

# FERROVAC GMBH

ULTRA HIGH VACUUM TECHNOLOGY

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## RM40, GMD40, RMD40, RMDG40 Sample Transporter DN40CF

### Instruction Manual

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*Version 1.1*

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## ***Warranty***

Ferrovac GmbH warrants this product to be free of defects in material and workmanship for a period of 12 months from the date of shipment.

In case of proof of any defective parts in the product, we will at our option, either repair the product or replace it.

## ***Warranty Limitations***

The warranty for this product does not apply to defects resulting from the following:

- non-observance of operational- and safety instructions
- natural wear of components
- modifications to our products without our written consent
- misuse of any product or part of the product

*This warranty stands in place of all other warranties, implied or expressed, including any warranty of merchantability implied or fitness for a particular use. The remedies provided herein are buyer's sole and exclusive remedies.*

*Neither the company Ferrovac GmbH nor any of its employees shall be liable for any direct, indirect, incidental, consequential or special damages arising out of the use of its products, even if the company Ferrovac GmbH has been advised in advance of the possibility of such damages. Such excluded damages shall include but are not limited to: Costs of removal and installation, losses sustained as the result of injury to any person, or damage to property.*

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## Terms and Symbols

The information in this document represents the state of the product at the date of print. Technical changes may be made without notice. Ferrovac GmbH makes no warranties or representations with respect to accuracy or completeness of the contents of this publication. Figures and photos are not binding. The used product names are for identification purposes and may be trademarks of their respective companies.



A triangle with explanation mark indicates a passage in the manual with information that is crucial for the operator. **READ THESE PARAGRAPHS CAREFULLY** or the product might be damaged by misuse.

### **CAUTION!**

The **CAUTION** heading in a manual explains hazardous situations that could damage the product. Such damage may invalidate warranty.

## Normal Use

The product described in this manual must always be used:

- With original accessories supplied by Ferrovac which are explicitly specified for the use with the product described in this publication.
- In an indoor research laboratory environment.
- By personnel qualified for operation of delicate scientific equipment.
- In accordance with this and all related manuals.



**CAREFULLY READ THE SAFETY INFORMATION AND ALL RELEVANT MANUALS BEFORE USING THE PRODUCT AND ANY RELATED INSTRUMENTATION!**

## 1. Introduction

The GMD40, RMD40 and RMDG40 are magnetically driven sample transporters with a mounting flange DN40CF. The three types are presented as simple linear/rotary transporters or dual shaft versions which allow to use a variety of pincers for almost any type of sampleholders.

## 2. Unpacking and Inspection

Ferrovac manipulators are shipped clean and ready to use in UHV. Prepare a sufficiently clean workspace and wear surgical gloves when unpacking and inspecting the device. Check for any visible damage of the package, manipulator and accessories. Compare the contents of the package with the delivery note. Any damage or missing items must be reported to Ferrovac **within 48 hours after delivery**.

### CAUTION!

- **Always** use powder-free examination gloves during unpacking to avoid contamination.
- **Please** ensure enough working space for unpacking and inspection.
- **Please** clean the working table/surface and cover it with Aluminium foil or household foil.
- **Never** hit the knife edge.
- **Never** expose the sample transporter to physical shocks (**brittle magnets!!!**).
- **Never** bend the tube nor the shaft.

### 3. Overview

The RM40, GMD40, RMD40 and RMDG40 are all metal sealed, linear-rotary feedthroughs. Their main purpose is to transport samples between UHV-chambers. A set of rare earth magnets on the air- and vacuum side provides the necessary force to ensure a rigid coupling from the handle to the shaft. Presented are three basic models which can be equipped with several accessories (see section 4).

#### RM40, GMD40

The RM40 (slide bearings driven)/GMD40(ball bearings driven) is a simple linear-rotary feedthrough.

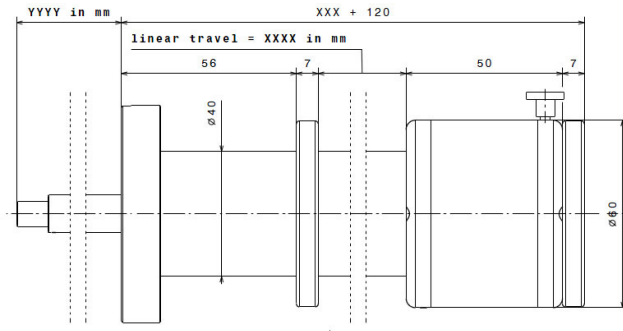


Fig1: RM40/GMD40 drawing

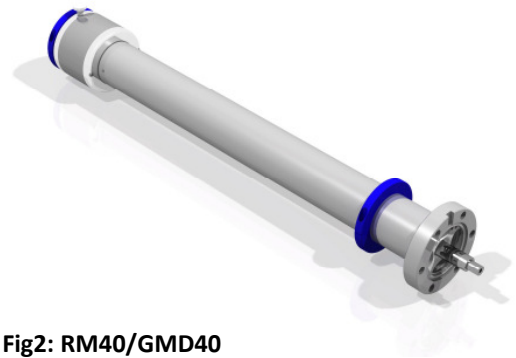


Fig2: RM40/GMD40

#### RMD40

The RMD40 is a dual shaft, linear-rotary feedthrough with independent rotation of the inner shaft.

