7 Motion & Manipulation

Section 7

Motion & Manipulation

Introduction

Triple axis micrometer driven XYZ stage page 426

- Vacuum environments
- Motion Technology
- Product line
- Port mount flanges
- Custom products

Vacuum Environments

Vacuum environments are an essential element in the analysis, development and fabrication of some of the world's most basic and sophisticated products. From complex experiments in particle physics and delicate x-ray tomography of the human body to the mass production of decorative coatings on automobile grills and exacting anti-reflective coatings on precision optical elements, vacuum environments are crucial. These and many other processes and products would be impossible to reproduce in an atmospheric environment. Near perfect vacuum environments can be attained in laboratory and production vacuum systems by careful selection of the vacuum components used in its design, construction and operation, keeping in mind that the system's ultimate vacuum level will be limited by its weakest component.

Motion Technology

Precise motion and manipulation of samples in an atmospheric environment can be a challenging endeavor. The complexity of the task is greatly increased if the samples are isolated from atmosphere inside a vacuum chamber while trying to effect precise manipulation on them through the chamber wall, without compromising vacuum integrity. This section represents MDC's ongoing efforts in the development and production of practical and dependable air to vacuum sample motion and manipulation solutions for the scientific and industrial vacuum community. It provides scientists, vacuum technologists and engineers with the most comprehensive line of high and ultrahigh vacuum motion and manipulation instruments available from one source. This section is divided into three basic sections including motion, manipulation and motorization. MDC's motion and manipulation products are precision vacuum instruments manufactured to exacting tolerances in a production facility by skilled craftsmen, machinists and technicians using advanced robotic machining technology. All vacuum components produced by MDC are constructed of high grade vacuum compatible materials required for today's most demanding ultrahigh vacuum applications. At the heart of MDC motion and manipulation instrument design is the reliability and performance of edge welded stainless steel bellows. The use of edge welded stainless steel bellows has become a vacuum industry standard and an essential component in the construction of quality vacuum equipment. With the exception of a small number of direct drive products, all MDC motion and manipulation actuator seals are fitted with edge welded stainless steel bellows.

MDC rotary motion instruments allow the transmission of rotation through a chamber wall via a unique bellows sealed wobble shaft mechanism. Drive shaft bearing supports on both the air and vacuum sides of the drive shaft provide smooth rotary motion. Bearings on all MDC motion and manipulation instruments are coated with a Dicronite® UHV compatible dry lubricant impinged on to the metal bearing surfaces. Linear motion is transmitted through a chamber wall using precision fine pitch lead screws coupled to bellows sealed, bearing supported shafts. MDC rotary and linear motion instruments are ideal for continuous or intermittent rotary and linear motion within a vacuum system. Sample motion is measured along laser etched scales on an actuator housing. MDC precision micrometers are offered on select

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.

Rotary, linear and multi-motion products page 376

Load-lock systems page 430

instruments. These micrometers employ a unique plus-minus scale which divides the overall travel of a device into positive or negative travel as measured from a central starting position. Products are offered in standard manual, pneumatic and motorized configurations.

Product Line

The motion section details basic rotary, linear and multi-motion devices. Rotary products are offered in standard, high temperature, pneumatic, miniature, precision, magnetic and direct drive configurations. Linear products offer most of the configurations listed in the rotary section with the addition of push-pull, rack and pinion and tunnel access drives. Multi-motion products offer both rotary and linear motion within the same instrument in standard, precision and direct drives. Also available in the multi-motion products are various wobble stick configurations.

The manipulation section details XYZ stages, load-lock systems, port aligners and in-vacuum accessories. Stages are available in various configurations including V-Plane® modular building block stages. Single and multiple axes stages are also available in compact, standard and heavy duty models. Stages are used for two and three dimensional sample manipulation inside UHV vacuum systems. Load-lock systems are available with circular or rectangular entry ports and come equipped with magnetically coupled sample transporters. Load-lock systems are sample staging chambers used to introduce samples into larger vacuum systems without breaking the larger system's vacuum. Port aligners are adjustable port flange interfaces designed to correct mate-up between components with alignment imperfections. In-vacuum accessories are available for most motion and manipulation products found in this catalog. Cab-Fast® sample holders provide a quick, simple and flexible solution to most sample transfer applications. Mini-Scaffold™ mounting systems take advantage of existing vacuum ports for the permanent or temporary installation of in-vacuum support structures. Rotary and linear in-vacuum accessories are components designed to expand the capabilities of motion products presented in this catalog.

The motorization section includes AC, DC analog, DC stepper motors and the necessary controls required to optimize their operation. Motor specifications for all product motorization options are detailed in this section. Motor specifications are listed as support information for the products specifying their use. In-vacuum stepper motors for both high and ultrahigh vacuum applications are also offered.

Port Mount Flanges

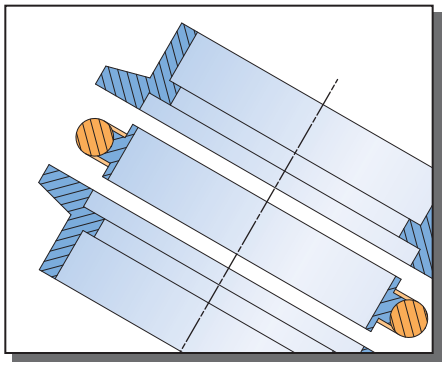
Motion and manipulation product mount styles include two industry standard flange formats. Kwik-Flange™ ISO KF flanges are ideal for $1x10^{-8}$ Torr high vacuum systems requiring frequent assembly and disassembly. Fastening and sealing is achieved by a single hinged radial clamp, which provides compression of an elastomer gasket. Kwik-Flange™ flanges comply with all ISO specifications for vacuum hardware. Select products are offered with Del-Base™ 1" baseplate, elastomer seal mounts which are also suitable for high vacuum service.

Ultrahigh vacuum products are supplied with Del-Seal™ CF Conflat® compatible metal seal flanges. A knife-edge sealing mechanism produces a seal through cold-flow deformation of a metal copper gasket. Del-Seal™ CF flanges are suitable for $1x10^{-13}$ Torr UHV environments where high temperature bakeouts are a must. For a complete line of vacuum connection hardware refer to Section 1.

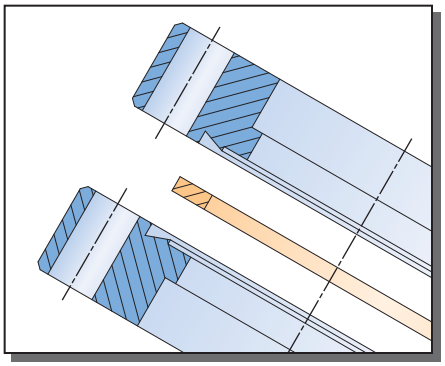
Custom Products

MDC's technical sales engineers can assist you with the modification of standard motion and manipulation products, as required by your special application; or we can produce components to specifications on your manual or electronic AutoCAD® DWG and DXF drawings. Developing and producing solutions to your vacuum needs is our business; we know that today's custom inquiries may become tomorrow's standard products. From the simplest of airtight seals to sophisticated motion and manipulation instruments, MDC provides a complete solution for vacuum science and industry.

Motorization and controls page 456



Kwik-Flange™ ISO KF elastomer seal flange system



Del-Seal™ CF metal seal flange system

MDC Precision micrometers measure along unique plus-minus laser etched scales.

Abbe Error

Linear off-axis error introduced through amplification of tilt and wobble with a long moment arm. This type of error occurs when the point under measurement is at a relatively long distance from the axis of motion.

Accuracy

The maximum expected difference between the actual and a desired position for a given input. Highly dependent on method of actual position measurement.

Accuracy, Absolute

The output of a system versus the commanded or ideal input.

Accuracy, On-Axis

The uncertainty of position after all sources of linear error are eliminated. Linear errors include: cosine error, leadscrew pitch error, abbe error and thermal expansion effects.

Backlash

The maximum magnitude of an input that produces no measurable output upon reversing direction. Typically the result of poor meshing between drivetrain components as with lead screw threads.

Display Resolution

The smallest motion detectable by a motion device's precision rule, micrometer or motor controls.

Eccentricity

Sometimes called concentricity, eccentricity in a rotary device is the deviation of the center of rotation from its mean position as the device turns.

Error

The difference between an obtained performance parameter and the ideal or desired result. Errors fall into two primary categories, on-axis and off-axis errors.

Friction

Friction is defined as the resistance to motion between surfaces in contact. Friction can be constant or it can vary with speed. Elements contributing to overall friction may be in the form of drag, sliding friction, system wear or lubricant viscosity.

Friction, Static

The friction that must be overcome to impart motion to a body at rest. Since static friction is higher than sliding friction, the force which must be applied to impart motion is greater than the force required to keep the body in motion. As a result, when a force is initially applied, the body will begin to move with a jump in some unpredictable and unrepeatable manner, producing non-linear, non-repeatable motion.

Gear Ratio, Drive Train

A motion instrument's drive train gear ratio is the relationship between received input motion and the delivered output motion. Ratios are expressed in the numerical notation *a:b*, where *"a"* represents the received motion or device input in revolutions or some other unit, and *"b"* represents the delivered or resulting output motion in revolutions for rotary devices or 1" of travel in linear motion instruments.

Hysteresis

The difference in the absolute position of an object for a given commanded input when approached from opposite directions. It is due to elastic forces accumulated in various drivetrain components, leadscrew wind-up, for instance. Often confused with backlash.

Load Capacity, Stage

The maximum centered load that can be placed directly on an XYZ motion stage and is typically limited by the load capacity of the bearings.

Load Capacity, Lateral or Moment

Also called side or bending load capacity, it is the maximum load that can be applied perpendicular to a shaft's axis of motion.

Load Capacity, Axial

The maximum centered and balanced compressive or tensile load that can be applied to a stage's or shaft's longitudinal or parallel axis of motion.

Minimum Incremental Motion

The smallest motion a device is capable of delivering reliably, not the smallest display resolution increment.

Play

Uncontrolled movement due to looseness of mechanical parts. Usually increases with the components age. Play is a contributor to backlash.

Position Stability

The ability to maintain a constant position over time. Variation from stable position is called drift. Contributors to drift include worn parts, migration of lubricant, and thermal variation.

Precision

Also known as repeatability, it is the range of deviations in output position that will occur for 95% of the motion excursions from the same error-free input. Accuracy and precision are not the same.

Repeatability

The ability of a motion instrument to reliably achieve a commanded position over many attempts regardless of the direction from which the position is approached.

Runout

The linear, not angular, portion of off-axis error. It is the deviation between ideal straight line motion and actual measured motion in a translation stage. Runout has two orthogonal components, straightness, a measure of in-plane deviation, and flatness, the out-of-plane deviation.

Sensitivity

The minimum input required to produce output motion or the ratio between output motion and input drive. Applicable particularly to manually actuated motion devices.

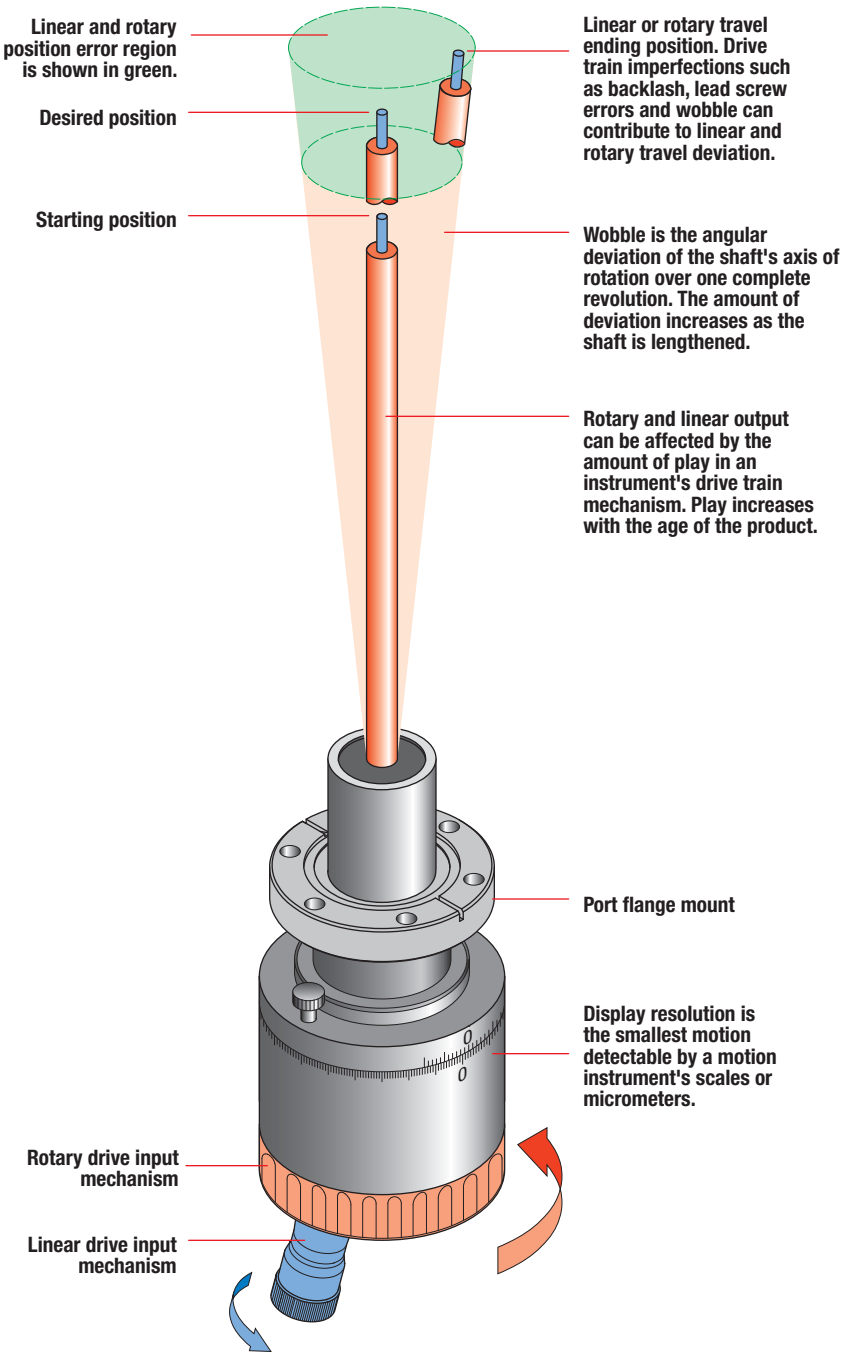
Tilt

The angular portion of off-axis error. It is the deviation between ideal straight line motion and actual measured motion in a translation stage. Tilt and wobble have three orthogonal components commonly referred to as roll, pitch, and yaw.

Wobble

Wobble is the angular deviation of the axis of rotation over one complete revolution.

Common Motion Deviations



This illustration is provided for reference only. Linear and rotary deviations have been exaggerated for illustration purposes.

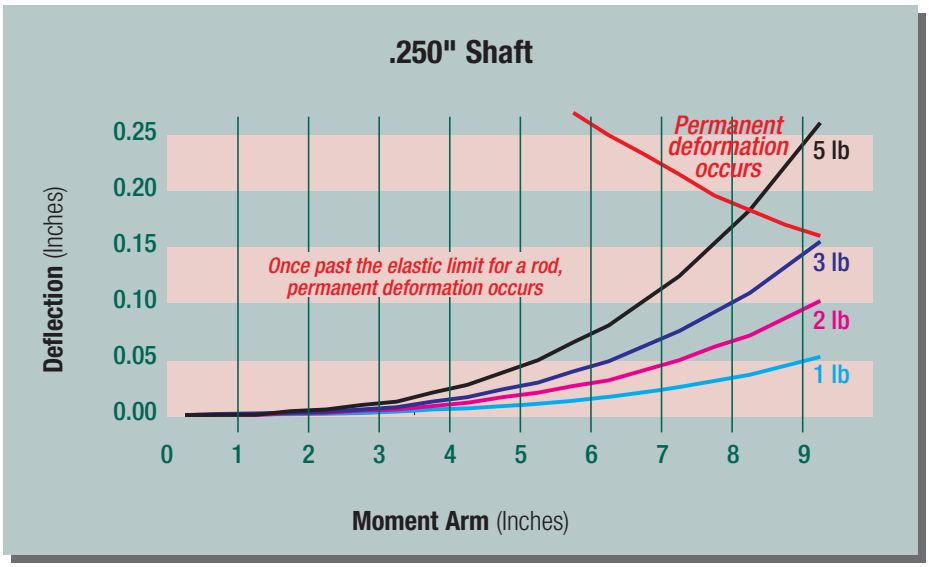
Shaft Deflection Graphs

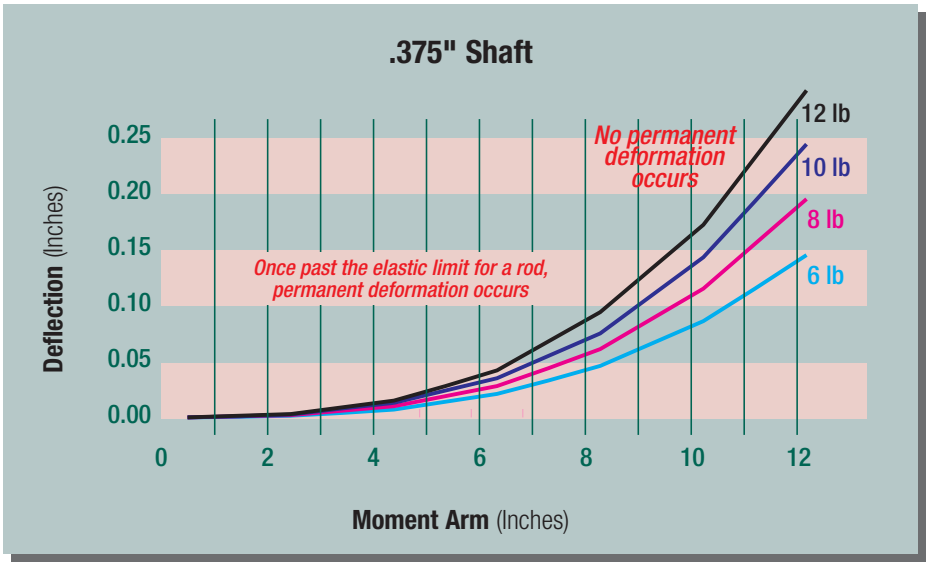
These graphs represent the deflection caused by a lateral or moment load applied to solid cylindrical cross section rods.

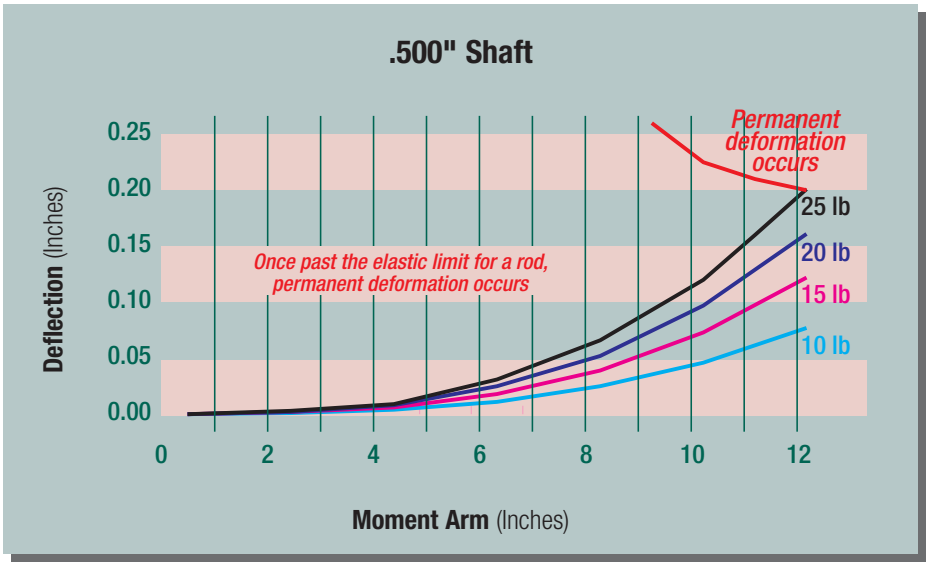
For test purposes, 0.250" diameter rods in lengths of one to nine inches and 0.375" and 0.500" diameter rods in lengths of two to twelve inches were tested. Rods were mounted horizontally with one end fixed and supported while opposite ends were left free and unsupported. Rod end deflection measurements were made after applying each sample load to each unsupported rod length. Loads for the 0.250" diameter rods ranged from one to five pounds and five to twenty-five pounds for the 0.375" and 0.500" diameter rods. Rod material is 304 stainless steel, as used in the shaft construction of all MDC motion and manipulation instruments.

These graphs are for reference only and do not represent actual motion instrument shaft deflection. They are provided as visual aids for understanding the effects of lateral loading of any stainless steel rod.

Since shaft deflection may have a significant effect on the positioning of samples, careful consideration must be given to shaft loading and whether the shaft needs to be supported. MDC recommends that all shafts in excess of twelve inches must have additional linear or radial support.







Motion

Motion
Introduction

Multi-motion wobble sticks with integral pincer, page 408

- Motion in vacuum
- Rotary motion
- Linear motion
- Multi-motion

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to dis-color when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.

Motion In Vacuum

MDC Precision motion products are vacuum compatible precision instruments ideal for demanding in-vacuum sample handling applications. The motion feedthrough product line presented in this section is divided into three basic categories including rotary, linear and multi-motion instruments. Each product category is comprised of one or more of the following drive configurations: standard, high-temperature, pneumatic, miniature, precision, magnetic and direct drive.

Motorization is available for most motion instruments featured throughout this catalog. High, medium and low torque, DC stepper motors as well as conventional AC motor options are available. Please note that motor controls are not included with motorization options and must be purchased separately. Detailed motor specifications as well as control electronics are offered in the motorization section beginning on page 455.

MDC Precision motion instruments detailed herein are available for either high or ultrahigh vacuum service. High vacuum products are mounted on ISO standard KF flanges. Better known in the industry as the MDC Kwik-Flange™, these versatile flanges provide quick-make and quick-break installation, making them ideal for vacuum systems requiring frequent assembly and disassembly. Sealing is achieved by compressing a FKM / FPM fluoroelastomer elastomer between two mating flanges fastened with a single, hinged aluminum clamp.

Ultrahigh vacuum devices are fitted with industry standard, Conflat® compatible, Del-Seal™ CF metal seal flanges. MDC Del-Seal™ CF flanges are designed with a standard knife-edge sealing geometry which produces a seal through cold-flow deformation of a copper gasket. Del-Seal™ CF flanges are typically used in UHV environments where high temperature bakeouts are a must. Bakeout temperatures greater than those specified may be achieved by disassembling and removing temperature sensitive components. Please reference feedthrough instruction manuals or contact MDC's technical staff for higher temperature ratings and detailed instructions on instrument disassembly and low temperature component removal. For maximum vacuum integrity, reliability and extended service life all motion device actuator seals incorporate edge welded stainless steel bellows.

Rotary Motion

Standard rotary motion feedthroughs are a practical and economical solution for rotary motion in most vacuum applications. Rotary motion position is measured along a 360° laser etched scale graduated in 5° increments. Welded stainless steel bellows with a unique off-axis wobble design, combined with rotary shaft bearing supports, provide rotary motion of unsurpassed reliability and performance. In contrast to standard rotary motion products, the high temperature standard rotary motion devices are constructed entirely of 304 stainless steel to endure the rigors of high temperature vacuum service.

Pneumatic drive rotary products are designed for in-vacuum shutters and other light-duty two-position motion applications. Pneumatic drive rotation is adjustable from 30° to 90°.

Miniature rotary motion feedthroughs are specifically designed for in-vacuum light-duty service where torques will not exceed 20 oz-in. Their small footprint makes them ideal for applications with severe space limitations.

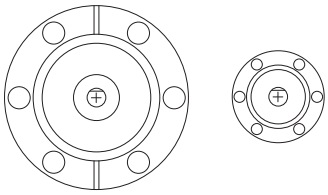
Precision rotary motion instruments are a step higher than standard rotary motion products. They offer greater precision with very low backlash and a display resolution of 0.1°.

Magnetically coupled rotary motion feedthroughs provide basic rotation and UHV compatibility without the use of bellows . This product is intended for light-duty service not exceeding 20 oz-in of torque. Direct drive rotary motion products provide basic rotation with HV compatibility. Vacuum integrity is maintained by a single preloaded FKM / FPM fluoroelastomer elastomer shaft seal. Fitted with dual rotary bearing shaft supports, this device can be manually or mechanically operated at intermittent speeds of up to 300 rpm. They are mounted on MDC Del-Base™ 1" baseplate mounts.

Differentially pumped direct drive rotary motion feedthroughs provide 100 lb-in maximum rotational torque and 500 rpm maximum rotation. The rotary shaft is supported by two radial bearings located inboard of dual FKM / FPM fluoroelastomer elastomer shaft seals. The region between the seals can be differentially pumped through a 1/8" female pipe thread port provided to attain UHV compatibility to 10^{-9} Torr.

Linear Motion

Standard linear motion feedthroughs are the perfect solution for most linear displacement vacuum applications. Linear position is measured along both radial and linear scales laser etched on actuator barrel and housing. Radial and linear scales are graduated in 0.001" and 0.025" increments respectively. One revolution of the barrel translates into 0.025" of linear travel. The housing's linear scale also includes graduation in 1mm increments for added convenience. Edge welded stainless steel bellows, a 40 pitch lead screw design and the use of linear bearing shaft support provide devices with excellent durability and performance. Unlike the standard motion products the high temperature linear motion feedthroughs are constructed entirely of 304 stainless steel to endure the rigors of high temperature vacuum service.



1-3/4" and 1-1/3" Del-Seal™ Shaft to flange orientation

Compact high temperature linear motion feedthroughs have a small footprint and are constructed with high temperature vacuum grade materials. Linear position is measured along a laser etched stainless steel barrel graduated in 20 equally spaced increments. A full revolution of the barrel translates into 1.25mm of linear travel. Formed stainless steel bellows, a 1.25mm fine pitch lead screw design and the use of radial bearings provide this product with excellent durability and performance. All drive mechanism components are located on the atmosphere side of the reentrant formed bellows.

Miniature linear motion feedthroughs are specifically designed for light-duty service. Full revolution of the barrel translates into 0.025" of linear travel.

Push-pull linear motion feedthroughs are the most basic of the manual motion devices offered in this catalog. They provide quick action linear motion via a stainless steel hand-held actuator shaft. They are typically operated by observing instrument motion through a vacuum viewport. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". The actuator can be locked in position by tightening an integral lock knob located on the actuator housing.

Rack and pinion linear motion feedthroughs are very similar to push-pull devices, but provide finer control of linear motion. The 90° rack and pinion drive mechanism provides a quick-action drive with greater control than push-pull devices. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". A 1-1/4 turn on the handle generates 1 inch of linear travel. The actuator can be locked in position by tightening an integral lock knob located on the actuator housing.

Pneumatic linear motion feedthroughs provide two-position fast action linear motion. Typical motion applications would include on-off, open-close and in-out motions similar to those of in-vacuum shutters. Linear travel can be shortened or lengthened via an integral stroke adjustment knob. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025"

Heavy duty manual, pneumatic and push pull linear motion feedthroughs allow linear displacement of heavier samples and components. With the exception of the precision micrometer fitted unit, these devices do not provide position indication. Position of samples or components being moved must be verified visually. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construction.

Multi-Motion

Multi-motion feedthroughs are instruments with more than one degree of freedom. This product category includes combinations of linear, rotary and wobble motion.

Rotary-linear standard devices offer 360° of rotation and one inch of linear travel via two separate drive knob actuators. Both rotary and linear positions are measured along a laser etched actuator barrel and housing. The 360° rotary scale is graduated in 5° increments. The linear scale has both a linear and rotary scale component, the linear portion is graduated in 0.050" increments while the rotary portion is graduated in 0.001" increments. Full revolution of the linear scale produces 0.025" of travel.

Precision rotary-linear motion instruments are a step higher than the standard rotary-linear products. They offer greater precision with very low backlash, a rotary display resolution of 0.1°, and 0.500" of micrometer precision linear travel with 0.001" resolution.

Wobble stick multi-motion devices with linear, angular wobble, rotary and articulated pincer configurations are available in this product category. The most elaborate device provides 360° sample rotation, 4.50" of push-pull linear travel, 22° of angular tilt or wobble and a mechanical pincer jaw with 0.880" diameter sample capacity.

Rotary motion instruments page 378

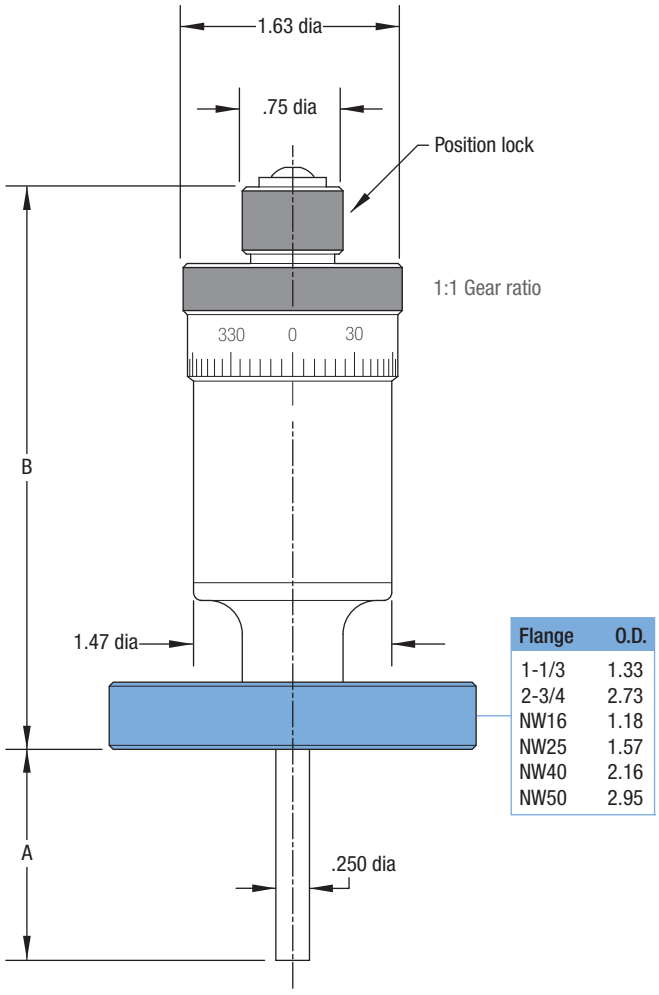
Linear motion instruments page 386

Multi-motion instruments page 403

ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual or Motorized actuator
- Rotary position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts



Flange	O.D.
1-1/3	1.33
2-3/4	2.73
NW16	1.18
NW25	1.57
NW40	2.16
NW50	2.95

- Shown with 2-3/4" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

Description

MDC standard rotary motion feedthroughs are a popular and economical solution for in-vacuum sample or device rotation. They are constructed of the highest grade vacuum compatible materials. Position is measured along a 360° laser etched black-anodized barrel graduated in 5° increments. Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide devices of unsurpassed reliability and performance. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts. Automation can be achieved with one of four motorization options and controls. Motor controls must be purchased separately. Motor control options, specifications and ordering information begin on page 464.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Speed	20 rpm
Torque	50 oz-in maximum
Axial load	6 lb maximum
Lateral load	10 lb maximum
Weight & Dimensions	See table

[1] UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

FLANGE SIZE	FLANGE O.D.	A	B	M	N	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	1.57	4.30	5.63	4.64	1	BRM-133	670000
2-3/4	2.73	1.57	4.30	5.63	4.64	2	BRM-275	670002

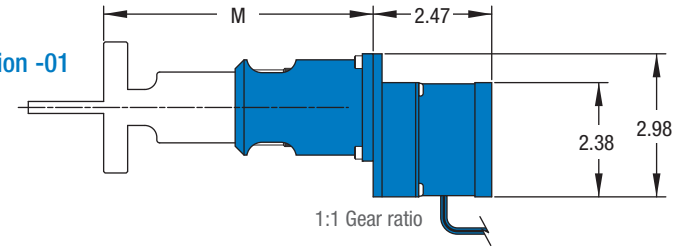
HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

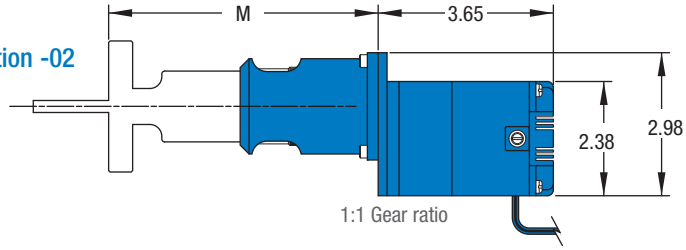
FLANGE SIZE	FLANGE O.D.	A	B	M	N	WT LB	REFERENCE	PART NUMBER
NW16	1.18	1.45	4.42	5.75	4.86	1	K075-BRM	670020
NW40	2.16	1.62	4.25	5.58	4.69	2	K150-BRM	670022

Motorization Options

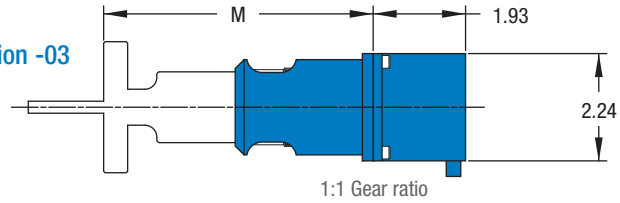
Option -01



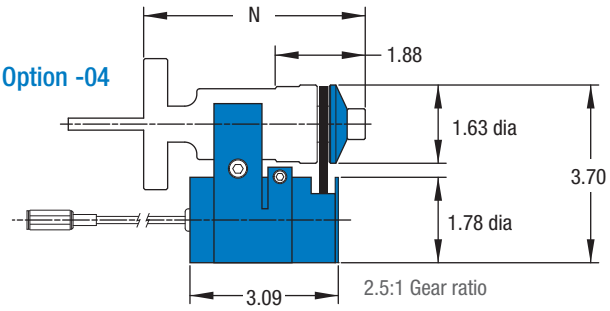
Option -02



Option -03



Option -04



OPTION -01
INLINE 115V AC MOTOR

OPTION -02
INLINE 90V DC MOTOR

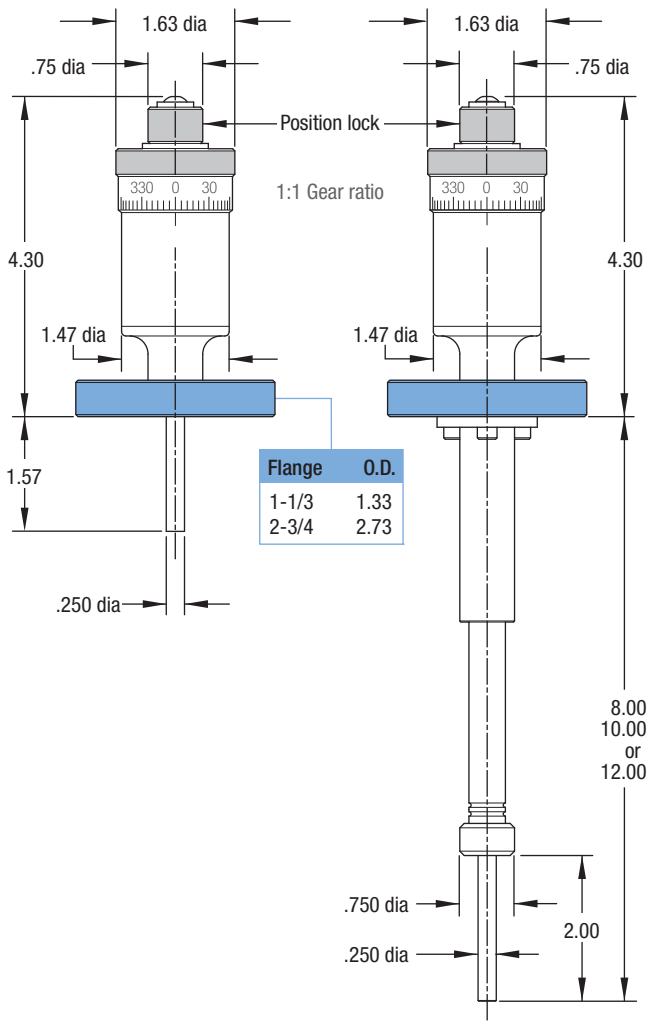
OPTION -03
INLINE STEPPER MOTOR

OPTION -04
SIDE MOUNT 12V DC MOTOR

MOTORIZATION [2]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
INLINE AC	A	3	-01
INLINE DC	B	6	-02
INLINE STEPPER	D	2	-03
SIDE-MOUNT DC	C	2	-04

[2] When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 670002-03. For total unit weight, add option weight to component weight. Motor specifications begin on page 458.

Rotary Motion
High Temperature Standard



- Shown with 2-3/4" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

ULTRAHIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual actuator
- Rotary position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts
- Guide tube included on extended models

Description

MDC Precision high temperature rotary motion feedthroughs are the per-fect solution for UHV sample rotation. They are constructed of 304ss to endure the rigors of high temperature vacuum service. Rotation can be measured along a 360° laser etched barrel graduated in 5° increments. Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bear-ing supports provide a product of unsurpassed reliability and performance. Extended length models are constructed with bearing fitted shaft support guide tubes for maximum rigidity. Feedthroughs are available on industry standard Conflat® com-patible Del-Seal™ CF metal seal flanges.

Specifications

Material

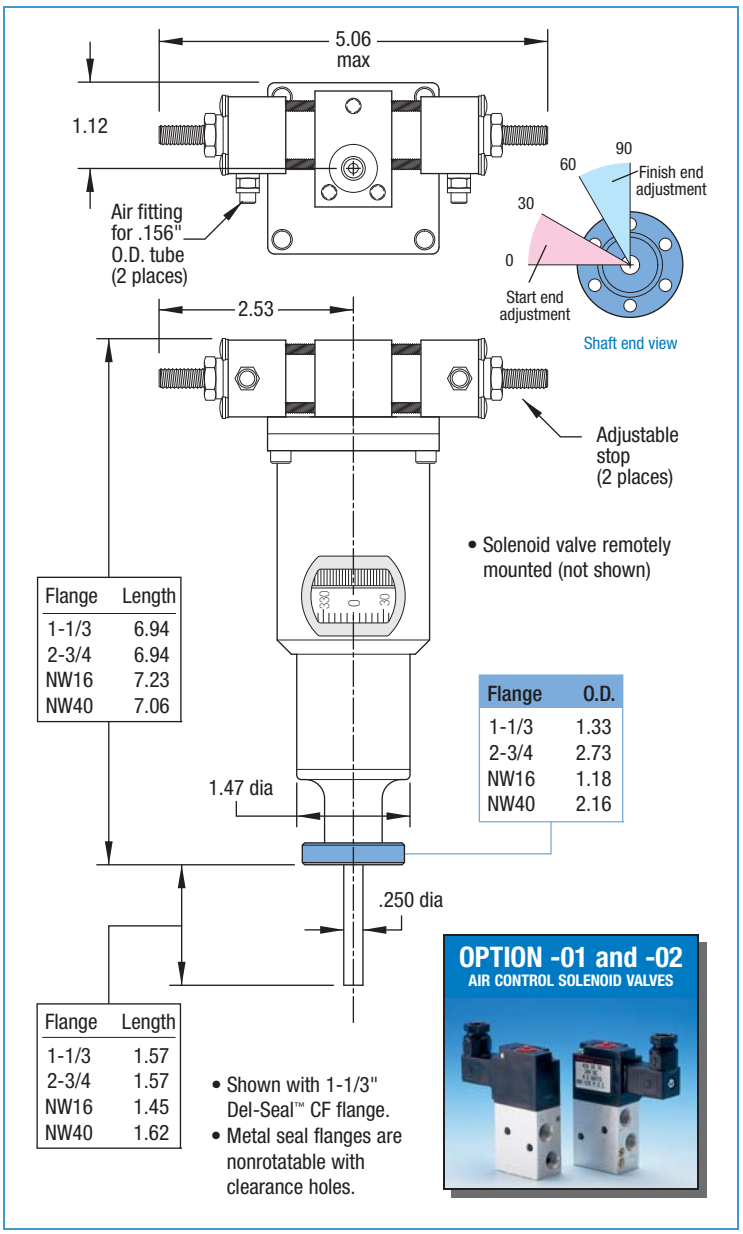
Flange / Actuator body	304ss
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	-20°C to 230°C
Torque	50 oz-in maximum
Axial load	6 lb maximum
Lateral load	10 lb maximum
Weight & Dimensions	See table

SHAFT LENGTH	FLANGE	WT LB	REFERENCE	PART NUMBER
STANDARD				
1.57	1-1/3	1	HTBRM-133	670004
1.57	2-3/4	2	HTBRM-275	670005
EXTENDED				
8.00	2-3/4	8	HTBRM-275-8	670006
10.00	2-3/4	9	HTBRM-275-10	670007
12.00	2-3/4	10	HTBRM-275-12	670008

ULTRAHIGH & HIGH VACUUM SERIES

Features

- Adjustable 90° rotary motion
- Pneumatic actuator
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts
- Solenoid air pressure to 100 PSIG maximum



Description

MDC pneumatic rotary feedthroughs are designed for in-vacuum shutters and other light-duty two-position rotary motion applications. Feedthrough rotation has two adjustable stops. One adjusts the start position from 0° to 30°, and the other adjusts the finish position from 60° to 90°. One air control solenoid valve (120VAC 50/60Hz) is also included. Feedthroughs are available on Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum AM
Shaft seal / Piston seal	350 welded bellows / FKM / FPM
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Torque	50 oz-in maximum
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	2	ABRM-133	670050
2-3/4 UHV	3	ABRM-275	670051

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	2	K075-ABRM	670052
NW40 HV	3	K150-ABRM	670053

DESCRIPTION [2]	OPTION NUMBER
24V DC AIR CONTROL SOLENOID VALVE	-01
240V AC AIR CONTROL SOLENOID VALVE	-02

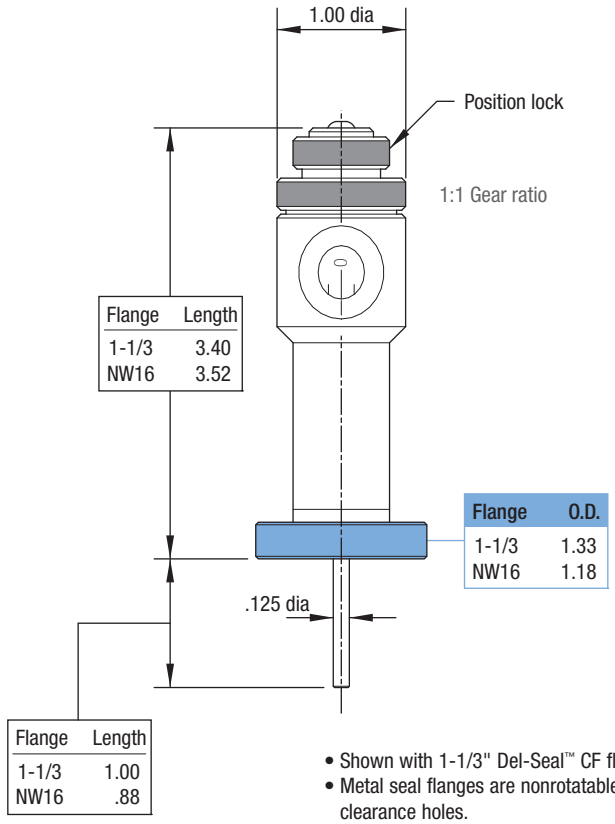
[1] UHV units are bakeable to 230°C with actuator removed.

