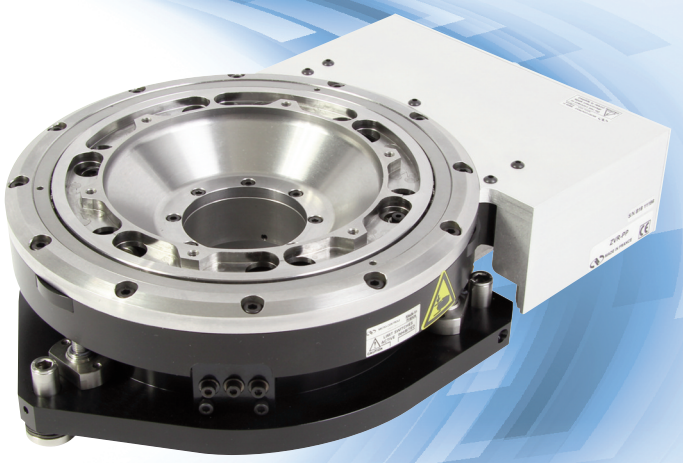
Integrated Vertical and Rotation Stages for Wafer Positioning

ZVR



Utilizing its unique three point drive and bearing design, the ZVR integrates Z and Theta positioning, designed to precisely elevate and rotate wafer chucks.

Payload Design

The ZVR rigidly supports and drives the payload at three points (separated by 120 degrees) along the outer circumference of the stage. Ordinary designs use a single cam, wedge, or screw located at the center of the stage. Newport's three point design with an inline guide and drive, has advantages for applications that have slight to extreme unbalanced loading such as wafer probing, which can have vertical forces applied at locations along the outer edges of the chuck. Angular deflections due to these off-center loads are minimized and binding during vertical motion is eliminated.

Open Aperture

An important feature of the ZVR's unique design includes a 50 mm clear aperture through the center of the rotation stage to allow for cables, lines and other utilities.

Adjustable Limit Switch

The ZVR features an upper limit switch with a 4 mm adjustment range enabling the user to set the upper limit of vertical travel.

Rotational and vertical positioning

Newport's ZVR-PP and ZVR-PC are integrated Z-vertical and Theta-rotation positioning stage designed to precisely elevate and rotate 200 mm and/or 300 mm diameter wafer chucks.

- Precise 10 mm vertical and continuous 360 degree angular travel in a very low profile design
- Three-point bottom interface for stable mounting to any XY stage or other platfor
- Large center aperture simplifies vacuum and electrical cable management
- Low mass and a high natural frequency enable rapid step-and-settle applications
- Stainless steel recirculating ball bearings
- Plug and Play - ESP compatible

Metrology Report Included at No Additional Cost

Newport guarantees specification values which are measured and recorded following ASME B5.57 and ISO 230-2 standards. The typical performance values are two times better than the guaranteed specifications.

DESIGN DETAILS

Base Material	Aluminum and Stainless Steel
Bearings	Stainless steel ball bearing
Drive Mechanism	Vertical: 3 ballscrews with 1 mm pitch. Rotation: Self-compensating, preloaded, precision worm gear with 1:90 ratio
Reduction Gear	ZVR-PC: Belt reduction 16:44
Feedback	ZVR-PC: 8,000 cts/rev. rotary encoder
Feedback (Vertical)	ZVR-PP, ZVR-PC: Optional linear encoder 0.1 µm
Limit Switches	Optical ±165° (Limit switches can be disabled)
Origin	Centered on both rotation and vertical movements
Cable	3-meter, shielded cable
MTBF	20,000 hours

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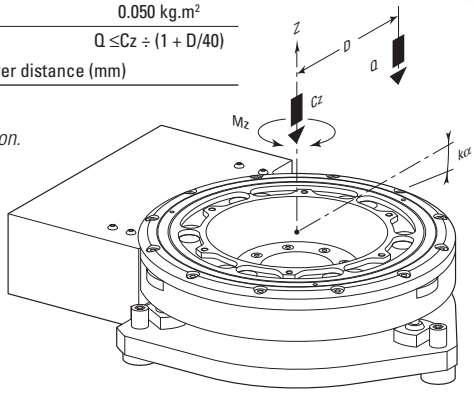
SPECIFICATIONS

Theta Rotation Stage Specifications	ZVR-PP	ZVR-PC
Travel Range (°)	±165 or continuous 360	
Minimum Incremental Motion [1] (°)	0.0002	0.002
Accuracy [3], Typical (Guaranteed) (°)	±10 (±17)	±10 (±15)
Unidirectional Repeatability [3], Typical (Guaranteed) (°)	±0.001 (±0.0015)	±0.0005 (±0.0015)
Bidirectional Repeatability [3], Typical (Guaranteed) (°)	±0.003 (±0.006)	±0.0013 (±0.003)
Max. Speed (°/s)	40	80
Wobble [3], Typical (Guaranteed) (µrad)	±22 (±40)	
Eccentricity [3], Typical (Guaranteed) (µm)	±2.2 (±4)	
Z Vertical Stage Specifications		
Travel (mm)	10	
Minimum Incremental Motion [1] (µm)	0.5	
Accuracy [3], Open Loop, Typical (Guaranteed) (µm)	±0.5 (±2)	
Unidirectional Repeatability [3], Open Loop, Typical (Guaranteed) (µm)	±0.4 (±2)	
Bidirectional Repeatability [3], Open Loop, Typical (Guaranteed) (µm)	±1.2 (±2)	
XY Cross Talk [2], Typical (µm)	±0.1	
Max. Speed (mm/s)	10	
Pitch, Yaw [3][4], Typical (Guaranteed) (µrad)	±17 (±35)	

