E53.D1E-J Compact Piezo Motor Controller

User Manual and Software Manual

Version: V2.0 Date: 2025.04

This document contains the following content:

- Basic information of E53.D1E-J compact piezo motor controller
- Introduction of the upper computer software of E53.D1E-J

Declaration

Declaration
➢ This manual is only applicable to the E53.D1E-J compact piezo motor controller produced and sold by CoreMorrow. To avoid potential dangers that may threaten the safety of users' lives and property, please read this manual carefully before use. If you find any unclear or incorrect descriptions, please provide timely feedback to our company. ➢ This product can only be used within the specified environmental range. Please refer to the instructions in the manual during use. If there are any problems, please contact our company for technical support. If the product is not operated according to this manual or disassembled and modified by oneself, the company will not be responsible for any consequences arising therefrom.
Notice!
➢ Do not touch any exposed ends of the product and its accessories. ➢ There is high voltage inside, do not open the case without permission. ➢ Do not connect or disconnect input, output, or sensor cables with power on. ➢ Please keep surface clean and dry, and don't operate in humid or static environment. ➢ After use, output voltage should be cleared to zero before turning off the controller switch, such as switching the servo state to the open-loop state.
Cautious!
➢ The piezo controller housing is a heat dissipation conductor and needs to be installed in an area with a 3cm air circulation area on a horizontal plane or on a plane with a heat dissipation device to avoid damage to the controller.

Danger!
➢ The piezo motor controller described in this manual is a high-voltage device capable of outputting high currents, which can cause serious or even fatal damage if not used properly. ➢ It is strongly recommended that you do not touch any parts that connect to the high voltage output. ➢ Special Note: If you connect it with other products in addition to our company, please follow the general accident prevention procedures. ➢ Operating the high-voltage ampliffcation requires training professional operators.
Warning!
➢ To avoid damage to the core PZT device, it is necessary to ensure that the positive and negative poles of PZT are connected correctly before applying voltage to the two poles of PZT. At the same time, the operating voltage must be within the allowable voltage range of PZT to avoid exceeding it and causing permanent damage to PZT devices. ➢ The modification or maintenance of the instrument must be carried out by personnel authorized by our company, and the corresponding original parts of our company must be used. If the instrument is damaged due to improper maintenance or improper use, our company will not be held responsible.

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1. Introduction

1.1 Typical characteristics

- 1 output channel
- 24V（20~30V）power supply
- Rated output: 9W
- Static dissipation: ＜5W
- Output short-circuited current: 60mA
- Software control
- Small volume integrated design
- Servo control or open loop control

1.2 Typical applications

- Driving Piezo Motor Displacement Stage
- Driving Piezo Motor Tip/Tilt Stage
- Driving Piezo Motor Rotation Stage
- Driving 6-Axis Piezo Motor Displacement Stage, etc.

1.3 Order information

- E53.D1E-J—compact piezo motor controller, servo control, software control；
- E53.C1K-J—compact piezo motor controller, open loop, software control；

Accept customized according to requirements.

1.4 User Manual Notes

- The contents described in user manual are standard product descriptions, special product parameters are not described in detail in this manual.
- When using the piezo controller, the user manual should be placed near the system for easy reference in time. If the user manual is lost or damaged, please contact our customer service department.
- If your user manual is incomplete, it will miss a lot of important information, cause serious or fatal injuries, and cause property damage.
- You have read and understood the contents of the user manual before installing and operating the E53.D1E-J compact piezo motor controller.
- Our company's official website (www.coremorrow. com) provides the latest user manual download.
- Only authorized professionals who meet the technical requirements can install, operate, maintain and clean the controller.

1.5 User Manual Download

User manual download process instructions:

1. Open the website www.coremorrow.com;
2. Search for product model (e.g. E53.D1E-J) or series (e.g. piezo motor controller) on the website;
3. Click on the corresponding product to open the product details page;
4. On the product details page, scroll down to "Downloads";

5. Click on the desired file to download.

Be careful! If the manual is lost or there are problems downloading, please contact our customer service department.

2. Series&Appearance

The E53.D1E-J compact piezo motor controller is designed for driving piezo motor displacement stage of CoreMorrow, and it can achieve real-time communication with the upper computer through USB interface or RS-232/422 interface, and supports secondary development of upper computer software. The controller has a compact size and structural design, making it suitable for applications with limited space. Servo control mode, and customers can choose the open loop version(Model: E53.C1K-J) according to their usage needs.

