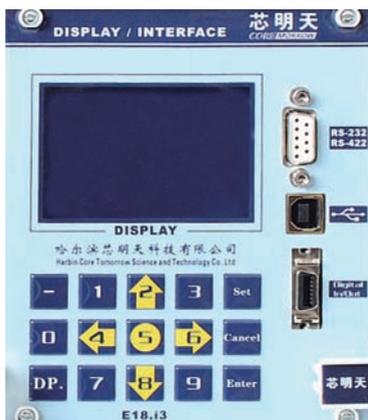**COREMORROW**
Piezo Nano Motion

E18 Software
User Manual

Version: V1.0

This document describes the following products:

- E18.i1   Display and Interface Module, USB, RS-232/422, I/O   1 channel
- E18.i3   Display and Interface Module, USB, RS-232/422, I/O   3 channels
- E18   Software

DECLARATION

Declaration!

➢ The module is used in accordance with this operating instructions. Please read these instructions before use.

➢ When the controller has amplifier Module, E18 could be operated.

➢ After the product is received, the piezo control system should be adapted to room temperature for about 2 hours before being energized.

Notice!

➢ All parameters of the system are calibrated before shipping them. User does not need to make any zero adjustments while the system is running.

➢ Do not arbitrarily change the piezo stage corresponding to the piezo control system. Strictly follow the serial number of the label between the devices.

➢ Before running E18, please power on the system for at least half an hour, and the system will achieve the best stability.

➢ If the piezo system oscillates: servo operation, immediately turn off the servo. Open loop operation, please stop the drive immediately.

➢ Please use original parts, additional cables or connectors may change the calibration data and cause a malfunction.

➢ Please working in a clean, dry environment

Danger!

Piezo controller could output high voltage. Touching high voltage will cause serious or even fatal injuries. Therefore, please read the installation instructions carefully and ensure that only authorized and qualified engineers operate the power supply.

Warning!

➢ If the controller is changed or maintained by a person not expressly authorized by CoreMorrow, if it is improperly maintained or is used incorrectly, CoreMorrow does not assume any responsibility.

➢ Changes or maintenance must be made by personnel authorized by CoreMorrow. Only original parts can be used for maintenance.

Cautious!

E00/E01 housing needs to be installed in an area with a 3cm air circulation area on a horizontal base. The vertical direction prevents internal convection. Insufficient airflow can cause equipment to overheat or premature instrument damage. Do not block the vents or place the chassis near a radiator, oven, or other heat source. Do not put anything on top of the controller chassis.

Note!

When there is no corresponding module in the E00/E01 system, please do not control the corresponding module for the controller. When there is no module, there is no control signal to provide a loop for the amplifier module, which will cause the controller to malfunction.

The module position corresponding to the E00/E01 could only be placed in the corresponding module. If you upgrade your E00/E01 system, please contact the sales engineer or contact our customer service department.

Contents

1.Introduction

1.1 Features

▷ 6 digits display voltage and travel / angle

▷ Button control operating mode

▷ RS-232/422、USB interface

▷ Waveform generator with I/O control

▷ Low noise 16bit DA converter

▷ 1 channel or 3 channels

1.2 Working Environment

Environmental conditions	Conditional Description
Application field	Used indoors only
Environment humidity	Highest relative humidity to 80%, temperature to 30° C. Lowest relative humidity to 50% , temperature to 40℃
Operating temperature	0 ℃ ~ +50 ℃
Storage temperature	-10 ℃ ~ +85 ℃
Voltage range	Tolerance of the main voltage does not exceed ±10% of the nominal value

1.3 Module

E18 include :

▷ E18.i1 Display and Interface Module, USB, RS-232/422, 16Bit D/A , 1 channel

▷ E18.i3 Display and Interface Module, USB, RS-232/422, 16Bit D/A , 3 channels

1.4 Out of Box Audit

E18 display/interface module is installed in E00/E01 piezo control system. Open the package and check it according to the items in packing list. If the part is missing or shows signs of damage, please contact us immediately. Please keep all packaging materials in a safe place for

use when transporting the product again! E18 includes the following components :