LOAD CHARACTERISTICS AND STIFFNESS

Cz,	Normal centered load capacity	100 N
Mz,	Nominal torque	1 Nm
Jz,	Max. load inertia	0.050 kg.m²
Q,	Off-center load (N)	Q ≤Cz ÷ (1 + D/40)
	Where D = Cantilever distance (mm)	

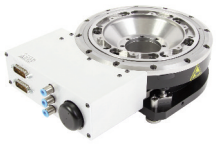


1) *Depends on controller, see www.newport.com for more information.*
2) *XY deviation when Z direction of motion is reversed.*
3) *For the definition of Typical and Guaranteed specifications see "Motion Basics Terminology & Standards" Tutorial at www.newport.com*
4) *To obtain arcsec units, divide µrad value by 4.8.*

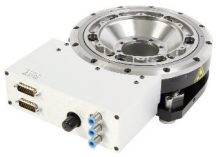
ORDERING INFORMATION

Model	Description
ZVR-PC	Integrated Vertical and DC Rotation Stage for Wafer Positioning
ZVR-PP	Integrated Vertical and Stepper Motor Rotation Stage for Wafer Positioning

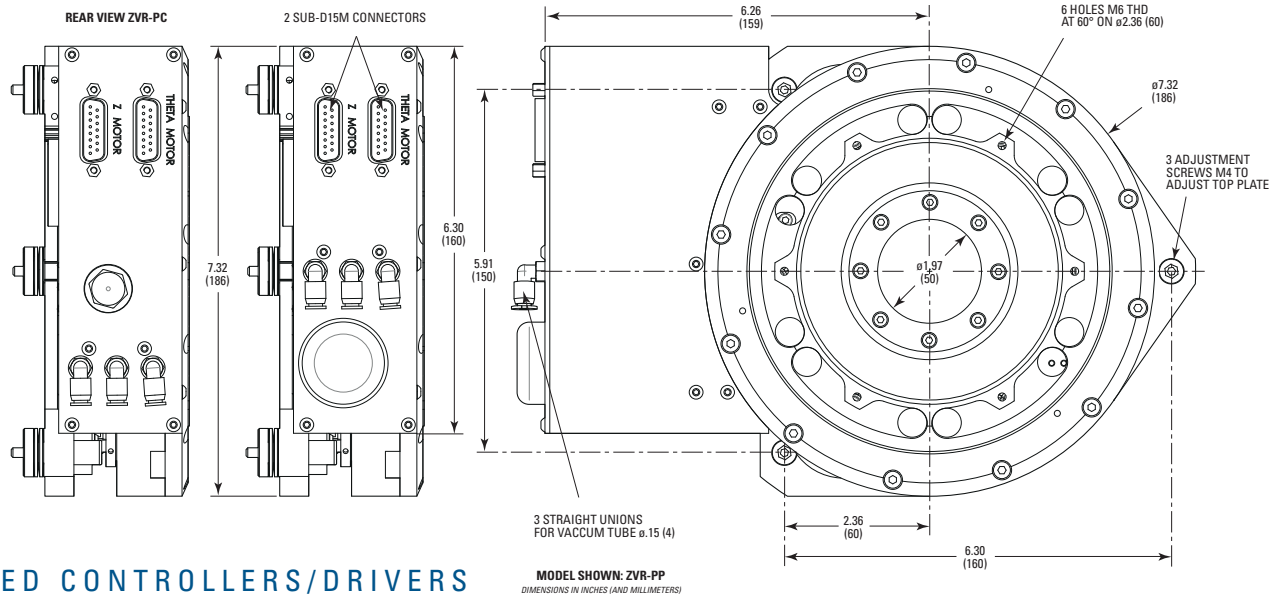
DIMENSIONS



ZVR-PP



ZVR-PC



RECOMMENDED CONTROLLERS/DRIVERS

Model	Description
XPS-D	1- to 8-axis universal high-performance motion controller/driver
XPS-DRV11	Universal digital driver card for stepper, DC and direct motors
XPS-RL	1- to 4-axis universal high-performance motion controller/driver
XPS-DRV01	PWM drive module for DC brush and stepper motors, 3 A/43 V max.
ESP301	1- to 3-axis motion controller/driver
SMC100CC	Single-axis DC motor controller/driver
SMC100PP	Single-axis stepper motor controller/driver

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