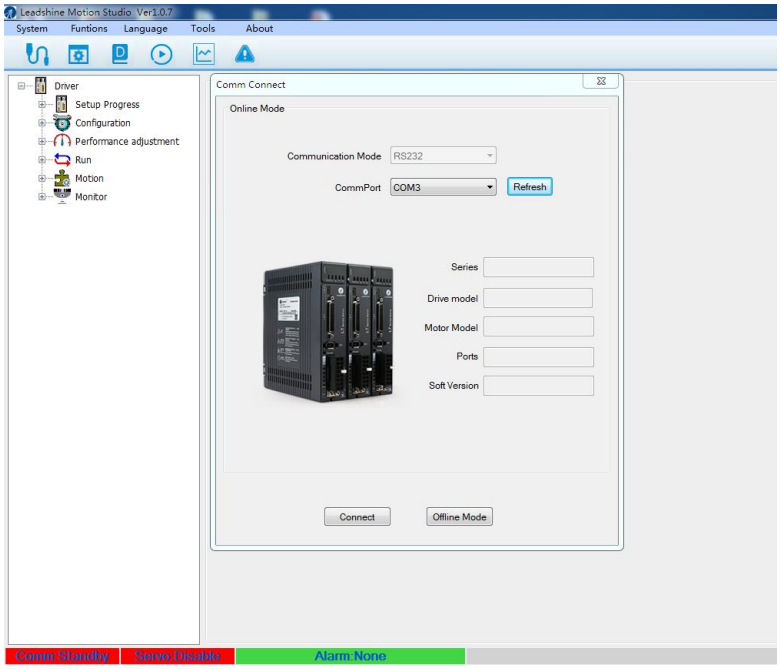
LeadshineMotionStudio Software User Manual

CS1-D Series

Closed Loop Stepper Drives



Revision 1.0

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Notice

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Record of Revisions

Revision	Date	Author	Description of Release
1.0	*Oct, 2019*	*MF*	*Initial Release*

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1. Introduction

Thank you for choosing Leadshine Products. The CS1-D series closed loop stepper drives include 4 models, CS1-D403, CS1-D507, CS1-D808, and CS1-D1008. When those drives are implemented with compatible stepper motors with encoders, your motion control system performance will get significant imProvement over traditional open loop stepper systems such as no loss of step, higher torque, lower noise & heating, and smoother motion. Leadshine closed loop Products are also ideal alternatives to replace similar frame size brushless servo systems in low-to-middle speed applications because of their features of much lower cost, much higher torque, and much easier system setup and configuration.

For most applications Leadshine closed loop stepper systems are easy to configure & setup and can be implemented without any tuning efforts, same as classic open loop stepper systems. But in some cases this free LeadshineMotionStudio software tool can still be used for performance tuning, and configuring custom settings like output current, micro-step resolution, control type, etc.

2. Prerequisites

Leadshine LeadshineMotionStudio for CS1-D closed loop stepper drives is a free Windows based software. To successfully run this software, the following Prerequisites must be satisfied.

2.1 Operation System

This LeadshineMotionStudio software must be installed and run on a computer with Windows 7 or Window 10 operating system for either 32 or 64 bit.

2.2 Motor Connection

From LeadshineMotionStudio software settings of a CS1-D drive can be changed with or without a stepper motor connected.

- Without a stepper motor connected, a user can only use the LeadshineMotionStudio software to change the CS1-D drive parameter values.
- With a stepper motor connected Properly to the CS1-D drive, a user can not only configure settings of the connected drive but also run the motor to test and tune motion performance. Refer to the CS1-D drive user manual for how to connect a stepper motor.

2.3 Accessories

To connect a CS1-D Closed loop stepper drive to the computer, Leadshine offers a special RS232 cable (Figure 1). It can be used to connect to the RS232 connector on the computer. If such a RS232 connector does not exist

on that computer, a user can use a USB to RS232 adaptor (Figure 2) or conversion cable to get the drive connected. Please note that not all USB to RS232 adapters will work. Contact your CS1-D drive seller or Leadshine technical support for getting such a USB to RS232 adaptor, which have been confirmed to work fine with the CS1-D series closed loop stepper drives.

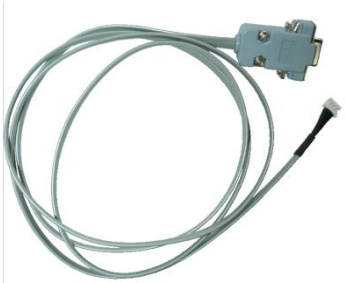


Figure 1: RS232 Tuning cable

Figure 2: USB to RS232 converter

3. Software Overview

Refer the following sections for a quick overview for this LeadshineMotionStudio software.