[2] When ordering solenoid options, add the option number and price to the desired UHV or HV part number listed above. For example: 670050-02.

ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual or Motorized actuator
- Rotary position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts



Description

MDC miniature rotary feedthroughs are specifically designed for in-vacuum light-duty applications where torques will not exceed 20 oz-in. Feedthroughs are available in both manual or low voltage DC motor configurations. Motors can be fitted with optional magnetic encoder. Motor controls must be purchased separately. Reference page 464 for motor control options.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1] Manual	-20°C to 100°C
Torque	25 oz-in maximum
Axial load	2 lb maximum
Lateral load	6 lb maximum
Weight & Dimensions	See table

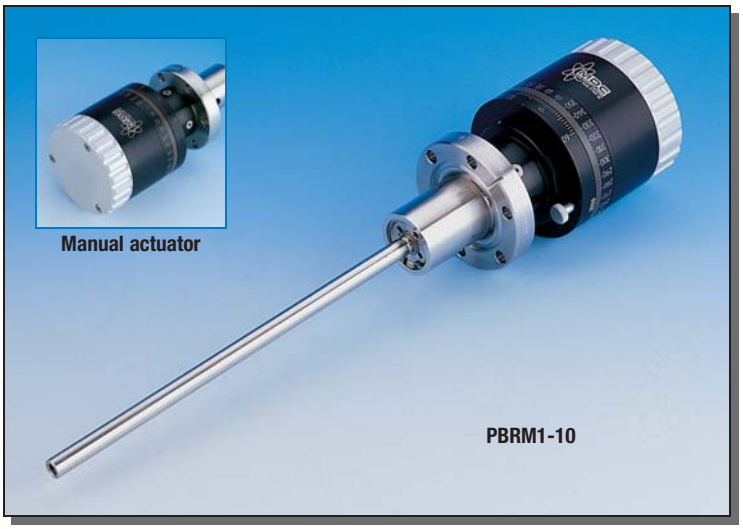
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	2	MBR-133	671500

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	2	K075-MBR	671501

MOTORIZATION [2]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
MOTOR	C	1	-01
MOTOR & ENCODER	C	1	-02

[1] UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized.

[2] When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 671500-02 For total unit weight, add option weight to component weight. Refer to page 459 for motor specifications.



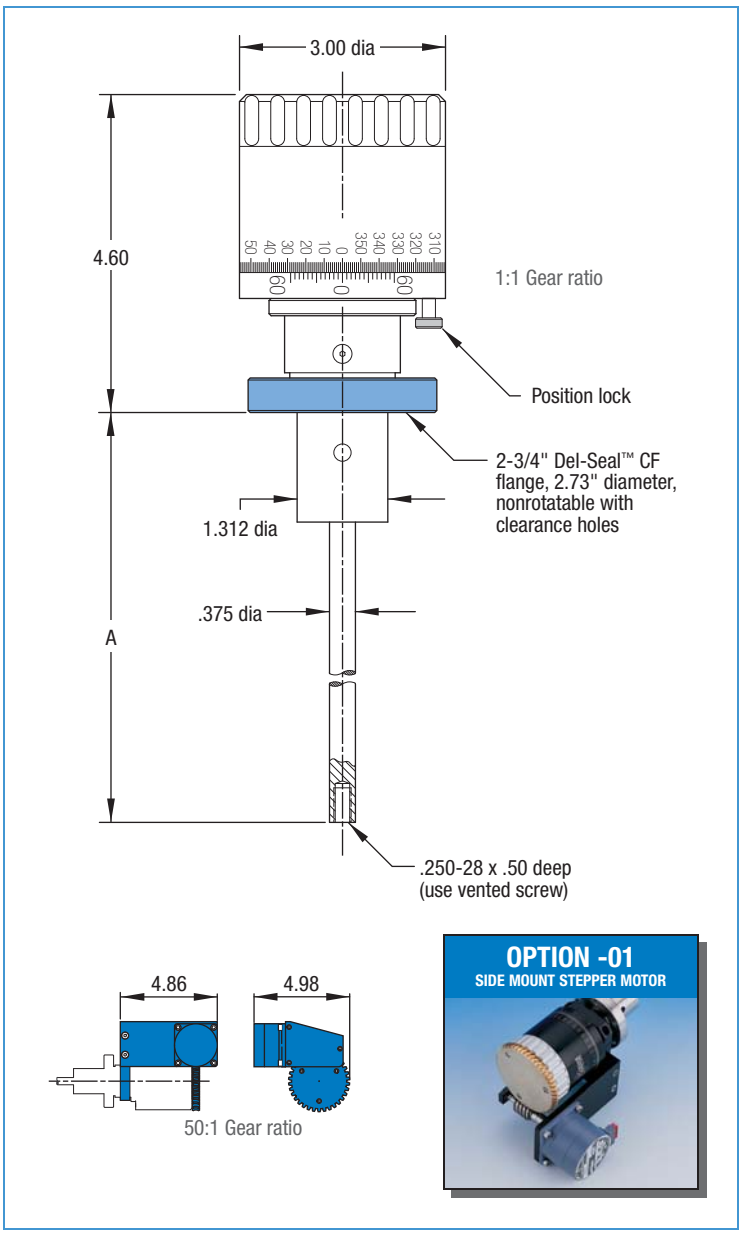
ULTRAHIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual or Motorized actuator
- Rotary position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts
- Low backlash design

Description

Precision rotary motion feedthroughs are low backlash instruments with a display resolution of 0.1°. Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide long life and smooth operation. Feedthroughs are available on Conflat® compatible Del-Seal™ CF metal seal flanges. Motorization option is available. Motor controls must be purchased separately. Reference page 465.



Specifications

Material	
Flange / Actuator knob	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	-20°C to 230°C
Torque	7 lb-in maximum
Axial load	5 lb maximum
Lateral load	10 lb maximum
Weight & Dimensions	See table

A	FLANGE	WT LB	REFERENCE	PART NUMBER
10.00	2-3/4	7	PBRM1-10	670024
15.75	2-3/4	7	PBRM1-15	670027
23.62	2-3/4	8	PBRM1-23	670030
31.50	2-3/4	8	PBRM1-31	670033

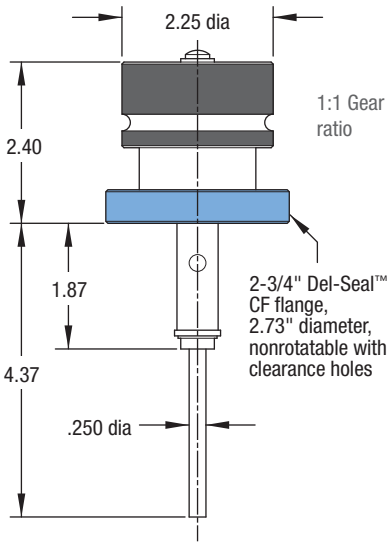
MOTORIZATION [1]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
STEPPER MOTOR	D	5	-01

[1] When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 670024-**01**. For total unit weight, add option weight to component weight. Refer to page 459 for motor specifications.

Ultrahigh Vacuum, Magnetic Drive

Features

- Continuous rotary motion
- Manual Actuator
- Bakeable to 100°C
- Del-Seal™ CF port mount
- Magnetically coupled



• Position lock not available

Description

MDC Precision magnetically coupled rotary motion feedthroughs provide basic rotation and UHV compatibility without the use of bellows . This product is intended for manually operated light-duty service not exceeding 20 oz-in of torque. Conflat® compatible 2-3/4" diameter Del-Seal™ CF metal seal flanges are the standard mount.

Specifications

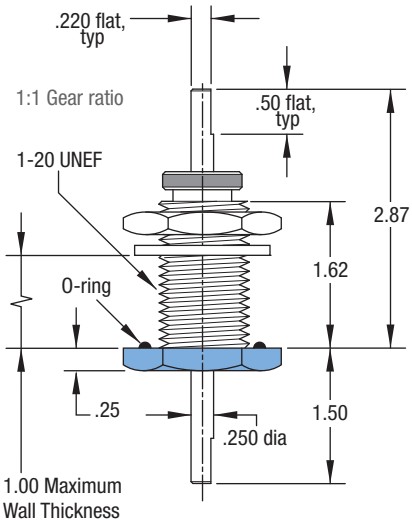
Materials	UHV compatible
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	-20°C to 100°C
Speed	50 rpm maximum
Torque	20 oz-in maximum
Axial load	2.5 lb maximum
Lateral load	5 lb @ 4" extension maximum

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
MANUAL ACTUATION 2-3/4 DEL-SEAL UHV	2	MRM-275	671000

High Vacuum, Direct Drive

Features

- Continuous rotary motion
- Manual actuator
- FKM / FPM fluoroelastomer elastomer shaft seal
- Bakeable to 100°C
- 1" bolt hole installation



• Hex nut 1.50 flat-to-flat (2 places)
• O-ring seals on vacuum side of chamber wall
• Position lock not available

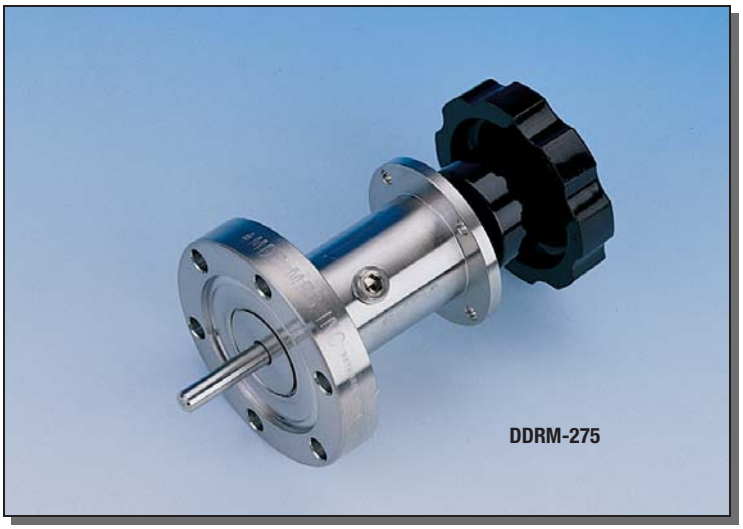
Description

MDC direct drive rotary motion feedthroughs provide basic rotation and HV compatibility. Vacuum integrity is maintained by a single pre-loaded FKM / FPM fluoroelastomer elastomer shaft seal. Fitted with dual rotary bearing shaft supports, this product can be manually or mechanically operated at intermittent speeds up to 300rpm. It is mount-ed on the traditional 1" baseplate mount.

Specifications

Materials	HV compatible
Vacuum Range	$1x10^{-8}$ Torr
Temperature Range	-20°C to 100°C
Speed	300 rpm maximum
Torque	100 oz-in maximum
Axial load	2.5 lb maximum
Lateral load (higher loads at reduced rpm)	5 lb

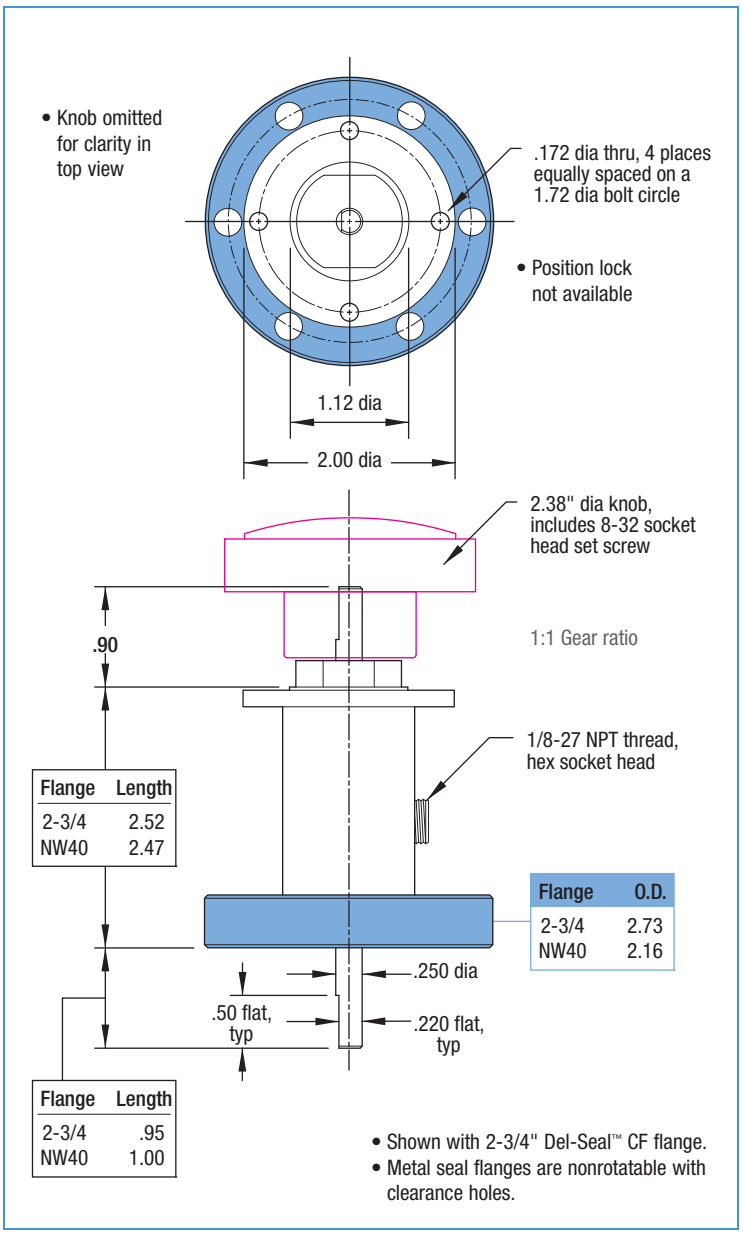
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
MANUAL ACTUATION 1" BASEPLATE HV	2	FRM-125	652000



ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual actuator
- UHV or HV compatible materials
- Differentially pumped, Dual FKM / FPM fluoroelastomer elastomer shaft seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts



Description

Differentially pumped direct drive rotary motion feedthroughs provide 100 lb-in maximum rotational torque and 500rpm maximum rotation. The rotary shaft is supported by two radial bearings located inboard of dual FKM / FPM fluoroelastomer elastomer shaft seals. The region between the seals can be differentially pumped through the 1/8" female pipe thread port provided and thus attain UHV compatibility to 10^{-9} Torr. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts.

Specifications

Material

Flange / Actuator body	304ss
Shaft seal	FKM / FPM fluoroelastomer
Vacuum Range	$1x10^{-9}$ Torr
Temperature Range[1]	-20°C to 100°C
Speed	500 rpm maximum
Torque	100 lb-in maximum
Axial load	2.5 lb maximum
Lateral load (higher loads at reduced rpm)	5 lb
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	2	DDRM-275	652100

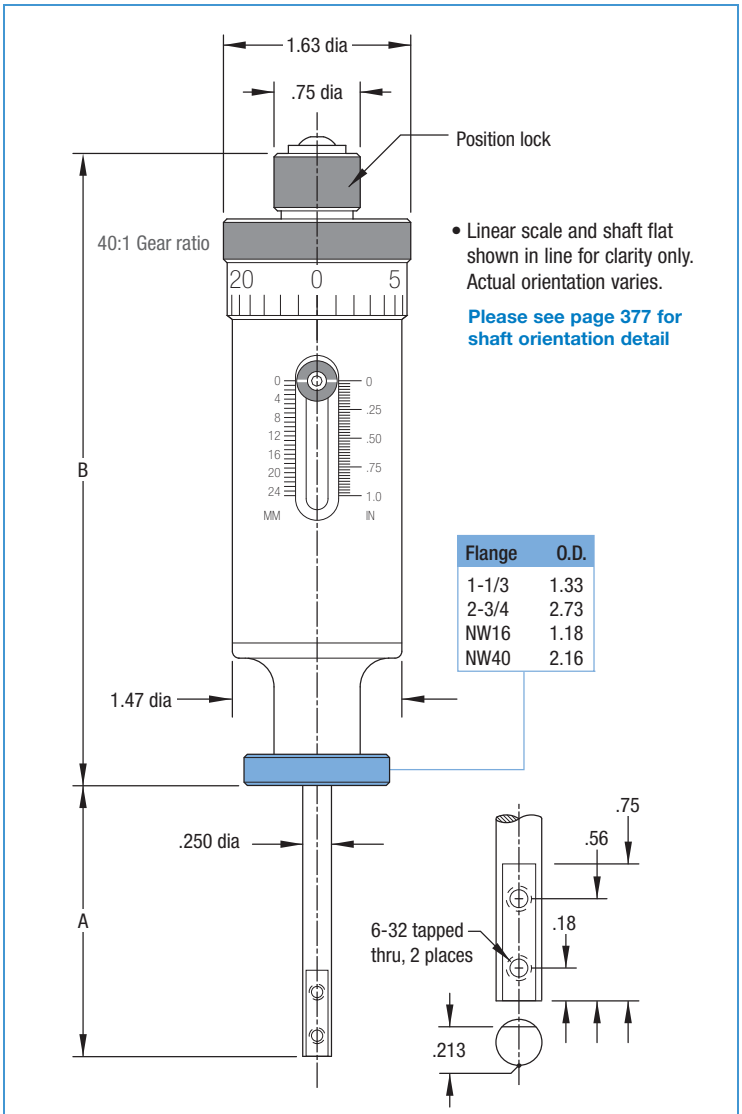
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-DDRM	652101

[1] UHV units are bakeable to 150°C with actuator removed.

ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1 to 6 inch linear travel
- Manual or Motorized actuator
- Linear position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts



- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

Description

MDC standard linear motion feedthroughs are the perfect solution for linear displacement of in-vacuum samples or devices. They are constructed of the highest grade vacuum compatible materials. Linear position is measured along a laser etched black-anodized barrel graduated in 0.001" increments. A full revolution of the barrel translates into 0.025" of linear travel. A linear scale on the body is also provided and is marked in both inch and metric units. The inch scale is graduated in increments of 0.025" while the metric scale is graduated in 1mm increments. Welded stainless steel bellows, a 40 pitch lead screw design and the use of linear bearing shaft support provide devices with excellent durability and performance. They are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts. Automation can be attained with one of four motorization options and controls. Motor controls must be purchased separately. Motor control options, specifications and ordering information begin on page 464.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Axial load	5 lb maximum
Lateral load	5 lb @ 2" extension maximum
Weight & Dimensions	See table

[1] UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

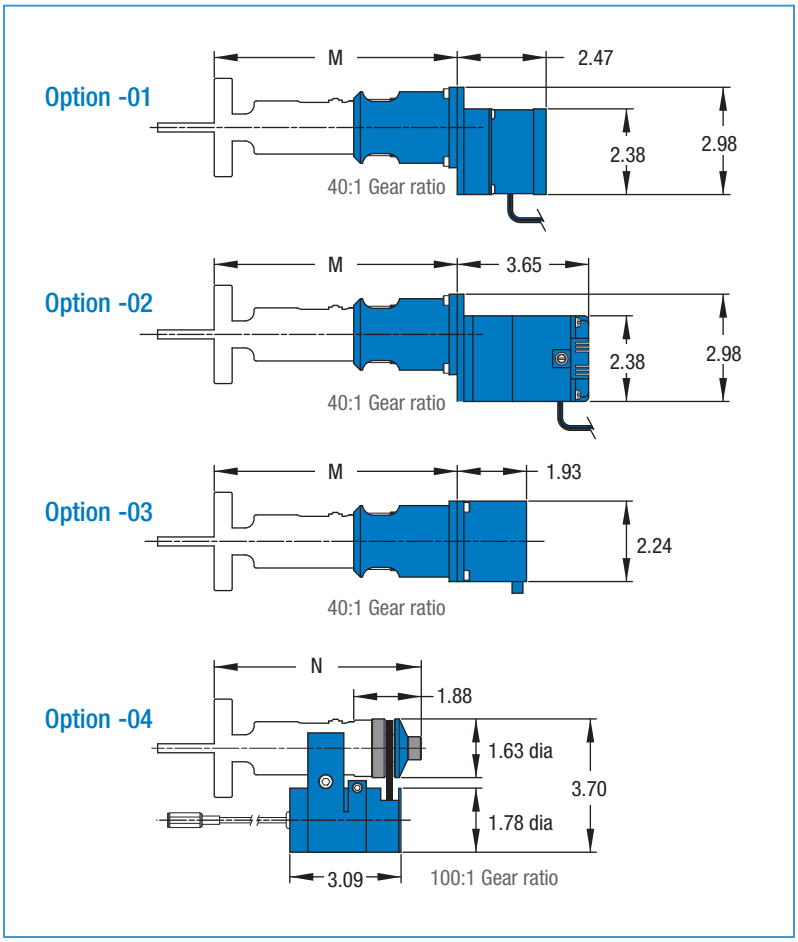
FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B	M	N	WT LB	REFERENCE	PART NUMBER
1-1/3	1.00	3.55	4.55	5.50	6.76	5.76	1	BLM-133-1	660000
1-1/3	2.00	3.55	5.55	7.00	8.26	7.26	2	BLM-133-2	660004
1-1/3	4.00	3.55	7.55	10.08	11.76	10.76	3	BLM-133-4	660008
1-1/3	6.00	3.55	9.55	12.55	14.76	13.76	4	BLM-133-6	660012
2-3/4	1.00	3.55	4.55	5.50	6.76	5.76	2	BLM-275-1	660002
2-3/4	2.00	3.55	5.55	7.00	8.26	7.26	2	BLM-275-2	660006
2-3/4	4.00	3.55	7.55	10.08	11.76	10.76	3	BLM-275-4	660010
2-3/4	6.00	3.55	9.55	12.55	14.76	13.76	4	BLM-275-6	660014

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B	M	N	WT LB	REFERENCE	PART NUMBER
NW16	1.00	3.43	4.43	5.62	6.98	5.98	1	K075-BLM-1	660020
NW16	2.00	3.43	5.43	7.12	8.48	7.48	2	K075-BLM-2	660024
NW16	4.00	3.43	7.43	10.62	11.98	10.98	3	K075-BLM-4	660028
NW16	6.00	3.43	9.43	13.62	14.98	13.98	4	K075-BLM-6	660032
NW40	1.00	3.60	4.60	5.45	6.81	5.81	1	K150-BLM-1	660022
NW40	2.00	3.60	5.60	6.95	8.31	7.31	2	K150-BLM-2	660026
NW40	4.00	3.60	7.60	10.45	11.81	10.81	3	K150-BLM-4	660030
NW40	6.00	3.60	9.60	13.45	14.81	13.81	4	K150-BLM-6	660034

Motorization Options



OPTION -01
INLINE 115V AC MOTOR

OPTION -02
INLINE 90V DC MOTOR

OPTION -03
INLINE STEPPER MOTOR

OPTION -04
SIDE MOUNT 12V DC MOTOR

MOTORIZATION [2]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
INLINE AC	A	3	-01
INLINE DC	B	6	-02
INLINE STEPPER	D	2	-03
SIDE-MOUNT DC	C	2	-04

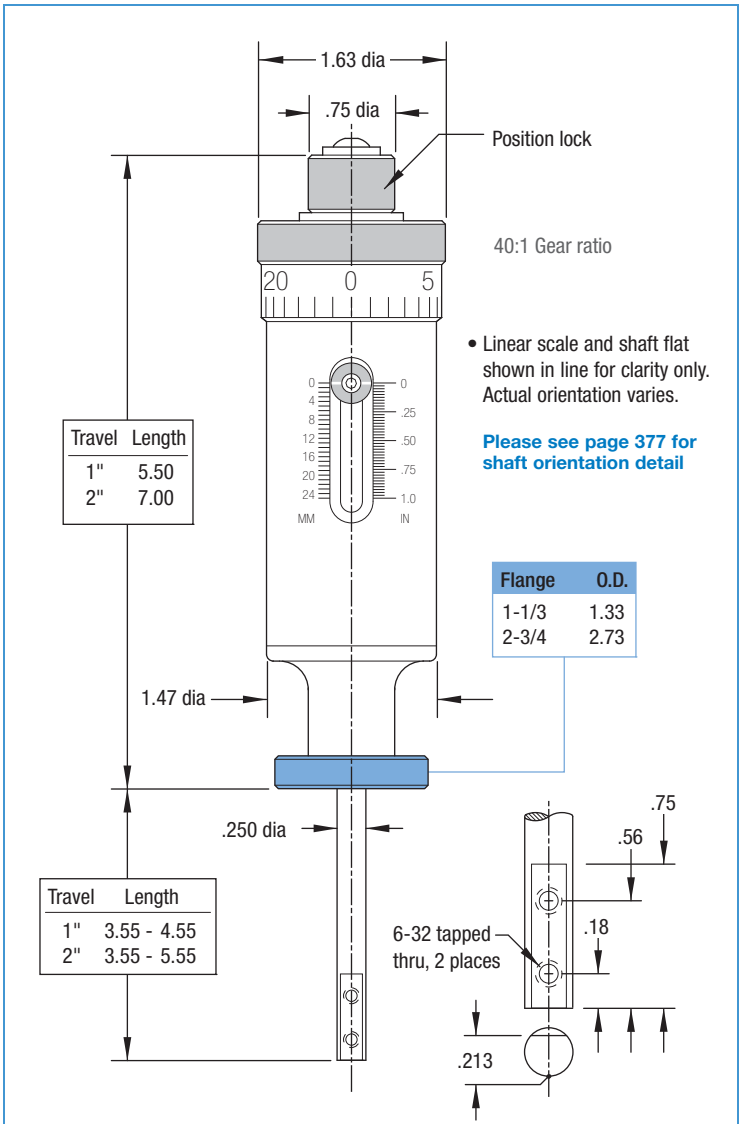
[2] When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 660000-**03**. For total unit weight, add option weight to component weight. Motor specifications begin on page 458.

Linear Motion
High Temperature Standard

ULTRAHIGH VACUUM SERIES

Features

- 1 to 2 inch linear travel
- Manual actuator
- Linear position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts



Description

MDC Precision high temperature linear motion feedthroughs are the per-fect solution for linear displacement of in-vacuum samples or devices. They are constructed of 304ss to endure the rigors of high temperature vacuum service. Linear position is measured along a laser etched stainless steel barrel graduated in 0.001" increments. A full revolution of the barrel translates into 0.025" of linear travel. A linear scale on the body is also provided and is marked in both inch and metric units. The inch scale is graduat-ed in increments of 0.025" while the metric scale is graduated in 1mm increments. Welded stainless steel bellows, a 40 pitch lead screw design and the use of linear bearing shaft support provide devices with excellent durability and performance. They are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material

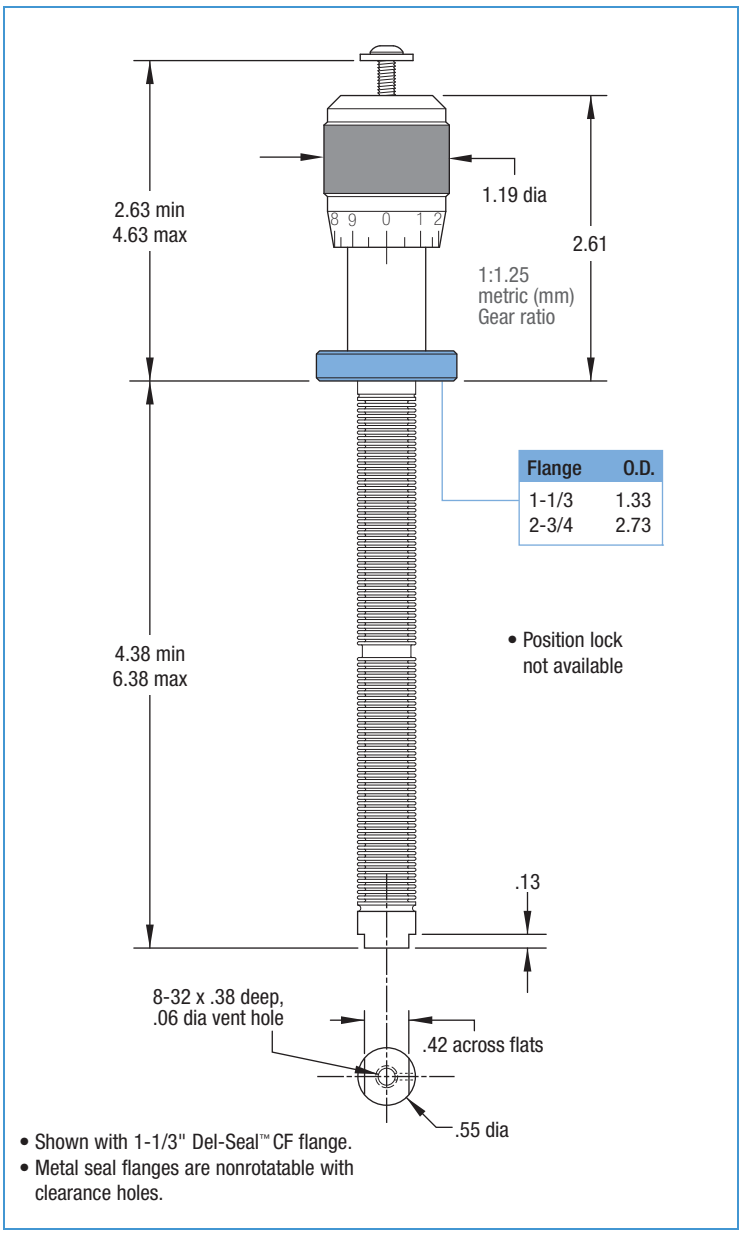
Flange / Actuator body	304ss
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	-20°C to 230°C
Axial load	5 lb maximum
Lateral load	5 lb @ 2" extension maximum
Weight & Dimensions	See table

LINEAR TRAVEL	FLANGE	WT LB	REFERENCE	PART NUMBER
1.00	1-1/3	1	HTBLM-133-1	660036
1.00	2-3/4	2	HTBLM-275-1	660037
2.00	1-1/3	2	HTBLM-133-2	660038
2.00	2-3/4	3	HTBLM-275-2	660039

ULTRAHIGH VACUUM SERIES

Features

- 2 inch linear travel
- Manual actuator
- UHV compatible materials
- Formed bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts



Description

Compact high temperature linear motion feedthroughs have the smallest atmosphere side envelope and are constructed with high temperature vacuum grade materials. Linear position is measured along a laser etched stainless steel barrel graduated in 20 equally spaced increments. A full revolution of the barrel translates into 1.25mm of linear travel. Air side linear clearance must be considered to accommodate the rising lead screw mechanism. Formed stainless steel bellows, a 1.25mm pitch lead screw design and the use of radial bearings provide this product with excellent durability and performance. All drive mechanism components are located on the atmosphere side of the formed bellows. Vacuum mounts include 1-1/3" or 2-3/4" diameter, industry standard, Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

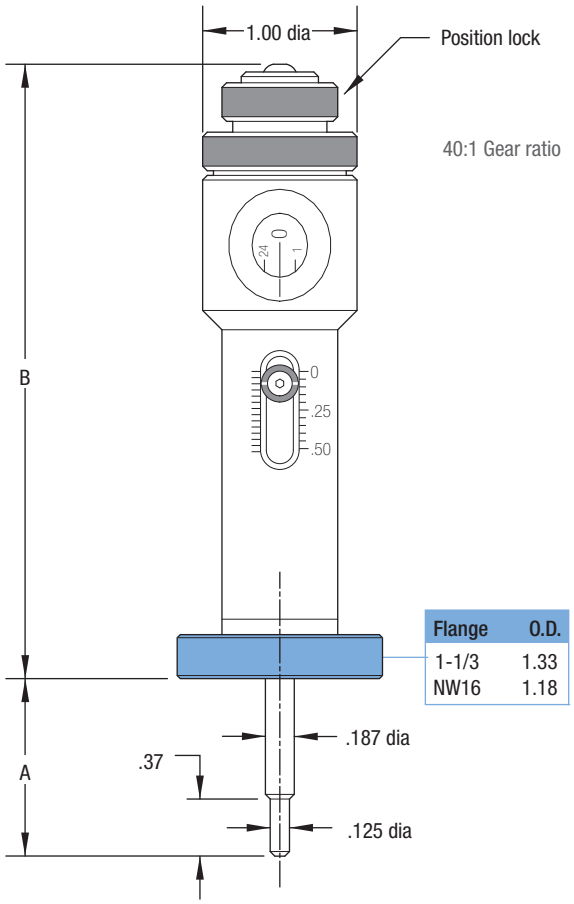
Material	
Flange / Actuator body	304ss
Shaft seal	Type 321stainless steel formed bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	-20°C to 230°C
Axial load	10 lb maximum
Lateral load	5 lb @ 2" extension maximum
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	1	LMD-133-2	665514
2-3/4 UHV	3	LMD-275-2	665515

ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1/2 to 1 inch linear travel
- Manual or Motorized actuator
- Linear position lock
- UHV and HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts



Flange	O.D.
1-1/3	1.33
NW16	1.18

- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

Description

MDC Precision miniature linear feedthroughs are specifically designed for in-vacuum light-duty applications. Full revolution of the bar-rel translates into 0.025" of linear travel. These instruments are available in both manual or low voltage 12 VDC motor config-urations. Motor options with an integral magnetic encoder are also available. See page 459 for complete motor specifications.

Motor controls are not included with the motor options and must be purchased separately. Motor controls and specifications are detailed on page 464.

MDC miniature linear feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1] Manual	-20°C to 100°C
Axial load	2.5 lb maximum
Lateral load	6 lb maximum
Weight & Dimensions	See table

[1] UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

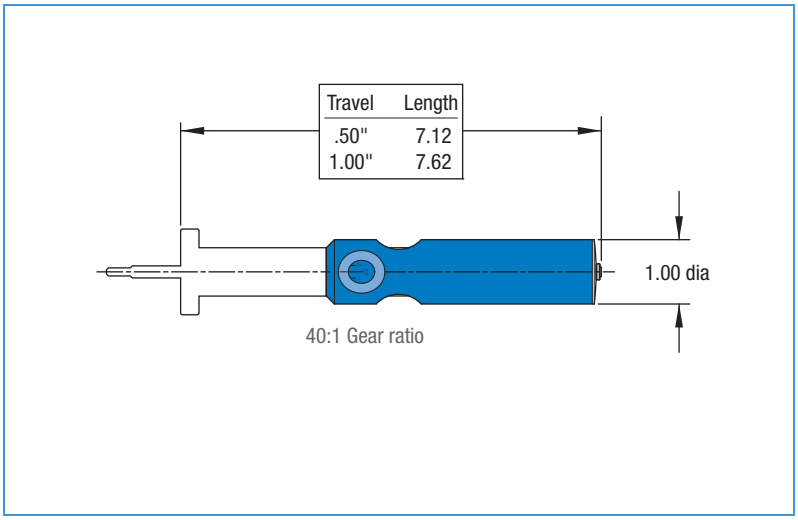
FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B	WT LB	REFERENCE	PART NUMBER
1-1/3	0.50	1.00	1.50	4.50	2	MBL-133-0	660500
1-1/3	1.00	1.00	2.00	5.00	2	MBL-133-1	660501

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

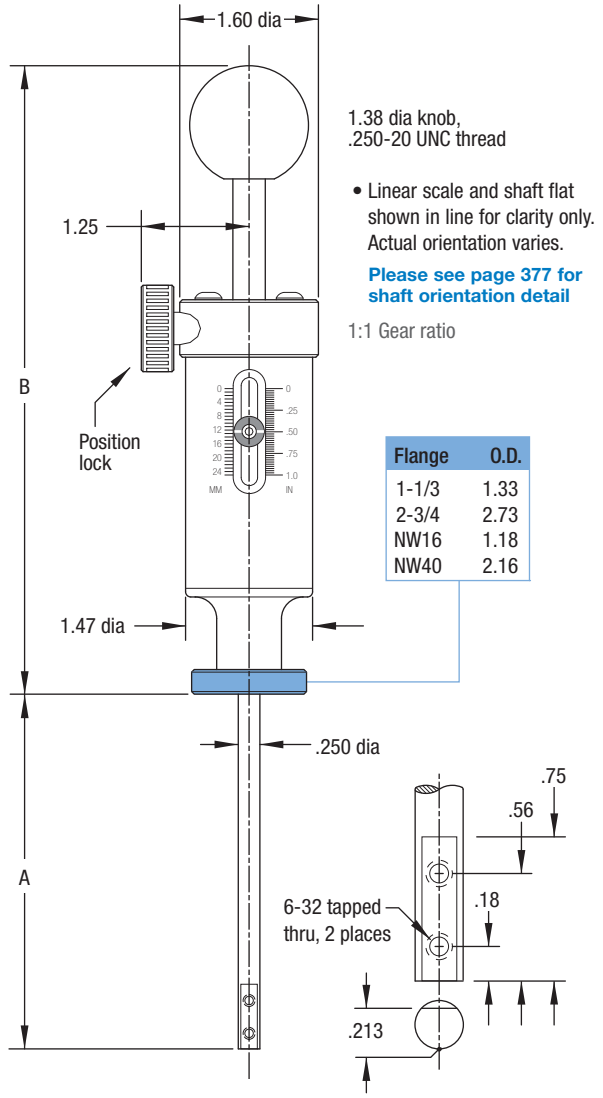
FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B	WT LB	REFERENCE	PART NUMBER
NW16	0.50	1.00	1.50	4.62	2	K075-MBL-0	660502
NW16	1.00	1.00	2.00	5.12	2	K075-MBL-1	660503

Motorization Options



MOTORIZATION [2]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
MOTOR	C	1	-01
MOTOR & ENCODER	C	1	-02

[2] When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 660502-**02**. For total unit weight, add option weight to component weight. Refer to page 459 for motor specifications.



- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

MDC Precision push-pull linear motion feedthroughs are the most basic of the manual motion devices offered in this catalog. They pro-vide quick action linear motion via a stainless steel hand-held actuator shaft. They are typically operated by observing the motion process through a vacuum viewport. For quick and easy positioning reference the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". An attractive black anodized finish provides high con-trast visibility of the laser etched graduated scale. The actuator can be locked in position by simply tightening the position lock located at the top end of the actuator body.

Push-pull linear motion feedthroughs are offered in travel lengths between 1" and 6". They are constructed of the high-est grade vacuum compatible materials. Welded stainless steel bellows and the use of linear bearing shaft supports provide reli-ability and smooth operation. Push-pull feedthroughs are avail-able on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Axial load	10 lb maximum
Lateral load	5 lb @ 2" extension maximum
Weight & Dimensions	See table

[1] UHV units are bakeable to 230°C with actuator removed.

ULTRAHIGH VACUUM SERIES

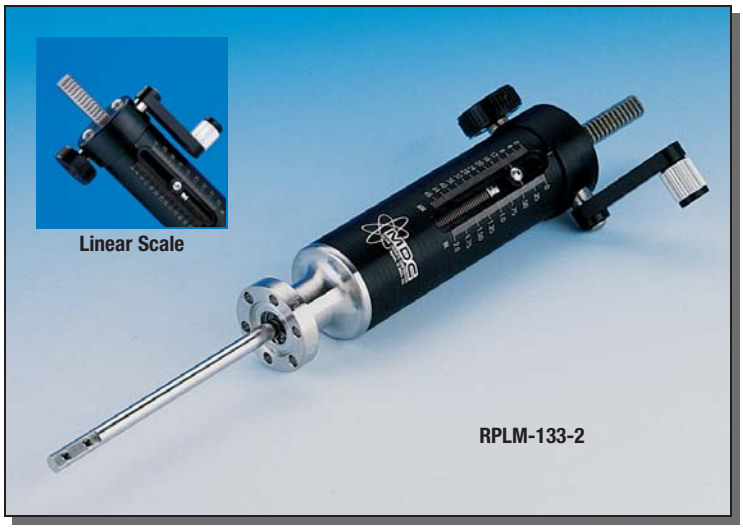
Del-Seal™ CF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B MIN	B MAX	WT LB	REFERENCE	PART NUMBER
1-1/3	1.00	3.55	4.55	6.5	7.5	1	SBLM-133-1	663000
1-1/3	2.00	3.55	5.55	8.0	10.0	2	SBLM-133-2	663004
1-1/3	4.00	3.55	7.55	11.5	15.5	3	SBLM-133-4	663016
1-1/3	6.00	3.55	9.55	14.5	20.5	4	SBLM-133-6	663018
2-3/4	1.00	3.55	4.55	6.5	7.5	2	SBLM-275-1	663002
2-3/4	2.00	3.55	5.55	8.0	10.0	2	SBLM-275-2	663006
2-3/4	4.00	3.55	7.55	11.5	15.5	3	SBLM-275-4	663017
2-3/4	6.00	3.55	9.55	14.5	20.5	4	SBLM-275-6	663019

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

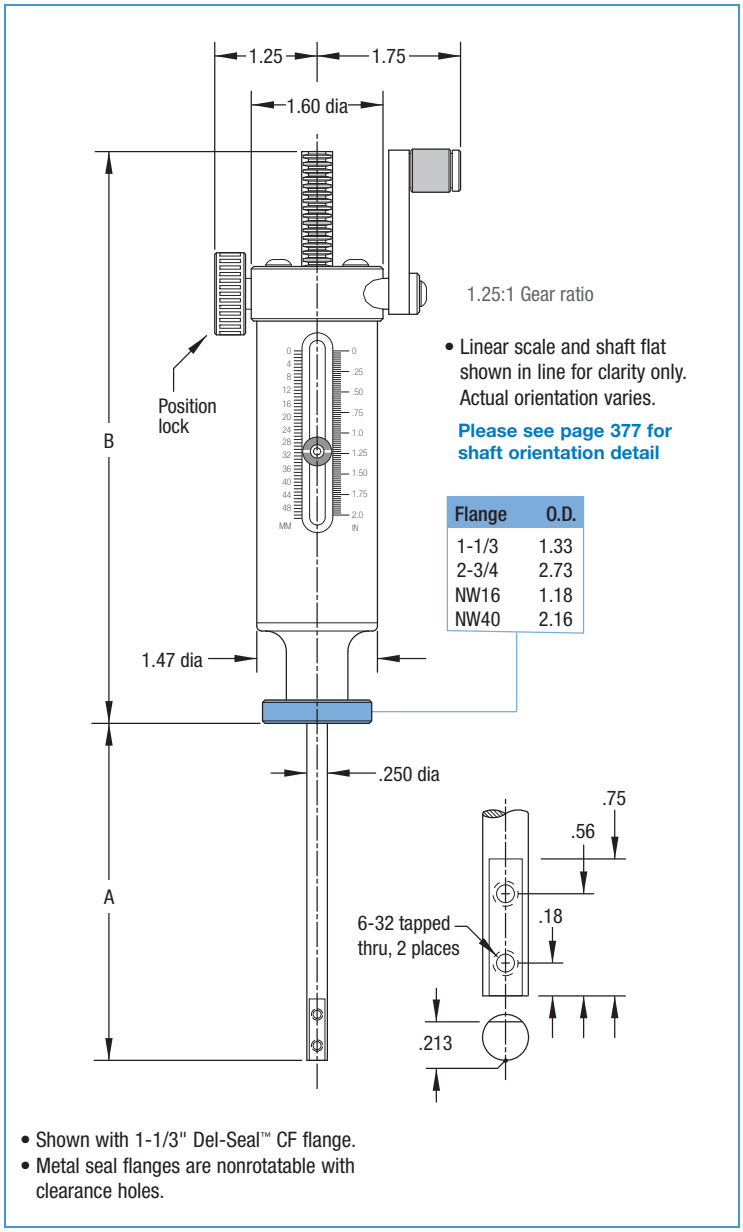
FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B MIN	B MAX	WT LB	REFERENCE	PART NUMBER
NW16	1.00	3.43	4.43	6.6	7.6	1	K075-SBLM-1	663008
NW16	2.00	3.43	5.43	8.1	10.1	2	K075-SBLM-2	663012
NW16	4.00	3.43	7.43	11.7	15.7	3	K075-SBLM-4	663020
NW16	6.00	3.43	9.43	14.6	20.6	4	K075-SBLM-6	663024
NW40	1.00	3.60	4.60	6.5	7.6	1	K150-SBLM-1	663010
NW40	2.00	3.60	5.60	8.0	10.0	2	K150-SBLM-2	663014
NW40	4.00	3.60	7.60	11.5	15.5	3	K150-SBLM-4	663022
NW40	6.00	3.60	9.60	14.5	20.5	4	K150-SBLM-6	663026



ULTRAHIGH & HIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts



Description

MDC Precision rack and pinion linear motion feedthroughs are very sim-ilar to push-pull devices, but provide finer control of linear motion. The rack and pinion drive mechanism is still consid-ered quick-action when compared to rotating actuator, linear motion devices. They too are operated by observing the motion process through a vacuum viewport. For quick and easy positioning reference the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". A 1-1/4 turn on the handle generates 1 inch of lin-ear travel. An attractive black anodized finish provides high con-trast and visibility of the laser etched graduated scale. The actu-ator can be locked in position by simply tightening the posi-tion lock located at the top end of the actuator body.

