# Y, XY AND XYZ MOTION

## Introduction to Y, XY and XYZ Stages

- **Y Shifts**
- **XY MultiBase Manipulators**
- **XY MultiBase Manipulators with Rotatable Axis**
- **XYZT Single Bellows Stages**
- **XYZ Dual Bellows Stages**
**Y, XY and XYZ Motion**

**Introduction**

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

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

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

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

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

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

**Y Motion Only**

- Precise, repeatable axial alignment along Y axis.

**X & Y Motion**

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

**X, Y and Z motion**

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

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

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

Overview

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

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

Specification Table

<table>
<thead>
<tr>
<th>MODEL</th>
<th>LDM64/38</th>
<th>LDM64/64</th>
<th>LDM100/38</th>
<th>LDM100/64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed flange</td>
<td>CF64 114mm (4.5&quot;) OD CF</td>
<td>CF100 152mm (6&quot;) OD CF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travelling flange</td>
<td>CF64 114mm (4.5&quot;) OD CF</td>
<td>CF64 114mm (4.5&quot;) OD CF</td>
<td>CF64 114mm (4.5&quot;) OD CF</td>
<td></td>
</tr>
<tr>
<td>Offset</td>
<td>+/- 7.5mm</td>
<td>+/- 31mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bellows bore</td>
<td>60mm</td>
<td>90mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear bore</td>
<td>38mm</td>
<td>60mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flange to flange</td>
<td>87.5mm</td>
<td>182mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Y-SHIFT KEY ADVANTAGES

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

Design Concept

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

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

Base Drive Dimensions

LDM64-38-H

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

LDM100-38-H

LDM Series Part Code Generator

Example Configured Part Number:
LDM64-64-IS
LSM, CF64 fixed flange, CF64 travelling flange, CF64, with in-line stepper motor IS

For details of ‘plug & play’ motor controllers please see section 13

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MultiBase XY Stages

The MultiBase XY stage is the first choice for both research and demanding production environments due to its precise motion, true UHV performance and rugged construction which allows mounting in any-orientation. The MultiBase design includes two parallel flanges. One remains fixed, whilst the other provides the movement. A high quality, supple, edge-welded bellows spans the flanges to accommodate the required motion while ensuring an all-metal vacuum enclosure. The device works by adjusting the position of the travelling flange in relation to the fixed system mounting flange. Positioning of the travelling flange is controlled through two external lead-screws, each benefiting from anti-backlash systems. A kinematic mechanism ensures smooth and precise motion. This novel mechanism incorporates a high precision drive and guidance system, removing the requirement for vulnerable cross-roller slides used by other manufacturers. Combining this with a rigid construction allows mounting in any-orientation without additional supports. Scales are fitted to each axis for resolving the position of the travelling flange on the manual version. The motorised stages are fitted with stepper motors and pre-wired limit and home switches.

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

Modular platforms for the manipulation of components in the X and Y planes. Kinematic design ensures smooth and precise motion.

Specification Table

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Travelling flange</th>
<th>Mounting flange</th>
<th>X Y travel</th>
<th>Xmax, Ymax</th>
<th>Clear bore diameter</th>
<th>Maximum Probe OD</th>
<th>X Y resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>XY14-64-38</td>
<td>CF64 70mm (2.75&quot;) OD with M6 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>+/- 14mm (vector)</td>
<td>+/- 24mm</td>
<td>51mm</td>
<td>22mm max to achieve full movement</td>
<td>Manual drive +/- 0.01mm. Stepper motor drive +/- 0.005mm</td>
</tr>
<tr>
<td>XY14-100-38</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF100 152mm (6&quot;) OD with M8 straddled holes</td>
<td>+/- 31mm (vector)</td>
<td>+/- 40mm</td>
<td>90mm</td>
<td>28mm max to achieve full movement</td>
<td>Manual drive +/- 0.01mm. Stepper motor drive +/- 0.005mm</td>
</tr>
<tr>
<td>XY31-100-38</td>
<td>CF100 152mm (6&quot;) OD with M8 straddled holes</td>
<td>CF150 203mm (8&quot;) OD with M8 straddled holes</td>
<td>+/- 57mm (vector)</td>
<td>+/- 54mm</td>
<td>150mm</td>
<td>36.5mm max to achieve full movement</td>
<td>Manual drive +/- 0.01mm. Stepper motor drive +/- 0.005mm</td>
</tr>
<tr>
<td>XY31-150-38</td>
<td>CF150 203mm (8&quot;) OD with M8 straddled holes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>XY31-150-64</td>
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<tr>
<td>XY31-150-150</td>
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<td></td>
<td></td>
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<tr>
<td>XY57-150-150</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Example Configured Part Number:
XY14-64-38-H

