

INSTRUCTION MANUAL

Model 806D

***In situ* Test Apparatus for Muscle Lever Systems**

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1.0 Introduction

The 806D *in situ/ex vivo* test apparatus is used with either a 300/305C series muscle lever system. The apparatus enables physiology researchers to easily test muscle tissue *in situ* or perform footplate style experiments with an ASI muscle lever system. The apparatus was primarily designed for use with rats however it can accommodate other small animals. The 806D consists of a heated anodized aluminum mounting plate on which the animal lies, a raised platform for holding the limb of interest, various clamps for immobilizing the limb, motor mount and a fine horizontal translation stage for adjusting resting tension or resting length. Also included are screws to mount the motor to the motor mounting plate extra screws that allow the height of the limb plate, a set of metric Allen keys and an adapter cable for stimulation electrodes. Both the animal plate and the raised limb plate can be temperature controlled by circulating water through these plates. A lab circulating bath can easily maintain the animal and limb plates at the desired physiological temperature. The 806D frame is designed to allow the animal plate to easily be moved with respect to the motor. This allows the system to be adjusted to suit the size of the animal and the desired attachment point on the animal. The animal plate can be locked at the desired horizontal location with thumb screws. Likewise the vertical and lateral position of the motor can also be adjusted through a wide range with the precision adjusting stage.

All parts are manufactured from corrosion resistant materials (anodized aluminum, stainless steel and Delrin). The frame is formed from an extrusion that includes T-slots that allow additional equipment to be easily mounted on the frame. These T-slots also permit the animal plate to be repositioned by simply loosening thumb screws and sliding the component to the new position. Extra T-nuts and screws can be purchased from ASI.

The location of the motor with respect to the tissue can be fine adjusted by using the fine XYZ translation stage connected between the rear rail of the frame and the motor mounting plate. The fine position control allows the resting tension or resting length of the muscle tissue to be easily and accurately set. Once positioned the fine translation stage can be locked in place with the screws located on the sides of each axis of the stage.

The height of the limb plate can be adjusted by removing or adding spacers. The lateral position of the limb plate can also be adjusted to three separate locations. A series of tapped mounting holes, in the limb plate, allow the limb clamps to be positioned over a wide range. The limb plate has also been drilled with 1.0 mm diameter holes that can accept pins/hypodermic needles that can be used to hold the limb in place.

1.1 Specifications

Frame:	IPS anodized extruded aluminum "T" profile
Overall Dimensions:	520 mm L x 425 mm W x 200 mm H
Animal Plate:	Anodized Aluminum
Dimensions:	200 mm L x 400 mm W
Water Fitting:	1/4" Hose ID dry-break quick-connect fitting
Water Fitting:	1/4" push lock
Animal Plate Movement	225mm
Limb Plate:	Anodized aluminum
Dimensions:	88 mm L x 88 mm W
Mounting Holes:	26 – M3 tapped holes on 12.7 mm (0.5") centers
Pin Holes:	21 – 1.5 mm diameter holes on 12.7 mm (0.5") centers
Clamping Fixtures:	Limb clamp with conical fixating screws Limb clamp for 27G Hypodermic Needles Knee clamp with sharpened fixating screws Knee clamp with buttressing delrin pad.
Motor Movement	
Vertical:	70 mm
Horizontal:	Coarse: 235 mm Fine: 2.0 mm/rotation +/-10 mm total travel
Temperature Control:	Animal plate and limb plate have water channels to provide stable temperature control. They incorporate dry-break quick-connect fittings.
Accessories:	<ul style="list-style-type: none">- M6x20mm, M6x25mm, M6x30mm stainless steel socket head cap screws for adjusting platform height- 10mm, 15mm and 20mm spacers for adjusting platform height- M4x10 mm / M3 x 6mm stainless steel socket head cap screws for mounting the motor- metric Allen key set- 2x 27G EMG electrodes & stimulation adapter cable- water circulation tubing (2 6-foot lengths), and dry-break quick-connect fittings for the tubing

2.0 Apparatus Setup

2.1 Unpacking

Unpack the apparatus from the shipping container. The 806D comes completely assembled. Screws are included to mount the Dual Mode motor to the motor mount. Also enclosed in the small separate box are a set of metric Allen keys, the motor mount screws, the drill clamp, spacers and extra screws and electrode adapter cables. In the main shipping container are 2 6-foot lengths of Tygon tubing complete with quick-connect fittings. Remove all parts from the shipping container.

