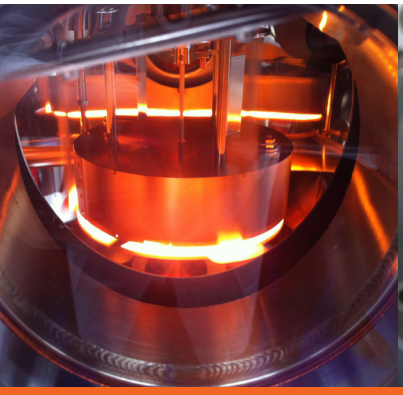
UHVD



DEPOSITION STAGES

ANALYTICAL STAGES

SAMPLE TRANSFER

COMPONENTS

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UHV Motion and Heating Specialists

UHV Design leads the field in high-technology motion, manipulation and heating product solutions for the vacuum industry.

Unrivalled in-house resources

Every stage of the production process is controlled in-house, from design to manufacture, assembly, testing and after-sales support to ensure that rigorous standards are always met.

Exceptional scientific and engineering capability

Our highly-qualified, dedicated team provides:

- detailed understanding of process, applications and techniques
- the ability to model magnetic devices, stress and thermal dynamics
- state-of-the-art designs through best engineering practices
- rapid, competitive customisation to meet individual requirements

Outstanding Customer Support

UHV Design guarantees the highest level of customer support both before and after ordering.

UHV Design's custom-built UK manufacturing facility.

Contents

Section 01

01

ROTARY DRIVES

Magnetic Rotary Drives

The production-proven MagiDrive range of rotary feedthroughs enables rotation to be transferred into a vacuum system using a stiff high flux magnetic coupling. With no bellows, fluids or dynamic seals, the MagiDrive range offers reliable and leak-tight UHV operation.

MagiDrive concept

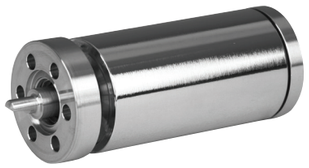
Using the latest magnetic materials technology, a large number of high flux magnetic fields interlock inner and outer rotating assemblies through a solid stainless steel enclosure. The enclosure or vacuum envelope is manufactured from one piece ensuring vacuum integrity. The high density of interlocking fields ensures exceptionally high torsional rigidity.

MagiDrives used in excess of their torque rating simply release their magnetic grip and lock back onto the next magentic pole. This protects the drive and whatever it is driving from incurring any damage, thereby avoiding expensive maintenance. MagiDrives offer high precision rotation with zero angular backlash under low load and acceleration. All drives are fitted with magnetic shielding.

MagiDrives are available in a range of CF flange sizes and include hollow variants to enable stacking of drives to provide three independent axes of rotation or to enable services, such as heating, to be fed through. MagiDrives can be actuated manually, pneumatically or motorised using stepper or DC motors. MagiDrives are available in both Solid and Hollow configurations.

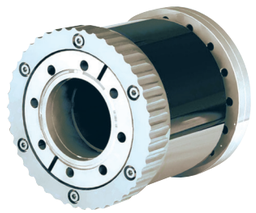
KEY ADVANTAGES

- Magnetically-coupled, fail safe design
- Single piece vacuum enclosure ensures leak-free performance
- Magnetic shielding permits use in magnetically-sensitive environments
- No bellows, organics or sliding seals
- Bakeable to 250ºC (including magnets)
- High torque to size ratio
- Zero backlash under low load and acceleration
- Hollow variants allow stacking of concentric drives



Solid MagiDrive Series

The solid shaft series provides a range of standard shaft options as detailed in the product configuration options. Customised shafts are available upon request. For longer shafts, where concentricity and stability of the rotating shaft is critical, UHV Design offer a range of extended bearing housings to support the shaft along its axis of rotation. Details are available upon request.



Hollow MagiDrive Series

The four largest MagiDrives are available in a hollow configuration, terminating with a non-rotating CF flange at the rear. This allows services to be passed through the drive or alternatively, an additional MagiDrive to be mounted to the rear, providing a secondary axis of rotation. Up to four independent axes of rotation can be provided by combining the MD16, MD40H, MD64H and MD100H MagiDrives. This stacking capability is typically used to provide simple solutions to sophisticated manipulation requirements.

MagiDrive Selection Table

		Standard Torque	Medium Torque	High Torque	Ultra-High Torque
MagiDrive	**Mounting Flange**	**0.04-2.0 Nm**	**2.1-4.5 Nm**	**4.6-10.0 Nm**	**11-40 Nm**
MD10	CF10, (1" OD CF)	✓ (page 8)			
MD16N/MD16A	CF16, (1.33" OD CF)	✓ (page 10)			
MD40N/MD40A	CF40, (2.75" OD CF)	✓ (page 12)			
MD40/MD40H				✓ (page 14/20)	
MD35LB				✓ (page 22)	
MD64/MD64H	CF64, (4.5" OD CF)			✓ (page 16/24)	
MD64LB				✓ (page 26)	
MD64LBM					✓ (page 26)
MD100H	CF100, (6" OD CF)				✓ (page 28)
MD150H	CF150, (8" OD CF)				✓ (page 30)

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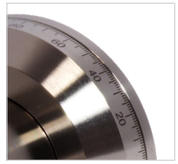
MAGIDRIVE Actuation options

The MagiDrive range is available with a variety of manual, pneumatic and motorised actuation methods.

Manual actuation

Code	Item	Description
T	Standard drive	The standard manual drive.
F	Friction control	An adjustable external friction system enables the drive to hold its position when the desired position is reached. Resistance to turn is adjusted by tightening/ loosening a single screw located at the rear of the drive. Ideal for shutter applications.
B	Brake	A thumbscrew brake facility enables the drive to be locked in any position.
CB	Calibrated thimble with brake	Calibrated thimble with 1° increments and thumbscrew brake facility.
D	Dual shaft	MagiDrives can be supplied with both input and output shafts. This allows the customer to retrofit their own motorisation option or to fit a position encoder.
P	Timing pulley	A pulley is mounted on the end of the drive allowing users to install their own motor assembly.



Calibrated thimble

Brake

Dual shaft

Timing pulley

Pneumatic actuation

Code	Item	Description
RA	Rotary actuator	Pneumatically actuated MagiDrives are fitted with an adjustable rotary actuator providing from 30-170° sweep. Flow controllers enable input and exhaust to be throttled to control speed.
RAI	Rotary actuator with visual position indicators and reed switches for position feedback	As above but fitted with two reed switches to provide position feedback for system interlock facilities. This option also includes LEDs allowing the user to see the position of the shutter in open or closed states.

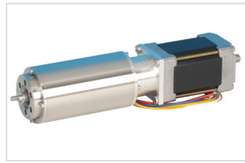
Pneumatic actuation

Motorised actuation

Motorised MagiDrives can be driven with DC or stepper motors, and are available with a selection of motor and gearbox combinations to cover a wide range of load, speed and positioning requirements (see page 33).

Motors can be mounted either to the side or in-line with the drive (as shown below), to suit the space available. Motors are easily removed for bakeout and have pre-set mounting brackets to ensure the correct re-alignment and belt tension is maintained when the motor is replaced.

Code	Item	Description
Stepper Motors		
IS	In-line stepper motor	A co-axially mounted stepper motor providing minimum lateral footprint.
SS	Side-mounted stepper motor	A stepper motor mounted to the side of the drive.
DC Motors		
ID	In-line DC motors	A co-axially mounted DC motor providing minimum lateral foot-print.
SD	Side-mounted DC motor	A DC motor mounted to the side of the drive.



In-line motor

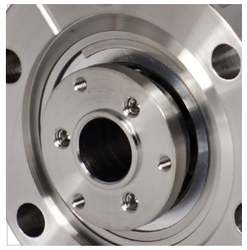
Side-mounted motor

Additional options for motorised MagiDrives

Code	Item	Description
S	Home Sensor	Single optical sensor for home positioning whilst allowing continuous rotation
L	Limit Switches	End of travel switch limiters
E	Rotary Encoder	Rotary positional data

Shaft Options

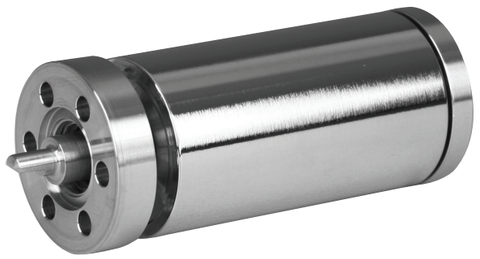
Code	Item	Description
X000	Stub shaft or spigot	Stub shaft - short stub shaft for end users to connect to. Spigot flange - spigot flanges to provide a rigid coupling to the driven load, whilst ensuring drive and shaft concentricity.
X030	30mm shaft	30 mm long stub shaft with a machined flat to aid connection (MD16). 30 mm long hollow tube shaft (MD35LB).
D	Dual shaft	Drive is provided with both input and output shafts.



Spigot Flange

CF10, 1" OD Flange

Solid MagiDrive Series



MD10 Series

This miniature drive is made possible through the use of the CF10 micro flange, which has an outside diameter of just 25.4mm. The body diameter is no bigger than the flange 1" OD, which makes the MD10 ideal for rotating small instrumentation loads, in applications where space is at a premium.

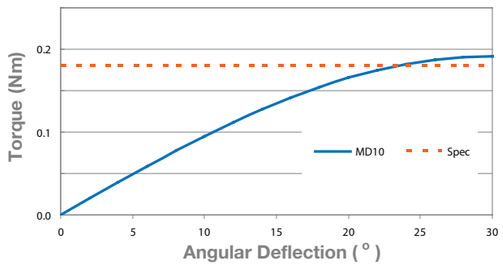
MD10 KEY ADVANTAGES

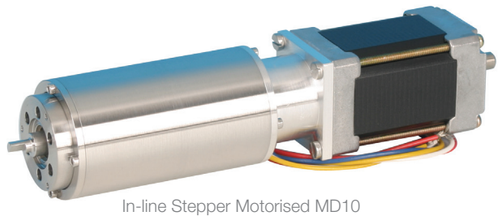
- Magnetically-coupled fail-safe design
- Smallest UHV drive on market
- High torque / size ratio
- No bellows or dynamic seals
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

Specification Table

MAGIDRIVE BODY	MD10
System mounting flange	CF10 25.4mm (1") OD CF
Construction	Machined from one piece 316L
Shaft style	Solid
Break-away torque	0.18Nm (0.13 lbf ft)
Max. no load spin speed (standard bearings)	200 rpm
Maximum shaft axial thrust	20N (4.5 lbf ft)
Maximum bakeout temp	250°C

Torsional Stiffness





In-line Stepper Motorised MD10

Pneumatically actuated MD10 with custom shaft

CF16, 1.33" OD Flange

Solid MagiDrive Series

MD16N/MD16A Series

The MD16N is the 'work horse' of the MagiDrive series providing sufficient torque (0.45Nm) for the majority of miniature feedthrough requirements. The MD16A provides the highest torque on the market for a CF16 flange (1.8Nm) and is ideal for shutter applications. Both variants benefit from our simple actuation upgrade options via a simple 'do it yourself' upgrade kit.

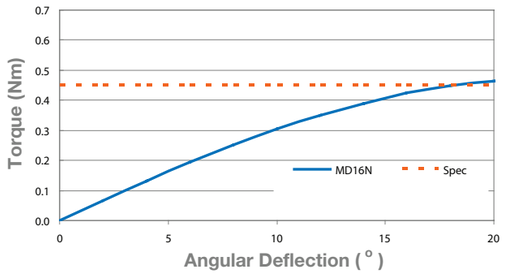
MD16N/MD16A KEY ADVANTAGES

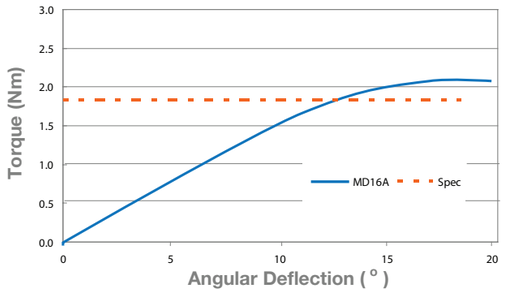
- Magnetically-coupled fail-safe design
- High torque / size ratio
- No bellows or dynamic seals
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

Specification Table

MAGIDRIVE BODY	MD16N	MD16A
System mounting flange	CF16 34mm (1.33") OD CF	
Construction	Machined from one piece 316L	
Shaft style	Solid	
Break-away torque	0.45 Nm (0.33 lbf ft)	1.8 Nm (1.33 lbf ft)
Maximum no load spin speed (standard bearings)	1000 rpm	
Maximum shaft axial thrust	20 N (4.5 lbf)	
Maximum bakeout temp	250°C	

Torsional Stiffness





MD16 with optical sensor

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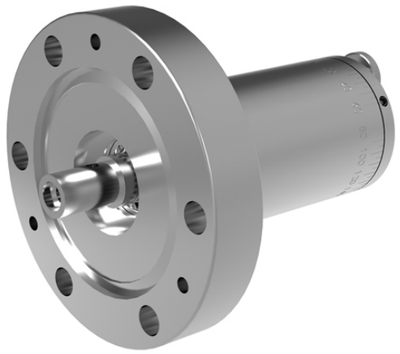
CF40, 2.75" OD Flange

Solid MagiDrive Series



MD40N/MD40A Series

The MD40N and MD40A provide 0.45Nm and 1.8Nm break-away torque for low- to medium-torque applications.

Both versions can be upgraded from manual actuation to motorisation at a later date using a simple-to-install motorisartion kit.

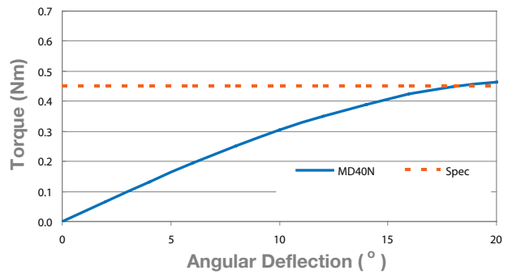
MD40N/MD40A KEY ADVANTAGES

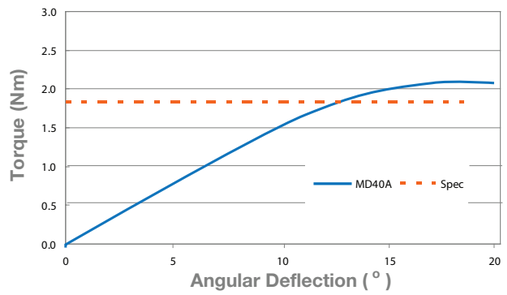
- Magnetically-coupled fail-safe design
- High torque / size ratio
- No bellows or dynamic seals
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

Specification Table

MAGIDRIVE BODY	MD40N	MD40A
System mounting flange	CF40 70mm (2.75") OD CF	
Construction	Machined from one piece 316L	
Shaft style	Solid	
Break-away torque	0.45 Nm (0.33 lbf ft)	1.8 Nm (1.33 lbf ft)
Maximum no load spin speed (standard bearings)	1000 rpm	
Maximum shaft axial thrust	20 N (4.5 lbf)	
Maximum bakeout temp	250°C	

Torsional Stiffness





CF40, 2.75" OD Flange

Solid MagiDrive Series

MD40 Series

The MD40 MagiDrive provides 9Nm torque on a 70mm OD (2¾" OD CF) flange. The drive is ideally suited to applications such as the rotation of samples and small platens, where stability is key. The MD40 is also available in a hollow configuration (see MD40H, page 20). For larger bore requirements on this flange size see MD35LB Series (6Nm) on page 22.

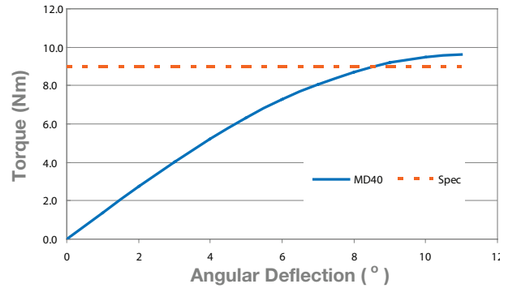
MD40 KEY ADVANTAGES

- Magnetically-coupled fail-safe design
- No bellows or dynamic seals
- High torque rotation (9Nm)
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

Specification Table

MAGIDRIVE BODY	MD40
System mounting flange	CF40 70mm (2.75") OD CF
Construction	Machined from one piece 316L
Shaft style	Spigot flange
Break-away torque	9 Nm (6.64 lbf ft)
Maximum no load spin speed (standard bearings)	500 rpm
Maximum shaft axial thrust	142 N (32 lbf)
Maximum bakeout temp	250°C

Torsional Stiffness



MD40 with dual shaft option

CF64, 4.5" OD Flange

Solid MagiDrive Series

MD64 Series

The MD64 MagiDrive provides high torque rotation through a high stiffness coupling. This drive would be ideally suited to robot type or platen rotation applications. The MD64 is also available in a hollow configuration (see page 26). For higher torque applications (up to 40Nm) see MD64LBM & MD100H on pages 28 and 30.

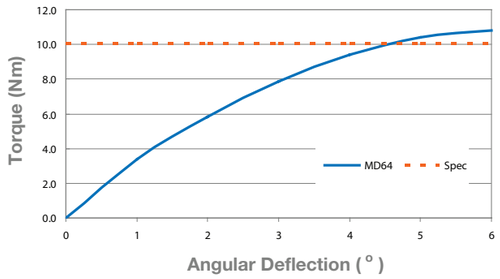
MD64 KEY ADVANTAGES

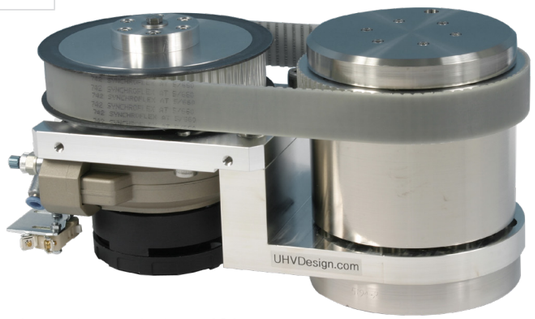
- **Magnetically-coupled fail-safe design**
- **High torque**
- **No bellows or dynamic seals**
- **Bakeable to 250°C**
- **Zero backlash under low load**
- **True UHV performance**

Specification Table

MAGIDRIVE BODY	MD64
System mounting flange	CF64 114mm (4.5") OD CF
Construction	Machined from one piece 316L
Shaft style	Spigot flange
Break-away torque	10 Nm (7.38 lbf ft)
Maximum no load spin speed (standard bearings)	500 rpm
Maximum shaft axial thrust	415 N (93 lbf)
Maximum Bakeout Temp	250°C

Torsional Stiffness



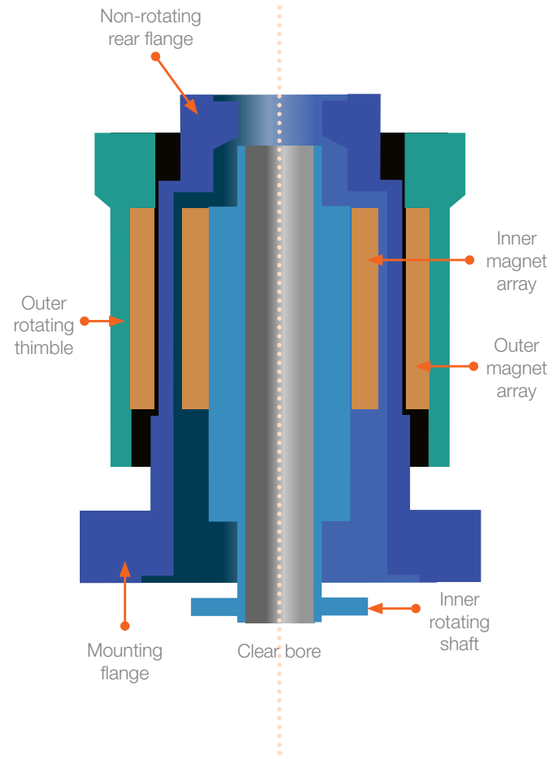


Pneumatically actuated MD64

Hollow Magnetic Rotary Drives

The four largest MagiDrives are available in a hollow configuration, terminating with a non-rotating CF flange at the rear. This allows services to be passed through the drive or alternatively, an additional MagiDrive to be mounted to the rear, providing a secondary axis of rotation. Up to five independent axes of rotation can be provided by combining the MD16A, MD40H, MD64H, MD100H and MD150H MagiDrives.

This stacking capability is typically used to provide simple solutions to sophisticated manipulation requirements.



HOLLOW MAGIDRIVE KEY ADVANTAGES

- Allows services to pass through the centre, i.e. power feedthroughs, thermocouples, cooling tubes etc.
- Co-axial combinations of drives, providing up to five axes of independent rotation for sophisticated manipulation requirements
- All MagiDrives are:
  - Failsafe – with excess torque a MagiDrive will simply release and lock back onto the next pole avoiding possible costly damage, maintenance and downtime
  - Bakeable to 250°C
- MagiDrives benefit from:
  - A single piece vacuum enclosure* guaranteeing vacuum integrity
  - No bellows, organics or sliding seals
  - True UHV performance
  - High torque
  - Zero backlash under low load and acceleration
  - Magnetic shielding permitting use in magnetically-sensitive environments

*Excluding MD100H & MD150H

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CF40, 2.75" OD Flange

Hollow MagiDrive Series

MD40H Series

MD40H is a medium torque, medium stiffness rotary drive. Configured with a hollow body, the MD40H has a fixed rear flange enabling a component to pass through the centre, such as a heater module, a feedthrough, a second MagiDrive rotary feedthrough or a cold lance.

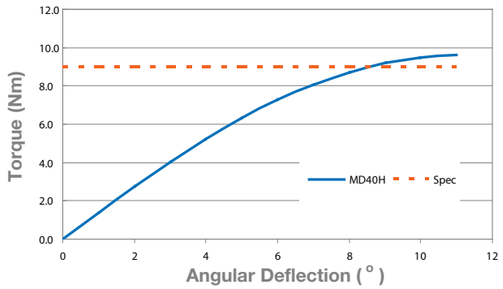
MD40H KEY ADVANTAGES

- 14.5mm clear bore
- Magnetically-coupled fail-safe design
- Medium torque
- No bellows or dynamic seals
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

Specification Table

MAGIDRIVE BODY	MD40H
System mounting flange	CF40 70mm (2.75") OD CF
Fixed rear flange	CF16 34mm (1.33") OD CF
Construction	Machined from one piece 316L
Clear bore diameter	14.5mm
Shaft style	Spigot flange
Break-away torque	9 Nm (6.62 lbf ft)
Maximum no load spin speed (standard bearings)	500 rpm
Maximum shaft axial thrust	142 N (32 lbf)
Maximum bakeout temp	250°C

Torsional Stiffness



CF40, 2.75" OD Flange

Hollow MagiDrive Series

MD35LB Series

MD35LB is a medium/high torque, medium stiffness rotary drive. The MD35LB is provided with calibrated thimble, brake and timing pulley as standard. An adjustable rear flange enables rotation of position prior to fixing. The large 27mm clear bore allows a component to pass through the centre, such as a heater module, a feedthrough or a cold lance.