Rack and pinion linear motion feedthroughs are offered in travel lengths between 2" and 6". They are constructed of high grade vacuum compatible materials. Welded stainless steel bel-lows and the use of linear bearing shaft supports provide relia-bility and smooth operation. Rack and pinion feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Axial load	10 lb maximum
Lateral load	5 lb @ 2" extension maximum
Weight & Dimensions	See table

[1] UHV units are bakeable to 230°C with actuator removed.

ULTRAHIGH VACUUM SERIES

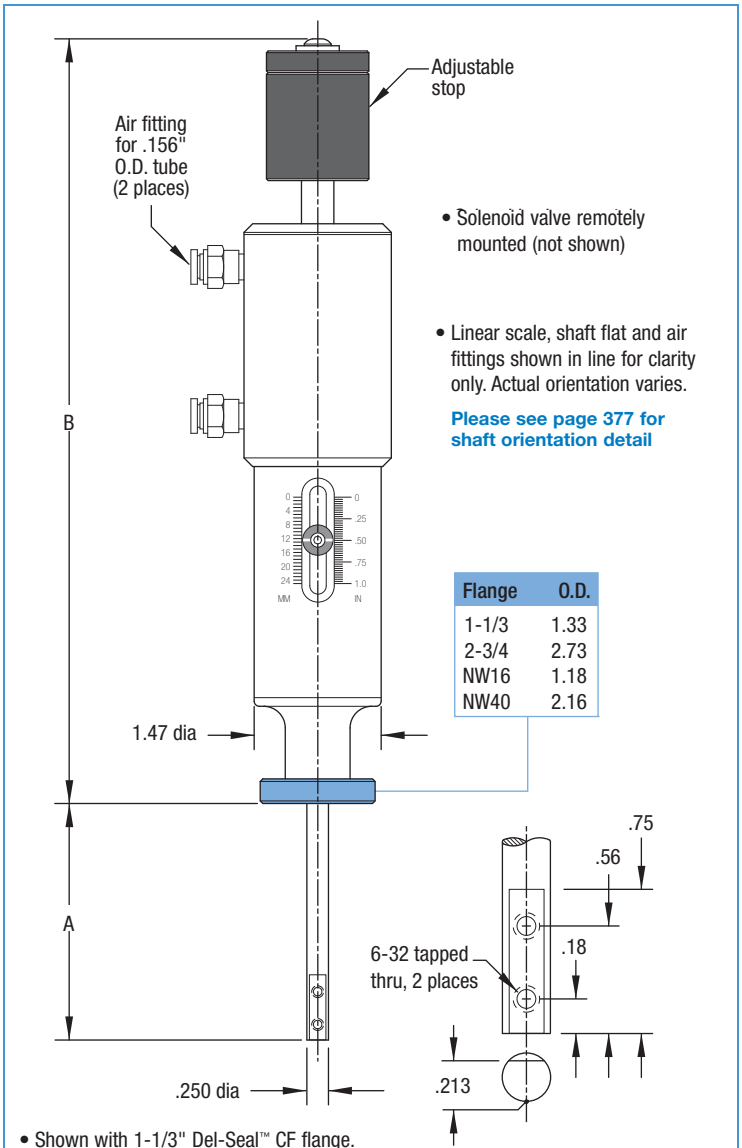
Del-Seal™ CF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B MIN	B MAX	WT LB	REFERENCE	PART NUMBER
1-1/3	2.00	3.55	5.55	6.5	8.5	2	RPLM-133-2	666000
1-1/3	4.00	3.55	7.55	10.0	14.0	3	RPLM-133-4	666002
1-1/3	6.00	3.55	9.55	13.0	19.0	4	RPLM-133-6	666004
2-3/4	2.00	3.55	5.55	6.5	8.5	3	RPLM-275-2	666001
2-3/4	4.00	3.55	7.55	10.0	14.0	4	RPLM-275-4	666003
2-3/4	6.00	3.55	9.55	13.0	19.0	5	RPLM-275-6	666005

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B MIN	B MAX	WT LB	REFERENCE	PART NUMBER
NW16	2.00	3.43	5.43	6.62	8.62	2	K075-RPLM-2	666006
NW16	4.00	3.43	7.43	10.12	14.12	3	K075-RPLM-4	666010
NW16	6.00	3.43	9.43	13.12	19.12	4	K075-RPLM-6	666014
NW40	2.00	3.60	5.60	6.45	8.45	2	K150-RPLM-2	666008
NW40	4.00	3.60	7.60	9.95	13.95	3	K150-RPLM-4	666012
NW40	6.00	3.60	9.60	12.95	18.95	4	K150-RPLM-6	666016



ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1 to 2 inch linear travel
- Pneumatic actuator
- Adjustable linear travel stop
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts
- Air control solenoid valve
- Solenoid air pressure to 100 PSIG maximum

Description

Pneumatic linear motion feedthroughs provide two-position fast action linear motion. Typical motion applications would include on-off, open-close and in-out motions similar to those of in-vacuum shutters. Linear travel can be shortened or lengthened by turning the adjustment knob located at the top end of the pneumatic actuator. Once adjusted the jam nut locks the knob in place. Linear travel adjustment is from 0" to 1" for one inch travel devices and from 1" to 2" for two inch travel devices. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". A black anodized finish provides high contrast and visibility of the laser etched graduated scale. Pneumatic linear motion feedthroughs are offered in travel lengths of 1" and 2". They are constructed of high grade vacuum compatible materials. Welded stainless steel bellows and the use of linear bearing shaft supports provide reliability and smooth operation. Pneumatic feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Piston seal	FKM / FPM fluoroelastomer O-ring
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Axial load	20 lb maximum
Lateral load	5 lb @ 2" extension maximum
Actuator Pressure	60-80 psi
Piston Surface Area	0.88 in^2
Solenoid Valve	120 VAC 50/60 Hz
Weight & Dimensions	See table

[1] UHV units are bakeable to 230°C with actuator removed.

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B MIN	B MAX	WT LB	REFERENCE	PART NUMBER
1-1/3	1.00	3.55	4.55	8.5	9.5	2	ABLM-133-1	662000
1-1/3	2.00	3.55	5.55	11.0	13.0	3	ABLM-133-2	662004
2-3/4	1.00	3.55	4.55	8.5	9.5	3	ABLM-275-1	662002
2-3/4	2.00	3.55	5.55	11.0	13.0	3	ABLM-275-2	662006

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN	A MAX	B MIN	B MAX	WT LB	REFERENCE	PART NUMBER
NW16	1.00	3.43	4.43	8.6	9.6	2	K075-ABLM-1	662008
NW16	2.00	3.43	5.43	11.1	13.1	3	K075-ABLM-2	662012
NW40	1.00	3.60	4.60	8.5	9.5	2	K150-ABLM-1	662010
NW40	2.00	3.60	5.60	11.0	13.0	3	K150-ABLM-2	662014

Solenoid Options

OPTION -01 AND -02
AIR CONTROL SOLENOID VALVE

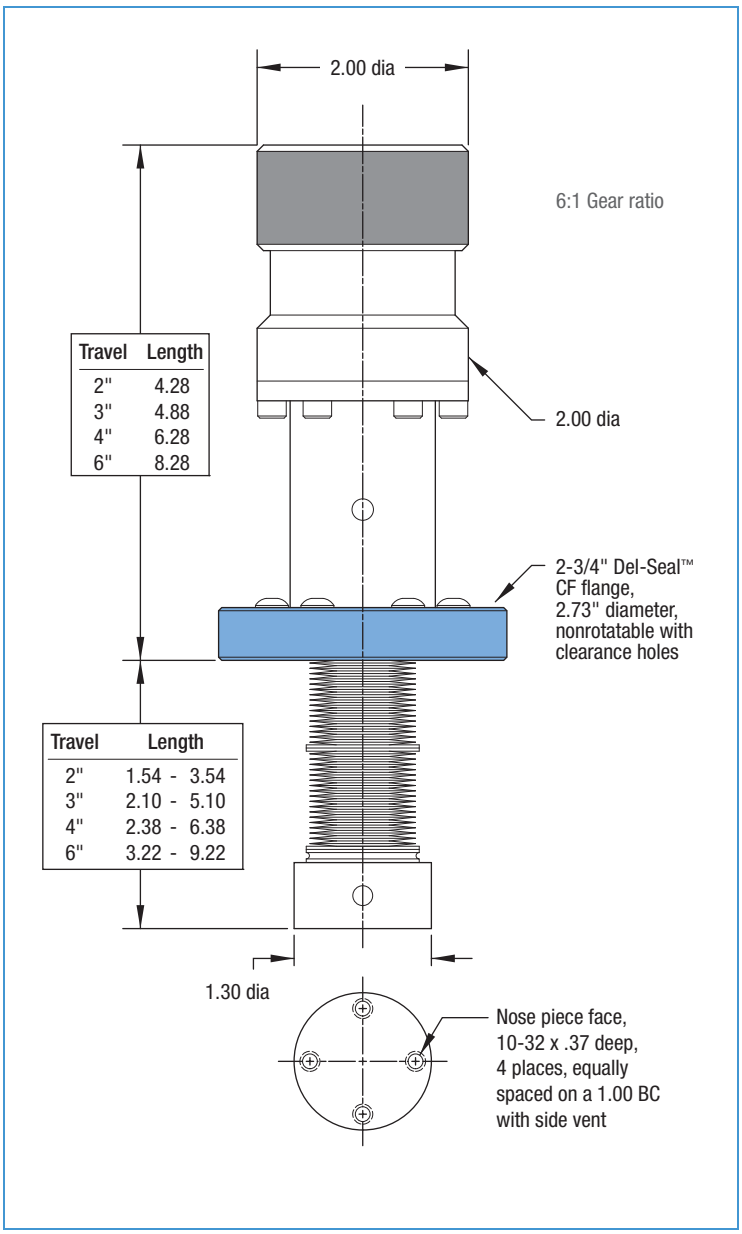
DESCRIPTION [1]	OPTION NUMBER
24V DC AIR CONTROL SOLENOID VALVE	-01
240V AC AIR CONTROL SOLENOID VALVE	-02

[1] When ordering solenoid options, add the option number to the end of the desired UHV or HV component part number listed above. For example: 662000-**01**. For total unit weight, add option weight to manual component weight.

ULTRAHIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts



Description

Heavy duty linear motion feedthroughs allow linear displacement of larger in-vacuum samples and components. This feedthrough has basic, rotary manual actuation and does not provide position indication. Position must be determined by visual inspection of the in-vacuum sample or component. A heavy duty acme thread lead screw provides 1" of linear travel for every six revolutions of the actuator knob. Unlike conventional motion feedthroughs, heavy duty models have a reentrant welded bellows configura-tion.

All feedthroughs are constructed using high grade vacuum compatible materials. Feedthroughs are available on industry stan-dard Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1]	-20°C to 100°C
Axial load	20 lb maximum
Lateral load	20 lb @ 4" extension maximum
Weight & Dimensions	See table

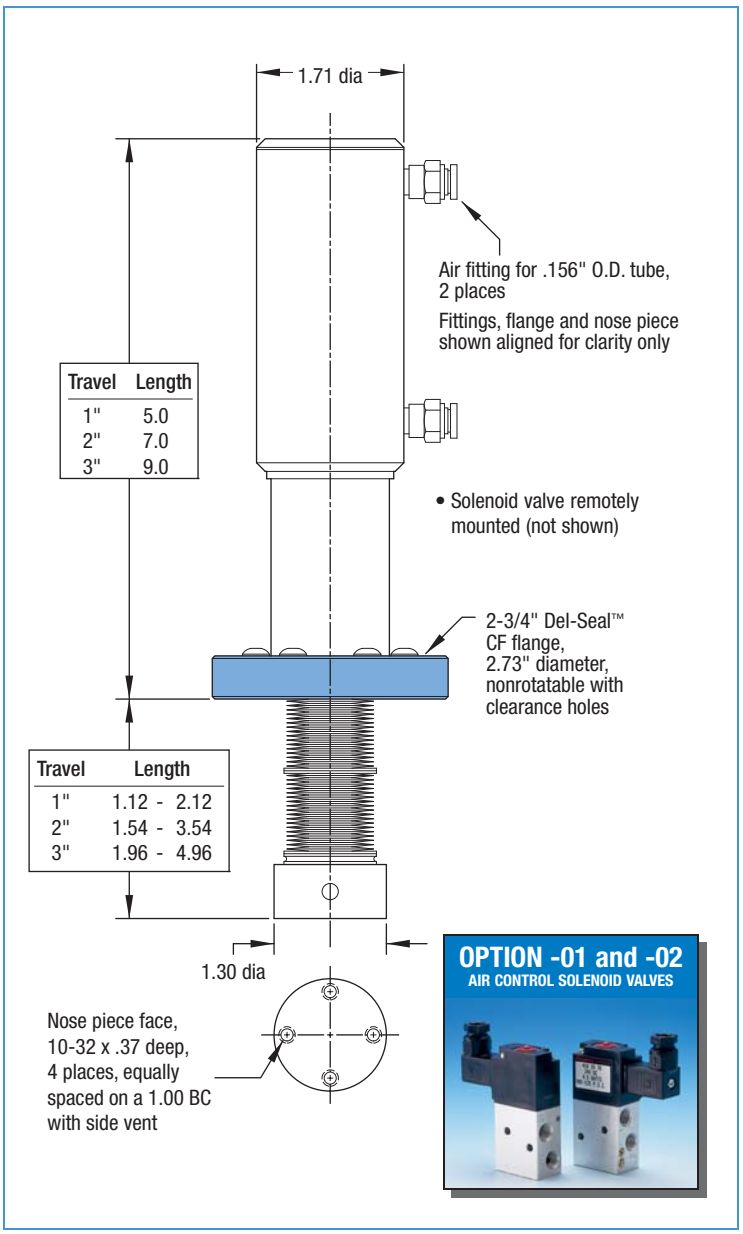
LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
2.00	UHV	2	HLM-275-2	661018
3.00	UHV	2	HLM-275-3	661000
4.00	UHV	2	HLM-275-4	661016
6.00	UHV	3	HLM-275-6	661017

[1] UHV units are bakeable to 230°C with actuator removed.

ULTRAHIGH VACUUM SERIES

Features

- 1 to 3 inch linear travel
- Pneumatic actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts
- Solenoid air pressure to 100 PSIG maximum



Description

Heavy duty pneumatic linear motion feedthroughs provide two-position fast action linear motion for heavy sample loads. Typical motion applications would include open-close or in-out motions similar to those used for in-vacuum shutters. Sample linear position is not adjustable and is limited to the one, two or three inch strokes available.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Actuator Gaskets	FKM / FPM fluoroelastomer
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1]	-20°C to 100°C
Axial load	20 lb maximum
Lateral load	20 lb @ 3" extension maximum
Weight & Dimensions	See table

LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
1.00	UHV	2	ALM-275-1	661050
2.00	UHV	3	ALM-275-2	661051
3.00	UHV	3	ALM-275-3	661052

DESCRIPTION [2]	OPTION NUMBER
24V DC AIR CONTROL SOLENOID VALVE	-01
240V AC AIR CONTROL SOLENOID VALVE	-02

[1] UHV units are bakeable to 230°C with actuator removed.

[2] When ordering solenoid options, add the option number to the end of the desired UHV part number listed above. For example: 661050-02.

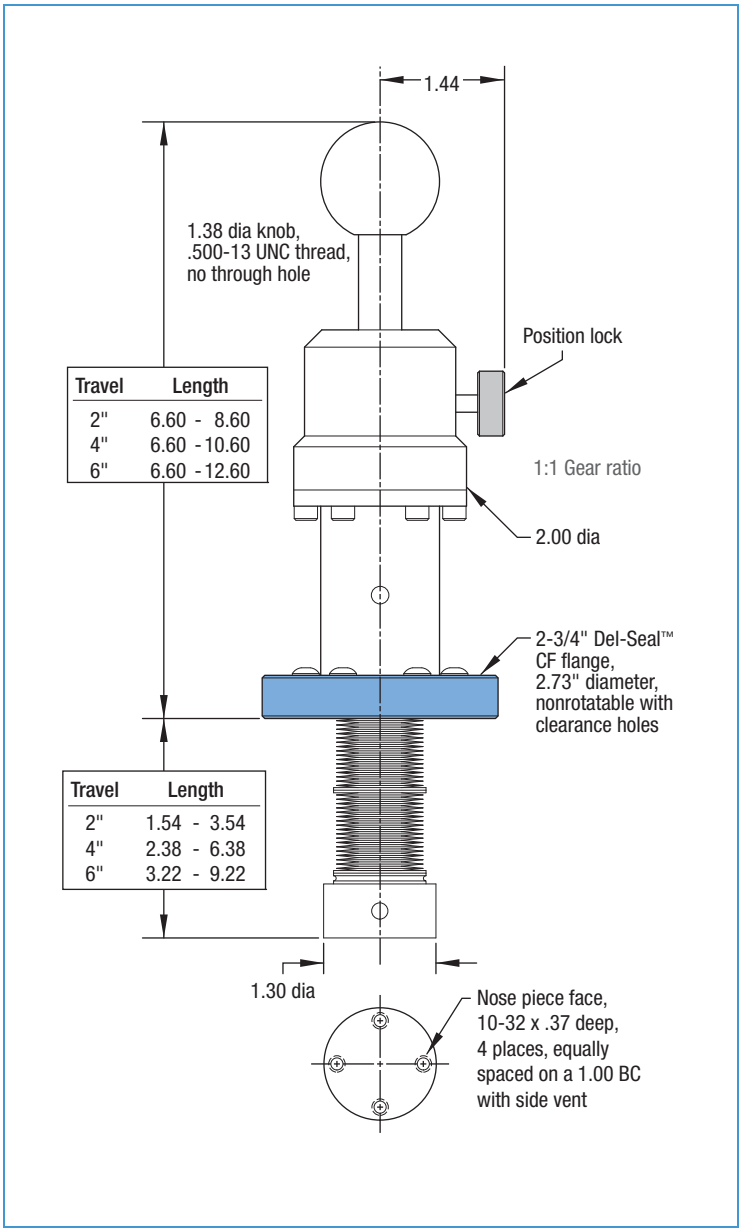
Linear Motion

Heavy Duty, Push-Pull

ULTRAHIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts



Description

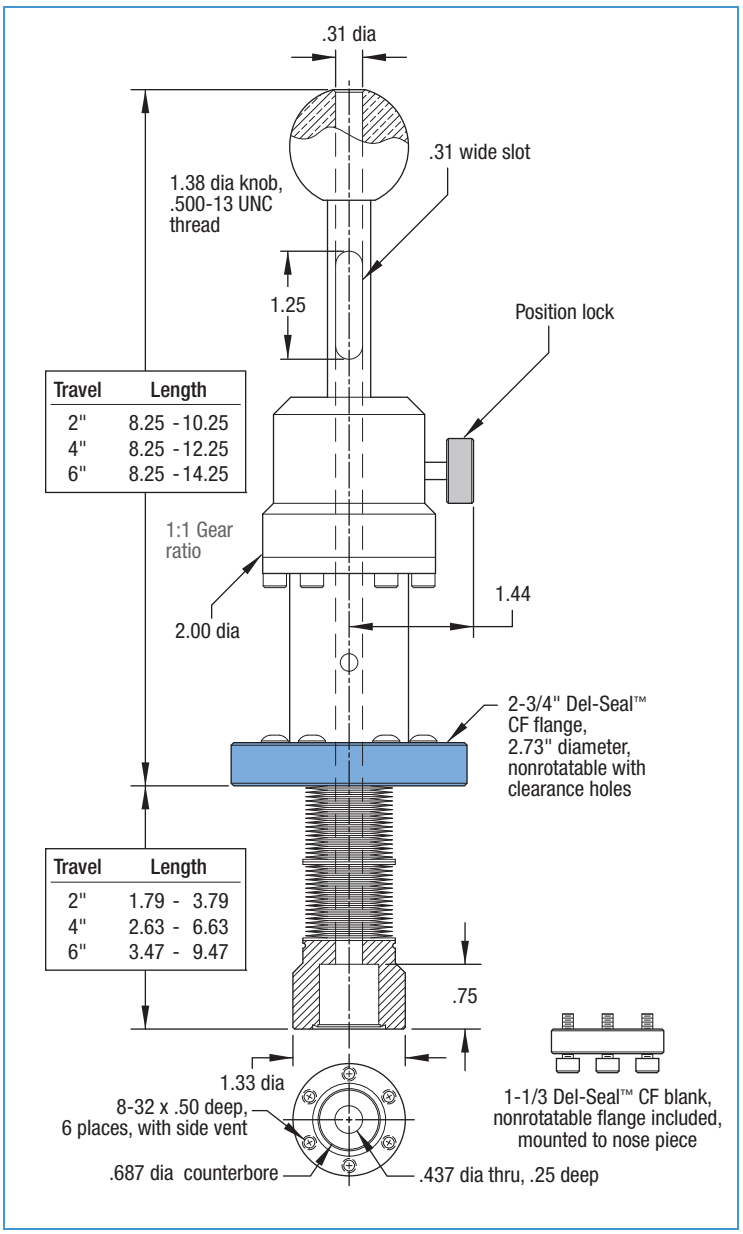
Heavy duty push-pull linear motion feedthroughs allow linear displacement of heavier samples and components than conventional designs. These devices do not provide position indica-tion. Sample or component position must be verified visually through a viewport. Sample linear position can be fixed with an integral position lock knob mounted on the actuator housing. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construction allowing the use of sturdier and larger diameter shafts. Push-pull linear motion feedthroughs provide two-position fast action motion ideal for applications including open-close or in-out motions similar to those used for in-vacuum shutters. Standard models with two-, four- and six-inch maximum travel are offered on 2-3/4" Conflat® compatible Del-Seal™ CF metal seal flanges. Special configurations, such as the three-inch version displayed in the photograph, may be quoted upon request.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1]	-20°C to 100°C
Axial load	20 lb maximum
Lateral load	20 lb @ 4" extension maximum
Weight & Dimensions	See table

LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
2.00	UHV	3	SLM-275-2	674001
4.00	UHV	4	SLM-275-4	674003
6.00	UHV	5	SLM-275-6	674005

[1] UHV units are bakeable to 230°C with actuator removed.



ULTRAHIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts

Description

Heavy duty tunnel access, push-pull linear motion feedthroughs allow linear displacement of heavy samples and components. The push-pull shaft is hollow providing tunnel access for instrumentation leads such as those used for thermocouple temperature measurements and other low voltage electrical applications. The vacuum nose piece is shipped with a blank 1-1/3" Del-Seal™ CF mini flange which can be removed or modified to accept electrical feedthroughs as required. These devices do not provide position indication. Sample or component position must be verified visually through a viewport. Sample linear posi-tion can be fixed with an integral position lock knob mounted on the actuator housing. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construc-tion allowing the use of sturdier and larger diameter shafts. Models with two-, four- and six-inch maximum travel are offered on 2-3/4" Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1]	-20°C to 100°C
Axial load	20 lb maximum
Lateral load	20 lb @ 4" extension maximum
Weight & Dimensions	See table

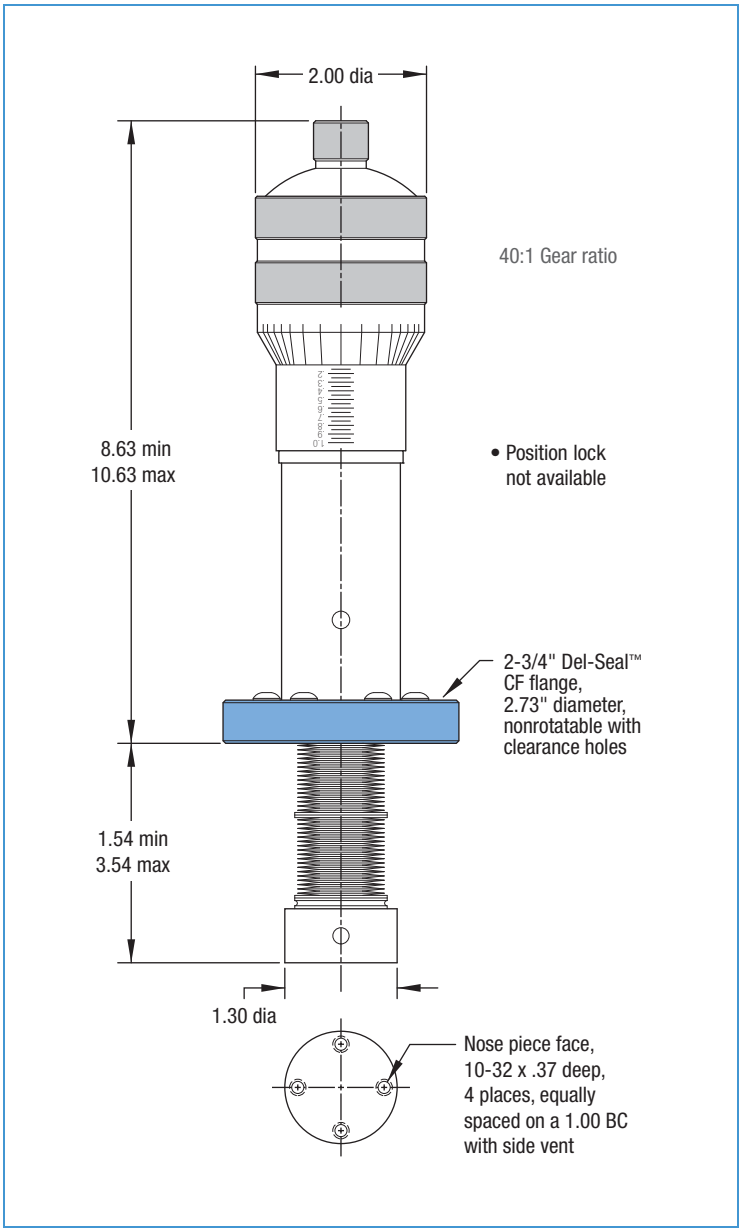
LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
2.00	UHV	3	TLM-275-2	667000
4.00	UHV	4	TLM-275-4	667001
6.00	UHV	5	TLM-275-6	667002

[1] UHV units are bakeable to 230°C with actuator removed.

ULTRAHIGH VACUUM SERIES

Features

- 2 inch linear travel
- Manual, precision micrometer actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mount



Description

Heavy duty, micrometer driven linear motion feedthroughs allow linear displacement of heavier samples and components with the accuracy and precision of fine pitch thread micrometers. These devices provide position indication on both rotary and linear scales with display resolutions of 0.0001" on the rotary scale and 0.025" on the linear scale. A full revolution of the rotary scale translates into 0.025" of linear travel. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construction allowing the use of sturdier and larger diameter shafts. Models with two inch maximum travel are offered on 2-3/4" Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1]	-20°C to100°C
Axial load	10 lb maximum
Lateral load	20 lb @ 4" extension maximum
Weight & Dimensions	See table

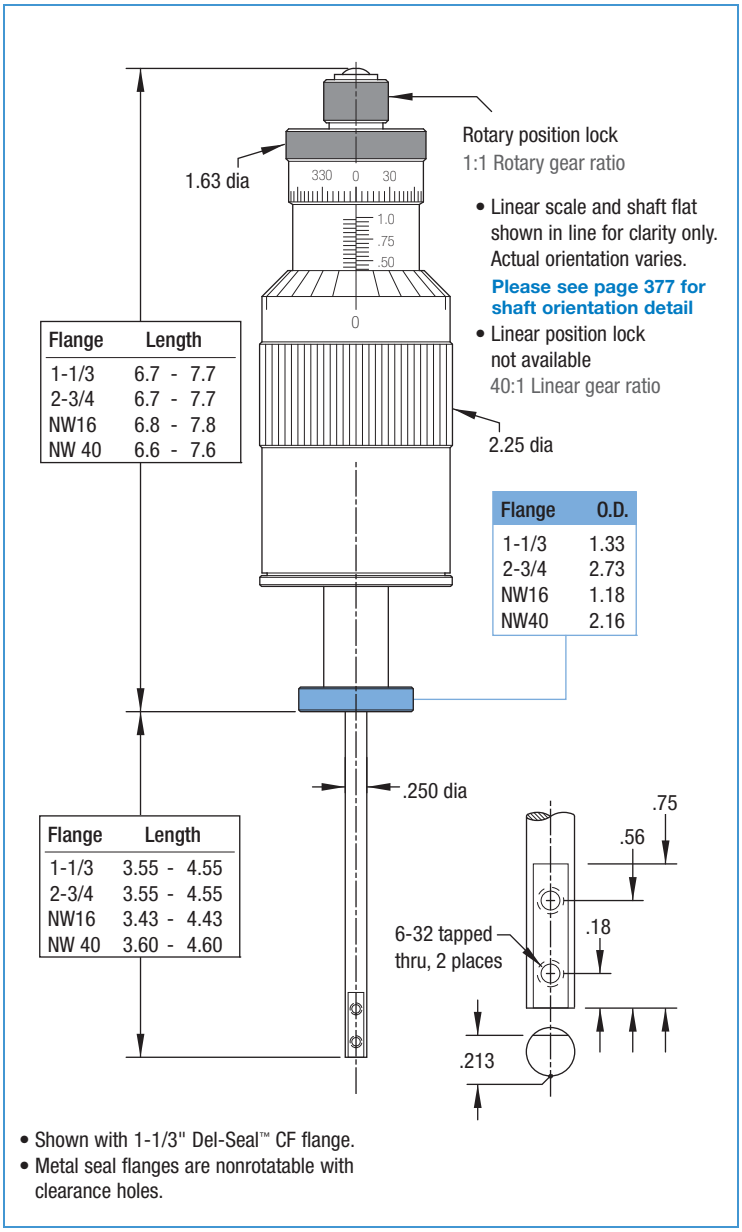
LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
2.00	UHV	3	LMM-275-2	668002

[1] UHV units are bakeable to 230°C with actuator removed.

ULTRAHIGH & HIGH VACUUM SERIES

Features

- 360° rotary motion and 1 inch linear travel
- Manual actuator
- Rotary position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts



- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

Description

Rotary-linear standard devices offer 360° of rotation and one inch of linear travel via two separate drive knob actuators. Both rotary and linear positions are measured along laser etched scales on actuator barrel and housing. The 360° rotary scale is graduated in 5° increments. The linear scale has both a linear and rotary scale components, the linear portion is graduated in 0.025" increments while the rotary portion is graduated in 0.001" increments. Full revolution of the linear scale produces 0.025" of linear travel. These instruments are offered on both Del-Seal™ CF metal seal flanges for ultrahigh vacuum service and Kwik-Flange™ ISO KF elastomer seal flanges for high vacuum service.

Specifications

Material	
Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Torque	50 oz-in maximum
Axial load	4 lb maximum
Lateral load	4 lb @ 2" extension maximum
Weight & Dimensions	See table

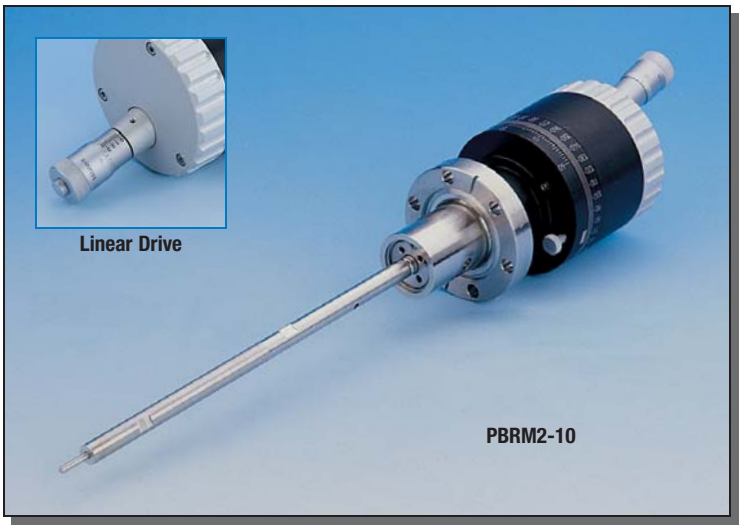
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	3	BRLM-133	672000
2-3/4 UHV	3	BRLM-275	672002

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	3	K075-BRLM	672004
NW40 HV	3	K150-BRLM	672006

[1] UHV units are bakeable to 230°C with actuator removed.

Multi-Motion

Rotary-Linear, Precision



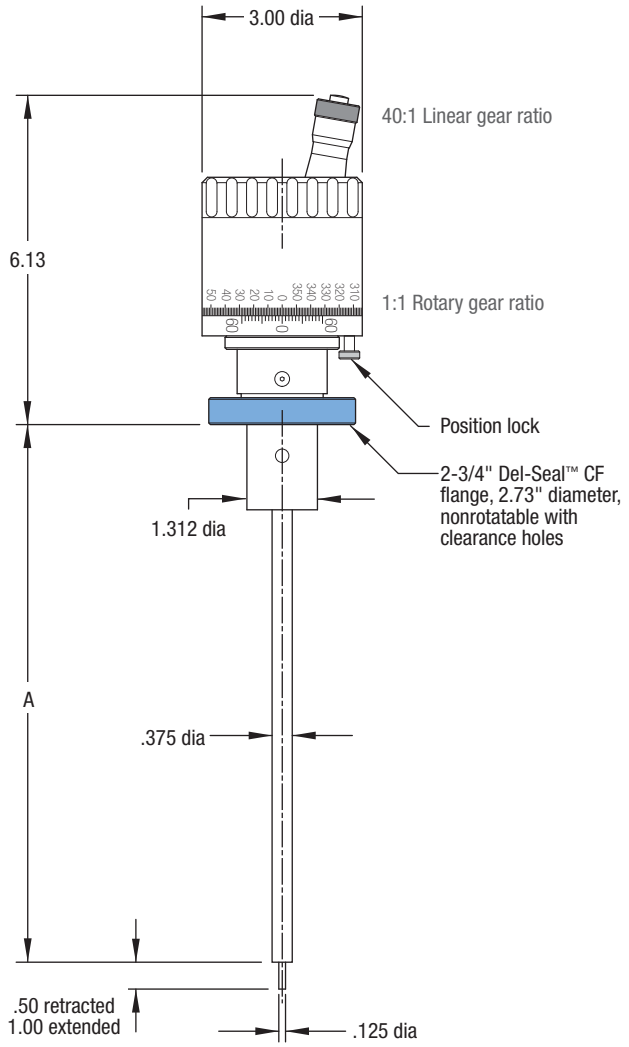
ULTRAHIGH VACUUM

Features

- Continuous rotary motion and 1/2 inch linear travel
- Manual or Motorized actuator
- Rotary position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mount

Description

Precision rotary-linear motion feedthroughs are low backlash instruments with a rotary display resolution of 0.1° and a linear display resolution of 0.001". Full revolution of the linear drive translates into 0.025" of linear travel with a maximum overall linear travel of 0.500". Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide long life and smooth operation. Feedthroughs are available on 2-3/4" diameter Conflat® compatible Del-Seal™ CF metal seal flanges. Motorization options are available for both linear and rotary drive components. If motorization is required on both drives, add each option number to the end of the base part number. Note that the entire linear drive mechanism (manual or motorized) will rotate when the rotary drive is actuated. This must be considered when allocating space for its installation. Motor controls are not included with the motorization options and must be purchased separately. Reference page 465 for motor controllers.



Specifications

Material	
Flange / Actuator body	304ss / Aluminum
Shaft seal	AM 350 welded bellows
Position knob & internal washer	Brass
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range [1]	-20°C to 230°C
Torque	7 lb-in maximum
Axial load	
Rotary	5 lb maximum
Linear	1 lb maximum
Lateral load	10 lb @ 2" extension maximum
Weight & Dimensions	See table

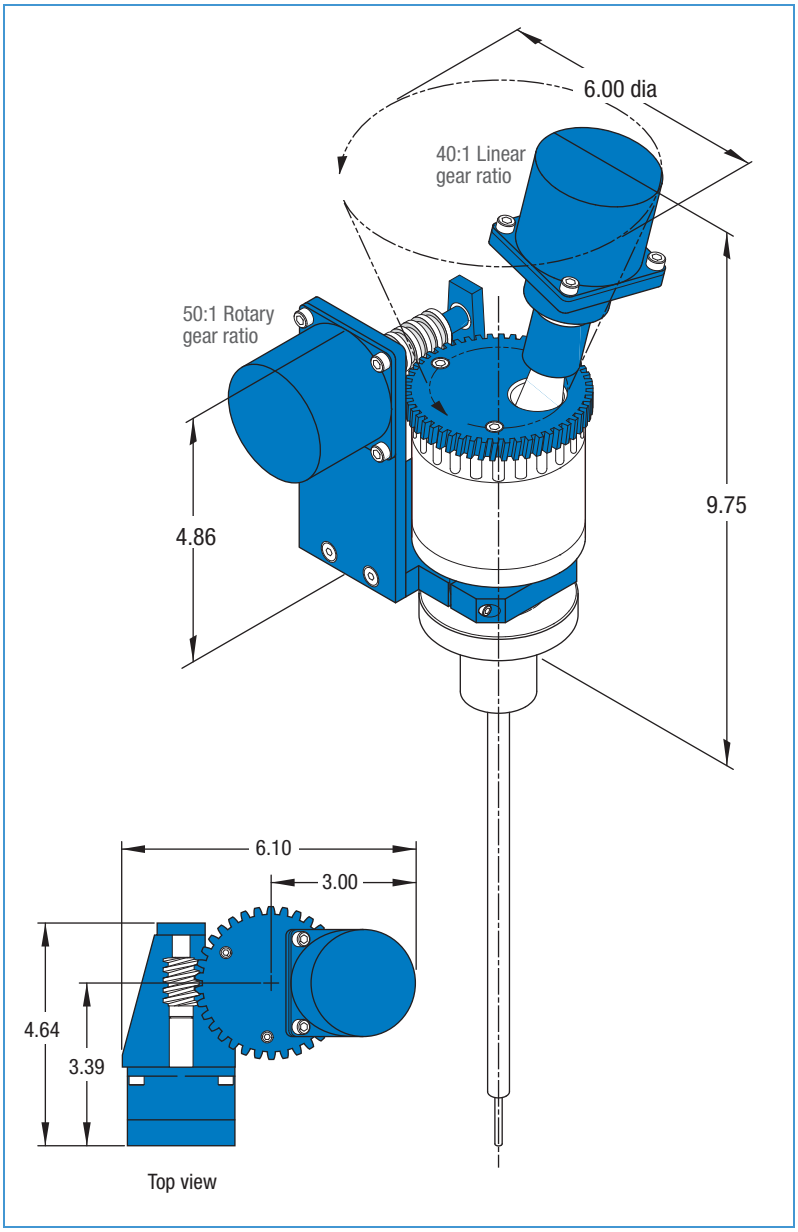
[1] UHV units are bakeable to 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 230°C

FLANGE SIZE	FLANGE O.D.	A	WT LB	REFERENCE	PART NUMBER
2-3/4	2.73	10.00	8	PBRM2-10	670025
2-3/4	2.73	15.75	8	PBRM2-15	670028
2-3/4	2.73	23.62	9	PBRM2-23	670031
2-3/4	2.73	31.50	9	PBRM2-31	670034

Motorization Options



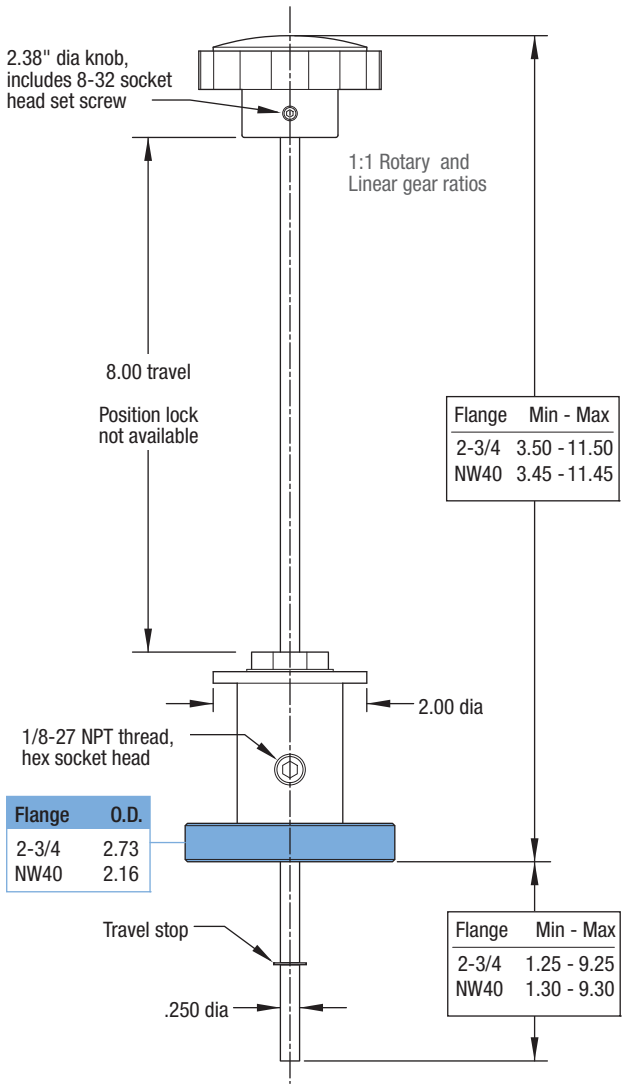
OPTION -01
ROTARY MOTORIZATION

OPTION -02
LINEAR MOTORIZATION

MOTORIZATION [2]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
ROTARY AXIS	D	5	-01
LINEAR AXIS	D	2	-02

[2] When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 670025-**01-02**. For total unit weight, add option weight to component weight. Refer to page 460 for motor specifications.

