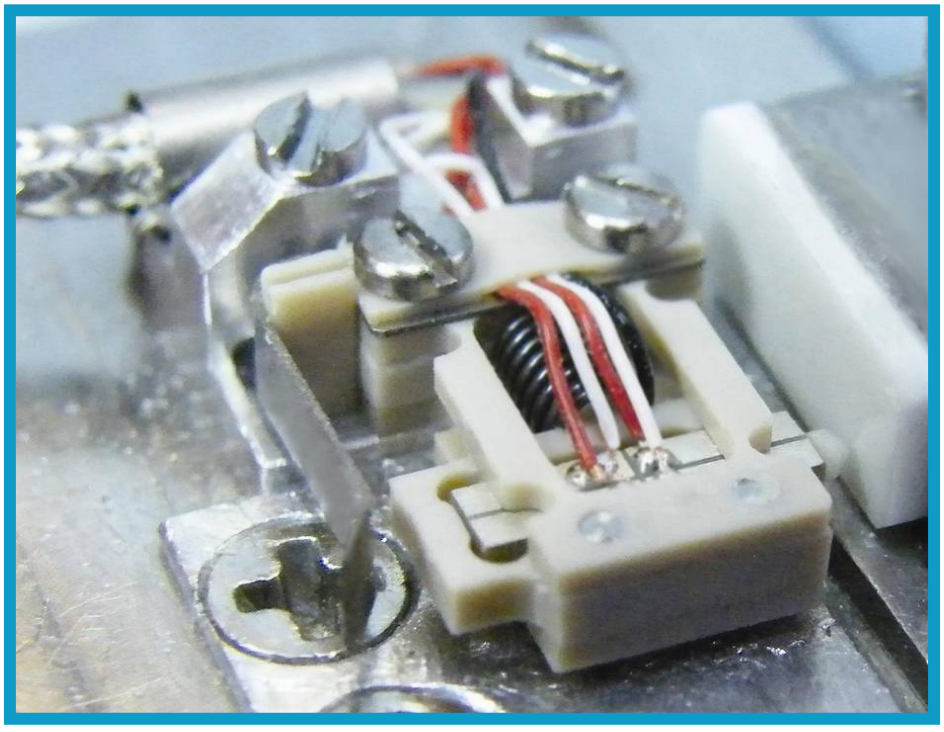
NANOMOTION

A Johnson Electric Company

Micro Motor (MM)

User Manual



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Copyright

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Patent Information

Nanomotion products are covered under one or more of the following registered or applied for patents.

5,453,653; 5,616,980; 5,714,833; 111597; 5,640,063; 6,247,338; 6,244,076; 6,747,391; 6,661,153; 69838991.3; 6,384,515; 7,119,477; 7,075,211; 69932359.5;1186063; 7,211,929; 69941195.5; 1577961; 4813708; 6,879,085; 6,979,936; 7,439,652; 7061158 ;1800356; 1800356; 1800356; 2007-533057 (pending); 2011-093431 (pending); 7,876,509; 10-2007-7009928 (pending); 200780019448.6 ; 7713361.9 (pending); 12/294,926 (pending); GB2008000004178 (pending); GB2009000003796 (pending); 12/398,216 (pending); GB2446428; 12/517,261 (pending); 08702695.1 (pending); 10-2009-7017629 (pending); 12/524,164 (pending); 12/581,194 (pending)

Revision History

Ver/Rev	Date	Details
00/A	Feb 2009	New release
01/A	June 2010	Add "Mounting the Motor" section
NA	August 2012	Administrative change – added patent information to front matter.

Table of Contents

List of Figures

1 General

1.1 Scope

The purpose of this user manual is:

- To introduce the user to the Nanomotion Micro Motor structure.
- To help the user verify motor's correct setting so that the mounting process is successful.
- To guide the user how to correctly mount the motor on the user stage and operate it.
- To provide the user with motor specifications.

1.2 Handling and Safety Precautions

Do not power on the motor unless it is properly mounted as explained in chapter 2 further in this user manual.

Ensure that the motor and specifically its tip are not subjected to mechanical shocks.

The mounting base and the method used for mounting should be designed for maximum mechanical rigidity and stiffness.

WARNING! HIGHT VOLTAGE!

- **For safety and EMI reasons, it is important to set the power to the motor only after it has been well encased and shielded inside a metal enclosure.**

