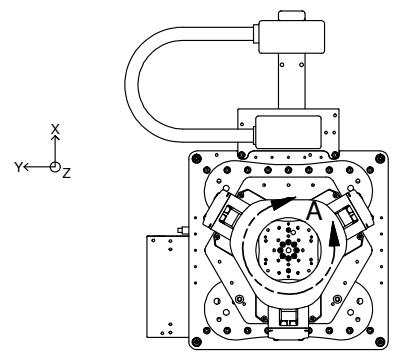
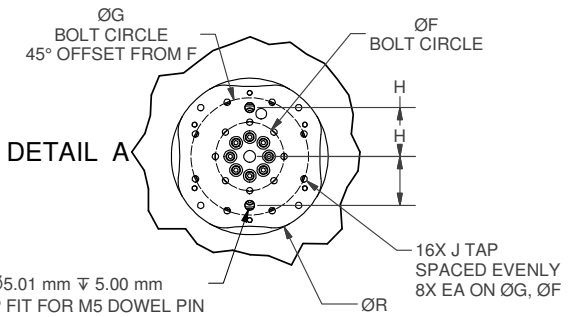
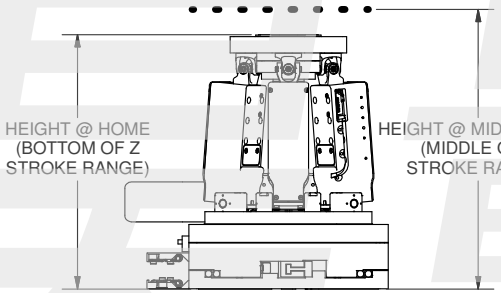
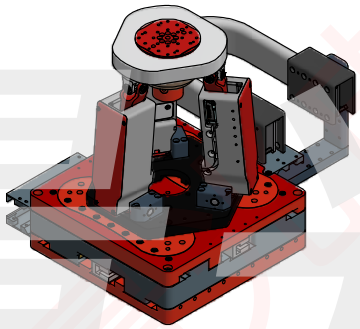
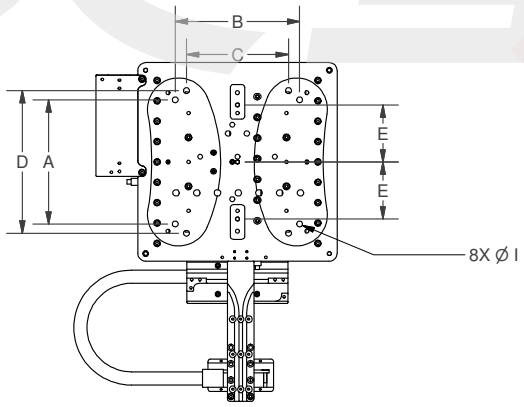








STANDARD FEATURES	
Stage	Hybrid Hexapod
Travel	6 Degrees of Freedom (X, Y, Z, Pitch, Roll, and Yaw)
XY Travel	60-200 mm
Z Travel (Tripod)	62
Angular Travel (Tripod)	+/- 30 degrees (Pitch and Roll), 360 degrees continuous (Yaw)
Max Payload	5-10 kg
Motor (XY)	Frameless Torque Motor with Precision Ball Screw or Linear brushless AC servo motor
Motor (Tripod)	Frameless Torque Motor with Precision Ball Screw
Motor (Rotary)	Frameless Torque Motor with Brake
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



XY TRAVEL	Z TRAVEL	PITCH & ROLL TRAVEL	R DIAMETER	LENGTH	WIDTH	HEIGHT @ HOME	HEIGHT @ MID-STROKE	A (inch)	B (inch)	C	D	E	F	G	H	I	J
60	62	+/- 30 degrees	80	204.8	180	299.7	330.8	4	3	75	100	35	35	55	25	M6 or 1/4-20	M4
100	62	+/- 30 degrees	80	244	244	312.2	343.3	6	6	125	175	70	35	55	25	M6 or 1/4-20	M4
200 (CM)	62	+/- 30 degrees	80	275	275	292.2	323.3	6	6	125	175	70	35	55	25	M6 or 1/4-20	M4
200	62	+/- 30 degrees	80	336	336	322.2	353.3	7	5	200	225	100	35	55	25	M6 or 1/4-20	M4

