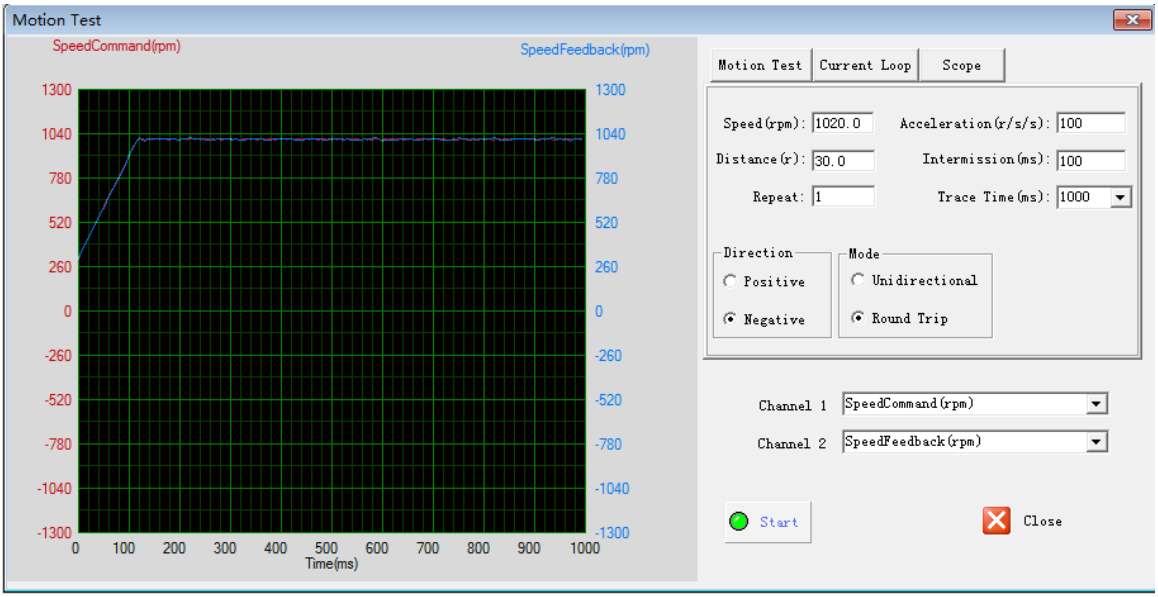
Software User Manual

CS-D Series

Closed Loop Stepper Drives



Revision 1.0

Address: Floor 11, Block A3, Nanshan iPark, Xueyuan Avenue 1001, Shenzhen, Guangdong, 518055, China

Tel: (86)755-26409254 ***Fax:*** (86)755-26402718

Web: www.leadshine.com ***Sales:*** sales@leadshine.com

Support: tech@leadshine.com

Notice

Read this manual carefully before any assembling and using. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information regarding installation requirements.

Record of Revisions

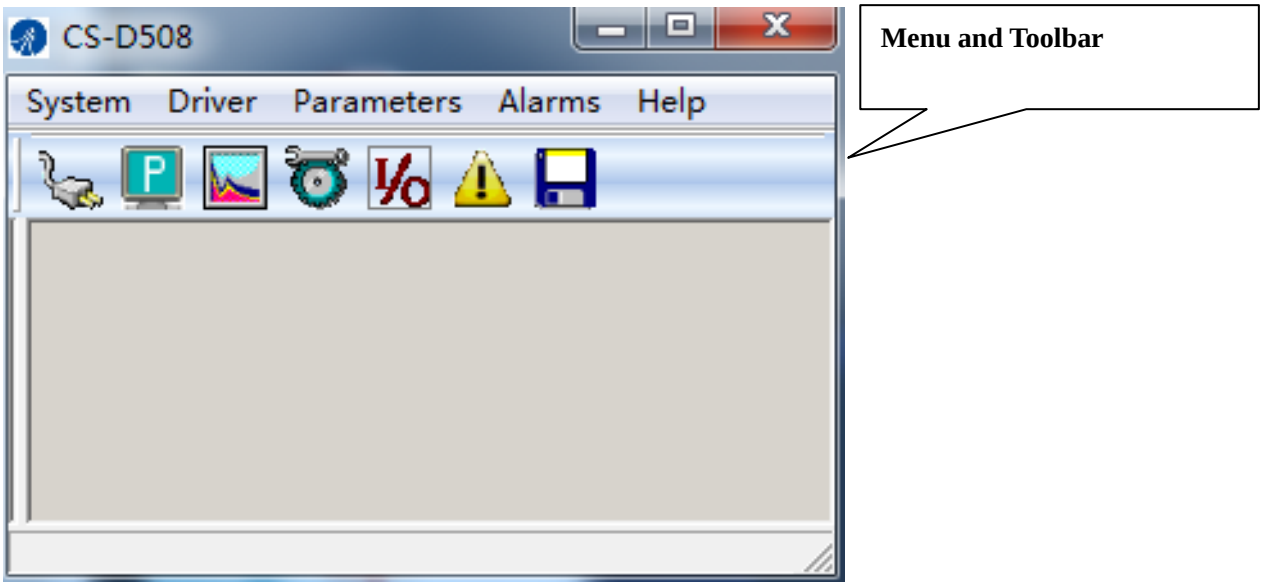
Revision	Date	Description of Release
1.0	*Oct, 2017*	*Initial Release*

Table of Contents

1. Introduction

The ProTuner is a software tool designed to configure and tune the Leadshine's CS-D series closed loop steppers. The user can configure the drive's output current, microstep resolution, command type and tune the motion performance in this software.

1.1 Workspace



1.2 Menus and Toolbar

Menus and toolbars are at the top of the workspace. You can click menu bar to view pull-down menu. The toolbar below offers the most frequency commands.

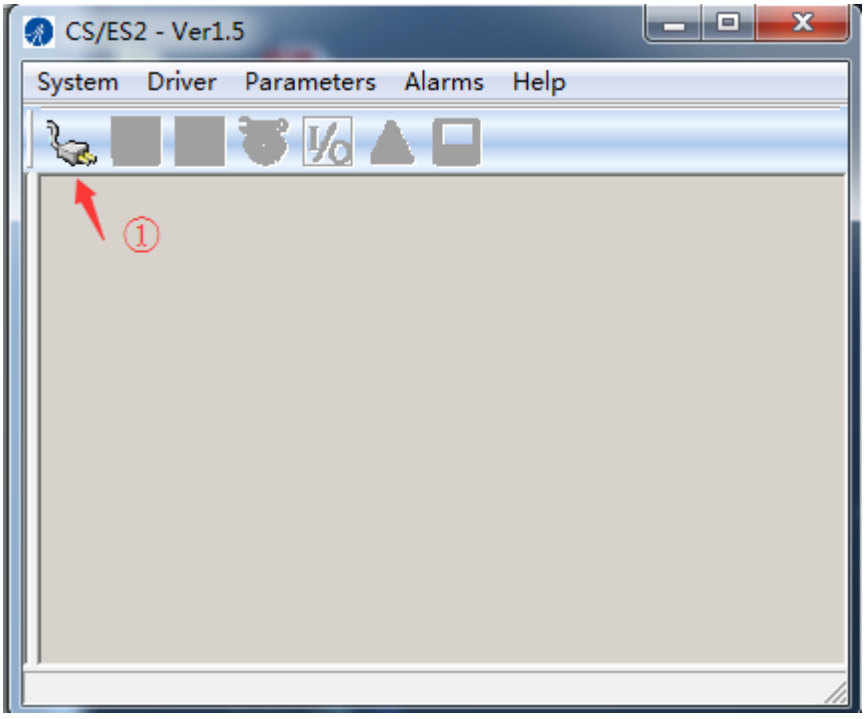
Menu	Pull Down	Toolbar	Function
System ->	Communication		Open the serial port and connect to drive
	I/O Setting		Set the command type, active level of the I/O signal.
	Motor Setting		Set micro step resolution, position following limit
Driver ->	Motion Test		Tune the perform Motion Test.
Parameters ->	Parameter Manage		Download / upload data between the ProTuner and the drive. Or you can also save parameters to a file and restore parameters

