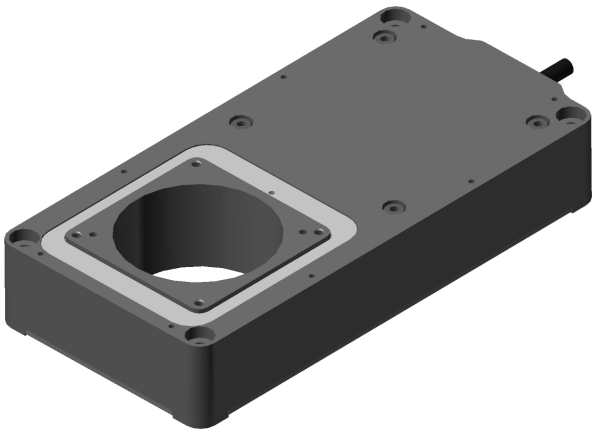
PZ247E

P-63x Nanopositioner

User Manual

Version: 1.1.0 Date: 29.04.2022



This document describes the following products:

- **P-630.XCD**
  Linear piezo nanopositioner with aperture, 40 µm, direct position measuring, capacitive sensor

- **P-631.XCD**
  Linear piezo nanopositioner with aperture, 80 µm, direct position measuring, capacitive sensor

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Contents

1 About this Document

In this Chapter

1.1 Objective and Target Group of this User Manual

This user manual contains the information required for using the P-63x as intended ("x" stands for the different models (p. 9)).

Basic knowledge of control technology, drive technologies, and suitable safety measures is assumed.

The latest versions of the user manuals are available for download (p. 3) on our website.

1.2 Symbols and Typographic Conventions

The following symbols and typographic conventions are used in this user manual:

CAUTION

Dangerous situation
Failure to comply could lead to minor injury.

➢ Precautionary measures for avoiding the risk.

NOTICE

Dangerous situation
Failure to comply could cause damage to equipment.

➢ Precautionary measures for avoiding the risk.

INFORMATION

Information for easier handling, tricks, tips, etc.

Symbol/ Label	Meaning
1. 2.	Action consisting of several steps with strict sequential order
➢	Action consisting of one or more steps without relevant sequential order.
▪	Bullet
p. 5	Cross-reference to page 5
RS-232	Label on the product indicating an operating element (example: RS-232 interface socket)
	Warning signs on the product that refer to detailed information in this manual.

1.3 Definition of Terms

Term	Explanation
Positioner	Electrically driven mechanics (here: P-63x) with one or more motion axes
Electronics	Piezo amplifier or piezo controller that supplies the operating voltage for positioners or piezo actuators
Piezo amplifier	Electronics without sensor evaluation for open-loop operation of positioners and piezo actuators
Piezo controller	Electronics with sensor evaluation for closed-loop operation of positioners and piezo actuators

1.4 Figures

For better understandability, the colors, proportions, and degree of detail in illustrations can deviate from the actual circumstances. Photographic illustrations may also differ and must not be seen as guaranteed properties.

1.5 Other Applicable Documents

The devices and software tools from PI mentioned in this documentation are described in separate manuals.

Product	Document
E-709 Digital Piezo Controller	PZ222 User Manual
E-709.CHG Digital Piezo Controller	PZ222 User Manual
E-709.1C1L Digital Piezo Controller	PZ305 User Manual
E-754 Digital Piezo Controller	E754T0001 User Manual
P-5xx / P-6xx / P-7xx Piezo Positioners	PZ240EK Short Instructions

1.6 Downloading Manuals

INFORMATION

If a manual is missing or problems occur with downloading:

➢ Contact our customer service department (p. 31).

Downloading Manuals

1. Open the website **www.pi.ws**.
2. Search the website for the product number (e.g., P-630) or the product family (e.g., nanopositioner).
3. Click the corresponding product to open the product detail page.
4. Click the ***Downloads*** tab.

   The manuals are shown under ***Documentation***. Software manuals are shown under ***General Software Documentation***.
5. Click the desired manual and fill out the inquiry form.

   The download link will then be sent to the email address entered.

2 Safety

In this Chapter

2.1 Intended Use

The P-63x is a laboratory device as defined by DIN EN 61010-1. It is intended for indoor use and use in an environment that is free of dirt, oil, and lubricants.

Inb accordance with its design, the P-63x is intended for fine positioning as well as the fast and precise motion of small objects. The motion takes place linearly in one axis. The specifications of the P-63x apply to horizontal mounting. Vertical mounting is only possible under certain conditions (p. 18).

It is only possible to use the P-63x as intended in conjunction with suitable electronics (p. 11) available from PI. The electronics is not included in the scope of delivery of the P-63x.

The electronics must provide the required operating voltages. To ensure proper performance of the servo control system, the electronics must be able to read out and process the signals from the capacitive sensors.

2.2 General Safety Instructions

The P-63x is built according to state-of-the-art technology and recognized safety standards. Improper use can result in personal injury and/or damage to the P-63x.

- Use the P-63x for its intended purpose only, and only when it is in perfect technical condition.
- Read the user manual.
- Eliminate any malfunctions that may affect safety immediately.

The operator is responsible for the correct installation and operation of the P-63x.