NOTE: AI-HH-100XY-62Z-80R MODEL SHOWN

DRAWN	K. CHAFFER	12/17/2019
CHECKED		
Tolerances: x.x ± 0.5 mm, x.xx ± 0.13 mm, x.xxx ± 0.05 mm, ANGLES ± 0.5°	Surface Roughness: √ RMS MAX.	
MATERIAL		
FINISH	SEE NOTES	

ALIO 6-D

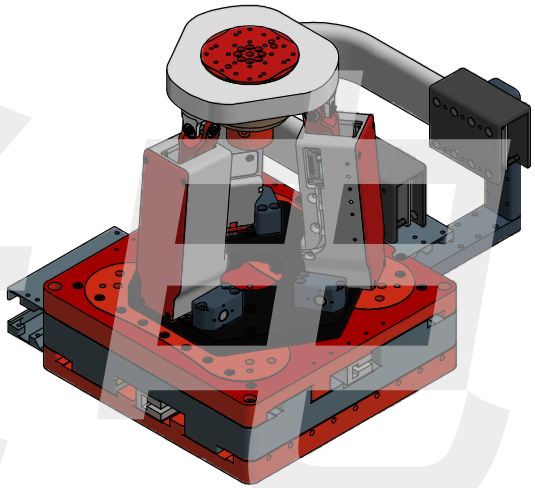
TITLE

AI-HH-30D-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMETER)R

SIZE	DWG NO	REV
B	0010-09990	002

SCALE | 0090-07999-015 ALIO STD TEMPLATE | SHEET 1 OF 3

MODEL		UNITS	AI-HH-30D-60XY-62Z-80R			AI-HH-30D-100XY-62Z-80R			AI-HH-30D-200XY-62Z-80R-CM			AI-HH-30D-200XY-62Z-80R		
XY TRAVEL		mm	60			100			200			200		
Z TRAVEL		mm	62			62			62			62		
XYZ VOLUMETRIC TRAVEL [15]		mm	60 x 60 x 62			100 x 100 x 62			200x200x62			200x200x62		
NOMINAL Z POSITION		mm	26			26			26			26		
PITCH (THETA Y) ANGULAR TRAVEL [10]		deg	+/- 31			+/- 31			+/- 31			+/- 31		
ROLL (THETA X) ANGULAR TRAVEL [10]		deg	+/- 31			+/- 31			+/- 31			+/- 31		
CONICAL TILT ANGULAR TRAVEL [10]		deg	+/- 30			+/- 30			+/- 30			+/- 30		
COMPOUND PITCH AND ROLL TRAVEL [14]		deg	+/- 22			+/- 22			+/- 22			+/- 22		
YAW TRAVEL		deg	360 deg continuous			360 deg continuous			360 deg continuous			360 deg continuous		
PERFORMANCE SPECIFICATIONS [1]			(STD)	ULTRA	NANO	(STD)	ULTRA	NANO	(STD)	ULTRA	NANO	(STD)	ULTRA	NANO
BIDIRECTIONAL REPEATABILITY	XY	nanometers	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70
	Z	nanometers	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70
	PITCH AND ROLL	arc-sec	+/- 0.6		+/- 0.4	+/- 0.6		+/- 0.4	+/- 0.6		+/- 0.4	+/- 0.6		+/- 0.4
	YAW	arc-sec	+/- 0.6		+/- 0.4	+/- 0.6		+/- 0.4	+/- 0.6		+/- 0.4	+/- 0.6		+/- 0.4
BACKLASH	XY	nanometers	0 nm / arc-sec (no backlash on any axis)			0 nm / arc-sec (no backlash on any axis)			0 nm / arc-sec (no backlash on any axis)			0 nm / arc-sec (no backlash on any axis)		
	Z	nanometers												
	PITCH AND ROLL	arc-sec												
	YAW	arc-sec												
MINIMUM INCREMENTAL STEP SIZE	XY	nanometers	< 20			< 20			< 20			< 20		
	Z	nanometers	< 20			< 20			< 20			< 20		
	PITCH AND ROLL	arc-sec	< 0.1			< 0.1			< 0.1			< 0.1		
	YAW	arc-sec	< 0.1			< 0.1			< 0.1			< 0.1		
3D ACCURACY [11]	LINEAR ACCURACY	um	CONTACT ALIO TO DISCUSS 3D ACCURACY			CONTACT ALIO TO DISCUSS 3D ACCURACY			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	12	10	5	12	10	5	12	10	5	12	10	5
	RADIAL RUNOUT	um	12	10	5	12	10	5	12	10	5	12	10	5
	WOBBLE	arc-sec	20	15	10	20	15	10	20	15	10	20	15	10
RESOLUTION	XY	nanometers	~ 5 nm			~ 5 nm			~ 5 nm			~ 5 nm		
	Z	nanometers	~ 5 nm			~ 5 nm			~ 5 nm			~ 5 nm		
	PITCH AND ROLL	arc-sec	~ 0.15			~ 0.15			~ 0.15			~ 0.15		
	YAW	arc-sec	0.04			0.04			0.04			0.04		
MOTION PROFILE SPECIFICATIONS														
