

User Manual

P-604.300

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2 About this Document

2.1 Objective and Target Group

This user manual contains the information needed for the intended use of the P-604.300. Basic knowledge of motion control concepts and applicable safety measures is assumed.

2.2 Other Applicable Documents

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

Document number	Document type	Product
PZ70	User manual	E-610 piezo amplifier / servo controller (OEM)
PZ167	User manual	E-625 Piezo Servo Controller
PZ151, PZ191, PZ235	User manual	E-831 piezo amplifier module (OEM)

The latest versions of the user manuals can be [downloaded \(p. 6\)](#) at www.pi.ws.



2.3 Explanation of Symbols

This chapter explains the symbols and markings used in this user manual.

2.3.1 Typographic Conventions

Symbol / Label	Meaning
1.	Action consisting of several steps whose sequential order must be observed
2.	
►	Action consisting of one or several steps whose sequential order is irrelevant
■	Lists
p. 5	Cross-reference to page 5
RS-232	Labeling of an operating element on the product (example: socket of the RS-232 interface)
Start > Settings	Menu path in the PC software (example: to open the menu, the Start and Settings menus must be clicked successively)
POS?	Command line or a command from PI's General Command Set (GCS) (example: command to get the axis position)
Device S/N	Parameter name (example: parameter where the serial number is stored)
5	Value that must be entered or selected via the PC software

2.3.2 Symbols Used

Symbol / Label	Meaning
	General hazard symbol
	Electrical voltage



DANGER

Dangerous situation

Failure to observe can lead to death or serious injury.

- Measures for avoiding the risk.



WARNING

Dangerous situation

Failure to observe can lead to serious injury.

- Action to take to avoid the risk.



CAUTION

Dangerous situation

Failure to observe can lead to minor injury.

- Actions to take to avoid the risk.

NOTICE



Dangerous situation

Failure to observe can lead to material damage.

- Action to take to avoid the risk.

Information

Additional information on the P-604.300 that can affect your application.

2.4 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.

2.5 Downloading Manuals

The latest versions of the user manuals can be [downloaded \(p. 6\)](#) at www.pi.ws.

For products that are supplied with software (CD in the scope of delivery), access to the manuals is protected by a password. Protected content is only displayed on the website after entering the access data. You need the product CD to get the access data.

If a manual is missing or problems occur with downloading, contact our [customer service department \(p. 25\)](#).

Downloading Manuals

1. Open the website www.pi.ws.

2. If the product was shipped with a CD: Log into the website:
 - a) Click **Login**.
 - b) Enter the login data.

The login data is in the *[...]_Releasenews_[...].pdf* in the **Manuals** directory on the product CD.

If necessary: Follow the link and register yourself to get the login data.
 - c) Click **Login** or press the **Enter** key.
3. Search for the product:
 - a) Click **Search**.
 - b) Enter the product number up to the period (e.g., P-604) or the product family (e.g., PiezoMove®) into the search field.
 - c) Click **Start search** or press the **Enter** key.
 - d) If necessary: Click **Load more results** at the bottom of the list.
4. Click on the corresponding product in the list of search results.
5. Scroll down to the **Downloads** section on the product detail page.
→ *The manuals are shown under Documentation.*
6. Click on the desired manual and save it.

3 Safety

3.1 Intended Use

The P-604.300 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.

In accordance with its design, the P-604.300 is intended for the following applications:

- Positioning of loads
- Dynamic positioning
- Vibration damping
- Force generation

The P-604.300 is intended to be built into systems that fulfill the safety requirements according to EN 61010-1 and the EMC requirements according to EN 61326-1. The operator is responsible for the electrical safety and the electromagnetic compatibility when the P-604.300 is built into the overall system. The P-604.300 fulfills the RoHS directive and the corresponding requirements of the EN 50581 standard.

The P-604.300 is **not** intended for applications in areas in which a failure would present severe risks to human beings or the environment.

The motion of the P-604.300 is along one axis.

The intended use of the P-604.300 is only possible when completely mounted and connected. The P-604.300 must be operated with suitable electronics. The electronics are not included in the scope of delivery of the P-604.300.

The P-604.300 must not be used for purposes other than those stated in this user manual. The P-604.300 may only be used in compliance with the technical specifications and instructions in this user manual.

3.2 General Safety Instructions

The P-604.300 is built according to state-of-the-art technology and recognized safety standards. Improper use of the P-604.300 may result in personal injury and/or damage to the P-604.300.

