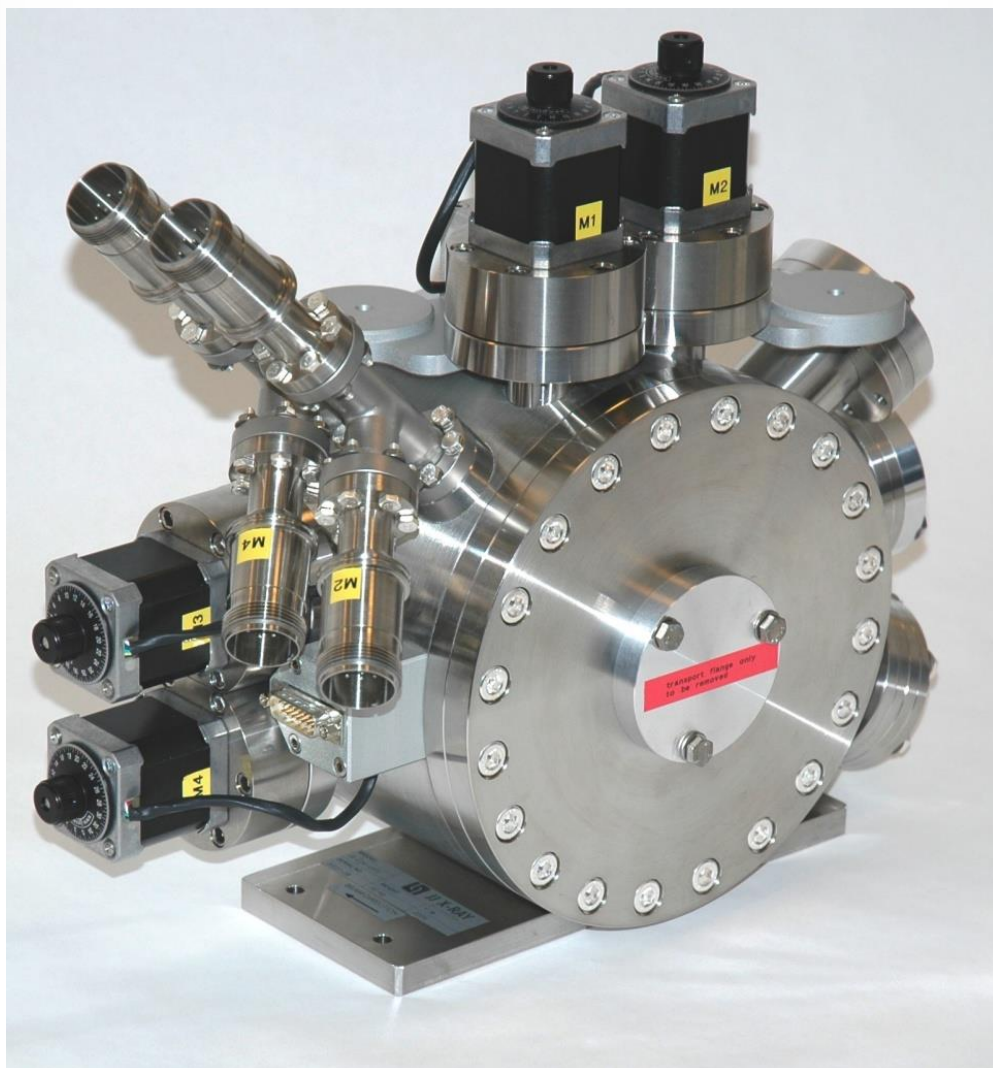


USERS MANUAL IB-C30-UHV



JJ X-RAY

Danish Science Design

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IB-C30-UHV

This is based on the classic JJ X-Ray IB-C30 slit system known for its sturdiness, reliability and precision.

IB-C30-UHV adapted for Ultra High Vacuum (UHV) applications where O-ring sealing is not sufficient.