▷ E18 display/interface module

▷ E18 software user manual

▷ USB Flash Drive with E18 software

▷ RS-232/422 cable

▷ USB cable

▷ I/O cable

2.Operating

2.1 Boot Interface

The interface below is the boot. The interface displays "CoreMorrow" Logo first, then the "Welcome E00/E01 Series" text is displayed. After a total of 8 seconds, the two interfaces will automatically jump to the "Menu" interface below.

```
        Welcome
     E00/E01 Series

       CoreMorrow
```

2-1. Boot interface

2.2 Menu

After boot interface, the LCD display function menu interface is divided into 3 options:"Control Way", "Device Info", "Version No.", press"Up" and "Down" keys (2 is up, 8 is down) to select the corresponding item to set.

```
          Menu
    1 Control Way
    2 Device Info
    3 Version No.
```

2-2. Menu

▷ **Control Way**

In menu, move the cursor to here and press "Enter" to enter the interface. In this interface, you can see 3 control modes: keys control, analog control, and Pc control. Press the "Cancel" button to return to the menu.

```
        Control Way
     1  Keys Control
     2  Analog Control
     3  Pc Control
```
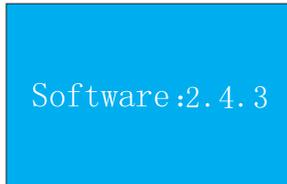
2-3. Control Way

▷ **Device info**

In menu, move the cursor to here and press "Enter" to enter in. Press the"Up" and "Down" keys to view the relevant parameters in the device information. Press the "Cancel" key to return to the menu. Parameter information includes min output voltage, max output voltage, min travel (angle), max travel (angle), max power, and load capacitance. (Before shipment, the relevant unit will be set according to the product driven by the controller.)

Output V_{min}		Output V_{max}	
CH1	0.00000V	CH1	150.000V
CH2	0.00000V	CH2	150.000V
CH3	0.00000V	CH3	150.000V
Min.Travel		Max.Travel	
CH1	0.00000um	CH1	10.0000um
CH2	0.00000um	CH2	10.0000um
CH3	0.00000um	CH3	10.0000um
Max.Power		Load Capacitance	
CH1	7.00000W	CH1	2.200uF
CH2	7.00000W	CH2	2.200uF
CH3	7.00000W	CH3	2.200uF

2-4. Device info

▷ **About the Controller**

In menu, move the cursor to here and press "Enter" to enter in. Displays E18 controller software version number. Press the "Cancel" key to return to menu.

Software:2.4.3

2-5. About the controller

3.Control Way

3.1 Keys Control

In "Control Way" interface, move the cursor to "Keys Control" and press "Enter" to enter the "Keys Control" mode. After entering the "Keys control" interface, press "Cancel" to return to the "Control Way" interface.

Keys Control
1 Single Point
2 Wave Control
3 Step Control

3-1.keys control

▷ **Single Point**

In "Keys Control", move the cursor to "Single Point" and press "Enter" to enter the "Single Point" control mode. In the "Single Point" and press the "Cancel" key to return to the "Keys Control".

Single Point	Measured Value
CH1 0.00000V	CH1 0.123 V / 0.000 m
CH2 0.00000V	CH2 0.456 V / 0.000 um
CH3 0.00000V	CH3 0.789 V / 0.000 um

3-2. Single point & measured value

In "Single point", press"Up(2)" and "Down(8)" keys to select the channel to be controlled. Press the "Set" key to clear the channel data and press the numeric keys to input the data (E18 controller automatically determines the open or servo of the controller, automatically switch the display unit. The actual input data should be consistent with the current open or servo. Open-loop voltage unit: V; closed-loop travel unit: μm; closed-loop angle unit: mrad), press "Enter" key after input. If you enter incorrect data during data entry, you can press the "Cancel" key to clear the input error data. In the non-input data state, press the ""Left"(4) key or "Right"(6) key to enter the measurement interface. The "Measured value" interface displays the monitored voltage and travel/angle, and then press "Left"or "Right" key returns to the input interface.