- ▶ Use the P-604.300 only for its intended purpose and if it is in perfect condition.
- ▶ Read the user manual.
- ▶ Eliminate any faults and malfunctions that are likely to affect safety immediately.

The operator is responsible for correct installation and operation of the P-604.300.

3.3 Organizational Measures

3.3.1 User Manual

- ▶ Always keep this user manual available with the P-604.300. The latest versions of the user manuals can be [downloaded \(p. 6\)](#) at www.pi.ws.
- ▶ Add all information from the manufacturer such as supplements or technical notes to the user manual.
- ▶ If you give the P-604.300 to a third party, also include this user manual as well as other relevant information provided by the manufacturer.
- ▶ Only use the device on the basis of the complete user manual. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.
- ▶ Only install and operate the P-604.300 after you have read and understood this user manual.

3.3.2 General Personnel Qualification

The P-604.300 may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

4 Product Description

4.1 Product Labeling

4.1.1 Type Plate

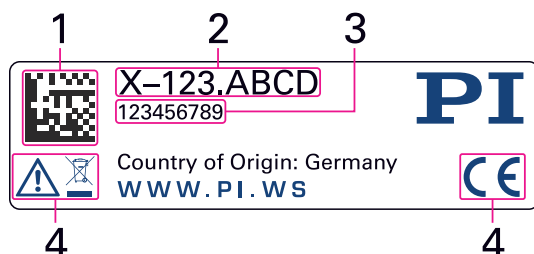


Figure 1: Type plate of the P-604.300

1. Data matrix code (example; contains the serial number)
2. Product number (example)
3. Serial number (example), individual for each P-604.300
Meaning of the position (counting from the left):
1 = internal information,
2 and 3 = year of manufacture,
4 to 9 = consecutive numbers
4. Warning and conformity symbols ([Old equipment disposal \(p. 29\)](#), [CE mark \(p. 31\)](#))

4.2 Scope of Delivery

Product number	Description
P-604.300	Actuator according to order
PZ282EN	User manual for the P-604.300
INYY-0005	Shorting clamp, 2.5 mm²

4.3 Overview

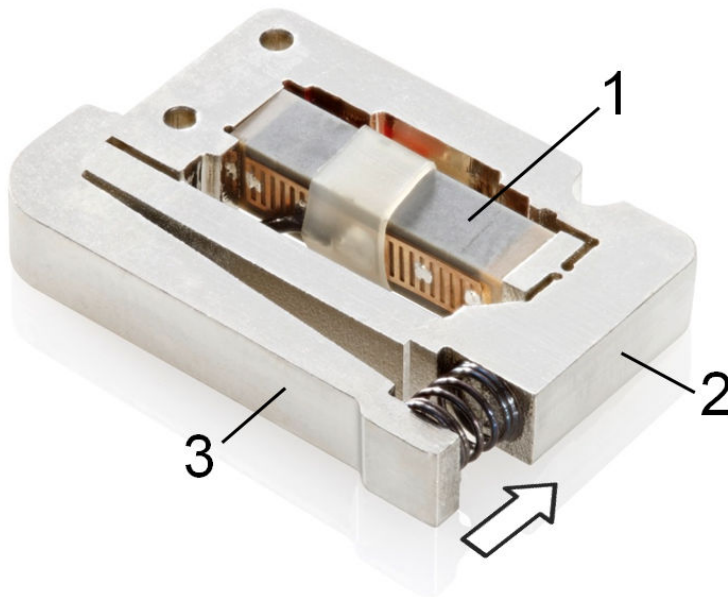


Figure 2: Product overview

- 1. PICMA® piezo actuator
- 2. Base body
- 3. Movable part

The arrow indicates the positive direction of motion.

4.3.1 Shorting Clamp

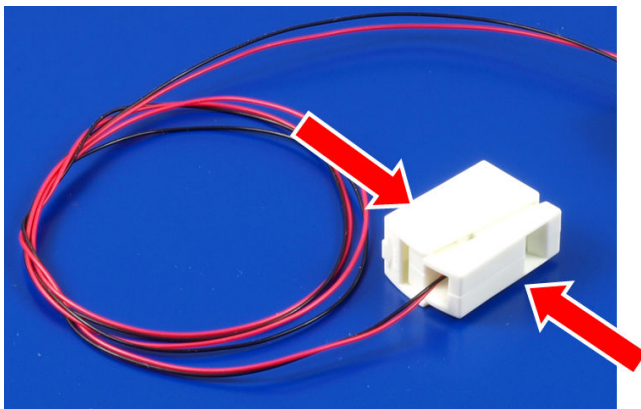


Figure 3: Example of a shorting clamp that is connected to bare stranded wires. The arrows show how the stranded wires are removed from the clamp.