The aperture is defined by four independently movable, highly polished tungsten carbide blades. These blades are controlled by a high precision guiding rail system and high resolution stepping motors.

The blades can be installed in two configurations, either providing a curved surface of radius 16 or providing a knife-edge sloping at 0.5 degrees. Standard blades are polished to obtain a roughness better than 25 nm RMS.

To avoid issues of UHV contamination and overheating of the motors, the high-resolution stepping motors are positioned outside the vacuum, and all motions are established via magnetically coupled feedthroughs.

In its basic configuration, the slit is delivered with beam flanges of either DN40-CF, DN63-CF or DN-100CF.



Environmental and Safety Hazard Identification Assessment.

1.1 General

In normal operation, the system is designed to operate safely. The user should, however, be aware of potential hazards which exist in and around equipment of this type and of the ways of avoiding possible injury and equipment damage which may result from inappropriate ways of working. A description of such potential hazards and how to avoid them is given.

If the equipment is used in a manner not specified in the User Manual, the protection provided by the equipment may be impaired.

This manual adopts the following convention:



WARNING

Indicates a potential hazard which may result in injury or death



CAUTION

Indicates a potential hazard which may result in damage to equipment

See original manufactures manual for further safety data on third party equipment supplied with the system.



WARNING

Do not take risks. You have a responsibility to ensure the safe condition and safe operation of equipment.

1.2 Electrical Safety

In normal use, the user is protected from the dangers associated with the voltage, current, and power levels used by the equipment. Only personal who are qualified to work with the voltages and currents used by this equipment should attempt to disconnect, dismantle, or modify the equipment.

1.3 Potential Electrical Hazards

The following list is not intended as a complete guide to all the electrical hazards on the system, but illustrates the range of potential hazards that exist:

- Electric shock
- Electric burn
- Fire of electrical origin
- Electric arcing

1.4 Recommended Precautions



WARNING

1. All of the electrical equipment supplied as part of the system should be provided with a protective ground. Do not remove protective grounds as this may give rise to an electrical safety hazard. It is vitally important that the system is properly grounded at all times.
2. Follow local and national electrical regulations and procedures.
3. Do not defeat interlocks, remove connectors, disconnect equipment, open safety covers, dismantle, or modify equipment unless you are qualified and authorized to do so and you are fully conversant with its operation and potential hazards or have a total assurance through your local electrical permit-to-work-system, that the equipment has been made safe.
4. Make sure that the main supply is breakered at an appropriate rating and that it can be isolated locally via a clearly labeled, clearly visible, and easily accessible isolating switch. Isolate the supply before carrying out any maintenance work.

1.5 Mechanical Handling Safety



WARNING

The system itself and some components are heavy and require careful handling. Use safe lifting procedures for heavy items to prevent possible strain injury.

1.6 Safe Mechanical Practice

In normal use, personnel are not required to undertake mechanical work. Servicing or repair may, however, necessitate access to any part of the system. Only suitably qualified personnel should attempt to dismantle, modify, or repair equipment.

1.7 Moving Parts

There are no moving parts accessible under a normal operation.

1.8 Modification and Service

The safety, reliability, or performance of the equipment may be impaired if assembly operations, extensions, re-adjustments, modifications, or repairs are not carried out in accordance with the instructions provided in the manual and with any other instructions issued by the manufacturer. If you wish to modify the equipment please contact JJ X-Ray for further advice.