Multi-Motion
Rotary-Linear, Direct



- Shown with 2-3/4" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion and 8 inch linear travel
- Manual actuator
- UHV or HV compatible materials
- Differentially pumped, Dual FKM / FPM fluoroelastomer elastomer shaft seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Differentially pumped direct drive rotary-linear motion feedthroughs are a basic and economical solution for vacuum applications requiring both rotary and linear motion. Their simple construction provides 100 lb-in of manual rotational torque.

The rotary shaft is supported by two phosphor bronze bearings and uses dual FKM / FPM fluoroelastomer elastomer shaft seals. The region between the seals can be differentially pumped through the 1/8" female pipe thread port provided and thus attain UHV compatibility to 10^{-9} Torr. Feedthroughs are available on industry standard Conflat® compatible 2-3/4" diameter Del-Seal™ CF metal seal flanges or ISO KF NW40 Kwik-Flange™ port mounts.

Specifications

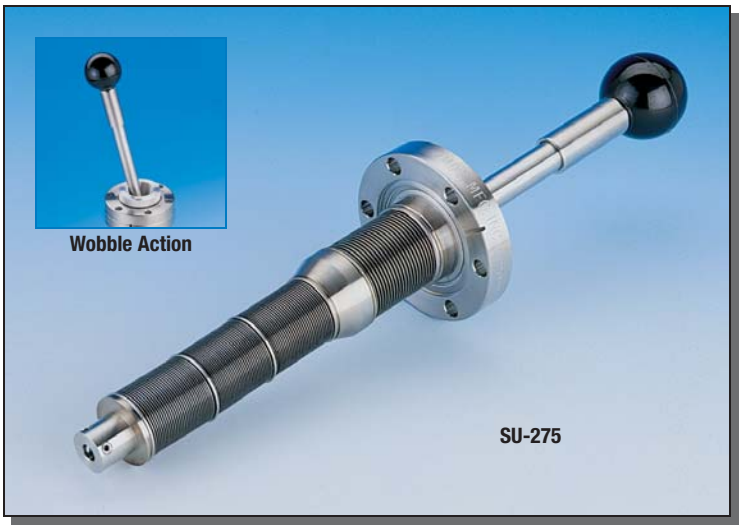
Material

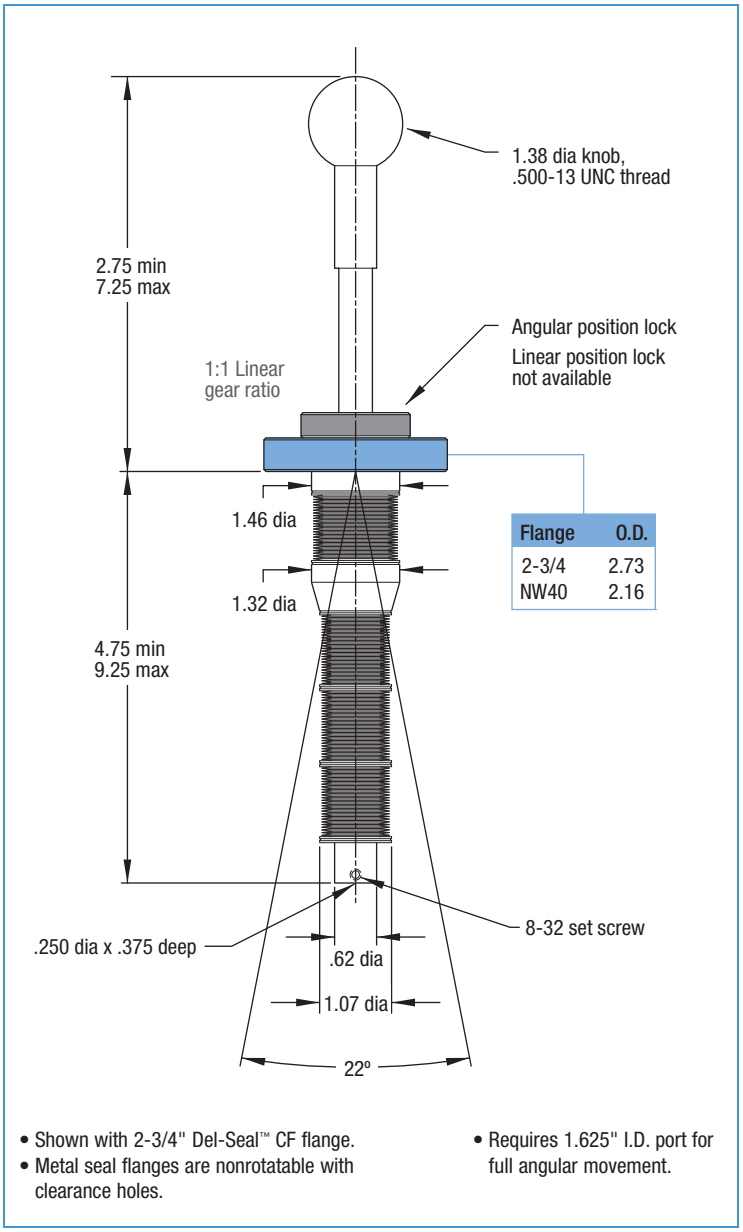
Flange / Actuator body	304ss
Shaft seal	FKM / FPM fluoroelastomer
Vacuum Range UHV / HV	$1x10^{-9}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Torque	100 lb-in maximum
Axial load (no lock to support weight)	10 lb maximum
Lateral load	5 lb @ 2" extension maximum
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	CRPP-1	672008

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K-CRPP-1	672009

[1] UHV units are bakeable to 150°C with actuator removed.





Flange	O.D.
2-3/4	2.73
NW40	2.16

- Shown with 2-3/4" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.
- Requires 1.625" I.D. port for full angular movement.

ULTRAHIGH & HIGH VACUUM SERIES

Features

- 4-1/2 inch linear travel and 22° wobble motion
- Manual actuator
- Angular position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Wobble stick linear-angular motion feedthroughs are basic and manual sample motion devices. They provide quick action linear travel and angular wobble motion via a stainless steel hand-held actuator shaft with a ball and socket joint design. They are typically operated by observing sample motion through a vacuum viewport. The actuators angular position can be locked in place by tightening the lock collar located on the port mount flange. Wobble stick linear-angular motion feedthroughs are offered with 4-1/2 inch linear travel and a maximum 22° of angular wobble with unrestricted mating flange and port diameter. Reentrant, welded stainless steel bellows are standard on these products. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts.

Specifications

Material

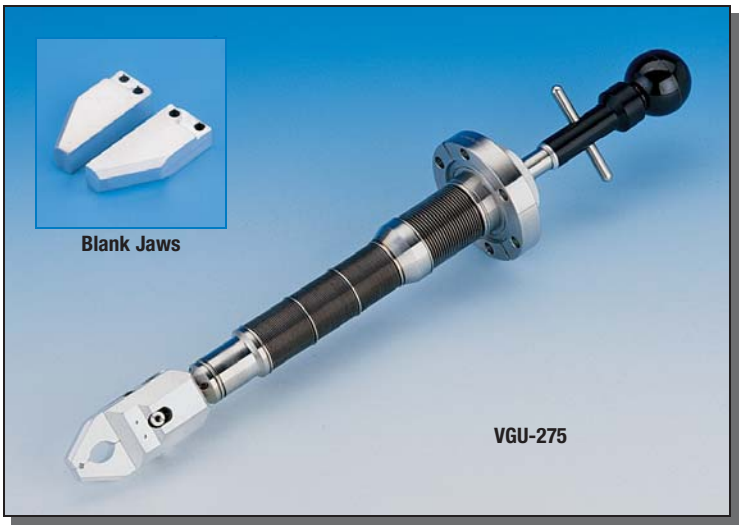
Flange / Actuator body	304ss
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Axial load (no lock to support weight)	20 lb maximum
Lateral load	20 lb @ 4" extension maximum
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	SU-275	696000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-SU	696001

[1] UHV units are bakeable to 230°C with actuator removed.

Multi-Motion
Wobble Stick, Pincer



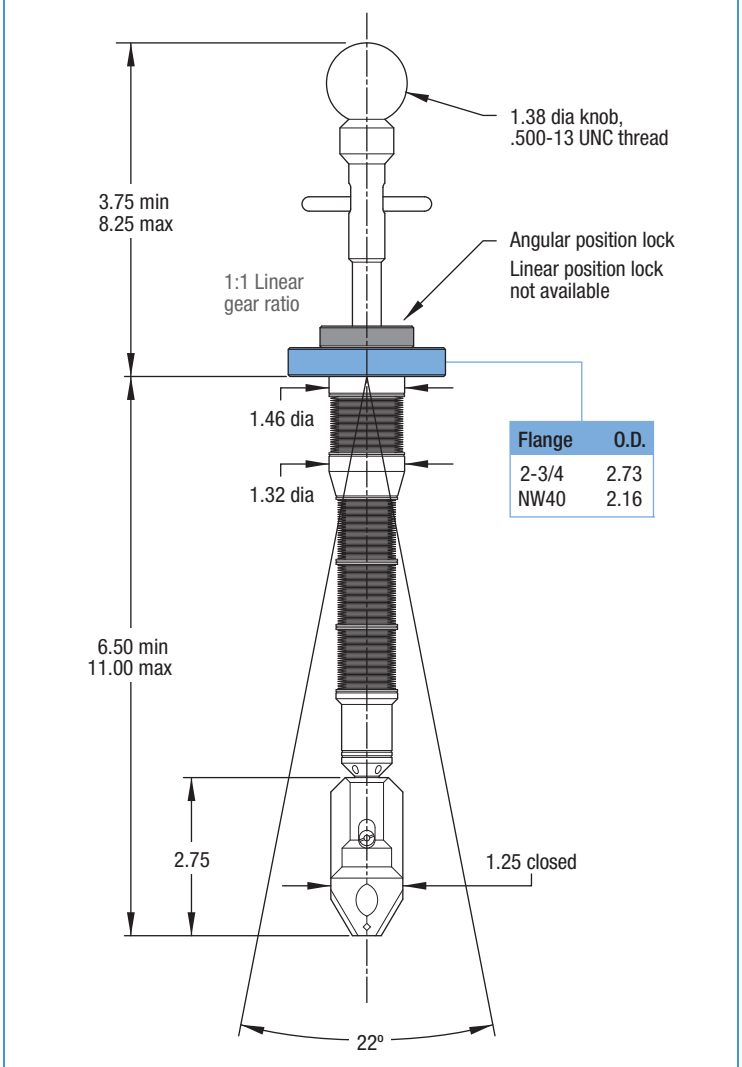
ULTRAHIGH & HIGH VACUUM SERIES

Features

- 4-1/2 inch linear travel and 22° wobble, with pincer-grip
- Manual actuator
- Angular position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Wobble sticks with pincer action are identical to the wobble-linear products, except for the addition of an integral and articulated sample holding pincer mechanism. The pincer is activated via two shaft mounted finger grips allowing the pincer jaws to grip 0.880" maximum sample diameters. These feedthroughs provide quick action linear-angular motion via a manually activated shaft with ball and socket joint design. They are typically operated by observing sample motion through a vacuum viewport. Angular position can be locked with an integral lock collar located on the port mount flange. They are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or Kwik-Flange™ port mounts.



- Shown with 2-3/4" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.
- Requires 1.625" I.D. port for full angular movement.

Specifications

Material	
Flange / Actuator body	304ss
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Axial load	2 lb maximum
Lateral load	2 lb maximum
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	VGU-275	695000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-VGU	695001

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
JAW KIT, BLANK	1	DG-275-BJ	694001

[1] UHV units are bakeable to 230°C with actuator removed.

Multi-Motion
Wobble Stick, Rotary Pincer

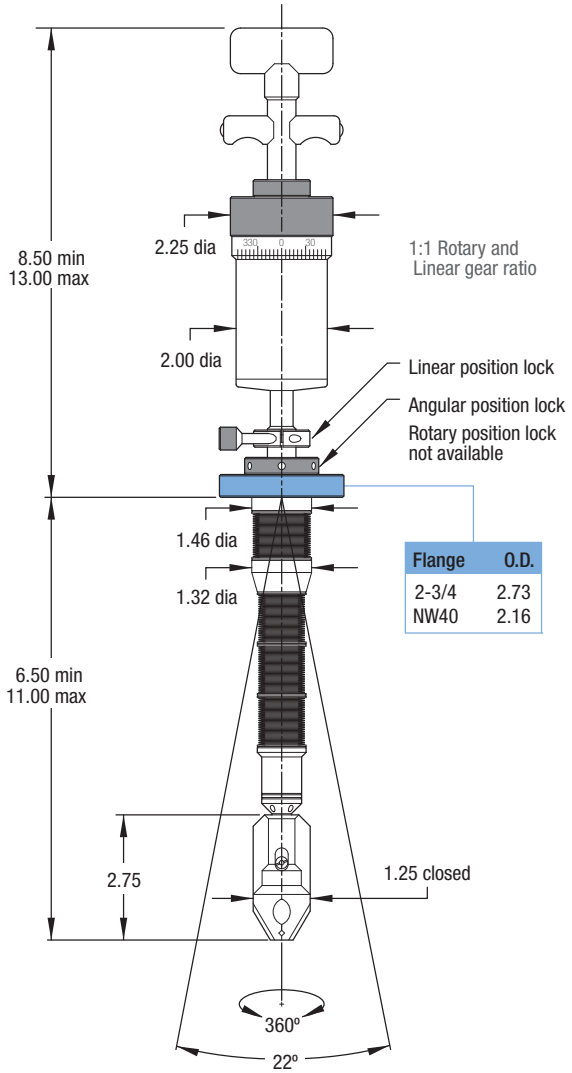
ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion, 4-1/2 inch linear travel and 22° wobble, with pincer-grip
- Manual actuator
- Linear and angular position locks
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

These products are rotary-linear-pincer action wobble sticks identical to the linear and linear-pincer wobble stick products with the addition of full 360° rotary motion. The pincer mechanism is activated via two shaft mounted finger grips allowing the pincer jaws to grip up to 0.880" sample diameters. These feedthroughs provide quick action rotary, linear and angular motion with an actuator shaft ball and socket joint design. Angular and linear positions can be locked with integral lock collars located on the port mount flange and actuator shaft. They are available on industry standard Del-Seal™ CF metal seal flanges or Kwik-Flange™ port mounts.



- Shown with 2-3/4" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.
- Requires 1.625" I.D. port for full angular movement.

Specifications

Material	
Flange / Actuator body	304ss / Aluminum
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range[1] UHV / HV	-20°C to 100°C
Torque	50 oz-in maximum
Axial load	2 lb maximum
Lateral load	2 lb maximum
Weight & Dimensions	See table

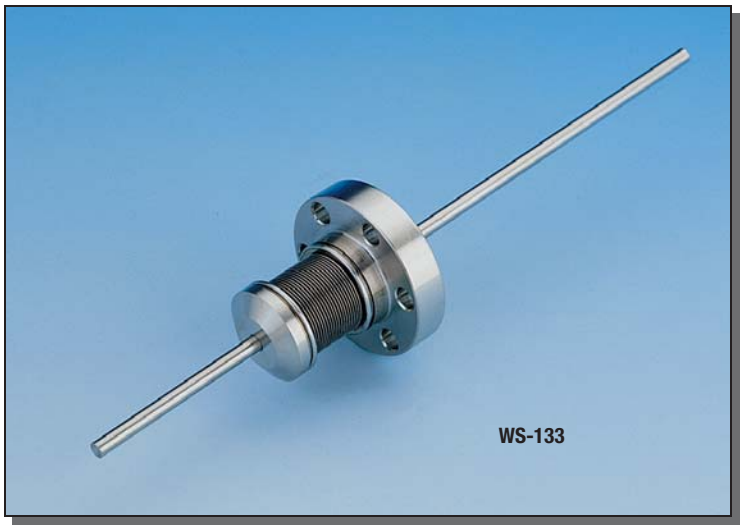
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	DG-275	694000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-DG	694002

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
JAW KIT, BLANK	1	DG-275-BJ	694001

[1] UHV units are bakeable to 230°C with actuator removed.

Multi-Motion
Wobble Stick, Wide Angle



ULTRAHIGH & HIGH VACUUM SERIES

Features

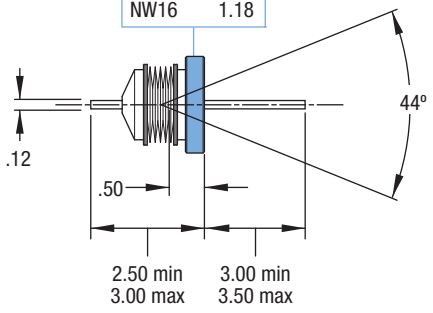
- 1/2 or 2 inch linear travel and 44° or 60° wobble, respectively
- Manual actuator
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Wide angle wobble sticks, the most basic products of the wobble stick family provide an economical solution for light duty sample motion and manipulation. They are stripped down wob-ble sticks ideally suited for user customization. Under vacuum load the bellows are compressed and the shaft completely extended into the vacuum chamber. Offered in two models they provide 44° and 60° of angular displacement respectively. They are available with both Conflat® compatible Del-Seal™ CF metal seal flanges and Kwik-Flange™ ISO KF elastomer seal flanges.

1/2" Linear Travel, 44° Wobble

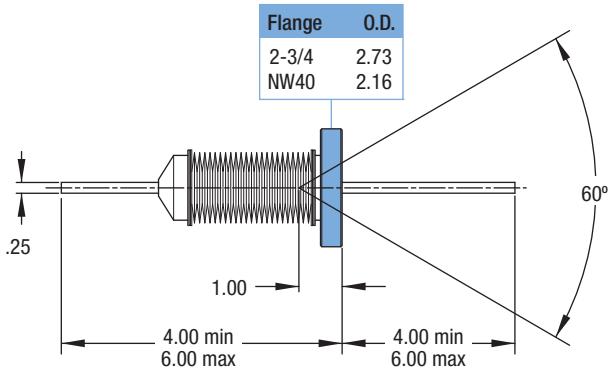
Flange	O.D.
1-1/3	1.33
NW16	1.18



1:1 Linear gear ratio

2" Linear Travel, 60° Wobble

Flange	O.D.
2-3/4	2.73
NW40	2.16



1:1 Linear gear ratio

- Requires 1.625" I.D. port for full angular movement.
- Position lock not available

Specifications

Material	
Flange / Actuator body	304ss
Shaft seal	AM 350 welded bellows
Vacuum Range UHV / HV	$1x10^{-11}$ Torr / $1x10^{-8}$ Torr
Temperature Range	
UHV	-20°C to 230°C
HV	-20°C to 150°C
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	3	WS-133	693001
2-3/4 UHV	3	WS-275	693000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	3	K075-WS	693002
NW40 HV	3	K150-WS	693003

Manipulation

Section 7.2

Manipulation

Introduction

Triple axis micrometer driven XYZ Stages page 426

- V-Plane® XY and Z stages
- V-Plane® Guide Tubes
- Compact XY and Z stages
- Heavy duty Z stages
- Standard XY and Z stages
- Rotatable axis stages

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.

V-Plane® XY and Z Stages

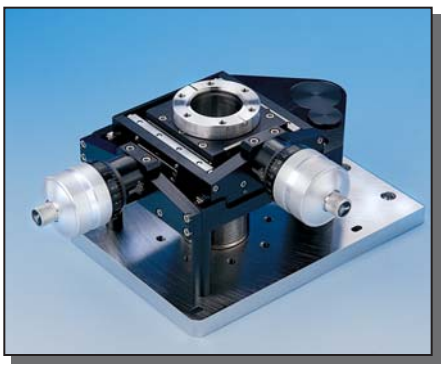
MDC's V-Plane® modular stages are building block components designed to streamline the implementation of a sample manipulation system. They can be used as stand alone components or combined with other V-Plane® instruments to attain customized motion and manipulation solutions. V-Plane® dual axis XY stages are micrometer driven and guided by cross roller bearing slides. MDC micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement. V-Plane® single axis stages employ handwheel and worm gear reduction drive mechanisms with linear displacement measured along the stage's frame mounted scale. Z axis linear travels of up to 36" are available. MDC V-Plane® stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments. V-Plane® Z stages can also be fitted with guide tubes to further expand their capabilities. For a step-by-step pictorial description of a typical guide tube installation and usage reference page 421 of this catalog.

V-Plane® Guide Tubes

MDC guide tubes provide bellows support for V-Plane® manipulator stages fitted with long-stroke bellows as well as secondary rotary and linear motion feedthroughs installed on the stage. Guide tubes mount directly onto V-Plane® manipulator stages fitted with 2-3/4" Del-Seal™ CF port flanges with a bore clearance suitable for the 1.125" guide tube diameter. They are supplied with both rotary and linear bearing supports. Rotary bearings for .250" and .375" diameter shafts are included. For applications requiring sample heating, cooling, high voltage biasing, thermocouple temperature measurements, etc., the guide tube tip has been fitted with two slots 180° apart through which wires or tubes can be fed. Four 1-1/3" and one 2-3/4" Del-Seal™ CF flange accessory ports allow the installation of up to five additional accessory components. When a manipulator stage is not under vacuum or is let up to air with the bellows in some state of compression, the compressed bellows' spring force may force the bellows to shift off-axis at some point during its travel. The off-axis shift could be sudden and violent causing user injury or damage to the bellows. MDC recommends that all long-stroke 1.50" diameter bore Z axis V-Plane® stages, with linear travels exceeding six inches, be fitted with guide tubes.

Rotatable Axis Stages

Rotatable axis stages replace conventional rotatable mounting tables previously offered by MDC. They provide 360° positioning with greater precision, control and ease of use. Rotatable stages are constructed with worm gear drive mechanisms which offer substantial mechanical advantage over non-geared designs, a feature which allows effortless manual operation, even under a full vacuum load. High torque stepper motors are also available for these stages. MDC rotatable stages can be used to rotate heavy samples or sample support apparatus and structures. Two spring energized PTFE face seals are at the heart of the rotatable stage's sealing mechanism. With provision for differential pumping between the seals, these rotatable stages can be used in UHV environments with bakeout temperatures as high as 200°C.



Dual axis, micrometer driven XY stage page 416

Single axis 360° rotating stages page 428

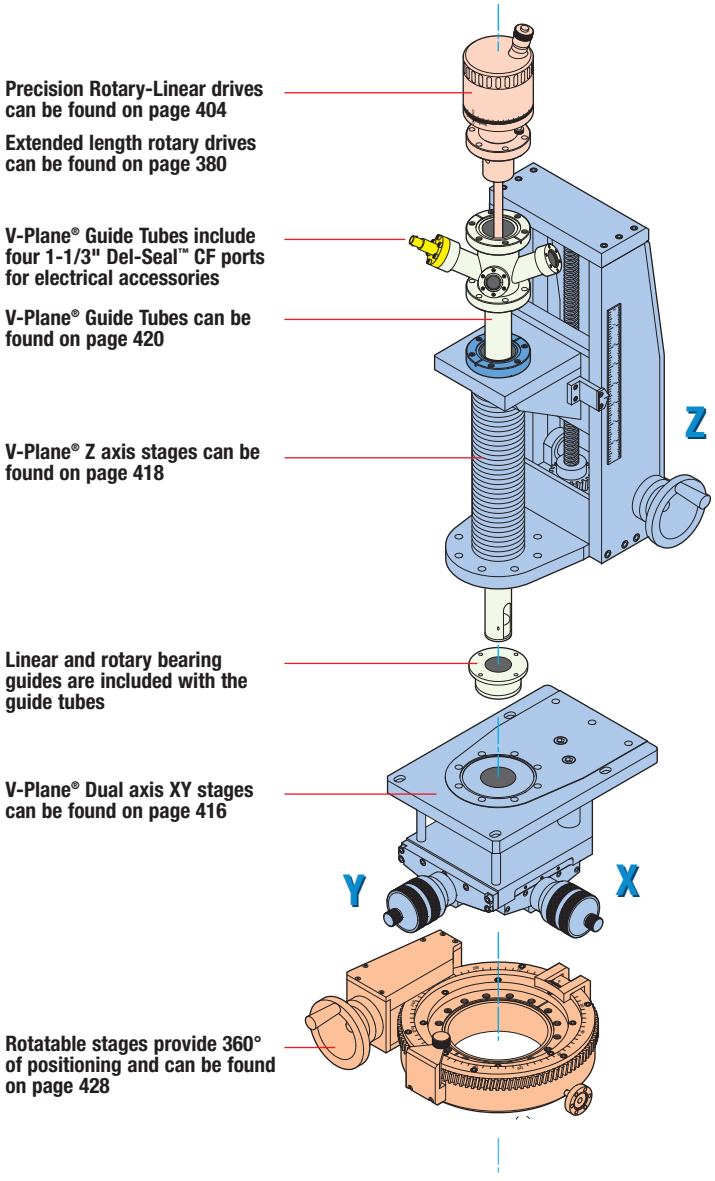
Standard XY and Z Stages

Standard XYZ stages are large bore stages which incorporate triple axis motion in a single stage. The XY travels are micrometer driven and guided by cross roller bearing slides. MDC micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement and are available for 0.500" or 1.00" of linear XY displacement. The Z axis employs a handwheel and worm gear reduction drive mechanism with displacement measured along the stage's frame mounted scale. Z axis linear travels of up to 12" are available. MDC standard stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments.

Compact XY and Z Stages

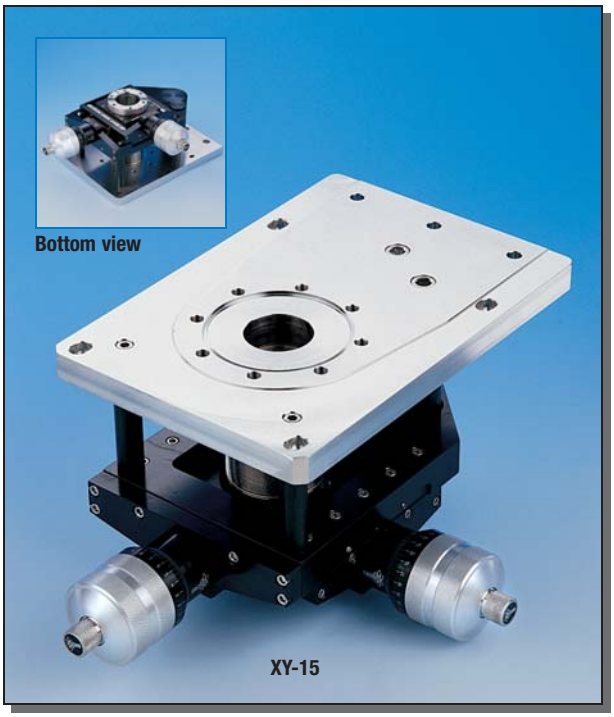
Compact stages are small footprint single or triple axis stages and are ideally suited for applications with limited space. They are available in a Z only or XYZ configuration. They provide the means for precise sample manipulation inside ultrahigh vacuum environments.

Typical Installation



Intermediate hardware may be required for joining components. These have been omitted for clarity.

V-Plane®
Dual Axis XY Stage



ULTRAHIGH VACUUM SERIES

Features

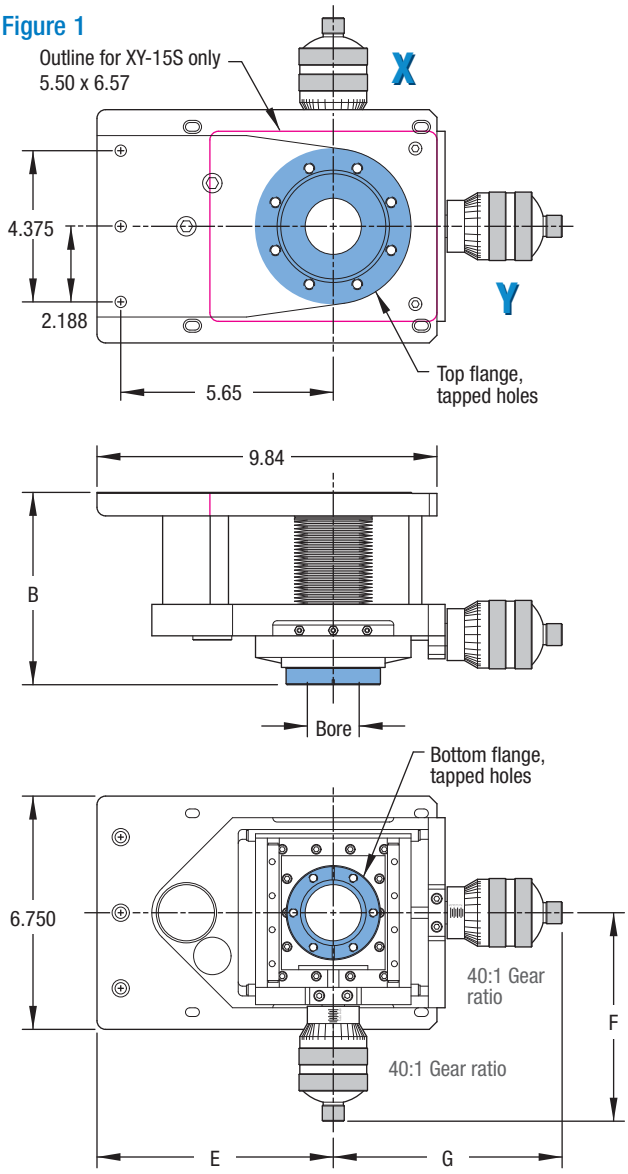
- V-Plane® building block component[1]
- Plus or minus 1/2 and 1 inch off center XY motion
- 1-1/2 to 4 inch bore diameters
- Manual or Motorized actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Description

MDC's V-Plane® modular stages are building block components designed to streamline the implementation of a sample manipulation system. They can be used as stand alone components or combined with other V-Plane® instruments to attain customized motion and manipulation solutions.

V-Plane® dual axis XY stages are micrometer driven and guided by cross roller bearing slides. Micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement. MDC V-Plane® dual axis XY stages provide precise motion and manipulation of samples inside ultrahigh vacuum environments. Dual axis XY stages can be stacked with V-Plane® single axis Z stages and also fitted with guide tubes to further expand their capabilities. Look for the ↗ symbol for other mating building block components.

Figure 1



Specifications

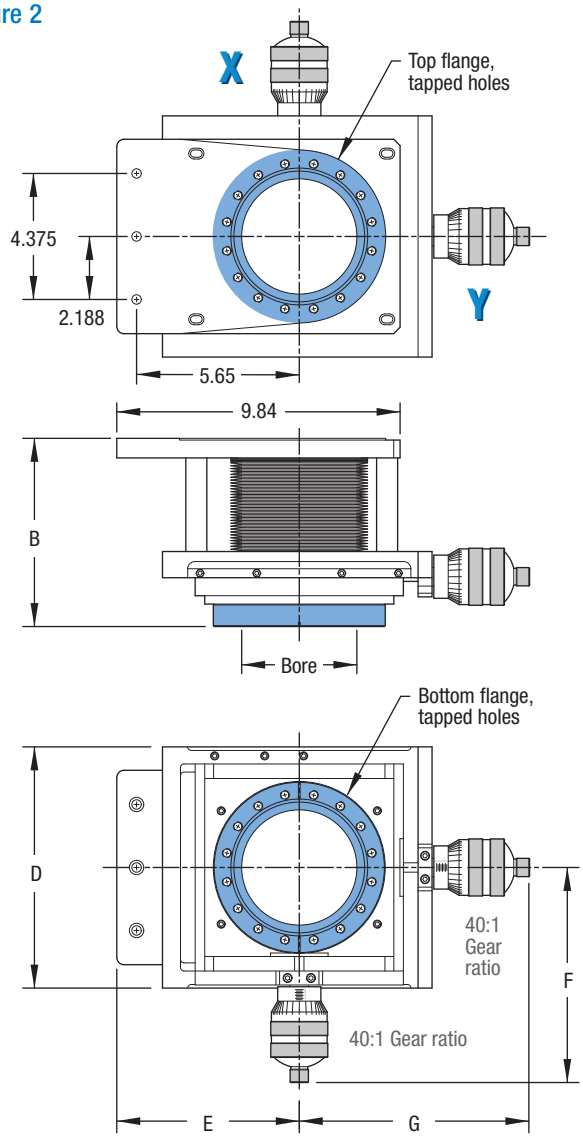
Material	
Flange	304ss
Actuator body	Anodized aluminum
Bellows	AM 350
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range [2]	-20°C to 230°C
Weight & Dimensions	See table

[1] Reference page 414 for related V-Plane® components.
[2] Units are bakeable to 30°C maximum when motorized.

BORE SIZE	TRAVEL [4] ±	FIGURE	TOP FLANGE	BOTTOM FLANGE	B	D	E	F	G	H	J	WT LB	REFERENCE	PART NUMBER
1.50	0.50	1	2-3/4	2-3/4	5.00	-	3.25	5.75	6.18	7.63	8.23	24	XY-15S	677020
1.50	0.50	1	4-1/2	2-3/4	5.62	-	6.33	5.75	6.18	7.63	8.23	25	XY-15	677002
2.50	0.50	1	4-1/2	4-1/2	5.75	-	6.33	6.50	6.87	8.26	8.83	28	XY-25	677003
2.50	0.50	1	4-1/2	6	5.85	-	6.33	7.47	8.00	9.07	9.60	29	XY-26	677016
2.50	1.00	1	4-1/2	4-1/2	6.62	-	6.33	9.12	9.75	9.26	9.83	28	LXY-25	677006
2.50	1.00	1	4-1/2	6	6.72	-	6.33	9.12	9.75	10.07	10.60	29	LXY-26	677017
4.00 [3]	0.50	2	4-1/2	6	6.50	8.37	6.33	7.47	8.00	9.07	9.60	30	XY-40	677004
4.00	0.50	2	6	6	6.50	8.37	6.33	7.47	8.00	9.07	9.60	32	XY-44	677005
4.00 [3]	1.00	2	4-1/2	6	7.25	8.37	6.33	10.00	10.50	10.07	10.60	32	LXY-40	677007
4.00	1.00	2	6	6	7.25	8.81	6.33	10.25	10.05	10.07	10.60	34	LXY-44	677008

[3] 4.00" bore diameter is reduced to 2.50" at 4-1/2" top flange [4] Match sample support structure and stage bore for maximum XY travel.

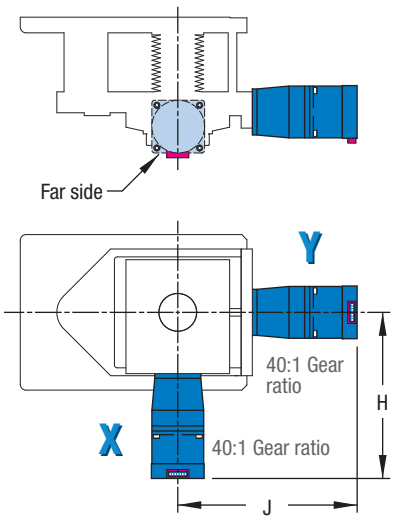
Figure 2



Motorization Options

[5] When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 677020-**01**. For total unit weight, add option weight to component weight. Refer to page 460 for motor specifications.

MOTORIZATION [5]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
XY INLINE STEPPER	D	3	-01



V-Plane®
Single Axis Z Stage

MDC PRECISION
Enabling Science to Change the World

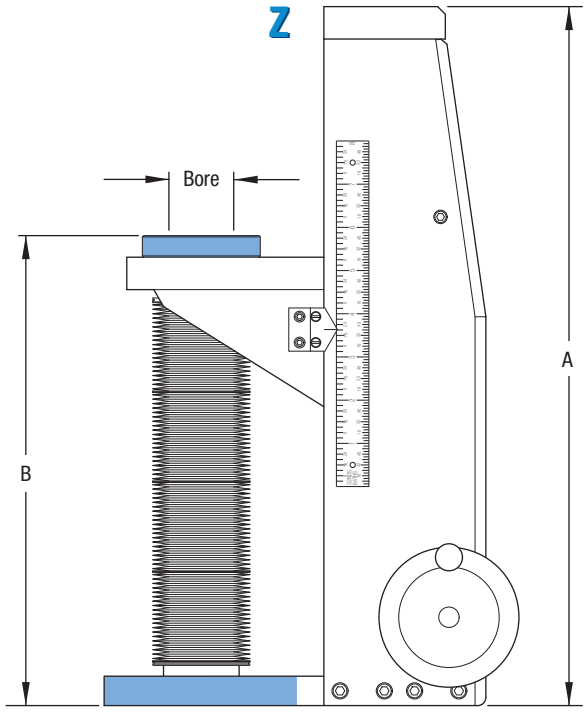
ULTRAHIGH VACUUM SERIES

Features

- V-Plane® building block component[1]
- 6 to 36 inch Z-Axis travel
- 1-1/2 to 4 inch bore diameters
- Manual or Motorized actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Description

MDC's V-Plane® modular stages are building block components designed to streamline the implementation of a sample manipulation system. They can be used as stand alone components or combined with other V-Plane® instruments to attain customized motion and manipulation solutions. V-Plane® single axis stages employ handwheel and worm gear reduction drive mechanisms with linear displacement measured along the stage's frame mounted scale. Z axis linear travels of up to 36" are available. MDC V-Plane® stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments. MDC recommends that all long-stroke 1-1/2" diameter bore Z axis V-Plane® stages, with linear travels exceeding six inches, be fitted with guide tubes. See page 420 for guide tube ordering information. Look for the ↗ symbol for other mating building block components.



All LMTA flanges nonrotatable

Specifications

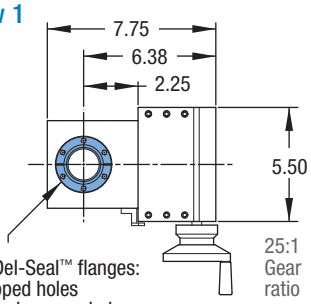
Material	
Flange	304ss
Actuator body	Anodized aluminum
Bellows	AM 350
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range [2]	-20°C to 230°C
Weight & Dimensions	See table

[1] Reference page 414 for related V-Plane® components.
[2] Units are bakeable to 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

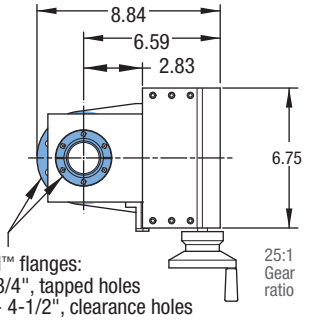
Del-Seal™ CF 230°C

End View 1



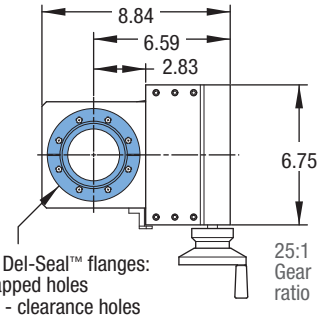
2-3/4" Del-Seal™ flanges:
top - tapped holes
bottom - clearance holes

End View 2



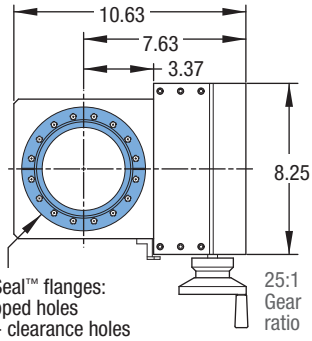
Del-Seal™ flanges:
top - 2-3/4", tapped holes
bottom - 4-1/2", clearance holes

End View 3



4-1/2" Del-Seal™ flanges:
top - tapped holes
bottom - clearance holes

End View 4



6" Del-Seal™ flanges:
top - tapped holes
bottom - clearance holes

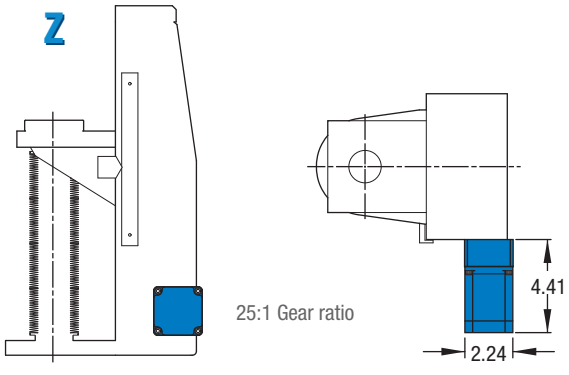
BORE SIZE	Z TRAVEL	END VIEW	A	B MIN - MAX	WT LB	REFERENCE	PART NUMBER
1.50	6.00	1	13.2	6.7 - 12.7	38	LMTA-1506S	665540
1.50	8.00	1	15.2	6.7 - 14.7	42	LMTA-1508S	665541
1.50	12.00	1	21.4	8.9 - 20.9	50	LMTA-1512S	665542
1.50	16.00	1	27.7	11.2 - 27.2	58	LMTA-1516S	665543
1.50	24.00	1	40.3	15.8 - 39.8	74	LMTA-1524S	665544
1.50	36.00	1	59.1	22.6 - 58.6	98	LMTA-1536S	665545
1.50	6.00	2	14.2	7.6 - 13.6	40	LMTA-1506	665528
1.50	8.00	2	16.2	7.6 - 15.6	44	LMTA-1508	665529
1.50	12.00	2	20.2	7.6 - 19.6	52	LMTA-1512	665530
1.50	16.00	2	26.2	9.6 - 25.6	60	LMTA-1516	665531
1.50	24.00	2	38.2	13.6 - 37.6	76	LMTA-1524	665532
1.50	36.00	2	56.2	19.6 - 55.6	100	LMTA-1536	665533
2.50	6.00	3	14.0	7.6 - 13.6	45	LMTA-2506	665552
2.50	8.00	3	16.0	7.6 - 15.6	49	LMTA-2508	665553
2.50	12.00	3	21.4	9.0 - 21.0	57	LMTA-2512	665554
2.50	16.00	3	26.7	10.3 - 26.3	65	LMTA-2516	665555
2.50	24.00	3	37.4	13.0 - 37.0	81	LMTA-2524	665556
2.50	36.00	3	53.4	17.0 - 53.0	105	LMTA-2536	665557
4.00	6.00	4	14.0	7.7 - 13.7	50	LMTA-4006	665564
4.00	8.00	4	16.0	7.7 - 15.7	54	LMTA-4008	665565
4.00	12.00	4	20.0	7.7 - 19.7	62	LMTA-4012	665566
4.00	16.00	4	25.0	8.8 - 24.8	70	LMTA-4016	665567
4.00	24.00	4	35.2	10.9 - 34.9	86	LMTA-4024	665568
4.00	36.00	4	50.3	14.0 - 50.0	110	LMTA-4036	665569

Motorization Options

MOTORIZATION [3]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
Z INLINE STEPPER	F	3	-01

OPTION -01
INLINE STEPPER MOTOR

[3] When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 665540-**01**. For total unit weight, add option weight to component weight. Refer to page 461 for motor specifications.

