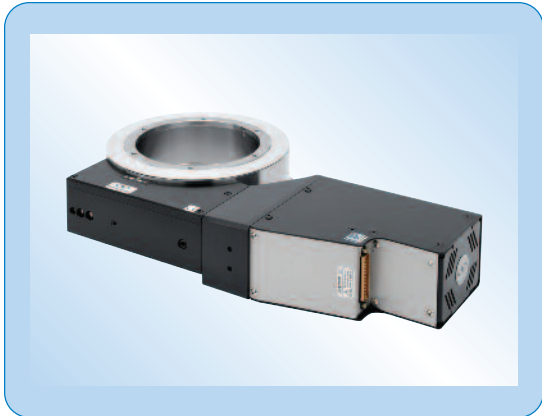


# RV Series

## HIGH-PERFORMANCE PRECISION ROTATION STAGES



- Precision 80–350 mm diameter rotation stages
- Monolithic design ensures high structural stiffness
- Ideal for high-load application
- High-accuracy versions with direct reading encoder and better than 0.0001° (0.36 arcsec) resolution

The RV Series rotation stages provide high-precision angular positioning accuracy combined with high load capacity. There are five stage sizes and six drive configurations available, optimizing load capacity, torque, speed and resolution for a variety of operating conditions.

All RV stages are constructed of tool steel, with rotation accuracy ensured by ground bearing surfaces. A double row of preloaded bearings allows for high off-center loads in a reduced footprint. The single monolithic design offers improved stiffness without compromising dynamic performance. The largest RV stage can bear up to 6500 N or rotate up to 80 °/s, while maintaining less than 4 µm eccentricity.

Precise rotation is ensured by a precision ground and hardened worm gear. A rotary encoder mounted on the worm gear shaft provides 0.001° position feedback resolution (0.00025° resolution with RVS80CC) on the standard configurations. For more demanding applications, the HAT and HAHLT options are available on the RV120 to RV350 models. These stages are equipped with a direct reading optical encoder attached to the moving platen for superior resolution and accuracy.

The selection of the drive configuration should be based on the precision and speed requirements relative to the inertia of the payload.

### Motor Drive Versions

Stepper motor-driven stages are available in full step PE and ministep PP versions. The mini-step drive version (PP) enables high angular speed motions up to 20 °/s. The larger models, RV120PP to RV350PP, feature a worm mounted rotary encoder for improved accuracy and repeatability. The encoder also provides a method for detecting motor stalling, an important feature for applications with high acceleration ramps and high torques or payload inertias.

The RVS80PP does not use an encoder. Instead, position is attained by the number of commanded steps and micro-steps. The high output torque of the stepper motor, combined with extensive performance tests, ensures position accuracy as long as the recommended load, torque and payload inertia are not exceeded. The RVS80PP provides very high motion sensitivity with good linearity between commanded micro-steps and the actual motion of the stage at a very reasonable price. The full-step PE version is equipped with a reduction gear providing higher torque. This version is only available on the models RV120 to RV350 and is recommended for high inertia payloads and vacuum applications.

DC motor-driven stages are available in high speed (CC and HAT) and high torque (CCHL and HAHLT) versions. The CC and HAT versions enable speeds up to 80 °/s. The HAT features a high-resolution direct reading encoder and tachometer for superior repeatability, position stability and speed regulation. The CCHL and HAHLT versions are equipped with a reduction gear providing higher torque and payload inertia capacity. The HAHLT features a high-resolution direct reading encoder and tachometer for superior repeatability, position stability and speed regulation.



RVS80CC



RV120HAT-F



RV160PP



RV240CCHL



RV350HAHLT

## Design Details

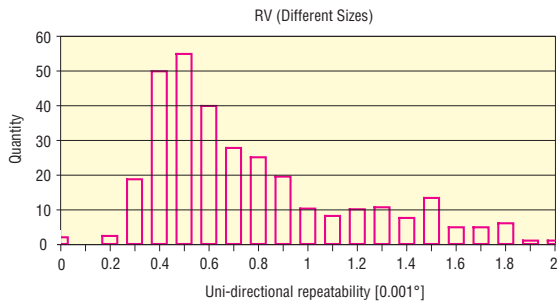
Base Material	Stainless Steel				
Bearings	Double row ball bearings				
Drive Mechanism	Ground worm gear with self compensating preload				
Feedback	RVS80CC: Worm mounted rotary encoder, 8,000 pts/rev, Index pulse RVS80PP: None. One full-step equals 0.01° RV120 to RV350, except for HAT and HAHLT versions: Worm mounted rotary encoder, 4,000 pts/rev, Index pulse HAT and HAHLT versions: Direct reading optical encoder on the rotating platen, 20 mm signal period				
Limit Switches	Optical, at ±170, can be disabled for continuous rotation (except HAT & HAHLT versions)				
Origin	Optical				
Cable Length	3 m cable included				
Vacuum Compatibility	Vacuum compatible versions are available up to 10 <sup>-6</sup> hPa using full-step motor (PEV6)				
Weight [lb (kg)]	RVS80	RV120	RV160	RV240	RV350
	4.0 (1.8)	14.3 (6.5)	19.8 (9)	35.3 (16)	57.5 (27)
	–	RV120HAT	RV160HAT	RV240HAT	RV350HAT
		17.6 (8)	24.2 (11)	41.9 (19)	72.8 (33)

## Specifications

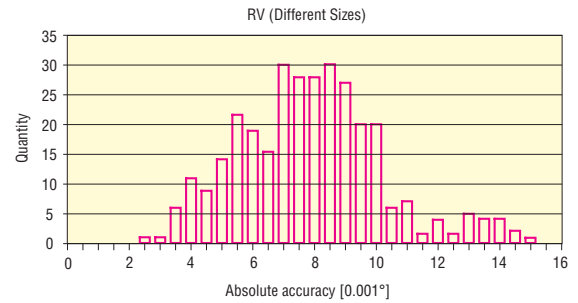
Travel Range (°)	360 continuous	With disabled limits, except HAT & HAHLT
	±170	HAT & HAHLT versions
Minimum Incremental Motion (°)	0.001	Except RVS80PP, HAT & HAHLT versions
	0.0002	RVS80PP
	0.00075	HAT versions
	0.0002	HAHLT versions
Uni-directional Repeatability, Guaranteed <sup>(1)</sup> (°)	0.002	Except RVS80CC, HAT & HAHLT versions
	0.001	RVS80CC
	0.001	RVS80PP
	0.0002	HAT & HAHLT versions
Bi-directional Repeatability, Guaranteed <sup>(1)</sup> (°)	0.004 or ± 0.002	Except RVS80, HAT & HAHLT versions
	0.003 or ± 0.0015	RVS80CC
	0.003 or ± 0.0015	RVS80PP
	0.0012 or ± 0.0006	HAT & HAHLT versions
Absolute Accuracy, Guaranteed <sup>(1)</sup> (°)	0.01 ° or ± 0.005	Except RVS80, HAT & HAHLT versions
	0.015 or ± 0.0075	RVS80CC
	0.015 or ± 0.0075	RVS80PP
	0.005 ° or ± 0.0025	HAT & HAHLT versions
Maximum Speed (°/s)	80	CC & HAT motor option, except RVS80CC
	40	RVS80CC
	20	PP motor option
	16	CCHL & HAHLT motor option
	2	PE motor option
Wobble, Guaranteed <sup>(1)(2)</sup> (μrad)	40 or ± 20	RVS80
	20 or ± 10	RV120 & RV160
	16 or ± 8	RV 240 & RV350
Eccentricity, Guaranteed <sup>(1)</sup> (μm)	4 or ±2	
MTBF (h)	20,000	

<sup>1)</sup> Shown are peak to peak, guaranteed specifications or ± half the value as sometimes shown. The typical specifications are about 2X better than the guaranteed values.

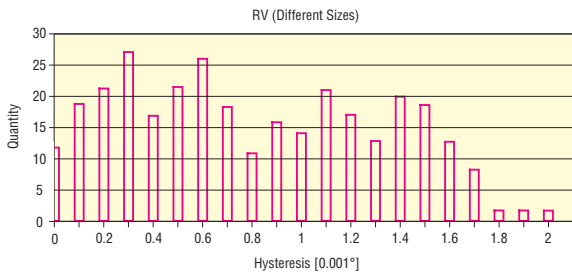
<sup>2)</sup> To obtain arcsec units, divide the μrad value by 4.8.



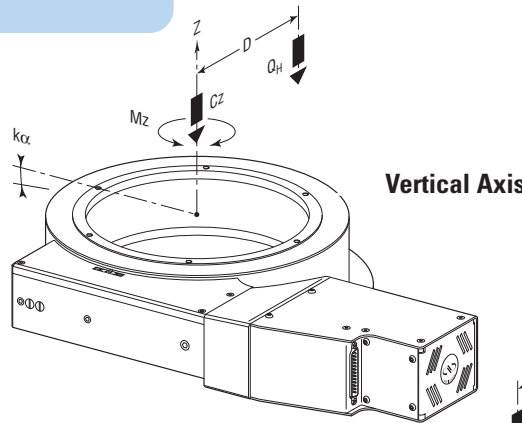
Uni-directional repeatability plot for RV Series stages. The typical (mean) uni-directional repeatability is 0.001°. The guaranteed value is 0.002°.



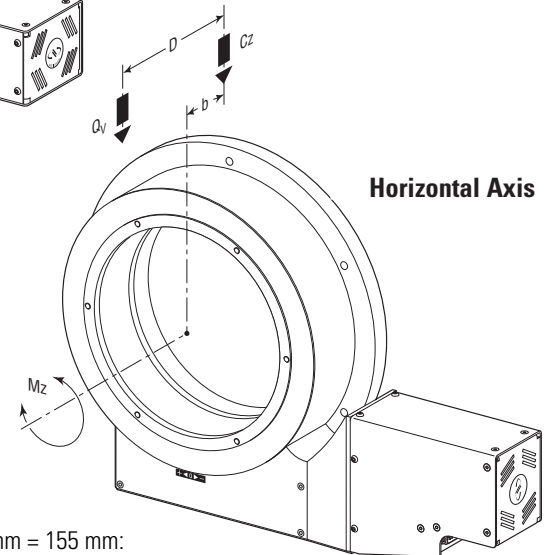
On-axis accuracy plot for RV Series stages. The typical (mean) on-axis accuracy is 0.001°. The guaranteed value is 0.002°.



Reversal value (Hysteresis) plot for RV Series stages. The typical (mean) reversal value is 0.001°. The guaranteed value is 0.002°.



Vertical Axis



Horizontal Axis

## Load Characteristics

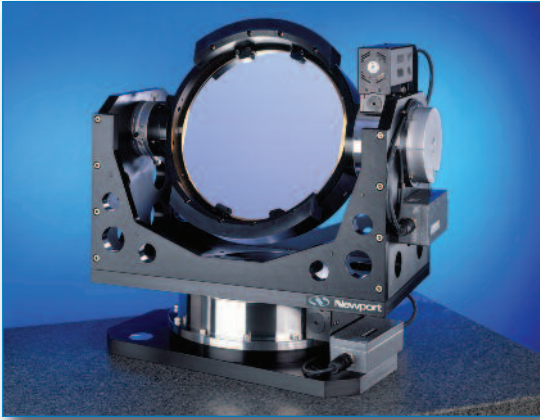
	RVS80CC	RV120CC	RV160	RV240	RV350
C <sub>z</sub> , Normal centered load capacity (N)	900	1800	2700	4000	6500
a, Construction parameter (mm)	30	40	50	70	100
b <sup>(1)</sup> , (mm)	except HAT & HAHLT		39	53	57
	for HAT & HAHLT		71	75	77
k <sub>α</sub> , Radial compliance (μrad/Nm)	3.5	1.5	0.6	0.3	0.1
Q <sub>H</sub> , Off-center load, vertical rotation axis	$Q_H \leq C_z / (1 + D/a)$				
Q <sub>V</sub> , Off-center load, horizontal rotation axis	$Q_V \leq C_z / 2 / (1 + D/a)$				

<sup>1)</sup> Construction parameter: Distance between the top surface of the RV stage and the bearing center.

### Example:

Q<sub>V</sub> at a distance of 80 mm from the top surface for a RV160HAT rotation stage, D = 80 mm + 75 mm = 155 mm:

$$Q_V = 2700 \text{ N} / 2 / (1 + 155 \text{ mm} / 50 \text{ mm}) = 329 \text{ N}$$



This Azimuth/Elevation gimbal system positions a 350 mm dia. mirror that can be used for laser based qualification and characterization of precision optical sensors, LIDAR analysis, or target tracking.

## Torque and Payload Inertia

Model	Max. Torque	Max. Inertia	Max. Speed
	Mz (N.m)	Iz (kg.m <sup>2</sup> )	(°/s)
RVS80PP	2	0.5	20
RVS80CC	2	0.1	40
RV120PP	15	1	20
RV120PE	20	70	2
RV120CC	10	0.2	80
RV120CCHL	15	7	16
RV120HAT	4	0.9	80
RV120HAHLT	6	7	16
RV160PP	20	3	20
RV160PE	35	100	2
RV160CC	11	0.7	80
RV160CCHL	20	24	16
RV160HAT	6	1	80
RV160HAHLT	8	8	16
RV240PP	22	4	20
RV240PE	60	150	2
RV240CC	13	1.5	80
RV240CCHL	30	38	16
RV240HAT	7	1.1	80
RV240HAHLT	10	10	16
RV350PP	25	4	20
RV350PE	80	220	2
RV350CC	14	1.8	80
RV350CCHL	30	56	16
RV350HAT	7	1.2	80
RV350HAHLT	10	10	16

This table lists the maximum torque and the maximum payload inertia for all RV rotation stages. The maximum payload inertia equals the maximum kinetic energy that the rotation stage can absorb in the event of a sudden stop at the maximum speed. Likewise, this is the maximum inertia to accelerate from stop to the maximum stage speed in 250 ms. Some RV stages can handle higher payload inertias at reduced speed. For detailed information, please contact a Newport Applications Engineer.

## Compatible Motion Controllers/Drivers

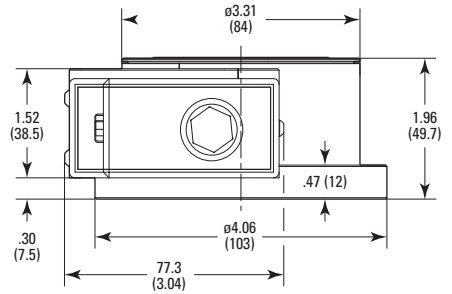
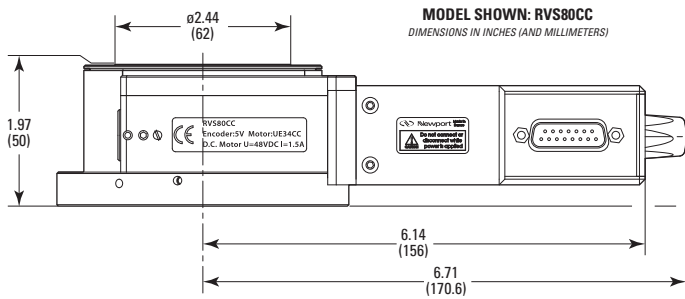
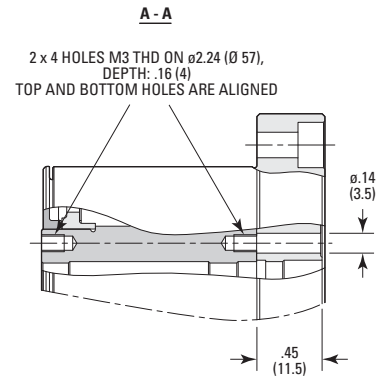
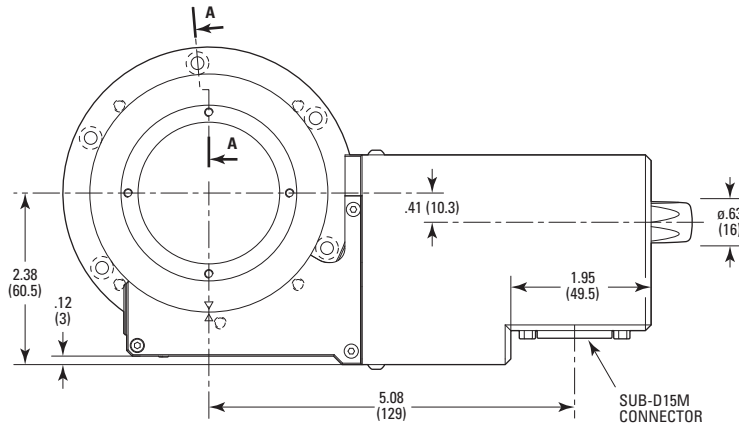
Family	Max. Power Consumption (W)	XPS <sup>(1)</sup> Driver Module	Compatibility		
			ESP301 <sup>(1)</sup>	SMC100CC <sup>(1)</sup>	SMC100PP <sup>(1)</sup>
RV120CC to RV350CC	130	XPS-DRV03			
RV120CCHL	40	XPS-DRV03	✓		
RV160CCHL to RV350CCHL	130	XPS-DRV03			
RV120HAT to RV350HAT	170	XPS-DRV03			
RV120HAHLT to RV350HAHLT	170	XPS-DRV03			
RV120PE to RV350PE	60	XPS-DRV01	✓		
RV120PP to RV350PP	60	XPS-DRV01	✓		
RVS80CC	40	XPS-DRV01	✓	✓	
RVS80PP	20	XPS-DRV01	✓		✓ <sup>(2)</sup>

<sup>1)</sup> Enhanced System Performance (ESP) Controller.

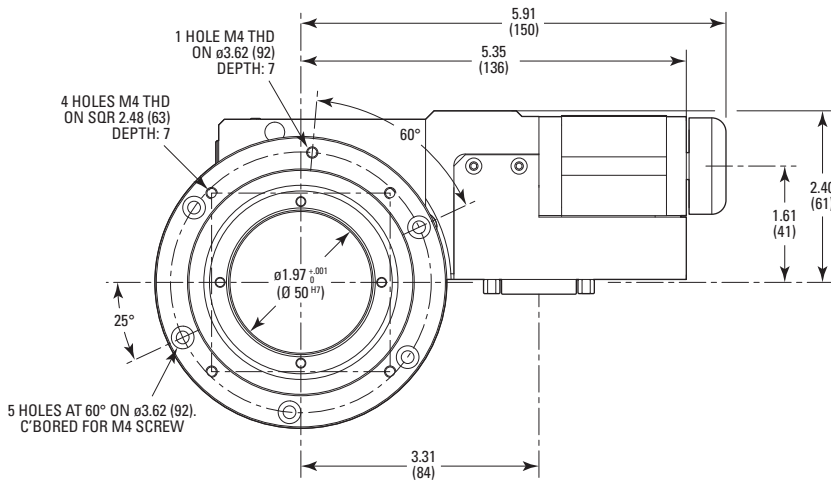
<sup>2)</sup> Compatible, but MIM is 1/20 th of a full step.

# Dimensions

## RVS80 Models



**BOTTOM VIEW OF THE RVS80PP**



RVS80PP and RVS80CC rotations stages.







## Ordering Information

### Direct Motor Versions

	Models				
Mini-step	RVS80PP	RV120PP	RV160PP	RV240PP	RV350PP
Full-step	–	RV120PE	RV160PE	RV240PE	RV350PE
Full-step & vacuum preparation	–	RV120PEV6	RV160PEV6	RV240PEV6	RV350PEV6
Vacuum compatible to 10 <sup>-6</sup> hPa. In this case, max. speed and load capacity have to be divided by two.					
DC	RVS80CC	RV120CC	RV160CC	RV240CC	RV350CC
HAT: DC & integral optical encoder	–	RV120HAT	RV160HAT	RV240HAT	RV350HAT
CCHL: DC & gear reduction	–	RV120CCHL	RV160CCHL	RV240CCHL	RV350CCHL
HAHLT: CCHL version & integral optical encoder	–	RV120HAHLT	RV160HAHLT	RV240HAHLT	RV350HAHLT

### Folded motor versions

Except RVS80, add -F for folded motor versions.

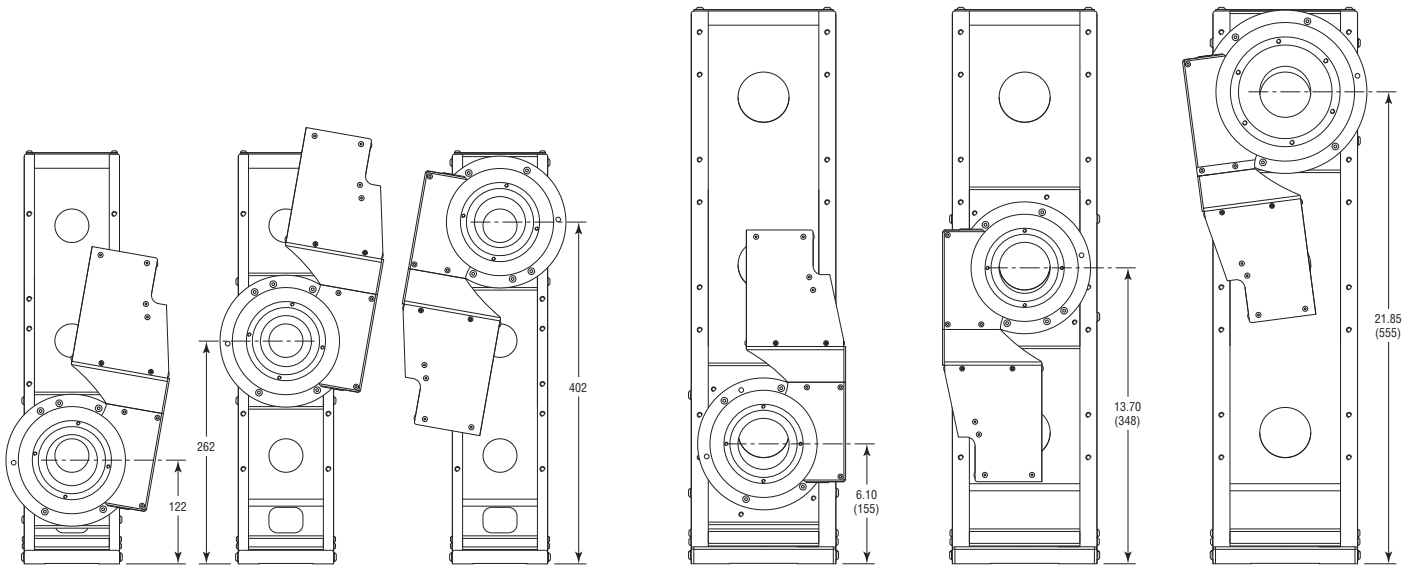
Note: For higher capacity rotary stages, please call an Applications Engineer.

## Accessories

Newport's EQ120 and EQ180 brackets (to order separately) are ideal for mounting our ILS or IMS Series of linear stages and RV80 to RV160 rotation stages for stable and stiff multi-axis positioning systems.

Model	Description
EQ120	Right-Angle Bracket for ILS and RV
EQ180	Right-Angle Bracket for IMS, RV120 and RV160

EQ180 bracket on an (M-I)MS stage, with an RV160 in vertical configuration.



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