3.2 Work Space

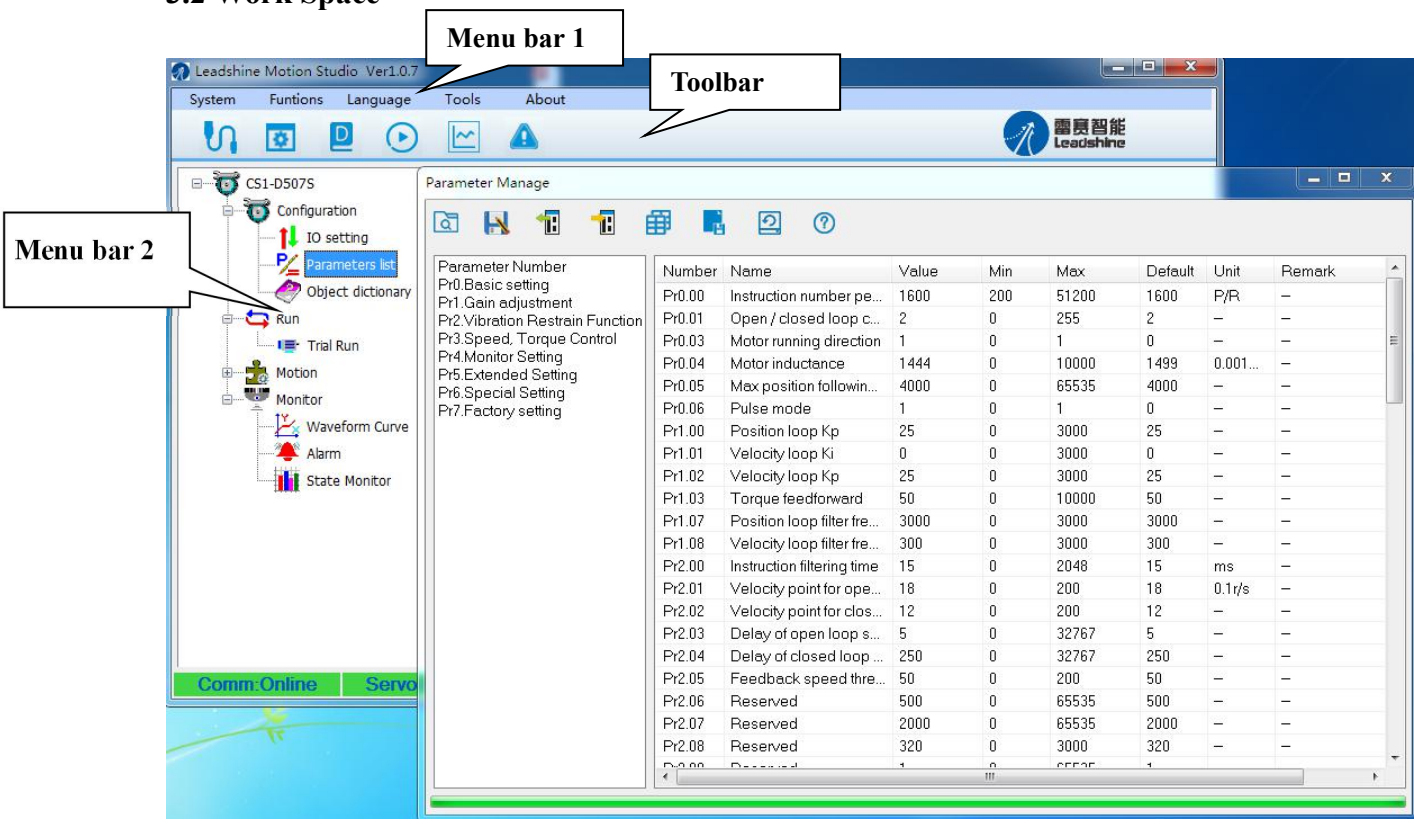


Figure 3: Software space

3.3 Menu and Toolbar

There are two menu bars, menu bar 1 is used to set up the Leadshine Studio software, menu bar 2 is used to set up the drive, Menu items and respective toolbar items are described in the following table:

Menu bar 1	Sub-menu Item	Toolbar Icon	Function
System	Connect		Connect/disconnect the drive to/from the computer
	Exit	-	Close Leadshine Motion Studio software
Functions	Save Parameter		Save modified parameter values to drive, it will be invalid after powering off
	Software Reset	-	The modified parameters take effect, and no power supply restart is required.
Language	Chinese	-	-
	English	-	-
Tools	Series Port Tool	-	No need to use
	USB Tool	-	
	Object Dict Tool	-	
	Register Tool	-	
About	Platform info	-	-
	Parameter Doc	-	-

Menu bar 2	Submenu Item	Toolbar Icon	Function
Configuration	IO setting	-	Connect/disconnect the drive to/from the computer
	Parameter list		Close Leadshine Motion Studio software
	Object dictionary		No need to use
Run	Trial Run		Refer to Chapter 5.4
Motion	PTP	-	No need to use
Monitor	Waveform Curve		Refer to Chapter 5.5
	Alarm		Monitor drive alarm
	State Monitor	-	No need to use

4. Connect the Drive

Follow the following steps to connect a CS1-D closed loop step drive to the LeadshineMotionStudio software on your computer.

- Read section 2.3 first, then connect the drive to your computer through a RS232 connection.
- Power on the CS1-D closed loop stepper drive.
- Launch Leadshine Motion Studio software, Step 1 to click the icon as Figure 4. Please do not click offline mode and any other icon
- Step 2 to select the correct COM port from “CommPort” dropdown list control (Figure 4). When a USB to RS232 adaptor is used, you can go to Device Manager of your computer to find the correct port.

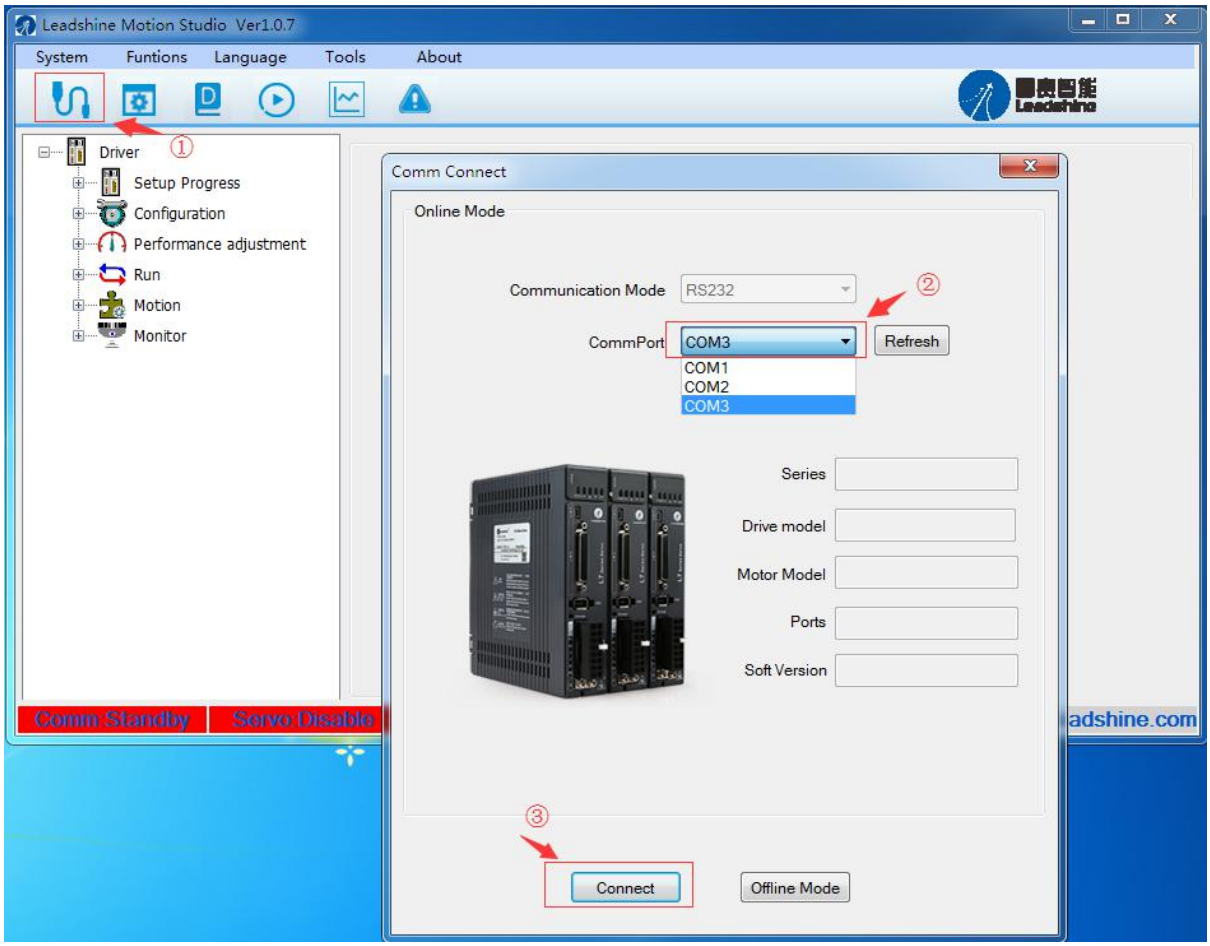


Figure 4: Communication screen

- Click “Connect” button and wait a few seconds. If the drive has been successfully connected, the screen will be automatically displayed with the Series and Drive Model as shown in Figure 5. Otherwise, the following error message will be displayed (Figure 5) .

