

# Handling and Electrical Contacting of Piezoceramic Components

## Contents

<b>About this Document</b> .....	<b>2</b>
<b>Symbols and Typographic Conventions</b> .....	<b>2</b>
<b>Safety Instructions</b> .....	<b>2</b>
Personnel Qualification .....	2
Safe Handling .....	3
<b>Electrical Contacting</b> .....	<b>4</b>
Labeling of the Polarity .....	4
Soldering On Stranded Wires .....	4
Gluing On Stranded Wires .....	7
<b>Discharging a Piezo Component</b> .....	<b>8</b>
<b>Cleaning a Piezo Component</b> .....	<b>8</b>
<b>Storage and Storability</b> .....	<b>9</b>
<b>RoHS and REACH Conformity</b> .....	<b>9</b>
<b>Customer Service</b> .....	<b>9</b>
<b>Disposal</b> .....	<b>10</b>

## About this Document

This document contains information on the handling and electrical contacting of piezoceramic components. For the purposes of this document, the term "piezoceramic components" (hereinafter referred to as "piezo components") refers, for example, to piezoceramic discs, plates, shear plates, tubes or rings. The term "large piezo components" refers to components which, due to their properties, can become charged so that electrical voltages of several kilovolts are present on their electrodes.

## Symbols and Typographic Conventions

The following symbols and typographic conventions are used in this document:

### **DANGER**



#### **Imminently hazardous situation**

If not avoided, the hazardous situation will result in death or serious injury.

- Actions to take to avoid the situation.

### **NOTICE**



#### **Dangerous situation**

If not avoided, the dangerous situation will result in property damage.

- Actions to take to avoid the situation.

### **INFORMATION**

Information for easier handling, tricks, tips, etc.

## Safety Instructions

### Personnel Qualification

The piezo components may only be installed, started up, operated, maintained and cleaned by authorized and appropriately qualified personnel.

- Follow general accident prevention rules!

## Safe Handling

### **DANGER**



#### **Dangerous voltage and residual charge on piezo components!**

Temperature changes and compressive stresses can induce charges in piezo components. When a piezo component is electrically charged, electrical voltages of several kilovolts can be present on the electrodes, depending on the size, material and capacity of the piezo component. Touching the live parts of large piezo components can result in serious injury or death from electric shock.

- Discharge (p. 8) the piezo component before touching it.
- Wear insulating, powder-free nitrile or latex gloves when handling the piezo component.
- Keep the outer electrodes (solder connections) short-circuited.

### **NOTICE**



#### **Destruction of the piezo component by impurities!**

Contamination of the piezo component with conductive fluids (e.g., finger sweat) and conductive materials (e.g., metal dust) can lead to damage from electrical flashovers during operation.

- Wear insulating, powder-free nitrile or latex gloves when handling the piezo component.
- Prevent the piezo component from coming into contact with conductive liquids (e.g., finger sweat) and conductive materials (e.g., metal dust).
- If the piezo component has been accidentally contaminated, clean it in accordance with the instructions in section "Cleaning a Piezo Component" (p. 8).

### **NOTICE**



#### **Destruction of the piezo component by mechanical overload!**

Piezoceramic components are brittle and hard. Mechanical forces can damage the piezo component.

- Use non-metallic tweezers for handling.
- Avoid sudden shear or tensile stresses.

## Electrical Contacting

The piezo components from PI Ceramic are equipped with metal thin-film or thick-film electrodes.

The electrodes can make contact in one of the following ways:

- Soldering on stranded wires (p. 4)
- Gluing on stranded wires (p. 7)

For clear labelling of the connections, it is recommended to use a red wire for contacting the positive electrode and a black wire for contacting the negative electrode.

## Labeling of the Polarity

The surface of the electrode which is at the positive potential during polarization is marked with a dot or a cross. Alternatively and particularly for thin-film electrodes, the direction of polarization is marked by coloring the electrode material: A reddish or golden/yellow color indicates the electrode which was at the positive potential during the polarization.

## Soldering On Stranded Wires

### NOTICE



#### Damage from overheating of the piezo components during soldering!

Heating up the entire piezo component above the Curie temperature will cause the piezo ceramic to become depolarized. Depolarization can damage the piezo ceramic. Long and repeated soldering processes can cause damage to the electrode.

- Choose the soldering temperature so that it is only as high as necessary.
- Make sure that the soldering time does **not** exceed 1 to 2 seconds.
- Let the soldering point cool down in the meantime after repeated soldering.

### NOTICE



#### Damage from mechanical stress on the solder connection!

Mechanical stresses (e.g., shear forces) on the solder connection can cause damage to the piezo component.

- When wires are moved, ensure strain relief via shrink tubing or a fixation with adhesive.

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**INFORMATION**

To prevent the piezo component from becoming charged during the soldering process, PI Ceramic recommends soldering large piezo components while they are short-circuited.

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**INFORMATION**

Thick-film electrodes can become tarnished due to the reaction of the silver surface with atmospheric sulfur. This tarnishing can make it more difficult to wet with solder.

- Carefully clean tarnished thick-film electrodes with a glass brush or with steel wool.

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**INFORMATION**

Soldering the electrodes using the reflow process is possible with specially adapted thin-film electrodes.

- If you want to use the reflow process, contact our customer service department (p. 9).

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**Requirements**

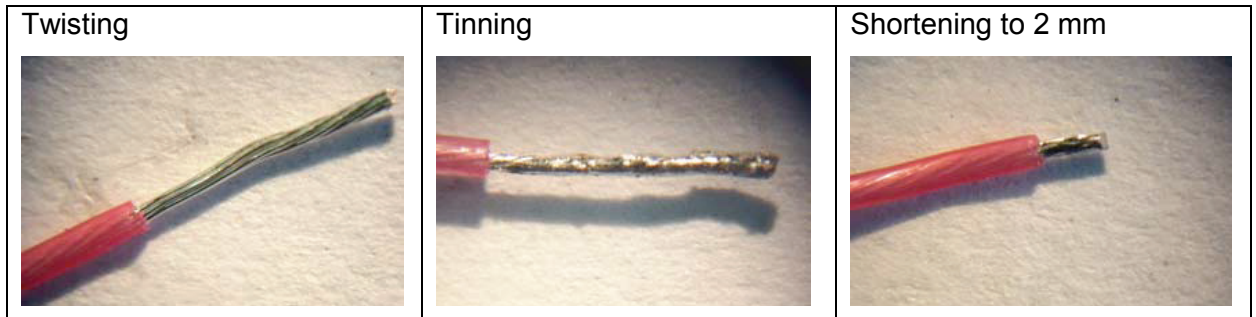
- ✓ You have read and understood the information in "Safe Handling" (p. 3).
- ✓ The piezo component has been discharged (p. 8).

**Tools and accessories**

- Suitable stranded wires that meet the applicable standards for the conditions of use
- Suitable soldering iron
- Suitable solder: Sn 95.5, Ag 3.8, Cu 0.7
- Suitable flux according to one of the following standards:
  - DIN EN 29454, part 1, paragraph 1.1.1 or 1.2.3
  - ANSI J-STD-004, flux with low halogen content  
ROL0, ROL1, REL0, REL1
- Suitable cable tools

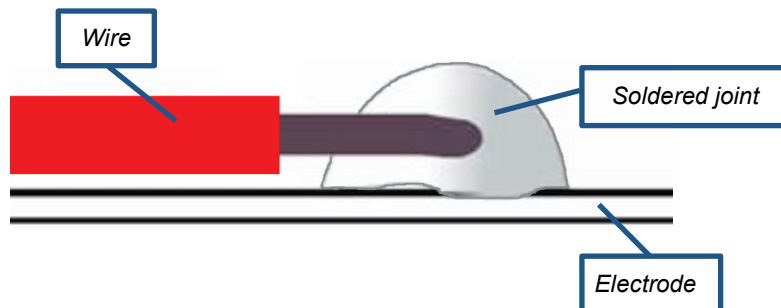
### Soldering on stranded wires

1. Twist and tin the stripped end of the wire. Shorten the tinned end to a length of 2 mm.



*Fig. 1: Preparation of the wire*

2. Apply the flux to the tinned end of the wire and the intended soldering point of the electrode.
3. Hold the wire flat on the tinned end on the soldered joint.
4. Coat the soldering tip of the soldering iron with a small amount of solder.
5. Hold the soldering tip of the soldering iron on the tinned end of the wire at the soldering point for a maximum of 1 to 2 seconds so that the solder flows. The soldered joint must be flat or point-shaped.



*Fig. 2: Point-shaped soldered joint (sectional view)*

6. Repeat steps 1 to 5 for the second stranded wire.
7. If necessary, remove flux residue with isopropanol. Do the cleaning according to the instructions in section "Cleaning a Piezo Component" (p. 8).

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## Gluing On Stranded Wires

### NOTICE



#### **Damage from overheating during the heat curing of the adhesive!**

Heating up the entire piezo component above the Curie temperature will cause the piezo ceramic to become depolarized. Depolarization can damage the piezo ceramic.

- Make sure that a temperature of 200 °C is **not** exceeded while the adhesive hardens.

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### INFORMATION

For optimum electrical contacting, it is recommended to use silver-plated wires.

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### Requirements

- ✓ You have read and understood the information in "Safe Handling" (p. 3).
- ✓ You have read and understood the user information of the manufacturer of the adhesive.
- ✓ The piezo component has been discharged (p. 8).

### Tools and accessories

- Suitable stranded wires that meet the applicable standards for the conditions of use
- Electrically conductive, silver-filled epoxy resin adhesive
- Suitable cable tools

### Gluing on stranded wires

1. If necessary, clean the bonding surfaces so that they are dry, dust-free and grease-free. Do the cleaning according to the instructions in section "Cleaning a Piezo Component" (p. 8).
2. Remove the insulation on the end of the wire to be glued on and shorten the stripped end to a length of 2 mm.
3. Glue the untwisted and untinned stranded wire to the electrode:
  - a) Apply the thinnest possible layer of adhesive on the intended bonding surface of the electrode.
  - b) Apply a small amount of adhesive to the stripped end of the wire.
  - c) Hold the wire in the desired orientation on the adhesive point and fix the wire.
4. Repeat steps 2 and 3 for the second stranded wire.
5. Wait until the adhesive has completely hardened.

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## Discharging a Piezo Component

### Requirements

- ✓ You have read and understood the information in "Safe Handling" (p. 3).

### Tools and accessories

- Suitable discharge resistor
- Alternatively: Wire or electrically conductive material (e.g., metal foil or other conductive foil)

### Discharging a piezo component

1. Ensure adequate protection against touching live parts.
2. Short-circuit the electrodes of the piezo component for a few seconds with a suitable discharge resistor, a wire or a conductive material.

## Cleaning a Piezo Component

### **INFORMATION**

All components are supplied free of oil and grease. The customer does **not** normally need to clean them.

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### Requirements

- ✓ You have read and understood the information in "Safe Handling" (p. 3).
- ✓ The piezo component has been discharged (p. 8).
- ✓ The piezo component is **not** connected to the electronics.

### Cleaning a piezo component

1. Remove contamination such as oil residue with organic solvents (e.g., isopropanol).
2. Ensure residue-free drying.

When cleaning in an ultrasonic bath:

- Reduce the energy input to the necessary minimum.
- Do not use any liquids other than isopropanol for cleaning.
- Make sure that the cleaning time in the ultrasonic bath does not exceed two minutes.
- After cleaning, dry the piezo component completely in a drying cabinet (recommended duration: 30 minutes at 40 °C).



## Storage and Storability

The electrodes of the piezo components offered by PI Ceramic can be stored at temperatures <40 °C and a relative humidity of <60 % for several months. A significant decrease in the solderability of the electrodes is not to be expected even over longer periods of time.

### Storage-related changes on the electrode surface

Thick-film electrodes can become tarnished due to the reaction of the silver surface with atmospheric sulfur. This tarnishing can make it more difficult to wet with solder.

Thin-film electrodes can become easily discolored from UV or sunlight. This is only an optical effect and does not decrease the solderability or conductivity of the electrode. We recommend protecting the electrode surface from direct sunlight.

## RoHS and REACH Conformity

The products manufactured by PI Ceramic are RoHS-compliant according to the Directive 2011/65/EU. For PZT-based materials containing lead, the exemption in Annex III (7c. I) and Annex IV (14) of the directive applies. Otherwise, our products only contain substances or mixtures of substances that meet the requirements of the Directive 2011/65/EU.

The products manufactured by PI Ceramic are products in accordance with Article 3 Paragraph 3 of the REACH Regulation, in which PZT (lead zirconate titanate, CAS No. 12626-81-2) is the main constituent of the piezo ceramic. PZT is thus contained in a concentration of more than 0.1 percent by weight. After the sintering process, the lead oxide contained in PZT is bound in a crystalline and insoluble form and is thus physiologically safe in all our products. When our components are handled properly, PZT will never be released.

It is imperative to prevent the release of PZT by mechanical processing steps in which dust or slag can form that can be absorbed by the respiratory tract or swallowed.

## Customer Service

For inquiries and orders, call PI Ceramic or send us an e-mail ([info@piceramic.com](mailto:info@piceramic.com)).

If you have questions concerning your system, have the following information ready:

- Product codes and serial numbers of all products in the system
- Firmware version of the controller (if present)
- Version of the driver or the software (if present)
- Operating system on the PC (if present)

## Disposal

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

For disposal, observe the international, national, and local rules and regulations.

In order to fulfil the responsibility as the product manufacturer, PI Ceramic GmbH offers the environmentally correct disposal of PI products made available on the market after August 13, 2005, without charge.

Any product from PI Ceramic that is to be disposed of can be sent free of shipping costs to the following address:

PI Ceramic GmbH  
Lindenstrasse  
D-07589 Lederhose