The P-63x is driven by piezo actuators. Temperature changes and compressive stress can induce charges in piezo actuators. Piezo actuators can remain charged for several hours after disconnecting the electronics. Touching or short-circuiting the contacts in the P-63x's connector can lead to minor injuries from electric shock. The piezo actuators can be destroyed by an abrupt contraction.

- Do **not** open the P-63x.
- Discharge the positioner's piezo actuators before installing:
  Connect the positioner to the switched-off PI electronics equipped with an internal discharge resistor.
- Do **not** pull the plug connector out of the electronics during operation.

Touching the contacts in the plug connector can lead to an electric shock (max. 130 V DC) and minor injuries.

- Do **not** touch the contacts in the plug connector.
- Use screws to secure the positioner's connector against being pulled out of the electronics.

If a protective earth conductor is not or not properly connected, dangerous touch voltages can occur on the P-63x in the case of malfunction or failure of the system. If there are touch voltages, touching the P-63x can result in minor injuries from electric shock.

- Connect the P-63x to a protective earth conductor (p. 16) before starting.
- Do **not** remove the protective earth conductor during operation.
- If the protective earth conductor has to be removed temporarily (e.g., in the case of modifications), reconnect the P-63x to the protective earth conductor before restarting.

Mechanical forces can damage or misalign the P-63x.

- Avoid impacts that affect the P-63x.
- Do **not** drop the P-63x.
- Do **not** exceed the maximum permissible stress and load capacities according to the specifications (p. 33).
- Do **not** touch any sensitive parts (e.g., motion platform) when handling the P-63x.

The P-63x is maintenance-free and achieves its positioning accuracy as a result of the optimal alignment of mechanical components and piezo actuators. Loosened screws cause a loss in positioning accuracy.

- Loosen screws only when instructed in this manual.
- Do **not** open the P-63x.

2.3 Organizational Measures

User manual

- Always keep this user manual together with the P-63x.
  The latest versions of the user manuals are available for download (p. 3) on our website.
- Add all information from the manufacturer to the user manual, for example supplements or technical notes.
- If you give the P-63x to a third party, include this user manual as well as other relevant information provided by the manufacturer.
- Do the work only if the user manual is complete. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.
- Install and operate the P-63x only after you have read and understood this user manual.

Personnel qualification

The P-63x may only be installed, started, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

3 Product Description

In this Chapter

3.1 Model Overview

The P-63x is available in the following versions:

Model	Description
P-630.XCD	Linear piezo nanopositioner with aperture, 40 µm, direct position measuring, capacitive sensor
P-631.XCD	Linear piezo nanopositioner with aperture, 80 µm, direct position measuring, capacitive sensor

3.2 Product View

The figure serves as an example and can differ from your positioner model.

- Pay attention to the symbols on your device.

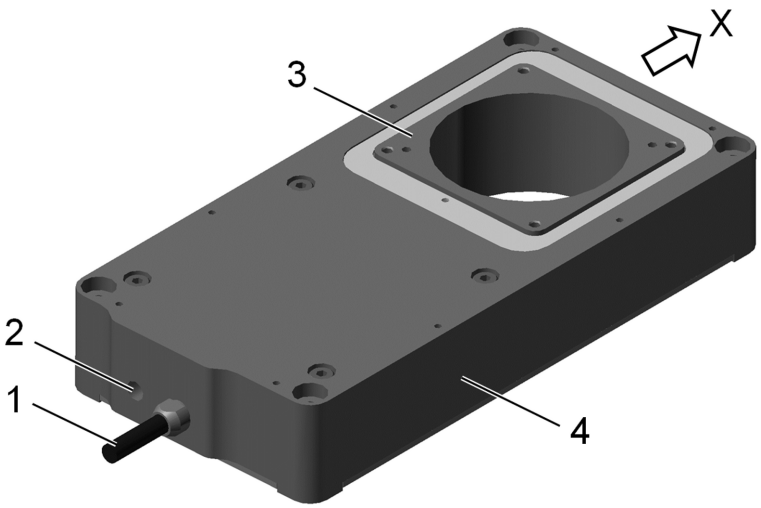

Figure 1: Example of product view

1 Cable exit
2 Protective earth connector (M4 hole)
3 Motion platform
4 Base body
X (Positive) direction of motion of the positioner

3.3 Product Labeling

Labeling	Description
PI	Manufacturer's logo
P-630.XCD	Product number (example)
123456789	Serial number (example), individual for each P-63x Meaning of each position (from the left): 1 = internal information 2 and 3 = year of manufacture 4 to 9 = consecutive number
WWW.PI.WS	Manufacturer's address (website)
CE	CE conformity mark
⚠	Warning sign "Pay attention to the manual!"
⏚	Symbol for the protective earth conductor (p. 16)

The arrow indicates the positive direction of motion.

Figure 2: "Residual Voltage" warning sign on the connector of the P-63x
Risk of electric shock (p. *5*)

3.4 Scope of Delivery

Product number	Description
P-63x	Positioner according to order (p. 9)
000036450	M4 screw set for protective earth, consisting of: ▪ 1 M4x8 flat-head screw with cross recess, ISO 7045 ▪ 2 lock washers ▪ 2 flat washers
000044620	Screw set: ▪ 4 socket-head screws, M2.5x20, ISO 4762 ▪ 1 hex key AF 2
PZ240EK	Short instructions for P-5xx / P-6xx / P-7xx piezo positioners

3.5 Suitable Electronics

You need suitable electronics to operate a P-63x. The device is selected depending on the type of application.