Figure 5: Communication error message

- If the wrong COM port is selected or the drive is not powered on, the following window will pop up

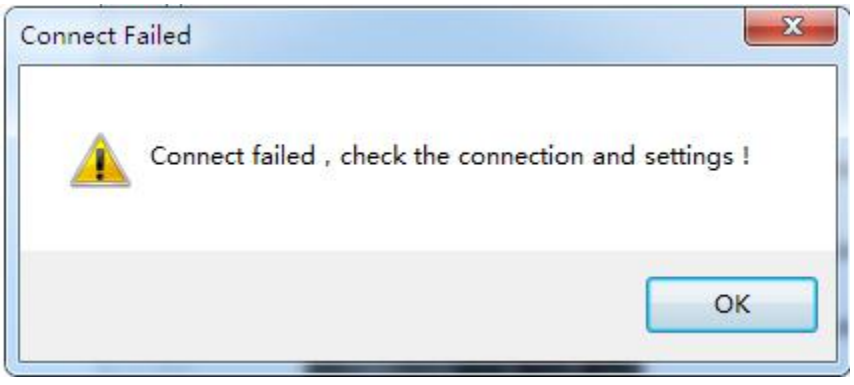


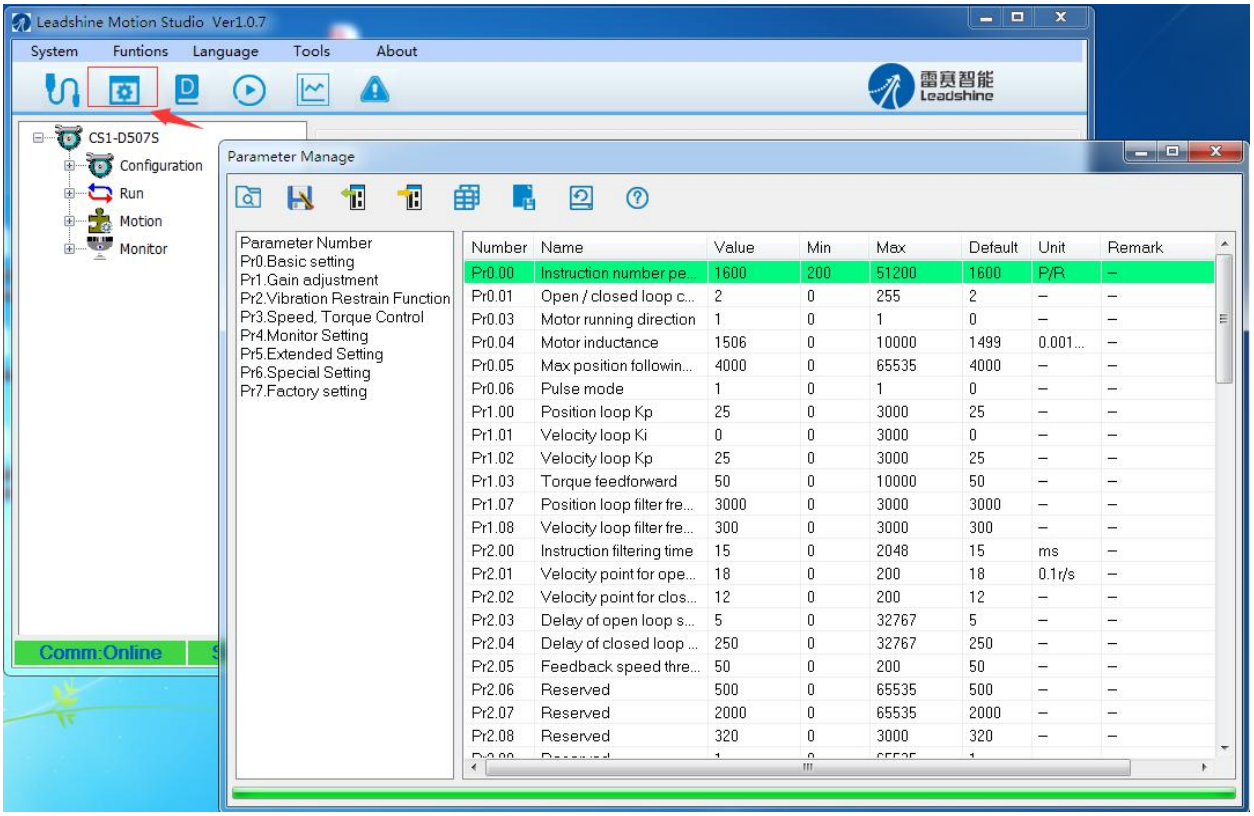
Figure 6: Communication error message

5. Manage Drive Parameters

Settings and configurations of the connected CS1-D closed loop stepper drive are all stored in parameters. They can be read, changed, and saved through the LeadshineMotionStudio CS1-D software.

5.1 Read Parameters

After the drive is connected successfully connected to computer, after clicking icon on the tool bar, current settings of the CS1-D drive will be automatically uploaded and displayed (Figure 7). Or the Parameters window can also be opened any time by clicking the "Configuration->Parameters list " on the menu bar 2.



Number	Name	Value	Min	Max	Default	Unit	Remark
Pr0.00	Instruction number pe...	1600	200	51200	1600	P/R	--
Pr0.01	Open / closed loop c...	2	0	255	2	--	--
Pr0.03	Motor running direction	1	0	1	0	--	--
Pr0.04	Motor inductance	1506	0	10000	1499	0.001...	--
Pr0.05	Max position followin...	4000	0	65535	4000	--	--
Pr0.06	Pulse mode	1	0	1	0	--	--
Pr1.00	Position loop Kp	25	0	3000	25	--	--
Pr1.01	Velocity loop Ki	0	0	3000	0	--	--
Pr1.02	Velocity loop Kp	25	0	3000	25	--	--
Pr1.03	Torque feedforward	50	0	10000	50	--	--
Pr1.07	Position loop filter fre...	3000	0	3000	3000	--	--
Pr1.08	Velocity loop filter fre...	300	0	3000	300	--	--
Pr2.00	Instruction filtering time	15	0	2048	15	ms	--
Pr2.01	Velocity point for ope...	18	0	200	18	0.1r/s	--
Pr2.02	Velocity point for clos...	12	0	200	12	--	--
Pr2.03	Delay of open loop s...	5	0	32767	5	--	--
Pr2.04	Delay of closed loop ...	250	0	32767	250	--	--
Pr2.05	Feedback speed thre...	50	0	200	50	--	--
Pr2.06	Reserved	500	0	65535	500	--	--
Pr2.07	Reserved	2000	0	65535	2000	--	--
Pr2.08	Reserved	320	0	3000	320	--	--

Figure 7: Parameters

Filter Displayed Parameters

On the left of parameters manage window, you can use filter the displayed parameters (Figure 8).