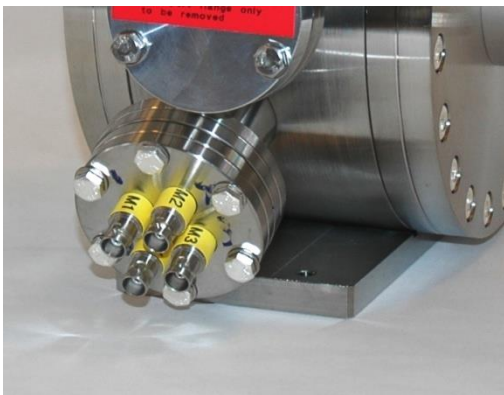
Technical Specifications

Standard Equipment for IB-C30-UHV

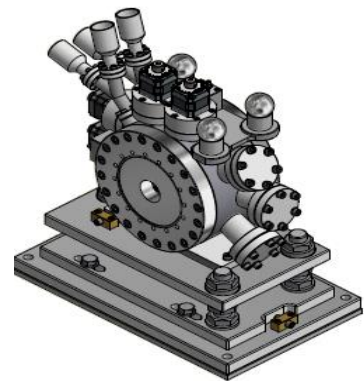
Aperture size:	30 mm x 30 mm (maximum) -30 mm x -30 mm (minimum with full overlap)
Vacuum	~10 ⁻⁹ mbar
Resolution:	1 micron in full step (less than 200 nm using microstepping)
Repeatability:	± 0.4 micron (uni-directional)
Accuracy:	± 2 micron over 3 mm in open loop and 0.5 micron in closed loop
Blades:	Blade material made of tungsten carbide Each blade is 2 mm thick and has two highly polished edges; One edge is curved into radius 16 mm the other edge sloping at 0.5 degrees Standard polishes are better than 25 nm RMS roughness Other options are possible
Electrical connection:	See pin-out and wiring diagram. Can be customized.
Limit switches:	UHV compatible high quality limit switches on all blades incl. UHV compatible wires UHV electrical feed-through into external 15 pin SUB-D connector
Mechanical dimensions:	External diameter of UHV chamber: 202.50 mm Distance from center to outer motor part: 210 mm 140 mm length in beam direction (flange to flange)
Weight:	~30 kg
Motors:	2-phase stepping motor, 0.9 degrees/step, 3.3 ohm, 0.85 A amp (bipolar)
Mechanical connection:	DN-100CF on both sides as standard Others are possible
Outer surface:	Stainless steel
Bake out-temperature:	120°C - limited by in-vacuum encoders and magnetic rotary feedthroughs

Technical Specifications Options

Options for IB-C30-UHV		Surcharge
Additional Probes	Drain current, viewing ports, pin diode, thermocouples etc.	Yes
Blades	Custom blade design and other blade material is possible	Yes
Mounting of Blades	Blades can be mounted with the curved R16 edge (instead of the standard 0.5 degrees knife edge)	No
Encoders	Internal linear in-vacuum encoders (Renishaw) can be mounted on the inside, measuring actual blade motion. Incremental or absolute.	Yes
	Alternatively, incremental or absolute rotary encoders can be mounted on the backside of the motors.	Yes
Alternative Vacuum Connection	Normally, vacuum is established through beam flanges. Alternative evacuation through optional flange in the base-plate is possible.	Yes
Drain Current	The electrical current is measured for each blade via a BNC connector in order to decide the position of the beam.	Yes
Positioning	Alignment base with the following motions: x and y directions, roll and pitch (Phi, Chi), and yaw (Theta)	Yes
Passive cooling	Copper braids mounted between each blade and the steel chamber (cooled for operation up to 5 Watt per blade).	Yes
Motors	Alternative motors e.g. IMS motors or 5-phase motors	Yes



IB-C30-UHV with feedthrough for drain current (option)



