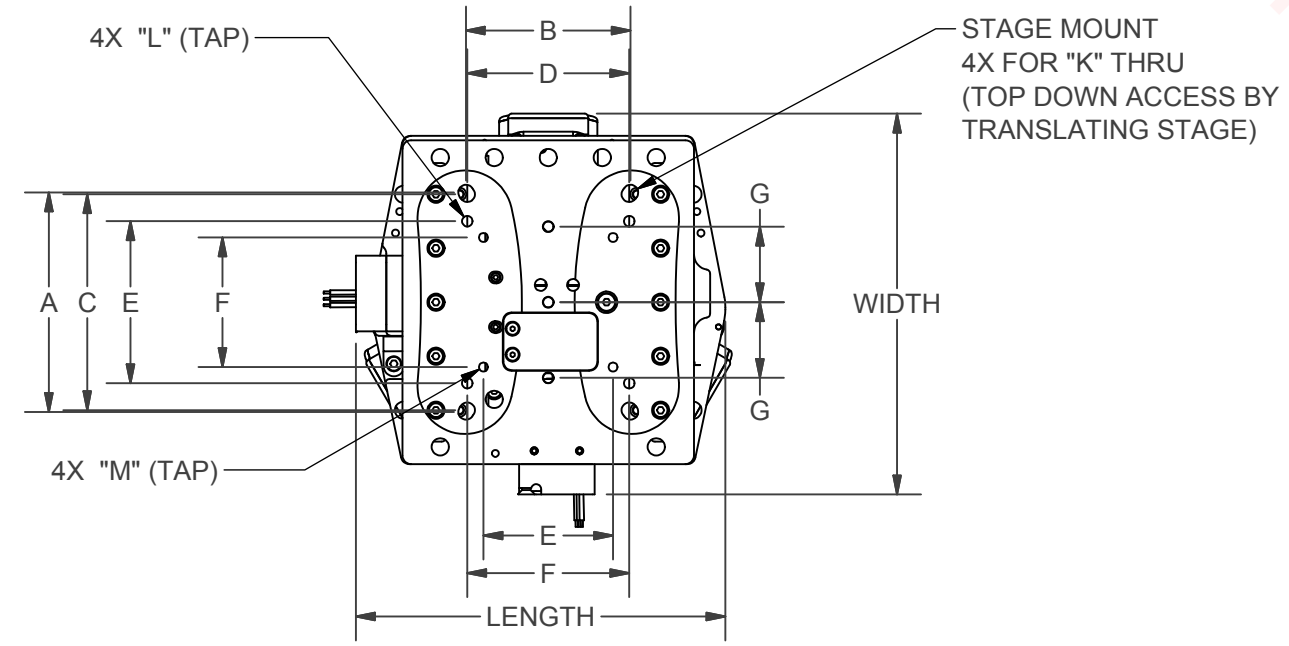


XY TRAVEL	Z TRAVEL	PITCH & ROLL TRAVEL	R DIAMETER	OPTION	LENGTH	WIDTH	HEIGHT @ HOME	HEIGHT @ MID-STROKE	A (inch)	B (inch)	C	D	E	F	G	H	I	J	K	L	M	N	P
60	15	+/- 10 degrees	80	-	174	176.3	201	209	4	3	100	75	75	60	35	30	22.5	50	M6 or 1/4-20	M6	M5	M3	M4
60	15	+/- 10 degrees	80	LM	170	163.5	224.5	232.5	5	4	125	75	100	75	35	30	22.5	50	M6 or 1/4-20	M6	M5	M3	M4

\* All units millimeters unless otherwise noted.  
 \* All hole patterns centered on M5 dowel pin at center of XY stage or centered on thru hole of top rotary stage.  
 \* All axes shown at their mid-stroke or home position except tripod which is shown at its lowest position which coincides with Z axis home position.  
 \* See specification sheet and contact ALIO technical sales for assistance in model selection.

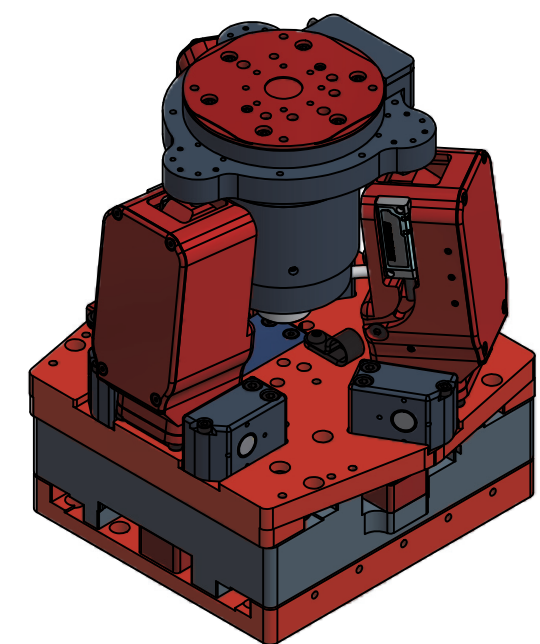


NOTE: MODEL AI-HH-60XY-15Z-80RGR SHOWN.

STANDARD FEATURES	
Stage	Hybrid Hexapod
Travel	6 Degrees of Freedom (X, Y, Z, Pitch, Roll, and Yaw)
XY Travel	60 mm
Z Travel (Tripod)	15 mm
Angular Travel (Tripod)	+/- 10 degrees (Pitch and Roll), 360 degrees continuous (Yaw)
Max Payload	5.0+ kg
Motor (XY)	Frameless Torque Motor with Precision Ball Screw Optional: Ironless Core Linear Motor
Motor (Tripod)	Frameless Torque Motor with Precision Ball Screw
Motor (Rotary)	Frameless Torque Motor w/ 1:100 Strain Wave Gear Ratio
Feedback (XY + Tripod)	Non-Contact Optical Linear Encoder (Gold Tape Scale)
Feedback (Rotary)	Non-Contact Optical Angle Encoder (Stainless Steel Ring)
Backlash	0 nm or 0 arc-sec (No Backlash on Any Axis)
Resolution	~5 nm (Linear), < 0.04 arc-sec (Angular)
Sensors	Integrated Home and End of Travel Limits
Bearings	High Precision Crossed Roller Bearings (All Axes)
Cables	High Flex, 10M Cycle, 3m Length
Structure	Anodized Aluminum 6061-T6
Environment	Standard
Temperature	0°C to 50°C
Humidity	10% to 80% Non-Condensing
Precision	6-D Nano Precision™ Test Methods

DRAWN	NBROWN	2018-04-05			
CHECKED					
Tolerances:			Surface Roughness:		
x.x ± 0.5 mm			RMS MAX.		
x.xx ± 0.13 mm			✓		
x.xxx ± 0.05 mm					
ANGLES ± 0.5°					
MATERIAL			SIZE	DWG NO	REV
			B	0010-08116	001
FINISH			SCALE	0090-07999-014 ALIO STD TEMPLATE	
SEE NOTES			SHEET 1 OF 3		