2.1 Series

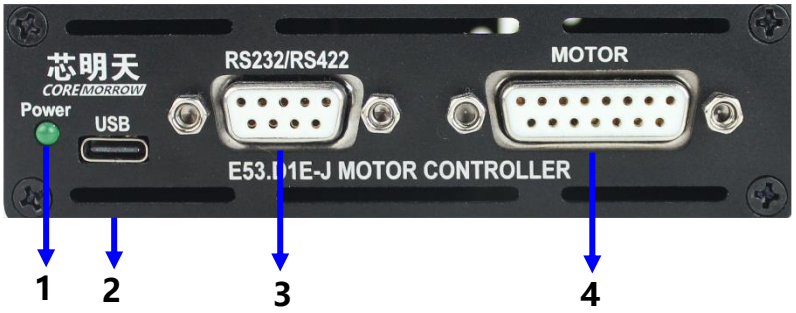
Model	Description
E53.D1E-J	Servo control, 1 output channel digital signal control, USB or RS-232/422 connection

2.2 Appearance and panel introduction

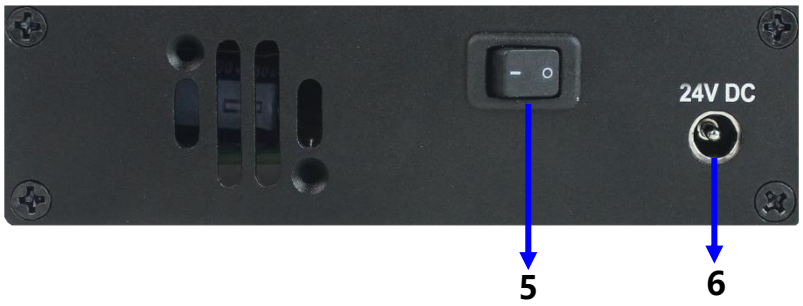
2.2.1 Appearance

2.2.2 panel introduction

Front Panel



Rear Panel



No.	Function	Model	Description
1	Power indicator	LED green	If it lights up, the controller is in a powered on operational state; otherwise, it is in a non operational state
2	USB interface	Type-C	Connect the computer with the controller through USB interface to realize computer control
3	RS-232/422 interface	D-Sub 9	Connect the computer with the controller through RS-232/422 interface to realize computer control
4	Motor connector	D-Sub 15	Connect to piezo motor displacement stage
5	Switch	Rocker switch	Control the power on and off of the piezo controller
6	Power port	MR5-111-C5N-BB	Power connector socket, 24V DC interface

3. Power Calculation

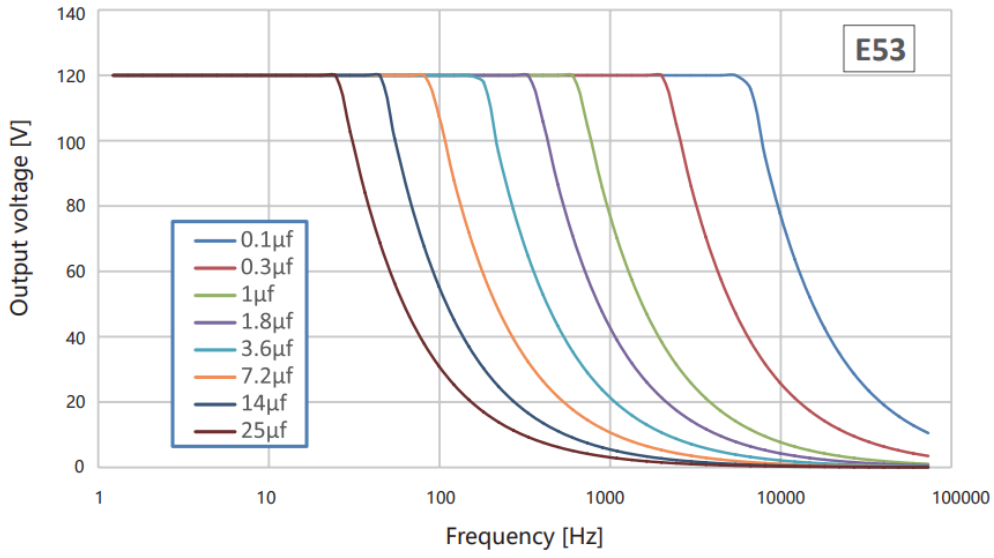
Average output(Sine wave operation mode):

$$P_a \approx U_{p\text{-}p} \cdot U_s \cdot f \cdot C_{piezo}$$

In the above formula:

- P_a: Average output [W]
- $U_{p\text{-}p}$: Peak and peak drive voltage [V]
- U_s: Drive voltage [V]((Vs+)-(Vs-))
- f: Operating frequency of the sine wave [Hz]
- C_{piezo}: Piezo actuator capacitance [F]