4.3.2 Drive Connection

The P-604.300 has connecting wires that make the electrical [connection to the electronics \(p. 16\)](#).

4.4 Suitable Electronics

The P-604.300 must be connected to suitable electronics that supply the necessary voltage for operating the P-604.300. The following electronics are suitable for operating the P-604.300:

Product number	Description
E-625	Piezo servo controller
E-610	Piezo amplifier / servo controller (OEM)
E-831	Piezo amplifier module (OEM)

To order, contact our customer service department.

5 Unpacking



CAUTION



Dangerous voltage and residual charge in piezo actuators!

Temperature changes and compressive load can induce charges in piezo actuators. The P-604.300 can remain charged for several hours after it is disconnected from the electronics. Touching the live parts of the P-604.300 can result in minor injury from electric shock.

- ▶ Do **not** touch the P-604.300 unless it is discharged.
- ▶ Keep the P-604.300 short-circuited when it is not connected to the electronics.
- ▶ Remove the supplied shorting clamp from the stranded wires only if this is required for installation or operation.
- ▶ Do **not** disconnect the P-604.300 from the electronics during operation.
- ▶ Do **not** disassemble the P-604.300.

NOTICE



Damage due to tensile forces on the connecting wires!

Tensile forces on the connecting wires can damage the P-604.300.

- ▶ Avoid tensile forces on the connecting wires.

NOTICE



Destruction of the piezo actuator due to contamination!

Contamination on the surface of the piezo actuator can result in destruction of the piezo actuator by electric flashovers during operation.

- ▶ When handling the P-604.300, wear powder-free nitrile or latex gloves.
- ▶ Prevent the P-604.300 from coming into contact with conductive liquids (e.g., finger sweat) and conductive materials (e.g., metal dust).
- ▶ If the piezo actuator of the P-604.300 is contaminated accidentally, contact our [customer service department \(p. 25\)](#).

NOTICE



Destruction of the P-604.300 due to mechanical overload!

Mechanical forces can destroy the P-604.300.

- ▶ Avoid impacts that affect the P-604.300.
- ▶ Do not drop the P-604.300.

Unpacking the P-604.300

1. Unpack the P-604.300 with care.
2. Compare the contents with the items listed in the contract and the packing list.
3. Inspect the contents for signs of damage. If any parts are damaged or missing, contact our [customer service department \(p. 25\)](#) immediately.
4. Keep all packaging materials in case the product needs to be returned.

6 Installation

6.1 Mounting the P-604.300 and Connecting to a Protective Earth Conductor

The protective earth connection of the P-604.300 is established as follows:

- Mounting holes in the base body of the P-604.300
- Suitable, conductive dowel pins
- The surface that is connected to the protective earth conductor

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

Overview

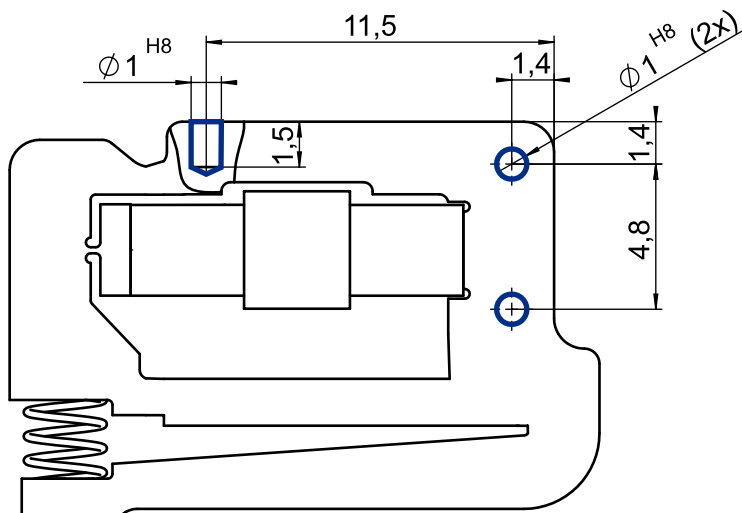


Figure 4: Mounting holes in the base body of the P-604.300

Tools and Accessories

- Suitable protective earth conductor: Cable cross section $\geq 0.75 \text{ mm}^2$
- Electrically conductive dowel pins of suitable size and length (see figure)
- Electrically conductive adhesive

