

Manipulation

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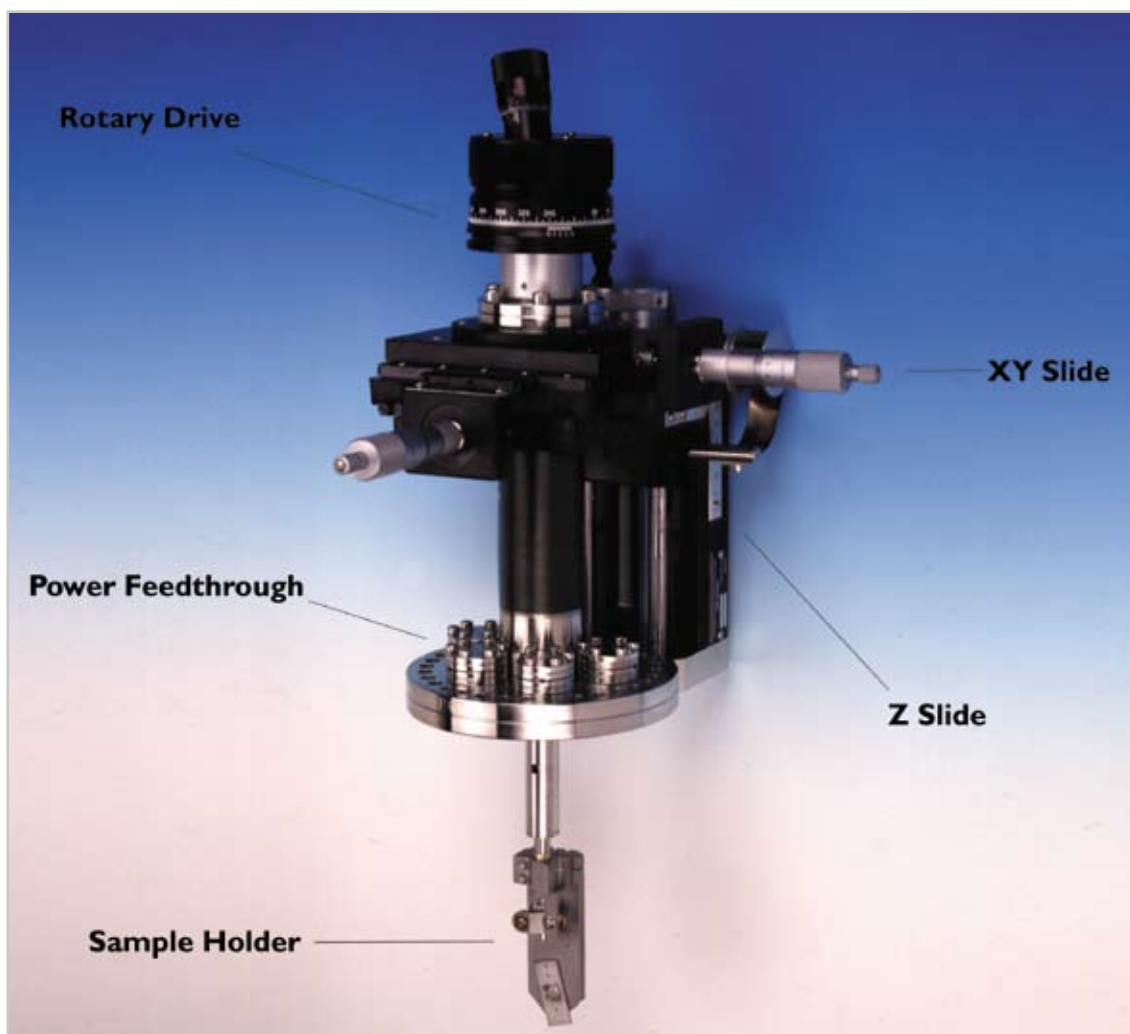
Introduction to Manipulators



The VG Scienta range of manipulator equipment is designed to be modular for convenience and to give total flexibility. The individual modules such as the Z stage, XY stage, rotary drive

and sample holder are compatible to allow complex applications to be built up from a range of standard units.

Checklists are included with each translator to guide you through the configuration process and to help you choose the modules that, when combined, result in the manipulator best suited to your individual application. In addition a more detailed questionnaire will be requested at the time of order to confirm the chosen configuration (this is usually completed by one of our sales agents but a copy can also be supplied on request). With the numerous options available, this questionnaire is your guarantee that the configuration you have requested will be compatible and that you have specified the correct options for the manipulator that you require.



Basic manipulator modules.

Configuring and Ordering Manipulators

Use the selection chart on page 294 to choose the most suitable translator or manipulator for your application, e.g.

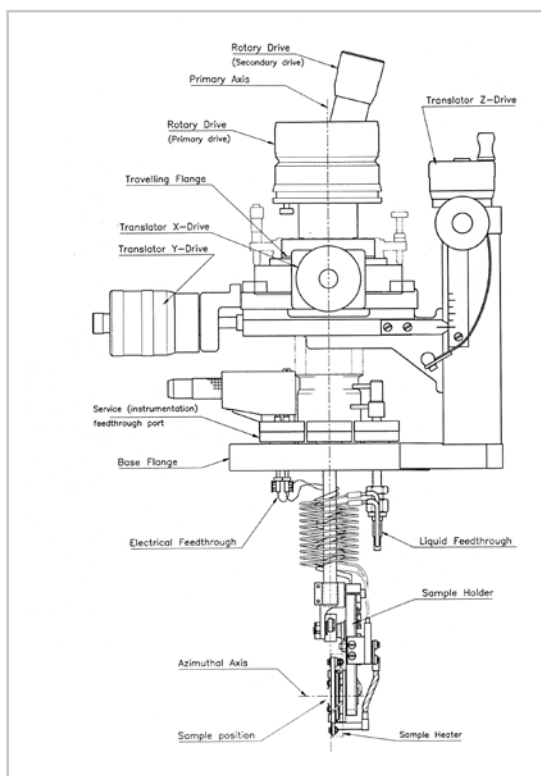
- HPT
- Transax
- Omniax

Choose the required modules and accessories

- Z Slide
- XY Stage
- Rotary Module
- Motors
- Sample Holder
- Sample Services

Complete the checklist for the chosen translator

Contact VG Scienta or your local agent with any queries and for completion of the ordering questionnaire



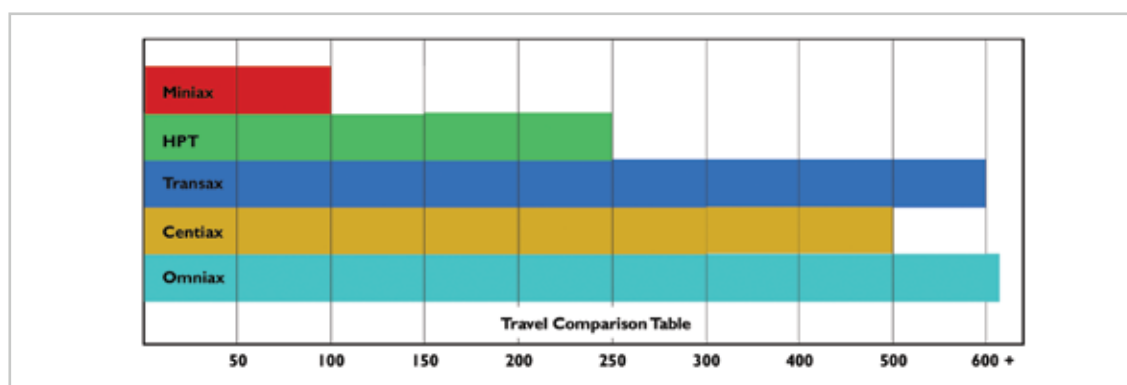
IMPORTANT PRODUCT INFORMATION

Due to our policy of continuous improvement, our products are subject to change without notice. We strongly recommend that you contact VG Scienta, or your local agent, to discuss particular requirements before placing your order.

Configuring and Ordering Manipulators

In order to successfully configure a suitable manipulator for your application, you will need to take several criteria into consideration. Travel range, stability, size of probe and the accessory options you will need, will all have a bearing

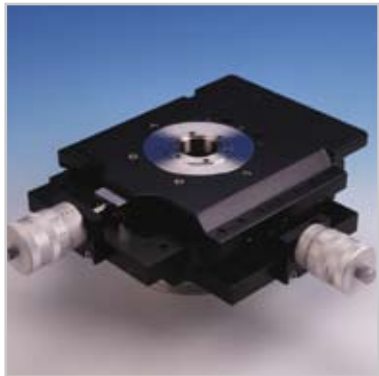
on your final choice. The diagram below gives information on the basic options. The general specifications on bore, probe size, XY travel and Z travel are listed in the table below.



	Description	XY Travel	Z Travel	Clear Bore	Probe Size
XY Tables	A large range of precision XY stages with a choice of flange sizes, travel options probe capacities. Manual or motor drives.	± 12.5 or ± 25.0	-	From 41 to 108	From 16 to 60
MiniAx Translator	Low cost single bellows translator for XY and Z movement. Supplied as an un-configured unit. Not suitable for motorised movement.	± 12.5	50 or 100	35	10
HPT Translator	Precision single bellows translator with full range of motors and sample handling. Supplied fully configured.	± 12.5	50, 100, 150 or 250	35 or 44	10 or 19
Transax Translator	Double bellows translator with good stability and a wide range of travel options. Supplied fully configured.	$\pm 6.0, \pm 12.5$ or ± 25.0	150, 300, 450 or 600	28 with support tube or 33 without	28 or 33
Centiax Translator	Wide bore single bellows translator for large diameter payloads	± 12.5 or ± 25.0	150, 300, or 500	100	up to 100
Omniax Translator	Highly stable double bellows translator with a large probe size. Fully configured with a wide range of options.	± 12.5 or ± 25.0	100, 200, 400, 600, 800 or 1000	28 or 50 with support tube	28 or 50
Cryostats	Choose from four liquid nitrogen and helium cryostats to provide temperatures down to 4.2K. Manipulation in up to five axes. Open or closed cycle operation.	± 12.5 400 or 600 ± 25.0	100, 200,	N/A	N/A
Cryoax 6	Six axis helium-cooled manipulator with a base temperature of <20K. Polar rotation range is 320°, with 190° of azimuthal and 10° of tilt rotation. All axes can be motorised.	± 12.5 or ± 25.0	100, 200, 400, 600, 800 or 1000	N/A	N/A

All dimensions in mm unless otherwise stated.

Configuring and Ordering Manipulators



XYTable - see page 318.



Miniax Translator - see page 322.



HPT Translator - see page 325.



Transax Translator - see page 334.



Centiax Translator - see page 343.



Omniax Translator - see page 346.



Cryostats - see page 357.

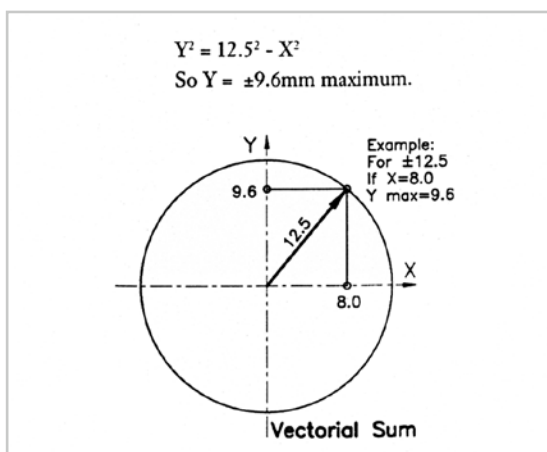
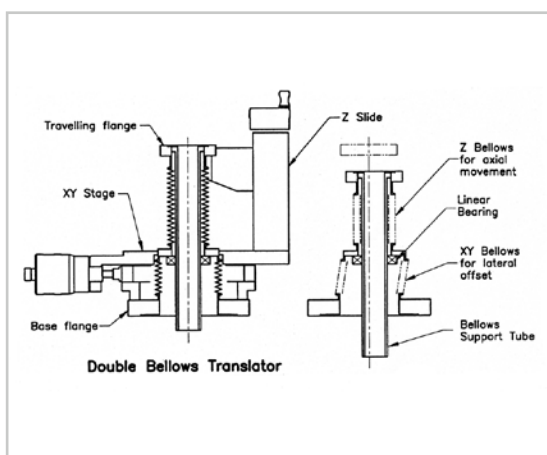
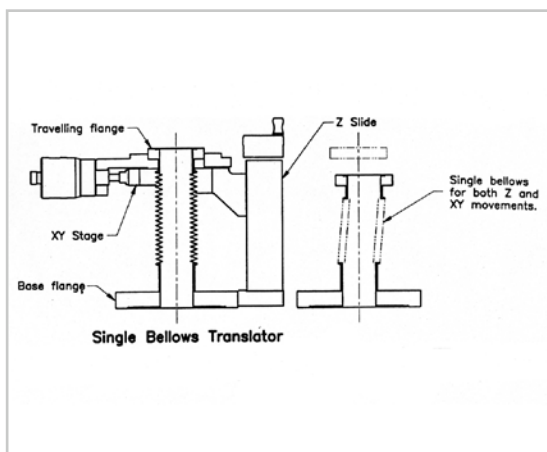


6 - Axis Manipulator - see page 363.

Glossary of Manipulator Terms

Manipulator

A combination of the translator, sample holder and rotary drive modules, connected to the vacuum chamber and used for sample manipulation. Accessories and services such as heating and cooling are frequently included in the manipulator's configuration.



Module

Where an assembly can be built up from sub-assemblies that vary to suit the application, the sub-assemblies are described as modules. Modules can often be used separately or with other assemblies, for example rotary drives or sample holders. VG Scienta's modules are designed to be suitable for the widest possible range of applications.

Translator

The module that provides X, Y and Z motions and is mounted to the vacuum vessel by means of the base flange.

Single Bellows Translator

These utilise the same bellows to give X, Y and Z movements. They are simple and easy to use in any orientation. Feedthroughs for sample services are attached to the base flange.

Double Bellows Translator

These have separate bellows for the XY and the Z movements, with the benefits of increased sample stability and greater range of movement. Feedthroughs for sample services are attached to the travelling flange.

Z Slide

This is the part of the translator which provides the Z movement. The Z axis refers to the translator and is independent of the mounting orientation of the manipulator.

XY Stage

This is the part of the translator which provides the X and Y movement. The XY stage used on double bellows translators can be adapted for use as a separate item (i.e. XY table).

Vectorial Sum

The XY movement is restricted by the total vectorial displacement or offset from the central position. For example, if the vectorial limitation is ± 12.5 mm and $X = 8$ mm, then Y is given by:

$$Y^2 = 12.5^2 - X^2$$

$$\text{So } Y = \pm 9.6 \text{ mm maximum}$$

Glossary of Manipulator Terms

R1 Rotation

Referred to as primary or polar rotation. This is rotation about the axis of the travelling flange.

R2 Rotation

Referred to as azimuthal or Theta rotation, where the axis of the rotation is normal to the sample surface.

R3 Rotation

Referred to as sample tilt or flip, where the axis of rotation is parallel to the sample surface.

Secondary Movement

Where a drive is used to provide a movement in addition to the primary rotation.

Translator Tilt

This is the ability to tilt the rotary drive, an option only available on HPT translators. This option is often used to achieve additional X or Y travel.

Bellows Support Tube

These are fitted within the bellows and along the Z-axis of double bellows translators. They are used for protection of the bellows, securing the sample service wiring and improvement of the sample stability. Where differentially pumped rotary feedthroughs (DPRFs) are used, the support tube can be made to rotate.

Clear Bore

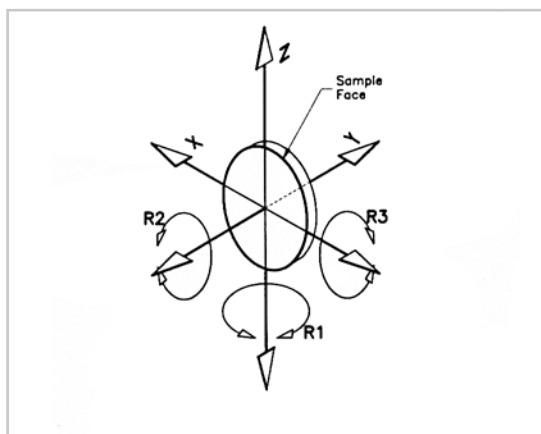
This refers to the bore of the translator, excluding the travelling flange, when the XY stage is in the central position. The clear bore of single bellows translators reduces as the X and Y movements are offset. See also "Probe".

Sample Holder

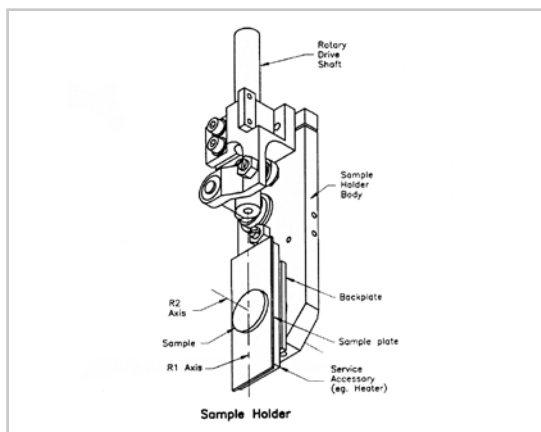
These attach to rotary drives (or other devices) to provide mounting for sample services such as heating, cooling or thermocouples and may include a mechanism for secondary rotation of the sample. Various styles are available, offering different rotation options. The sample itself is usually attached to the sample plate of the service accessory rather than the sample holder itself. All models have an offset adjustment to allow for variations in sample thickness.

Probe

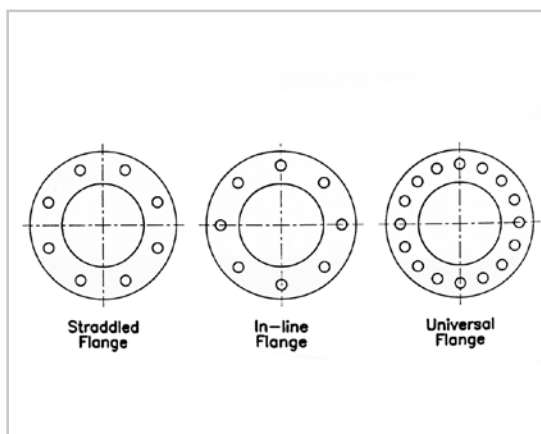
This is an object, such as a rotary drive, fitted along the Z axis of the manipulator. The maximum probe diameter is limited by the bellows



Translation and rotation definitions.



Sample holder.



Bolt hole pattern.

or flange bore, and by the XY offset. Wider probes can be fitted, but the XY movement will be restricted on single bellows translators. Where a support tube is fitted, the probe size does not affect the XY stage movement.

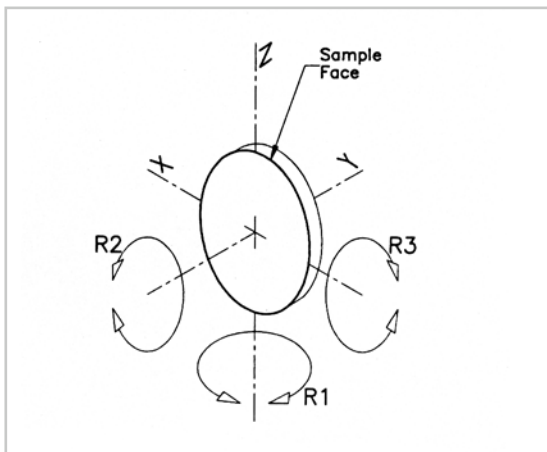
Bolt Pattern

Flange bolt holes can be straddled, in-line or universally aligned to a given axis. In most cases, alternative types can be provided.

Sample Holders



SH2E50 sample holder.



Translation and rotation definitions.

Introduction to Sample Holders

Sample holders attach to the tip of rotary drives and provide rotation to the sample and connection for sample services such as heating or cooling. Several types of sample holder are available, offering a range of movements and sample position. Features such as low magnetic permeability and small swept volume allow these products to be used in sensitive surface science applications.

- Wide choice of positive and accurate rotational movement options
- The sample is normally attached to one of the service accessories which fits to the backplate of the sample holder; these accessories include heaters or plain sample mounts
- The sample size is normally 14 mm x 14 mm with an option for 25 mm x 25 mm.
- All sample holders can accept the HST resistive heater, the EBH electron bombardment heater or the SPA sample mounts. Extra thermocouples can be provided
- All sample holders accept the LN liquid nitrogen cooling accessory, and are compatible with the Helistat and Cryoax 5 cryostats for liquid helium cooling
- The very low swept volume of these sample holders allows samples to be positioned very close to the analysis equipment
- Most sample holders have low magnetic properties for use in sensitive surface science applications
- The SH series have shielded isolators to reduce electrostatic charging
- Offset adjustment enables the sample surface to be preset with respect to the primary or tilt axis. This allows for different sample thickness and is important where the sample face must be coincident with the axis of rotation
- Sample holders are normally supplied as part of a manipulator configuration, but they can be supplied individually for mounting to rotary drive shafts

Construction

Sample holders are fully UHV compatible. The main materials used are stainless steel, alumina, beryllium copper and OFHC copper. The construction of each sample holder varies to give the required axes of rotation. However, the method of attachment and actuation of the secondary motion is the same in all cases.

Glossary of Sample Holder Terms

Rotation

Please refer to the diagram and explanations on page 297.

H Dimension

This is the distance from the rotary drive tip to the sample centre. Increasing this dimension allows larger samples to be fitted and the rotational range increased (see diagram).

Swept Radius

The swept radius (R) gives the clearance required around the primary axis to avoid clashes when the primary axis is rotated through 360° (see diagram).

Enclosed Wiring

The unique VG Scienta design allows the electrical connections to pass through the azimuthal spindle. Combined with the 'Cryo-joint' (another unique VG Scienta feature to control the cooling braid, whilst actually improving performance) the service connections are efficient, tidy and electrostatically screened (see diagram).

Sample Offset

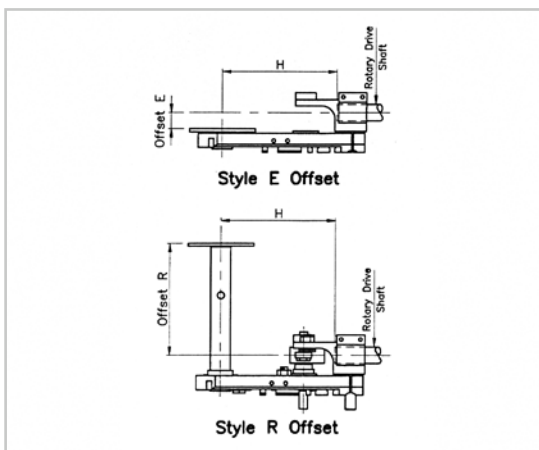
This is the distance of the sample holder backplate from the R1 axis. Offset adjustment is available on all models (see diagram).

Sample Size and Placement

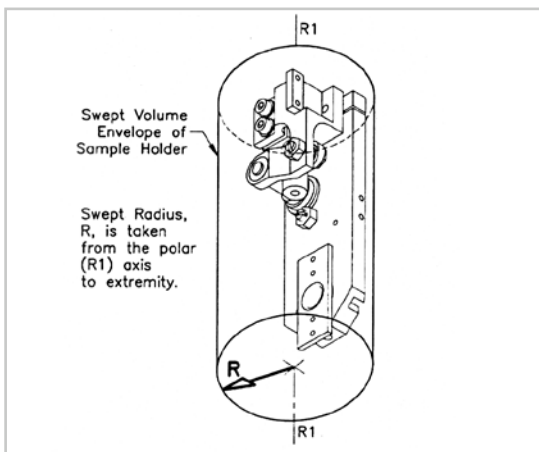
All sample holders are intended for use with a service accessory such as the HST heater. These are equipped with clips suitable for retaining samples up to 1.6mm thick and 14mm square. The clips are also suitable for wobble stick transfer. For thicker and larger samples alternative clips and service accessories can normally be provided.

Magnetic Properties

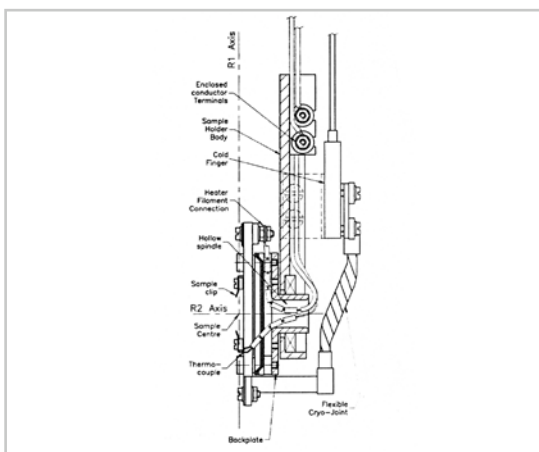
Low magnetic induction is important in low energy spectroscopy and is determined by the relative permeability of the material and by the magnetic field strength. The residual induction is measured at the sample centre after the application of a strong magnetic field.



H dimension and sample offset.



Swept radius and swept volume definitions.



Enclosed wiring.

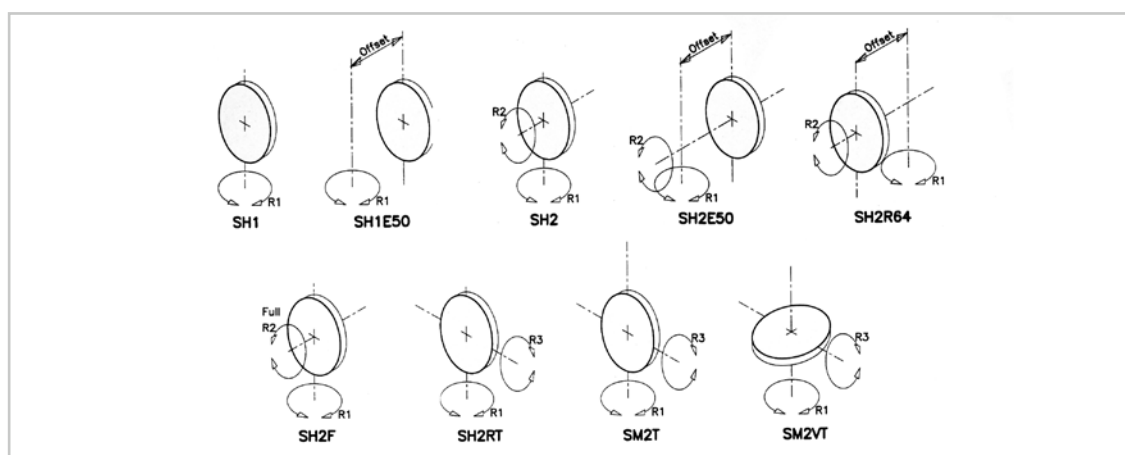
Temperature Ranges

Specifications refer to the achievable temperature of a heated (or cooled) sample plate with no sample attached. The sample temperature is dependant on the nature of the sample itself and on experimental conditions.

Sample Holder Selection

This page gives an overview of the standard range of VG Scienta sample holders, together with their basic specifications. Full details of all types of sample holder including heating and cooling services are given on pages 302 to 317.

Definitions of the specified parameter (rotation range, offsets etc.) are given on pages 296 to 299.

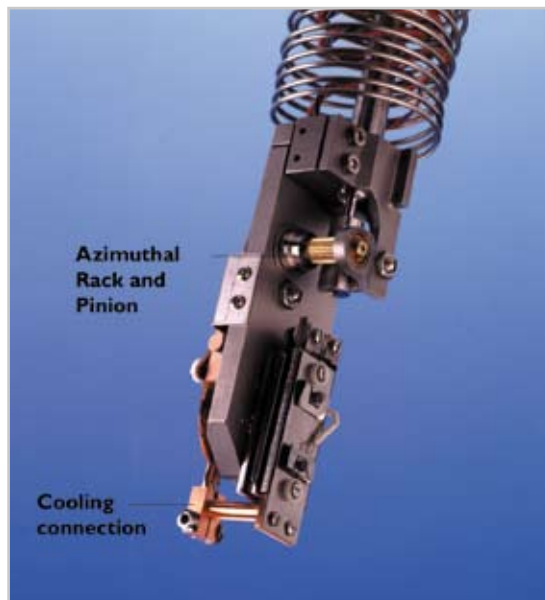
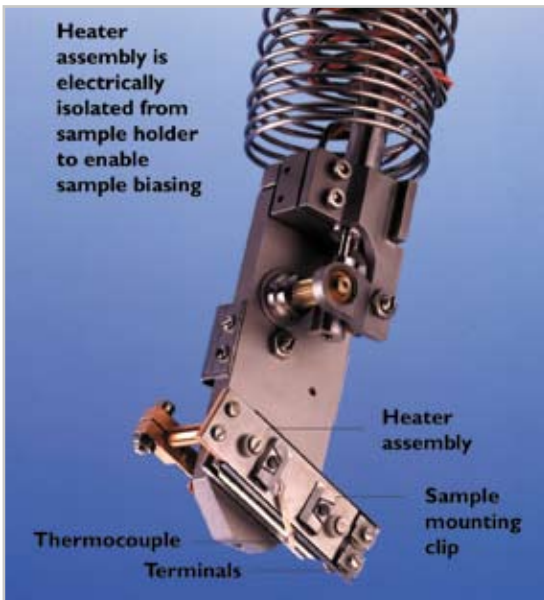
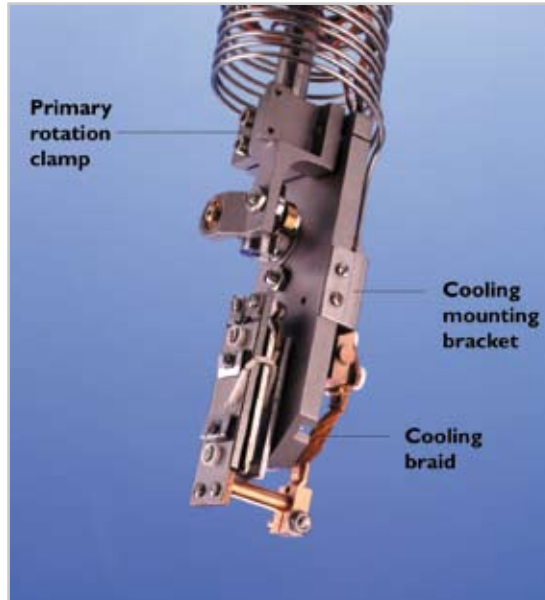
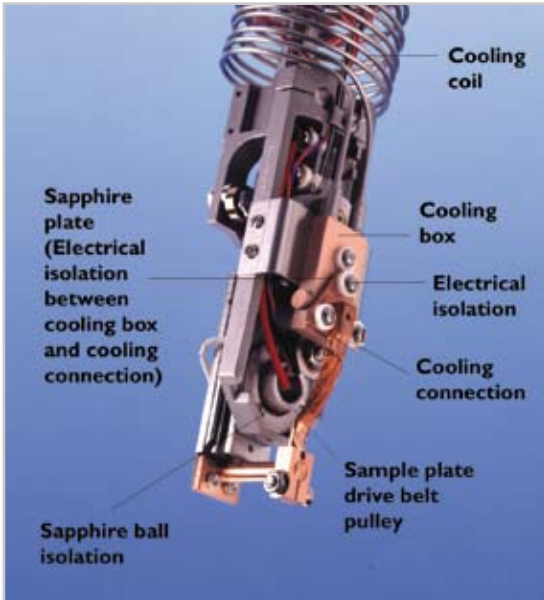


Sample Holders - Basic Specifications									
	SH1	SH1E50	SH2	SH2E50	SH2R64	SH2F	SH2RT	SM2T	SM2VT
Rotary Drive Required	RD1	RD1	RD2	RD2	RD2	RD224	RD2	RD2	RD2
Primary (R1) Rotation									
No services	360°	360°	360°	360°	360°	360°	360°	360°	360°
With services	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°
Azimuthal (R2) Rotation									
Preset	±180°	±180°							
Variable			±110°	±110°	±110°	±180°			
Tilt (R3) Rotation							±110°	±10°	±10°
Sample Offset		E	E	E	R	E	E	E	E
Bare backplate (mm)	9 to 12	9 to 50	9 to 12	9 to 50	54 to 64	9 to 12	5.5 to 9.5	5.5 to 7.5	5.5 to 7.5
Plain or heater unit (mm)	0 to 3	0 to 41	0 to 3	0 to 41	60 to 66	0 to 3	0 to 2.5	0 to 2.5	0 to 2.5
Swept Radius		From		From					
No services (mm)	25	25 (min)	25	25 (min)	54 to 64	25	31	35	24
With all services (mm)	38	38 (min)	38	38 (min)	54 to 64	38	44	Variable	Variable
Magnetic Permeability	Low	Low	Low	Low	Low	Low	Low	Normal	Normal
'H' dimension (mm)	66	66	66	66	66	103	66	66	66
Temperature Ranges									
Resistive heater (HST)	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C
EB heater (EBH)	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C	-160 °C	-160 °C	-140 °C	-160 °C	-160 °C	-160 °C	-160 °C
Approx. resolution per halfstep of RD motor									
R1 rotation (stepper)	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°
R2 rotation (stepper)	-	-	0.001°	0.001°	0.001°	0.001°	-	-	-
R3 rotation (stepper)	-	-	-	-	-	-	0.001°	0.0001°	0.0001°

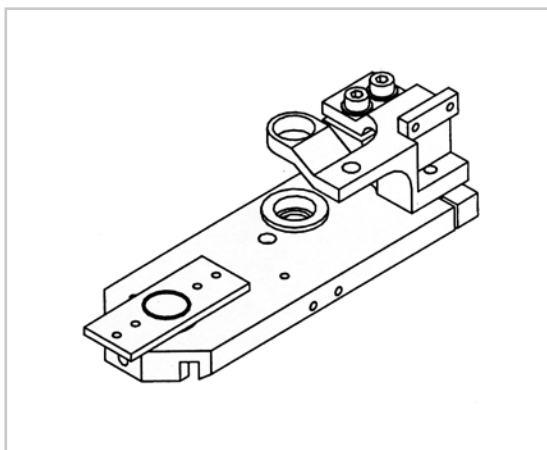
Sample Holder Selection

This series of photographs show an example of a ZSH2 sample holder fitted with a resistance heating accessory (ZHST) together with the liquid nitrogen cooling accessory (ZLN).