Frequency, Voltage and Load Curves



4. Parameter

4.1 Technical Data

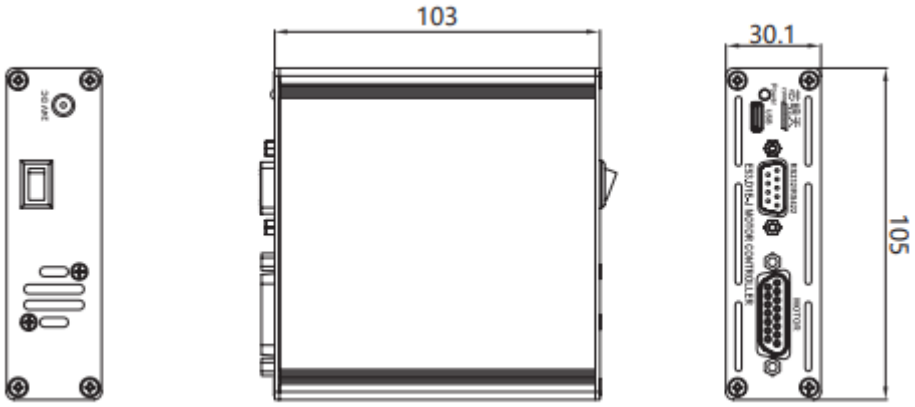
Type	E53.D1E-J	Units
Control mode	Servo control	
Channels	1	
Power supply	24VDC/1A(20~30V)	
Static dissipation	< 5	W
Processor	32bit 480MHz	
D/A converter	16bit	
Communication interface	Type-C, RS-232/422	
Rated output	9	W
Operating temperature	0~50	℃
Output short-circuited current	60	mA
PZT connector	DB15	
Communication connector	DB9, Type-C	
Size	105×103×30.1	mm^3
Mass	260	g±5%

4.2 Environmental conditions

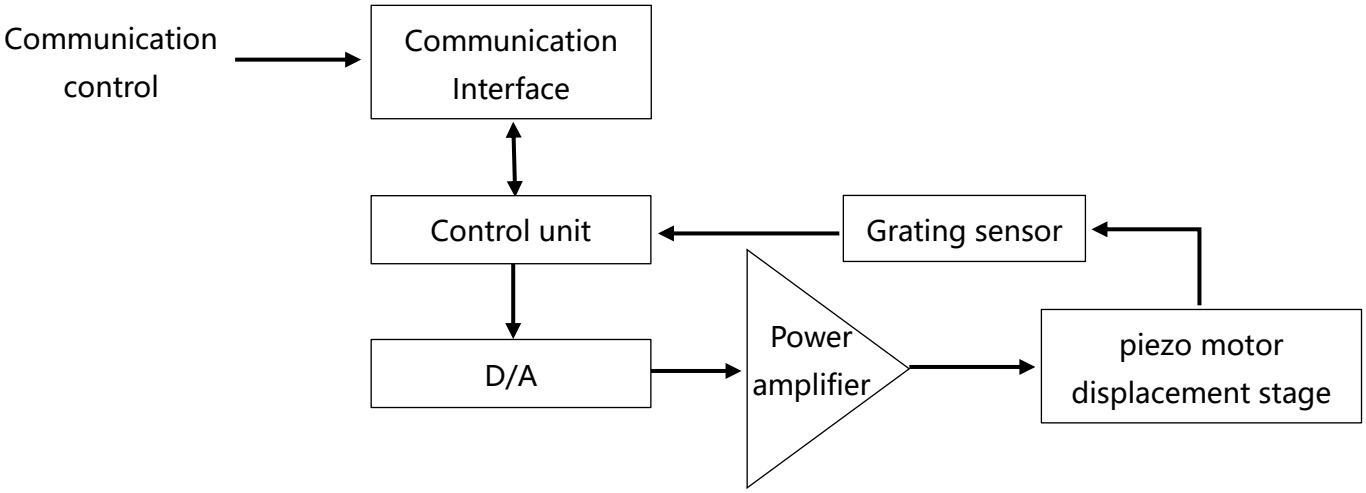
The operating environment of E53.D1E-J compact piezo motor controller:

Environmental conditions	Condition description
Application	For room use only
Environment humidity	Highest relative humidity 80%, temperature can reach 30℃ Highest relative humidity 50%, temperature can reach 40℃
Operating temperature	0~50℃
Storage temperature	-10~85℃

