

# **MYOGRAPH SYSTEM – 840MD**

**USER GUIDE VOL. 3.0**

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# CHAPTER 1 - MYODYNAMICS MUSCLE STRIP MYOGRAPH OVERVIEW

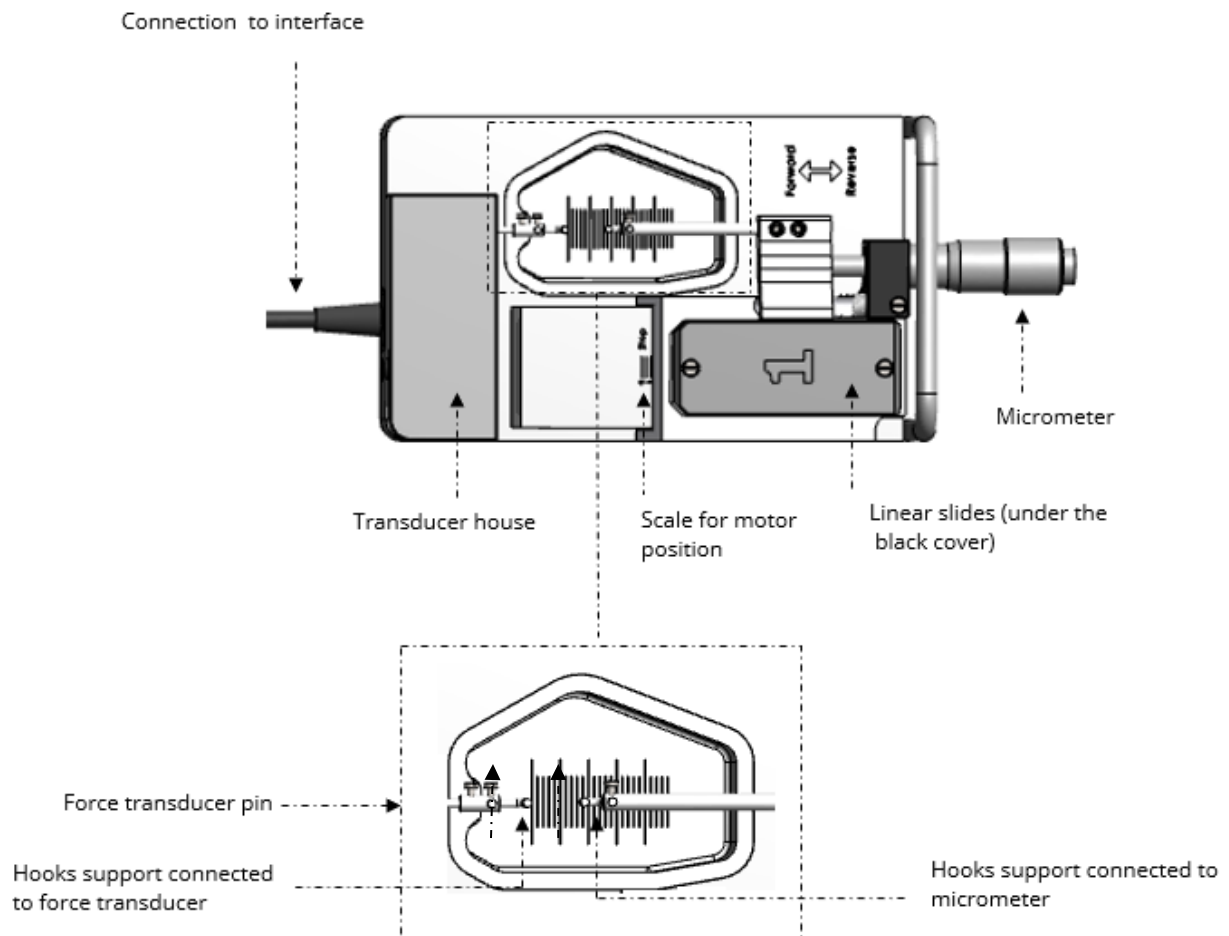


Figure 1.1 MyoDynamics Muscle Strip Myograph with close-up of the chamber

## CHAPTER 2 - SETTING UP MYODYNAMICS MUSCLE STRIP MYOGRAPH

Each chamber contains supports with mounting hooks to facilitate the mounting of muscle strips with sutures. DMT is also able to deliver a large variety of different mounting supports. Please contact DMT Sales to acquire more information about available mounting supports for the MyoDynamics Muscle Strip Myograph.