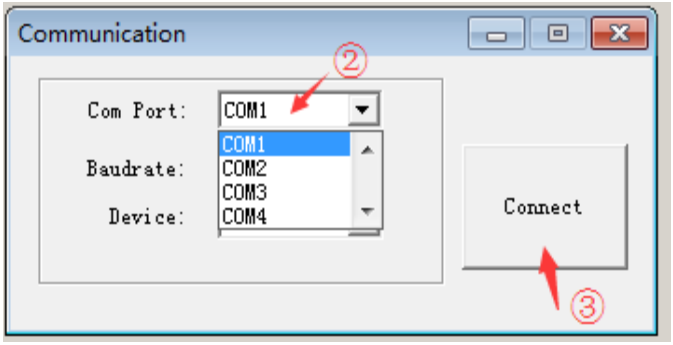
			from a file.
Alarms ->	Alarms Display		Check drives error.
Help ->	Drive Info		Display drive and ProTuner information

2. Using the Software

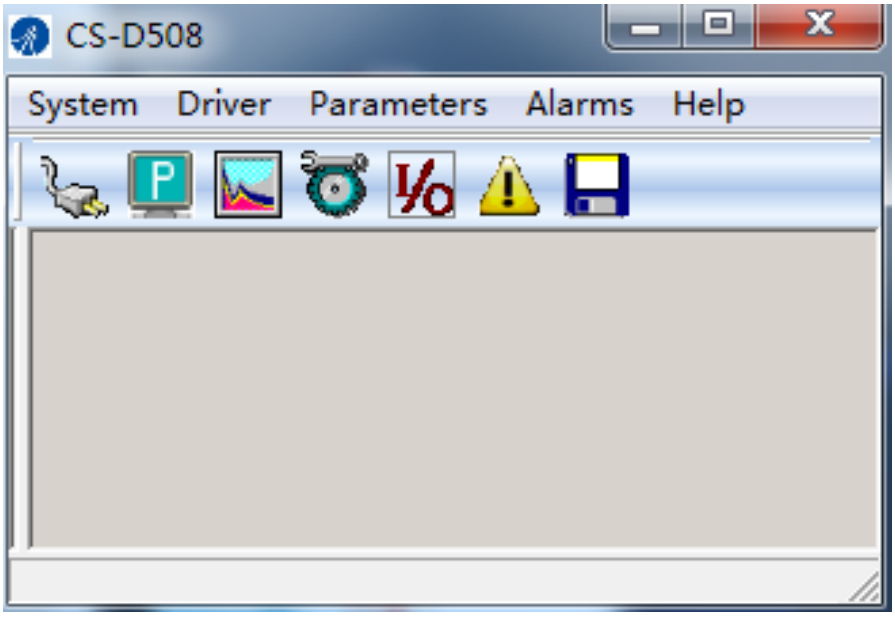
2.1 Connecting Drive

You need to click  or **System -> Communication** to appear communication window when you open **CS ES2 Series ProTuner**. Select the serial port number and click on the **Connect** button. The operation steps as below:

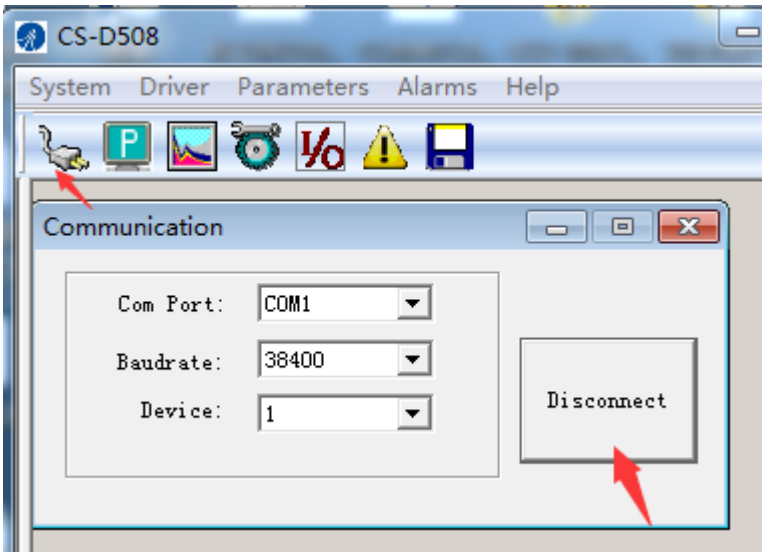




The software will try to connect to the drive and read the settings. It may take several minutes. Please wait. After connecting successfully, the color of toolbar icons will change from gray to bright as below:



If you need to disconnect the drives with ProTuner, you can click  once again, the operation as below:



Before connecting the drive, please make sure:

1) The RS232 cable .has been connected between the drive and PC serial port.
2) Power has been applied to the drive and the green LED is turned on.