If the input data exceeds the upper and lower limits set in the device information, it will prompt "overrange)" in the data display area. You must re-enter the data. Press "Enter"to return to the input screen to re-enter the data.

▷ **Waveform control**

In "Keys Control", move the cursor to "Waveform Control" and press "Enter" to enter the Waveform control mode. In "Waveform Control" interface, press "Cancel" key to return to the "Keys Control".

In "Waveform Control" interface, press "Up" and "Down" keys to move the cursor, and press the "Left" and "Right" keys (the numeric keypad "4", "6") to switch channels. The cursor stays at the setting parameter, press the "Set" key to set the corresponding parameter. With the cursor in the "On/off", press "Enter" key to start or stop the waveform output.

Note:
M1: Single mode
M2: Multiple mode
M3: Phase mode
▶ : Off
■ : On
II : Pause

3-3.Waveform control

• Waveform control

There are three waveform transmission modes: single mode, multiple mode, and phase mode. The cursor stays at "M1/M2/M3" and press the "Set" key to switch between the three modes.

The interface displays the character "M2" to represent the multi-channel simulation. In multi-channel mode, 3 channels could simultaneously transmit different frequencies and different peak-to-peak waveforms. Each output waveform has a frequency of up to 1KHz.

The interface displays the character "M1" to represent the one-channel mode. In single-channel mode, only one waveform output could be used, and the other two waveforms are in a stopped state. The single-channel transmit waveform frequency can reach 10KHz.

The interface displays the character "M3" to represent the adjustable phase mode. In this mode, 3 channels can simultaneously transmit waveforms. The 3-channel waveform transmission frequency, wave type, and I/O port direction(same as input or output) must be the same. Output waveform frequency could reach 1KHz. In setting parameter item, the phase mode has more phase angle setting items than the single and multi-channel modes, and the phase angle setting range is 0-360 degrees. Three channels need to set their respective phase angles. The three phase angles are set to the same value, and the three output waveforms have the same phase.

• Send waveform type

The cursor stays at the "waveform icon" and press the "Set" key to switch the type of wave to be output. There are 4 types of waveforms to choose from: sine, square, triangle, and sawtooth.

• Digital In/Out

The cursor stays at "I/O" and press the "Set" key to switch the I/O port direction. The interface is displayed as "O" to indicate that the current I/O port is set as an output port. The interface is displayed as "I" to indicate that the current I/O port is set as an input port.

When set to output port, controller output waveform, a square wave signal is collected on the corresponding channel I/O port in the MDR interface, and each level change (rising or falling) indicates that the E18 module has sent a cycle waveform and detect that the I/O port output square wave frequency should be half of the output waveform frequency. As shown below:
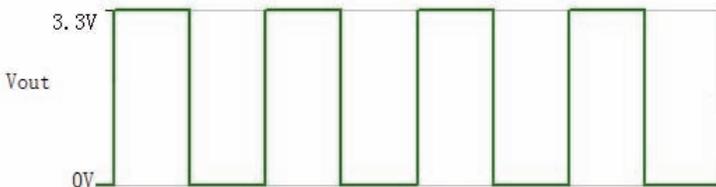
3-4. Waveform detected by I/O port

When set to input port, the waveform is output after the corresponding waveform parameters are set. There will be no waveform output at this time. It is necessary to input the trigger signal (low level active (0V)) corresponding to the I/O channel on MDR interface to output the waveform. If the trigger signal is removed during the waveform output or is connected to a high level (3.3V), the waveform will be in a pause state, maintain the voltage value currently being output, reconnect the low level trigger signal, and the waveform continues to output at the pause position. The output waveform is finally stopped only when the keyboard control stops outputting.

Note! If the phase mode is set and the I/O port is set as the input port, the trigger signal only uses the first channel to trigger the 3 channels waveform output, and the other two channels cannot access the trigger signal. The access trigger level cannot exceed 3.3V, otherwise the controller will be damaged.