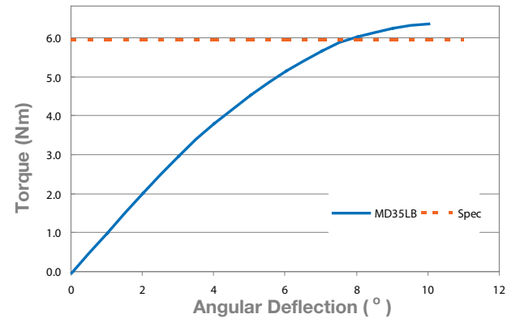
MD35LB KEY ADVANTAGES

- 27mm clear bore
- Magnetically-coupled fail-safe design
- Medium/high torque
- No bellows or dynamic seals
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

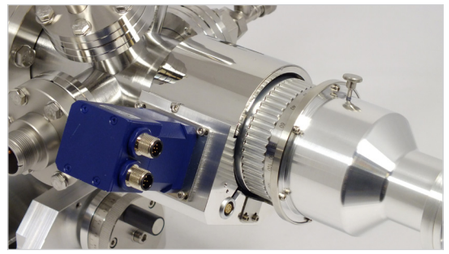
Specification Table

MAGIDRIVE BODY	MD35LB
System mounting flange	CF40 70mm (2.75") OD CF
Fixed rear flange	CF40 70mm (2.75") OD CF
Construction	Machined from one piece 316L
Clear bore diameter	27mm
Shaft style	Tube
Break-away torque	6 Nm (4.43 lbf ft)
Maximum no load spin speed (standard bearings)	500 rpm
Maximum shaft axial thrust	145 N (32.5 lbf)
Maximum bakeout temp	250°C

Torsional Stiffness



MD35LBCBP 27mm clear bore



MD35LBCBP as part of a manipulator

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CF64, 4.5" OD Flange

Hollow MagiDrive Series

MD64H Series

The MD64H MagiDrive provides high torque rotation through a high stiffness coupling. This drive is ideally suited to platen rotation or robot type applications. The MD64H has an adjustable rear flange enabling rotation of position prior to fixing. The hollow bore allows a component to pass through the centre such as a heater module, or a second MagiDrive rotary feedthrough shaft.

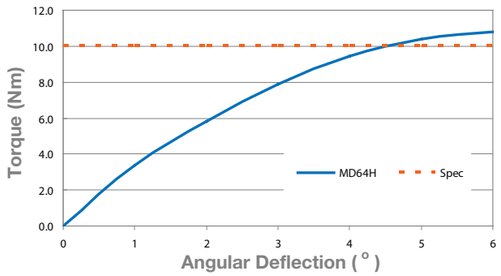
MD64H KEY ADVANTAGES

- 26mm clear bore
- Magnetically-coupled fail-safe design
- High torque / stability
- No bellows or dynamic seals
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

Specification Table

MAGIDRIVE BODY	MD64H
System mounting flange	CF64 114mm (4.5") OD CF
Fixed rear flange	CF40 70mm (2.75") OD CF
Construction	Machined from one piece 316L
Clear bore diameter	26mm
Shaft style	Spigot flange
Break-away torque	10 Nm (7.38 lbf ft)
Maximum no load spin speed (standard bearings)	500 rpm
Maximum shaft axial thrust	415 N (93 lbf)
Maximum bakeout temp	250°C

Torsional Stiffness



MD64H with timing pulley

MD64H with side-mounted stepper motor

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CF64, 4.5" OD Flange

Hollow MagiDrive Series

MD64LB(M) Series

The MD64LB & MD64LBM MagiDrives provides high (8 Nm) or ultra-high (40 Nm) torque rotation through a high stiffness coupling with a large 48.5mm clear bore. This drive is ideally suited to platen rotation or robot type applications. The MD64LBM supplies higher torque with the same dimensions.

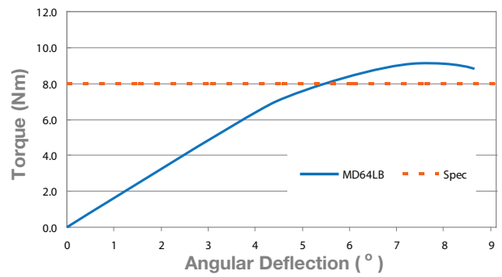
MD64LB(M) KEY ADVANTAGES

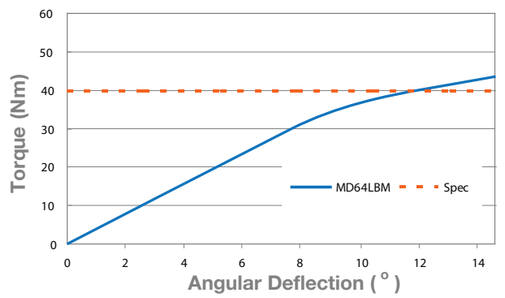
- 48.5mm clear bore
- High torque / stability
- No bellows or dynamic seals
- Bakeable to 250°C
- Zero backlash under low load
- True UHV performance

Specification Table

MAGIDRIVE BODY	MD64LB	MD64LBM
System mounting flange	CF64 114mm (4.5") OD CF	
Fixed rear flange	CF64 114mm (4.5") OD CF	
Construction	Machined from one piece 316L	
Clear bore diameter	48.5mm	
Shaft style	Tube with spigot flange	
Clear bore	48.5mm	
Break-away torque	8 Nm (5.90 lbf ft)	40 Nm (29.50 lbf ft)
Maximum no load spin speed	500 rpm	
Maximum shaft axial thrust	415 N (93 lbf)	
Maximum bakeout temp	250°C	

Torsional Stiffness





MD64LB with side-mounted stepper motor

CF100, 6" OD Flange

Hollow MagiDrive Series

MD100H Series

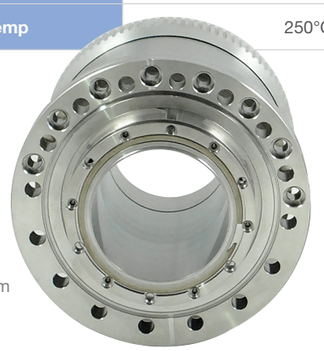
The MD100H is selected for demanding high torque and stiffness applications where a large bore is required, such as indexing robots or providing substrate rotation. The MD100H has a 65mm clear bore which enables a component to pass through the centre such as a heater module, cooling tubes or a second MagiDrive rotary feedthrough.

MD100H KEY ADVANTAGES

- » 65mm clear bore
- » Powerful, stiff coupling
- » No bellows or dynamic seals
- » Bakeable to 250°C
- » Zero backlash under low load
- » True UHV performance

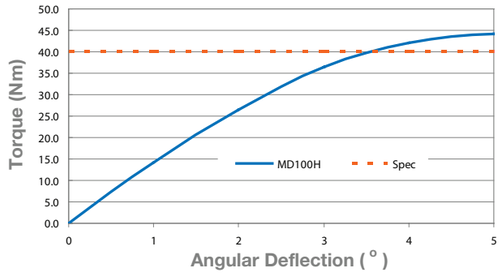
Specification Table

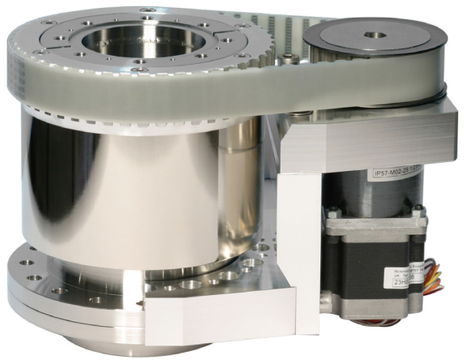
MAGIDRIVE BODY	MD100H
System mounting flange	CF100 152mm (6") OD CF
Fixed rear flange	CF64 114mm (4.5") OD CF
Construction	Fabrication
Clear bore diameter	65mm
Shaft style	Spigot flange
Break-away torque	40 Nm (29.50 lbf ft)
Maximum no load spin speed	200 rpm
Maximum shaft axial thrust	415 N (93 lbf)
Maximum bakeout temp	250°C



MD100H 65mm clear bore

Torsional Stiffness





MD100H with side-mounted stepper motor

MAGIDRIVE Motorisation Details

Gearbox Options

		MAXIMUM OUTPUT TORQUE Nm FOR GEAR OPTION:					MAXIMUM OUTPUT SPIN SPEED RPM FOR GEAR OPTION:				
DRIVE	MOTOR TYPE	1	2	3	4	5	1	2	3	4	5
MD10	In-Line DC motor (ID)	0.18	0.18	0.18	0.18	0.18	230	135	70	42	21
	In-Line stepper motor (IS)	0.07	0.18	0.18	0.18	-	200	23	16	8	-
MD16N	In-Line DC motor (ID)	0.21	0.35	0.45	0.45	-	230	135	70	42	-
	In-Line stepper motor (IS)	0.3	0.45	0.45	0.45	-	1000	375	107	63	-
MD16A	In-Line DC motor (ID)	0.21	0.35	0.6	0.6	-	230	135	70	42	-
	In-Line stepper motor (IS)	0.3	1.1	1.8	1.8	-	1000	375	107	63	-
MD40N	In-Line DC motor (ID)	0.21	0.35	0.6	0.6	-	230	135	70	42	-
	In-Line stepper motor (IS)	0.3	0.45	0.45	0.45	-	1000	375	107	63	-
MD40A	In-Line DC motor (ID)	0.21	0.35	0.6	0.6	-	230	135	70	42	-
	In-Line stepper motor (IS)	0.3	1.1	1.8	1.8	-	1000	375	107	63	-
MD40 MD40H	In-Line (ID) & side-mounted (SD) DC motor options	0.5	1.1	2.5	5.0	-	460	230	92	46	-
	Side-mounted stepper motor (SS)	1.0	1.9	5.8	9.0	-	500	188	54	31	-
	In-Line stepper motor (IS)	0.7	3.2	6.4	9.0	-	500	300	150	60	-
MD35LBCBP	Side-mounted DC motor (SD)	0.4	1.7	6.0	6.0	6.0	538	104	28	17	23
	Side-mounted stepper motor (SS)	0.8	3.7	6.0	6.0	6.0	500	150	75	30	23
MD64 MD64H* *side-mounted options only	Side-mounted DC motor (SD)	1.7	4.3	7.9	10	-	245	98	49	25	-
	In-Line DC motor (ID)	0.9	1.8	4.2	8.4	-	440	220	88	44	-
	Side-mounted stepper motor (SS)	3.5	6.9	10	10	-	150	75	30	15	-
	In-Line stepper motor (IS)	4.6	3.7	8.4	10	-	300	150	60	30	-
MD64LBCB (MD64LBMCB)	Side-mounted DC motor (SD)	1.7	4.3	7.9	10	-	245	98	49	25	-
	Side-mounted stepper motor (SS)	3.7	7.3	8.0 (16.8)	8.0 (33.6)	-	150	75	30	15	-
MD100H	Side-mounted DC motor (SD)	1.8	4.6	8.4	16.8	-	230	92	46	23	-
	Side-mounted stepper motor (SS)	3.7	7.3	16.8	33.6	-	150	75	30	15	-
MD150H	Contact us for details.										

For detailed technical information including gearing ratios please contact us

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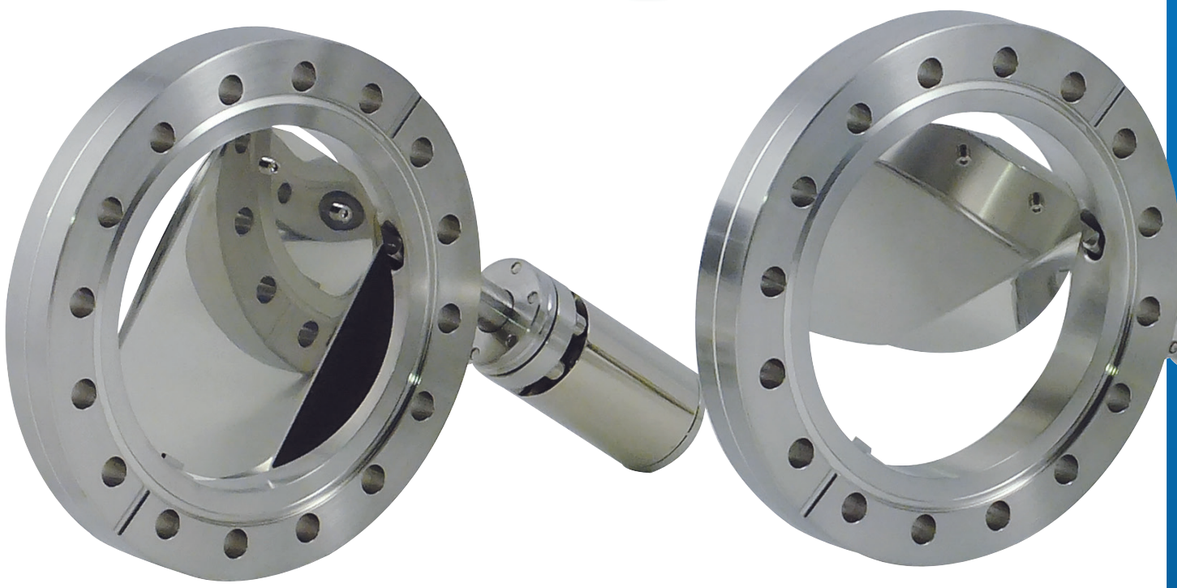
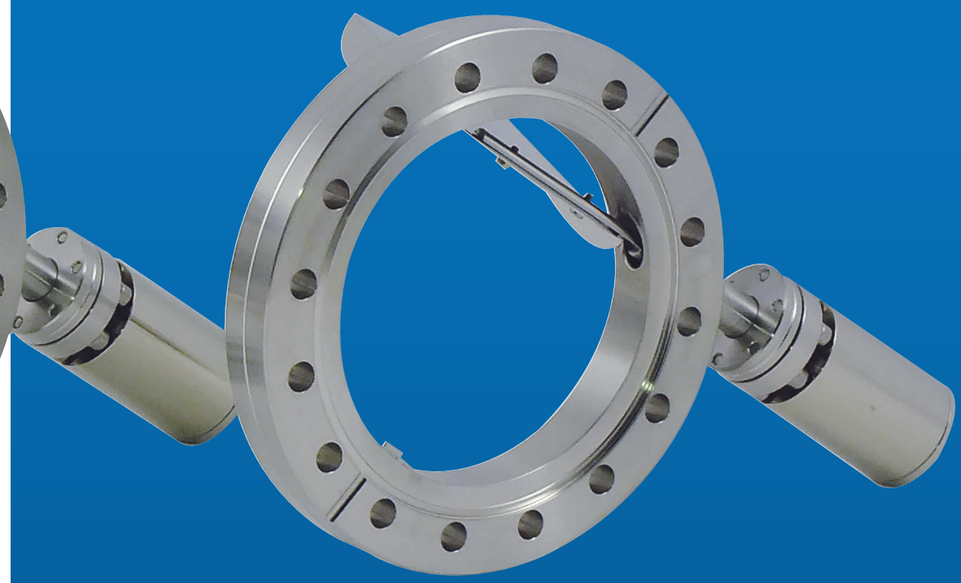


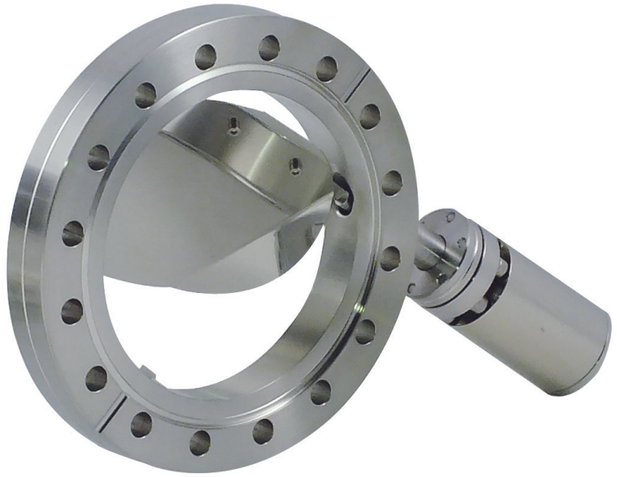
Section 02

SHUTTERS

02



Viewport Shutters



Designed to protect system windows during processes such as vacuum deposition.

Utilising the magnetically-coupled MagiDrive rotary feedthroughs (see section 1) for shutter actuation, the range can be actuated manually or pneumatically where remote control is required.

VPS KEY ADVANTAGES

- » Available on CF38 to CF150 flanges
- » Manual or pneumatic actuation
- » Fully bakeable to 250°C
- » Friction control system
- » 100% full closure option
- » Position switch option

Manual Actuation

Manually actuated viewport shutters are fitted with an external friction control system, ensuring the blade remains in the desired position without the need for position locks.

Pneumatic Actuation

Viewport shutters can also be fitted with a pneumatically actuated MagiDrive for remote operation from a control panel or switch or interlocked to the vacuum process, such that activating a deposition source, for example, would automatically close the viewport shutter. For critical applications, an optional feedback-switch assembly can be fitted to the drive to confirm to the process controller that the shutter is in the closed position.

100% Full Closure Option

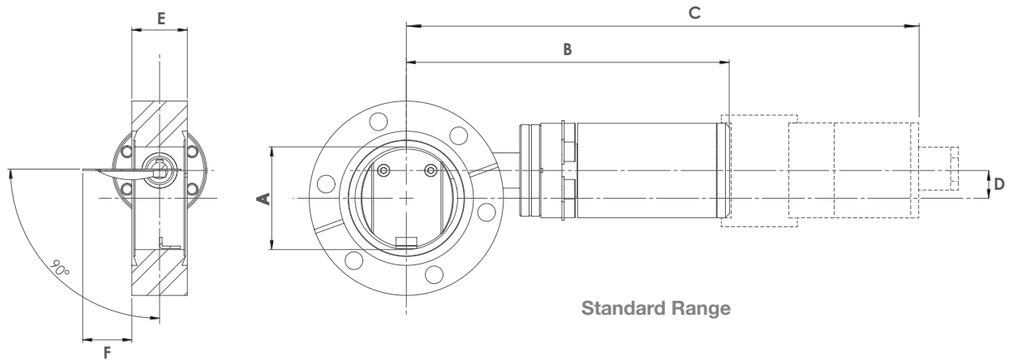
The full closure option provides maximum protection against the coating of viewports. Ideally suited to applications such as MBE where viewports cannot easily be cleaned or replaced.

Standard option

100% Full Closure option with pneumatic actuation

Example Dimensions (mm)

For the complete range of 2D drawings & 3D models contact us or visit www.uhvdesign.com



Standard Range

Dimensions (mm)	A	B (Manual)	C (Pneumatic)	D	E	F
VPS38	37.0	116.0	180.2	10.0	20.0	17.7
VPS38FC	31.0	116.0	180.2	10.0	20.0	16.8
VPS64	63.5	135.0	199.2	19.5	17.4	41.8
VPS64FC	58.0	135.0	199.2	19.5	17.4	40.8
VPS100	101.9	158.0	222.0	35.5	19.8	74.7
VPS100FC	96.0	158.0	222.0	35.5	19.8	73.1
VPS150	152.4	173.0	236.7	52.5	22.4	115.6
VPS150FC	152.4	173.0	236.7	52.5	22.4	113.3

Specification Table

VIEW PORT SHUTTER SPECIFICATION	VPS38	VPS64	VPS100	VPS150
System mounting flange size (with clear holes)	CF38 (2¾" OD CF)	CF64 (4½" OD CF)	CF100 (6" OD CF)	CF150 (8" OD CF)
Blade aperture coverage (Standard)	88.4%	90.6%	84.0%	87.0%
Blade aperture coverage (Full Closure option)	100%	100%	100%	100%
Bakeout temperature	250°C with pneumatic cylinder removed			
Pneumatic option - cylinder sweep	set at 90 degrees (adjustable 30-170°)			
Pneumatic option - cylinder switch	5-24V 2 wire reed switch			
Pneumatic option - max rotation speed	0.5 seconds per 90°	0.5 seconds per 90°	1 second per 90°	1 second per 90°

Viewport Shutter Part Code Generator

Viewport Shutter	
Standard viewport shutter	VPS
Full closure version	VPSFC

+

Flange Size	
CF38	38
CF64	64
CF100	100
CF150	150

+

Actuation Options (optional)	
Pneumatic actuator	RA
Pneumatic actuator + position feedback switches	RAI

Example Part Number: **VPS38**
= **VPS** CF38 flange **38**

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Section 03

PUSH PULL DEVICES

03

Magnetically-coupled Push Pulls

High duty, high torque, linear & linear/rotary motion

For high duty process applications the magnetically-coupled Push Pull (MPP) devices are ideally suited with high torque, high axial stiffness and zero thrust due to vacuum.

The magnetically-coupled Push Pull range provides linear and linear/rotary motion solutions with up to 300mm (12") stroke. Strong magnetic coupling eliminates the use of bellows and dynamic seals which are vulnerable to failure, providing a robust long life design.

The MPP range is ideally suited to high duty cycle applications such as production lines where uptime is critical.

The range provides smooth motion in both directions with zero thrust due to vacuum unlike bellows-sealed devices. Ranges provide linear motion (with free rotation of the shaft), guided linear motion (no rotation of the shaft) and linear and rotary motion (shaft rotation controlled by the thimble). Manual actuation is provided as standard with motorised and pneumatic options available. Pneumatic actuation is ideal for high duty, two position applications such as source or beam shutters.

MPPRL Series

Linear & rotary motion

Page 44

MPPL Series

Guided linear motion

Page 46

MPP Series

Unguided linear motion

Page 48

Linear Bellows Drives

High precision, multi-position, linear only motion

For applications where precise multi-positioning is required, our Linear Bellows Drives provide exceptional resolution (2 times better than conventional units), a guaranteed minimum lifetime of 10,000 cycles and the ability to easily motorise in the field.

The Linear Bellows Drives (LBDs) are a range of cost-effective UHV bellows-sealed devices that provide smooth and precise linear motion solutions for low load applications with 0.01mm linear resolution. They are available on a 34mm (1.33") OD CF flange as standard or 70mm (2.75") OD CF flange option with a range of strokes up to 150mm. They are ideal for simple linear motion applications through to precise positioning such as required for beamline diagnostics.

The LBD is manufactured and assembled to high tolerances using quality materials throughout, including 316L bellows, which offer a guaranteed minimum lifetime of 10,000 cycles.

A simple user-friendly retrospective motor upgrade is available, which includes home and limit switches for positional accuracy that can easily be removed for bake-out. The Linear Bellows Drive range offers four interchangable actuation methods; simple push pull rod, micrometer style actuation, high precision motorisation and pneumatic.

LBD-H Series

Precise, micrometer scale

Page 50

LBD-IS Series

High precision motorisation

Page 50

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Linear & Rotary Motion

MPPRL Series

Magnetically-coupled Push Pull devices providing rotary and linear motion solutions for low load applications in both high and ultra-high vacuum. Provided on a CF16 flange as standard with a choice of stroke lengths from 50mm to 300mm.

MPPRL KEY ADVANTAGES

- Linear and continuous rotary motion
- High power-to-size ratio
- No bellows - smooth operation
- No thrust due to vacuum
- Over 90 N (20 lbf) linear thrust
- Torque in excess of 0.4 Nm (0.29 lbf ft)
- Entire unit bakeable to 250°C

The MPPRL provides linear and continuous rotary motion of the vacuum shaft. The range provides a simple and intrinsically safe alternative to bellows-sealed push pull systems and is ideal for high duty cycle/performance critical applications such as synchrotrons and MBE systems where downtime is not acceptable. Linear strokes between 50mm and 300mm are offered as standard, with special strokes available upon request.