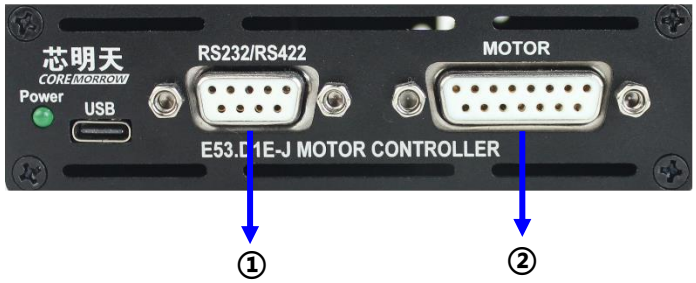
4.3 Drawing



4.4 Driving Principle

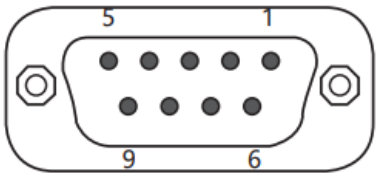


4.5 Interface introduction



① RS-232/422(D-Sub9)

No.	Pin Definition
1	Null
2	RS-232 TxD
3	RS-232 RxD
4	Null
5	GND
6	RS-422 RxD+
7	RS-422 RxD-
8	RS-422 TxD-
9	RS-422 TxD+



② Piezo motor connector(D-Sub15)

No.		Pin Definition
	8	Differential input signal A-
15		Differential input signal A+
	7	Differential input signal B+
14		Differential input signal B-
	6	Differential input signal E-(LVDS)
13		CAL signal
	5	Differential input signal Z+
12		Differential input signal Z-
	4	5V
11		5V_GND
	3	Null
10		Drive_GND
	2	Null
9		Null
	1	DriveOut

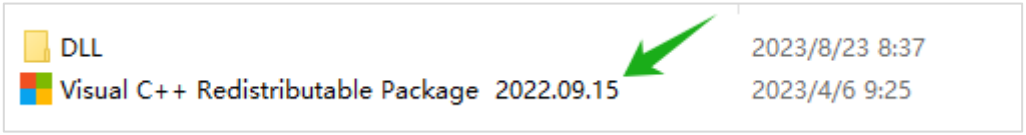
5. Software Introduction

5.1 Installation Introduction

Firstly, open the USB drive that comes with the product shipment, click to enter the corresponding software compression package, and enter the decompressed folder.

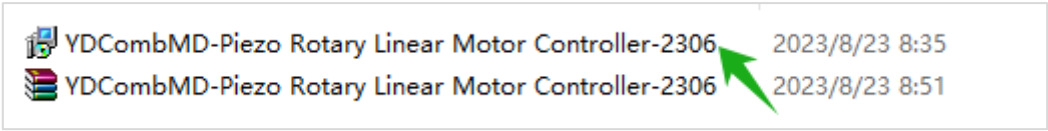
Step 1, click on the"1.Software operating environment "folder.

and click on the " Visual C++ Redistributable Package 2022.09.15.exe"application to configure the software running environment to prevent software installation failure. (Note: With the continuous updates and iterations of the upper computer software version, the version number in the name will change according to the actual situation)



Then, enter the "4.Control Software" folder.

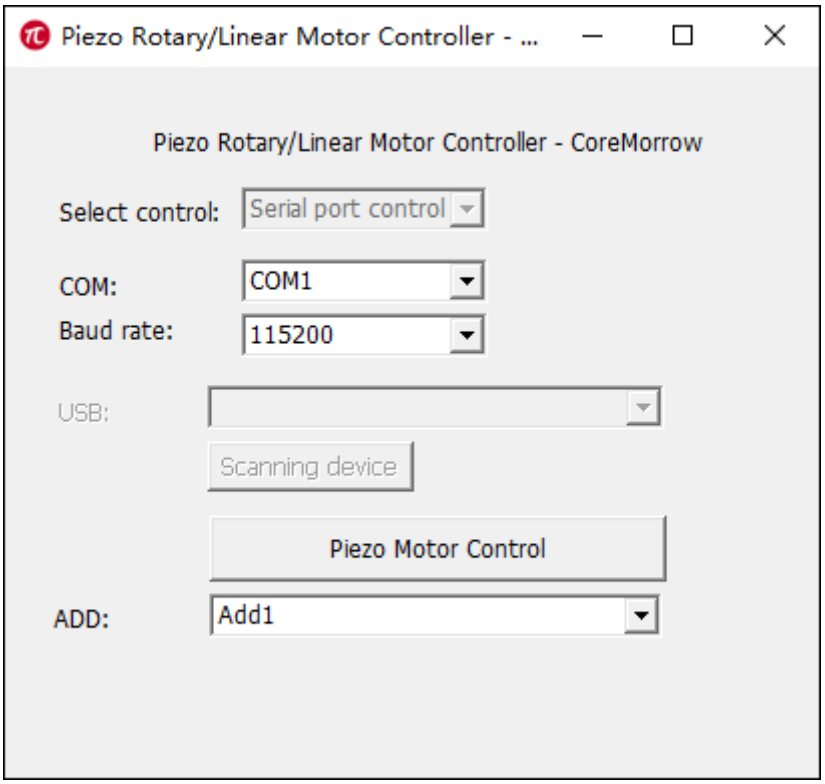
and click to install " YDCombMD-Piezo Rotary Linear Motor Controller-2306.msi", double-click to install the upper computer operation software, select the next step during the installation process, and finally click "Finish" to complete the installation of the controller driver software. (Note: With the continuous updates and iterations of the upper computer software version, the version number in the name will change according to the actual situation)