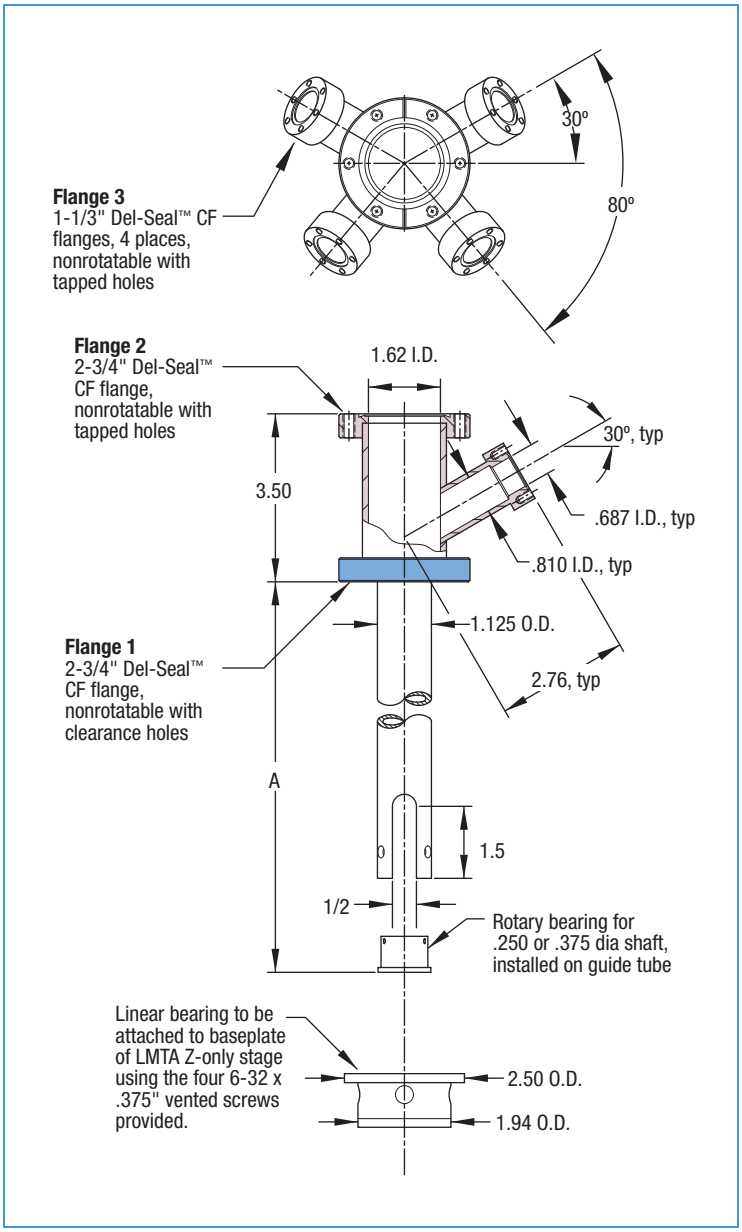


V-Plane®
Z Axis Guide Tube

ULTRAHIGH VACUUM SERIES

Features

- V-Plane® building block component[1]
- Used with 1-1/2 inch bore Z-axis V-Plane® stages with greater than 6 inch travel
- Bakeable to 230°C
- 1-1/3 inch Del-Seal™ CF access ports
- Linear bearing guide tube support
- Includes 1/4 and 3/8 inch diameter shaft rotary bearing supports



Description

MDC guide tubes provide bellows support for V-Plane® manipulator stages fitted with long-stroke bellows as well as secondary rotary and linear motion feedthroughs installed on the stage. Guide tubes mount directly onto V-Plane® manipulator stages fitted with 2-3/4" Del-Seal™ CF port flanges with a bore clearance suitable for the 1.125" guide tube diameter. They are supplied with both rotary and linear bearing supports. Rotary bearings for .250" and .375" diameter shafts are included. For applications requiring sample heating, cooling, high voltage biasing, thermocouple temperature measurements, etc., the guide tube tip has been fitted with two slots 180° apart through which wires or tubes can be fed. Four 1-1/3" and one 2-3/4" Del-Seal™ CF flange accessory ports allow the installation of up to five additional accessory components. When a manipulator stage is not under vacuum or is let up to air with the bellows in some state of compression, the compressed bellows' spring force may force the bellows to shift off-axis at some point during its travel. The off-axis shift could be sudden and violent causing injury or damage to the bellows.

MDC recommends that all long-stroke 1.50" diameter bore Z axis V-Plane® stages, with linear travels exceeding six inches, be fitted with guide tubes. Look for the ↗ symbol for other mating building block components. Note that the linear bearing support on a guide tube requires a 2.5" bore in any mating component.

Specifications

Material	
Flange / Body	304ss
Bearings	300 series stainless steel with Dicronite® coating
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	-200 to 230°C
Weight & Dimensions	See table

[1] Reference page 414 for related V-Plane® components.

V-Plane®
Z Axis Guide Tube

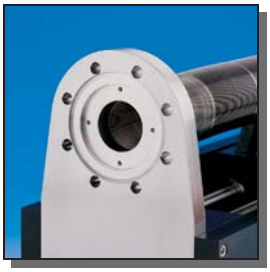
ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 230°C

A	USE [2] WITH	FLANGE 1	FLANGE 2	FLANGE 3	WT LB	REFERENCE	PART NUMBER
19.50	665528	2-3/4	2-3/4	1-1/3	8	GT-1506	665576
21.50	665529	2-3/4	2-3/4	1-1/3	8	GT-1508	665577
25.50	665530	2-3/4	2-3/4	1-1/3	9	GT-1512	665578
31.50	665531	2-3/4	2-3/4	1-1/3	10	GT-1516	665579
43.50	665532	2-3/4	2-3/4	1-1/3	12	GT-1524	665580
61.50	665533	2-3/4	2-3/4	1-1/3	14	GT-1536	665581

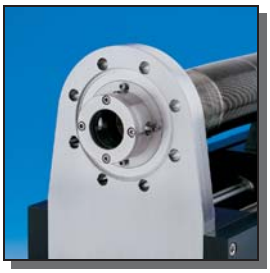
[2] Use with 1.50 inch bore, single axis Z stages on page 418.

Typical Guide Tube Application



The 4-1/2" Del-Seal™ CF base flange on V-Plane® stages with 1-1/2" bore is fitted with a counterbore and four tapped holes. This counterbore and tapped holes provide the means of attaching the guide tube's linear bearing support.

The guide tube extends into vacuum beyond the linear bearing support. The rotary bearing radial screws, located at guide tube tip, may need removing to properly fit guide tube through linear bearing housing.

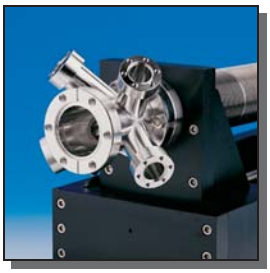


The linear bearing support is shown fastened to the 4-1/2" Del-Seal™ CF base flange of a V-Plane® single axis Z stage using four vented stainless steel socket head screws supplied with each guide tube assembly. The linear bearing support requires a 2.5" bore in any mating component.

Other motion products may be attached to the guide tube's main flange. Shown here is a precision rotary-linear instrument found in Section 7.3, page 404.

Six threaded studs are fastened to the V-Plane® Z axis stage top flange prior to inserting the guide tube through the top flange and bellows.

The rotary-linear drive shaft extends into vacuum beyond the rotary bearing support on the guide tube tip.



The guide tube assembly is secured to the V-Plane® Z axis stage top flange using the nuts and washers supplied.

Four mini Del-Seal™ CF ports can be used for the input or output of sample voltage biasing as well as thermocouple and other instrumentation signals. Insulated wires exit into vacuum through slots on guide tube tip.

Single Axis
Compact Z Stage

ULTRAHIGH VACUUM SERIES

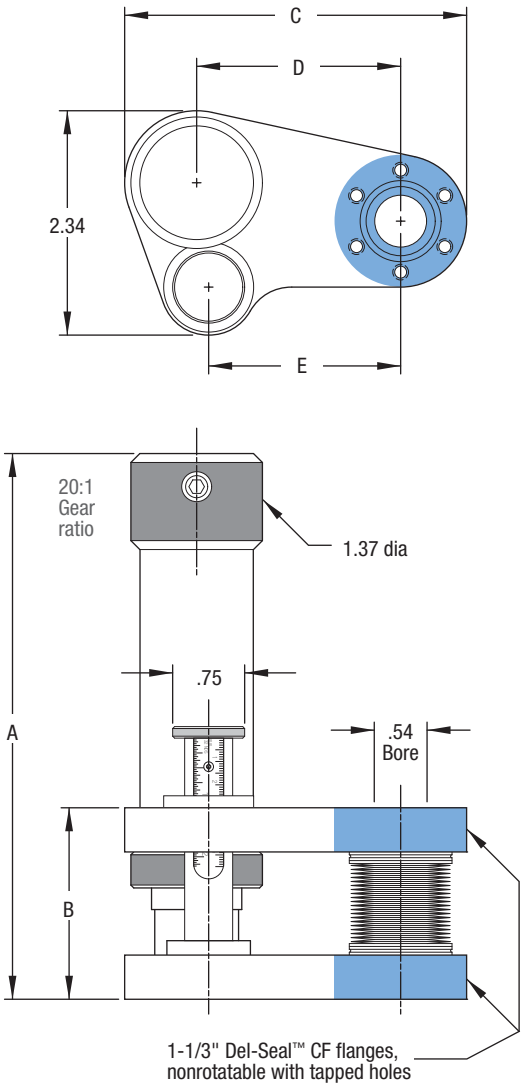
Features

- 1 to 4 inch Z-axis travel
- 1/2, 1-1/2 and 2-1/2 inch bore diameters
- Manual or Motorized actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Description

Compact single axis Z stages have smaller footprints than V-Plane® and other stages. They are a practical and economical solution for applications with limited space. Models with one to four inches of linear travel and bore diameters from 0.50" to 2.50" are available. The instrument's precision drive employs a fine pitch lead screw mechanism. Approximate positions can be measured along a graduated machinist's scale with both inch and millimeter units included. Top and bottom port flanges are available in 1-1/3", 2-3/4" and 4-1/2" Conflat® compatible, tapped Del-Seal™ CF metal seal flanges. Edge welded stainless steel bellows are used to connect the port flanges on all com-pact stages.

Figure 1



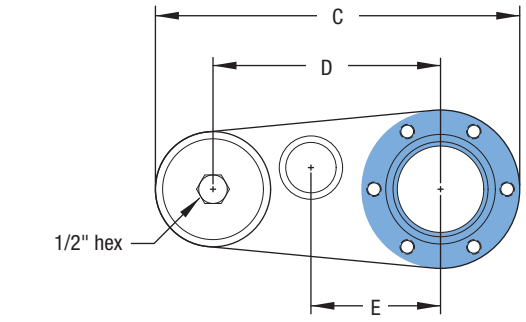
Specifications

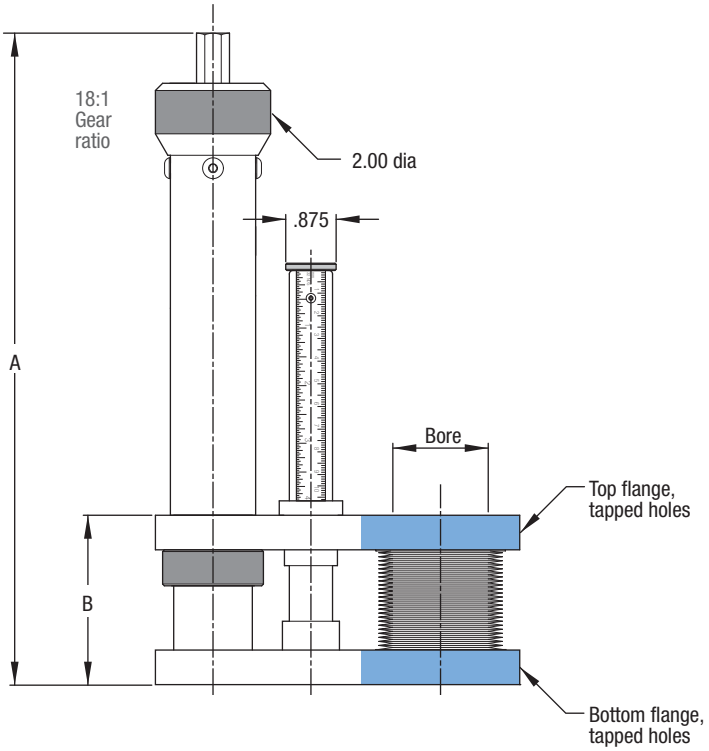
Material	
Flange / Body	304ss
Bellows	AM 350
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range [1]	-20°C to 230°C
Weight & Dimensions	See table

[1] Units are bakeable to 30°C maximum when motorized.

BORE SIZE	LINEAR TRAVEL	FLANGE SIZE	FIGURE	A MIN - MAX	B MIN - MAX	C	D	E	F	G	WT LB	REFERENCE	PART NUMBER
0.54 [3]	1.00	1-1/3	1	5.00 6.00	1.56 2.56	3.56	2.13	2.00	-	-	5	LMT-051	665516
0.54 [3]	2.00	1-1/3	1	6.40 8.40	2.00 4.00	3.56	2.13	2.00	-	-	5	LMT-052	665517
1.50	1.00	2-3/4	2	8.71 9.71	2.20 3.20	6.33	3.95	2.25	8.62	8.33	8	LMT-151	665501
1.50	2.00	2-3/4	2	8.71 10.71	2.20 4.20	6.33	3.95	2.25	9.62	8.33	9	LMT-152	665503
1.50	4.00	2-3/4	2	11.32 15.32	2.95 6.95	6.33	3.95	2.25	15.25	5.25	11	LMT-154	665505
1.50	6.00	2-3/4	2	13.75 19.75	3.25 9.25	6.33	3.95	2.25	20.25	8.33	13	LMT-156	665520
2.50	1.00	4-1/2	2	8.71 9.71	2.20 3.20	8.13	4.60	2.88	8.62	9.85	8	LMT-251	665522
2.50	2.00	4-1/2	2	8.71 10.71	2.20 4.20	8.13	4.60	2.88	9.62	9.85	9	LMT-252	665523
2.50	4.00	4-1/2	2	11.32 15.32	2.95 6.95	8.13	4.60	2.88	15.25	9.85	11	LMT-254	665524

Figure 2



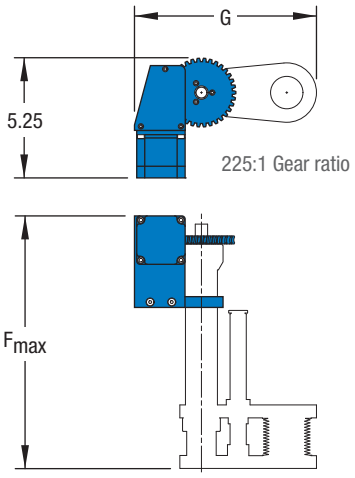


Motorization Options

[2] When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 665516-**01**. For total unit weight, add option weight to component weight. Refer to page 460 for motor specifications.

[3] Motorization not available on 0.54" bore diameter stages.

MOTORIZATION [2]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
Z SIDE MOUNT	E	3	-01



Triple Axis
Compact XYZ Stage

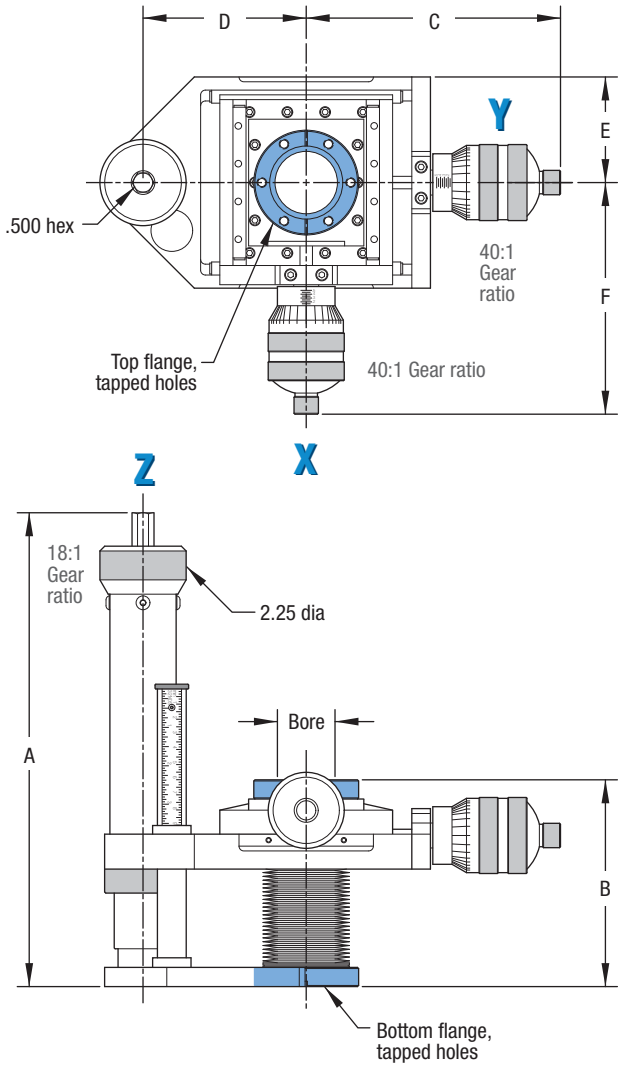
ULTRAHIGH VACUUM SERIES

Features

- 2 or 4 inch Z-axis travel
- Plus or minus 1/2 inch off center XY motion
- 1-1/2 and 2-1/2 inch bore diameters
- Manual or Motorized actuators
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Description

Compact triple axis XYZ stages have smaller footprints than V-Plane® stages. They are a practical and economical solution for applications with limited space. Models with two and four inch-es of linear travel and bore diameter of 1.50" and 2.50" are available. The instruments precision Z drive employs a fine pitch lead screw mechanism with approximate positions measured along a graduated machinist's scale with both inch and mil-limeter units included. The XY axes are micrometer driven and guided by cross roller bearing slides. Micrometers have unique laser etched plus-minus scales that indicate positive or nega-tive port displacement. MDC triple axis XY stages provide pre-cise motion and manipulation of samples inside ultrahigh vacu-um environments. Top and bottom port flanges are available in 2-3/4" and 4-1/2" Conflat® compatible, tapped Del-Seal™ CF metal seal flanges. Edge welded stainless steel bellows are used to connect the port flanges on all XYZ compact stages.



Specifications

Material

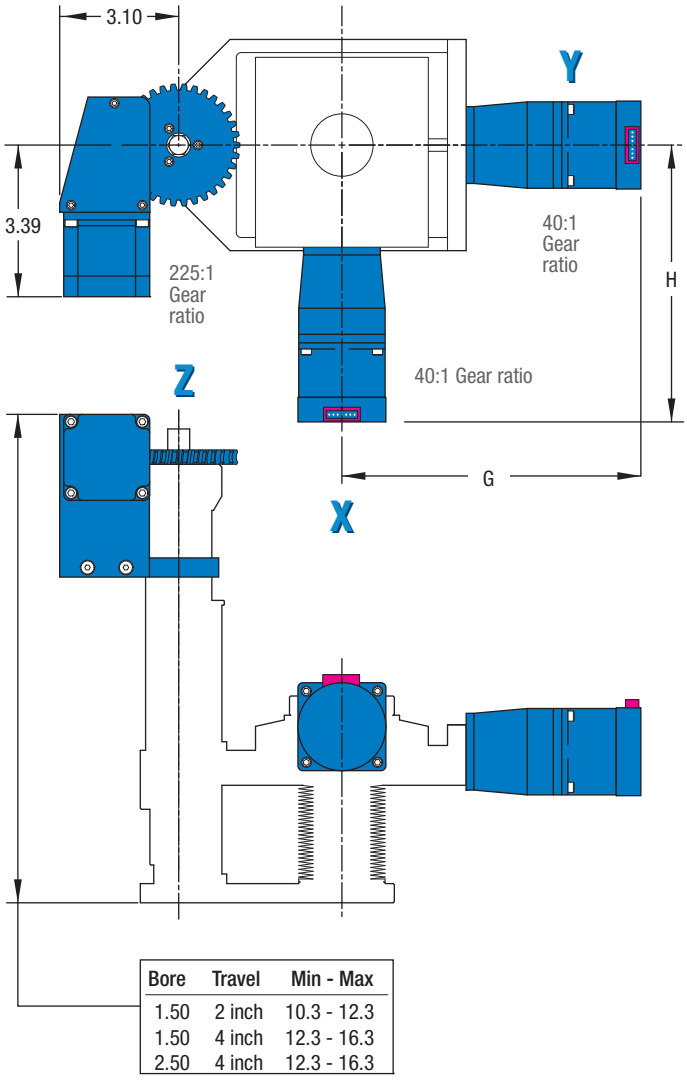
Flange	304ss
Actuator body	Anodized aluminum
Bellows	AM 350
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1]	-20°C to 230°C
Weight & Dimensions	See table

[1] Units are bakeable to 30°C maximum when motorized.

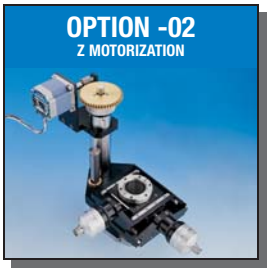
Triple Axis
Compact XYZ Stage

BORE SIZE	± XY TRAVEL	Z TRAVEL	FLANGE	A MIN	A MAX	B MIN	B MAX	C	D	E	F	G	H	WT LB	REFERENCE	PART NUMBER
1.50	0.50	2	2-3/4	9.8	11.8	4.9	6.9	6.45	4.13	2.75	5.90	8.50	7.78	24	PSM-1502	678004
1.50	0.50	4	2-3/4	11.8	15.8	4.9	8.9	6.45	4.13	2.75	5.90	8.50	7.78	25	PSM-1504	678005
2.50	0.50	4	4-1/2	13.92	17.92	5.8	9.8	7.00	5.25	3.40	6.37	8.96	8.21	28	PSM-2504	678006

Motorization Options



Bore	Travel	Min - Max
1.50	2 inch	10.3 - 12.3
1.50	4 inch	12.3 - 16.3
2.50	4 inch	12.3 - 16.3



MOTORIZATION [1]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
XY INLINE STEPPER	D	3	-01
Z SIDE MOUNT	E	3	-02

[1] When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 678004-**01-02**. For total unit weight, add option weight to component weight. Motor specifications are on page 460.

Triple Axis
Standard XYZ Stage

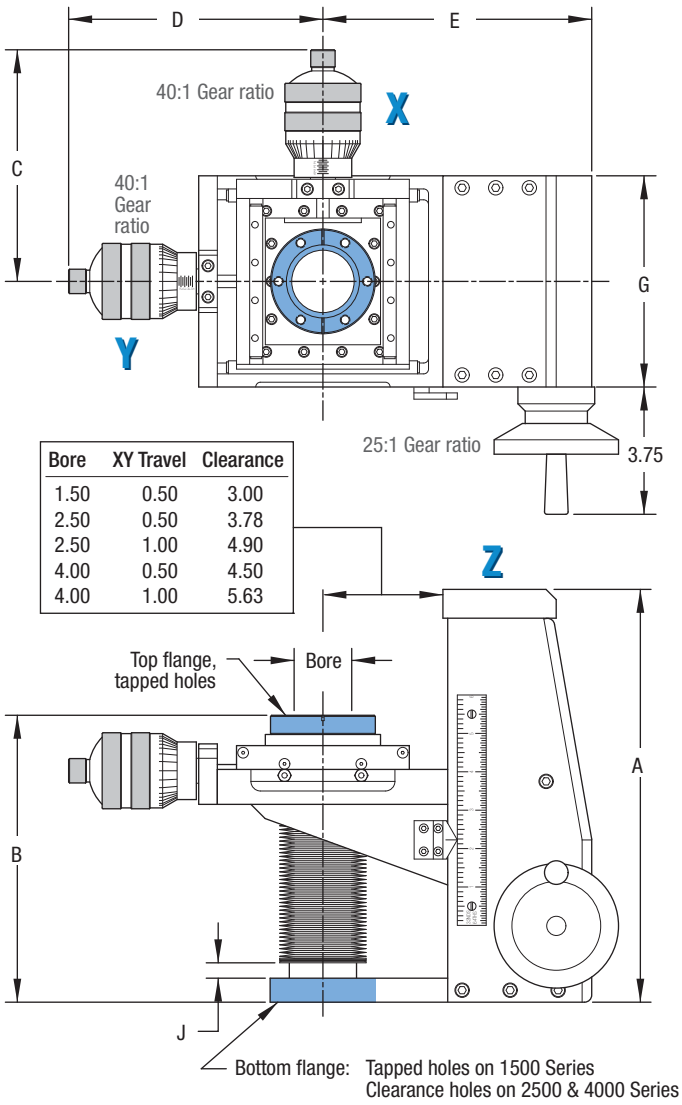
ULTRAHIGH VACUUM SERIES

Features

- 4 to 12 inch Z-axis travel
- Plus or minus 1/2 and 1 inch off center XY motion
- 1-1/2, 2-1/2 and 4 inch bore diameters
- Manual or Motorized actuators
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Description

Standard XYZ stages are large bore stages which incorporate triple axis motion in a single stage. The XY travels are micrometer driven and guided by cross roller bearing slides. MDC micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement and are available with either 0.50" or 1.00" of linear XY displacement. The Z axis employs a handwheel and worm gear reduction drive mechanism with displacement measured along the stage's frame mounted machinist's scale. Z axis linear travels of up to 12" are available. MDC standard stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments. They are fitted with industry standard Conflat® compatible Del-Seal™ CF port flanges.



Bore	XY Travel	Clearance
1.50	0.50	3.00
2.50	0.50	3.78
2.50	1.00	4.90
4.00	0.50	4.50
4.00	1.00	5.63

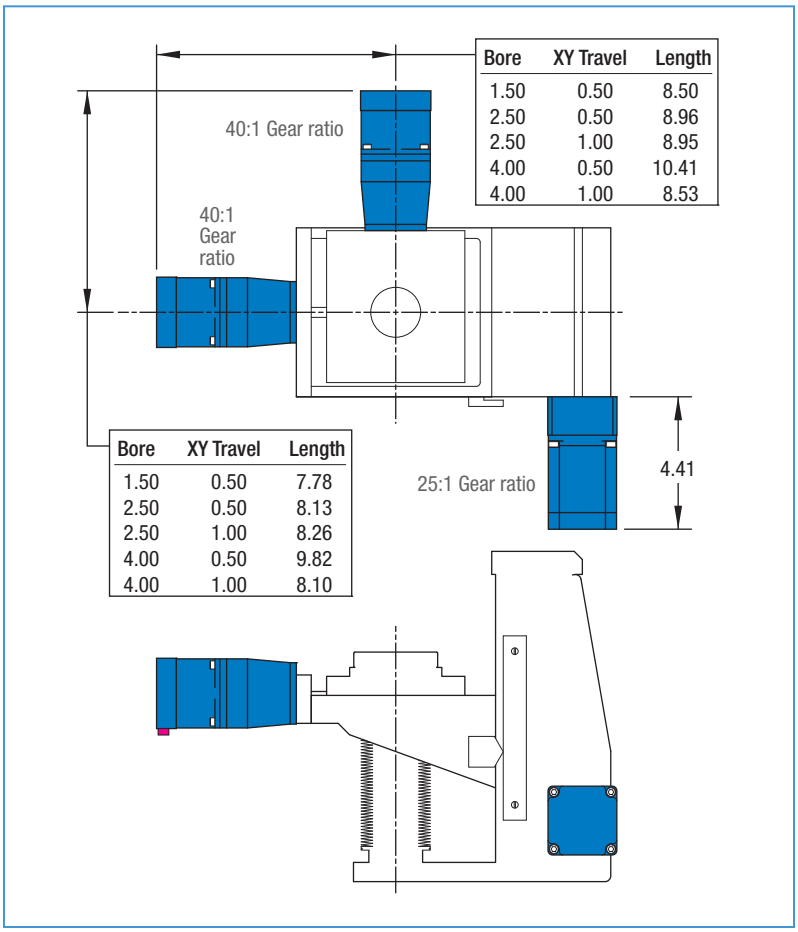
Specifications

Material	
Flange	304ss
Actuator body	Anodized aluminum
Bellows	AM 350
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range[1]	-20°C to 230°C
Weight & Dimensions	See table

[1] Units are bakeable to 30°C maximum when motorized.

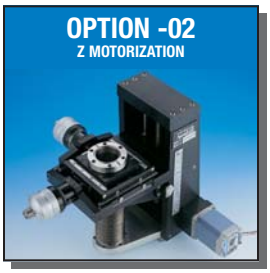
BORE	± X-Y TRAVEL	Z TRAVEL	FLANGE	A	B MIN	B MAX	C	D	E	G	J	WT LB	REFERENCE	PART NUMBER
1.50	0.50	4.00	2-3/4	10.8	7.0	11.0	5.90	6.45	7.00	5.50	1.25	20	PSMA-1504	678026
1.50	0.50	6.00	2-3/4	12.8	7.0	13.0	5.90	6.45	7.00	5.50	1.25	25	PSMA-1506	678027
1.50	0.50	8.00	2-3/4	15.9	8.2	16.2	5.90	6.45	7.00	5.50	1.25	42	PSMA-1508	678028
1.50	0.50	12.00	2-3/4	22.2	10.5	22.5	5.90	6.45	7.00	5.50	1.25	46	PSMA-1512	678029
2.50	0.50	4.00	4-1/2	11.7	8.3	12.3	6.37	7.00	7.70	7.12	2.25	44	PSMA-2504	678034
2.50	0.50	6.00	4-1/2	13.7	8.3	14.3	6.37	7.00	7.70	7.12	2.25	46	PSMA-2506	678035
2.50	0.50	8.00	4-1/2	16.0	8.5	16.5	6.37	7.00	7.70	7.12	2.25	48	PSMA-2508	678036
2.50	0.50	12.00	4-1/2	20.2	8.8	20.8	6.37	7.00	7.70	7.12	2.25	51	PSMA-2512	678037
2.50	1.00	4.00	4-1/2	12.4	9.0	13.0	8.12	8.87	9.00	7.35	2.25	48	PSML-2504	678010
2.50	1.00	6.00	4-1/2	14.4	9.0	15.0	8.12	8.87	9.00	7.35	2.25	50	PSML-2506	678011
2.50	1.00	8.00	4-1/2	16.7	9.3	17.3	8.12	8.87	9.00	7.35	2.25	52	PSML-2508	678012
2.50	1.00	12.00	4-1/2	20.63	9.39	21.39	9.95	10.15	9.00	7.35	2.16	55	PSML-2512	678013
4.00	0.50	4.00	6	12.4	9.0	13.0	7.25	7.68	9.90	8.37	2.50	48	PSMA-4004	678042
4.00	0.50	6.00	6	14.6	9.3	15.3	7.25	7.68	9.90	8.37	2.50	50	PSMA-4006	678043
4.00	0.50	8.00	6	16.9	9.5	17.5	7.25	7.68	9.90	8.37	2.50	52	PSMA-4008	678044
4.00	0.50	12.00	6	21.0	9.7	21.7	7.25	7.68	9.90	8.37	2.50	56	PSMA-4012	678045
4.00	1.00	4.00	6	13.2	9.7	13.7	10.00	10.50	10.40	8.81	2.50	52	PSML-4004	678018
4.00	1.00	6.00	6	15.3	9.8	15.8	10.00	10.50	10.40	8.81	2.50	54	PSML-4006	678019
4.00	1.00	8.00	6	17.7	10.2	18.2	10.00	10.50	10.40	8.81	2.50	56	PSML-4008	678020
4.00	1.00	12.00	6	21.7	10.2	22.2	10.00	10.50	10.40	8.81	2.50	60	PSML-4012	678021

Motorization Options



Bore	XY Travel	Length
1.50	0.50	8.50
2.50	0.50	8.96
2.50	1.00	8.95
4.00	0.50	10.41
4.00	1.00	8.53

Bore	XY Travel	Length
1.50	0.50	7.78
2.50	0.50	8.13
2.50	1.00	8.26
4.00	0.50	9.82
4.00	1.00	8.10



MOTORIZATION [1]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
XY INLINE STEPPER	D	3	-01
Z INLINE STEPPER	F	3	-02

[1] When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 678026-**01-02**. For total unit weight, add option weight to component weight. Motor specifications begin on page 460.

Rotatable Axis

360° Adjustable Stage

RMTG-450

HIGH VACUUM SERIES

Features

- 360° continuous rotary positioning
- Manual or motorized actuator
- Rotary position lock
- Differentially pumped, dual PTFE elastomer seals
- HV compatible materials
- Bakeable to 200°C
- Del-Seal™ CF port mounts

Description

Rotatable axis stages replace conventional rotatable mounting tables previously offered by MDC. They provide 360° positioning with greater precision, control and ease of use. Rotatable stages are constructed with worm gear drive mechanisms which offer substantial mechanical advantage over non-geared designs, a feature which allows effortless manual operation, even under a full vacuum load. High torque stepper motors are also available for these stages.

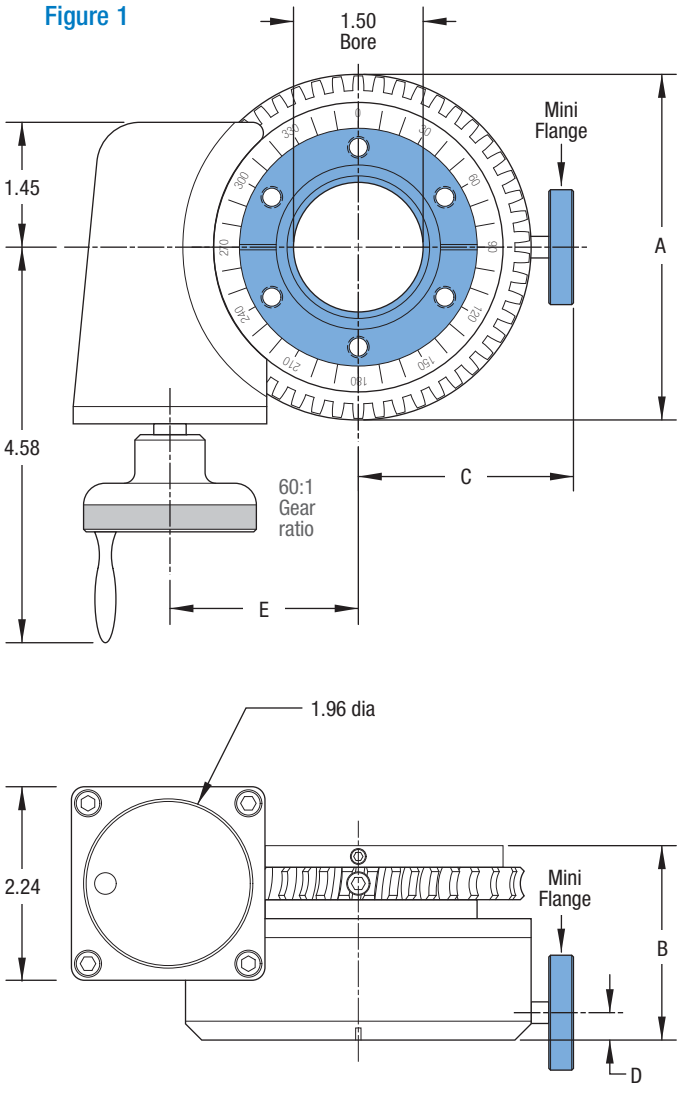
MDC rotatable stages can be used to rotate heavy samples or sample support apparatus and structures. Two spring energized PTFE face seals are at the heart of the rotatable stage's sealing mechanism. With provision for differential pumping between the seals, these rotatable stages can be used in UHV environments with bakeout temperatures as high as 200°C. They are fitted with industry standard Conflat® compatible Del-Seal™ CF port flanges.

Specifications

Material	
Flange	304ss
Actuator body	Anodized aluminum
Gasket Seals	PTFE
Vacuum Range	
HV applications:	$1x10^{-8}$ Torr
UHV applications:	Differentially pumped to 10^{-2} Torr
Temperature Range[1]	-20°C to 200°C
Weight & Dimensions	See table

[1] Units are bakeable to 30°C maximum when motorized.

Figure 1



Both top and bottom flanges have tapped holes

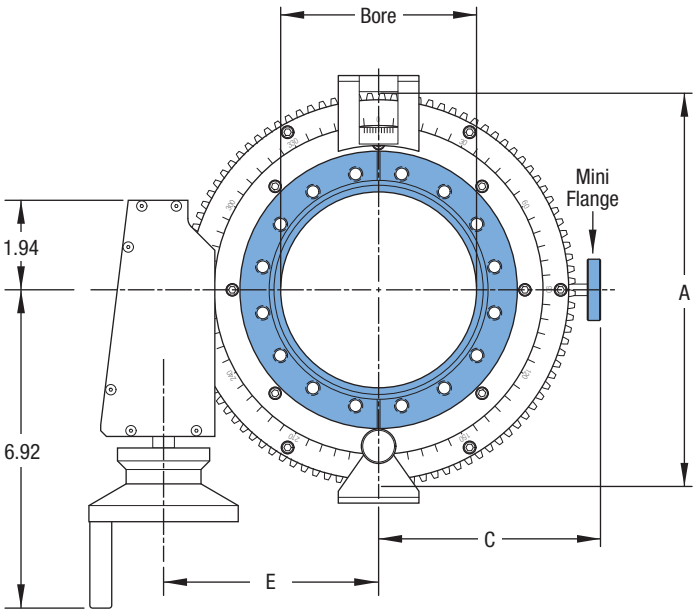
Motion & Manipulation

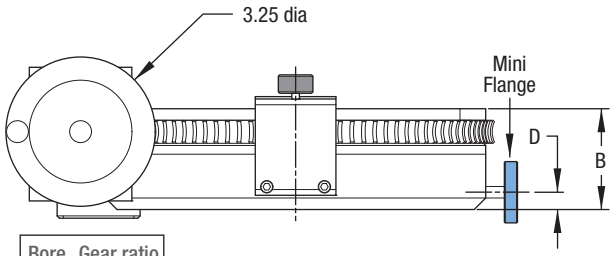
Rotatable Axis
360° Adjustable Stage

HIGH VACUUM SERIES
Del-Seal™ CF 200°C

BORE SIZE	FLANGE SIZE	FIG.	A	B	C	D	E	WT LB	REFERENCE	PART NUMBER
1.50 [3]	2-3/4	1	4.00	2.25	2.49	0.31	2.18	10	RMTG-275	665410
2.50	4-1/2	2	6.81	2.19	4.50	0.44	2.67	20	RMTG-450	665411
4.25	6	2	8.35	2.19	4.82	0.38	4.67	25	RMTG-600	665412
6.25	8	2	12.25	2.44	6.25	0.38	6.75	40	RMTG-800	665413
8.25	10	2	12.75	2.44	7.25	0.38	7.00	55	RMTG-1000	665414

Figure 2





Bore	Gear ratio
2.50	80:1
4.00	100:1
6.00	96:1
8.00	100:1

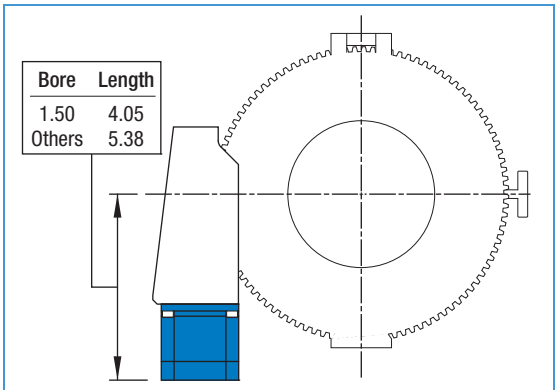
Both top and bottom flanges have tapped holes

Motorization Options

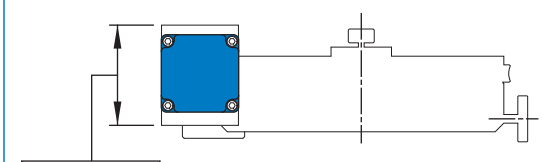
[2] When ordering motorized options, add the option number and price to the desired HV component part number listed above. For example: 665410-**01**. For total unit weight, add option weight to component weight. Refer to page 461 for motor specifications.

[3] The 1.50" bore stage uses specification E medium torque stepper motors.

MOTORIZATION [2]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
SIDE STEPPER	E & F	3	-01



Bore	Length
1.50	4.05
Others	5.38



Bore	Length
1.50	2.24
Others	2.90

Load-Lock Systems

Introduction

Circular and rectangular entry Load-Lock systems, page 432

- Load-lock systems
- Sample staging chamber
- Gate valves
- Magnetic transporters
- Quick-access doors
- Observation Viewports
- Port Aligners

Load-Lock Systems

Load-lock systems are atmosphere to vacuum sample staging and entry systems typically mounted to larger research or process systems. They are a convenient and practical method for transferring samples in and out of vacuum systems. MDC load-lock systems are available with both circular and rectangular entry ports. Circular port systems will accommodate sample sizes of 1-3/8", 2-3/8" and 3-3/4" in diameter. Rectangular port systems will accommodate sample sizes 8" in diameter. All load-lock systems are comprised of five basic components including a sample staging chamber, gate valve, sample transporter, quick-access door and an observation window.

Sample Staging Chambers

Spherical sample staging chambers are constructed with seven vacuum ports, six of these are arranged in a six-way cross pattern. Four of the seven ports are occupied by load-lock system components including a circular gate valve, magnetic transporter, a side mounted quick-access door and an observation viewport. Two additional ports are used for system pumpdown and venting. The seventh and final port is blanked off and available for customer disposition.

Rectangular sample staging chambers are constructed with five vacuum ports, four of which are arranged in a four-way cross pattern. Three of the five ports are occupied by load-lock system components including a rectangular gate valve, magnetic transporter and a top mounted quick-access door with an integral observation window. The two remaining ports are used for system pumpdown and venting.

Gate Valves

The stainless steel vacuum gate valves used on load-lock systems incorporate a patented gate valve locking mechanism. No contact is made between the valve's body and the locking mechanism, a feature which markedly decreases vibration and insures smooth valve operation. Valve low outgassing characteristics can be attributed to a fusion welded stainless steel body, edge welded stainless steel bellows as well as small cross-section o-rings and the elimination of blind internal cavities.

The valve's gate and carriage can be removed through the valve's bonnet flange for gate seal replacement, cleaning, etc., without removing the valve body from the system. MDC gate valves require about half the number of moving parts found in comparable valves. This reduction in moving components minimizes wear and particulate generation which in turn provides valves of superior performance and reliability. Circular load-lock systems are offered with three gate valves sizes 1-1/2, 2-1/2 and 4 inch port diameters. Standard port mounts are Del-Seal™ CF metal seal flanges, which are ideal for ultrahigh vacuum systems. Gate valve actuation is manual with electropneumatic configurations available on request.

Rectangular valves are designed for use in high vacuum applications including semiconductor processing. Flange-to-flange body thickness is 2.75" (70mm). Load-lock systems are offered with a slit port 1.00" tall by 8.30" wide. These gate valves are fitted with manual actuators but can be ordered in electropneumatic configurations.

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to dis-color when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.

Small bore Load-Lock system page 432

Viewport fitted Quick-Access doors page 438

Load-Lock Systems
Introduction

Magnetic Transporters

All load-lock systems are supplied with UHV magnetically coupled sample transporters. Sample transporters provide manually actuated linear travel and a full 360° sample rotation, ideal for transporting samples between the sample staging chamber and a main process chamber.

Linear positioning is controlled by sliding an external sleeve which is magnetically coupled with the transporter rod and sample holder inside the system. Optional linear guide rods can be added to circular entry load-lock systems. Rectangular entry load-lock systems include the guide rod option since rotation of large diameter samples is not possible on these systems. Guide rods prevent sample rotation during linear travel.