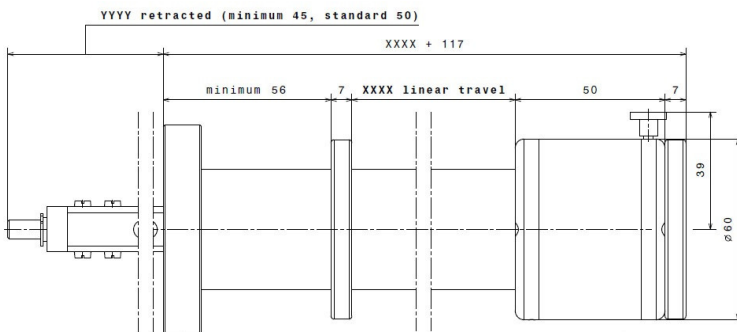


Fig3: RMD40 drawing



Fig4: RMD40

#### RMDG40

The RMDG40 is a dual shaft, linear-rotary feedthrough with independent rotation of the inner as well as the outer shaft.

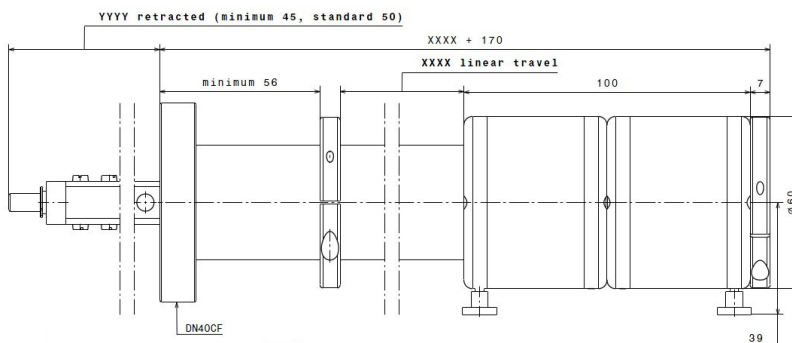


Fig5: RMDG40 drawing



Fig6: RMDG40

### 3.1 Nomenclature

The main parts of the sample transporters are named as follows:

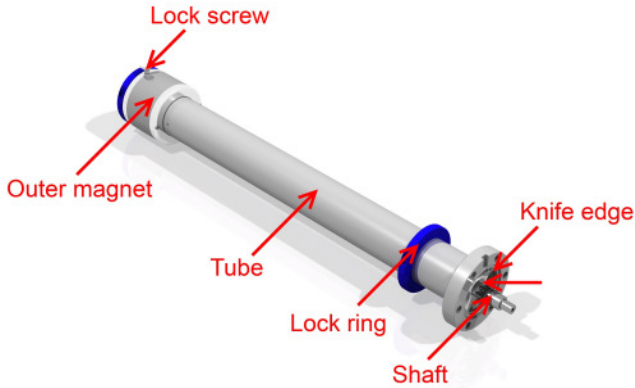


Fig7: RM40/GMD40 nomenclature

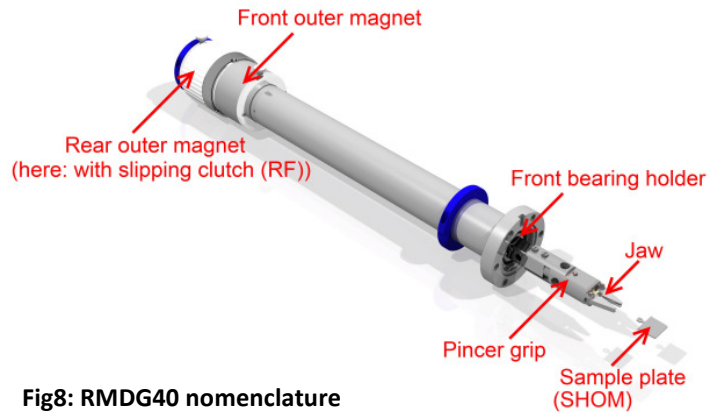


Fig8: RMDG40 nomenclature

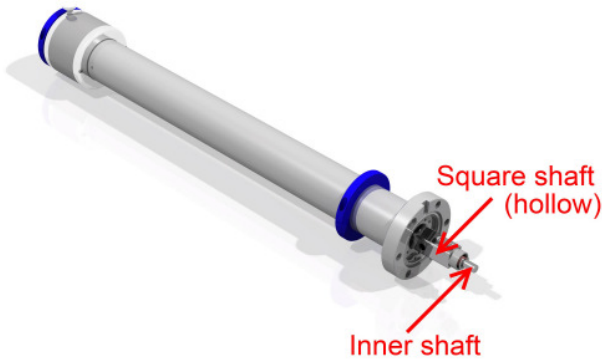


Fig9: RMD40 nomenclature

#### CAUTION!

- **Always** use the sample transporter for its purpose (not as a lever, screwdriver nor similar).
- **Never** expose the sample transporter to physical shocks (**brittle magnets!!!**).
- **Never** bend the tube nor the shaft.
- **Never** pull the outer magnets off the tube (maximal force per magnet is 70N!).
- **Never** overtighten the outer magnet in respect to the shaft (maximal torque is 5Nm!).

### 3.2 Handling

Linear and rotating motion are simply realized by handling the outer magnet as shown in the following pictures.