*IMPORTANT: BE VERY CAREFUL WHEN TIGHTENING THE SUTURE ON THE TRANSDUCER. EXCESSIVE PRESSURE ON THE SCREW OR EXCESSIVE TORQUE FORCE WILL DAMAGE THE FORCE TRANSDUCER.*

## 2.1 CHANGING THE MOUNTING HOOKS (FIGURE 2.1)

1. Use the small screwdriver provided to gently loosen screw “B”.
2. Gently pull the support away from the transducer pin.
3. Loosen screws “A” on the micrometer side with the appropriate fitting Allen key.
4. Pull the support away.

*NOTE: NUMBER THE SUPPORTS WITH THE CHAMBER NUMBER THEY WERE REMOVED FROM USING A PERMANENT MARKER. STORE THE SUPPORTS IN THE PROVIDED PLASTIC CASE. NUMBERING THE SUPPORTS WILL SAVE TIME WHEN THE SUPPORTS ARE REPLACED. IT WILL REDUCE THE AMOUNT OF ADJUSTMENTS REQUIRED AFTER EACH CHANGE.*

### 2.3 ADJUSTMENT OF THE MOUNTING HOOKS

1. Loosen screw “A” to move the micrometer-side pin toward or away from the micrometer and swing the hook to the right or left
2. Loosen screw “B” to move transducer-side pin toward or away from the transducer and swing the hook to the right or left.

*NOTE: BETWEEN THE BACK SIDE OF THE TRANSDUCER PIN AND THE CHAMBER WALL THERE MUST BE A SMALL GAP OF 0,1 TO 0.3 MM.*

3. Loosen screw “C” to vertically align the hook on the micrometer side and rotate the hook.
4. Loosen screw “D” to vertically align the hook on the transducer side and rotate the hook. Screw “D” is the screw on the transducer side support that is furthest away from the transducer.