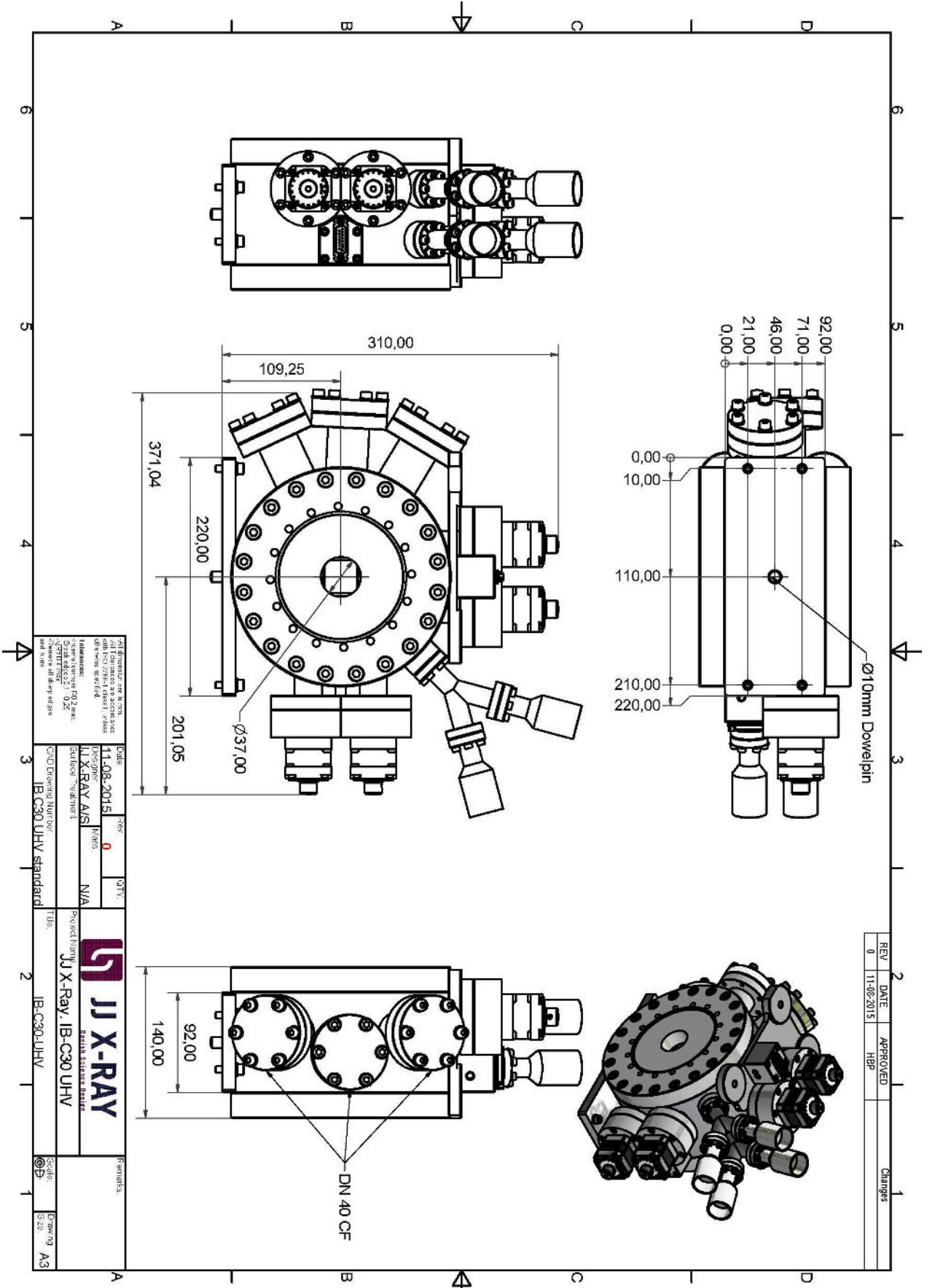
IB-C30-UHV on alignment base (option)

Recommended Driver Settings	
The motors (PK245m-01b) should be run <u>at 0.85 A per phase.</u> The motors have been tested at:	
Running speeds	1000 steps/second
Starting speeds	300 steps/second
Ramp times	0.1 second

Always use “backlash correction” if available (i.e. the motor always approaches the final position from the same side). A useful backlash parameter could be 0.1 mm.

Warning:

If you are using systems/detectors that can be damaged by overexposure, where the slits are used to remove a lot of the intensity, be careful when changing aperture size since the backlash correction may result in the slit being opened significantly more than you anticipated during adjustment.