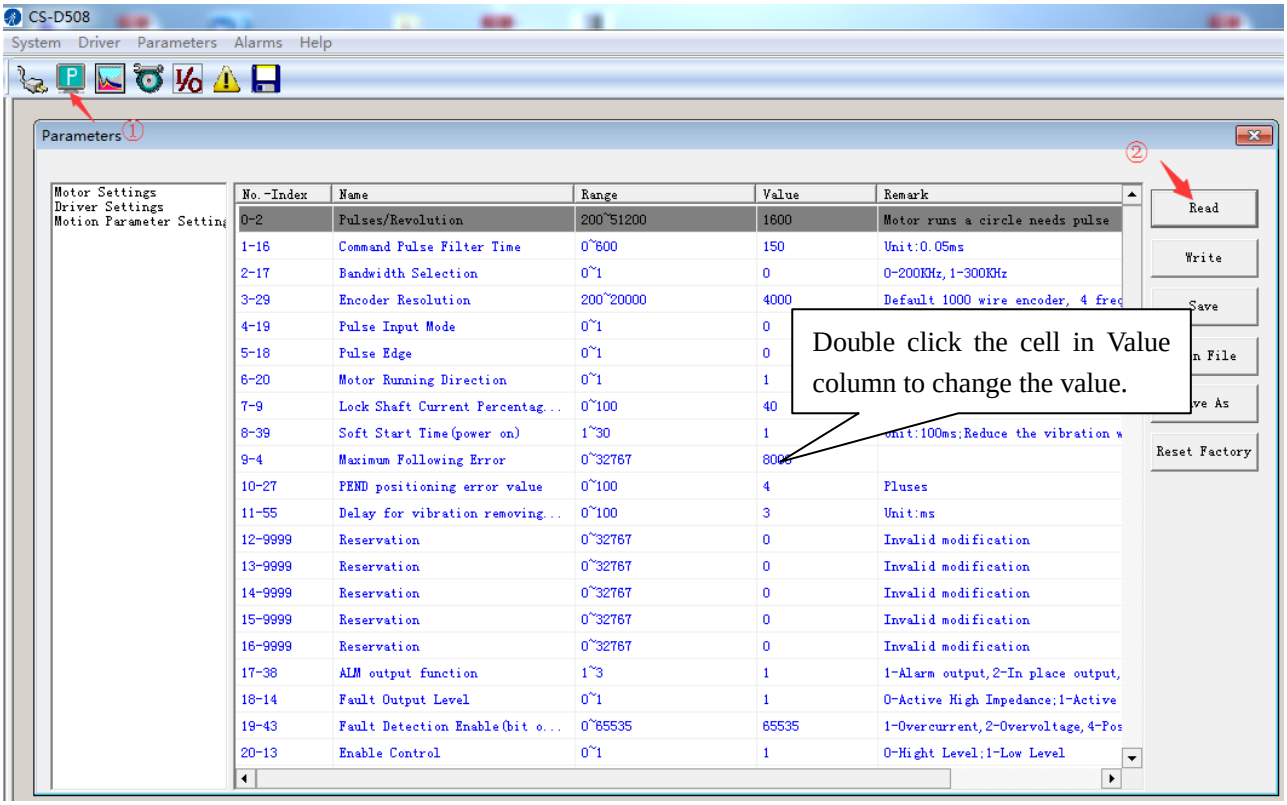
The motor is no need to connect to the drive if you just want to change the parameters but not tuning.

Do not plug or unplug serial cable when drive is powered on. The drive's communication circuit may be damaged.

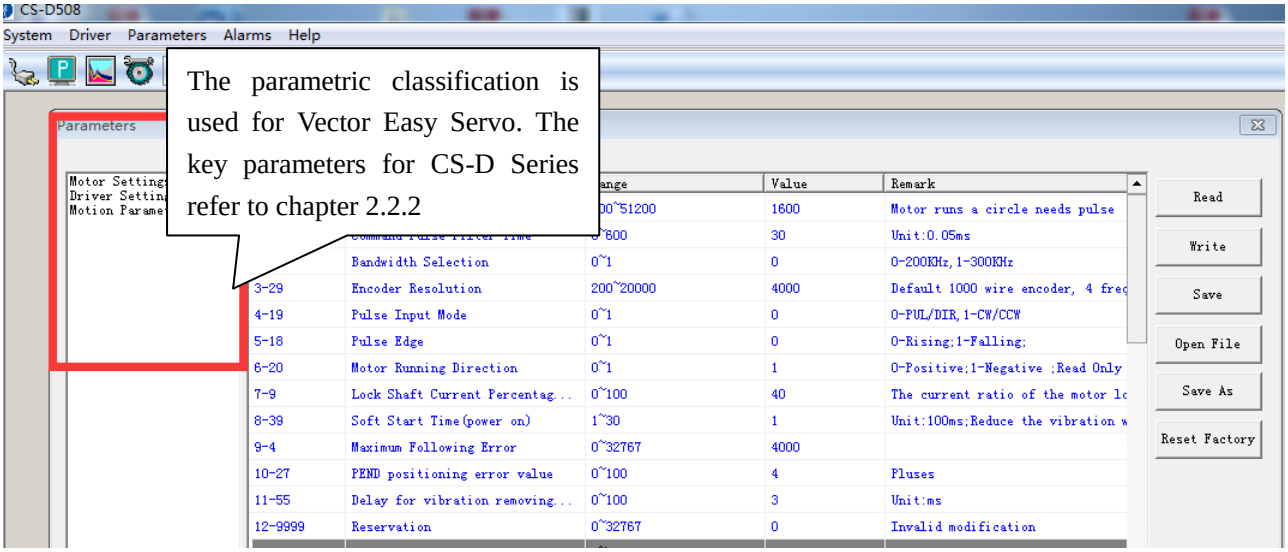
2.2 Parameters Configuration

2.2.1 Read Parameters

Click  or **Parameter-> Parameter manage** to open the parameters list window, then click the **Read** button to upload all the parameter from the drive to ProTuner, Double click the value of the parameter, then you can change them. The operation steps as below:



The parameter classification in the left of the ProTuner is available when using vector easy servo of ES-D508-V, ES-D1008-V, ES2-DA808 and ES2-DA1208. Because the two series drives use the one same ProTuner.



2.2.2 Available Parameters for CS-D Series

NO.	Name	Range	Default Value	Note
0	Pulse/Revolution	200-51200	1600	Motor runs a circle needs pulse
1	Command Pulse Filter Time	0-600	30	Interior acceleration time (unit: 0.05ms)
3	Encoder Resolution	200-20000	4000	4 multiplying frequency for 1000 line encoder, must be value of 4000
4	Pulse Input Mode	0-1	0	0-PUL/DIR, 1-CW/CCW
5	Pulse Edge	0-1	0	0-Rising, 1-Falling
6	Motor Running Direction	0-1	1	0-Position direction 1-Negetive direction
7	Lock Shaft Current Percentage(power on)	0-100	40	Unit: %，multiply by motor peak current
8	Soft Start Time (power on)	1-30	1	The time of output current from 0 to the value of lock shaft current. (unit: 100ms)
9	Maximum Following Error	0-32767	4000	Position following error limited value
17	ALM output function	1-3	1	Invalid
18	Fault Output Level	0-1	1	0-High, 1-Low
19	Fault Detection Enable (bit operation)	0-65536	65535	0-Disable，1-Enable Bit 0-Over current Bit 1-Over voltage Bit 7-Position following error
20	Enable Control	0-1	1	0-High, 1-Low
21	Choosing Shaft Locking in Disable	0-1	0	0-No locking, 1-Lock
22	Enable for Error Clearing	0-1	0	0-Close function of error clearing 1-Open function of error clearing
25	Choosing Winding Short of Lower Bridge Arm	0-1	0	0-No winding short 1-Winding short
27	Motor Peak Current	0-200	80	Unit: 100mA
28	Closed Loop Holding Current Percentage	0-100	45 or 60	Unit: % 45 for CS-D508 60 for CS-D808/CS-D1008