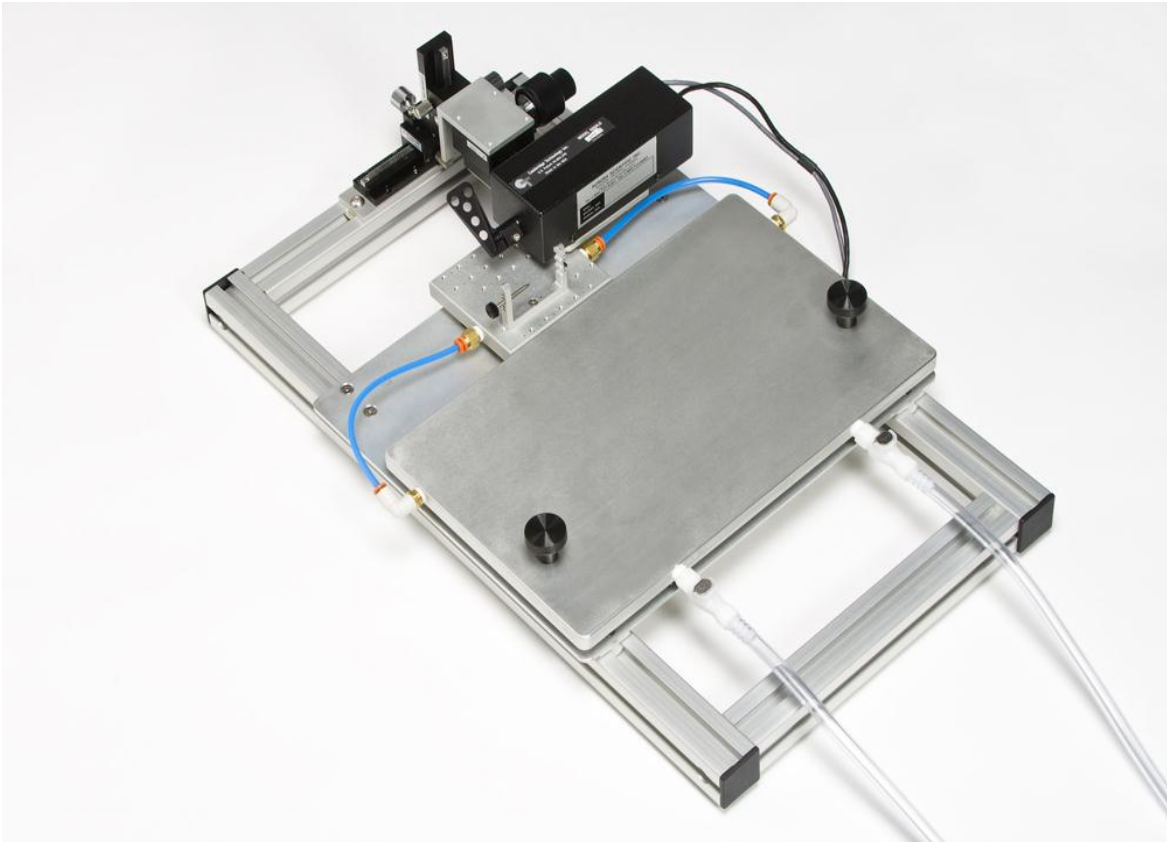


Photo 1 806D with 305C Motor Attached

2.2 Attaching the Motor

Refer to drawing 806D-A001 at the back of this manual and mount the motor on the Motor Mount (6) with the shaft of the motor pointing towards the left side of the apparatus and the lever arm pointing down, or footplate pointing up, also see Photo 1. Remove the four motor mount screws from the package (the 305C mounts with M4 x 0.7 x 10mm socket head cap screws, and the 300C mounts with M3 x 0.5 x 6mm socket head cap screws) and attach the motor to the plate using the metric Allen keys provided.

