PROFILING

Manual Micromanipulator (MM)









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Specification:

Manual Micromanipulator for use with NTH and IMP microsensors

Document filename: IM MM dv2

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1 Preface

You have chosen a new, innovative technology for measuring oxygen and pH.

Chemical optical oxygen & pH microsensors (also called optrodes) have several important features:

- They are small and only minimally invasive.
- Their signal does not depend on the flow rate of the sample.
- They allow measurements with high spatial resolution.

Therefore, they are ideally suited for the examination of small sample volumes. A set of different microsensors is available to make sure you have the sensor which matches your application.

Please feel free to contact our service team to find the best solution for your application.

Your PreSens Team

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE WORKING WITH THIS DEVICE. WHEN DISREGARDING THESE INSTRUCTIONS THE SAFETY OF THE DEVICE CAN BE IMPAIRED.

2 Description of the Manual Micromanipulator



Fig. 1 Manual Micromanipulator with NTH

The Manual Micromanipulator is specifically designed for PreSens needle-type housed (NTH) microsensors. The system allows moving the microsensor vibration-free in 3 axes with μm reading accuracy. A solid base plate ensures a stable set-up of the micromanipulator and enables safely tilting the whole system up to 90° - so it can be used in any required position. With the safe-insert function the microsensor retracted in its steel needle can be securely inserted into your area of interest; the sensor tip can then be extended with a precise, specially designed mechanism, without risk of breaking the sensor fiber. The Manual Micromanipulator enables exact localization of the microsensor in the sample, and allows profiling in step sizes down to 10 μm .

Features

- Micromanipulation in 3D
- Fine drive with μm reading accuracy
- 10 µm resolution
- Vibration-free due to proven bearing technology (Maerzhaeuser)
- 90° tilting mechanism
- Safe-insert function

2.1 Scope of Delivery



Fig. 2 Case (5) with all delivered equipment: (1) Manual Micromanipulator, (2) clamp for bare fiber microsensors, (3) Allen key, (4) key for knurled screw.

Scope of Delivery

- Manual Micromanipulator with attached base plate
- Clamp for bare fiber microsensors
- Allen key (size 3.0)
- Key for knurled screw

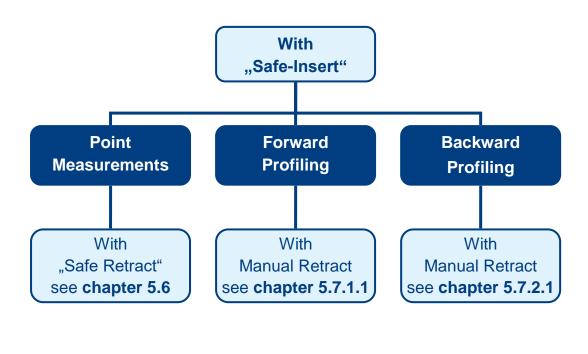


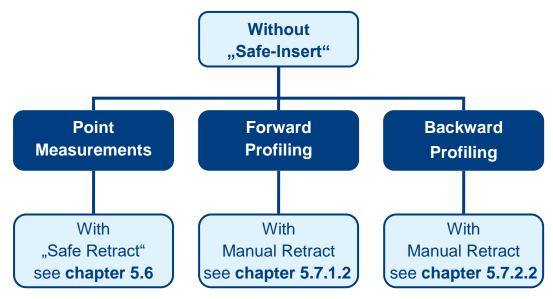
Fig. 3 Manual Micromanipulator: Naming of single parts

2.2 Use Guide

This use guide describes the basic operational functions of the Manual Micromanipulator with NTH microsensors.

- Please note that not all functions may be available with every NTH sensor model.
- It is recommended to always apply the safe-insert function for placing the microsensor inside semi-solid or solid samples.





3 Set-Up Adjustment

Make sure the Manual Micromanipulator is placed on a flat, clean surface, and all four nonslip rubber bumpers on the base plate are touching the surface to guarantee vibration-free operation.

3.1 Rotation of the Micromanipulator

The orientation in which the Manual Micromanipulator rests on its base plate can be adjusted to your measurement set-up. To do so:

1. Loosen both locking screws at each side of the tilting platform (see Fig. 4), and tilt the micromanipulator, until you can comfortably reach the knurled screw below, which fixes the tilting platform to the base plate.