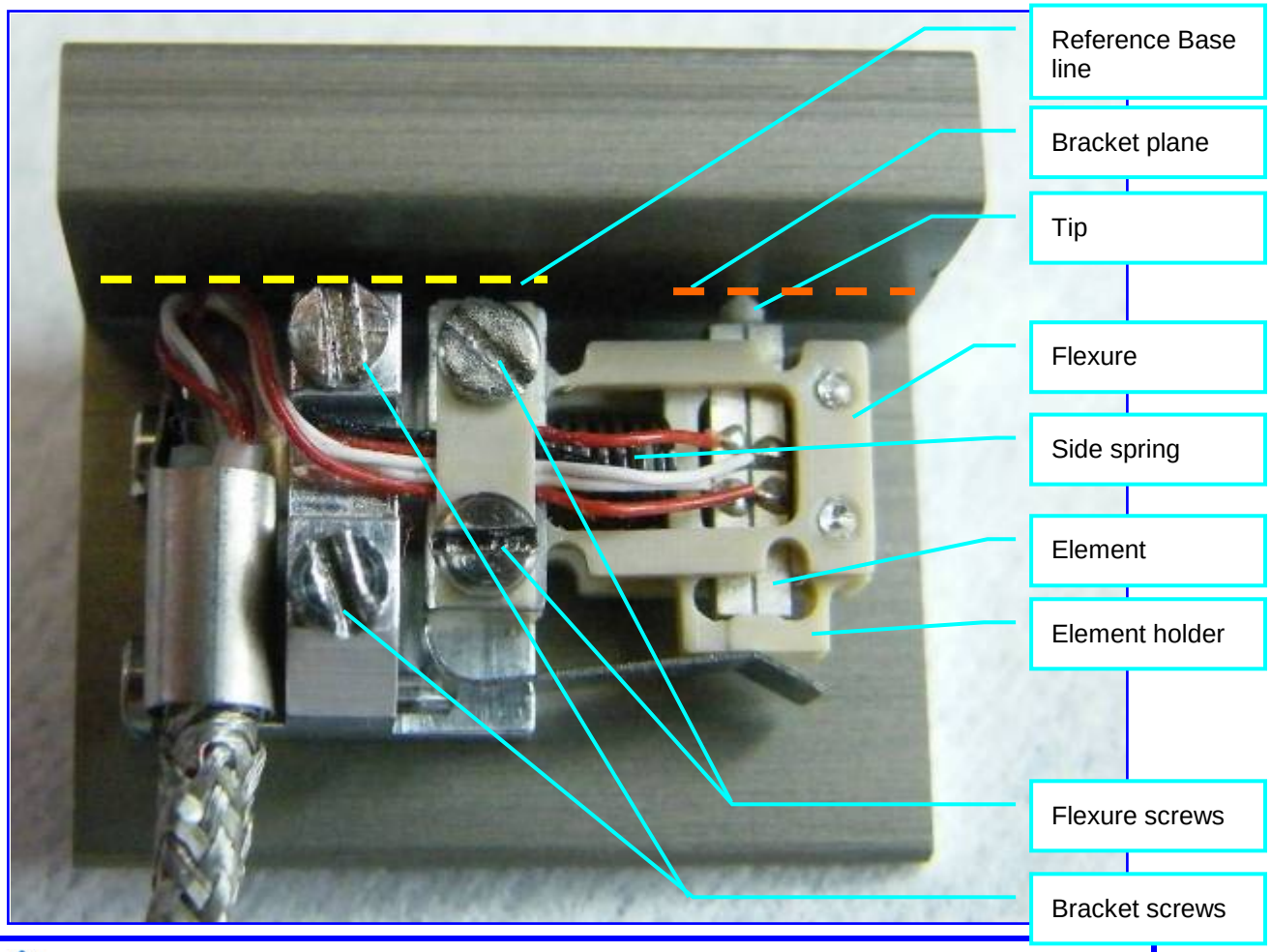
1.3 Motor Grounding

Be sure to ground the motor (or its conductive base plate) to the electrical network ground, before operating.

2 Motor Mounting

2.1 Motor Nominal Description

Nanomotion supplies a bracketed, mounted Micro Motor, see Figure 1.



Important:

- **Nanomotion supplies an aligned and tested Micro Motor. However, before the removing from the bracket and mounting on the user stage, the user is required to verify the correct motor flexure position, described further in this manual.**
- **DO NOT remove the motor from the bracket prior to reading the instructions specifically listed in section 2.2.**

2.2 Correct Flexure Position Verification

Important:

- **The flexure screws are for factory use only. Opening them will impact motor's performance.**
- **Use a suitable flat screwdriver for the Eccenter Pin (other than for the mounting screws.**

2.2.1 By using pincers, insert the Eccenter Pin (supplied by Nanomotion) between the Leaf Spring and the Element Holder, right under the flexure screws, with the groove facing up, see Figure 2.

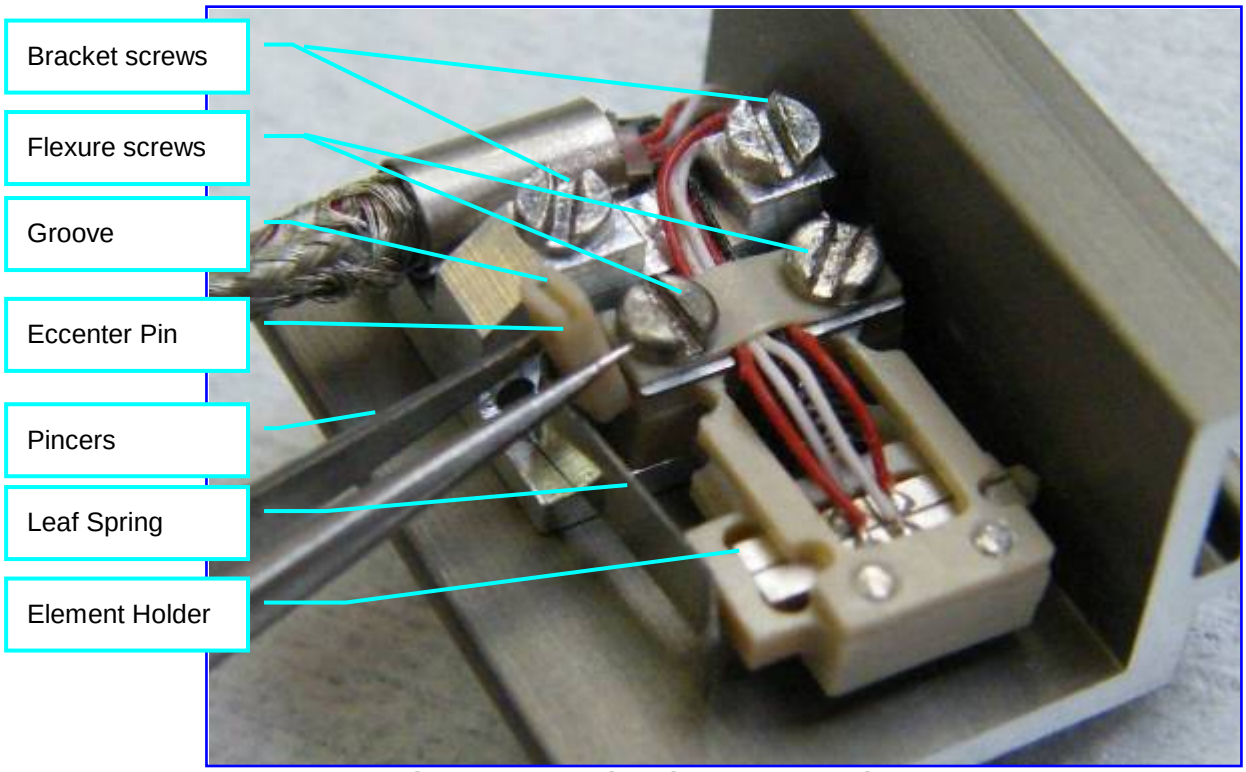


Figure 2: Inserting the Eccenter Pin

2.2.2 Gently turn the Eccenter Pin (see Figure 3), by using a flat screwdriver, so the Eccenter Pin retracts the Leaf Spring (see Figure 4). Thus there is no contact between the Element Holder and the Leaf Spring. Ensure that the flat screwdriver