Utilising UHV Design's magnetic coupling technology, the Magnetic Push Pull removes the need for edge-welded bellows 'stacks', incorporated within traditional push pull designs. Their elimination maximises vacuum integrity, providing a robust, cost-effective solution.

Unlike a bellows-sealed device, the MPPRL offers the additional advantage of not being subject to thrust due to vacuum, resulting in smooth free-moving, user-friendly operation.

The CF16 flange version of the MPPRL is typically available from stock. CF35 flange versions are available at additional cost.

Guided Linear Motion

MPPL Series

Magnetically-coupled Push Pull devices providing linear guided motion solutions for low load applications in high vacuum and ultra-high vacuum provided on CF16 flange as standard with strokes from 50mm to 300mm. Manual, pneumatic and motorised actuation options with additional switches to prevent over-travel and aid system interlocks are available.

MPPL KEY ADVANTAGES

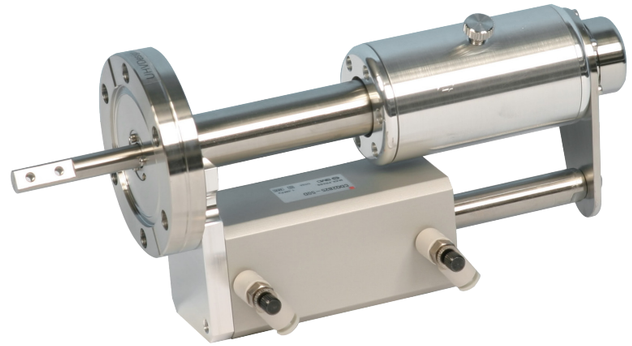
- Internally-guided linear motion
- Guaranteed rotation-free motion
- No bellows - smooth operation
- No thrust due to vacuum
- Over 90 N (20 lbf) linear thrust
- Entire unit bakeable to 250°C

The MPPL provides internally-guided linear motion of the vacuum shaft, guaranteeing rotation-free motion. Furthermore, the high axial thrust coupling produces no torque and so external rotation of the thimble does not apply a rotational force internally, ensuring smooth motion.

The range can be actuated manually, pneumatically or motorised with DC or stepper motors. Additionally, switches can be provided to prevent over-travel and to aid system interlocks.

The MPPL provides a simple and intrinsically safe alternative to bellows push pull systems. Utilising UHV Design's magnetic coupling technology the Magnetic Push Pull removes the need for edge-welded bellows stacks, incorporated within traditional push pull designs. Their elimination maximises vacuum integrity, providing a robust, cost-effective solution. Also, unlike a bellows-sealed device, the MPPL is not subject to the thrust due to vacuum, resulting in smooth, free-moving operation.

The CF16 flange versions of the MPPL are typically available from stock. CF35 flange versions are available at additional cost.



Unguided Linear Motion

MPP Series

Unguided linear motion solutions for low load applications in high/ultra-high vacuum. The vacuum shaft is free to rotate, avoiding possible conflict with an internal chamber mechanism. Available in CF16 and CF35 flanges and six stroke lengths from 50mm to 300mm. Manual, pneumatic and motorised actuation options with additional switches to prevent over-travel.

MPP KEY ADVANTAGES

- Unguided linear motion of the vacuum shaft
- Vacuum shaft free to rotate
- High power-to-size ratio
- No bellows - smooth operation
- No thrust due to vacuum
- Over 90 N (20 lbf) linear thrust
- Entire unit bakeable to 250°C

MPPs provide linear motion of an unguided vacuum shaft (free to rotate). This is used to manipulate slides or pivot arms where a guided system may conflict with the mechanism. Please note that although the vacuum shaft is free to rotate, the MPP does not provide rotation.

The range can be actuated manually, pneumatically or motorised with DC or stepper motors. Additionally, switches can be provided to prevent over-travel and to aid system interlocks.

The MPP range provides a simple and intrinsically safe alternative to bellows push pull systems. Utilising UHV Design's magnetic coupling technology, the Magnetic Push Pull removes the need for edge-welded bellows stacks, incorporated within traditional push pull designs. Their elimination maximises vacuum integrity, providing a robust, cost-effective solution. Also, unlike a bellows-sealed device, the MPP is not subject to the thrust due to vacuum, resulting in smooth, free-moving operation.

The CF16 flange versions of the MPPL are typically available from stock. CF35 flange versions are available at an additional cost.

Linear Bellows Drive with micrometer scale

Linear Bellows Drive

Bellows-sealed, precise lead-screw driven linear motion solutions for low load applications in ultra-high vacuum. Available in CF16 and CF35 flange sizes with stroke length options from 25mm to 150mm.

Manual or stepper motor actuation options.

LBD KEY ADVANTAGES

- 316L high-quality bellows
- 10,000 cycle guarantee
- Simple to motorise retrospectively
- High resolution performance: 10 micron manual, 1 micron motorised
- 25N (5.6 lbf) axial thrust
- Bakeable to 250°C with motor removed

The Linear Bellows Drives (LBDs) are a range of ultra-high vacuum compatible, bellows-sealed devices that provide smooth and reliable linear motion solutions for low load applications.

The CF16 flange versions of the LBD are typically available from stock, and are ideal for simple linear motion applications through to precise positioning such as beamline diagnostics.

CF35 flange versions are available at an additional cost.

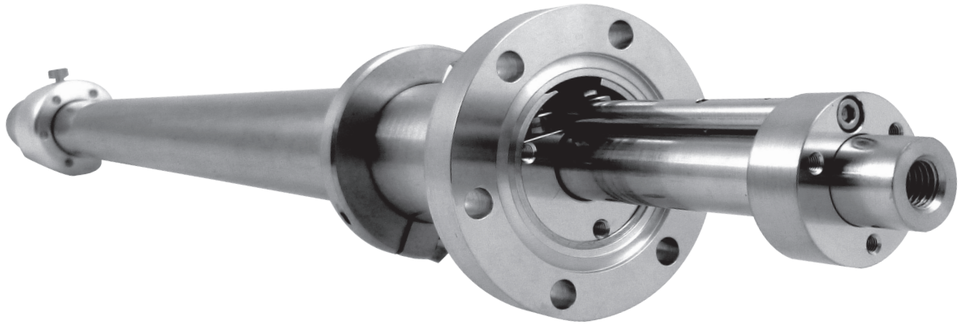
The LBD is manufactured and assembled to high tolerances using quality materials throughout, including 316L bellows, which offer a guaranteed minimum lifetime of 10,000 cycles.

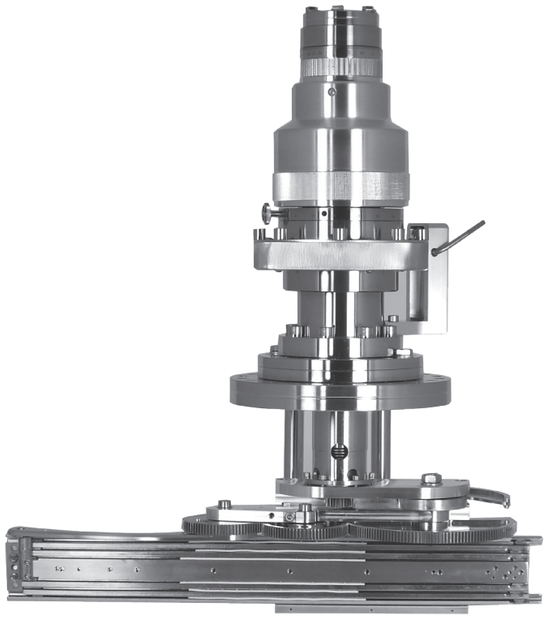
The driving mechanism, which incorporates a precision cut lead-screw that is supported internally via a ceramic linear bush for greater rigidity, can either be manually actuated via a micrometer scale or stepper motor driven, both of which offer a factor twice the resolution of conventional units.

As actuation mechanisms are interchangeable a user-friendly retrospective motor upgrade is possible at any time. This upgrade includes pre-wired home and limit switches for positional accuracy that can easily be removed for bake-out.

Specification Table

LINEAR BELLOWS DRIVE	
Mounting flange	CF16 (1.33" OD CF)
Calibrated drive resolution	10 microns
Motorised drive resolution	1 micron
Maximum cantilevered load	0.5 Nm
Maximum axial load	25 N (5.6 lbf)
Lateral float of shaft in retracted position	0.3mm max





Section 04

04

SAMPLE TRANSFER

Sample Transfer Arms

PowerProbe sample transfer arms enable secure transfer of samples within UHV. This is a consequence of their unrivalled magnetic coupling strength. In addition to linear and linear/rotary probes, this extensive range includes the Elevating PowerProbe and the Dual-Axis PowerProbe designed to transfer specific industry-standard sample holders using a variety of actuation methods.

Exceptional performance

PowerProbes have unrivalled thrust performance. The standard linear coupling has a break-away force of 180 N (40 lbf), in comparison to the 26-50 N of conventional units available on the market. A high power option is also available with an unrivalled 310 N (69 lbf). Figure 1 illustrates the axial stiffness of the coupling under load, demonstrating that the standard probe deflects <1mm for a 98 N (22 lbf) load.

In terms of rotation, the rotary transmission is essentially based upon the MD35 MagiDrive delivering 4 Nm (3 lbf ft) break-away torque. This is four times the level offered by more conventional units. The unique rotary coupling retains the renowned angular rigidity of the MagiDrive series (see Figure 2). Figure 3 shows the vertical deflection at the end of a horizontally-mounted PowerProbe transfer arm as a function of extended length, and with an applied weight/load of 10 N on the end of the probe. The relationship between load and deflection is approximately linear for typical transfer loads.

The crucial aspect of these performance characteristics is not necessarily the load-carrying capacity, but the stiffness of the coupling. The probes are, therefore, ideal for sample transfer applications.

All PowerProbes are fully bakeable to 250°C and do not require dismantling, unlike some conventional units available. The probes are suitable for use between atmospheric pressure and ultra-high vacuum.

Figure 1: Axial Stiffness

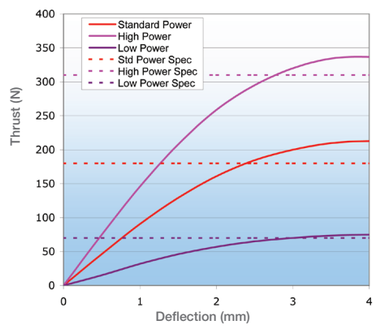


Figure 2: Torsional Stiffness

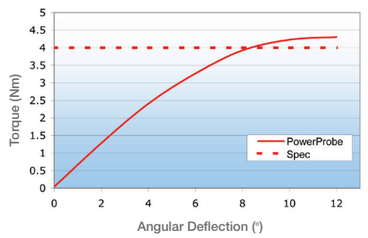
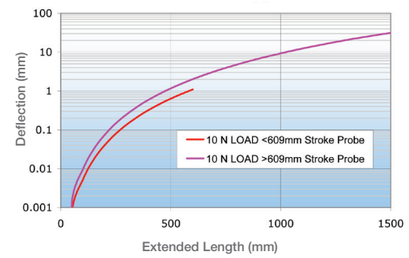
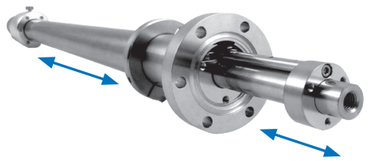


Figure 3: Probe Deflection vs Applied Load



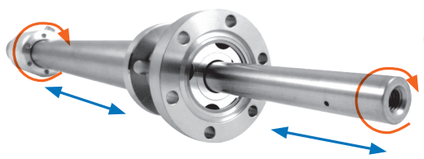
LPP: Linear Power Probe



The Linear PowerProbe should be selected where only linear motion is required and twisting or turning of the sample would be undesirable.

Page 58

PP: Linear & Rotary Power Probe



The PowerProbe provides both linear and rotary motion of the sample, via a single actuator.

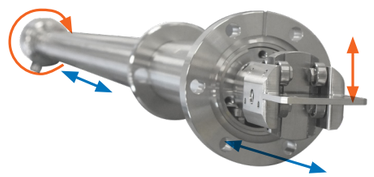
Page 60

DAPP: Dual Axis Power Probe

For system designers our Dual Axis Power Probe provides an outer tubular shaft with linear only motion and an inner shaft with independent rotary motion. Ideal for grippers, elevators and other manipulators.

Page 62

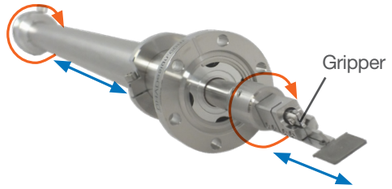
EPP: Elevating Power Probe



The Elevating PowerProbe incorporates an internally-guided linear motion, with the ability to elevate its end-effector throughout its stroke, providing 12.7mm of lift (with 25mm and 50mm options) in the Y axis for sample hand-off.

Page 64

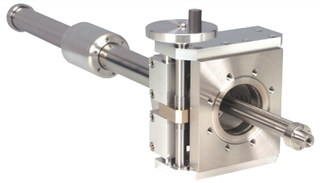
TAPP: Triple Axis Power Probe



The Triple Axis PowerProbe provides linear and rotary motion with a unique sample gripping mechanism, allowing samples to be locked on/off of the probe.

Page 66

Power Probe & Y-shift



By combining a Y-shift with any of the standard PowerProbes, an additional lift and lower motion is achieved for durable production-proven sample transfer.

Page 68

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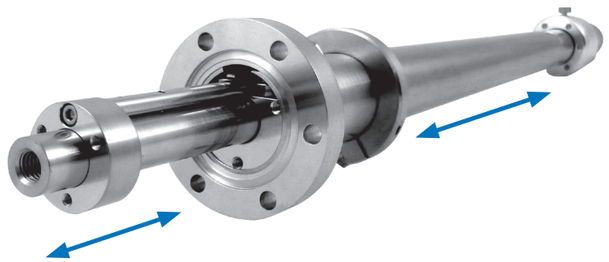
Linear Motion Only

Linear PowerProbe

(LPP Series)



High performance magnetically-coupled linear devices, designed for sample transfer where only linear motion is required and rotation is undesirable.

Available in standard stroke lengths from 304mm to 1524mm with motorisation options. The LPP is bakeable to 250°C without removing any components.

LPP KEY ADVANTAGES

- Internal anti-rotation system ensures straight in-line motion
- No need for conventional external linear guide bars
- 10x the thrust of conventional probes
- Unrivalled axial coupling strength
- Exceptional axial stiffness
- Zero backlash under low load

The Linear PowerProbe should be selected where only linear motion is required and twisting or turning of the sample would be undesirable.

An anti-rotation system is fitted internally ensuring straight, in-line motion, despite any rotation of the external drive thimble. This removes the need for the unwieldy and bulky external linear guide bars used by other manufacturers and guarantees no rotation during the stroke.

Furthermore the external drive carriage has only a linear magnetic coupling (no rotary magnetic coupling) meaning no torque is applied to the shaft when rotating the thimble. Fewer parts also means that this linear only version of the PowerProbe is a lower cost than the rotary and linear versions.

A retracted switch option is available which provides indication when the probe is fully retracted. This signal can be interlocked to prevent, for example, the premature closing of a gate valve before the PowerProbe has fully retracted.

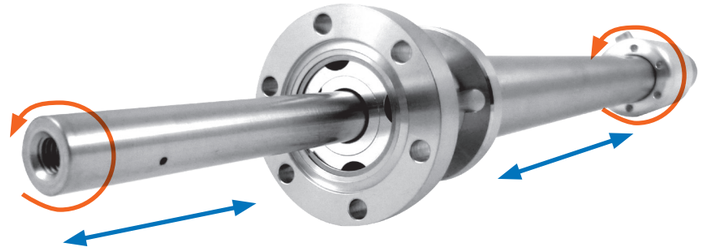
Specification Table

LINEAR POWERPROBE	STANDARD	
Mounting flange size	CF38 70mm (2.75") OD CF	CF64 114mm (4.5") OD CF
Linear axial coupling break-away force	180 N (40.5 lbf) standard with 90N (20 lbf) & 310N (69.7 lbf) versions available on request.	
Sample weight / load capacity	Maximum recommended internal load-carrying capacity will be a function of probe extension, but we recommend not to exceed a moment of 20 Nm (15 lbf ft).	
Maximum recommended internally applied load when vertically installed	This is a function of the load acceleration. In a static case the load may approach the coupling linear break-away force, however, it would be wise to apply a sensible safety factor.	
Pressure range	Atmosphere to $5x10^{-11}$ mbar	
Bakeout temperature	PowerProbes are bakeable to 250°C without the removal of any components (except for motors).	
Position locking	Thumbscrew (manual only)	
Axial & Torsional Stiffness	Refer to graphs on page 57	

Linear & Rotary

PowerProbe

(PP Series)



High performance magnetically-coupled combined linear/rotary devices, designed for sample transfer. Both linear and rotary motion of the sample achieved via a single actuator with stroke length from 304mm to 1524mm.

PP KEY ADVANTAGES

- Unrivalled axial coupling strength
- 10x thrust and 4x torque compared to conventional devices
- Exceptional axial stiffness
- Zero backlash under low load
- Bakeable to 250°C without removing any components

The PowerProbe provides both linear and rotary motion of the sample, via a single actuator.

The PowerProbe's powerful magnetic coupling technology provides performance far in advance of conventional probes on the market avoiding magnetic hysteresis and de-coupling issues suffered by traditional designs.

The high torque characteristics are achieved by utilising MagiDrive rotary coupling technology. Combined with a high thrust linear coupling, this ensures optimum drive performance on both axes. Therefore, actuation of the thimble in either axis will result in the precise transmission of this motion to the sample.

The PowerProbe can be fitted with a bakeable limit switch for the retracted position, aiding system interlocks.

Specification Table

POWER PROBE	STANDARD	
Mounting flange size	CF38 70mm (2.75") OD CF	CF64 114mm (4.5") OD CF
Linear axial coupling break-away force	180 N (40.5 lbf) standard with 90N (20 lbf) & 310N (69.7 lbf) versions available on request.	
Rotary coupling break-away torque	4 Nm (2.95 lbf ft)	
Sample weight / load capacity	Maximum recommended internal load-carrying capacity will be a function of probe extension, but we recommend not to exceed a moment of 20 Nm (15 lbf ft).	
Maximum recommended internally applied load when vertically installed	This is a function of the load acceleration. In a static case the load may approach the coupling break-away force, however, it would be wise to apply a sensible safety factor.	
Bakeout temperature	PowerProbes are bakeable to 250°C without the removal of any components (except for motors).	
Position locking	Thumbscrew (manual only)	
Axial & Torsional Stiffness	Refer to graphs on page 57	

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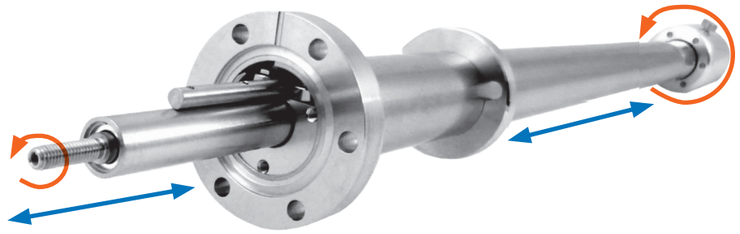


Linear With Rotatable Inner Shaft

Dual Axis PowerProbe

(DAPP Series)

High performance magnetically-coupled devices designed for sample transfer with outer shaft linear motion and independent rotary motion of inner shaft. Ideal for systems where a secondary motion is required to actuate an end-effector mechanism. Range includes end-effectors to transfer industry-standard flag and puck sample holders.

DAPP KEY ADVANTAGES

- Independent linear & rotary motion
- Unrivalled axial coupling strength
- 10x thrust and 4x torque compared to conventional devices
- Exceptional axial stiffness
- Zero backlash under low load
- Bakeable to 250°C without removing any components

The Dual Axis PowerProbe (DAPP) has two concentric output shafts providing independent axes of motion. The outer tubular shaft has linear only motion provided by the linear PowerProbe magnetic coupling. The inner shaft has independent rotary motion provided by the PowerProbe rotary magnetic coupling. The DAPP has a single driving thimble allowing simultaneous actuation of both the linear and rotary axes.

This PowerProbe variant is ideally suited to system designers who wish to employ a secondary motion to actuate an end-effector mechanism, such as a sample locking system, for example.

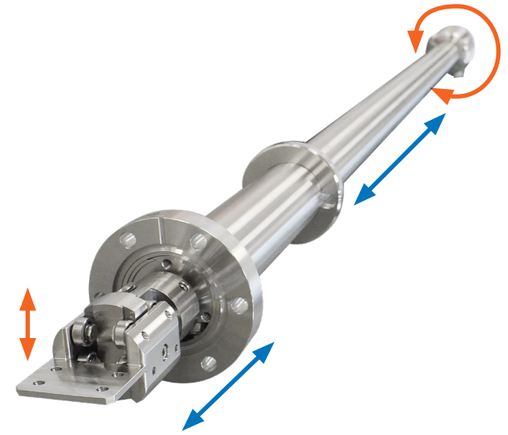
The Dual Axis PowerProbe benefits from our powerful magnetic coupling technology providing robust, reliable performance. Additionally, the internal linear guidance system, prevents rotation of the main shaft, thus removing the need for conventional external guide bars, providing an elegant and compact solution to sample transfer.

Standard End-effectors

Two standard end-effectors are offered to grip and safely transfer industry-standard surface analysis flag and puck sample holders.

Specification Table

DUAL AXIS POWERPROBE	STANDARD
Mounting flange	CF35 70mm (2.75") OD
Linear coupling break-away force	180 N (40.5 lbf) standard with 90N (20 lbf) & 310N (69.7 lbf) versions available on request.
Rotary coupling break-away torque (second shaft)	4 Nm (2.95 lbf ft)
Sample weight / load capacity	Maximum recommended internal load-carrying capacity will be a function of probe extension, but we recommend not to exceed a moment of 20 Nm (15 lbf ft) at full extension.
Pressure range	Atmosphere to $5x10^{-11}$ mbar
Bakeout temperature	PowerProbes are bakeable to 250°C without the removal of any components (except for motors).
Position locking	Thumbscrew (manual only)
Axial & Torsional Stiffness	Refer to graphs on page 57



Linear & Elevation

Elevating PowerProbe

(EPP Series)

Complete sampling-handling system providing linear motion and up to 50mm of lift in the Y-axis for sample hand-off. Stroke lengths from 304mm to 1219mm and motorisation options available.

EPP KEY ADVANTAGES

- Up to 50mm of lift in the Y-axis
- Unrivalled axial coupling strength
- 10x the thrust of conventional probes
- Exceptional axial stiffness
- Zero backlash under low load
- Bakeable to 250°C without removing any components

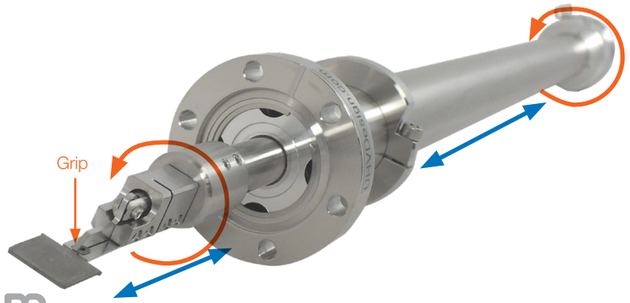
The Elevating PowerProbe transforms conventional approaches to sample transfer. In addition to its internally-guided linear motion, the probe has the ability to elevate its end-effector throughout its stroke, providing 12.7mm of lift as standard (with 25mm and 50mm options) in the Y axis for sample hand-off.