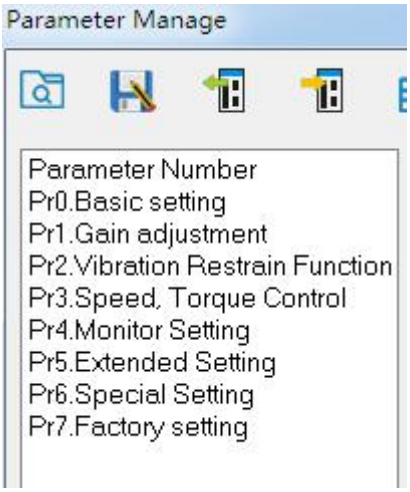


Figure 8: parameter type

5.2 Edit Parameters

To edit a parameter value, double click the "Value" field for that parameter. You can then change its value. Make sure the input value is an integer in the range defined in the "Range" field. See Figure 9.

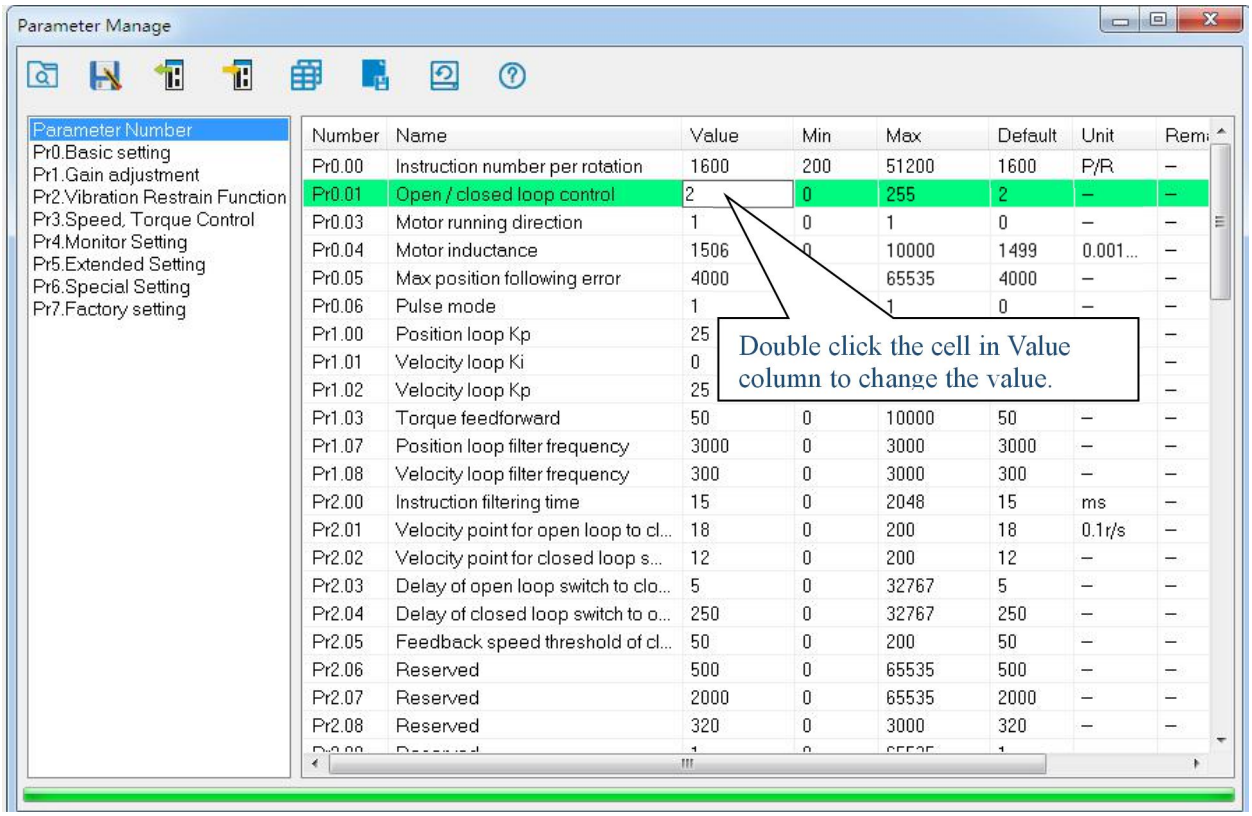


Figure 9: edit parameter value

When trying to make parameter value changes, please note:

- Some parameters are read-only, and take no effect whatever you type in.
- Some parameters are only effective after the related DIP switches on the CS1-D closed loop stepper drive are set to “default”, such as parameters “Pulse/Rev”, “Filter time”, and “Encoder Resolution”.
- Some parameters only can be set by DIP switch, such as parameters “Pulse Mode”, “Control Mode”and “No Auto Tuning”
- Some parameters are “Reserved” means invalid parameter.

5.3 Key Parameter Description

All parameters for the CS1-D series closed loop stepper drives are described in this section.

5.3.1 Pulse/Rev (Instruction number per rev) (Pr 0.00)

This parameter is used to set micro step resolution. To make this parameter effective,

- DIP switches 1-4 (DP1-4) of the CS1-D drive must be all set to “ON” positions.
- It can be any value in the range of 200 – 51,200.

5.3.2 Peak Current (Pr 5.00)

This parameter is used to set the peak current that the CS1-D drive can output.

5.3.3 Closed Loop Holding Current Percentage (Pr 5.01)

This parameter is a percentage value of the peak current in Pr 5.00. It is used for both holding and idle current in closed loop control mode (Pr 0.01 value “2”). Increase this parameter value can improve response time and better torque, but may result in higher heating. For Leadshine motors, it is suggested keep the default value unless you really make your own configurations.

5.3.4 Encoder Resolution (Pr 7.01)

This parameter value must be set to 4 times of the encoder lines. For example, for a 1000-line encoder this parameter value must be set to 4000.

5.3.5 Allowed Max Position Following Error Pulses (Pr 0.05)

This parameter is used to set the allowed maximum pulse number of position errors.

5.3.6 Control Mode (read only) (Pr 0.01)

This parameter is set by SW8, used to select open loop control or closed loop control. When its value is “0” for open loop control; “2” is for closed loop control (default).