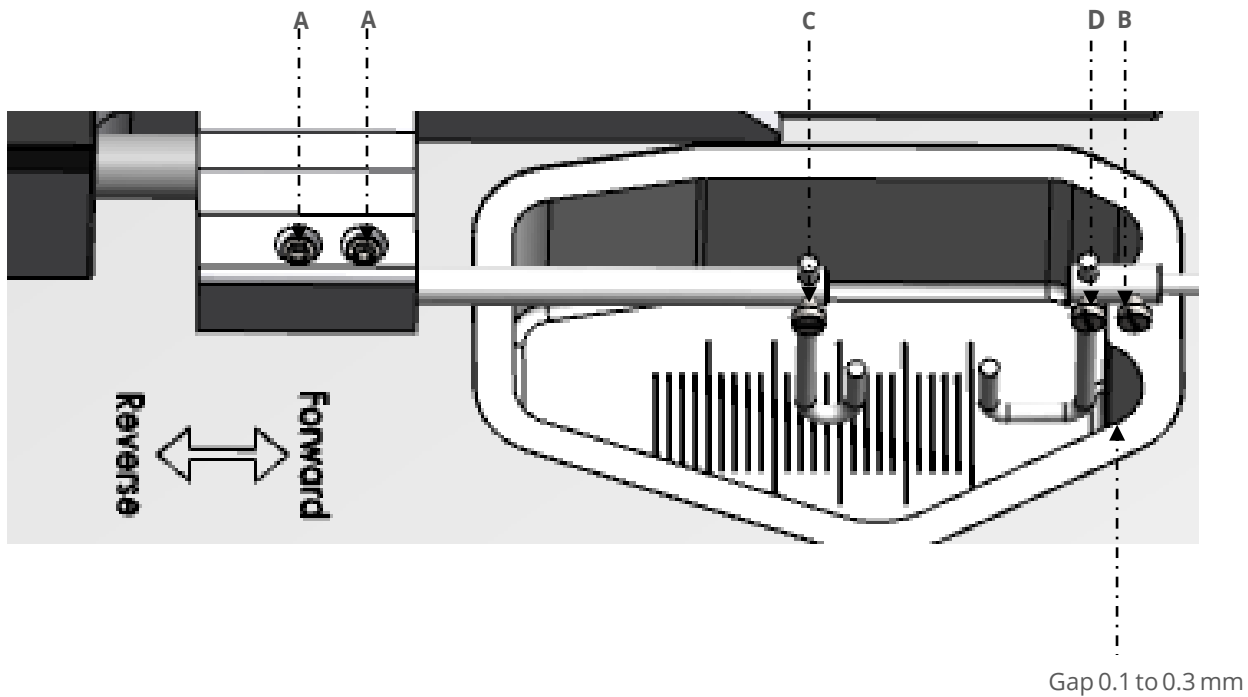


Figure 2.1 – Changing and adjusting the hooks

## **2.3 THE FIRST FORCE CALIBRATION**

Prior to shipping the MyoDynamics Muscle Strip Myograph is subjected to two days of continuous testing, including a final force calibration. However, DMT recommends that a new force calibration is performed before using the MyoDynamics Muscle Strip Myograph for the first time. The force calibration procedure is described in detail in chapter 3.6.1 Force calibration in MyoDynamics Muscle Strip Myograph System - User Manual.

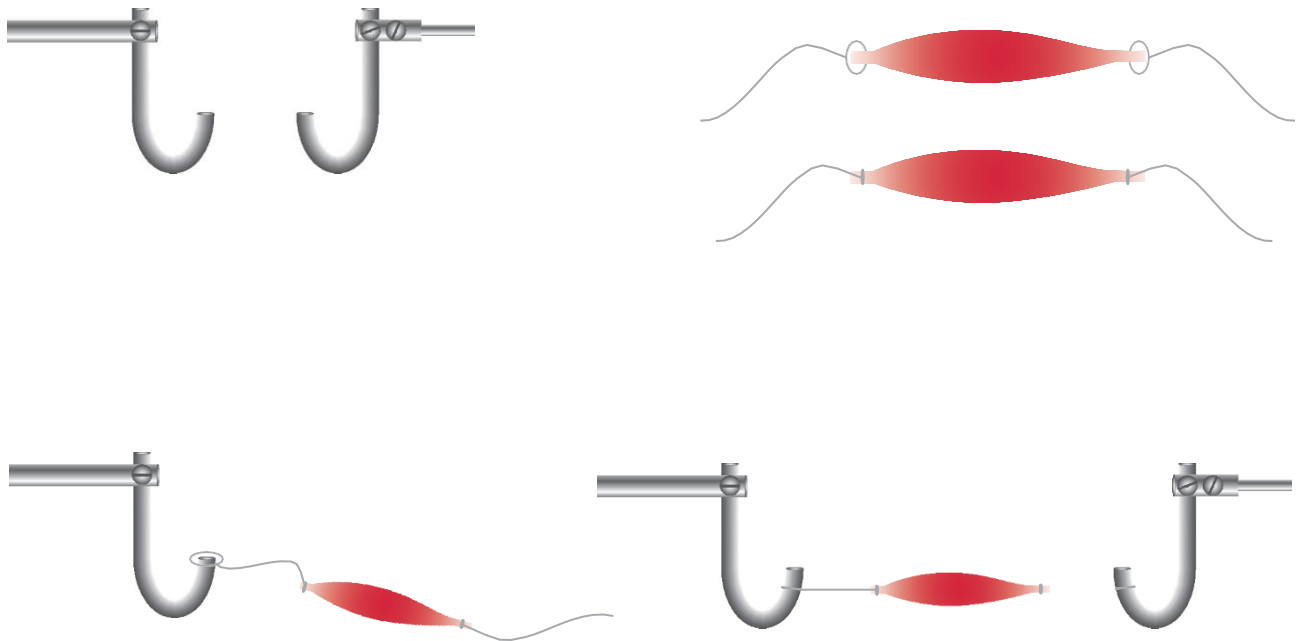
# CHAPTER 3 - EXPERIMENTAL SET-UP

This Chapter contains experimental set-up examples and recommendations to do proper isometric force contraction studies of isolated striated muscle using the DMT 840MD Myograph.

## 3.1 MOUNTING PROTOCOL

Each chamber contains supports with mounting hooks to facilitate the mounting of muscle strips in the myograph chambers.