This PowerProbe variant greatly simplifies sample transfer techniques, providing a single device to provide both linear motion for sample introduction and the lift/lower motion to collect or hand-off the sample.

With a range of industry-standard effectors, the Elevating PowerProbe provides a complete sample-handling system in its own right removing the need for secondary motion tools. This reduces cost and simplifies the transfer process.

Specification table

ELEVATING POWERPROBE	STANDARD
Mounting flange	CF38 70mm (2.75") OD or CF64 114mm (4.5") OD
Elevating (lift/lower) motion	12.7mm (0.5"), 25.4mm (1.0") or 50mm (2.0")
Linear coupling break-away force	180 N (40.5 lbf) standard with 90N (20 lbf) & 310N (69.7 lbf) versions available on request.
Sample weight / load capacity	Maximum recommended internal load-carrying capacity will be a function of probe extension, but we recommend not to exceed a moment of 20 Nm (15 lbf ft) and 1.5 Nm (1.1 lbf ft) on elevating plate.
Pressure range	Atmosphere to $5x10^{-11}$ mbar
Bakeout temperature	PowerProbes are bakeable to 250°C without the removal of any components (except for motors).
Position locking	Thumbscrew (manual only)
Axial & Torsional Stiffness	Refer to graphs on page 57



Rotary Inner Shaft with Trigger Mechanism

Triple Axis PowerProbe

(TAPP Series)

Magnetically-coupled triple axis transfer arm, providing linear and rotary motion with a unique sample gripping mechanism allowing samples to be locked onto and off the probe. Linear and rotary motion of the sample is achieved via a single actuator with stroke length from 304mm to 1219mm. Unique lock/unlock mechanism then activates an independent shaft to provide gripper activation.

TAPP KEY ADVANTAGES

- Independent linear & rotary motion with unique sample gripping system
- End-effectors for flag & puck systems
- Unrivalled axial coupling strength
- 10x thrust and 4x torque compared to conventional devices
- Exceptional axial stiffness
- Zero backlash under low load

The Triple Axis PowerProbe (TAPP) has two concentric output shafts providing two independent axes of motion. Linear and rotary motion of the outer shaft is provided through a high power magnetic coupling, driven by the thimble.

Compared with conventional devices the Triple Axis Power Probe provides more than 10 times the thrust and 4 times the torque with exceptional axial stiffness.

Unique Lock/unlock mechanism

In addition to linear and rotary motion the thimble incorporates a unique secondary linear motion that can be used to lock/unlock samples held by a gripping end-effector.

This PowerProbe variant is ideally suited to system designers who need linear and rotary motion with an independent end-effector mechanism. When ordered with an end-effector the Triple Axis Power Probe provides the ultimate in secure sample transfer.

Standard End-effectors

Two standard end-effectors are offered to grip and safely transfer industry-standard surface analysis flag and puck sample holders.

Specification Table

TRIPLE AXIS POWERPROBE	STANDARD
Mounting flange	CF38 70mm (2.75") OD
Linear coupling break-away force	180 N (40.5 lbf) standard with 90N (20 lbf) & 310N (69.7 lbf) versions available on request.
Rotary coupling break-away torque	4 Nm (2.95 lbf ft)
Sample weight / load capacity	Maximum recommended internal load-carrying capacity will be a function of probe extension, but we recommend not to exceed a moment of 20 Nm (15 lbf ft).
Pressure range	Atmosphere to $5x10^{-11}$ mbar
Bakeout temperature	PowerProbes are bakeable to 250°C without the removal of any components (except for motors).
Position locking	Thumbscrew (manual only)
Axial & Torsional Stiffness	Refer to graphs on page 57

Sample Hand-off System

Y Shift with PowerProbe

Combines the linear/rotary motion of the PowerProbe with the ability to lift and lower a sample by +/-7.5mm or +/-31mm to enable transfer.

Available in CF64 & CF100 mounting flange options with manual or motorised actuation. Customised transfer forks available - contact us for more details.

Y SHIFT KEY ADVANTAGES

- Suitable for automated systems
- Lift/Lower transfer motion
- Kinematic design provides smooth & precise lift/lower of samples
- High load-carrying capability
- Customised transfer forks available

The combination of Y Shift and PowerProbe has been used for many years in production applications. The system combines the linear/rotary motion of the Sample Transfer Tool range with the ability to lift and lower the whole transfer tool and therefore the sample to enable hand-off (transfer).

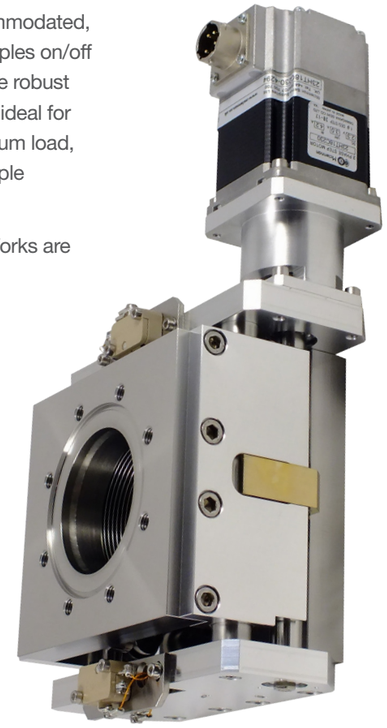
The Y Shift consists of a bellows assembly with a flange at each end. One flange is fixed to the chamber, the other moving flange is used to mount the transfer arm. The Y Shift mechanism then precisely manipulates the transfer arm up and down along the Y axis and therefore the sample.

Use of the Y Shift and PowerProbe combination is ideal for transferring samples between multiple chambers (e.g. load lock, preparation chamber, process chamber) where differing transfer heights can be accommodated, or the transfer of samples on/off sample cassettes. The robust Y Shift mechanism is ideal for high duty cycle, medium load, multiple position sample transfer applications.

Customised transfer forks are available on request.

Specifications

Y-Shift Type		
Travelling Flange	Mounting Flange	Y motion (lift/lower)
CF38	CF64	+/- 7.5 mm
CF64	CF64	
CF38	CF100	+/- 31mm
CF64	CF100	



Motorised Y-shift

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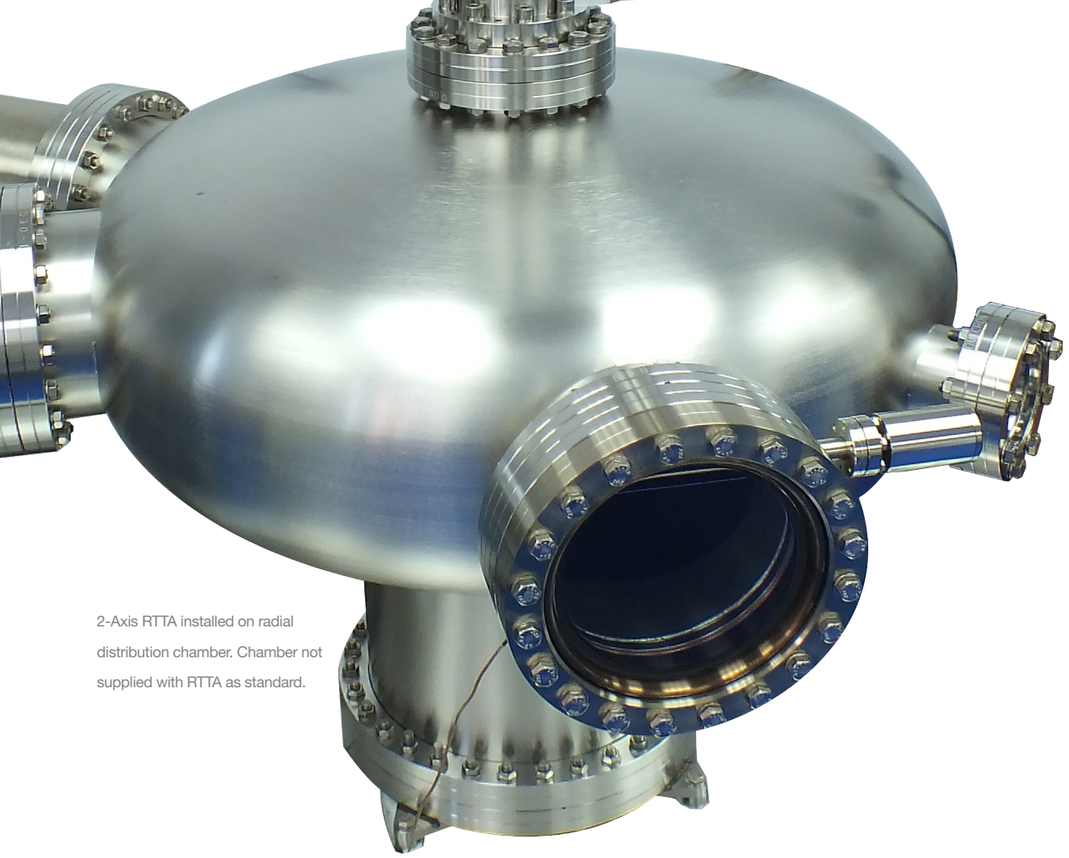
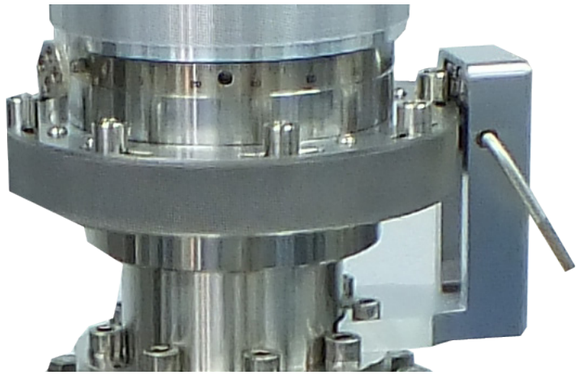
Radial Distribution Chamber Solutions
Rotary Telescopic Transfer Arm



2-Axis RTTA installed on radial distribution chamber. Chamber not supplied with RTTA as standard.

RTTA KEY ADVANTAGES

- 2.5x the reach of conventional systems
- Typically <1mm deflection at full extension with 10N load
- Excellent substrate position reproducibility: <0.2mm laterally & axially
- 2 and 3-Axis variants
- True UHV performance



True UHV rotation with no oil, slip rings, bellows or differential pumping

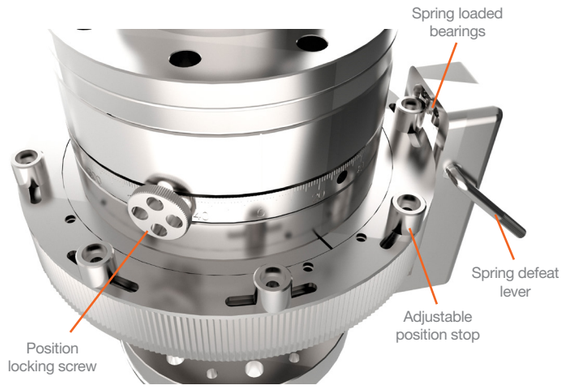
The Radial Telescopic Transfer Arm is actuated by the MD64LB and MD35 magnetically-coupled MagiDrive rotary feedthroughs. They provide true UHV performance, without any bellows, oil, slip rings or differential pumping. The larger MD64LB has a break-away torque of ~40Nm, providing an extremely stiff coupling, ideal for rotating the arm assembly. The smaller MD35 actuates the mechanisms to drive the arm in and out.

User-friendly Manual Arm Alignment

The RTTA is offered in manual or motorised versions.

The manual version of the RTTA is supplied with an innovative, user-friendly system to align the arm with the desired ports.

Fitted to the top of the thimble ring are a number of adjustable position stops. These engage with a pair of spring-loaded bearings that can be withdrawn while the drive is rotated into position then re-engaged to hold the drive firmly in position by using a simple lever. Each stop can be individually aligned with a port axis to define default angular positions which are very reproducible.



Motorised 'Talk Free' Concept

An issue with many radial distribution chambers system designs is the issue of the rotating arm motion causing the arm extension assembly to move (often described as the axis cross-talk). Therefore, rotation of the arm also causes the sample to be driven in and out, losing its position. To overcome this, complex software programming is required to unwind the secondary drive during rotation of the arm. UHV Design recognises this to be an unwanted feature and has, therefore, removed this as an issue through a unique mechanical design used on many other UHV Design manipulators over the years. In brief, this links the rotary motion of the MD64 arm to the motor mounting of the smaller MD35, mechanically unwinding the undesired motion, without the need for complex software.

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2-Axis RTTA

(Rotary & telescopic extension)

The 2-axis RTTA provides 360° rotation and 760mm linear extension within an ultra-compact footprint.

Typically <1mm deflection at full arm extension with 10N load, linear reproducibility of <0.2mm and rotational reproducibility of <0.2mm. Motorisation options available.

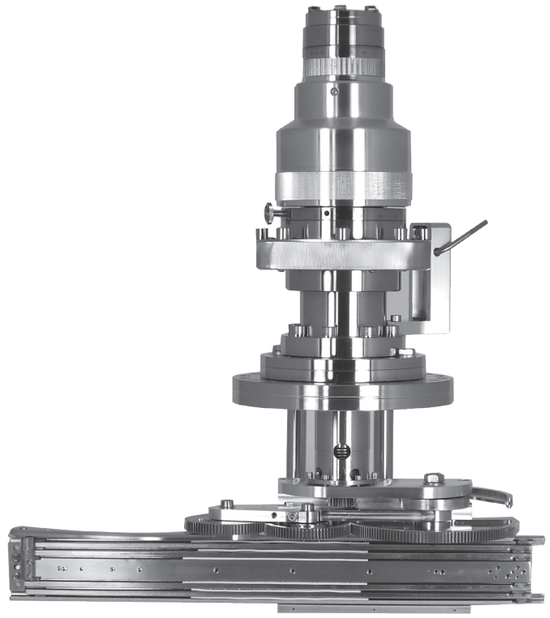
RTTA 2-AXIS KEY ADVANTAGES

- 760mm extension
- Typically <1mm deflection at full extension under 10N load
- Rotational reproducibility <0.2mm
- Linear reproducibility <0.2mm
- Clean, UHV performance
- Competitively priced compared to conventional designs

The 2-axis RTTA provides a cost-effective solution for radial distribution sample transfer applications providing arm rotation and arm extension.

A high torque magnetically-coupled MagiDrive precisely rotates the transfer arm to align with the desired chamber port. A second MagiDrive is used to drive the innovative telescopic mechanism to provide an arm extension of 760mm to transport the sample in and out of the desired satellite chamber.

The 2-axis RTTA can be motorised using stepper or SMART motors. Alternatively the RTTA can be configured to accept any standard NEMA23 motor.



3-Axis RTTA

(Rotary & telescopic extension with lift/lower)

The 3-axis RTTA provides 360° rotation, 760mm linear extension and 50mm Z motion to provide arm lift and lower to aid sample transfer. Typically <1mm deflection at full arm extension with 10N load. Linear reproducibility of <0.2mm and rotational reproducibility of <0.2mm. Motorisation options available.

RTTA 3-AXIS KEY ADVANTAGES

- 760mm extension
- Typically <1mm deflection at full extension under 10N load
- Rotational reproducibility <0.2mm
- Linear reproducibility <0.2mm
- Clean, UHV performance
- Competitively priced compared to conventional designs

The 3-axis RTTA provides a cost-effective radial distribution sample transfer solution for applications that require arm rotation, arm extension and arm lift and lower for sample transfer.

A high torque magnetically-coupled MagiDrive provides arm rotation to align with the desired chamber port. A second MagiDrive is used to drive the innovative telescopic mechanism to provide an arm extension of 760mm to transport the sample in and out of the desired satellite chamber. A linear shift mechanism is used to provide 50mm lift/lower of the sample arm for gravity based sample hand off, typically used on our MBE, sputtering and CVD sample manipulators and heating stages.

The 3-axis RTTA can be fully motorised using stepper or SMART motors. Alternatively the RTTA can be configured to accept any standard NEMA23 frame motor.

WS40

(Linear, Rotary & Tilt Movement)

Magnetically-coupled wobble stick with a choice of 100mm to 350mm linear stroke, rotation and +/-22° tilt. Smooth, free-running operation with no thrust due to vacuum.

Available with a choice of end effector options for flag, puck and ESCA sample holders.

WSL KEY ADVANTAGES

- **Rotation with +/- 22° tilt**
- **100mm to 350mm linear stroke**
- **In-line and right angle versions**
- **No thrust due to vacuum, smooth reliable operation**
- **Bakeable to 250°C without removing any components**

The WS40 series provides linear motion and rotation of the vacuum shaft with +/-22° tilt allowing precise manipulation of a range of sample holders.

Magnetic coupling technology eliminates the need for edge-welded bellows. This reduces the risk of leaks and in doing so, improves the reliability of the system for sensitive applications.

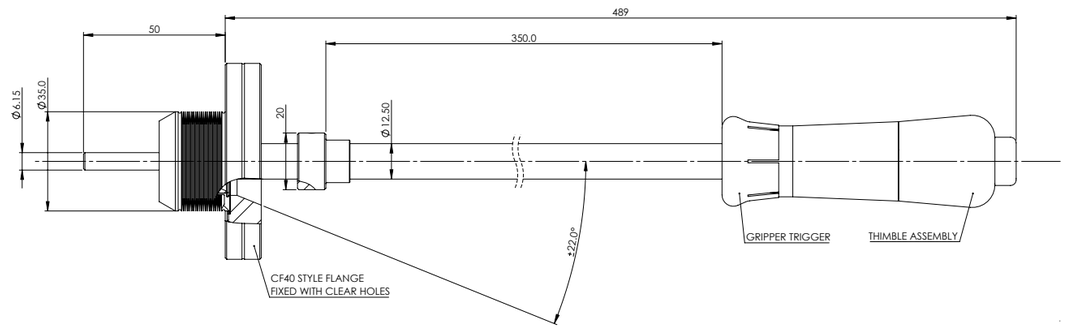
Unlike conventional bellows-sealed wobble sticks there is no resistance to linear motion due to vacuum thrust.

Specification Table

WS40	STANDARD
Mounting flange	CF38 70mm (2.75") OD with clear holes
Angular sweep	+/-22°
Magnetic rotary breakaway torque	0.4 Nm (0.30 lbf ft)
Magnetic linear breakaway thrust	40N (9 lbf)
Available stroke range	100mm to 350mm (50mm increments)
Bakeout temperature	Bakeable to 250°C without the removal of any components
Shaft radial runout	1mm
Maximum cantilevered moment / axial load	0.5Nm (0.37 lbf ft) / 25N (5.6 lbf)
Trigger axial stroke	Not applicable (see page 74)
Default configuration	Supplied without end-effector
End-effector options	Flag, Puck and ESCA stub sample holders

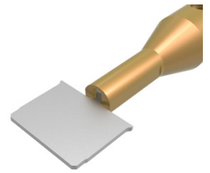
Example Dimensions

For comprehensive 2D drawings & 3D models contact us or visit www.uhvdesign.com



End Effectors

WS40 No End Effector



In-line Flag Style Toggle

In-line Puck Style Fork

In-line ESCA Style Fork

WS40 Part Code Generator

Wobble Stick		+	Linear Stroke (select one)		+	End Effector	
Linear, rotary & tilt	WS40		100mm	100		None	H
			150mm	150		Flag in-line toggle	FT
			200mm	200		Puck in-line	PI
			250mm	250		Puck right angle	PR
			300mm	300		ESCA in-line	EI
			350mm	350		ESCA right angle	ER

Example Part Number:
WS40-250-H
= **WS40 with 250mm linear stroke and no end effector.**

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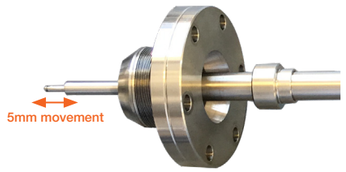
WSG40

(Linear, Rotary & Tilt Movement with Trigger-actuated Gripper)



Magnetically-coupled wobble stick with a choice of 100mm to 350mm linear stroke, rotation and +/-22° tilt. Smooth, free-running operation with no thrust due to vacuum.

Available with a choice of end effector options for flag style sample holders actuated via a trigger mechanism.

WSL KEY ADVANTAGES

- **Rotation with +/- 22° tilt**
- **100mm to 350mm linear stroke**
- **In-line and right angle versions**
- **No thrust due to vacuum, smooth reliable operation**
- **Bakeable to 250°C without removing any components**

The WSG40 series provides linear motion and rotation of the vacuum shaft with +/-22° tilt allowing precise manipulation of a range of sample holders which are actuated via a trigger mechanism on the outer magnetic assembly.

Magnetic coupling technology eliminates the need for edge-welded bellows. This reduces the risk of leaks and in doing so, improves the reliability of the system for sensitive applications.

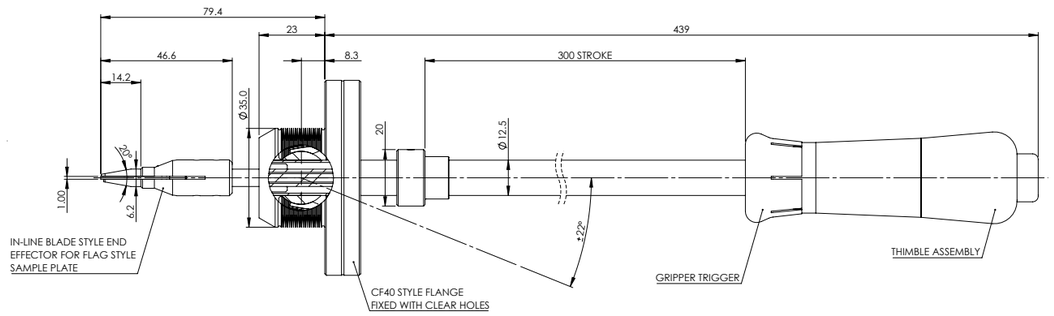
Unlike conventional bellows-sealed wobble sticks there is no resistance to linear motion due to vacuum thrust.