5.3.7 Open Loop Output Current Percentage (Pr 5.02)

This parameter is used to set the output and idle current in a percentage value of the peak current value (Pr 0.01), when the CS1-D drive operates in open loop control mode. It is only effective when parameter Pr 0.01 is set to “0” for open loop control.

5.3.8 Control Type (read only) (Pr 0.06)

This parameter is read only, because it’s set by SW7. Value “0” is for pulse & direction (also called step & direction) control; value “1” for CW/CCW control.

5.3.9 Pulse Effective Edge (Pr 5.19)

This parameter is used to determine when a pulse will be recognized. Set its value to “0” for rising edge (default); set its value to “1” for falling edge.

5.3.10 Delay of Loosening Brake (Pr 4.19)

This parameter is used to set the delay time before brake releasing. Usually keep the default value of this parameter unless you really want.

5.3.11 Delay of Closing Brake (Pr 4.20)

This parameter is used to set the delay time before starting to close the brake. Usually keep the default value of this parameter unless you really want.

5.3.12 "ENA" Input Signal Level Setting (Pr 4.30)

This parameter is used to set the “ENA” signal voltage level of the CS1-D drive. Set its value to “0” for high level; set its value to “1” for low level(default).

5.3.13 "ALM" Output Signal Impedance State(Pr 4.31)

This parameter is used to set the “ALM” signal impedance level of the CS1-D drive. Set its value to “1” for high level (default); set its value to “0” for low level.

5.3.14 “PEND” Output Signal Impedance State (Pr 4.00)

This parameter is used to set the “PEND” signal impedance level of the CS1-D drive. Set its value to “1” for high level; set its value to “0” for low level (default).

5.3.15 Distance to Send "In Position" Output Signal (Pr 4.24)

This parameter is used to set the distance (in number of pulses) to send out the In-Position signal.Usually keep the default value of this parameter unless you really want.

5.3.16 Fault clearing input signal level (Pr 4.33)

This parameter is used to set the "RST" signal voltage level of the CS1-D drive. Set its value to "0" for high level(default); set its value to "1" for low level.

5.3.17 Current Loop Kp (Pr 7.03)

This parameter is used to set the current loop bandwidth of the CS1-D drive. It is for advanced users only. Usually keep the default value for powering Leadshine motors.

5.3.18 Current Loop Ki (Pr 7.04)

This parameter is used for tuning current loop integral gain.. Usually keep the default value for Leadshine motors and 3rd party motors with normal inductance.

5.3.19 Position Loop Kp (Pr 1.00)

This parameter is used for tuning position loop Proportional gain. Usually keep the default value for Leadshine stepper motors, unless really needed to do so.

- Increase this value will reduce position following error, but could result in motor vibration.
- Decrease the value if the motor vibrates.

5.3.20 Velocity Loop Kp (Pr 1.02)

This parameter is used for tuning velocity loop integral gain. Usually keep the default value for Leadshine stepper motors, unless really needed to do so.

- Increase the value can increase velocity stiffness.
- Reduce this value when the motor vibrates at low speed.

5.3.21 Velocity Loop Ki (Pr 1.01)

This parameter is used for tuning Velocity loop Proportional gain. Usually keep the default value for Leadshine stepper motors unless really needed to do so. Set it to 0 if the motor shakes during settling.

5.3.22 Instruction Filtering Time (Pr 2.00)

This parameter is used to configure the time for internal command filtering. In some applications, change this value could improve overall system performance.

Note: *for multi-axis systems with interpolation, this value must be set to the same for all axes.*

5.3.23 Locking shaft current time (Pr 5.04)

This parameter is used to configure the internal smoothing time for the CS1-D drive initial current ramp-up

when the drive is turned on. Increase this value if there is a motor overshooting like “JUMP” at powered-on.

5.3.24 Motor Inductance (Pr 0.04)

This parameter is read-only, when the Auto-Tuning on the drive is turned on. It is for reference only.

5.3.25 Auto-Tuning at Power-on (Pr 5.13)

This parameter is used to set if the drive auto-tuning is turned on at power-on. It is read-only parameter for informational only. Its value is actually determined by dip switch SW6 of the CS1-D drive.

5.3.26 Velocity Switching Point: Open Loop to Closed Loop (Pr 2.01)

This parameter is used to set the velocity switching point from open loop to closed loop. Usually keep the default value. Only change it when it causes motor vibration at this mode switching velocity point.

5.3.27 Velocity Switching Point: Closed Loop to Open Loop (Pr 2.02)

This parameter is used to set the velocity switching point from closed loop control to open loop control. Usually keep the default value. Only change it when it causes motor vibration at this mode switching velocity point.

5.3.28 VBS function (Pr 2.13)

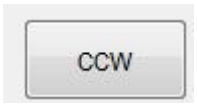
This parameter is used to vibration compressing, mainly solves the problem of motor vibration in 0.5 rps to 2 rps at low speed. Little effect on the performance of the speed segment above 3rps。

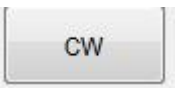
5.4 Run Test

Click the icon or double click Run->Trial Run menu item for running test. This Run Testing window of LeadshineMotionStudio software can be used to make motor run, but can not monitor the motion wave. The steps are as follows:

- Step 1 to set Jog Speed (running test speed) and Acceleration, then click “Download” to take effective;
- Step 2 to click “Servo Enable” to make the icon change from

to

.
- Step 3 to click 

or 

to make motor run in JOG Speed . Or set first “current position” value to position 1, then make motor runs to achieve second “current position” as

position 2. At last to click

to make motor runs back and forth.

5.5 Monitor Window

The Monitor Window includes 3 sub-menu: “Waveform Curve”, “Alarm”, and “State Monitor” in Figure 10,

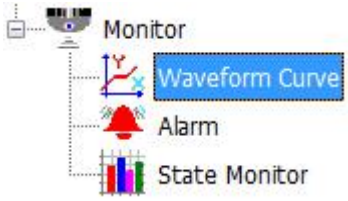


Figure 10: Monitor window

The most useful sub-menu “Waveform Curve” as Figure 11, is a scope used to display colored curves based on what have been chosen on Channel 1 and Channel 2 dropdown lists during the test. It can be used to:

- Perform motion performance test for current drive parameter setting.
- Monitor motion performance when the CS1-D drive takes control signals from a connected motion controller/PLC/pulse generator…

