User Manual

CS-D1008

Closed Loop Stepper Drive

Revision 1.0

1. Introduction

Leadshine CS-D1008 is a closed loop stepper drive designed to solve the loss of step problem in open loop stepper control systems, thus increase system reliability at minimal cost increase. It implements advanced control algorithm of Leadshine based on its tens of years' experience in stepper and servo controls. The CS-D1008 is highly reliable and affordable and performs excellent in many industrial applications such as CNC, medical, electronics, packaging...

The CS-D1008 can power 2-phase NEMA 34 stepper motors with incremental encoders. Compared with traditional open loop stepper systems, a CS-D1008 adopted closed loop step system can eliminate potential loss of step, make real-time position error correction, and do not need torque reservation (100% torque implementation). Also it can power the driven stepper motor with reduced heating, lower noise, low vibration…

1.1 Features

- No loss of step
- No torque reservation
- No hunting or overshooting
- No tuning for easy setup
- Low noise and vibration, smooth motion
- 20-70VAC or 30-100VDC supply voltage, max 8A output current
- Max 200 KHz input frequency
- 15 micro step settings of 800-51,200 via DIP switches, or 200-51,200 via software (increase by 200)
- Protections for over voltage, over current and position following error

1.2 Applications

When a CS-D1008 closed loop stepper drive is implemented with a compatible stepper motor with encoder, the closed stepper system can be adopted in many small to median speed applications such as CNC routers, CNC mills, CNC laser cutters, CNC plasmas, lab automation instruments, plotters, medical equipment, electronic equipment, small packaging machines, etc.

2. Specifications

2.1 Electrical Specifications

Parameters	Min	Typical	Max	Unit
Output Current	0.5	-	8.0(Peak)	A
Operating Voltage	30	48, 60, 72	100	VDC
	20	63	70	VAC
Logic signal current	7	10	16	mA
Pulse input frequency	0	-	200	kHz
Minimal pulse width	2.5	-	-	µS
Minimal direction setup	5.0	-	-	µS
Isolation resistance	500			MΩ

2.2 Environment

Cooling	Natural Cooling or Forced Cooling	
Operating Environment	Environment	Avoid dust, oil fog and corrosive gases
	Ambient Temperature	0°C ─ 65°C (32°F - 149°F)
	Humidity	40%RH─90%RH
	Operating Temperature	0°C ─ 50°C (32°F - 122°F)
	Vibration	10-50Hz / 0.15mm
Storage Temperature	-20°C ─ 65°C (-4°F - 149°F)	
Weight	Approx. 570 g (20.2 Oz)	

2.3 Mechanical Specifications

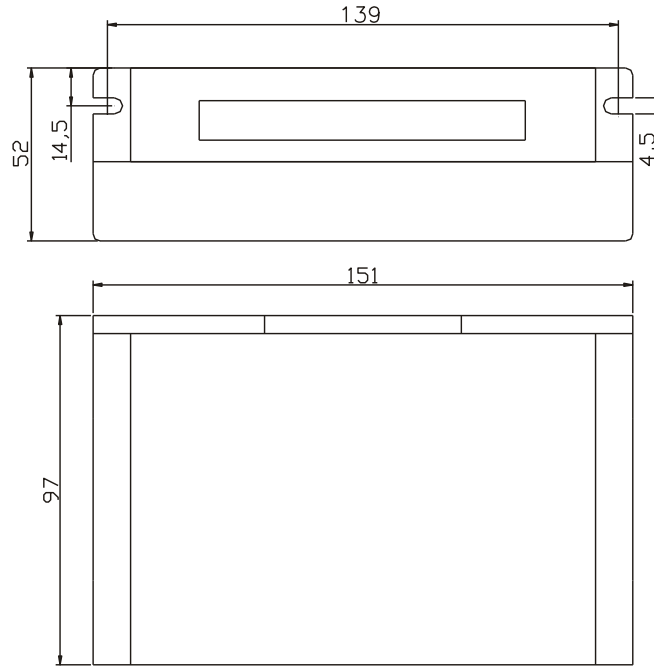(unit: mm [1inch=25.4mm])

Figure 1: Mechanical specifications

2.4 Heat Dissipation

- CS-D1008 reliable working temperature should be no more than 60°C (140°F)
- It is recommended to mount the drive vertically to maximize heat dissipation. Mount a cooling fan nearby if necessary.
- If multiple CS-D1008 drives are installed, it is suggested to keep a minimal 30mm (12 inches) between two of them.

3. Connections and LED Indication

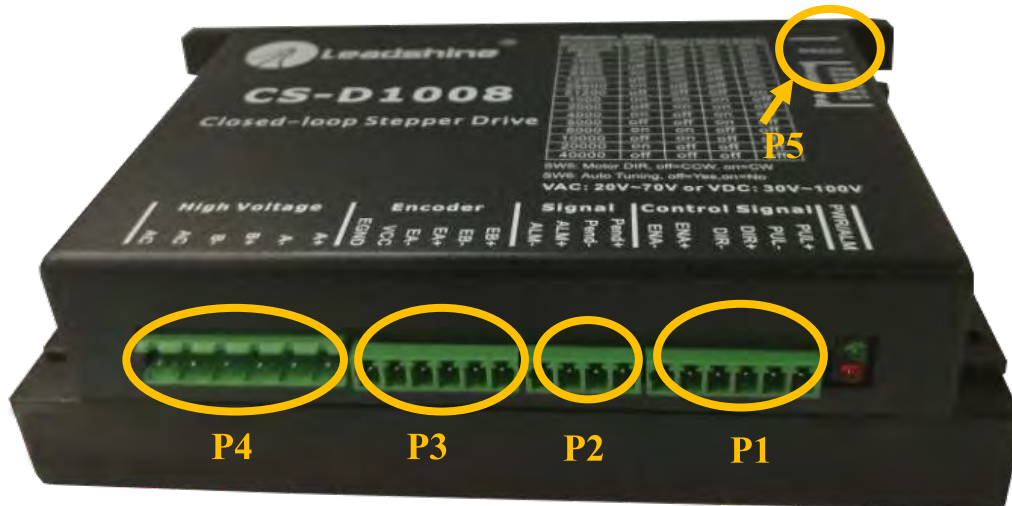A CS-D1008 closed loop stepper drive has 5 connection blocks from P1 to P5 (see figure 2).

Figure 2: CS-D1008 connectors

3.1 Connector P1 & P2– Control Input and Output Connections

3.1.1 Pin Assignments of P1 & P2

The P1 & P2 connector in Figure 2 is for control signal and fault output connections. Refer to the following table for details.

Pin Name	I/O	Details
PUL+	I	Pulse signal: (1). In single pulse (pulse & direction) control mode, this input represents pulse signal. A pulse signal is active at the rising or falling voltage edge (set by PC software). (2). In double-pulse (CW/CCW) control mode (set by PC software), this signal input represents clockwise (CW) pulse, and is active at both high voltage level and low voltage level. (3). 4.5-24V for voltage HIGH, 0-0.5V for voltage LOW (same for DIR and ENA signals). (4). Pulse width should be set to 2.5μs or longer.
PUL-	I	
DIR+	I	Direction signal: (1). In single pulse (step & direction) control mode, this signal's low and high voltage levels represent the two directions of motor rotation (e.g. clockwise and counterclockwise). (2). In double-pulse (CW & CCW) control mode, this signal represents counterclockwise (CCW) rotation. It is active at both voltage high level and low level. (3). Minimal DIR signal setup time should be at least 5μs. (4). Rotation direction is related to your motor/drive wiring. You can reverse the default rotation direction by toggling the SW5 DIP switch.
DIR-	I	
ENA+	I	Enable signal: This signal is used for enabling/disabling the drive. High voltage level of 4.5-24V (NPN control signal) for enabling the drive and low voltage level of 0-0.5VDC for disabling the drive. PNP and Differential control signals are on the contrary, namely Low level for enabling. By default this signal is left UNCONNECTED & ENABLED.
ENA-	I	
Pend+	O	In-position Signal: OC output signal, active when the difference between the actual position and

Pend-	**O**	the command position is zero. This port can sink or source 20mA current at 24V. The resistance between Pend+ and Pend- is active at high impedance.
ALM+	**O**	**Fault Signal**: An OC output signal which is active when one of the following error protection is activated: over-voltage, over-current, and position following error. This port can sink or source 20mA current at 24V. The resistance between ALM+ and ALM- is low impedance in normal operation, and will change to high when the drive goes into error protection. The voltage active level of this false output signal can be configured by configuration software.
ALM-	**O**	

Notes: (1) Shielding control signal wires is suggested; (2) to avoid/reduce interference, don't tie control signal cables and power wires together.