After installation, the desktop of the upper computer will display the software icon of the controller. Before use, click on the icon on the system desktop to enter the establishing communication connections interface between the upper computer and the controller.

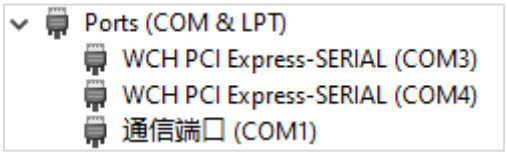
5.2 Introduction to Establishing Communication Connections

Click on the icon on the system desktop to enter the establishing communication connections interface between the upper computer and the controller, as follows:



Select control: Default serial port control, no need to select; (Note: Using a USB cable or RS-232/422 serial port cable has no effect on control selection)

COM: Select the corresponding COM port according to the actual situation. The confirmation method for the Win10 serial port is as follows: Win10→This PC→Properties→Device Manager→Ports(COM & LPT) to view;

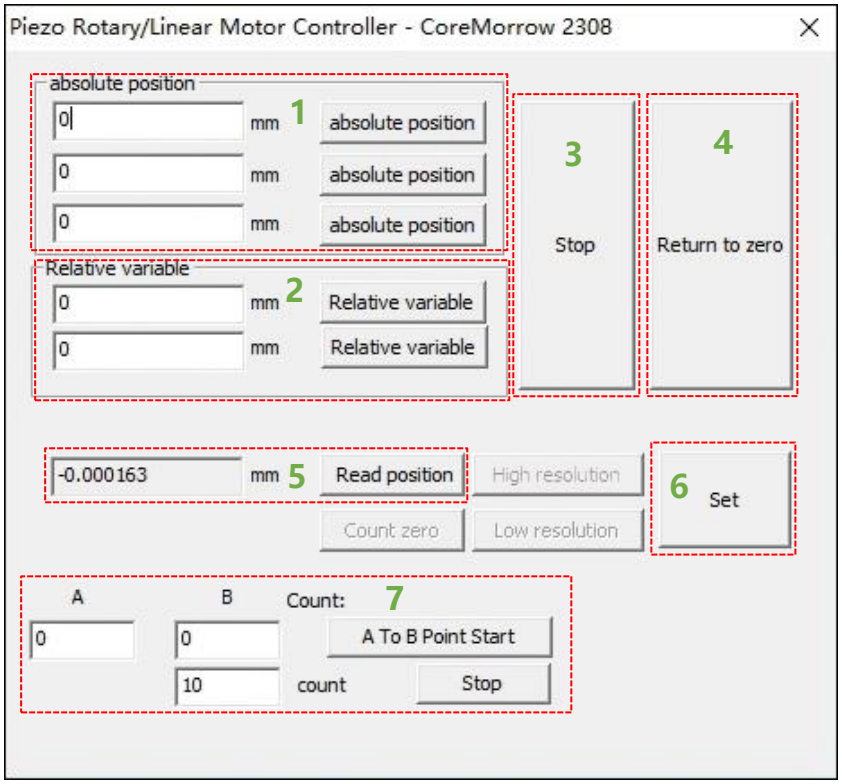


Baud Rate: Default is 115200, no need to select;

ADD: Optional Add1, no need to select;

After completing the selection of COM and baud rate, click "Pizeo Motor Control" to establish a connection between the controller and the upper computer, and enter the upper computer software operation interface;

5.3 Introduction to the operating interface



The introduction of each control area is as follows:

1) **Absulute Position**: Specifies displacement control based on the absolute zero position. Enter the position information you want the piezo motor to reach in one of the three input boxes, and then click the absolute position button to implement position control. (Note 1: The motor moves in bi-directions. To enter the position information, please add +/- in front of the number, unsigned defaults to positive. Note 2: the unit of linear motor is mm, the unit of angular motor is °, the unit is consistent with the control product unit in Part 6 "Set"; Note 3: the function of the three input boxes is the same).