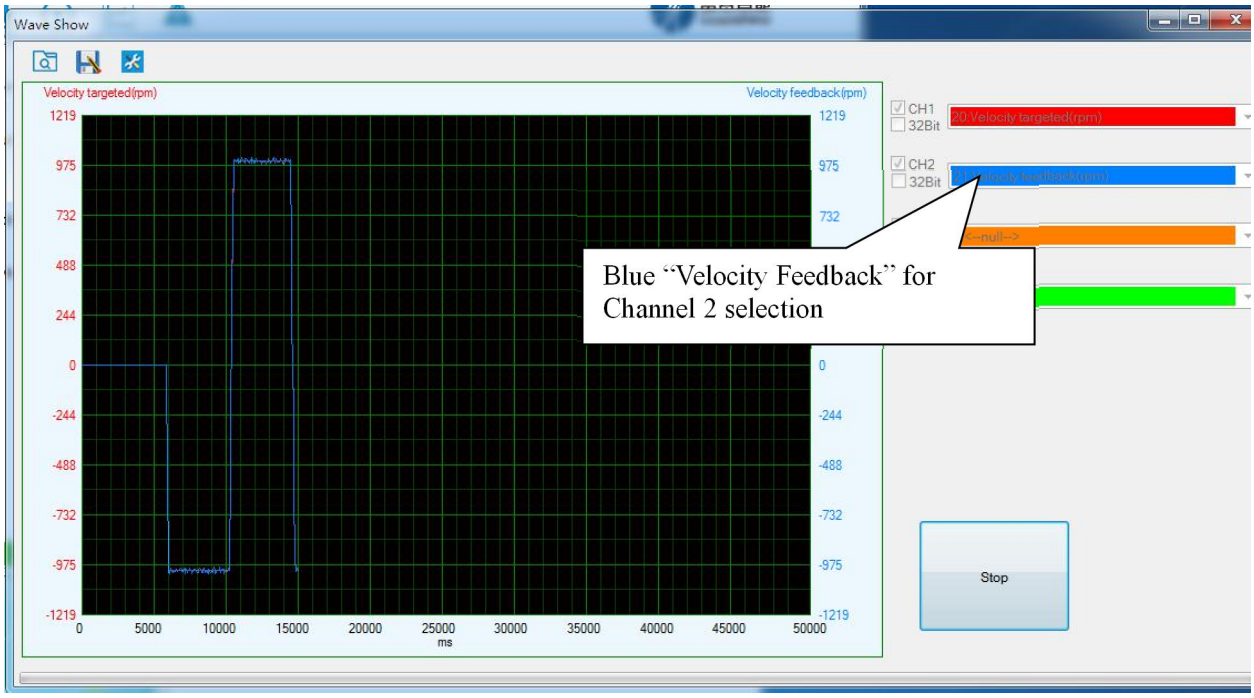


Figure 11: Scope portion of Motion Test window

Available options for Channel 1 add 2 dropdown list controls include “Position Error”, “Velocity

Feedback", "Position Feedback", "Velocity Targeted", "Position Targeted", "Resultant Current", "Bus Voltage", "Phase A Current", and "Phase B Current". See Figure 12.

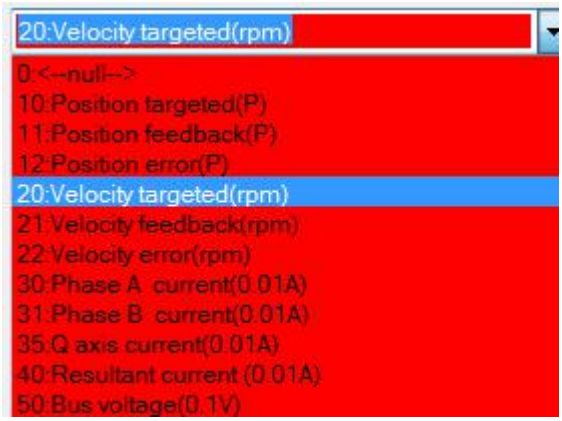


Figure 12 curve type options

When click the icon

, it will have a setup window as shown in Figure 13. The "Capture Trigger" on the left is used for monitoring motion performance when the CS1-D drive controlled by exterior controller or PLC. The "Sampling Frame and Precision" on the right is used to perform motion performance test for current drive parameter setting .

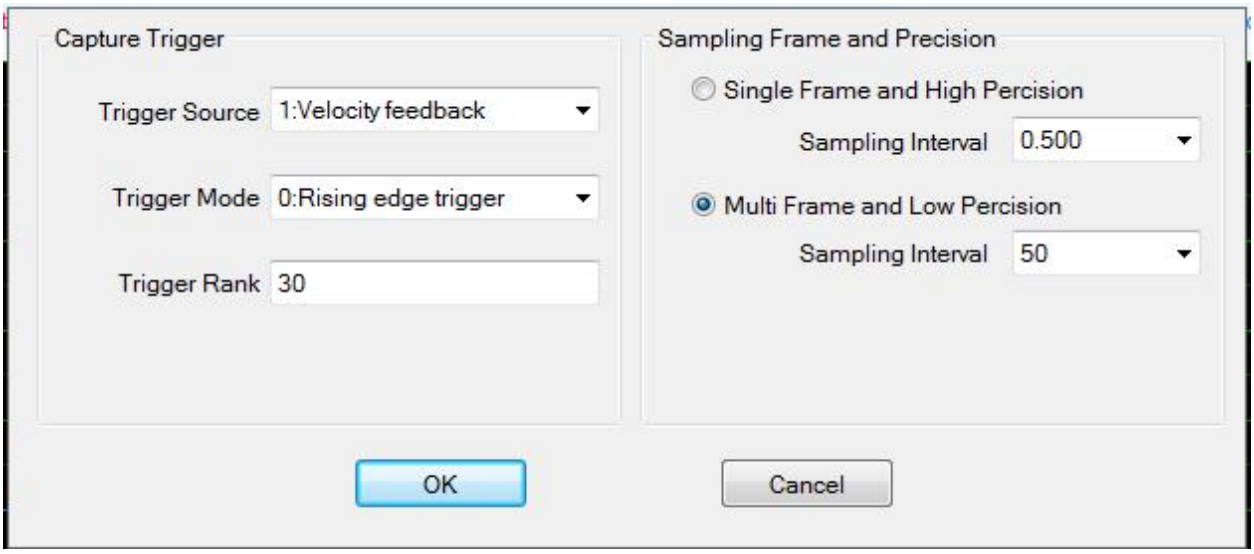


Figure 13: motion test parameters

When you have completed the above settings, please click the icon

to monitor motion wave

6. Write to Drive (Download to Drive)

After parameters tuned & optimized and motion performance tested, you must download their changes to the drive. Otherwise, those changes will be lost next time when the drive is re-powered.

Following the following steps to write parameters to the drive.

- Click the icon

on the parameter manage. A confirmation will be popped up to confirm the modified parameters and download them to the drive as shown in Figure 14.