The lever arm or footplate can be attached before or after the motor is mounted.

Position the motor cable so that it does not get pinched when the animal plate is moved or when the motor is moved either up and down or laterally.

2.3 Attaching the Temperature Controller to the Animal Plate

There are two fluid connectors (11) on the front of the animal plate (9). Two 6-foot lengths of 1/4" ID x 3/8" OD vinyl tubing have been supplied with the mating quick-connectors attached to the tubing. These tubes should be attached to a temperature controlled lab circulator. One connector attached to the supply and the other attached to the return. It doesn't really matter which connector is attached to the supply however the side of the animal plate that is attached to the supply side of the circulator is slightly warmer than the return side. If the animal is positioned on one side of the animal plate it may be best to attach the supply to that side. T fittings are included to allow the water to circulate through both the animal plate and through the limb plate before returning to the circulator.

3.0 Using the 806D – Animal on it's side, one leg on platform

3.1 Adjusting the Position of the Animal Plate

The animal plate (9) is an aluminum plate with a water channel machined inside it. There are 2 locking knobs (10) that lock the plate in place on the frame. Loosen these knobs about 1 turn and then slide the animal plate to the desired position. It is convenient to move the animal plate as far away from the motor as possible while attaching the animal and performing surgery. Once the animal is ready to have the lever arm attached simply slide the animal plate back towards the motor and lock it in the desired position. Fine control of the motor/lever arm position, with respect to the animal, is accomplished using the translation stage located at the back of the 806D (2,3,5) (see section 3.5 for further details of fine positioning).

3.2 Attaching the Animal to the 806D

Muscle mechanics experiments that are done *in situ* often involve resting the anesthetized animal on a temperature controlled platform and then clamping the limb of interest on a second raised platform. The animal plate provides a large surface for resting the animal. If necessary the animal can be held in place using tape, Velcro or other attachment means. If tape is used it is best to avoid having the tape wrap over the aluminum frame as this will prevent movement of the animal plate.

The limb can be located on the Limb plate (13) and held in place using any or all of the clamps provided. Three clamps are included with the 806D. The first clamp features a single conical fixating screw with a mating conical set screw and adjustable horizontal pad that is screwed into the limb platform (see Photo 2). The second clamp has two vertical slots and a shim plate that allow a 25-27 Gauge hypodermic to be clamped vertically between one of the 1.0 mm holes in the limb plate and the clamp (see Photo 3). The third and fourth clamps are strictly for footplate experiments and are U shaped. The knee of the animal is immobilized either by using sharpened screws which fasten into the clamp horizontally or by buttressing the knee against a channel in the side of the clamp (see Photo 4). Either of the clamps can be positioned at any desired position on the grid of M3 tapped holes located in the Limb plate. Note that the both clamps have a 1.0 mm dowel pin protruding from their base. This dowel pin must be inserted into one of the mating holes drilled in the limb platform. Simply remove the screw holding the clamp in place, lift the clamp vertically off of the limb platform and reposition it at the desired location.

The conical fixating screw clamp is used by clamping the bone between the tips of the upper and lower screw. The upper screw is then tightened to keep the bone motionless. The hypodermic needle clamp is used to clamp a 26-27 Gauge needle that has been forced through the joint and left in place. The lower end of the needle is slid into one of the holes in the limb platform and then upper end of the needle is held by a fixation set screw.

The height of the Limb platform can be adjusted by choosing a combination of the black Delrin spacers that support the Limb plate. As shipped, the platform is level with the animal plate. The Limb plate can be lowered adjusted from a minimum of 3 mm to a maximum of 48 mm by using combinations of the spacers. Simply remove the four screws holding the Limb plate to the aluminum base plate then select the desired spacers and reinstall the screws. Different length M6 socket head cap screws are supplied to provide screw lengths appropriate to all heights.