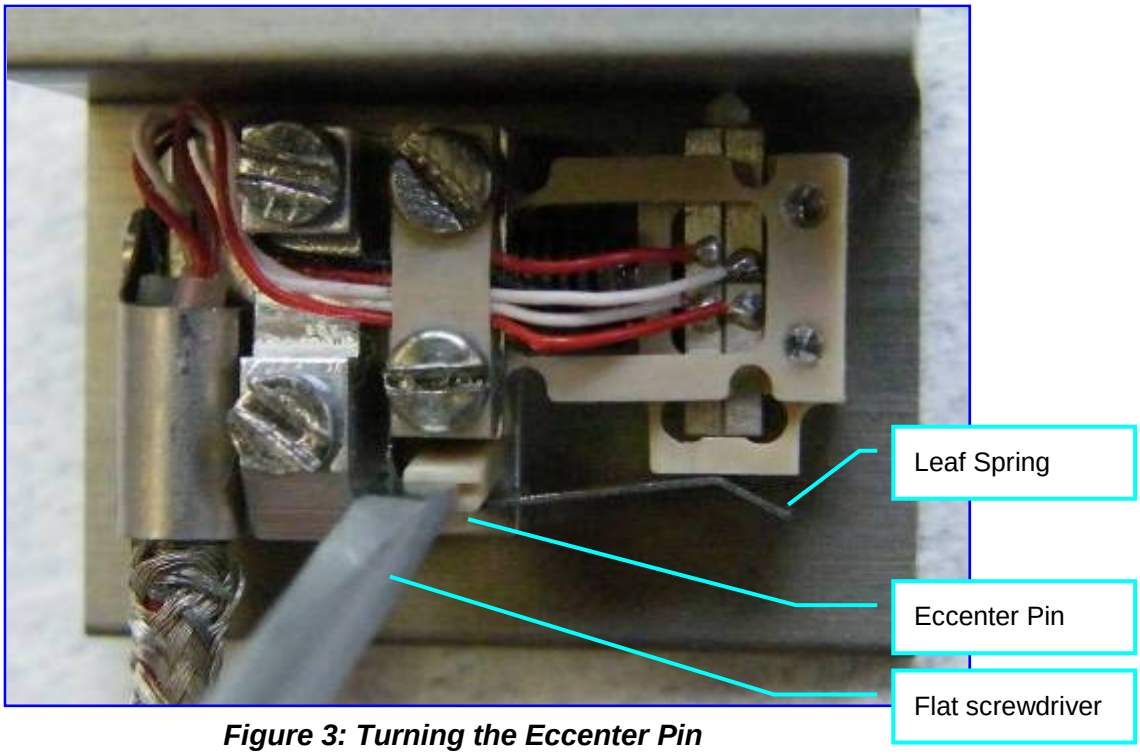


Figure 3: Turning the Eccenter Pin

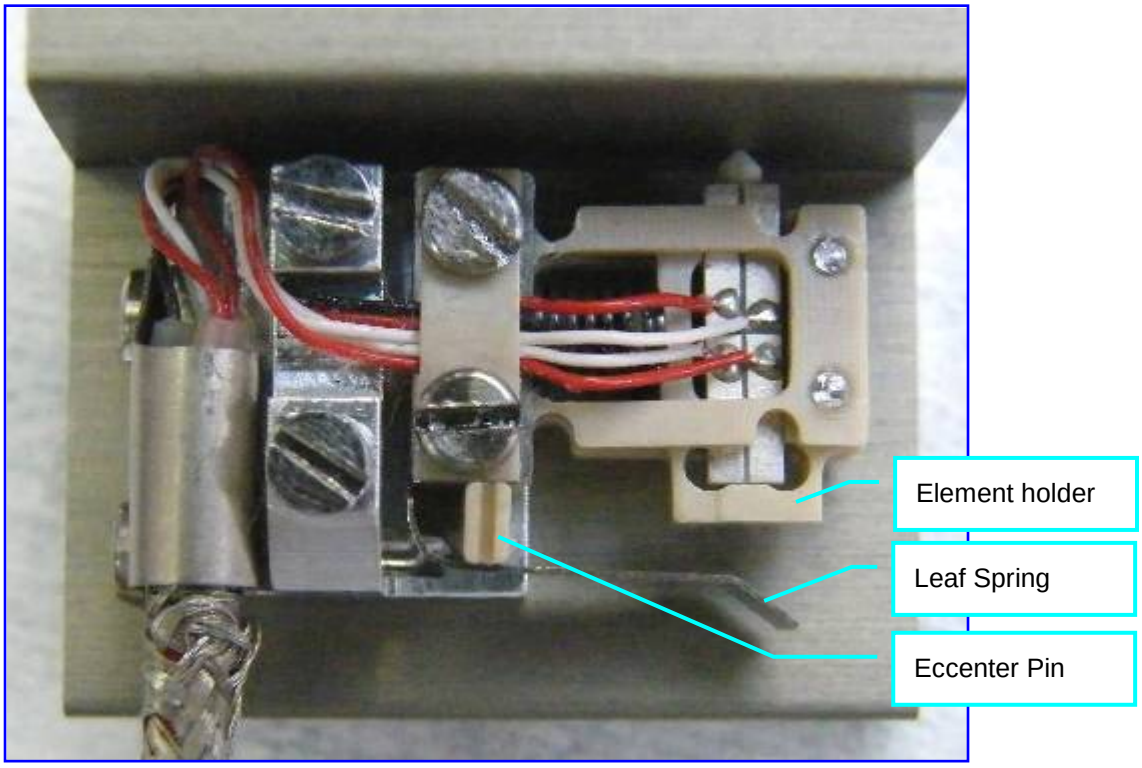


Figure 4: The Leaf Spring is Retracted

2.2.3 Detach the motor from the bracket, by unscrewing the bracket screws.

2.2.4 Place the motor on a clean workplace.

2.2.5 Observe the motor before mounting. Verify that the flexure is parallel to the Reference Base Line when the Leaf Spring is retracted, see Figure 5. If not, refer to section 2.3 for correcting the flexure position.

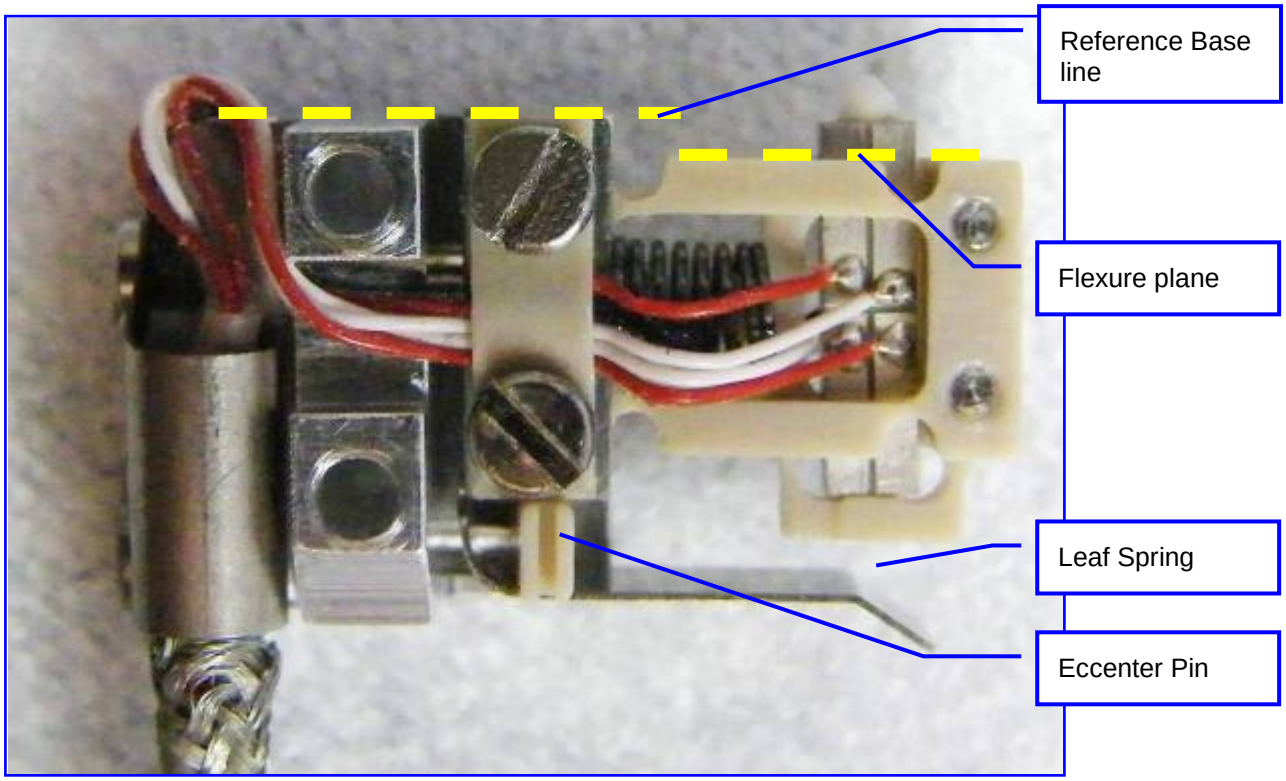


Figure 5: Correct Flexure Position

2.2.6 Ensure that there is a contact between the element and the Element Holder surface at point (a). In case not, gently push the element toward point (a), see Figure 6.