2) **Relative Variable**: Indicates the displacement control based on the current position, enter the desired position information in one of the two input boxes, and

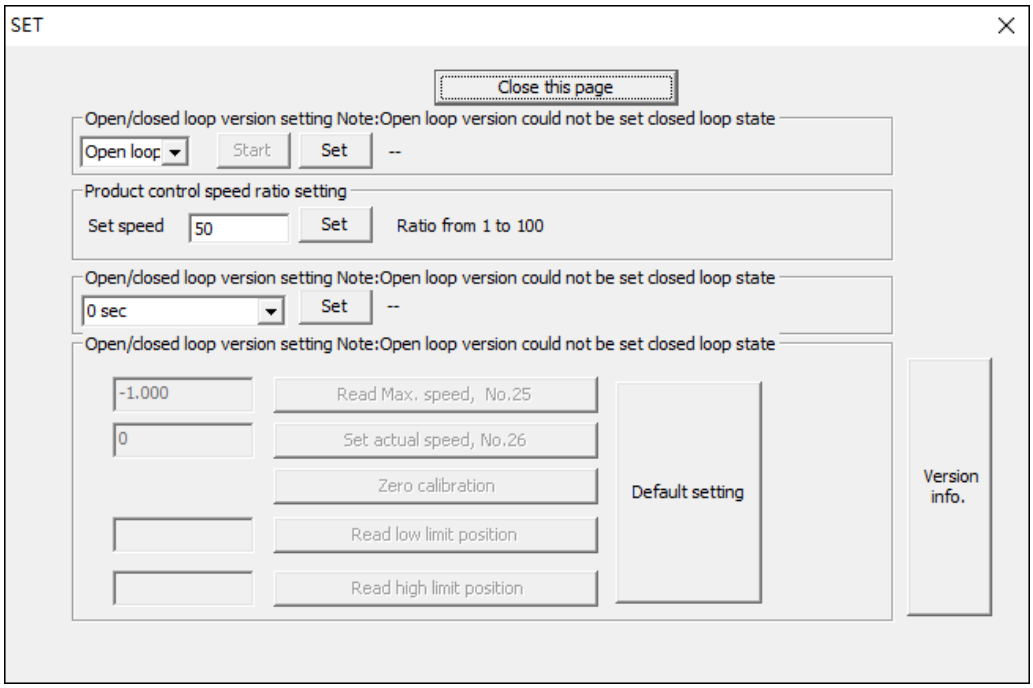
click the relative variable button to realize the displacement control at the current position. (Note 1: the unit of linear motor is mm, and the unit of angular displacement motor is °, the unit is consistent with the control product unit in Part 6 “Set”; Note 2: the function of the two input boxes is the same).

3) **Stop**: Aborts the motion of piezo motor.

4) **Return to zero**: Indicates that the piezo motor returns to absolute zero position.

5) **Read position**: Click to display the current physical position that the motor is moving to in absolute coordinates, "+" is in the positive direction of absolute zero, "-" is in the negative direction of absolute zero;

6) **Set:** Click set, you can choose closed loop or open loop, adjust the parameters of control speed, control product unit, low/high limit position reading, controller driver software version information query; (Note 1: Factory Settings have been carried out according to customer requirements. Note 2: high and low limits will be applied to the closed-loop linear motors; not involved in the open-loop or rotary products whose travel range over 360°).



7) **Reciprocating motion**: Indicates that the piezo motor carries out the reciprocating motion of the AB ends by itself.

Point A: starting point;

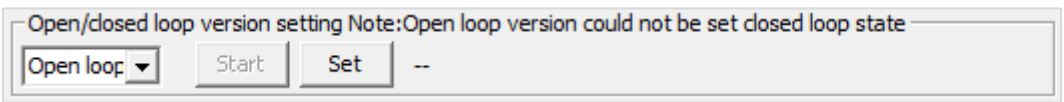
Point B: end point;

A to B Point Start: Click to drive the piezo motor to move from A to B;

Stop: reciprocating motion stop button, can stop halfway;