REV	DATE	APPROVED	Changes
0	11-08-2015	HBP	

All dimensions are in mm.
 All tolerances are according to ISO 2768-MS unless otherwise specified.
 Material:
 JJ X-RAY ANS
 Surface Treatment:
 Nickel
 Surface Finish: Ra 0,2 µm.
 Chamfers: 45° x 0,25 mm.
 Fillets: R0,5 mm.
 Dimensions at shop edges and 90°.

Scale: 1:1
 Date: 11-08-2015
 Revision: 0
 Drawing: JJ X-RAY ANS
 Project Name: JJ X-Ray, IB-C30 UHV
 Title: IB-C30 UHV standard



Formal: JJ X-Ray, IB-C30 UHV
 Scale: 1:1
 Drawing: A3

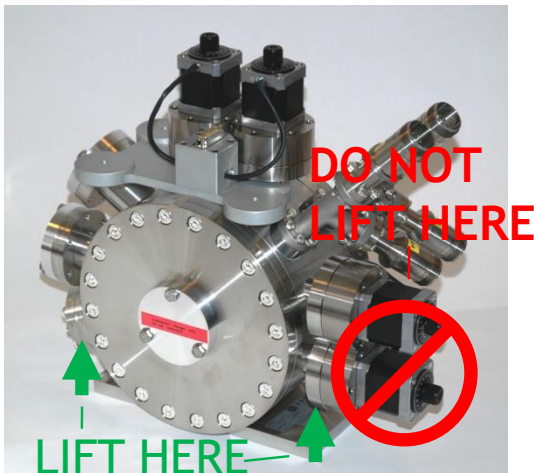
Mounting and Handling

The slit system can be lifted safely in the flanges as close to the chamber body as possible. The total weight is 32 kg.

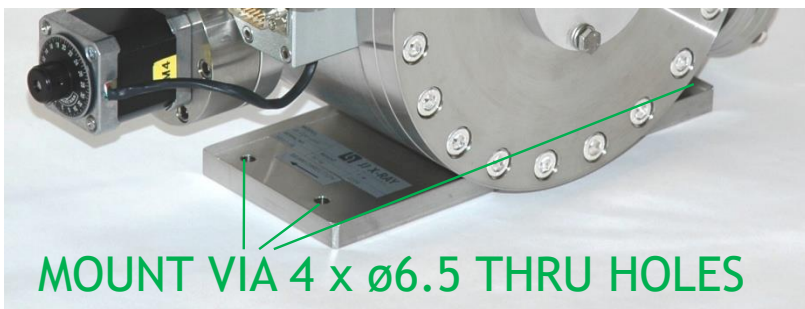


CAUTION

Do NOT lift the slit system in the motors or the outer motor flanges.



The slit system is mounted with 4 x M6 screws via the for 4 x $\varnothing 6.5$ thru holes in the base plate.



Blade Configuration and Beam Direction

The aperture is defined by four independently movable, highly polished tungsten carbide blades. These blades are controlled by a high precision guiding rail system and high resolution stepping motors. All blades have a full travel of 30 mm and with full overlap, i.e. not possible to crash.