Requirements

- ✓ You have read and understood the general safety instructions.
- ✓ You have provided suitable equipment for mounting the P-604.300:
 - The equipment has suitable holes for accommodating the dowel pins. For more details, see ["Dimensions" \(p. 28\)](#).
 - The equipment is connected to the protective earth conductor.
 - The holes for accommodating the dowel pins are sufficiently conductive to ensure proper function of the protective earth conductor.
 - The flatness of the contact surface(s) is $\leq 40 \text{ }\mu\text{m}$.
 - For applications with large temperature changes: The equipment should have the same thermal expansion properties as the P-604.300 (e.g., equipment made of aluminum).
- ✓ You have accounted for the space required to route cables without bending and according to regulations.
- ✓ The P-604.300 is [discharged \(p. 20\)](#) and [short-circuited \(p. 20\)](#).

- ✓ You have read and understood the user information from the manufacturer of the adhesive.

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

If the protective earth conductor is missing or not properly connected, risk of dangerous touch voltages on the P-604.300 in the event of malfunction or failure of the system. If touch voltages exist, touching the P-604.300 can lead to minor injury from electric shock.

- ▶ Connect the P-604.300 to a protective earth conductor before startup.
- ▶ Do not remove the protective earth conductor during operation.
- ▶ If the protective earth conductor has to be temporarily removed (e.g., for modifications), reconnect the P-604.300 to the protective earth conductor before restarting.

Information

The P-604.300 can heat up during operation. The heat produced during operation can affect your application.

Mounting the P-604.300 and Connecting to a Protective Earth Conductor

1. Glue the dowel pins in the mounting holes in the base body of the P-604.300 or in the equipment that the P-604.300 is to be fixed to.
2. Align the P-604.300 and the equipment to each other so that each dowel pin can be inserted into the corresponding mounting hole.
3. Glue the P-604.300 to the equipment.
4. Wait until the adhesive has hardened completely.
5. Make sure that the contact resistance is $<0.1 \Omega$ at 25 A at all connection points relevant for attaching the protective earth conductor.
6. Check for firm seating of the P-604.300 in the equipment.

6.2 Mounting the Load onto the P-604.300

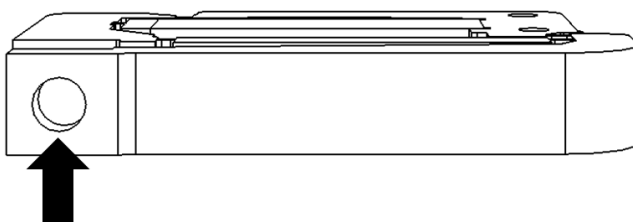
Overview

Figure 5: Hole for affixing a load to the movable part

Tools and Accessories

- An M2 screw of suitable [length \(p. 28\)](#)
- Suitable tool to hold the movable part of the P-604.300 firmly
- Suitable tools for tightening the screws

Requirements

- ✓ You have read and understood the general safety instructions.
- ✓ You have [mounted \(p. 14\)](#) the P-604.300 properly.
- ✓ The P-604.300 is **not** connected to the controller.

- ✓ The distance between the center of gravity of the load and the center of the hole in the movable part is as small as possible in all directions.

NOTICE



Mechanical overload due to high torques and high loads!

High torques when tightening the load and high loads can overload the movable part of the P-604.300. Mechanical overload can cause damage to the piezo actuators and flexures of the P-604.300 and also lead to loss of accuracy.

- ▶ Pay attention to the [torque range \(p. 30\)](#) given for the screws used during installation.
- ▶ Avoid torques higher than 5 Ncm on the movable part of the P-604.300.
- ▶ Do **not** exceed the maximum permissible loads according to the [specifications \(p. 26\)](#).

NOTICE



Excessively long screws!

Screws inserted too deeply can damage the P-604.300.

- ▶ Pay attention to the depth of the mounting hole in the movable part of the P-604.300.
- ▶ Only use screws with the right length for the mounting hole.