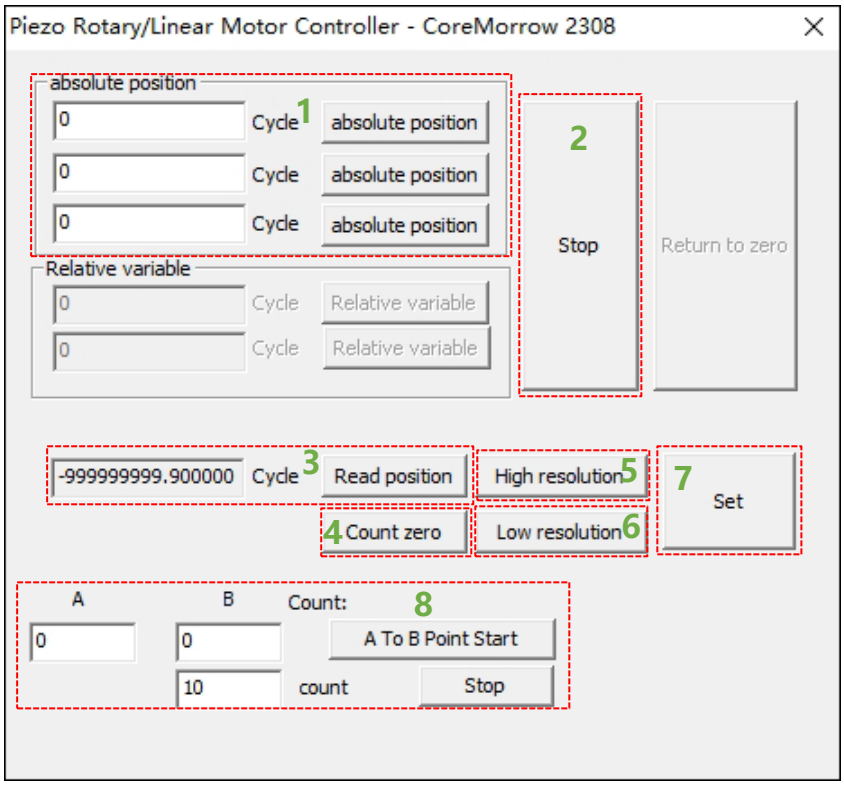
Count: the number of reciprocating motion;

5.4 Instructions for switching to open-loop controller operation interface



Switching between open loop and closed loop by setting the region, E53.D1E-J can be switched to an open-loop controller, which does not have closed-loop feedback

function: (Note: Open loop version could not be set closed loop state.)



The introduction of each control area is as follows:

1) **Absulute Position**: This function is to command a relative motion with reference to the current position. It can be specified by the cycle parameter. Enter the number of cycles you want the piezo motor to achieve in one of the three input boxes, and click absolute position button to control the motion of the piezoelectric motor. (Note 1: The motor moves in bi-direction. To enter the position information, please add +/- in front of the number, unsigned defaults to positive. Note 2: The definition of cycle at different resolutions: low resolution, 1 cycle=the controller commands the motor to move the displacement of 1 sawtooth wave; High resolution: 1 cycle=the controller commands the motor to move 1 point displacement [1 sawtooth wave consists of several points]; Note 3: the function of

the three input boxes is the same.)

2) **Stop**: Aborts the motion of piezo motor. (Consistent with the closed-loop controller function)

3) **Read position**: Reads the current motion cycles of the piezo motor. "+" indicates forward motion and "-" indicates reverse motion(Note: The number is based on the actual reading).

4) **Count zero**: Clears the current count of cycles. Zero setting.

5) **High resolution**: The unit step distance is smaller thus the positioning is more accurate, but at the same time the travel speed is very slow. It is recommended that you first move to the extreme target position at low resolution, and if you are not satisfied with the accuracy, you can switch to high resolution to obtain a finer unit step distance. For large displacements of a single motion, it is recommended to switch back to low resolution for faster motion speed. (After switching between high and low resolution, our company's host computer automatically sends the cycle clearing command to the lower computer. Since the counting methods of high and low resolution are different, when users do secondary development, they need to clear the cycle themselves.)

6) **Low resolution**: The unit step distance is larger and the speed is faster. It is recommended to first move to the extreme target position at low resolution, and if you are not satisfied with the accuracy, switch to high resolution for finer unit step distance.For large displacements of a single motion, it is recommended to switch back to low resolution for faster motion speed. (After switching between high and

low resolution, our company's host computer automatically sends the cycle clearing command to the lower computer. Since the counting methods of high and low resolution are different, when users do secondary development, they need to clear the cycle themselves.)

7) **Set**: Click Set to adjust the control speed, check the version information of the controller driver software, and so on.

8) **Reciprocating motion**: Indicates that the piezoelectric motor carries out the reciprocating motion of the AB ends by itself.

