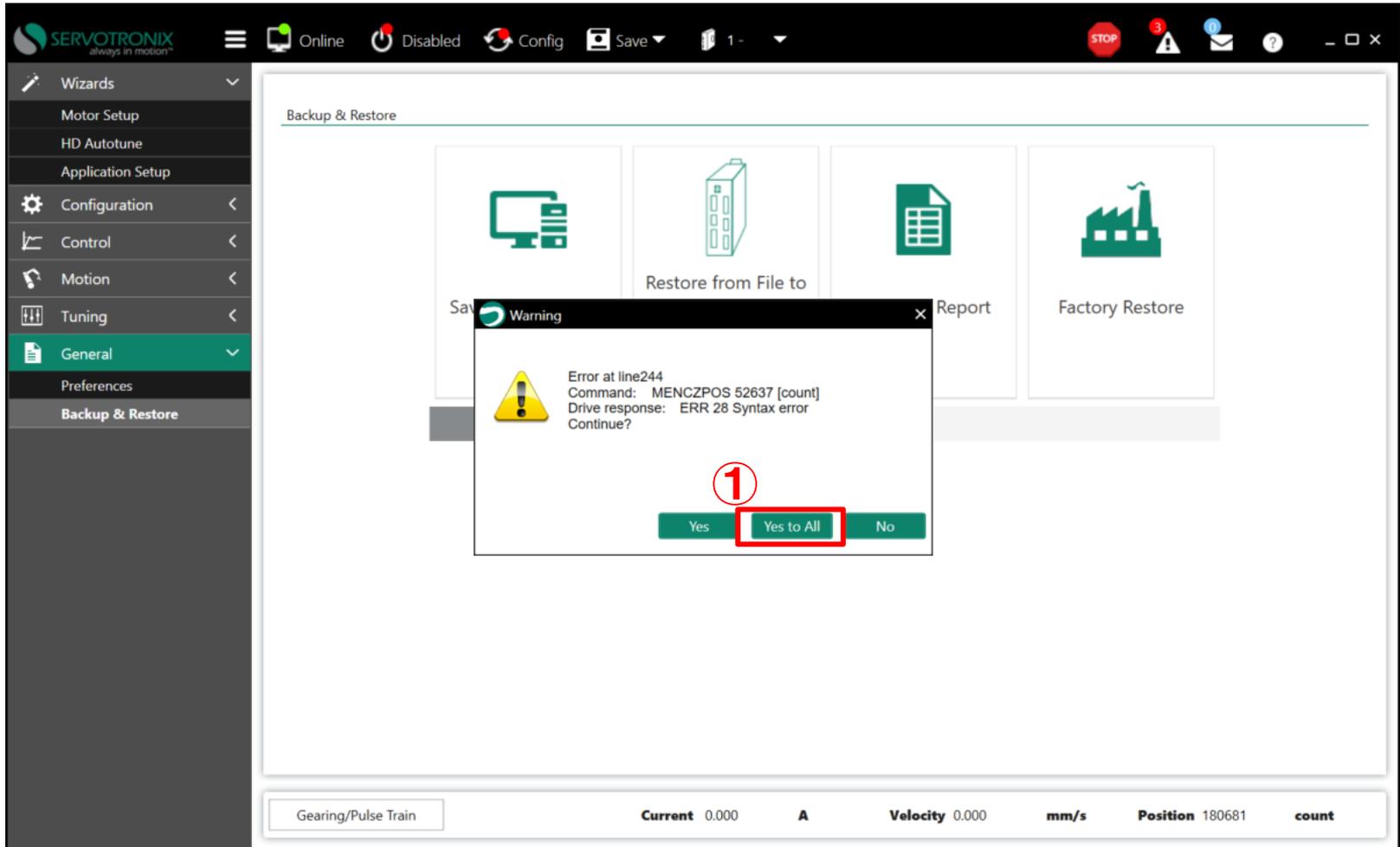
파라미터 Restore

- ① OK를 클릭해서 드라이브에 다운로드 진행



파라미터 Restore

- ①을 클릭하여 계속 진행



The screenshot shows the SERVOTRONIX software interface. The top bar includes the logo and status indicators: Online, Disabled, Config, Save, and a dropdown menu showing '1'. The left sidebar lists various settings categories, with 'Backup & Restore' selected. The main area displays the 'Backup & Restore' screen with options for 'Restore from File to' and 'Factory Restore'. A 'Warning' dialog box is overlaid on the screen, displaying the following text:

Warning

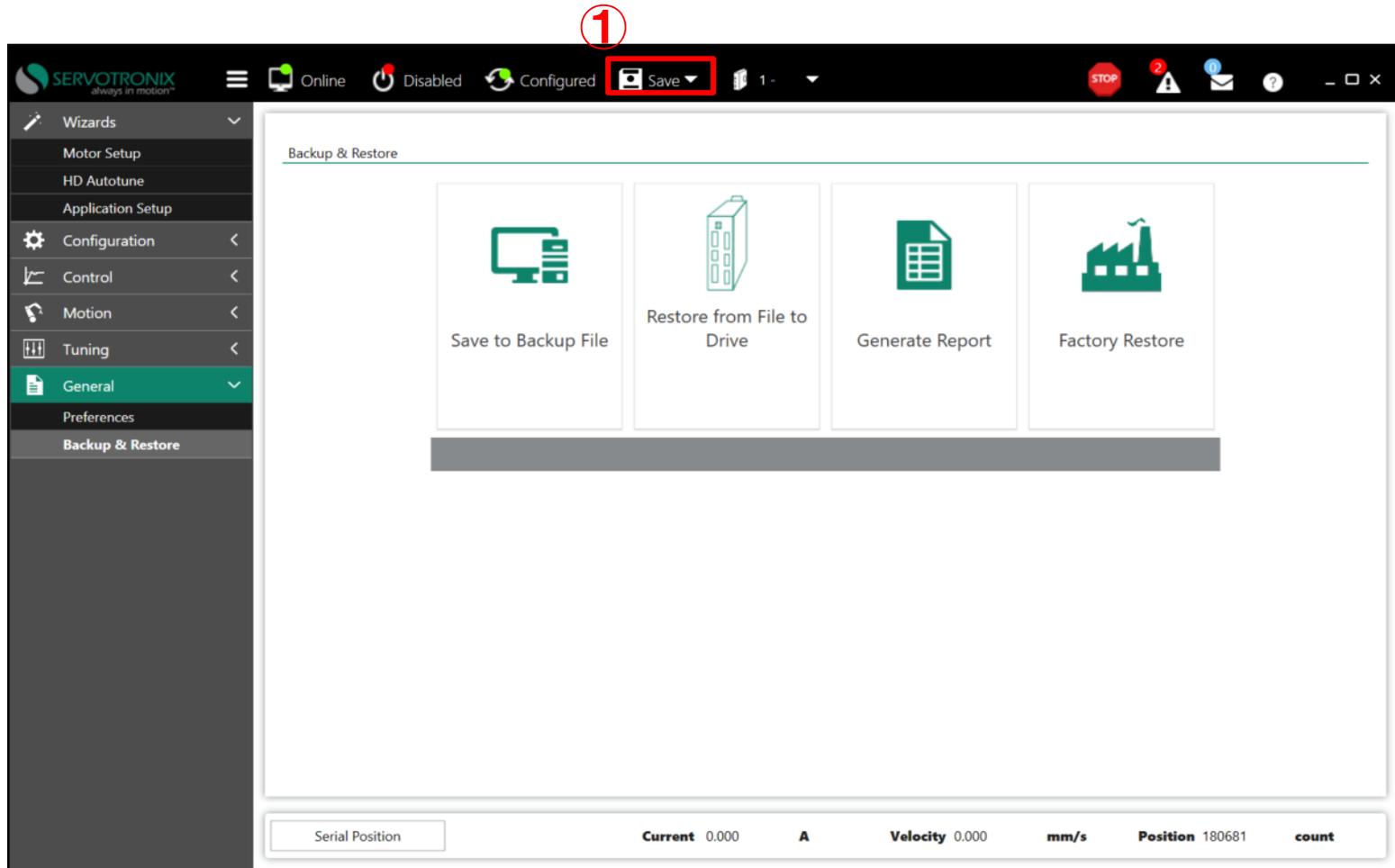
Error at line244
Command: MENCZPOS 52637 [count]
Drive response: ERR 28 Syntax error
Continue?

The dialog box has three buttons: 'Yes', 'Yes to All', and 'No'. The 'Yes to All' button is highlighted with a red circle and a '1' inside it, indicating the action to be taken.

At the bottom of the interface, there is a status bar showing 'Gearing/Pulse Train' and various parameters: Current 0.000 A, Velocity 0.000 mm/s, and Position 180681 count.