Specification Table

WSG40	STANDARD
Mounting flange	CF38 70mm (2.75") OD with clear holes
Angular sweep	+/-22°
Magnetic rotary breakaway torque	0.4 Nm (0.30 lbf ft)
Magnetic linear breakaway thrust	40N (9 lbf)
Available stroke range	100mm to 350mm (50mm increments)
Bakeout temperature	Bakeable to 250°C without the removal of any components
Shaft radial runout	1mm
Maximum cantilevered moment / axial load	0.5Nm (0.37 lbf ft) / 25N (5.6 lbf)
Trigger axial stroke	5mm
Default configuration	Supplied without end-effector
End-effector options	Blade type and Jaws type for Flag style sample holders

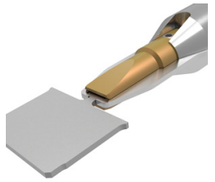
Example Dimensions

For comprehensive 2D drawings & 3D models contact us or visit www.uhvdesign.com

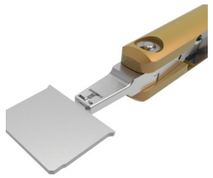


End Effectors

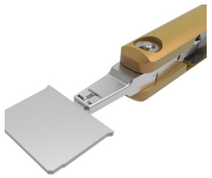
WSG40 No End Effector



In-line Flag Style Blade



In-line Flag Style Jaws



Right Angle Flag Style Jaws

WSG40 Part Code Generator

Wobble Stick		+	Linear Stroke (select one)		+	End Effector	
Linear, rotary & tilt	WSG40		100mm	100		None	H
			150mm	150		Flag in-line blade	FB
			200mm	200		Flag in-line jaw	FI
			250mm	250		Flag right angle jaw	FR
			300mm	300			
			350mm	350			

Example Part Number:

WSG40-150-FI

= **WSG40 with 150mm linear stroke and in-line flag end effector.**

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Section 05

LINEAR MOTION AND ALIGNMENT

05

Linear Motion and Alignment

Linear Shift Mechanisms (LSMs) provide linear motion along the port axis (Z). Typical applications include the positioning of beamline filters, adjustment of sputter sources and deposition stages through to production style applications.

UHV Design has the largest range of LSMs in the world, ranging from CF35 to CF150 flanges, up to 1m stroke, tilt & X alignment versions with manual, pneumatic and motorisation options, all available with a range of position encoders. Bakeable to 250°C, the range is supplied on CF flanges and provides true UHV performance.

The bellows-sealed LSMs provide smooth, precise motion via a kinematically-designed external leadscrew driven mechanism, complete with anti-rotation and anti-deflection systems.

This design ensures smooth and precise motion along the Z axis. The range has a high load capability ensured through its rigid construction. Ball screw driven versions are available for fast acting, high duty cycle, high load, production applications.

The bellows are manufactured from 316L stainless steel as standard and offer a minimum design life of 10,000 cycles. Customised units are available offering a design life of up to 3 million cycles.

In addition to the standard range of LSMs we offer customised LSMs which are application-specific for use on synchrotrons, and in critical production applications.

LSM KEY ADVANTAGES

- **2x flange parallelism of conventional designs**
- **2x load-carrying capability of conventional designs**
- **Smooth kinematic motion**
- **10,000 cycle lifetime guarantee (3 million cycle option)**
- **Demountable bellows assembly**
- **Reliable and rigid construction**
- **Bakeable to 250°C**

Example of long travel LSM

Standard LSM

Up to 350mm

Page 54

Long Travel LSM

Up to 1000mm

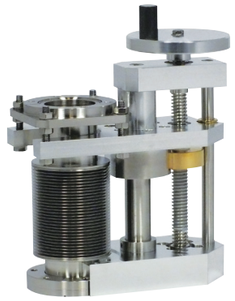
Page 55

Compact LSM

Up to 150mm

Page 56

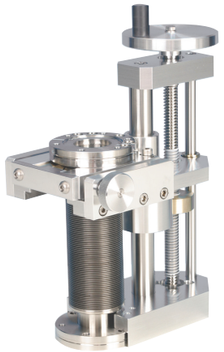
LSM with Tilt



Up to 150mm
+/- 2° tilt

Page 57

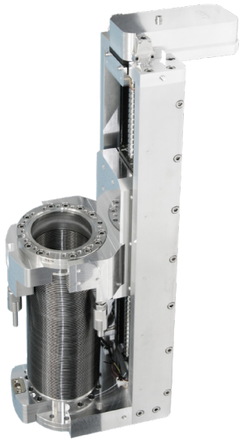
LSM with X motion



Up to 150mm
+/- 5mm lateral (x) motion

Page 58

Production LSMs



Production-proven
LSMs

Page 59

Port Aligners

+/-5mm linear motion
+/-3° angle adjustment

Page 61

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Standard Linear Shift Mechanism

LSM Series

Production-proven linear motion along the port axis (Z) for sample positioning and production applications.

Comprehensive series offering true UHV performance with a vast range of flange sizes, strokes, actuation and encoder options.

LSM KEY ADVANTAGES

- 2x flange parallelism compared with conventional designs
- 2x load-carrying capability compared with conventional units
- Smooth kinematic motion
- 10,000 cycle lifetime guarantee
- Demountable bellows assembly
- Bakeable to 250°C

Overview

The LSM is the most comprehensive series in the range, offering the largest number of flange, stroke and actuation options. All flanges within the series are supplied with tapped bolt holes as standard. Special variants with clear holes on the mounting flange can be provided for most sizes, these are labelled HLSM in the partcodes and specification tables.

Actuation methods

The series can be actuated via a manual handwheel, pneumatic cylinder, DC motor or stepper motor. Each LSM can also be fitted with a digital linear scale, offering visual position indication with 10 micron resolution.

Motorised LSMs are fitted with bakeable limit and home switches, pre-wired to a single bakeable connector mounted on the frame ('UP' option must be selected). LSMs are compatible with UHV Design's SADC and Stepper motor controller range, details of which can be found in Section 13.

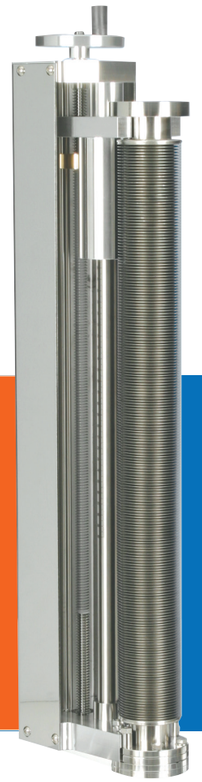
Specification Table

MODEL	Flange information		Bolt holes		Clear Bore (mm)	Maximum Bakeout
	Flange code	Flange size	Travelling flange	Mounting flange		
LSM	38	CF38 70mm (2.75") OD CF	M6 Tapped	M6 Tapped*	38	250°C
	64	CF64 114mm (4.5") OD CF	M8 Tapped	M8 Tapped*	65	
HLSM	100	CF100 152mm (6") OD CF	M8 Tapped	Clear holes	102	
	150	CF150 203mm (8") OD CF			149	

* Clear bolt holes on mounting flange available (HLSM option).

Long Travel Linear Shift Mechanism

HLSML Series



The HLSML provides strokes of up to 1000mm (39") with high precision motion maintained throughout the stroke. The HLSML is also chosen for shorter strokes where ultimate stability is required.

HLSML KEY ADVANTAGES

- Up to 1m stroke
- Smooth kinematic motion
- Reliable and rigid construction
- 'Plug and play' production solutions
- True UHV performance
- Bakeable to 250°C
- Demountable bellows

Overview

The HLSML series of long travel Linear Shift Mechanisms, incorporates an upgraded structure with rear spine and large bore shafts and supports. The rigid structure maintains precise motion and unrivalled stability with strokes up to 1m.

High duty cycle production HLSMLs are available providing reliable, smooth and rigid motion with long operational life. Production ready HLSMLs can be supplied with pre-wired switches and connectors for 'plug & play' operation.

Actuation methods

The series can be actuated via a manual handwheel, DC motor or stepper motor.

Motorised HLSMLs are fitted with bakeable limit and home switches, pre-wired to a single, bakeable connector mounted on the frame. HLSMLs are compatible with UHV Design's SADC and Stepper motor controller range.

Each HLSML can be supplied with a digital linear scale, offering visual position indication with 10 micron resolution.

Specification Table

MODEL	Flange information		Bolt holes		Clear Bore (mm)	Maximum Bakeout
	Flange Code	Flange Size	Travelling flange	Mounting flange		
HLSML	38	CF38 70mm (2.75") OD CF	M6 Tapped	Clear holes	38	250°C
	64	CF64 114mm (4.5") OD CF	M8 Tapped	Clear holes	65	250°C

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Compact Linear Shift Mechanism

CLSM Series

A compact solution to linear motion along the port axis (Z). The CLSM series provides the shortest available flange-to-flange dimension, without compromising on performance or reliability.

CLSM KEY ADVANTAGES

- » Compact design
- » Smooth kinematic motion
- » Reliable and rigid construction
- » True UHV performance
- » Bakeable to 250°C
- » Demountable bellows assembly

Overview

The CLSM compact series offers the shortest flange-to-flange dimension in the range. As such, the series is offered with limited flange and stroke options.

Actuation methods

The series can be actuated via a manual handwheel, pneumatic cylinder, DC motor or Stepper motor.

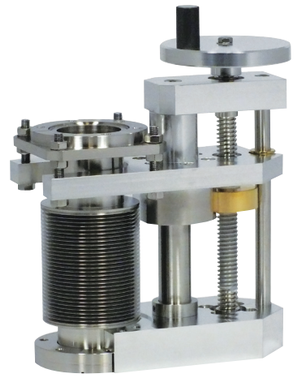
Each CLSM can be supplied with a digital linear scale, offering visual position indication with 10 micron resolution.

Specification Table

MODEL	Flange information		Bolt holes		Clear Bore (mm)	Maximum Bakeout
	Flange code	Flange size	Travelling flange	Base flange		
CLSM	38	CF38 (2.75" OD)	M6 Tapped	M6 Tapped	38	250°C

Linear Shift Mechanism With Tilt

LSMT Series



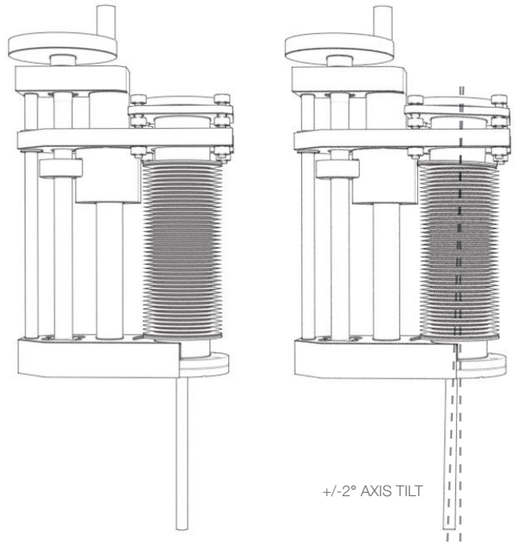
Smooth kinematic linear motion along the port axis (Z) with the additional facility to tilt the travelling flange so it serves as an integrated port aligner. This makes the LSMT ideal for applications where precise alignment with a fixed point is essential.

LSMT KEY ADVANTAGES

- » Up to 150mm stroke
- » +/- 2° tilt for final alignment
- » Adjustment via 4 threaded support shafts
- » Smooth kinematic motion
- » Bakeable to 250°C
- » Demountable bellows assembly

Overview

The LSMT is based on the standard LSM series with the additional facility to tilt the moving flange by +/- 2° for final alignment, acting as an integrated port aligner. Typically used on beamlines to align diagnositcs or for ion/sputter source alignment. Adjustment is actuated via four threaded support shafts. All flanges in the series are supplied with tapped bolt holes on the base flange as standard.



Actuation methods

The series can be actuated with a manual handwheel, pneumatic cylinder, DC motor or stepper motor.

Specification Table

MODEL	Flange information		Bolt holes	Travelling flange tilt	Clear Bore (mm)	Maximum Bakeout
	Flange code	Flange size				
LSMT	38	CF38 70mm (2.75") OD CF	M6 Tapped	+/-2°	38	250°C
	64	CF64 114mm (4.5") OD CF	M8 Tapped	+/-2°	65	250°C

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Linear Shift Mechanism With X Travel

LSMX Series

Linear motion along the port axis (Z) with the additional facility to adjust the travelling flange laterally (X axis) to facilitate alignment. The travelling flange angle remains constant throughout actuation.

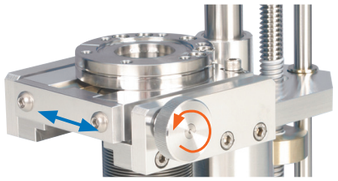
LSMX KEY ADVANTAGES

- » +/- 5mm lateral (X axis) motion
- » Smooth kinematic alignment
- » Reliable and rigid construction
- » True UHV performance
- » Bakeable to 250°C
- » Demountable bellows assembly

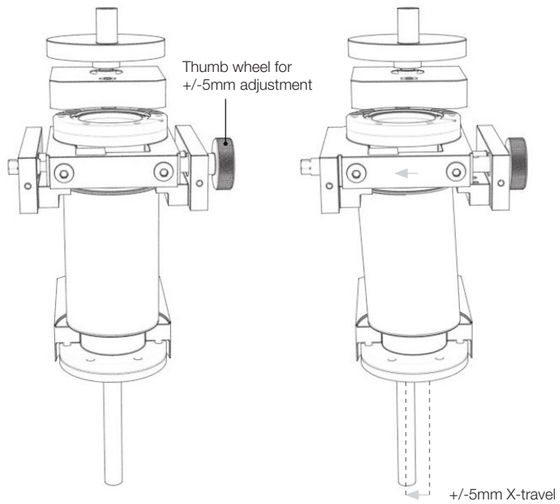
Overview

The LSMX is based on the standard LSM series. Where the LSMX version differs is that, in addition to the Z motion, the user has the option to adjust the X motion of the moving flange by up to +/-5mm via a manual thumb wheel. The thumb wheel can be moved to the opposite side if required.

This is useful if the user needs the flexibility to make lateral alignment adjustments to the linear shift without altering the travelling flange angle. A typical application would be the alignment of a sample holder with a sample transfer arm within the system.



Thumb wheel provides +/-5mm lateral (X axis) movement



Specification Table

MODEL	Flange information		Bolt holes	Travelling flange offset (X motion)	Clear Bore (mm)	Maximum Bakeout
	Flange code	Flange size				
LSMX	38	CF38 70mm (2.75") OD CF	M6 Tapped	+/-5mm	38	250°C
	64	CF64 114mm (4.5") OD CF	M8 Tapped	+/-5mm	65	250°C

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Production-proven Linear Shift Mechanism

PLSM Series

In addition to the main ranges of Linear Shift Mechanisms (LSMs), variants designed specifically to work in demanding high duty cycle production environments are available.

PLSM KEY ADVANTAGES

- » >100m/s translation possible
- » <1 mrad deflection under vacuum
- » Reliable and rigid construction
- » True UHV performance
- » Bellows bakeable to 250°C
- » Demountable bellows assembly

Application specific design

With the world's largest range of LSMs at their disposal, UHV Design's in-house design team can customise any of the standard designs to specifically match production requirements.

Customised designs can accommodate the required flange size, stroke, bore size, duty cycle and space envelope. In addition, any required sensors, motors and encoders can be incorporated and pre-wired for plug and play operation.

All production LSMs benefit from:

- Ultra-stiff construction for minimal deflection
- High cantilevered load capacity
- Ball screw drive mechanism with recirculating linear slides
- Bellows with greater than 3 million cycles guaranteed

Manufactured and assembled for use in ultra clean applications

UHV Design's in-house manufacturing facility enables us to cost-effectively and rapidly produce highly toleranced, high quality components.

Components are cleaned prior to assembly in an ISO 7 Class 10,000 clean room.

LSM Actuation options

The LSM range is available with a variety of manual, pneumatic and motorised actuation methods.

Manual actuation

- Manual handwheel
- Geared handwheel for large bore linear shifts

Pneumatic actuation

- Wide range of pneumatic options
- 3-position actuators available

Motorised actuation

- DC or stepper motorisation
- pre-wired home & limit switches

Position readout/feedback

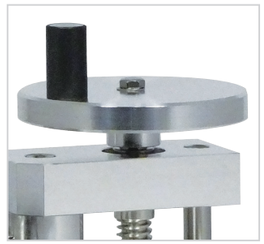
- Engraved shaft
- Digital linear scale with 10 micron resolution
- Magnetic encoder with 10 micron resoution (option to upgrade to 1 micron resolution)
- Absolute encoders

High speed actuation

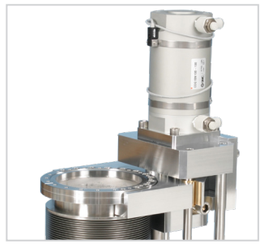
- Ball screw mechanism can provide up to 100mm/s actuation

Synchrotron specification

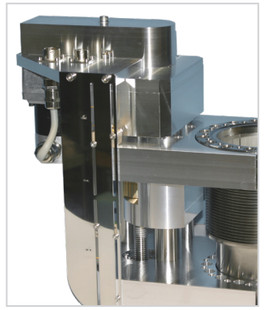
- DC or stepper motorisation
- pre-wired home & limit switches



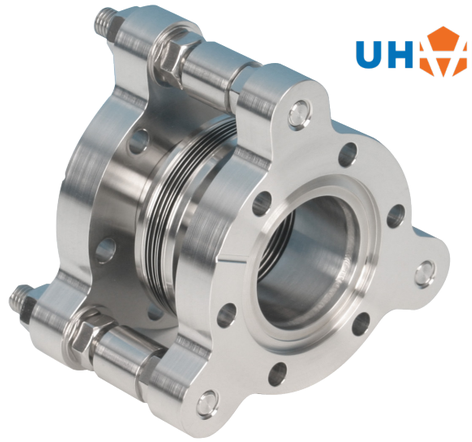
Manual handwheel



Pneumatic actuation



Motorised LSM



Port Aligner Range

Enables the distance and angular relationship between two flanges to be adjusted, where a fixed flange supports three equi-spaced threaded shafts, and in parallel, a travelling flange has adjustable floating mounts. A typical application would be the final alignment of sample transfer arms.

PA KEY ADVANTAGES

- » **Any-orientation mounting**
- » **+/- 5mm axial adjustment**
- » **+/- 3° angular tilt**
- » **High quality flexible 316L bellows accommodates motion, whilst maintaining ultra-high vacuum**
- » **Bakeable to 250°C**

Overview

The Port Aligner range enables the distance and angular relationship between two flanges to be adjusted. The range consists of five series, which can be supplied with either tapped or clear bolt holes on the flanges. Each range provides +/-5 mm axial length adjustment, with +/- 3° angular tilt.

Essentially, this is a simple device that once adjusted, provides a stable platform. The design consists of two approximately parallel flanges, one of which remains fixed, whilst the position of the second may be adjusted with respect to the first.

The fixed flange supports three equi-spaced threaded shafts. Alignment of the travelling flange is achieved by adjusting the floating mounts attached to each threaded shaft. The port aligner can be mounted in any-orientation and is bakeable to 250°C.

A high quality, flexible, 316L edge-welded bellows, spans the flanges to accommodate the required motion while ensuring an all-metal vacuum enclosure.

Specification Table

PART NUMBER	PA35-H	PA35-T	PA64-H	PA64-T	PA100-H	PA100-T	PA150-H	PA150-T	PA200-H	PA200-T
Flange size	CF38 70mm (2.75") OD CF		CF64 114mm (4.5") OD CF		CF100 152mm (6") OD CF		CF150 203mm (8") OD CF		CF200 254mm (10") OD CF	
Flange bolt hole type	Clear M6	Tapped M6	Clear M8	Tapped M8	Clear M8	Tapped M8	Clear M8	Tapped M8	Clear M8	Tapped M8
Axial length adjustment	+/- 5mm									
Tilt	+/- 3°									
Bellows clear bore	38mm		65mm		102mm		127mm		127 - 200mm (made to order)	
Bakeout temperature	250°C									

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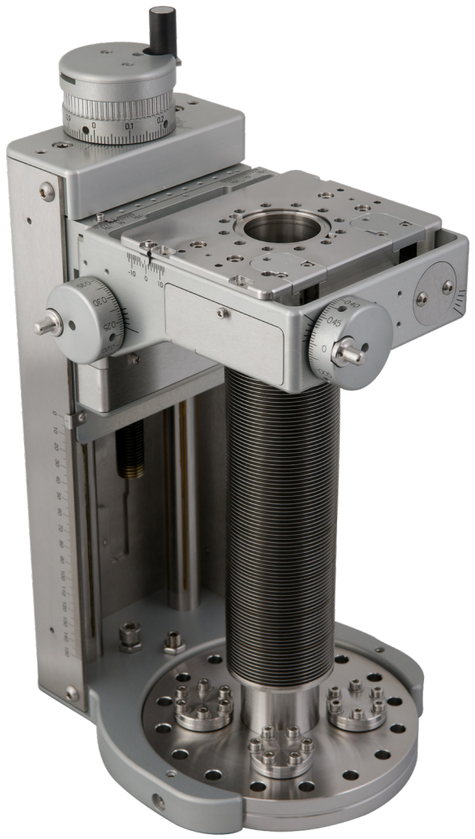
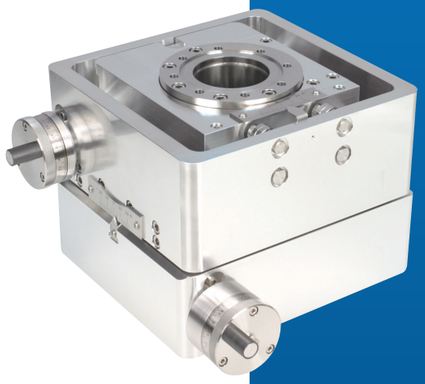
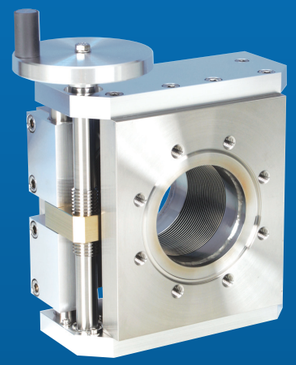






Section 06

Y, XY AND XYZ MOTION

06

Y, XY and XYZ Motion

Introduction

Many vacuum applications such as sample transfer, beamline diagnostic positioning and sample positioning for analysis require precise manipulation along Y, XY or XYZ axes.

UHV Design provides a field-proven range of precise manipulators that can be used in isolation or combined with magnetically-coupled rotary drives (see Section 1) to build sophisticated manipulators with up to six axes of independent motion.

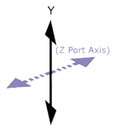
All of our manipulators benefit from kinematic design which ensures smooth, precise motion, high load capability and a minimum bellows design life of 10,000 cycles.

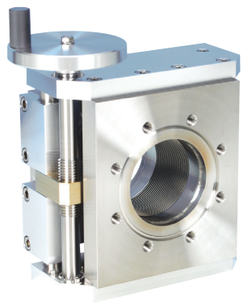
Manipulators can be configured using our modular XYZ and XYZT stages (see pages 126-133). Options include:

- Bellows support tubes
- Service collars
- Rotary drives providing up to 2 additional axes of manipulation

In addition to this modular approach we provide complete sample manipulation solutions which include sample heating, cooling and rotation (see MultiCentre section - page 134).

Y Motion Only



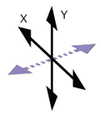


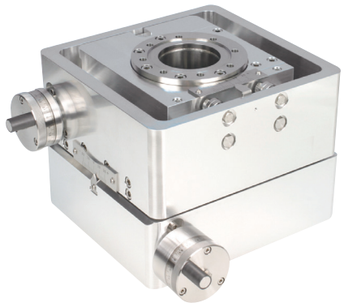
Y-shift Range

Precise, repeatable axial alignment along Y axis.