Product number	Description
E-709.CRG	Digital piezo controller, 1 axis, -30 to 130 V, capacitive sensor, benchtop device
E-709.CR	Digital piezo controller, 1 axis, -30 to 130 V, capacitive sensor, OEM module
E-709.CHG	Digital piezo controller, 1 channel, -30 to 130 V, capacitive sensor, high power output, benchtop device
E-709.1C1L	Digital piezo controller, 1 axis, -30 to 130 V, capacitive sensor, monitoring functionality, benchtop device
E-754.1CD	Single-channel, digital high-speed piezo controller for capacitive sensors, with TCP/IP, USB, and RS-232 interface

➢ To order, contact our customer service department (p. 31).

3.6 Technical Features

3.6.1 PICMA® Piezo Actuators

P-63x positioners are driven by PICMA® piezo actuators. PICMA® actuators have all-ceramic insulation and their performance and lifetime are therefore far superior to conventional actuators. The ceramic insulation layer protects the monolithic piezoceramic block against humidity and failure due to increased leakage current. In this way, an especially high reliability is achieved even under extreme ambient conditions. In contrast to motorized drives, there are no rotating parts or friction. The piezo actuators are therefore free of backlash, maintenance, and wear.

3.6.2 Flexure Guides

P-63x positioners have flexure guides for friction-free motion and high guiding accuracy.

A flexure guide is an element that is free of static and sliding friction. It is based on the elastic deformation (bending) of a solid (e.g., steel) and does not have any rolling or sliding parts. Flexure elements have a high stiffness and load capacity. Flexure guides are maintenance and wear free. They are 100% vacuum compatible, function in a wide temperature range and do not require any lubricants.

3.6.3 Capacitive Sensors

Capacitive sensors measure the position directly on the platform (direct metrology) and work without contact. Neither friction nor hysteresis interferes with the motion, which allows excellent linearity values to be achieved together with the high position resolution. In conjunction with suitable electronics, capacitive sensors achieve the best resolution, stability, and bandwidth.

3.6.4 ID Chip

An ID chip is in the D-sub connector of the P-63x. When the P-63x is calibrated at the factory with digital electronics, the calibration data is saved on the ID chip together with specific product information. After switching on, the digital electronics read the data from the ID chip of the P-63x connected. A P-63x with an ID chip containing calibration data can therefore be connected to any suitable digital electronics without renewed calibration.

Refer to the manual for the controller for more information on the ID chip.

4 Unpacking

NOTICE

Mechanical overload due to incorrect handling!
An impermissible mechanical load on the motion platform of the P-63x can cause damage to the piezo actuators, sensors, and flexures of the P-63x as well as loss of accuracy.

➢ Do **not** touch any sensitive parts (e.g., motion platform) when handling the P-63x.

1. Unpack the P-63x with care.
2. Compare the contents with the scope of delivery according to the contract and the delivery note.
3. Inspect the contents for signs of damage. If any parts are damaged or missing, contact our customer service department (p. 31) immediately.
4. Keep all packaging materials in case the product needs to be returned.

5 Installation

In this Chapter

5.1 General Notes on Installing

CAUTION

Dangerous voltage and residual charge in piezo actuators!

The P-63x is driven by piezo actuators. Temperature changes and compressive stress can induce charges in piezo actuators. Piezo actuators can remain charged for several hours after disconnecting the electronics. Touching or short-circuiting the contacts in the P-63x's connector can lead to minor injuries from electric shock. The piezo actuators can be destroyed by an abrupt contraction.

- Do **not** open the P-63x.
- Discharge the positioner's piezo actuators before installing:
  Connect the positioner to the switched-off PI electronics equipped with an internal discharge resistor.
- Do **not** pull the plug connector out of the electronics during operation.

Touching the contacts in the plug connector can lead to an electric shock (max. 130 V DC) and minor injuries.

- Do **not** touch the contacts in the connector.
- Use screws to secure the positioner's connector against being pulled out of the electronics.

NOTICE

Mechanical overload due to incorrect handling!

An impermissible mechanical load on the motion platform of the P-63x can cause damage to the piezo actuators, sensors, and flexures of the P-63x as well as loss of accuracy.

- Do **not** touch any sensitive parts (e.g., motion platform) when handling the P-63x.

NOTICE

Damage due to unsuitable cables!
Unsuitable cables can damage the P-63x and the electronics.

- ➢ Use cables provided by PI only to connect the P-63x to the electronics.

NOTICE

Damage due to improper mounting!
Improper mounting of the P-63x or incorrectly mounted parts can damage the P-63x.

- ➢ Only use the holes or threads intended for the purpose of fixing the P-63x and loads.
- ➢ Install the P-63x so that the platform and all parts attached to it can move freely within the entire travel range.

NOTICE

Damage due to incorrectly tightened screws!
Incorrectly tightened screws can cause damage.