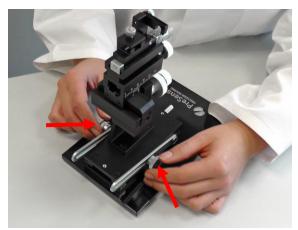


Fig. 4 Loosening both locking screws to tilt the Manual Micromanipulator

2. Insert the delivered key for the knurled screw in the respective hole on the screw head (see Fig. 5) and loosen the screw (it is not necessary to remove it completely).

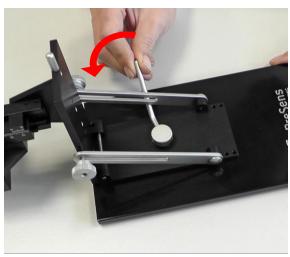


Fig. 5 Loosening the knurled screw with the delivered key.

3. Adjust the orientation of the Manual Micromanipulator as required by your measurement set-up.

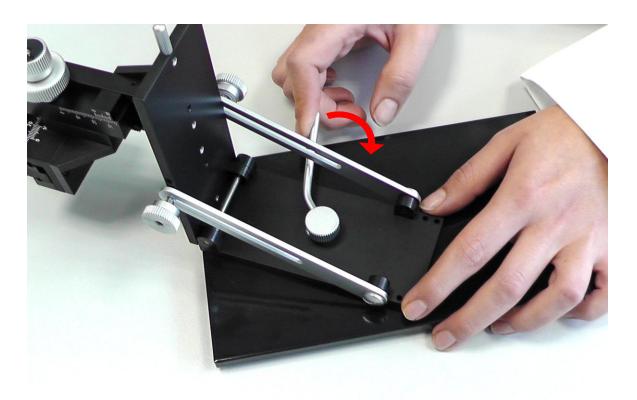


Fig. 6 Fastening the knurled screw after the orientation is adjusted.

4. Then tighten the knurled screw again using the key (see Fig. 6). Tilt back the micromanipulator and fasten the locking screws on both sides of the tilting platform.

Make sure the tilting platform is reattached firmly to the base plate, to guarantee vibration-free operation.

3.2 Micromanipulator Position on Tilting Platform

The position of the Manual Micromanipulator on the tilting platform can be adjusted, if required by your measurement set-up, or by your microsensor's needle length. To do so:

1. Loosen both screws that attach the Manual Micromanipulator to the tilting platform (see Fig. 7) with the Allen key.

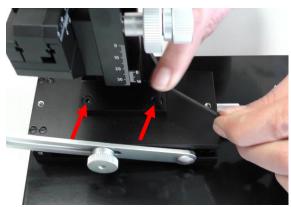


Fig. 7 Loosening the screws at the micromanipulator base

2. There are four threaded holes in the tilting platform, giving you two more options to adjust the micromanipulator's position (see Fig. 8). Choose the position required for your measurement set-up. Place the Manual Micromanipulator so that the screw holes at its base match those in the tilting platform and fasten it with the two screws.

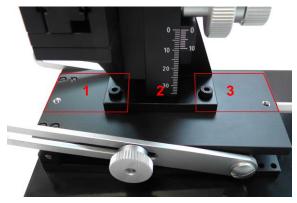


Fig. 8 Options for positioning the Manual Micromanipulator on the tilting platform

Make sure the Manual Micromanipulator is reattached firmly to the tilting platform, to guarantee vibration-free operation.

4 Mounting the Microsensor

The Manual Micromanipulator is specifically designed for PreSens needle-type housed (NTH) microsensors, but can also be used with implantable (IMP) microsensors, using the clamp for bare fiber microsensors. The safe-insert function will only work with NTH microsensors.

4.1 Mounting a Needle-Type (NTH) Microsensor on the Micromanipulator

Do not remove the transport block, or the protective plastic cap covering the needle of the NTH before mounting the microsensor. The sensor fiber is very fragile and could break when not secured inside the needle housing.

4.1.1 Mounting an NTH Microsensor without Safe-Insert

If you do not wish - or do not need - to use the safe-insert function, you can simply place your needle-type microsensor in the sensor holder. Fasten the holder with the screw on top, so the microsensor is attached firmly to the micromanipulator and cannot slide back and forth or even wedge in the holder.