NO.	Name	Range	Default Value	Note
29	Open Loop Holding Current Percentage	0-100	45 or 60	Unit: % 45 for CS-D508 60 for CS-D808/CS-D1008
32	Self-test Enable	0-1	0	Invalid
33	Open/Close -loop Mode	0-1	1	0-Opeen-loop, 1-Closed-loop
39	Current Loop KP	0-32767	2086	Only Read
40	Current Loop KI	0-32767	608	Only Read
43	Motor Model	0-100	5	Invalid
49	Position Loop Kp	0-3000	35	Position Loop Proportional Gain
50	Speed Loop Kp	0-3000	35	Speed Loop Proportional Gain
51	Speed Loop KI	0-3000	3	Speed Loop Integral Gain
52	Position Loop KpH	0-3000	15	High speed situation(>900rpm)
53	Speed Loop KpH	0-3000	60	High speed situation(>900rpm)
54	Speed Loop Integral Limited	0-80	10	Unit: 100mA
55	Speed Feed-forward	0-32	10	Keep default
56	Torque Feed-forward	0-3000	0	Keep default
57	Position Loop Filter Frequency	0-31	1	Keep default
58	Speed Loop Filter Frequency	0-31	4	Keep default
59	Speed Loop Simple Frequency	0-31	4	Keep default
60	Gravity Compensation	0-1	0	0-Disable, 1-Enable
Others	Reserve	0-32767	0	Keep default

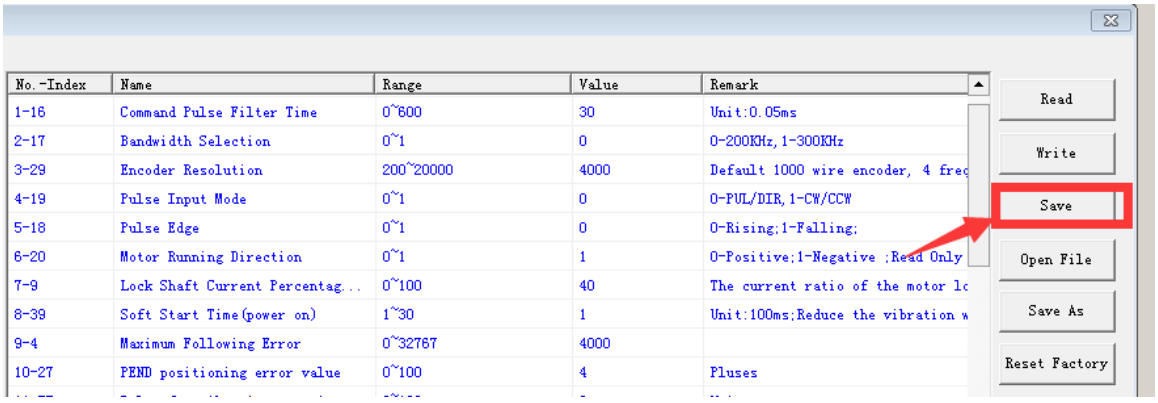
Note: The parameters with black font are available for CS-D series, but the parameters gray font are not.

2.2.3 Key Parameters

NO.	Name	Range	Default Value	Note
0	Pulse/Revolution	200-51200	1600	Motor runs a circle needs pulse
1	Command Pulse Filter Time	0-600	30	Interior acceleration time (unit: 0.05ms)
4	Pulse Input Mode	0-1	0	0-PUL/DIR, 1-CW/CCW
5	Pulse Edge	0-1	0	0-Rising, 1-Falling
8	Soft Start Time (power on)	1-30	1	Decrease vibration of power on and enable (unit: 100ms)
9	Maximum Following Error	0-32767	4000	Position following error limited value
18	Fault Output Level	0-1	1	0-High, 1-Low
27	Motor Peak Current	0-200	80	Unit: 100mA
28	Closed Loop Holding Current Percentage	0-100	45 or 60	Unit: % 45 for CS-D508 60 for CS-D808/CS-D1008
29	Open Loop Holding Current Percentage	0-100	45 or 60	Unit: % 45 for CS-D508 60 for CS-D808/CS-D1008
33	Open/Close -loop Mode	0-1	1	0-Opeen-loop, 1-Closed-loop

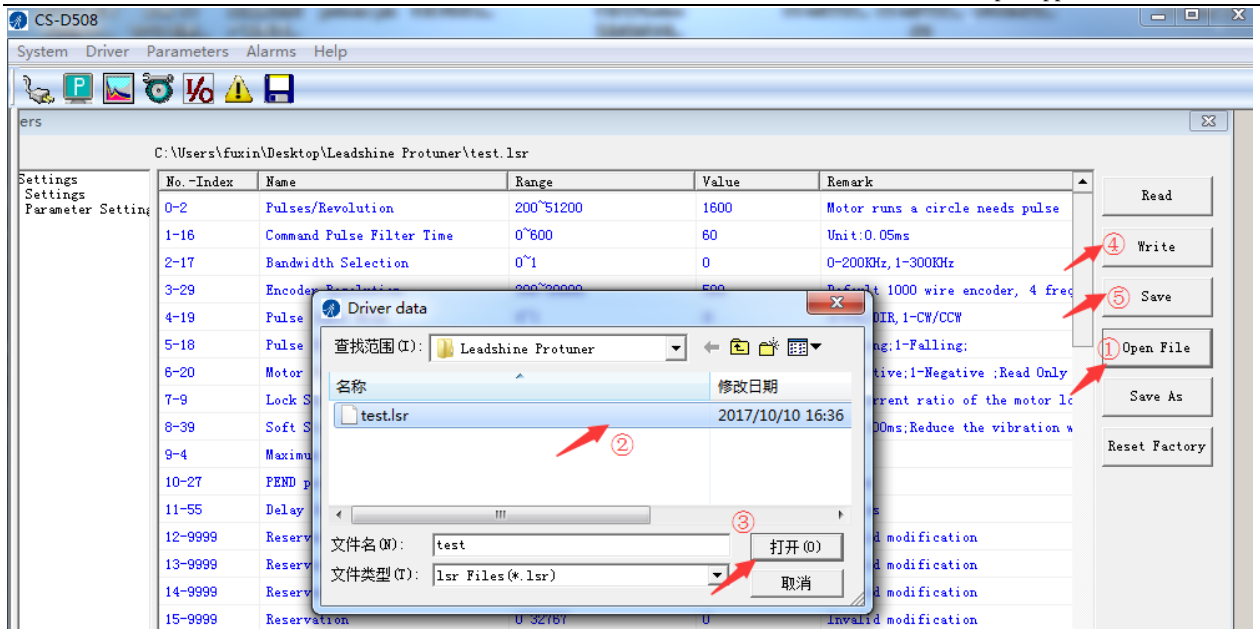
2.2.4 Download to Drive

The parameter values are only loaded to the drive board's RAM when you change them in ProTuner. After power-off, they will be lost. So you have to click ***Save*** button to save all parameters to the drive board's non-volatile memory.