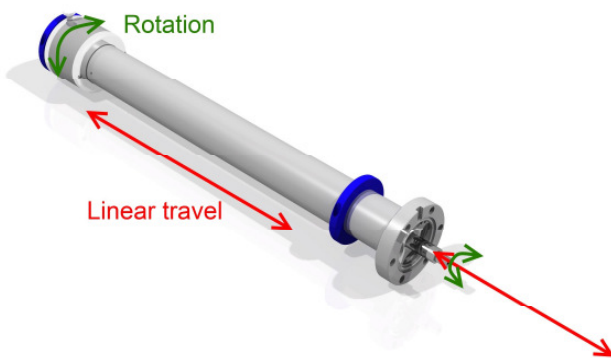


Fig10: RM40/GMD40 handling

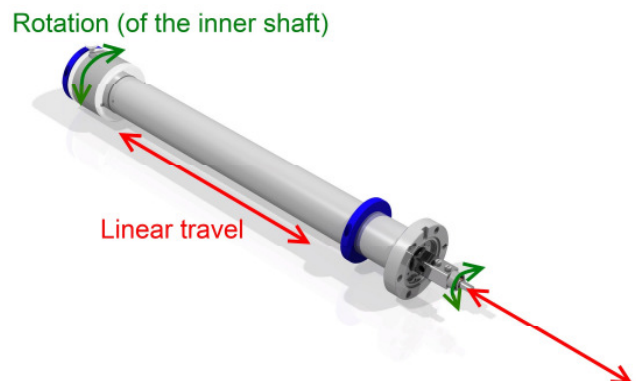


Fig11: RMD40 handling

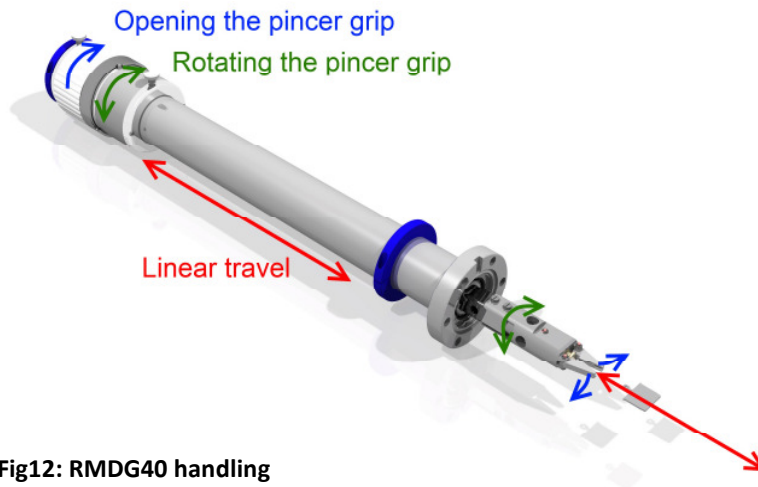


Fig12: RMDG40 handling

- Typical working procedure with a RMD40/RMDG40 with pincer grip:
  1. Untighten the lock screw.
  2. Linear motion is realized by pushing (nearly forcefree) the outer magnet along the "linear travel"-arrow.
  3. Position the tip of the pincer grip near to the sample plate.
  4. Clockwise turning of the outer magnet opens the pincer grip.
  5. Position the jaws such that the head of the sample plate lies between them.
  6. Counter clockwise turning of the outer magnet closes the pincer grip.
  7. The sample plate is clamped and can be carried away.
  8. To unclamp the sample plate, turn again the outer magnet clockwise
  9. Use a parking rail if provided after the use of the wobblestick.
  10. Tighten the lock screw.

### 3.3 Bakeout

All UHV manipulators including the presented sample transporters are bakeable up to 150°C. Do **not** remove the magnetic coupling for the bakeout procedure. It is recommended to use the parking rail if provided during bakeout. In order to minimize evolution of residual gas, it is helpful to move the coupling back and forth if possible. Do that during cooldown of the UHV system after bakeout.



**CAUTION!** **Never** remove the magnetic coupling for the bakeout procedure. Make sure, its temperature **never** exceeds **150°C!**



## 4. Accessories

### 4.1 Pincer grip straight PGRMS(OMH)

The PGRMS(OMH) is made with the appropriate groove to fetch SHOM style sample plates. In its standard version, angular degree of freedom of the sample plate held by the pincer is minimized.

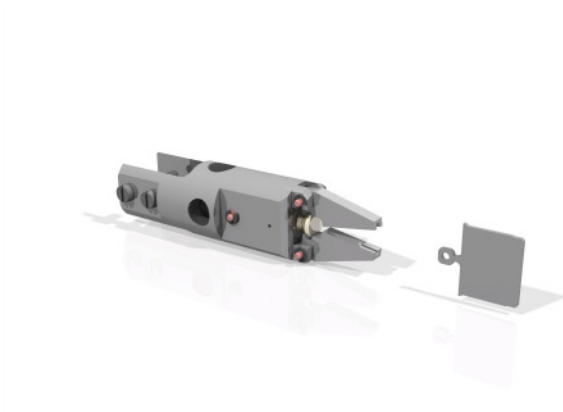


Fig13: PGRMS(OMH)

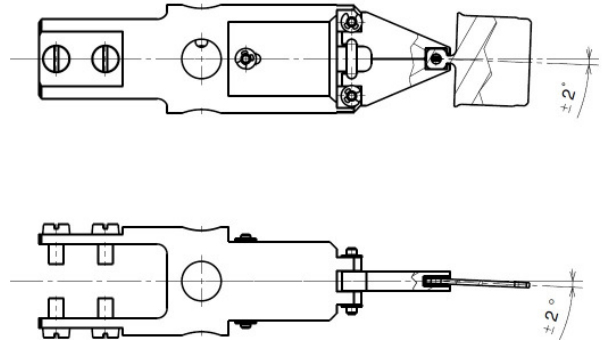


Fig14: PGRMS(OMH): tilt of a SHOM sample plate

### 4.2 Carousel RSCRMD2OM

The revolving sample carrier transports and stores two SHOM sample plates. The sample holders are typically placed into the RECOM receptors using a dual shaft WMG40 wobble-stick with a PGWMS(OM) pincer grip. The RSCRMD2OM is compatible with RMD40 and RMDG40 sample transporters.