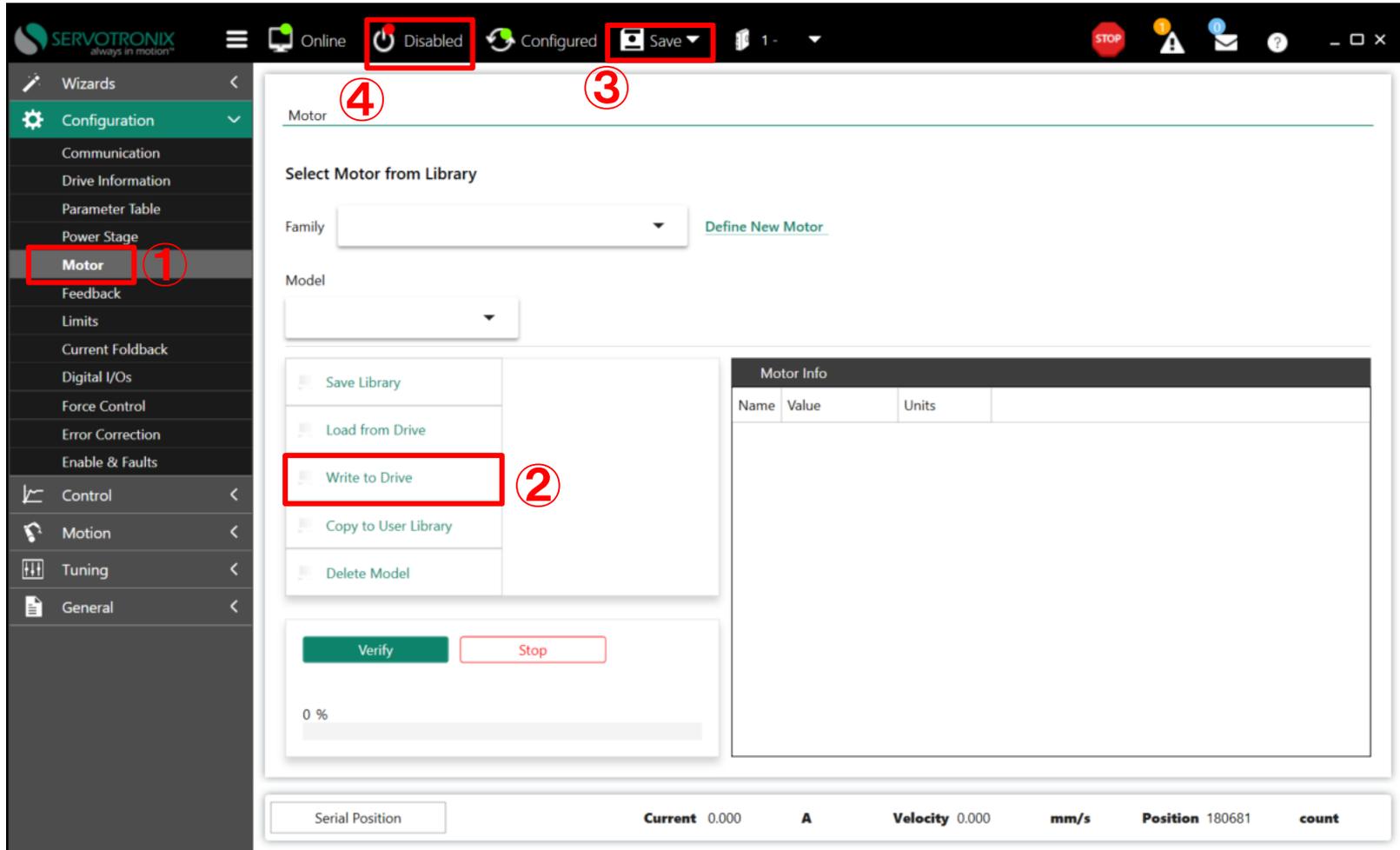
파라미터 Restore 후 Save

- 다운로드가 끝나면 ①을 선택하여 Save to Drive를 클릭하여 드라이브에 저장
- 이후 드라이브 전원 OFF진행



모터 파라미터 입력

- 전원을 다시 투입하여 ① → ② → ③ → Save to Drive → ④ 를 순서대로 클릭



The screenshot displays the SERVOTRONIX software interface. The top status bar shows 'Online', 'Disabled', 'Configured', and 'Save'. The left sidebar contains a menu with 'Motor' highlighted and circled with a red '1'. The main window shows the 'Motor' configuration page with a 'Write to Drive' button circled with a red '2'. A 'Save' button in the top bar is circled with a red '3'. The 'Motor Info' table is empty. At the bottom, a status bar shows 'Current 0.000 A', 'Velocity 0.000 mm/s', and 'Position 180681 count'. A 'Serial Position' input field is also visible.

Motor Info			
Name	Value	Units	

Serial Position Current 0.000 A Velocity 0.000 mm/s Position 180681 count

- ①을 클릭하여 Disabled, 지금까지 모터의 데이터 저장이 완료됨

The screenshot shows the SERVOTRONIX software interface. The top status bar indicates the system is 'Enabled', with a red box and a circled '1' highlighting the power icon. The left sidebar shows the 'Configuration' menu expanded to 'Motor'. The main area is titled 'Motor' and contains a 'Select Motor from Library' section with 'Family' and 'Model' dropdown menus. Below these are buttons for 'Save Library', 'Load from Drive', 'Write to Drive', 'Copy to User Library', and 'Delete Model'. A 'Verify' button and a 'Stop' button are also present. The 'Motor Info' table is empty. The bottom status bar shows 'Serial Position', 'Current 0.006 A', 'Velocity 0.000 mm/s', and 'Position 180697 count'.

Motor Info			
Name	Value	Units	

Serial Position Current 0.006 A Velocity 0.000 mm/s Position 180697 count

셋업 후 구동테스트

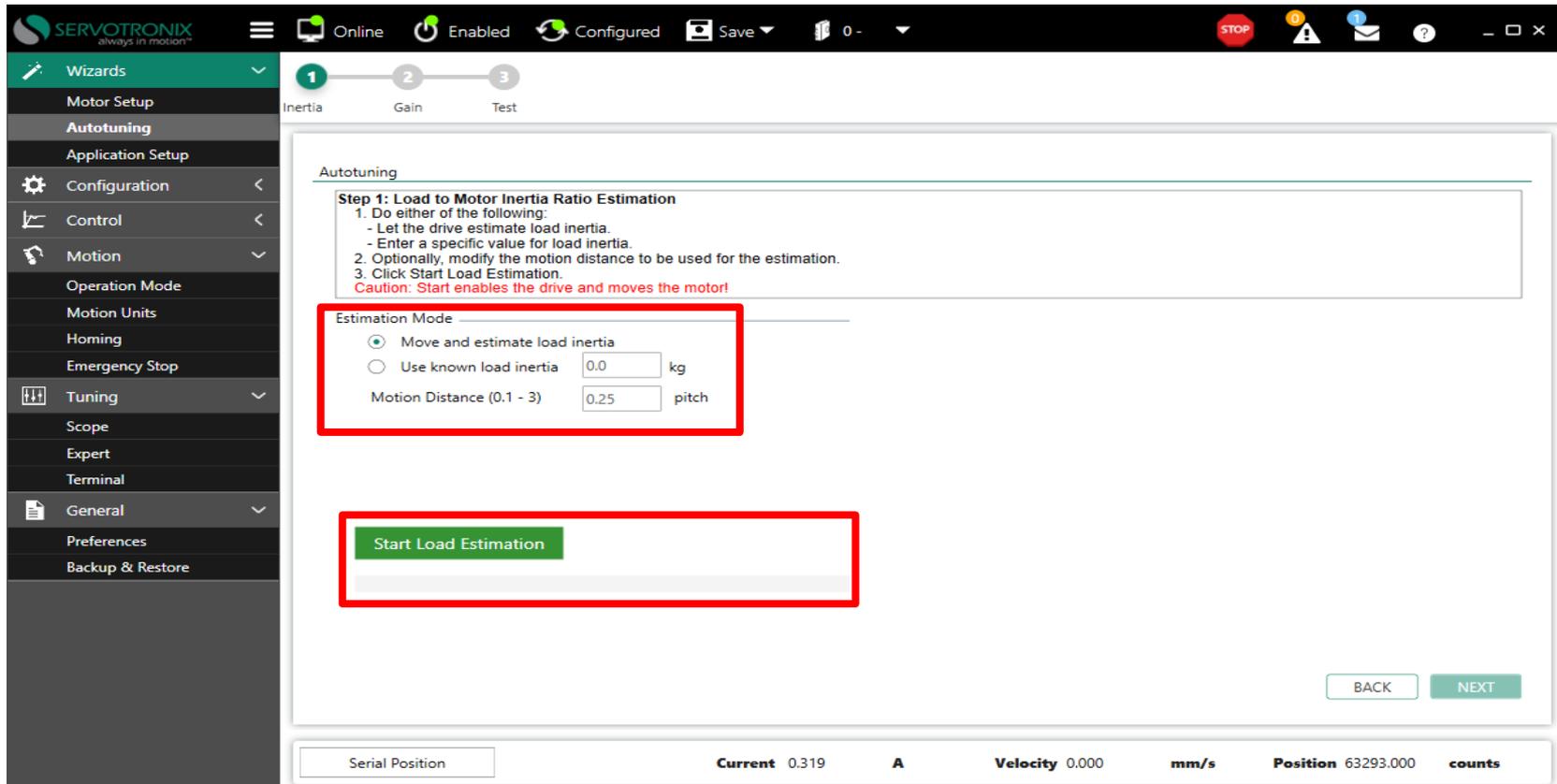
- 셋업 완료 후 이상이 있는지 확인하기 위해 시운전 테스트 진행
- 이때 리니어 액츄에이터의 가동자는 가운데 위치해야 함
- ①→② (이동거리:50,000count 설정, 50mm) →③ (속도 : 200mm/sec 설정) →④→⑤
- (클릭하여 Enabled로 변경) →⑥
- 순서대로 Step이동하여 구동확인.

The screenshot shows the SERVOTRONIX software interface. The top bar includes a power button labeled 'Disabled' (circled 5), 'Configured', and 'Save'. The left sidebar has 'Scope' highlighted (circled 1). The main area shows motion control parameters: Position 50000 (circled 2), Velocity 200 (circled 3), and a 'Start' button (circled 6). A velocity profile graph shows a trapezoidal shape. The 'Record Variables' table is visible (circled 4):

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

The status bar at the bottom shows: Serial Position, Current 0.000 A, Velocity 0.000 mm/s, Position 180697, count.

- Motor의 기본 Setup 및 단동 구동까지 진행 완료 하였으며 튜닝이 필요할 경우 튜닝 진행
- Wizards → Auto Tuning을 들어가게 되면 Auto Tuning 가능
- 페이로드를 모를 경우 Move and estimate load inertia의 앞에 박스를 체크하면 Auto Tuning을 진행하면서 자동으로 페이로드를 찾아 주기 때문에 페이로드를 몰라도 상관없음
- 페이로드를 알 경우 페이로드와 Motion Distance를 입력 후 "Start Load Estimation을 Click"하면 자동으로 페이로드 및 무게를 찾아줌



Step 1: Load to Motor Inertia Ratio Estimation

1. Do either of the following:
 - Let the drive estimate load inertia.
 - Enter a specific value for load inertia.
2. Optionally, modify the motion distance to be used for the estimation.
3. Click Start Load Estimation.

Caution: Start enables the drive and moves the motor!

Estimation Mode

- Move and estimate load inertia
- Use known load inertia kg
- Motion Distance (0.1 - 3) pitch

Start Load Estimation

Serial Position Current 0.319 A Velocity 0.000 mm/s Position 63293.000 counts

- 페이로드 및 무게 측정 완료 된 후에는 팝업창에서 OK 버튼을 Click 후 Next 버튼을 Click 하여 다음 Step이동.

Autotuning

Step 1: Load to Motor Inertia Ratio Estimation

1. Do either of the following:

- Let the drive estimate load inertia.
- Enter the load inertia manually.

2. OK

3. Cancel

Caution

Estimated motor mass (MMAS)	2.000	Kg
Estimated payload	6.974	Kg
Estimated total load	8.974	Kg
Load/motor mass ratio (LMJR)	3.487	

Display results...

Serial Position **Current** 0.295 **A** **Velocity** 0.000 **mm/s** **Position** -178157.000 **counts**

- Speed , Distance , Acceleration 을 입력 후, Start Tuning 클릭시 자동으로 Auto Tuning 진행
- Auto Tuning 이 진행되면 Motor가 구동 되면서 우측에 Gain값들이 자동으로 변경.