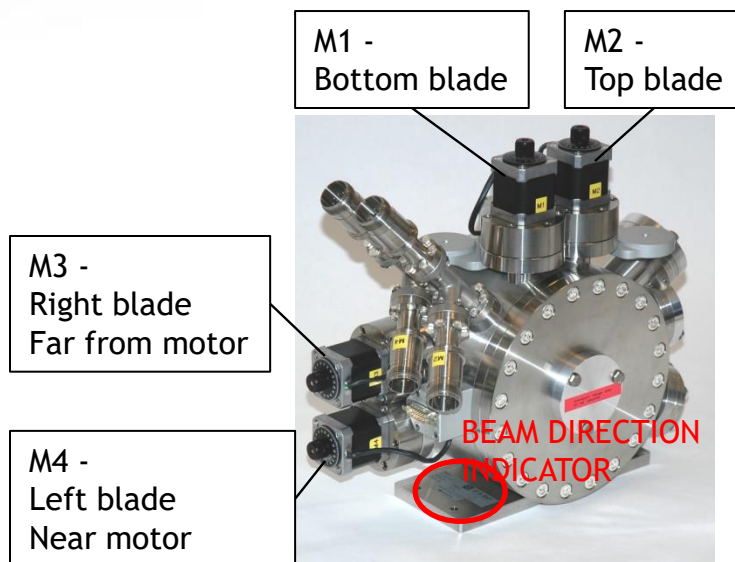
The stepper motors guides the blades as shown in the picture below as follows:

M1: Bottom blade

M2: Top blade

M3: Right blade (far from the motor)

M4: Left blade (near motor)

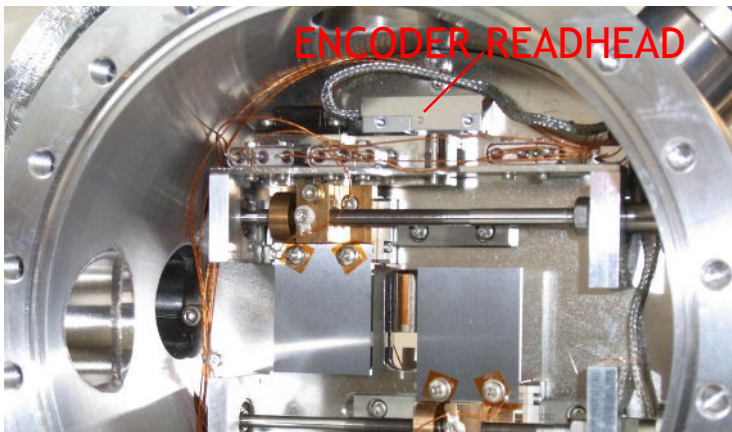


The **beam direction** is indicated by an arrow on a sticker on the vacuum vessel.

Encoder Option

Each motion is encoded with an in-vacuum linear encoder mounted very close to the actual blade, thus minimizing errors that would be caused by stress, strains and temperature variation in the system.

The electronics of the in-vacuum encoder is protected from radiation by a 3 mm stainless steel or equivalent shielding in the line of sight to the direct synchrotron beam.



The signal from the encoders is wired to the 19-pin vacuum feedthrough connectors and connected to the patch panel.

The encoders used are a linear UHV-version from Renishaw. For details about the encoder specifications, we refer to the manufacturer's manual.

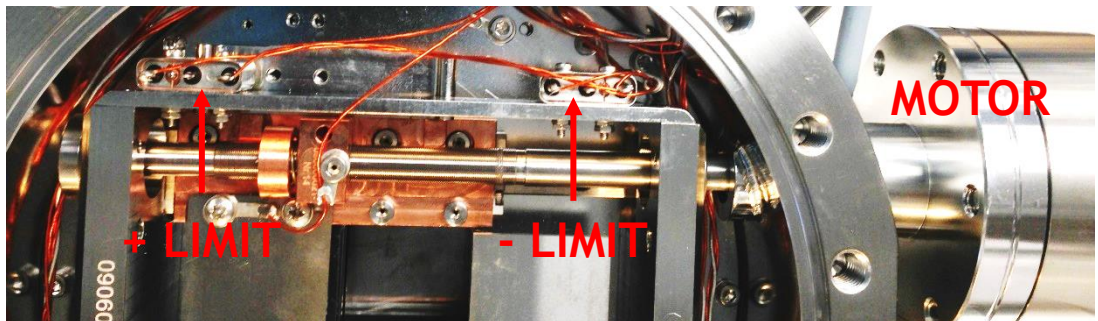
Limit Switches

Each motion has end-of-travel in-vacuum limit switches that are configured in a 'normally closed' mode.