Page 66

X & Y Motion



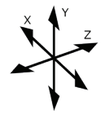


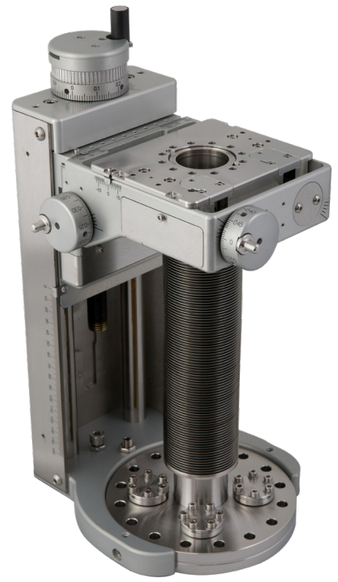
Multibase XY Stage

XY translation with a range of flange sizes, clear bores and actuation methods.

Page 67

X, Y and Z motion





XYZT Stage

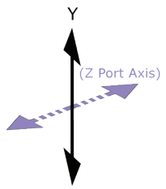
Compact stage with up to +/-15mm X&Y translation and up to 300mm Z travel. Integrated +/- 2° tilt for final alignment.

Page 68

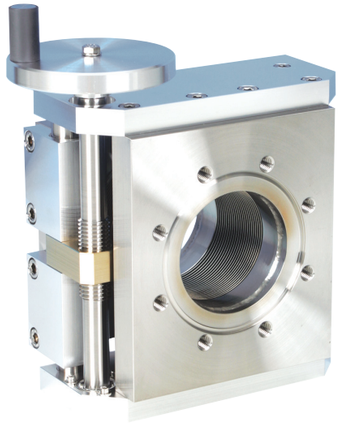
MultiStage XYZ Stage

Modular stage with up to +/- 57mm X & Y translation and up to 1000mm of Z travel.

Page 69



Y-shift Range



Accurate, repeatable alignment on the Y-axis. Typically used to lift and lower sample transfer arms for sample transfer.

Y-SHIFT KEY ADVANTAGES

- **Kinematic design provides smooth, precise motion in parallel plane**
- **Four different fixed/travelling flange combinations**
- **Any-orientation mounting**
- **Bellows-sealed all-metal vacuum enclosure**

Overview

The Y-Shifts provide accurate, repeatable axial alignment on the Y-axis, and might be used in conjunction with a sample transfer arm, such as a PowerProbe, to effect sample hand-off (see section 4). The robust, production-proven devices offer true UHV performance and are available in two sizes providing +/-7.5mm or +/-31mm Y axis adjustment, with four different fixed/travelling flange combinations.

Suitable for use in both production and R&D applications, the Y-Shifts are supplied with a range of actuation methods including manual hand wheels or stepper motors. Motorised Y-Shifts are supplied with pre-wired bakeable limit switches, terminating with a bakeable, frame-mounted connector. Plug and play motor controllers are available. For more information please see section 13.

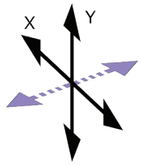
Design Concept

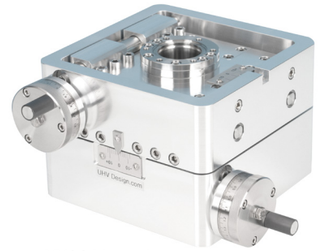
The Y-Shift design includes two parallel flanges, one remaining fixed, whilst the other provides the movement. The device works by adjusting the position of the travelling flange in relation to the fixed system mounted flange. The travelling flange position is controlled through an external leadscrew and benefits from an anti-backlash mechanism.

A kinematic guide mechanism ensures smooth and precise motion. Vacuum integrity is ensured through the use of high quality 316L edge-welded bellows which have a minimum design life of 10,000 cycles. The Y-Shift's rigid construction enables large cantilevered loads to be accommodated and allows the units to be mounted in any orientation. Y-Shifts are used for a number of applications, for example in transfer system alignment to adjust a linear probe to achieve sample hand-off (see 'Sample Transfer Section' page 54).

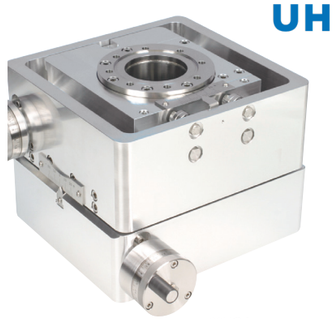
Specification Table

MODEL	LDM64/38	LDM64/64	LDM100/38	LDM100/64
Fixed flange	CF64 114mm (4.5") OD CF		CF100 152mm (6") OD CF	
Travelling flange	CF 38 70mm (2.75") OD CF	CF64 114mm (4.5") OD CF	CF 38 70mm (2.75") OD CF	CF64 114mm (4.5") OD CF
Offset	+/- 7.5mm		+/- 31mm	
Bellows bore	60mm		90mm	
Clear bore	38mm	60mm	38mm	60mm
Flange to flange	87.5mm		182mm	





XY14 Manual



XY31 Manual

MultiBase XY Stages

Modular platforms for the manipulation of components in the X and Y planes.

Kinematic design ensures smooth and precise motion.

MULTIBASE KEY ADVANTAGES

- **Any-orientation mounting without additional supports**
- **High precision kinematic drive and guidance system – eliminates need for vulnerable cross-roller slides**
- **Rigid stops limit X/Y travel protecting the bellows**
- **Robust construction for high loads**

The MultiBase XY stage is the first choice for both research and demanding production environments due to its precise motion, true UHV performance and rugged construction which allows mounting in any-orientation.

The MultiBase design includes two parallel flanges. One remains fixed, whilst the other provides the movement. A high quality, supple, edge-welded bellows spans the flanges to accommodate the required motion while ensuring an all-metal vacuum enclosure. The device works by adjusting the position of the travelling flange in relation to the fixed system mounting flange.

Positioning of the travelling flange is controlled through two external lead-screws, each benefiting from anti-backlash systems.

A kinematic mechanism ensures smooth and precise motion. This novel mechanism incorporates a high precision drive and guidance system, removing the requirement for vulnerable cross-roller slides used by other manufacturers. Combining this with a rigid construction allows mounting in any-orientation without additional supports. Scales are fitted to each axis for resolving the position of the travelling flange on the manual version. The motorised stages are fitted with stepper motors and pre-wired limit and home switches.

Specification Table

MODEL	XY14-64-38	XY14-100-38	XY31-100-38	XY31-100-64	XY31-150-64	XY57-150-150
Travelling flange	CF38 70mm (2.75") OD with M6 straddled holes			CF64 114mm (4.5") OD with M8 straddled holes		CF150 203mm (8") OD with M8 straddled holes
Mounting flange	114mm (4.5") OD CF64 with M8 straddled holes	CF100 152mm (6") OD with M8 straddled holes			CF150 203mm (8") OD with M8 straddled holes	
X Y travel	+/- 14mm (vector)		+/- 31mm (vector)			+/- 57mm (vector)
X_{MAX}, Y_{MAX}	+/- 10mm		+/- 22mm			+/- 40mm
Clear bore diameter	51mm		90mm			150mm
Maximum Probe OD	22mm max to achieve full movement		28mm max to achieve full movement			36.5mm max to achieve full movement
X Y resolution	Manual drive +/- 0.01mm. Stepper motor driven +/- 0.0005mm					Manual drive +/- 0.01mm. Stepper motor driven +/- 0.0005mm

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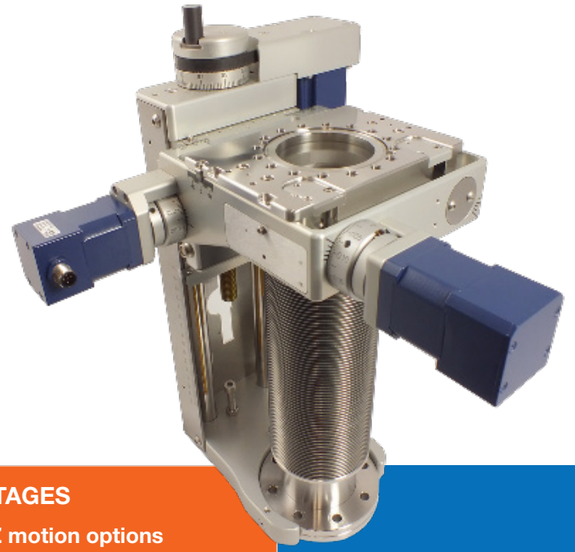
TETRAXE XYZT Stage



The ultra-compact TetrAxe manipulator offers precise manipulation in X, Y and Z axis with convenient +/-2° tilt integrated into the mounting flange assembly. Ideal when space is at a premium.

KEY ADVANTAGES

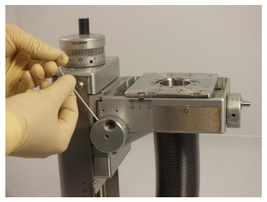
- » 50-300mm Z motion options
- » XY options include +/-12.5mm
- » (38mm bore) and +/-15mm (65mm bore)
- » High resolution performance
- » Easy to retrospectively motorise

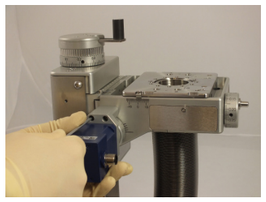
In situations where availble space is limited, in addition to an ultra-compact footprint, the TetrAxe allows both the X and Y actuation methods to be moved to alternative positions to avoid mechanical clashes if required.

Moving the manual handwheels or motorisation kits requires no specialist tools or training and can be completed on-site by following a simple process.

In addition to this feature, the mounting flange incorporates an integrated +/-2° tilt for convenience during final alignment.

The TetrAxe is availble in manual or motorised configurations with the option to upgrade from manual actuation to motorisation at a later date using simple to install motorisation kits which include beakeable limit and home switches.





Simple motorisation upgrade

Specification Table

MODEL	TTX40	TTX63	
Travelling flange	CF40 (2 ¾") metric tapped	CF63 (4 ½") metric tapped	CF63 (4 ½") metric tapped
Mounting flange	CF100 (6") clear holes	CF63 (4 ½") clear holes	CF100 (6") clear holes
XY travel	+/-12mm	+/-15mm	+/-15mm
Z travel	25mm, 50mm, 100mm, 150mm, 200mm, 250mm, 300mm options		
Flange tilt	+/-2° integrated into the mounting flange		
Clear bore diameter	38mm	65mm	65mm
Bakeout temperature	250°C (with motors removed)		
Max probe diameter	13mm (for max. X or Y travel)	22mm (for max. simultaneous X&Y travel)	22mm (for max. simultaneous X&Y travel)

MultiStage XYZ Stages

Manual

Ultra-stable dual bellows stages providing smooth, precise motion with up to +/-31mm X & Y travel and up to 1000mm in Z travel.

Can be mounted in any-orientation.

XYZ KEY ADVANTAGES

- » 25mm-1000mm Z motion in combination with XY
- » Mounting in any-orientation without additional supports
- » Smooth, precise kinematic motion
- » Robust construction for high loads
- » True UHV performance

MultiStage manipulators provide precise motion along the X, Y and Z axes. Their robust construction provides a stable platform, enabling mounting in any-orientation.

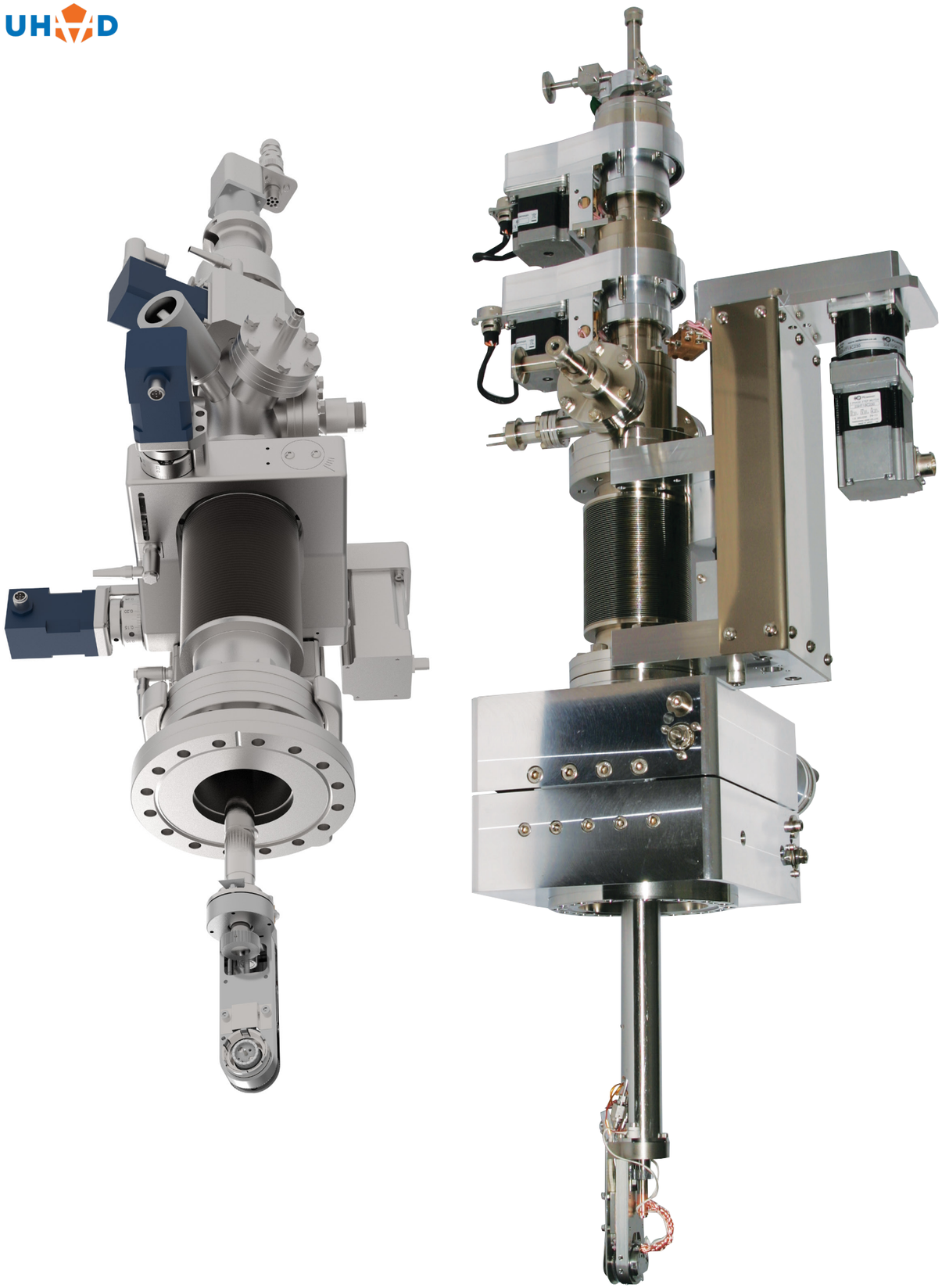
The range is modular utilising the MultiBase XY stages to provide two generic platforms offering +/-14mm or +/-31mm of motion (vector sum of X & Y). Various Linear Shift Mechanisms can then be fitted to these platforms to provide between 100mm (4") and 1000mm (39") Z stroke. The kinematic motion provided results in smooth and reliable motion.

MultiStage manipulators are offered with manual or motorised actuation. Manual XY actuation is delivered via a combined micrometer handwheel and linear scale assembly. Manual Z motion can be fitted with a 1mm increment scale.

DC and stepper motor driven solutions are also available, along with 'plug and play' motion control systems (see Section 13).

Specification Table

MODEL	XY14-64-38	XY14-100-38	XY31-100-38	XY31-100-64	XY31-150-64
Travelling flange	CF38 70mm (2.75") OD with M6 straddled holes			CF64 114mm (4.5") OD with M8 straddled holes	
Mounting flange	CF64 114mm (4.5") OD with M8 straddled holes	CF100 152mm (6") OD with M8 straddled holes			CF150 203mm (8") OD with M8 straddled holes
X Y travel	+/- 10mm (+/- 14mm vector)		+/- 22mm (+/- 31mm vector)		
X Y resolution	Manual drive +/- 0.01mm. Stepper motor driven +/- 0.005mm (based upon 400 half-steps per revolution).				
Z travel	Z shifts are available with following strokes as standard: 100, 200, 400, 600, 800 and 1000mm.				
Z resolution (manual)	Manual drive +/- 0.5mm with engraved shaft, with digital linear scale 0.01mm				
Z resolution per ½ step (motorised)	100 & 200mm Z travel - +/- 0.000254mm 400 & 600mm Z travel - +/- 0.000508mm			100 & 200mm Z travel - +/- 0.000127mm 300 to 1000mm Z travel - +/- 0.000635mm	



Section 07

ANALYTICAL STAGES

07

MultiCentre Analytical Stages

Configurable analytical stages offering up to 5 axes of motion and options for sample biasing, heating to 1200°C and cooling to <30K. MultiCentres can be configured to accept most common surface analysis sample holders including pucks, flags and ESCA stubs.

The MultiCentre and associated accessories provide a complete solution for sample transfer and manipulation. Typical applications include analytical instrumentation for surface analysis equipment and synchrotron end stations.

The MultiCentre range includes the XL-T Series which provides compact single bellows stages and the XL-R series which utilises dual bellows with dual-point support to provide increased stability and precision.

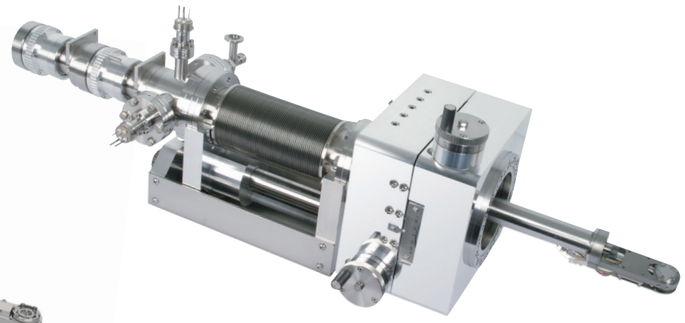
Each series offers a full range of options including motorisation, resistive or e-beam heating, temperature measurement, sample biasing/current measurement and LN_2 and LHe cooling options. MultiCentres are unique in their ability to provide continuous azimuthal rotation and temperature measurement even when cooling with LN2 and heating to 1200°C.

MULTICENTRE KEY ADVANTAGES

- **Compact and high stability, high precision stages**
- **Modular stage design allows functionality to be configured to suit application**
- **Innovative sample stage with ultra compact swept volume and unique range of additional stage options**
- **Heating to 1200°C & cooling to <30K (with LN2 precooling to reduce LHe consumption and costs)**
- **Unique ability to provide continuous azimuthal rotation and LN2 cooling**
- **Flag, puck and ESCA sample compatible stages**

XL-T Series

Compact stages (see page 142)



XL-R Series

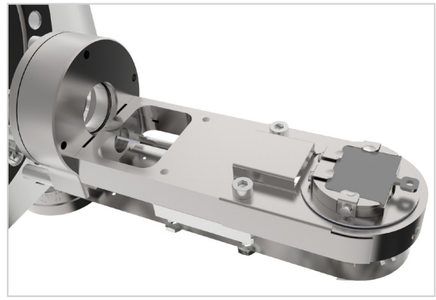
High stability, precision stages (see page 144)

Configure to suit your application

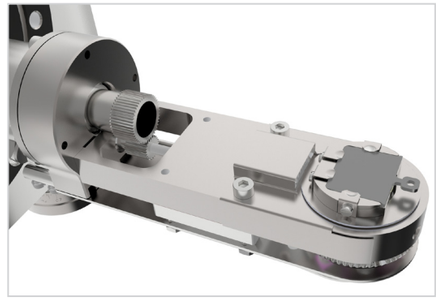
The modular XL-T and XL-R series of MultiCentres can be configured to meet your requirements.

Choose 4-axis for polar rotation only, and 5-axis if azimuthal rotation is also required. In addition, heating and cooling can also be specified. If sample heating is required, resistive heating to 900°C and e-beam heating to 1200°C options are available. If sample cooling is required, LN2 cooling to <-150°C and LHe to <30K options can be included.

Manipulation Options



- 4 Axes (X,Y,Z,R1)



- 5 Axes (X,Y,Z,R1,R2)

Heating Options

- Resistive Heating to 900°C
- E-beam Heating to 1200°C

Cooling Options

- LN2 cooling to <-150°C
- LHe cooling to <30K

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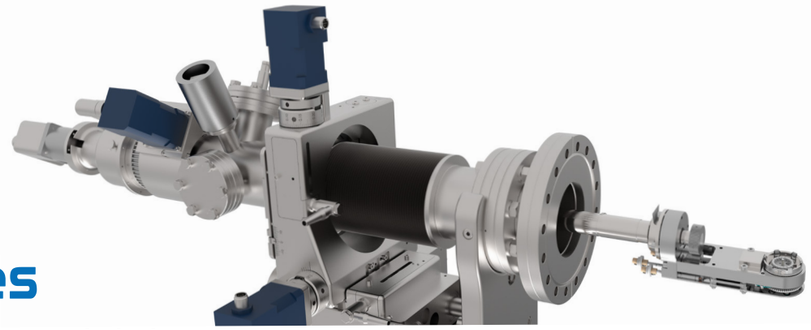


XL-T Series

Single bellows, compact analytical stages

The XL-T series is an entry level single bellows compact stage, offering a full range of functions. Based on the proven design of the TETRAXE XYZT manipulator, its rugged construction and smaller platform is ideal for surface science chambers where space is at a premium.

XL-T KEY ADVANTAGES

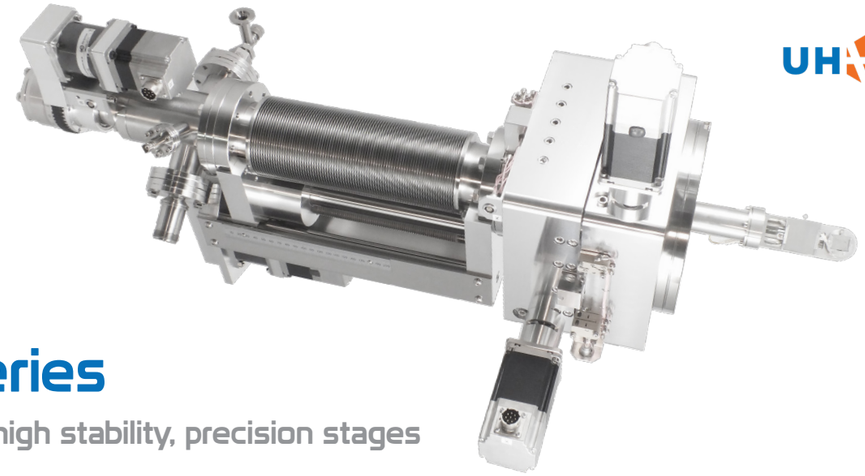
- Single bellows 3, 4 or 5 axes
- +/- 12.5mm XY Motion
- 50-250mm Z Motion
- Puck, Flag or ESCA sample handling
- E-beam heating, LN2 cooling plus biasing options
- Continuous azimuthal rotation & LN2 cooling

The large 65mm ID bellows bore allows for all services, including LN_2 cooling coils, to be routed at the top of the stage resulting in a very uncluttered, compact design at the sample stage, significantly reducing the swept radius.

A unique feature is the continuous azimuthal rotation even when cooling with LN_2. This is achieved via a proprietary design which not only acts as a bearing for rotation, but provides electrical isolation of the sample.

