



MPM-20

Piezo translator for M3301 and DC3001 micromanipulators

INSTRUCTION MANUAL

Serial No. _____

051210

World Precision Instruments

www.wpiinc.com

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Description

The MPM-20 Piezo Translator is specifically designed for ultra-fast advance of intracellular microelectrodes into tissues that are mechanically unsupported and for impaling cells of small diameter. The heart of the device is a cylindrical piezoelectric ceramic driver element in a sealed metal housing. Precise construction and special vibration stabilizers ensure that the MPM-20 has excellent puncture characteristics. Lateral deviation from the ideal axis of puncture (measured at the tip of the electrode holder) is $\pm 5\%$ of the step size.

The MPM-20 is a complete system consisting of a control unit and the piezo module which is ready for use as received. It requires a 110-volt, 60-Hertz outlet and pulled capillary tips or some other type of microelectrode.

Because the range of travel of the piezo translator is much too limited (single steps of 1 to 20 microns) for it to be useful independently, it must be mounted on a micromanipulator such as WPI's **M3301** or **DC3001**.

Contents

Each unit includes one of each of the following components:

- a. PM20 Controller
- b. Piezo element
- c. Piezo element clamp
- d. PM7 Microelectrode holder
- e. High voltage cable
- f. BNC cable
- g. Instruction manual

Equipment Set Up

Piezo Element Mounting

The piezo element should be mounted in an appropriate micromanipulator. If WPI's DC3001 or M3301 is used, the tool holder which is mounted on the micromanipulator must be removed by unscrewing the two retaining screws on the top. The piezo element clamp can then be mounted in place of the tool holder. Mount the clamp so that the piezo element hangs down beside the motorized axis of the manipulator. Depending on whether the micromanipulator is a right or left handed model only two of the holes will line up. The piezo element should have the end with the microelectrode holder attachment (male screw) facing in the direction of the work station. If it is not facing in the correct direction, loosen one of the two knurled screws on the clamp and remove the other one. The piezo element will now slide out and can be replaced in the opposite direction.

The high voltage cable can now be attached to the piezo element by screwing the mini-coax connector into the piezo element and connecting the TNC plug end into the outlet marked **HIGH VOLTAGE** on the back of the PM20 controller

ATTENTION: Voltages up to 2000 V may exist at some components on the printed circuit board (inside the box) and at the HIGH VOLTAGE output. After switching off the power supply, four capacitors store the high voltage for hours. All high voltage carrying parts are located so that they cannot be touched from the upper side of the printed circuit board.

UNDER NO CIRCUMSTANCES should the printed circuit board be removed from the housing. Refer servicing to qualified personnel.

Although the built-in safety circuit will turn off the high voltage output if no piezo module (capacity) is connected to the control unit, the connector outlets should **NEVER** be touched for safety reasons.

Under no circumstances should any other device be connected to this high voltage output.

The power switch of the control unit should NOT be turned on if the piezo module is not connected.

Microelectrode mounting

A microelectrode should now be prepared and mounted in the PM7 microelectrode holder. Begin by unscrewing both pieces on the tip of the PM7 and exposing most of the silver wire which is mounted inside the holder. The end of this wire (about one inch) should first be chlorided. Replace the first part of the tip. Now mount a pulled pipette tip over the wire and secure it by screwing the outer piece of the holder in place. The microelectrode can be connected to a preamplifier or head stage by pulling apart the pin on the side of the PM7 and soldering the removable male end to a short wire. Once the microelectrode is prepared, screw the holder onto the end of the piezo element and plug it into the preamplifier.

Control Elements

Front Panel LEDs

POWER ON Lights up when Power Switch **POWER ON** is switched on. If this LED does not light up after switching on check the power connection and the fuse.

PIEZO ON Lights up when the piezo is triggered. The high voltage output carries up to 2000 volts.

H.V. OFF Lights up if the built-in safety circuit deactivates the high voltage output, e.g., when the high voltage connection to the piezo module is interrupted. To reactivate the high voltage turn the power switch off and on again.

Front Panel Controls

STEP SIZE The step made by the piezo module can be preset from 0 to 20 microns continuously.

PIEZO SPEED (forward) The piezo forward speed can be preset from 1 to 100 mm/sec continuously.

PIEZO SPEED (reverse) The piezo backward speed can be preset from 1 to 50 mm/sec continuously.

Inputs and Outputs

TRIGGER INPUT	The piezotranslator can be triggered with an upward TTL-slope.
TRIGGER OUT	After the tip of the piezo has carried out the selected step the level of TRIGGER OUT switches from "low" to "high" (+5 volt) and remains so until the piezo is reset.
RESET IN	To activate this input it is necessary that the signal to this input is switched to "high" less than 0.5 msec after the signal of TRIGGER OUT has switched to high. In this case the piezo stays activated until a negative-going edge to this input resets the piezo.
REMOTE (front panel)	This 8-pin connector encloses a chatter-proof input for a remote control.
REMOTE (rear panel)	This 6-pin jack includes the same input as TRIGGER INPUT and also a chatter-proof input for an external switch (remote control).