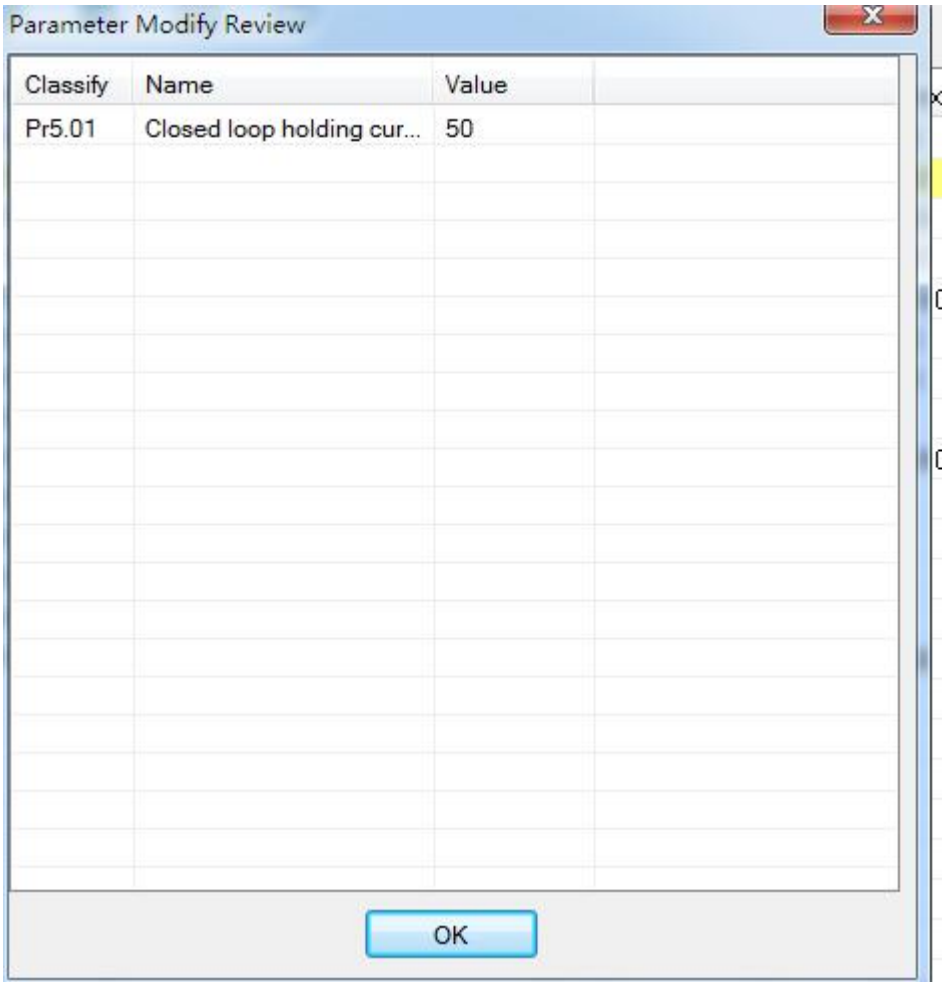


Figure 14: Write to drive confirmation message

- Click "OK" to continue downloading parameter values to the CS1-D drive.

7. Resetting Drive

To reset the current drive configurations back to factory settings, follow the following steps.

- Click the icon

in parameter manage window. The confirmation message will be popped up (Figure 15). Select “Driver Parameter” item, then click the “OK” button to continue resetting Process.

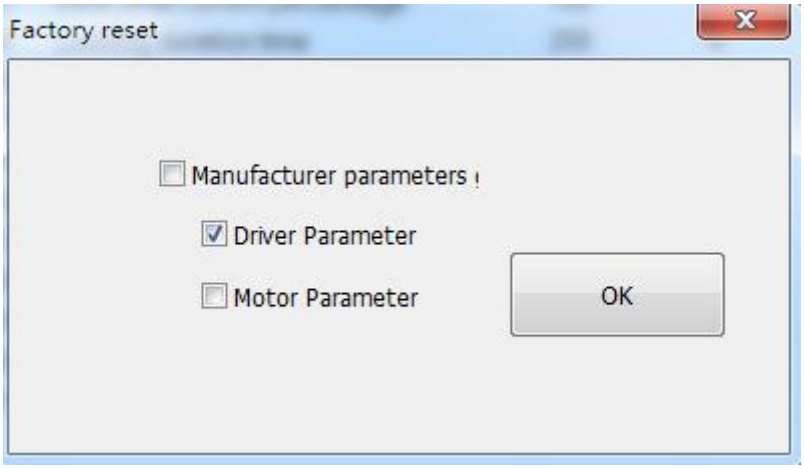


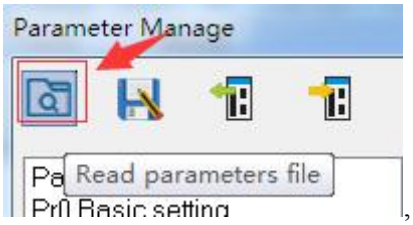
Figure 15: resetting confirmation message

8. Manage Configuration File

After the drive performance is tuned and parameter values optimized, its settings can be saved to a configuration file in .lsr format. You can also open an existing .lsr configuration file and load the settings to the LeadshineMotionStudio CS1-D software.

7.1 Open a Configuration File

Follow the following steps to load settings from an .lsr configuration file

- Open parameter window, then click icon 

, then it will show as

Figure 16 .

Figure 16: open an .lsr configuration file window

- Find and select the .lsr configuration fil click “OK” button. After the configuration file is open, then click the icon

.

After a configuration file is opened, to get back to its original settings you will need to repower the CS1-D closed loop stepper drive.

7.2 Save a Configuration File

Follow the following steps to save the current parameters into an .lsr configuration file