The lateral position of the Limb plate can also be adjusted 54 mm to the right or left of the centerline by mounting the Limb plate in the other tapped holes on the aluminum base plate.

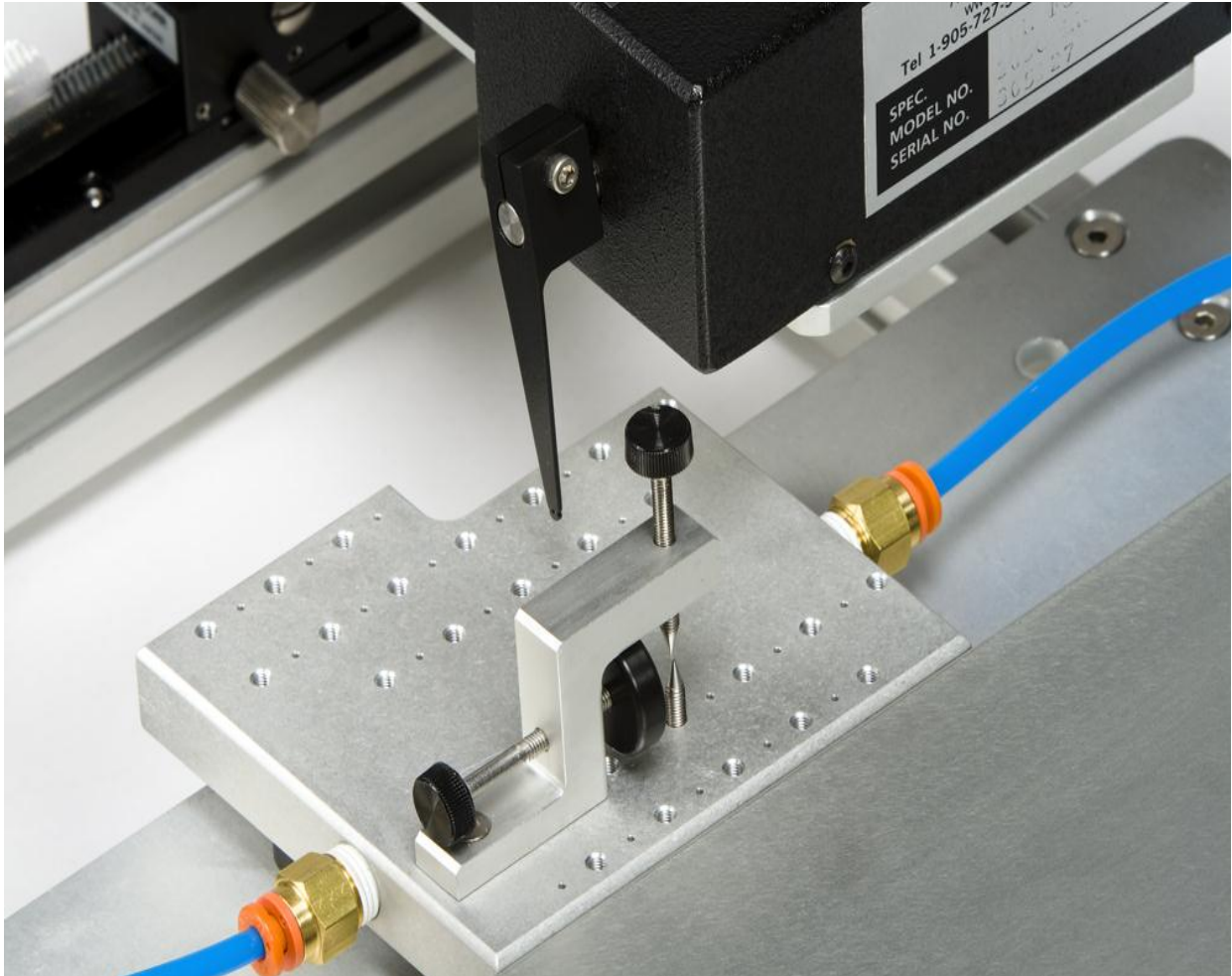


Photo 2 Limb Plate with Screw Clamp



Photo 3 Limb Plate with Vertical Needle Clamp

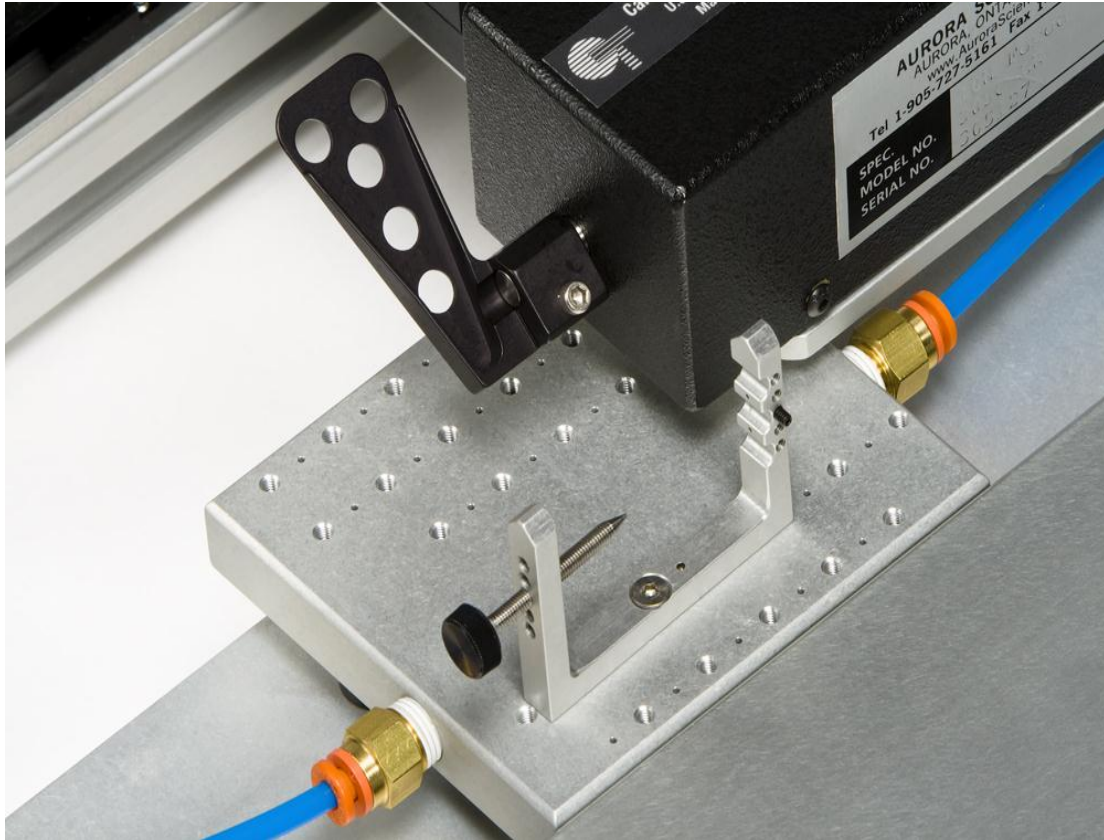


Photo 4 Limb Plate with Knee Clamp and footplate

3.3 Adjusting the Motor Position

The motor will normally need to be positioned prior to attachment of the muscle or tendon to the lever arm. There are three controls that can be used to position the motor with respect to the animal's limb.

The 3 axis position stage can be used to control the up/down and lateral position of the motor. Simply loosen the locking screws/tabs and use the appropriate knobs to finely adjust the motors position in XYZ.

The axis of force application can be further fine adjusted using the fine adjustment knob on its translation stage. This fine adjustment knob provides 2.0 mm of movement per rotation and a total of +/-10 mm of movement. This stage is used to set the resting tension as described in section 3.6.