Operation

Once the setup is complete, operation of the MPM-20 is relatively straightforward. Select the desired step size and the forward and reverse speed for the piezo element. The piezo-step can be triggered by the push button (**START**) on the front panel, by remote control (**REMOTE**) or by a positive TTL-pulse into **TRIGGER INPUT** at the rear panel. The piezo manipulator can also be triggered by another unit (e.g., injection units) using the inputs **REMOTE** on the rear panel or using the BNC jack **TRIGGER INPUT**.

The interval between two successive steps must exceed one second. The high voltage may otherwise break down.

There are two possible settings for triggering a piezo-step. If the sliding switch below the push button **START** is in the left position the tip of the piezo module stays advanced as long as the push button is held down or a positive signal is applied to **TRIGGER INPUT**. If the sliding switch is in the right position the tip of

the piezo module remains advanced even after the push button is released or the positive signal to **TRIGGER INPUT** is removed. The tip returns after pressing the button again or after applying a new signal ("toggle").

The tip of the piezo module does not remain in its forward position for an unlimited length of time because the piezo is electrically coupled to the high voltage source

by a capacitor, which discharges slowly. Depending on the step size the holding time (maximum step) is at least 2 minutes. For smaller steps the time increases by 2 minutes/micron.

Connecting an Injector

There are three ways an injector can be combined with the MPM-20.

1. The Injection Unit triggers the Piezo Manipulator

If the injection unit delivers a positive TTL-signal during the injection phase the TTL-output must be connected to **TRIGGER INPUT** or to the 6-pin jack **REMOTE**, both at the rear panel. The sliding switch below the button "START" must be in the left position.

2. The Piezo Manipulator triggers the Injection Unit

If the injection unit has a TTL-input for starting the injection process with an upward slope, the BNC-plug **TRIGGER OUT** at the front panel must be connected to this input.

3. The Piezo Manipulator triggers the Injection Unit and the Injection Unit resets the Piezo Manipulator

This combination is provided for using the **PV820 Pneumatic PicoPump**. The BNC-plug **TRIGGER OUT** of the piezo manipulator unit must be connected to the BNC-plug **EXT. INPUT** of the PV820 PicoPump and the plug **RESET IN**, to the output **MONITOR**.

After the piezo module has executed the complete step the upward slope of the signal of **TRIGGER OUT** starts the PicoPump. If the switch on the PicoPump is positioned at **GATED** the injection process continues as long as the piezo is activated. If the switch is positioned to **TIMED** the PicoPump resets the piezo (**MONITOR...RESET IN**) after the injection process has been terminated.

Service

The PM7 microelectrode holder may be replaced if broken. The unit operates on 100-120 V or 200-240 V AC (50/60 Hz, 8 W). The line voltage selector is inside the case. To change the range unplug the power cord, open the case (four screws on the bottom) and switch the voltage selector near the transformer with a screwdriver. Under no circumstances should the four trimmers inside the case be adjusted. This unit is protected by a 63 mA slow blow fuse which is easily accessible from the rear side of the case. Under the transformer is a thermal fuse (104°C). This can only be replaced by the manufacturer.

Accessories

The PM7 microelectrode holder can accommodate glass pipettes of 1.0 mm, 1.2 mm and 1.5 mm outer diameter. WPI provides several types of glass in these diameters.

Warranty

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

- Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim settles. In some instances, photographic documentation may be required. Some items are time sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container.
- WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.
- Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.
- Goods returned for repair must be reasonably clean and free of hazardous materials.
- A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.
- Equipment which was built as a special order cannot be returned.
- Always refer to the RMA# when contacting WPI to obtain a status of your returned item.
- For any other issues regarding a claim or return, please contact the RMA department.

Warning: This equipment is not designed or intended for use on humans.

** Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*



World Precision Instruments, Inc.

USA

International Trade Center, 175 Sarasota Center Blvd., Sarasota FL 34240-9258
Tel: 941-371-1003 • Fax: 941-377-5428 • E-mail: sales@wpiinc.com

UK

Astonbury Farm Business Centre • Aston, Stevenage, Hertfordshire SG2 7EG
Tel: 01438-880025 • Fax: 01438-880026 • E-mail: wpiuk@wpi-europe.com

Germany

Zossener Str. 55, 10961 Berlin
Tel: 030-6188845 • Fax: 030-6188670 • E-mail: wpide@wpi-europe.com

Japan

Physio-Tech Co., Ltd.
1-6-3 Iwamoto-cho, Chiyoda-ku, Tokyo 100-0032
Tel: 81-3-3864-2781 • Fax: 81-3-3864-2787 • E-mail: sales@physio-tech.co.jp

Australia

Coherent Life Sciences Pty. Ltd.
116 Sir Donald Bradman Dr • Hilton, South Australia 5033
Tel: (03) 9887-6262 • Fax: (03) 9887-9585 • E-mail: wpi.au@ozemail.com.au

China & Hong Kong

WPI Shanghai Trading Co., Ltd.
Rm 20a, No8 Dong Fang Rd., Lu Jia Zui Financial District, Shanghai PRC
Tel: +86 688 85517 • E-mail: chinasales@china.wpiinc.com

Internet

www.wpiinc.com