• Waveform parameter

The cursor moves to "Vp-p", "Freq", "Bias", "Phase" (this setting is only available in Phase Mode). After pressing the "Set" key to clear the current channel data, press the numeric keys to enter the data. After the input is completed, press the "Enter" key to make the parameters take effect. If you enter incorrect data during data entry, you can press the" Cancel" key to clear the incorrect input data. When the input parameter exceeds the upper and lower limits of the system parameters calibrated in the device information, the "over range" will be displayed. At this time, press the "Enter" key to continue inputting data.

• Start/stop waveform output

After all parameters have been set, move the cursor to the "Off" and press the "Enter" key to output the waveform. "Off" on the interface will change to "On". If the parameters meet the requirements of the output waveform, the waveform will be output directly. To stop the waveform output, press "Enter", and "On" in the interface will change to "Off" and the waveform will stop output. When the current channel is outputting the waveform, you cannot move the cursor by pressing the "Up" or "Down" keys. The cursor can be moved only when the current channel is in the stop state.

Note!The transmit waveform has a power over run stop output function. After setting all the parameters, press "Enter", the system will check whether the output over power is output according to the following formula. If the power exceeds the limit, it will prompt "Over Power". At this time, you need to press the "Enter" key to re-enter the waveform parameter that meets the following formula.

Please calculate according to the following formula:

$$P_a \approx U_{pp} \bullet U_{pp} \bullet f \bullet C_{piezo}$$

In the formula :
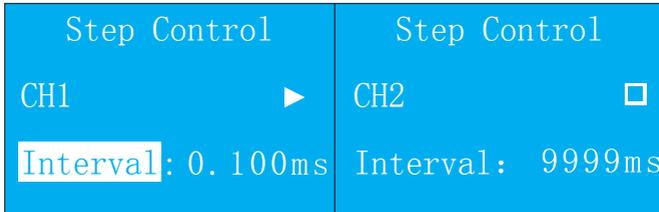
P_a = Ave. power[W]

U_{pp} = (Waveform control) Vpp[V]

f = (Waveform control) operating frequency[Hz]

C_{piezo} = Piezo actuator electrostatic capacity [F]

▷ **Step control**

In "Keys Control" interface, move the cursor to "Step Control" and pressn "Enter" to enter the "Step Control" control mode. Go to the "Step Control" interface and press the "Cancel" key to return to the "Keys Control" interface.


3-5. Step Control

Before using single point step function, the software is required to store the voltage or travel value of the step output in the E18 module. Each channel can store up to 192 voltage or travel values. After the storage is successful, the stored value is still saved in the E18 module after the power is turned off. The next step can be omitted. The method of storing the voltage/travel value to the E18 module through the host computer software, refer to the E18 software instruction manual.

On the "Step Control" interface, press the "Up" and "Down" keys to move the cursor to "Interval", press "Set" key to clear the current channel interval time data, and press the numeric keys to enter the data. If you enter incorrect data during data entry, you can press "Cancel" key to clear the input error data. In the non-input data state, you can switch channels by pressing the "Left" key (number "4") or "Right" (number "6"). The input data is not in the interval time range (range:

0.1ms-9999ms, one digit after the decimal point is valid. If the input data contains more than 1 decimal place, press the "Enter" key, the decimal digit will be cleared after the first digit. The input data should be an integer multiple of 0.1ms). It will display "over range" in the data display. You must re-enter the data. Press "Enter" to return to the input interface to re-enter the data. Press the "Up" and "Down" keys to move the cursor to "Off" and press the "Enter" key to output the stored voltage/travel value. In the interface, "Off" changes to "On", and the stored voltage/travel values are cyclically output in order according to the set interval time. In the "On" state, the cursor cannot move up and down, you can press the "Left" and "Right" keys to switch channels. In the "On" state, press the "Enter" key, the interface "On" changes to "Off", and the voltage/trravel output is stopped (output is 0). Press the "Set" key in the "On" state, "On" in the interface will change to "Pause", and pause the voltage/position value currently being output. Pressing the "Enter" or "Set" key in the "Pause" state will continue the output at the pause voltage/travel.