3.1.2 Typical Control and Fault Output Connections

The CS-D1008 can accept differential and single-ended control signal inputs (open-collector and PNP output). A CS-D1008 has 3 optically isolated control inputs, PUL, DIR, and ENA. Refer to the following two figures for connections of open-collector and PNP signals.
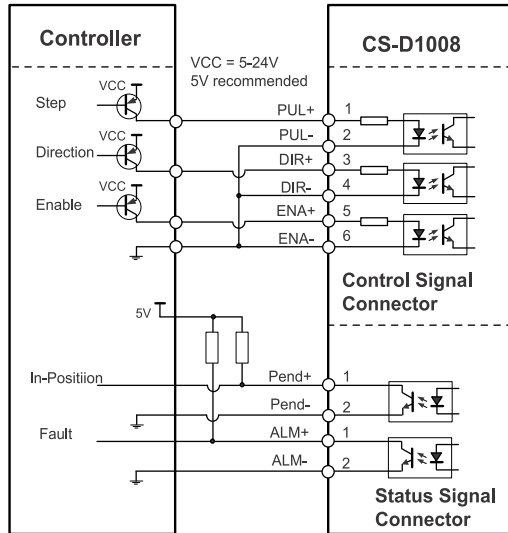

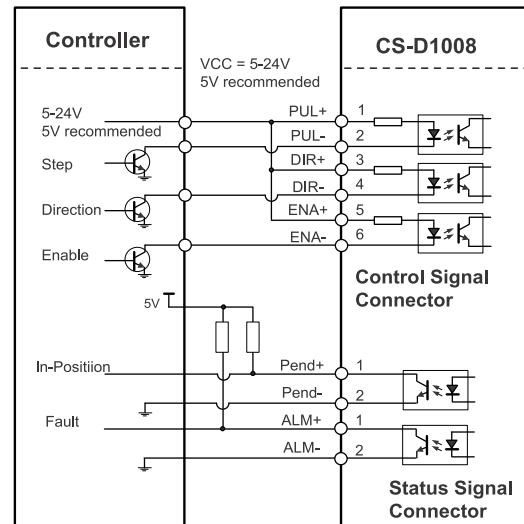Figure 3: Connections to PNP signal
(common-cathode)

Figure 4: Connections to open-collector signal
(common-anode)

3.2 Connector P3 - Encoder Connection

The P3 connector in Figure 2 is for encoder signal connection. Refer to the following table for details.

Drive Pin Name	Description
EB+	Encoder B+ input connection
EB-	Encoder B- input connection
EA+	Encoder A+ input connection
EA-	Encoder A- input connection
VCC	encoder +5V voltage output connection
EGND	Power ground connection

Notes: encoder resolution must be 1000-line.

3.3 Connector P4 - Motor and Power Supply Connection

The P4 connector in Figure 2 is for motor connection. Refer to the following table for details.

Pin Name	Details
A+	Stepper motor A+ connection. Connect motor A+ wire to this pin
A-	Stepper motor A- connection. Connect motor A- wire to this pin
B-	Stepper motor B+ connection. Connect motor B+ wire to this pin
B-	Stepper motor B- connection. Connect motor B- wire to this pin
AC	Power supply connection. 30-100VDC or 20-70VAC power supply voltage
AC	

Notes: see Appendix B for compatible Leadshine power supplies

3.4 Connector P5 – RS232 Connection

The P5 connector in Figure 2 is a RS232 communication port for PC connection. Refer to the following pin definitions.

RS232 Communication Port – RJ11

Pin	Name	I/O	Description
1	NC	-	Not connected.
2	+5V	O	+5V power output.
3	TxD	O	RS232 transmit.
4	GND	GND	Ground.
5	RxD	I	RS232 receive.
6	NC	-	Not connected.
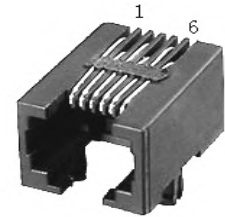
Notes: RS232 connection of CS-D1008 is for tuning purpose only, not for RS232 command controls.

3.5 LED Light Indication

There are two LED lights for CS-D1008, one red and one green. The GREEN one is the power indicator which will be always on generally. The RED one is a protection indicator. It is off always when a CS-D1008 operates normally, but will flash 1, 2 or 7 times in a 5-second period when error protection is enabled. Different number of flashes indicates different protection type (read Section 9).

4. Motor Selection

The CS-D1008 is designed to power 2-phase (or 4-phase 0.9 degree) NEMA 34 stepper motors with 1000-line incremental encoders. Leadshine offers many high performance stepper motors compatible with the CS-D1008 which you can find in the Appendix A of this document. The CS-D1008 can also power similar stepper motors with 1000-line incremental encoders from third-party suppliers.

5. Power Supply Selection

The CS-D1008 can power medium size closed loop stepper motors (frame size NEMA 34) from Leadshine (see Appendix A) or other motor manufacturers. To get good system performance, it is important to select proper supply voltage and output current. Generally speaking, supply voltage determines the high speed performance of the motor,

while output current determines the output torque of the driven motor (particularly at lower speed). Higher supply voltage will allow higher motor speed to be achieved, at the price of more noise and heating. If the motion speed requirement is low, it's better to use lower supply voltage to decrease noise, heating and improve reliability.

Notes: See Appendix B at the end of this document for Leadshine CS-D1008 compatible switching power supplies specially designed for stepper & servo controls.

5.1 Regulated or Unregulated Power Supply

Both regulated and unregulated power supplies can be used to supply the drive. However, unregulated power supplies are preferred due to their ability to withstand current surge and fast response for current change. If you prefer to a regulated power supply, it is suggested to choose such a power supply specially designed for stepper/servo controls such as Leadshine RPS series (http://www.leadshine.com/producttypes.aspx?producttype=regulated-switching). Or, in the case when only normal switching power supplies are available, it is important to use "OVERSIZE" high current output rating power supplies (for example, using a 4A power supply for 3A stepper motor) to avoid problems such as current clamp. On the other hand, if unregulated supply is used, one may use a power supply of lower current rating than that of motor (typically 50%-70% of motor current). The reason is that the drive draws current from the power supply capacitor of the unregulated supply only during the ON duration of the PWM cycle, but not during the OFF duration. Therefore, the average current withdrawn from power supply is considerably less than motor current. For example, two 3A motors can be well supplied by one power supply of 4A rating.

5.2 Power Supply Sharing

Multiple CS-D1008 drives can share one power supply to save space and reduce cost, if that power supply has enough power capacity. To avoid cross interference, connect each stepper drive directly to the shared power supply separately. To avoid cross interference, DO NOT daisy-chain connect the power supply input pins of the Drivers. Instead connect them to power supply separately.

5.3 Selecting Supply Voltage

The CS-D1008 is designed to operate within 20-70VAC or 30-100VDC voltage input. When selecting a power supply, besides voltage from the power supply power line voltage fluctuation and back EMF voltage generated during motor deceleration needs also to be taken into account. Ideally it is suggested to use a power supply with the output of **20-70VAC or 48-100VDC**, leaving room for power line voltage fluctuation and back-EMF.

Higher supply voltage can increase motor torque at higher speeds, thus helpful for avoiding losing steps. However, higher voltage may cause bigger motor vibration at lower speed, and it may also cause over-voltage protection or even drive damage. Therefore, it is suggested to choose only sufficiently high supply voltage for intended applications.