The photographs show the key features of the sample holder and the associated heating and cooling accessories

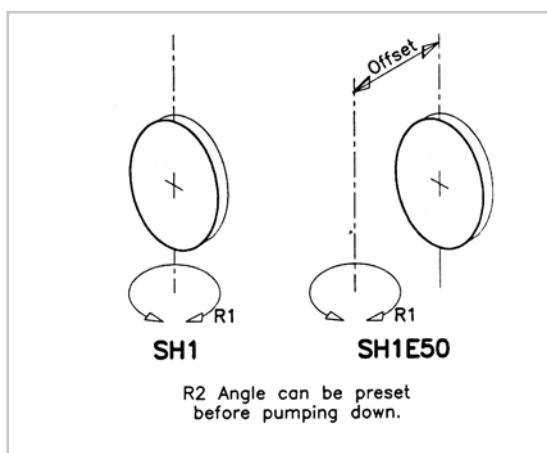


SHI Series for Primary Rotation



The construction uses an exceptionally low magnetic grade stainless steel. Relative permeability is <1.005

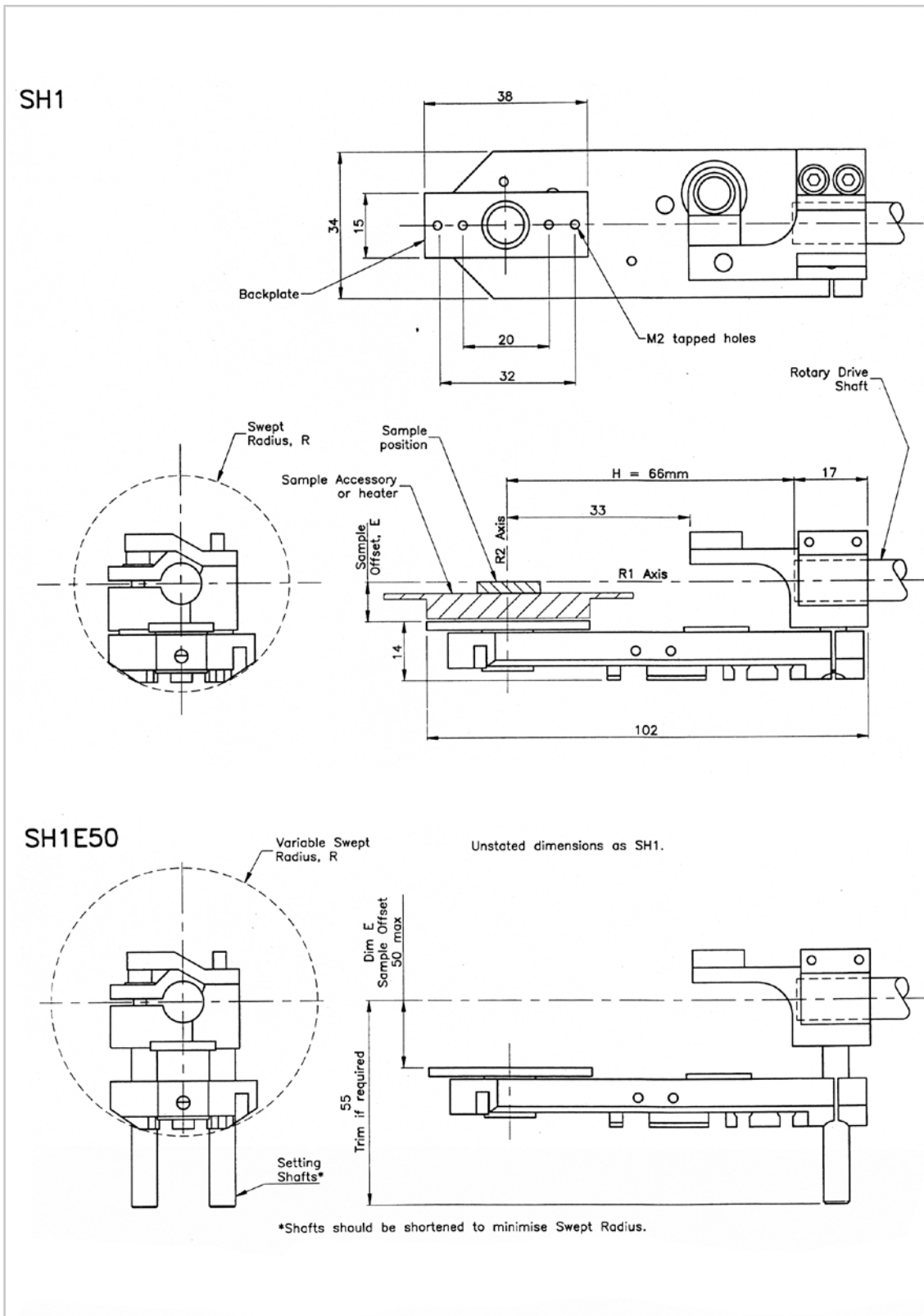
- The wiring is enclosed in this unique design to give the lowest swept volume of a fully serviced sample holder in its class
- The electrical insulation is screened, reducing electrostatic charge build-up
- The sample mounting plate can be adjusted relative to the R1 axis. This allows samples of varying thickness to be rotated on axis
- ZSPA plain accessories are available to make up the offset distance where heating is not required



SHI Technical Data		
	SHI	SH1E50
Rotary Drive required	RD1	RD1
Primary (R1) Rotation		
No services	360°	360°
With services	$\pm 180^\circ$	$\pm 180^\circ$
Azimuthal (R2) Preset	$\pm 180^\circ$	$\pm 180^\circ$
Sample Offset, E		
Bare backplate (mm)	9 to 12	9 to 50
With heater (mm)	0 to 3	0 to 41
Swept Radius		
No services (mm)	25	25 min
With services (mm)	38	38 min
Residual Magnetism (milliGauss)	10	10
'H' dimension (mm)	66	66
Temperature ranges		
Resistive heater (HST)	950 °C	950 °C
EB heater (EBH)	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C

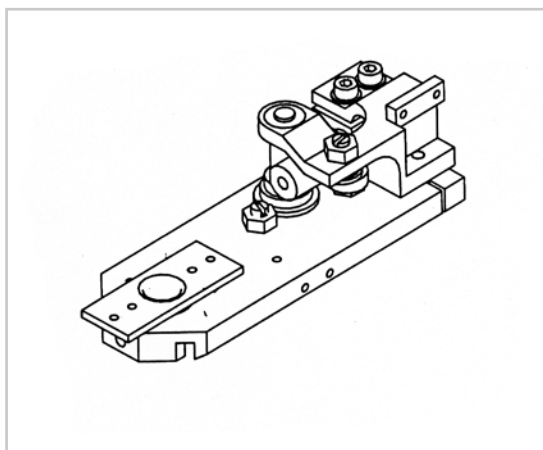
ZSHI Sample Holders and Accessories		
Sample Holder or Accessory	Description and Notes	Order Code
SHI Sample Holder		ZSHI
SH1E50 Sample Holder		ZSH1E50
14 mm Plain Accessory	For attachment of samples where heating is not required	ZSPA14
25 mm Plain Accessory	For attachment of samples where heating is not required	ZSPA25
Resistive Heating	Heating, cooling and thermocouple services can be combined	ZHST
Controller for ZHST		ZRHCH
EB Heating	Details depend on translator used	ZEBH
Controller for ZEBH		ZEBHC
Liquid Nitrogen Cooling	For more information on these services, temperature controllers	ZLN
ZLN Transfer Accessory	and accessories refer to page 312	ZLNHX

SHI Series for Primary Rotation

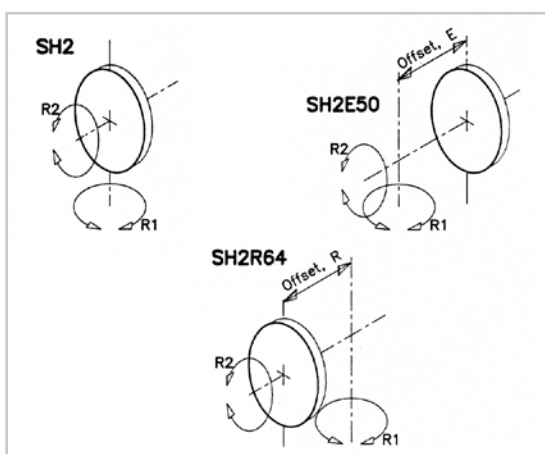


SH1 and SH1E50 sample holders.

SH2 Series for Primary and Azimuthal Rotation



- The construction uses an exceptionally low magnetic grade of stainless steel, ceramic and beryllium copper to minimise residual magnetism
- The wiring is enclosed in this unique design to give the lowest swept volume of a fully serviced sample holder in its class
- The electrical insulation is screened, reducing electrostatic charge build-up
- The sample mounting plate can be adjusted relative to the R1 axis. This allows samples of varying thickness to be rotated on axis
- ZSPA plain accessories are available to make up offset distance where heating is not required.

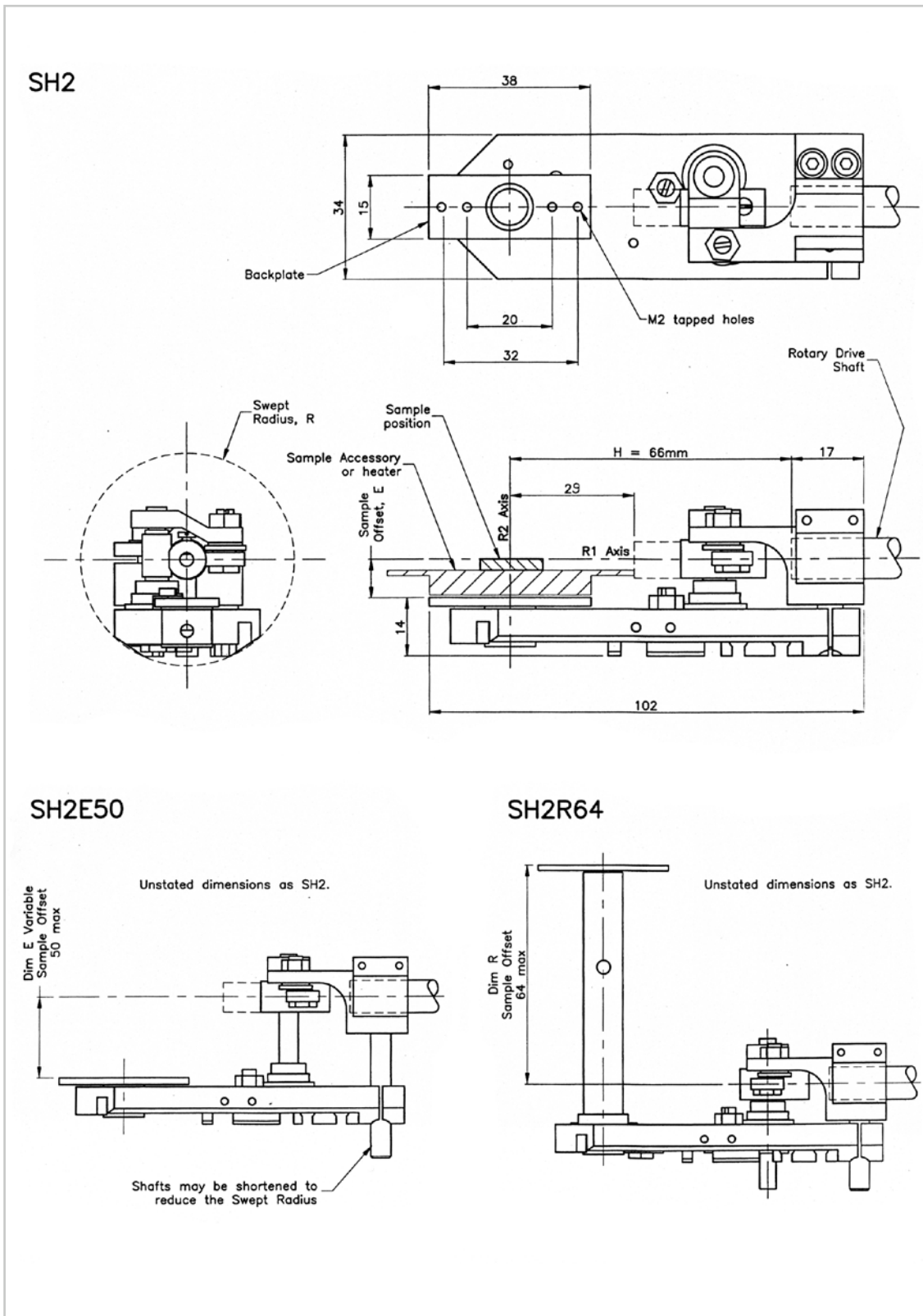


SH2 Technical Data			
	SH2	SH2E50	SH2R64
Rotary Drive required	RD2	RD2	RD2
Primary (R1) Rotation			
No services	360°	360°	360°
With services	±180°	±180°	±180°
Azimuthal (R2) Movement	±110°	±110°	±110°
Sample offset	Standard	(E style)	(R style)
Bare backplate (mm)	9 to 12	9 to 50	54 to 64
With heater (mm)	0 to 3	0 to 41	60 to 66
Swept Radius			
No services (mm)	25	25 min	54 to 64
With services (mm)	38	38 min	54 to 64
Residual Magnetism (milliGauss)	10	10	10
'H' Dimension (mm)	66	66	66
Temperature Ranges			
Resistive heater (HST)	950 °C	950 °C	950 °C
EB heater (EBH)	1200 °C	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C	-140 °C

ZSH2 Sample Holders and Accessories		
Sample Holder or Accessory	Description and Notes	Order Code
SH2 Sample Holder		ZSH2
SH2E50 Sample Holder		ZSH2E50
SH2R64 Sample Holder		ZSH2R64
14 mm plain accessory	For attachment of samples where heating is not required	ZSPA14
25 mm plain accessory	For attachment of samples where heating is not required	ZSPA25
Resistive Heating	Heating, cooling and thermocouple services can be combined	ZHST
Controller for ZHST		ZRHC
EB Heating	Details depend on translator used	ZEBH
Controller for ZEBH		ZEBHC
Liquid Nitrogen Cooling	For more information on these services, temperature controllers	ZLN
ZLN Transfer Accessory	and accessories refer to page 312	ZLNHX
Wire Drive Belt for SH2		ZSH2WDB ⁽¹⁾
SH2 Torque Screw Driver		ZSH2WDTS ⁽¹⁾

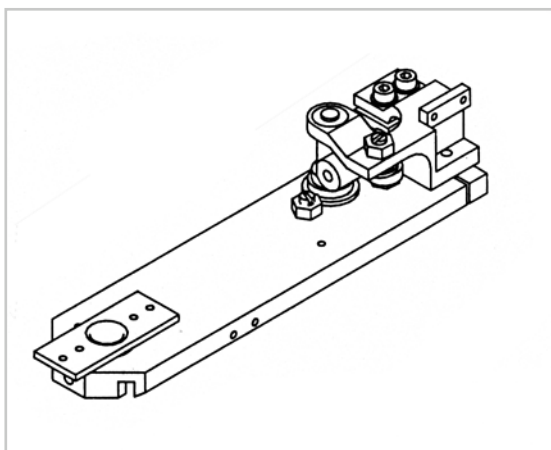
(1) Spare parts and tools for replacing the azimuthal drive wire.

SH2 Series for Primary and Azimuthal Rotation



SH2, SH2E50 and SH2R64 sample holders.

SH2F Series for Primary and Full Azimuthal Rotation



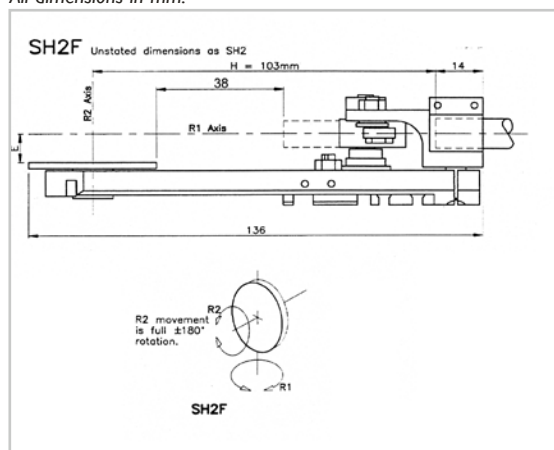
The construction and features of the SH2F are similar to the SH2, but the H dimension is increased from 66mm to 103mm. This permits full azimuthal rotation of $\pm 180^\circ$ or a sample diameter up to 4 inches. Please note that azimuthal rotation is limited to $\pm 120^\circ$ if cooling is fitted.

The SH2F is fitted to the RD224 rotary drive which provides both the primary and the full secondary movement. The RD224 can replace the standard RD2 rotary drive in any manipulator configuration. This should be stated clearly on the ordering questionnaire.

IMPORTANT PRODUCT INFORMATION

Note that the rotation is limited to $\pm 120^\circ$ if cooling is fitted.

All dimensions in mm.



SH2F Technical Data			
	SH2F	SH2FE50	SH2FR64
Rotary Drive required	RD224	RD224	RD224
Primary (R1) Rotation			
No services	360°	360°	360°
With services	$\pm 180^\circ$	$\pm 180^\circ$	$\pm 180^\circ$
Azimuthal (R2) Movement	$\pm 180^\circ$ ⁽¹⁾	$\pm 180^\circ$ ⁽¹⁾	$\pm 180^\circ$ ⁽¹⁾
	$\pm 120^\circ$ ⁽²⁾	$\pm 120^\circ$ ⁽²⁾	$\pm 120^\circ$ ⁽²⁾
Sample Offset	Standard	(E style)	(R style)
Bare backplate (mm)	9 to 12	9 to 50	54 to 64
With heater (mm)	0 to 3	0 to 41	60 to 66
Swept Radius			
No services (mm)	25	25 min	54 to 64
With services (mm)	38	38 min	54 to 64
Residual Magnetism (milliGauss)	10	10	10
'H' Dimension (mm)	103	103	103
Temperature Ranges			
Resistive heater (HST)	950 °C	950 °C	950 °C
EB Heater (EBH)	1200 °C	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C	-140 °C

(1) No cooling

(2) With cooling

ZSH2F Sample Holders and Accessories		
Sample Holder or Accessory	Description and Notes	Order Code
SH2F Sample Holder		ZSH2F
SH2FE50 Sample Holder		ZSH2FE50
14 mm plain accessory	For attachment of samples where heating is not required	ZSPA14
25 mm plain accessory	For attachment of samples where heating is not required	ZSPA25
Resistive Heating	Heating, cooling and thermocouple services can be combined but note that cooling restricts the azimuthal range to $\pm 120^\circ$	ZHST
Controller for ZHST		ZRHC
EB Heating	Details depend on translator used	ZEBH
Controller for ZEBH		ZEBHC
Liquid Nitrogen Cooling	For more information on these services, temperature controllers	ZLN
ZLN Transfer Accessory	and accessories refer to page 312	ZLNHX
SH2F Wire Drive Belt		ZSH2FWDB ⁽¹⁾
Torque Screw Driver		ZSH2WDTS ⁽¹⁾

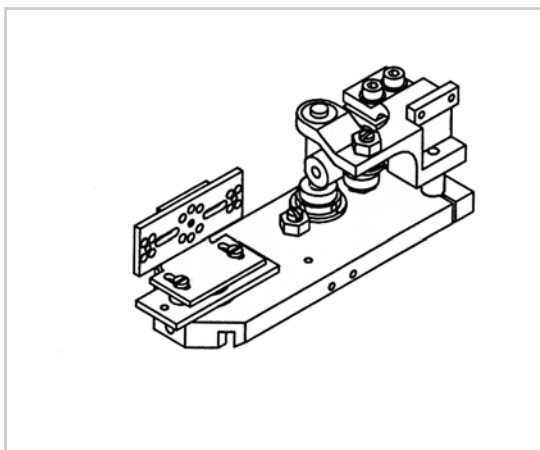
(1) Spare parts and tools for replacing the azimuthal drive wire.

SH2RT Series for Primary and Tilt Rotations

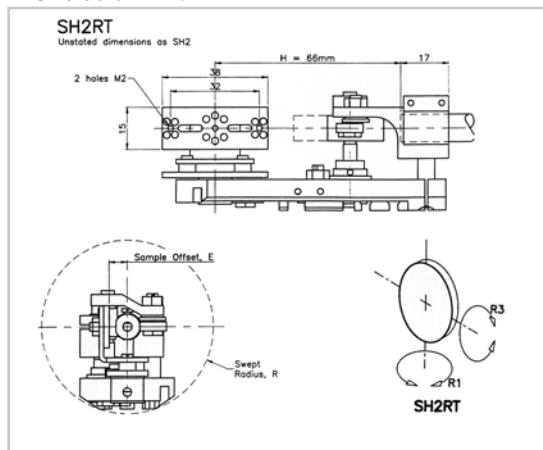
- The construction uses an exceptionally low magnetic grade stainless steel, ceramic and beryllium copper
- The wiring is enclosed to reduce the swept volume and to reduce charge build-up
- The sample holder can be adjusted relative to the R1 axis

IMPORTANT PRODUCT INFORMATION

Note that the body can partially obscure the sample when viewed from some angles. The SH2RT cannot be fitted with the 25 mm sample attachment.



All dimensions in mm.



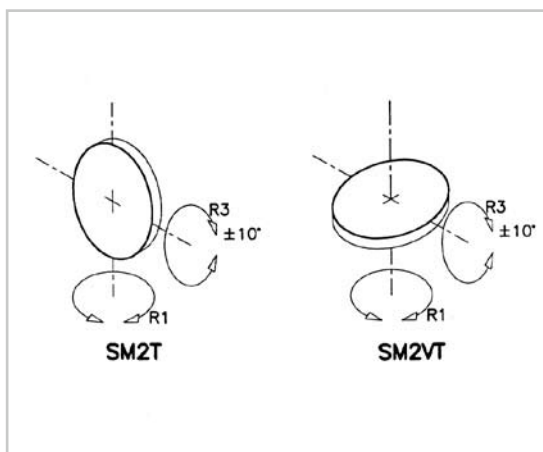
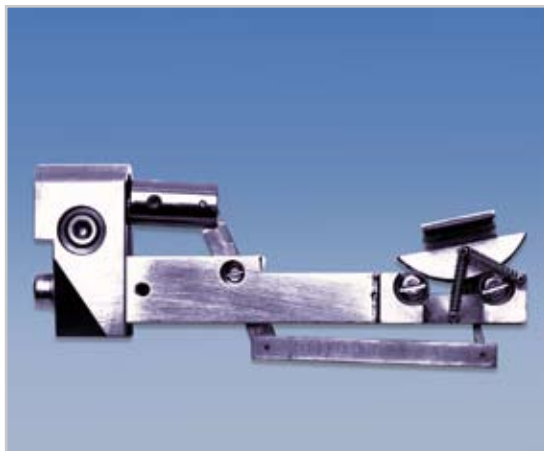
SH2RT Technical Data	
	SH2RT
Rotary Drive required	RD2
Primary (R1) Rotation	
No services	360°
With services	±180°
Tilt (R3) Movement	±110°
Sample Offset, E	
Bare backplate (mm)	5.5 to 9.5
With heater (mm)	0 to 2.5
Swept Radius	
No services (mm)	31
With services (mm)	44
Residual Magnetism (milliGauss)	10
'H' Dimension (mm)	66
Temperature Ranges	
Resistive heater (HST)	950 °C
EB heater (EBH)	1200 °C
Cooling (LN)	-160 °C

ZSH2RT Sample Holders and Accessories

Sample Holder or Accessory	Description and Notes	Order Code
SH2RT Sample Holder		ZSH2RT
14 mm plain accessory	For attachment of samples where heating is not required	ZSPA14
Resistive Heating	Heating, cooling and thermocouple services can be combined but note that cooling restricts the azimuthal range to ±120°	ZHST
Controller for ZHST		ZRHC
EB Heating	Details depend on translator used	ZEBH
Controller for ZEBH		ZEBHC
Liquid Nitrogen Cooling	For more information on these services, temperature controllers	ZLN
ZLN Transfer Accessory	and accessories refer to page 312.	ZLNHX
Wire Drive Belt for SH2		ZSH2WDB ⁽¹⁾
SH2 Torque Screw Driver		ZSH2WDTS ⁽¹⁾

(1) Spare parts and tools for replacing the azimuthal drive wire.

SM2T and SM2VT Series for Primary and Tilt Rotations



- Both the SM2T and the SM2VT provide high resolution sample tilt (or flip) with clear access for glancing incidence work
- The SM2T is arranged with the sample face parallel to the primary axis, whilst the SM2VT is arranged with the sample face perpendicular to the primary axis
- Low magnetic versions of these sample holders can be provided
- The sample mounting plate can be adjusted in height to allow samples of varying thickness to be tilted on-axis
- Due to the geometry of these sample holders, the tilt rotation is non-linear at the extremes of travel

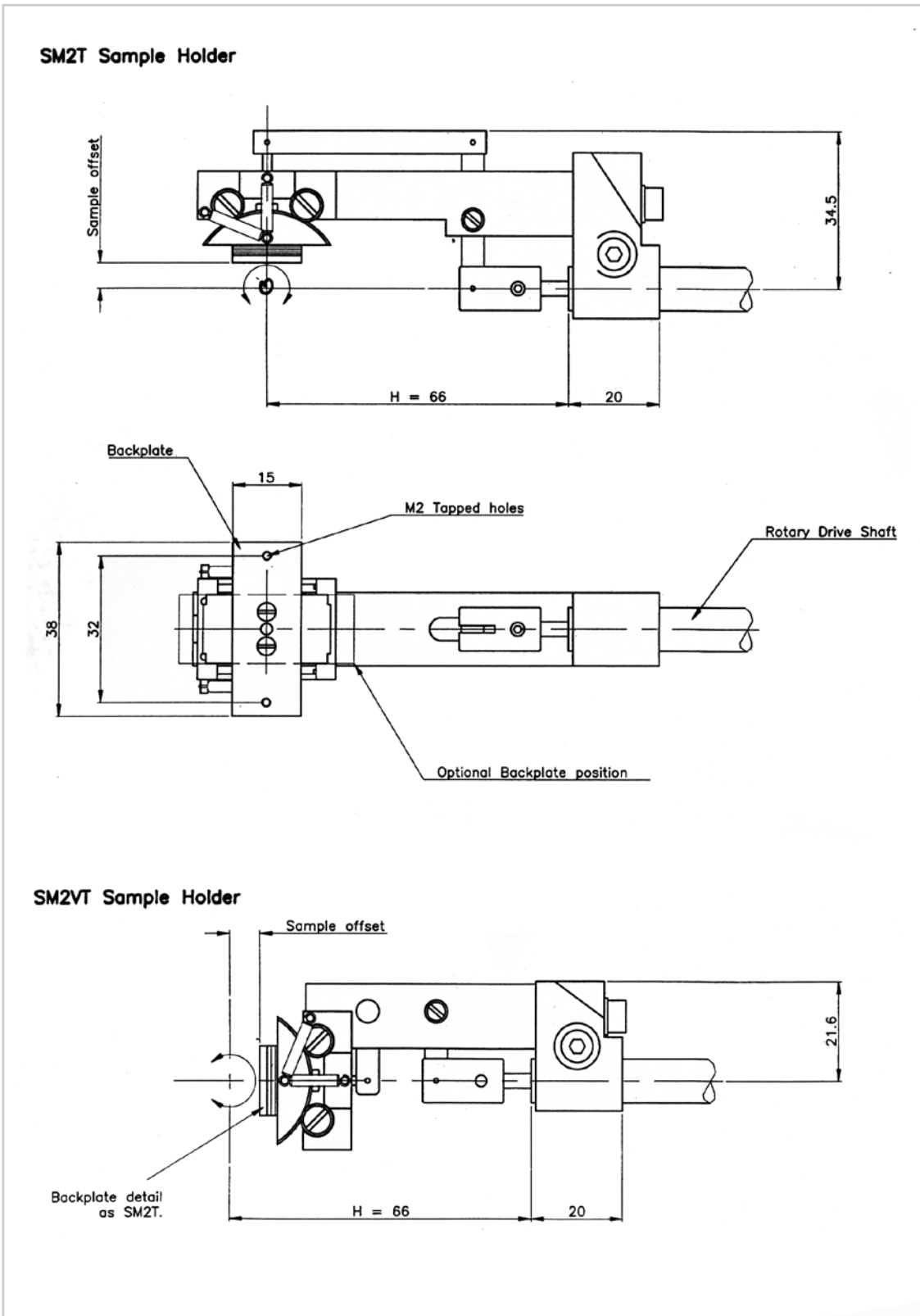
SM2T and SM2VT Technical Data

	SM2T	SM2VT
Rotary Drive required	RD2	RD2
Primary (R1) Rotation		
No services	360°	360°
With services	±180°	±180°
Azimuthal (R2) Movement	±10°	±10°
Sample Offset, E		
Bare backplate (mm)	5.5 to 7.5	5.5 to 7.5
With heater (mm)	0 to 2.5	0 to 2.5
Swept Radius		
No services (mm)	35	24
With services (mm)	variable	variable
'H' Dimension (mm)	66	66
Temperature Ranges		
Resistive Heater (HST)	950 °C	950 °C
EB Heater (EBH)	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C

ZSM2T and ZSM2VT Sample Holders

Sample Holder or Accessory	Description and Notes	Order Code
SM2T Sample Holder		ZSM2T
SM2VT Sample Holder		ZSM2VT
14 mm plain accessory	For attachment of samples where heating is not required	ZSPA14
25 mm plain accessory	For attachment of samples where heating is not required	ZSPA25
Resistive Heating	Heating, cooling and thermocouple services can be combined	ZHST
Controller for ZHST		ZRHC
EB Heating	Details depend on translator used	ZEBH
Controller for ZEBH		ZEBHC
Liquid Nitrogen Cooling	For more information on these services, temperature controllers	ZLN
ZLN Transfer Accessory	and accessories refer to page 312	ZLNHX

SM2T and SM2VT Series for Primary and Tilt Rotations

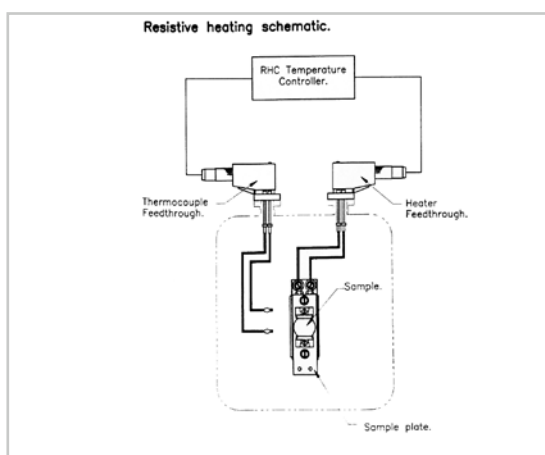
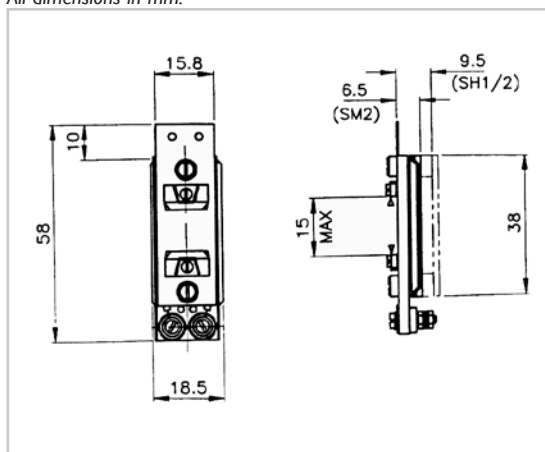


SM2T and SM2VT sample holders.

Resistive Heating



All dimensions in mm.