Mounting the Load onto the P-604.300

1. Align the load so that the mounting hole in the movable part of the P-604.300 can be used for affixing the load.
2. Hold the movable part of the P-604.300 firmly.
3. Affix the load to the mounting hole in the movable part of the P-604.300 with a suitable screw.
4. Loosen the movable part of the P-604.300 that was held firmly so it can move freely again.

6.3 Connecting the P-604.300

The P-604.300 is connected to a LEMO socket, a terminal, or soldering pins, depending on the electronics. This section describes how the P-604.300 is connected with the P-890.xx coaxial cable to electronics with a single-pole LEMO socket.

If you use a self-made connecting cable instead of the P-890.xx coaxial cable for connecting to a single-pole LEMO socket, pay attention to the relevant standards as well as the assembly information of the manufacturer of the connector used.

- For connection to the electronics with a two-pole LEMO socket, contact our [customer service department \(p. 25\)](#).
- For connection to terminals or solder pins, see the [manual of the respective electronics used \(p. 5\)](#).

Overview

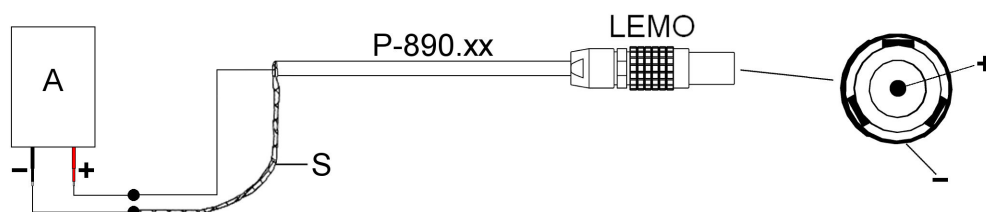


Figure 6: Connecting an actuator with bare stranded wires to the P-890.xx coaxial cable

A: Actuator

S: Cable shield of the connecting cable

LEMO: LEMO plug

Tools and Accessories

- [P-890.xx coaxial cable \(p. 10\)](#), LEMO single-pole to open end (can be ordered separately)
- Suitable soldering iron
- Suitable solder
- Suitable cable tools

Requirements

- ✓ You have read and understood the general safety instructions.
- ✓ You have read and understood the user manual for the electronics used.
- ✓ If the P-604.300 is not short-circuited: The P-604.300 is [discharged \(p. 20\)](#).
- ✓ You have installed the electronics properly.
- ✓ The electronics is switched off.
- ✓ The electronics have a single-pole LEMO socket.

NOTICE



Damage due to incorrect connection of the P-604.300!

Connecting unsuitable electronics or a wrong cable can damage the P-604.300 or the electronics.

- ▶ Make sure that the electronics support the drive type of the P-604.300 and are configured accordingly.
- ▶ Pay attention to correct [pin assignment \(p. 30\)](#).

Connecting the P-604.300

1. If necessary, shorten the wire and the cable shield of the coaxial cable to the correct length.
2. Make the stranded wires of the P-604.300 accessible:
 - a) If the stranded wires of the P-604.300 are short-circuited, sever the connection between the stranded wires.
 - b) Remove all aids and components that have been connected to the P-604.300 for short-circuiting or discharging (e.g., discharge resistor).
3. Solder the red stranded wire of the P-604.300 to the wire of the coaxial cable that is connected to the inner contact of the LEMO connector.
4. Solder the black stranded wire of the P-604.300 to the cable shield of the coaxial cable.
5. Insulate the soldered cable connections appropriately.
6. Connect the connector of the P-604.300 to the corresponding connection on the electronics.

7 Startup / Operation

7.1 Starting up the P-604.300

Requirements

- ✓ You have read and understood the general safety instructions.
- ✓ For startup with a load or in a multi-axis system: You have installed the P-604.300 [properly \(p. 14\)](#).
- ✓ You have read and understood the user manual for the electronics used.
- ✓ If a digital controller is used: You have read and understood the manual for the PC software used.
- ✓ The electronics and if required, the PC software, have been installed (see the user manual for the electronics).



CAUTION



Dangerous voltage in piezo actuators during operation!

The P-604.300 carries voltages up to 120 V during operation. Touching live parts of the P-604.300 can result in minor injuries from electric shock.

- ▶ Do **not** touch the P-604.300 during operation.
- ▶ Insulate the P-604.300 electrically from the surrounding mechanics before startup to prevent direct or indirect contact with live parts. Pay attention to both the clearance and creepage distances required for the operating voltage and the standards applicable to your application.



