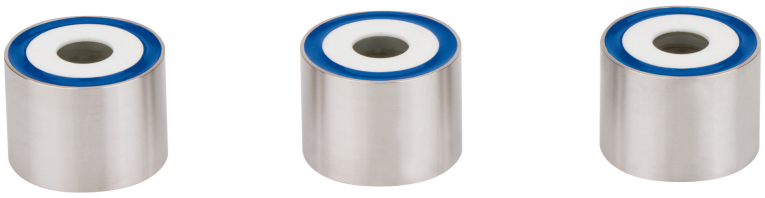

User Manual

P-131.12 PIREST ACTIVE SHIM

Contents

1 Legal Information

Original instructions
First print: 11/18/2019
Document number: PZ292en, CBo

Subject to change. This manual is superseded by any new release. The latest versions of the user manuals are available for download (p. 6) at www.pi.ws.

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2 About this Document

2.1 Objective and Target Group

This manual contains the information required for the intended use of the P-131.12 actuator (hereinafter referred to as "piezo actuator").

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
PZ290EN	User manual	E-135.601M PIRest drive electronics

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 by PI in their user manuals.

2.3.1 Typographic Conventions

Symbol / Label	Meaning
1. 2.	Action consisting of several steps whose sequential order must be observed
■	List item
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

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-131.12 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

Information

If a manual is missing or problems occur with downloading:

► Contact our customer service department (p. 19).

Downloading Manuals

1. Open the website **www.pi.ws**.
2. Search the website for the product number (e.g., P-882) or the product family (e.g., PICMA® bender).
3. Click the corresponding product to open the product detail page.
4. Click ***Downloads***.
   The manuals are shown under ***Documentation***.
5. Click the desired manual and fill out the inquiry form.
   The download link will then be sent to the email address entered.

3 Safety

3.1 Intended Use

The P-131.12 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-131.12 actuator is intended to be used as an electrically adjustable shim for compensating drift or tolerances. The motion takes place in one axis. A voltage supply is not required to maintain the position. The P-131.12 is **not** intended for applications in areas where failure would result in considerable risks for human beings or the environment.

The intended use of the P-131.12 is only possible when completely mounted and connected. The P-131.12 must be operated with suitable electronics (p. 9). The electronics are not in the scope of delivery of the P-131.12.

The P-131.12 may not be used for purposes other than those stated in this user manual. The P-131.12 may only be used in compliance with the technical specifications and instructions in this user manual.

3.2 General Safety Instructions

The P-131.12 is built according to state-of-the-art technology and recognized safety standards. Improper use of the P-131.12 may result in personal injury and/or damage to the P-131.12.

- ► Use the P-131.12 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-131.12.

3.3 Organizational Measures

3.3.1 User Manual

- ► Always keep this user manual available with the P-131.12. 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-131.12 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-131.12 after you have read and understood this user manual.

3.3.2 General Personnel Qualification

The P-131.12 may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

4 Product Description

4.1 Product Labeling

Labeling	Description	Position of the labeling
P-131.12	Product number	Base body
123456789	Serial number (example), individual for each P-131.12 Meaning of the position (counting from the left): 1 = internal information, 2 and 3 = year of manufacture, 4 to 9 = consecutive numbers	Base body
PI	Manufacturer's logo	Connecting cable
WWW.PI.WS	Manufacturer's address (website)	Connecting cable
Country of origin: Germany	Country of origin	Connecting cable
⚠	Warning sign "Pay attention to the manual!"	Connecting cable
	Old equipment disposal (p. 22)	Connecting cable
CE	CE conformity mark	Connecting cable