3.2 Analog control

In "Control Way" interface, move the cursor to "Analog Control" and press "Enter" to enter the "Analog" control mode. The screen displays the analog measurement interface. Press"Cancel" key to return to the "Control Way" interface.
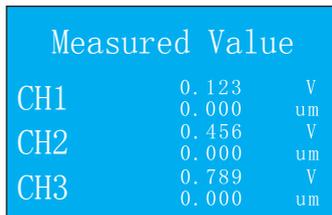
3-6. Analog control measured value

Connect BNC cable to the controller CONTROL INPUT (external analog signal input terminal) and the other end to the analog signal (the analog signal voltage requirement: unipolar voltage range is 0V-10V, bipolar voltage range It is -10V - +10V), the red alligator clip is the input positive pole, the black alligator clip is the input negative pole, the analog signal is amplified by the amplifier, and the amplified analog signal is output from the power output end. The adjustment knob output voltage can be used simultaneously with the external signal input as a output. At the

same time, the LCD monitors the actual output voltage in real time, and the analog control mode interface will display in real time. If you use the analog control function to enter the "Analog Control" interface or switch the system state to the analog state through the PC communication command, the analog control function can be used normally.

3.3 PC control

Connect the port communication cable to the serial port of the computer, the other end to the RS-232/422 port of the controller, or connect the device and computer through the USB connection cable.

In "Control Way" interface, move the cursor to "PC Control" and press "Enter" to enter the Software control mode. The screen displays "Connecting...". After successful communication, it will jump to the software measured interface. Press"Cancel" key to return to the Control Mode interface.

Note! Direct communication on any interface, you do not need to enter "PC control" interface. If the communication has been successfully completed before entering the PC Control" interface, the "Measured Value" interface will be displayed directly when entering the "PC control" interface, and "Connecting.." will not be displayed. You could also send commands from the PC to switch directly from the other interface to the software measured value interface to display the current voltage/travel value.


3-7. Connecting & Measured value after communication success

4.How to Use

4.1 Installment

Open the E18 software CD/USB Flash Drive and install the PC operating software. In the installation package, searching for "Install_E18.msi". As shown below. Select the next step in the process to install successfully.

WindowsInstaller3_1	2017/9/13 11:58	文件夹	
Install_E18.msi	2017/9/13 11:59	Windows Install...	68,704 KB
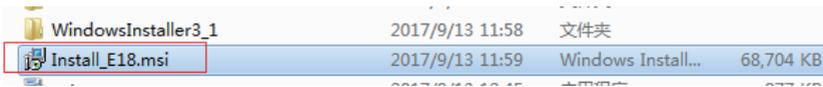
E18 software icon will be displayed after installation. Click the E18 software icon on the system desktop to enter it.

4.2 Software Structure
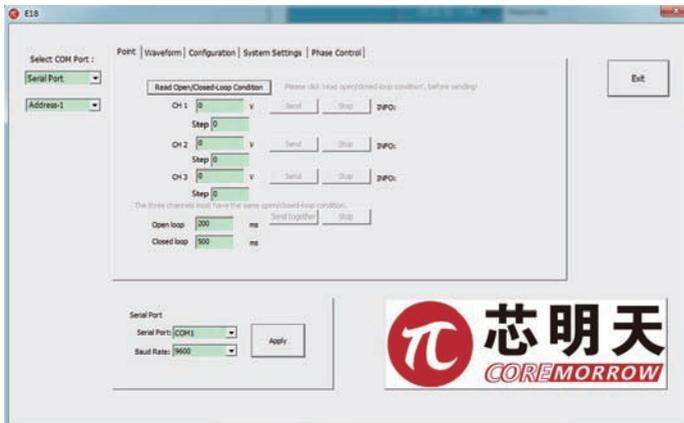
4.3 Communication Mode

Note! RS-232/RS-422 serial communication and USB communication can run at the same time, but two upper computer operation programs must be run at the same time, and commands can be received and executed in order.