2.2.7 Ensure that the element contacts the Element Holder at both points (b). If not: use pincers in order to place the element so it contacts points (b), see Figure 6.

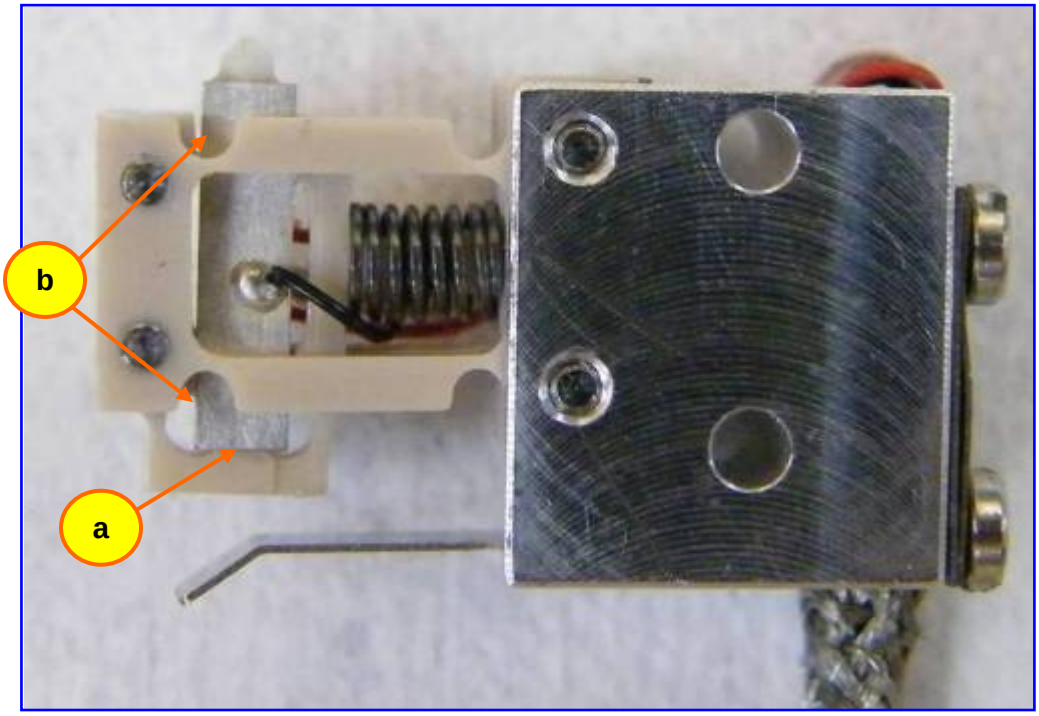


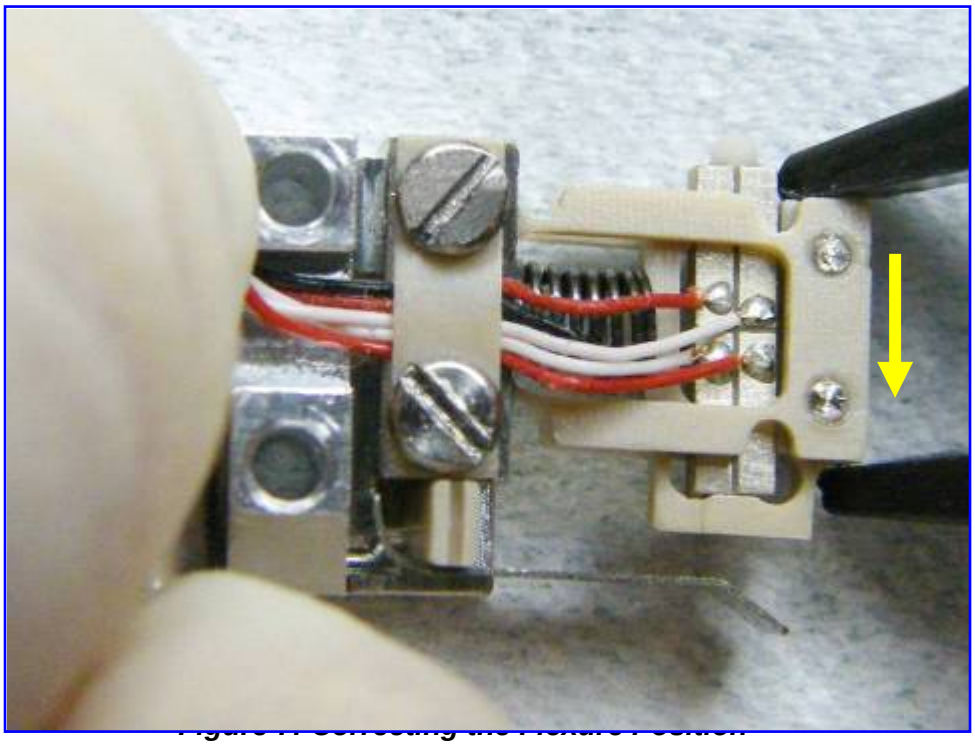
Figure 6: Motor Bottom View

2.3 Flexure Position Correction

Motor's flexure position could be inclined toward the tip. In order to correct flexure position, perform the following steps:

2.3.1 Hold the motor with one hand.

2.3.2 **Gently** pull the flexure in the opposite direction to flexure inclination, by using pincers with Teflon tips. For instance, if the flexure is inclined toward the tip, pull the flexure toward the Leaf Spring, as shown in Figure 7.



2.3.3 Repeat step 2.3.2 until the flexure plane is parallel to the reference base line.

2.3.4 Proceed to step 2.2.6.

2.4 Motor Mounting

2.4.1 While the Leaf Spring is retracted, mount the motor on the base plate.

2.4.2 Insert both mounting screws into the mounting holes.

2.4.3 Loosely screw both mounting screws by using a flat screwdriver. (Refer to the motor layout drawing in section 5.6).