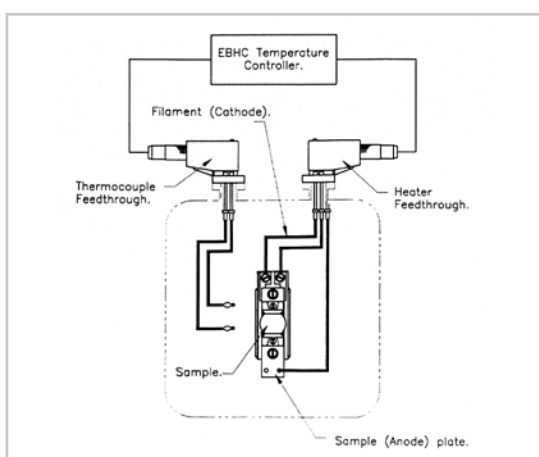
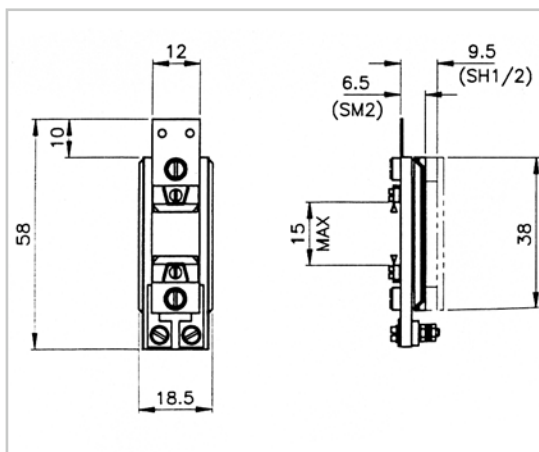
- The HST resistive heater can be fitted to all SH and SM series sample holders and all standard translators. Details may vary
- A tungsten filament is used to heat the molybdenum sample plate to a maximum of 950 °C
- The standard HST heater includes a power feedthrough, a thermocouple feedthrough, two K-type thermocouple pairs, the molybdenum sample plate and sample retaining clips, internal wiring and external bakeable feedthrough sockets
- A low magnetic version of the HST is available which uses N-type thermocouples and molybdenum fixings
- HST rating: 80 Watts consumption at 3 Amps maximum. The sample size is 14 x 14 mm maximum
- The RHC temperature controller has many features for accurate temperature control between -250 °C and 1300 °C, including self-tuning, overshoot inhibition, process interlock, automatic cold junction compensation and 0.2 % accuracy
- The RHC reads K-type or N-type thermocouple ranges. All cables are supplied. Readings are given in degrees Celsius, Fahrenheit or Kelvin. Mains supply voltage 110/120 VAC or 220/240 VAC, 350 VA
- RS-485 or RS-232 communications options
- RHC output rating: 300 VA output at 5 Amps maximum
- The RHC is housed in a 19" rack mounting enclosure, 3U high. Unit complies with European EMC and Low Voltage Directives
- Details of options required (thermocouple material, mains voltage, etc.) are requested with the ordering questionnaire

ZHST Resistive Heater and Accessories

Heater and Accessories	Order Code
Standard Resistive Heater	ZHST
Low Magnetic HST Heater	ZHSTLM
Resistive Heater Controller	ZRHC
External Communications Link	ZEUCOMMS
Replacement Filament	ZHSTFIL
Replacement Heater for SH	ZHSTSH
Replacement Heater for SM2M (older style sample holders)	ZHSTSKM

Electron Bombardment (EB) Heating

- The electron bombardment heater (EBH) can be fitted to all SH and SM series sample holders and all standard translators. Details may vary
- A high emissivity iridium filament is biased at -650 V relative to the earthed molybdenum sample plate. This causes heating by thermionic emission to a maximum of 1200 °C
- The EBH module includes a power feedthrough, a thermocouple feedthrough, two K-type thermocouple pairs, the sample plate and sample retaining clips, internal wiring and external bakeable feedthrough sockets. A low magnetic version of the EBH is available which uses N-type thermocouples and molybdenum fixings
- EBH rating: 100 Watts rating at 2 Amps maximum. Sample size is 14 x 14 mm maximum
- The EBHC temperature controller has many features for accurate temperature control between -250 °C and 1300 °C, including self-tuning, overshoot inhibition, HT interlock, automatic cold junction compensation and 0.2 % accuracy
- The EBHC reads K-type or N-type thermocouple ranges. All cables are supplied. Readings are given in degrees Celsius, Fahrenheit or in Kelvin. Mains supply voltage 110/120 VAC or 220/240 VAC, 250 VA
- RS-485 or RS-232 communications options
- EBHC ratings: Filament 75 VA output at 2.5 Amps maximum. Emission 100 VA
- The EBHC is housed in a 19" rack mounting enclosure, 3U high. Unit complies with European EMC and Low Voltage Directives
- Details of options required (thermocouple material, mains voltage, etc.) are requested with the ordering questionnaire



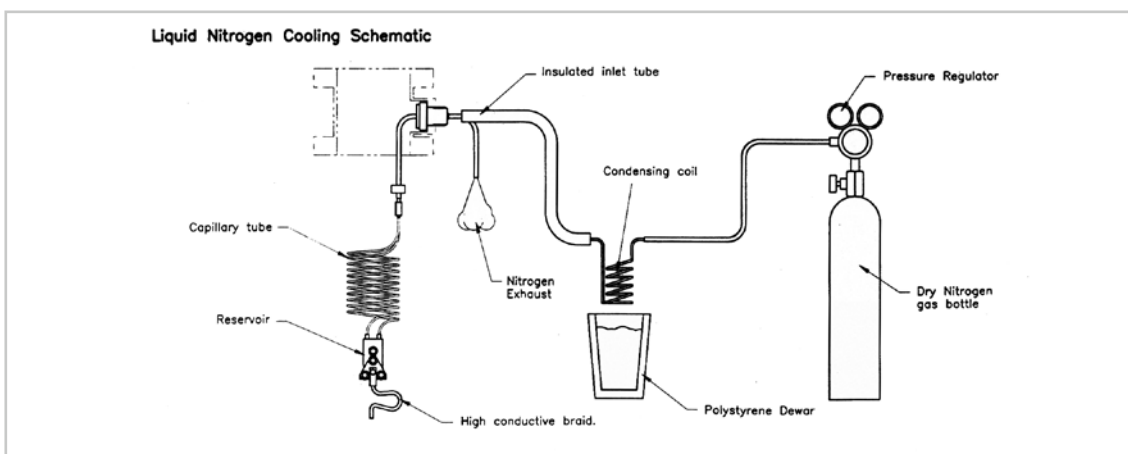
ZEBH Electron Bombardment (EB) Heater and Accessories

Heater and Accessories	Order Code
Standard EB Heater Module	ZEBH
Low Magnetic EB Heater	ZEBHLM
EB Heater Controller	ZEBHC
External Communication Link	ZEUCOMMS
EB Heater Replacement Filament	ZEBHRF

Liquid Nitrogen Cooling



- The liquid nitrogen cooling module (ZLN) can be fitted to all SH and SM series sample holders and all standard translators. Details may vary
- Liquid nitrogen is transferred through flexible capillary tubes to a reservoir mounted onto the sample holder. Heat is transferred to this reservoir from the sample mounting plate by means of high conductivity flexible braid. This system allows both primary and secondary sample rotations and can achieve temperatures below $-165\text{ }^{\circ}\text{C}$ (113 K) measured on the sample mounting plate
- The LN cooling module can be combined with the resistive or the electron bombardment heating modules. The heater controllers used with these units can be used to monitor liquid nitrogen temperatures
- If no heating is required, then the plain sample accessory (ZSPA) series is recommended to provide sample and cooling braid attachment
- To operate the LN cooling module efficiently and safely, the LNHX accessory kit is recommended. This allows dry nitrogen gas from a pressurised gas bottle to be used as the liquid nitrogen source. The LNHX kit includes a condensing coil and polystyrene dewar with insulated connecting tubes

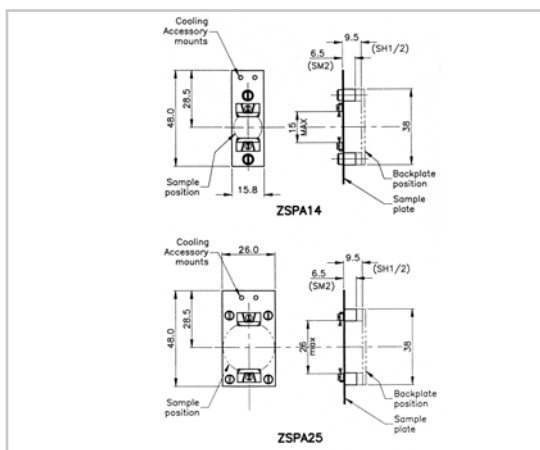


ZLN Cooling Module and Accessories

Liquid Nitrogen Module and Accessories	Order Code
Liquid Nitrogen Cooling Module	ZLN
Cooling Accessory Kit	ZLNHX
Copper Gaskets for HPT RX/WX LN Cooling	ZLN2CU6
Copper Gasket for RX/WX LN Cooling	ZLN2CU
Polystyrene LN ₂ Dewar	ZMS100D

Plain Sample Accessories

- This accessory can be fitted to all SH or SM series sample holders and consists of a molybdenum sample mounting plate and attachment clips. Low magnetic permeability versions can be supplied which use molybdenum fixings
- The plain module height is the same as the heater modules, with similar attachment to the sample holder
- These plain accessories are required with liquid nitrogen cooling when heating is not used. This is necessary for sample and cooling braid attachment to the sample holder
- Two options are available for attachment of either 14 x 14 mm samples or 25 x 25 mm samples



Plain Sample Accessories	
	Order Code
Plain Accessory: 14 x 14 mm	ZSPA14
Low Magnetic Version of ZSPA14	ZSPA14LM
Plain Accessory: 25 x 25 mm	ZSPA25
Low Magnetic Version of ZSPA25	ZSPA25LM

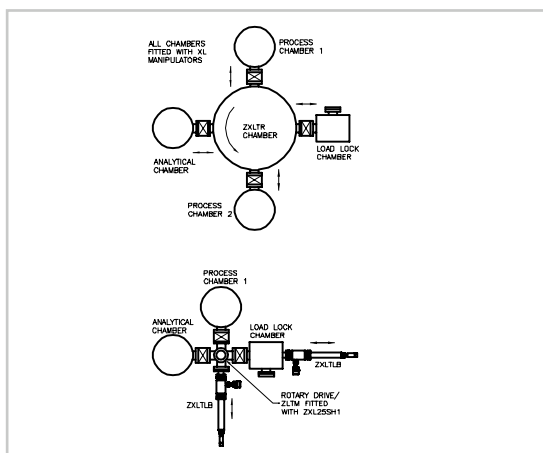
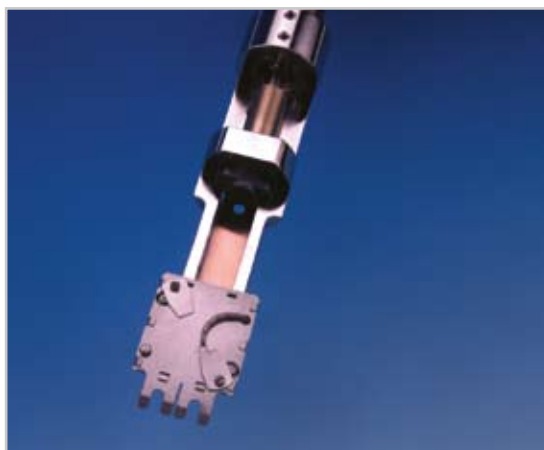
Electrostatic Shielding Kit

- The two versions of shield available will only fit EBH or HST version heaters on SH1 or SH2 sample holders
- A shielding kit is available for attachment to all standard SH series sample holders (but not SM series)
- The non-magnetic shield surrounds the heater module to reduce the effects of electrostatic charging of ceramic isolators
- Access to the sample is possible through the cut-out which allows for wobble stick transfer
- The shields allow the use of heating, cooling and thermocouple services
- Please note retro-fit variant (ZSHESK) is only available as an after sale modification. ZSHESKE is the factory default version



Electrostatic Shielding Kits	
	Order Code
Electrostatic Shielding Kit HST and EBH (Retro fit)	ZSHESK
Electrostatic Shielding Kit HST and EBH (Factory fit)	ZSHESKE

XL25 Sample Handling



Introduction to XL25 Sample Handling

The XL25 is a range of high specification modules for sample transfer, manipulation, conditioning and monitoring. It can be used with samples up to 25.4 mm diameter and is suitable for low energy electron spectroscopy.

Construction

The sample is mounted onto a sample carrier and then transferred onto a receiver included with the sample holder. The receiver grips the carrier securely during manipulation by the sample holder. Electrical and cooling services are associated with the sample holder. The XL25 components are selected for extreme UHV conditions and low magnetic properties to allow use with low energy electron analytical techniques such as UPS or ARUPS. The XL25 modules are compatible with most VG Scienta translators.

- Component based modules for easy custom building. Select the interchangeable modules from the range of sample carriers, sample holders, sample services and transfer arms
- Sample size up to 25.4 mm (1") diameter
- Secure transfer through 34 mm and 38 mm bore ports
- Sample manipulation in primary (R1) and azimuthal (R2) rotations. Compatible with most translators
- The sample conditioning services include heating to 1200 °C and cooling down to -140 °C. The monitoring services include an N-type thermocouple and sample current or bias connection
- The sample carrier includes the sample heater and thermocouple for positive thermal contact and accurate temperature monitoring
- Both the sample carrier and holder use low magnetic components such as the molybdenum sample plate, beryllium copper bearings, alumina isolators and N-type thermocouples. The stainless steel housing is a special grade of material with low magnetic permeability
- The isolators are shielded to reduce electrostatic charge build-up
- The unique sample transfer method means that the sample is exposed at all times for monitoring and conditioning
- The compact size and low swept volume, even with all conditioning and monitoring services attached, allows the XL25 to be used in crowded multi-technique analysis chambers

XL25 Sample Handling

XL25 Sample Carriers

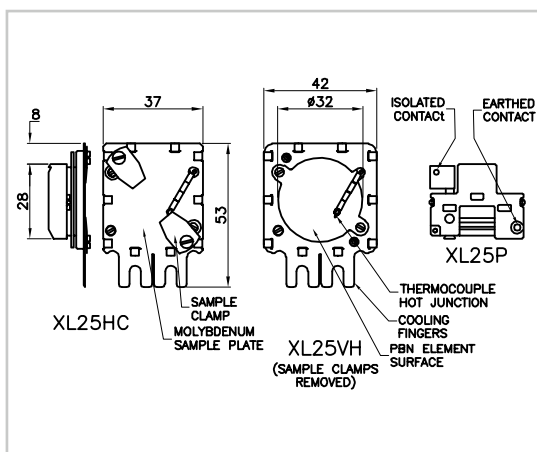
The three main XL25 sample carriers (also called 'blocks') described below are interchangeable as the receiver mounting is common.

XL25HC 'Hot and Cold' Carriers

- Range -140 °C to 1000 °C flash
- Maximum continuous temperature is 500 °C
- Transfers through 34 mm ID port
- On-board heater and N-type thermocouple
- Low magnetic materials. Residual induction is 5 milliGauss maximum at sample centre
- Isolators are electrostatically shielded
- Shallow grazing incidence is possible



All dimensions in mm.



XL25VH 'Very Hot' Carriers

- Range -80 °C to 1200 °C flash
- Maximum continuous temperature is 500 °C
- Transfers through 38 mm ID port
- On-board heater and N-type thermocouple
- Low magnetic materials. Residual induction is 5 milliGauss maximum at sample centre
- Sample mounts directly on PBN element
- Shallow grazing incidence is possible

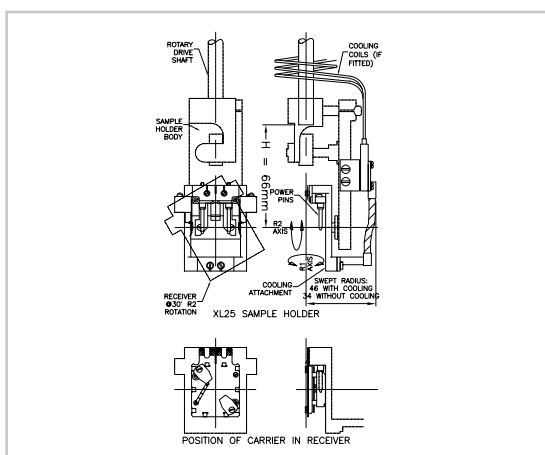
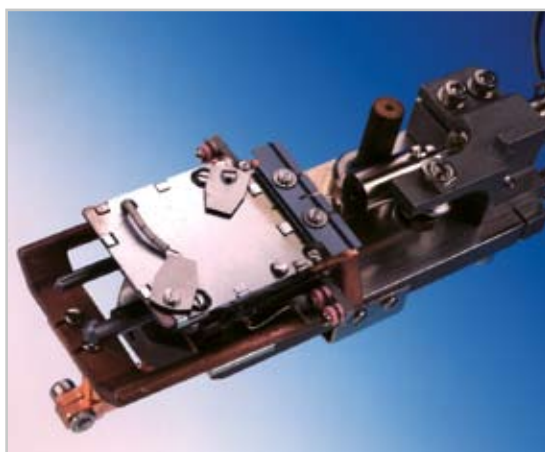
XL25P 'Plain' Carriers

- Used for custom builds and set-up
- This is the body used on the other carriers
- No heating, no thermocouple
- Maximum continuous current is 1.2 A
- Maximum flash current is 5 A

XL25 Sample Carriers		
Sample Carrier	Main Features	Order Code
Hot and Cold Carrier	-140 °C to 1000 °C flash ⁽¹⁾	ZXL25HC
Very Hot Carrier	-80 °C to 1200 °C flash ⁽¹⁾	ZXL25VH
Plain Carrier	5 Amps flash current	ZXL25P

(1) The appropriate sample services must be installed for heating and cooling. These are described on the following page. All values will depend to some extent on the nature of the sample and the experimental conditions.

XL25 Sample Handling - Sample Holders



- Both sample holders have the XL25 receiver fitted which accepts all sample carriers in the XL25 range
- The sample holder mounts to the shaft of the RD1 or RD2 rotary drive. Please note that the XL25 transfer forces require that an extended bearing housing is fitted to support the shaft of the rotary drive. For single bellows translators such as the HPT, the maximum permitted "L" dimension is limited
- The sample holder encloses and contains the service wires to reduce the effective swept volume of the sample holder. This also reduces electrostatic charge build up
- The sample holder is constructed from low magnetic materials, such as beryllium copper bearings, for a maximum residual magnetic induction of 5 milliGauss at the sample centre
- Non-magnetic version available

XL25 Sample Holder Services

- Options include power connections for the on-board heater, liquid nitrogen cooling, N-type thermocouple pick-ups for the on-board thermocouple and a sample bias connection
- All services are independent but they can be combined and do not affect other specifications or sample transfer
- All services include the appropriate feedthrough
- Details of the LNHX accessory and RHC controller are included with standard sample services refer to pages 310 to 312

XL25 Sample Holders

The two XL25 sample holders are based on the standard SH1 and SH2 sample holders. They serve three functions:

1. Sample carrier receiving (or docking)
2. Sample rotation: up to $\pm 180^\circ$ in R1 and $\pm 110^\circ$ in R2
3. Attachment of the sample services

XL25 Sample Holders and Services	
Sample Holders and Services	Order Code
Primary (R1) only rotation sample holder	ZXL25SH1
Primary (R1) and azimuthal (R2) rotation sample holder	ZXL25SH2
Primary (R1) and azimuthal (R2) rotation sample holder - non-magnetic	ZXL25SHN
Power kit for sample heating	MXLHEAT
N-type thermocouple kit	MXLTCN
Sample bias kit to 500 V, 0.5A	MXLBIAS
Liquid nitrogen cooling kit	MXLCOOL
External cooling accessory	ZLNHX
Temperature controller	ZRHC

XL25 Sample Handling - Sample Transfer Device

XL25 Sample Transfer Device

The XLTL series of linear transfer devices are rack and pinion drives based on the RLRP transfer arm described on pages 278 to 280. This has an NW35CF (70 mm OD) mounting flange and is available in a range of travels from 305 mm to 914 mm. The secondary motion of the RLRP is used to disengage the carrier from the transfer arm.

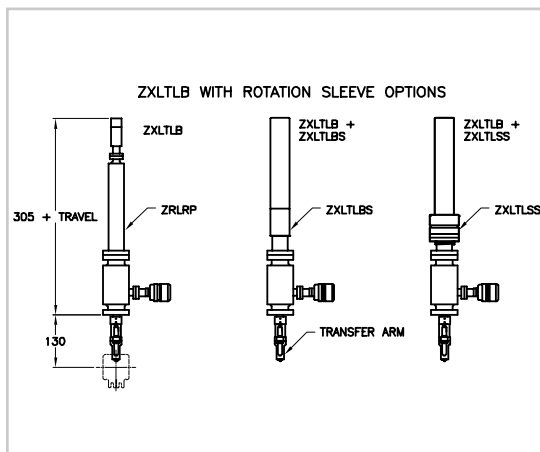
The basic transfer arm, the XLTLB, can be supplied with an extension sleeve to bring the secondary movement close to the mounting port. This is recommended for long travels. A spring release extension sleeve with limit stops can be supplied for additional security.

The XLTR radial transfer mechanism is based on the innovative R2P3 device. This is positioned as the hub of the system chambers which are located around the XLTR. Samples can then be distributed radially from the entry lock into process, preparation and analysis chambers and so on. This has the advantage that a single device can be used for all sample transfer requirements.

The XLRD series of linear transfer devices are magnetically coupled and based on our MLRD range of drives. This is a lower cost option than the XLTL version but does not offer the same sample security as the XLTLxxx and XLTLSS combination.



All dimensions in mm.

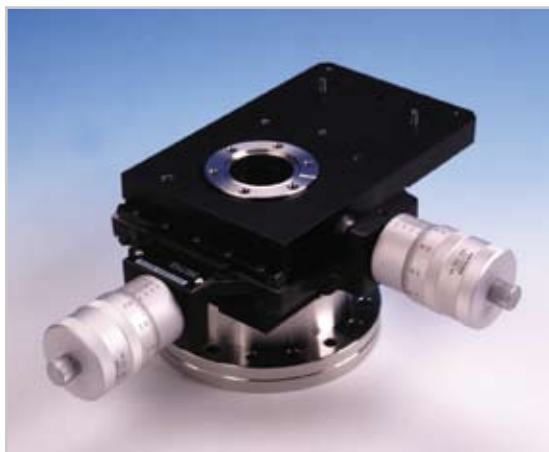


XL25 Sample Handling		
	Main Features	Order Code
Linear Transfer Arms	310 mm travel	ZXLTB3
	460 mm travel	ZXLTB4
	609 mm travel	ZXLTB6
	909 mm travel	ZXLTB9
Transfer Arm Accessories	Plain extension sleeve	ZXLTBS
	Spring return extension sleeve	ZXLTSS
Radial Transfer Mechanism	4 position	ZXLTR4
	6 position	ZXLTR6
	8 position	ZXLTR8
Magnetic Linear Transfer	305 mm travel	ZXLRD203
	460 mm travel	ZXLRD204
	610 mm travel	ZXLRD206
	914 mm travel	ZXLRD209

XY Tables - MT Series

The range of XY tables is based on the XY stages used for translators, but modified for stand-alone applications.

- All units use cross roller bearings in their construction. This gives high load capacity and precise operation
- All stages are UHV compatible and bakeable to 230 °C
- All micrometers are the large barrel type that are preferred for ease of use. These are conditioned for bakeout
- XY offset movement is either ± 12.5 mm or ± 25.0 mm. The travel limitation is the vectorial sum of the X and Y motions
- The base flange bolt pattern is straddled about the X axis in all cases. In-line bolt patterns can be supplied to order
- All XY tables can be fitted with stepper motors. These come with wired connectors to suit VG Scienta's motor control systems; microswitch limits are provided as standard. Encoded motors are also available; this option will be supplied wired to suit our controllers
- These XY tables can be used in any orientation. If more than 5 kg is applied to horizontally mounted units, we recommend that horizontal gravity compensation is fitted



T105 Series XY table.



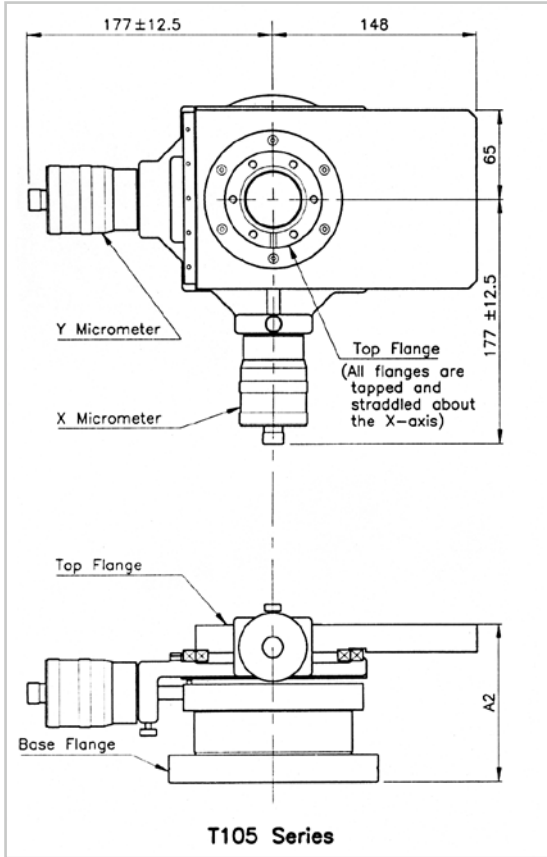
T108 Series XY table (T208 and T211 are similar in design).

XT Tables - T105, T108, T208 and T211 Series							
	Top Flange Style	Base Flange Style	Base Flange Holes	Bellows Bore	Probe Size	Height A2	Order Code
± 12.5 mm XY motion							
	NW40CF (2.75")	NW40CF (2.75")	M6	41	16	114	ZT105A2S
	NW40CF (2.75")	NW100CF (6")	$\varnothing 8.4$	44	19	114	ZT105A6S
	NW40CF (2.75")	NW100CF (6")	M8	85	40	135	ZT108A6S
	NW63CF (4.5")	NW100CF (6")	M8	85	58	135	ZT108B6S
	NW63CF (4.5")	NW150CF (8")	$\varnothing 8.4$	85	58	135	ZT108B8S
	NW100CF (6")	NW100CF (6")	M8	85	60	135	ZT108C6S
	NW100CF (6")	NW150CF (8")	$\varnothing 8.4$	85	60	135	ZT108C8S
± 25.0 mm XY motion							
	NW40CF (2.75")	NW100CF (6")	M8	85	35	167	ZT208A6S
	NW63CF (4.5")	NW100CF (6")	M8	85	35	167	ZT208B6S
	NW63CF (4.5")	NW150CF (8")	$\varnothing 8.4$	85	35	167	ZT208B8S
	NW63CF (4.5")	NW100CF (6")	M8	108	58	175	ZT211B6S
	NW63CF (4.5")	NW150CF (8")	$\varnothing 8.4$	108	58	175	ZT211B8S
	NW100CF (6")	NW100CF (6")	M8	108	58	175	ZT211C6S
	NW100CF (6")	NW150CF (8")	$\varnothing 8.4$	108	58	175	ZT211C8S

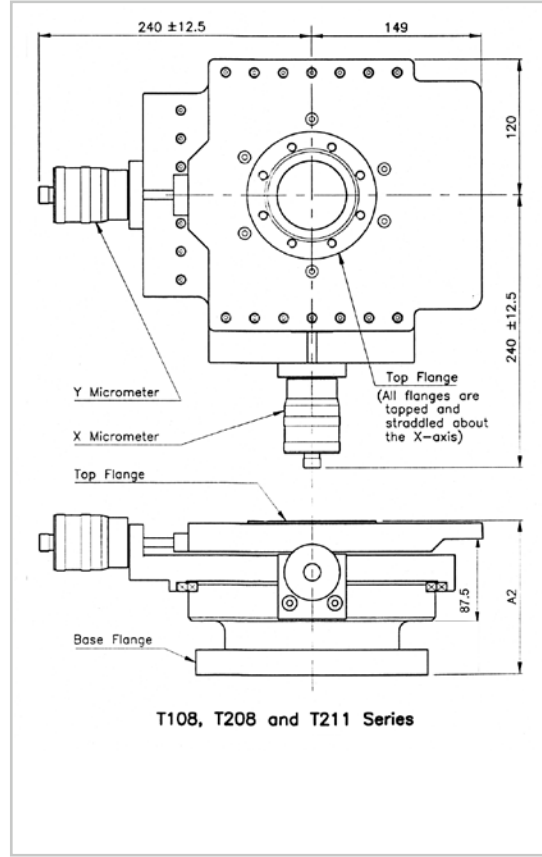
All dimensions in mm unless otherwise stated.

XY Tables - MT Series

All dimensions in mm.



All dimensions in mm.



Specifications for XY Tables

XY Table Series	Manual Resolution	Repeatability	Resolution	Motorised ⁽¹⁾ Repeatability	Maximum Speed mm.s ⁻¹
T105	5	5	2.5	5	2.5
T108, T208, T211	5	5	0.5	1	4

Dimensions in microns (μm) unless otherwise stated.

(1) Motor specifications assume the use of VG Scienta motor controllers.

Options and Accessories for XY Tables

T105 Series	Order Code
X Axis Stepper Motor ⁽¹⁾	MT05X
X Axis Stepper Motor and Encoder ⁽¹⁾	MT05XE
Y Axis Stepper Motor ⁽¹⁾	MT05Y
Y Axis Stepper Motor and Encoder ⁽¹⁾	MT05YE
X Axis DC Motor Drive ⁽²⁾	MT05DCX
Y Axis DC Motor Drive ⁽²⁾	MT05DCY
Horizontal Mounting Compensation Stand ⁽³⁾	ZT05HC
T108, T208 and T211 Series	Order Code
X Axis Stepper Motor ⁽¹⁾	MT08X
X Axis Stepper Motor and Encoder ⁽¹⁾	MT08XE
Y Axis Stepper Motor ⁽¹⁾	MT08Y
Y Axis Stepper Motor and Encoder ⁽¹⁾	MT08YE
X Axis DC Motor Drive ⁽²⁾	MT08DCX
Y Axis DC Motor Drive ⁽²⁾	MT08DCY
Horizontal Mounting Compensation Stand ⁽³⁾	ZT08HC

(1) Drive is assembled to stepper motor and is supplied with wired connector(s) to suit VG Scienta's stepper motor control system. Separate mating connector(s) available.

(2) The DC motor is assembled to the drive unit and is supplied complete with power supply and control unit (see page 375).

(3) Horizontal compensators must be fitted with the correct load compensation springs; please state the load requirements when ordering.

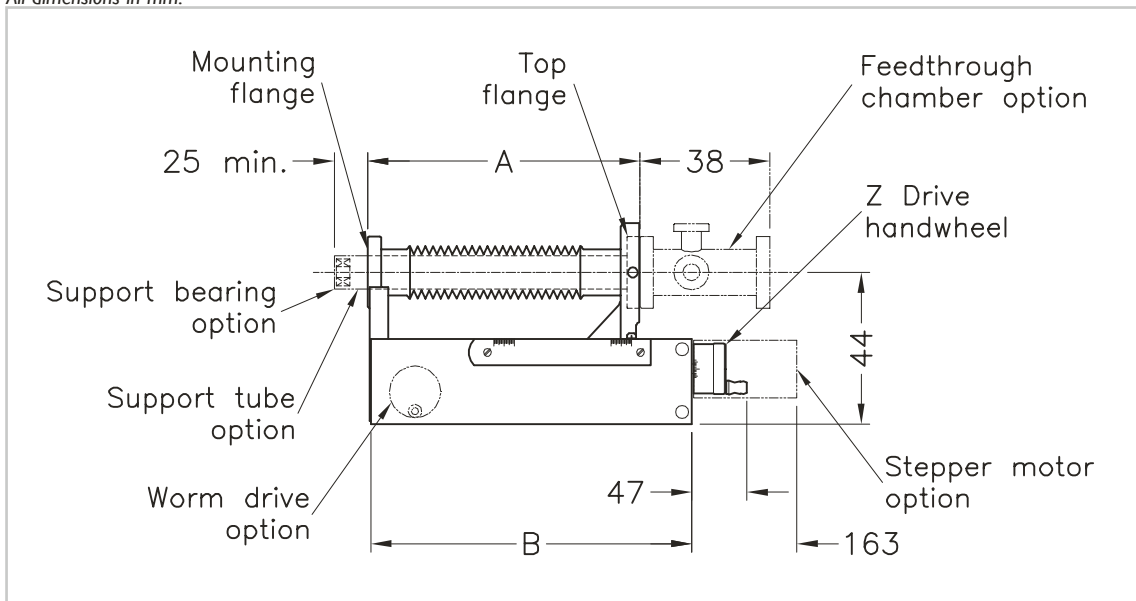
Z-Only Translator - TR Series



Introduction to Z-only Translators

- Z travel ranges are 150, 300, 450 and 600 mm
- Screw drive for all Z ranges (optional worm drive for longer travels, recommended for 450 and 600 mm translators)
- Z resolution 0.01 mm manual, 0.005 mm motorised
- Linear motion per turn is 2 mm (wormwheel drive 4 turns)
- Clear bore of 33 mm (without support tube) - see Omniax range for large clear bore
- Mounting flange is 70 mm OD CF
- Top flange is 70 mm OD CF tapped (clearance hole option at time of order)
- Bakeout temperature to 230 °C fully assembled (motors and switches removed)
- Any mounting orientation

All dimensions in mm.



Z-Only Translators - TR Series							
Flange OD		Z Travel	Resolution	Dimension A		B	Order Code
mm	inch			Extended	Retracted		
70	2.75	150	0.01 ⁽¹⁾	129	279	314	ZTR1570
70	2.75	300	0.01 ⁽¹⁾	166	466	499	ZTR3070
70	2.75	450	0.01 ⁽¹⁾	202	652	685	ZTR4570
70	2.75	600	0.01 ⁽¹⁾	215	815	849	ZTR6070

All dimensions in mm unless otherwise stated.

(1) Resolution is 0.005 mm when used with stepper motor option.

Z-Only Translator - TR Series

TR Series Accessories

- Support tube with 31.7 mm OD and 28.5 mm ID
- Feedthrough chamber 70 mm OD top and bottom flanges and three mini flanges for services; this is necessary when using an RD1 or RD2 rotary drive with support tube
- Support bearing housing with bearings for 9.52 mm (3/8") diameter rotary shaft support, with outlet ducts for cabling and cooling
- Motorised Z travel with stepper motor and limit switches
- Support stand for horizontal mounting
- Worm drive for longer travel translators and vertical operation (excluding ZTR1570)

Z-Only Translator - TR Series - Accessories	
Accessory	Order Code ⁽¹⁾
Feedthrough Chamber with 3 Mini Ports	ZTRFC
Support Tube	ZTRST
Support Bearing	ZTRRB
Support Stand for Horizontal Mounting	ZTRS
Worm Drive Kit	ZTRWD
Stepper Motor Kit for Factory Fit and Retrofit ⁽²⁾	ZTRSMK
DC Motor Kit for Factory Fit and Retrofit ⁽³⁾	ZTRDCMK
Lubrication Kit	ZLUBEK

(1) If ordered together the different items will be supplied fitted and configured, otherwise supplied separately.

(2) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(3) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Miniax Translator



Introduction to the Miniax Translator

The Miniax XYZ translator offers a source of simple, low cost, manipulation. The single bellows construction makes it easy to use in any orientation. Despite the simple construction of the translator, the Miniax has good precision and is fully UHV compatible.

Construction

The Miniax uses a single edge-welded bellows for X, Y and Z movements. Cross roller bearings are used for the XY movements with plain bushings guiding the Z slide. The micrometers are vacuum conditioned and do not need to be removed for bakeout.