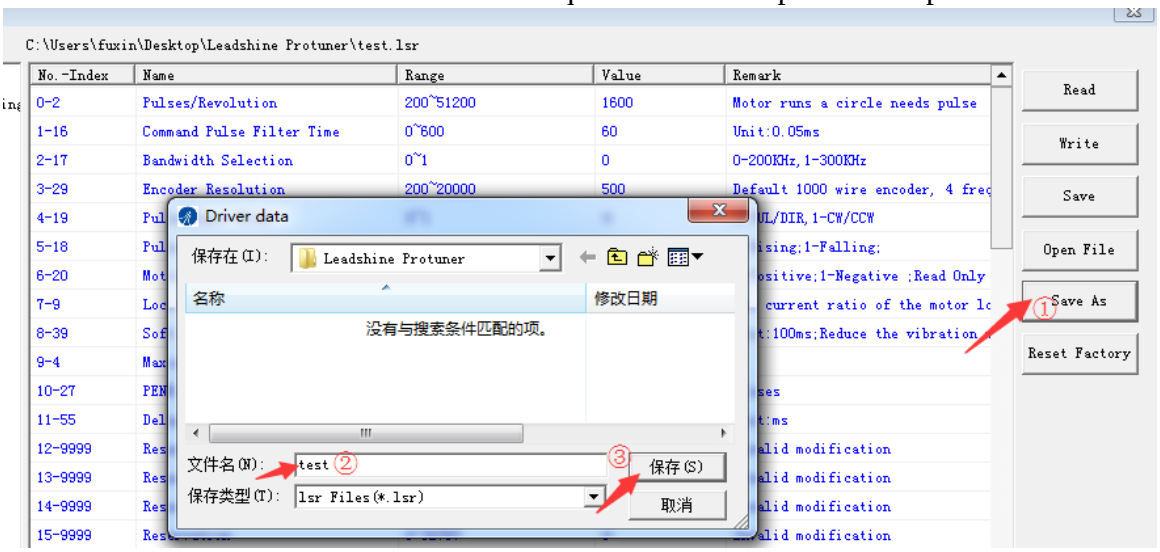
2.2.5 Open File

If you want to download parameters from a file with .lsr format to the drive, click **Open File** button in the Parameters Window, choose the correct path of the file, The parameters in the file will be uploaded to the ProTuner, you need to click the **Write** button, then click the ***Save*** button. The operation steps as below:



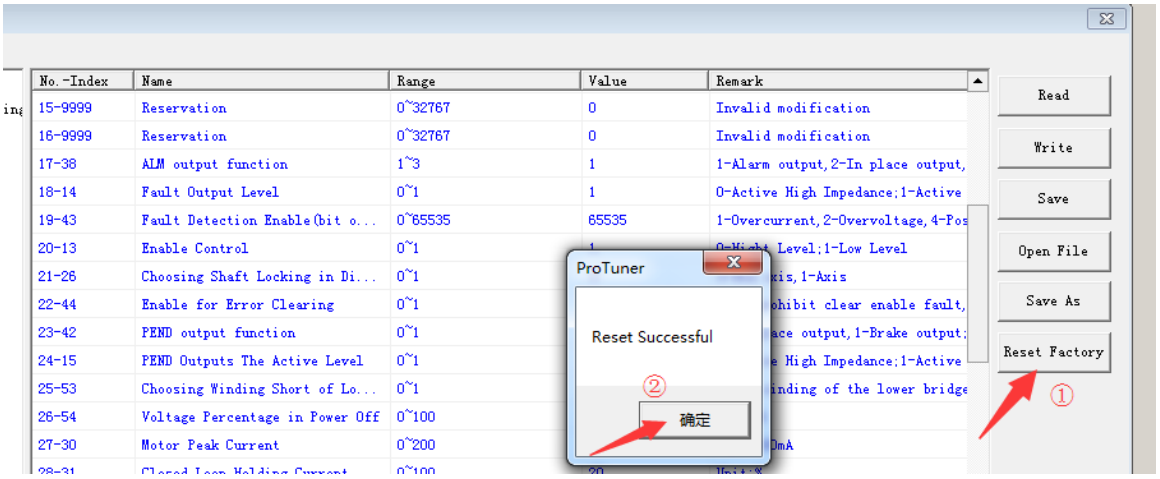
2.2.6 Save File

Click **Save As** button to save the parameters in current workspace as a file with .lsr format. This file can be used for the other drive with the same requirement. The operation steps as below:



2.2.7 Reset Factory

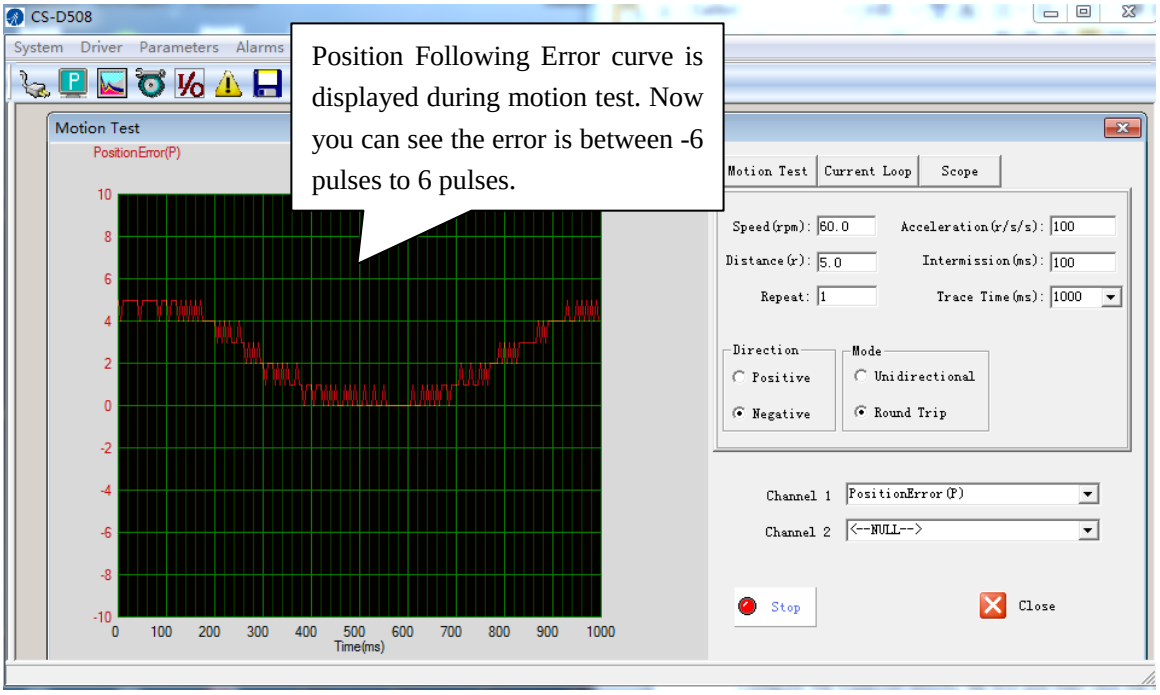
It is possible that the parameter value is changed by accident and you want to restore the default value. You can click **Reset Factory** button for this purpose. Then all the parameters will be set default. The operation steps as below:



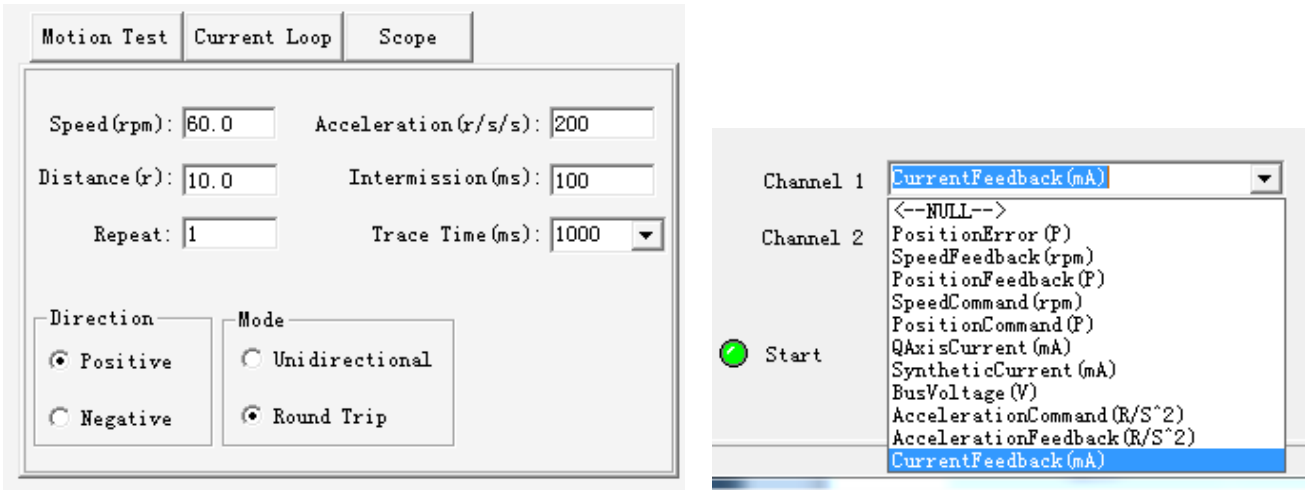
2.3 Motion Test Window

Click  or **Drive->Motion test** to open tuning window. There are three child windows as below:

2.3.1 Motion Test Tab



In the Motion Test tab, you can make the motor rotate without pulse generator or motion controller. Configure the trapezoid velocity file first and then click the **Start** button. There are two channels can be used to monitor the "Current Feedback, Position Error, Position Feedback, etc." as below:



Item	Description	Range
Speed (rpm)	Target velocity of Motion Test.	1– 5000 rpm
Acceleration (r/s/s)	Acceleration of Motion Test.	1 – 3000 r/s^2
Distance (r)	Move distance of Motion Test.	1 – 655 r
Intermission (ms)	Interval between moves.	1 – 32767 ms
Repeat	Repeat times.	1– 65535
Trace Time	The time to sample the position following error data.	100-3000 ms
Direction	Move direction.	Positive/ Negative
Mode	Motion Test mode includes single direction motion or two direction Motion. Unidirectional: Run in one direction, Round Trip: Run forward and back	-
Start	Click to start the Motion Test.	-
Stop	Stop the move immediately.	-
Close	Close the Current / Position Loops window	-

2.3.2 Current Loop Tab

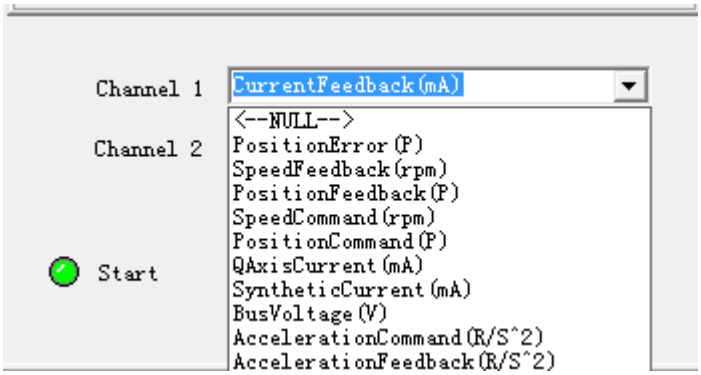
Click **Current Loop** tab to open this window. But you can't adjust the current loop Kp (proportional gain) and Ki (integral gain) in this window, it is auto-tuning the motor when the DIP switch SW6 of CS-D series drive is set to OFF, while the SW6 is set to ON, the current loop Kp and Ki are configured to the default value can't be changed.

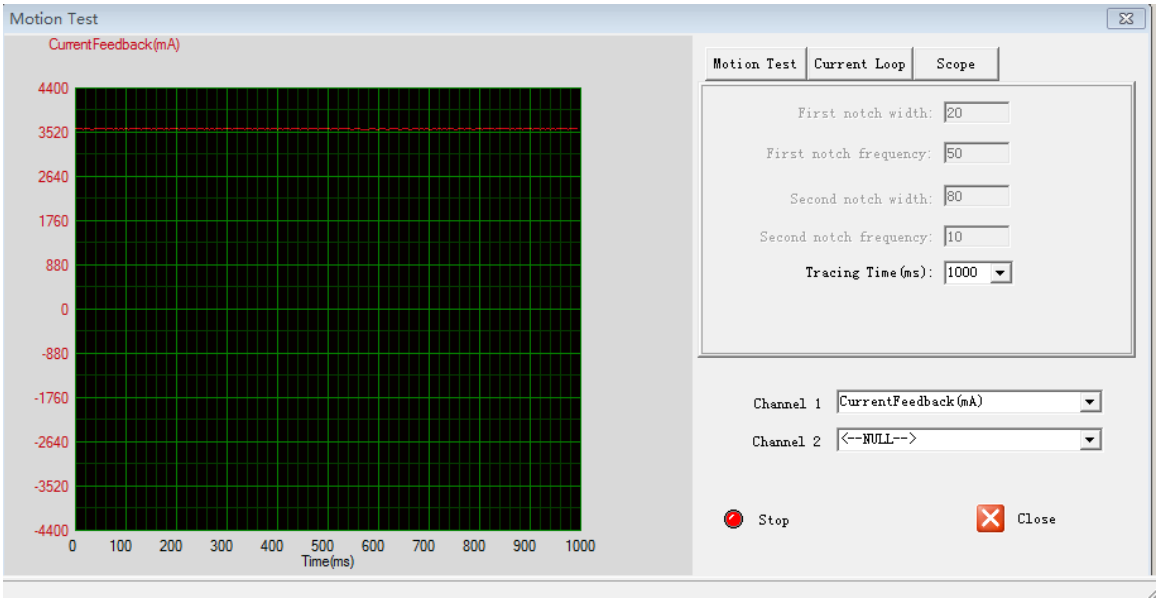
Notice

For CS-D series, the drive board will perform the auto-configuration and the current loop parameters will be calculated automatically at power-up. The current loop can't be changed.