- Open the parameter manage window, click the icon

, then it will show as Figure 17

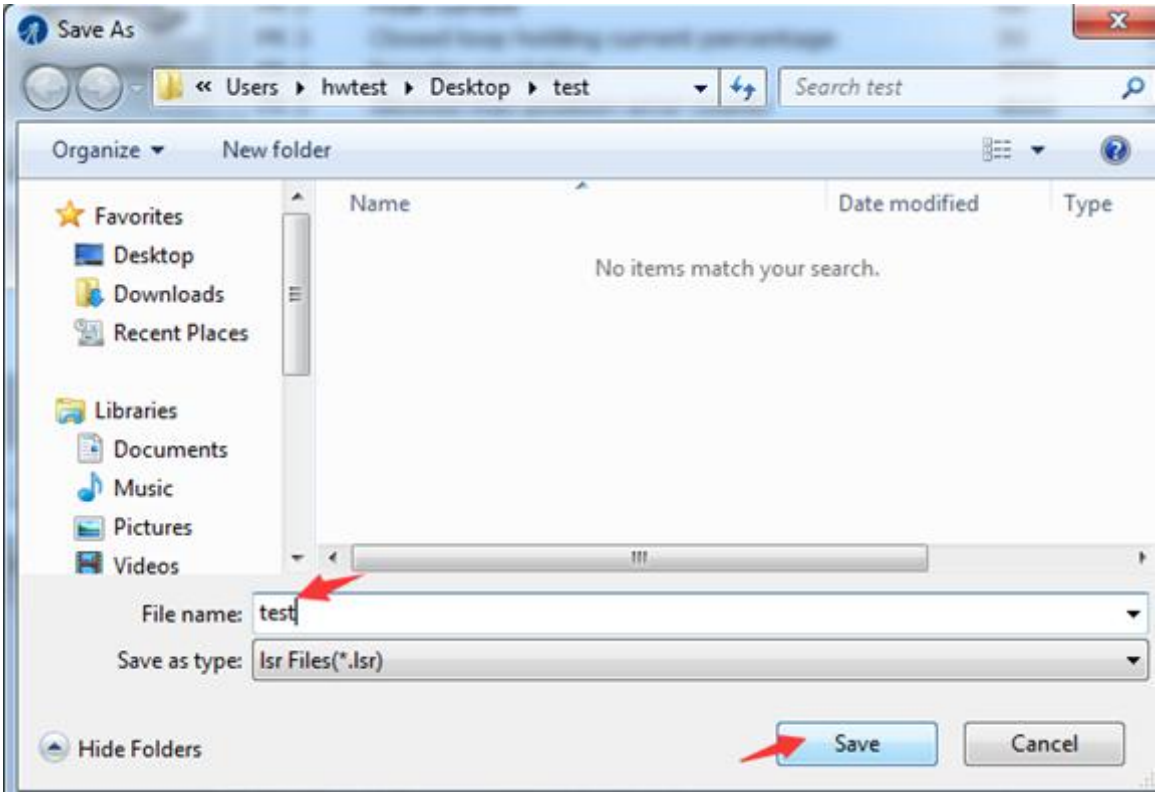
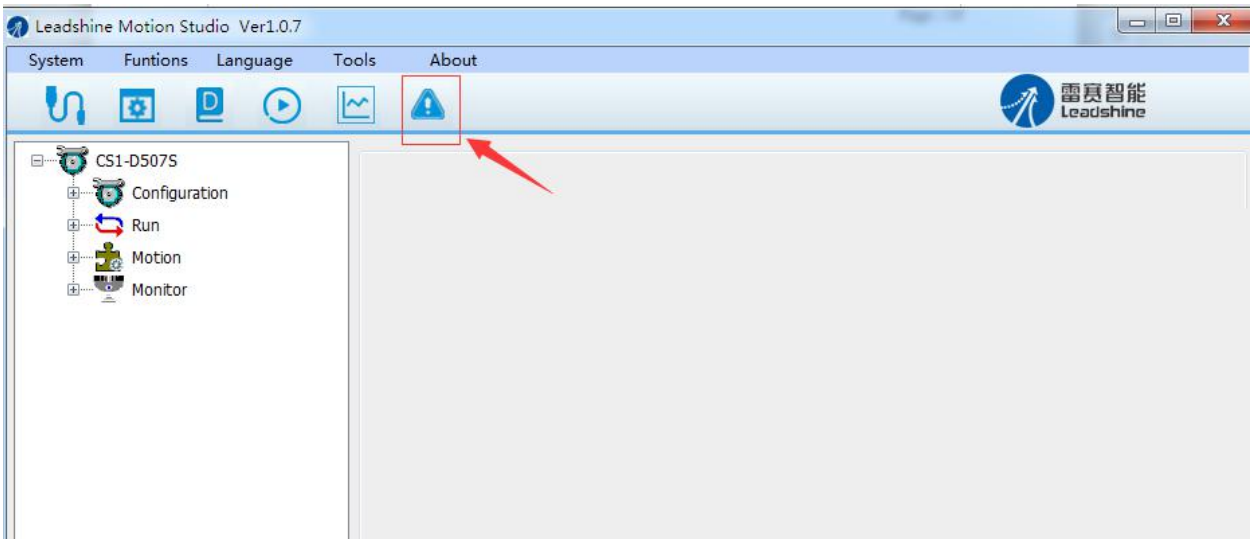


Figure 17: save configuration file

- Choose the location and file name and click the Save button.

9. Manage Drive Error History

You can use the LeadshineMotionStudio for CS1-D software to track error history Previously happened to the connected CS1-D closed loop stepper drives. Follow the following steps for that:



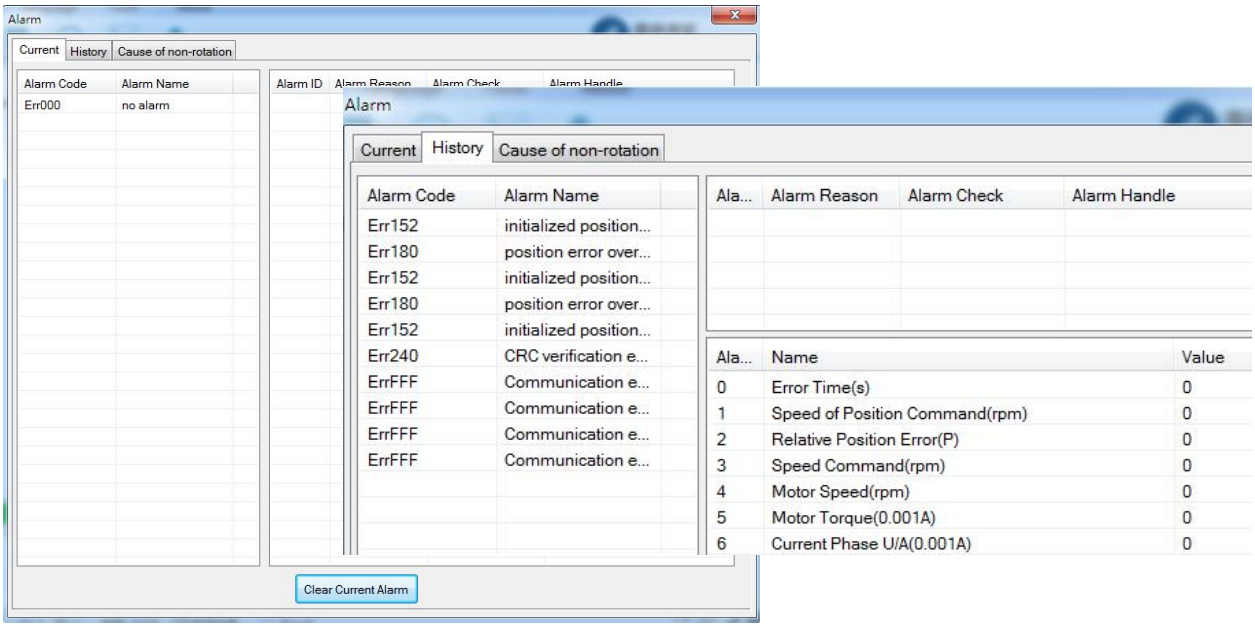


Figure 18: Show the drive's alarm