Any or all axes of motion can be motorised (including Polar and Azimuthal rotation). For details of suitable controllers refer to Section 13.

MODEL	Puck-Style	Flag-Style	ESCA Stub
Mounting flange	CF64 114mm (4.5") OD CF or CF100 152mm (6") OD CF		
X-Y travel	+/- 12.5mm		
Z travel	50, 100, 150 and 250mm		
Polar rotation	+/- 180°		
Azimuthal rotation	Continuous with LN_2 cooling		N/A
Maximum sample size	25mm diameter	15mm x 18mm	14mm diameter
Resistive heating	> 900°C	> 900°C	> 900°C
e-beam heating	> 1200°C	> 1200°C	N/A
LN_2 cooling	< -150°C (<-170°C typically achievable) (< -150°C with continuous azimuthal rotation)		< -140°C
Sample current measurement	Isolation > +/- 1000 V Resistance > 500 MOhm		



XL-R Series

Dual bellows, high stability, precision stages

The XL-R series is a truly modular dual bellows stage. Based on the proven design of the MultiStage series of manipulators, a full range of XY and Z stage modules are available which are interchangeable, resulting in complete flexibility.

XL-R KEY ADVANTAGES

- Dual bellows with 3, 4 or 5 axes
- Up to +/- 40mm XY Motion
- Dual-point support for ultimate stability
- 100-1000mm Z Motion
- Puck, Flag or ESCA sample handling
- E-beam heating, LN2 cooling plus biasing options

With the addition of an integrated dual-point support, the XL-R series offers greatly increased stability, making it an ideal choice for surface analytical and synchrotron end-station applications where long travel and stability are essential.

All stage modules use proven kinematic designs that eliminate thermal stressing problems, such that even after repeated bakeout at 250°C, smooth operation is assured.

Any or all axes of motion can be motorised (including Polar and Azimuthal rotation). For details of suitable controllers refer to Section 13.

MODEL	Puck-Style	Flag-Style	ESCA Stub
Mounting flange	CF100 152mm (6") OD CF / CF150 203mm (8") OD CF		
X-Y travel	+/- 19mm or +/- 40mm		
Z travel	100, 200, 300, 400, 600, 800 and 1000mm		
Polar rotation	+/- 180° (+/- 100° with LHe option)		
Azimuthal rotation	Continuous with LN_2 cooling (+/- 100° with LHe cooling)		N/A
Maximum sample size	25mm diameter	15mm x 18mm	14mm diameter
Resistive heating	> 900°C	> 900°C (600°C with LHe option)	> 900°C
e-beam heating	> 1200°C	> 1200°C (Not available with LHe option)	N/A
LN_2 cooling	< -150°C (<-170°C typically achieved)		< -140°C
LHe cooling	Not available	<30K	N/A
Sample current measurement	Isolation > +/- 1000 V Resistance > 500 MOhm.		

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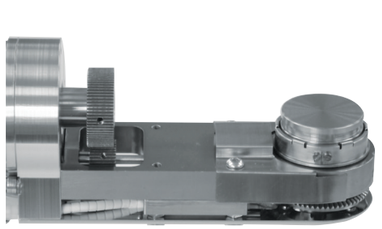
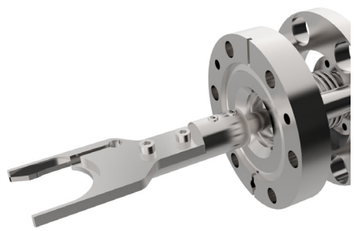
Sample Handling

Compatible sample handling throughout all experimental modules is essential to maintain full system integration. UHV Design offers a range of Industry-standard Transfer Solutions which includes Flag-style, Puck-style and ESCA Stub options, all three of which can be fitted to either wobble sticks (Section 5) or PowerProbes (Section 4).

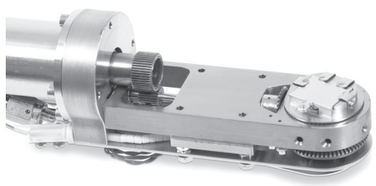
Puck-Style

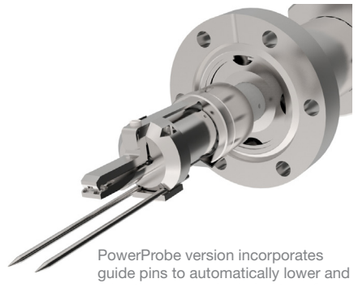




Puck-style gripper available with Wobblestick (Section 5) or PowerProbe (Section 4)

Flag-Style



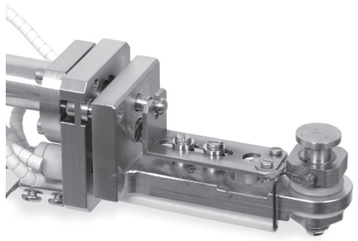


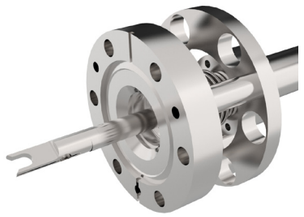
PowerProbe version incorporates guide pins to automatically lower and raise thermocouple during transfer.

Flag-style gripper available with Wobblestick (Section 5) or PP PowerProbe (Section 4).

For Wobblestick sample transfer there is an option to include a toggle switch (b) on the stage to raise and lower the thermocouple before and after sample transfer.

ESCA Stub





ESCA stub gripper only available on Wobblestick (Section 5).

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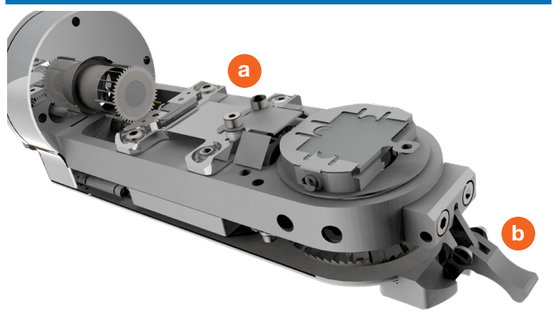
Additional Stage Options

In addition to the small swept volume and generally uncluttered design, the flat area of the platform adjacent to the sample plate itself can be utilised for additional modules if required. Some examples of our innovative parking stages are shown below.

Single flag-style parking position for 5-axis stage

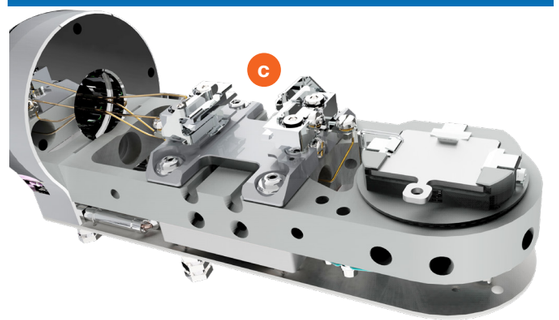


5-axis flag-style heat / cool stage with the following additional features:

(a) Single flag-style sample parking position which can loaded from either side by a wobble stick, is electrically floating for biasing and sample current measurement, and can be cooled

(b) Toggle mechanism which can be operated by a wobble stick to disengage the thermocouple from the back of the sample plate. Normally this functionality is accomplished by the forks on the magnetic transfer arm which engage in the end of the manipulator and disengage the thermocouple in the process

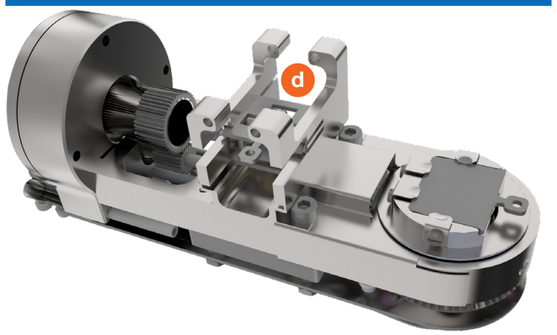
Two level parking positions for 4-axis stage



4-axis flag-style heat / cool stage with a 2 level parking stage (c), both electrically floating and coolable into which can be loaded from either side:

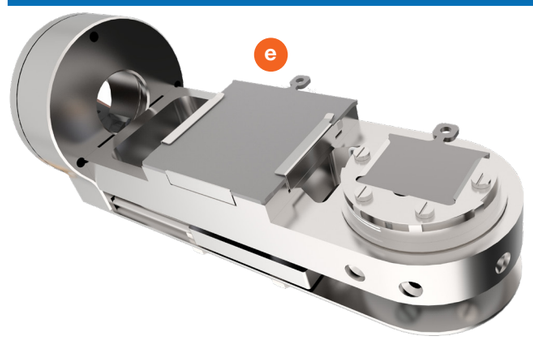
- 2 standard flag samples, or
- two direct current heating flag samples, or
- a mixture thereof
- a special flag-style sample plate with a QMB (Quartz Micro-balance) FTM (Film Thickness Monitor) mounted on it, or
- a special flag-style sample plate with an e-beam heater module which when loaded into the lower position can be used to heat a standard flag-style sample in the upper level to 1200°C

Flag mounted STM tip holder parking stage for 5-axis stage

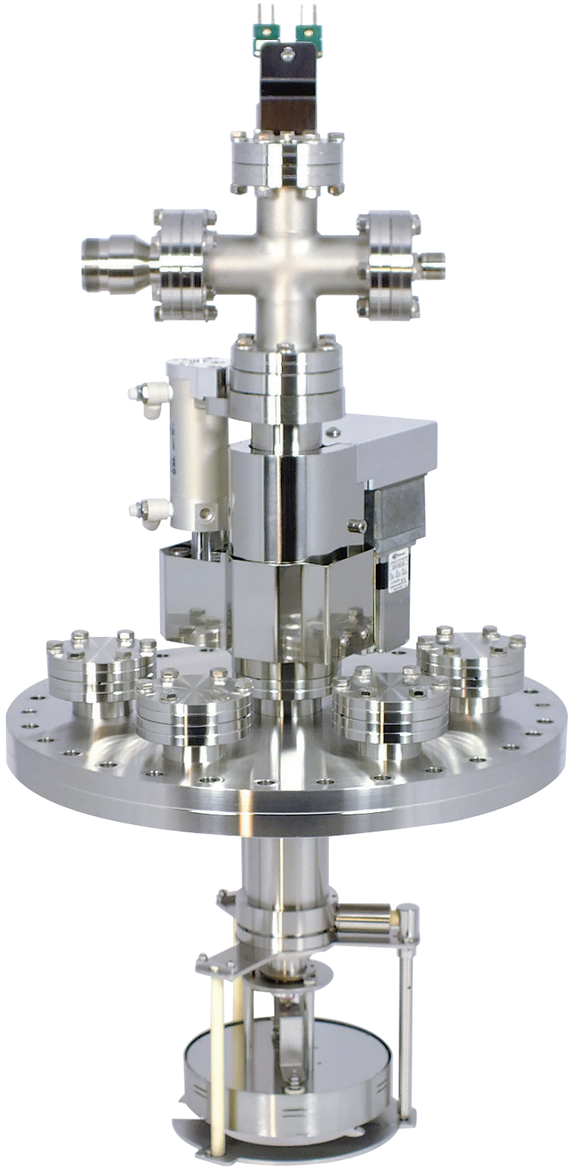


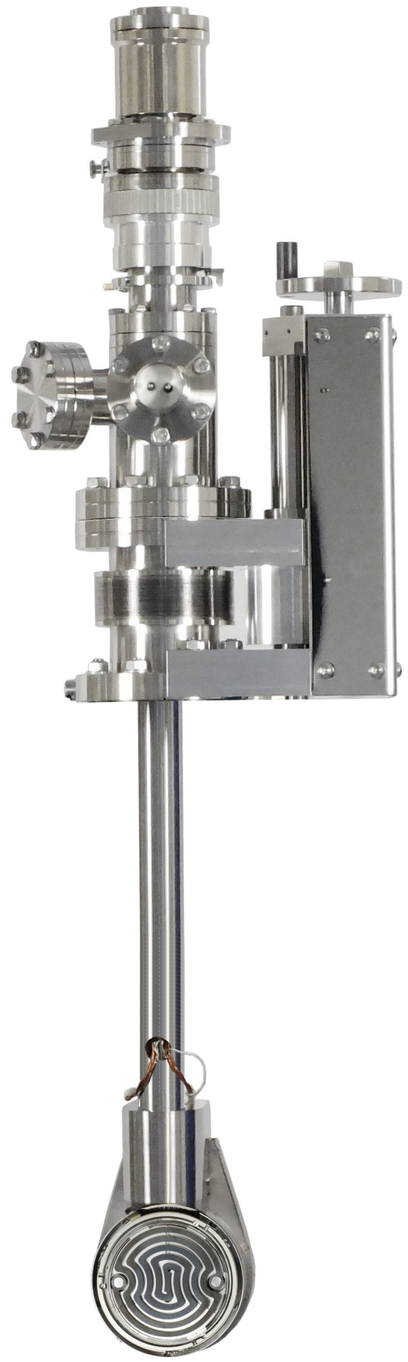
5-axis flag-style heat / cool stage showing a custom parking position for the conditioning of flag mounted STM tips (d)

Large flag-style parking position for 4-axis stage



4-axis flag-style heat / cool stage - showing an additional parking position for a large (30x30mm) flag-style sample plate (e), which is also electrically isolated for biasing and sample current measurement, and can be cooled





Section 08

08

DEPOSITION STAGES

EpiCentre Deposition Stages

The EpiCentre range of deposition stages employs cutting -edge design and engineering technology to give high temperature, uniform and durable substrate heating with precise manipulation under true UHV conditions.

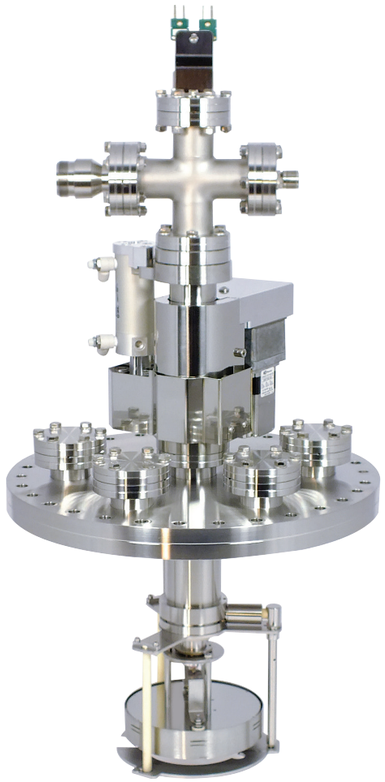
EpiCentres have been designed for deposition applications such as MBE (Molecular Beam Epitaxy), sputtering and CVD (Chemical Vapour Deposition). Substrate annealing, degassing and other high temperature material modifications can also be performed.

EpiCentres can be mounted in any-orientation to suit customer chamber designs and application configurations.

The EpiCentre range has been used by pioneering research laboratories around the world for many years. End user references are available for a variety of applications and substrate types and sizes. The range comprises four model types: EC-I, EC-R, GLAD and Preparation Stages summarised on the opposite page.

EPICENTRE KEY ADVANTAGES

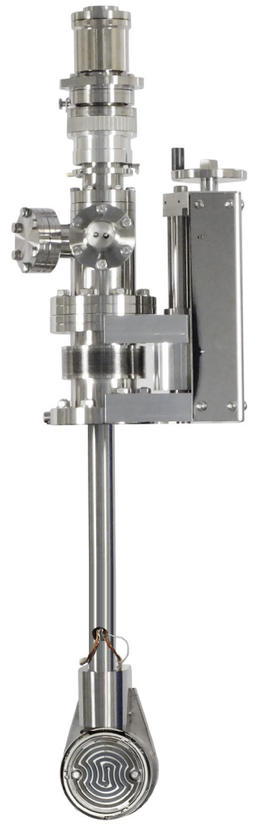
- **Choice of in-line, right-angle and glancing angle configurations**
- **High uniformity substrate heating to 1200°C**
- **RF & DC substrate biasing with ultra-stable plasma**
- **Substrate rotation to 60rpm**
- **Modular design allows application specific configuration**
- **Substrate sizes up to 8"**



EC-I Series

An in-line design presenting the substrate parallel to the mounting flange. The EC-I provides substrate rotation, heating, electrical biasing, substrate transfer motion, deposition height adjustment and homing for automatic transfer.

Page 84



EC-R Series

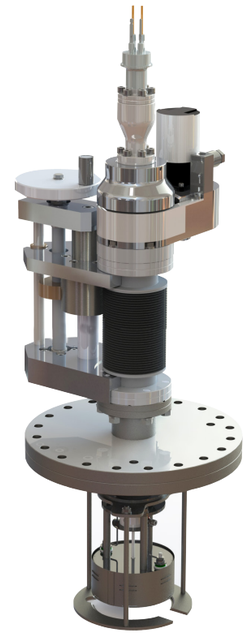
A right-angle design presenting the substrate at 90° to the mounting flange. The EC-R provides substrate tilt, rotation, heating and electrical biasing with X,Y and Z motion options if required.

Page 86

GLAD Series

An in-line glancing-angle design presenting the substrate at a variable glancing angle to the mounting flange. Additionally includes continuous rotation, heating, electrical biasing, deposition height adjustment and rotation of tilt axis to align with numerous sources.

Page 88



Preparation Stages

A basic range of in-line stages configured for sample preparation offering heating to 800°C, rotation and transfer/deposition height adjustment options.

Page 89

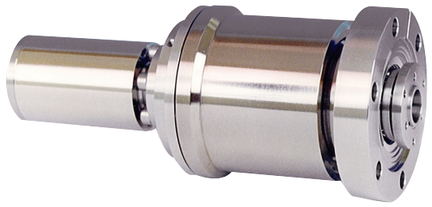
Technology Advantages

Substrate tilt and azimuthal rotation

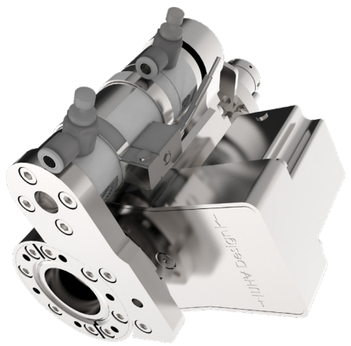
The EpiCentre uses magnetically-coupled drives in high duty cycle areas for substrate and polar rotation or tilt. Eliminating the use of edge-welded bellows, o-ring seals and ferromagnetic components improves reliability and removes possible sources of contamination.

Hollow variants of MagiDrives allow coaxial stacking for true independence of polar and azimuthal rotation without the need for costly head positioning gears.

Eliminating unnecessary bellows and dynamic seals from the EpiCentre design ensures true UHV performance, increases reliability and reduces the risk of down-time making them ideal for critical applications.



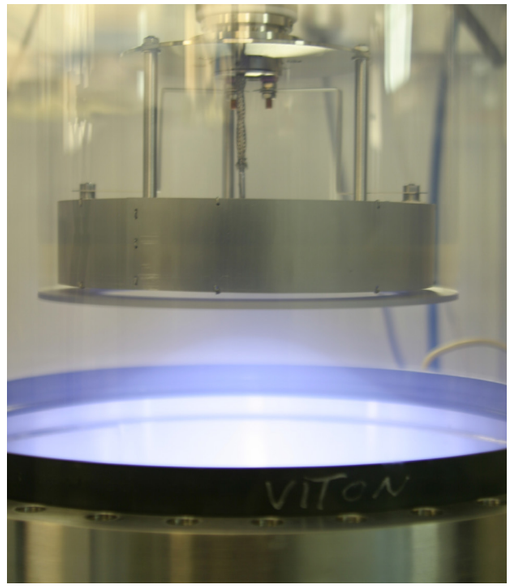
MD16/MD35H MagiDrive magnetically-coupled stack provides substrate rotation and tilt on EC-R and GLAD stages.



MagiLift magnetically-coupled drive provides substrate rotation and cradle lift/lower on the EC-I stages.

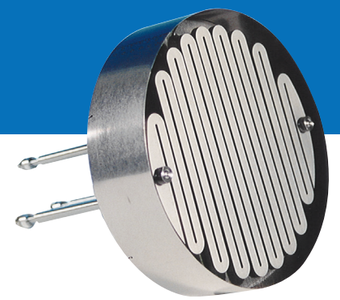
Substrate biasing with ultra-stable plasma

EpiCentre stages can be provided with the facility to apply an electrical bias to control substrate deposition characteristics and to generate a plasma for substrate sputter cleaning prior to deposition. Bias can be applied during continuous heating and rotation at up to 1kV DC and/or up to 300 W RF power as standard. Dark space shielding is provided as standard to prevent parasitic plasma formation around the electrical path and other susceptible areas.



Propriety substrate biasing technology provides unrivalled ultra-stable performance, typically with zero maintenance and long operational life.

High uniformity, high temperature substrate heating



Until recently, Pyrolytic Graphite Coated Graphite (PgG) heaters have been used in the majority of deposition stages providing robust performance in UHV applications. However, graphite heaters oxidise and are consumed when run in the presence of high partial pressures of O_2 at high temperature. For sputtering applications that involve high partial pressures of O_2, other technologies are also available. UHV Design now offer a choice of either Solid Silicon Carbide (sSiC) or Silicon Carbide coated Graphite (SiCg) heater elements which deliver excellent temperature uniformity in addition to O_2 resistance.

Both options have been fully characterised in terms of typical lifespan against partial pressure of O_2 and temperature, and guidance is available from UHV Design on the best option for your application.

EpiCentre heater modules have a self-supporting element, refractory metal enclosure and are capable of producing substrate temperatures up to 1200°C as standard. Higher temperatures are available on request. By virtue of the exceptionally high ratio of heated to open heater area, the elements run at considerably lower temperatures than conventional metal wire heaters. This extends the operational life of the heating element. Multiple layer heat shielding is also provided to reduce unwanted heating of surroundings.

SiCg heater element

sSiC heater element

Temperature Uniformity

UHV Design's heater modules provide outstanding temperature uniformity without the need for dual zone heaters. Performance is dependent on substrate type and sample holder design.

SiC coated elements

SiCg elements are similar to PgG elements being primarily composed of graphite but have a coating of Silicon Carbide (SiC). This provides improved durability when using oxidising atmospheres in comparison to PgG. However, as SiC is an insulator, gaps are required in the coating to allow connections to be made to the underlying graphite. The heater is therefore still somewhat vulnerable to oxidation at these locations in the longer term.

Solid SiC heaters

Solid SiC heaters are manufactured from a conducting solid SiC material in the ß phase and are more robust in all respects. They are durable under mechanical or electrical shocking and when exposed to reactive gases including oxidising atmospheres at high temperature. They are also optimised to give the very best in temperature uniformity.

In-line Deposition Stages

EpiCentre EC-I Series

Substrate parallel to plane of mounting flange

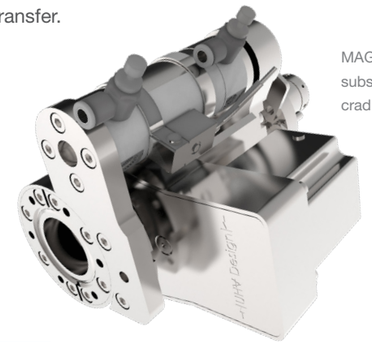
The EC-I series provides state-of-the-art performance for various growth and deposition techniques including MBE, sputtering and CVD. The EC-I offers continuous substrate rotation, high temperature and high uniformity heating, DC/RF biasing, and facilities for substrate transfer, while maintaining true UHV compatibility.