CAUTION



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

If the protective earth conductor is missing or not properly connected, risk of dangerous touch voltages on the P-604.300 in the event of malfunction or failure of the system. If touch voltages exist, touching the P-604.300 can lead to minor injury from electric shock.

- ▶ Connect the P-604.300 to a protective earth conductor before startup.
- ▶ Do not remove the protective earth conductor during operation.
- ▶ If the protective earth conductor has to be temporarily removed (e.g., for modifications), reconnect the P-604.300 to the protective earth conductor before restarting.



CAUTION



Burning due to hot surface!

The surface of the P-604.300 and the surroundings can heat up during operation. Touching the P-604.300 and surrounding parts can result in minor injuries from burning.

- ▶ Make sure that the hot P-604.300 and the surrounding parts cannot be touched.

NOTICE**Destruction of the piezo actuator due to electric flashovers**

Using the P-604.300 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-604.300 in environments that can increase the electrical conductivity.
- ▶ Operate the P-604.300 only within the permissible [ambient condition and classifications \(p. 27\)](#).

NOTICE**Destruction of the piezo actuator due to continuously high voltage!**

The constant application of high voltage to piezo actuators can lead to leakage currents and flashovers that will destroy the ceramic.

When the P-604.300 is not in use but the electronics remain switched on to ensure temperature stability:

- ▶ Set the piezo voltage to 0 V on the controller.

NOTICE**Damage after reconnecting due to a charged P-604.300!**

The P-604.300 can remain charged when the connecting cable is pulled out of the electronics during operation. Reconnecting a charged P-604.300 to electronics during operation can cause a mechanical impulse that will damage the P-604.300.

- ▶ Do **not** pull the connecting cable of the P-604.300 out of the electronics during operation.
- ▶ If the connecting cable of the P-604.300 is accidentally pulled out of the electronics during operation: Switch off the electronics before you reconnect the P-604.300.

NOTICE**Uncontrolled oscillation!**

Oscillation can cause irreparable damage to the P-604.300. Oscillation is indicated by a humming noise and can be caused by the following:

- A change in the load and/or dynamics requires the operating parameters to be adjusted.
- The P-604.300 is operated near to its resonant frequency.
- ▶ If you notice oscillation, stop the P-604.300 immediately.

Information

Unsuitable operating parameter settings can be perceived as follows:

- Oscillation
- Imprecise positioning
- Long settling times

If the performance of the P-604.300 is not satisfactory:

- ▶ Check the operating parameter settings of your electronics.

Starting up the P-604.300

1. Follow the instructions on startup and operation of the P-604.300 in the user manual for the electronics used.

7.2 Discharging the P-604.300

The P-604.300 must be discharged in the following cases:

- When the P-604.300 is not in use but the electronics remain switched on to ensure temperature stability
- When the connecting wires of the P-604.300 are to be short-circuited without a discharge resistor, e.g., with the shorting clamp supplied
- If the P-604.300 is accidentally disconnected from the electronics during operation

Requirements

- ✓ You have read and understood the general safety instructions.

Tools and Accessories

- 10 kΩ discharge resistor (not included in the scope of delivery); touchable parts must be adequately insulated for the [operating voltage range \(p. 26\)](#) of the actuator

Information

The P-604.300 is discharged via the internal discharge resistor of the electronics when connecting to PI electronics that are switched off.

Discharging a P-604.300 Connected to the Electronics

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

Discharging a P-604.300 not Connected to the Electronics

1. Ensure adequate protection against touching live parts.
2. Short-circuit the connecting wires of the P-604.300 for at least a few seconds with a 10 kΩ discharge resistor.

7.3 Short-Circuiting the P-604.300

The P-604.300 must be [discharged \(p. 20\)](#) and short-circuited before demounting (e.g., before cleaning and transporting the P-604.300) as well as for modifications.

Requirements

- ✓ You have read and understood the general safety instructions.
- ✓ You have [discharged \(p. 20\)](#) the P-604.300 and disconnected it from the electronics.

Tools and Accessories

- [Shorting clamp \(p. 10\)](#)

NOTICE



Destruction of the piezo actuator due to rapid discharging!

If the P-604.300 is not connected to the electronics, it must be short-circuited to prevent the piezo actuator from charging during temperature changes and compressive stress.

