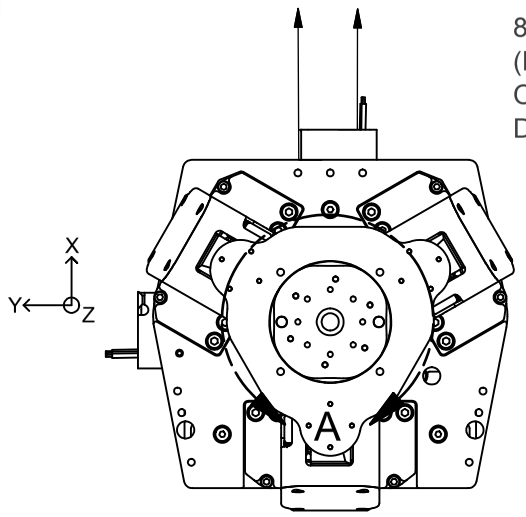
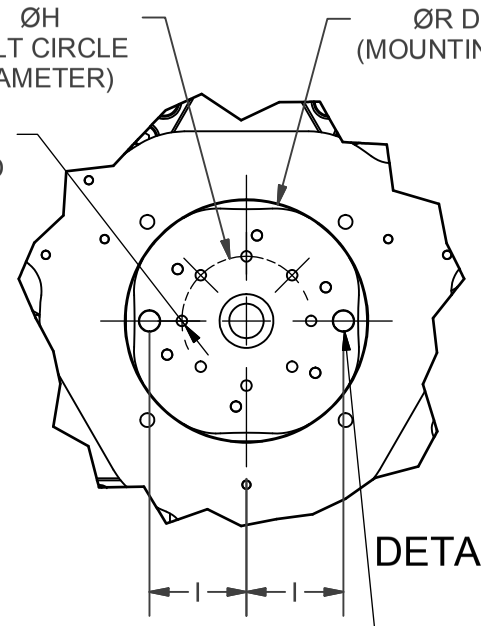
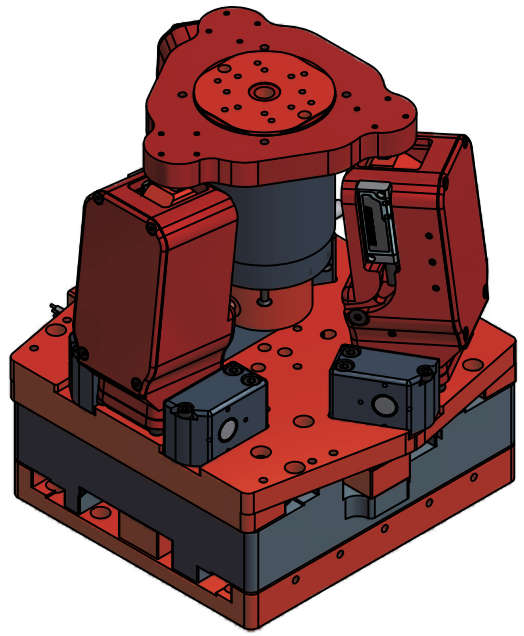
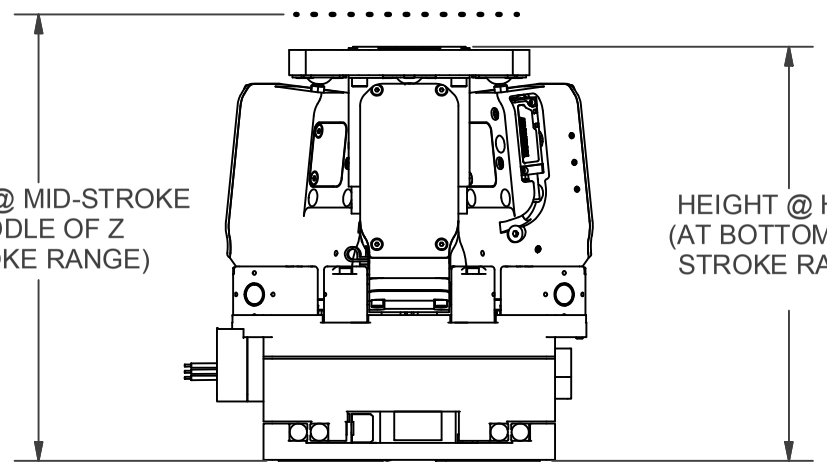
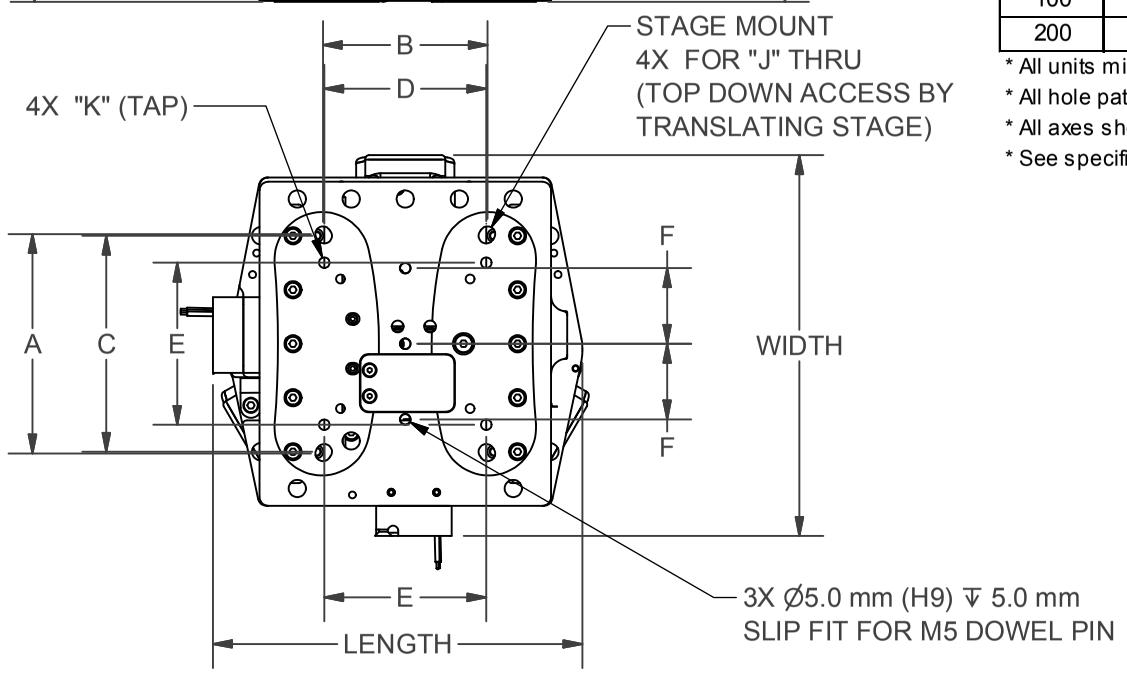