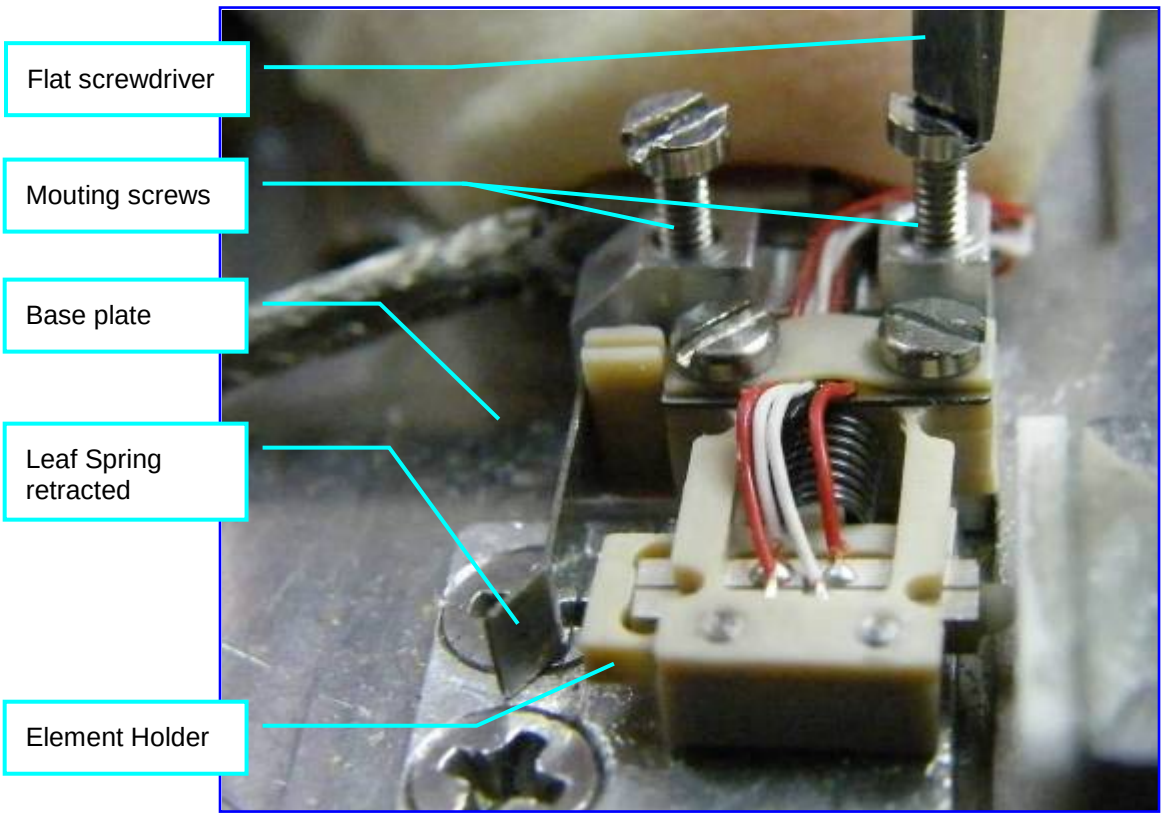


Figure 8: Mounting the Motor

2.4.4 Move the slide to the left side of the tip, until the end of the travel (see green arrow, Figure 10).

2.4.5 Assure a distance of 0.8 +0/-0.05 mm between the ceramic strip and the motor by using a standard filler gauge, refer to Figure 9 **or** alternatively, machine a cavity in the base, refer to Figure 9.