- Single bellows translator for mounting in any orientation
- Full UHV specification, bakeable to 200 °C, and compatible with VG Scienta sample handling and accessories
- Z travel options of 50 mm or 100 mm
- XY travel of ± 12.5 mm
- The standard base flange is 152 mm OD (NW100CF) with straddled clearance holes for mounting the translator. Four mini ports, tapped M4, are provided for service feedthroughs
- An optional 70 mm OD (NW35CF) base flange is available. Note that this has no service ports. The flange has clearance holes straddled about the Y axis
- The travelling flange is 70 mm OD (NW35CF) with M6 tapped holes, straddled about the Y axis
- The VG Scienta range of rotary drives, sample holders and sample services are compatible with the Miniax, but are supplied separately
- An overview of the sample holder range is given on page 300; full details are given on pages 298 to 317

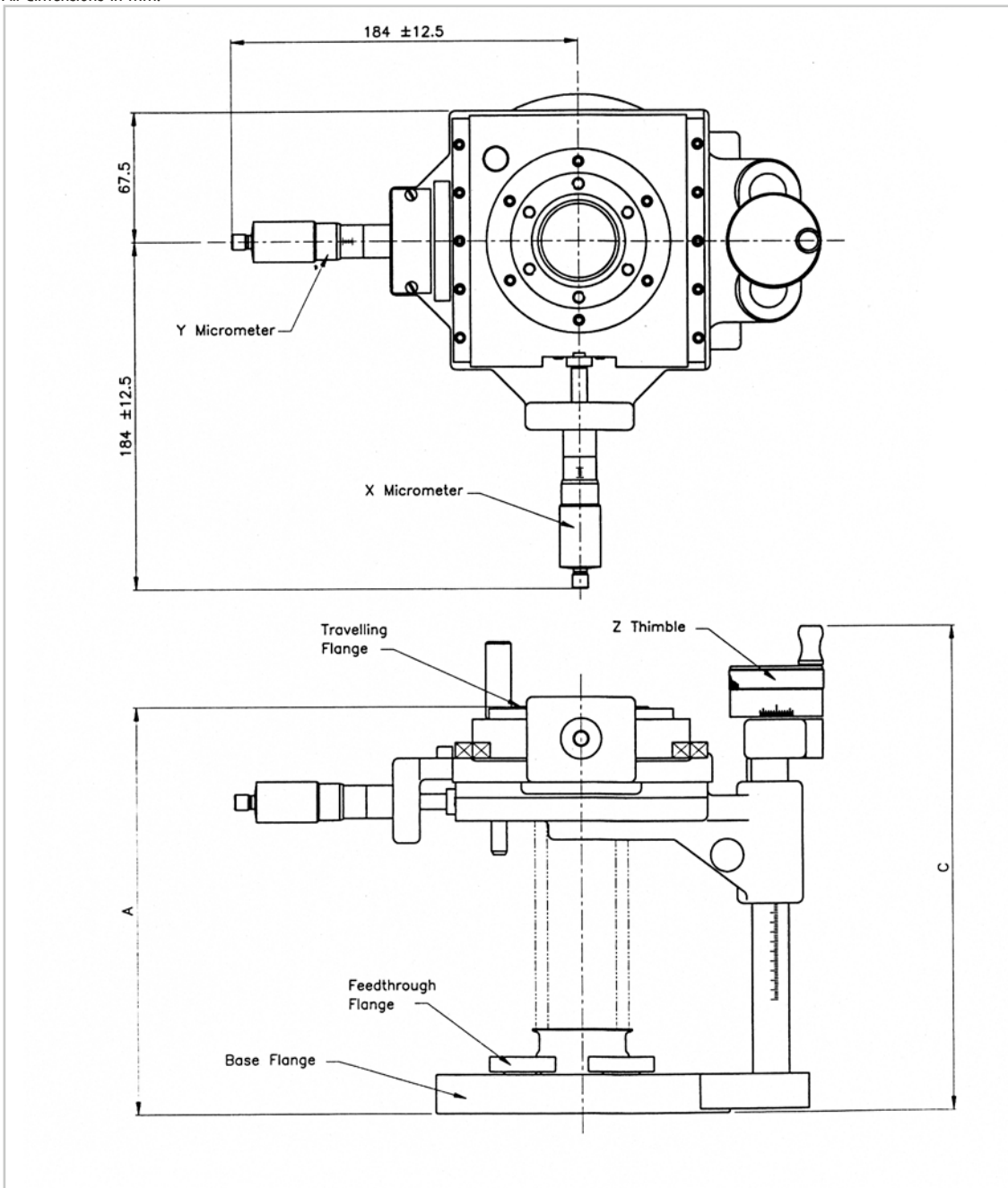
Miniax Technical Data

Miniax Technical Data		
X and Y axes	Resolution*	1 micron*
	Repeatability	5 microns
Z axis	Resolution	5 microns
	Repeatability	10 microns

*The X and Y micrometers are fitted with a 1 micron Vernier scale. Normal resolution is 10 microns.

Miniax Translator

All dimensions in mm.



Manipulation
Miniax

Miniax Translators					
Base Flange OD		Z Travel	A	C	Order Code
mm	inch				
70 ⁽¹⁾	2.75	50	160 to 210	250	ZXYZ0570
70 ⁽¹⁾	2.75	100	160 to 260	301	ZXYZ1070
152	6.0	50	160 to 210	250	ZXYZ0515
152	6.0	100	160 to 260	301	ZXYZ1015

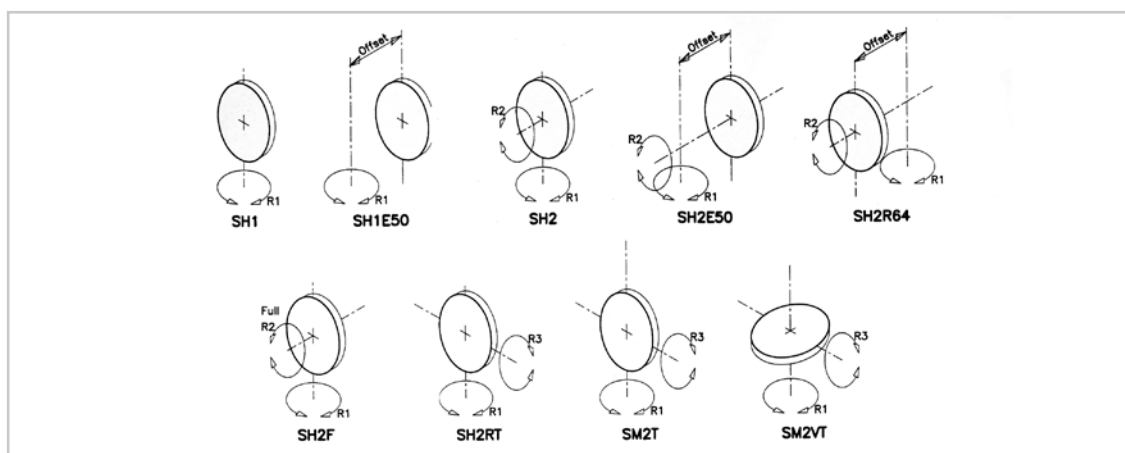
All dimensions in mm.

(1) The NW35CF flange is not available with feedthrough ports.

Miniax - Sample Holder Selection

This page gives an overview of the standard range of VG Scienta sample holders, together with their basic specifications. Full details of all types of sample holder including heating and cooling services are given on pages 302 to 317.

Definitions of the specified parameter (rotation range, offsets etc.) are given on pages 296 to 299.

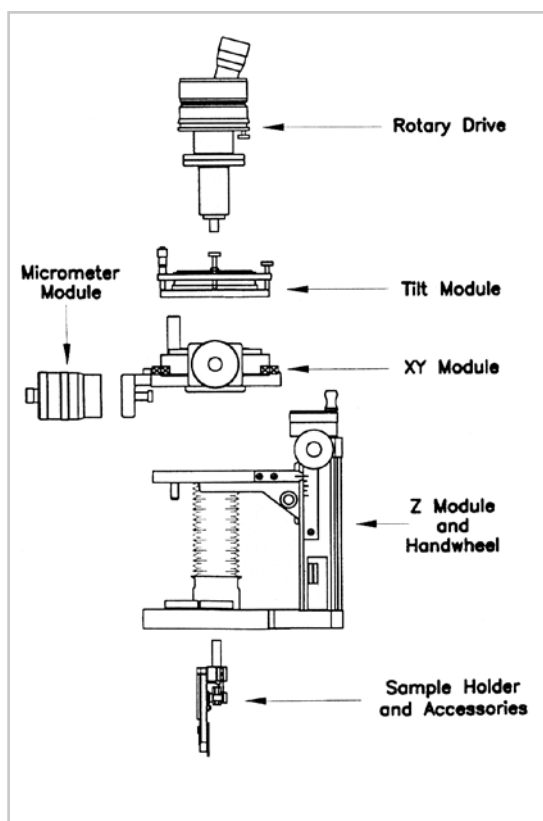


Sample Holders - Basic Specifications									
	SH1	SH1E50	SH2	SH2E50	SH2R64	SH2F	SH2RT	SM2T	SM2VT
Rotary Drive Required	RD1	RD1	RD2	RD2	RD2	RD224	RD2	RD2	RD2
Primary (R1) Rotation									
No services	360°	360°	360°	360°	360°	360°	360°	360°	360°
With services	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°
Azimuthal (R2) Rotation									
Preset	±180°	±180°							
Variable			±110°	±110°	±110°	±180°			
Tilt (R3) Rotation							±110°	±10°	±10°
Sample Offset									
Bare backplate (mm)	E	E	E	E	R	E	E	E	E
Plain or heater unit (mm)	9 to 12 0 to 3	9 to 50 0 to 41	9 to 12 0 to 3	9 to 50 0 to 41	54 to 64 60 to 66	9 to 12 0 to 3	5.5 to 9.5 0 to 2.5	5.5 to 7.5 0 to 2.5	5.5 to 7.5 0 to 2.5
Swept Radius									
No services (mm)	25	From 25 (min)	25	From 25 (min)	54 to 64	25	31	35	24
With all services (mm)	38	38 (min)	38	38 (min)	54 to 64	38	44	Variable	Variable
Magnetic Permeability	Low	Low	Low	Low	Low	Low	Low	Normal	Normal
'H' dimension (mm)	66	66	66	66	66	103	66	66	66
Temperature Ranges									
Resistive heater (HST)	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C
EB heater (EBH)	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C	-160 °C	-160 °C	-140 °C	-160 °C	-160 °C	-160 °C	-160 °C
Approx. resolution per halfstep of RD motor									
R1 rotation (stepper)	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°
R2 rotation (stepper)	-	-	0.001°	0.001°	0.001°	0.001°	-	-	-
R3 rotation (stepper)	-	-	-	-	-	-	0.001°	0.0001°	0.0001°

HPT Translators

Introduction to the HPT Translator Range

- Precision single bellows translator with mounting in any orientation
- Full UHV specification, bakeable to 230 °C and compatible with the full range of VG Scienta sample handling accessories
- Base mounting flange options are 152 mm OD (NW100CF) with feedthrough ports for sample services, or 70 mm OD (NW35CF) without feedthrough ports
- The travelling flange is 70 mm OD (NW35CF)
- Alternative bellows options with 35 mm (the HPT-RX) or 44 mm (the HPT-WX) bore.
- Z travel ranges: 50 mm, 100 mm, 150 mm or 250 mm. All lengths have vacuum compensation springs which reduce load on the Z micrometer
- XY travel up to ± 12.5 mm
- X, Y and Z axes can be motorised
- Precision tilt adaptor option available



Basic modules of the HPT translator.

The HPT High Precision Translator is built up from a selection of modules for a wide range of applications. The single bellows construction is easy to use in any orientation. The use of high quality guidance components give the HPT excellent precision, repeatability and long life, in even the most extreme UHV conditions.

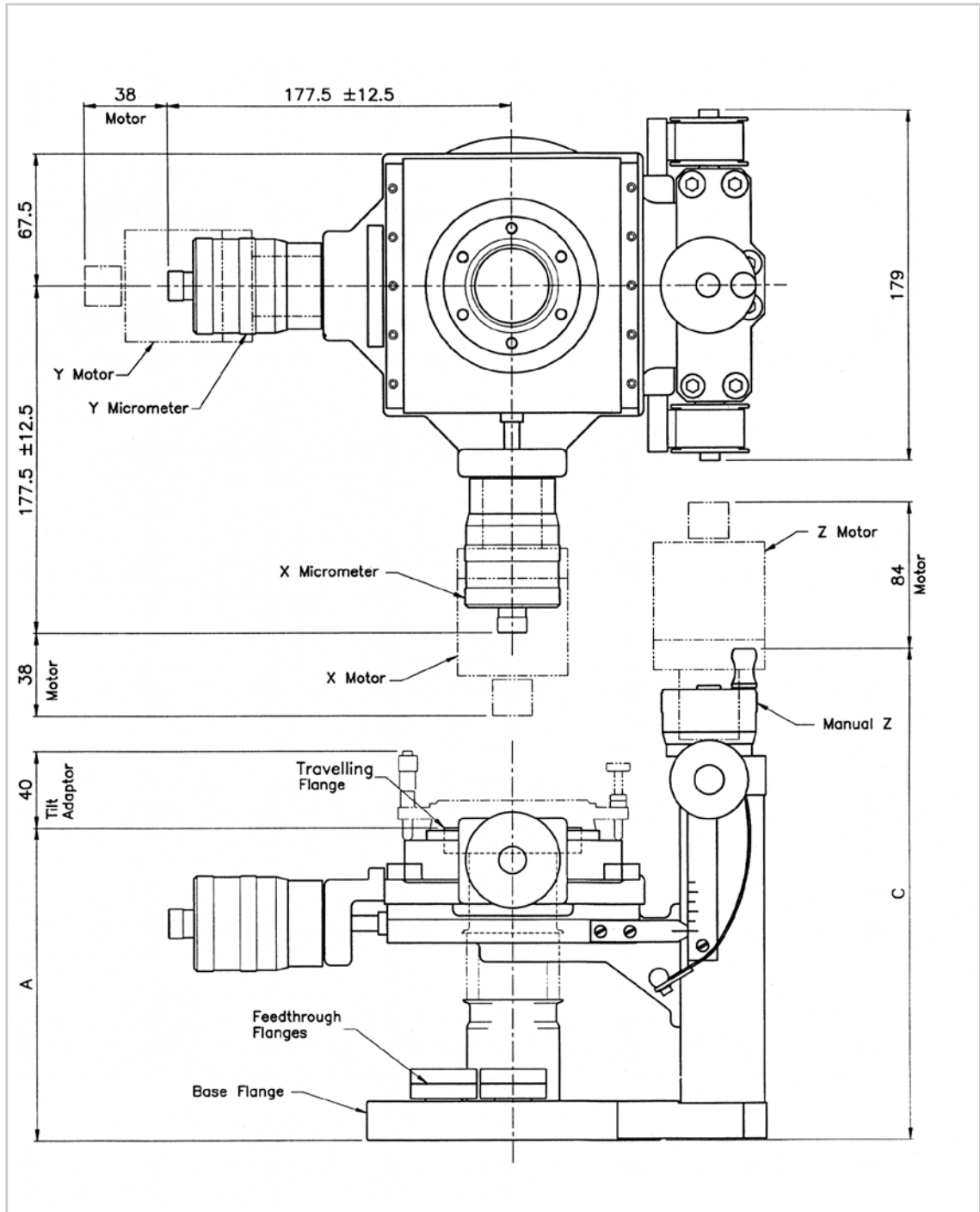
Construction

The HPT is a high specification translator that uses a single edge welded bellows for X, Y and Z movements. This construction gives the HPT its ease of use in any orientation. The VG Scienta modular system gives high versatility. Build quality and the use of the best components are a feature of the HPT; the XY stage uses cross roller bearing slides and the Z slide uses re-circulating ball guides. These rolling elements extend high precision and long life even after prolonged bakeouts. The Z slide has vacuum compensation springs for ease of use and to increase the life

further. Precision micrometers actuate the X, Y and Z manual movements. Stepper motors can replace the micrometers for higher resolution motorised movement.

HPT Translators

All dimensions in mm.



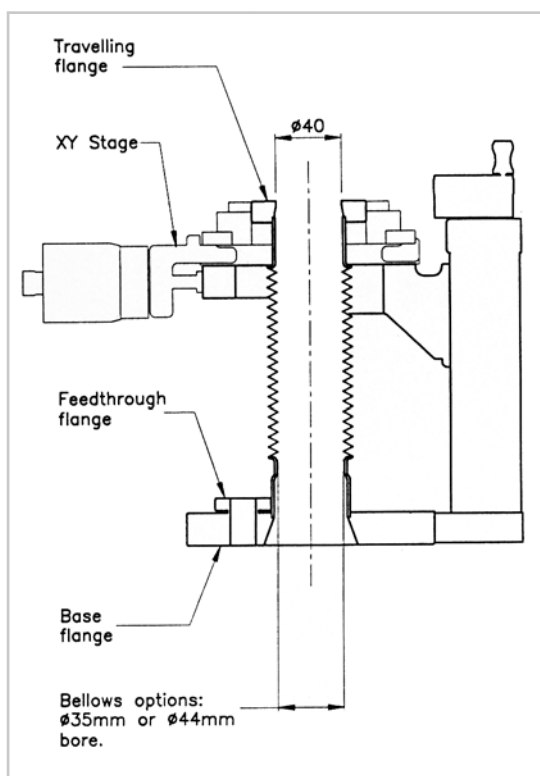
HPT Translators - Basic Dimensions				
Z Travel	HPT-RX Bellows Bore of Ø35		HPT-WX Bellows Bore of Ø44	
	A	C	A	C
50	160 to 210	244	210 to 260	294
100	160 to 260	294	210 to 310	344
150	160 to 310	344	275 to 425	459
250	175 to 425	459	226 to 476	510

All dimensions in mm.

HPT Translators - Z Slide Modules

Z Slide Modules

- Two bellows sizes are available with options of 35 mm bore (HPT-RX) or 44.4 mm bore (HPT-WX). These options allow probe sizes of 10 mm or 19.4 mm respectively with full XY travel. This probe size is not affected by adding feedthroughs
- Standard travel options are 50 mm, 100 mm, 150 mm and 250 mm
- The standard base flange is 152 mm OD (NW100CF) with 4 mini ports tapped M4 for service feedthroughs. The base flange has combined straddled and in-line clearance holes for universal mounting
- An optional 70 mm OD (NW35CF) base flange is available. Note that this has no service ports. The flange has clearance holes straddled about the Y axis
- The travelling flange is 70 mm OD (NW35CF). The holes are tapped M6 and straddled about the Y axis
- Vacuum and gravity compensation springs are matched to the mounting orientation to give high precision over the full working life
- The manual Z-drive is included in the Z Slide module
- The stepper motor option is compatible with all VG Scienta motor drive-controllers. Limit switches and all mounting hardware are provided. The stepper motor is supplied with a wired connector to suit VG Scienta's stepper motor control system. Encoded motors are also available; this option will be supplied wired to suit our controllers (see pages 376 to 378). The DC motorisation



HPT Series - Z-slide - Technical Data

Parameter	Specification
Resolution - manual	5 microns
Resolution - motorised ⁽¹⁾	2.5 microns
Repeatability	10 microns
Maximum Speed - motorised	2.5 mm.s ⁻¹

(1) Motor specifications assume the use of a VG Scienta motor drive controller.

option includes the power supply (see page 375)

HPT Translators - HPT-RX and HPT-WX Series

Base Flange OD mm	inch	Travel mm	HPT-RX (35 mm Bore) Order Code	HPT-WX (44 mm Bore) Order Code
70	2.75	50	MRXZ0570	
70	2.75	100	MRXZ1070	
70	2.75	150	MRXZ1570	
70	2.75	250	MRXZ2570	
152	6.0	50	MRXZ0515	MWXZ0515
152	6.0	100	MRXZ1015	MWXZ1015
152	6.0	150	MRXZ1515	MWXZ1515
152	6.0	250	MRXZ2515	MWXZ2515
Z Axis Stepper Motor Upgrade Kit ⁽¹⁾			MRXMOTZ	MRXMOTZ
Z Axis DC Motor ⁽²⁾			MRXMDCZ	MRXMDCZ

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available.

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

HPT Translators - XY Stage Modules



HPT Series XY Stage - Technical Data

XY Drive	Parameters	Specification
Large Barrel Micrometers	Resolution	5 microns
	Repeatability	5 microns
High Resolution Micrometers	Resolution	1 micron with Vernier
	Repeatability	5 microns
Motors	Resolution ⁽¹⁾	2.5 microns ⁽¹⁾
	Repeatability ⁽¹⁾	5 microns ⁽¹⁾
	Maximum Speed	2.5 mm/s motorised ⁽¹⁾

(1) Motor specifications assume the use of a VG Scienta motor controller. Repeatability and resolution apply to stepper motor option.

IMPORTANT PRODUCT INFORMATION

Two micrometers or motor kits are required, one for the X axis and one for the Y axis.

HPT XY Stage Modules

- All HPT translators require an XY module. The options include a Z-only adaptor, and a precision stage that has a maximum travel of ± 12.5 mm vectorial offset
- Two options of XY micrometer can be supplied. The large barrel type is easiest to read and has 5 micron graduations, whilst the high resolution micrometers have a Vernier scale for 1 micron resolution. Both types are interchangeable with the motor modules
- A tilt adaptor is available to incline the travelling flange by up to 7° with respect to the primary axis. The maximum tilt angle will be limited by the position of the Z slide and by the probe diameter. This unit can be used with any orientation of the HPT and does not change the position of the travelling flange
- The stepper motors are compatible with all VG Scienta motor controllers. Limit switches and all mounting hardware are provided. The motors are supplied with a wired connector to suit VG Scienta's stepper motor control system. Encoder options are available (see pages 376 to 378)
- The DC motorisation option includes the power supply and controller
- A removable index pin through the XY stage indicates the central position and acts as a transit lock. It must be removed before use

HPT Translators - XY Stage Modules and Accessories

XY Module or Accessory	Order Code
Z-only XY Adaptor (allows no XY travel)	MRXXY00
Precision XY Module (± 12.5 mm XY travel) ⁽¹⁾	MRXXY12
Large Barrel X or Y Axis Micrometer (each)	MRXMIC05
High Resolution X or Y Axis Micrometer (each)	MRXMIC01
X Axis Stepper Motor Kit (each) ⁽²⁾	MRXMOTX
Y Axis Stepper Motor Kit (each) ⁽²⁾	MRXMOTY
Y Axis DC Motor ⁽³⁾	MRXMDCX
X Axis DC Motor ⁽³⁾	MRXMDCY
Tilt Adaptor	MRXTAA

(1) Note that the XY travel will be restricted if the probe diameter is greater than 19.4 mm for the 44 mm bellows, or greater than 10 mm for the 35 mm bore bellows.

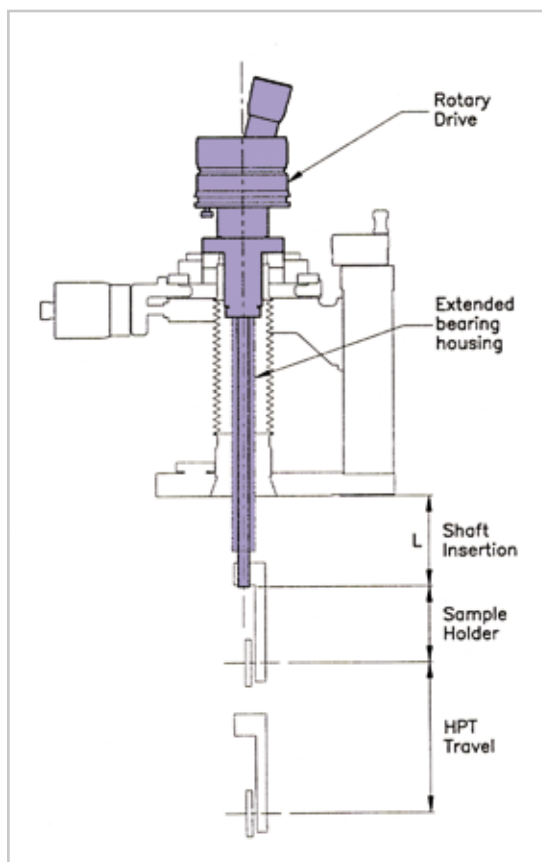
(2) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available.

(3) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

HPT Translators - Rotary Drive Modules

HPT Rotary Drive Modules

- The rotary drive modules for HPT translators are based on the RD1 for primary rotation (R1) only, or on the RD2 for primary rotation with a secondary movement
- Specifications and dimensions of the RD1 and RD2 drives are given on page 220 to 225
- The rotary drive shaft insertion length, L, can be made to suit most requirements. The retracted L dimension will be requested when ordering the rotary drive module
- Please note that limits apply to the retracted L dimension when the cooling accessory is fitted (see table below)
- Rotary drives with an M prefix (MR1R and MR2R) are fitted with an extended bearing housing to increase rigidity. This is 19 mm in diameter and will restrict the XY travel of the HPT manipulators with 35 mm bore bellows to ± 8 mm. HPT's with the 44 mm bore bellows are not affected



L Dimension Limitations with Cooling Accessory Fitted

HPT Travel Range	L Minimum	L Maximum
50	46	195
100	61	210
150	76	225
250	106	255

All dimensions in mm.

HPT Translators - Rotary Drive Modules

Rotary Drive Options	Notes	Order Code
Fixed Length Rotary Drive; A+L=256: R1 Only ⁽¹⁾	Z-coded drives do not have extended bearing housings	ZRD1
Fixed Length Rotary Drive; A+L=256: R1 + Secondary		ZRD2
Extended Bearing Housing for ZRD1 or ZRD2		ZBH050
Variable Length Rotary Drive: R1 Only	M-coded drives have extended bearing housings. Note restriction	MR1R
Variable Length Rotary Drive: R1 + Secondary		MR2R
Stepper Motor Kit for Primary Axis of RD1 or RD2 ⁽²⁾	Stepper motor kits include all mounting hardware and limit switches	ZRDPMK
Stepper Motor Kit for Secondary Axis of RD2 ⁽²⁾		ZRDSPMK
R1/ RD2 Primary Drive DC Motor Kit ⁽³⁾		ZRDPCMK

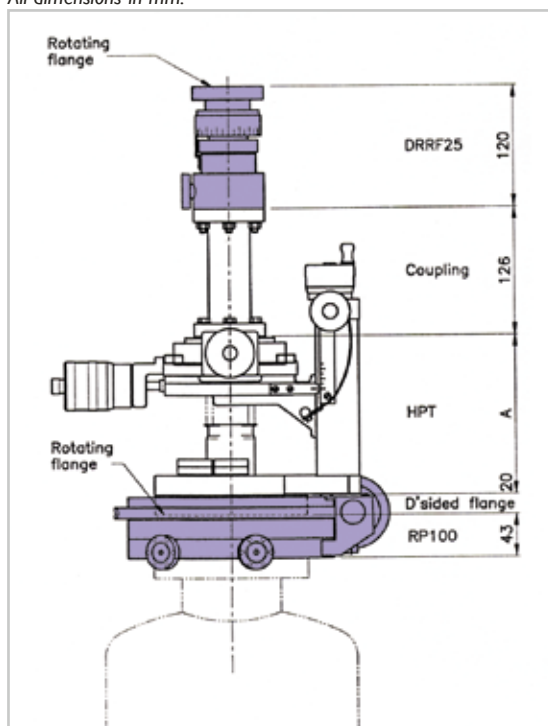
(1) Dimension A is the "compressed" dimension of the HPT - see page 326.

(2) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available.

(3) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

HPT Translators - Differentially Pumped Rotary Modules

All dimensions in mm.



Dimension A is the "compressed" dimension of the HPT - see page 326.

Differentially Pumped Rotary Modules

For alternative rotations of the sample or the manipulator itself, differentially pumped rotary drives are available. Two types can be used with the HPT; the DPRF25 or the RP100.

- The DPRF25 rotary feedthrough has a clear bore of 25 mm diameter and is fitted to the travelling flange. A tubulated coupling is required as the mating flanges are both tapped. Specifications and dimensions for the DPRF25 are given on page 234
- The RP100 rotating platform rotates the manipulator about the axis of the chamber mounting flange, independent of XY movement. The RP100 is fitted between the HPT base flange and the chamber. A double-sided flange is required to avoid clashing with the HPT base plate. Specifications and dimensions for the RP100 are given on page 240

HPT Translators - Differentially Pumped Rotary Modules

Rotary Modules	Order Code
DPRF25 with Coarse Manual Actuator	ZDPRF25
DPRF25 with Precision Manual Actuator	ZDPRF25H
DPRF25 with Stepper Motor ⁽¹⁾	ZDPRF25M
DPRF25 with DC Motor ⁽²⁾	ZDPRF25D
RP100 with Coarse Manual Actuator	ZRP100C
RP100 with Precision Manual Actuator	ZRP100H
RP100 with Stepper Motor ⁽¹⁾	ZRP100M
RP100 with DC Motor ⁽²⁾	ZRP100DC
Adaptor Modules	
Tubulated Coupling for DPRF25 Mounting	ZBS41
Double-sided Flange for RP100 Mounting	ZFC100D

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scientia's stepper motor control system. A separate mating connector is available.

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

HPT Translators - Sample Handling Equipment

The full range of sample handling equipment is available for the HPT. Some of this equipment has special requirements as follows:

- The normal specifications for sample heating, cooling and movement are unaffected by attachment to the HPT
- If XL25 sample handling is required, the rotary drive must be fitted with an extended bearing housing to resist the forces due the sample to transfer. For the same reason, the shaft insertion length, L, is limited (see table below)

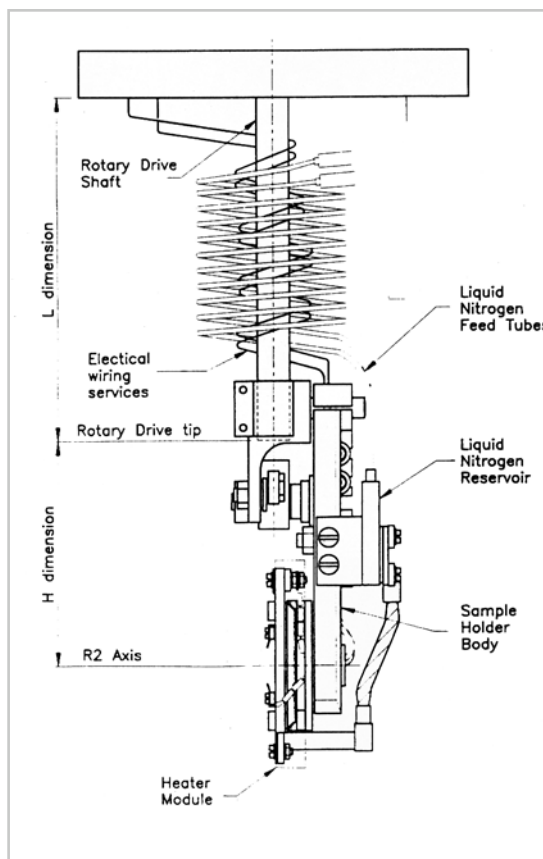


L Dimension Limitations with XL25 Sample Holders Fitted to HPT Manipulators				
Z Travel	HPT-RX		HPT-WX	
	Z Travel	L Maximum	Z Travel	L Maximum
50		180	50	130
100		130	100	80
150		80	150	Not Available
250		Not Available	250	Not Available

All dimensions in mm.

Full details of VG Scienta's range of sample holders and heating and cooling accessories can be found on pages 298 to 317.

An overview of the sample holder range is given on the next page

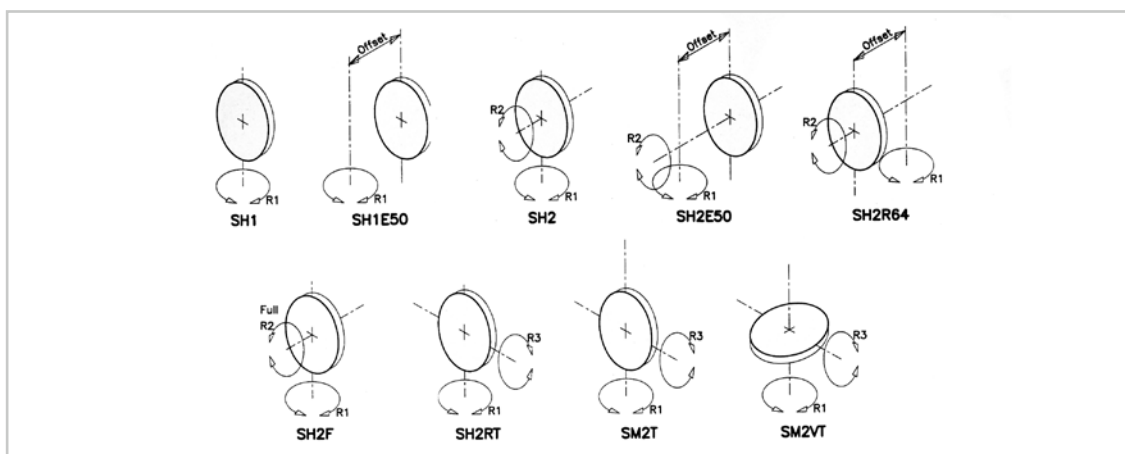


Sample heating and cooling accessories.

HPT Translators - Sample Holder Selection

This page gives an overview of the standard range of VG Scienta sample holders, together with their basic specifications. Full details of all types of sample holder including heating and cooling services are given on pages 302 to 317.

Definitions of the specified parameter (rotation range, offsets etc.) are given on pages 296 to 299.



Sample Holders - Basic Specifications

	SH1	SH1E50	SH2	SH2E50	SH2R64	SH2F	SH2RT	SM2T	SM2VT
Rotary Drive Required	TDI	TDI	RD2	RD2	RD2	RD224	RD2	RD2	RD2
Primary (R1) Rotation									
No services	360°	360°	360°	360°	360°	360°	360°	360°	360°
With services	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°
Azimuthal (R2) Rotation									
Preset	±180°	±180°							
Variable			±110°	±110°	±110°	±180°			
Tilt (R3) Rotation							±110°	±10°	±10°
Sample Offset	E	E	E	E	R	E	E	E	E
Bare backplate (mm)	9 to 12	9 to 50	9 to 12	9 to 50	54 to 64	9 to 12	5.5 to 9.5	5.5 to 7.5	5.5 to 7.5
Plain or heater unit (mm)	0 to 3	0 to 41	0 to 3	0 to 41	60 to 66	0 to 3	0 to 2.5	0 to 2.5	0 to 2.5
Swept Radius		From		From					
No services (mm)	25	25 (min)	25	25 (min)	54 to 64	25	31	35	24
With all services (mm)	38	38 (min)	38	38 (min)	54 to 64	38	44	Variable	Variable
Magnetic Permeability	Low	Low	Low	Low	Low	Low	Low	Normal	Normal
'H' dimension (mm)	66	66	66	66	66	103	66	66	66
Temperature Ranges									
Resistive heater (HST)	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C
EB heater (EBH)	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C	-160 °C	-160 °C	-140 °C	-160 °C	-160 °C	-160 °C	-160 °C
Approx. resolution per halfstep of RD motor									
R1 rotation (stepper)	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°
R2 rotation (stepper)	-	-	0.001°	0.001°	0.001°	0.001°	-	-	-
R3 rotation (stepper)	-	-	-	-	-	-	0.001°	0.0001°	0.0001°

HPT Translator - Checklist

This checklist is intended to help you configure the HPT translator to suit your individual application. To place an order, VG Scienta will require a more detailed Ordering Questionnaire based on the information below. Please contact

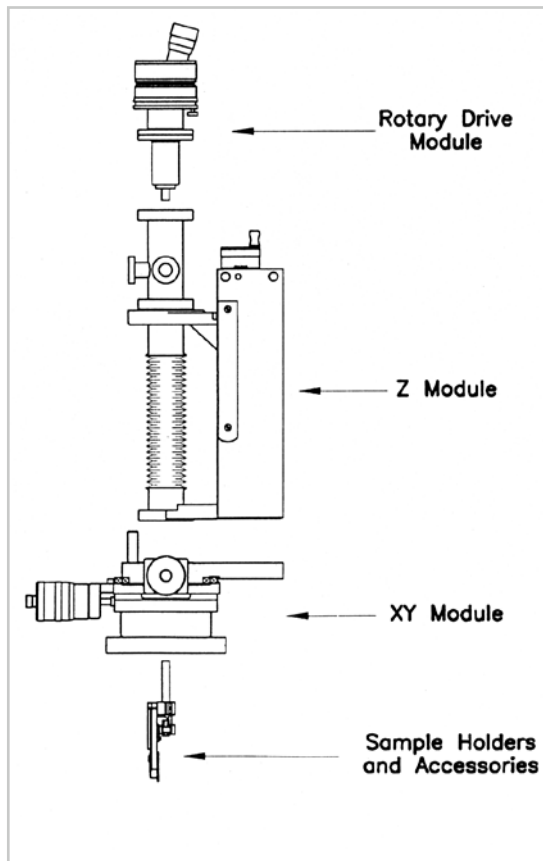
your agent who will discuss your application and help you complete the questionnaire.

If any details are unclear, or you have special requirements, please call for assistance.

Questionnaire				Example		
Options	Notes	Code	Price	Notes	Code	Price
Bellows Bore Option				35 mm		
Z Travel				150 mm	MRXZ1515	
Mounting Flange				152 mm		
Z Drive: Manual or Motor?				manual		
XY Travel				±12.5 mm	MRXXY12	
X Drive: Manual or Motor?				manual	MRXMIC05	
Y Drive: Manual or Motor?				manual	MRXMIC05	
Tilt Adaptor				no		
Primary Rotation (R1)				yes	MR2R	
Secondary Movement				yes		
RI Drive: Manual or Motor?				manual	-	
Secondary: Manual or Motor?				manual	-	
DPRF25 Rotary Device				no		
RP100 Rotary Device				no		
DPRF and RP Mounting				none		
Sample Holder (page 298)				yes	ZSH2	
Sample Heating (page 310)				EBH	ZEBH	
Sample Cooling (page 312)				yes	ZLN	
LN Heat Exchanger (page 312)				yes	ZLNHX	
Heater Controller				yes	ZEBHC	
Motor Controller (page 372)				no		
Miscellaneous				Tool kit	ZTOOLK	
			Total:	Total:		
Application Notes Include any non-standard detail and special information that would be helpful in conveying your requirements.						

This example describes a typical HPT manipulator configuration with manual actuation using the large barrel micrometers on the X and Y axes. The sample can be rotated about the primary and azimuthal axes. Electron bombardment heating and liquid nitrogen cooling services are fitted.

Transax Translators



Basic Transax modules.

Introduction to the Transax Translator

- Fully UHV compatible double bellows translator with a probe capacity of 28 mm diameter
- The Transax has a guided support tube and the unique VG Scienta hinged flange to give improved sample stability by more than 5 times that of a cantilevered support tube
- Z travels up to 450 mm and XY vectorial travel up to ± 25 mm
- The construction is thermally matched to eliminate bi-metal deformation even after repeated bakeouts to 230 °C
- All axes can be manually or motor (stepper or DC) operated
- The motors are simple to remove for bakeout
- The interchangeable modules allow most configurations to be updated later
- Mounting in any orientation

The Transax bridges the performance gap between the user friendly HPT and very high stability Omniax. All the normal VG Scienta sample handling equipment and rotary modules are compatible with the Transax.

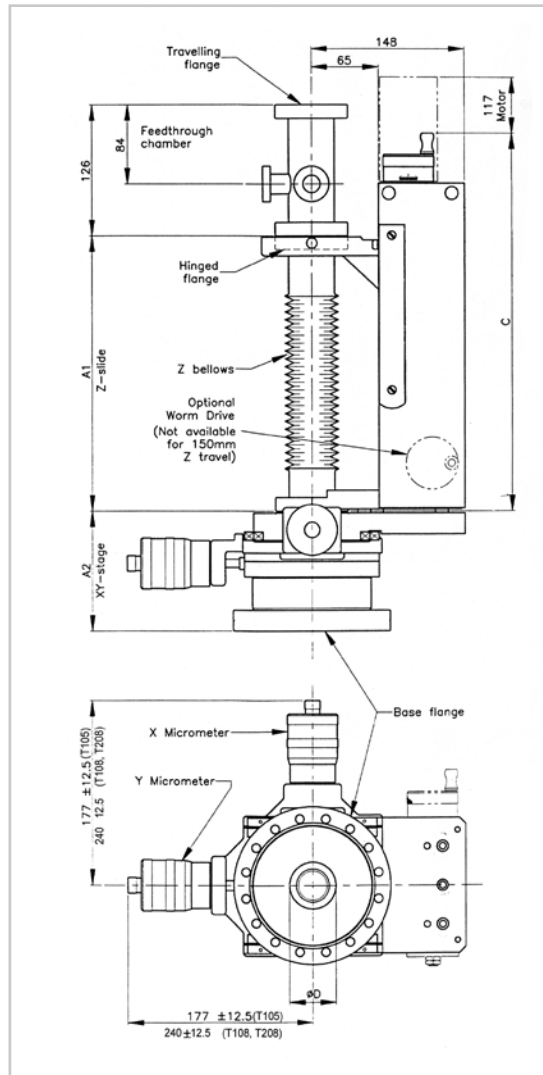
Construction

The stability and versatility of the Transax is possible due to the double bellows construction. This construction follows the principle of the Omniax translator, but the Transax offers a more cost effective solution where a large capacity and extreme stability of the Omniax are not required. The basic Transax combines a linear Z slide with an XY table joined with a rigid interface that eliminates strain from the mating flanges of the Z slide.

Transax Translators

Transax Series - Technical Data	
Travelling Flange	
NW40CF (70 mm OD) Conflat flange with clearance holes, straddled about the X-axis	
Base Flanges	
NW35CF (70 mm OD) Conflat with 6.8 mm diameter straddled clearance holes (Z-only option only)	
NW100CF (152 mm OD) Conflat with 8.4 mm diameter straddled clearance holes (T000 and T105 XY stages)	
NW100CF (152 mm OD) Conflat with straddled M8 tapped flanges (T108 and T208 XY stages)	
VG Scienta can normally provide alternative base flanges to specific requirements.	

All dimensions in mm.



Transax Z Slide - Basic Dimensions			
Z Travel	A1	C	Weight ⁽¹⁾ kg
150	129 to 279	360	22
300	166 to 466	545	24
450	202 to 652	731	25

All dimensions in mm unless otherwise stated.

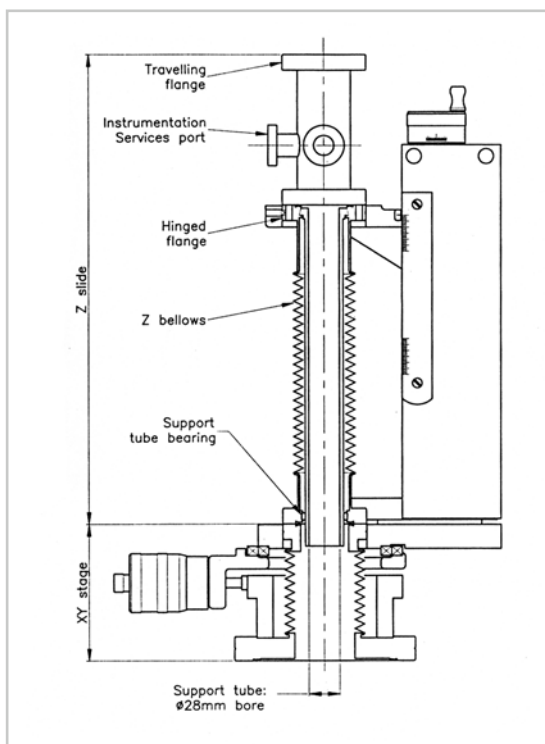
(1) The weight of the Transax manipulator will vary depending on the configuration details.

Transax XY Module - Basic Dimensions			
XY Travel	Basic Code of XY stage	A2	Bellows Bore ØD
±0	T000	80	95
±6.0	T105 ⁽¹⁾	114	44
±12.5	T108	135	85
±25.0	T208	167	85

All dimensions in mm.

(1) The T105 stage has a normal range of ±12.5 mm, but will allow only ±6 mm vectorial travel when the Ø32 mm OD support tube is fitted.

Transax Translator - Z Slide Modules



Transax Z-slide - Technical Data

Parameter	Specification
Resolution - Manual	10 microns
Resolution - Motorised ⁽¹⁾	5 microns
Repeatability - Manual	10 microns
Repeatability - Motorised ⁽¹⁾	5 microns
Maximum Speed - Motorised ⁽¹⁾	10 mm.s ⁻¹

(1) Specifications assume the use of VG Scienta's motor control system.

- Three travel options from 150 mm to 450 mm
- The guided support tube is included with the Z slide and has a clear bore of 28 mm bore (32 mm OD). The guide bearing is also included. These items can be omitted on request
- If required the support tube can be rotated using a differentially pumped rotating feedthrough. See page 234 for more details on this option
- The feedthrough chamber is included with the Z slide and has three radial mini ports for attachment of service feedthroughs. If cooling is required, one port is used as a liquid nitrogen feedthrough. The chamber may be omitted on request, but note that rotary drives cannot be mounted directly to the hinged flange due to the clash with the bellows bore
- The manual Z drive is included with the Z slide module and has a rapid action of 2 mm linear travel per turn of the handwheel. For long travel Transax translators (above 150 mm), a worm drive can be fitted to bring the handwheel position close to the base flange. This option gives 0.5 mm travel per turn
- The stepper motor option is compatible with all VG Scienta motor drive controllers. Limit switches and all mounting hardware is provided. The motors are supplied with a wired connector to suit VG Scienta's stepper motor control system. Encoded motors are available; this option will be supplied wired to suit our controllers (see pages 376 to 378). The DC motorisation option includes the power supply (see page 375)

Z Slide Modules and Accessories

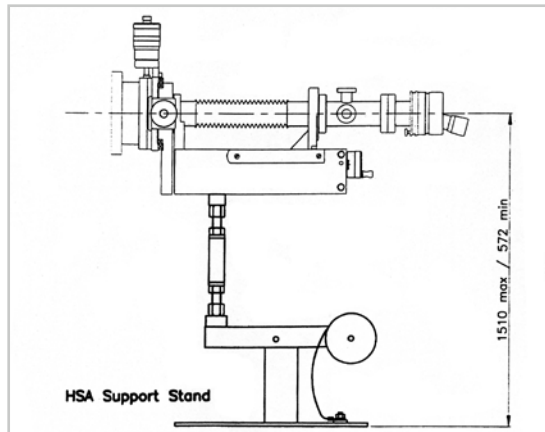
Travel Range, mm	Order Code
150	MTX1570
300	MTX3070
450	MTX4570
Worm Drive Upgrade (not available for MTX1570)	MTRWD
Z Axis Stepper Motor Upgrade ⁽¹⁾	MTRSMK
Z Axis DC Motor Upgrade ⁽²⁾	MTRDCMK

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available.

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Transax Translator - XY Stage Modules

- Travel options are ± 6 mm, ± 12.5 mm or ± 25.0 with precision movement. All stated movements refer to the maximum vectorial offset
- If mounting to an NW35CF base flange, the T000A6S adaptor module is not necessary if a Z-only translator is required. The Transax Z slide base flange can be mounted directly to the chamber port. The Z slide flange has clearance holes straddled about the X axis
- All micrometers are easy to read, large barrel types with 5 micron graduations. These are interchangeable with the motor modules
- The VG Scienta stepper motor options are compatible with all motor controllers. Limit switches and all mounting hardware are provided. The motors are supplied with a mating connectors; encoder options are available and will be supplied wired to suit our controllers
- The HSA Horizontal Compensation Stand is required for all horizontally mounted Transax manipulators with XY movement. This reduces load on the micrometers and translator components, but allows free movement of the X and Y axes



Transax XY Module - Technical Data		
Parameter		Specification
Resolution - Manual	All Stages	5 microns
Resolution - Motorised ⁽¹⁾	T105 Stage	2.5 microns
	T108 Stage	0.5 microns
	T208 Stages	0.5 microns
Repeatability - Manual	All Stages	5 microns
Repeatability - Motorised ⁽¹⁾	T105 Stage	5 microns
	T108 Stage	1 microns
	T208 Stages	1 microns

(1) Specifications assume the use of VG Scienta's motor control system.

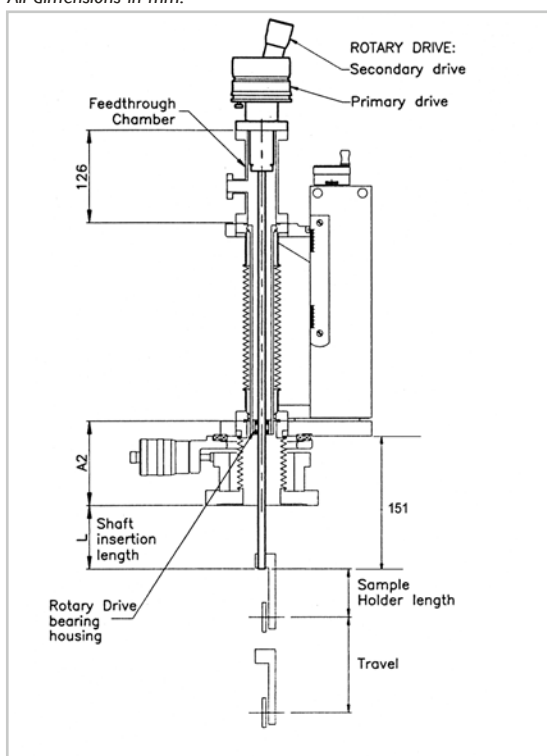
- The TRS module is simple, adjustable stand for horizontally mounted Z-only manipulators

Transax XY Stage Modules and Accessories	
XY Stage Module - 152 mm OD Base Flange	Order Code
± 0 mm Adaptor	MT000A6S
± 6.0 mm Stage ⁽¹⁾	MT105A6S
± 12.5 mm Stage	MT108A6S
± 25.0 mm Stage	MT208A6S
XY Stage Motorisation	
X Axis Stepper Motor Upgrade: MT105 ⁽²⁾	MT05X
Y Axis Stepper Motor Upgrade: MT105 ⁽²⁾	MT05Y
X Axis DC Motor Upgrade: MT105 ⁽³⁾	MT05DCX
Y Axis DC Motor Upgrade: MT105 ⁽³⁾	MT05DCY
X Axis Stepper Motor Upgrade: MT108/MT208 ⁽²⁾	MT08X
Y Axis Stepper Motor Upgrade: MT108/MT208 ⁽²⁾	MT08Y
X Axis DC Motor Upgrade: MT108/MT208 ⁽³⁾	MT08DCX
Y Axis DC Motor Upgrade: MT108/MT208 ⁽³⁾	MT08DCY
Horizontal Compensation Stand	
Horizontal Compensation Stand	MHSA
Adjustable Stand for Z-only Option	ZTRS

- (1) The T105 stage micrometers indicate ± 12.5 mm movement but only ± 6.0 mm vectorial travel is possible with the support tube fitted.
- (2) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available.
- (3) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Transax Translators - Rotary Drive Modules

All dimensions in mm.



Rotary Drive Module

- The rotary drives are based on the RD1 for primary rotation only, or on the RD2 for primary rotation with a secondary movement
- The feedthrough chamber must be fitted to mount the rotary drive
- The rotary drive shaft insertion length, L, can be made to suit individual requirements. The retracted L dimension will be requested when ordering the rotary drive module. Note the restrictions set out below
- Rotary drives used with Transax translators are supplied with a bearing assembly located at the end of the support tube. This fully supports the tip of the rotary drive. All sample services pass through this bearing assembly which includes clamps to secure electrical wires and cooling tubes without impeding movement
- The RD1 and RD2 specifications, dimensions and motor details are given on pages 220 to 225
- Please note the minimum limits of the retracted L dimension set out in the table below. These limits are to allow heating and cooling services to be fitted and are dependant on the XY stage chosen

L Dimension Limitations with Cooling Accessories Fitted

XY Stage Module	Travel	A2	L Dimension Minimum
None	0	0	176
T000	0	80	96
T105	±6.0	114	62
T108	±12.5	135	40
T208	±25.0	167	10

All dimensions in mm.

Transax Rotary Drive Modules and Motorisation

Rotary Drive Module		Order Code
Variable Length Rotary Drive	RI Only	MR1T
Variable Length Rotary Drive	RI + secondary	MR2T
Rotary Drive Motorisation		
Stepper Motor Upgrade for Primary Axis ⁽¹⁾	RI Rotation	ZRDPMK
Stepper Motor Upgrade for Secondary Axis ⁽¹⁾		ZRDSMK
RD1/RD2 Primary Drive DC Motor Kit Upgrade ⁽²⁾	RI Only	ZRDPDCMK

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scientia's stepper motor control system. A separate mating connector is available.

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Transax Translators - Differentially Pumped Rotary Modules

For additional rotations of the sample or the manipulator itself, differentially pumped devices can be used. Two types can be used with the Transax; the DPRF55 or the RP100. In either case, it is important to discuss your particular requirements with your local agent or with VG Scienta's Technical Sales Department to confirm the configuration most suitable.

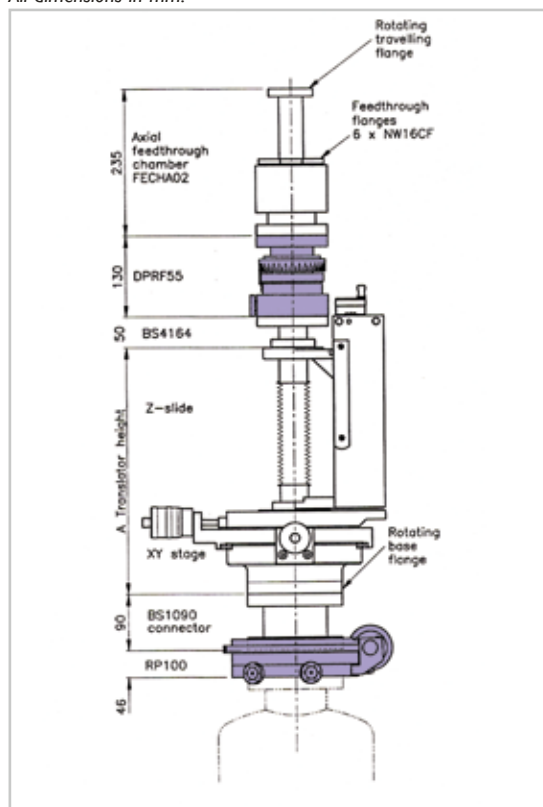
DPRF55 specifications and dimensions are given on pages 237 to 239.

- To allow the support tube to rotate, the DPRF55 can be mounted, via a tubulated adaptor, to the hinged flange. The support tube is connected to the rotating flange of the DPRF55
- If the instrumentation services are to rotate, an axial feedthrough chamber (ZFECHA02) must be fitted to the rotating flange of the DPRF55. This replaces the standard radial feedthrough chamber and includes a central port suitable for mounting a rotary drive

RP100 specifications and dimensions are given on pages 240 to 242.

- Vertically mounted Transax manipulators can be rotated by fitting an RP100 rotating platform between the Transax base flange and the chamber flange
- The RP100 rotates the manipulator about the chamber mounting flange, since the XY stage is above the rotating flange; alternative configurations can be provided. For example, to rotate about the travelling flange,

All dimensions in mm.



- a Z-only Transax can be fitted above the RP100 with an XY Table (e.g. order code ZT108C6S) mounting to the chamber port
- Note the RP100 has tapped NW100CF (152 mm OD) flanges both sides. A BS1090 straight connector is therefore required when mounting to the tapped base flange of the T108 or T208 XY stages

Transax Differentially Pumped Rotary Modules and Accessories

DPRF Module	Order Code
DPRF55 with Coarse Manual Actuator	ZDPRF55
DPRF55 with Precision Manual Actuator	ZDPRF55H
DPRF55 with Stepper Motor ⁽¹⁾	ZDPRF55M
DPRF55 with DC Motor Fitted ⁽²⁾	ZDPRF55D
RP100 Module	
RP100 with Coarse Manual Actuator	ZRP100C
RP100 with Precision Manual Actuator	ZRP100H
RP100 with Stepper Motor ⁽¹⁾	ZRP100M
RP100 with DC Motor Fitted ⁽²⁾	ZRP100DC
Accessories	
Axial Feedthrough Chamber	ZFECHA02
Adaptor for DPRF55 Module Attachment	ZBS4164
Straight Connector for RP100 Mounting	ZBS1090

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available.

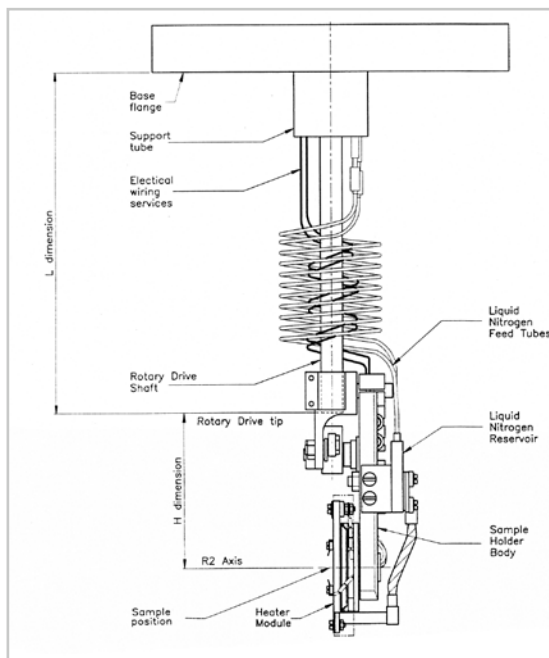
(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Transax Translator - Sample Handling Equipment



- All VG Scienta sample handling equipment is suitable for use with Transax translators
- The normal specifications for sample heating, cooling and movement are unaffected by attachment to the Transax.

Full details of VG Scienta's range of sample holders and heating and cooling accessories can be found on pages 298 to 317. An overview of the sample holder range is given on the next page.

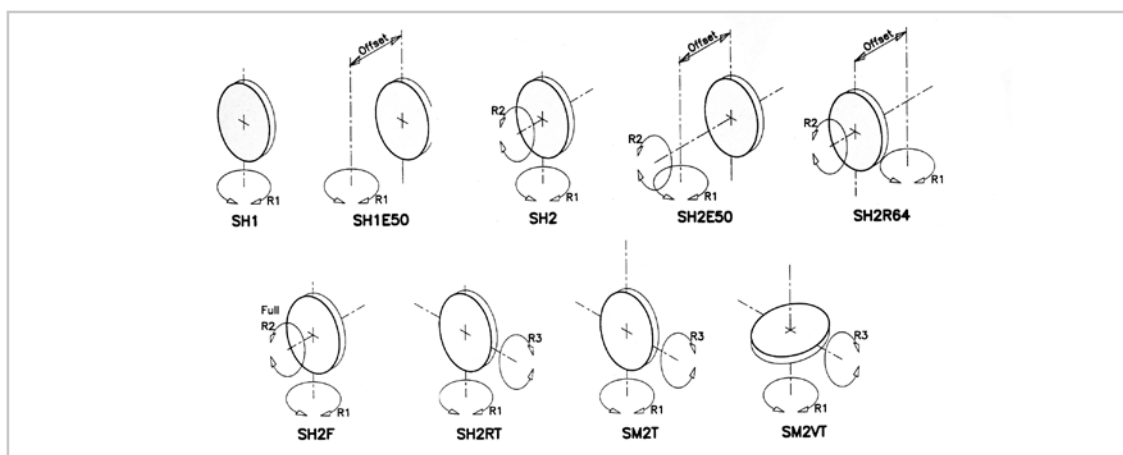


Sample heating and cooling accessories.

Transax - Sample Holder Selection

This page gives an overview of the standard range of VG Scienta sample holders, together with their basic specifications. Full details of all types of sample holder including heating and cooling services are given on pages 302 to 317.

Definitions of the specified parameter (rotation range, offsets etc.) are given on pages 296 to 299.



Sample Holders - Basic Specifications									
	SH1	SH1E50	SH2	SH2E50	SH2R64	SH2F	SH2RT	SM2T	SM2VT
Rotary Drive Required	RD1	RD1	RD2	RD2	RD2	RD224	RD2	RD2	RD2
Primary (R1) Rotation									
No services	360°	360°	360°	360°	360°	360°	360°	360°	360°
With services	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°
Azimuthal (R2) Rotation									
Preset	±180°	±180°							
Variable			±110°	±110°	±110°	±180°			
Tilt (R3) Rotation							±110°	±10°	±10°
Sample Offset	E	E	E	E	R	E	E	E	E
Bare backplate (mm)	9 to 12	9 to 50	9 to 12	9 to 50	54 to 64	9 to 12	5.5 to 9.5	5.5 to 7.5	5.5 to 7.5
Plain or heater unit (mm)	0 to 3	0 to 41	0 to 3	0 to 41	60 to 66	0 to 3	0 to 2.5	0 to 2.5	0 to 2.5
Swept Radius		From		From					
No services (mm)	25	25 (min)	25	25 (min)	54 to 64	25	31	35	24
With all services (mm)	38	38 (min)	38	38 (min)	54 to 64	38	44	Variable	Variable
Magnetic Permeability	Low	Low	Low	Low	Low	Low	Low	Normal	Normal
'H' dimension (mm)	66	66	66	66	66	103	66	66	66
Temperature Ranges									
Resistive heater (HST)	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C
EB heater (EBH)	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C	-160 °C	-160 °C	-140 °C	-160 °C	-160 °C	-160 °C	-160 °C
Approx. resolution per halfstep of RD motor									
R1 rotation (stepper)	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°
R2 rotation (stepper)	-	-	0.001°	0.001°	0.001°	0.001°	-	-	-
R3 rotation (stepper)	-	-	-	-	-	-	0.001°	0.0001°	0.0001°

Transax Translator - Checklist

This checklist is intended to help you configure the Transax device to suit your individual application. To place an order, VG Scienta will require a more detailed Ordering Questionnaire based on the information below. Please contact

your agent who will discuss your application and help you complete the questionnaire.

If any details are unclear, or you have special requirements, please call for assistance.

Questionnaire				Example		
Options	Notes	Code	Price	Notes	Code	Price
Z Travel				300 mm	MTX3070	
Z Drive: Manual or Motor?				motor	MTRSMK	
Worm Drive Upgrade?				no		
XY Travel				±12.5 mm	MT108A6S	
X Drive: Manual or Motor?				manual	-	
Y Drive: Manual or motor?				manual	-	
Horizontal Stand				yes	MHSA	
Primary Rotation (R1)				yes		
Secondary Movement				yes	MR2T	
R1 Drive: Manual or Motor?				manual	-	
Secondary: Manual or Motor?				manual	-	
DPRF55 Rotary Device				no		
RPI00 Rotary Device				no		
Axial Feedthrough Chamber				no		
Adaptor for DPRF				no		
Connector for RPI00				no		
Sample Holder (page 298)				yes	ZSH2	
Sample Heating (page 310)				no		
Sample Cooling (page 312)				no		
LN Heat Exchanger (page 312)				no		
Heater Controller				no		
Motor Controller (page 372)				yes	ZSIM240	
Miscellaneous				Lube. kit	ZLUBEK	
Total:				Total:		
<i>Application Notes</i> Include any non-standard detail and special information that would be helpful in conveying your requirements.						

This example describes a horizontally mounted Transax manipulator with motorized Z axis. The sample can be rotated about both the primary (R1) and azimuthal (R2) axes. No sample attachment services are requested. A single motor controller is included.

Centiax Translators

Introduction to Centiax Translators

- Fully UHV-compatible single bellows translator
- Probe capacity up to 100 mm
- Z travel of 150, 300 and 500 mm
- X and Y travel up to ± 25 mm (vector sum); the total XY range available depends on probe diameter
- Base flanges options of DN150CF and DN200CF
- All axes can be motorised
- Will withstand repeated bakeout to 230 °C
- High load carrying capacity
- Proven design of precision XY table
- Unit can be mounted in any orientation; horizontal mounting is possible using the support unit

The Centiax wide bore translator provides the opportunity to pass objects of up to 100 mm diameter into a UHV system. The Centiax is a single bellows design and so the XY travel range depends on the diameter of the probe that is fitted to the translator.

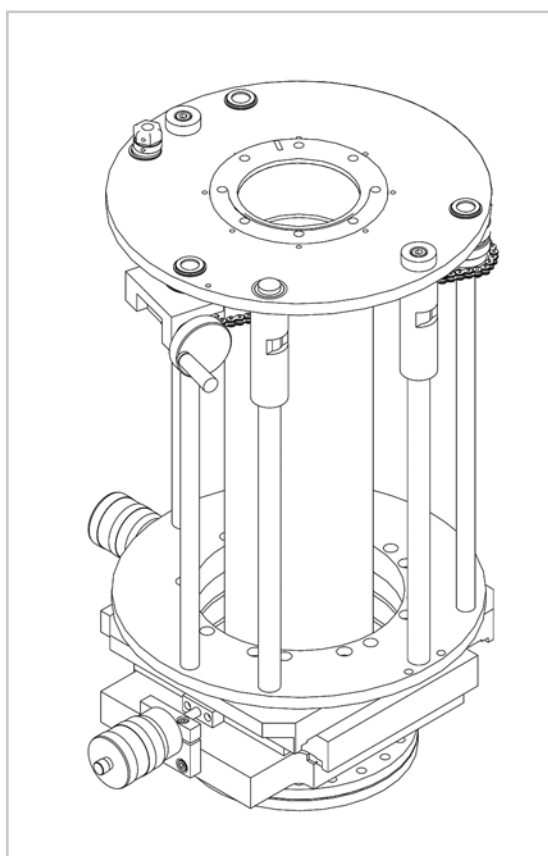
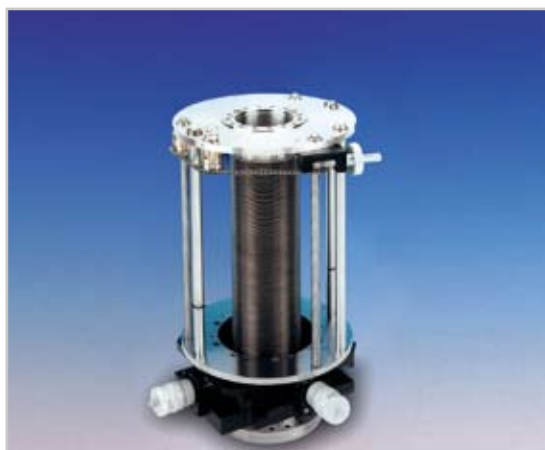
Three options are available giving Z translations of 150, 300 and 500 mm. The XY translation system gives precision motion of up to ± 25 mm (vector sum). Note that the XY travel is limited by the probe diameter.

The Centiax is particularly suitable for use with devices such as high power cryostats and custom-designed sample holders.

Construction

The Centiax is of modular construction which supports a range of travel options. The Z module uses three simultaneously-driven lead screws to provide stable parallel motion.

In the basic manual version the Z motion is applied via a hexagonal drive nut, giving a linear motion of 4 mm per revolution. The use of the optional hand wheel drive gives a linear motion of 0.4 mm per revolution of the handwheel.

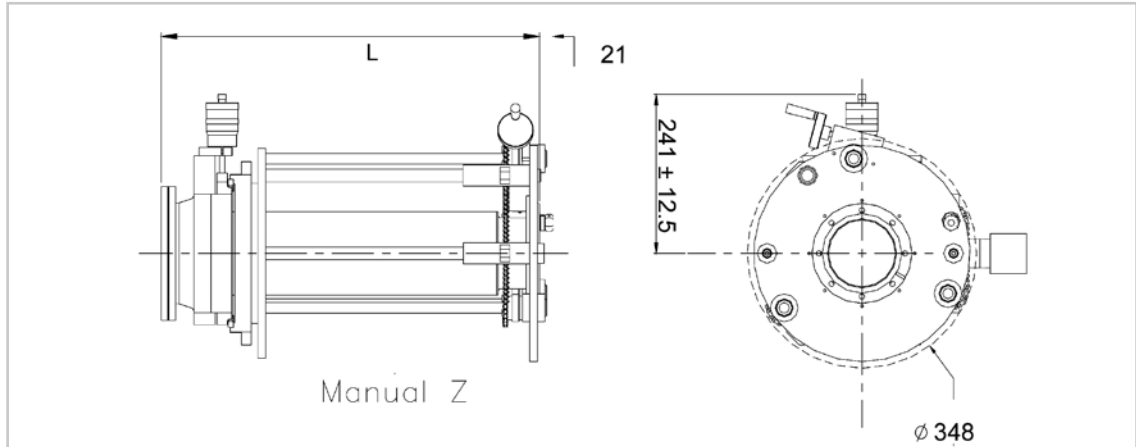


Use of the stepper motor Z drive allows much smaller incremental motions.

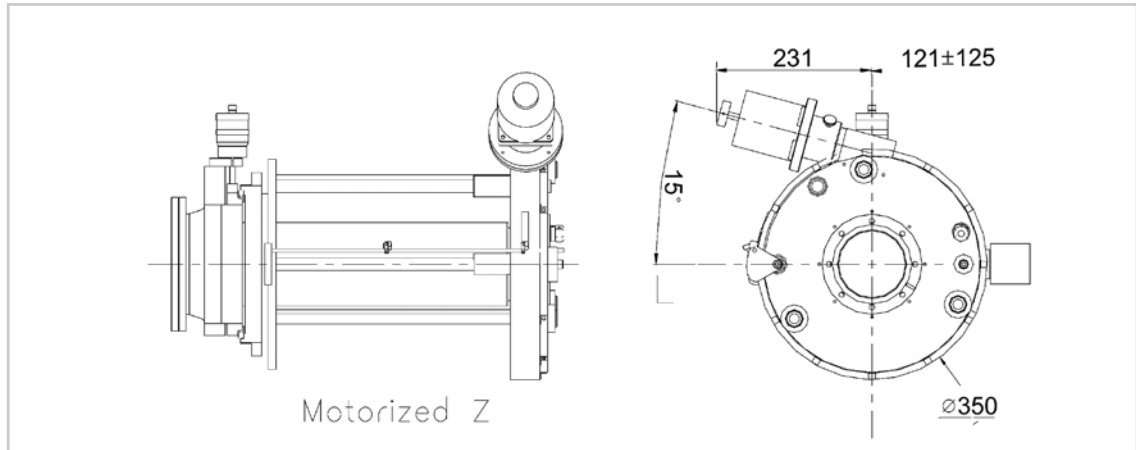
The XY stage uses high quality cross roller bearings that allow smooth operation under the highest load conditions.

Centiax Translators

All dimensions in mm.



Centiax with manual Z drive.



Centiax with motorised Z drive.

Centiax Translator - Basic Dimensions		
Centiax Travel Length	Centiax Base Module Part Code ⁽¹⁾	L Dimension
150	MWB15xxx	254 - 404
300	MWB30xxx	275 - 575
500	MWB50xxx	302 - 802

All dimensions in mm.

(1) See page 345 for full part code descriptions.

Centiax - Technical Data		
Pressure Range		UHV to 1 bar
Leak Rate		10^{-10} mbar.l.s ⁻¹
Bakeout Temperature		230°C
Construction	Body	Stainless steel
	Mechanism	Stainless steel/ phosphor bronze/ aluminium
	Bellows	Stainless steel
Mounting Position ⁽¹⁾		Any

(1) Horizontal mounting needs additional support stand.

Centiax Translators

Centiax Order Codes

The order codes for the Centiax translator are built up in a logical sequence which reflects the building blocks of the modules. Thus the part code MWB15126 comprises the following components:

The complete range of basic Centiax order codes are given in the table below.

M = Modular Design

WB = Centiax Wide Bore Translator

15 = 150 mm Z Travel

12 = +/- 12.5 mm X and Y Travel

6 = 6 inch (152 mm) OD Mounting Flange

Centiax Translators							
Base Flange OD ⁽¹⁾		Travelling Flange OD ⁽²⁾		Z Travel	X and Y Travel	Shipping Weight kg	Order Code
mm	inch	mm	inch	mm	mm		
152	6	150	6	150	+/-12.5	20	MWB15126
203	8	150	6	150	+/-12.5	22	MWB15128
152	6	150	6	150	+/-25.0	20	MWB15256
203	8	150	6	150	+/-25.0	22	MWB15258
152	6	150	6	300	+/-12.5	24	MWB30126
203	8	150	6	300	+/-12.5	26	MWB30128
152	6	150	6	300	+/-25.0	24	MWB30256
203	8	150	6	300	+/-25.0	26	MWB30258
152	6	150	6	500	+/-12.5	26	MWB50126

(1) Specify straddled or in-line bolt hole orientation at time of ordering.

(2) Note that the travelling flange has bolt holes oriented in-line with the X and Y table axes.

Centiax Option and Accessories

A number of options and accessories are available for the Centiax translator. Horizontal mounting of the translator requires the use of the MWBHK horizontal support stand which

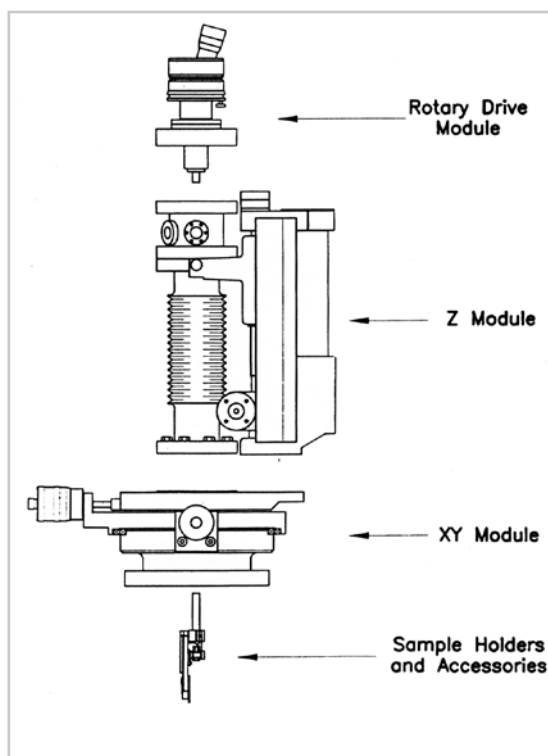
should be specified at the time of ordering. The manual handwheel and motorisation options can be fitted at the time of manufacture or can be retrofitted as upgrades at a later date.

Centiax Translator - Options and Accessories		
Motorisation Options		Order Code
Stepper Motor Upgrade for the X Axis Travel ⁽¹⁾		MT08X
Stepper Motor Upgrade for the Y Axis Travel ⁽¹⁾		MT08Y
DC Motor Upgrade for the X Axis Travel ⁽²⁾		MT08DCX
DC Motor Upgrade for the Y Axis Travel ⁽²⁾		MT08DCY
Stepper Motor Upgrade for the Z Axis Travel ⁽¹⁾		MWBMTZ
DC Motor Upgrade for Z Axis Travel ⁽²⁾		MWBMTZDC
Accessories		
Horizontal Stand	Support stand for horizontal operation of the Centiax	MWBHK
Manual Handwheel	Upgrade kit to convert the hexagon nut drive to handwheel operation	ZLTSHWK
Lubrication Kit	Lubrication kit suitable for use with the Centiax	ZLUBEK

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Omniax Translators



Basic Omniax modules.

Introduction to the Omniax Translator

- The Omniax is a fully UHV compatible double bellows translator with large probe capacity
- The Omniax uses the unique VG Scienta hinged flange and guided support tube to eliminate deflection due to vacuum loading and for extreme stability

- The standard Omniax support tube is typically five times more rigid than that of the Transax or twenty-five times that of a conventional extended bearing housing
- The Omniax has a large load carrying capacity and can accept probes up to 50 mm diameter with full ± 25 mm XY travel
- The construction is thermally matched to eliminate bi-metal deformation even after repeated bakeouts to 230 °C
- All axes can be manually or stepper motor operated to high resolution and repeatability. The X-axis actuator positions can be moved to the opposite side for convenience. The motors are exceptionally easy to remove for bakeout
- The interchangeable modules allow for most configurations to be updated at a later time

The Omniax is a highly versatile translator designed for excellent stability without compromise. The large variety of modules available for the Omniax means that suitable configurations can be matched to the most extreme applications. Long travels, multiple rotations, specimen rigidity, capacity for feedthroughs and sheer versatility mean that the Omniax is used as the basis for the Helistat and Cryoax range of cryostats. The Omniax continues to offer excellent value at an unrivalled level of quality that makes this impressive translator the best selling double bellows translator on the market.

Construction

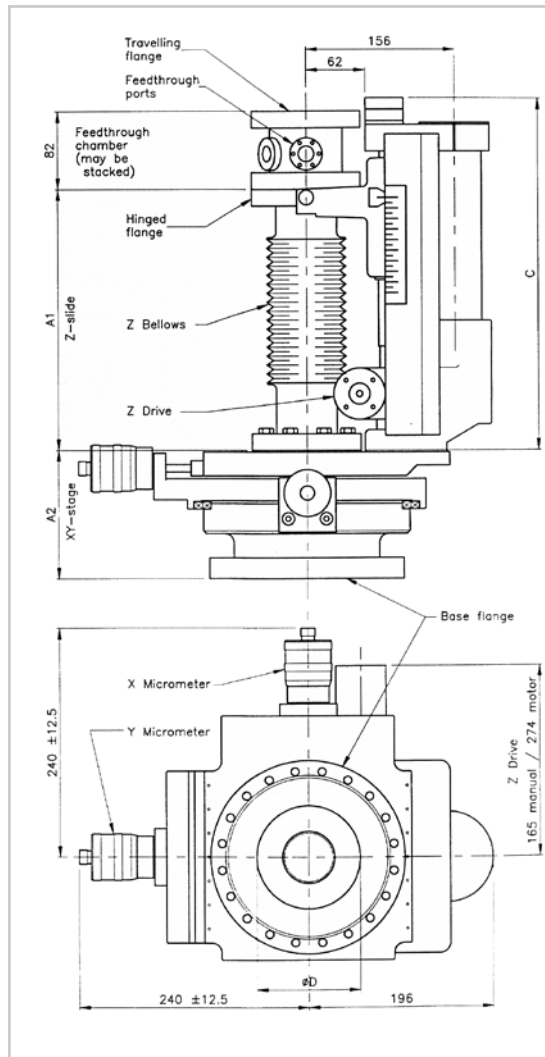
The stability and versatility of the Omniax is possible due to the double bellows construction. No compromises are made in order to achieve the best stability possible for long travel manipulation: thermally matched components, spring mounted linear bearings, anti-backlash drives, the hinged knee concept, cross roller slide-ways, recirculating ball linear guide bushes, and very robust construction are some of the reasons behind the claim that the Omniax cannot be beaten if the positional stability of your sample is important.

Omni-ax Translators

Omni-ax Series - Technical Data	
Travelling Flange	
NW63CF (114 mm OD) Conflat flange with straddled clearance holes.	
Base Flanges⁽¹⁾	
NW100CF (152 mm OD) Conflat with straddled M8 tapped flange	
NW150CF (203 mm OD) Conflat flange with straddled clearance holes.	

(1) VG Scienta can normally provide alternative base flanges for specific requirements.

All dimensions in mm.



Omni-ax Z Slide - Basic Dimensions			
Z Travel	A1	C	Weight ⁽¹⁾ (kg)
100	184 to 284	374	40
200	186 to 386	477	42
400	186 to 586	677	46
600	229 to 829	920	52
800	273 to 1073	1164	56
1000	317 to 1317	1408	61

All dimensions in mm unless otherwise stated.

(1) The weight of the Omni-ax manipulator will vary depending on the configuration details.

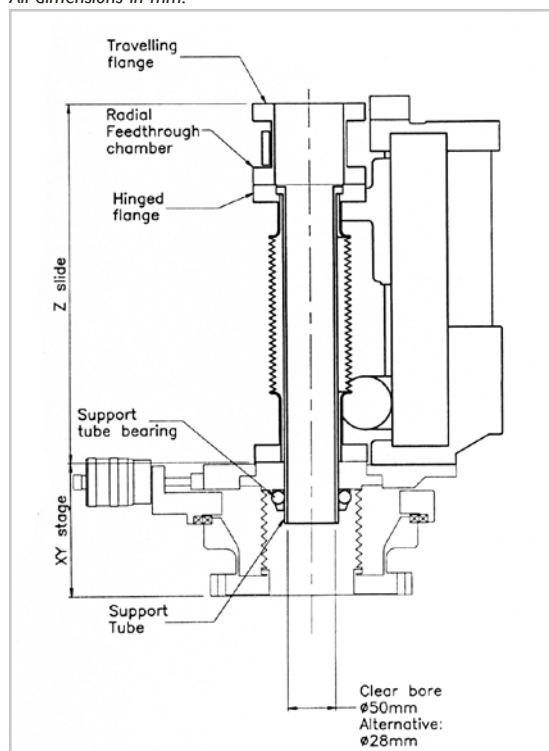
Omni-ax XY Module - Basic Dimensions			
XY Travel	Basic Code of XY stage	A2	Bellows Bore ØD
±0	T000	80	95
±12.5	T108	135	85
±25.02	T208 ⁽²⁾	167	85
±25.0	T211	175	108

All dimensions in mm.

(2) The T208 XY stage can only be used with the 28 mm ID support tube.

Omniax Translators - Z Slide Modules

All dimensions in mm.



- Standard travel options from 100 mm to 1000 mm (longer Z travel on request)
- A guided support tube is fitted as standard. This has a clear bore of 50 mm (54 mm OD) with an alternative 28 mm bore option (32 mm OD)
- If required, the support tube can be made to rotate by using a differentially pumped rotating feedthrough and rotary support bearing
- The standard feedthrough chamber is included with the Z slide. This has four radial mini ports, tapped M4, for attachment of feedthroughs for services. These include a dedicated cooling port. Additional feedthrough chambers can be stacked to increase capacity
- The manual Z drive is included with the Z slide module. An index dial is fitted to eliminate backlash on the worm drive
- The VG Scienta stepper motor option is compatible with all motor controllers. Limit switches and all mounting hardware are provided. The motor is supplied with a wired connector to suit VG Scienta's stepper motor control system. Encoded motors are also available; this option will be supplied wired to suit our controllers
- A DC motor drive is available for the Z slide module. This option includes the controller and power supply
- The Z slide has been tested to 10 km travel distance under typical load conditions to assure the long life of the components

Omniax Z Slide - Technical Data

Parameters	Specification
Resolution - Manual	10 microns
Resolution - Motorised ⁽¹⁾	0.5 microns
Repeatability - Manual	10 microns
Repeatability - Motorised ⁽¹⁾	1 micron
Maximum Speed - Motorised ⁽¹⁾	4 mm.s ⁻¹

(1) Specification assumes the use of VG Scienta's motor control system.

Omniax Z Slide Modules and Accessories

Travel Range ⁽¹⁾ , mm	Order Code
100	MXZ100
200	MXZ200
400	MXZ400
600	MXZ600
800	MXZ800
1000	MXZ1000
Z Slide Motorisation	
Z Axis Stepper Motor Upgrade ⁽²⁾	MMOTZST
Z Axis DC Motor Upgrade ⁽³⁾	MMOTZDC

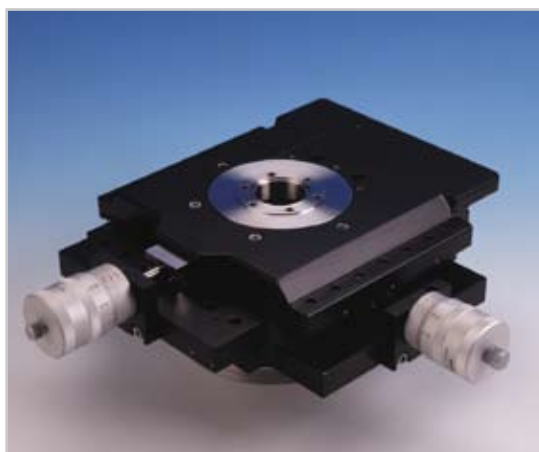
(1) Other travel options can be supplied.

(2) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(3) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Omniax Translators - XY Stage Modules

- All Omniax translators require an XY module to be fitted
- Options are: Z-only adaptor (± 0 mm), ± 12.5 mm or ± 25.0 with precision movement. All movements indicate the maximum vectorial offset
- The XY movement is not restricted by probe sizes up to the maximum clear bore of the support tube
- Both micrometers are easy to read, large barrel types with 5 micron graduations. These are easily interchangeable with the motor modules
- The VG Scienta stepper motor option is compatible with all motor controllers. Limit switches and all mounting hardware are provided. The motor is supplied with a wired connector to suit VG Scienta's stepper motor control system. Encoded motors are also available; this option will be supplied wired to suit our controllers
- A DC motor drive is available for the Z slide module. This option includes the controller and power supply



Omniax XY Module - Technical Data

Parameters	Specification
Resolution - Manual	10 microns
Resolution - Motorised ⁽¹⁾	0.5 microns
Repeatability - Manual	10 microns
Repeatability - Motorised ⁽¹⁾	1 micron
Maximum Speed - Motorised ⁽¹⁾	4 mm.s ⁻¹

(1) Specification assumes the use of VG Scienta's motor control system.

Omniax XY Stage Modules and Accessories

Base Flange	Travel Range	Order Code
NW100CF (6" OD)	Z-only ± 0 mm	MT000B6S
NW100CF (6" OD)	± 12.5 mm Stage	MT108B6S
NW100CF (6" OD)	± 25.0 mm Stage ⁽¹⁾	MT208B6S ⁽¹⁾
NW100CF (6" OD)	± 25.0 mm Stage	MT211B6S
NW150CF (8" OD)	Z-only ± 0 mm	MT000B8S
NW150CF (8" OD)	± 12.5 mm Stage	MT108B8S
NW150CF (8" OD)	± 25.0 mm Stage ⁽¹⁾	MT208B8S ⁽¹⁾
NW150CF (8" OD)	± 25.0 mm Stage	MT211B8S
XY Module Motorisation		
X Axis Stepper Motor Upgrade ⁽²⁾		MT08X
Y Axis Stepper Motor Upgrade ⁽²⁾		MT08Y
X Axis DC Motor ⁽³⁾		MT08DCX
Y Axis DC Motor ⁽³⁾		MT08DCY

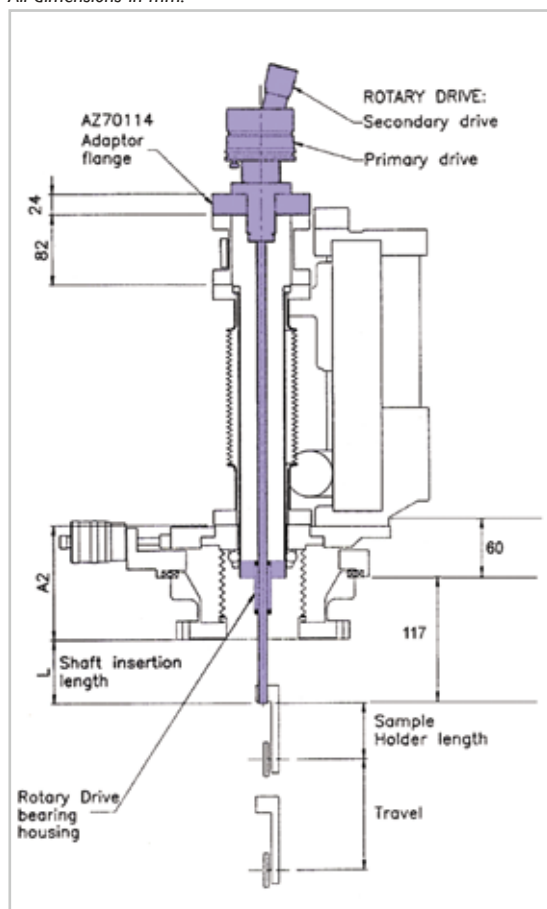
(1) The MT208 stages are intended for use with the smaller support tube (28 mm bore) only.

(2) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(3) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Omniax Translators - Rotary Drive Modules

All dimensions in mm.



- The adaptor flange must be fitted to provide mountings for the rotary drive (see diagram)
- The rotary drive shaft insertion length, L, can be made to suit individual requirements. This dimension will be requested when ordering the rotary drive module
- Rotary drives used with Omniax translators are supplied with a bearing assembly located in the end of the support tube. This fully supports the tip of the rotary drive. All sample services pass through this bearing assembly which includes clamps to secure electrical wires and cooling tubes
- The RD1 and RD2 specifications, dimensions and motor details are given in pages 220 to 225
- Please note the minimum limits of the retracted L dimension set out in the table below. These limits are necessary to allow heating and cooling to be fitted and are dependant on the XY stage chosen
- The VG Scienta stepper motor option is compatible with all motor controllers. Limit switches and all mounting hardware are provided. The motor is supplied with a wired connector to suit VG Scienta's stepper motor control system. Encoded motors are also available; this option will be supplied wired to suit our controllers
- A DC motor drive is available for the Z slide module. This option includes the controller and power supply

- The rotary drives are based on the RD1 for primary rotation only, or on the RD2 for primary rotation with a secondary movement

L Dimension Limitations with Cooling Accessory Fitted			
XY Stage Module	Travel	A2	L Dimension Minimum
T000	0	80	96
T108	±12.5	135	40
T208 ⁽¹⁾	±25.0 ⁽¹⁾	167	10
T211	±25.0	175	0

All dimensions in mm.

(1) The T208 stage is intended for use with the smaller support tube (Ø28 mm bore) only.

Omniax Rotary Drive Modules and Motorisation		
Rotary Drive Module		Order Code
Variable Length Rotary Drive	RI Only	MR1M
Variable Length Rotary Drive	RI + Secondary	MR2M
Adaptor Flange for Mounting the Rotary Drive		ZAZ70114
Rotary Drive Motorisation		
Stepper Motor Upgrade for Primary Axis ⁽¹⁾	RI Rotation	ZRDPMK
Stepper Motor Upgrade for Secondary Axis ⁽¹⁾		ZRDSMK
RD1/RD2 Primary Drive DC Motor Kit ⁽²⁾		ZRDPDCMK

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Omniax Translators - Differentially Pumped Rotary Modules

For additional rotations of the sample or the manipulator itself, differentially pumped devices can be used. Two types can be used with the Omniax; the DPRF55 or the RP100. In either case, it is important to discuss your particular requirements with VG Scienta's Technical Sales Department to confirm the configuration most suitable.

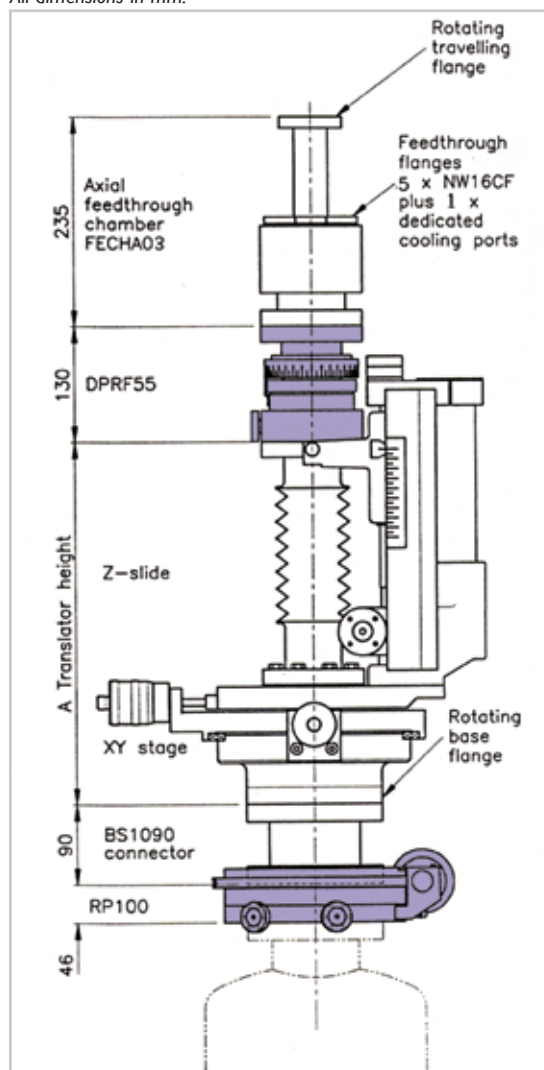
DPRF55 specifications and dimensions are given on pages 237 to 239.

- To allow the support tube to rotate, the DPRF55 can be mounted to the hinged flange. The support tube is connected to the rotating flange of the DPRF55
- If the instrumentation services are to rotate, an axial feedthrough chamber (FECHA03) must be fitted to the rotating flange of the DPRF55. This replaces the standard radial feedthrough chamber and includes a central port suitable for mounting a rotary drive

RP100 specifications and dimensions are given on pages 240 to 242.

- Vertically mounted Omniax manipulators can be rotated by fitting an RP100 rotating platform between the Omniax base flange and the chamber flange
- The RP100 rotates the manipulator about the chamber mounting flange, since the XY stage is above the rotating flange. Alternative configurations can be provided. For example, to rotate about the travelling flange, a Z-only Omniax can be fitted above the RP100 with an XY table mounting to the chamber port. Note that the RP100 has tapped NW100CF (152 mm OD) flanges

All dimensions in mm.



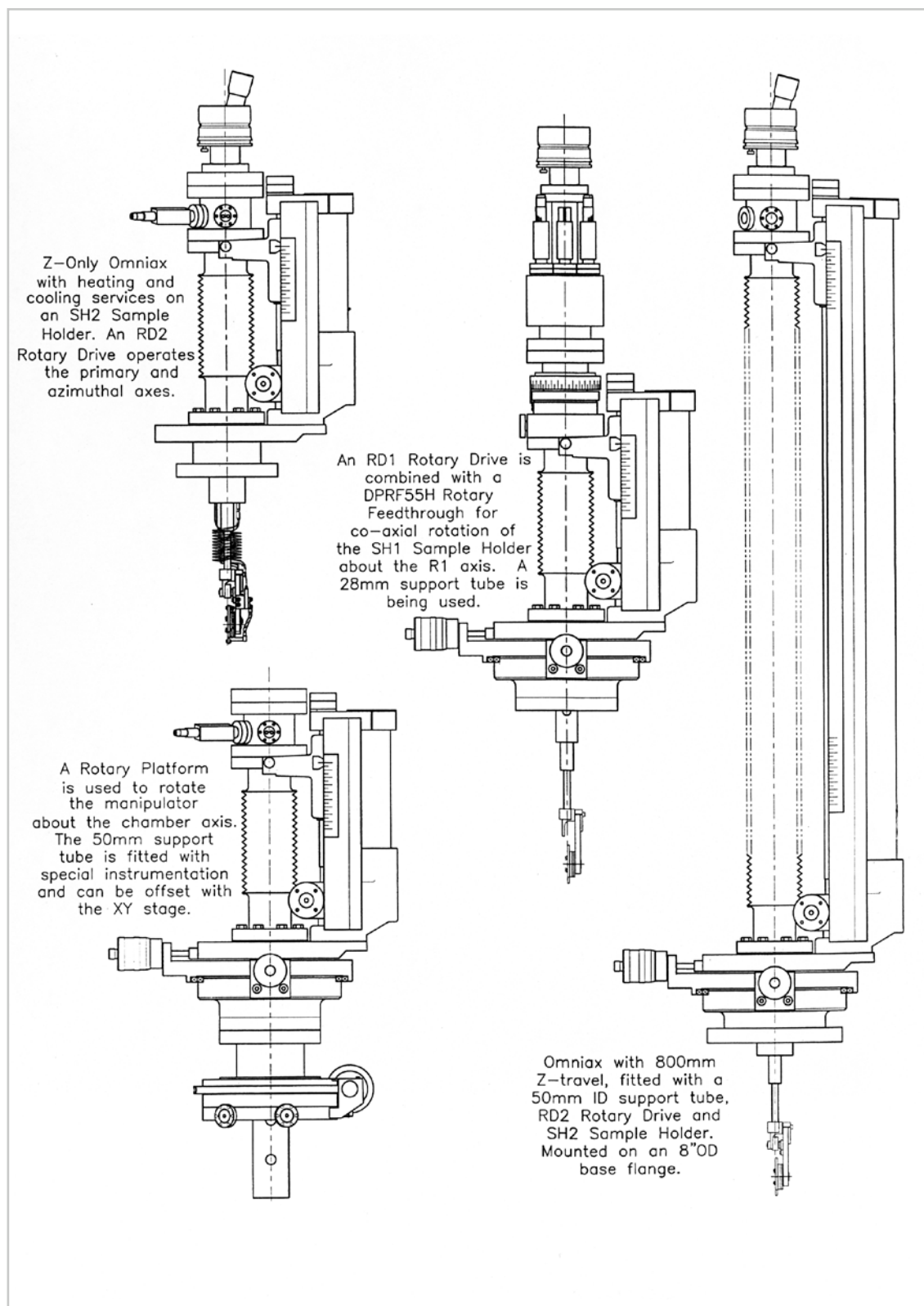
both sides. A BS1090 straight connector is therefore required for mounting to the tapped base flange of the XY stage

Omniax Differentially Pumped Rotary Modules and Accessories	
DPRF Module	Order Code
DPRF55 with Coarse Manual Actuator	ZDPRF55
DPRF55 with Precision Manual Actuator	ZDPRF55H
DPRF55 with Stepper Motor ⁽¹⁾	ZDPRF55M
DPRF55 with DC Motor Fitted ⁽²⁾	ZDPRF55D
RP100 Module	
RP100 with Coarse Manual Actuator	ZRP100C
RP100 with Precision Manual Actuator	ZRP100H
RP100 with Stepper Motor ⁽¹⁾	ZRP100M
RP100 with DC Motor Fitted ⁽²⁾	ZRP100DC
Accessories	
Axial Feedthrough Chamber	ZFECHA03
Straight Connector for RP100 Mounting	ZBS1090

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Omniax Translator Schematics



Examples of different Omniax configurations.

Omniax Translators - Mounting Stand Options

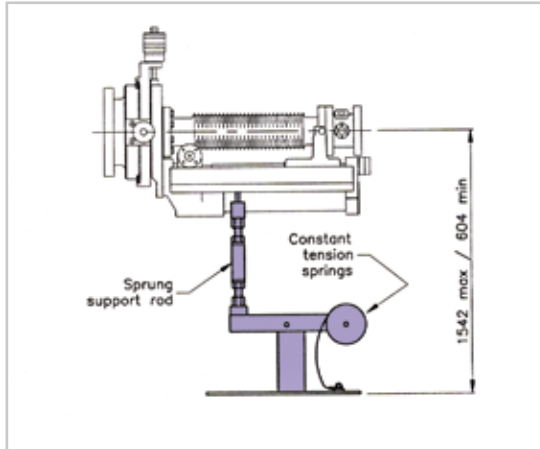
Horizontal Mounting Stands

All horizontally mounted Omniax manipulators require a support stand to prevent damage to the chamber and translator. The stand allows the Z slide to move freely in the XY plane and limits stresses on bearings and drive components.

HSA Stand (order code MHSA)

This is for use with Z travel options in the range 100 mm to 600 mm where a precision XY stage is fitted. It uses a sprung support rod mounted at the centre of gravity. Note the clearance required underneath the Omniax to mount this support stand.

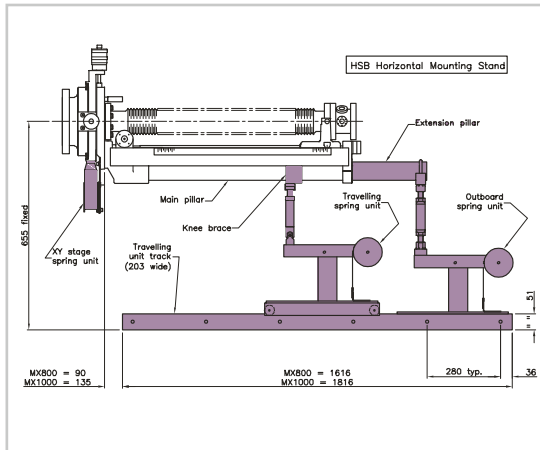
All dimensions in mm.



HSA support stand.

HSB Stand (order code MHSB)

This is for use with Z travel options of 800 mm or 1000 mm where a precision XY stage is fitted. This stand comprises three elements: (1) a sprung support rod, fitted to the Omniax knee, and travelling on a guide track to support the moving mass; (2) a static sprung support rod to take the outboard mass of the translator, and; (3) a spring arrangement that transfers the inboard mass of the manipulator to the system flange.

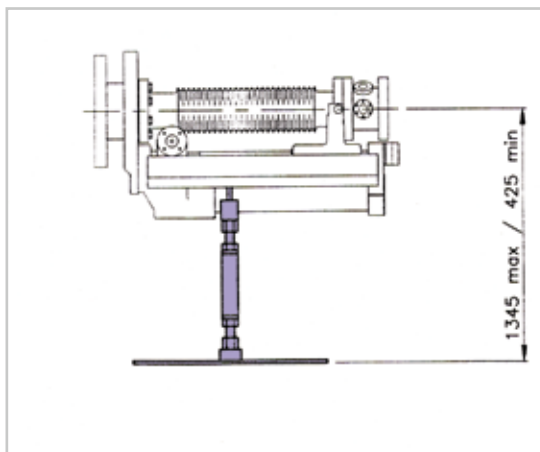


HSB support stand.

Note the clearance required underneath the Omniax to mount this support stand. Also note that this stand requires the chamber to support a large proportion of the translator weight.

HSC Stand (order code MHSC)

This is for use with all Z travel options where the fitted XY and Z-only stage (T000) are used. A fixed support rod is mounted at the centre of gravity. Note the clearance required underneath the Omniax to mount this support stand.



HSC support stand.

Omniax Translators - Sample Handling Equipment



High Power Kits

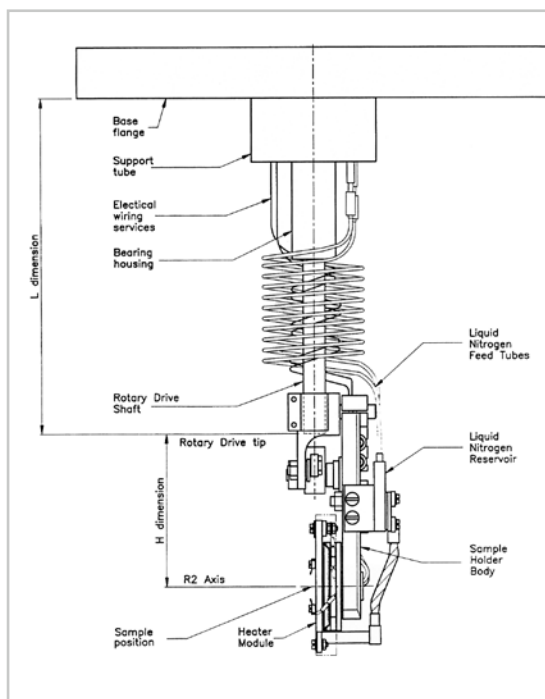
The Omniax can be fitted with specialised feedthrough kits for high current use such as direct (ohmic) heating. Note that the in-vacuum connections are normally customer specified, or left unconnected.

15 Amp Kit (order code **MMX15AMP**)

This includes the feedthrough, multiple flexible wires and barrel connectors for in-vacuum use.

40 Amp Kit (order code **MMX40AMP**)

This includes feedthrough, twin insulated conductor rods and barrel connectors for in-vacuum use. Note that this option is for use with the 50 mm ID support tube only.



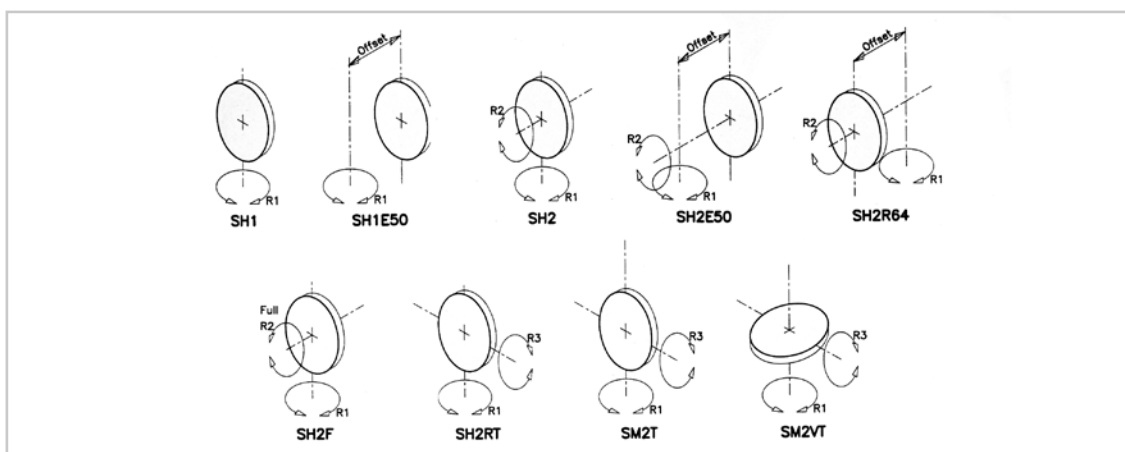
Sample heating and cooling accessories.

Full details of VG Scienta's range of sample holders and heating and cooling accessories can be found on pages 298 to 317. An overview of the sample holder range is given on the next page.

Omniax - Sample Holder Selection

This page gives an overview of the standard range of VG Scienta sample holders, together with their basic specifications. Full details of all types of sample holder including heating and cooling services are given on pages 302 to 317.

Definitions of the specified parameter (rotation range, offsets etc.) are given on pages 296 to 299.



Sample Holders - Basic Specifications

	SH1	SH1E50	SH2	SH2E50	SH2R64	SH2F	SH2RT	SM2T	SM2VT
Rotary Drive Required	RD1	RD1	RD2	RD2	RD2	RD224	RD2	RD2	RD2
Primary (R1) Rotation									
No services	360°	360°	360°	360°	360°	360°	360°	360°	360°
With services	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°	±180°
Azimuthal (R2) Rotation									
Preset	±180°	±180°							
Variable			±110°	±110°	±110°	±180°			
Tilt (R3) Rotation							±110°	±10°	±10°
Sample Offset	E	E	E	E	R	E	E	E	E
Bare backplate (mm)	9 to 12	9 to 50	9 to 12	9 to 50	54 to 64	9 to 12	5.5 to 9.5	5.5 to 7.5	5.5 to 7.5
Plain or heater unit (mm)	0 to 3	0 to 41	0 to 3	0 to 41	60 to 66	0 to 3	0 to 2.5	0 to 2.5	0 to 2.5
Swept Radius		From		From					
No services (mm)	25	25 (min)	25	25 (min)	54 to 64	25	31	35	24
With all services (mm)	38	38 (min)	38	38 (min)	54 to 64	38	44	Variable	Variable
Magnetic Permeability	Low	Low	Low	Low	Low	Low	Low	Normal	Normal
'H' dimension (mm)	66	66	66	66	66	103	66	66	66
Temperature Ranges									
Resistive heater (HST)	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C	950 °C
EB heater (EBH)	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C	1200 °C
Cooling (LN)	-160 °C	-160 °C	-160 °C	-160 °C	-140 °C	-160 °C	-160 °C	-160 °C	-160 °C
Approx. resolution per halfstep of RD motor									
R1 rotation (stepper)	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°	0.01°
R2 rotation (stepper)	-	-	0.001°	0.001°	0.001°	0.001°	-	-	-
R3 rotation (stepper)	-	-	-	-	-	-	0.001°	0.0001°	0.0001°

Omniax Translator - Checklist

This checklist is intended to help you configure the Omniax device to suit your individual application. To place an order, VG Scienta will require a more detailed Ordering Questionnaire based on the information below. Please contact

your agent who will discuss your application and help you complete the questionnaire.

If any details are unclear, or you have special requirements, please call for assistance.

Questionnaire				Example		
Options	Notes	Code	Price	Notes	Code	Price
Z Travel				400 mm	MXZ400	
Z Drive: Manual or Motor?				motor	MMOTZST	
Mounting Flange					NWI00CF	
XY Travel				±12.5 mm	MTI08B6S	
X Drive: Manual or Motor?				motor	MTO8X	
Y Drive: Manual or Motor?				motor	MTO8Y	
Primary Rotation (R1)				yes		
Secondary Movement				yes	MR2M	
Adaptor Flange				yes	ZAZ70114	
R1 Drive: Manual or Motor?				manual	-	
Secondary: Manual or Motor?				manual	-	
DPRF25 Rotary Device				no		
RPI00 Rotary Device				no		
Axial Feedthrough Chamber				no		
RPI00 Mounting Connector				no		
Horizontal Stand				no		
Sample Holder (page 298)				yes	ZSH2T	
Sample Heating (page 310)				yes	ZHST	
Sample Cooling (page 312)				yes	ZLN	
LN Heat Exchanger (page 312)				yes	ZLNHX	
Heater Controller				yes	ZRHC	
Motor Controller (page 372)				yes	ZSIM240	
Miscellaneous				Lube. kit	ZLUBEK	
Total:				Total:		
<i>Application Notes</i> Include any non-standard detail and special information that would be helpful in conveying your requirements.						

This example describes a typical Omniax manipulator with motorised X, Y and Z movements. The sample can be rotated about both the primary (R1) and tilt (R3) axes. Resistive heating and liquid nitrogen cooling services are fitted. Heater and motor controllers are included.

Introduction to Cryostats

Five cryostats can be supplied for applications that require sample manipulation at very low temperature. The range includes four open cycle cryostats and a closed cycle refrigeration system. Our own cryostats, together with those from other suppliers are integrated with VG Scienta manipulation to provide a powerful range of cryogenic manipulators for a wide range of applications.

The Helistat Range

The Helistat has been developed for fast response and for low temperature angle resolved work. The low mass heat exchanger is mounted close to the sample and connected to it by high conductivity flexible braid. The Helistat uses the same liquid helium and liquid nitrogen transfer equipment as the Cryoax 5. Sample heating to 1200 °C is available.

The Cryoax 4 Range

The Cryoax 4 is fully compatible with the Omniax manipulator and provides primary rotation. The Cryoax 4 can be used with either liquid helium or liquid nitrogen without any modification, and can provide a base temperature of 4.2 K without pumping. An optional temperature range of 4-800 K is available. Unique design features like a shielded flow transfer line and a matrix heat exchanger at the sample tip permit high cooling power, and a high temperature stability at the sample. A wide range of sample mounts can be installed at the tip.

The Cryoax 4CC Range

The Cryoax 4CC is a closed cycle cryocooler with an axial design that is fully compatible with the Omniax. The axial geometry permits primary rotation of the cryocooler when installed on the manipulator. Temperature at the tip of the cryocooler is 10-350 K without use of liquid helium or liquid nitrogen. A temperature range of 6-800 K is available as an option. A wide range of sample mounts can be installed at the tip of the cryostat.

The Cryoax 5 Range

The Cryoax 5 has been developed by VG Scienta to achieve the minimum sample temperature with 5 axes of movement. The Cryoax 5 can be fitted with VG Scienta sample holders. Two cooling circuits are provided; the main cooling to the sample plate is via the syphon entry which permits cooling with either liquid nitrogen or helium. A secondary liquid nitrogen cooling system is provided for the radiation shield. This construction thermally isolates the sample from any heat source. Sample heating to 1200 °C (1473K) is available.

The Cryoax 6 Range

The Cryoax 6 is a state-of-the-art computer controlled cryogenic manipulator. As with other VG Scienta cryostats, the main linear motions are based on the Omniax translator. Up to three rotations - polar, azimuthal and tilt - can also be provided whilst maintaining the sample at less than 20 Kelvin.

The unique transfer system allows samples to be exchanged whilst the manipulator remains under vacuum. The base temperatures are achieved without requiring an outer radiation shield. This means that the Cryoax 6 is very well suited to precision angle resolved photoemission and x-ray photoelectron diffraction experiments.

Cryostats

This table summarises the features and performance specification of VG Scienta's range of liquid helium cryostats. More detailed information for each cryostats is provided on the following

pages. All data is approximate and depends on the nature of the sample and the experiment conditions.

Liquid Helium Cryostats					
	Helistat	Cryoax 4	Cryoax 4CC	Cryoax 5 ⁽¹⁾	Cryoax 6
Maximum Degrees of Freedom	Up to 5 axes	Up to 4 axes	Up to 4 axes	Up to 5 axes	Up to 6 axes
Liquid Helium Cold Finger Base Temperature	13 K	4.2 K	10K ⁽⁴⁾ (6 K Option)	13 K	8 K
Sample Mounting Plate Temperature with Secondary Rotation ⁽²⁾	60K ⁽²⁾	-	-	50 K ⁽²⁾	18 K
Maximum Temperature with Resistive Heater	1223 K (950 °C) ⁽²⁾ (Option 800 K)	300 K (27 °C) (Option 800 K)	350 K (77 °C)	1223 K (950 °C)	-
Maximum Temperature with EB Heater	1473 K (1200 °C) ⁽²⁾	-	-	1473 K (1200 °C)	-
Cool Down Consumption	1 litre	1.5 litres	None	2 litres	(5)
Running consumption rate	2 litres/hour	1 litre/hour	None	2 litres/hour	(5)
Cool Down Time	30 min	35 min	20K in <60 min	1 hour ⁽³⁾	1 hour
Liquid Nitrogen: Base Temperature	103 K (-170 °C) ⁽²⁾	77 K (-196 °C)	-	98 K (-175 °C)	-
Sample Mounting Plate Temperature with Secondary Rotation ⁽²⁾	113 K (-160 °C) ⁽²⁾	-	-	108 K (-165 °C) ⁽²⁾	-
Maximum temperature with Resistive Heater	1223 K (950 °C) ⁽²⁾	300 K (27 °C)	-	1223 K (950 °C)	-
Maximum Temperature with EB Heater	1473 K (1200°C) ⁽²⁾	-	-	1473 K (1200 °C)	-

(1) These figures for the Cryoax 5 are given for operation with the radiation shield cooled by liquid nitrogen.

(2) These temperatures are given for the sample mounting plate of the SH2 sample holder to permit R2 (azimuthal) rotation of the sample in addition to normal R1 (primary) rotation. This typical configuration is not adapted for cryogenic use.

(3) Shield cooled with nitrogen for 30 minutes before starting helium flow.

(4) Temperature at the tip of the cryocooler.

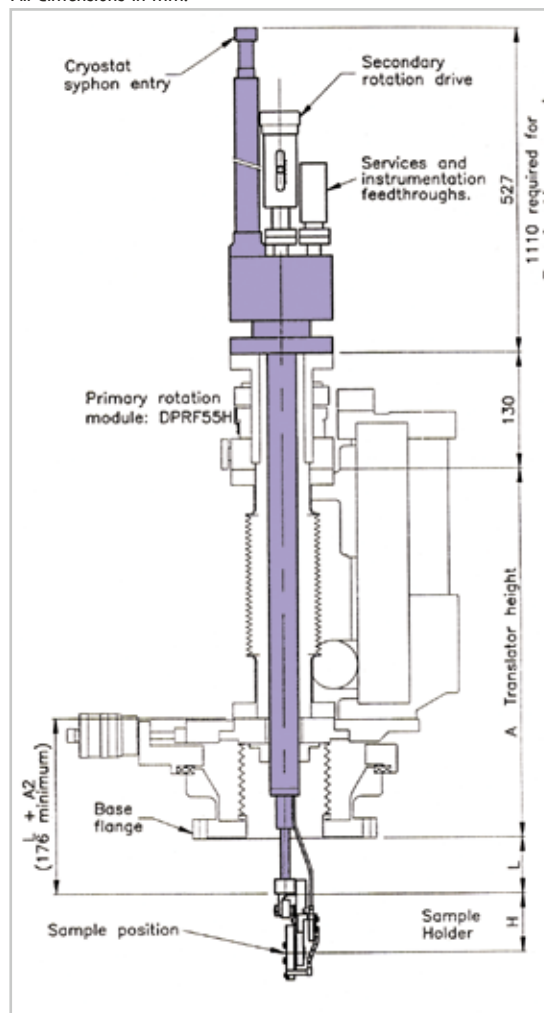
(5) Contact Technical Support Department for further information.

Helistat

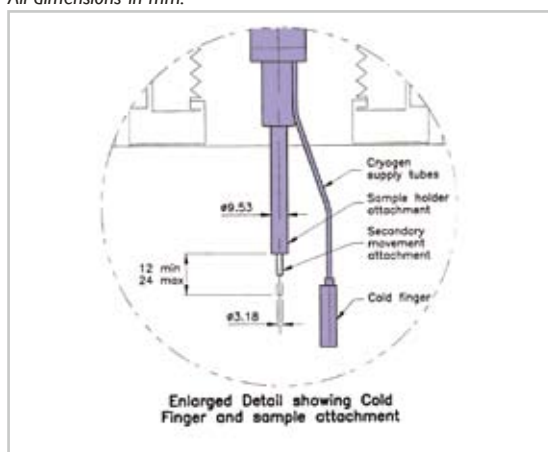
- Base temperature <13 K. Can be used for up to five axes of manipulation.
- Rapid temperature response with stable secondary movement
- The Helistat is mounted on the Omniax translator with a wide range of movement options. The standard support tube is 28 mm ID
- Fully bakeable to 230 °C once any motors and the transfer syphon are removed
- Compatible with VG Scienta sample holders
- Sample heating to 1200 °C is possible
- Liquid nitrogen transfer requires a different syphon which is interchangeable with the helium syphon
- Can be mounted vertically or horizontally (but not inverted)
- The probe insertion length, L, can be made to suit most requirements. Some limits may apply. Please refer to page 347 for the basic Omniax dimensions
- Includes two N type thermocouples
- Four service feedthrough ports are fitted. All wiring should be specified with the order. Please refer to pages 367 to 370 for ordering information and details of cryostat



All dimensions in mm.

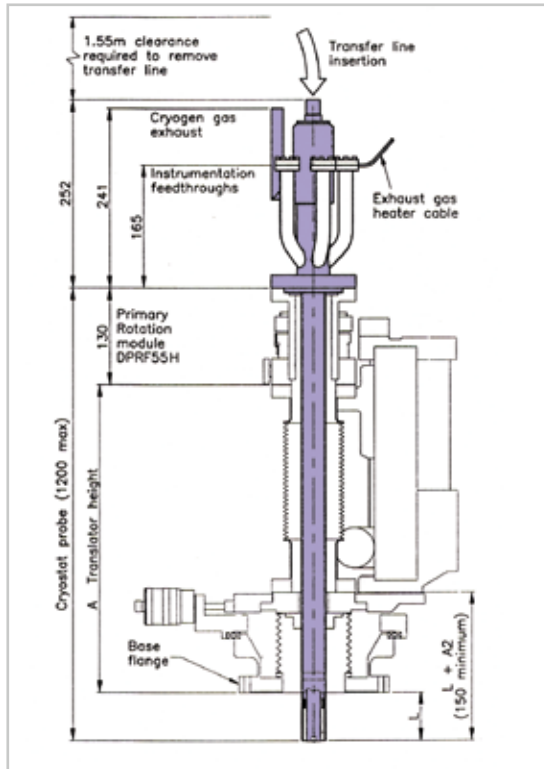


All dimensions in mm.



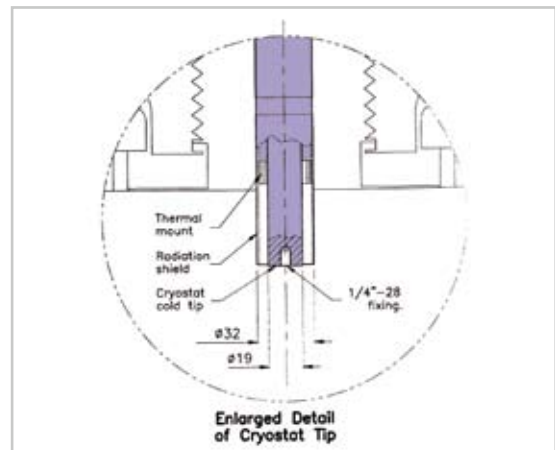
Cryoax 4

All dimensions in mm.



- Base temperature of 4.2 K. This can be reduced further by pumping the exhaust gas. Cooling power of 0.75 Watts at 4.2 K on the cold tip
- The Cryoax 4 is mounted on the Omniax translator and has a wide range of movement options in up to 4 axes
- Liquid nitrogen transfer uses the helium syphon without modification
- Fully bakeable to 200 °C once any motors and the transfer syphon are removed
- Can be mounted in any orientation
- The probe insertion length, L, can be made to suit most requirements. Some limits may apply. Please refer to page 347 for the basic Omniax dimensions. Please refer to pages 367 to 370 for ordering information and details of cryostat accessories

All dimensions in mm.

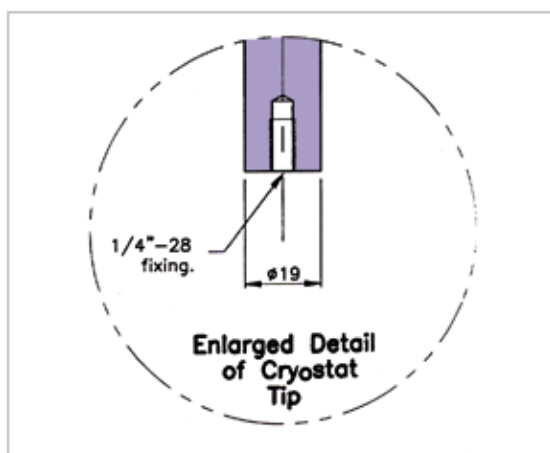
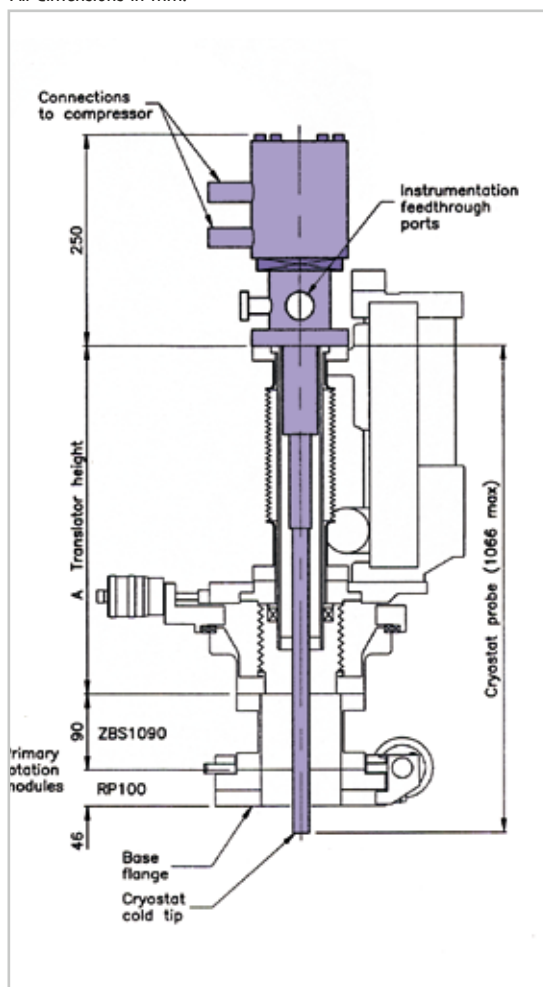


Cryoax 4 CC

- Two stage Gifford-McMahon type refrigerator mounted on an Omniax translator
- The Cryoax 4CC can achieve and maintain temperatures as low as 10 K (6 K option) at the cold tip of the cryocooler
- Temperatures range up to 350 K
- Refrigeration capacity: 0.5 Watt at 10 Kelvin at 60 Hz
- The Cryoax 4CC can be used with four manipulation axes. The arrangement shown provides rotation about the mounting port axis, since the XY stage is mounted above the rotary module. Alternative arrangements can be supplied to give rotation about the probe axis
- No helium consumption
- Conflat flange mounting
- Can be baked to 200 °C once the displacer is removed. Normal bakeout is 70 °C maximum
- Can be mounted vertically or inverted only
- Supplied with the compressor and connecting hoses
- The probe insertion length, L, can be made to suit most requirements. Some limits may apply

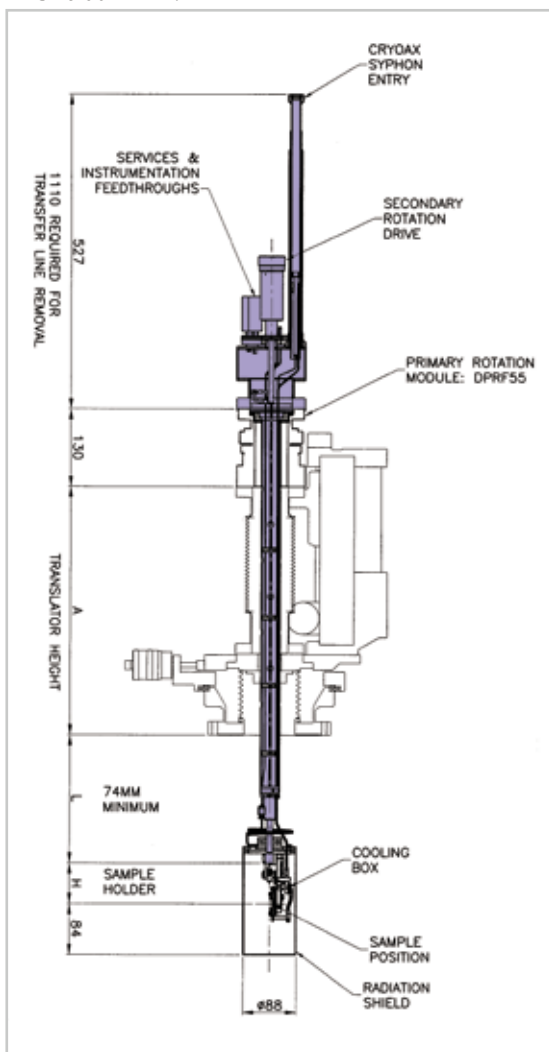
Please refer to page 347 for the basic Omniax translator dimension.

All dimensions in mm.



Cryoax 5

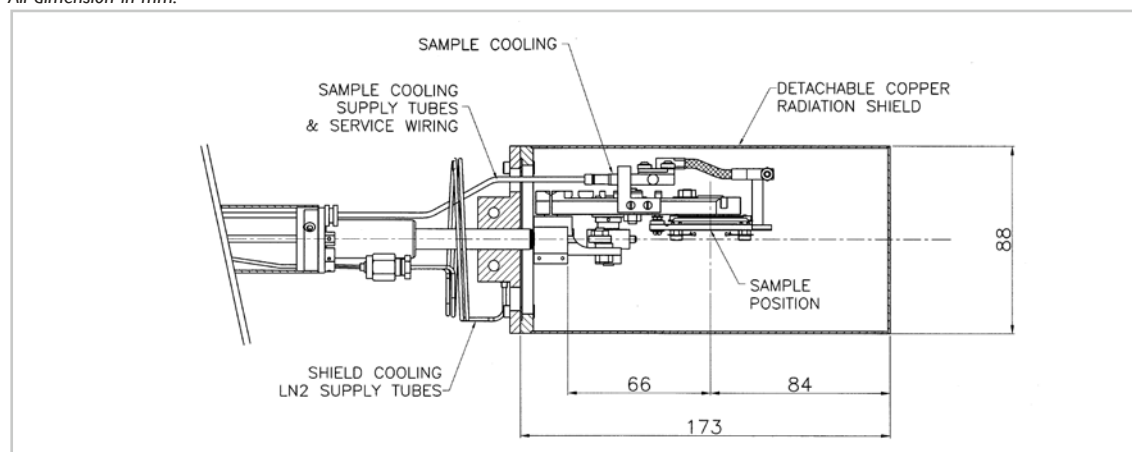
All dimension in mm.



Cryoax 5 cryostat manipulator.

- Base temperature <13 K. Can be used for up to five axes of manipulation
- The Cryoax 5 uses an open cycle cryostat mounted on an Omniax translator with a standard support tube of 28 mm ID
- The Cryoax 5 has a wide range of movement options in five axes
- Fully bakeable to 230 °C once any motors and transfer syphon are removed
- Compatible with VG Scienta sample holders
- Sample heating to 950 °C is possible with resistance heating
- Liquid nitrogen transfer requires a different syphon which is interchangeable with the helium syphon
- Can be mounted vertically or horizontally (but not inverted)
- The probe insertion length, L, can be made to suit most requirements. Some limits may apply. Please refer to page 347 for the basic Omniax dimensions
- Four service feedthrough ports are fitted. All wiring should be specified with the order. Please refer to pages 367 to 370 for ordering information and details of cryostat accessories

All dimension in mm.



Cryoax 5 fitted with SH2 sample holder. Radiation shield is shown in place.

- Up to three precision rotation axes
- Base temperature is less than 20 K without radiation shields
- Linear translation provided by the extremely stable Omniax translator
- Samples can be exchanged in-situ without breaking vacuum
- Range of sample transfer and storage devices are available
- Ideal for angle-resolved photoemission and x-ray photoelectron diffraction experiments
- Based on a proven design from IFW Dresden

Introduction to the Cryoax 6

This outstanding manipulator combines the technical expertise of both VG Scienta and IFW Dresden in a single high specification unit.

The manipulator is based on the world renowned skills of IFW Dresden in their cryogenic cooling and sample transfer, and the well known VG Scienta Omniax manipulator with its high stability and precision.

This combination has resulted in a single high precision multi axis helium cooled manipulator giving six axis of freedom with a base temperature of less than 20 Kelvin.

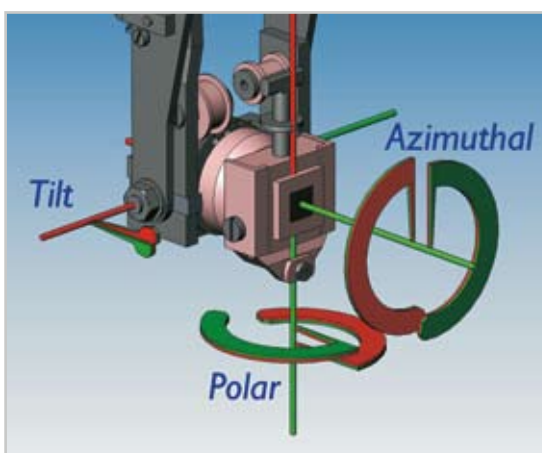
This unit has wide ranging applications within the surface analysis field providing both the high precision sample movement and temperature stability required for ARPES techniques, whilst allowing sample transfer from traditional VG Scienta linear transfer mechanisms.

Features

The VG Scienta six axis computer-controlled cryo-manipulator is a unique engineering achievement which allows positioning of the sample with the precision of order of $<1^\circ$ in a wide temperature range (20 - 298 K). The sample can be rotated around the three perpen-



Cryoax 6 sample mount.



Rotation definitions.

dicular axes as well as translated along equivalent directions. The manipulator is designed to meet all requirements of the angle-resolved photoemission and X-ray photoelectron diffraction experiments. Such flexibility considerably simplifies the alignment procedure and makes possible to detect ejected electrons at practically any emission angle.

Cryoax 6

Application Note

To study the electronic properties of solids it is essential to know the distribution of the electrons in momentum-energy space. In quasi-2D systems, such as the superconducting cuprates, this space becomes three-dimensional. The VG Scienta electron energy analyser, together with its angle-multiplexing mode, is a direct window into such a space. With the 3-axis rotation manipulator designed by IFW-Dresden we can effectively explore the electronic structure of quasi-2D solids via precise positioning of such a window in the momentum-energy space.

Another essential factor needed for such experiments is the excitation of radiation of different types. We use an unpolarised light from the VG Scienta UV source to map the electronic bandstructure in the whole Brillouine zone; the linearly polarized synchrotron radiation with variable photon energy from BESSY storage ring to investigate the elusive features of the electronic structure (such as the bilayer splitting in Bi-2212); and circularly polarized radiation from the ELETTRA synchrotron to address the symmetry related issues.

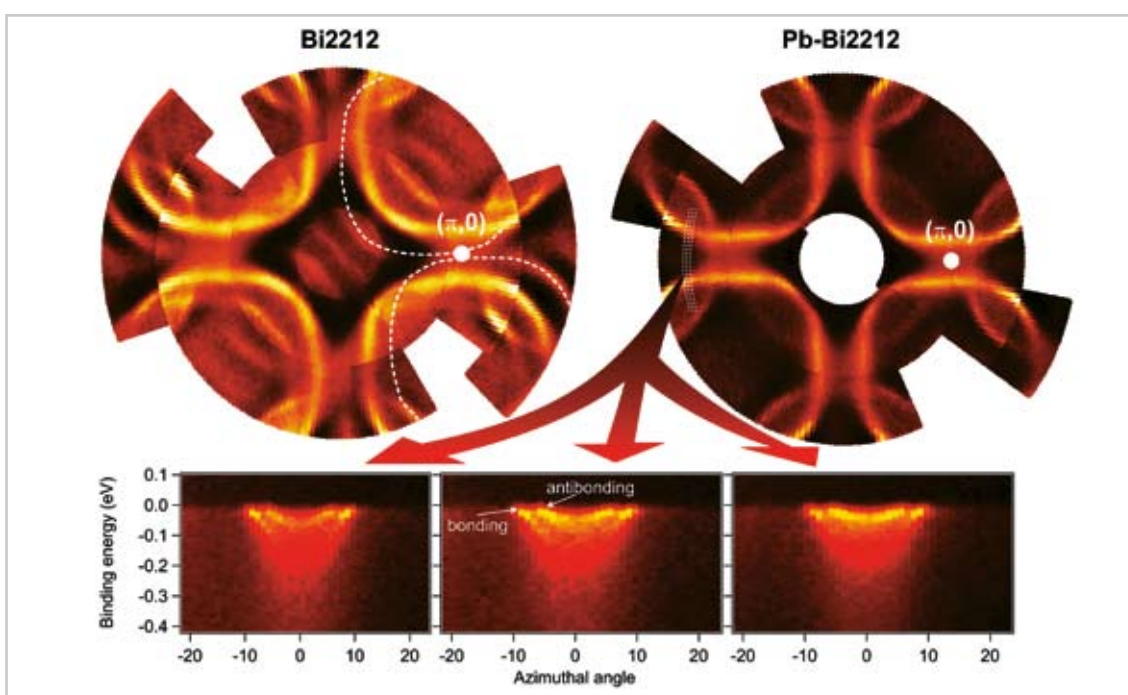
So we combine the power of the VG Scienta analysers and sample manipulators in two momentum-energy space explorers: stationary unit, which is based on the SES-200 and UV source and is located in the IFW-Dresden and the mobile unit, which is based on the SES-100 and can be taken to the synchrotron light sources. One of the key advantages of such a system is a possibility to investigate the same samples successively with two experimental setups.

*Dr. S.V. Borisenko
and
Dr. A.A. Kordyuk
IFW Dresden*



Abbreviations

IFW - Leibniz-Institute for Solid State and Materials Research, Dresden
BESSY - Synchrotron light source (Berlin, Germany)
ELETTRA - Synchrotron light source (Trieste, Italy)



In the diagram above the top row represents the Momentum Distribution Maps (Fermi-surfaces) of Bi-2212 and Bi (Pb) - 2212 recorded in the lab while the bottom row shows the bilayer split electronic structure as Energy Distribution Maps (a direct snapshot as recorded by the detector measured at BESSY).

Open Cycle Operation for Helistat, Cryoax 4 and Cryoax 5

Liquid Helium Vacuum Method

By reducing the pressure of the exhaust gas, the boiling point of the helium is also reduced, lowering the base temperatures. A combined flow pump flow regulator kit is available. Refer to page 369.

Liquid Helium Pressure Method

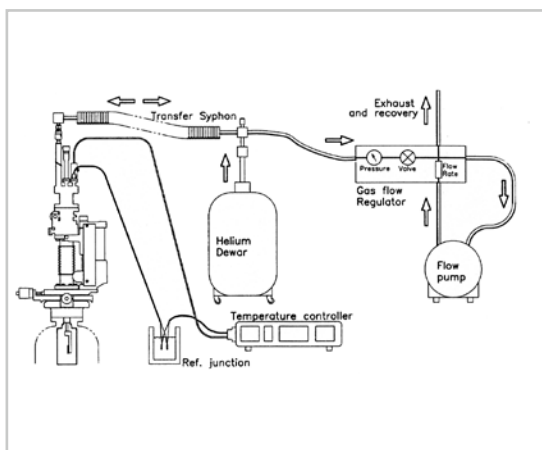
Liquid helium is forced from the pressurised storage dewar and into the cryostat. This is a simpler method of operation, but the boiling point of the helium is increased, and some flow instability can result.

Liquid Nitrogen Pressure Method

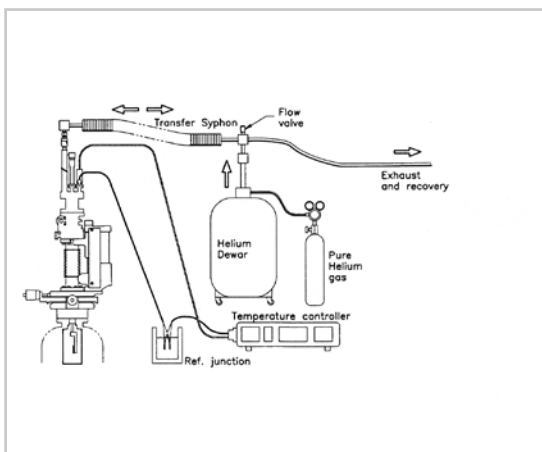
Dry nitrogen gas from a pressurised bottle is condensed and transferred to the cryostat.

IMPORTANT PRODUCT INFORMATION

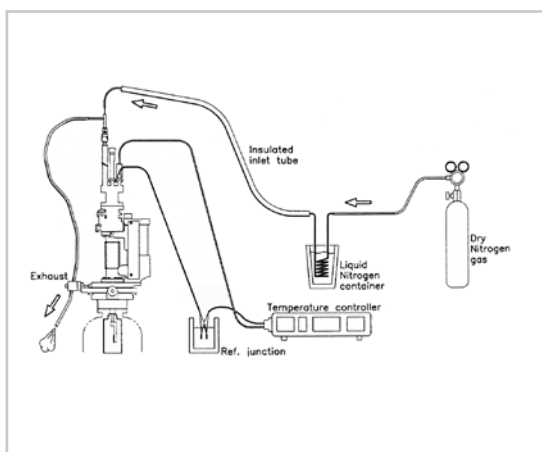
Note that the helium transfer syphon, used on the Cryoax 4 and 5 and Helistat, is not suitable for liquid nitrogen transfer. A simplified nitrogen syphon is available for these units.



Helium vacuum method.

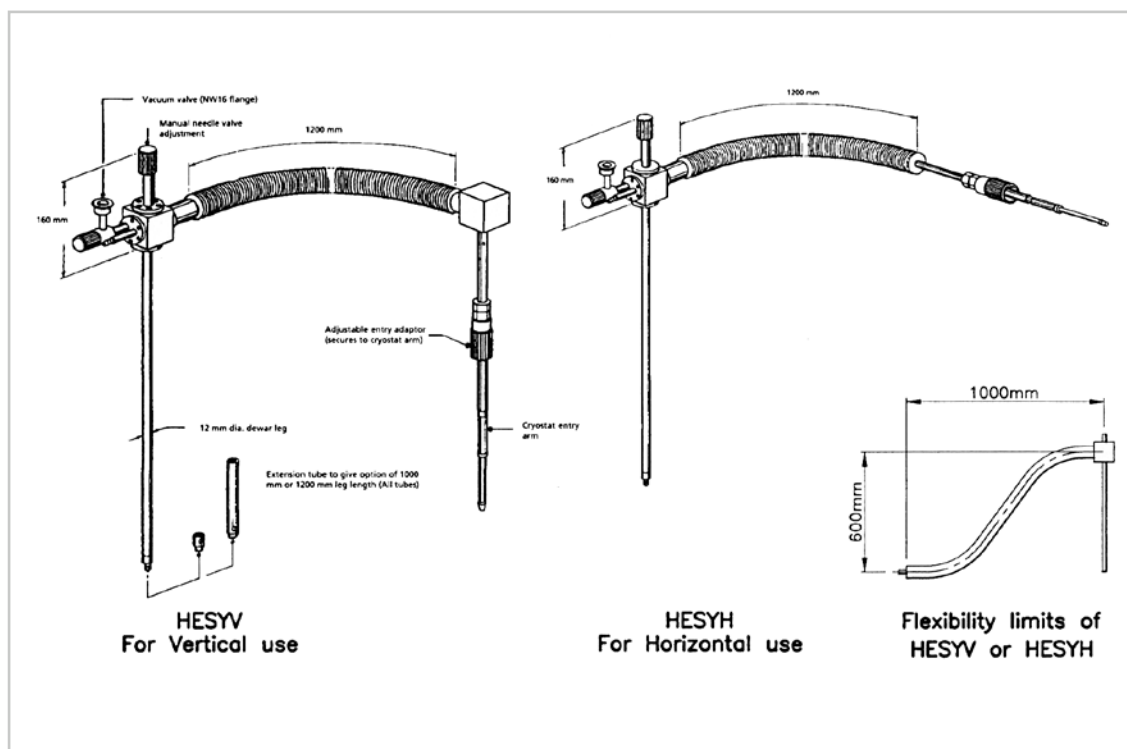


Helium pressure method.

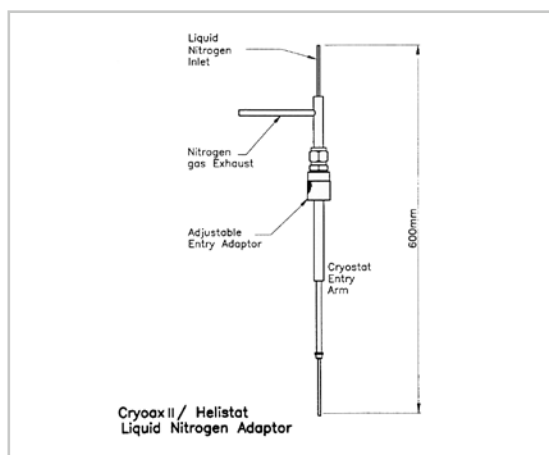


Nitrogen pressure method.

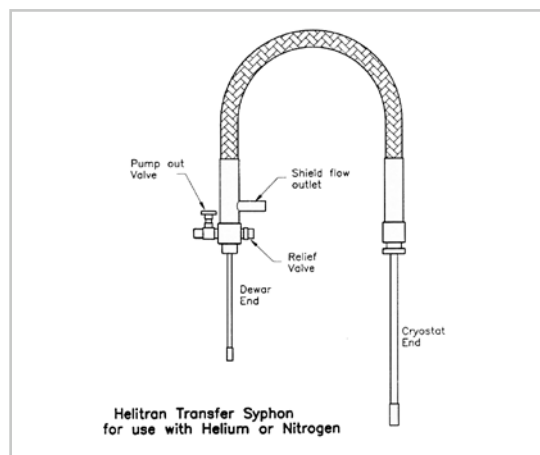
Open Cycle Transfer Syphons



Helistat and Cryoax 5 transfer syphons



Helistat and Cryoax 5 liquid nitrogen adapter.



Cryoax 4 transfer syphon suitable for liquid nitrogen or liquid helium.

Cryostats - Z Slide Modules

Z Slide and Primary Rotation Modules

- This module includes the Z slide, the cryostat itself and the primary rotation module
- For cryostats without primary rotation or without Z movement, contact VG Scienta for information
- All cryostats are mounted on the Omniax Z slide. The Z movement specifications are the same as for the Omniax, although the Z movement range is limited
- Primary rotation uses the DPRF55H differentially pumped unit, except the Cryoax 4 CC which uses the RP100H rotating platform
- Primary rotation is limited during helium transfer by the flexibility of the transfer syphon, since relative movement with the cryostat is not possible. For vertically mounted units this is approximately $\pm 30^\circ$, but for horizontally mounted units, no significant rotation is possible

Helistat, Cryoax 4, Cryoax 4CC and Cryoax 5 Z Slide Modules

Cryostat Type	Z Travel mm	Order Code
Helistat	100	MHEZ100
Helistat	200	MHEZ200
Helistat	400	MHEZ400
Helistat	600	MHEZ600
Cryoax 4	100	MC4Z100
Cryoax 4	200	MC4Z200
Cryoax 4	400	MC4Z400
Cryoax 4	600	MC4Z600
Cryoax 4CC	100	MCCZ100
Cryoax 4CC	200	MCCZ200
Cryoax 4CC	400	MCCZ400
Cryoax 4CC	600	MCCZ600
Cryoax 5	100	MCRZ100
Cryoax 5	200	MCRZ200
Cryoax 5	400	MCRZ400
Cryoax 5	600	MCRZ600
Z Slide Module Motorisation		
Z Axis Stepper Motor Upgrade ⁽¹⁾		MMOTZST
Z Axis DC Motor Upgrade ⁽²⁾		MMOTZDC
DPRF55 Stepper Motor Upgrade ⁽¹⁾		MDPRF55S
RP100 Stepper Motor Upgrade ⁽¹⁾		MRP100S

(1) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(2) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Cryoax 6 Z Slide Modules

Z Travel mm	Rotation Axes ⁽¹⁾	Order Code
100	Polar	MC6Z100I
200	Polar	MC6Z200I
400	Polar	MC6Z400I
600	Polar	MC6Z600I
100	Polar and Azimuthal	MC6Z1002
200	Polar and Azimuthal	MC6Z2002
400	Polar and Azimuthal	MC6Z4002
600	Polar and Azimuthal	MC6Z6002
100	Polar, Azimuthal and Tilt	MC6Z1003
200	Polar, Azimuthal and Tilt	MC6Z2003
400	Polar, Azimuthal and Tilt	MC6Z4003
600	Polar, Azimuthal and Tilt	MC6Z6003

(1) See page 363 for definitions of polar, azimuthal and tilt rotations. The required number of rotation axes must be specified at the time of ordering; it is not possible to upgrade the Cryoax 6 cryostat to add additional rotation axes.

Cryostats - XY Stage Modules

XY Stage Modules

- The XY module includes the base mounting flange
- All cryostats require an XY module (including Z-only movements) as it includes the base flange
- Options and specifications are identical to the Omniax translator (see page 346)

Omniax XY Stage Modules and Accessories		
Base Flange	Travel Range	Order Code
NW100CF (6" OD)	Z-only ± 0 mm	MT000B6S
NW100CF (6" OD)	± 12.5 mm stage	MT108B6S
NW100CF (6" OD)	± 25.0 mm stage ⁽¹⁾	MT208B6S
NW100CF (6" OD)	± 25.0 mm stage	MT211B6S
NW100CF (8" OD)	Z-only ± 0 mm	MT000B8S
NW100CF (8" OD)	± 12.5 mm stage	MT108B8S
NW100CF (8" OD)	± 25.0 mm stage ⁽¹⁾	MT208B8S
NW100CF (8" OD)	± 25.0 mm stage	MT211B8S
XY Stage Module Motorization		
X Axis Stepper Motor Upgrade ⁽²⁾		MT08X
Y Axis Stepper Motor Upgrade ⁽²⁾		MT08Y
X Axis DC Motor Upgrade ⁽³⁾		MT08DCX
Y Axis DC Motor Upgrade ⁽³⁾		MT08DCY

(1) The MT208 stages are intended for use with the smaller support tube (28mm bore) only. As such, they are not suitable for the Cryoax 4CC.

(2) Drive is assembled to stepper motor and is supplied with a wired connector to suit VG Scienta's stepper motor control system. A separate mating connector is available (see pages 376 to 378).

(3) The DC motor is assembled to the drive and is supplied complete with power supply and control unit (see page 375).

Cryostats - Accessories

Sample Rotation - Secondary Movement (Helistat and Cryoax 5 Only)

- A secondary movement drive is optional for the Cryoax 5 or Helistat but it cannot be retrofitted
- The drive actuates a linear push rod to operate the secondary rotation. Compatible with all VG Scienta secondary motion sample holders
- For the Cryoax 5, the sample temperature must be stabilised for accurate secondary rotation as some movement will occur due to temperature change. The Helistat is recommended for angular stability with varying temperature

Helistat and Cryoax 5 - Secondary Rotation	
Secondary Drive	Order Code
Secondary Rotation Drive for the Cryoax 5	MCRR2
Secondary Rotation Drive for the Helistat	MHER2
Stepper Motor Upgrade for the Secondary Rotation Drives	MHXR2MOT

Horizontal Mounting Stands

- All horizontally mounted cryostats must be fitted with a support stand. These are the same stands used for the Omniax
- Two mounting stand options apply to these cryostats. Please refer to Omniax data on page 346 for details

Cryostat Horizontal Mounting Stands	
XY Model Type	Order Code
Units with ± 12.5 mm or ± 25.0 mm XY Stages. All Travels to 600 mm.	MHSA
Units with Fixed XY Stages (± 0 mm or Z-only). All Travels to 600 mm.	MHSC

Open Cycle Helium Accessories	
Helistat and Cryoax 5 Accessories	Order Code
Helium Transfer Syphon Vertical Use ⁽¹⁾	ZHESYV
Helium Transfer Syphon Horizontal Use ⁽¹⁾	ZHESYH
Nitrogen Transfer Syphon ⁽²⁾	ZHELNA
Combined Flow Pump and Regulator	ZHEPR
Helium Storage Dewar: 30 litres	ZHESD30
Helium Dewar Top Fitting	ZHESVF
Nitrogen Accessory Kit, (includes copper condenser coil, polystyrene container and tubing with insulation)	ZLNHX
Cryoax 4 Accessories	
Transfer Syphon Suitable for Helium and Nitrogen (includes the special dewar top fitting)	ZHESC4

(1) The Helistat and Cryoax 5 helium syphons cannot be used with liquid nitrogen.

(2) The liquid nitrogen syphon is interchangeable with the Helistat and Cryoax 5 helium syphon.

Cryostats - Temperature Controllers



Sample Handling Equipment - Helistat and Cryoax 5 Only

Full details of VG Scienta's range of sample holders and accessories can be found on page 300 to 317.

Temperature Control

Required set point temperatures above the minimum temperature are normally achieved by applying small amounts of heat to the sample. A range of controllers is available for specific applications.

- Details of the RHC and EBHC controllers are given on pages 310 and 311
- For temperature control at cryogenic temperatures, the HEC controller is recommended. The controller uses liquid nitrogen as a reference junction for improved accuracy and has several features, including: RS232 interfacing, automatic or manual control, safety features such as front panel lock-out and external override, multiple sensor compatibility and multiple set point sweeping. Automatic helium flow control is available as an option

Cryostats - Temperature Controllers			
Cryostat	Description	Temperature Range	Order Code
Helistat and Cryoax 5	Resistive Heater Controller	75 K to 1220 K	ZRHC
Helistat	EB Heater Controller	75 K to 1470 K	ZEBHC
All Cryostats	Cryogenic Temperature Controller	0 K to 300 K	ZHEC

Cryostat - Checklist

This checklist is intended to help you configure the Cryostat device to suit your individual application. To place an order, VG Scienta will require a more detailed ordering questionnaire based on the information below. Please contact

your agent who will discuss your application and help you complete the questionnaire.

If any details are unclear or you have special requirements please call for assistance.

Questionnaire				Example		
Options	Notes	Code	Price	Notes	Code	Price
Cryostat Z Module				Cryoax 5	MCRZ400	
Z Travel				400 mm		
Z Drive: Manual or Motor?				manual	-	
XY Travel				±12.5 mm	MT108B8S	
Base Flange				8" OD		
X Drive: Manual or Motor?				manual		
Y Drive: Manual or Motor?				manual		
RI Drive: Manual or Motor?				manual		
Secondary Movement				yes	MCRR2	
Secondary: Manual or Motor?				manual		
Horizontal Stand (page 353)				vertical		
Sample Holder (page 298)				SH2	ZSH2	
Heater Module				resistive	ZHST	
Temperature Controller				75K-1220K	ZRHC	
Helium Accessories				vertical		
Syphon				no	-	
Flow Pump and Regulator				no	-	
Storage Dewar				no	-	
Dewar Fittings						
Nitrogen Accessories				yes	ZHELNA	
Syphon Accessory Kit				yes	ZLNHX	
Motor Controller (page 372)				no	-	
Miscellaneous				Lube. kit	ZLUBEK	
			Total:			
<i>Application Notes</i> Include any non-standard detail and special information that would be helpful in conveying your requirements.						

This example describes a Cryoax 5 configuration with manual drives. It includes an azimuthal drive for five axis manipulation of the sample, and is equipped for use with both helium and nitrogen.

Motorisation



Introduction to Motorisation

Stepper motors can be fitted to most VG Scienta manipulation equipment. Motors allow remote and fast operation and, when combined with our high performance drive control units, these systems provide higher resolution than is possible with manual control.

A modular range of controllers and accessories is available which allows a wide range of single axis or multi-axis control systems to be assembled. The controllers can operate either open-loop or encoded stepper motors.



All control units have interfaces for remote control under RS232. In addition, a range of manual (joystick or jog box) control options are available giving a choice of manual operation of the instrument that is being controlled. All motors are compatible with all controllers, and the controllers are certified for incorporation within the EU Safety Directives.

DC motors can also be fitted to most of VG Scienta's manipulators and drives. The motors are supplied complete with the drive controller and power supply. The controller allows basic control of speed and direction.

Stepper Motors and Controllers

Stepper Motors

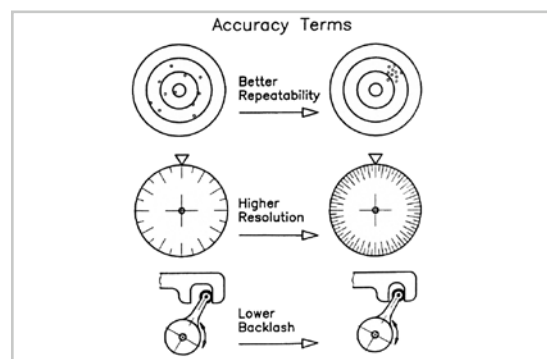
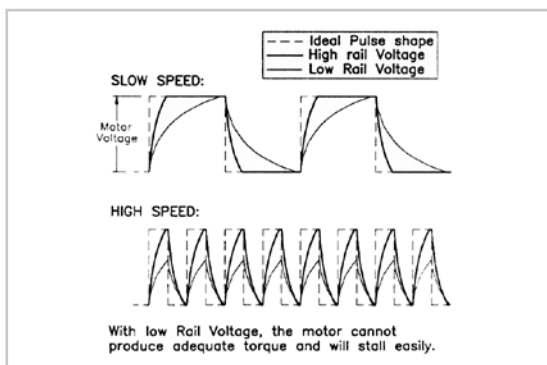
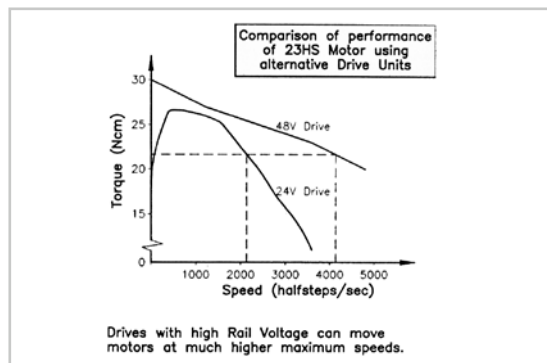
- Motors are 4 phase, 8 lead hybrid stepper motors. They are supplied either as part of the manipulator or drive configuration, or as manual to motorised upgrades, and include the appropriate mounting hardware and microswitches
- Motors are normally supplied with wired into the mating connector, suitable for all VG Scienta controllers.
- All motors can be fitted with an incremental encoder for closed-loop control. To select this option add 'E' to the end of the motor kit order code, e.g. MRXMOTZE. The encoder option is supplied with connectors and wiring suitable for all controllers



Controllers

- All motors and controllers are compatible and interchangeable
- The controllers are housed in screened enclosures that resist electro-magnetic radiation and conform with the latest European Safety Directives
- Three control levels are available: simple push button or joystick control, programmable open-loop control and programmable closed-loop control
- All controllers use the same high power drive so that the motor torque-speed performance is the same with any controller
- Programmable controllers use a simple control language that can be entered through the RS232 interface. Program sequences can be downloaded and stored in the controller for repetitive control operations

Glossary of Motion Control Terms



Torque-Speed Performance

The torque-speed characteristic is an important measure of stepper motor performance. High torque reduces the risk of motor stall which is a major problem with low performance motorisation. Whilst modern stepper motors of the same type are very similar in performance, the driver circuits that provide the pulsed signals to the motor can vary enormously. Important factors include:

- **Phase Switching.** This determines the sequence in which the four motor phases are energised. Our controllers use 'bi-polar chopped' phase switching, which utilises all phases at the same time for maximum efficiency

- **Rail Voltage.** This reference voltage determines the shape of the pulse sent to the motor. In general, the higher the rail voltage, the more energy will be transmitted to the motor. We use a 36 V rail, which gives the motor significantly more torque than a 12 V or 24 V rail supply

Step Sequencing

Stepper motors are typically constructed to give 200 steps per revolution (1.8° per step). Motor drives are produced for full step, half step or microstepping modes. VG Scienta controllers all use half step sequencing (0.9° per half step).

- **Full Step mode.** This is a common sequencing method as it is simple and provides good torque and repeatability. The drive delivers 200 electrical pulses to give 200 mechanical steps per revolution. Resonance and vibration can be a problem in full step mode
- **Half Step mode.** The drive can be arranged so that the magnetic poles of the motor are energised in either direction allowing the motor to be driven in smaller increments of 0.9° per step, or 400 steps per revolution. This is much smoother than full step mode and the angular resolution is improved by a factor of two
- **Microstepping.** This is a more complex sequencing arrangement in which the motor is 'balanced' between steps to give (typically) 1400 microsteps per revolution. This gives very smooth operation, but positional accuracy is affected by load. The repeatability of microstep drives is not as good as half step or full step drives

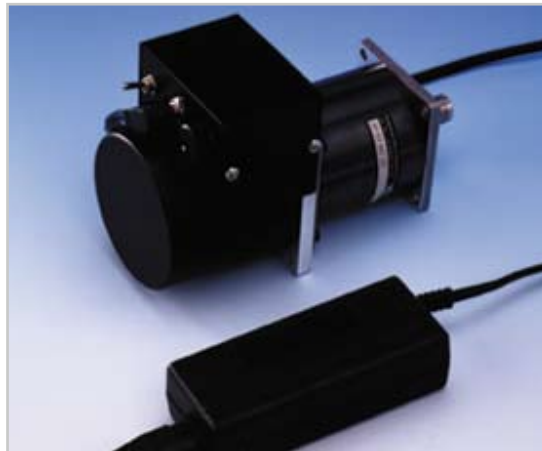
Open and Closed Loop Control

Open loop controllers supply a number of electrical pulses to the motor corresponding to the number of steps required. They rely on good torque-speed performance to avoid motor stall which will not be detected by the controller. Closed loop controllers check either the angular position of the motor at the end of the move, or the position of the device being moved. Any error between the demand and the actual position will be corrected if possible. This position check requires an encoder to be fitted to either the motor or the driven component. VG Scienta stepper controllers have encoder input channels and can therefore operate under open or closed loop control.

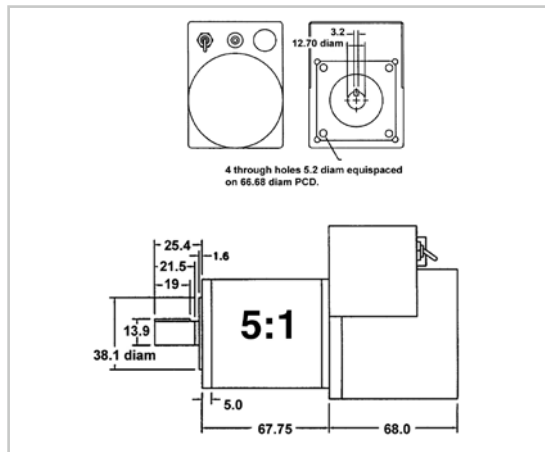
DC Motor Drives

DC Geared Motor Drives

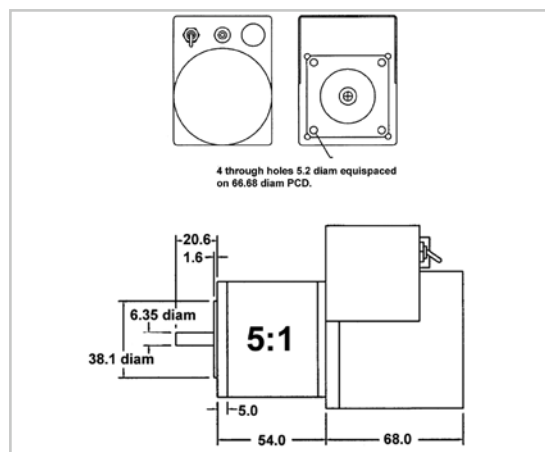
- Cost effective motorisation of a wide range of VG Scienta's drives
- Geared 50W brushless motor
- Local manual controls:
Forward and reverse drive
Variable speed control
- Common mechanical interface with VG Scienta stepper motors/gearboxes
- Motors available to replace 23 and 34 ungeared stepper motors
- Supplied with a universal 24 V power supply
- does not require a separate mains transformers



All dimensions in mm.



DC motor drive; size 34 replacement option.



DC motor drive; size 23 replacement option.

DC Motor Drives in Operation

DC motor drives provide a simple and cost effective way of motorising many of the VG Scienta standard drive and manipulation products. The motor gearbox assembly is complete with local controls for speed and direction. Power is provided from a 24 VDC supply which is included with the DC motor drive package.

Two types of geared DC drives can operate a wide range of standard products. The 5:1 gear ratio units replace ungeared 23 and 34 frame size motors and provide variable speeds up to 600 rpm.

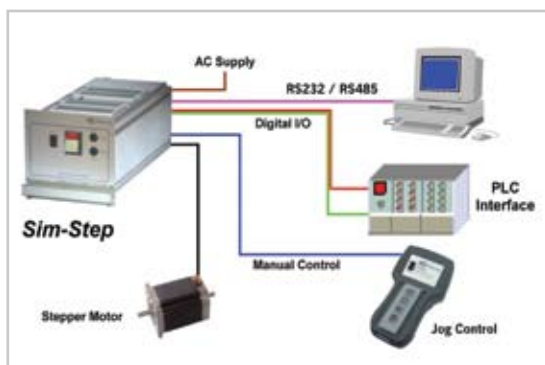
The order codes for drives fitted with a DC motor drive option are listed on the appropriate product pages.

If you cannot find the part code of the motorised drive you require, please contact either your local sales representative or VG Scienta direct.

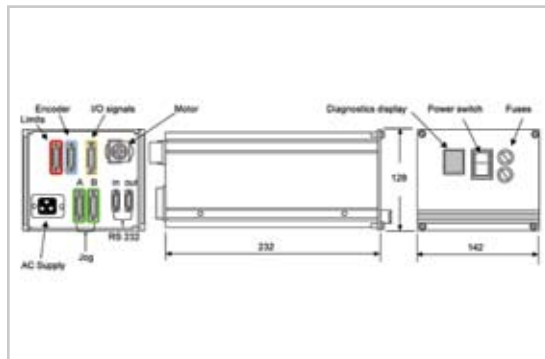
Stepper Motor Controllers



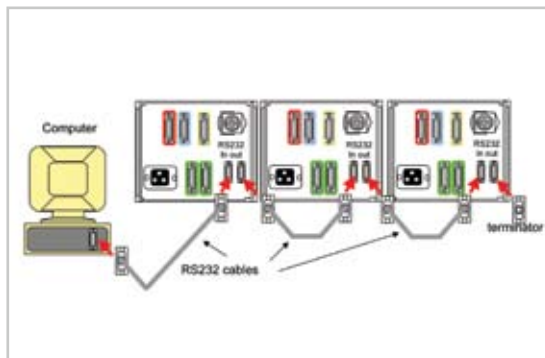
Single axis controller module.



General control system set-up.



Controller dimensions.



Multiaxis controller.

- Compatible with all VG Scienta stepper motor driven products
- Integrated motion controller
- RS232 or RS485 communications as standard
- Up to 99 units can be daisy-chained to a single port
- Programmable position, acceleration, deceleration and velocity
- Optional jog box for manual operation
- Output current adjustable and matched to size 17, 23 and 34 frame motors
- 400 Steps per revolution for increased drive smoothness
- Configured for standard or encoded motors
- Internal memory stores sequences for standalone operation
- 16 programmable digital I/O channels to interface to other equipment
- Integrated power supply - 115 or 230 VAC, 50 or 60 Hz operation
- All connections via plug or socket with standard cables for plug-and-play operation
- Standard rack mount interface for easy installation

Introduction

The new range of VG Scienta stepper motor controllers provides a cost effective solution to a wide range of applications involving control of our drives and manipulation devices.

The ZSIM unit is a plug-and-play package that greatly simplifies installation; simply connect the intelligent drive controller to a PC, motorised device, limit switches etc., and an AC supply using the cable provided, and the system is fully operational.

Base Unit

The ZSIM is a single axis controller that provides for computer control via the PC interface or manual control operation via the jog box options. The ZSIM can drive standard or encoded motors with or without limit switches.

The ZSIM is supplied with a mains power lead, RS232 cable and RS232 terminator. The unit is supplied pre-configured for either 110 VAC (ZSIM110) or 240 VAC (ZSIM240) operation; however, the internal power supply can be adjusted if necessary.

Stepper Motor Controllers

The unit can be used by itself to control a single motor, or can be connected to other ZSIM units to create a twin or multi-axis control system by daisy-chaining the PC interface signals.

The controller can be used to build up a sophisticated motion control system by making use of input and output channels to provide enabling signals or drive status feedback.

Plug and Play Cables

The connectors on the rear panel of the controller are colour coded to match the standard range of cables. The range includes motor cables, limits/datum cables and encoder cables. VG Scienta offer a wide range of standard cable lengths; custom lengths up to 30 m can be supplied on request.

Rack Mounting

A full range of accessories is also available for mounting up to three ZSIM controllers in a standard Eurocrate 19 inch rack configuration (ZSIMBOX). Blanking panels are available to complete the rack mounting installation (ZSIMBLAN).

Jog Boxes

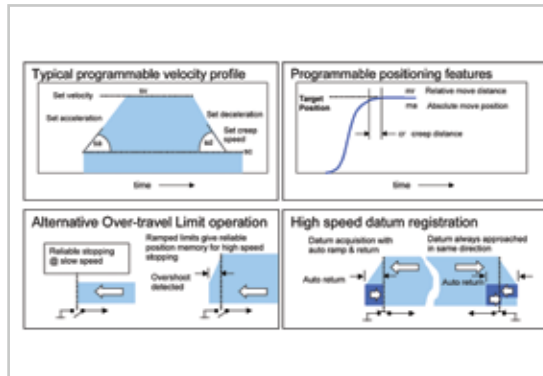
A two axis jog box (ZSIMJOG2) is available to allow switching between two axes. Multi-axis jog control is provided by means of the ZSIMJOGM jog box, allowing installations of up to 15 axes to be controlled.

Motor Junction Box

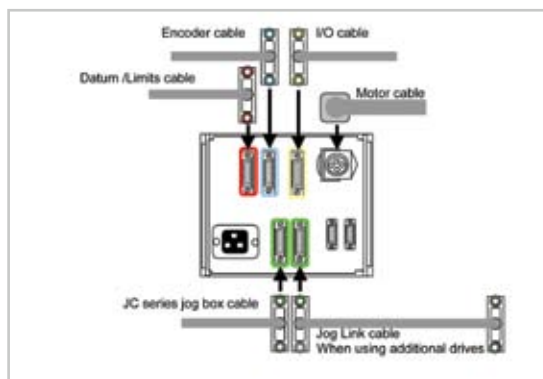
A junction box is available to enable motors with flying leads to be easily interfaced to the ZSIM controller. This junction box is also configured to accept flying leads from limit and datum switch contacts on the motorised device (ZSIMMOT).

16 Channel I/O Breakout Box

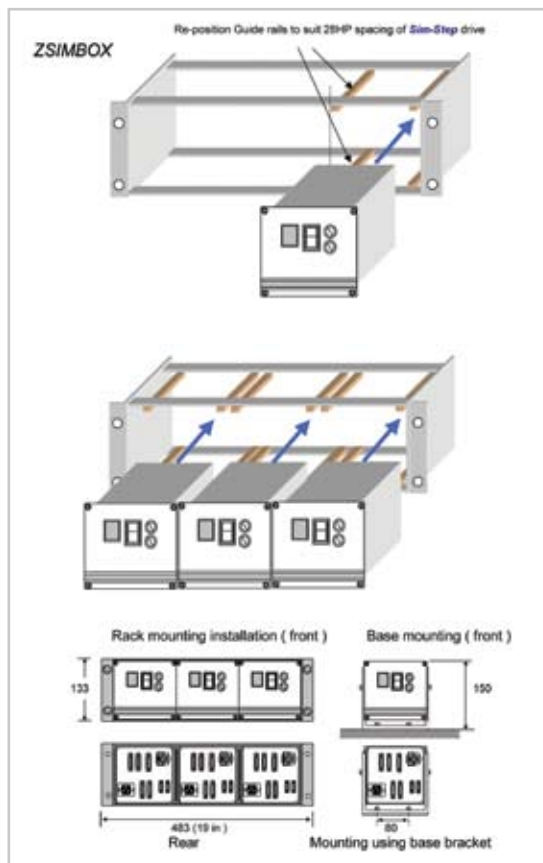
In order to make it easy to connect external equipment to the 16-channel I/O port of the controller, an I/O breakout box is available (ZSIMIO). A range of standard cables are available to connect the breakout box to the ZSIM.



Operational modes.

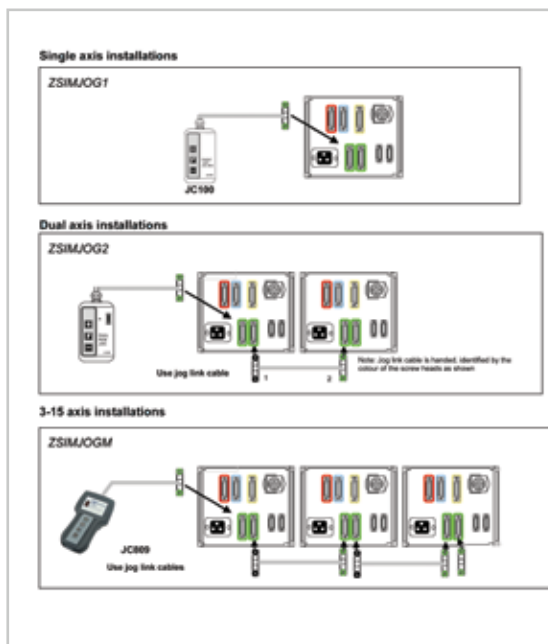


Plug and play cable connections.

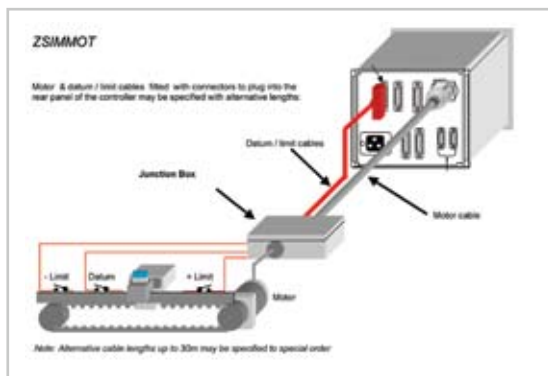


Rack mounting options.

Stepper Motor Controllers



Single and multi-axis installations.



Motor junction box connections.

Ordering

An order questionnaire is provided on page 379 to help guide you through the process of selecting the necessary components to configure your system. Please provide information about the device that you want to drive. This will help us check your requirements.

Step 1 - Motor Controllers

All systems are based on the ZSIM unit. This is supplied with a mains lead, RS232 cable, RS232 terminator and any additional connectors that are necessary. Choose the number of ZSIM controllers that you require (take note of the mains voltage for your installation).

Step 2- Eurocrate Mounting Options

Select the number of ZSIMBOX Eurocrates that you require, and any necessary blanking panels (ZSIMBLAN). Remember that you can mount up to three ZSIM controllers in one Eurocrate.

Step 3 - Motor and Encoder Cables

A motor cable (ZMOTSLxx) is required when the ZSIM is used with a VG Scienta motorised product; select an encoder cable (ZMOTENxx) option if the product has an encoded motor.

Motor cables and encoder cables are available in 1 m, 2 m, 3 m, 5 m and 10 m lengths; other lengths are available on request.

If the motor does not have the necessary connector, or has flying leads, choose the Junction Box option ZSIMMOT and the appropriate motor junction box cable (ZMOTJBxx).

Step 4 - Limit/Datum Switch Cables

Choose the appropriate number and lengths of cables to connect to the limits and datum switches. Limit/Datum cables are available in 1 m, 2 m, 3 m, 5 m and 10 m lengths; other lengths are available on request.

Note that the ZSIMMOT motor/limits junction box can be used if the switches are not fitted with the appropriate connectors.

Step 5 - Manual Control

Choose either a two axis jog box (ZSIMJOG2), or the multi-axis jog box option (ZSIMJOGM) depending on your application.

Step 6 - External I/O Functions

Choose the ZSIMIO breakout box if you need to add digital I/O functions to your control system. If you need this option you will also have to select the appropriate length of I/O connection cable (ZIOCxx).

Motorisation Ordering Questionnaire

Customer Information

Please fully complete this questionnaire. This will assist us in the supply of the motor controller and accessories to your requirements. These units will then come fully configured.

1	Device to be Driven						
	Linear Drive						
	Rotary Drive (Primary Drive)						
	Azimuthal Drive (Secondary Drive)						
	X Axis						
	Y Axis						
	Z Axis						
	Other Components Model:						
	Customers special option (please state requirements on separate sheet)						
2	Controller and Mounting Kit						
2.1	Voltage (Supplied with UK, Euro and USA mains Lead)						
	High Voltage	220V/240 V (Part Code ZSIM240)					
	Low Voltage	110V/120 V ((Part Code ZSIM110)					
2.2	Number of Axis						
	One	Two	Three	Four	Five	Six	
2.3	3U Euro Crate (Part Code ZSIMBOX - Please Note: One Create will hold THREE ZSIM240/ZSIM110)						
	No	One	Two	Three			
2.4	Blanks Front Plate Covers (For above crates - Part Code ZSIMBLAN)						
	No	One	Two	Three	Four	Five	
3	Cables						
3.1	Motor Power Cables			3.2	Limit and Datum Cables		
	1 m	Quantity		1 m	Quantity		
	2 m	Quantity		2 m	Quantity		
	3 m	Quantity		3 m	Quantity		
	5 m	Quantity		5 m	Quantity		
	10 m	Quantity		10 m	Quantity		
	Special	Quantity	Length m	Special	Quantity	Length m	
3.3	Encoder Cables						
	1M	Quantity					
	2M	Quantity					
	3M	Quantity					
	5M	Quantity					
	10M	Quantity					
	Special	Quantity	Length	m			
4	Accessories						
4.1	Jog Box (Supplied with Connecting Cable)			4.3	Motor and Limits Junction Box		
	Not required			Not required			
	2 Axis	(This will control one or two motors)		One	Two	Three	
	Multi Axis	(This will control up to 15 Motors)		More - please specify			
4.2	I/O Breakout Box (Supplied with Connecting Cable)						
	Not required						
	1 m	Quantity					
	2 m	Quantity					
	5 m	Quantity					
	10 m	Quantity					