4.2 Scope of Delivery

Product number	Description
P-131.12	PIRest active shim, 5 µm travel range

4.3 Overview

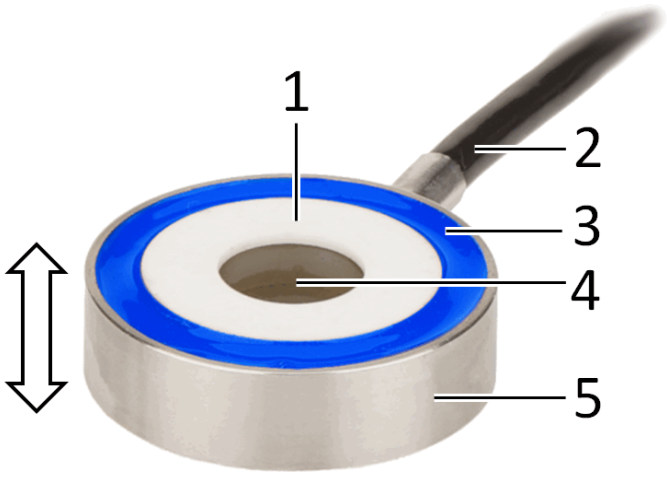


Figure 1: Product view (example view of a P-131.11)

1. Ceramic end surface of the actuator (ceramic made of Al_2O_3; respectively on the top and bottom of the P-131.12)
2. Cable exit
3. Silicone casting (respectively on the top and bottom of the P-131.12)
4. Inner hole
5. Housing

The double arrow indicates the actuator's direction of motion.

4.3.1 Drive Connector

The P-131.12 is equipped with a HD Sub-D 15 connector (m) for making the electrical connection to the electronics (p. 12). The drive connector transmits the operating voltage as well as the signals from the temperature sensor and the ID chip.

4.4 Suitable Electronics

The P-131.12 must be connected to suitable electronics that provide the voltages necessary for operating the P-131.12 and evaluate the signals from the temperature sensor. The following electronics are suitable for operating the P-131.12:

Product number	Description
E-135.601M	PIRest drive electronics for up to 6 actuators, HD Sub-D 15 sockets, TCP/IP and USB interface

To order, contact our customer service department (p. 19).

4.5 Accessories

Product number	Description
E-815.AK200	PIRest adapter cable, 2 channels, 2 × HD Sub-D 15 (f) to HD Sub-D 15 (m), 0.5 m
E-815.AK300	PIRest adapter cable, 3 channels, 3 × HD Sub-D 15 (f) to HD Sub-D 15 (m), 0.5 m
E-815.AK600	PIRest adapter cable set, 6 channels, consisting of 2 × E-815.AK300 (channels 1 to 3 and channels 4 to 6)

Selecting the cables depends on the number of actuators to be connected. To order, contact our customer service department (p. 19).

5 Unpacking

NOTICE

Destruction of the P-131.12 due to mechanical overload!

Mechanical forces can destroy the P-131.12.

- ► Avoid knocks that affect the P-131.12.
- ► Do **not** drop the P-131.12.

Unpacking the P-131.12

1. Unpack the P-131.12 with care.
2. Compare the contents with the items listed in 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. 19) immediately.
4. Keep all packaging materials in case the product needs to be returned.

6 Installation

6.1 Mounting the P-131.12

P-131.12 actuators are electrically adjustable shims that are inserted into a mechanical system. A suitable screw is inserted into the hole in the actuator to mount it.

The following mounting options are possible:

- Mounting the actuator with an expansion screw
- Mounting the actuator with a screw and a spring washer