6. DIP Switch Configurations

The CS-D1008 has a built-in 8-bit DIP switch to set microstep resolution, motor direction, auto tuning switch and so on.
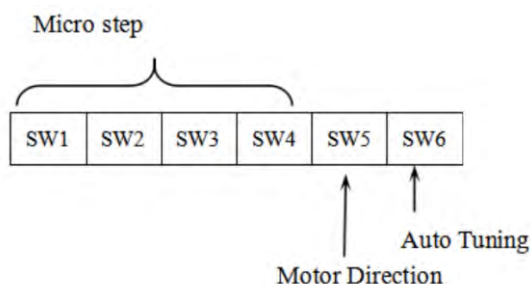
Figure 5 DIP switch Setting

6.1 Microstep Resolution (SW1-SW4)

Microstep resolution is set by SW1, 2, 3, 4 of the DIP switches as shown in the following table:

Steps/Revolution	SW1	SW2	SW3	SW4
Software Configured (Defaulted to 1600)	on	on	on	on
800	off	on	on	on
1600	on	off	on	on
3200	off	off	on	on
6400	on	on	off	on
12800	off	on	off	on
25600	on	off	off	on
51200	off	off	off	on
1000	on	on	on	off
2000	off	on	on	off
4000	on	off	on	off
5000	off	off	on	off
8000	on	on	off	off
10000	off	on	off	off
20000	on	off	off	off
40000	off	off	off	off

6.2 Other DIP Switch Settings (SW5-SW6)

	Function	On	Off
SW5	Default Direction	CW (clockwise)	CCW (counterclockwise)
SW6	Auto Tuning	No	Yes

7. Typical Connection

A complete closed loop stepper system should include a stepper motor with encoder, CS-D1008 drive, power supply and controller (pulse generator). A typical connection is illustrated in figure 6.
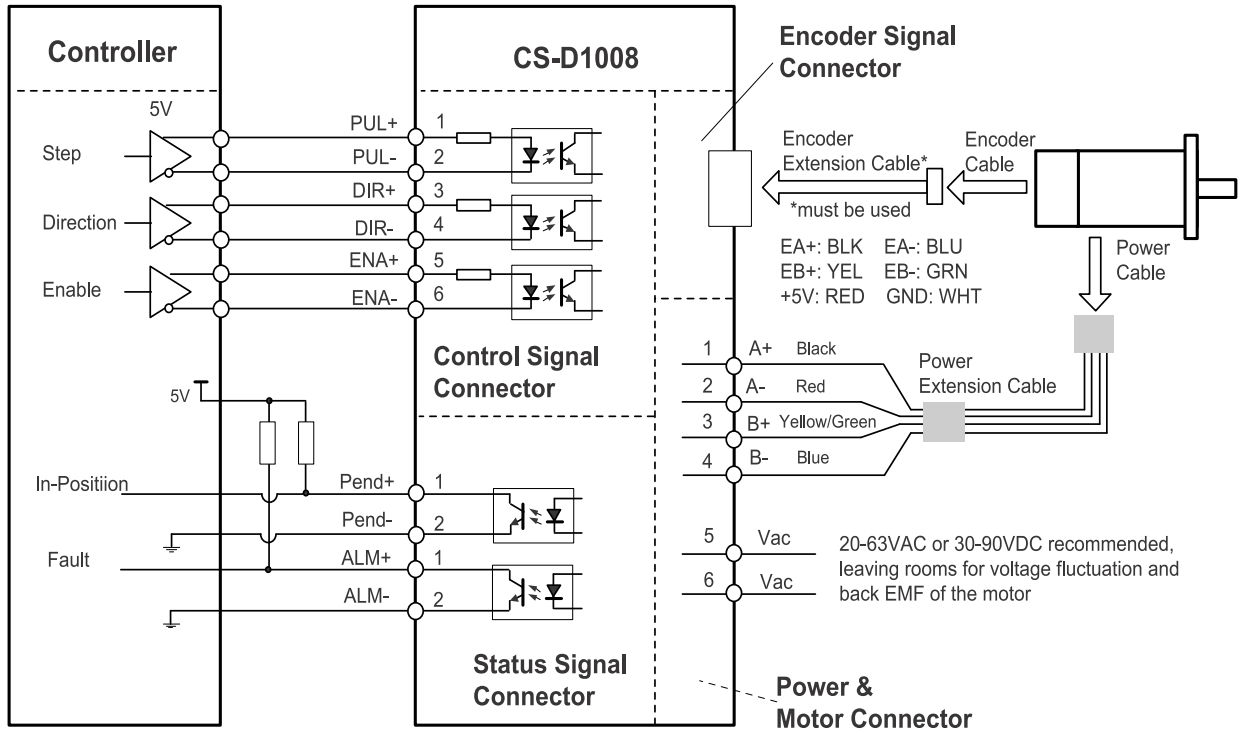
Figure 6: Typical connection

8. Sequence Chart of Control Signals

In order to avoid some fault operations and deviations, PUL, DIR and ENA should abide by some rules, shown as following diagram:
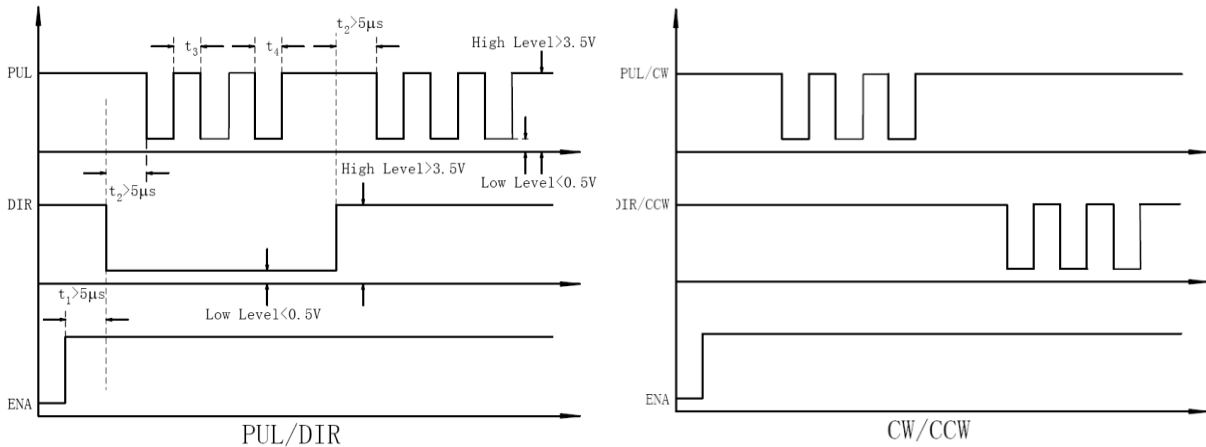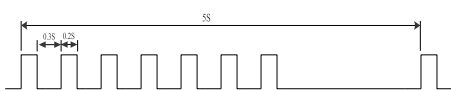

Figure 7: Sequence chart of control signals
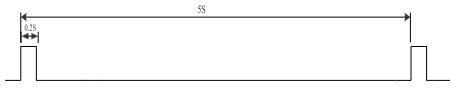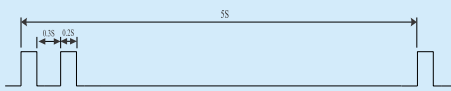
Remark:

a) t_1: ENA must be ahead of DIR by at least 5 s. Usually, ENA+ and ENA- are NC (not connected). See "Connector P1 Configurations" for more information.

b) t_2: DIR must be ahead of PUL effective edge by 5 s to ensure correct direction;

c) t_3: Pulse width not less than 2.5 s;

d) t_4: Low level width not less than 2.5 s.

9. Protection Functions

To improve reliability, the drive incorporates some built-in protections features.

Priority	Time(s) of Blink	Sequence wave of red LED	Description
1st	1		Over-current protection activated when peak current exceeds the limit.
2nd	2		Over-voltage protection activated when drive working voltage is greater than 160VDC
3nd	7		Position following error

When above protections are active, the motor shaft will be free or the red LED blinks. Reset the drive by repowering it to make it function properly after removing above problems.

10. Software Configuration

The CS-D1008 is designed for simple setup and implementation. For most applications no software configuration or tuning is needed especially when driving Leadshine stepper motors with encoders (see Appendix A). If you want to do fine tuning or custom configurations such as micro-step, current percentage change…, you can use Leadshine's free ProTuner software to make the changes. Download ProTuner at
http://www.leadshine.com/UploadFile/Down/ProTuner_CS_Ds.V1.0.zip or
http://www.leadshineusa.com/UploadFile/Down/ProTuner_CS_Ds.V1.0.zip. Download the software manual at
http://www.leadshine.com/UploadFile/Down/CS-Dsm_V1.0.pdf or
http://www.leadshineusa.com/UploadFile/Down/CS-Dsm_V1.0.pdf.

11. Accessories

If you plan to use the ProTuner software, contact your supplier or Leadshine to purchase the RS232 cable with part number 1.4.4-0609505-B3 for connecting the CS-D1008 to a computer with Windows XP / 7 installed. In the case of using USB to RS232 conversion, contact your supplier or Leadshine for such a cable with part number USBToRS232 which has been verified working fine.

1.4.4-0609505-B3
(RS232 tuning cable)

USBToRS232
(USB to RS232 Conversion Cable)

12. Troubleshooting

In the event that your drive doesn't operate properly, the first step is to identify whether the problem is electricral o

mechanical in nature. The next step is to isolate the system component that is causing the problem. As part of this process you may have to disconnect the individual components that make up your system and verify that they operate independently. It is important to document each step in the troubleshooting process. You may need this documentation to refer back to at a later date, and these details will greatly assist our Technical Support staff in determining the problem should you need assistance.

Many of the problems that affect motion control systems can be traced to electrical noise, controller software errors, or mistake in wiring.

Symptoms	Possible Problems	Solutions
Motor is not rotating	No power	Connect power supply correctly
	Microstep resolution setting is wrong	Setting appropriate microstep
	Fault condition exists	Check wiring and restart power
	The drive is disabled	Drive restore factory setting, and keep ENA+, ENA- input signals unconnected.
Wrong motor rotation direction	The Direction signal level is reverse	Toggling the SW5 DIP switch
The drive in fault	Red light flashes once in a 5-second period	The motor coil may short circuit or exiting the wrong wiring
	Red light flashes twice in a 5-second period	The power supply exceeds Max. operation voltage
Erratic motor motion	Control signal is too weak	Ensure the current of control signal is within 7-16mA
	Control signal is interfered	Don't tie the control signal cable with power cable together
	Wrong motor connection	Refer to user manual of drive and motor datasheet
	Something wrong with motor coil	Check the motor is normal
Motor stalls during acceleration	Current setting is too small	Choose another power supply with lager power or increase the output current of drive
	Motor is undersized for the application	Choose another motor with higher torque
	Acceleration is set too high	Reduce the acceleration
	Power supply voltage too low	Choose another power supply with large voltage output
Excessive motor & drive heating	Inadequate heat sinking / cooling	Refer to chapter 2.4
	Motor peak current setting is too high	Reduce the current value refer to motor datasheet
Motor vibration when power on	Speed loop Kp is too high	Reduce the speed loop Kp value

13. Warranty

Twelve Month Warranty

Leadshine Technology Co., Ltd. warrants its products against defects in materials and workmanship for a period of 12 months from shipment out of factory. During the warranty period, Leadshine will either, at its option, repair or replace products which proved to be defective.

Exclusions

The above warranty does not extend to any product damaged by reasons of improper or inadequate handlings by customer, improper or inadequate customer wirings, unauthorized modification or misuse, or operation beyond the electrical specifications of the product and/or operation beyond environmental specifications for the product.

Obtaining Warranty Service

To obtain warranty service, please contact your seller to obtain a returned material authorization number (RMA) before returning product for service.

Shipping Failed Products

If your product fail during the warranty period, please contact your seller for how and where to ship the failed product for warranty or repair services first, you can also e-mail customer service at tech@leadshine.com to obtain a returned material authorization number (RMA) before returning product for service. Please include a written description of the problem along with contact name and address.

Appendix A. Leadshine CS-D1008 Compatible Stepper Motors

The following Leadshine stepper motors with 1000-line encoders have been tested working with the CS-D1008 closed loop stepper drive.

Model	Frame Size (NEMA)	Torque (N.m / Oz-In)	Series	Length (mm / inch)	Notes
CS-M23435	34	3.5 / 495	CS-M	95 / 2.20	0.551-inch (14-mm) shaft
CS-M23435-S		3.5 / 495		95 / 2.48	0.50-inch (12.7-mm) shaft
CS-M23445		4.5 / 637		109 / 2.76	0.551-inch (14-mm) shaft
CS-M23445-S		4.5 / 637		109 / 3.27	0.50-inch (12.7-mm) shaft
CS-M23445B		4.5 / 637		135 / 2.44	0.551-inch (14-mm) shaft, with 24VDC brake
CS-M23480		8.0 / 1132		127 / 3.03	0.551-inch (14-mm) shaft
CS-M23480-S		8.0 / 1132		127 / 3.82	0.50-inch (12.7-mm) shaft
CS-M23480B		8.0 / 1132		173 / 3.82	0.551-inch (14-mm) shaft, with 24VDC brake
CS-M23485		8.5 / 1202		147 / 4.13	0.551-inch (14-mm) shaft
CS-M23485-S		8.5 / 1202		147 / 4.13	0.50-inch (12.7-mm) shaft
CS-M23485B		8.5 / 1202		173 / 3.46	0.551-inch (14-mm) shaft, with 24VDC brake
CS-M234120		12.0 / 1698		158 / 4.29	0.551-inch (14-mm) shaft
CS-M234120B		12.0 / 1698		184 / 4.29	0.551-inch (14-mm) shaft, with 24VDC brake
ES-M23440		4.0 / 566	ES-M	73 / 2.87	0.551-inch (14-mm) shaft
ES-M23440-S		4.0 / 566		73 / 2.87	0.50-inch (12.7-mm) shaft
ES-M23480		8.0 / 1132		93 / 3.66	0.551-inch (14-mm) shaft
ES-M23480-S		8.0 / 1132		93 / 3.66	0.50-inch (12.7-mm) shaft

Note: all above stepper motors are mounted with 1000-line incremental encoders

# Appendix B.   Leadshine CS-D1008 Compatible Power Supplies

It is highly suggested to use the following Leadshine power supplies to power CS-D1008 to get optimized performance. Those power supply are specially designed for stepper and servo controls.

Model	Output Voltage (VDC)	Series Model	Continuous Current (A)	Max Current (A)	Input Voltage (VAC)
RPS488V20	48	RPS	8.3	24.9	85-132 / 176-264
RPS4810V20	48		10.5	31.5	85-132 / 176-264
RPS488	48		7.3	8.5	85-132 / 176-264
RPS4810	48		10.4	12.5	85-132 / 176-264
RPS608	60		8.5	10.5	85-132 / 176-264
SPS487	48		7.0	9.0	180-240
SPS487-L	48		3.0	9.0	90-130
SPS705	68		5.0	7.0	180-240
SPS705-L	68		3.0	7.0	90-130

Software User Manual
CS-D Series
Closed Loop Stepper Drives
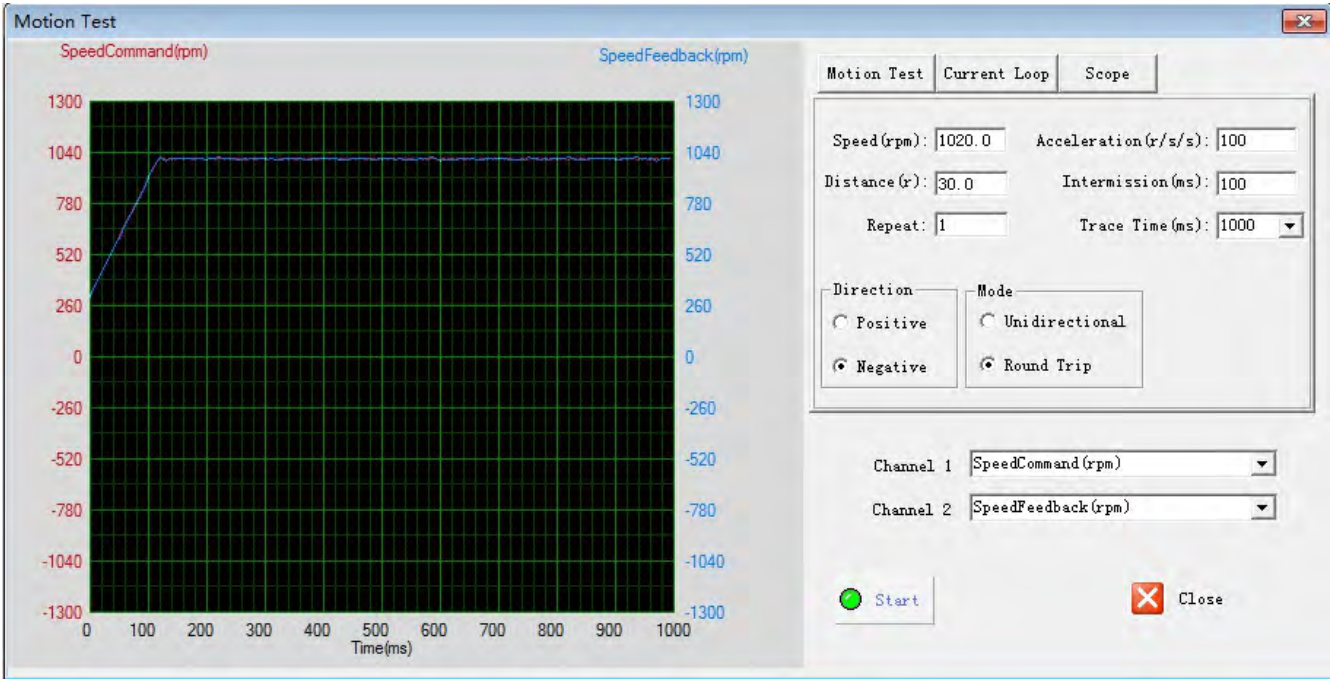
1. Introduction

The ProTuner is a software tool designed to configure and tune the Leadshine's CS 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

Menu and Toolbar

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 [icon] 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:
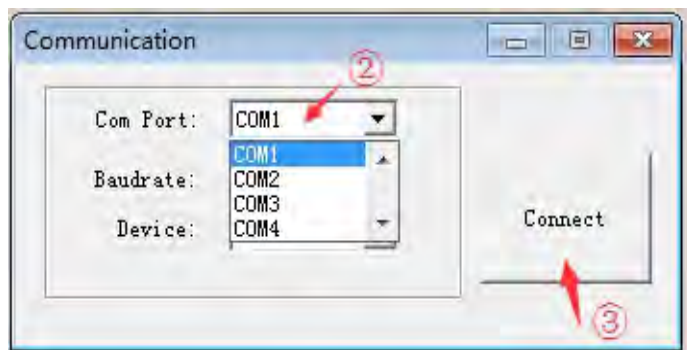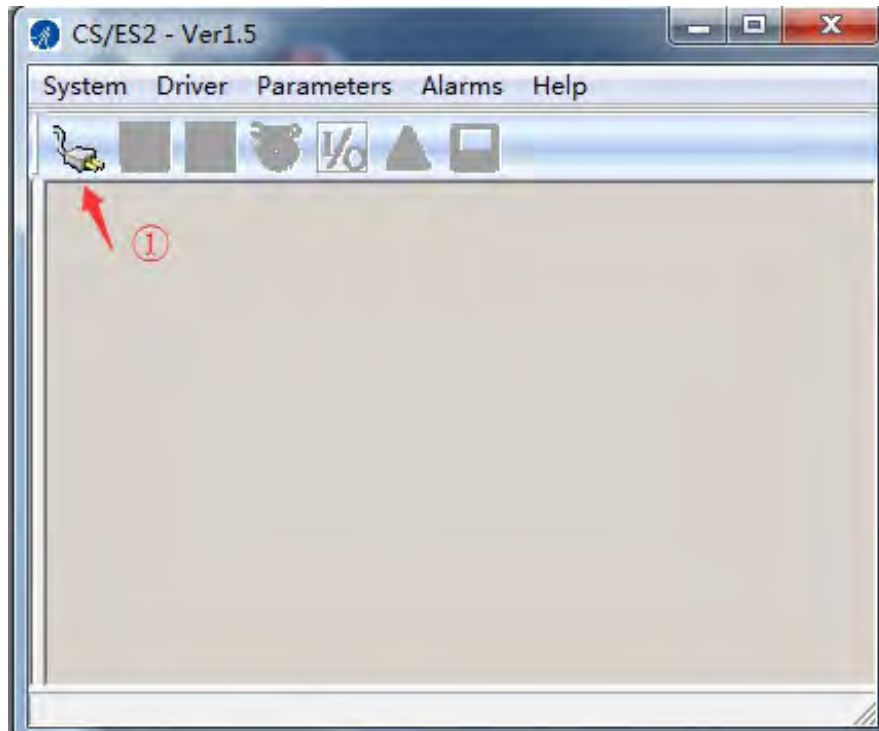
The software will try to connect to the drive and read the settings. It may take several minutes. Please wait. After connecting successfully, the color of toolbar icons will change from gray to bright as below:
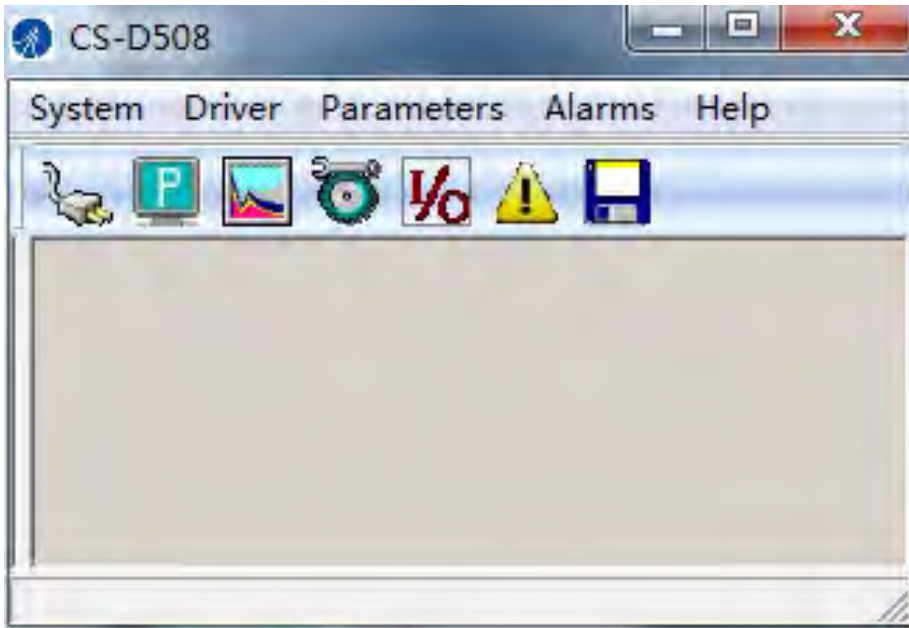
If you need to disconnect the drives with ProTuner, you can click once again, the operation as below:
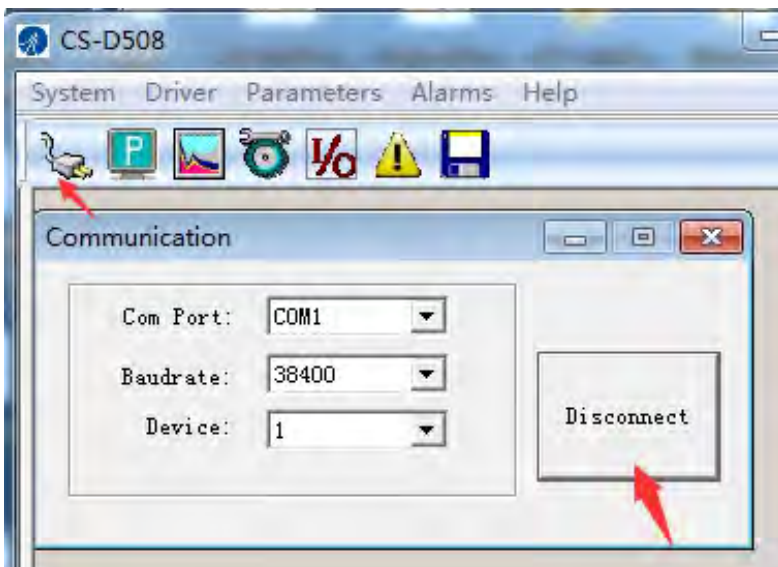
 Before connecting the drive, please make sure:
1) The RS232 cable .has been connected between the drive and PC serial port.
2) Power has been applied to the drive and the green LED is turned on.
The motor is no need to connect to the drive if you just want to change the parameters but not tuning.

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

2.2 Parameters Configuration

2.2.1 Read Parameters

Click [P] 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:

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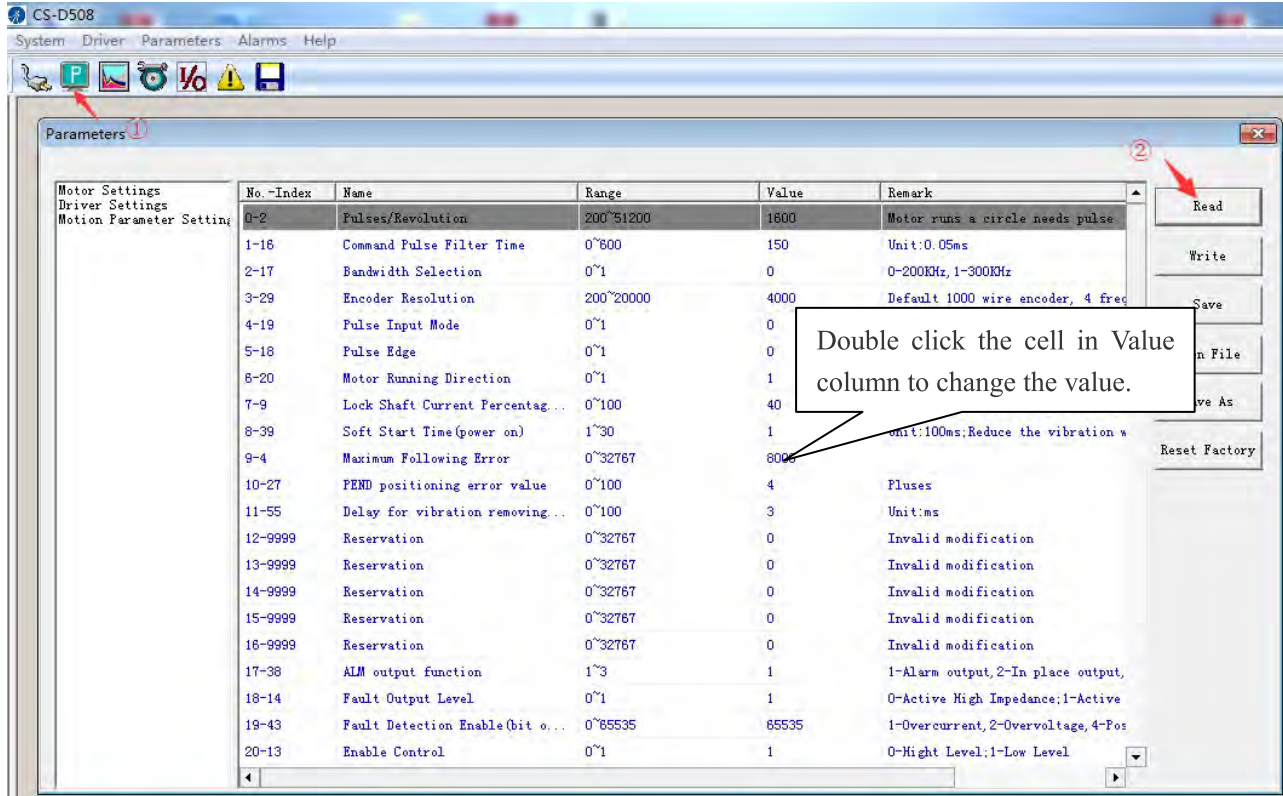
The parameter classification in the left of the ProTuner is available when using vector easy servo of ES-D508-V, ES-D1008-V, ES2-DA808 and ES2-DA1208. Because the two series drives use the one same ProTuner.

The parametric classification is used for Vector Easy Servo. The key parameters for CS-D Series refer to chapter 2.2.2
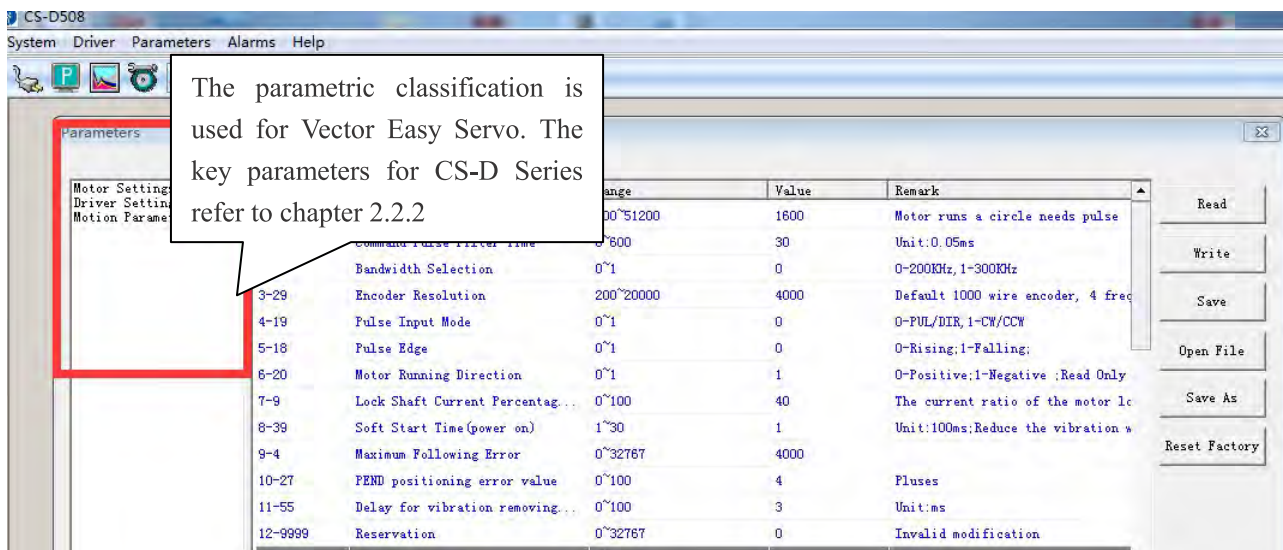
2.2.2 Available Parameters for CS-D Series

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 item 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.
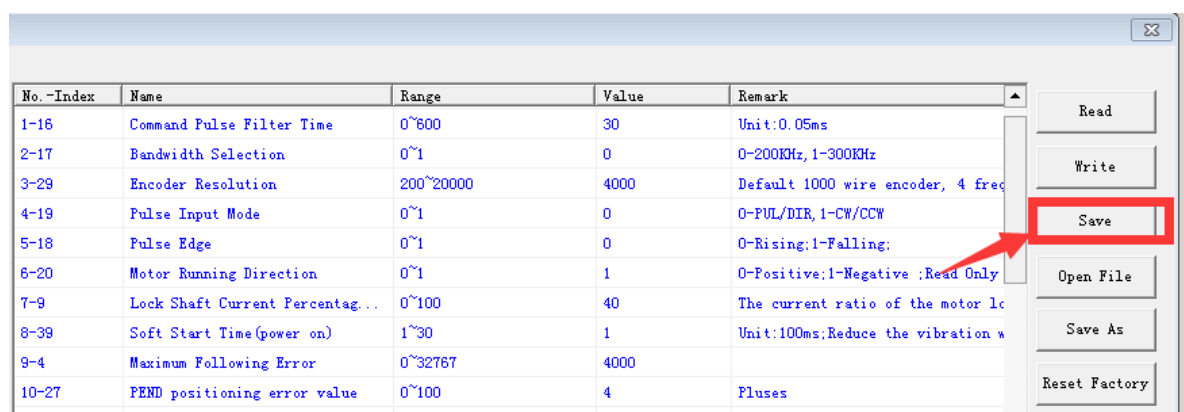

2.2.5 Open File

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:
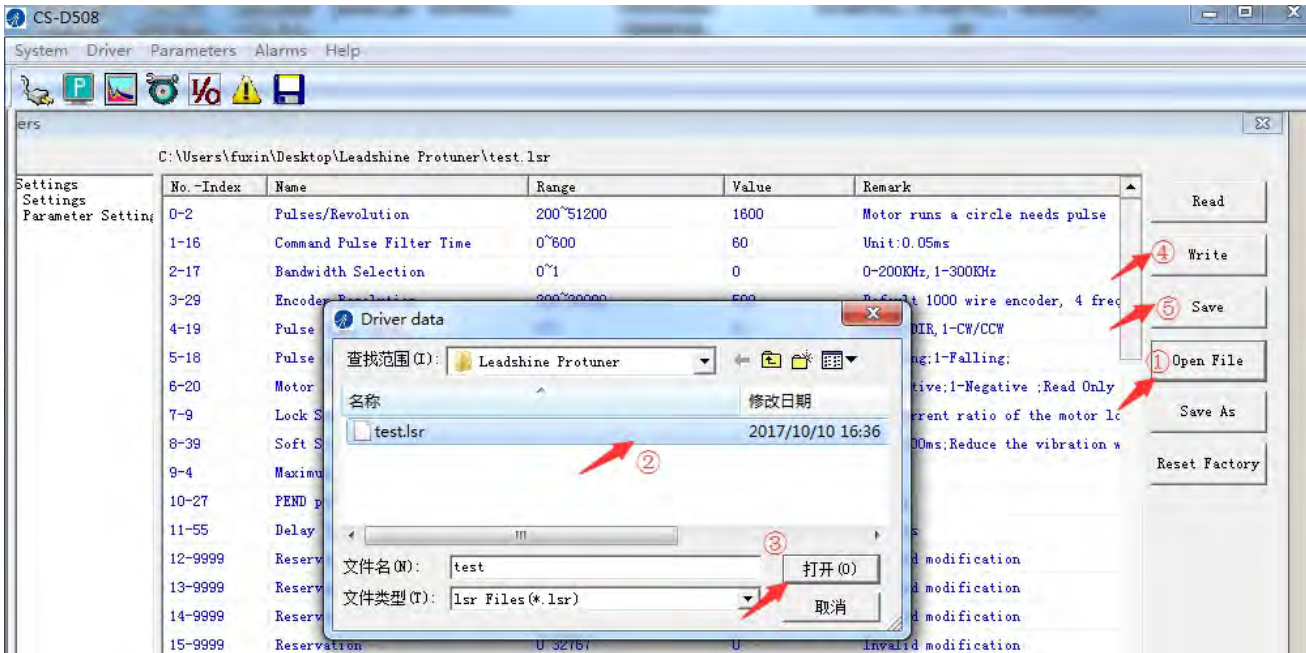
2.2.6 Save File

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:
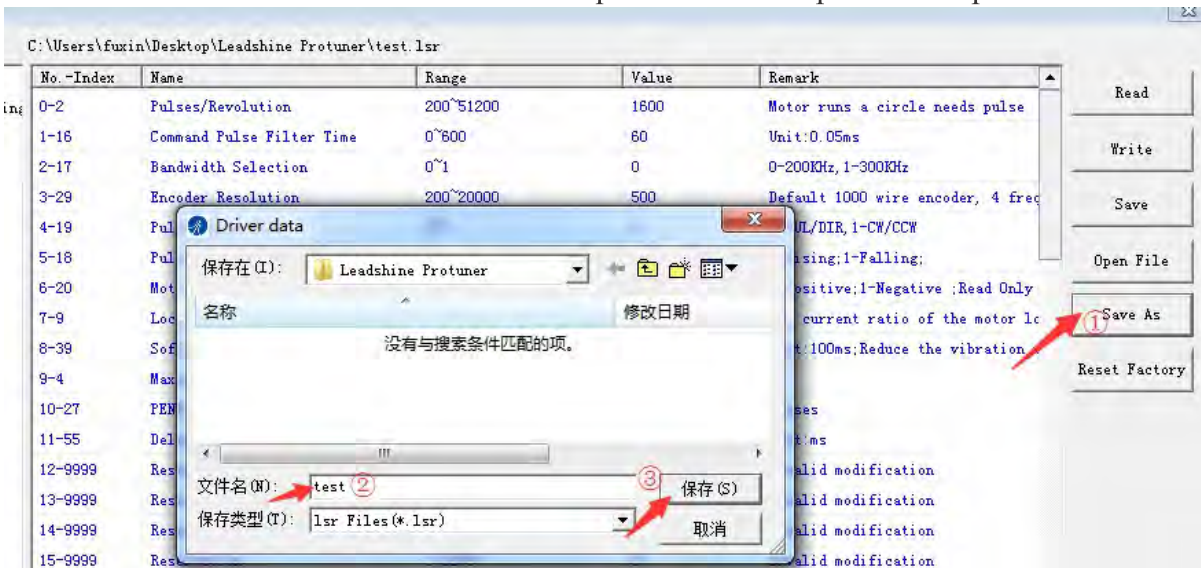
2.2.7 Reset Factory

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:
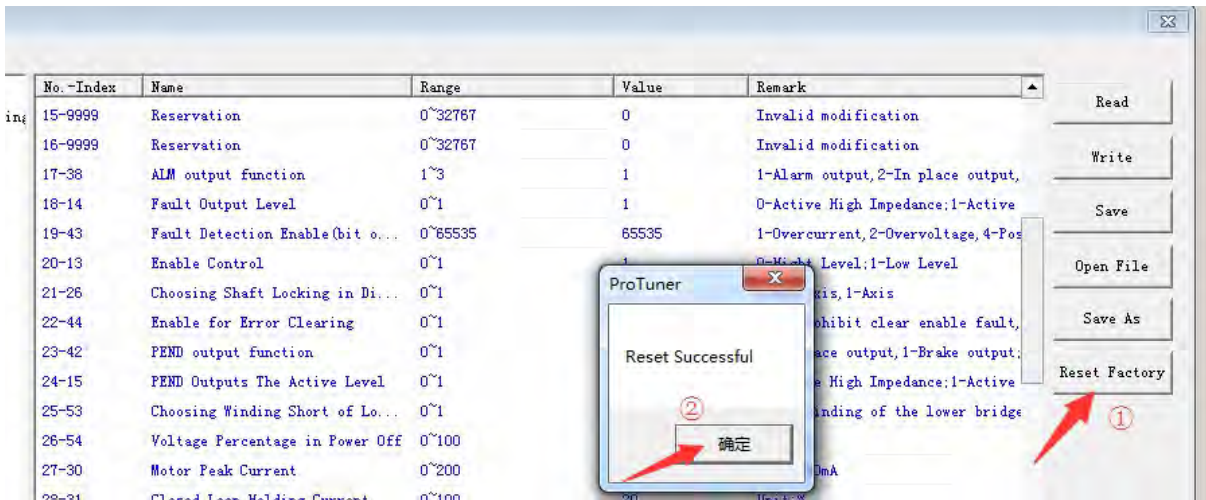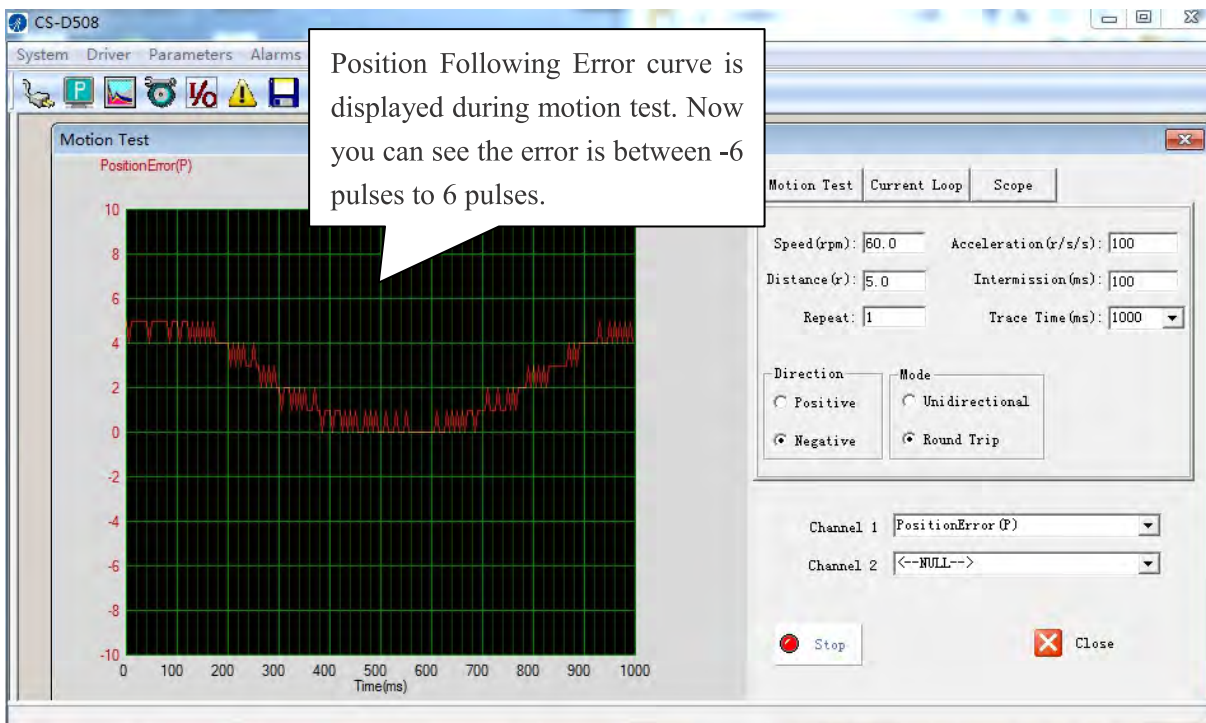
2.3 Motion Test Window

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:
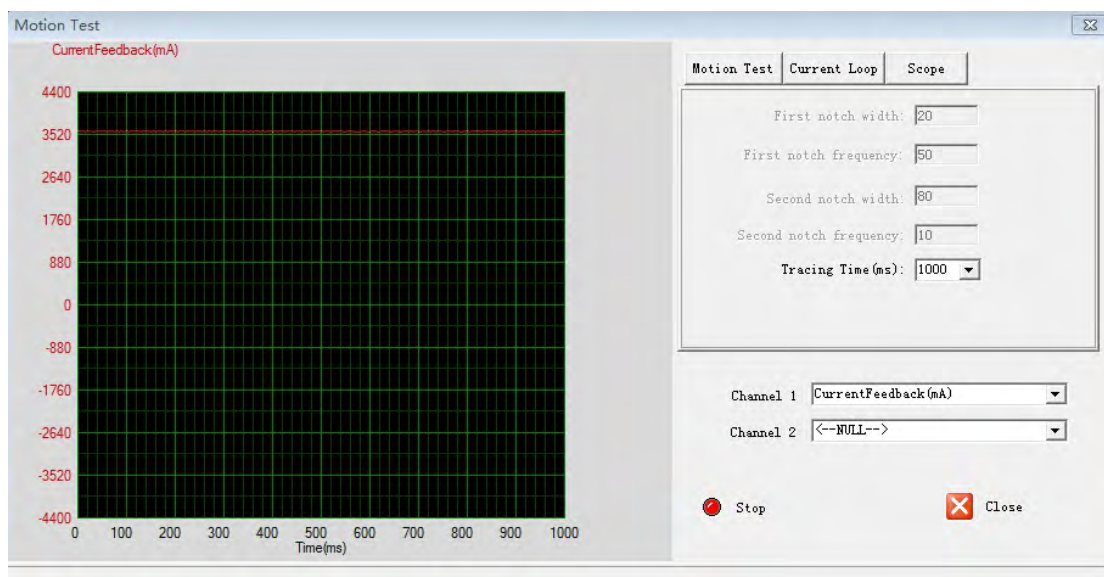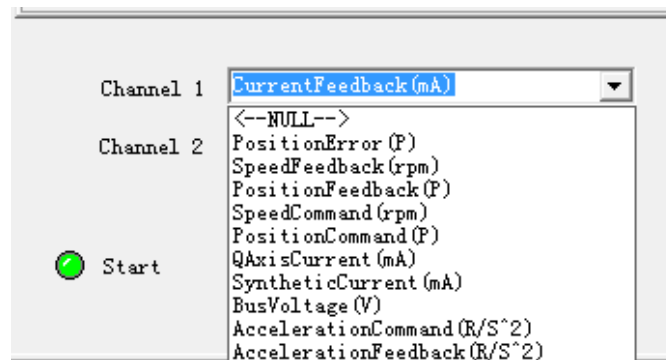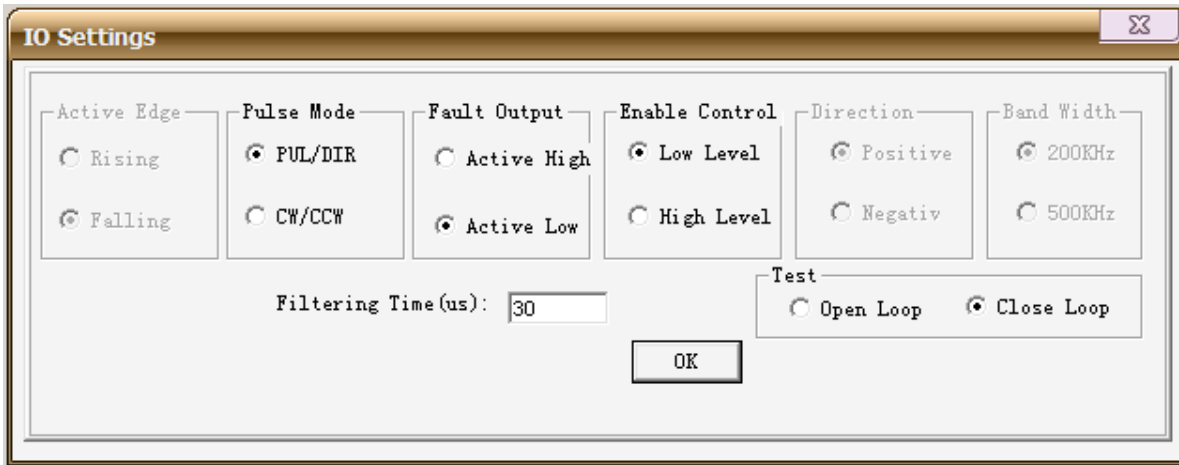

Item	Description	Range
Trace Time	Time to sample the position following error. For example, if the trace time is 1000ms, the drive board acquires the error data every 1000ms.	100-3000ms
Start	Start to monitor and display the position following error.	-
Stop	Stop monitoring.	-

2.4 Other Workspace

2.4.1 Inputs/Outputs Window

Click [I/O] 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

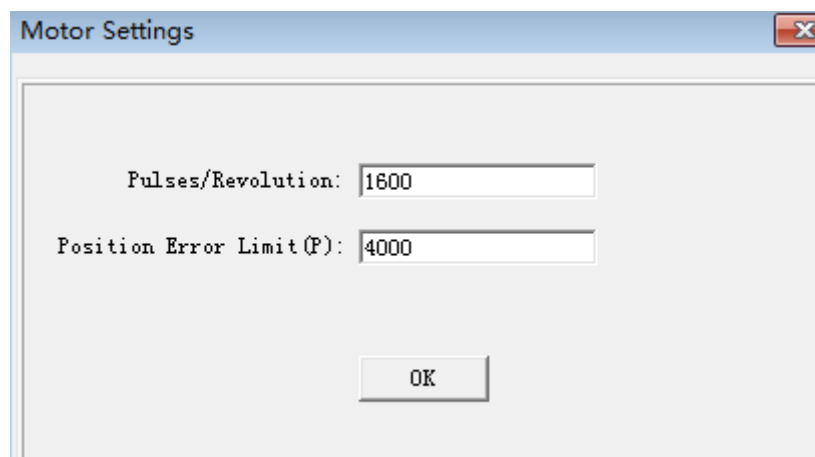| Test	Motion mode, the motor can run in open loop without encoder signals	Open loop/ Close loop

2.4.2 Motor Settings Window

Click ![icon] 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 ![icon] 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**.
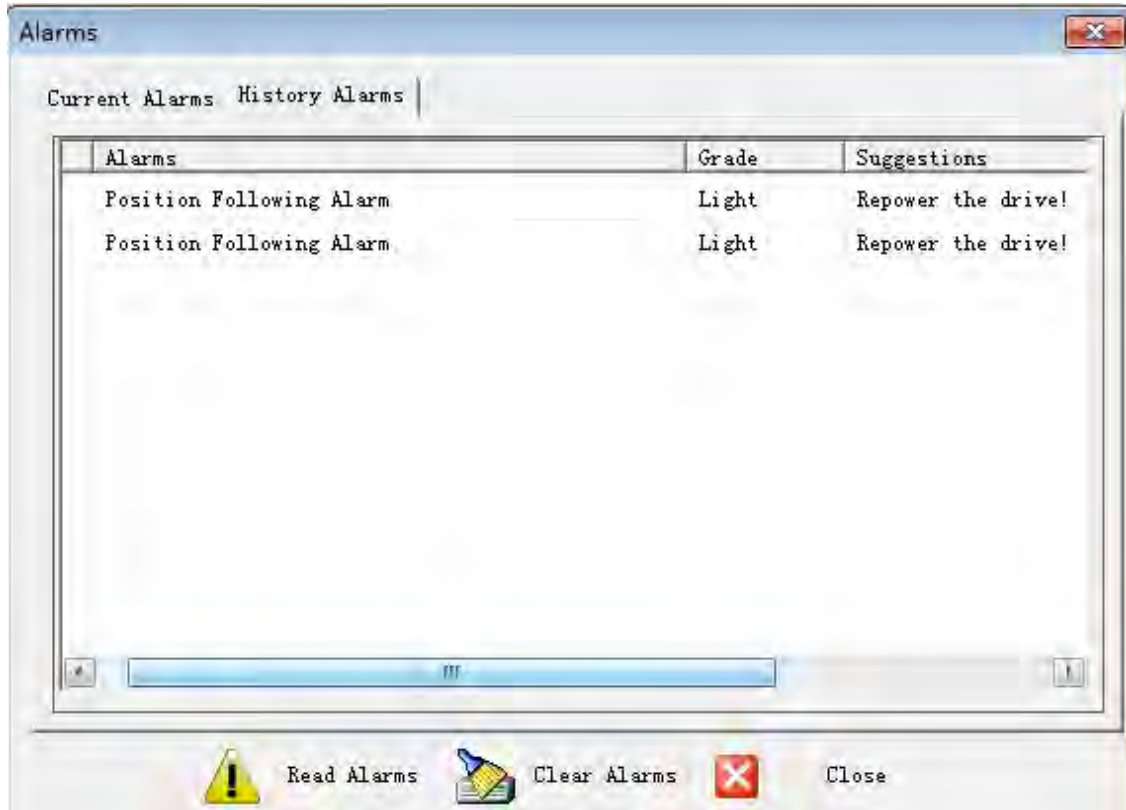
3. Configuring the Drive

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,** see 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:

Closed Loop Holding Current ＝ Motor Peak Current ✕ Closed Loop Holding Current Percentage (%)
Open Loop Holding Current ＝ Motor Peak Current ✕ 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)

Caution

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!