- ➢ Pay attention to the torque range (p. 36) specified for the screws used during installation.

INFORMATION

Extension cables can reduce the positioning accuracy of the P-63x or affect sensor processing by the electronics.

- ➢ Do **not** use extension cables. If you need longer cables, contact our customer service department (p. 31).

5.2 Connecting the P-63x to the Protective Earth Conductor

INFORMATION

- ➢ Pay attention to the applicable standards for connecting the protective earth conductor.

INFORMATION

- ➢ If there is any vibration in your application, secure the screw connection for the protective earth conductor in a suitable manner (e.g., with conductive liquid adhesive) to prevent it from unscrewing by itself. If this is not possible, check the screw connection at regular intervals and retighten the screw if necessary.

INFORMATION

Ground loops can occur when the P-63x is grounded via its protective earth connector and also via the shielding around the cable connected to the electronics.

➢ If a ground loop occurs, contact our customer service department (p. 31).

The P-63x has an M4 hole for attaching the protective earth conductor. This hole is marked with the symbol for the protective earth conductor ⏚. Refer to "Dimensions" (p. 35) for the exact position of the hole.

Requirements

✓ You have read and understood the general notes on installing (p. 15).

✓ The P-63x is **not** connected to the electronics.

Tools and accessories

- Suitable protective earth conductor: Cable cross section ≥0.75 mm²
- M4 protective earth screw set (p. 11) supplied for connecting the protective earth conductor
- Suitable screwdriver

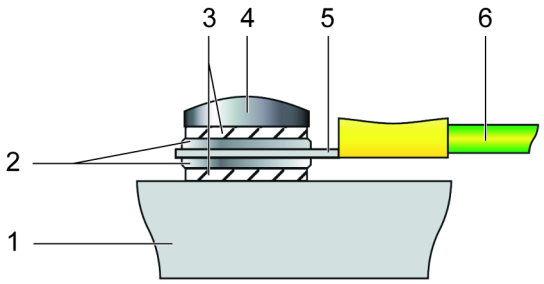

Figure 3: Connecting the protective earth conductor (profile view)

1 Base body of the P-63x
2 Flat washer
3 Lock washer
4 Screw
5 Cable lug
6 Protective earth conductor

Connecting the P-63x to the protective earth conductor

1. If necessary, attach a suitable cable lug to the protective earth conductor.
2. Use the M4 screw (together with the flat and lock washers) to attach the cable lug of the protective earth conductor to the threaded hole in the P-63x as shown in the profile view.
3. Tighten the M4 screw with a torque of 1.2 Nm to 1.5 Nm.
4. Make sure that the contact resistance at all connection points relevant for connecting the protective earth conductor is <0.1 Ω at 25 A.

5.3 Mounting the P-63x

NOTICE

Warping the P-63x when mounting onto uneven surfaces!
Fixing the P-63x onto an uneven surface can warp the P-63x. Warping reduces the accuracy.

- ➢ Fix the P-63x onto a flat surface. The recommended flatness of the surface is ≤20 µm.
- ➢ For applications with large temperature fluctuations:
  Only fix the P-63x onto surfaces that have the same or similar thermal expansion properties as the P-63x (e.g., surfaces made of aluminum).

NOTICE

Tensile stress on piezo actuator due to mounting in wrong orientation!
The P-63x is intended for mounting in horizontal orientation (standing on a surface, not suspended). Mounting in other orientations can cause tensile stress that reduces the preload and destroys the piezo actuator.

- ➢ If you want to mount the P-63x in a different orientation to that intended (e.g., vertically or upside down), contact our customer service department (p. 31).

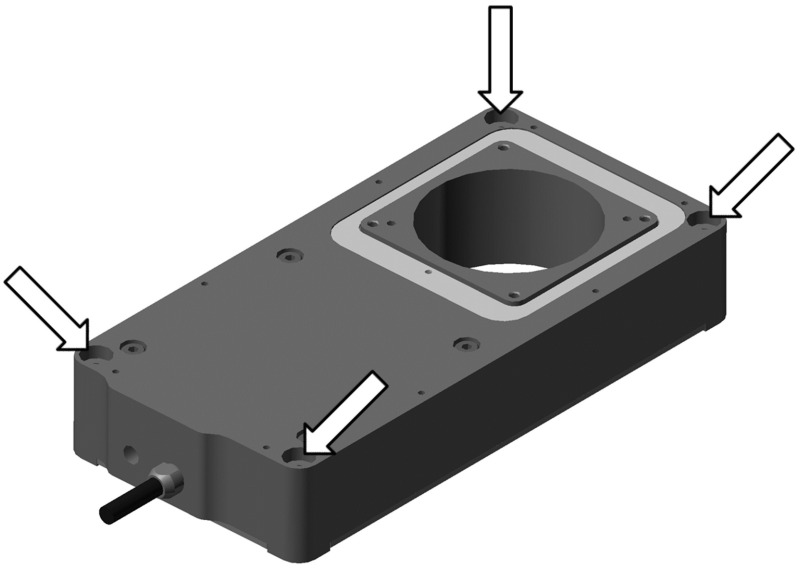

Figure 4: Mounting holes in the base body

Requirements

- ✓ You have read and understood the general notes on installing (p. 15).
- ✓ The P-63x is **not** connected to the electronics.

✓ You have provided a suitable surface for fixing the P-63x:

- The surface has four suitable threaded holes for M2.5 screws. Refer to "Dimensions" (p. 35) for the required position and depth of the holes.
- The surface flatness is ≤20 µm.
- For applications with large temperature fluctuations: The surface should have the same thermal expansion properties as the P-63x (e.g., surface made of aluminum).

Tools and accessories

- 4 M2.5x20 screws (p. 11)
- Hex key AF 2 (p. 11)

Mounting the P-63x

1. Align the P-63x on the underlying surface so that the corresponding mounting holes in the base body (see figure) and the surface are in line.
2. Fix the P-63x with the screws:
   a) Insert a screw into each hole.
   b) Tighten the screws. Pay attention to the specified torque range (p. 36) while doing so.
3. Check that the P-63x is sitting firmly on the surface.

5.4 Fixing the Load

NOTICE

Mechanical overload of the motion platform!
High torques during fastening of the load as well as heavy loads can overload the motion platform of the P-63x. Mechanical overload can cause damage to the piezo actuators, sensors, and flexures of the P-63x and lead to loss of accuracy.

➢ Avoid torques >0.5 Nm on the motion platform.
➢ Do **not** exceed the maximum permissible loads according to the specifications (p. 33).
➢ Hold the load and adhere to the specified torque range (p. 36) when tightening (or loosening) the screws.

NOTICE

Warping of the P-63x when fixing loads with an uneven contact surface!

Fixing loads with an uneven contact surface could warp the P-63x. Warping reduces the accuracy.

- Fix loads to the P-63x only when the surface contacting the P-63x's platform has a flatness of at least 20 µm.
- For applications with large temperature fluctuations:
  Mount loads onto the P-63x only if they have the same or similar thermal expansion properties as the P-63x (e.g., loads made of aluminum).

NOTICE

Center of load at unsuitable position!

If the center of load is located too far away from the center of the motion platform (e.g., tall load and unwanted lever effect), the P-63x can be damaged, especially in dynamic operation, by high strain on the flexure guides, high torques, and oscillations.

- If the center of the load to be fixed is too high or to the side of the motion platform, adjust the controller settings before starting and operating or or contact our customer service department (p. 31).

NOTICE

Excessively long screws!

The P-63x could be damaged by screws inserted too deeply.

- Pay attention to the depth of the mounting holes in the motion platform (p. 35).
- Use screws of the correct length for the respective mounting holes only.

INFORMATION

The positive direction of motion is in the opposite direction of the cable exit.

Center of load at the optimal position:

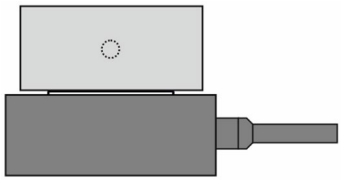

Figure 5: Example of an optimally placed load

Center of load at an unsuitable position:

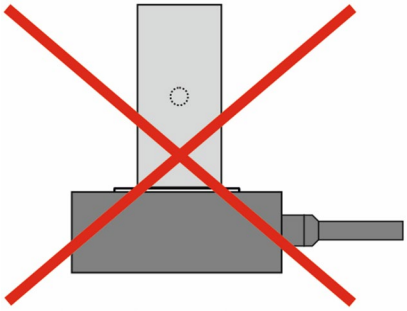

Figure 6: Tall load and center of load too far above the platform

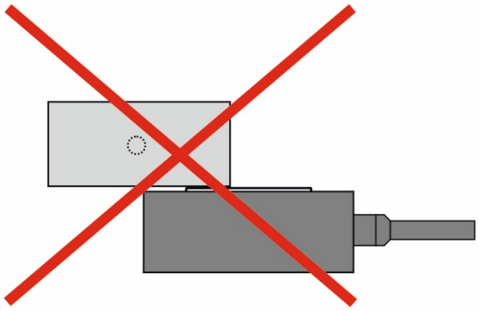

Figure 7: Unwanted lever effect and center of load on the side of the platform

Requirements

- ✓ You have read and understood the general notes on installing (p. 15).
- ✓ The P-63x is **not** connected to the electronics.

Tools and accessories

- Screws of suitable size and length (p. 35)
- Suitable screwdriver

Fixing the load

1. Align the load on the P-63x so that the mounting holes in the load and the holes in the platform are in line.
2. Hold the load so that it cannot move while tightening the screws.
3. Fix the load by tightening the screws in the mounting holes (p. 35) provided. Pay attention to the torque range (p. 36) specified for the screws, and avoid torques >0.5 Nm on the motion platform.
4. Check that the load is sitting firmly on the motion platform.

5.5 Connecting the P-63x to the Electronics

INFORMATION

➢ When connecting, pay attention to the assignment specified on the labeling of the sockets, plug connectors, and cables.

Requirements

✓ You have read and understood the general notes on installing (p. 15).

✓ You have installed suitable electronics (p. 11).

✓ You have read and understood the user manual for the electronics.

✓ The electronics are switched off.

Connecting the P-63x to the electronics

1. Plug the connector of the P-63x into the corresponding connection socket of the electronics (refer to the user manual for the electronics).
2. If possible, secure the connectors against accidental disconnection.

6 Starting and Operating

In this Chapter

6.1 General Notes on Starting and Operating

CAUTION

Risk of electric shock if the protective earth conductor is not connected!

If a protective earth conductor is not or not properly connected, dangerous touch voltages can occur on the P-63x in the case of malfunction or failure of the system. If there are touch voltages, touching the P-63x can result in minor injuries from electric shock.

- Connect the P-63x to a protective earth conductor (p. 16) before starting.
- Do **not** remove the protective earth conductor during operation.
- If the protective earth conductor has to be removed temporarily (e.g., in the case of modifications), reconnect the P-63x to the protective earth conductor before restarting.

NOTICE

Destruction of the piezo actuator due to electric flashovers!

Using the P-63x in environments that increase the electrical conductivity can lead to the destruction of the piezo actuator by electric flashovers. Electric flashovers can be caused by moisture, high humidity, liquids, and conductive materials (e.g., metal dust). In addition, electric flashovers can also occur in certain air pressure ranges due to the increased conductivity of the air.

- Avoid operating the P-63x in environments that can increase the electric conductivity.
- Operate the P-63x only within the permissible ambient conditions and classifications (p. 35).

NOTICE

Decreased lifetime due to permanently high voltage!

Applying a continuous high static voltage to piezo actuators leads to a considerable reduction in the lifetime of the piezo ceramic.

- When the P-63x is not used but the electronics remain switched on to ensure temperature stability, discharge the P-63x (p. 25).

NOTICE

Operating voltage too high or incorrectly connected!

Operating voltages that are too high or incorrectly connected can cause damage to the P-63x.

- ➢ Operate the P-63x only with controllers/drivers and original accessories from PI.
- ➢ Do **not** exceed the operating voltage range (p. 34) specified for the P-63x.
- ➢ Operate the P-63x only when the operating voltage is properly connected; refer to "Pin Assignment" (p. 36).

NOTICE

Uncontrolled oscillation!

Oscillation can cause irreparable damage to the P-63x. Oscillation is indicated by a humming noise and can be caused by the following:

- A change in the load and/or dynamics requires the servo control parameters to be adjusted.
- The P-63x is operated close to its resonant frequency, or with too high operating frequency.

If you notice oscillation:

- ➢ In closed-loop operation, switch off the servo mode immediately.
- ➢ In open-loop operation, stop the P-63x immediately.

INFORMATION

The positive direction of motion is in the opposite direction of the cable exit.

INFORMATION

Sound and vibration (e.g., footfall, knocks) can be transmitted to the P-63x and can affect its performance with regard to position stability.

- ➢ Avoid sound and vibration while the P-63x is being operated.

6.2 Operating the P-63x

Requirements

- ✓ You have read and understood the general notes on starting and operating.
- ✓ You have read and understood the user manual for the electronics.
- ✓ You have read and understood the user manual for the PC software.
- ✓ You have correctly installed (p. 15) the P-63x, and connected it to the protective earth conductor (p. 16).
- ✓ The electronics and the required PC software were installed. All connections to the electronics were made (refer to the user manual for the electronics).

Operating the P-63x

➢ Follow the instructions for starting and operating the P-63x in the manual for the electronics (p. 11) used.

6.3 Discharging the P-63x

The P-63x must be discharged in the following cases:

- Before Installation
- When the P-63x is not used but the electronics remain switched on to ensure temperature stability
- Before demounting (e.g., before cleaning and transporting the P-63x and for modifications)

The P-63x is discharged via the discharge resistor inside the electronics from PI.

Discharging a positioner connected to the electronics

In closed-loop operation:

1. Switch off the servo mode on the controller.
2. Set the piezo voltage to 0 V on the controller.

In open-loop operation:

➢ Set the piezo voltage to 0 V on the electronics.

Discharging a positioner not connected to the electronics

➢ Connect the positioner to the switched-off electronics from PI.

7 Maintenance

In this Chapter

7.1 General Notes on Maintenance

NOTICE

Misalignment due to loosening screws!
The P-63x is maintenance-free and achieves its positioning accuracy as a result of the optimal alignment of mechanical components and piezo actuators. Loosened screws cause a loss in positioning accuracy.

- ➢ Loosen screws only when instructed in this manual.
- ➢ Do **not** open the P-63x.

7.2 Cleaning the P-63x

NOTICE

Damage from ultrasonic cleaning!
Ultrasonic cleaning can damage the P-63x.

- ➢ Do **not** do any ultrasonic cleaning.

Requirements

- ✓ You have discharged the piezo actuators of the P-63x (p. 25).
- ✓ You have disconnected the P-63x from the electronics.

Cleaning the P-63x

- ➢ Clean the surfaces of the P-63x with a cloth dampened with a mild cleanser or disinfectant (e.g., isopropyl alcohol).

8 Troubleshooting

Problem	Possible causes	Solution
No or limited motion	Cable not connected correctly	➢ Check the cable connections.
	Excessive load	➢ Do **not** exceed the maximum permissible stress and load capacities according to the specifications (p. 33).
	Zero shift of the sensor for the following reasons: ▪ Load in direction of motion ▪ Ambient/operating temperature of the positioner is far above or below the calibration temperature (21 °C to 24 °C)	➢ Adjust the zero-point of the sensor (refer to the controller manual).
Reduced accuracy	The base body or the platform is warped	➢ Mount the P-63x onto surfaces with the following characteristics only: – Flatness of at least 20 µm – The thermal expansion properties are similar to those of the P-63x (e.g., surface made of aluminum). ➢ Mount loads onto the P-63x with the following characteristics only: – The contact surface of the load has a flatness of at least 20 µm. – The thermal expansion properties are similar to those of the P-63x (e.g., load made of aluminum).
The positioner starts oscillating or positions inaccurately	Servo control parameters incorrectly set because for example, the load was changed	1. Switch off the servo mode of the corresponding motion axes immediately. 2. Check the settings of the servo control parameters on the controller. 3. Adjust the servo control parameters on the controller according to the load change.
	Open-loop operation near the resonant frequency	➢ In open-loop operation, operate the positioner only with a frequency that is below the resonant frequency.

If the problem with your system is not listed in the table above or cannot be solved as described, contact our customer service department (p. 31).

9 Customer Service

For inquiries and orders, contact your PI sales engineer or send us an email (service@pi.de).

- If you have any questions concerning your system, provide the following information:
  - Product and serial numbers of all products in the system
  - Firmware version of the controller (if applicable)
  - Version of the driver or the software (if applicable)
  - Operating system on the PC (if applicable)
- If possible: Take photographs or make videos of your system that can be sent to our customer service department if requested.

The latest versions of the user manuals are available for download (p. 3) on our website.

10 Technical Data

Subject to change. You can find the latest product specifications on the product web page at www.pi.ws (https://www.pi.ws).

In this Chapter

10.1 Specifications

10.1.1 Data Table

	P-630.XCD	P-631.XCD	Unit
Active axes	X	X	
Motion and positioning			
Integrated sensor	Capacitive	Capacitive	
Travel range at -20 to 120 V, open loop	45	90	µm
Travel range, closed loop	40	80	µm
Resolution, open loop	0.1	0.1	nm
Resolution, closed loop	0.2	0.2	nm
Linearity error, closed loop	0.02	0.02	%
Repeatability over the entire travel range	±2	±3	nm
Pitch / yaw	±5	±5	µrad
Straightness / flatness	50	50	nm
Mechanical properties			
Stiffness in motion direction	5.5	5	N / µm
Resonant frequency, unloaded	3250	2850	Hz
Resonant frequency, under load, 60 g	1600	1200	Hz
Push/pull force capacity in positioning direction	10	10	N
Load capacity	10	10	N

	P-630.XCD	P-631.XCD	Unit
Drive properties			
Piezo ceramic	PICMA® P-887	PICMA® P-885; P-887	
Electrical capacitance	6.4	12.6	µF
Miscellaneous			
Operating temperature range	0 to 40	0 to 40	°C
Material	Aluminum	Aluminum	
Dimensions	102 mm × 50 mm × 18 mm	102 mm × 50 mm × 18 mm	
Mass	300	320	g
Cable length	1.5	1.5	m
Sensor/voltage connector	D-sub 7W2 (m)	D-sub 7W2 (m)	
Recommended electronics	E-709, E-709.CHG, E-709.1C1L, E-754	E-709, E-709.CHG, E-709.1C1L, E-754	

Ask about custom designs!

10.1.2 Maximum Ratings

P-63x positioners are designed for the following operating data:

Model	Maximum operating voltage	Maximum operating frequency (unloaded)[1]	Maximum power consumption[2]
P-630.XCD	-20 to +120 V	1080 Hz	8 W
P-631.XCD	-20 to +120 V	950 Hz	19 W

[1] To ensure stable operation, the maximum operating frequency has been defined as around one third of the mechanical resonant frequency.

[2] The heat that is generated by the piezo actuator during dynamic operation limits the value for maximum power consumption.

Details can be found at the following website:
https://www.physikinstrumente.com/en/technology/piezo-technology/properties-piezo-actuators/electrical-operation/

10.1.3 Ambient Conditions and Classifications

Pay attention to the following ambient conditions and classifications for the P-63x:

Area of application	For indoor use only
Maximum altitude	2000 m
Air pressure	1100 hPa to 0.1 hPa
Relative humidity	Highest relative humidity 80% for temperatures up to 31 °C Decreasing linearly to 50% relative humidity at 40 °C
Operating temperature	0 °C to 40 °C
Storage temperature	-20 °C to 80 °C
Transport temperature	-25 °C to 85 °C
Overvoltage category	II
Protection class	I
Degree of pollution	1
Degree of protection according to IEC 60529	IP20