Magnetic transporters come ready to accept the complete range of Cab-Fast® in-vacuum sample handling accessories. Cab-Fast® sample handlers are specifically designed for use with the transporters featured in this catalog. Sample holding accessories are not included with base load-lock systems and must be purchased separately. Reference page 444 for the complete line of Cab-Fast® sample handling components and their specifications.

Quick-Access Doors

Quick-Access doors provide convenient and fast manual loading of samples in and out of sample staging chambers. Circular load-lock systems are fitted with blank stainless steel quick-access doors while the rectangular systems have quick-access doors with integral glass observation ports. Circular load-lock systems can be fitted with viewport fitted doors if requested. All access doors are supplied with FKM / FPM fluoroelastomer elastomer seals. High temperature Kalrez® elastomers can be used to increase the systems maximum temperature rating.

Doors are hinged and use a swing-away hand knob locking mechanism. Viewport fitted doors are constructed with Corning type 7056 glass fused to Kovar® transition sleeves.

Observation Viewports

Load-lock system viewports are centered on the sample staging chamber directly above and perpendicular to the transporter's axis of motion. They are observation ports that allow visual monitoring of the sample loading process as well as subsequent sample rotation during transfer between chambers.

Circular load-lock systems are fitted with flange mounted viewports bolted to the staging chamber. Rectangular load-lock systems on the other hand have a limited number of ports and therefore have viewports installed directly to the quick-access door. Regardless of the method of installation, all viewports are constructed of vacuum compatible materials suitable for high and ultrahigh vacuum service. The viewport windows are manufactured of optical grade Corning type 7056 glass which is suitable for most vacuum optical applications. These glass viewports are bakeable to 400°C and limited only by elastomer seals elsewhere in the system. The 7056 glass is fused to a Kovar® metal sleeve which in turn is fusion welded to a stainless steel Del-Seal™ CF flange or directly to a quick-access door. The Kovar® sleeve is a low expansion nickel-iron alloy ideally suited for glass to metal bonding. It provides flexibility necessary for the survival of the glass seal during thermal excursions. Care should be taken during the bakeout process of any glass to metal sealed component. The maximum recommended thermal gradient for glass to metal sealed components should not exceed 5°C per minute. Thermal gradients in excess of this can damage the glass to metal seal interface.

Port Aligners

Port aligners are adjustable port flange interfaces designed to correct mate-up between components with alignment imperfections.

Load-lock gimbals are unique port alignment instruments specifically designed for the precision alignment of magnetically coupled transporters as used with circular and rectangular entry load-lock systems presented herein. Load-lock gimbal port aligners are fitted with precision micrometer adjustments for both horizontal tilt (above and below a horizontal plane of travel) and side to side parallel axial displacement. They include a stainless steel formed bellows adapter which mates between the magnetic transporter and the sample staging chamber. See page 440 for more details on load-lock gimbal port aligners.

Other port alignment tools offered in this catalog include standard gimbals, precision off-axis and heavy duty off axis port aligners. For more details on these port alignment tools please reference page 441.

HV and UHV Magnetic Transporters page 436

Transporter alignment gimbals page 440

Cab-Fast® and Auto-Dock™ components page 443

Load-Lock Systems

Circular Entry

ULTRAHIGH VACUUM SERIES

Features

- Circular port, manually actuated, UHV gate valve
- 1-3/8, 2-3/8 and 3-3/4 inch sample diameters
- Continuous rotary motion and 12 to 36 inch linear travel
- Magnetically coupled, guided or unguided transporters
- Rotary position lock on guided model transporters
- Sample chamber with viewport and quick-access door
- Vertical or horizontal installation
- UHV compatible materials
- Bakeable to 150°C
- Del-Seal™ CF port mounts

Description

Circular entry load-lock systems allow quick and easy loading or unloading of samples between connected vacuum chambers without breaking the main system vacuum. Samples are loaded onto the magnetically coupled transporter through a quick-access door on the spherical sample staging chamber. Loading can be monitored through the viewport located directly above the access door. After the transfer chamber has been evacuated to the desired vacuum level the chamber load-lock valve is opened for sample transfer into the main system chamber. The sample can be moved from 12 to 36 linear inches, depending on transporter model installed. Sample positioning is controlled by sliding an external actuator housing, fitted with permanent magnets, which magnetically couples with the transporter rod inside the sample chamber. These transporters are UHV compatible and fitted with a linear bearing shaft support. To prevent sample rotation, an optional transporter guide rod can be installed. Optional transporter alignment gimbals provide compensation for chamber port misalignment and other minor system imperfections. Transporter alignment gimbals must be purchased separately and are detailed on page 440 of this catalog.

Specifications

Gate Valves	See gate valve catalog
Transporter	See page 436
Quick-Access Doors	See page 438
Vacuum Range	$1x10^{-10}$ Torr
Temperature Range[1]	-20°C to 150°C
Weight & Dimensions	See table

[1] Magnets must be removed for 150°C rating; 30°C maximum when attached.

The back side of circular entry load-lock systems are fitted with an auxiliary 2-3/4" Del-Seal™ CF port for attachment of other vacuum hardware. This port is shipped blanked-off and is available for customer hardware installation. Just below and to the left of this port is a 1-1/3" Del-Seal™ CF port used for the installation of an up to air valve.

The quick-access door swings clear for sample entry and removal. The tip of the magnetic transporter is accessible through this door and is shown here with a Cab-Fast® sample handling fork. The FKM / FPM fluoroelastomer elastomer seal is mounted to the chamber face. High temperature Kalrez® elastomer seals can be purchased separately to increase the system's bakeout temperature to 200°C.

This is the LLC-112 circular entry load-lock system, which is specifically designed for 1-3/8" or smaller sample diameters. The quick-access door on these miniature load-lock systems has been redesigned with a 2.00" aperture to allow easy sample entry and removal. All load-lock systems are sold standard with UHV rated magnetic transporters.

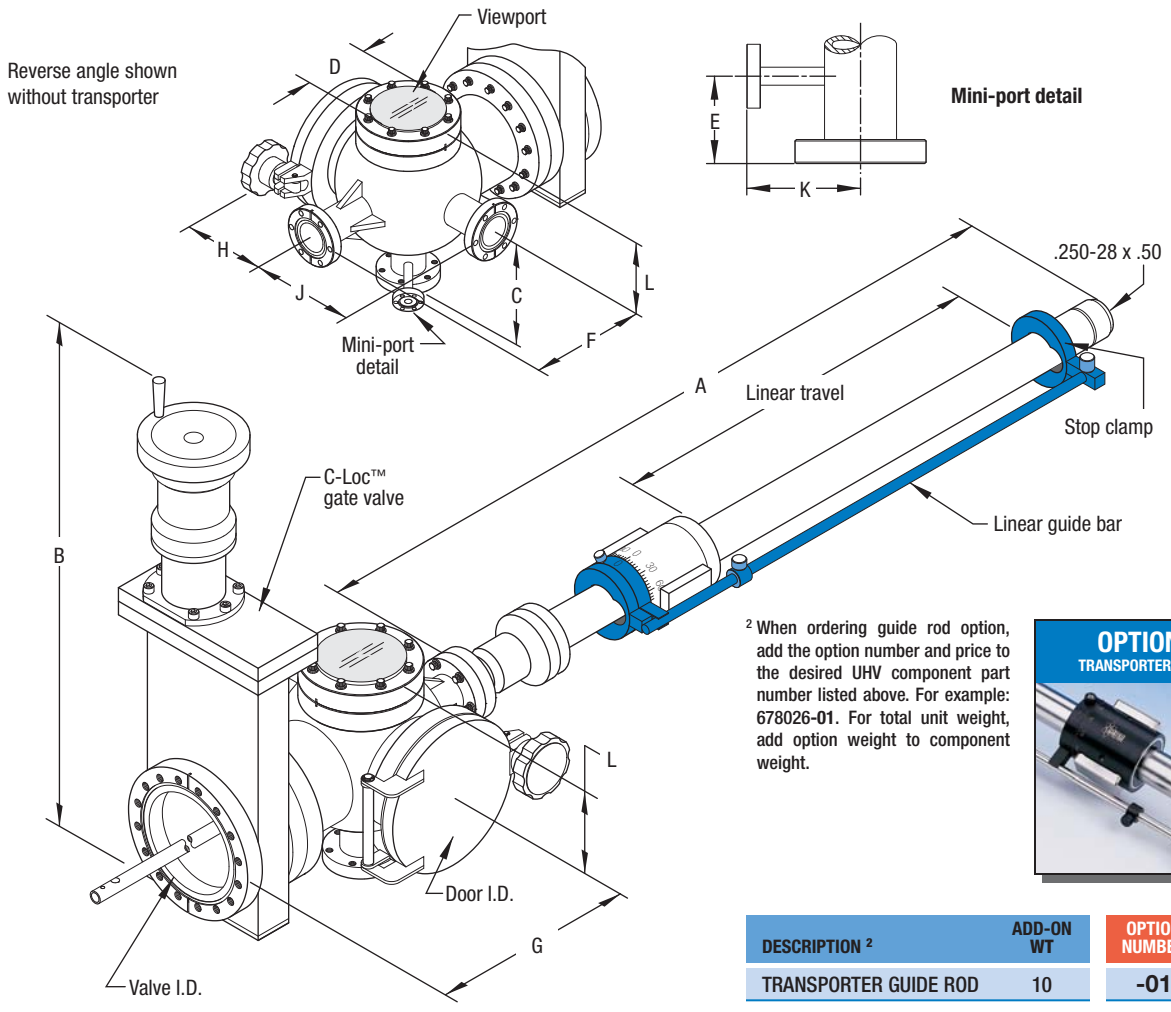
ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 150°C

SAMPLE SIZE	LINEAR TRAVEL	DOOR ID	VALVE ID	A	WT LB	REFERENCE	PART NUMBER
1-3/8	12.0	2.00	1.50	27.50	20	LLC-112	665080
1-3/8	24.0	2.00	1.50	41.00	22	LLC-124	665081
1-3/8	36.0	2.00	1.50	53.00	24	LLC-136	665082
2-3/8	12.0	2.38	2.50	27.50	36	LLC-212	665083
2-3/8	24.0	2.38	2.50	41.00	38	LLC-224	665084
2-3/8	36.0	2.38	2.50	53.00	40	LLC-236	665085
3-3/4	12.0	3.83	4.00	27.50	55	LLC-412	665086
3-3/4	24.0	3.83	4.00	41.00	57	LLC-424	665087
3-3/4	36.0	3.83	4.00	53.00	59	LLC-436	665088

Additional drawing dimensions

SAMPLE SIZE	B	C	D	E	F	G	H	J	K	L
1-3/8	10.32	1.83	1.40	-	1.83	6.06	3.25	1.83	3.25	2.33
2-3/8	12.71	4.12	2.69	1.25	3.25	6.88	3.80	3.25	2.50	3.18
3-3/4	21.00	4.88	3.88	1.25	4.75	8.36	5.36	4.75	2.75	3.68



[2] When ordering guide rod option, add the option number and price to the desired UHV component part number listed above. For example: 678026-**01**. For total unit weight, add option weight to component weight.

OPTION -01
TRANSPORTER GUIDE ROD

DESCRIPTION [2]	ADD-ON WT	OPTION NUMBER
TRANSPORTER GUIDE ROD	10	-01

Load-Lock Systems

Rectangular Entry

LLR-824

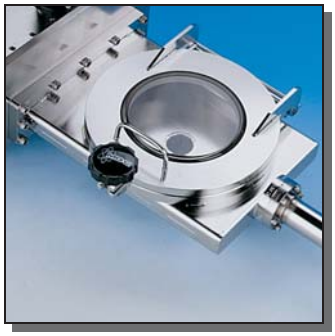
HIGH VACUUM SERIES

Features

- Rectangular port, manually actuated, HV gate valve
- 8 inch maximum sample diameter
- 12 to 36 inch linear travel
- Magnetically coupled guided transporter
- Rotary position lock
- Sample chamber with viewport fitted quick-access door
- Horizontal installation recommended
- HV compatible materials
- Bakeable to 150°C
- Del-Seal™ CF port mounts

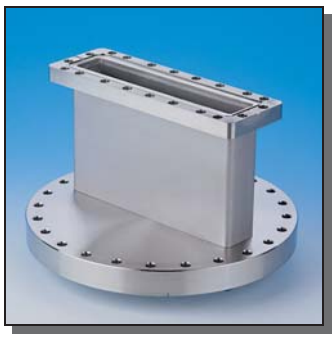
Description

Rectangular entry load-lock systems allow quick and easy load-ing or unloading of samples between connected vacuum cham-bers without breaking the main system vacuum. Samples are loaded onto a magnetically coupled transporter through the quick-access door located on the rectangular sample staging chamber. After the staging chamber has been evacuated to the desired vacuum level, the rectangular load-lock valve is opened for access into the main vacuum chamber. The sample can be moved 12 to 36 linear inches, depending on transporter model installed. Sample positioning is controlled by sliding an external actuator housing, fitted with permanent magnets, which mag-netically couples with the transporter rod inside the sample chamber. These transporters are UHV compatible and fitted with a linear bearing shaft support. To prevent sample rotation trans-porter is fitted with an external linear guide rod. Optional trans-porter alignment gimbals provide compensation for chamber port misalignment and other minor system imperfections. Transporter alignment gimbals must be purchased separately and are detailed on page 440 of this catalog.



The quick-access door swings clear for sample entry and removal. The tip of the magnetic transporter is accessible through this door. Various sample handling accessories including Cab-Fast® and Auto-Dock™ sample handling systems are available. Doors are sealed with FKM / FPM fluoroelastomer elastomer gaskets. High temperature Kalrez® elastomers can be used to increase the systems bake-out temperature to 200°C.

Rectangular entry load-lock systems are fitted with UHV rated magnetic transporters and include a transporter guide rod mechanism. The guide rod mechanism allows rotation lock during sample transfer. The magnets in the transporter actuator (black cylinder in photograph) must be removed for 150°C service or bakeout. The mag-nets must not be subjected to temper-atures in excess of 30°C.



Rectangular to circular flange adapters provide connectability between rectan-gular entry load-lock system gate valves and any vacuum chamber fitted with a 13-1/4" Del-Seal™ CF mating flange. These flange adapters are also available in other sizes for use with the full range of MDC rectangular gate valves. See page 435.

Specifications

Rectangular Gate Valve	See page 182
Magnetic Transporter	See page 436
Quick-Access Door	See page 438
Vacuum Range	$1x10^{-8}$ Torr
Temperature Range[1]	-20°C to 150°C
Weight & Dimensions	See table

[1] Magnets must be removed for 150°C rating; 30°C maximum when attached.

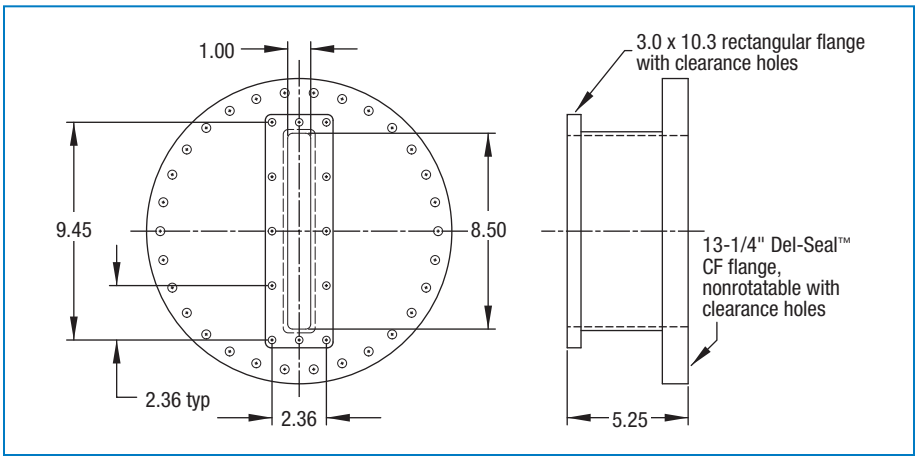
HIGH VACUUM SERIES
Elastomer Seal 150°C

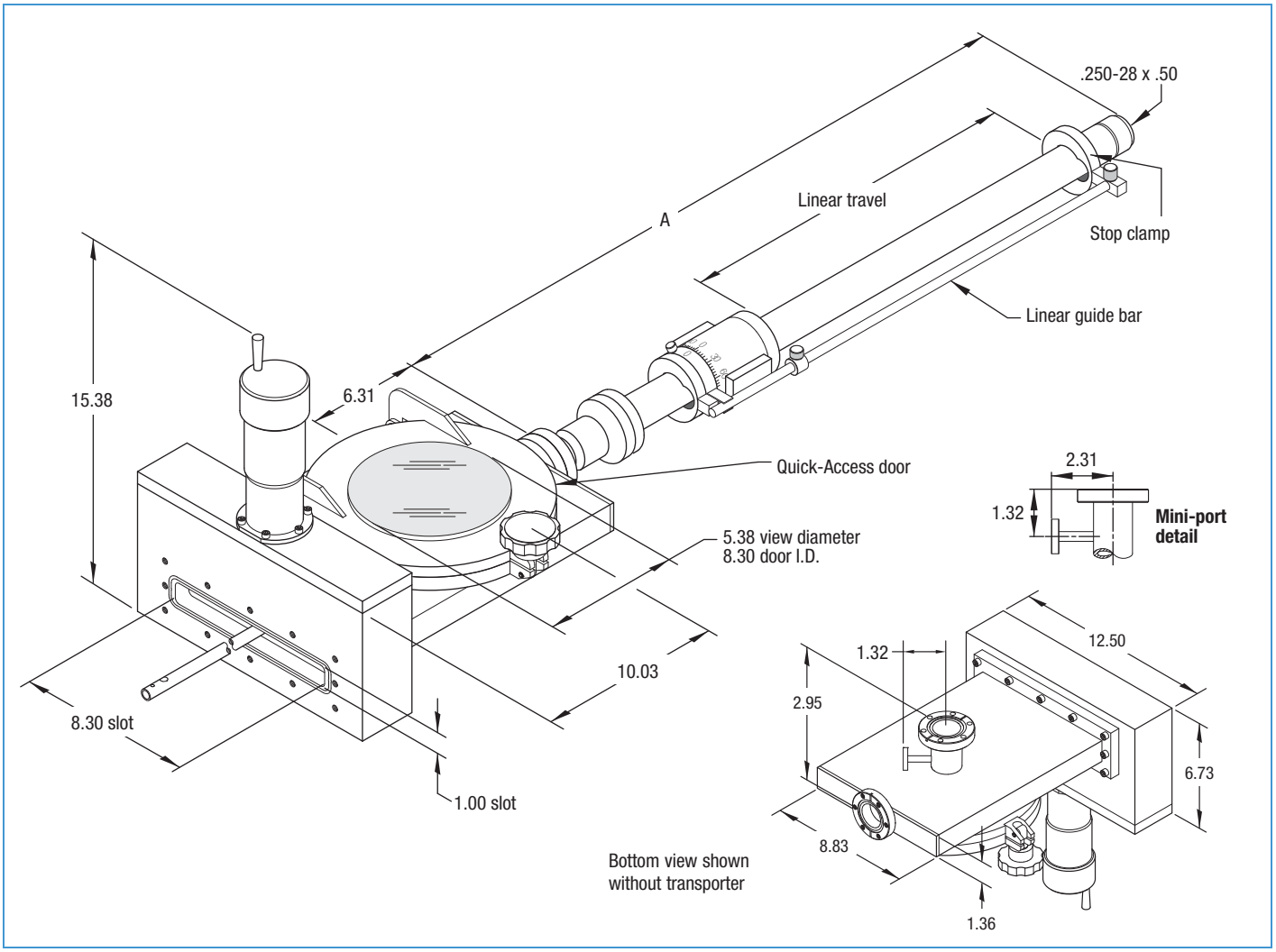
SAMPLE SIZE	LINEAR TRAVEL	A	VALVE APERTURE	WT LB	REFERENCE	PART NUMBER
8	12.00	27.50	1.0 x 8.3	105	LLR-812	665609
8	24.00	41.00	1.0 x 8.3	107	LLR-824	665610
8	36.00	53.00	1.0 x 8.3	110	LLR-836	665611

Flange Adapter

This drawing only represents the flange adapter used with the rectangular entry load-lock systems presented in this section. A photograph and description are detailed on the previous page.

REFERENCE	WT LB	PART NUMBER
F1x8	46	665801





Magnetic Transporter

Guided & Unguided

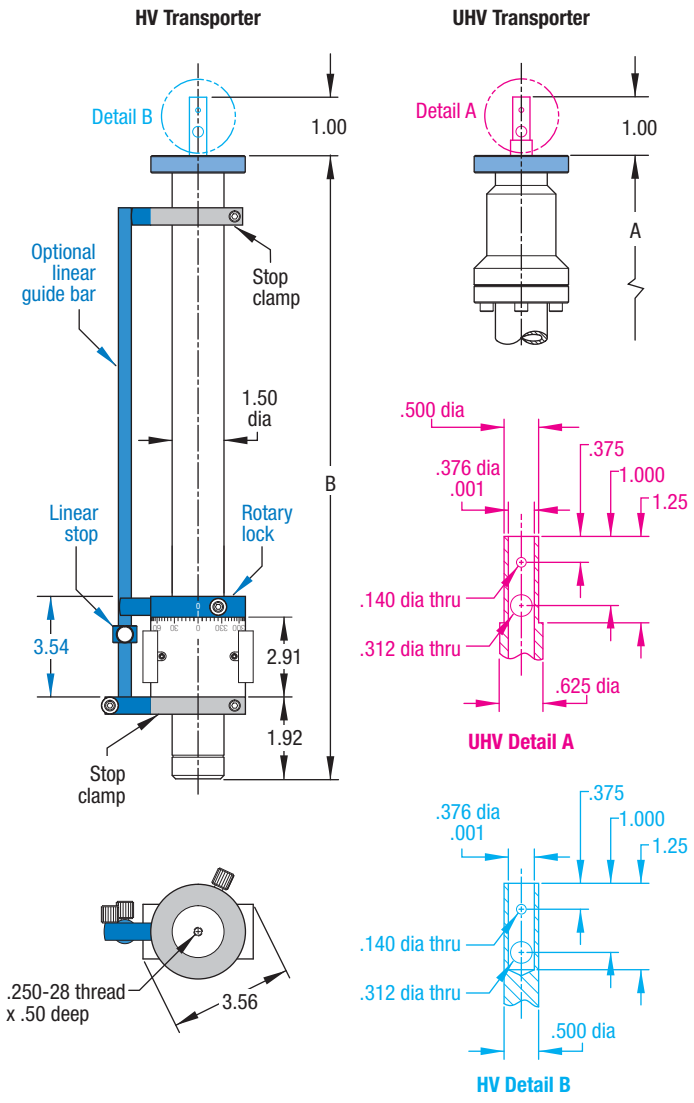
ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion when unguided
- 12, 24 and 36 inch linear travel
- Manual or Motorized linear travel actuator
- Rotary position lock when guided
- UHV or HV compatible materials
- Bakeable to 200°C
- Del-Seal™ CF port mounts

Description

Sample transporters provide manually actuated linear travel and full 360° sample rotation, ideal for transporting samples between vacuum chambers. Linear positioning is controlled by sliding an external sleeve which is magnetically coupled with the transporter's rod and sample holder inside the system. The shaft is supported with Vespel® or stainless steel linear bearings. Optional linear guide rods can be added to these transporters to prevent sample rotation during linear travel. Magnetic transporters accept a complete range of Cab-Fast® and Auto-Dock™ in-vacuum sample handling accessories. Cab-Fast® and Auto-Dock™ sample handlers are specifically designed for use with the transporters featured in this catalog. Sample holding accessories are not included with transporters and must be purchased separately. Reference page 443 for the complete line of sample handling components and their specifications.



• All transporters have 2-3/4" Del-Seal™ CF flanges, 2.73" diameter, nonrotatable with clearance holes.

Specifications

Material	
Flange and tube	304ss
Actuator housing and stop clamps	Anodized aluminum
Bearings HV / UHV	Vespel® / 300ss
Vacuum Range HV / UHV	$1x10^{-9}$ Torr / $1x10^{-11}$ Torr
Temperature Range[1] HV / UHV	150°C / 200°C
Decoupling Axial load [2]	5 pounds maximum
Torque	8.5 lb-in maximum
Lateral load	20 lb maximum
Weight & Dimensions	See table

[1] 30°C maximum with magnets or motorized.
[2] Dual magnet configuration is available to increase axial load capacity.

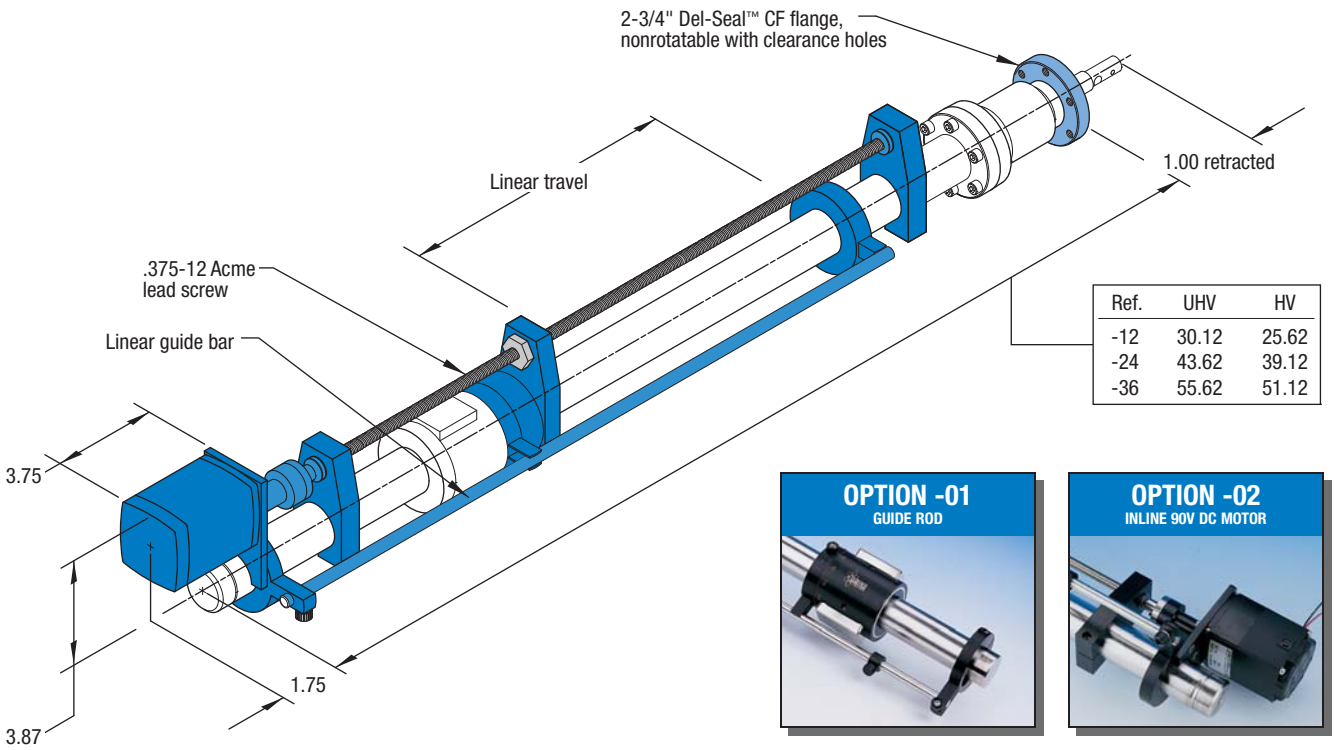
ULTRAHIGH VACUUM SERIES
Ball Bearings 200°C

TRANSPORTER TYPE	NOMINAL TRAVEL	FLANGE SIZE	A	WT LB	REFERENCE	PART NUMBER
UNGUIDED	12.00	2-3/4	27.50	10	MTM-12	665700
UNGUIDED	24.00	2-3/4	41.00	12	MTM-24	665701
UNGUIDED	36.00	2-3/4	53.00	14	MTM-36	665702

HIGH VACUUM SERIES
Vespel® Bearings 150°C

TRANSPORTER TYPE	NOMINAL TRAVEL	FLANGE SIZE	B	WT LB	REFERENCE	PART NUMBER
UNGUIDED	12.00	2-3/4	23.00	10	MT-12	665100
UNGUIDED	24.00	2-3/4	36.50	12	MT-24	665101
UNGUIDED	36.00	2-3/4	48.50	14	MT-36	665102

Transporter Options



Ref.	UHV	HV
-12	30.12	25.62
-24	43.62	39.12
-36	55.62	51.12

Motorized UHV Transporter

Motorized option includes a linear guide bar

OPTION -01
GUIDE ROD

OPTION -02
INLINE 90V DC MOTOR

DESCRIPTION [3]	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
GUIDE ROD	-	3	-01
MOTOR 90V DC [4]	B	3	-02

[3] When ordering transporter options, add the option number and price to the desired UHV or HV component part number listed above. For example: 665700-**02**. For total unit weight, add option weight to component weight. Refer to page 458 for motor specifications.

[4] Variable speed motor controller must be purchased separately. Refer to page 464 for details.

Quick-Access Doors

Blank & Viewport

HIGH VACUUM SERIES

Features

- Blank or viewport fitted doors
- FKM / FPM fluoroelastomer elastomer door seal
- HV compatible materials
- Bakeable to 150°C
- Del-Seal™ CF port mounts
- Tapped or clearance hole mounting port flange

Description

Quick-Access doors provide convenient and fast manual loading of samples in and out of vacuum chambers. Doors are hinged and fitted with a swing-away hand knob locking mechanism. Viewport fitted doors are constructed with Corning type 7056 glass fused to a Kovar® nickel-iron transition sleeve. All access doors are supplied with FKM / FPM fluoroelastomer elastomer seals suitable for high vacuum service. High temperature Kalrez® elastomers can be used to increase a door's maximum temperature rating.

Quick-Access doors with clearance mounting holes are intended for installation on chamber ports with tapped holes. To order this hardware, reference the hardware table below. Note that the mounting hardware listed below is not long enough to join a clearance hole door with a clearance hole flange.

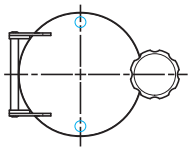
Quick-Access doors with tapped mounting holes are intended for installation on chamber ports with clearance holes. The hardware required to mount tapped hole doors is the same as for joining a standard clearance hole and tapped hole Del-Seal™ CF flange combination. To order this hardware reference Section 1.1 for Del-Seal™ CF flanges. Note that the mounting hardware listed below is not long enough for installation of a Quick-Access door with tapped mounting holes.

Non-opening viewports may be found in Section 5.1, page 306.

Specifications

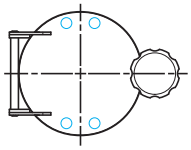
Material	
Flange	304ss
Door seal	FKM / FPM fluoroelastomer
Viewport	7056 Glass
Vacuum Range	$1x10^{-8}$ Torr
Temperature Range[1]	-20°C to 150°C
Weight & Dimensions	See table
Bolt Hole Orientation	Reference

On centerline



QD-275
QD-458
QD-675

Straddles centerline



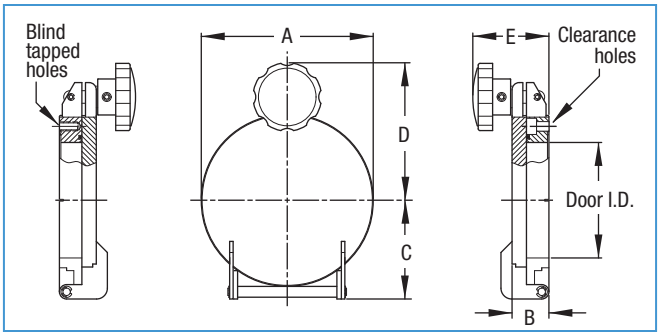
QD-338
QD-450
QD-600
QD-800
QD-1000
QD-1200
QD-1325
QD-1400
QD-1650

[1] Contact factory for high temperature rating.

Bolt Kits for Quick-Access Doors with Clearance Holes

DOOR FLANGE	BOLT SIZE	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
2-3/4	.250-28 x 1/2	6	1	BQD-275-CH	190138
3-3/8	.312-24 x 3/4	8	1	BQD-450-CH	190139
4-1/2	.312-24 x 3/4	8	1	BQD-450-CH	190139
4-5/8	.312-24 x 1	20	2	BQD-800-CH	190140
6	.312-24 x 1	20	2	BQD-800-CH	190140
6-3/4	.312-24 x 1	20	2	BQD-800-CH	190140
8	.312-24 x 1	20	2	BQD-800-CH	190140
10	.312-24 x 1-1/4	24	2	BQD-1000-CH	190141
12	.312-24 x 1-1/2	32	3	BQD-1200-CH	190152
13-1/4	.375-24 x 1-1/2	36	3	BQD-1325-CH	190142
14	.375-24 x 1-1/2	36	3	BQD-1325-CH	190142
16-1/2	.375-24 x 1-1/2	36	3	BQD-1325-CH	190142

BLANK DOOR
BLIND TAPPED HOLES

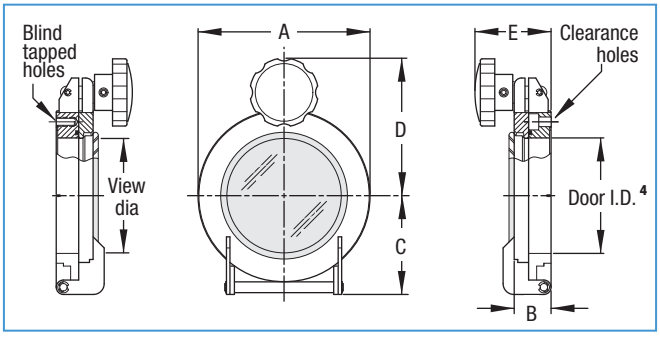


BLANK DOOR
CLEARANCE HOLES

PART NUMBER	REFERENCE	FLANGE SIZE	TAPPED HOLES	CLEAR HOLES	DOOR ID	A	B	C	D	E	WT LB	REFERENCE	PART NUMBER
665200	QD-275	2-3/4	.250-28	.265	1.60 [2]	2.73	0.89	1.74	2.25	1.46	2	QD-275-CH	665210
665236	QD-338	3-3/8	.312-24	.332	2.00	3.37	1.00	2.06	2.56	1.59	3	QD-338-CH	665237
665201	QD-450	4-1/2	.312-24	.332	2.51	4.47	1.06	2.97	3.76	1.86	5	QD-450-CH	665211
665220	QD-458	4-5/8	.312-24	.332	3.01	4.63	1.13	2.84	3.83	1.95	6	QD-458-CH	665221
665202	QD-600	6	.312-24	.332	4.01	5.97	1.28	4.04	4.77	2.64	11	QD-600-CH	665212
665224	QD-675	6-3/4	.312-24	.332	4.88	6.75	1.35	3.83	5.17	2.71	12	QD-675-CH	665225
665203	QD-800	8	.312-24	.332	6.02	7.97	1.38	5.03	5.78	2.78	20	QD-800-CH	665213
665204	QD-1000	10	.312-24	.332	8.02	9.97	1.51	5.63	6.77	2.91	25	QD-1000-CH	665214
665254	QD-1200	12	.375-24	.332	10.00	12.05	1.65	6.75	7.82	3.07	30	QD-1200-CH	665255
665228	QD-1325	13-1/4	.375-24	.390	10.77	13.25	1.77	7.74	8.42 [3]	3.17	35	QD-1325-CH	665229
665232	QD-1400	14	.375-24	.390	11.63	14.00	1.77	8.24	8.79 [3]	3.17	40	QD-1400-CH	665233
665250	QD-1650	16-1/2	.375-24	.390	14.00	16.50	1.77	4.25	10.04	3.17	50	QD-1650-CH	665251

Dimensions given in the center tables above and below apply to both the doors with tapped holes on the left and the doors with clearance holes on the right.

VIEWPORT DOOR
BLIND TAPPED HOLES



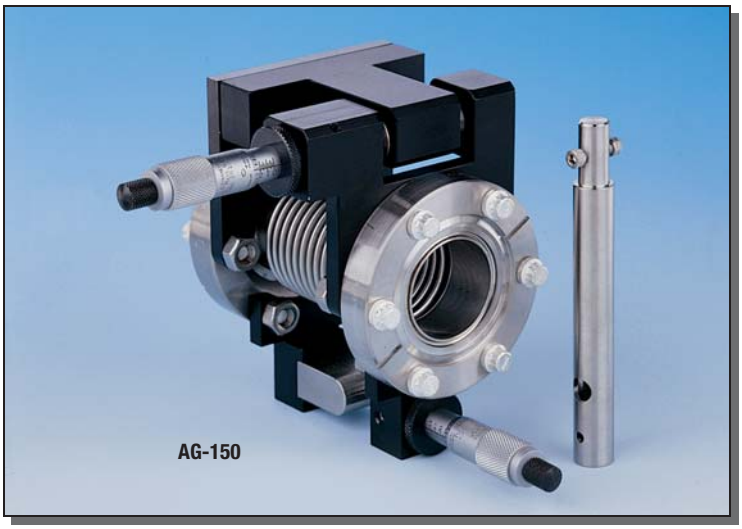
VIEWPORT DOOR
CLEARANCE HOLES

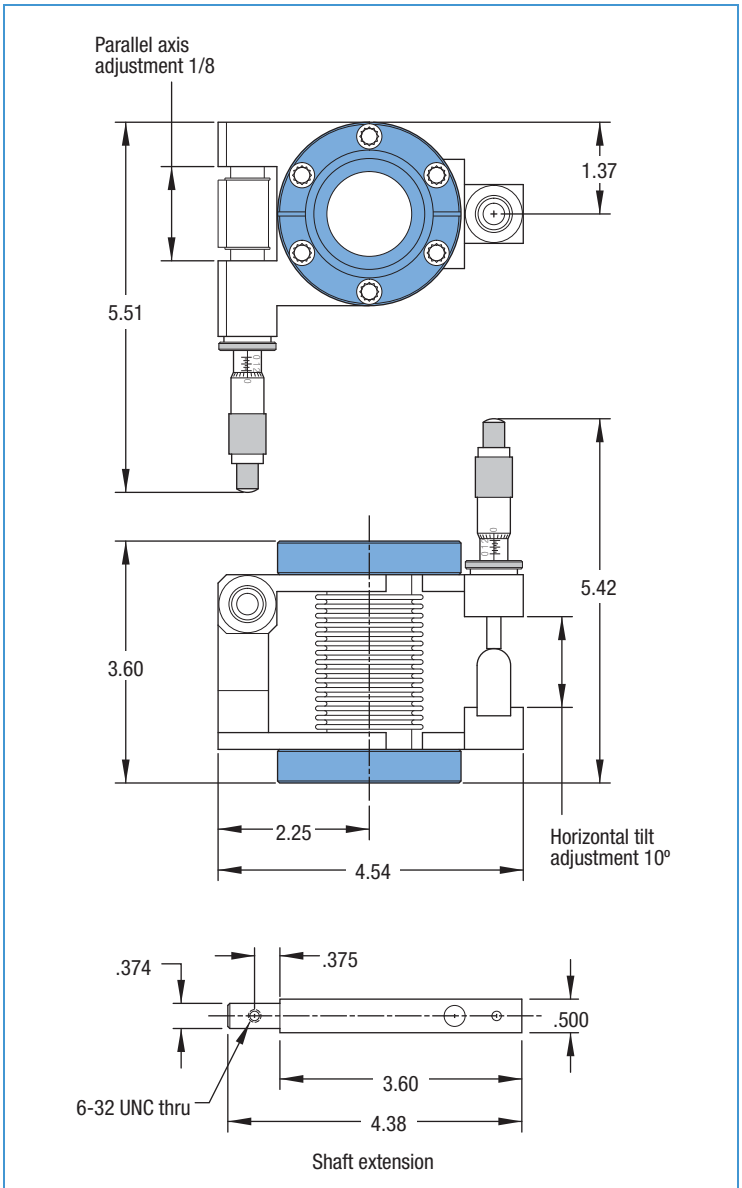
PART NUMBER	REFERENCE	FLANGE SIZE	TAPPED HOLES	CLEAR HOLES	VIEW DIA	A	B	C	D	E	WT LB	REFERENCE	PART NUMBER
665205	QD-275-VP	2-3/4	.250-28	.265	1.40	2.73	0.89	1.74	2.25	1.46	2	QD-275-VP-CH	665215
665238	QD-338-VP	3-3/8	.312-24	.332	1.40	3.37	1.00	2.06	2.56	1.59	3	QD-338-VP-CH	665239
665206	QD-450-VP	4-1/2	.312-24	.332	2.69	4.47	1.06	2.97	3.76	1.86	5	QD-450-VP-CH	665216
665222	QD-458-VP	4-5/8	.312-24	.332	2.69	4.63	1.13	2.84	3.83	1.95	6	QD-458-VP-CH	665223
665207	QD-600-VP	6	.312-24	.332	3.88	5.97	1.28	4.04	4.77	2.64	11	QD-600-VP-CH	665217
665226	QD-675-VP	6-3/4	.312-24	.332	3.88	6.75	1.35	3.83	5.17	2.71	12	QD-675-VP-CH	665227
665208	QD-800-VP	8	.312-24	.332	5.38	7.97	1.38	5.03	5.78	2.78	20	QD-800-VP-CH	665218
665209	QD-1000-VP	10	.312-24	.332	5.38	9.97	1.51	5.63	6.77	2.91	25	QD-1000-VP-CH	665219
665256	QD-1200-VP	12	.375-24	.332	5.38	12.05	1.65	6.75	7.82	3.07	30	QD-1200-VP-CH	665257
665230	QD-1325-VP	13-1/4	.375-24	.390	5.38	13.25	1.77	7.74	8.42 [3]	3.17	35	QD-1325-VP-CH	665231
665234	QD-1400-VP	14	.375-24	.390	5.38	14.00	1.77	8.24	8.79 [3]	3.17	40	QD-1400-VP-CH	665235
665252	QD-1650-VP	16-1/2	.375-24	.390	5.38	16.50	1.77	4.25	10.04	3.17	50	QD-1650-VP-CH	665253

[2] Nominal I.D. of door gasket is 1-3/8".
[3] Includes two latches at 45° above horizontal centerline.
[4] For viewport door I.D., use blank door I.D. in table above

Port Aligner
Load-Lock Gimbal

MDC PRECISION
Enabling Science to Change the World





ULTRAHIGH VACUUM SERIES

Features

- 10° horizontal tilt
- 1/8 inch axial displacement
- Micrometer actuators with position lock
- Formed bellows seal
- Bakeable to 200°C
- Del-Seal™ CF port mounts
- Includes magnetic transporter extension kit
- Horizontal orientation

Description

Port aligners are adjustable port flange interfaces that provide motion instruments with angular tilt and axial shift. They can also be used to correct mate-up between components with minor alignment imperfections.