For details of ‘plug & play’ motor controllers please see section 13

Base Drive Dimensions

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

A unique feature for XY manipulators from UHV Design allows the X and Y axes to be rotated about the axis of the manipulator, whilst under vacuum, such that they can be aligned precisely with a particular port axis on a chamber. This is a unique feature for XY manipulators, developed by UHV Design. The feature is particularly useful when using techniques where focusing is critical, avoiding the conventional step movements required by other manufacturers of XY stages.

The Rotatable Axis MultiBase XY manipulator enables the X and Y axes to be rotated around the axis of the manipulator, whilst under vacuum, enabling precise alignment with a port axis. For use with techniques where focusing is critical, avoiding the conventional step movements required by other manufacturers of XY stages.

Using the Rotatable Axis MultiBase, the sample can be precisely moved along the axis of any port until optimum focusing is achieved. It can then be moved orthogonally to explore other areas of the sample, without losing focus. A conventional XY stage would require repeated step movements in the X and Y axes to reach a specific location, followed by further stepping movements on each axis to travel along the desired path or angle. The Rotatable Axis MultiBase removes this requirement, greatly simplifying positioning and focusing tasks. Rotation can be actuated manually or motorised.

Specification Table

<table>
<thead>
<tr>
<th>MODEL</th>
<th>XY14-64-38</th>
<th>XY14-100-38</th>
<th>XY31-100-38</th>
<th>XY31-100-64</th>
<th>XY31-150-64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travelling Flange</td>
<td>CF38 70mm (2.75&quot;) OD with M6 straddled holes</td>
<td>CF38 70mm (2.75&quot;) OD with M6 straddled holes</td>
<td>CF38 70mm (2.75&quot;) OD with M6 straddled holes</td>
<td>CF38 70mm (2.75&quot;) OD with M6 straddled holes</td>
<td>CF38 70mm (2.75&quot;) OD with M6 straddled holes</td>
</tr>
<tr>
<td>Mounting Flange</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
</tr>
<tr>
<td>X Y travel</td>
<td>+/- 14mm (vector)</td>
<td>+/- 31mm (vector)</td>
<td>+/- 28mm (vector)</td>
<td>+/- 22mm (vector)</td>
<td>+/- 28mm (vector)</td>
</tr>
<tr>
<td>Xmax, Ymax</td>
<td>+/- 10mm</td>
<td>+/- 10mm</td>
<td>+/- 10mm</td>
<td>+/- 22mm</td>
<td>+/- 22mm</td>
</tr>
<tr>
<td>X Y resolution</td>
<td>Manual drive +/- 0.01mm, Stepper motor driven +/- 0.005mm (based upon 400 half-steps per revolution)</td>
<td>Manual drive +/- 0.01mm, Stepper motor driven +/- 0.005mm (based upon 400 half-steps per revolution)</td>
<td>Manual drive +/- 0.01mm, Stepper motor driven +/- 0.005mm (based upon 400 half-steps per revolution)</td>
<td>Manual drive +/- 0.01mm, Stepper motor driven +/- 0.005mm (based upon 400 half-steps per revolution)</td>
<td>Manual drive +/- 0.01mm, Stepper motor driven +/- 0.005mm (based upon 400 half-steps per revolution)</td>
</tr>
<tr>
<td>Rotational resolution</td>
<td>Stepper motor driven +/-0.006° per ½ step</td>
<td>Stepper motor driven +/-0.006° per ½ step</td>
<td>Stepper motor driven +/-0.006° per ½ step</td>
<td>Stepper motor driven +/-0.006° per ½ step</td>
<td>Stepper motor driven +/-0.006° per ½ step</td>
</tr>
<tr>
<td>Probe OD</td>
<td>22mm max to achieve full movement</td>
<td>22mm max to achieve full movement</td>
<td>22mm max to achieve full movement</td>
<td>22mm max to achieve full movement</td>
<td>22mm max to achieve full movement</td>
</tr>
<tr>
<td>Actuation</td>
<td>Manual via combined micrometer handwheel and linear scale. Motorised units are stepper motor driven</td>
<td>Manual via combined micrometer handwheel and linear scale. Motorised units are stepper motor driven</td>
<td>Manual via combined micrometer handwheel and linear scale. Motorised units are stepper motor driven</td>
<td>Manual via combined micrometer handwheel and linear scale. Motorised units are stepper motor driven</td>
<td>Manual via combined micrometer handwheel and linear scale. Motorised units are stepper motor driven</td>
</tr>
</tbody>
</table>

RAMB KEY ADVANTAGES

- Alignment of X & Y axis with any port/beam under vacuum
- Allows precise movement of sample along port axis then orthogonal movement for scanning without loss of focus
- No need for sliding seal or differentially pumped rotary housing

Rotatable Axis MultiBase Series Part Code Generator

Example Configured Part Number: XY31-100-64-H-RH

« XY31, CF100 fixed flange, CF38 travelling flange, CF64 with manual handwheel for XY motion H and manual handwheel for MultiBase motion RH »

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Y, XY and XYZ Should your requirements fall outside our standard specifications then please contact us at:
**TETRAXE XYZT Stage**

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

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

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

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

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

**Specification Table**

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

**TetrAxé Series Part Code Generator**

For complete analytical stages - see Section 10

Example Configured Part Number: TTX40-100-25-XS

1. TTX40 travelling flange 40; CF63 fixed flange 63; 100mm Z stick 100 with manual stepper motorised X-axis XS

For complete analytical stages - see Section 10

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MultiStage XYZ Stages

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

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

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

Specification Table

<table>
<thead>
<tr>
<th>MODEL</th>
<th>XY14-64-38</th>
<th>XY14-100-38</th>
<th>XY31-100-38</th>
<th>XY31-100-64</th>
<th>XY31-150-64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travelling range</td>
<td>CF38 70mm (2.75&quot;) OD with M6 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF100 152mm (6&quot;) OD with M8 straddled holes</td>
<td>CF150 203mm (8&quot;) OD with M8 straddled holes</td>
</tr>
<tr>
<td>Mounting flange</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF64 114mm (4.5&quot;) OD with M8 straddled holes</td>
<td>CF100 152mm (6&quot;) OD with M8 straddled holes</td>
<td>CF150 203mm (8&quot;) OD with M8 straddled holes</td>
</tr>
<tr>
<td>X travel</td>
<td>+/- 10mm (+/- 14mm vector)</td>
<td>+/- 22mm (+/- 31mm vector)</td>
<td>+/- 31mm (+/- 31mm vector)</td>
<td>+/- 31mm (+/- 31mm vector)</td>
<td>+/- 31mm (+/- 31mm vector)</td>
</tr>
<tr>
<td>Y travel</td>
<td>+/- 0.01mm</td>
<td>Manual drive</td>
<td>Manual drive</td>
<td>Manual drive</td>
<td>Manual drive</td>
</tr>
<tr>
<td>Z travel</td>
<td>Z shifts are available with following strokes as standard: 100, 200, 400, 600, 800 and 1000mm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

Six Axes Motion
Combining the MultiStage with UHV Design’s MagiDrive rotary feedthroughs allows transmission of rotary motion through the centre. In addition, the hollow MagiDrive allows services, for example heating and cooling apparatus, to be passed through the centre.

The hollow configuration enables stacking of MagiDrives to provide further independent axes of rotation. In this way, the three axes of motion already provided by the MultiStage can be supplemented with up to three more.

MultiStage Part Code Generator

Example Configured Part Number:
XY31-100-64-H-Z-400-H
= XY31, CF100 fixed flange, CF64 travelling flange CF38, with manual handwheel for XY motion H, 400mm of Z travel Z400 and manual Z actuation H.

For complete analytical stages - see Section 10

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Y, XY and XYZ
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