▷ **Serial port communication**

1)Connect E18 to the PC using a serial cable,

2)Select the "Serial Port" from the communication mode drop-down menu on the left side of the main interface,

3)Select serial communication baud rate 9600,

4)Select the data serial port corresponding to E18 and the computer, such as "COM1", or the serial port corresponding to the controller,

5)After completing the above steps, click the "Enter" key to complete the serial communication control.
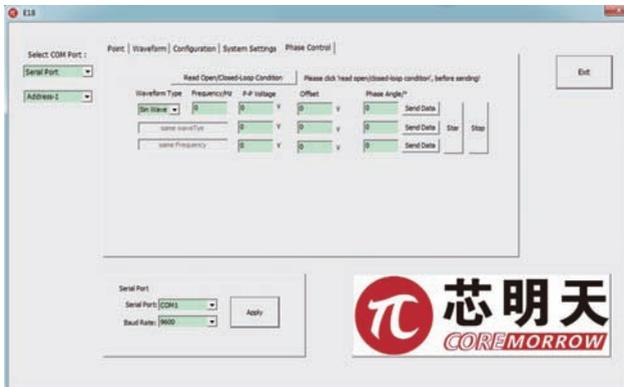

Note! It is recommended to use the serial port as standard on the computer to improve the stable data control signal. If the computer uses a USB to serial port instead, data loss will occur when transferring data, especially when transferring large amounts of data.

▷ **USB communication**

1. Connect E18 to a PC with a USB cable(Please use a standard USB2.0 cable),

2.Select "USB Communication" from the communication mode drop-down menu on the left side of the main interface,

3.In the window below, select the "Enter" key to select USB as the communication mode,

Note! If the USB driver is installed correctly, the pull-down menu below will display the USB driver name: USB_XMT_1, click "Enter" key to complete the USB communication connection. No display indicates that the USB driver has not found the relevant device or the installation is incorrect. Please re-install or restarting the computer, try the above steps again, as shown in the figure below.
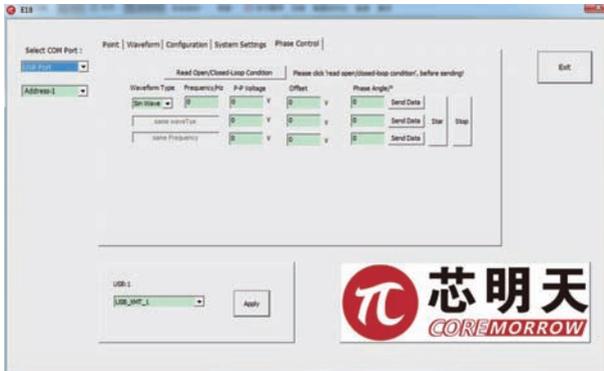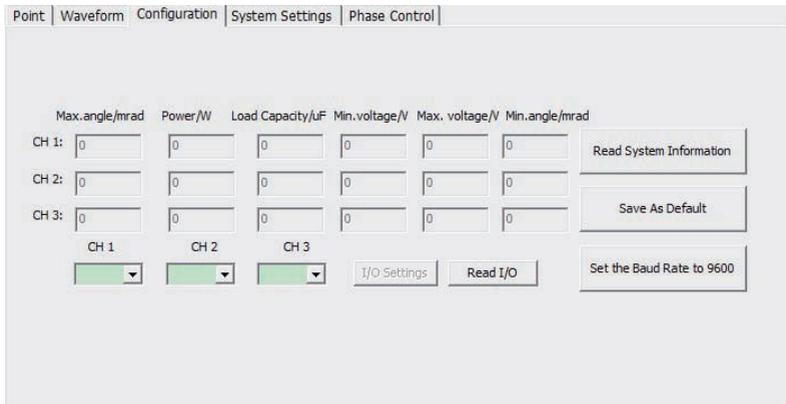

4.4 Control Function Selection

Computer operating procedures include: classic single point, classic waveform, classic configuration, system function settings, phase angle waveform and more.

4.4.1 Configuration

Note! Device information is calibrated before the controller is shipped. User can only read it as information. Calibration information is the user unavailable mode. **Special reminder**: When the new controller is used on the computer, two steps are required: first Step, click "Read System Information", second step, click "Save as Default". To complete the matching of the new controller to the computer. In addition, if the controller has parameter changes, it needs to complete the first step and the second step to match the parameters of the controller and the computer.

I/O port setting function: First click "Read I/O port", read the status of I/O port of the lower computer, and then set the status of the I/O port of the lower computer as needed. The waveform only could be output through when the lower computer I/O port is output; when the lower computer I/O port is input, the waveform function is waiting for external trigger (E18 is 0V trigger) to start transmitting the waveform; as shown in the following figure.

1)Complete communication mode selection,

2)Click on the function selection menu and select "Configuration",

3)Click "Read System Information" key while waiting for the relevant system data information to be read from the lower computer. The default information status is displayed as "0" after the

software is turned on. The corresponding system data information is successfully read as follows:

- Max travel/angle,

- Power information,

- Load setting information,

- Min voltage,

- Max voltage,

- Second of arc,

- System calibration information, include: min voltage, max voltage, Max travel/angle,

load, power.

4)First time to use E18 software to control the controller, you must first read the calibration information before it can be used normally. After the calibration information is successfully read for the first time, you can click "Save as Default" key to save the read calibration information as the default value and save it in the software. The next time you use E18 software, if the controller calibration information is not recalibrated, you can use the software to control the controller without reading the calibration information again.

5)"Set baud rate to 9600", set the serial port baud rate to 9600 through USB. When the baud rate of the lower computer is 25600, you need to set the baud rate of the lower computer to be 9600. When the upper computer needs serial communication, please use this baud rate setting function.

4.4.2 Waveform

1)Complete communication mode selection,

2)Click on the function selection menu and select "Waveform",

3)Read "read open loop/servo" state; in open loop , the control value is the voltage (V), in servo state, the control valye is the travel(μm) / angle (mrad),

4)Select control waveform mode; single-channel waveform control, multi-channel waveform concurrency (each channel separately controls different waveform type and stop sending),

5)Select waveform type, including four standard waveforms: sine wave, square wave, triangular wave, sawtooth wave; and the duty cycle of the waveform is 1:1,

6)Vp-p(V/μm/mrad), (The Vp-p input range is the difference between the calibrated max voltage/angle/travel and the min voltage/angle/travel),

7)Freq(Hz),

8)Bias(V/μm/mrad),（In unipolar control, the bias is one-half of the Vp-p voltage; in bipolar control, the bias is set to "0"）,

9)Click "Send" key to complete the corresponding waveform,

10)If the transmission is successful, the button is grayed out and "Stop" button is available.

Similarly, for multiple waveforms, select multiple simultaneous waveforms through the pull-down menu, as shown below:
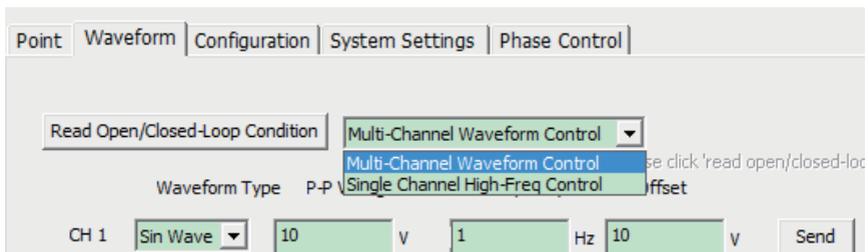
Note! Waveform control function has a power over run stop output function, which is calculated according to the following formula:

$$P_a \approx U_{pp} \cdot U_{pp} \cdot f \cdot C_{piezo}$$

In the formula : :

P_a= (Calibration information) Ave. power [W]

U_{pp}=Transmit waveform Vpp[V]

f = (Spontaneous waveform) operating frequency[Hz]

C_{piezo} = (Load setting) Piezo actuator capacity[F]

4.4.3 Point

1)Complete communication mode selection,

2)Click on the function selection menu and select "Point",

3)Read "read open loop/servo Condition" state; in open loop , the control value is the voltage (V); in servo state, the control valye is the travel(μm) / angle (mrad),

4)Input controlV/μm/mrad ;

5)Click the "Send" key to complete the data sending command. ;

6)Click the "Stop" key to stop sending data, or enter the data "0", then click the "Send" key to complete the data clear command.