3.4 Attaching Muscle/Tendon to the Lever Arm

Ensure that the data acquisition program is running on the control computer before attaching muscle tissue. The 300/305C should be turned on and all controls adjusted correctly. This ensures that the arm will be held in the correct starting position and that force and length can be viewed on the computer screen. It is also recommended that the Length Offset potentiometer knob on the front panel of the 300/305C be set to its middle position (5

on the turns-counting dial or 5 turns from either end on older models that don't feature a turns counting dial).

It is recommended that before attaching the muscle the Fine Translation Stage should be adjusted close to the centre of its range of motion. Once the muscle is attached then there will be the up to ± 10 mm of horizontal range of movement available to set the resting length and resting tension of the muscle.

Suture material or wire can be attached to the muscle (normally attached to the tendon) and then attached to the lever arm of the 300/305C. The lever arm has a hole near the tip that can be used for a hook or simply tie the suture through the hole. When attaching the muscle it is not that important to minimize slack in the attachment since this slack can be taken up by a combination of moving the animal plate and moving the translation stage. However the attachment method should offer little extra compliance. One method of attaching the suture to the arm is to fashion an "S" hook from stainless steel wire and then place one end of the hook through the hole in the lever arm. Loop the suture over the other end of the hook when attaching the muscle tissue.

3.5 Attaching the Foot to the Footplate

As is the case when attaching a muscle directly to the lever arm the data acquisition program and controls for the motor should be properly adjusted. Additionally both the offset potentiometer knob and the offset of the Fine Translation stage should be set at their center positions.

The foot of the animal can be secured in the footplate by wrapping a small amount of tape around the plate itself to keep the foot from slipping out. Once the foot has been secured in the footplate and there is no slipping or movement within the footplate itself, the knee of the animal should then be clamped at a desired height and distance from the plate itself.

3.6 Adjusting the Resting Tension

A Fine Translation Stage (Photo 5) is provided to allow the resting length or resting tension to be set. Each rotation of the knob moves the motor 2.0 mm. A locking screw is provided on the side of each axis of the translation stage to lock the stage in position. It is recommended to tighten this screw prior to taking data.

Another method of fine adjusting the resting tension is to use the Length Offset potentiometer knob on the front panel of the 300/305C. This control will move the lever arm back and forth to obtain the desired resting tension. Normally the resting tension is set with the translation stage and then fine tuned with the Length Offset control. You shouldn't need to move the Length Offset knob more than a few minor divisions either way to fine-tune the resting tension.