- ▶ [Discharge the piezo actuator \(p. 20\)](#) before short-circuiting.
- ▶ Keep the P-604.300 short-circuited when it is not connected to the electronics.
- ▶ If the piezo actuator is not short-circuited, ensure adequate protection against touching live parts.

Short-Circuiting the P-604.300

1. Make sure that the stranded wires of the P-604.300 are stripped sufficiently.
2. Short-circuit the connecting wires of the **discharged** P-604.300 with the shorting clamp.

8 Maintenance

The P-604.300 is maintenance-free.

8.1 Cleaning

Requirements

- ✓ You have disconnected the P-604.300 from the electronics.
- ✓ The P-604.300 is [discharged \(p. 20\)](#) and [short-circuited \(p. 20\)](#).

Auxiliary Materials Required

- Powder-free nitrile or latex gloves
- Soft, lint-free cloth
- Mild, pH-neutral cleaning agent or disinfectant

If you have any questions on the auxiliary materials recommended for the P-604.300 contact our [customer service department \(p. 25\)](#).

Information

- Do **not** clean with water or acetone.

Cleaning the P-604.300

1. Dampen the cloth with the cleaning agent or disinfectant.
2. Wipe the base body (**not** the piezo actuator!) of the P-604.300 carefully.

9 Troubleshooting

System function is impaired

The electronics or mechanics were replaced ► Run the [startup \(p. 18\)](#) once again.

10 Transportation

Preparing the P-604.300 for Transportation

1. Pay attention to the [ambient conditions and classifications \(p. 27\)](#).
2. Pack the P-604.300 in the original packaging.
3. If the P-604.300 is to be sent, use a stable outer box.

11 Customer Service Department

For enquiries and orders, contact your PI representative or send us an [email](#).

If you have any questions on 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.

Customer service address:

Physik Instrumente (PI) GmbH & Co. KG
Auf der Roemerstrasse 1
76228 Karlsruhe
Germany

service@pi.de

www.pi.de


12 Technical Data

12.1 Specifications

	P-604.300	Unit	Tolerance
Active axes	Z		
Motion and positioning			
Travel range at -20 to 120 V, open loop	300	μm	+20 % / -0 %
Resolution, open loop	0.5	nm	typ.
Mechanical properties			
Stiffness in motion direction	0.01	N/μm	±20 %
Resonant frequency, no load	900	Hz	±20 %
Push/pull force capacity in motion direction	2 / 1.5	N	max.
Drive properties			
Piezo ceramic	PICMA® P-883		
Electrical capacitance	0.27	μF	±20 %
Miscellaneous			
Operating temperature range	-20 to 80	°C	
Material	Steel		
Dimensions	19.5 mm × 13 mm × 4.1 mm		
Mass	4	g	±10 %
Cable length	0.1	m	±10 mm
Voltage connection	Stranded wires		
Recommended electronics	E-610, E-625, E-831		

12.2 Maximum Ratings

The P-604.300 is designed for the following operating data:

Maximum operating voltage 	Maximum operating frequency (no load) ¹	Maximum power consumption ²
-20 to 120 V	100 Hz	3 W

¹ To ensure stable operation, the maximum operating frequency has been defined as around 1/3 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.

Further information is available online here: <http://www.piceramic.com/en/piezo-technology/properties-piezo-actuators/electrical-operation>

12.3 Ambient Conditions and Classifications

The following ambient conditions and classifications for the P-604.300 must be observed:

Area of application	For indoor use only
Maximum altitude	2000 m above msl
Air pressure	1100 hPa to 0.1 hPa
Relative humidity	Max. 80 % for temperatures to 31 °C, linearly decreasing to 50 % at 40 °C
Storage temperature	-20 °C to 80 °C
Transport temperature	-25 °C to 80 °C
Supply voltage fluctuations	Max. ± 10 % of the nominal voltage
Overvoltage category	II
Degree of pollution	1
Protection class	I
Degree of protection according to IEC 60529	IP20