# ALIO HYBRID HEXAPOD PERFORMANCE SPECIFICATIONS



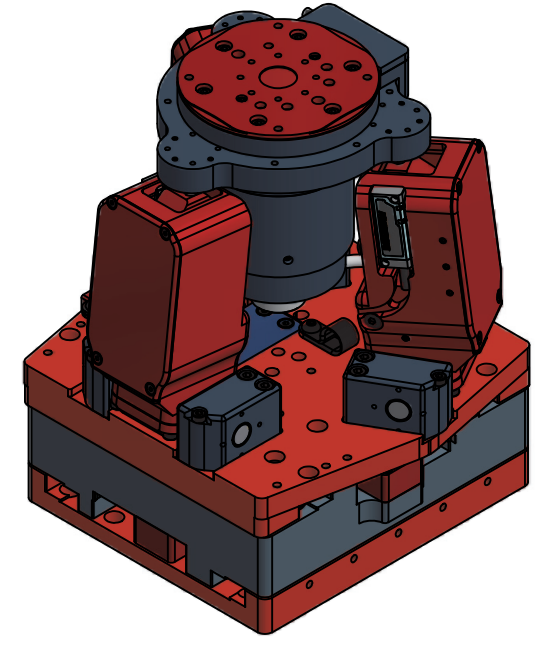
MODEL		UNITS	AI-HH-60XY-15Z-80RGR			AI-HH-60XY-15Z-80RGR		
OPTION		--	--			"LM"=HIGH FORCE LINEAR MOTOR XY		
XY TRAVEL		mm	60			60		
Z TRAVEL		mm	15			15		
PITCH AND ROLL TRAVEL [10]		deg	+/- 10			+/- 10		
YAW TRAVEL		deg	360 deg continuous			360 deg continuous		
PERFORMANCE SPECIFICATIONS [1]			(STD)	ULTRA	NANO	(STD)	ULTRA	NANO
BIDIRECTIONAL REPEATABILITY	XY	nanometers	+/- 100	+/- 70	+/- 70	+/- 100	+/- 70	+/- 70
	Z	nanometers	+/- 100	+/- 70	+/- 70	+/- 100	+/- 70	+/- 70
	PITCH AND ROLL	arc-sec	+/- 0.6	+/- 0.4	+/- 0.4	+/- 0.6	+/- 0.4	+/- 0.4
	YAW	arc-sec	+/- 0.6	+/- 0.4	+/- 0.4	+/- 0.6	+/- 0.4	+/- 0.4
BACKLASH	XY	nanometers	0 nm / arc-sec			0 nm / arc-sec		
	Z	nanometers	(no backlash on any axis)			(no backlash on any axis)		
	PITCH AND ROLL	arc-sec						
	YAW	arc-sec						
MINIMUM INCREMENTAL STEP SIZE	XY	nanometers	< 20			< 20		
	Z	nanometers	< 20			< 20		
	PITCH AND ROLL	arc-sec	< 0.1			< 0.1		
	YAW	arc-sec	< 0.1			< 0.1		
3D ACCURACY [11]	LINEAR ACCURACY	um	CONTACT ALIO TO DISCUSS 3D ACCURACY			CONTACT ALIO TO DISCUSS 3D ACCURACY		
	STRAIGHTNESS	um						
	FLATNESS [2]	um						
	PITCH	arc-sec						
	YAW	arc-sec						
	ROLL	arc-sec						
YAW RUNOUT	AXIAL RUNOUT	um	15	12	10	15	12	10
	RADIAL RUNOUT	um	15	12	10	15	12	10
	WOBBLE	arc-sec	25	20	15	25	20	15
RESOLUTION	XY	nanometers	~5 nm			~5 nm		
	Z	nanometers	~5 nm			~5 nm		
	PITCH AND ROLL	arc-sec	~0.04			~0.04		
	YAW	arc-sec	0.03			0.03		
MOTION PROFILE SPECIFICATIONS								
MAX LINEAR VELOCITY [3]	XY	mm/s	25			150		
	Z	mm/s	15			15		
MAX LINEAR ACCELERATION [3]	XY	G	0.5			0.3		
	Z	G	0.5			0.3		
MAX ANGULAR VELOCITY [3]	PITCH AND ROLL	deg/sec	15			15		
	YAW	deg/sec	10			10		
MAX ANGULAR ACCELERATION [3]	PITCH AND ROLL	deg/sec^2	>1000			>1000		
	YAW	deg/sec^2	>1000			>1000		
MAX PAYLOAD		kg	5			5		
PAYLOAD CENTER OF GRAVITY [12]	MAX XY OFFSET	mm	75			75		
	MAX Z OFFSET	mm	75			75		
ASSEMBLY MASS		kg	5.7			9.0		
MOVING MASSES	X	kg	5.4			7.9		
	Y	kg	3.8			5.3		
	Z	kg	1.39			1.39		
	YAW	kg	0.43			0.43		
YAW MASS MOMENT OF INERTIA		kg*mm^2	207			207		

- Notes:
- Specifications measured on stage centerline, 50mm above mounting surface. ALIO provides NIST traceable proof for all options/specs per quote.
  - Flatness specifications dependent on system base. Contact ALIO for more information.
  - Stage limitation at no load. Does not account for drive or resolution limitations.
  - Back EMF plus IR drop must not exceed maximum line to line bus voltage.
  - Resistance values do not include cable resistance. Cable resistance adds approximately 0.2 ohm/m.
  - Continuous operating limits are based on continuous operation at maximum temperature with aluminum heat sink (300mm x 12.5mm x motor length).
  - Maximum on time at peak operating limits is 10 seconds.
  - All electrical specifications may vary by 12% from listed values.
  - Additional motor and travel options are available for each stage for optimized performance as necessary per customer requirements.
  - Angular travel is specified when the Z axis is at mid-stroke and all other angles are at zero degrees. Translation from this specified (mid-stroke) position reduces angular travel.
  - Three dimensional accuracy is affected by all error sources of all axes as well as the infinite possible process points or tool center points. Thus a single specification is not applicable. ALIO specifies three dimensional accuracy specifications on a case by case basis.
  - Payload Cg ideally should be in line with the yaw rotation axis (centered on mounting surface). Offset payload must be within specified range and may influence performance.

DRAWN NBROWN		2018-04-05				
CHECKED						
Tolerances: Surface Roughness:				<b>AI-HH-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMTER)RGR</b>		
x.x ± 0.5 mm		x.xx ± 0.13 mm				
x.xxx ± 0.05 mm		RMS MAX.		TITLE		
ANGLES ± 0.5'				SIZE		
MATERIAL				DWG NO		REV
				0010-08116		001
FINISH		SEE NOTES		SCALE		
				0090-07999-014 ALIO STD TEMPLATE		
				SHEET 2 OF 3		



# ALIO MOTOR SPECIFICATIONS



MODEL	UNITS	AI-HH-60XY-15Z-80RGR	AI-HH-60XY-15Z-80RGR-LM
OPTION	--	--	"LM"=HIGH FORCE LINEAR MOTOR XY
XY MOTOR INFORMATION			
MOTOR TYPE	--	FRAMELESS TORQUE MOTOR WITH PRECISION BALL SCREW	LINEAR BRUSHLESS MOTOR
MOTOR MODEL	--	AI-TM-32A8-Y	AI-LM-144ASN-D
MAGNETIC PITCH (N-N)	deg	180	--
MAGNETIC PITCH (N-N)	mm	--	30.48
BALL SCREW PITCH	mm	1	--
MAX VOLTAGE (LINE TO LINE) [4]	V	340	500
MAX MOTOR TEMP	°C	155	125
THERMAL SENSOR	--	--	NEG. COEFF. THERMISTOR
MOTOR CONNECTION	--	WYE	DELTA
TORQUE CONSTANT	Nm/Arms	0.030	--
FORCE CONSTANT	N/Apk	--	8.4
PHASE RESISTANCE (@25° C) [5]	Ohm	2.2	5.8
PHASE RESISTANCE (@130° C) [5]	Ohm	--	8.0
INDUCTANCE	mH	1.1	1.3
CONTINUOUS FORCE [6]	N	113	26.7
CONTINUOUS TORQUE [6]	Nm	0.08	--
CONTINUOUS CURRENT [6]	Apk	2.78	3.2
PEAK FORCE [7]	N	200	84
PEAK TORQUE [7]	Nm	0.26	--
PEAK CURRENT [7]	Apk	8.79	10.1
BACK EMF CONSTANT	Vrms/krpm	1.8	--
BACK EMF CONSTANT	V/m/s	--	8.4
TRIPOD MOTOR INFORMATION			
MOTOR TYPE	--	FRAMELESS TORQUE MOTOR WITH PRECISION BALL SCREW	
MOTOR MODEL	--	AI-TM-32A8-Y	AI-TM-32A8-Y
MAGNETIC PITCH (N-N)	deg	180	180
BALL SCREW PITCH	mm	1	1
MAX VOLTAGE (LINE TO LINE) [4]	V	340	340
MAX MOTOR TEMP	°C	155	155
THERMAL SENSOR	--	NONE	NONE
MOTOR CONNECTION	--	WYE	WYE
TORQUE CONSTANT	Nm/Arms	0.030	0.030
PHASE RESISTANCE (@25° C) [5]	Ohm	2.2	2.2
INDUCTANCE	mH	1.1	1.1
CONTINUOUS FORCE [6]	N	113	113
CONTINUOUS TORQUE [6]	Nm	0.08	0.08
CONTINUOUS CURRENT [6]	Arms	2.8	2.8
PEAK FORCE [7]	N	200	200
PEAK TORQUE [7]	Nm	0.26	0.26
PEAK CURRENT [7]	Arms	8.8	8.8
BACK EMF CONSTANT	Vrms/krpm	1.8	1.8
YAW (ROTARY) MOTOR INFORMATION			
MOTOR TYPE	--	FRAMELESS TORQUE MOTOR W/ MECHANICAL GEAR REDUCTION	
MOTOR MODEL	--	AI-TM-44AE-Y	AI-TM-44AE-Y
MAGNETIC PITCH (N-N)	deg	120	120
MECHANICAL GEAR RATIO	--	1:100	1:100
MAX VOLTAGE (LINE TO LINE) [4]	VDC	340	340
MAX MOTOR TEMP	°C	155	155
THERMAL SENSOR	--	NONE	NONE
MOTOR CONNECTION	--	WYE	WYE
INPUT TORQUE CONSTANT	Nm/Arms	0.09	0.09
PHASE RESISTANCE (@25° C) [5]	Ohm	4.5	4.5
INDUCTANCE	mH	3.2	3.2
CONTINUOUS OUTPUT TORQUE [6]	Nm	5.40	5.40
CONTINUOUS INPUT TORQUE [6]	Nm	0.21	0.21
CONTINUOUS CURRENT [6]	Arms	2.31	2.31
PEAK OUTPUT TORQUE [7]	Nm	19.0	19.0
PEAK INPUT TORQUE [7]	Nm	0.66	0.66
PEAK CURRENT [7]	Arms	7.3	7.3
BACK EMF CONSTANT	Vrms/krpm	5.5	5.5

- Notes:
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  - Stage limitation at no load. Does not account for drive or resolution limitations.
  - Back EMF plus IR drop must not exceed maximum line to line bus voltage.
  - Resistance values do not include cable resistance. Cable resistance adds approximately 0.2 ohm/m.
  - Continuous operating limits are based on continuous operation at maximum temperature with aluminum heat sink (300mm x 12.5mm x motor length).
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DRAWN	NBROWN	2018-04-05			
CHECKED					
TOLERANCES:			TITLE		
x.x ± 0.5 mm x.xx ± 0.13 mm x.xxx ± 0.05 mm ANGLES ± 0.5°			<h2>AI-HH-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMTER)RGR</h2>		
SURFACE ROUGHNESS: RMS MAX.					
MATERIAL	B	FINISH	SCALE	DWG NO	REV
SEE NOTES				0010-08116	001
SCALE			0090-07999-014 ALIO STD TEMPLATE	SHEET	3 OF 3