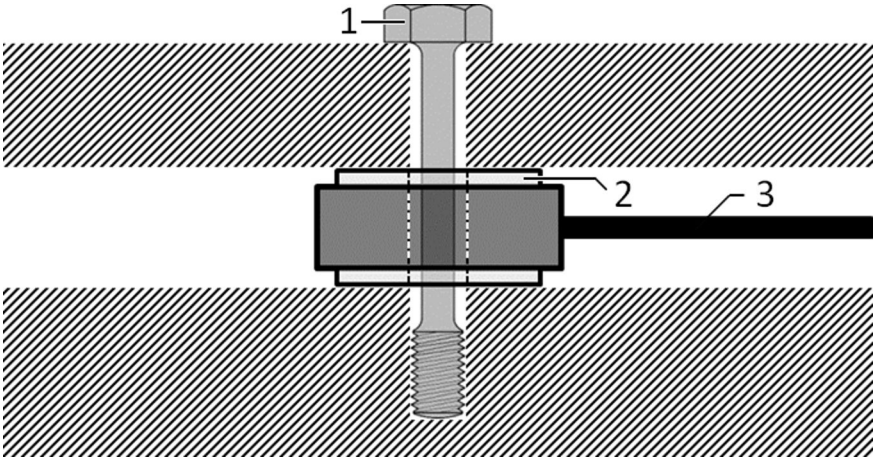


Figure 2: Mounting the actuator with an expansion screw

1. Expansion screw (maximum M6)
2. Ceramic end surface (2×) of the actuator
3. Connecting cable

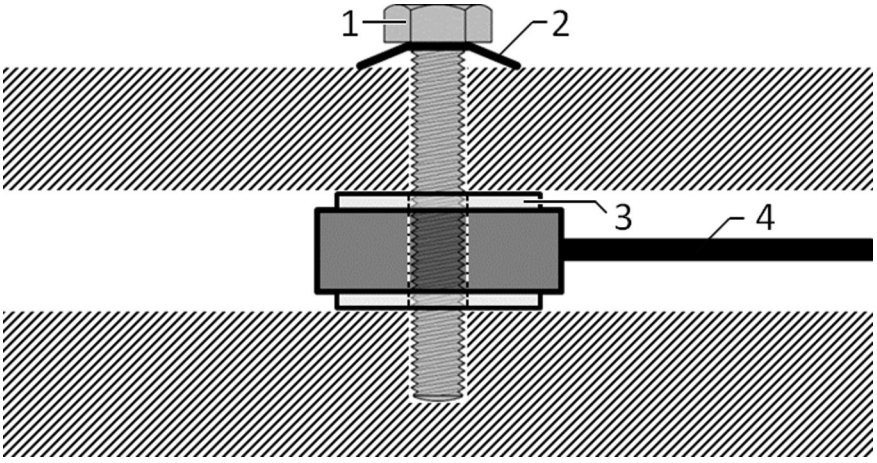


Figure 3: Mounting the actuator with a screw and a spring washer

1. Screw (maximum M6)
2. Spring washer
3. Ceramic end surface (2×) of the actuator
4. Connecting cable

Tools and Accessories

- Expansion screw or screw with spring washer:
  - Maximum screw size: M6

- The screw's length depends on the dimensions of the actuator (p. 21)

Requirements

✓ You have read and understood the general safety instructions (p. 7).
✓ The P-131.12 is not connected to the electronics.

NOTICE

Destruction of the P-131.12 due to mechanical overload!
Torques, lateral forces, tensile stress, and excessive loads can destroy the piezo actuator.

► Do **not** exceed the maximum load capacity according to the specifications (p. 20).
► Avoid torques and lateral forces on the piezo actuator.
► Avoid tensile stress on the piezo actuator. If it is not possible to avoid tensile stress, apply mechanical preload to make sure that the actuator is not subject to tensile stress.
► Make sure that the center of load of the moving system is on the piezo actuator's motion axis and the load is distributed evenly.
► Make sure that the contact surfaces of the mechanical system where the P-131.12 is installed has sufficient flatness and parallelism.

Information

For optimum actuator performance, the stiffness of the preload element (e.g., expansion screw or screw with spring washer) should be considerably lower than the actuator stiffness.

► If possible, choose preload elements with a stiffness of <10 % of the actuator stiffness (p. 20). This makes sure that the actuators achieves more than 90 % of its travel range.
► The preload should only be as high as the static and dynamic forces required in your application.

Mounting the P-131.12

1. Align the P-131.12 so that the inner hole of the P-131.12 and mounting holes of your mechanical system are in line.
2. Insert an expansion screw or screw with spring washer (see the figures above).
3. Tighten the screw and do **not** exceed the load capacity of the P-131.12 according to the specifications (p. 20).

6.2 Connecting the P-131.12

Tools and Accessories

- Optional: E-815.AKx00 (p. 9) adapter cable for connecting up to six actuators
- If necessary: Suitable screwdriver for the locking screws of the connectors.

Requirements

✓ You have read and understood the general safety instructions (p. 7).
✓ You have read and understood the user manual for the electronics used.
✓ You have installed the electronics properly.
✓ The electronics are switched off.

NOTICE

Damage due to incorrect connection of the P-131.12!

Connecting unsuitable electronics or a wrong cable can damage the P-131.12 or the electronics.

► Connect the P-131.12 only to suitable electronics from PI (p. 9).

► Use cables from PI only to connect the P-131.12 to the electronics.

Connecting the P-131.12

1. Connect the HD Sub-D 15 plug connector of the P-131.12 to the HD Sub-D 15 socket connector of the electronics.

   Pay attention to the assignment of the actuators to each individual channel of the electronics when connecting several actuators.
2. Optional: To connect several P-131.12 to the electronics with the E-815.AKx00 adapter cable, proceed as follows:
   a) Connect the HD Sub-D 15 plug connector of the P-131.12 to the HD Sub-D 15-socket connector on the adapter cable.
   b) Connect the HD Sub-D 15 plug connector of the adapter cable to the HD Sub-D 15 socket connector of the electronics.

   Pay attention to the assignment of the actuators to each individual channel of the electronics when connecting.
3. Secure the connectors against unintentional removal.

7 Startup / Operation

7.1 Starting and Operating the P-131.12

Tools and Accessories

- External position-measuring device (e.g., measuring sensor)

Requirements

✓ You have read and understood the general safety instructions (p. 7).
✓ You have installed (p. 11) the P-131.12 properly.
✓ You have read and understood the user manual for the electronics.
✓ The electronics and the PC software have been installed (see the user manual for the electronics).

NOTICE

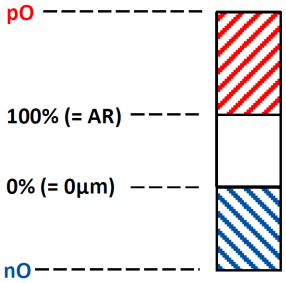
Destruction of the piezo actuator due to electric flashovers
Using the P-131.12 in environments that increase the electrical conductivity can lead to the destruction of the piezo actuator by electric flashovers. Electric flashovers can be caused by moisture, high humidity, liquids, and conductive materials (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-131.12 in environments that can increase the electrical conductivity.
► Operate the P-131.12 only within the permissible ambient conditions and classifications (p. 20).

NOTICE

Damage due to collisions!
When motion is commanded, the P-131.12 can overshoot its travel range limits **in both directions** before finally reaching the target position. In applications with limited installation space, overshooting can cause collisions between moving and fixed parts and lead to damage.

► Be aware that the P-131.12 can overshoot its nominal travel range (AR) as follows:
- When expanding: Positive overshooting (pO) up to 16.4 µm (±20 %)
- When contracting: Negative overshooting (nO) up to 8.5 µm (±20 %)



Information

The P-131.12 does not require electrical voltage to maintain its position, i.e., it only needs to be supplied with voltage during adjusting. The P-131.12 can be disconnected from the electronics after adjusting has been completed.

Starting and Operating the P-131.12

1. Follow the instructions in the manual for the electronics (p. 5) for startup and operation of the P-131.12.
2. Use an external position-measuring device to check whether the desired position has been reached.

8 Maintenance

The P-131.12 is maintenance-free.

8.1 Cleaning

Requirements

✓ You have disconnected the P-131.12 from the electronics.

Auxiliary Materials Required

- Soft, lint-free cloth
- Mild cleaning agent (e.g., isopropyl alcohol)

If you have any questions on the auxiliary materials recommended for the P-131.12, contact our customer service department (p. 19).

NOTICE

Short-circuiting due to cleaning fluid penetrating the housing!
Cleaning fluid penetrating the P-131.12's housing can short-circuit the actuator and drive electronics.

► Disconnect the P-131.12 from the electronics before cleaning.
► Prevent cleaning fluid from penetrating the P-131.12's housing.

NOTICE

Damage due to use of unsuitable cleaning agents!
Some cleaning agents can dissolve plastics, silicone or adhesives. Water can penetrate the housing easily and cause damage. Any water that has penetrated the housing cannot be removed completely.

► Do **not** use water and do **not** use acetone for cleaning.

NOTICE

Damage from ultrasonic cleaning!
Ultrasonic cleaning can damage the P-131.12.

► Do **not** do any ultrasonic cleaning.

Cleaning the P-131.12

1. Dampen the cloth lightly with the cleaning agent.
2. Carefully wipe the surfaces of the P-131.12.

9 Troubleshooting

No or limited motion	
Cable not connected correctly	► Check the cable connections.
Excessively high preload	► Reduce the preload while considering the static and dynamic forces expected for your system.
Excessive preload element stiffness	► Use a preload element (e.g., expansion screw or screw with spring washer) with lower stiffness. Example: The actuator achieves 90 % of its travel range when the preload element has 10 % of the actuator stiffness (p. 20).
Actuator damaged by exceeding the load capacity (p. 20)	► If possible, replace the defective actuator with another actuator and test the new combination.

10 Transportation

Preparing the P-131.12 for Transportation

1. Pay attention to the ambient conditions and classifications (p. 20).
2. Pack the P-131.12 in the original packaging.
3. If the P-131.12 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 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.

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-131.12	Unit	Tolerance
Dimensions OD × ID × L	22 × 8 × 17	mm	
Nominal travel range*	5	µm	±20 %
Minimum incremental motion*	<10	nm	
Load capacity	4000	N	max.
Stiffness	350	N/µm	typ.
Electrical capacitance	10.2	µF	±20 %
PIRest operating modes			
Operating point for active adjustment	120	V	max.
Operating point for long-term stable position	0	V	
Miscellaneous			
Cable length	1.5	m	
Voltage connection	HD Sub-D 15 (m)		
ID chip	Yes		
Temperature sensor	Yes		
Operating temperature range	5 to 40	°C	
Recommended electronics	E-135		

* At room temperature
Vacuum versions available on request.

12.2 Maximum Ratings

The P-131.12 is designed for the following operating data:

Maximum operating voltage	Maximum operating frequency*	Maximum power consumption*
		
125 V	20 Hz	10 W

* Depending on the electronics

12.3 Ambient Conditions and Classifications

The following ambient conditions and classifications for the P-131.12 must be observed:

Area of application	For indoor use only
Maximum altitude	5000 m above msl
Relative humidity	Max. 80 % for temperatures to 31 °C, linearly decreasing to 50 % at 40 °C
Storage temperature	0 °C to 80 °C
Transport temperature	0 °C to 80 °C
Overvoltage category	II
Protection class	I
Degree of pollution	1
Degree of protection according to IEC 60529	IP40

12.4 Dimensions

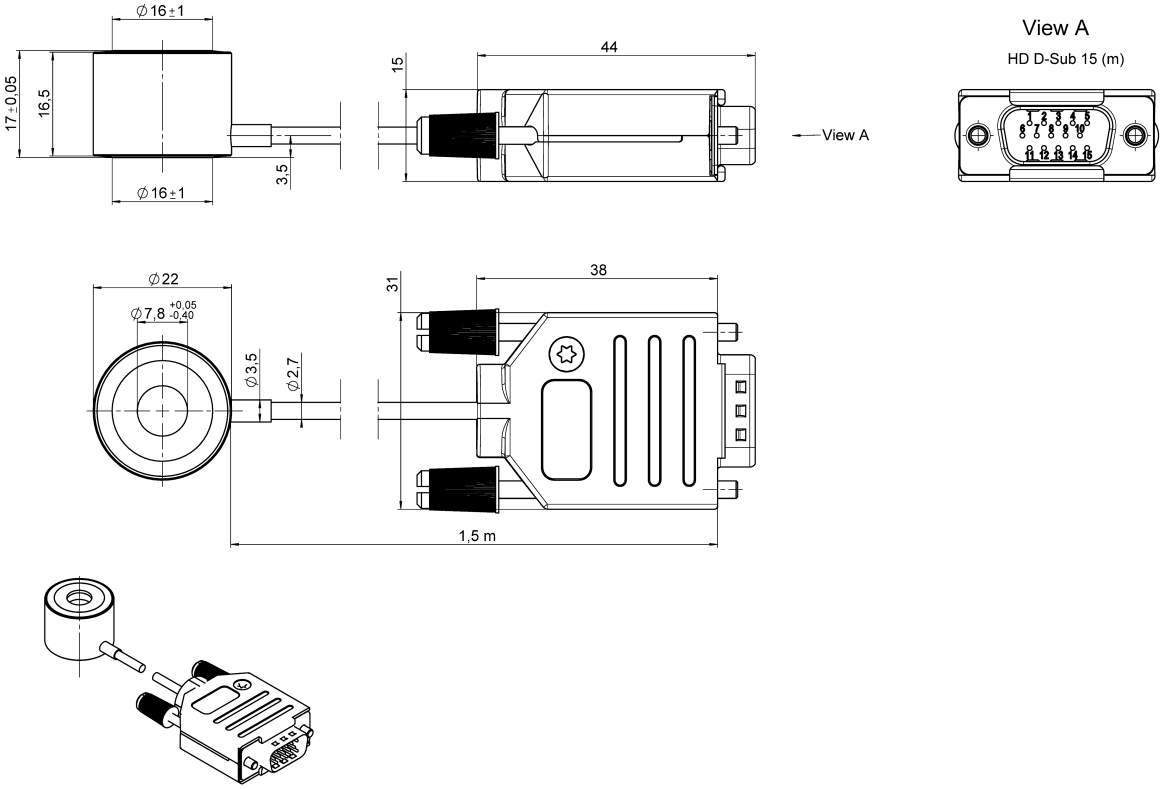


Figure 4: Dimensions of the P-131.12

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 Plug connector

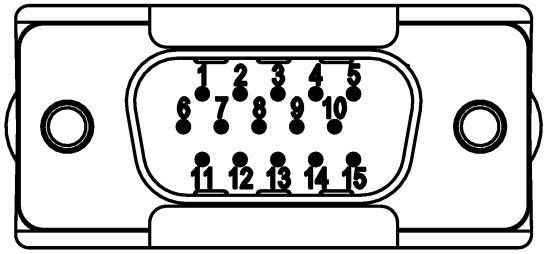


Figure 5: HD Sub-D 15 plug connector on the P-131.12 (front view)

Pin	Signal	Function	Direction
1	GND	Ground	GND
2	NC	Not connected	---
3	NC	Not connected	---
4	NC	Not connected	---
5	NC	Not connected	---
6	5 V	5 Volt supply voltage for the ID chip and temperature sensor	Input
7	DATA	Data line for ID chip and temperature sensor	Bidirectional
8	NC	Not connected	---
9	NC	Not connected	---
10	NC	Not connected	---
11	PZT +	Piezo voltage +	Input
12	PZT GND	Piezo voltage ground	Input
13	NC	Not connected	---
14	NC	Not connected	---
15	NC	Not connected	---

The cable shield is connected to the connector shell.

15 EU Declaration of Conformity

An EU Declaration of Conformity was issued for the P-131.12 in accordance with the following European directives:

- 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 50581