The signal from the limit switches are wired to the 12-pin vacuum feedthrough connectors and connected to the patch panel.

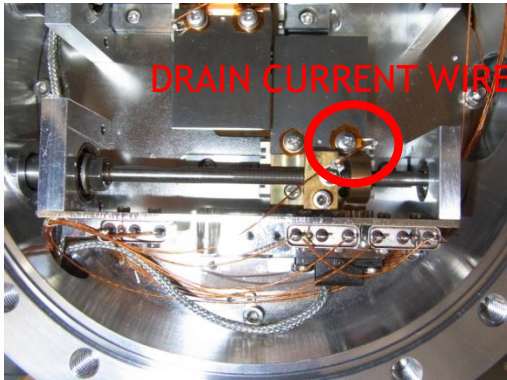
'+' limit is far from the motor

'-' limit is near the motor

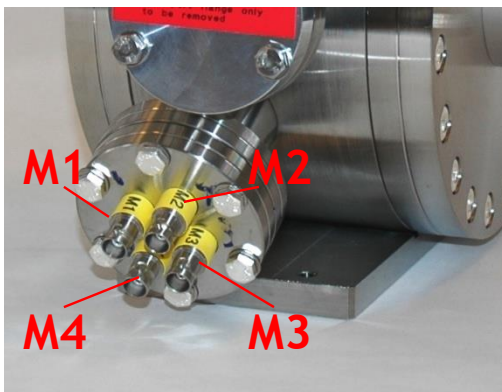


Drain Current Option

Each slit blade is electrically isolated from the surroundings by Kapton foil. A drain current Kapton wire is connected to the blade via a silver plated solder tag.

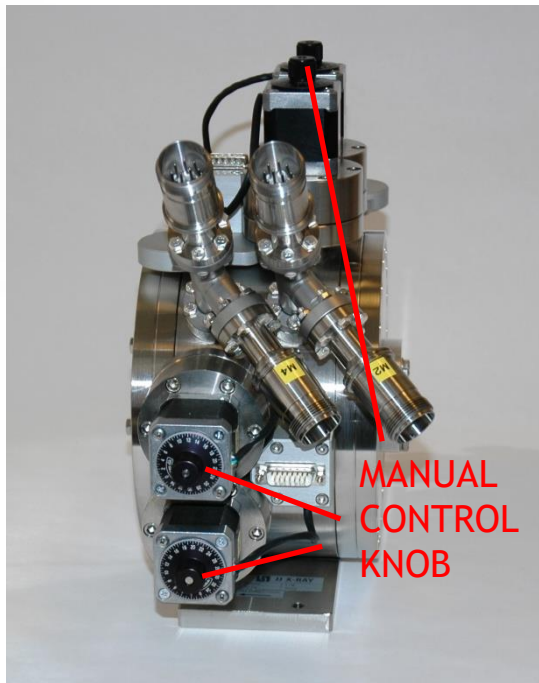


The drain current from the four blades is connected to a BNC connector electrical feedthrough.



Manual Control

If for some reason, you need to move the slit blades manually, it is possible to use the scale wheel (or control knob) attached to the back shaft of the motor. It is probably easiest, if this operation is done with an open cover so you can see what is going on.