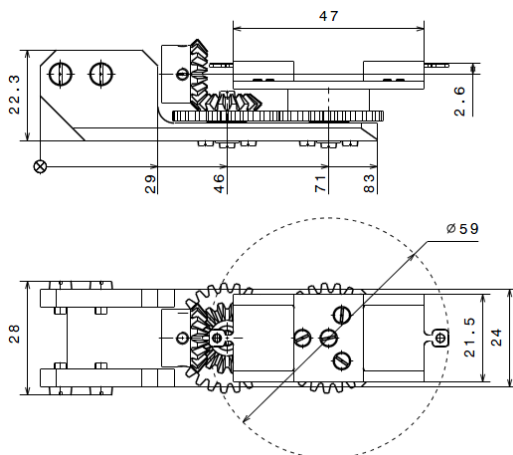


Fig15: RSCRMD2OM drawing

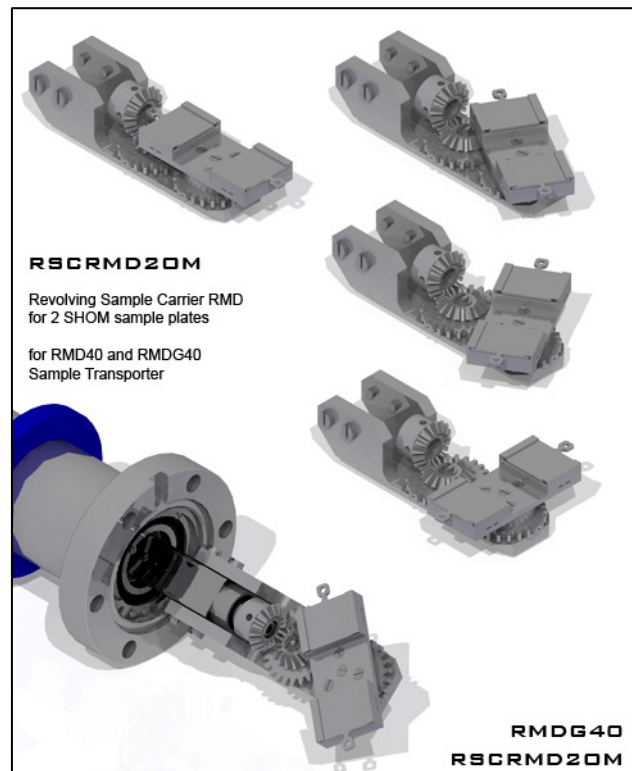


Fig16: Revolving sample carrier for 2 SHOM sample plates

### 4.3 Tube support TSRMB

This tube support lock ring has two alignment shafts with OD 16mm. Left/right threaded shafts allow for linear adjustment of +/-10.8mm by turning the shaft. The alignment shafts are equipped with M8 pivot mounts on both ends. In combination with our PA40 port aligners these alignment shafts can be very helpful for fine adjustment of the angular deflection.



Fig17: TSRMB

### 4.4 Port Aligner PA

These simple devices are particularly useful for angular alignment of sample transporters. The HEX-series allow also lateral (off axis) adjustments. The hexagonal geometry adds additional sturdiness.

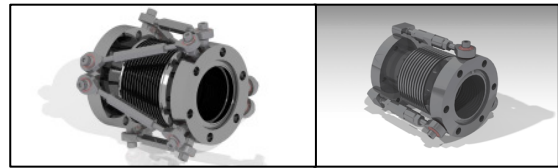


Fig18: PA40HEX and PA40

### 4.6 End switch LRSWITCH

The Lockring with electrical end switch is a simple device to indicate the position, if the sample transporter is fully retracted or extended. A typical application is the prevention of the manipulator colliding into a closed valve. **The LRSWITCH is not bakeable**, but it can be removed easily by loosening two screws.

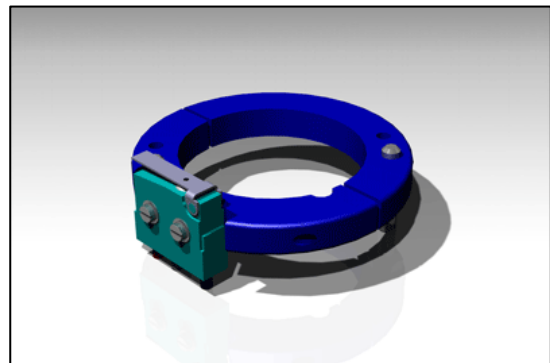


Fig19: LRSWITCH

### 4.7 Lifter FRKLIFT

The FRKLIFT is an accessory which can be used with the manipulator types RMD40 and RMDG40. It allows a movement perpendicular to the transferaxis. The interface can be customized to your needs.

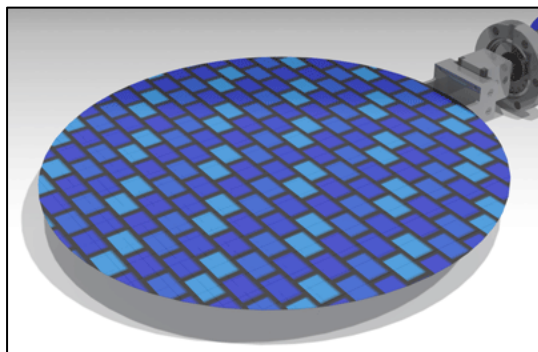


Fig21: FRKLIFT with wafer

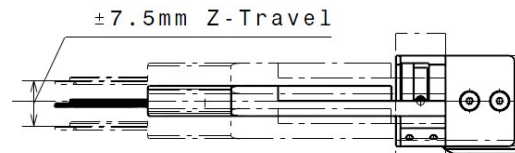


Fig20: FRKLIFT elevating distance

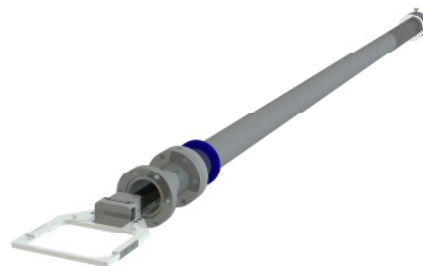


Fig22: FRKLIFT with customized interface and RMD40

## 6. Problem solving

Please follow the warning notes for this whole section:

### CAUTION!

- **Always** use powder-free examination gloves to avoid contamination.
- **Please** ensure enough working space for inspection.
- **Please** clean the working table/surface and cover it with Aluminium foil or household foil.
- **Never** hit the knife edge.
- **Never** expose the sample transporter to physical shocks (**brittle magnets!!!**).
- **Never** bend the tube nor the shaft.

### 6.1 Bearing replacement

The slide and ball bearings are the only parts of the sample transporter that wear out. Many bakeout periods lead to slight deformation of the slide bearings. This could result into disturbances of the motion smoothness and probably higher outgassing rates. The following section describes the ball bearing replacement and the dis-/reassembly of a sample transporter of the type RMDG40, which is considered as a more complicated manipulator to carry out a refurbishment service. To perform such a service on the other sample transporters, one recognizes the following subassemblies referring to the sample transporter at hand. The manual for the ball bearing replacement is basically carried out by the same procedure as for the RMDG40.



Fig23: GMD40 with ball bearing cage at the rear and slide bearing at the front



Fig24: RM40 with slide bearing at the rear and at the front



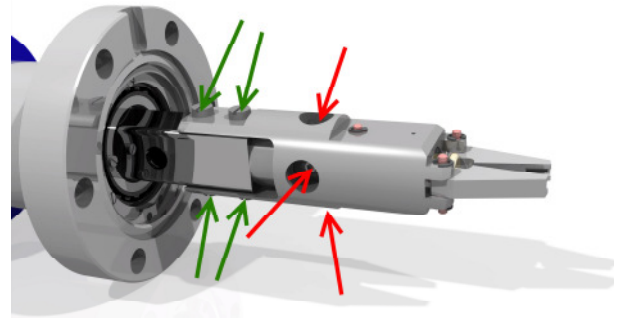
**Fig25: RMD40 with rear ball bearing and front ball bearing cage**



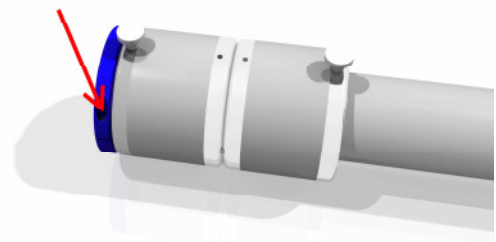
**Fig26: RMDG40 with rear ball bearing and front ball bearing cage**

1. In case of a sample transporter with pincer:

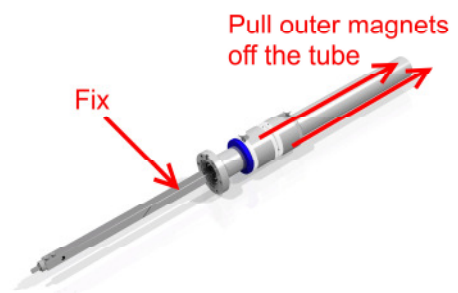
Loosen the three threaded pins as well as the four cylinder head screws. The threaded pins are arranged 120deg around the shaft. In order to reach them all, rotate the rear outer magnet.



2. Loosen the cylinder screw with hexagon socket and pull off the rear lock ring.

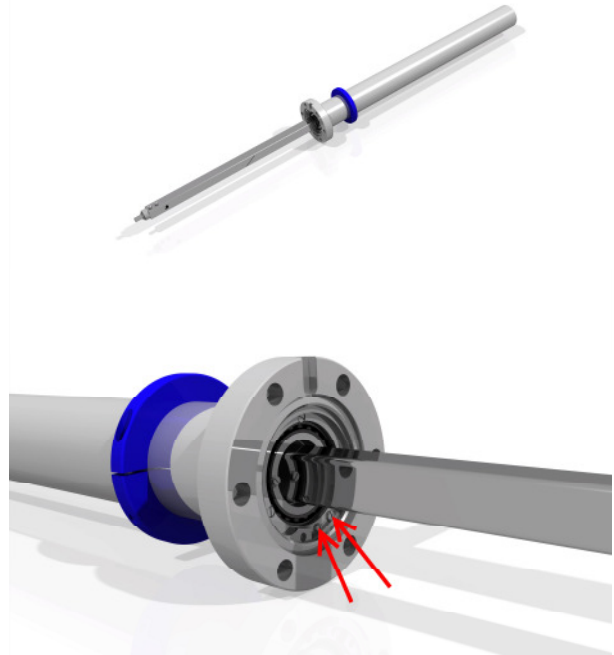


3. Move the outer magnets to the other lock ring. While fixing the square shaft with one hand, pull the outer magnets one by one off the tube. Holding the square shaft near the flange improves stability for pulling off the magnets.



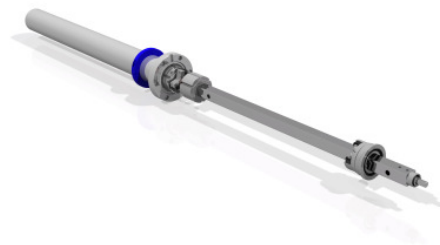
4. Outer magnets are now removed.

5. Remove the two threaded pins and the circlip with the correct pliers:

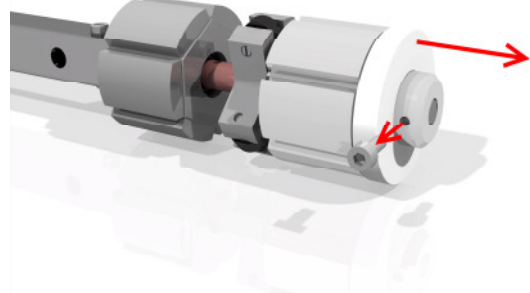


6. Pull out the square shaft carefully with the complete assembly (inner magnets and ball bearing holder).

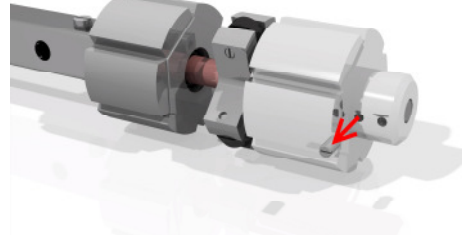
In case of a RM40/GMD40: Hold the manipulator vertically with the flange facing up. Extract the shaft, until the inner magnet hits up the front slide bearing from behind. With a slight jerk, the front slide bearing can be shaken out from its groove. Make sure the slide bearing isn't tilted, to prevent the slide bearing from hooking into the groove



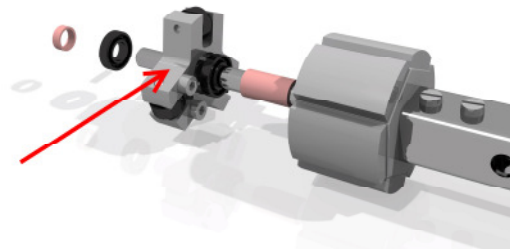
7. Remove the cylinder head screw and then the PTFE-ring from the inner magnet assembly.



8. Remove the threaded pin. The rear inner magnet is now loose. Remove it too.



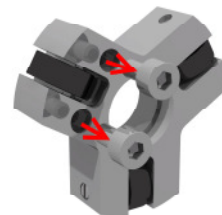
9. Now separate the rear ball bearing holder.



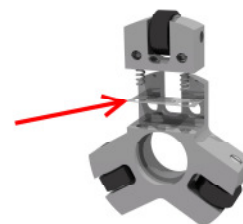
10. Replace the ball bearings by removing the threaded pin. For the RM40, jump to 13.



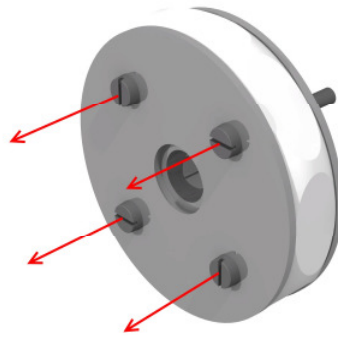
11. In case the thin platelet in the next picture 12. is standing out, remove the screws first.



12. Place the platelet properly and press the block against it and tighten again the screws.



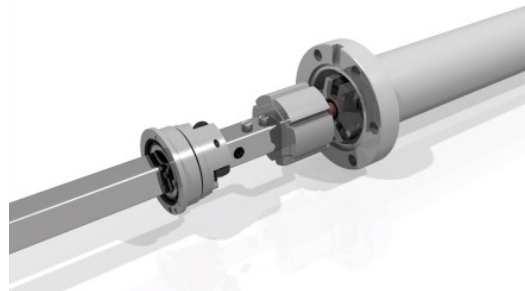
13. RM40: The slide bearing at the rear is attached to the inner magnet. Remove the four screws to replace the bearings.



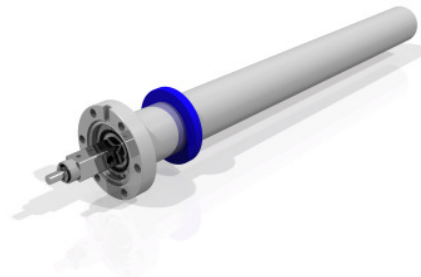
14. Reassembly the bearing holder and the rear inner magnet.



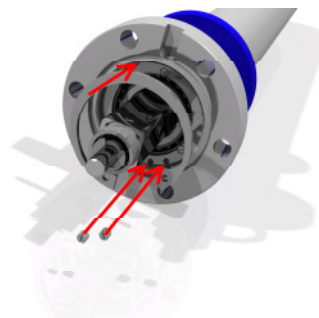
15. Insert the assembly carefully into the tube carefully (or you might damage the knife edge!!!)