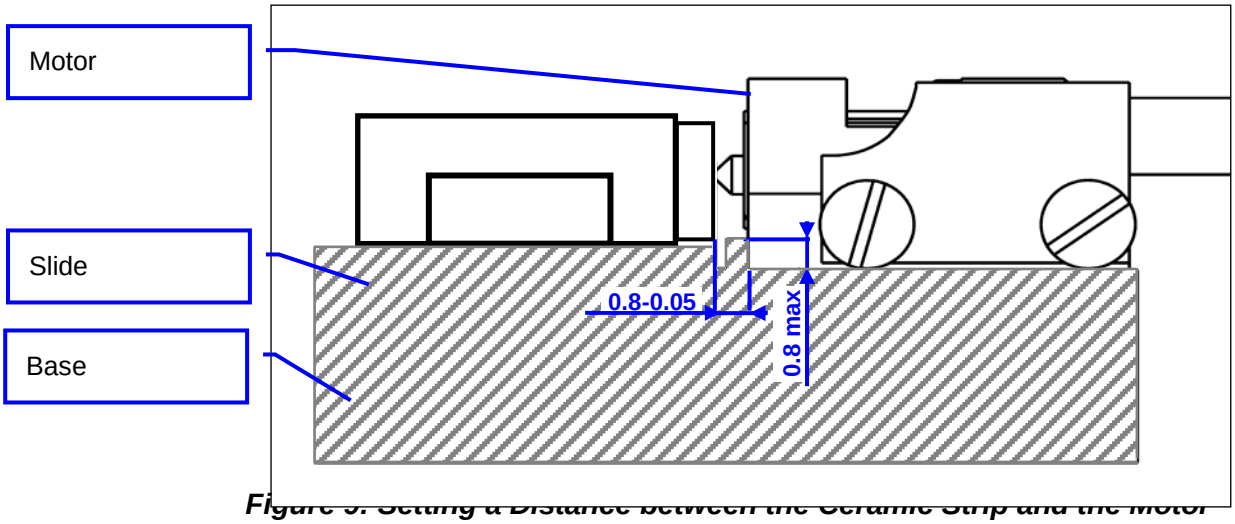


Figure 9: Setting a Distance between the Ceramic Strip and the Motor

2.4.6 Gently push the motor against the filler gauge.

2.4.7 While pushing the motor against the filler gauge (see yellow arrow, Figure 10), tighten both mounting screws.

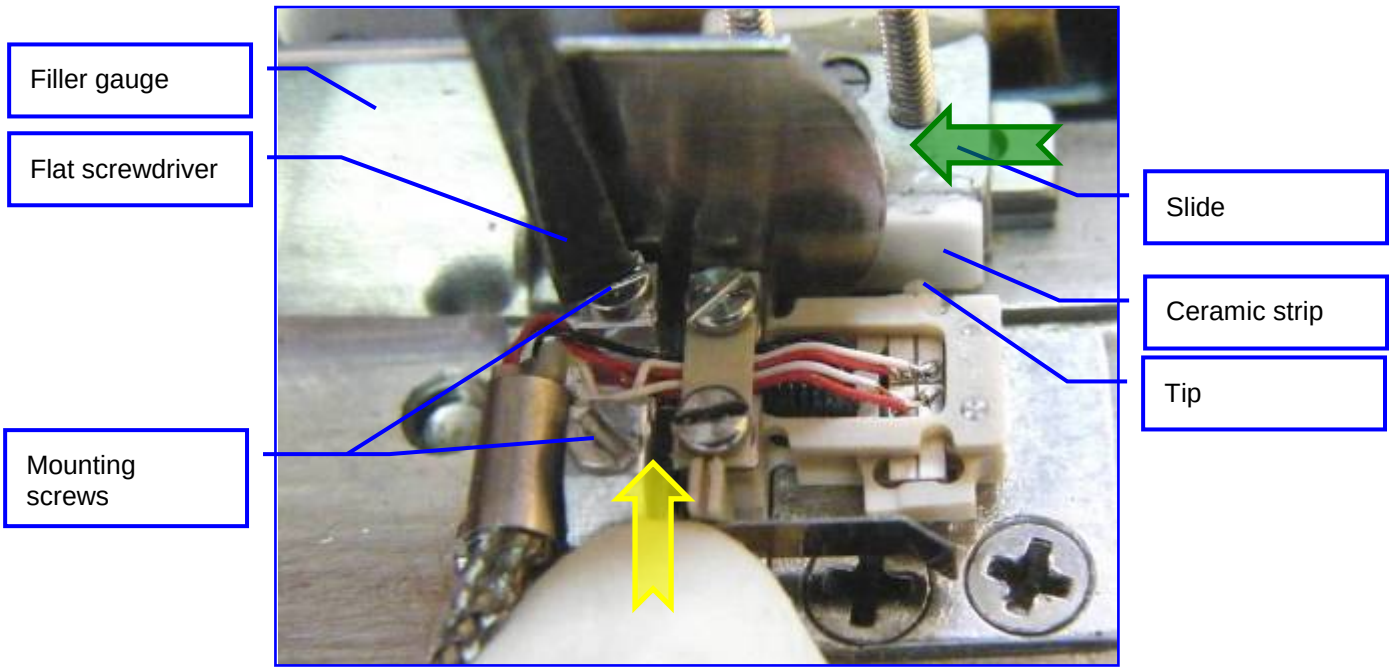
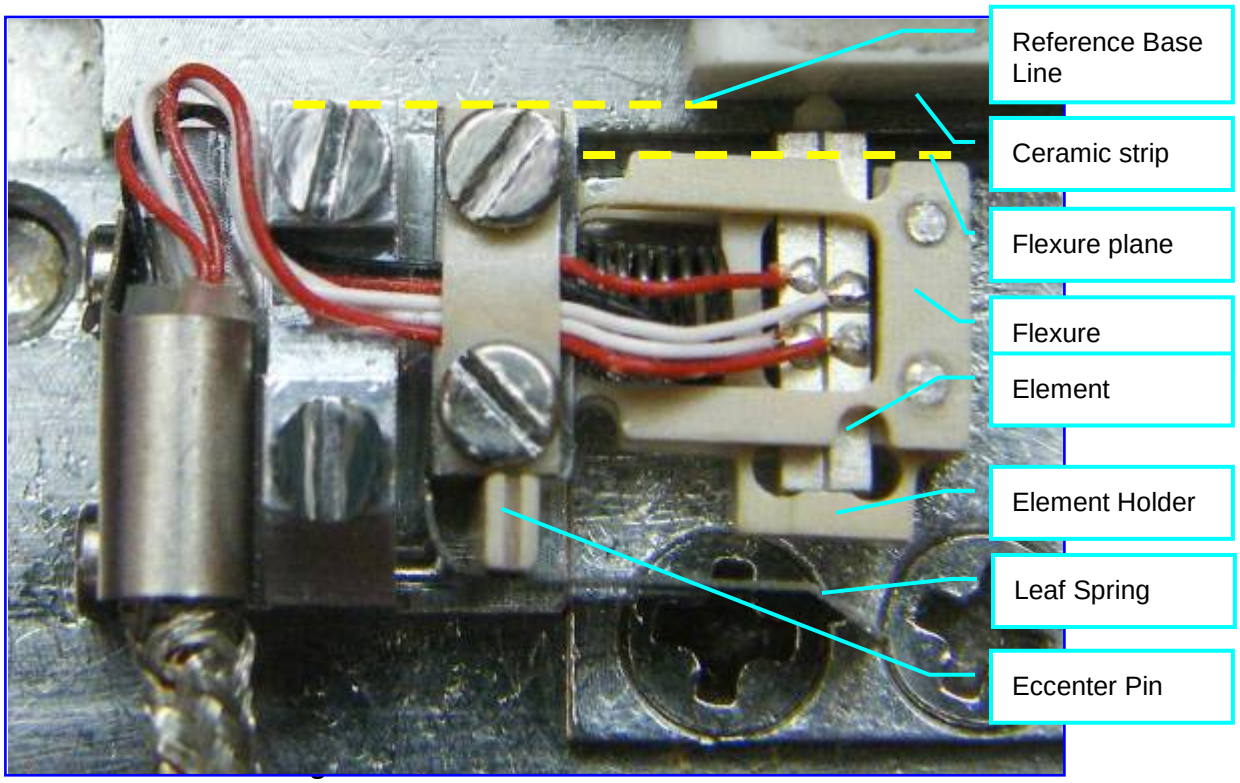


Figure 10: Using a Filler Gauge

2.4.8 Ensure the following conditions are met:

- The reference base line is parallel to the ceramic strip..
- The element should be in contact with the Element Holder on its rear side (counter to the tip). The element should be in a full contact with the flexure and the Spring Holder.
- The flexure plane should be parallel to the Reference Base Line.
- The slide moves freely with the tip contacting the strip but without friction between the tip and ceramic strip.



In case, the conditions are not met, dismount the motor and proceed to section 2.3.

2.4.9 Gently turn the Eccenter Pin 90°, using a flat screwdriver, so the Leaf Spring now applies pressure on the Element Holder.

