



# P32 Piezo Tip/Tilt and Z Platform

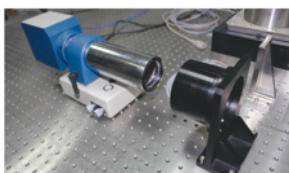
## User Manual

Version: V1.0



This document describes the following products:

- P32.ZT4S
- P32.ZT4K



# DECLARATION

Thank you for choosing CoreMorrow's products!

This user manual is applicable to P32 Piezo Z/Tip/Tilt Platform. For your smooth and correct use of this product, please read this manual carefully before use. Please follow the instructions in the manual installation and use procedures. Improper operation may cause injury to the operator or damage to the product. Therefore, the entire installation and operation process should be completed by a professional with a certain foundation and understanding of the product principle, or under the guidance of a professional.

If the product is disassembled or modified without permission, our company will not be responsible for any consequences arising therefrom.

It is illegal to change the product model and other false sales of our products. Users are advised to be vigilant. Once you find out or be deceived, contact us directly, we will crack down on illegal activities and prevent deception and economic losses. CoreMorrow will certainly investigate legal responsibility of the illegal subject and related parties.

With the continuous development and innovation of technology, we will add the latest information to the manual as needed without notice. Please contact us if you need any information.

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## 1. About this manual

### 1.1 Writing purpose and content

This manual is mainly for your correct use of our products.

The manual contains all the necessary information for the P32 Piezo Z/Tip/Tilt Platform.

Describes the precautions during installation and use.

### 1.2 Symbols and meanings



DANGER: Improper handling can cause injury to the operator.



Note: Improper handling can cause damage to the equipment.

► No order between items

1. Operate in order
- 2.

### 1.3 Expected readers

The default user of this manual has knowledge of Piezo Z/Tip/Tilt Platform and controllers, and has a basis for its installation and use.

### 1.4 Manual lost replacement

If this manual is accidentally lost, please contact our customer service department, our company will send you the latest version of the user manual for free.



## 2. Safety Guide

P32 Piezo Z/Tip/Tilt Platform is designed with the most advanced technology and safety standards. For your own safety and correct use of the product, please pay attention to the following points when using:



The temperature change and pressure will charge the piezo actuators. The piezo actuator will remain charged for a period of time after disconnected from the controller, so the operator should pay attention when using it:

- Do not disassemble the P32 Piezo Z/Tip/Tilt Platform without authorization.
- Discharge the P32 before installation, this can be achieved by connecting to the controller.
- Do not remove the controller during operation.
- Before use, first check whether the cable of this product is in good condition and the product and controller have been effectively grounded. The operation should be strictly regulated. Do not touch the product (up to 150V) with your hands after powering up to prevent danger.



In order to prevent damage to the product caused by improper operation, the following points should be noted when using:

- The P32 Piezo Z/Tip/Tilt Platform should be used in a dust-free, oil-free, lubricant-free environment.
- Since the product adopts flexible structure design, it is recommended that the load should not exceed the bearing capacity of the product. Pay attention to the torque when loading. Do not rub or twist the load surface to avoid damage to the structure.
- The recommended voltage range for long-term use is 0~120V.
- Do not disassemble the product to avoid damage to the product.
- Avoid stretching and bending the cable interface to prevent damage to the cable.
- Use the special cable provided by our company to connect P32 Piezo Z/Tip/Tilt Platform and controller.
- Do not use the cable extension cable. If you need a longer cable, please contact our customer service department.



## 3. Product Overview

### 3.1 Product Introduction

The P32 Piezo Z/Tip/Tilt Platform has below advantages:

- High reliability piezo actuators:

The P32 Piezo Z/Tip/Tilt Platform is driven by a high-reliability piezo ceramic actuators. The piezo ceramic actuator is fully insulated, so its performance and service life are far superior to those of conventional piezo ceramic actuators. The insulating layer can effectively prevent the piezo ceramic from being damaged by moisture. Therefore, the stability of the piezoelectric ceramic can be ensured under extreme conditions. Compared with the conventional driving mechanism, there is no rotating component and friction, so the ceramic actuator has the characteristics of no rebound, no maintenance, no wear and so on.