Motor Gasket Replacement

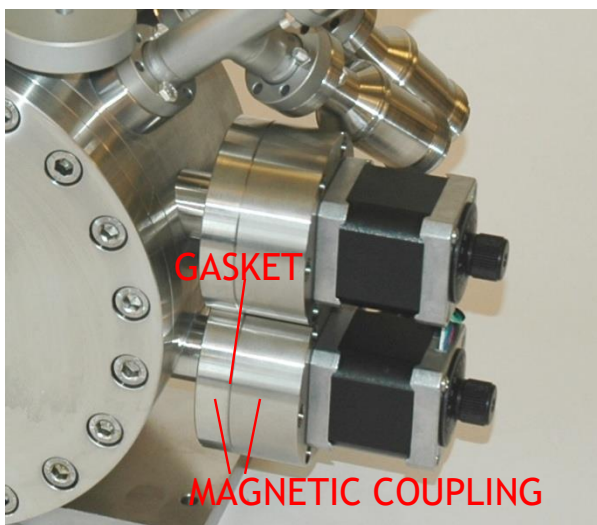
There is no mechanical feedthrough to the UHV chamber. The rotation of the stepper motors on the outside of the UHV is precisely mirrored by the spindle inside the UHV chamber through a magnetic coupling of strong magnets on both sides of the motor flange. The vacuum barrier is a custom made gasket connected to a this copper plate.

This gasket is easily replaced by removing the motor via the six flange screws.



CAUTION

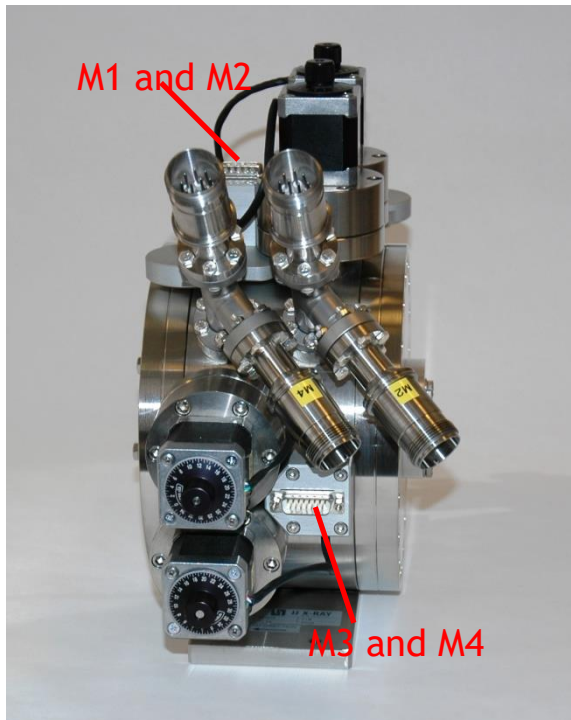
It is important that the motor is not rotated while dismantled so the magnetic pattern, on both sides of the gasket, is preserved after remounting of the motor.



Electrical Connections

The electrical connections for the motors, limit switches, encoder signals, and drain current are identified as follows:

- Motor 1 and motor 2 are connected to one common Sub-D 15-pin socket (M1 and M2)
- Motor 3 and motor 4 are connected to one common Sub-D 15-pin socket (M3 and M4)
- The limits and encoder signals for each motion are connected to round feedthrough connectors



Trouble Shooting

The most common issues and their resolutions are:

- ❏ The motor does not move when it should (it can be silent, be jittering or be making a noise).
 - The motor is not receiving enough current. Try setting the current a bit higher (for example 10%). If problems persist check with an amp-meter to see that your driver is working properly.
 - The wiring is bad. Check cabling.
 - One of the motors' phases is burnt. Check that the resistance on all phases is the same. If not, contact us to have the slit sent for repair.
 - The motor is stuck against a limit switch. Un-stick it, using the scale wheel or, if an AT-slit, open the slit (see manual control), and fix the limit switch issue.
- ❏ Restart the controller and the controller program.
- ❏ The blade system shows irreproducibility during operation.
 - The rail system may have become loose. Open the slit. Check if the rail-system is tight. Tighten screws if you need to.

The JJ X-Ray Product Range

- ☒ Slit Systems (AIR, HV, UHV)
- ☒ Complete Beamline Solutions
- ☒ Spectrometers
- ☒ Refractive Optics
- ☒ Foil Collimators
- ☒ Positioning

Contact JJ X-Ray A/S

If you have any questions, concerns, request for quotations or need general advice, please feel free to contact us:

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