10.2 Dimensions

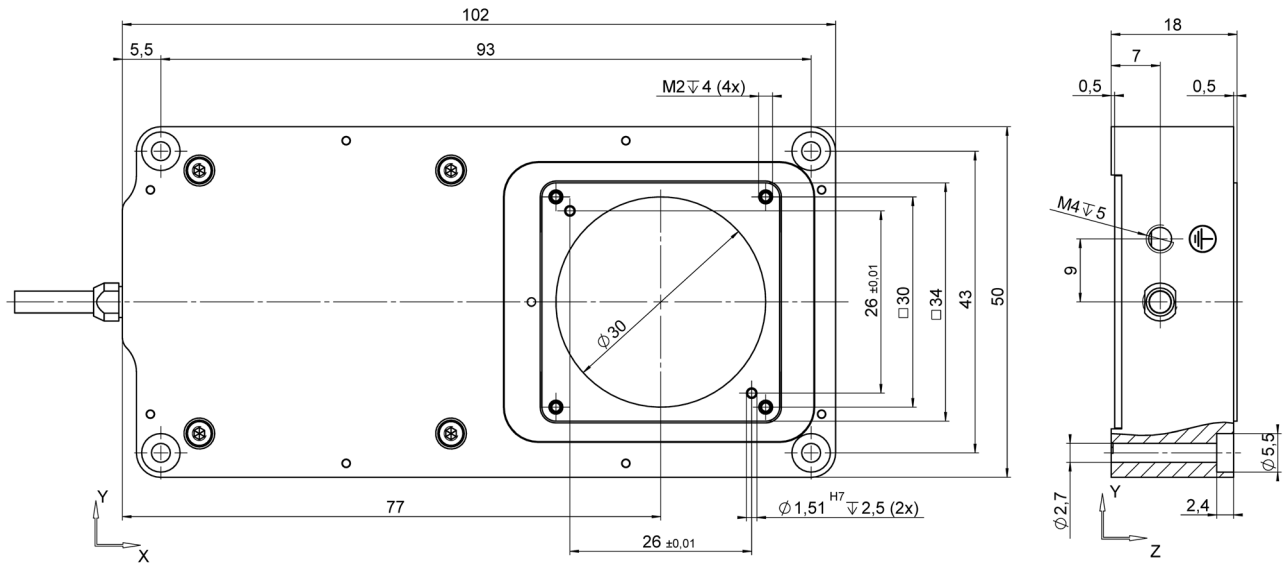

Figure 8: P-63x, dimensions in mm.
Note that the decimal points are separated by a comma in the drawings.

10.3 Torque for Stainless Steel Screws (A2-70)

Screw size	Minimum torque	Maximum torque
M6	4 Nm	6 Nm
M5	2.5 Nm	3.5 Nm
M4	1.5 Nm	2.5 Nm
M3	0.8 Nm	1.1 Nm
M2.5	0.3 Nm	0.4 Nm
M2	0.15 Nm	0.2 Nm
M1.6	0.06 Nm	0.12 Nm

➢ Pay attention to the screw-in depth required for the respective material according to the VDI directive 2230.

10.4 Pin Assignment

D-sub 7W2 (m) connector

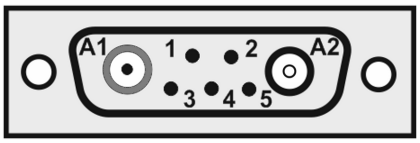

Figure 9: D-sub 7W2 (m) connector: Front with connections

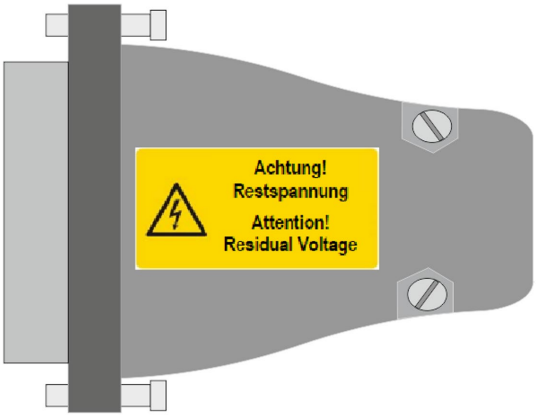

Figure 10: D-sub connector: Example top view

Pin	Signal	Function
A1	PZT	Piezo voltage
A2	Probe	Probe sensor signal (immovable part of the capacitive sensor)
1	Data ID chip	Data line for ID chip
2	GND Target and ID chip	Target and ID chip ground
3	GND PZT	Piezo voltage ground
4	---	(not connected)
5	Target	Target sensor signal (movable part of the capacitive sensor)
Housing	---	Shield

11 Old Equipment Disposal

In accordance with EU law, electrical and electronic equipment may not be disposed of in EU member states via the municipal residual waste.

Dispose of your old equipment according to international, national, and local rules and regulations.

In order to fulfill its responsibility as the product manufacturer, Physik Instrumente (PI) GmbH & Co. KG undertakes environmentally correct disposal of all old PI equipment made available on the market after 13 August 2005 without charge.

Any old PI equipment can be sent free of charge to the following address:

Physik Instrumente (PI) GmbH & Co. KG

Auf der Roemerstr. 1

D-76228 Karlsruhe, Germany

12 European Declarations of Conformity

For the P-63x, declarations of conformity were issued according to the following European statutory requirements:

Low Voltage Directive

EMC Directive

RoHS Directive

The standards applied for certifying conformity are listed below.

Safety (Low Voltage Directive): EN 61010-1

EMC: EN 61326-1

RoHS: EN IEC 63000