- Flexible hinge structure:

P32 series Piezo Z/Tip/Tilt Platform adopts flexible hinge mechanism, which has the advantages of no friction and high positioning accuracy. Flexible hinge is a kind of component that is not affected by static and dynamic friction. It is based on the elastic deformation of solid (such as steel) and has no rolling and sliding parts. The flexible unit has high stiffness and load capacity, the hinge guide is maintenance-free and wear-free, and no lubrication is required.

- Strain gage sensor:

The strain gauge sensors detect position information by deformation, they are fixed at appropriate positions in the transmission portion. This type of position measurement is measured by contact and indirect. The displacement of the motion platform is therefore measured by measuring the lever, the guide hinge or the piezoceramic stack.

The tilt range of P32 Piezo Z/Tip/Tilt Platform in  $\theta X / \theta Y$  is up to 6mrad, the overall use of flexible hinge structure, with no mechanical friction, fast response, high repeatability and other advantages. This product can also be customized according to the request, with high flexibility and easy operation to meet different applications.

### 3.2 Working principle

The control schematic of the P32 Piezo Z/Tip/Tilt Platform is as follows:

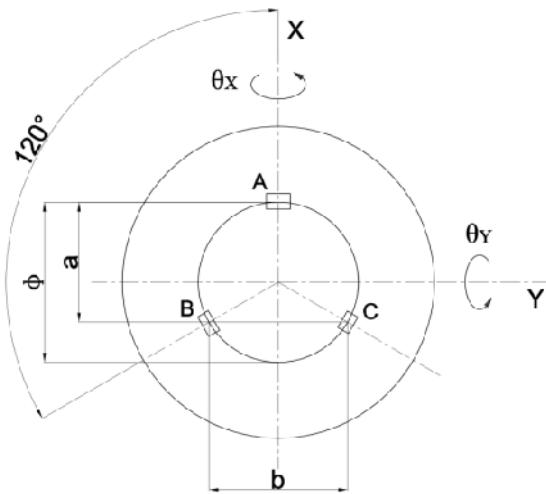


Figure 1 P32 control schematic

The P32 Piezo Z/Tip/Tilt Platform is driven by three piezo actuators that are located in  $120^\circ$  angles to one another. Each piezo actuator is controlled separately, and the tilt motion is completed by the push-pull mode of piezo actuators. The bridge is connected by a circuit. The P32 Piezo Z/Tip/Tilt Platform with bridge configuration can eliminate the effect of temperature change on piezo actuators, and maintains good angular stability over a wide range of temperature changes.

In addition to tilting, the platform is also used linearly in Z direction, which is important, for example, for correcting optical path lengths(phase shifters).

The platform's tilt angle and displacement in Z can be calculated as follows:

$$a = \frac{3}{4}\phi, \quad b = \frac{\sqrt{3}}{2}\phi$$

The tilt angle in  $\theta_x$ :

$$\theta_x = \frac{B - C}{b}$$

The tilt angle in  $\theta_y$ :

$$\theta_y = \frac{2A - (B + C)}{2a}$$

The displacement in Z:

$$Z = \frac{A + B + C}{3}$$

Whereby:

**A** - the linear displacement of A piezo actuator,

**B** - the linear displacement of B piezo actuator,

**C** - the linear displacement of C piezo actuator.

The dynamic characteristics of the platform:

The maximum operating frequency of the platform strongly depends on its mechanical resonant frequency, and also on amplifier, controller and sensor. In order to estimate the effective resonant frequency of the system (platform and mirror), the moment of inertia of the mirrors must be taken into account. The moment of inertia of a rotationally symmetric mirror can be calculated as follows:

$$I_m = m \left[ \frac{3R^2 + H^2}{12} + \left( \frac{H}{2} + T \right)^2 \right]$$

The moment of inertia of a rectangular mirror can be calculated as follows:

$$I_m = m \left[ \frac{L^2 + H^2}{12} + \left( \frac{H}{2} + T \right)^2 \right]$$

Whereby:

m - mirror weight, g

$I_m$  - moment of inertia of a mirror, g\*mm<sup>2</sup>

L - mirror length orthogonally to tilt axis, mm

H - mirror thickness, mm

T - distance of pivot point to platform surface, mm

R - mirror radius, mm

The resonant frequency of the system is calculated with resonant frequency of the platform and

moment of inertia of the mirror substrate as follows,

$$f' = \frac{f^0}{\sqrt{1 + I_m / I_0}}$$

Whereby:

$f'$  - resonant frequency of platform with mirror, Hz

$f^0$  - resonant frequency of platform without mirror, Hz

$I_0$  - moment of inertia of platform, g•mm<sup>2</sup>

$I_m$  - moment of inertia of a mirror, g•mm<sup>2</sup>

Control method:

Define the maximum control voltage as A, the control method is as follows:

AXIS1 ( $\theta_x$ ) control method:

$$CH2=A/2$$

$$CH1+CH3=A$$

AXIS2 ( $\theta_y$ ) control method:

$$CH1=CH3$$

$$CH2+CH1/CH3=A$$

AXIS Z control method:

$$CH1=CH2=CH3$$

### 3.3 Product Features

- ▷ Maximum tilt angle to 6 mrad
- ▷ High-precision sensor with high positioning accuracy
- ▷ Sub-microradian resolution
- ▷ Fast response

### 3.4 Motion direction

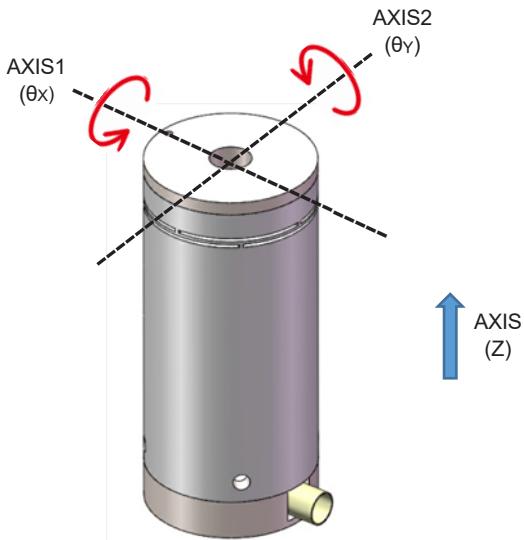


Figure 2 P32 piezo Z/Tilt/Tip platform motion directions

## 4. Operating environment

Operating temperature: -20~80°C

Environment free of dust, clean, and non-corrosive substances

Relative humidity: <60%

Recommended a voltage between 0 and 120V for long-term and high-reliability operation.

## 5. Installation and operation

### 5.1 Installation and Precautions

Before installation, first check the safety, such as whether the cable is damaged or broken, and whether the power supply has grounding protection.

The P32 installation diagram is as follows:

Mirror attachment surface



Grounding hole



Fixed mounting hole

(M4 screw)

Figure 3 P32 installation diagram

1. Before attaching a mirror, clean the bonding plane of the mirror. After the mirror is glued, it need to take a period of time for solidification of glue, then install the platform with mirror into your structure. You can also use mirror adapter, as shown in Figure 4.



Figure 4 mirror adhesive and mirror adapters

2. Select the mounting bracket or install the platform by transfer way. It is recommended to use the M3 screw. Clean the mounting bracket before installation. You can also contact us to select the proper transfer workpiece for installation.
3. Fix the platform on the installation plane or fix it on the installation plane through the relevant workpiece. Please note that if you want to use the platform in tilt or sideways, please contact us.

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Figure 5 Transfer workpiece

4. Connect the connectors of the P32 platform to the controller;
5. Connect the grounding protection as shown in below figure;

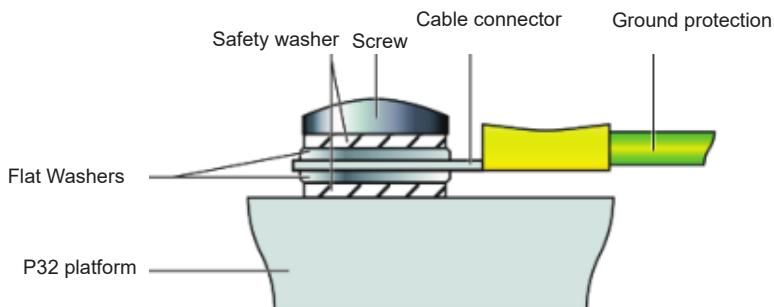


Figure 6 grounding protection diagram

## Installation Precautions:

- Be careful not to scratch the mirror during the process of attaching and installing;
- Do not drop the mirror adhesive into the gap of the flexible hinge, and keep no objects obstructing the platform movement, so as not to affect the accuracy or damage the equipment;

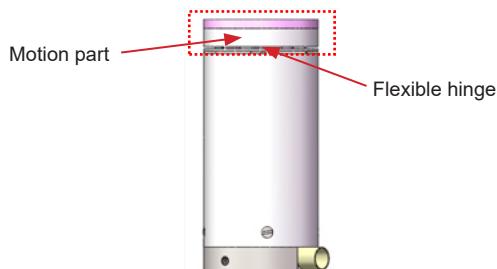


Figure 7 Flexible hinge diagram

- ▶ Please select the appropriate screws for the fixed connection to prevent the installation from being tight and the platform falling off and cause permanent damage. Pay attention to the standard operation during the whole installation and operation. Students should operate under the guidance of professionals.

## 5.2 Loading

The mirror's weight should be less than the load capacity of the P32 platform. Install the mirror at the center of the moving platform surface.

The correct placement of the load is shown below:

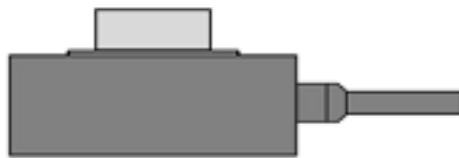


Figure 8 Load applied to the center of the platform

For the protection of the product, we do not recommend that the load is too high. If you must load a higher load, please low the position of the center of gravity of the load. The error placement method is as follows:

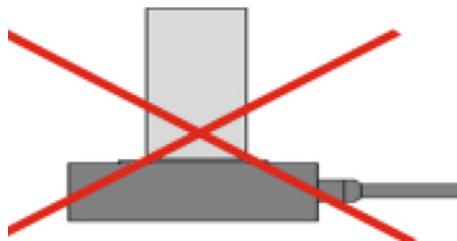


Figure 9 Try not to let the load's center of gravity far from the motion platform

It is forbidden to load the load on one side of the motion platform, which will cause serious damage to the product, as shown in the following figure:

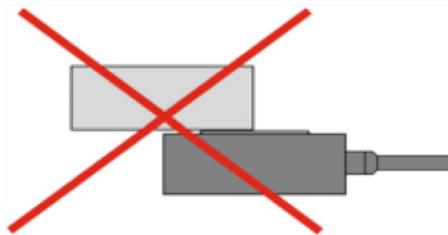


Figure 10 loading too long load and to the side of the active platform is prohibited

## Precautions:

- ▷ Slowly tighten the load when installing it, and the torque should not be too large to avoid damage to the mechanism;
- ▷ Avoid stretching cables and bending cables;
- ▷ Use the special cable provided by our company to connect P32 piezo platform and controller;
- ▷ Do not extend the cable without authorization. If you need a longer cable, please contact our customer service department.

## 5.3 Operation

Please confirm the following information before starting the power:

- ▷ P32 platform is grounded;
- ▷ The use environment meets the operating environment requirements of the P32 platform;
- ▷ The fixing screws must be tightened;

After the above information is confirmed, operate the controller:

1. Please read the user manual of the controller selected by the user before operation, and then start the controller.

2. Set the zero setting to the controller first;
3. After checking for no abnormality, set the input voltage value according to the demand (keyboard or analog control);
4. The platform can work normally within the rated voltage range of piezo actuator (0~120V, maximum not exceeding 150V);
5. Please perform voltage clear operation after use;

Please take light steps in the operation, and do not touch the product, so as not to affect the use of the product or even damage the product.

The resolution of the product itself is not limited. The resolution depends on the performance of the product controller. In order to better achieve the motion accuracy of the platform, it is recommended to use the supporting controller of our company. For the operation method of the controller, please refer to the controller manual to ensure that the correct operation can be performed afterwards.

#### Precautions:

- ▷ Do not remove the grounding protection during operation. If it needs to be temporarily removed, reconnect the grounding protection before starting again.
- ▷ The driving voltage should not exceed the maximum voltage allowed by the P32 platform;
- ▷ If abnormal noise or oscillation occurs during use, immediately turn off the power check parameter setting;
- ▷ The drive and sense lines should be pulled out in the correct way as follows:



(a) Error way



(b) Correct way



## 6. Transportation and inspection

### 6.1 Transportation

This platform is packed in carton. The transportation is carried out under the condition of packaging. This product can be transported by various means of transportation under normal conditions. During transportation, it should avoid direct rain and snow, avoid contact with corrosive substances, and avoid strong collision, try to avoid improper behavior such as squeezing, irregular placement.

### 6.2 Unpacking inspection

Check below information:

- Before opening the package, please carefully check the packaging for damage, bruising, wetting, moisture, deformation, etc.
- Please check the parts on a case-by-case basis based on the supply contract and the packing list;
- Whether there is obvious damage on the surface of the product;
- Whether the product identification is clear and complete;
- Whether the connector is loose, the connection line is broken or not, etc.;

If any of the above occurs, please make a detailed record and take a photo, and please contact us immediately.

Precautions:

- Please handle gently when unpacking to avoid permanent damage to the platform caused by bumps;
- Please do not use heavy tools or use rough methods to open them;
- Do not discard all packaging materials for return shipments.



## 7. Maintenance and Treatment

### 7.1 Problem Processing

The common problems are shown in the following table:

Problem Description	Possible reasons	Solution
The tilt range becoming smaller	The cable is not connected correctly or has poor contact	Check the connection of the cable
	Excessive load	The load weight should not exceed the platform's load capacity
	Sensor zero drift	Check the sensor
Reduced accuracy	The installation plane is uneven	Mount the platform on a flat surface
	Loose connection	Fastening connection
	Wiring is wrong	Check that the wiring is correct
Vibration or inaccurate positioning at start-up	The control parameters are incorrect.	Stop immediately, check the parameter settings
	Resonance	Making the drive frequency much smaller than the resonant frequency

Table 1 Common problems and solutions

If the user has problems that can't be solved during the use. Please record the fault situation and contact with our company. The professional technicians will help solve the problem.

Problems caused by improper operation are not covered by the warranty;

Our company is not responsible for any problems caused by dismantling the products without permission.

## 7.2 Daily maintenance

If the product is not used for a long time, please store it in an indoor environment with no dust, good ventilation, clean and non-corrosive substances.

Please do not loosen the bolts on the product structure during daily maintenance, so as not to affect the movement accuracy of the product.

Daily cleaning:

Please disconnect the platform to the controller, then clean the surface of the product.

When cleaning, first wipe a small amount of detergent with a towel and gently wipe the surface of the product, then wash it with alcohol. Do not use ultrasonic waves for cleaning.

When cleaning the surface, try not to pick up the product. If it is necessary to pick up, please place a sponge under the product for protection, the product should not be too high from the sponge to prevent the product from falling off.

## 7.3 Disposal of old/waste products

Disposal of waste products must be handled in accordance with national and local regulations.

In order to fulfill our company's responsibility as a product manufacturer, all old equipment on the market will be treated environmentally. If you have old or waste piezo equipment that cannot be processed, you can send it to our company. .

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

Tel: +86-451-86268790



## 8.Customer Service

If you have questions about the products you are currently using, please let us know the following information:

- Product model and relevant number
- The controller model
- Software driver version
- Computer operating system that installs supporting software



## 9. Contact us

### CoreMorrow Ltd.

Tel: +86-451-86268790

Email: info@coremorrow.com

Website: www.coremorrow.com

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

### CoreMorrow Official and CTO WeChat are below:

