Section 04

SAMPLE TRANSFER ARMS

Introduction to Sample Transfer Arms
Torque, Thrust and Deflection Graphs
Linear Power Probe
Linear/Rotary Power Probe
Elevating Power Probe
Dual Axis Power Probe
Triple Axis Power Probe
Power Probe & Y-shift
Sample Transfer Arms

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

Exceptional performance

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

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

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

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

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

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

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

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

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

By combining a Y-shift with any of the standard PowerProbes, an additional lift and lower motion is achieved for durable production-proven sample transfer.
High performance magnetically-coupled linear devices, designed for sample transfer where only linear motion is required and rotation is undesirable. Available in standard stroke lengths from 304mm to 1524mm with motorisation options. The LPP is bakeable to 250°C without removing any components.

The Linear PowerProbe should be selected where only linear motion is required and twisting or turning of the sample would be undesirable. An anti-rotation system is fitted internally ensuring straight, in-line motion, despite any rotation of the external drive thimble. This removes the need for the unwieldy and bulky external linear guide bars used by other manufacturers and guarantees no rotation during the stroke.

Furthermore the external drive carriage has only a linear magnetic coupling (no rotary magnetic coupling) meaning no torque is applied to the shaft when rotating the thimble. Fewer parts also means that this linear only version of the PowerProbe is a lower cost than the rotary and linear versions. A retracted switch option is available which provides indication when the probe is fully retracted. This signal can be interlocked to prevent, for example, the premature closing of a gate valve before the PowerProbe has fully retracted.

Specification Table

**LINEAR POWERPROBE**

<table>
<thead>
<tr>
<th>Mounting Flange Size</th>
<th>FLANGE WITH CLEAR HOLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF35 FLANGE WITH CLEAR HOLES</td>
<td>TAPPED M8 x 20.0</td>
</tr>
<tr>
<td>3 x TAPPED M3 ON A 22.0 PCD</td>
<td></td>
</tr>
<tr>
<td>STROKE (e.g. 609mm)</td>
<td></td>
</tr>
<tr>
<td>304</td>
<td>457</td>
</tr>
</tbody>
</table>

**Linear PowerProbe**

<table>
<thead>
<tr>
<th>Linear PowerProbe</th>
<th>Flange Size (select one)</th>
<th>Axial Stroke (select one)</th>
<th>Actuation Option (select one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Only</td>
<td>CF85 (Standard)</td>
<td>304</td>
<td>Linear Thimble</td>
</tr>
<tr>
<td>Linear Only</td>
<td>CF64 (Option)</td>
<td>457</td>
<td>Manual Thimble</td>
</tr>
</tbody>
</table>

Example Part Number:

LPP35-457-HR
= LPP CF35 flange 35, 457mm stroke 457, manual thimble with retracted switch HR
Sample Transfer
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PP KEY ADVANTAGES
- Unrivalled axial coupling strength
- 10x thrust and 4x torque compared to conventional devices
- Exceptional axial stiffness
- Zero backlash under low load
- Bakeable to 250°C without removing any components

The PowerProbe provides both linear and rotary motion of the sample, via a single actuator. The PowerProbe’s powerful magnetic coupling technology provides performance far in advance of conventional probes on the market avoiding magnetic hysteresis and de-coupling issues suffered by traditional designs.

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

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

Specification Table

<table>
<thead>
<tr>
<th>POWER PROBE</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting flange size</td>
<td>CF38 70mm (2.75&quot;) OD CF</td>
</tr>
<tr>
<td></td>
<td>CF64 114mm (4.5&quot;) OD CF</td>
</tr>
<tr>
<td>Linear axial coupling break-away force</td>
<td>180 N (40.5 lbf) standard with 90N (20 lbf) &amp; 310N (69.7 lbf) versions available on request.</td>
</tr>
<tr>
<td>Rotary coupling break-away torque</td>
<td>4 Nm (2.95 lbf ft)</td>
</tr>
<tr>
<td>Sample weight / load capacity</td>
<td></td>
</tr>
<tr>
<td>Maximum recommended internally applied load when vertically installed</td>
<td></td>
</tr>
<tr>
<td>Bakeout temperature</td>
<td></td>
</tr>
<tr>
<td>Position locking</td>
<td>Thumbscrew (manual only)</td>
</tr>
<tr>
<td>Axial &amp; Torsional Stiffness</td>
<td>Refer to graphs on page 57</td>
</tr>
</tbody>
</table>

PowerProbe + Flange Size (select one) + Axial Stroke (select one) + Actuation Options (select one)

- 35
- 45
- 69
- 914
- 1219
- 1524

Linear & Rotary: PP

- CF35
- CF44

- 350mm (12”)
- 457mm (18”)
- 690mm (24”)
- 914mm (36”)
- 1219mm (48”)
- 1524mm (60”)

- Manual Thimble
- Manual Thimble with retracted switch

Example Part Number: PP35-609-HR
- PP CF35 flange 35, 609mm stroke 609, manual thimble with retracted switch HR

Base Probe Dimensions

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

PP Part Code Generator

Example Part Number: PP35-609-HR
- PP CF35 flange 35, 609mm stroke 609, manual thimble with retracted switch HR
Linear With Rotatable Inner Shaft

Dual Axis PowerProbe
(DAPP Series)