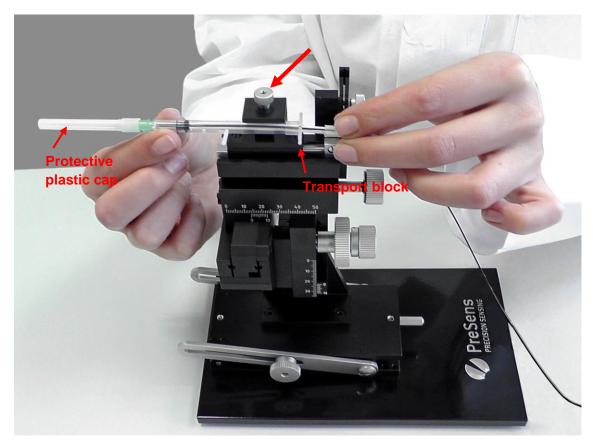


Fig. 9 Placing an NTH into the sensor holder on the Manual Micromanipulator; use the screw on top to close the holder and fix the NTH in place. Do not remove the protective plastic cap and transport block of the NTH before mounting.

4.1.2 Mounting an NTH Microsensor with Safe-Insert

1. Put the sliding table in the "front position", as shown in Fig. 10 (A), using the micrometer screw for the fine drive. Then open the sensor holder and plunger fixing by loosening the respective screws (B, C).

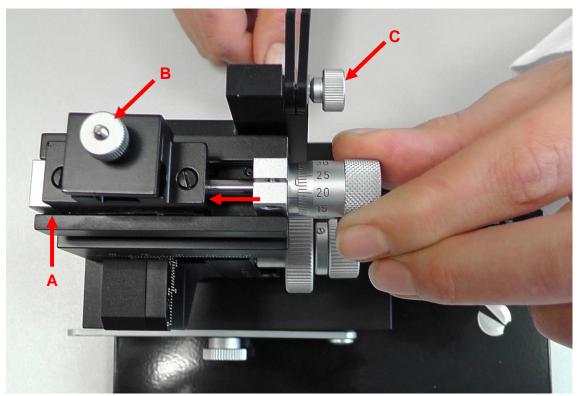
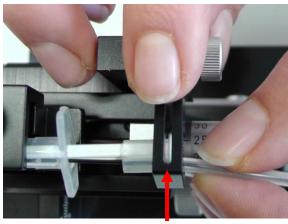


Fig. 10 Sliding table in "zero position"

2. Then place the microsensor in the sensor holder (do not close the holder yet), and attach the plunger fixing to the syringe plunger of the NTH. The plunger end must be clamped inside the fixing (see Fig. 11). Closing the thumbscrew on the plunger fixing, will press the two sides of the fixing together and hold the plunger end in place.



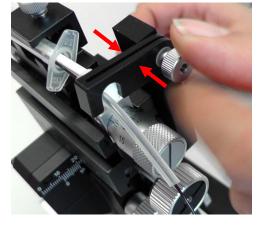


Fig. 11 Inserting and fixing the plunger

- Make sure to close the plunger fixing tightly. If there is a margin for the plunger to move, the fine drive will not work with the desired reading accuracy.
- 3. Now close the sensor holder.
- I The mounting has to end flush with the protruding edge of the syringe barrel (see Fig. 12).

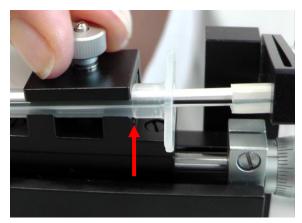


Fig. 12 The edge in the syringe barrel ends flush with the sensor holder.

4.2 Mounting an Implantable (IMP) Microsensor on the Micromanipulator

A special clamp is delivered with your Manual Micromanipulator, to attach an implantable microsensor.



Fig. 13 Clamp for bare fiber microsensors

Upon delivery the bare fiber and sensing tip of an IMP microsensor are protected by a glass housing. The fiber is prevented from slipping out of this housing by protective tubing. Loosen the protective tubing and carefully remove the IMP from the glass housing.

- Handle the IMP microsensor with care when it is removed from the glass housing. The glass fiber and sensor tip are very fragile and might break or get damaged when unprotected!
- 1. Take the clamp for bare fibers and loosen the thumbscrew in front.
- 2. Place the IMP microsensor in one of the two notches at the front of the clamp.