4.4.4 Point control-3 channels to send simultaneously
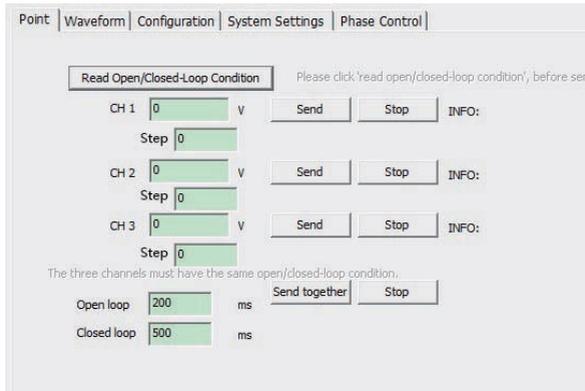
1) The 3 channels to fill in the sending data,

2) Control the 3 channels open loop/servo property (simultaneous open loop or simultaneous servo),

3) Click "Send together" to complete the simultaneous sending of 3 channels of data.

Click "Stop" to stop 3 channels output。

4.4.5 System Setting
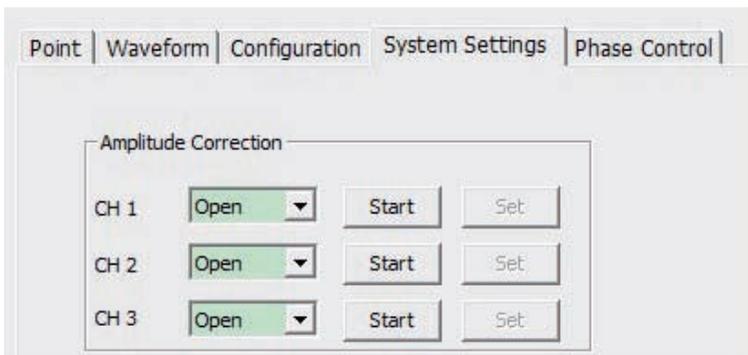
Click "On", select "alibration is on", and then click "Set" to complete the control switch for the amplitude correction of the corresponding channel. (Amplitude correction: In open loop state, when the controller is used dynamically with some piezo stages, the output waveform amplitude attenuation will occur. This function could be used to complete the attenuation correction. And it is only valid for small amplitude waveform output.). This feature is generally not required and should be set to the default off state.

4.4.6 Phase Waveform
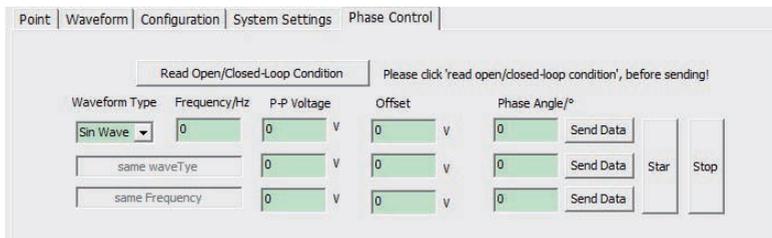
When the waveform and frequency are the same, the default is the same channel. The 3 channels are filled with independent Vp-p, Bias, and relative phase angles, the unit is degree and the is range (0 to 360), and then click "On". The button output fills in the waveform worth the phase angle. Click the "Stop" key to stop the output phase angle waveform. If you need to change the transmitted waveform, you need to stop sending, fill in waveform information, such as Vpp, offset, phase angle information, and then click "Send" to send data to complete the update of the waveform data.

5.Contact Us

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CoreMorrow Official and CTO WeChat are below: