INSTALLATION AND OPERATION MANUAL

FOC 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 FOC 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 FOC is a closed-loop, microscope objective nanopositioner with either 100, 200 or 300µm range.

TRANSLATION (µm) (X)	100, 200 or 300µm
VOLTAGE RANGE (V)	-5V to +150V
RESONANT FREQUENCY WITH 200 grams mass	500, 350 or 250Hz
STIFFNESS (N/µm)	0.6 , 0.5 or 0.4N/µm
MAXIMUM LOAD (hor/vert) (kg)	1/0.5
CABLE LENGTH (m)	>1.5m
CABLE CONNECTION	DB-9

1.1 Unpacking the FOC

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

1.2 Handling the FOC

The FOC is a high precision scientific instrument and therefore requires special handling in order to ensure proper operation. Mishandling can cause permanent damage to the nanopositioning stage. To ensure 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 translation 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 Nanopositioning stage.

Do not lift by the cable.

The surface to which the FOC is mounted to should be flat and clean. Likewise, the bottom of the FOC should be free of particles and dust before mounting.

Do not immerse in any liquid. If the FOC 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 FOC

The FOC is manufactured from a high performance Al 7075 alloy. The piezoactuators are preloaded within the FOC and supply the driving force for stage movement. 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 FOC stage.

The FOC is fitted with brass inserts for either RMS, M25, M26, M27 or M32. The female threaded brass insert is screwed onto the FOC using the M36 thread. The FOC was delivered with the appropriate female threaded brass insert in place. If not, it can be screwed either manually or with a lens spanner wrench.

The male threaded brass insert should be screwed into the objective lens holder of the microscope. Next, the 1.5mm hex wrench is used to loosen the M2 blocking set screw located on the FOC (see the photo below - screw is in red). The FOC is then placed onto the male threaded brass insert at the appropriate angle and the blocking set screw is tightened with the 1.5mm hex wrench.

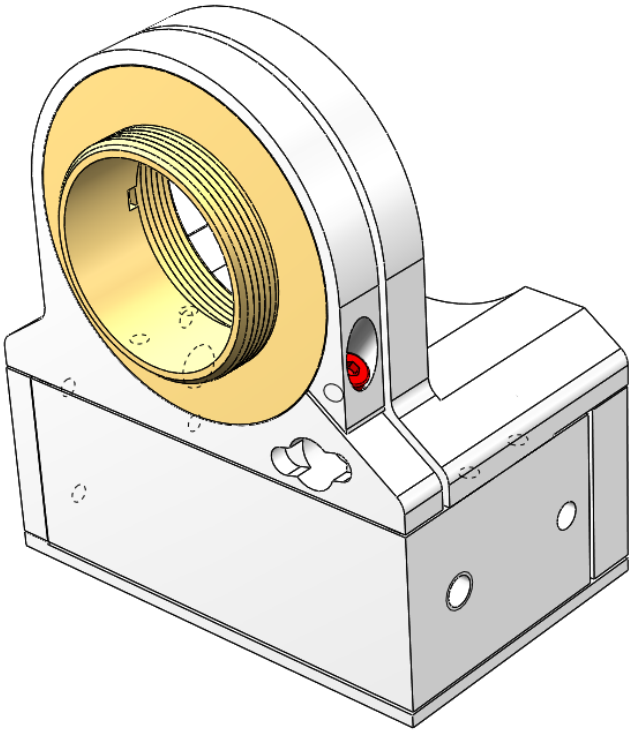

Figure 1 : M2 blocking set screw (in red)

2 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 FOC, and in some cases the oscillations may be severe enough to permanently damage the piezoactuators.

2.1 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.**

3 OPERATING THE NANOPOSITIONING STAGE

The FOC 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.

3.1 Operating in closed loop mode

The FOC comes with a 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.

1. Install the FOC as discussed in **Section 1**.
2. Turn the PIEZOCONCEPT's controller power off.

3. Set the command signal to 0.0 Volts either on the analog interface or the digital interface.
4. Connect the 9 pin D-type connector to the PIEZOCONCEPT's controller, secure the two screws.
5. Turn the power switch on.
6. The command voltage now controls the position of the nanopositioning stage.

Never disconnect the 9-Pin connector 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.

3.2 Care during operation

The FOC 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.