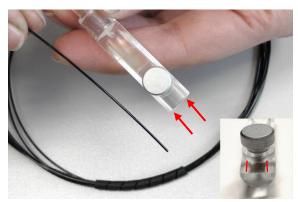
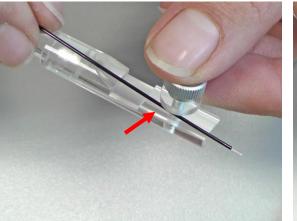


Fig. 14 Implantable oxygen microsensor and clamp for bare fiber microsensors; insert: clamp front – notches marked red.

Insert the IMP from the side. Do not try to thread it into the notch from the back or the top, because whenever the fiber or sensor tip touches a surface it might get damaged or break.



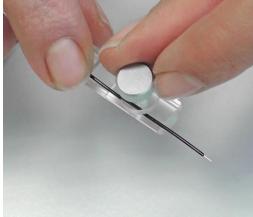


Fig. 15 Insert the IMP from the side and fix it in position by closing the thumbscrew.

- Close the screw on the clamp, so the sensor fiber is securely fixed in position within the notch.
- 4. Open the sensor holder and plunger fixing loosening the respective thumbscrews. Then place the narrow part of the clamp with installed IMP in the sensor holder and close the holder with its thumbscrew.

Make sure the sensor fiber of the IMP does not get caught in the sensor holder; the fiber might get damaged when fastening the holder.

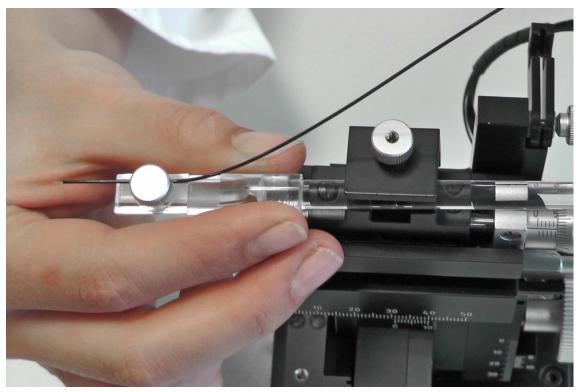


Fig. 16 Placing the clamp with attached IMP in the sensor holder. The sensor fiber should not get caught in the holder.

5 Operation of the Micromanipulator

5.1 Measurement Preparation

Remove the transport block and the protective plastic cap that covers the needle.

Make sure to hold the plastic base of the needle (not the syringe itself), so it does not come off when removing the cap.



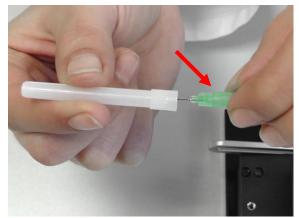


Fig. 17 Remove the transport block and protective plastic cap.

The sensor tip must be retracted in its needle housing, when inserting the microsensor into semi-solid or solid samples, else the sensor fiber might break.

5.2 Tilting

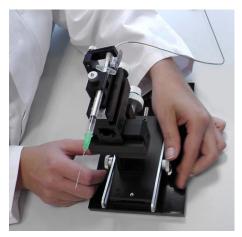
The Manual Micromanipulator can be tilted at an angle of up to 90°.



Fig. 18 Manual Micromanipulator tilted in 90° angle.

Adjust the tilting angle by loosening the locking screws on both sides of the tilting platform. Then move the micromanipulator in the desired position and tighten both locking screws firmly.

! Make sure the locking screws are tightened properly, so the micromanipulator does not change its angle or tip over during measurements, which will damage the equipment and can even cause injury.



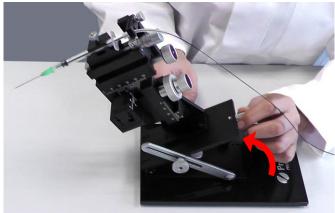


Fig. 19 Adjusting the tilting angle: Loosen the locking screws and tilt the Manual Micromanipulator in the desired position. Then tighten both locking screws.

5.3 3D Movement

Use the control knobs for x-, y-, and z-axis (see Fig. 20) to adjust the microsensor in roughly the right position. Coarse adjustments can be performed with 0.1 mm reading accuracy.

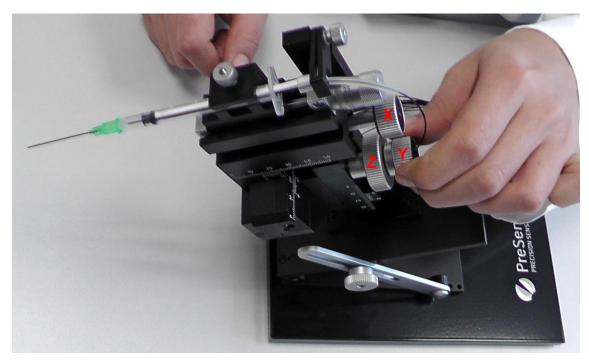


Fig. 20 Coarse adjustment of the y-axis.