EC-I KEY ADVANTAGES

- **Substrate heating to 1200°C**
- **Continuous substrate rotation**
- **Homing for automatic transfer alignment**
- **Substrate lift/lower for transfer**
- **DC/RF (up to 300W) substrate biasing**
- **Adjustable deposition height**
- **SEMI standard 2" to 200mm Ø samples**

The series includes models to accommodate SEMI standard wafers from 2" to 200mm diameter. Special substrate cradles can be provided to accommodate specific substrate shapes and designs up to 200mm diameter.

The EC-I series benefits from the success of UHV Design's unique hollow magnetic coupling technology using the CF38 mounted MagiLift drive. This single compact device provides magnetically-coupled substrate rotation and axial motion to lift and lower substrates for transfer. The hollow drive technology facilitates the passing of services through the drive to a stationary wafer heating module in close proximity to the substrate, eliminating the need for vulnerable high current rotational connections. The MagiLift provides continuous rotation of the substrate cradle, which supports the substrate, for better temperature and layer uniformity. It further provides a pneumatically actuated 25mm lift and lower for substrate transfer.



MAGILIFT provides substrate rotation and cradle lift and lower.

The stationary heater module employs multiple refractory metal Molybdenum heat shields to minimise heat loss, (Inconel and other materials available upon request), and a choice of either SiCg (SiC coated Graphite) or sSiC (solid SiC) heater elements, both of which are capable of heating wafers to 1200°C and operating within O_2 rich environments.

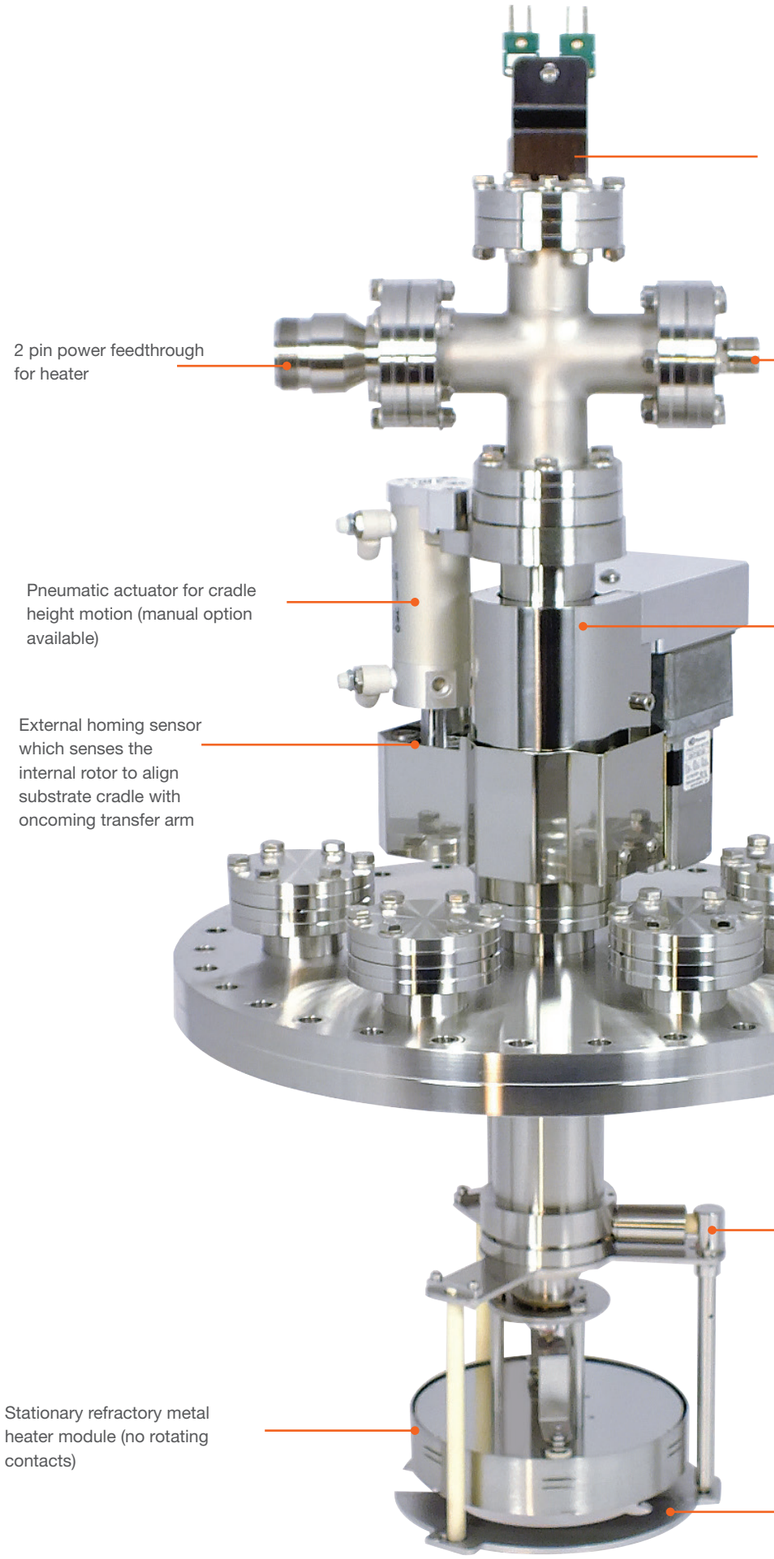
The electrically-isolated substrate cradle can be biased with either DC or RF (up to 300W) to facilitate sputter cleaning prior to deposition or for better control of deposition kinetics. 'Faraday Dark Space Shielding' is supplied as standard on all biased stages. This confines plasma to the substrate cradle region. Our proprietary substrate biasing technology provides unrivalled flicker-
free performance, typically with zero maintenance and long operational life.

The deposition height adjustment facility allows the Z position of the substrate to be adjusted to optimise the distance from the deposition flux.

The stages can be mounted in any-orientation, although they are most commonly mounted vertically with the wafer facing up or down and parallel to the mounting flange. Other orientations can be accommodated with special wafer holders. Options are also available to configure EpiCentres for higher pressure and corrosive environments.

The series has a full suite of options including choice of system mounting flanges, manual or pneumatic substrate shutters and thermocouple materials.

Should your requirements fall outside our standard specifications then please contact us at:



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Right Angle Deposition Stages

EC-R Series

Substrate at right angle to plane of mounting flange

The EC-R supports the substrate at a right-angle to the plane of the mounting flange. It can then provide continuous substrate rotation, tilt, heating and electrical biasing. It can also be mounted on UHVD's range of manipulators to provide motion in the X, Y and Z axes.

EC-R KEY ADVANTAGES

- » 2" to 6" substrate diameters
- » Substrate heating to 1200°C
- » Continuous azimuthal rotation
- » Polar rotation (tilt) up to +/- 180°
- » DC/RF substrate biasing
- » X,Y & Z motion options

The base EC-R configuration provides polar rotation to adjust the angle of incidence with respect to the depostion flux and sample heating. The modular EC-R concept provides the flexibility to select options such as azimuthal rotation to continuously rotate the substrate to maximise temperature and deposition uniformity. Electrical biasing is also available, DC and/or RF, to facilitate sputter cleaning prior to deposition or for better control of deposition kinetics. 'Faraday Dark Space Shielding' is supplied as standard on all biased stages. This confines plasma to the substrate cradle region. Our proprietary substrate biasing technology provides unrivalled flicker-free performance, typically with zero maintenance and long operational life. X, Y and Z motion can then be added to tailor the stage to meet your specific application.

The concept of this stage was strongly influenced by a complete review of existing right-angled deposition stages to provide unrivalled performance and durability.

By stacking two magnetically-coupled MagiDrive rotary feedthroughs, UHV Design are able to achieve a dual axis, concentric rotation system which eliminates the head positioning gear train typically used in other designs.

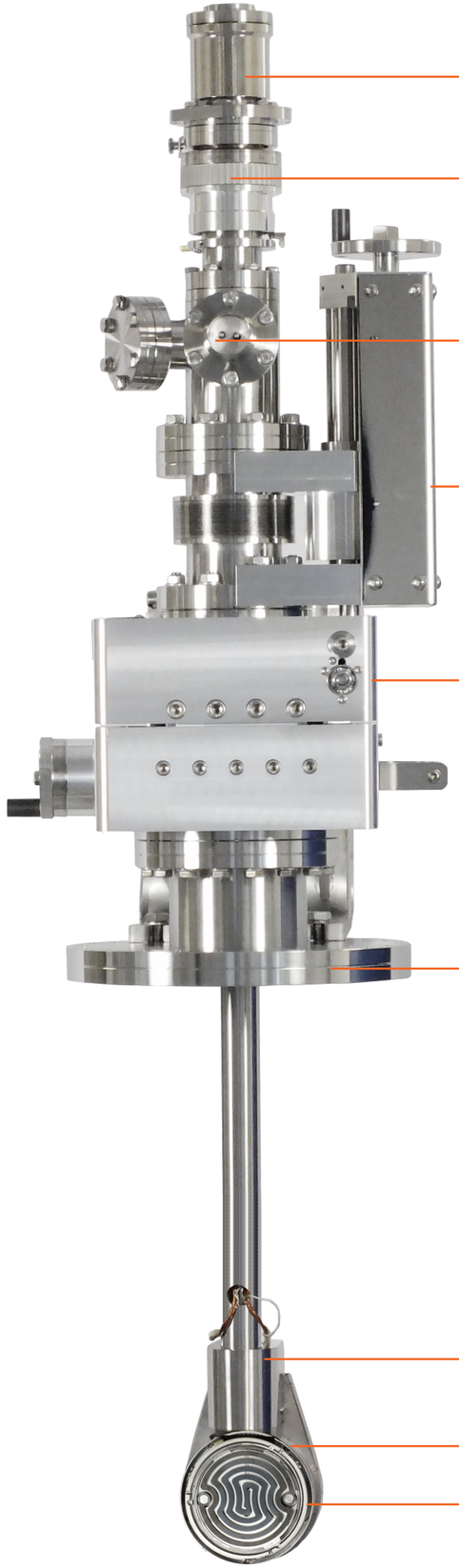
The absence of any bellows, O-rings or dynamic seals ensures clean, true UHV performance with high reliability making them ideal for critical applications.

High temperature heating

By incorporating our latest heater module technology into this stage (see section 12), improvements upon conventional designs have been achieved in terms of the ultimate temperature capability and uniformity and therefore deposition uniformity. Significant technology resides within the rotary head which enables continuous azimuthal rotation with high precision positioning whilst heating from ambient to 1200°C.

Refractory metal deposition shielding is provided as standard to protect the heating module.

The EC-R can also be configured specifically as a retrofit instrument for MBE systems such as the VG Semicon V80H.



EC-R with:

- Polar Rotation (R1)
- 50mm height adjustment
- High temperature heating

EC-R with:

- Polar Rotation (R1)
- Substrate Rotation (R2)
- 50mm height adjustment
- High temperature heating

Glancing Angle Deposition

GLAD Series Stages

Substrate at a variable glancing angle to the mounting flange

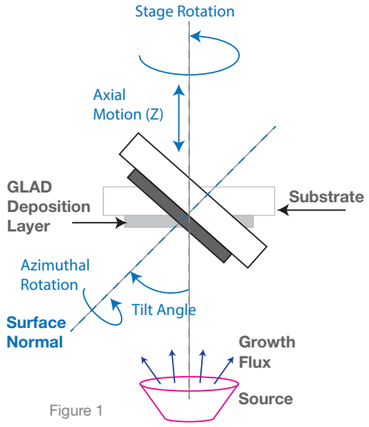


Figure 1

Glancing Angle Deposition (GLAD) is creating great interest in areas where structured three-dimensional deposition is required. Based on UHV Design's highly successful EpiCentre range, the GLAD stage provides an in-line solution (as with the EC-I Series) but with the addition of substrate tilt. Being an in-line stage, a large range of axial (Z) motion can be provided.

By precisely controlling the polar and azimuthal rotations simultaneously, novel structures can be grown, which have, for example, columnular morphology or a nano-helical structure or are structured via anisotropic shadowing. Such materials have applications in many highly topical fields such as photonics, catalysis, bio-compatible materials and fuel cells.

Being fully UHV compatible, the GLAD stage is eminently suitable for use with all the usual directional deposition sources, such as thermal evaporation, physical vapour deposition, pulsed laser deposition and magnetron sputtering.

Features

- Continuous azimuthal rotation from 0.1 - 20rpm, but at any tilt angle from zero to +/- 85 degrees. See Figure 1.
- Substrate temperature heating to 1200°C, with solid Silicon Carbide technology option to provide durability in O_2 rich environments.
- DC bias ≤ 1 kV for sputter process modification – ultra-stable plasma during azimuthal rotation.
- RF bias to 100W power for substrate cleaning prior to deposition. Ultra-stable plasma during azimuthal rotation.
- Z-axis travel up to 200mm to accommodate different source geometries.
- Optional rotation of the entire stage/tilt axis orientation to facilitate glancing angle deposition using out-of-plane sources. (Requires the use of a differentially pumped rotary feedthrough that can be fitted as an option.)

Preparation Stages

EPS Series

Substrate parallel to plane of mounting flange

Cost-effective in-line preparation stages for 2" & 4" substrate preparation offering high uniformity heating to 800°C with substrate rotation, height adjustment and shutter options.

EPS KEY ADVANTAGES

- 2" or 4" substrates
- Substrate heating to 800°C
- Substrate rotation to 60rpm
- 50mm height adjustment
- Manual and motorised actuation

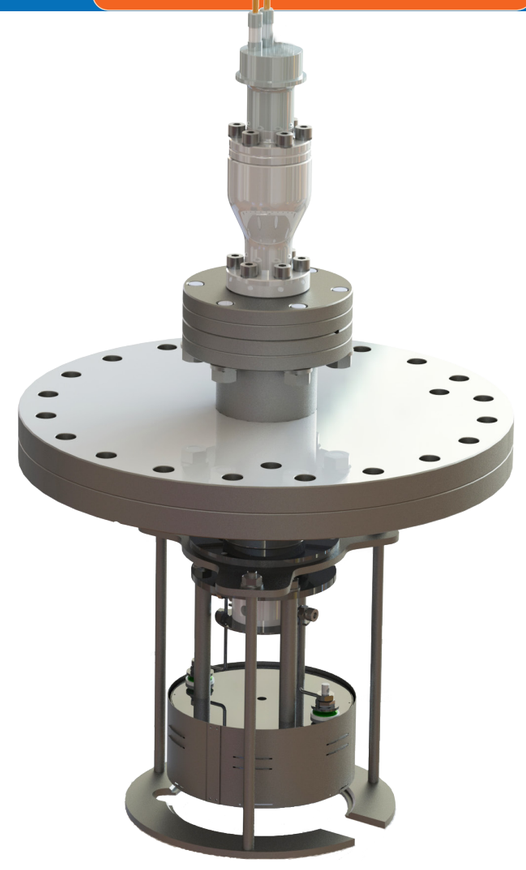
The EPS series of in-line preparation stages support the substrate parallel to the mounting flange. The stationary EPS heating module provides durable and uniform heating of 2" or 4" substrates to 800°C with Molybdenum heat shields provided to minimise heat loss. A Type K thermocouple is provided as standard.

Manual or motorised substrate rotation to 60rpm is provided by the magenetically-coupled MagiDrive rotary drives. Eliminating unnecessary bellows and dynamic seals from the EPS ensures true UHV performance and increases reliability.

In addition to substrate rotation, the 50mm height adjustment option allows the substrate position to be optimised via manual or motorised actuation.

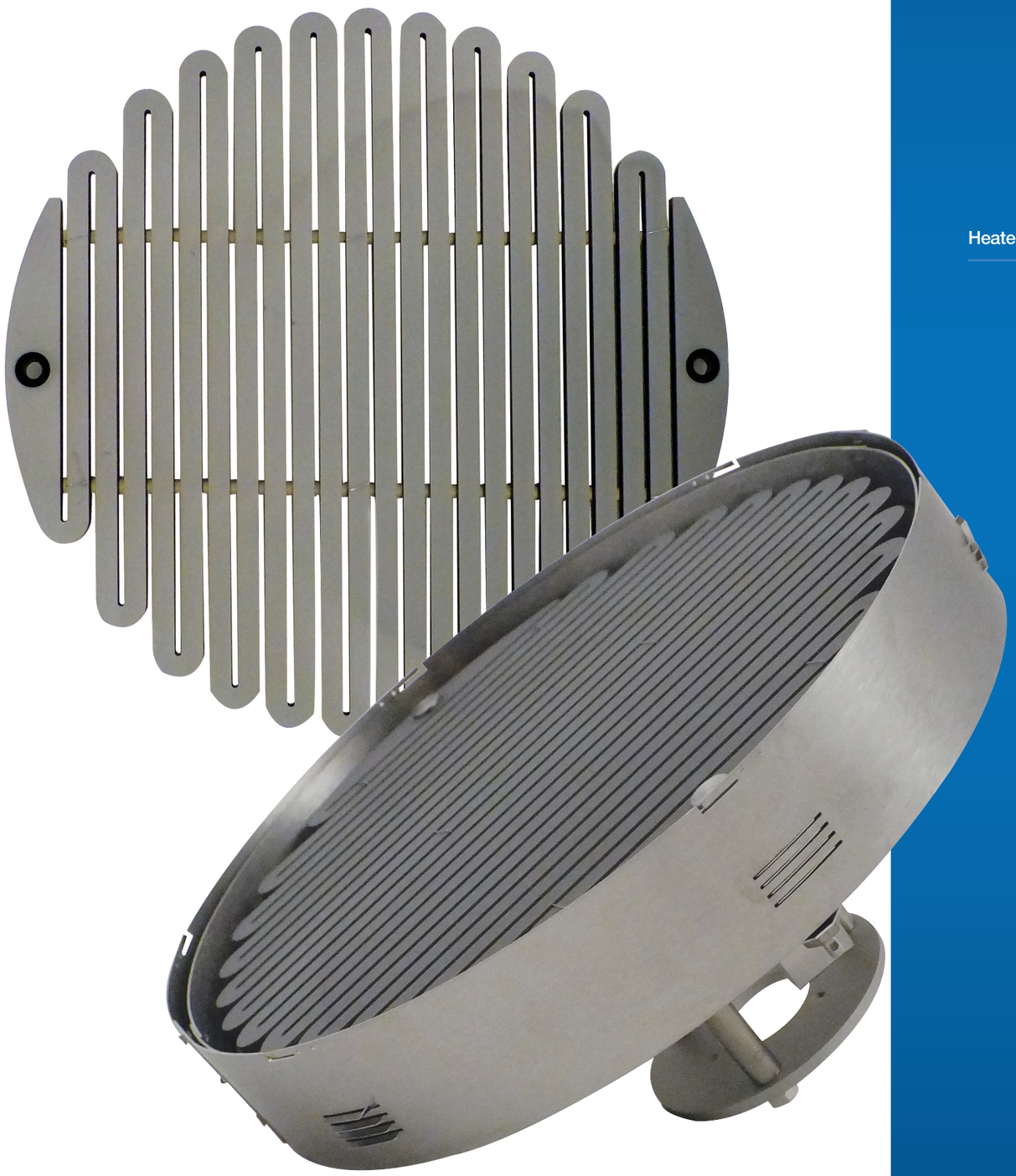
The EPS series of preparation stages provide cost-effective and durable sample preparation capability.

For higher temperature heating, DC/RF biasing or additional capabilities see the EC-I series on page 154.



09

HEATER MODULES



Heater Modules

A cost-effective solution to sample heating whilst benefiting from proven cutting-edge heater technology. They comprise CVD processed heating elements packaged in refractory metal cases.

Key Advantages

- **High uniformity heating to 1200°C**
- **Elements with large radiating surface to gap ratio – able to run at lower temperatures than conventional metal heaters**
- **Refractory metal hot zone – uncompromised performance at high temperatures**

In addition to the complete sample heating solutions offered in the EpiCentre section (page 148) UHV Design also offers a range of individual heater modules for end users to incorporate into their own heater stage designs. The range provides end users with a cost-effective solution to sample heating, whilst benefiting from a proven heater technology used in market leading stages.

Heater Module Overview

UHV Design heater modules are used in vacuum applications for radiantly heating semiconductor wafers, holder supported samples or various other substrates to high temperatures. The modules feature CVD processed heating elements packaged in refractory metal cases.

The immediate hot zone holding the element is constructed from refractory metals such as Molybdenum, Tantalum and ceramics and does not include any other materials to compromise performance at high temperature. These modules are therefore particularly suitable for ultra-high vacuum applications.

Thermocouples

Heater modules are available with type ‘C’ or ‘K’ thermocouples and can be supplied with semiconductor grade quartz guards to protect the heater element from mechanical damage, i.e. accidental contact with the sample transfer tool. Type C (Tungsten/Rhenium) thermocouples are provided as standard. For applications in which the use of Tungsten or Rhenium would be undesirable, a type K (Chromel/Alumel) thermocouple can be supplied.

Figure 1.Solid Silicon Carbide (sSiC) heater element option.

Choosing the right element

Until recently, graphite heaters have been used in the majority of deposition stages and are still the mainstay providing robust performance in UHV applications such as MBE. However, graphite heaters oxidise and are consumed when run in the presence of high partial pressures of O_2 at high temperature.
For sputtering applications which involve high partial pressures of O_2, other technologies are also available with superior performance.

SiCg Elements

Solid Silicon Carbide coated Graphite elements provide improved durability when using oxidising atmospheres by comparison with PgG. Being an insulating form of SiC, holes are required in the coating to make electrical connection and the underlying Graphite is exposed and vulnerable to oxidation at these locations.

sSiC Elements

Solid Silicon Carbide elements (see Figure 1) are manufactured from a conducting solid SiC material in the ß phase and are more robust in all respects. They are durable to mechanical or electrical shocking, reactive gas/oxidation immunity at temperature. They are also optimised to give the very best in temperature uniformity. By virtue of the large radiating surface to gap ratio, all these elements run at considerably lower temperatures than often used metal wire heaters which ensures heater longevity. The typical ratio of heated element surface to meander gap is >5:1 resulting in excellent substrate heating uniformity, even without rotation.

Quick Reference Guide: Typical Standard Heater Element Resistance

ELEMENT MATERIAL	SAMPLE SIZE	COLD RESISTANCE Ω (20°C)	HOT RESISTANCE Ω (1000°C)	ELECTRICAL CHARACTERISTICS AT 1000°C		
				WATTS	AMPS	VOLTS
SiC Coated Graphite	2"	1.4	1.2	840	26.5	31.7
	3"	1.7	1.1	1150	32.3	35.6
	90mm (EC282)	2.9	1.9	850	21.2	40.2
	100mm	1.6	1	1500	38.7	38.7
	150mm	1.8	1.3	2500	43.9	57.0
	200mm	2.2	1.45	3600	49.8	72.2
Solid SiC	1"	9.5	5.5	400	8.5	46.9
	2"	10	5.7	840	12.1	69.2
	3"	10	5.7	1150	14.2	81.0
	90mm (EC282)	12	7	850	11.0	77.1
	100mm	12	7	1500	14.6	102.5
	150mm	12	7	2500	18.9	132.3

Heater Module Power Supplies

For details of compatible power supply and temperature controller packages contact sales@uhvdesign.com.

Product Index

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