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)

Negative Positive

Move Command

Distance (encoder count)

Speed (mm/s)

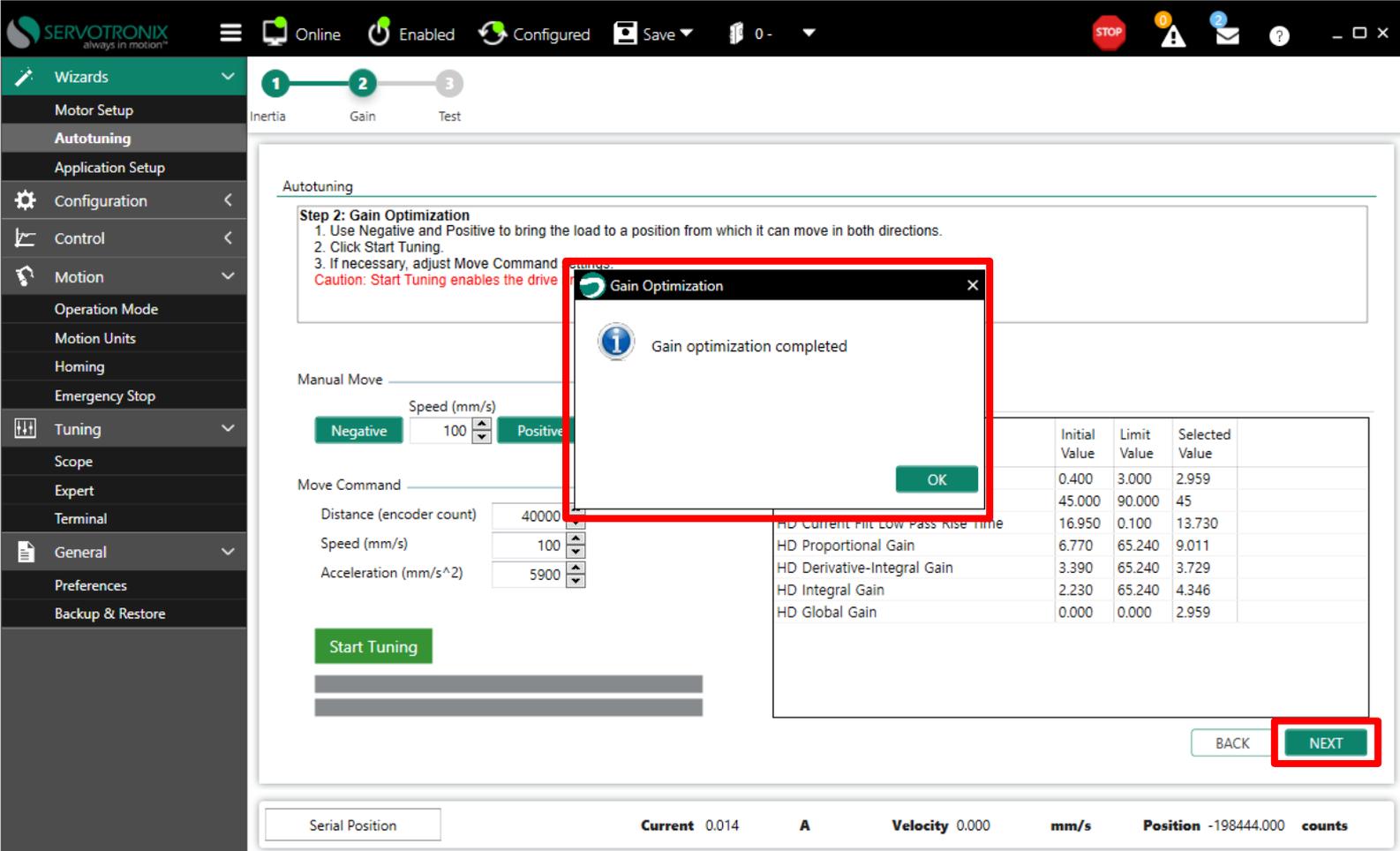
Acceleration (mm/s²)

Parameters

Name	Initial Value	Limit Value	Selected Value
HD Global Gain	0.400	3.000	2.959
HD Current Filter Damping	45.000	90.000	45
HD Current Filt Low Pass Rise Time	16.950	0.100	12.357
HD Proportional Gain	6.770	65.240	
HD Derivative-Integral Gain	3.390	65.240	
HD Integral Gain	2.230	65.240	
HD Global Gain	0.000	0.000	

Serial Position Current 0.190 A Velocity 0.000 mm/s Position -198442.000 counts

- Auto Tuning 완료 되면 튜닝값 확인후 Next버튼 Click하여 Plot데이터확인.