5.4 Fine Movement (x-axis)

Fine adjustment of the x-axis is performed with the micrometer screw on top, moving the sliding table with the mounted microsensor in 10 μ m reading accuracy. One rotation hereby corresponds to a movement of 500 μ m.

Please note, if you are using the safe-insert function, the micrometer screw will pull back the sensor housing while the position of the sensor tip will remain unchanged. Remove the plunger fixing, so you can move the sensor with the fine drive.

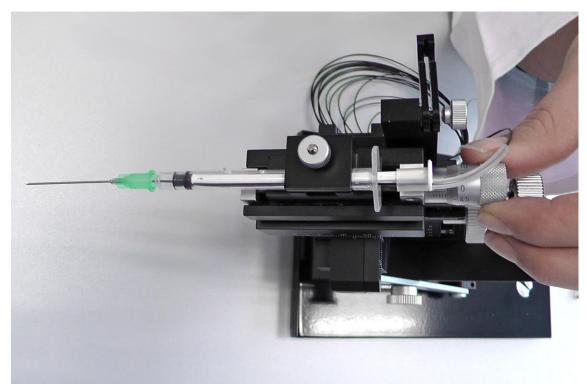


Fig. 21 Fine adjustment with micrometer screw; the plunger fixing must be open.

5.5 Safe-Insert Function

It is recommended to use the safe-insert function when inserting an NTH sensor in semi-solid or solid samples, such as in food, packaging or animal physiology applications. Most of these samples are non-transparent, therefore we recommend to apply the following procedure:

Mount the NTH sensor according to the description in chapter 4.1 using the plunger fixing.

Before you insert the microsensor into your sample, define the desired extension length of your sensor first. To do so, turn the micrometer screw for fine adjustment, so the sliding table moves backwards and pulls back the needle housing from the sensor fiber. Note the retraction length, or count the number of turns until the sensor tip is as far extended from the

needle as you wish. Cover the sensor tip again with the needle housing, turning the micrometer screw the other way.

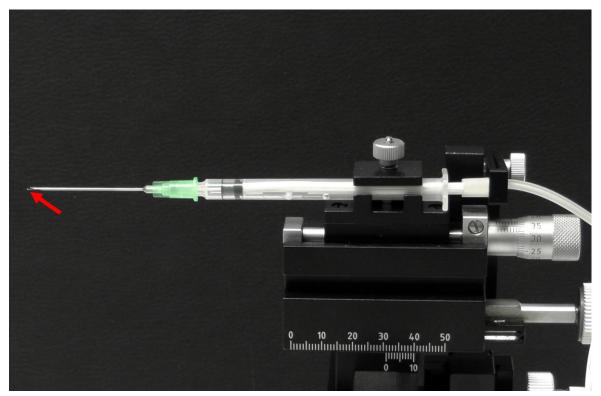


Fig. 22 Needle-type microsensor with sensor tip extended

Then move the microsensor with retracted sensor tip in the desired position inside your sample by using the x-, y-, and z-axis control knobs of the coarse drive. When the needle tip is in the right position, you can use the micrometer screw to pull back the needle housing from the sensor tip. Use the noted retraction length or the turn count you made previously to be sure the sensor tip is as far extended as you intended.

Now you can conduct measurements at the exact location you have chosen inside your sample.

Please make sure that not only your Manual Micromanipulator, but also your sample is positioned immobile and vibration free during measurements.

5.6 Safe Retract

When you have used the safe-insert function and are now finished with your measurements, reattach the plunger fixing and use the micrometer screw to again cover and protect the fragile sensor tip.

In case you insert the sensor without safe-insert function and want to use safe retract after your measurements, this will take some practice. The microsensor has to be placed in the right position before measurements so when the measurements are finished the plunger fixing can be attached. Fasten the plunger fixing to the plunger; then the micrometer screw can be used to cover and protect the fragile sensor tip.

Only then use the x-, y-, and z-axis control knobs of the coarse drive to remove the sensor from your sample.

