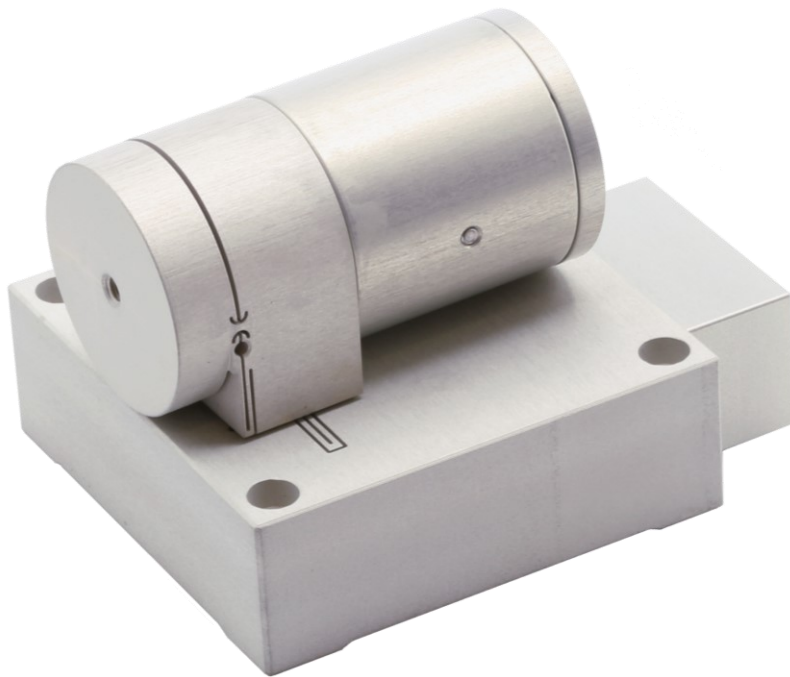


INSTALLATION AND OPERATION MANUAL
TT2 NANOPositionER



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IMPORTANT SAFETY INFORMATION

The high voltage drivers can produce hazardous voltages and currents. Use caution when operating the drivers and when handling the linear actuators. Piezoactuators have large capacitance and are capable of storing hazardous amounts of electrical energy over long periods of time. Various conditions such as load and temperature changes can also cause piezoactuators to accumulate charge.

Before disconnecting the DB-9 connector from the PIEZOCONCEPT controller, first set the command voltage to 0.0V, then turn the AC power to the PIEZOCONCEPT controller off, and finally wait one minute before disconnecting.

The TT2 has no user serviceable parts. Only trained service personnel should perform service.

IMPORTANT

All Technical Information, recommendations, and examples related to PIEZOCONCEPT Products made in this manual are based on information believed to be correct. The purchaser or user should determine the suitability of each product before using. The purchaser or user assumes all risks and liability whatsoever in connection with the use of any and all PIEZOCONCEPT products or services.

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1 INTRODUCTION

The TT2 is a two-axis PZT actuated rotational stage of exceptional resolution and stability. The TT2 comes complete with position sensitive detectors for closed loop operation.

ROTATION (mrad) (XY)	5mrad / 10mrad
VOLTAGE RANGE (V)	-5V to +150V
RESONANT FREQUENCY UNLOADED (Hz)	(X) 4 kHz / 2.2 kHz (Y) 2 kHz / 1.2 kHz
CABLE LENGTH (ft)	>1.5m
CABLE CONNECTION	DB-9

1.1 Unpacking the TT2

Before unpacking the TT2, read this entire operation manual, paying special attention to the following section on “**Handling the TT2**”. Check the contents of the package against the shipping list and notify PIEZOCONCEPT immediately if any items are missing.

1.2 Handling the TT2.

The TT2 is a high precision scientific instrument and therefore requires special handling in order to ensure proper operation. Mishandling can cause permanent damage. To insure a long and useful life the following guidelines should be strictly followed.

- **Never insert anything into the EDM grooves.** The EDM grooves are the cuts that form the flexure hinges and separate the moving portion of the stage from the stage frame. Severe damage may result if objects are inserted into these grooves.
- Do not move the rotational stage by pushing on it with your hands or any other object.
- Avoid applying a torque between the moving stage and the frame.
- Do not drop, treat roughly, or physically shock the rotational stage.
- Do not lift by the cable.
- The surface to which the TT2 is mounted to should be flat and clean. Likewise, the bottom of the TT2 should be free of particles and dust before mounting.
- Do not immerse in any liquid. If the TT2 requires cleaning slightly dampen a lint free cloth with iso-propanol or ethanol and lightly wipe the surface. Do not get any liquid or lint into the EDM grooves.
- Never disassemble the nanopositioning stage, there are no serviceable parts inside.

1.3 TT2

The TT2 is manufactured from a high strength Al alloy. The PZT actuators are preloaded within the TT2 and supply the driving force for stage rotation. The flexure hinges, which form the guidance mechanism, are cut into the stage using electric discharge machining (EDM). There are no serviceable parts in the TT2 stage.