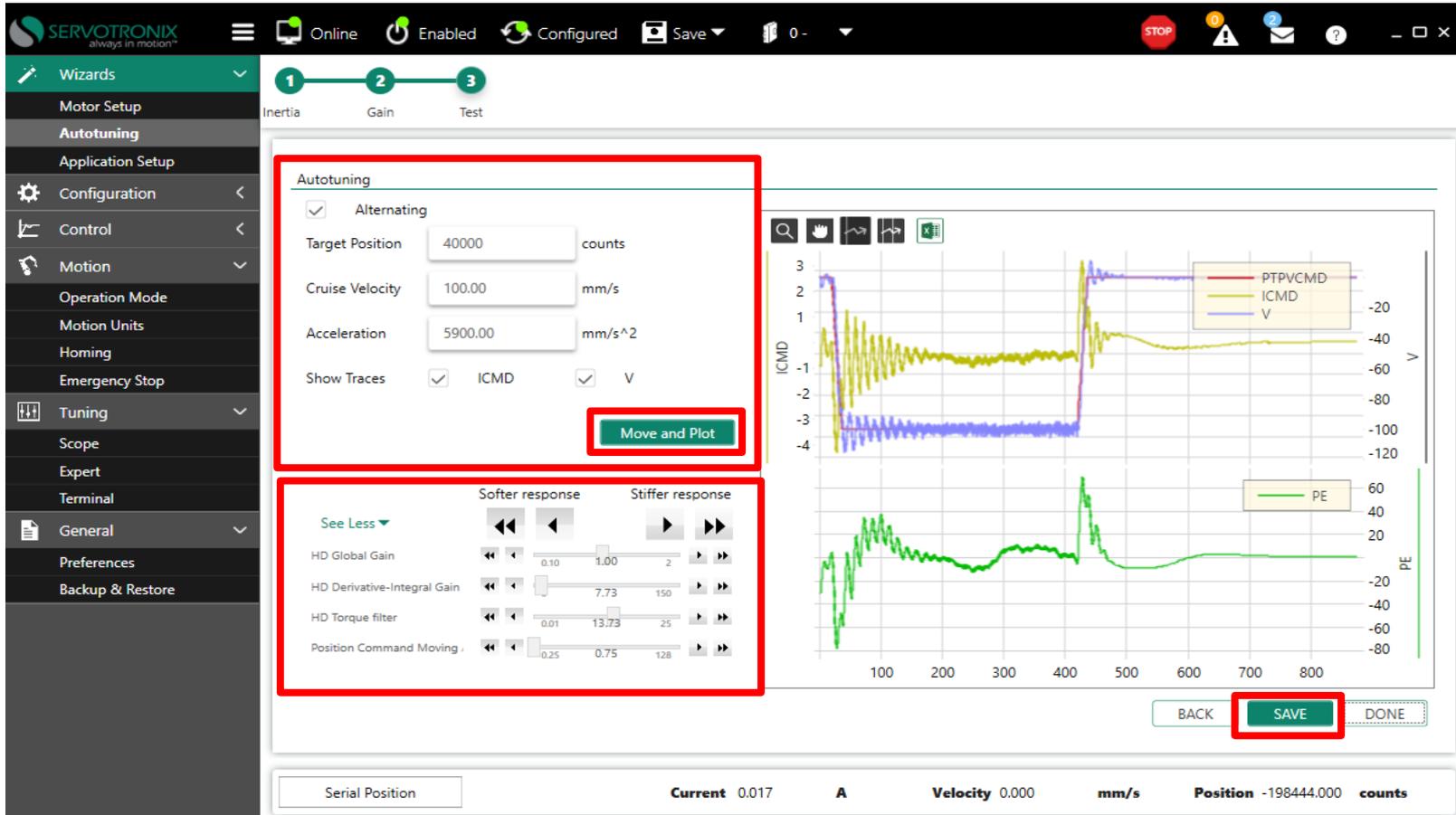
The screenshot displays the Servotronix software interface during the 'Gain Optimization' step of the auto-tuning process. The interface includes a top navigation bar with status indicators (Online, Enabled, Configured, Save) and a sidebar menu. The main area shows the 'Autotuning' wizard with three steps: Inertia, Gain, and Test. The 'Gain' step is active, and a dialog box titled 'Gain Optimization' is open, displaying the message 'Gain optimization completed' and an 'OK' button. Below the dialog, a table lists the optimized parameters:

	Initial Value	Limit Value	Selected Value
	0.400	3.000	2.959
	45.000	90.000	45
HD Current Filter Low Pass Rise Time	16.950	0.100	13.730
HD Proportional Gain	6.770	65.240	9.011
HD Derivative-Integral Gain	3.390	65.240	3.729
HD Integral Gain	2.230	65.240	4.346
HD Global Gain	0.000	0.000	2.959

The 'NEXT' button at the bottom right of the interface is highlighted with a red box, indicating the next step in the process. The status bar at the bottom shows: Serial Position, Current 0.014 A, Velocity 0.000 mm/s, Position -198444.000 counts.

Servotronix Auto Tuning 방법 (5/5)

- 튜닝 된 데이터를 Plot Data로 보고 싶을 경우 좌측 상단에 파라미터들을 입력 후 "Move and Plot"을 Click 하여 Plot 데이터 확인가능.
- 원하는 Plot 데이터가 나오지 않을 경우 좌측 하단에서 튜닝 값을 변경하여 원하는 Plot 데이터가 나올 때까지 확인가능.
- 원하는 데이터를 확인했으면 SAVE버튼 클릭 후 Save To Drive를 선택하여 드라이브에 저장.