1. Make a loop with nylon suture to use for securing the muscle to the hook. Double loops are best and will prevent the loops from slipping loose once tightened.
2. Position the sutures appropriately on both hooks so that they are ready for use when the muscle is mounted.





In User Guide “How to measure isometric force of striated muscle in vitro in an 820MS or 840MD Myograph”, we have examples with tips, tricks and how to do a proper ‘normalization’ of the mounted muscle before doing the real experiments.

It is important to read this guide before continuing with the experiments.

# CHAPTER 4 - CLEANING AND MAINTENANCE

## 4.1 CLEANING THE MYODYNAMICS MUSCLE STRIP MYOGRAPH

*NOTE: DMT STRONGLY RECOMMENDS THAT THE MYODYNAMICS MUSCLE STRIP MYOGRAPH CHAMBERS AND SURROUNDING AREAS ARE CLEANED AFTER EACH EXPERIMENT.*

At the end of each experiment, use the following procedure to clean the chambers and supports.

1. Fill the chamber to the edge with an 8% acetic acid solution and allow it to work for a few minutes to dissolve calcium deposits and other salt build-up. Use a cotton-tipped applicator to mechanically clean all chamber surfaces.
2. Remove the acetic acid and wash the chamber and supports several times with double-distilled water.
3. If any kind of hydrophobic reagents have been used which might be difficult to remove using steps 1) and 2), try incubating the chamber and supports with 96% ethanol or a weak detergent solution (i.e. 0.1% triton-100).
4. To remove more resistant or toxic chemicals, incubate the chamber and supports with 1M HCl for up to 1-2 minutes. In exceptional cases, incubate the chamber and supports with no stronger than a 3M HNO<sub>3</sub> solution for about 1-2 minutes.
5. Wash the chamber and supports several times with double-distilled water.
6. If acids such as 1M HCl and 3M HNO<sub>3</sub> are used to clean the chambers, make sure ALL surfaces are thoroughly dried after repeated washes with double-distilled water. Any residual acid will cause corrosion of the hooks.

To prevent the tubing from becoming blocked with buffer salt deposits after an experiment, remove the chamber cover and turn on the vacuum and press the vacuum valve button for about 10 seconds. Turn off the vacuum and gas supply. Remove any water or buffer remaining in the chamber or on the tubing using absorbent paper.

If red or brown discolorations appear on the chamber sides or on the supports, the following cleaning procedure will work in most cases:

*IMPORTANT: BE VERY CAREFUL USING HCL OR HNO<sub>3</sub> BECAUSE THESE ACIDS MAY CAUSE EXTREME DAMAGE TO THE STAINLESS STEEL CHAMBERS AND SUPPORTS. DO NOT USE BLEACH TO CLEAN THE CHAMBERS. REPEATED USE OF CHLORINATED SOLUTIONS SUCH AS BLEACH AND HCL WILL CAUSE DAMAGE TO THE STAINLESS STEEL PARTS OF YOUR MYODYNAMICS MUSCLE STRIP MYOGRAPH. AVOID USING THEM IF AT ALL POSSIBLE.*

*AFTER CLEANING, ALWAYS CHECK THAT THE GREASE AROUND THE TRANSDUCER PIN IS SUFFICIENT TO KEEP THE BUFFER AND WATER FROM ENTERING THE TRANSDUCER HOUSING(SEEFIGURE4.1)*

7. Incubate the chamber and supports for 30 minutes with 2mM T-1210 Tetrakis- (2-pyridylmethyl)-ethylenediamine solution dissolved in double-distilled water.
8. Use a cotton-tip applicator to mechanically clean all the affected surfaces during the last 15 minutes of the incubation period.
9. Wash the chamber and supports several times with double-distilled water.
10. Incubate the chamber with 96% ethanol for 10 minutes while continuing the mechanical cleaning with a cotton- tip applicator.
11. Remove the ethanol solution and wash a few times with double-distilled water. Incubate the chamber and supports with an 8% acetic acid solution for 10 minutes and continue the mechanical cleaning with a swab-stick.
12. Wash the chamber and supports several times with double-distilled water.
13. Dry the surfaces using absorbent paper (i.e. Kim-Wipes) or cotton-tip applicators.