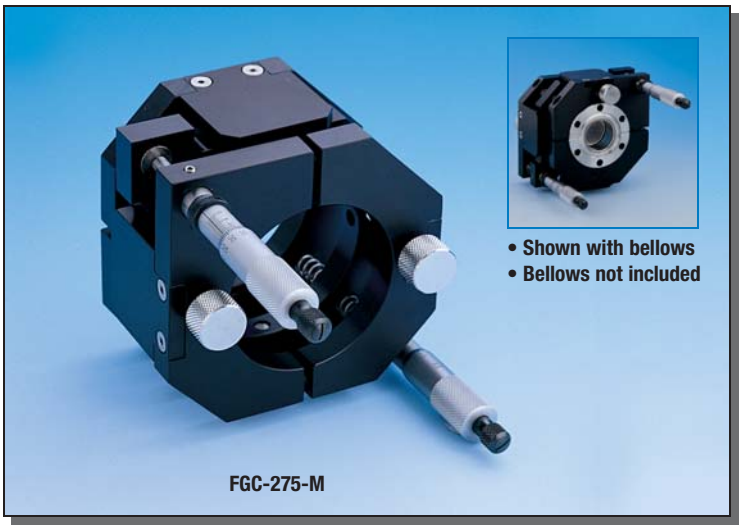
Load-lock gimbals are unique port alignment instruments specifically designed for the precision alignment of magnetically coupled transporters as used with circular and rectangular entry load-lock systems. Load-lock gimbal port aligners are fitted with precision micrometer adjustments for both horizontal tilt (above and below a horizontal plane of travel) and side to side parallel axis displacement. Load-lock gimbals are intended for horizontal installation with its tilt adjustment micrometer at a bottom 6 o'clock position. They include a stainless steel formed bellows adapter which mates between the magnetic transporter and the sample staging chamber. A transporter shaft extension kit to compensate for the increase in the transporters overall length is also included. For bellows assembly replacements reference part number 400003 found in Section 1.1, page 68.

Specifications

Material	
Flange	304ss
Body	Anodized Aluminum
Bellows, Formed	316ss
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	-20°C to 200°C
Maximum Load Rating	25 lbs
Weight & Dimensions	See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
ALIGNMENT GIMBAL	2	AG-150	665300

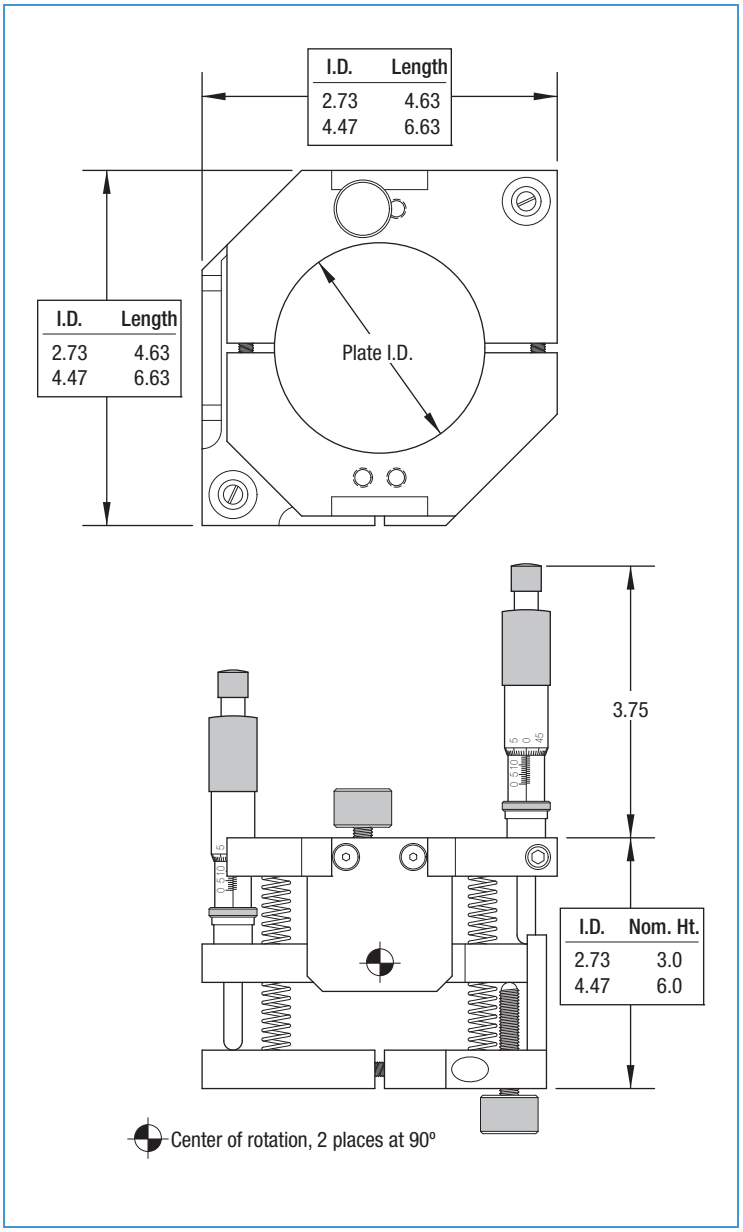
Port Aligner
Standard Gimbal



ULTRAHIGH VACUUM SERIES

Features

- Independent planes provide 15° tilt about x and y axes
- Tilt position lock for each plane
- Micrometer or screw adjustment actuators
- UHV compatible materials
- Bakeable to 230°C with screw type actuators
- Designed for use with Del-Seal™ CF port mount formed bellows adapters



Description

The standard gimbal geometry consists of three parallel and equidistant aluminum plates interconnected in a universal joint geometry. The top and bottom plates are equally spaced from the center plate and held in a parallel and neutral position with eight coil springs. Top and bottom plates are fitted with preci-sion micrometers used to produce a 15° tilt about the center plates X and Y axis respectively. When all adjustment mechanisms are disengaged the springs force the plates back to a neutral and parallel position. Economical screw type adjust-ments are also available in place of micrometers.

Standard gimbals are designed for use with MDC formed bellows flexible adapters with 1.25" and 2.00" bore diameters. Flexible bellows adapters are not included with standard gimbal assemblies and must be purchased separately.

Specifications

Material	
Flange	304ss
Body	Anodized Aluminum
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	
Screw Type	-20°C to 230°C
Micrometer Type	-20°C to 100°C
Weight & Dimensions	See table

PLATE I.D.	TYPE	WT LB	REFERENCE	PART NUMBER
2.73	MICROMETER	4	FGC-275-M	676000
2.73	SCREW	4	FGC-275-S	676001
4.47	MICROMETER	6	FGC-450-M	676002
4.47	SCREW	6	FGC-450-S	676003
2.73	BELLOWS	1	150-X	400003
4.47	BELLOWS	4	250-X	400005

Port Aligner

Precision & Heavy Duty Off-Axis

Precision Off-Axis Port Aligner

Features

- 10° off-axis alignment
- Manual adjustment
- UHV compatible materials
- Welded bellows seal
- Del-Seal™ CF port mount

Specifications

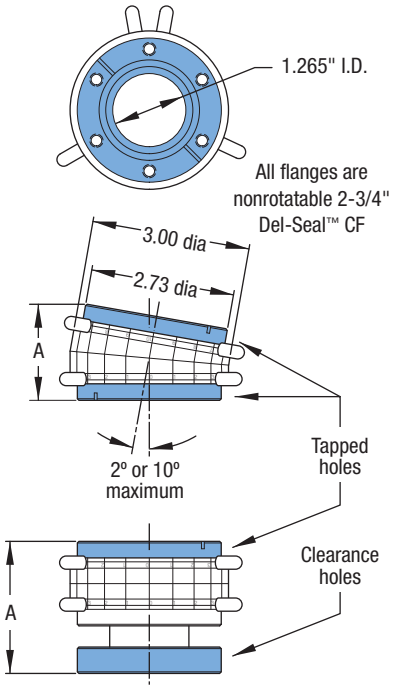
Material

Flange	304ss
Adjustment rings	Black oxide bronze
Seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	230°C
Weight & Dimensions	See table

Description

Precision port aligners provide 2° or 10° of off-axis angular displacement. Aligners are offered with tapped or clearance hole Del-Seal™ CF flanges. These port aligners are for light duty service and are not suitable for moment load conditions. See heavy duty port aligners below for 15 pound load capacity.

GIMBAL TYPE	HOLE OR THREAD	A MAX AT 0°	A MAX AT 2°	A MAX AT 10°	WT LB	REFERENCE	PART NUMBER
2°	.250-28	1.59	1.64	-	2	PAT-2	675000
10°	.250-28	1.37	1.43	1.63	2	PAT-10	675002
2°	.265	2.27	2.33	-	2	PAC-2	675001
10°	.265	2.06	2.11	2.32	2	PAC-10	675003



• Models with clearance holes include six each threaded studs, nuts and washers.

Heavy Duty Off-Axis Port Aligner

Features

- 25° off-axis alignment
- Moment loading to 15 lb
- Position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mount

Specifications

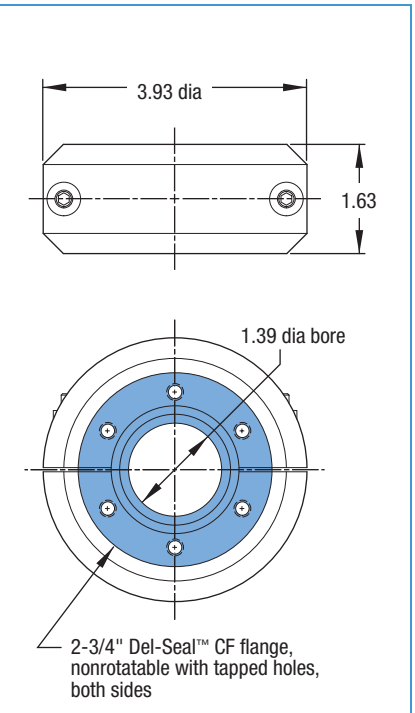
Material

Flange	304ss
Adjustment rings	Anodized Aluminum
Seal	AM 350 welded bellows
Vacuum Range	$1x10^{-11}$ Torr
Temperature Range	230°C
Weight & Dimensions	See table

Description

Heavy duty port aligners provide up to 25° of angular port adjustment. Tightening the clamp ring bolts to 100 lb-in of torque will allow this port aligner to support up to 15 pounds on a twelve inch moment arm. Metal seal flanges are 2-3/4" Del-Seal™ CF with .250-28 threaded holes. Graduation for angular displacement is not provided on the PA-25. Port alignment must be measured through external means.

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
HEAVY DUTY PORT ALIGNER	2	PA-25	675020



In-Vacuum Accessories

Introduction

Rotary-linear accessories for use with most rotary and linear motion instruments page 450

- Cab-Fast® Right angle sample handlers
- Auto-Dock™ Inline sample handlers
- Mini-Scaffold™ mounting system
- Rotary-linear accessories

Cab-Fast® Right-Angle Sample Handlers

The Cab-Fast® sample handling system provides a simple yet versatile means of loading samples for transportation to manipulators, parking carousels, deposition stations and other locations inside ultrahigh vacuum systems. They allow the transfer of samples between linear drive instruments positioned at right angles. Samples are first secured to platens using sample mounting strips. The loaded platen is placed inside a load-lock sample staging chamber through the chambers quick-access door. Inside, the platen is secured and attached to the platen fork previously installed to the tip of a magnetic transporter. Once the staging chamber is evacuated to the desired vacuum level and the gate valve is opened the sample is ready for transfer.

Auto-Dock™ Inline Sample Handlers

The MDC's Auto-Dock™ sample handling system is a patented group of modular sample handling components ideally suited for the transfer of samples between chambers and typically used in tandem with MDC magnetic transporters. In contrast with the Cab-Fast® system, Auto-Dock™ allows the transfer of samples between linear drive instruments positioned inline with each other. The Auto-Dock™ system is comprised of three basic components, a sample-holder plate, a vacuum-dock and a transport-dock. Samples are shuttled back and forth between a vacuum process chamber and a load-lock's sample staging chamber attached to it by fastening samples to the sample-holder plate. The sample-holder plate is manually secured to a transport-dock fixed to the tip of an MDC magnetic transporter inside the load-lock's sample staging chamber. The sample is then transported to the process chamber where the vacuum-dock component is strategically positioned and ready to receive the sample-holder plate.

Mini-Scaffold™ Mounting System

Mini-Scaffold™ mounting system is a versatile in-vacuum erector set comprised of interchangeable building block components that can be assembled in a variety of combinations. This unique in-vacuum system was designed to take advantage of existing vacuum ports for the temporary or permanent installation of sample support structures inside high and ultrahigh vacuum environments. They are ideally suited for situations where permanent mounts are not included or to expand the capabilities of existing vacuum chambers. The in-vacuum structure's foundation is the Mini-Scaffold™ patented port clamp. The port clamp is fastened to the inside diameter of an available 1-1/2" or 2-1/2" chamber port creating the base from which an apparatus or structure will rise. In addition to port clamps an assortment of components are available to complement the Mini-Scaffold™ system, some of these include extension rods, universal ball joints, rod clamps, sample mounting plates, specimen holders, rotary and linear bearing mounts, mirror and lens mounts, gear boxes, etc.

Rotary-Linear Accessories

Rotary-linear accessories are an assortment of in-vacuum hardware components used to complement and expand the capabilities of MDC rotary and linear motion and manipulation instruments. Various drive shaft attachments are offered including universal joints, bellows couplings, extension couplings, rotary and linear bearings and bearing mounts, ground shaft stock, set-screw collars and vented cap screws.

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.

Cab-Fast® and Auto-Dock™ sample handling

Mini-Scaffold™ mounting system

In-Vacuum Accessories

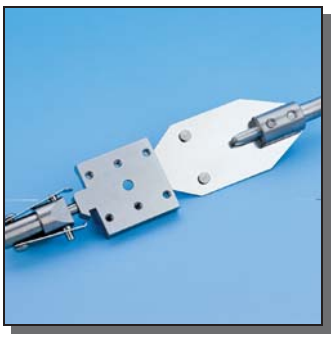
Sample Handling Systems

Cab-Fast® Right-Angle Sample Handlers

The Cab-Fast® sample handling system provides a simple yet versatile means of loading samples for transportation to manipulators, parking carousels, deposition stations and other locations inside ultra-high vacuum systems. They allow the transfer of samples between linear drive instruments positioned at right angles to each other. They are ideally suited for use with magnetically coupled transporters and other motion and manipulation instruments.

Auto-Dock™ Inline Sample Handlers

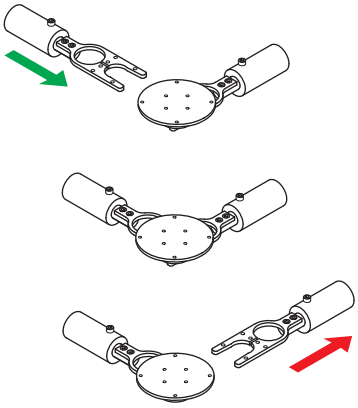
The Auto-Dock™ sample handling system is a group of modular sample handling components ideally suited for the transfer of samples between vacuum chambers when used with MDC magnetic transporters. Auto-Dock™ allows the transfer of samples between linear drive instruments positioned inline with each other. The Auto-Dock™ system is comprised of three basic components, a docking sample-holder, a vacuum-dock and a transport-dock.

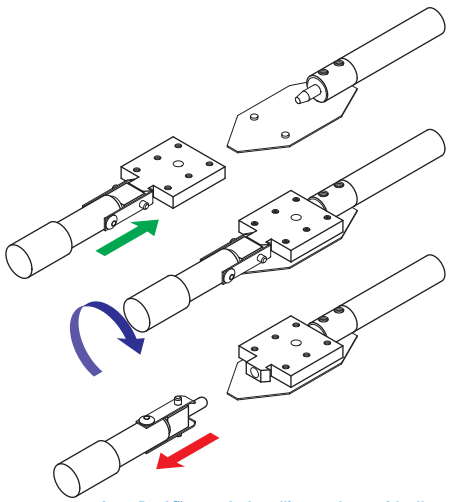


Features

- UHV sample handling
- Fast sample transfer
- 304ss construction

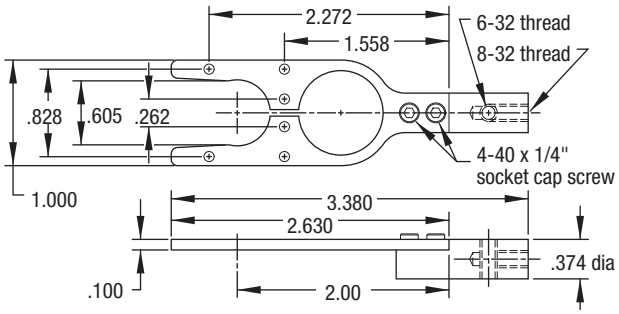
Cab-Fast® sample handling tools are designed to transport samples in and out of vacuum systems. This diagram shows a dual instrument arrangement which allows right angle sample transfer.





Auto-Dock™ sample handling tools are ideally suited for for use with MDC magnetic transporters in sample transfer load-lock systems. They are designed for inline sample transfer.

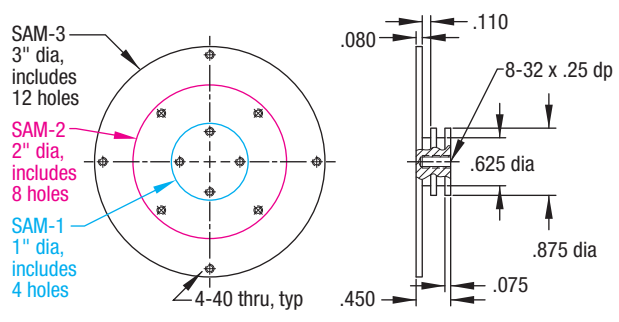
Platen Fork



REFERENCE	PART NUMBER
FOR-1	665029

Cab-Fast® platen forks are designed to lock on to and hold Cab-Fast® platens during the transport and transfer of samples between chambers or other motion and manipulation instruments. Quantity of 1.

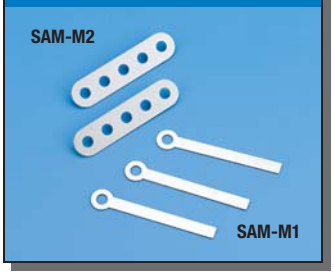
Platen Sample Holder

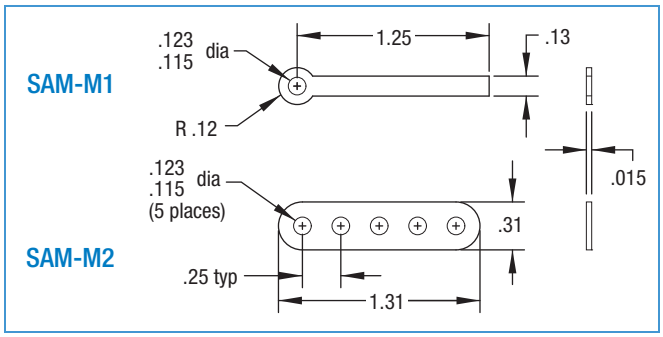


REFERENCE	PART NUMBER
SAM-1	665026
SAM-2	665027
SAM-3	665028

Cab-Fast® sample platens are designed to hold samples during in-vacuum sample processing. Samples can be secured in place using sample mounting strips and screws. Quantity of 1.

Sample Mount Strips

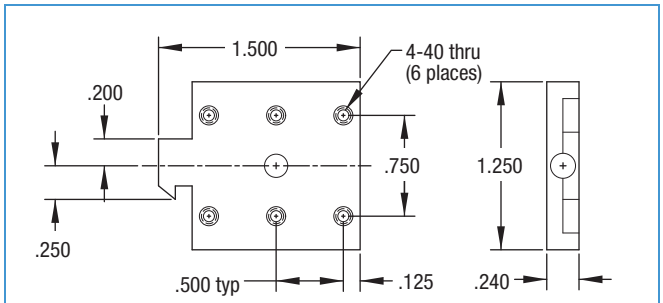




REFERENCE	PART NUMBER
SAM-M1	665039
SAM-M2	665040

MDC sample mounting strips offer a versatile means of fastening samples to Cab-Fast® sample platens and Auto-Dock™ docking sample-holders. Sold in packages of 5.

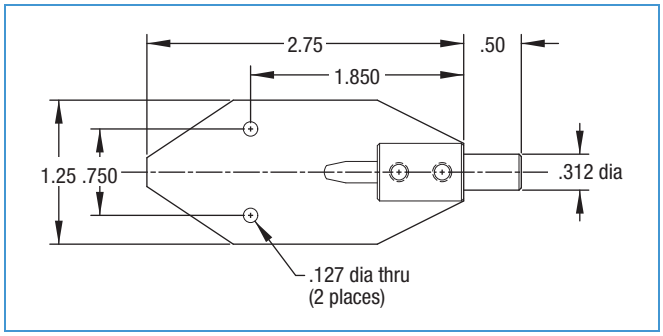
Dock Sample-Holder



REFERENCE	PART NUMBER
STA-1	665016

Auto-Dock™ docking sample-holders are designed to hold samples during in-vacuum sample processing. Samples are secured in place using sample mounting strips and screws. Quantity of 1.

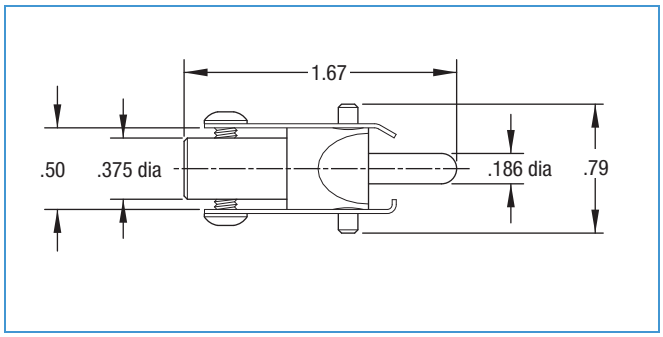
Vacuum-Dock



REFERENCE	PART NUMBER
STA-2	665017

Auto-Dock™ vacuum-docks are designed to receive and hold Auto-Dock™ sample-holders during in-vacuum sample processing. They are typically fixed inside a vacuum chamber as part of a sample processing structure. Quantity of 1.

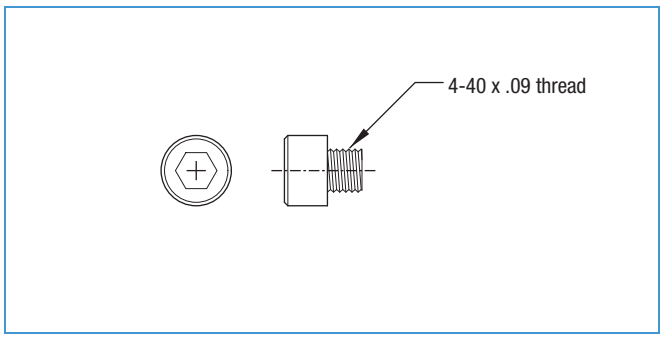
Transport-Dock



REFERENCE	PART NUMBER
STA-3	665018

Auto-Dock™ transporter-docks are designed to receive, hold and transport Auto-Dock™ sample-holders in and out of vacuum sample processing chambers. They are attached to the end of MDC magnetic transporter shafts. Quantity of 1.

Screws, non-vented



REFERENCE	PART NUMBER
SAM-S1	665041

Socket head screws made of 300ss ideal for Cab-Fast® and Auto-Dock™ sample handling systems and come in packages of 25 pieces. These screws are not vented and should only be installed into tapped through holes.

In-Vacuum Accessories

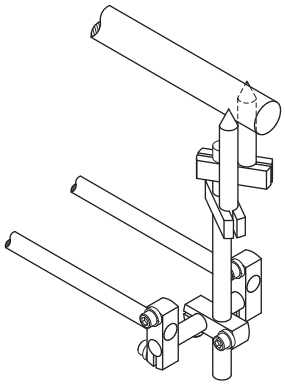
Mini-Scaffold™ Mounting System

Mini-Scaffold™ Mounting System

Mini-Scaffold™ mounting systems are versatile in-vacuum interchangeable building block components that can be assembled in a variety of combinations. This unique in-vacuum system was designed to take advantage of existing vacuum ports for the temporary or permanent installation of sample support structures inside ultrahigh vacuum environments. They are ideally suited for situations where permanent mounts are not included or to expand the capabilities of existing vacuum chambers. The in-vacuum structure's foundation is the Mini-Scaffold™ patented port clamp. The port clamp is fastened to the inside diameter of an available 1-1/2" or 2-1/2" chamber port creating the base from which an apparatus or structure will rise. In addition to port clamps, an assortment of components are available to complement the Mini-Scaffold™ system. The diagrams below depict the basic usage of Mini-Scaffold™ in-vacuum mounting systems.

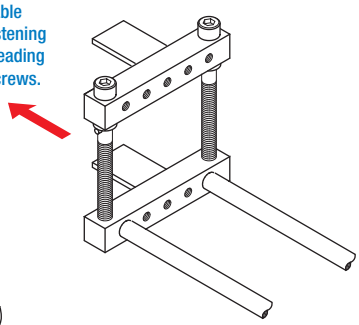
Features

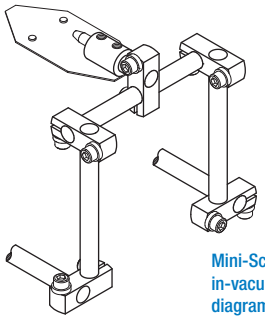
- UHV sample handling
- Fast sample transfer
- 300 series stainless steel



Using Mini-Scaffold™ guide rods in combination with inline and right-angle rod clamps, motion instrument drive shaft supports can be erected.

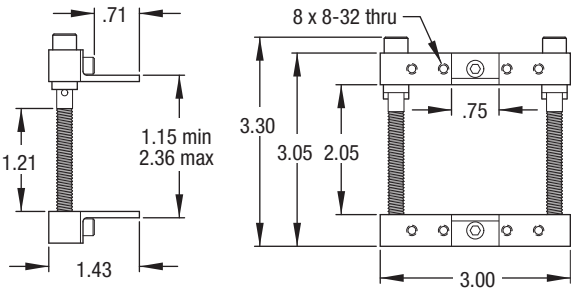
The port mount clamp is the foundation upon which all Mini-Scaffold™ structures are erected. Simply insert the clamp tabs to the inside diameter of an available 1-1/2" to 2-1/2" vacuum port. Fastening the clamp is accomplished by spreading the clamp bars with the built in screws.





Mini-Scaffold™ is ideally suited for in-vacuum sample support structures. This diagram depicts a typical installation of MDC's Auto-Dock™ vacuum sample dock.

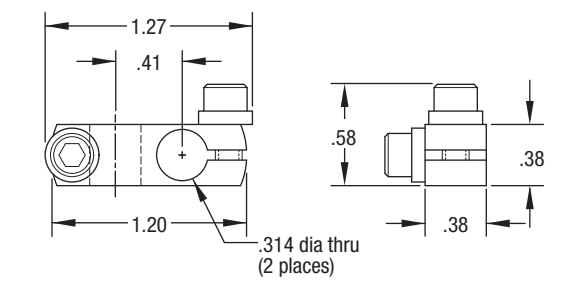
Port Clamp Mount



REFERENCE	PART NUMBER
PCM-1	680020

Port clamp mounts can be mounted to the inside diameter of any 1-1/2" or 2-1/2" vacuum port. Once they are secured these clamps become the foundation upon which other Mini-Scaffold™ components are attached. Quantity of 1.

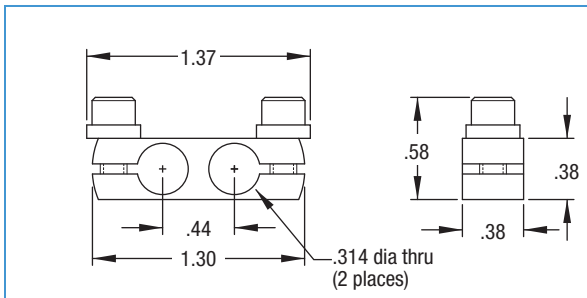
Rod Clamp 90°



REFERENCE	PART NUMBER
URC-1	680040

90° universal rod clamps provide the means of fastening 5/16" diameter shafts in right angle configurations. Socket head fasteners and washers are included with these products. Quantity of 1.

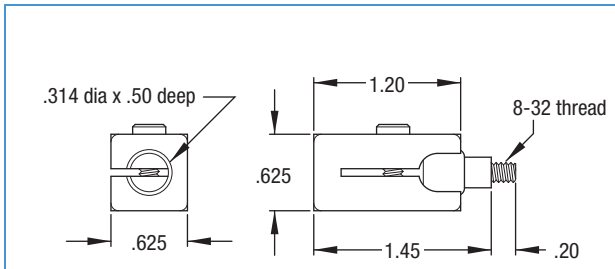
Rod Clamp 180°



REFERENCE	PART NUMBER
URC-2	680041

180° universal rod clamps provide the means of fastening 5/16" diameter shafts in parallel configurations with a .440" center to center spacing. Socket head fasteners and washers are included with these products. Quantity of 1.

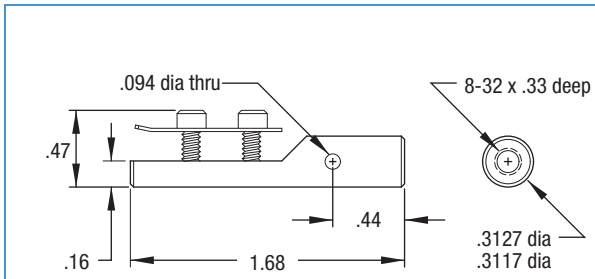
Universal Ball Joint



REFERENCE	PART NUMBER
UBJ-1	680080

Universal ball joints with built-in lock screw provide infinite sample position adjustment. One end accepts a .312" diameter shaft and the other is fitted with an 8-32 UNC male thread for attaching to other Mini-Scaffold™ components. Quantity of 1.

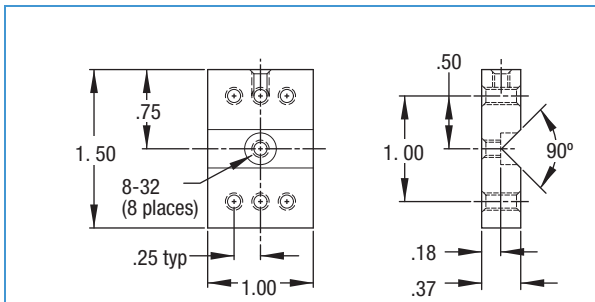
Specimen Holder



REFERENCE	PART NUMBER
SH-1	680160

Specimen holders hold samples during sample processing inside a vacuum chamber. Two socket head screws and a blade clamp secure the sample to the holder. 8-32 UNC female thread allows attachment of other Mini-Scaffold™ components. Quantity of 1 per pack.

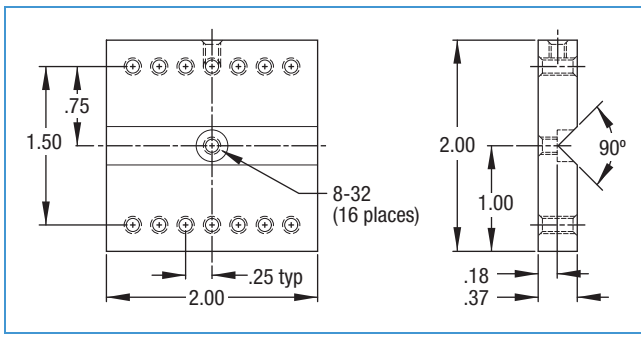
Mounting Plate, Small



REFERENCE	PART NUMBER
SMP-1	680120

Small mounting plates hold samples or other structures during sample processing inside a vacuum chamber. 8-32 UNC female threads allow a means of sample fastening or the attachment of other Mini-Scaffold™ components. Quantity of 1.

Mounting Plate, Large



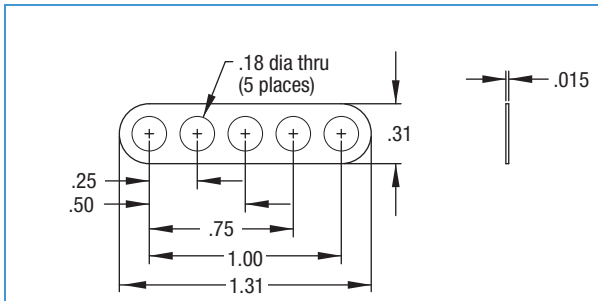
REFERENCE	PART NUMBER
SMP-2	680121

Large mounting plates hold samples or other structures during sample processing inside a vacuum chamber. 8-32 UNC female threads allow a means of sample fastening or the attachment of other Mini-Scaffold™ components. Quantity of 1.

In-Vacuum Accessories

Mini-Scaffold™ Mounting System

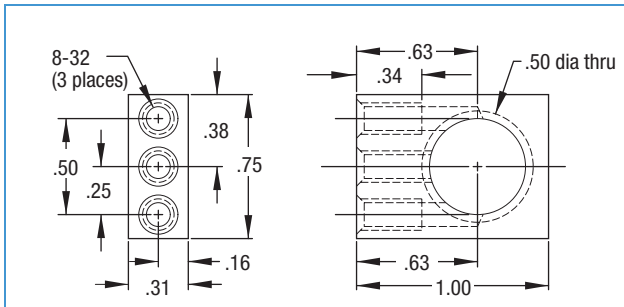
Mounting Strap



REFERENCE	PART NUMBER
SMS-1	680140

Sample mounting straps offer a versatile means of fastening samples to Mini-Scaffold™ small and large mounting holding plates. Quantity of 5 per package.

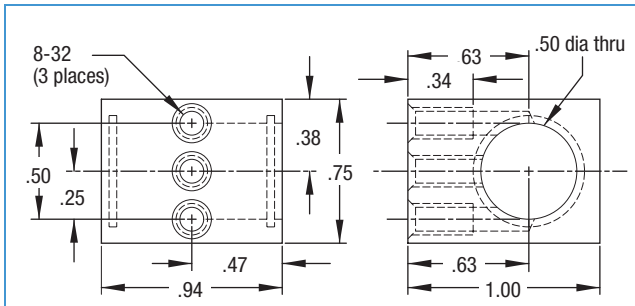
Bearing Mount, Radial



REFERENCE	PART NUMBER
BMB-1	680180

Radial bearing mounts are made of vacuum grade aluminum. They are designed to accept a radial bearing for a .250" shaft diameter and used with part number 686000 found on page 451. It includes two retainer rings to hold the bearing assembly in place. Quantity of 1.

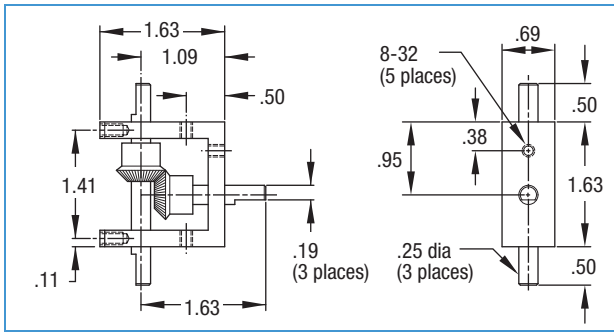
Bearing Mount, Linear



REFERENCE	PART NUMBER
BML-1	680200

Linear bearing mounts are made of vacuum grade aluminum. They are designed to accept a linear bearing for a .250" shaft diameter and used with part number 687000 found on page 452. It includes two retainer rings to hold the bearing assembly in place. Quantity of 1.

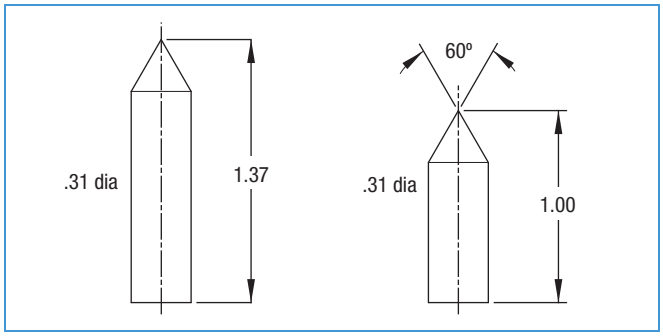
Gear Box - 90°



REFERENCE	PART NUMBER
GB-1	680300

This 90° gear box provides three .250" drive shafts for in vacuum rotary motion. It provides output rotation to a shaft which is perpendicular to the input shaft. Drive shaft locations are at 12, 3 and 6 o'clock positions. Quantity of 1.

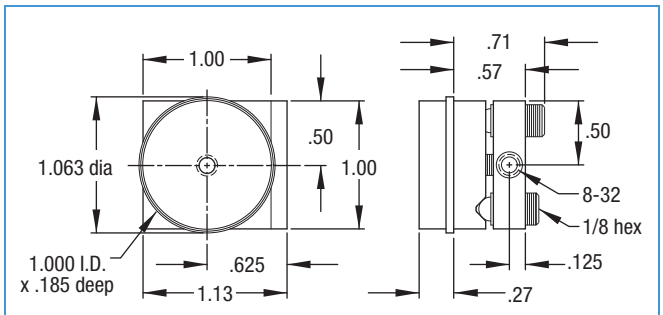
Rod Guide



REFERENCE	PART NUMBER
RG-1	680220

Rod guides provide a means of supporting long shafts inside a vacuum system. They are an inexpensive solution used in place of linear or rotary bearing mounts. They are intended for light duty rotation and linear support. Quantity of 1 each per package.

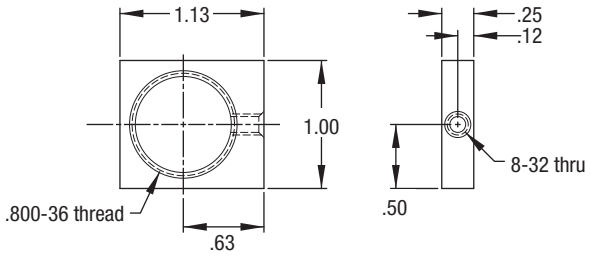
Mirror Mount



REFERENCE	PART NUMBER
MM-1	680240

MDC adjustable tilt mirror mounts are used for the installation of 1" diameter mirrors inside a vacuum system. They are constructed of vacuum grade aluminum and are fitted with mirror tilt adjustment screws. Quantity of 1.

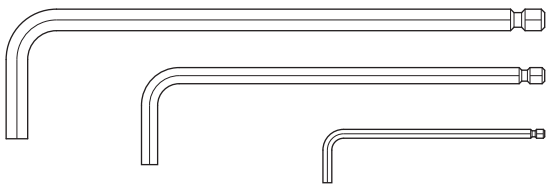
Lens Mount



REFERENCE	PART NUMBER
MOM-1	680260

Microscope objective lens mounts are designed to accept standard optical lenses fitted with an .800-36 mounting thread. They are constructed of vacuum grade aluminum and suitable for UHV service. Quantity of 1.

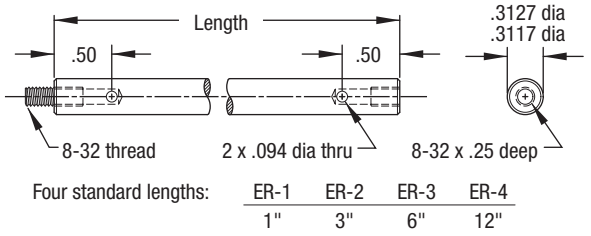
Wrench Kit



REFERENCE	PART NUMBER
WK-1	680280

This is a set of three tempered steel Allen wrenches consisting of one each of the following hexagonal sizes: 5/64", 9/64" and 3/16". They are ideally suited for use with the complete line of Mini-Scaffold™ accessories and components.

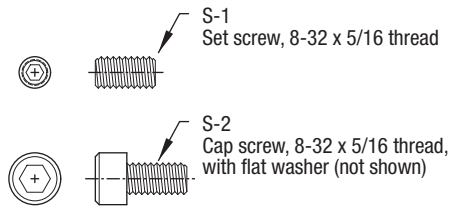
Extension Rods



REFERENCE	PART NUMBER
ER-1	680060
ER-2	680061
ER-3	680062
ER-4	680063

Extension rods have 8-32 UNC male and female threads on opposite ends. They can be connected end to end for custom length structures. Quantity of 1.

Screws, non-vented



REFERENCE	PART NUMBER
S-1	680100
S-2	680101

These are 300 series stainless steel socket head screws for use with all Mini-Scaffold™ hardware. They come in packages of 25 pieces. They are not vented since all Mini-Scaffold™ components use through holes.

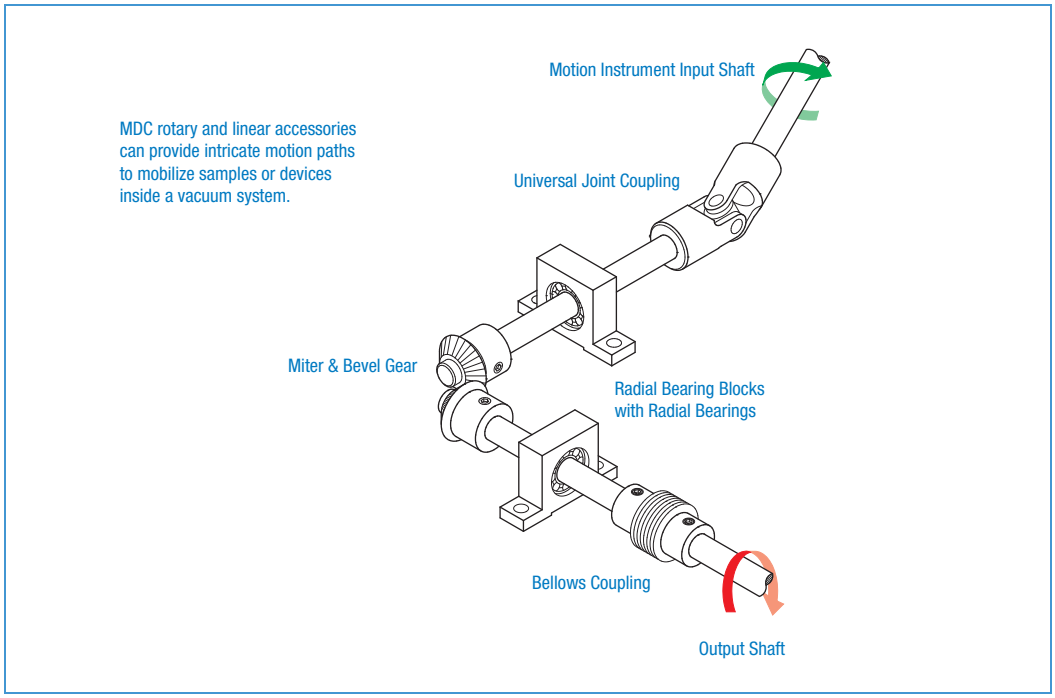
Rotary-Linear Accessories

Rotary-linear accessories are an assortment of in-vacuum hardware components used to complement and expand the capabilities of MDC rotary and linear motion and manipulation instruments. Various drive shaft attachments are offered including universal joints, bellows couplings, extension couplings, rotary and linear bearings and bearing mounts, ground shaft stock, set-screw collars and vented cap screws.

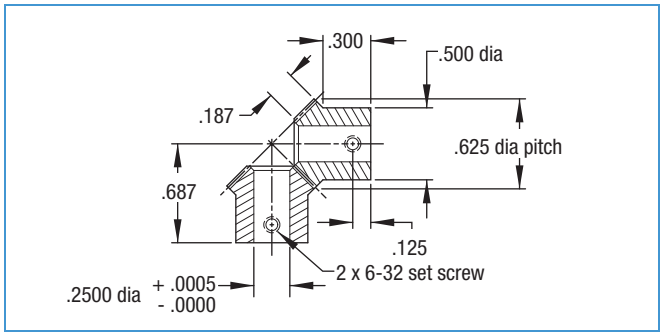
The components presented in this section can also be used in combination with products presented in the Cab-Fast®, Auto-Dock™ and Mini-Scaffold™ accessories sections of this catalog. Custom designed hardware is also available if required. Please contact MDC's technical sales engineers with your inquiries.

Features

- UHV sample handling
- Fast sample transfer
- 300 series stainless steel



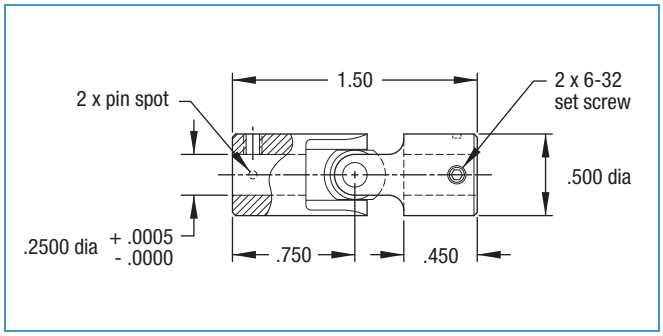
Miter & Bevel Gear



REFERENCE	PART NUMBER
AM48-1-S	685000

Miter & bevel gears provide the means of rotary input with 90° output rotation. They accept .250" diameter shafts and come in a set of two gears fitted with 6-32 UNC set screws for fastening to shafts. Quantity of 1.

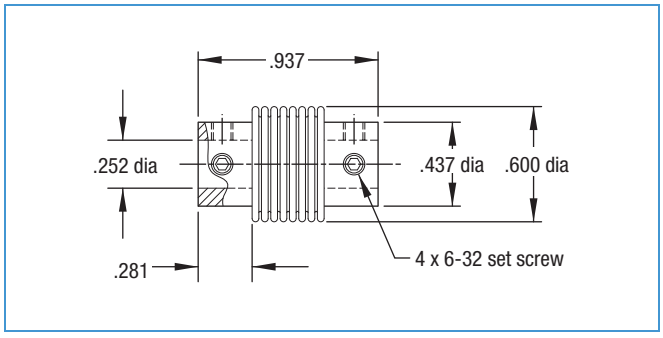
Universal Joint



REFERENCE	PART NUMBER
AUJ-3	680000

Universal joints provide rotary motion input with variable angle rotary output for .250" shaft diameters. The maximum operating angle is 30° at low speeds and 10° at high speeds. They are constructed of 300 series stainless steel and phosphor bronze. Quantity of 1.

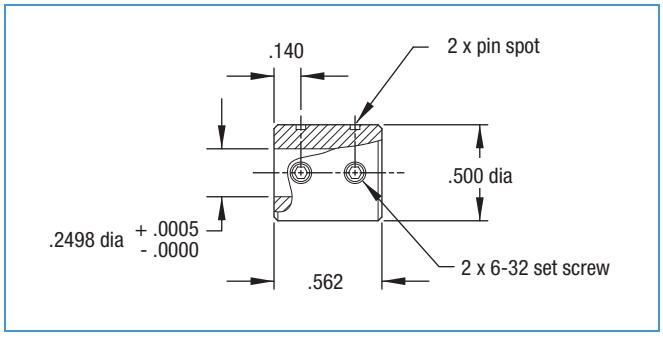
Bellows Coupling



REFERENCE	PART NUMBER
AC04-4	682000

Bellows couplings for .250" shaft diameters provide 50 oz-in maximum torque at a maximum tilt angle of 5° or maximum axial misalignment of 0.010". They provide zero backlash and uniform angular velocity with low vibration. Quantity of 1.

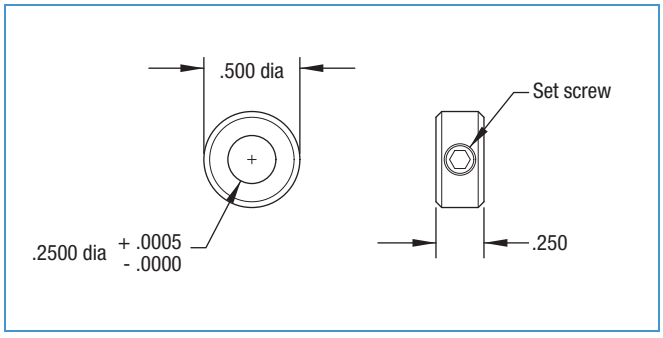
Sleeve Coupling



REFERENCE	PART NUMBER
ACT-3	683000

Sleeve couplings are used to customize and extend .250" diameter shafts inside a vacuum system. They are fitted with two 6-32 UNC set screws to lock shafts in position and are constructed of 300 series stainless steel. Quantity of 1.

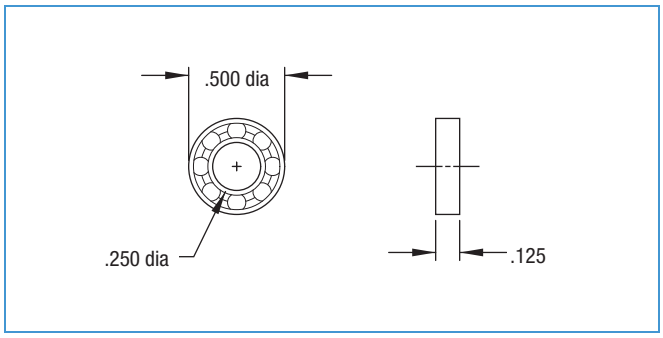
Set Screw Collar



REFERENCE	PART NUMBER
ACS-22	690000

Set screw collars are used to create mechanical stops along a shaft's length. They are constructed of 300 series stainless steel and are supplied with 6-32 UNC set screws for position lock. Quantity of 1.

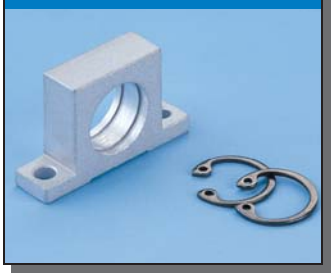
Radial Ball Bearing

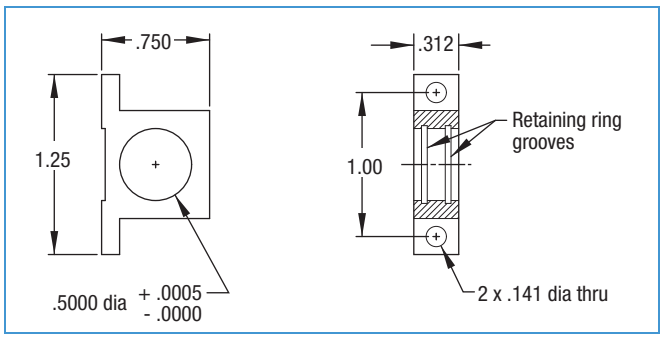


REFERENCE	PART NUMBER
ABI-32	686000

Rotary bearings are used to support .250" diameter rotary shafts. They are constructed of 440C stainless steel and coated with Dicronite® dry lubricant suitable for UHV service. Rotary bearing housings are offered below and on page 448.
Quantity of 1.

Bearing Mount, Radial

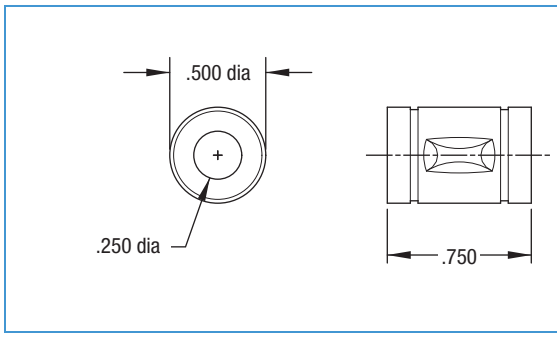




REFERENCE	PART NUMBER
ABME-1	688000

Radial bearing mounts are made of vacuum grade aluminum. They are designed to accept a radial bearing for a .250" shaft diameter. They include two retainer rings to hold the bearing assembly in place. Also see page 448 for alternate version.
Quantity of 1.

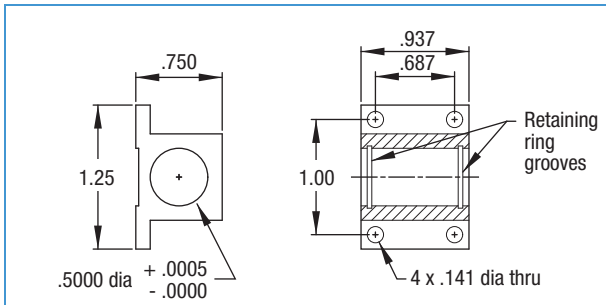
Linear Ball Bearing



REFERENCE	PART NUMBER
ALMB-1	687000

Linear bearings support .250" diameter linear motion drive shafts. They are constructed of 300 series stainless steel and coated with Dicronite® dry lubricant suitable for UHV service. Linear bearing housings are offered below and on page 448.

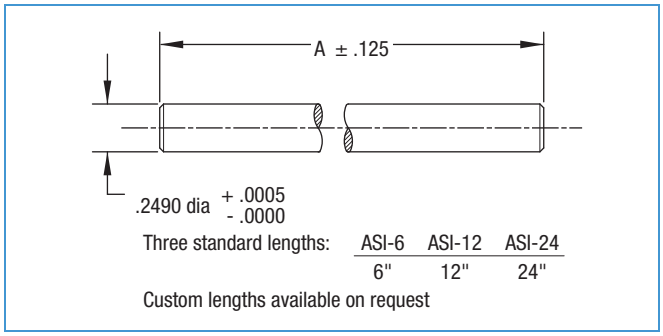
Bearing Mount, Linear



REFERENCE	PART NUMBER
ALME-1	689000

Linear bearing mounts are made of vacuum grade aluminum. They are designed to accept a linear bearing for a .250" shaft diameter. They include two retainer rings to hold the bearing assembly in place. Also see page 448 for alternate version.

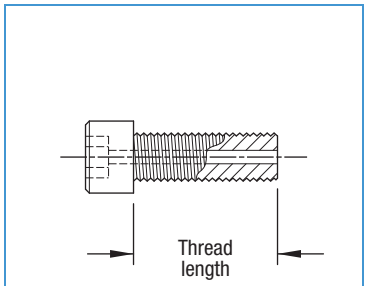
Ground Stock



REFERENCE	PART NUMBER
ASI-6	684000
ASI-12	684001
ASI-24	684002

Precision ground 304 stainless steel shafts offered in 6, 12 and 24 inch lengths. With coupling accessories these shafts can be used to extend motion instrument drive shafts.

Vented Screws



These are 300 series stainless steel socket head screws ideally suited for fastening inside an ultrahigh vacuum system. The screws have been drilled through their entire length to eliminate the possibility of virtual leaks caused by the trapped volume of air at the bottom of blind tapped holes. They come in packages of 10 pieces.

DESCRIPTION	HEAD DIAMETER	REFERENCE	PART NUMBER
6-32 UNC x 1/4	.22	AC-604	691000
6-32 UNC x 1/2	.22	AC-608	691001
6-32 UNC x 3/4	.22	AC-612	691002
8-32 UNC x 1/4	.27	AC-804	691003
8-32 UNC x 1/2	.27	AC-808	691004
8-32 UNC x 3/4	.27	AC-812	691005
8-32 UNC x 1	.27	AC-816	691006
10-32 UNC x 1/4	.31	AC-1004	691007
10-32 UNC x 1/2	.31	AC-1008	691008
10-32 UNC x 3/4	.31	AC-1012	691009
10-32 UNC x 1	.31	AC-1016	691010
10-32 UNC x 1-1/2	.31	AC-1024	691011
.250-28 UNF x 1/2	.37	AC-2808	691012
.250-28 UNF x 3/4	.37	AC-2812	691013
.250-28 UNF x 1	.37	AC-2816	691014

Motorization

Section 7.3

Motorization

Introduction

Direct current stepper motors page 460

- Motor specifications
- AC motors
- Analog DC motors
- Miniature DC motors
- DC Stepper motors
- In-vacuum stepper motors
- Motor controls

Motor Specifications

Featured throughout this catalog are motion and manipulation instruments which are suitable for motorization. Motorization options for specific instruments are listed on the page in which they appear. Specifications for each motor option are identified with a single letter code ("A" through "F") listed as “Motor Spec” in the options description table. Detailed specifications for each motor are listed in this section and are arranged alphabetically by letter code.

Alternating Current Motors

MDC reversible AC motors are an economical motorization solution for continuous motion applications. These motors are equipped with a load limiting clutch rated for 50 oz-in of torque to prevent instrument overload conditions. Motors come with three wire leads and a capacitor which must be wired by the customer to suit application circuit requirements. Motor direction reversal is accomplished by wiring reversal. Current applied to the blue and red leads produces a clockwise rotation while applying current to the blue and black leads produces counterclockwise rotation.

Direct Current Motors, Analog

MDC 90 volt direct current reversible motors are of the permanent magnet type featuring high efficiency, no field supply requirement, low heat and linear speed-torque characteristics. Two leads with integral connector provide easy mating with 90 volt motor controller. These motors are furnished with an integral gear unit with 180:1 gear reduction. The gearing is of the helical-spur design with helical gears in the primary stage for quiet operation and hardened spur gears in the secondary stages. Mounting dimensions conform to NEMA 2-11 standards.

Miniature DC Motors

Miniature DC motors are used on all MDC motorized miniature rotary and linear motion instruments. The built in gear head with a 262:1 gear ratio gives this motor a maximum torque load of 20 oz-in. Devices fitted with these miniature motors are constructed with a load limiting clutch to prevent motor burnout. Motors are mounted to motion instruments inside anodized aluminum housings with inline or side mount drive geometries. Inline geometries can also be purchased with a 16 pulse per revolution magnetic encoder.

DC Stepper Motors

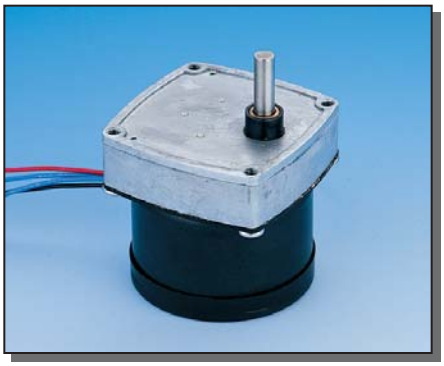
Stepper motors are devices which position loads by operating in discrete increments or steps. The stepping action is accomplished by switching the power to the motor windings so that the motor phases are energized in a specific sequence. Stepper motors are capable of very precise positioning without the use of complicated and expensive feedback devices.

MDC uses SLO-SYN® DC stepper motors on all motion and manipulation instruments fitted with stepper motors. These are brushless, permanent magnet motors that have full-step increments of 1.8°. They can also be made to operate in increments of 0.9° to 0.014° when half stepping or

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.



Alternating current motors page 458

Direct current, analog motors page 458

microstepping techniques are employed. SLO-SYN® motors have permanent magnet rotors and eight-pole stators. They do not have brushes, ratchets or detents to wear out and they use shielded, lubricated-for-life ball bearings to insure maximum reliability and long life. Tests indicate a typical minimum life of five years. These stepper motors operate on phase-switched DC power. The motor shaft advances in steps of 1.8° (200 steps per revolution) when a four step (full-step mode) input sequence is used and in steps of 0.9° (400 steps per revolution) when an eight-step (half-step mode) input sequence is used.

Microstepping is a method of stepper motor control that allows the rotor to be positioned at places other than the 1.8° and 0.9° positions provided by the full-step and half-step methods. Microstepping occurs between these two angular points in the rotation of the rotor. These stepper motors are suitable for 1/10 and 1/125 microstep increments. A benefit of microstepping is that it reduces the amplitude of the resonance which occurs when the motor is operated at its natural frequency or subharmonics of that frequency.

In-Vacuum Stepper Motors

In-vacuum stepper motors are ideally suited for the precision movement of delicate specimens such as silicon wafers in ultrahigh vacuum. The use of in-vacuum stepper motors results in considerable savings in mechanical complexity with resultant gains such as cost reduction, improved reliability and decreased backlash. In some cases the use of in-vacuum motors can mean the complete elimination of edge welded bellows. The particulate generation of these stepper motors is minimized by the total absence of metal to metal sliding surfaces. This and their low outgassing characteristics make these motors especially suitable for sensitive semiconductor handling applications. Other applications for which these motors have been employed include precision in-vacuum UHV manipulators, monochromator mechanisms for synchrotrons, ion beam lithography and sample transport in UHV.

Motor Controls

All motor controls are sold separately and are not included in the motorization option prices.

Alternating current (AC) motors do not require motor controls since they are designed to be wired directly into an alternating current wall circuit.

DCM-SC-90 controllers are designed for use with 90 VDC motorized instruments. This controller provides bidirectional motor control in continuous and jog modes. Motor speed is adjustable from 0 to 10 rpm via voltage regulation. Feedback circuitry uses the motor's "Back-EMF" to provide a flat torque-speed curve. Additional features include transient and surge protection, line voltage compensation, soft start, discrete silicon-controlled rectifiers and diodes for higher amperage output and better heat dissipation. Controller is wired for 115VAC input and is provided with a 2 conductor cable for direct connection to MDC 90V motorized components.

DCM-SC-12 controllers are designed for use with 12 VDC motorized instruments in this catalog. This controller provides bidirectional motor control in continuous and jog modes. It provides motor speed adjustment from 0 to 20 rpm via voltage regulation. Feedback circuitry uses the motor's "Back-EMF" to provide a flat torque-speed curve. The controller is wired for 115VAC input and is provided with a 2 conductor cable for direct connection to MDC 12V motorized components via a standard 2.5-mm plug. Rear panel voltage switch allows the DCM-SC-12 to accept 110 or 220 VAC line voltage.

SMC-M controllers are designed for all air and in-vacuum stepper motorized instruments. Current control output is vital in any stepper motor controller. MDC stepper motor controllers employ the time-tested bipolar chopper regulation of current. Output current is set to 0.6 amperes as required for the low torque motors. Output current is adjustable for the medium and high torque motors. Current output adjustment is accomplished by resetting the six internal DIP switches.

The SMC-1 indexer is a powerful and user friendly tool capable of complex motion profile control when interfaced with an IBM compatible PC. The indexer comes with the necessary software for programming via ASCII commands and a 37 pin Type-D subminiature interface provides the user with TTL input and output access.

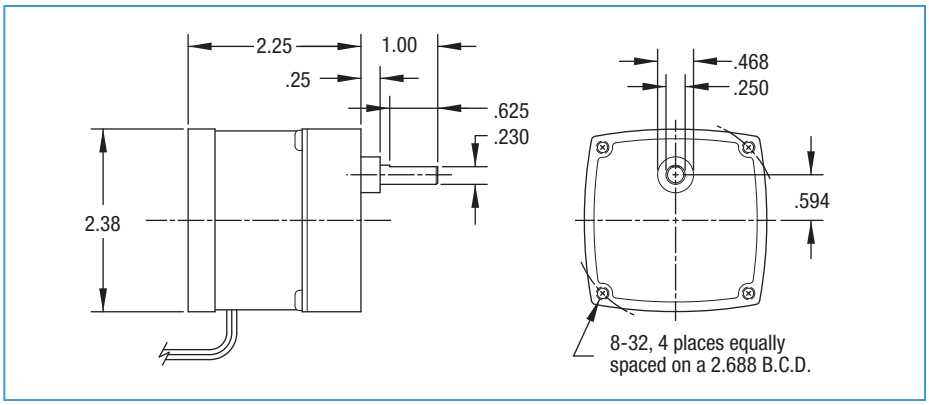
Direct current miniature analog motors page 459

In-vacuum direct current stepper motors page 462

Motor controls and electronics page 464

Motor Specification "A"

115V AC MOTOR



MDC reversible AC motors are an economical motorization solution for continuous motion applications. These motors are equipped with a load limiting clutch rated for 50 oz-in of torque to prevent instrument overload conditions. Motors come with three wire leads and a capacitor which must be wired by the customer to suit application circuit requirements. Motor direction reversal is accomplished by wiring reversal. Current applied to the blue and red leads produces a clockwise rotation while applying current to the blue and black leads produces counterclockwise rotation.

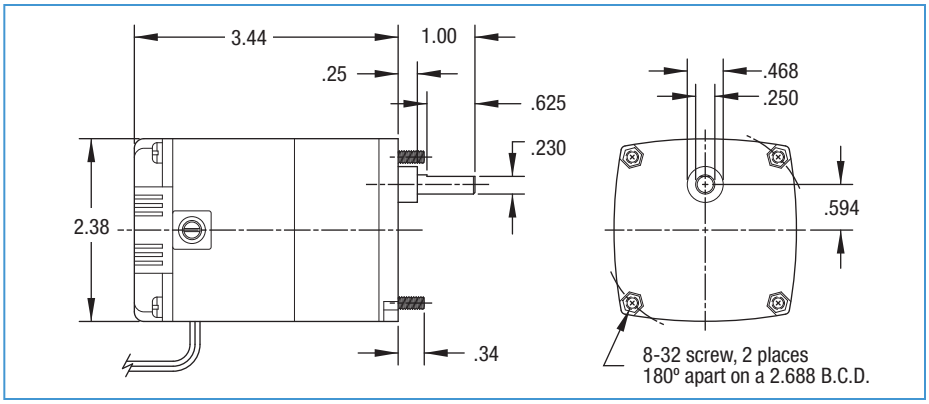
Specifications

Connections	
Type	leads
Number of wires	3
Input Voltage	115 VAC / 60 Hz
Power	7.50 W
Temperature Range	-40°C to 65°C
Dimensions	See drawing

Torque	
With load limiting Clutch	50 oz-in
Motor	126 oz-in @ 10 rpm
Weight	3 Lb

Motor Specification "B"

90V DC MOTOR



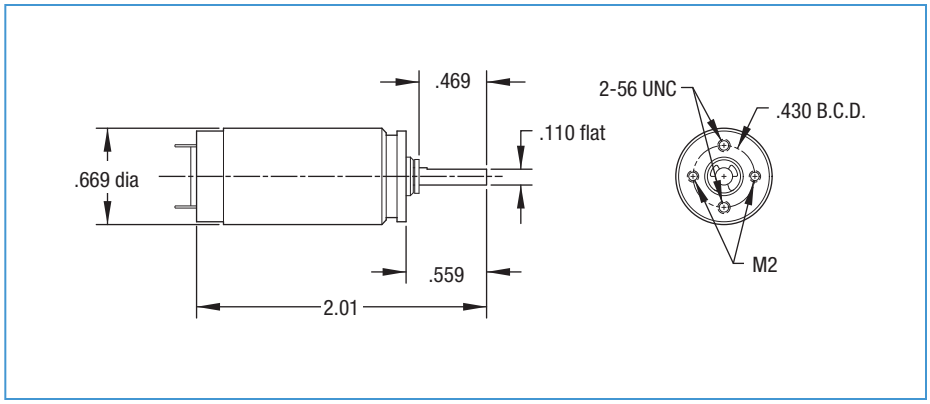
MDC 90 volt direct current reversible motors are of the permanent magnet type featuring high efficiency, no field supply requirement, low heat and linear speed-torque characteristics. Two leads with integral connector provide easy mating with 90 volt motor controller. These motors are furnished with an integral gear unit with 180:1 gear reduction. The gearing is of the helical-spur design with helical gears in the primary stage for quiet operation and hardened spur gears in the secondary stages. Mounting dimensions conform to NEMA 2-11 standards.

Specifications

Connections	
Type	Connector
Number of pins	2
Input Voltage	90 VDC
Power input	2.25 W
Temperature Range	-20°C to 65°C
Dimensions	See drawing

Torque	
With load limiting clutch	50 oz-in
Motor Geared @ 180 : 1	72 oz-in @ 10 rpm
Speed	0.7 to 10 rpm
Weight	6 Lb

Motor Specification "C"
12V DC MOTOR



Miniature DC motors are used on all MDC motorized miniature rotary and linear motion instruments. The built in gear head with a 262:1 gear ratio gives this motor a maximum torque load of 20 oz-in. Devices fitted with these miniature motors are constructed with a load limiting clutch to prevent motor burnout. Motors are mounted to motion instruments inside anodized aluminum housings with inline or side mount drive geometries.

Specifications

Connections	
Type	2 contact coaxial
Number of wires	2
As Motion Option 4	2.5 mm plug
Input Voltage	12 VDC
Input Current	140 mA
Temperature Range	-30°C to 65°C
Dimensions	See drawing

Torque	
Friction	0.006 oz-in
Stall	0.13 oz-in
Motor Geared @ 262 : 1	20 oz-in
Armature Resistance	80 ohm
Armature Inductance	1.2 mH
Weight	0.43 oz

Miniature rotary and linear motion instruments, which have inline geometries, can also be purchased with a magnetic encoder.

- Square wave output
- TTL / CMOS compatible
- 16 pulses per revolution
- 2 channels, 90° phase shift

Magnetic Encoder Specifications

Nominal Power Requirement	
	5mA max. @ 5 VDC @ 22°C
Max. Operating voltage	15.0 VDC
Signal Phase Shift and Tolerance	
	90° ±45° (2 phase signal)
Maximum Signal Frequency	7.2 kHz

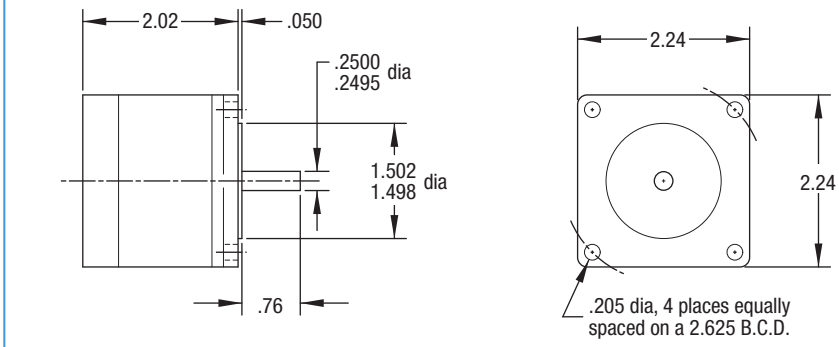
Temperature Range	
Operating	-20°C to 85°C
Storage	-40°C to 110°C
Connection	Ansley low-profile DIP plug, 8-pin
Maximum Asymmetry	10°
Signal Rise Time	less than 5 microseconds

DC Motor Controls, see page 464

DC Controller
12V DC MOTOR

DC Controller
90V DC MOTOR

Motor Specification "D"
LOW TORQUE STEPPER MOTOR



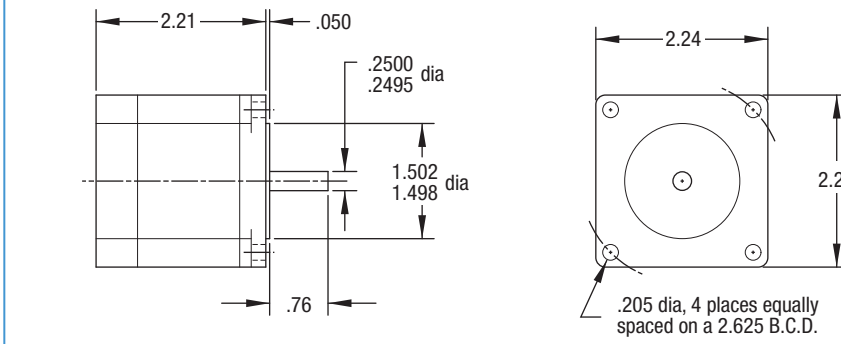
The M061-CS02 stepper motor is designed to NEMA standards 23D frame size specifications and is ideally suited for use on various MDC motion and manipulation devices. It has a ±3% noncumulative step accuracy and a 48-50 tooth pitch configuration which give it smooth operating soft step motion, less resonance and instability. This motor is connector fitted with 6 wire contacts. The motor specifications provided are for an in series bipolar wiring configuration. Motors can be used in a unipolar configuration. However, current, voltage and torque ratings would change. Contact factory for details.

Specifications

Connections	
Type	Connector
Number of pins	6
Input Voltage	5 VDC
Input Current	0.7 A
Temperature Range	-40°C to 65°C
Dimensions	See drawing

Steps per Revolution	200
Torque	
Holding with 2 phases on	75 oz-in
Residual	1 oz-in
Rotor Inertia	0.04 Lb-in^2
Overhang Load	15 Lb
Thrust Load	25 Lb
Weight	1.5 Lb

Motor Specification "E"
MEDIUM TORQUE STEPPER MOTOR



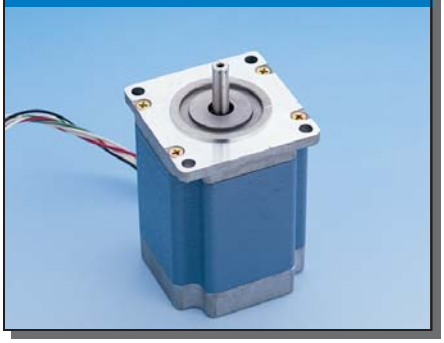
The KML061S04 stepper motor is designed to NEMA standards 23D frame size specifications, and is ideally suited for use with various MDC motion and manipulation devices. It has a ±2% noncumulative step accuracy and can operate in full-step (1.8°) or half-step (0.9°) increments. It can be microstepped to achieve increments as small as .0072° and operate at rates to 20,000 steps per second (6,000 rpm). The motor specifications provided are for in series bipolar wiring configuration.

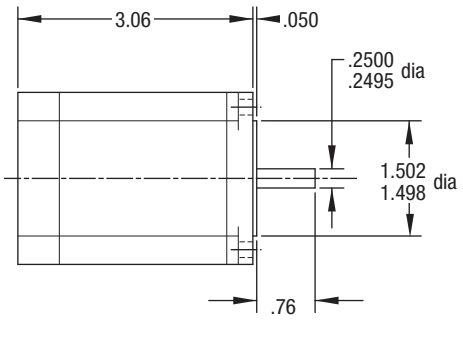
Specifications

Connections	
Type	Connector
Number of pins	6
Input Voltage	3 VDC
Input Current	2 A
Temperature Range	-40°C to 65°C
Dimensions	See drawing
Steps per Revolution	200

Torque	
Holding with 2 phases on	170 oz-in
Residual	1 oz-in
Rotor Inertia	0.0034 oz-in^2
Overhang Load	15 Lb
Thrust Load	25 Lb
Weight	1.6 Lb

Motor Specification "F"
HIGH TORQUE STEPPER MOTOR





KML062S04 stepper motors are designed to NEMA standards 23D frame size specifications. The dual-stack construction of this motor produces double the torque of standard motors. It has a ±2% noncumulative step accuracy and can operate in full-step (1.8°) or half-step (0.9°) increments. It can be microstepped to achieve increments as small as .0072° and operate at rates to 20,000 steps per second (6,000 rpm). Motor specifications represent an in series bipolar wiring configuration.

Specifications

Connections

Type	Connector
Number of pins	6
Input Voltage	4.67 VDC
Input Current	2.12 A
Temperature Range	-40°C to 65°C
Dimensions	See drawing
Steps per Revolution	200

Torque

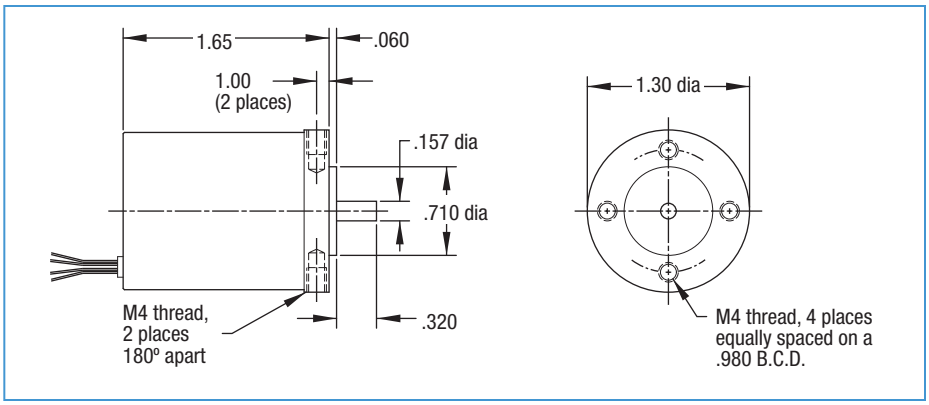
Holding with 2 phases on	250 oz-in
Residual	1.4 oz-in
Rotor Inertia	0.0056 oz-in^2
Overhang Load	15 Lb
Thrust Load	25 Lb
Weight	2.3 Lb

Stepper Motor Controls, see page 465

Controller

Indexer

MINIATURE HV
HIGH VACUUM STEPPER MOTOR



Specifications

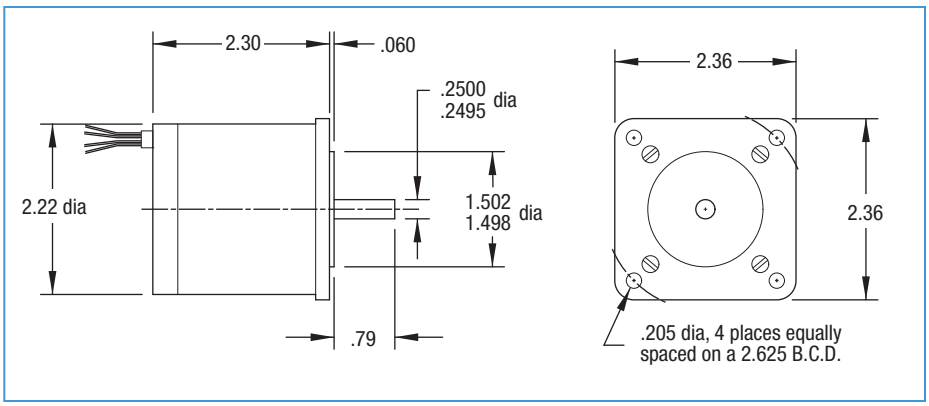
Connections	
Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Thermocouple wires	Not available
Input Voltage	3.12 VDC
Input Current	1.2 A
Temperature Range	-40°C to 150°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	$5x10^{-8}$ Torr
Torque	
Holding	7.5 oz-in
Detent	0.5 oz-in
Winding Resistance	2.6 Ohm
Winding Inductance	1.2 mH
Weight	0.5 Lb

With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside a high vacuum system. Their low outgassing characteristics, make these motors especially suitable for sensitive semiconductor handling and many other high vacuum applications.

REFERENCE	PART NUMBER
SM13-HV	665921

HIGH TORQUE HV
HIGH VACUUM STEPPER MOTOR



Specifications

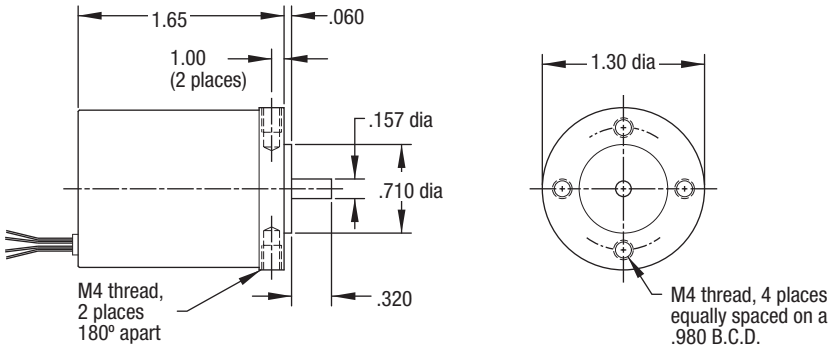
Connections	
Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Thermocouple wires	Not available
Input Voltage	6.8 VDC
Input Current	1.2 A
Temperature Range	-40°C to 150°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	$5x10^{-8}$ Torr
Torque	
Holding	60 oz-in
Detent	4.5 oz-in
Winding Resistance	5.7 Ohm
Winding Inductance	6.7 mH
Weight	1.5 Lb

With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside a high vacuum system. Their low outgassing characteristics, make these motors especially suitable for sensitive semiconductor handling and many other high vacuum applications.

REFERENCE	PART NUMBER
SM23-HV	665911

MINIATURE UHV
ULTRAHIGH VACUUM STEPPER MOTOR



Specifications

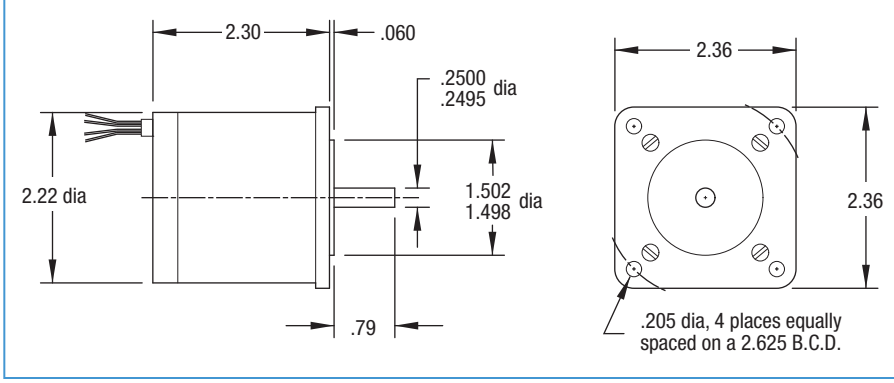
Connections	
Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Type K thermocouple wires	2
Input Voltage	3.12 VDC
Input Current	1.2 A
Temperature Range	-40°C to 250°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	$1x10^{-10}$ Torr
Torque	
Holding	7.5 oz-in
Detent	0.5 oz-in
Winding Resistance	2.6 Ohm
Winding Inductance	1.2 mH
Weight	0.5 Lb

With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside ultrahigh vacuum system. The particulate generation of these stepper motors is minimized by the total absence of metal to metal sliding surfaces. Their low outgassing characteristics, make these motors especially suitable for many sensitive ultrahigh vacuum applications.

REFERENCE	PART NUMBER
SM13-UHV	665922

HIGH TORQUE UHV
ULTRAHIGH VACUUM STEPPER MOTOR



Specifications

Connections	
Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Type K thermocouple wires	2
Input Voltage	6.8 VDC
Input Current	1.2 A
Temperature Range	-40°C to 250°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	$1x10^{-10}$ Torr
Torque	
Holding	60 oz-in
Detent	4.5 oz-in
Winding Resistance	5.7 Ohm
Winding Inductance	6.7 mH
Weight	1.5 Lb

With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside ultrahigh vacuum system. The particulate generation of these stepper motors is minimized by the total absence of metal to metal sliding surfaces. Their low outgassing characteristics, make these motors especially suitable for many sensitive ultrahigh vacuum applications.

REFERENCE	PART NUMBER
SM23-UHV	665912

Miniature 12V DC Motor Controller

Description

DCM-SC-12 controllers are designed for use with MDC 12 VDC motors featured in this catalog. For detailed motor specifications reference motor specification "C" on page 459. This controller provides bidirectional motor control in both continuous and jog modes. Motor speed is adjustable from 0 to 20 rpm via a convenient dial potentiometer. A feedback circuit using the motor's "Back-EMF" provides a flat torque-speed curve. Controller comes factory wired for 115VAC input and is provided with a pre-wired 2 conductor cable for direct connection to MDC 12V motorized components via a standard 2.5-mm plug. A rear panel voltage switch allows the DCM-SC-12 to accept 110 or 220 line voltage. Motor controls are not included as part of feedthrough motorization options and must be purchased separately.

Features

- Run and jog modes
- Variable voltage speed control
- Forward and reverse operation
- 12 volt DC output

Specifications

Controls

Run / Jog	Momentary toggle
Speed	Adjustable voltage potentiometer
Input Voltage	115 / 220 VAC
Input Current	0.25 A maximum
Output Voltage	Variable 0-12 VDC
Output Current	4 A maximum
Temperature Range	-20°C to 85°C
Weight	2 lb
Dimensions	6.75 x 5.80 x 2.85

REFERENCE	PART NUMBER
DCM-SC-12	692002

Standard 90V DC Motor Controller

Description

DCM-SC-90 controllers are designed for use with MDC 90 VDC motors featured in this catalog. For detailed motor specifications reference motor specification "B" on page 458. This controller provides bidirectional motor control in both continuous and jog modes. Motor speed is adjustable from 0 to 10 rpm via a convenient dial potentiometer. A feedback circuit using the motor's "Back-EMF" provides a flat torque-speed curve. Additional built-in features include transient and surge protection, line voltage compensation, soft start, discrete silicon-controlled rectifiers and diodes for higher amperage output and better heat dissipation. Controller comes factory wired for 115VAC input and is provided with a pre-wired 2 conductor cable for direct connection to MDC 90V motorized components. Motor controls are not included as part of feedthrough motorization options and must be purchased separately.

Features

- Run and jog modes
- Variable voltage speed control
- Forward and reverse operation
- 90 volt DC output

Specifications

Controls

Run / Jog	Momentary toggle
Speed	Adjustable voltage potentiometer
Input Voltage	115 VAC
Input Current	1 A
Output Voltage	Variable 0-90 VDC
Output Current	0.50 A
Temperature Range	-20°C to 85°C
Weight	2 lb
Dimensions	6.75 x 5.80 x 2.85

REFERENCE	PART NUMBER
DCM-SC-90	692007

Stepper Motor Controller

Description

SMC-M controllers are designed for use with MDC stepper motors featured in this catalog. Stepper motor specifications "D, E and F" can be found starting on page 460.
This controller is also recommended for use with the high and ultrahigh, in-vacuum stepper motors detailed on page 462. Current control output is vital in any stepper motor controller; MDC stepper motor controllers employ the time-tested, bipolar chopper regulation of current. Output current is factory set to 0.6 amperes required for the low torque "D" motor. Output current must be adjusted to 2.0 amperes for the medium and high torque motors, "E" and "F" respectively. Resetting current output for 2.0 amperes is accomplished by adjusting the six internal DIP switches to the off position. Stepper motor controls are not included with motorization options, and must be purchased separately.

Features

- Run and jog modes
- Variable speed control
- Forward and reverse operation
- 5 volt DC output

Specifications

Step Counter	Four digit LED
Resolution	Half-step increments
Controls	Manual Dial, Forward / Reverse
Input Voltage	115 VAC
Input Current	1 A
Output Voltage	5 VDC, 2 Phase
Output Current	Adjustable from 0.5 to 2.5 A
Temperature Range	-20 to 85°C
Weight	9 Lb
Dimensions	8.60 x 9.50 x 5.05

REFERENCE		PART NUMBER
CONTROLLER	SMC-M	692005

Stepper Motor Indexer

Description

The SMC-1 indexer is a powerful and user friendly tool capable of complex motion profile control when interfaced with an IBM compatible PC. The indexer comes with the necessary software for programming via ASCII commands. The 37 pin Type-D subminiature interface provides the user with TTL input and output access. Please note that stepper motor controllers and indexer are not included with motorization options, and must be purchased separately.

Features

- Bidirectional ramping
- RS-232C interface
- Programmable via host computer

Specifications

Interface	RS-232C
Input / Output	37 pin Type-D subminiature
Controller Interface	9 pin Type-D subminiature
Memory	100 Block programs, 512 bytes
Control	Via IBM compatible PC
Input Voltage	115 VAC
Speed	23,000 Steps / second maximum
Distance	65,000 Steps / move command
Temperature Range	-20 to 85°C
Weight	4 Lb
Dimensions	8.50 x 9.50 x 2.85

REFERENCE		PART NUMBER
INDEXER	SMC-1	692006