2.3.3 Scope Tab

Click **Scope** tab to open this window. You can monitor the position following error in this window. When the CS-M series motor runs in real applications (use pulses come from PLC/ Controller, etc.), this window helps to check the performance. There are two channels can be used to monitor the "Current Feedback, Position Error, Position Feedback, etc." as below:



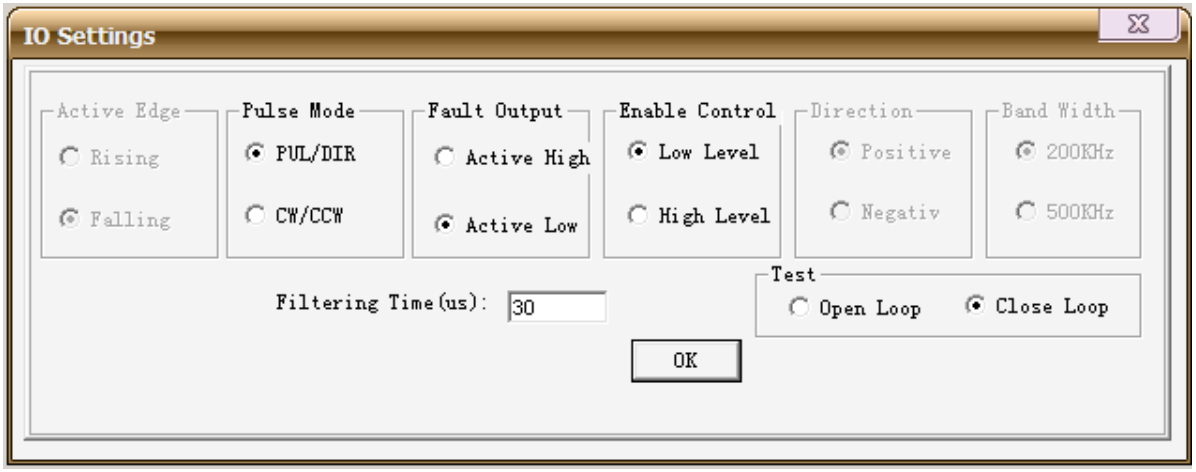


Item	Description	Range
Trace Time	Time to sample the position following error. For example, if the trace time is 1000ms, the drive board acquires the error data every 1000ms.	100-3000ms
Start	Start to monitor and display the position following error.	-
Stop	Stop monitoring.	-

2.4 Other Workspace

2.4.1 Inputs/Outputs Window

Click  to open the I/O configuration window. You can choose the input pulse mode, select the active level of fault output and enable, configure the given instructs filtering time, and chose motor runs in open loop or close loop. But the pulse mode also can be set by DIP switch SW7, you need to keep the two setting to be consistent, if not, the software setting about pulse mode is not available.

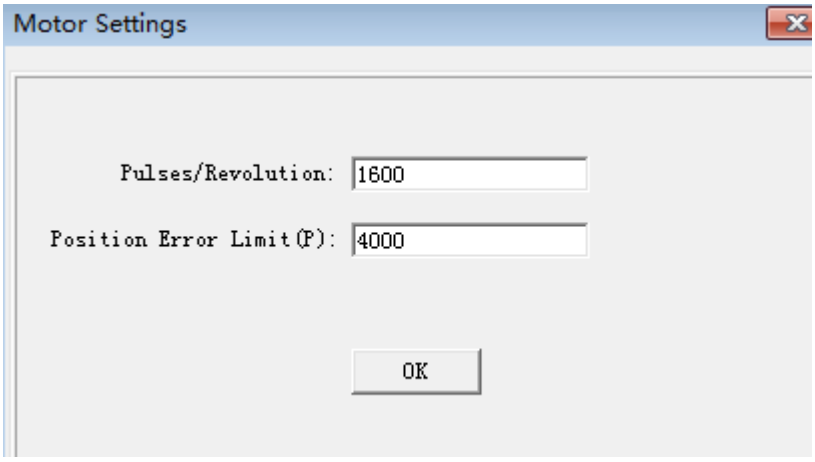


Item	Description	Range
Active Edge	Pulse active edge. The motor shaft moves one micro step every active edge. For CS-D508, setting depends on DIP switch ***SW8***, for CS-D808/CS-D1008, setting depends on ***Parameter No. 5***	Rising /Following
Pulse Mode	Pulse mode of control signal. Select PUL/DIR or CW/CCW according to command type of motion controller. PUL/DIR means pulse and direction mode; CW/CCW means double pulses mode. For CS-D508, setting depends on DIP switch ***SW7***, for CS-D808/CS-D1008, setting depends on ***ProTuner.***	PUL/DIR CW/CCW
Fault Output	Set active impedance for the fault output signal. Active High means high output impedance for drive error and Active Low means low output impedance for driver error.	Active Low /Active High
Enable Control	Specify the action the active level of the enable input.	Low level / High level
Filtering Time	Internal acceleration time in the drive	0-600

Test	Motion mode, the motor can run in open loop without encoder signals	Open loop/ Close loop

2.4.2 Motor Settings Window

Click  to open this window. You can set the pulses per revolution and position following error limit in this window.