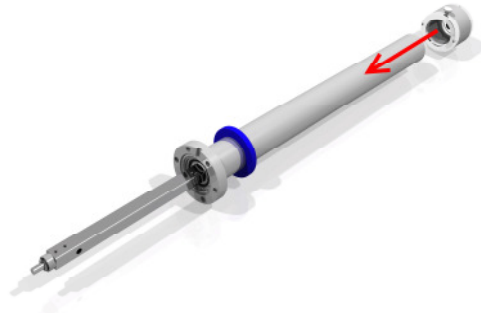
16. Insert the front ball bearing holder too.



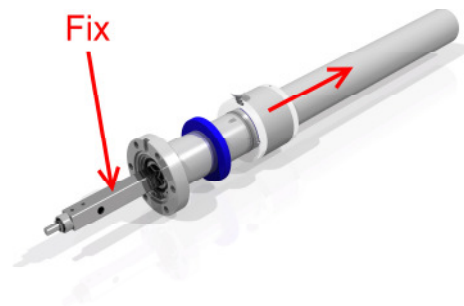
17. Use the pliers (see 5.) to insert the circlip and then screw in the threaded pins.



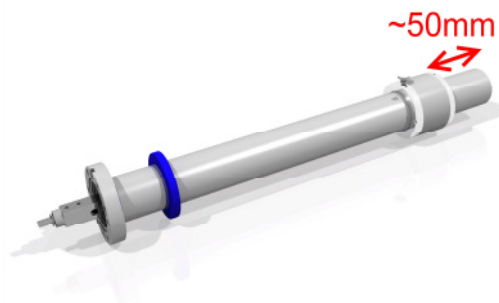
18. Pull the square shaft a bit out and slide the outer magnets over the tube while fixing the shaft with the other hand. You will feel a strong "click" when the outer magnet starts to attract the inner magnets. Slide the outer magnet over all inner magnets until.



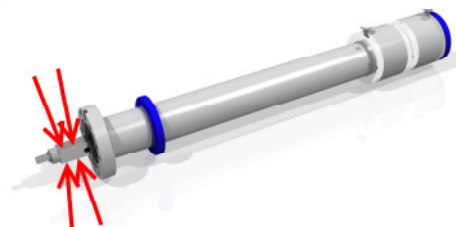
19. Pull slowly the outer magnet into the other direction until you feel again the strong "click". Now you must overcome **only one more** click to arrange the inner and outer magnet in a correct alignment.



20. To check if the alignment is correct, retract the shaft fully. For the RMDG40 you have to measure a distance of about 50mm between the end of the outer magnet to the end of the tube. For all other sample transporter, this distance is approximately zero.



21. Slide over the second outer magnet and mount the rear locking ring. If the manipulator has a pincer grip, continue with 23 instead. At last, tighten the four cylinder head screws.

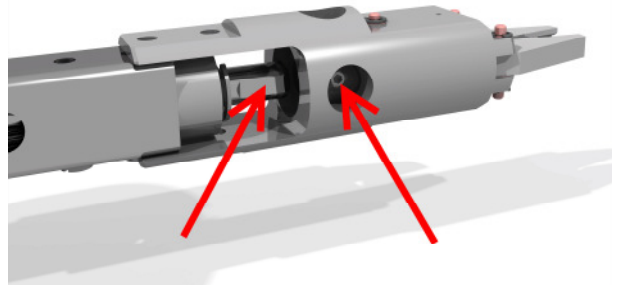


22. Finish.

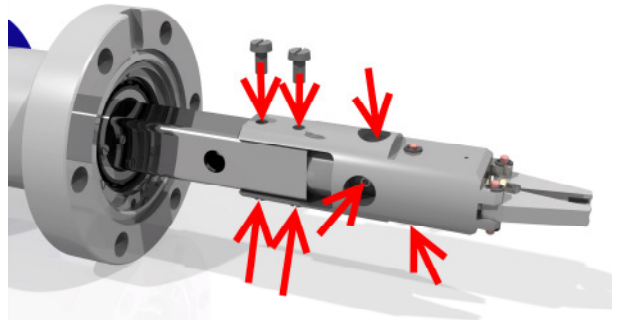




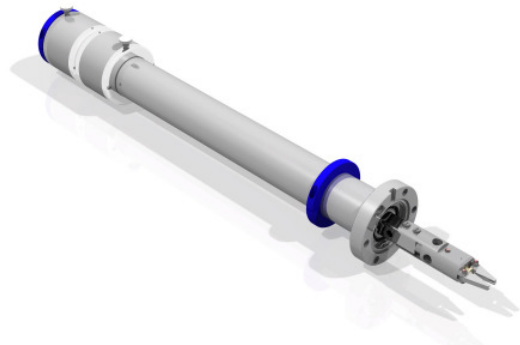
23. Turn the rear outer magnet such that the normal of the plane surface at the tip of the inner shaft is aligned with one of the three threaded pins of the pincer grip. Then slide the it over the square tube.