MAX LINEAR VELOCITY [3]	XY	mm/s	50			100			50			100		
	Z	mm/s	15			15			15			15		
MAX LINEAR ACCELERATION [3]	XY	G	0.1			0.3			0.1			0.3		
	Z	G	0.3			0.3			0.3			0.3		
MAX ANGULAR VELOCITY [3]	PITCH AND ROLL	deg/sec	20			20			20			20		
	YAW	deg/sec	>3000			>3000			>3000			>3000		
MAX ANGULAR ACCELERATION [3]	PITCH AND ROLL	deg/sec^2	>1000			>1000			>1000			>1000		
	YAW	deg/sec^2	>2000			>2000			>2000			>2000		
MAX PAYLOAD		kg	5-10 kg			5-10 kg			5 kg			5-10 kg		
PAYLOAD CENTER OF GRAVITY [12]	MAX XY OFFSET	mm	20			20			20			20		
	MAX Z OFFSET	mm	30			30			30			30		
ASSEMBLY MASS		kg				15			14			30		
MOVING MASSES	X	kg				13			11			22		
	Y	kg				8			6			10		
	Z	kg	2			2			2			2		
	YAW	kg	0.3			0.3			0.3			0.3		
YAW MASS MOMENT OF INERTIA		kg*mm^2	242			242			242			242		



Notes:

1. Specifications measured on stage centerline, 50mm above mounting surface. ALIO provides NIST traceable proof for all options/specs per quote.
2. Flatness specifications dependent on system base. Contact ALIO for more information.
3. Stage limitation at no load. Does not account for drive or resolution limitations.
4. Back EMF plus IR drop must not exceed maximum line to line bus voltage.
5. Resistance values do not include cable resistance. Cable resistance adds approximately 0.2 ohm/m.
6. Continuous operating limits are based on continuous operation at maximum temperature with aluminum heat sink (300mm x 12.5mm x motor length).
7. Maximum on time at peak operating limits is 10 seconds.
8. All electrical specifications may vary by 12% from listed values.
9. Additional motor and travel options are available for each stage for optimized performance as necessary per customer requirements.
10. 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.
11. 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.
12. 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.
13. "Conical Tilt" is the max tilt angle the top mounting surface of the hexapod can be tilted in any direction. The hexapod can sweep a cone at this angle around a full Theta Z rotation at the listed Z axis mid-stroke position and with the TCP at zero. Deviation from these Z and TCP limitations reduces angular travel.
14. Compound angular travel specified is the max combined +/- pitch and +/- roll travel that can be performed as a compound angle. This max travel is specified at the listed Z axis mid-stroke position and TCP at zero. Deviation from these Z and TCP limitations reduces angular travel.
15. Volumetric travel is X, Y, and Z rectangular prism the hexapod can sweep throughout with no limitations. Z travel does not reduce XY travel. This volume is specified with all angular travels at zero degrees.

DRAWN	K. CHAFFER	12/18/2019
CHECKED		
Tolerances: x.x ± 0.5 mm, x.xx ± 0.13 mm, x.xxx ± 0.05 mm, ANGLES ± 0.5°	Surface Roughness: √ RMS MAX.	
MATERIAL		
FINISH	SEE NOTES	

ALIO 6-D

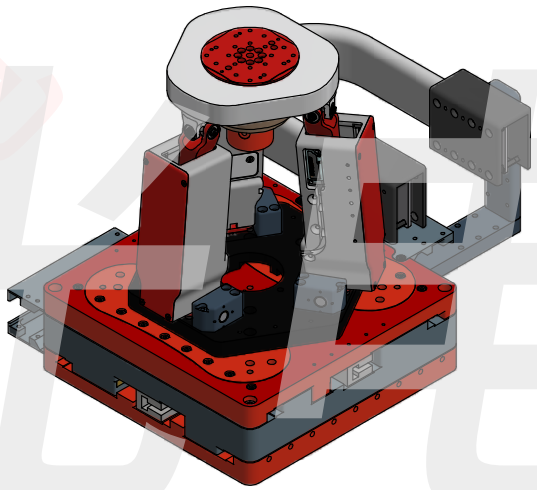
TITLE

AI-HH-30D-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMETER)R

SIZE		DWG NO	REV
B		0010-09990	002

SCALE | 0090-07999-015 ALIO STD TEMPLATE | SHEET 2 OF 3

MODEL	UNITS	AI-HH-30D-60XY-62Z-80R	AI-HH-30D-100XY-62Z-80R	AI-HH-30D-200XY-62Z-80R-CM	AI-HH-30D-200XY-62Z-80R
XY MOTOR INFORMATION					
MOTOR TYPE	--	FRAMELESS TORQUE AC SERVO MOTOR WITH PRECISION BALL SCREW	LINEAR BRUSHLESS AC SERVO MOTOR	LINEAR BRUSHLESS AC SERVO MOTOR	EAR BRUSHLESS AC SERVO MOT
MOTOR MODEL	--		P12-2	C12-2	P16-2
MAGNETIC PITCH (N-N)	mm	XY MOTOR SAME AS TRIPOD MOTOR IN SECTION BELOW	30.48	30.48	30.48
MAX VOLTAGE (LINE TO LINE) [4]	V		500	500	500
ELECTRICAL TIME CONSTANT	msec		0.19	0.2	0.2
MAX MOTOR TEMP	°C		130	130	130
THERMAL SENSOR	--		NEGATIVE COEFFICIENT THERMISTOR	NEGATIVE COEFFICIENT THERMISTOR	GATIVE COEFFICIENT THERMIST
MOTOR CONNECTION	--		DELTA	DELTA	DELTA
FORCE CONSTANT	N/Apk		16.3	7.1	28.7
PHASE RESISTANCE (@25°C) [5]	Ohm		11.6	5.8	11.7
PHASE RESISTANCE (@130°C) [5]	Ohm		16.4	8.3	16.6
INDUCTANCE	mH		2.1	1.2	2.3
CONTINUOUS FORCE [6]	N		47	19.8	93
CONTINUOUS CURRENT [6]	Apk		2.9	2.8	3.2
PEAK FORCE [7]	N		151	42	295
PEAK CURRENT [7]	Apk		9.2	6	10.3
BACK EMF CONSTANT	V/m/s		16.3	7.1	28.7
TRIPOD MOTOR INFORMATION					
MOTOR TYPE	--	FRAMELESS TORQUE AC SERVO MOTOR	FRAMELESS TORQUE AC SERVO	FRAMELESS TORQUE AC SERVO MOTOR	FRAMELESS TORQUE AC
MOTOR MODEL	--	AI-TM-32A8-Y	AI-TM-32A8-Y	AI-TM-32A8-Y	AI-TM-32A8-Y
MAGNETIC PITCH (N-N)	deg	180	180	180	180
MAX VOLTAGE (LINE TO LINE) [4]	VDC	340	340	340	340
MAX MOTOR TEMP	°C	155	155	155	155
THERMAL SENSOR	--	NONE	NONE	NONE	NONE
MOTOR CONNECTION	--	WYE	WYE	WYE	WYE
TORQUE CONSTANT	Nm/Arms	0.03	0.03	0.03	0.03
PHASE RESISTANCE (@25°C) [5]	Ohm	2.2	2.2	2.2	2.2
INDUCTANCE	mH	1.1	1.1	1.1	1.1
CONTINUOUS TORQUE [6]	Nm	0.08	0.08	0.08	0.08
CONTINUOUS CURRENT [6]	Arms	2.8	2.8	2.8	2.8
PEAK TORQUE [7]	Nm	0.26	0.26	0.26	0.26
PEAK CURRENT [7]	Arms	8.8	8.8	8.8	8.8
BACK EMF CONSTANT	Vrms/krpm	1.8	1.8	1.8	1.8
YAW (ROTARY) MOTOR INFORMATION					
MOTOR TYPE	--	FRAMELESS TORQUE AC SERVO MOTOR	FRAMELESS TORQUE AC SERVO MOTOR	FRAMELESS TORQUE AC SERVO MOTOR	MELESS TORQUE AC SERVO MO
MOTOR MODEL	--	AI-TM-65BY-Y	AI-TM-65BY-Y	AI-TM-65BY-Y	AI-TM-65BY-Y
MAGNETIC PITCH (N-N)	deg	90	90	90	90
MAX VOLTAGE (LINE TO LINE) [4]	VDC	420	420	420	420
MAX MOTOR TEMP	°C	100	100	100	100
THERMAL SENSOR	--	NONE	NONE	NONE	NONE
MOTOR CONNECTION	--	WYE	WYE	WYE	WYE
TORQUE CONSTANT	Nm/Arms	0.12	0.118	0.118	0.118
PHASE RESISTANCE (@25°C) [5]	Ohm	0.8	0.799	0.799	0.799
INDUCTANCE	mH	1.6	1.62	1.62	1.62
CONTINUOUS TORQUE [6]	Nm	0.7	0.66	0.66	0.66
CONTINUOUS CURRENT [6]	Arms	5.6	5.61	5.61	5.61
PEAK TORQUE [7]	Nm	0.9	0.85	0.85	0.85
PEAK CURRENT [7]	Arms	7.6	7.58	7.58	7.58
BACK EMF CONSTANT	Vrms/krpm	7.2	7.2	7.2	7.2



Notes:

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DRAWN K. CHAFFER 12/18/2019

CHECKED

Tolerances: Surface Roughness:
x.x ± 0.5 mm
x.xx ± 0.13 mm
x.xxx ± 0.05 mm √ RMS MAX.
ANGLES ± 0.5°

MATERIAL

FINISH SEE NOTES

ALIO 6-D

TITLE

AI-HH-30D-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMETER)R

SIZE	DWG NO	REV
B	0010-09990	002

SCALE | 0090-07999-015 ALIO STD TEMPLATE | SHEET 3 OF 3