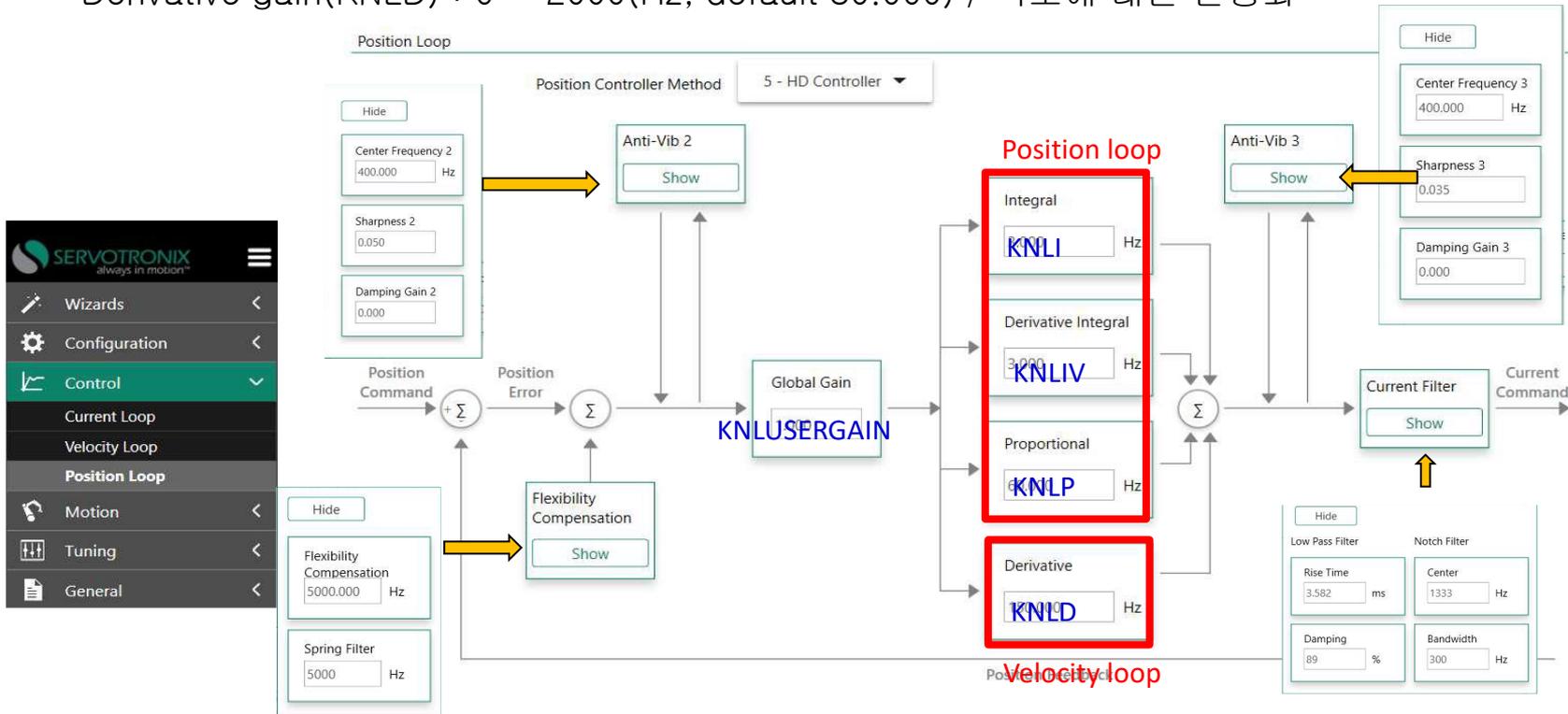
The screenshot displays the Servotronix software interface during the Autotuning process. The top navigation bar shows the system is Online, Enabled, and Configured. The left sidebar lists various settings categories, with 'Tuning' selected. The main window is divided into two sections:

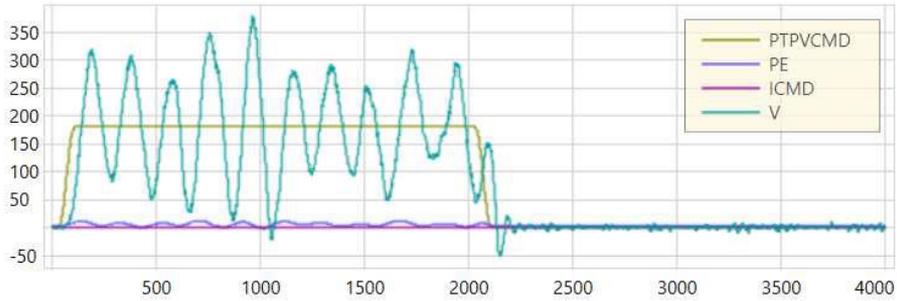
- Autotuning Configuration (Left):** This section is highlighted with a red box. It includes:
 - Alternating
 - Target Position: 40000 counts
 - Cruise Velocity: 100.00 mm/s
 - Acceleration: 5900.00 mm/s²
 - Show Traces: ICMD, V
 - A **Move and Plot** button is highlighted with a red box.
- Parameter Adjustment (Bottom Left):** This section is also highlighted with a red box. It shows sliders for:
 - HD Global Gain: 0.10 to 2.00
 - HD Derivative-Integral Gain: 7.73 to 150
 - HD Torque filter: 0.01 to 25
 - Position Command Moving: 0.25 to 128
- Plot (Right):** A graph showing motor data over time (0 to 800). The left Y-axis is ICMD (ranging from -4 to 3) and the right Y-axis is V (ranging from -120 to 20). The plot shows three traces: PTPVCMD (red), ICMD (yellow), and V (blue). A green trace labeled PE is also visible at the bottom of the plot area.
- Bottom Bar:** Displays real-time data: Serial Position, Current 0.017 A, Velocity 0.000 mm/s, and Position -198444.000 counts. A **SAVE** button is highlighted with a red box.