5.7 Profiling

Please mount your microsensor with or without safe insert function according to the descriptions in chapter 4.1.

- It is recommended to apply the safe-insert function for placing the microsensor inside semi-solid or solid samples.
- It is recommended to apply backward profiling when measuring in solid samples, as the sensor tip is very fragile and might break when pushed into the material. Forward profiling is suitable whenever measuring in soft samples.

5.7.1 Forward Profiling

5.7.1.1 Forward Profiling with Safe-Insert

When you are using the safe-insert function insert your microsensor into your sample and extend the sensor tip as described in chapter 5.5. Then remove the plunger fixing from the syringe plunger by opening the respective screw. Turning the micrometer screw clockwise will now move the microsensor forward in step sizes down to 10 μ m.

5.7.1.2 Forward Profiling without Safe-Insert

If you are not using the safe-insert function, make sure the sensor tip is not extended when inserting the microsensor into your sample. Position the microsensor with the control knobs and micrometer screw, until it is in the exact position inside the sample, where you want to start the profiling. Then carefully push forward the syringe plunger of the microsensor to extend the sensor tip. By turning the micrometer screw clockwise the microsensor can now be moved forward in step sizes down to $10~\mu m$.

Once the measurements are finished pull the syringe plunger back to cover and protect the fragile sensor tip. Only then use the x-, y-, and z-axis control knobs of the coarse drive to remove the sensor from your sample.

5.7.2 Backward Profiling

5.7.2.1 Backward Profiling with Safe-Insert

When you are using the safe-insert function insert your microsensor into your sample and extend the sensor tip as described in chapter 5.5. Then remove the plunger fixing from the syringe plunger by opening the respective screw. Turning the micrometer screw anti-clockwise will now move the microsensor backwards in step sizes down to $10 \, \mu m$.

5.7.2.2 Backward Profiling without Safe-Insert

If you are not using the safe-insert function, make sure the sensor tip is not extended when inserting the microsensor into your sample. Position the microsensor with the control knobs and micrometer screw, until it is in the exact position inside the sample, where you want to start the profiling. Then carefully push forward the plunger of the syringe housing of the microsensor to extend the sensor tip. By turning the micrometer screw anti-clockwise, the microsensor can now be moved backwards in step sizes down to $10 \, \mu m$.

Once the measurements are finished, pull the syringe plunger back to again cover and protect the fragile sensor tip. Only then use the x-, y-, and z-axis control knobs of the coarse drive to remove the sensor from your sample.

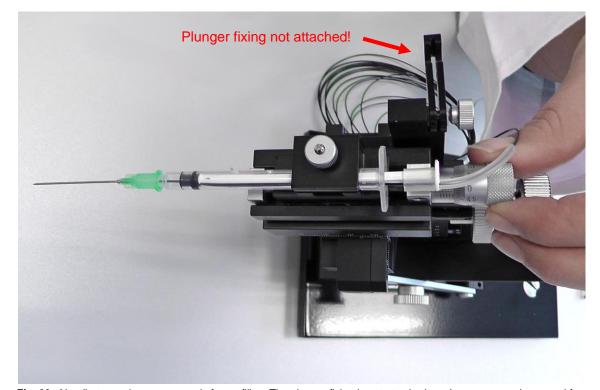


Fig. 23 Needle-type microsensor ready for profiling. The plunger fixing is not attached, so the sensor can be moved forwards or backwards in 10 μm steps.

6 Technical Data

Manual Micromanipulator		
Compatibility	Needle-type housed (NTH) and implantable (IMP) oxygen & pH microsensor	
Dimensions	230 mm x 130 mm x 200 mm	
Weight	Weight w/o base plate: 1100 g	
	Weight with base plate: 3030 g	
Travel range	x-axis: 37 mm, fine drive 10 mm	
	y-axis: 20 mm	
	z-axis: 25 mm	
Reading accuracy	Coarse adjustment: 0.1 mm	
	Fine adjustment: 0.01 mm	
Coarse positioning	x-axis: 70 mm	
Rotatability	360°	
Material	Aluminum & steel	

7 Concluding Remarks

Dear Customer,

With this manual, we hope to provide you with an introduction to work with the Manual Micromanipulator.

This manual does not claim to be complete. We are endeavored to improve and supplement this version.

We are looking forward to your critical review and to any suggestions you may have.

You can find the latest version at www.PreSens.de.

With best regards,

Your PreSens Team



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