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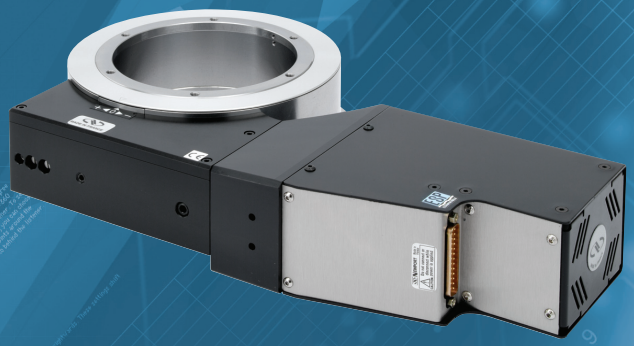
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RV High-Performance Precision Rotation Stages



Key Features

- **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 seven 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 at a reduced footprint. The single monolithic design offers improved stiffness without compromising dynamic performance. The largest RV stage can bear up to 650 kg or rotate up to 80 °/sec, while maintaining less than 4 um eccentricity.

Precise rotation is ensured by a precision ground and hardened worm gear. A rotary encoder mounted on the warm gear shaft provides 0.001 position feedback resolution position feedback (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.

RV rotation stages are available in seven drive configurations. The selection of the drive configuration should be done based on the precision and speed requirements relative to the inertia of the payload (see Torque and Payload Table).

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Stepper Drive Versions

Stepper motor-driven stages are available in two versions:

- The mini-step drive version (PP) enables high angular speed motions up to 20°/sec. 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 version (PE) is equipped with a reduction gear providing higher torque. When power is switched off, the unit maintains position and does not generate heat. This version is only available on the models RV120 to RV350 and is recommended for high inertia payload and vacuum applications.

DC-Servo Drive Versions

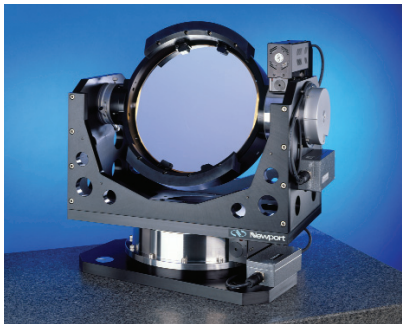
DC motor-driven stages are available in four versions:

- Two high-speed DC-servo versions (CC and HAT) enable speeds up to 80°/sec. The HAT features a high-resolution direct reading encoder and tachometer for superior repeatability, position stability and speed regulation.

- Two high-torque DC-servo versions (CCHL and HAHLT) 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.

Manual Drive Versions

All models, except RVS80 models, are also available with a manual drive (MS) with a rotary encoder providing 0.001° resolution. The manual knob permits a rotation of 4 °/rev.



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.

Design Details

Base Material	Stainless Steel				
Bearings	Double row ball bearings				
Drive Mechanism	Ground worm gear with self compensating preload				
Worm Gear Ratio	RVS80: 1:180 RV120–RV350: 1:90				
Reduction Gear	Reduction gear before encoder on some versions (please contact Newport for details)				
Feedback	RVS80CC: Worm mounted rotary encoder, 8,000 cts/rev, index pulse RVS80PP: One full-step equals 0.01° RV120 to RV350, except for HAT and HAHLT versions: Worm mounted rotary encoder, 4,000 cts/rev, index pulse HAT and HAHLT versions: Direct reading optical encoder on the rotating platen, 20 µm signal period.				
Limit Switches	Optical, at ±170°, can be disabled for continuous 360° rotation (except HAT and HAHLT)				
Origin	Optical				
Cable	3 m long cable included				
Vacuum Compatibility	Vacuum compatible versions are available up to 10^{-6} hPa using full-step motor (PE)				
MTBF (h)	20,000				
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	RV240	RV350
		17.6 (8)	24.2 (11)	41.9 (19)	72.8 (33)

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Motion Controller Options

For optimum performance and seamless startup, the following Motion Controllers/Drivers are recommended:

XPS	All models
ESP300	Except HAT, HAHLT
SMC100CC	Only RVS80CC

Motor Information

Model	Motor
RVS80CC	UE34CC
RVS80PP	UE34PP
RV120PE	UE41PP
RV120CCHL	UE404S
RV120HAHLT	UE404S-T
RV120PP to RV350PP	UE63PP
RV160PE to RV350PE	UE63PP
RV120CC to RV350CC	UE511S
RV120HAT to RV350HAT	UE511S-T
RV160CCHL to RV350CCHL	UE511S
RV160HAHLT to RV350HAHLT	UE511S-T

Specifications

Travel Range	360° continuous	With disabled limits, except HAT & HAHLT
	±170°	HAT & HAHLT versions
Resolution	0.001°	Except RVS80, HAT & HAHLT versions
	0.00025°	RVS80CC
	0.0001°	RV120HAT & HAHLT
	0.00075°	RV160HAT & HAHLT
	0.0005°	RV240HAT & HAHLT
	0.00035°	RV350HAT & HAHLT
Motion Sensitivity	0.001°	Except RVS80, HAT &HAHLT versions
	0.00025°	RVS80CC
	0.0002°	RVS80PP
	0.0001°	HAT & HAHLT versions
Uni-directional Repeatability	0.001° typical, 0.002° guaranteed	Except RVS80CC, HAT & HAHLT versions
	0.001° guaranteed	RVS80CC
	0.002° guaranteed	RVS80PP
	0.00011° typical, 0.0002° guaranteed	HAT & HAHLT versions
Reversal Value (Hysteresis)	0.001° typical, 0.002° guaranteed	Except RVS80PP, HAT & HAHLT versions
	0.005° guaranteed	RVS80PP
	0.0006° typical, 0.001° guaranteed	HAT & HAHLT versions
Absolute Accuracy	0.007° typical, 0.01° guaranteed	Except RVS80, HAT & HAHLT versions
	0.015° guaranteed	RVS80CC
	0.02° guaranteed	RVS80PP
	0.003° typical, 0.005° guaranteed	HAT & HAHLT versions
Maximum Speed	80 °/s	CC & HAT motor option, except RVS80CC
	40 °/s	RVS80CC
	20 °/s	PP motor option
	16 °/s	CCHL & HAHLT motor option
	2 °/s	PE motor option
Wobble	40 µrad guaranteed	RVS80
	10 µrad typical, 20 µrad guaranteed	RV120 & RV160
	8 µrad typical, 16 µrad guaranteed	RV240 & RV350
Eccentricity	1.4 µm typical, 4 µm guaranteed	

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Load Characteristics

		RVS80	RV120	RV160	RV240	RV350
Cz, normal centered load capacity	(N)	900	1800	2700	4000	6500
a, construction parameter	(mm)	30	40	50	70	100
b*, except HAT & HAHLT	(mm)	39	53	57	59	73
b*, for HAT & HAHLT	(mm)		71	75	77	91
kα, radial compliance	(μrad/Nm)	3.5	1.5	0.6	0.3	0.1
Q_H, Off-center load, horizontal rotation axis: $Q_H \leq Cz / (1+D/a)$						
Q_V, Off-center load, vertical rotation axis: $Q_V \leq Cz / 2 / (1+D/a)$						

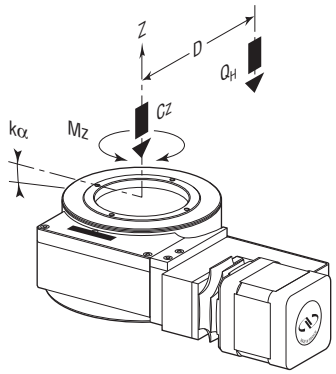
* Construction parameter = Distance between the top surface of the RV stage and the bearing center.

Example:

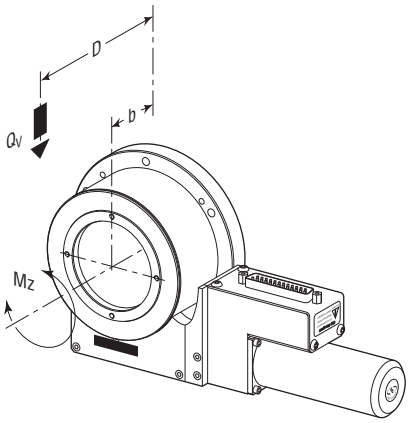
Q_V at a distance of 80 mm from the top surface for a RV160HAT rotation stage, D = 80 mm + 75 mm = 155 mm:

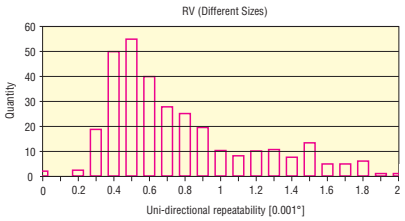
$$Q_V = 2700 \text{ N} / 2 / (1 + 155 \text{ mm} / 50 \text{ mm}) = 329 \text{ N}$$

Vertical Rotation Axis

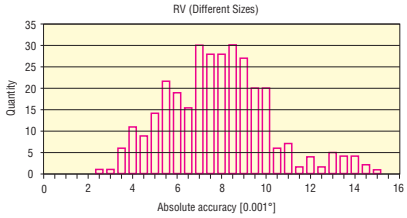


Horizontal Rotation Axis

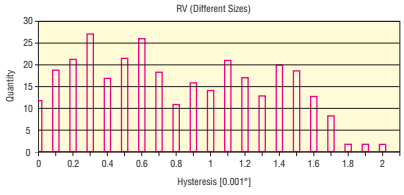




Uni-directional repeatability plot for RV Series stages. The typical (mean) uni-directional repeatability is 0.001 °. The guaranteed value is 0.002 °.



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

Torque and Payload Inertia

The following 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 Newport.

Model	Max. torque, Mz (Nm)	Max. inertia, Iz (kg.m²)	Max. speed (°/s)
RVS80PP	2	0.1	20
RVS80CC	15	1	40
RV120PP	15	1	20
RV120PE	20	70	2
RV120CC, RV120HAT	10	0.2	80
RV120CCHL, RV120HAHLT	15	7	16
RV160PP	20	3	20
RV160PE	35	100	2
RV160CC, RV160HAT	11	0.7	80
RV160CCHL, RV160HAHLT	20	24	16
RV240PP	22	4	20
RV240PE	60	150	2
RV240CC, RV240HAT	13	1.5	80
RV240CCHL, RV240HAHLT	30	38	16
RV350PP	25	4	20
RV350PE	80	220	2
RV350CC, RV350HAT	14	1.8	80
RV350CCHL, RV350HAHLT	30	56	16

Ordering Information

The RV Series rotation stages are configured as follows:

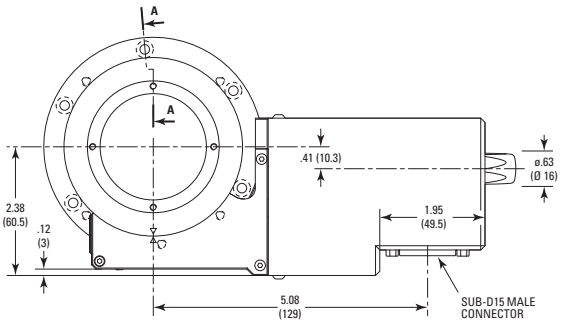
Series	Ø Stage (mm)	Drive	Folded Motor	Vacuum Preparation [2]
RV	S80 [1], 120, 160, 240, 350	PP, PE, CC, HAT, CCHL, HAHLT, MS	–F	V6

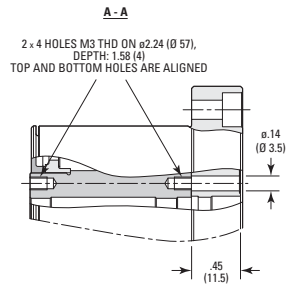
PP: *Mini-step* PE: *Full-step* CC: DC HAT: DC & *integral optical encoder*
CCHL: DC & *gear reduction* HAHLT: CCHL *version* & *integral optical encoder* MS: *Manual*

Example
The **RV240HAT-F** *is a* Ø 240 *mm* RV *rotation stage with a* DC *folded motor drive and an integral optical encoder.*

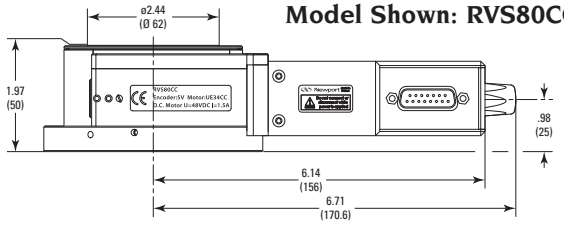
1) RVS80 *is only available as* RVS80CC *and* RVS80PP.
2) *Vacuum compatible to* 10^{-6} *hPa. In this case max. speed and load capacity have to be divided by two.*

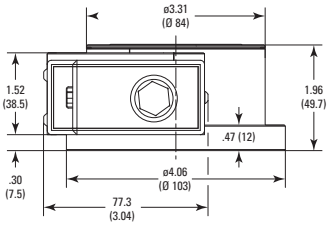
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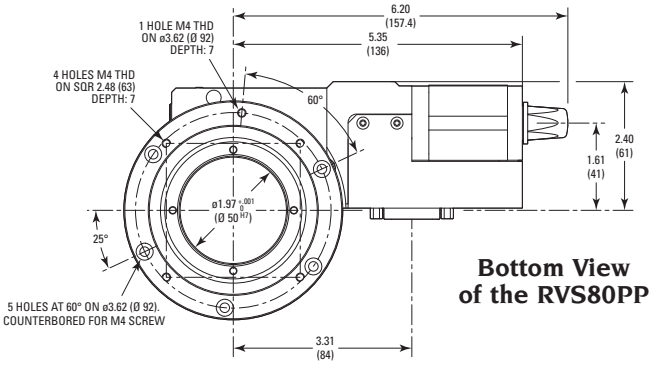




Model Shown: RVS80CC







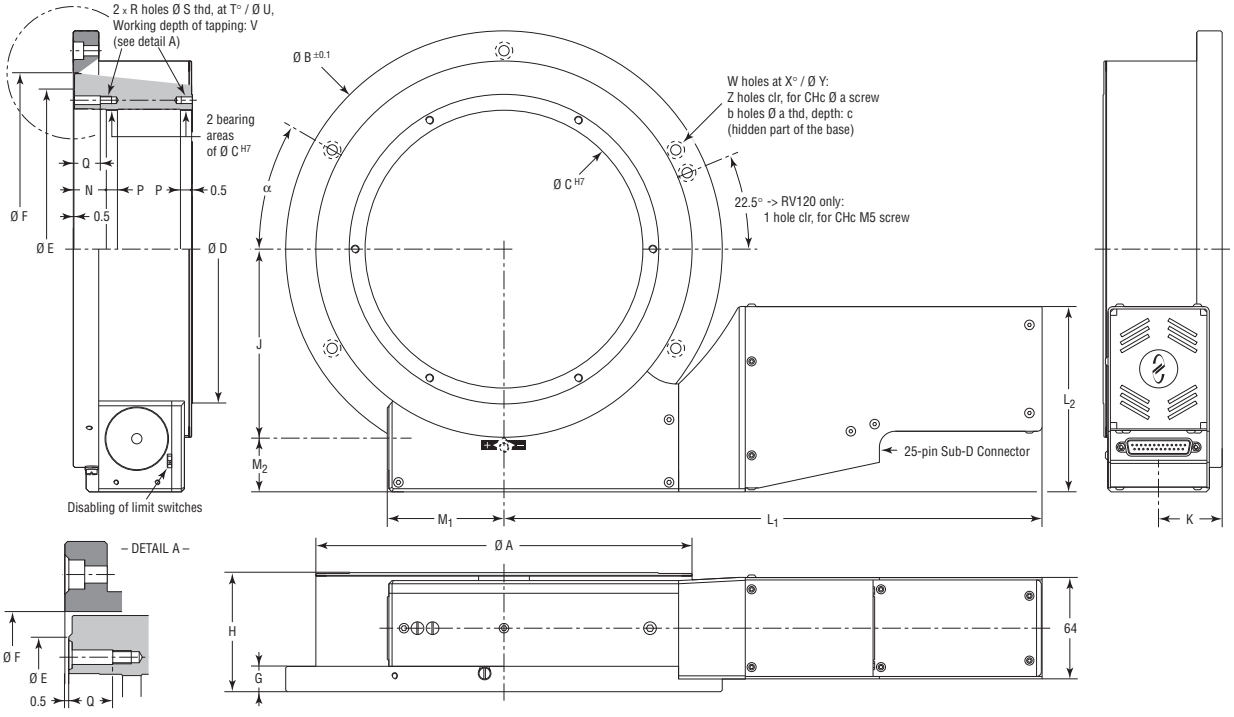
Bottom View of the RVS80PP

RVS80 Models



RV120 to RV350 Models

Model RV240CCHL Shown (*Dimensions in millimeters*)

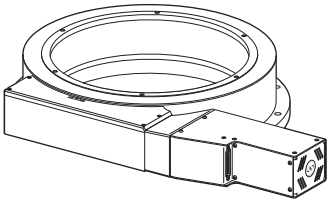


Dimensions

Model	A	B	C	D	E	F	G	H	J	K	N	P	Q
RV120	126	155	78	93	99	115.5	14	68	63	34	19	4	15
RV160	163	192	110	129	134	152	14	71	81.5	36	18.5	5	14.5
RV240	237	275	175	194	204	222	16	75	119.5	40	20.3	7	16.6
RV350	356	395	280	302	315	331.5	17.5	90	179	50	21.3	8	17.3

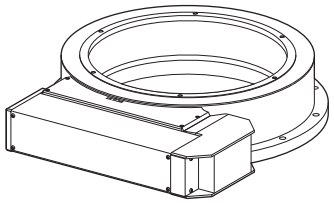
Dimensions

Model	R	S	T	U	V	W	X	Y	Z	a	b	c	
RV120	4	M4	90	87.5	6	6	60	137	5	M5	1	7	17.5
RV160	6	M5	60	120	7	6	60	174	5	M5	1	7	25
RV240	6	M5	60	187.5	7	6	60	250	5	M6	1	10	30
RV350	6	M6	60	295	7	12	30	372	10	M8	2	12	10



Rotation Stages, Direct Motor

Model	L_1				M_1	L_2	M_2
	PP	PE	CC	CCHL			
RV120	251.5	251.5	251.5	301.5	45.5	117	33.5
RV160	264	314	264	314	54		
RV240	289	339	289	339	73.5		
RV350	315	365	315	365	105		

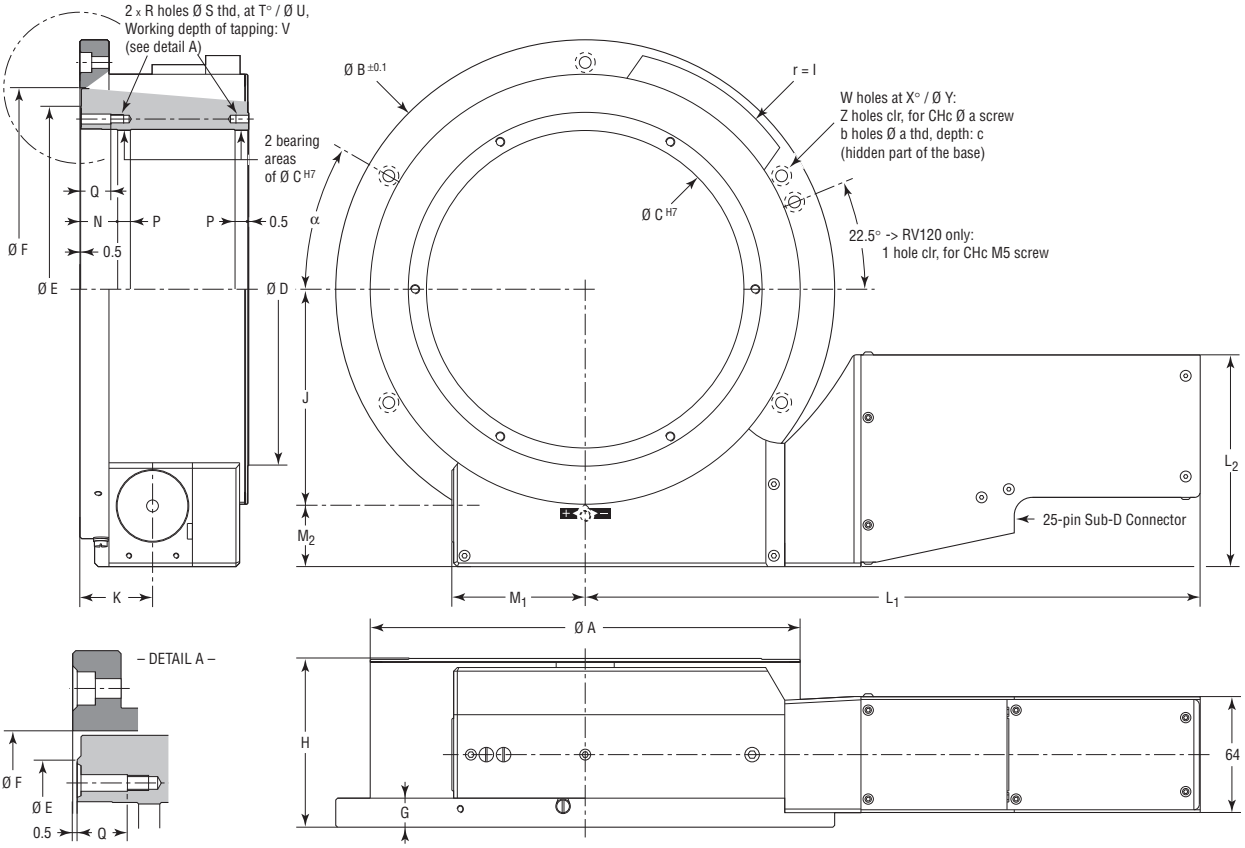


Rotation Stages, Folded Motor

Model	L_1	M_1	L_2	M_2
RV120	155.5	54.5	160.5	110.5
RV160	168	63		
RV240	193	82.5		
RV350	219	114		

RVHAT & RVHAHLT Models

Model RV240HAT Shown (*Dimensions in millimeters*)



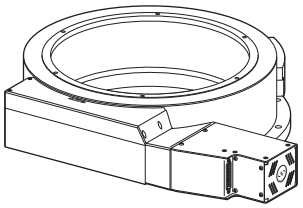
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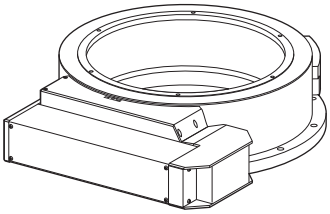
Dimensions

Model	A	B	C	D	E	F	G	H	I	J	K	N	P	Q
RV120	126	155	78	93	99	115.5	14	86	80	63	34	19	4	15
RV160	163	192	110	129	134	152	14	89	98	81.5	36	18.5	5	14.5
RV240	237	275	175	194	204	222	16	93	132.5	119.5	40	20.3	7	16.6
RV350	356	395	280	302	315	331.5	17.5	108	189	179	50	21.3	8	17.3

Dimensions

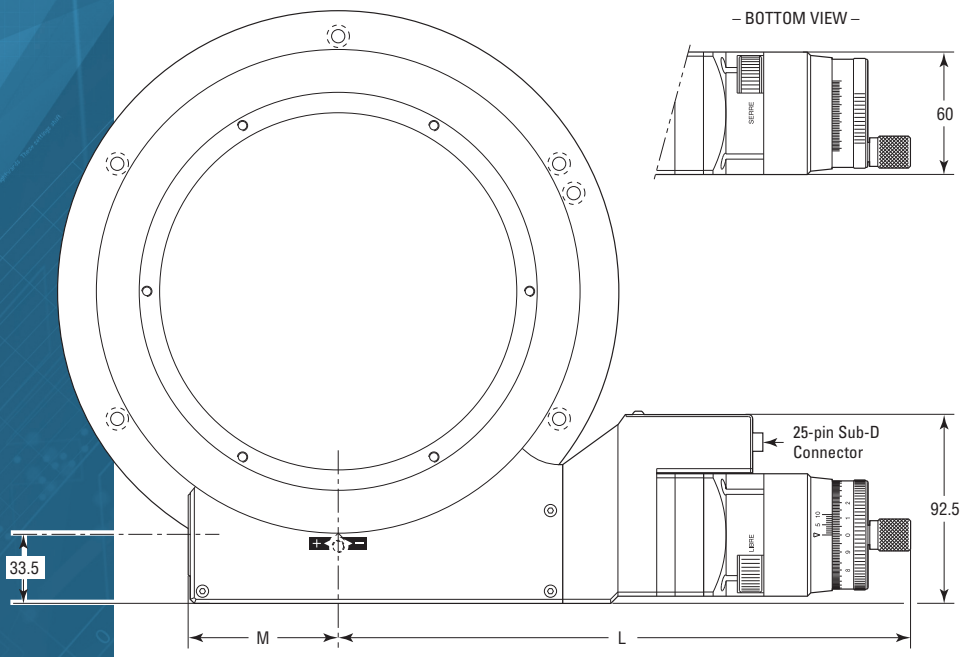
Model	R	S	T	U	V	W	X	Y	Z	a	b	c	
RV120	4	M4	90	87.5	6	6	60	137	5	M5	1	7	17.5
RV160	6	M5	60	120	7	6	60	174	5	M5	1	7	25
RV240	6	M5	60	187.5	7	6	60	250	5	M6	1	10	30
RV350	6	M6	60	295	7	12	30	372	10	M8	2	12	10





RVMS Models

Model RV240MS Shown (*Dimensions in millimeters*)



Rotation Stages, Direct Motor

Model	L_1		M_1	L_2	M_2
	HAT	HAHLT			
RV120	301.5	301.5	45.5	117	33.5
RV160	314	357	54		
RV240	339	382	73.5		
RV350	365	408	105		

Rotation Stages, Folded Motor

Model	L_1	M_1 HAT-F	M_1 HAHLT-F	M_2
RV120	155.5	54.5	75.5	110.5
RV160	168	63	107.5	
RV240	193	82.5	82.5	
RV350	219	114	114	

	Dimension (mm)	
Model	L	M
RV120MS	243	45.5
RV160MS	255.5	54
RV240MS	280.5	73.5
RV350MS	306.5	105

ISO 9001
FM 27207

Newport Corporation, Irvine, California, has been certified compliant with ISO 9001 by the British Standards Institution.

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