- Auto Tuning후 사용자가 더 정밀하게 튜닝하기 위해서는 아래의 파라미터들을 조정하면 정밀 튜닝 가능.

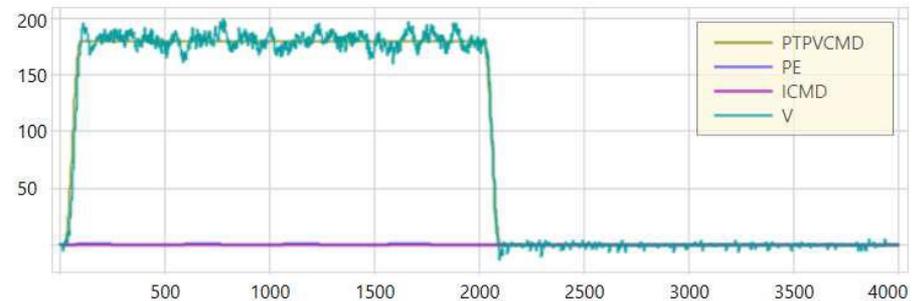
※ 파라미터 관련 설명

- Global gain(KNLUSERGAIN) : HD Adaptive gain scaling factor / 0.1 ~ 3.0(default 0.500) / 전체적인 시스템 강성에 대한 조정
- Integral gain(KNLI) : 0 ~ 200(Hz, default 10.000) / 정지 시 떨림 안정화
- Derivative-Integral gain(KNLIV) : 0 ~ 400(Hz, default 40.000) / 구동 및 정지 시 떨림 안정화
- Proportional gain(KNLP) : 0 ~ 400(Hz, default 30.000) / 강성 조정
- Derivative gain(KNLD) : 0 ~ 2000(Hz, default 80.000) / 속도에 대한 안정화

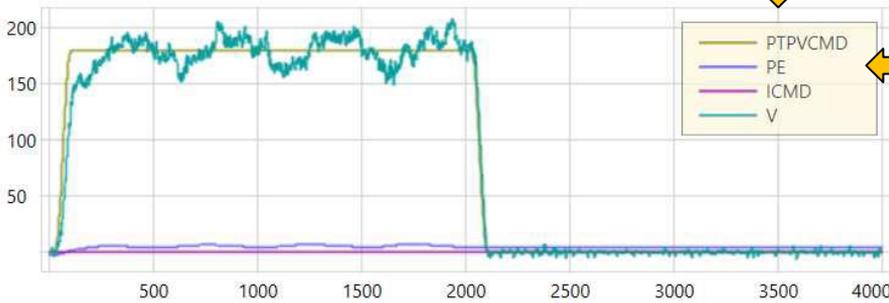




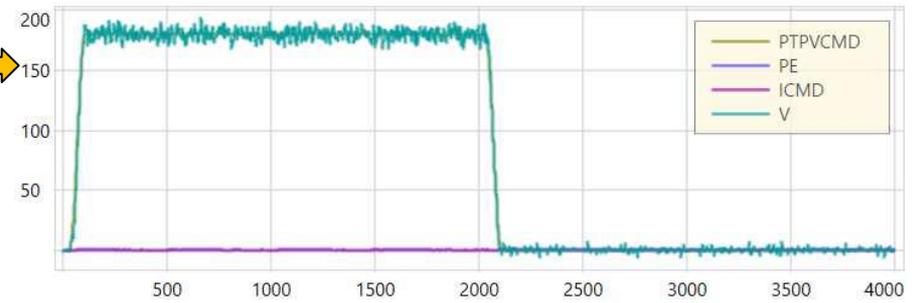
KNLP(Proportional gain) : motion profile 생성 및 강성 조정
 강성 GAIN 으로 값이 클수록 진동이 발생할 수 있음
 ※ KNLD 증가에 따라 값을 높일 수 있음



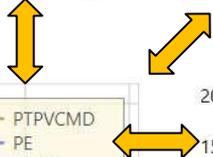
KNLI(Integral gain) : position error 및 settling time 감소
 ※ KNLD 증가에 따라 값을 높일 수 있음



KNLD(Derivative gain) : motion profile 추종 및 안정



KNLIV(Derivative-Integral gain) :
 position error 감소(KNLD 에 대한 integral gain 적용)



- 드라이브에 있는 화면에 아래와 같이 알람이 발생하면 조치필요.



내용 : 전압부족으로 알람 발생.
조치방법 : 드라이브에 연결되는 전원선 확인.



내용 : 모터가 움직이기 위한 위상각도를 찾지 못함.(P→F 반복 표시)
조치방법 : 드라이브 전원을 끄고 가동자위치를 변경 후 전원을 켜다.



내용 : 과전압으로 인한 알람 발생.
조치방법 : 드라이브에 회생저항 연결이 필요한지 확인.



내용 : 피드백정보 확인 안됨.(e→1→2→9 반복 표시)
조치방법 : 엔코더 관련 헤드,스케일,케이블 점검.



내용 : 토크제어모드.
조치방법 : 서보 온이 안될 경우 드라이브에 설정된 제어모드 확인.



내용 : EtherCAT 제어모드.
조치방법 : 서보 온이 안될 경우 드라이브에 설정된 제어모드 확인.



내용 : 위치제어모드.
조치방법 : 서보 온이 안될 경우 드라이브에 설정된 제어모드 확인.

Revision	Date	Reviser	Approver	Remark
1.0	2024.04.24	J.G.MIN	E.W.SHIN	First version

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