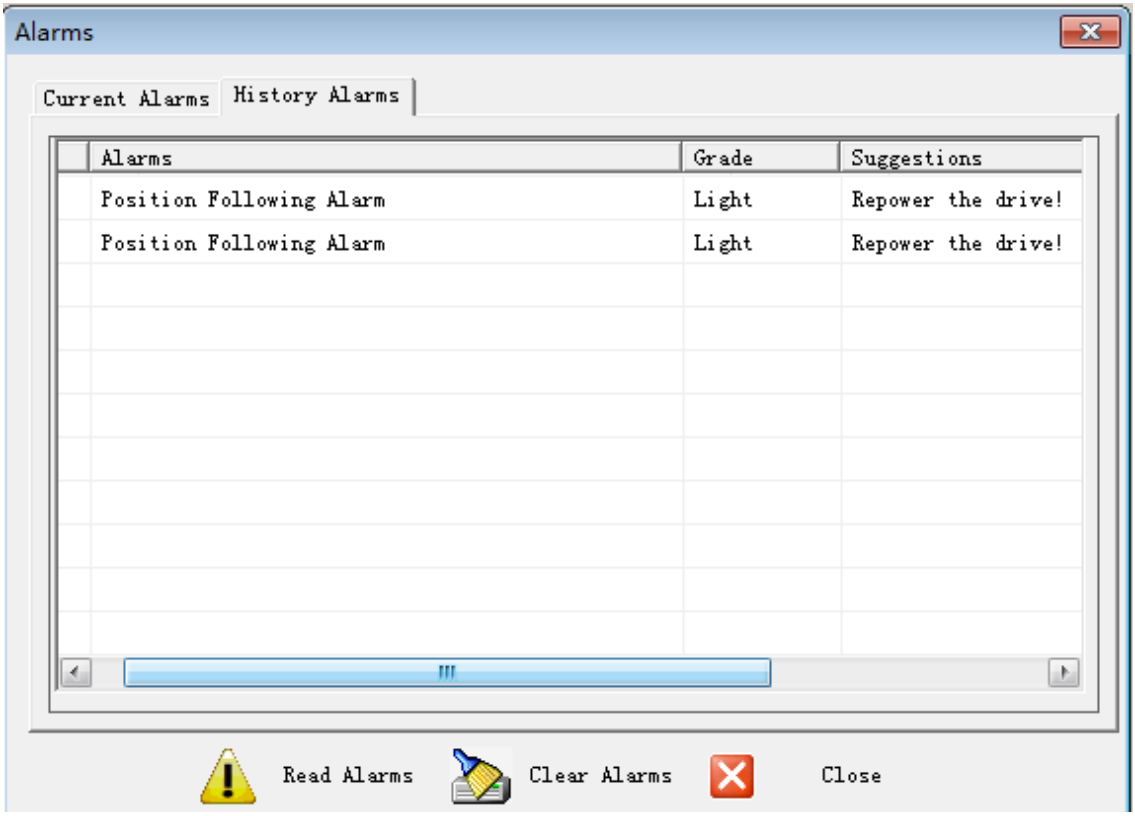


Item	Description	Range
Pulses / Revolution	Drive's Micro Step setting for the motor.	200-51200
Position Error Limit	The limit of the difference between commanded position and the actual measured position. When position following error exceeds the Position Following Error Limit in the drive, the following error protection will be activated.	0-65535

2.4.3 Check Errors

Click  to check the active error or the error log of the drive in this window. Type of error is shown as below:

Item	Description
Over Current Alarm	Error occurs when the motor coil current exceeds the drive's current limit.
Over Voltage Alarm	Error occurs when the input voltage exceeds the drive's voltage limit
Position Following Alarm	Error occurs when the actual position following error exceeds the limit which is set in **Position Error Limit**.



3. Configuring the Drive

Usually, you can follow the steps below to configure the drive.

(1) Set the input/output such as **Pulse/Revolution**, **Pulse Input Mode**, **Pulse Edge, Fault Output Level, Maximum Following Error, Open/Close -loop Mode** for your application.

(2) Adjust the current value of **Motor Peak Current, Closed Loop Holding Current Percentage, Open Loop Holding Current Percentage** if your closed loop stepper motors have different rate current from Leadshine.

(3) Increase the value of **Soft Start Time (power on)** if there are overshooting when the motor in enable or lock shaft.

(4) Increase the value of **Command Pulse Filter Time** from 300 to 600 if there is vibration when the motor in interpolation motion

(5) Adjust the **speed loop and position loop parameter** when the motor has vibration at standstill or mid-high speed.

3.1 Configuring Input/Output

Refer to the key parameters in chapter 2.2.3, you can set **Pulse/Revolution**, **Pulse Input Mode**, **Pulse Edge, Fault Output Level, s**ee more information in **Using the Software** chapter.

NO.	Name	Range	Default Value	Note
0	Pulse/Revolution	200-51200	1600	Motor runs a circle needs pulse. High resolution Micro Step makes the motor move more smoothly. Low Micro Step resolution reduces the high frequency requirement to the controller.

NO.	Name	Range	Default Value	Note
4	Pulse Input Mode	0-1	0	0-PUL/DIR, 1-CW/CCW
5	Pulse Edge	0-1	0	0-Rising, 1-Falling
9	Maximum Following Error	0-32767	4000	Position following error limited value (unit: pulse*4). If the application requires small position following error, reduce the Position Error Limit. Usually it is recommended to set it to 4000.
18	Fault Output Level	0-1	1	0-High, 1-Low

3.2 Configuring Output Current

NO.	Name	Range	Default Value	Note
27	Motor Peak Current	0-200	80	Unit: 100mA The maximum output current of the drive
28	Closed Loop Holding Current Percentage	0-100	45 for CS-D508 60 for CS-D808/CS-D1008	Unit: % Available in closed loop mode
29	Open Loop Holding Current Percentage	0-100	45 for CS-D508 60 for CS-D808/CS-D1008	Unit: % Available in open loop mode
33	Open/Closed Loop Mode	0-1	1	0-Opeen-loop, 1-Closed-loop It can be run in open loop mode without encoder signals.

When the CS-D drive is set to closed loop mode, the output current ranges between the motor peak current and closed loop holding current, and if there is no pulse sent to the drive, the CS-D drive goes into idle mode and the actual motor current is determined by the closed loop holding current percentage (similar to "idle current" of open loop stepper drives), if there is pulse sent to the drive, the output current changes dynamically based on the load.

When the CS-D drive is set to open loop mode, the output current is always the value of the open loop holding current.

The closed/open loop holding current is calculated as follows:

$$\text{Closed Loop Holding Current} = \text{Motor Peak Current} \times \text{Closed Loop Holding Current Percentage (\%)}$$
$$\text{Open Loop Holding Current} = \text{Motor Peak Current} \times \text{Open Loop Holding Current Percentage (\%)}$$

Low closed loop holding current can reduce motor heating, however also reduces the holding torque which is used to lock the motor shaft at standstill. It is recommended to determine the holding current by whether or not there is big vibration at start-up and how much lock torque is required, based on your actual applications.

3.3 Fine Tuning of Motion

NO.	Name	Range	Default Value	Note
1	Command Pulse Filter Time	0-600	30	Interior acceleration time (unit: 0.05ms) Increase the value from 300 to 600 if there is vibration when the motors run in interpolation motion, and the filter time must be the same if there are drives in X, Y, Z axis.
8	Soft Start Time (power on)	1-30	1	The time of output current from 0 to the value of lock shaft current. (unit: 100ms) Increase the value if there is overshooting when the motor in enable or lock shaft.
49	Position Loop Kp	0-3000	35	Position Loop Proportional Gain Appropriately reduce this value when the motor has vibration at standstill, usually keep the default value.
50	Speed Loop Kp	0-3000	35	Speed Loop Proportional Gain Appropriately reduce this value when the motor has vibration in low speed, usually keep the default value.
51	Speed Loop KI	0-3000	3	Speed Loop Integral Gain
53	Speed Loop KpH	0-3000	60	High Speed Loop Proportional Gain, Appropriately reduce this value when the motor has vibration in high speed (>900PRM)

The effect of Kp and Ki is similar as the items in servo control system. But they are not completely the same. It is recommended to adjust them by 10%-30%. Otherwise the drive's performance may go bad!

Contact Us

China Headquarters
Address: 3/F, Block 2, Nanyou Tianan Industrial Park, Nanshan District Shenzhen, China
Web: http://www.leadshine.com

Sales Hot Line:
Tel: 86-755-2641-7674 (for Asia, Australia, Africa areas)
86-755-2640-9254 (for Europe areas)
86-755-2641-7617 (for America areas)
Fax: 86-755-2640-2718
Email: sales@leadshine.com.

Technical Support:
Tel: 86-755-2641-8447, 86-755-2641-8774, 86-755-2641-0546
Fax: 86-755-2640-2718
Email: tech@leadshine.com (for All)

Leadshine U.S.A
Address: 25 Mauchly, Suite 318 Irvine, California 92618
Tel: 1-949-608-7270
Fax: 1-949-608-7298
Web: http://www.leadshineUSA.com
Email: sales@leadshineUSA.com and support@leadshineUSA.com.