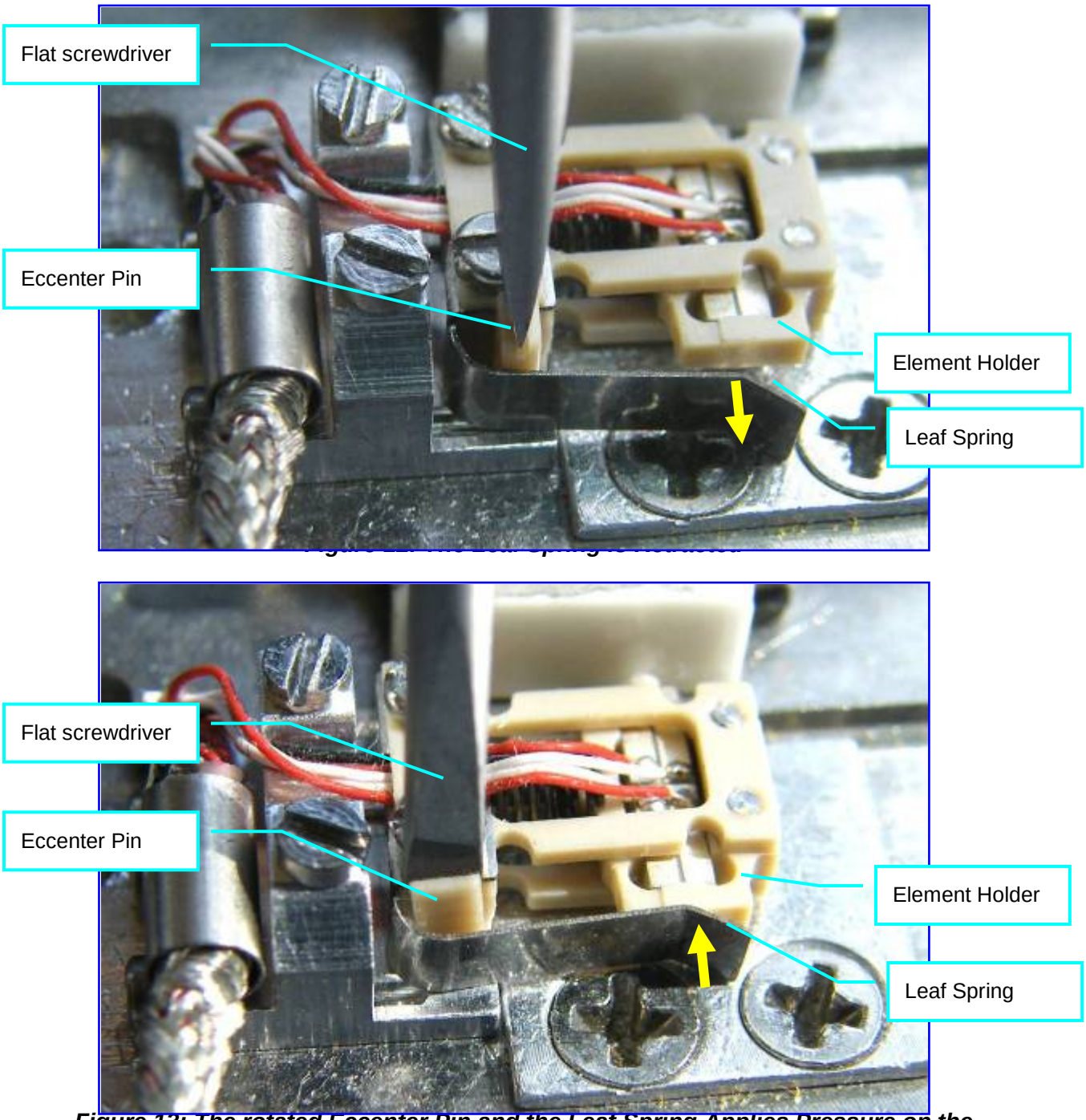


Figure 13: The rotated Eccenter Pin and the Leaf Spring Applies Pressure on the Element Holder

2.4.10 Pull the Eccenter Pin out of the motor, by using pincers.

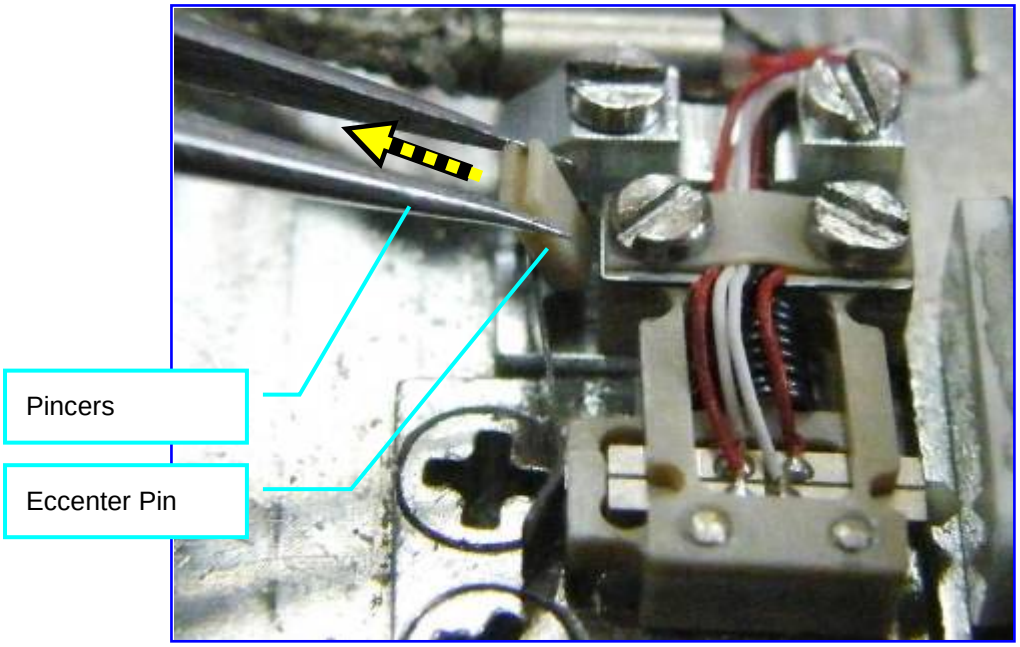


Figure 14: Removing the Eccenter Pin

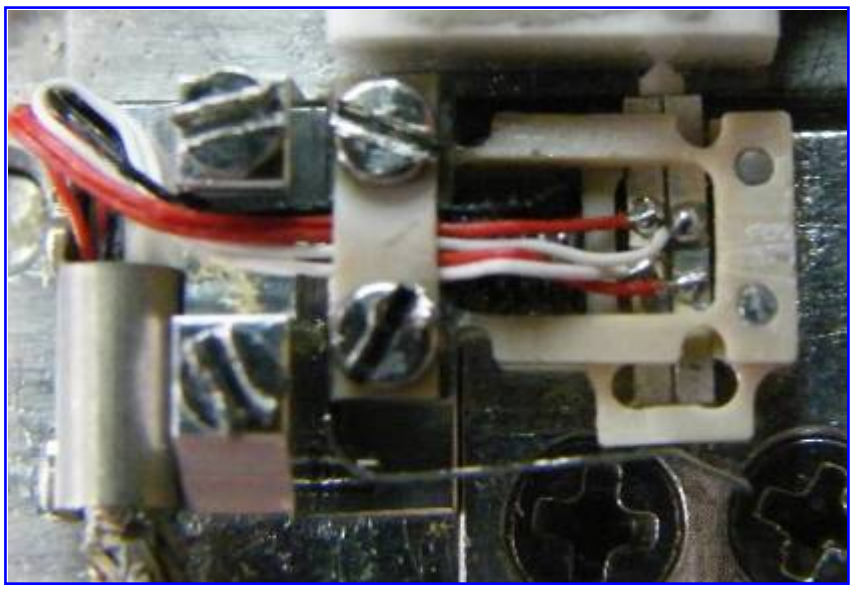


Figure 15: Motor Moutned

2.4.11 Proceed to chapter **Error! Reference source not found.** for connecting the motor.

Note:

- *Before dismounting the motor, insert the Eccenter Pin and turn it, so that it retracts the Leaf Spring (refer to steps 2.2.1 and 2.2.2.).*

3 Motor Connection

This section describes the MM connector pinout and the connections to the Nanomotion driver.

Extending the motor cable will not damage the motor, however it will affect its performance.

The motor - driver connection uses a standard 9-pin D-type female connector, refer to Figure 16 for connector pinout:

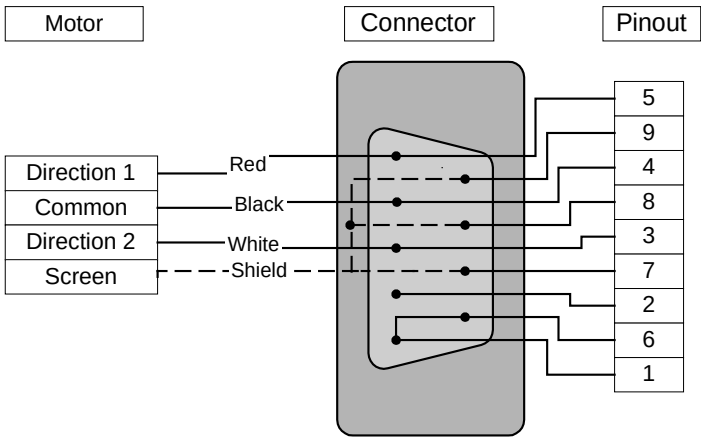


Figure 16: Motor Connector Pinout

Important:

- **For safety reasons, the driver voltage is disabled, unless pins 1 and 6 are shorted, when the motor is connected.**

4 Motor Run-in

In order to ensure proper Motor operation, reduce wear rate of the system and to increase its lifetime, it is important to run-in the motor before its normal use.

Following is the list of parameters for the MM Motor run-in.

- Velocity - 100 mm/sec.
- Duty cycle - 50%.
- Duration - 4 hours.

Once the run-in is completed, carefully clean the ceramic strip with a Q-Tip soaked in IPA, **without dismounting the motor**.

The run-in procedure should be repeated if the motor is disconnected and then remounted.

WARNING!

- **Never run-in the motor in a vacuum environment.**

5 Specifications

5.1 Performance

Maximum Allowable Velocity:	250 [mm/sec]
Dynamic Stall Force:	170 [mN]
Static Holding Force	160 [mN] (reference value)
Non-Energized Stiffness	0.04 [N/μ]
Nominal Preload on Stage	0.9 [N]
Kf	25 to 35 [mN/Volt command] - Driver and command dependant
Kfv	0.5 to 0.8 [N • sec/m]
Offset	2 [V] - Driver dependant
Attainable Resolution	Better than 50 nm – See application notes
Nominal Lifetime	20,000 hours under nominal operating conditions

5.2 Electrical

Maximal Voltage:	70 Vrms, sine wave
Maximal Current consumption:	18 mA rms (Cable length dependant)
Maximal Power Consumption:	350 mW

5.3 Environmental

Ambient Temperature:	0 - 50°C
Storage:	-40°C ÷ +70°C
Humidity:	0 - 80% non condensing
Residual Magnetism	0.22 nT
Vacuum compatibility	1E-7 Torr. Guaranteed after baking
Bake-out	Max 24 hrs at 120°C

5.4 Physical Properties

Weight:	5.5gr

5.5 Envelope of Performance

Maximum continues operation at 3.5-10V command	4 sec
Maximum Duty-Cycle at 10V command	10%

Important:

- **The MM driver has an internal protection that stops the driver after 4 seconds for command higher than 3.2V, so protecting the motor from overheating.**

5.6 Motor Layout

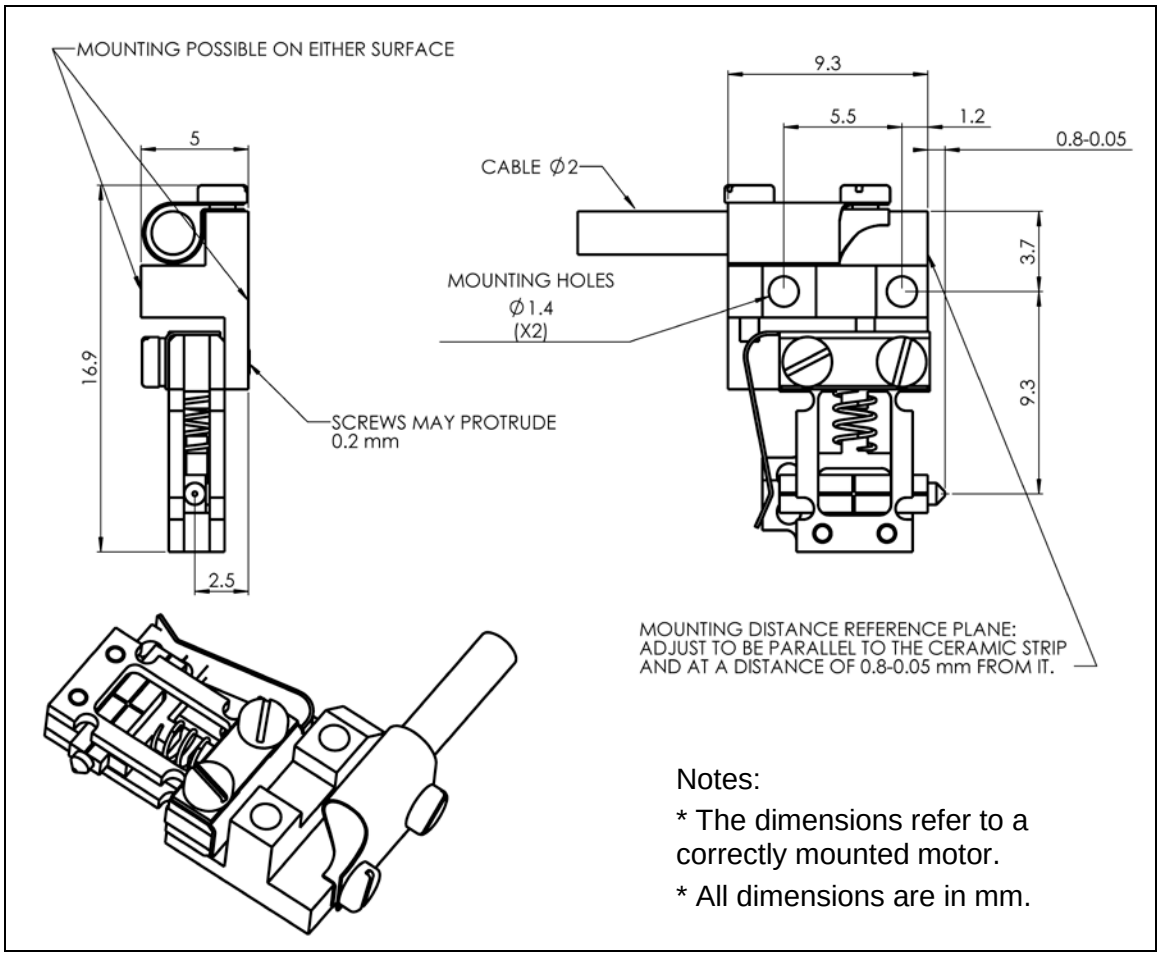


Figure 17: Motor Layout

6 Contact Information

6.1 Customer Service

Contact your local distributor or email Nanomotion Ltd. Technical Support Department at **techsupport@nanomotion.com**, with detailed problem description.

6.2 General Inquiries and Ordering

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