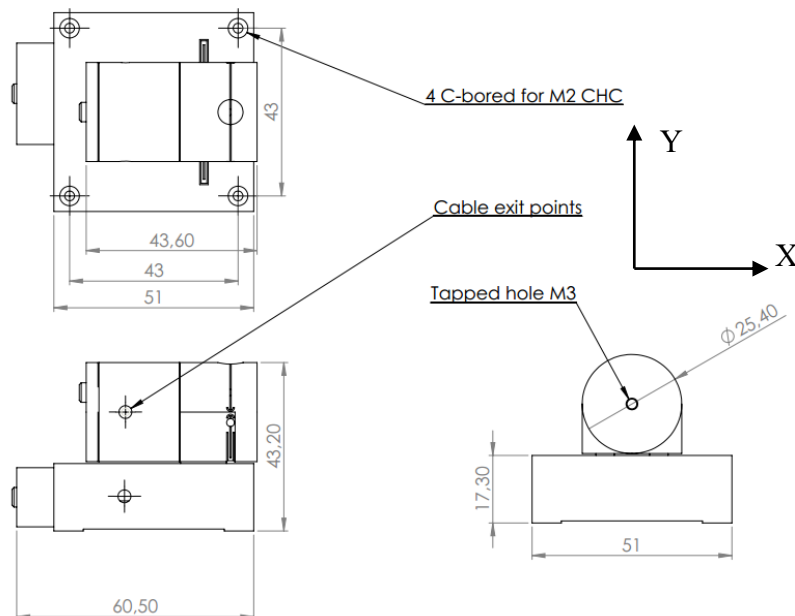
2 INSTALLATION

The TT2 may be installed either vertically or horizontally.

Irrespective of how you choose to install the TT2 :

- Make sure that the surface to be mounted to is clean, flat, and free of burs.
- Using a lint free cloth, gently wipe the bottom (or mounting surface) of the TT2 to remove any particles or dust.
- Always lift the TT2 by the Y-axis (bottom portion).
- Never lift, position, attach or unattach the TT2 with the power applied.
- **IMPORTANT!** Check for ground loops (**Section 3**) between the TT2 and the mounting surface.

To install, use the M2 CHC holes in the Y-Axis of the TT2, these holes are on a 43mm square. When tightening the screws, do not hold the TT2 by the mirror platform or X-axis, instead hold it at the Y-Axis (bottom portion). This will prevent any large forces from being applied to the flexure hinges.



The axis of rotation are defined in the figure above. The bottom, rectangular, portion of the stage is the Y-axis and it gives a rotation about the Y-axis. The top, cylindrical, portion of the stage is the X-axis and it gives a rotation about the X-axis. The DB-9 connectors are labeled CHANNEL 1 (X) and CHANNEL 2 (Y) defining which axis of rotation that particular DB-9 corresponds to.

3 GROUND LOOPS

The single greatest danger to your nanopositioning system is a ground loop between the stage and the mounting surface. Ground loops can be the source of noise in the TT2, and in some cases the oscillations may be severe enough to permanently damage the piezoactuators.

3.1 Prevention and identification of ground loops

Ground loops may sometimes be detected by a DVM and can usually be detected by using the differential mode of a dual channel oscilloscope.

Prevention of ground loops can be achieved in two ways. An effective and simple method is to insulate the stage from the mounting surface (e.g. mylar or paper between the stage and the mounting surface combined with non-conductive mounting screws). The second method is to connect the PIEZOCONCEPT's controller ground to the mounting surface. The stage is connected directly to the ground of the PIEZOCONCEPT's controller, which in turn is connected to the ground of the AC power cord. The PIEZOCONCEPT's controller enclosure is also at ground potential. Attaching a grounding wire between any of the PIEZOCONCEPT's controller enclosure screws and the mounting surface may short-circuit the ground loop. In a few cases, this may not be an effective method. When this occurs, please identify high current sources returning to ground through your mounting surface. Mounting surfaces should never be used as the electrical ground current path for any instrumentation (such as vacuum pumps, computers, etc.).

Should you observe unexpected oscillations in your nanopositioning stage after you have switched on the power, this likely indicates the continued presence of a ground loop or excessive sample mass (see Section 2). **SWITCH THE SYSTEM OFF IMMEDIATELY AND SEARCH FOR THE SOURCE OF THE GROUND LOOP. SHOULD THE PROBLEMS CONTINUE PLEASE CONTACT PIEZOCONCEPT FOR TECHNICAL ASSISTANCE.**

4 OPERATING THE NANOPositionING STAGE

The TT2 comes complete with a position sensitive detector for closed loop operation. In closed loop operation, achieved using the PIEZOCONCEPT's controller, the effects of creep and hysteresis are removed and the position is held constant at the command position.

4.1 Operating in closed loop mode

The TT2 comes with two 9 pin D-type connector and uses the PIEZOCONCEPT's controller for complete positioning control. To operate in closed loop mode use the following procedure.

- Install the TT2 as discussed in **Section 2**.
- Turn the PIEZOCONCEPT's controller power off.
- Set the command signal to 0.0 Volts either on the analog interface or the digital interface.
- Connect both 9 pin D-type connectors to the PIEZOCONCEPT's controller, secure with screws. The DB-9 connector labeled CHANNEL 1 (X-axis) goes to the CHANNEL 1 (X-axis) and the DB-9 connector labeled CHANNEL 2 (Y-axis) goes to the CHANNEL 2 (Y-axis) axis.
- Turn the power switch on.
- The command voltage now controls the position of the nanopositioning stage.
- Never disconnect the 9-Pin connectors with the power on. Always set the command voltage to zero and turn the power off before disconnecting. Allow 1 minute for the PZT actuators to discharge before disconnecting. For more information see the **“PIEZOCONCEPT'S CONTROLLER OPERATION MANUAL”**.

4.2 Care during operation

The TT2 is a high precision scientific instrument and should be handled with care during operation. Failure to do so may result in permanent damage.

- During operation ensure that there are no physical constraints on the moving stage or anything fixtured to the moving stage.
- Never apply a voltage greater than 150V or less than -5V to the PZT.
- Maintain a clean working environment to reduce the chance of particles or other substances from gathering in the EDM grooves.