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

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

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

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

Standard End-effectors

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

**Specification Table**

<table>
<thead>
<tr>
<th>DUAL AXIS POWERPROBE</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting flange</td>
<td>CF35 70mm (2.75&quot;) OD</td>
</tr>
<tr>
<td>Linear coupling break-away force</td>
<td>180 N (40.5 lbf) standard with 90N (20 lbf) &amp; 310N (69.7 lbf) versions available on request.</td>
</tr>
<tr>
<td>Rotary coupling break-away torque (second shaft)</td>
<td>4 Nm (2.95 lbf ft)</td>
</tr>
<tr>
<td>Sample weight / load capacity</td>
<td>Maximum recommended internal load-carrying capacity will be a function of probe extension, but we recommend not to exceed a moment of 20 Nm (15 lbf ft) at full extension.</td>
</tr>
<tr>
<td>Pressure range</td>
<td>Atmosphere to 5x10^-7 mbar</td>
</tr>
<tr>
<td>Bakeout temperature</td>
<td>PowerProbes are bakeable to 250°C without the removal of any components (except for motors).</td>
</tr>
<tr>
<td>Position locking</td>
<td>Thumbscrew (manual only)</td>
</tr>
<tr>
<td>Axial &amp; Torsional Stiffness</td>
<td>Refer to graphs on page 57</td>
</tr>
</tbody>
</table>

**DAPP KEY ADVANTAGES**

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

**Base Probe Dimensions**

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

<table>
<thead>
<tr>
<th>Stroke (mm)</th>
<th>304</th>
<th>457</th>
<th>609</th>
<th>914</th>
<th>1219</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>515</td>
<td>692</td>
<td>931</td>
<td>1225</td>
<td>1530</td>
</tr>
</tbody>
</table>

**DAPP Part Code Generator**

Example Part Number:
DAPP35-457-HR-F
= DAPP CF35 flange 35, 457mm stroke 457, manual thimble with retracted switch HR and flag end-effector F

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**Elevating PowerProbe**

**EPP Series**

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

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

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

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

**EPP KEY ADVANTAGES**

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

**Specification table**

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

**Example Probe Dimensions**

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

**EPP Part Code Generator**

Example Probe Dimensions

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

**EPP Part Code Generator**

Example Part Number: EPP64-609-H-25 = EPP-CF64 flange 64, 609mm stroke 609, manual thimble H, 25mm elevation option 25

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**Sample Transfer**

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Rotary Inner Shaft with Trigger Mechanism

**Triple Axis PowerProbe**
(TAPP Series)

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

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

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

**Specification Table**

<table>
<thead>
<tr>
<th>TRIPLE AXIS POWERPROBE</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting Flange</td>
<td>CF35 70mm (2.75&quot;) OD</td>
</tr>
<tr>
<td>Linear coupling break-away force</td>
<td>180 N (40.5 lbf) standard with 90N (20 lbf) &amp; 310N (69.7 lbf) versions available on request.</td>
</tr>
<tr>
<td>Rotary coupling break-away torque</td>
<td>4 Nm (2.95 lbf ft)</td>
</tr>
<tr>
<td>Sample weight / load capacity</td>
<td>Maximum recommended internal load-carrying capacity will be a function of probe extension, but we recommend not to exceed a moment of 20 Nm (15 lbf ft).</td>
</tr>
<tr>
<td>Pressure range</td>
<td>Atmosphere to 5x10⁻⁷ mbar</td>
</tr>
<tr>
<td>Bakeout temperature</td>
<td>PowerProbes are bakeable to 250°C without the removal of any components (except for motors).</td>
</tr>
<tr>
<td>Position locking</td>
<td>Thumbscrew (manual only)</td>
</tr>
<tr>
<td>Axial &amp; Torsional Stiffness</td>
<td>Refer to graphs on page 57</td>
</tr>
</tbody>
</table>

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

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

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

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

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

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

**TAPP Part Code Generator**

**Example Part Number:**
TAPP35-457-HR-F

= DAP CF35 flange 35, 457mm stroke 457, Manual Thimble with retracted switch HR, Flag end-effector F

**Base Probe Dimensions**

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

<table>
<thead>
<tr>
<th>Stroke (mm)</th>
<th>304</th>
<th>457</th>
<th>609</th>
<th>914</th>
<th>1219</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>515</td>
<td>692</td>
<td>870</td>
<td>1225</td>
<td>1530</td>
</tr>
</tbody>
</table>
Sample Hand-off System

Y Shift with PowerProbe

Combines the linear/rotary motion of the PowerProbe with the ability to lift and lower a sample by +/-7.5mm or +/-31mm to enable transfer. Available in CF64 & CF100 mounting flange options with manual or motorised actuation. Customised transfer forks available - contact us for more details.

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

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

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

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

Specifications

<table>
<thead>
<tr>
<th>Y-Shift Type</th>
<th>Travelling Flange</th>
<th>Mounting Flange</th>
<th>Y motion (lift/lower)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF38</td>
<td>CF64</td>
<td>+/- 7.5 mm</td>
<td></td>
</tr>
<tr>
<td>CF64</td>
<td>CF64</td>
<td>+/- 7.5 mm</td>
<td></td>
</tr>
<tr>
<td>CF38</td>
<td>CF100</td>
<td>+/- 31 mm</td>
<td></td>
</tr>
<tr>
<td>CF64</td>
<td>CF100</td>
<td>+/- 31 mm</td>
<td></td>
</tr>
</tbody>
</table>

Sample Hand-off Part Code Generator

Example:
LDM64-64-H-PP35-457-HR
= LDM CF64 fixed flange 64, CF64 travelling flange 64, manual thimble H fitted with Power Probe PP with CF35 flange 35, 457mm axial stroke 457 and manual thimble with retracted switch HR

Application example

Step 1
Sample
Transfer Fork
Chamber

Step 2
Z Travel From PowerProbe

Step 3
Y Travel From Y Shift

Step 4
Z Travel From PowerProbe

Sample Transfer

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