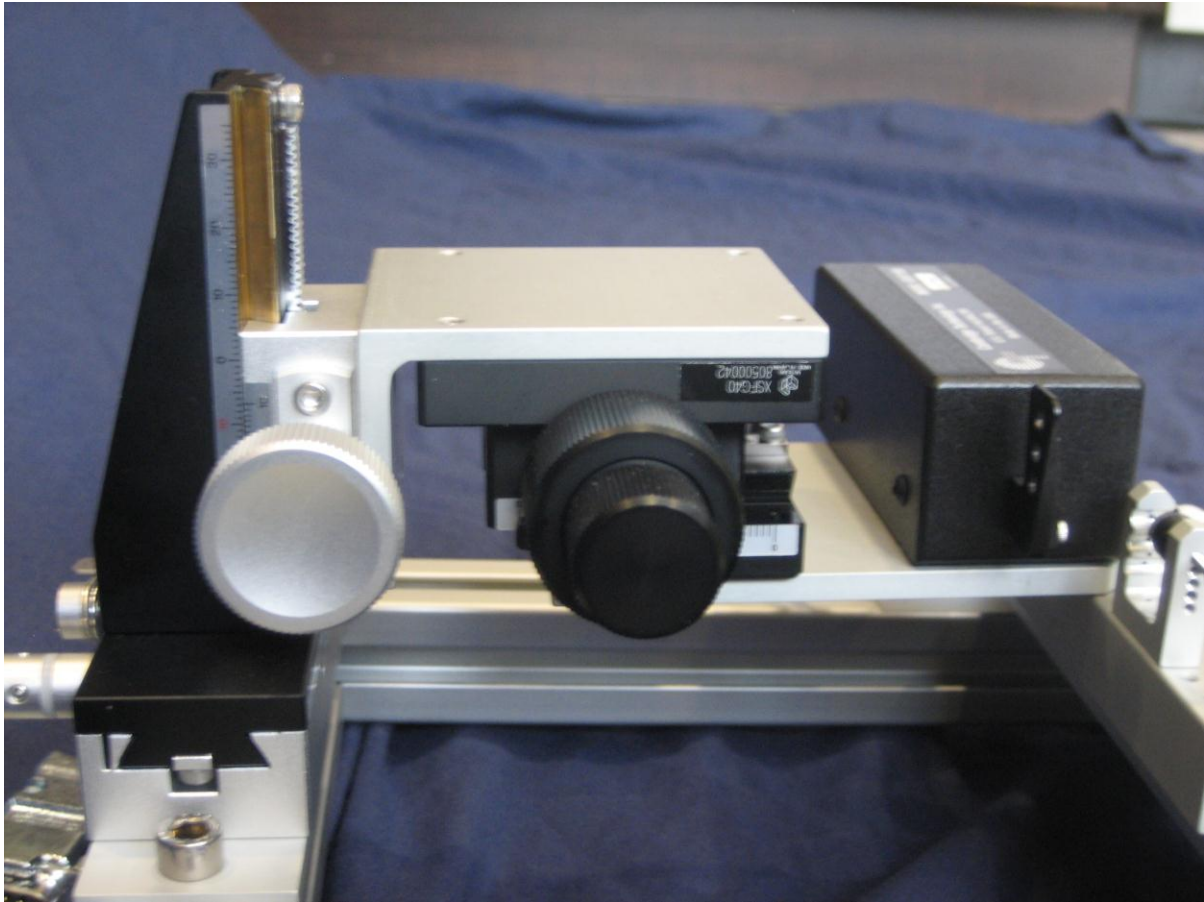


Photo 4 Close-up of Motor Fine Position Stage

4.0 Terms and Conditions for Returning Equipment

1. Aurora Scientific Inc. **will not** accept any equipment returned without prior authorization in the form of a return material authorization number.
2. **Please call Customer Service at (905) 727-5161 or toll free at 1-877-878-4784 to obtain an RMA number. Please specify the product line.**
3. Please package equipment properly. Goods that are damaged in shipment are the responsibility of the shipper.
4. **Aurora Scientific, Inc. withholds the right to assess charges for the repair or replacement of such damaged goods, regardless of warranty status.**
5. Warranty repairs will be shipped back to the customer via FedEx. If you require or request another form of shipment, the cost of such service is your full responsibility.
6. Aurora Scientific, Inc. **will not** be responsible for any return or replacement **shipping charges** incurred due to an incorrect order placed by the customer.

Return Shipping Address:

Aurora Scientific Inc.
360 Industrial Pkwy. S., Unit 4
Aurora, ON, Canada
L4G 3V7
Attn: RMA Returns

5.0 Warranty

The 806D *in situ* Apparatus is warranted to be free of defects in materials and workmanship for three years from the date of shipment. Aurora Scientific Inc. will repair or replace, at our option, any part of the system that upon our examination is found to be defective while under warranty. Obligations under this warranty are limited to repair or replacement of the instrument. Aurora Scientific Inc. shall not be liable for any other damages of any kind, including consequential damages, personal injury, or the like. Disassembly of the unit will void this warranty. Damage to the system through misuse will void this warranty. Aurora Scientific Inc. pursues a policy of continual product development and improvement therefore we reserve the right to change published specifications without prior notice.

Drawings

This section consists of the following drawings:

1) 806D in situ Test Apparatus

AS806D-A001, Rev. 1