24. Fix the pincer grip by tightening the four cylinder head screws and then the three threaded pins.



25. Finish.



### 6.3 Deflections

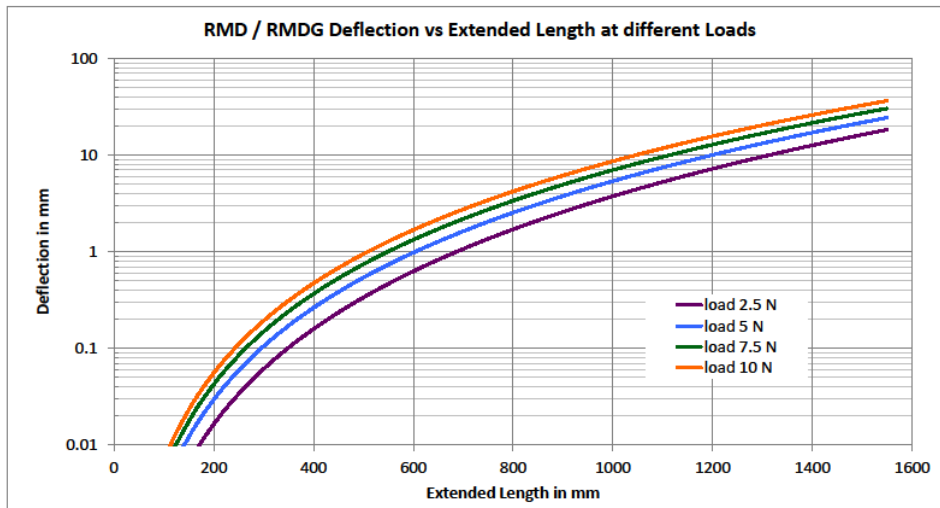
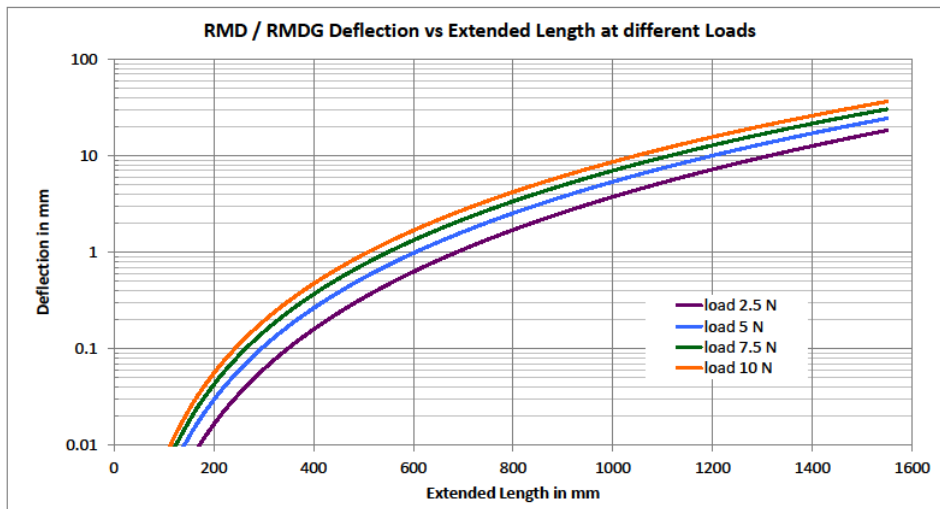
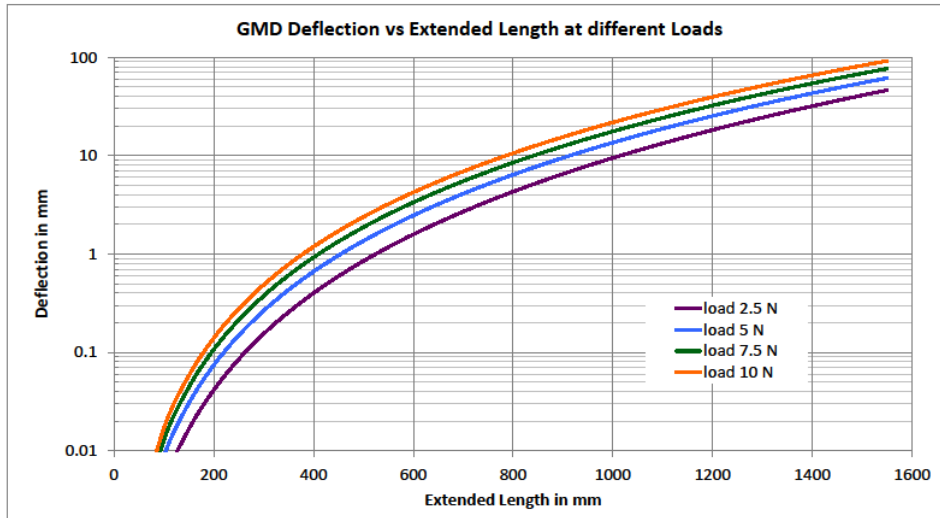


Fig27: Deflection vs. Extended Length: Sample Transporters

### ***6.4 Factory overhaul***

The slide and ball bearings are the only parts of the sample transporter that wear out. Many bakeout periods lead to slight deformation of the slide bearings. This could result into disturbances of the motion smoothness and probably higher outgassing rates. We offer an allover factory overhaul for inner and outer bearings and readjustement of any style of pincer grips. For more information please contact us directly.

### ***6.5 Declaration of decontamination***

In case of returning the sample transporter to us, it is necessary to complete a declaration of contamination and send it to us. Please contact us therefore.

### ***6.6 Download***

This manual can be downloaded from our website. It can be found in the specifications of each listed sample transporter.