12.4 Dimensions

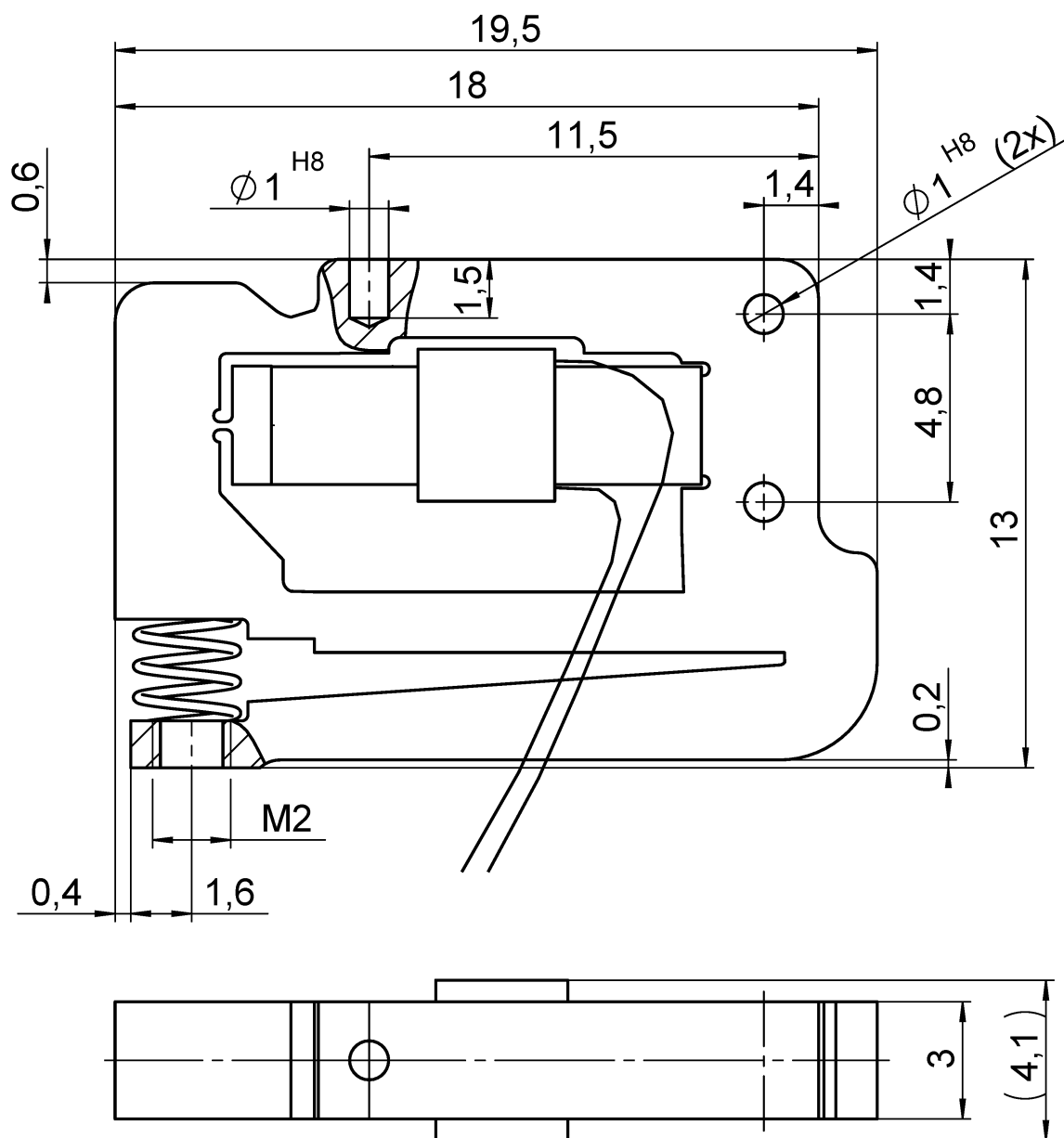


Figure 7: Dimensions of the P-604.300

Dimensions in mm. Note that the decimal places are separated by a comma in the drawings.

13 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 fulfil the responsibility as the product manufacturer, PI undertakes environmentally correct disposal of all PI equipment free of charge, if it was made available to the market after August 13, 2005.

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

Physik Instrumente (PI) GmbH & Co. KG

Auf der Roemerstrasse 1

76228 Karlsruhe

Germany

info@pi.de

www.pi.de



14 Appendix

14.1 Pin Assignment

14.1.1 Color Coding of the Connecting Wires

Color	Function
Red	PZT + (-20 to 120 V)
Black	PZT - (GND)

14.2 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

15 EU Declaration of Conformity

An EU Declaration of Conformity was issued for the P-604.300 in accordance with the following European directives:

- RoHS Directive

The standards applied for certifying the conformity are listed below.

- RoHS: EN 50581