Point A: starting point;

Point B: end point;

A to B Point Start: Click to drive the piezo motor to move from A to B;

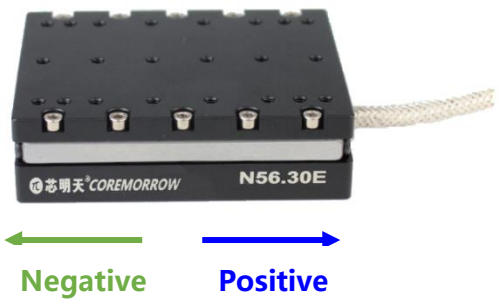
Stop: reciprocating motion stop button, can stop halfway;

Count: the number of reciprocating motion;

5.5 Explanation of the direction of the piezo motor

Object Description：N56 linear piezo motor displacement stage and N61 piezo motor rotation stage；

5.5.1 N56 linear piezo motor displacement stage

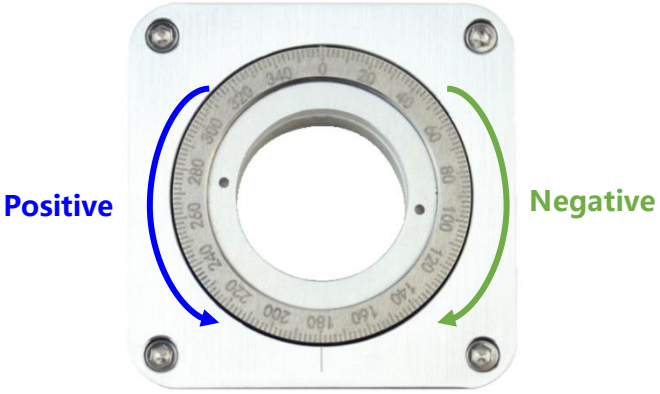


Motion direction of N56

- Movement towards the direction of the outlet is positive and the stroke is positive;
- Movement against the direction of the outlet is negative, and the stroke is negative;

(Note: The motion direction of of N56.50E is opposite to that shown in the figure.)

5.5.2 N61 piezo motor rotation stage



Motion direction of N61

- Counterclockwise direction of the angular displacement motor is positive movement, and the stroke is positive;
- Clockwise direction of the angular displacement motor is negative movement, and the stroke is negative;

(Note: Some products may be contrary to this definition of the direction of movement, please confirm with the actual products.)

6. Cleaning, Transportation and Storage

6.1 Cleaning measures

Note! The PCB board of the function module in the E53.D1E-J system is an ESD (electrostatic discharge) sensitive device. Take precautions against any static build-up of these devices before use to avoid contact with circuit component leads and PCB wiring. Before touching any electronic components, the body first touches the grounding conductor to discharge static electricity, ensuring avoiding that any type of conductive particles (metal, dust or debris, pencil lead, screws) enter the device. Be careful not to drop the equipment when cleaning, to avoid any form of mechanical shock!

- Disconnect the power plug of the E53.D1E-J system before cleaning.
- Prevent cleaning fluid and any liquid from entering the system module to avoid short circuits.
- The surface of the system chassis and the front panel of the module, please do not use an organic solvent for surface wiping.

6.2 Transportation and storage

- This product is packed in carton. Transportation must be carried out under product packaging conditions, and direct rain and snow, direct contact with corrosive gases and strong vibrations should be avoided during transportation.
- The instrument can be transported under various conditions of normal transportation, and should avoid damp, load, collision, extrusion, irregular

placement and other adverse conditions during transportation.

- If the instrument is not used for a long time, the instrument should be packaged and stored.
- The instrument should be stored in a non-corrosive atmosphere and in a well ventilated, clean room.

In the process of transportation, storage and use, attention should be paid to fire prevention, shockproof, waterproof and moisture proof.

7. Service&Maintenance

7.1 Disposal

➢ Waste products should be disposed according to national and local rules and regulations. In order to fulfill our responsibility as a product manufacturer, we will dispose all old equipments on the market in an environmentally friendly manner.

➢ If you have equipment that cannot be disposed, you can ship it to CoreMorrow.

Address: Building I2, No.191 Xuefu Road, Nangang District, Harbin, HLJ, China

Tel: +86-451-86268790

7.2 After-sales and maintenance

➢ The controller does not contain user repairable parts.

➢ The controlle for any service need to provide product number and repair must be returned to factory.

➢ Any attempt to remove any part of the controller system will not be covered by warranty.

➢ The controller is a precision instrument and should be handled with care.

➢ In case of problems, please record the fault and contact the dealer or manufacturer, so that professional technicians can repair.

8. Contact us

CoreMorrow Ltd.

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