*NOTE: IN EXCEPTIONAL CASES, THE HOOKS SUPPORTS MAY NEED TO BE REMOVED FROM THE CHAMBER AND CLEANED INDIVIDUALLY TO ASSURE PROPER CLEANING OF ALL SUPPORT SURFACES. NEVER SOAK THE SUPPORTS IN ANYTHING STRONGER THAN 8% ACETIC ACID FOR EXTENDED PERIODS OF TIME (I.E. SEVERAL HOURS OR OVERNIGHT).*

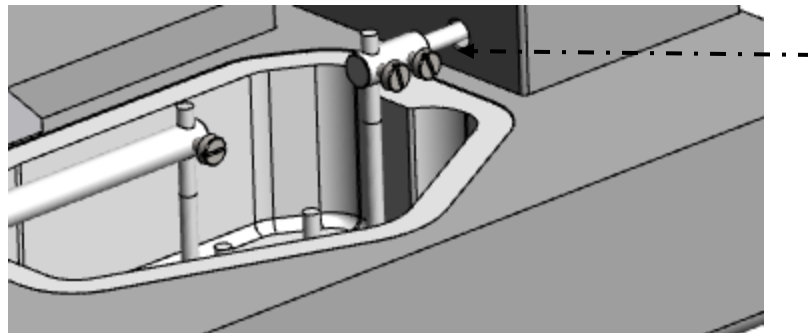
## 4.2 MAINTENANCE OF THE FORCE TRANSDUCER

The force transducer is the most delicate and fragile component of the MyoDynamics Muscle Strip Myograph. Extreme care must be used when handling or touching the force transducers. As a part of daily maintenance, inspect the grease around the transducer pin extending from the transducer housing pinhole (see figure 4.1) before starting any experiment. Insufficient grease in this area will allow buffer and water to enter the transducer housing and cause damage to the force transducer.

*IMPORTANT: DMT RECOMMENDS THAT THE HIGH VACUUM GREASE SEALING THE TRANSDUCER PINHOLE IS CHECKED AND SEALED AT LEAST ONCE A WEEK, ESPECIALLY IF THE MYOGRAPH IS USED FREQUENTLY.*

*DMT TAKES NO RESPONSIBILITIES FOR THE USE OF ANY OTHER KINDS OF HIGH VACUUM GREASE OTHER THAN THE ONE SUPPLIED BY DMT.*

*DMT TAKES NO RESPONSIBILITIES FOR ANY KIND OF DAMAGE APPLIED TO THE FORCE TRANSDUCERS.*



*Figure 4.1 - Close-up of transducer pin extending from the transducer housing pinhole. The arrow indicates the place that the grease needs to be applied to prevent water and buffer from damaging the transducer*

#### 4.2.1 CHECKING THE FORCE TRANSDUCER

The force transducer is a strain gauge connected to a Wheatstone bridge. The force transducers for each chamber are housed in a separate, protective compartment (transducer house). While the protective cover offers some mechanical protection for the force transducers, they are still very vulnerable to applied forces exceeding 2 Newton (200 grams) or fluid running into the transducer compartment due to insufficient greasing of the transducer pinhole. If the force readings on the Interface appear unstable or noisy, then first check that the MyoDynamics Muscle Strip Myographs are connected properly to the Interface and that the MyoDynamics Muscle Strip Myographs are plugged all the way into the Interface. If the force reading(s) are still unstable or noisy, then perform a new calibration of the force transducer. During the new calibration, monitor the relative force reading values on the Interface as described in chapter 3.6.1 Force calibration (step 4 of the calibration procedure) in MyoDynamics Muscle Strip Myograph System - User Manual. The normal operating values for the force transducer during calibration should be between 3000 and 3500.

- If the value is 0, a single digit, or a three digit number, the force transducer is broken and needs to be recompensated at the DMT workshop. Contact a DMT sales representative..
- If the value is less than 1500 or greater than 4500, the force transducer is broken and needs to be replaced.
- If the message "OFF" is displayed on the main page of the Interface, even though the MyoDynamics Muscle Strip Myograph is plugged in at the rear of the Interface, the force transducer is broken and needs to be replaced. In addition, if the force reading(s) appear yellow in color, cannot be reset to zero, AND the transducer cannot be recalibrated, the force transducer is broken and needs to be replaced.

If any other problems related to the force transducer are encountered, please contact DMT for advice or further instructions.

## 4.2.2 FORCE TRANSDUCER REPLACEMENT

If the force transducer breaks and needs to be replaced, follow this step-by-step replacement procedure carefully:

1. Remove the pin from the transducer pin coming out of the transducer housing.
2. Disconnect the MyoDynamics Muscle Strip Myograph from the Interface.
3. Turn the MyoDynamics Muscle Strip Myograph upside down and remove the bottom plate by loosening and removing the screws as illustrated in figure 4.2.

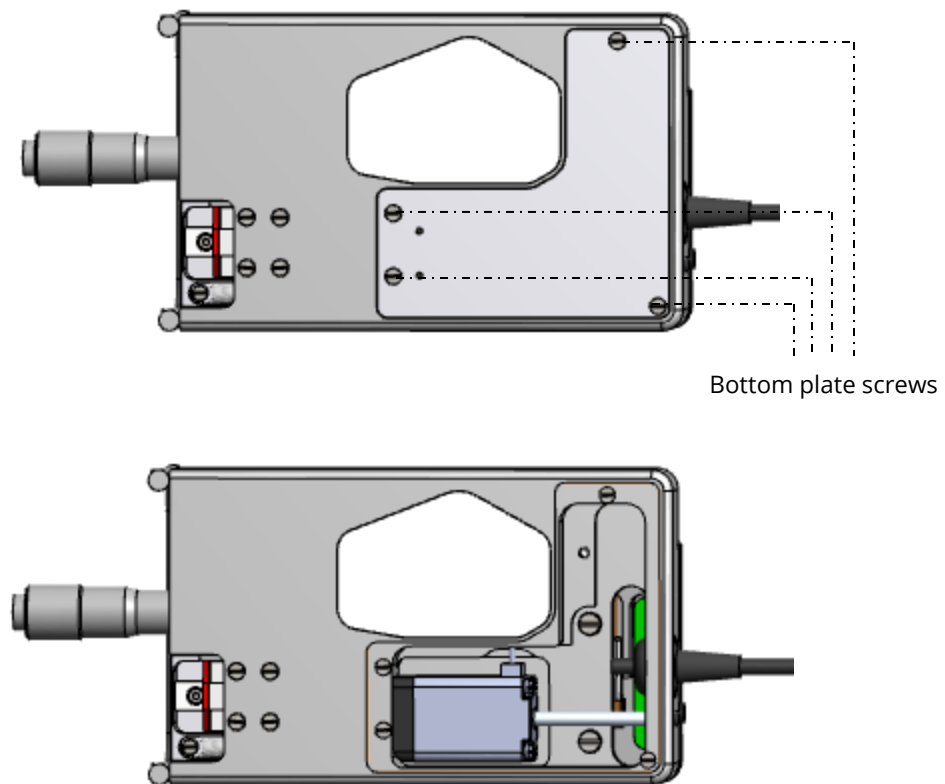


Figure 4.3 - Myograph without the bottom plate

4. Disconnect the connector to the transducer.
5. Remove the two transducer screws that hold the transducer housing, see figure 4.4.

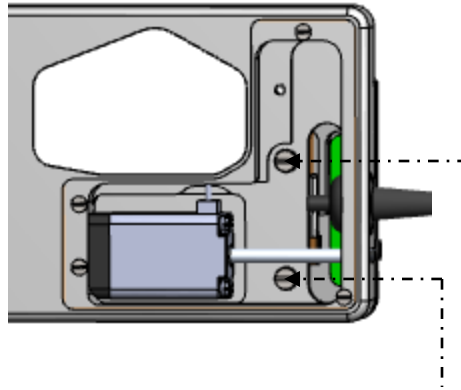


Figure 4.4 - The screws that secure the transducer housing to the chamber

6. The replacement transducer will be shipped with the new transducer inside a new transducer housing.
7. Place a small amount of vacuum grease (clear or whitish grease) around the bottom of the transducer housing to seal when put back in place.
8. Carefully realign the transducer housing with the new transducer on the MyoDynamics Muscle Strip Myograph and reinsert the Allen screws through the bottom of the MyoDynamics Muscle Strip Myograph.
9. Tighten the screws and place some vacuum grease around the transducer pin that protrudes from the transducer housing. Make sure that the hole is completely sealed to prevent buffer solution or water from entering the transducer housing and damaging the new force transducer (see figure 4.1).
10. Reconnect the new transducer connector.
11. Place some vacuum grease at the edge of the bottom plate. Place and tighten the bottom plates.

*IMPORTANT: CALIBRATE THE NEW FORCE TRANSDUCER BEFORE PERFORMING A NEW EXPERIMENT.*

### **4.3 MAINTENANCE OF THE LINEAR SLIDES**

Check the linear slides (under the black covers) for grease at least once a week. In case of insufficient lubrication, grease the slides with the “Grease for Linear Slides” included with your system.



# APPENDIX 1 - READING A MILLIMETRE MICROMETER

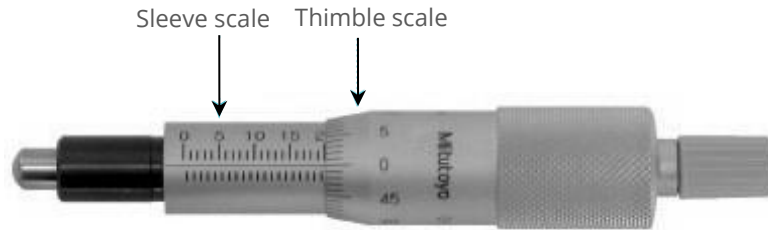


Figure A2.1 Overview of the micrometer parts (actual reading  $20000 \mu\text{m} = 20 \text{ mm}$ )

## SLEEVE SCALE

The micrometer sleeve scale has a total length of 25 mm divided into 50 equal parts. Each part of a division above the horizontal line represents 1 mm, where each 5<sup>th</sup> line is marked by a longer line and a number designating the length in mm. Each division below the horizontal line is placed between each 1 mm mark (scale above the horizontal line) and represents 0.5 mm.

## THIMBLE SCALE

The thimble is divided into 50 equal parts, and one complete rotation of the thimble is indicated by the smallest division on the sleeve, which equals 0.5 mm. Each division on the thimble scale is  $10 \mu\text{m}$ . If the thimble scale falls between two lines, then a number between 0 and  $10 \mu\text{m}$  must be approximated.

## EXAMPLE 1

1. Note that the thimble has stopped at a point beyond “10” on the sleeve indicating  $10000 \mu\text{m}$  (10 mm).
2. Note that there is no mark completely visible between the 10 mm mark and the thimble.
3. Read the value on the thimble corresponding to the intersection with the horizontal line on the sleeve.

A.	Reading on sleeve:	$10000 \mu\text{m}$
B.	No additional mark visible:	$0 \mu\text{m}$
C.	Thimble reading:	$380 \mu\text{m}$
	Total reading:	$10380 \mu\text{m}$



Figure A2.2 Example 1:  
reading =  $10380 \mu\text{m}$

Example 2:

Note that the thimble has stopped at a point beyond “16” on the sleeve indicating 16000  $\mu\text{m}$  (16 mm).

Note that this time a mark is visible between the 16 mm mark and the thimble indication 500  $\mu\text{m}$ .

Read the value on the thimble corresponding to the intersection with the horizontal line on the sleeve.

- |    |                              |                     |
|----|------------------------------|---------------------|
| A. | Reading on sleeve:           | 16000 $\mu\text{m}$ |
| B. | One additional mark visible: | 500 $\mu\text{m}$   |
| C. | Thimble reading:             | 280 $\mu\text{m}$   |
|    | Total reading:               | 16780 $\mu\text{m}$ |



Figure A2.3 Example 2:  
reading = 16780  $\mu\text{m}$

**Danish Myo Technology A/S**

**E-mail: [sales@dmtdk](mailto:sales@dmtdk)**

**Tel.: +45 87 41 11 00**

**Fax: +45 87 41 11 01**



**DMT-USA, Inc.**

**E-mail: [sales@dmtdusa.com](mailto:sales@dmtdusa.com)**

**Tel.: +1 734 707 0250**

**Fax: +1 678 302 7013**



**DMT-China**

**Tel.: 86-21-6486 9685**

**Fax: 86-21-5877 0063**



**DMT-Asia Pacific**

**Tel.: +61 2 8814 1597**