NOTE: MODEL AI-HH-60XY-15Z-56RT SHOWN.

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)	15 mm
Angular Travel (Tripod)	+/- 10 degrees (Pitch and Roll), 360 degrees continuous (Yaw)
Max Payload	2.5 - 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 Optional: Brake and High Torque Models
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	OPTION	LENGTH	WIDTH	HEIGHT @ HOME	HEIGHT @ MID-STROKE	A (inch)	B (inch)	C	D	E	F	H	I	J	K	L
60	15	+/- 10 degrees	56	--	171	177	191.7	199.7	4	3	100	75	75	35	30	22.5	M6 or 1/4-20	M6	M3
60	15	+/- 10 degrees	56	56RT	171	177	191.7	199.7	4	3	100	75	75	35	30	22.5	M6 or 1/4-20	M6	M3
60	15	+/- 10 degrees	56	CM	164	165	175.2	183.2	4	3	100	75	75	35	30	22.5	M6 or 1/4-20	M6	M3
60	15	+/- 10 degrees	56	LM	165	164	215.2	223.2	5	4	125	75	100	35	30	22.5	M6 or 1/4-20	M6	M3
100	15	+/- 10 degrees	56	CM	236	184	195.2	203.2	6	4	125	100	120	70	30	22.5	M6 or 1/4-20	M5	M3
200	15	+/- 10 degrees	56	CM	336.5	275	195.2	203.2	6	6	175	125	170	70	30	22.5	M6 or 1/4-20	M6	M3

* 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.

DRAWN	NBROWN	01/11/2017
CHECKED	NBROWN	01/11/2017
Tolerances: x.x ± .05 in, x.xx ± .01 in, x.xxx ± .005 in, ANGLES ± 0.5°	Surface Roughness: √ RMS MAX.	
MATERIAL		
FINISH	SEE NOTES	

ALIO 6-D

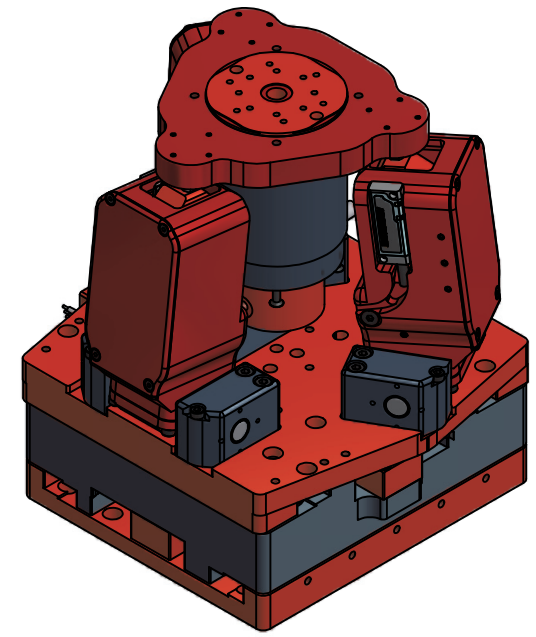
TITLE
AI-HH-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMETER)RT-(OPTION)

SIZE	DWG NO	REV
B	0010-08045	002

SCALE	ALIO STD TEMPLATE - REV 006	SHEET 1 OF 3

ALIO HYBRID HEXAPOD PERFORMANCE SPECIFICATIONS

MODEL		UNITS	AI-HH-60XY-15Z-56R			AI-HH-60XY-15Z-56RT			AI-HH-60XY-15Z-56R-CM			AI-HH-60XY-15Z-56R-LM			AI-HH-100XY-15Z-56R-CM			AI-HH-200XY-15Z-56R-CM		
OPTION		--	--			"56RT" =HIGH TORQUE THETA Z AXIS (Available on any Model)			"CM"=LOW FORCE LINEAR MOTOR XY			"LM"=HIGH FORCE LINEAR MOTOR XY			"CM"=LOW FORCE LINEAR MOTOR XY			"CM"=LOW FORCE LINEAR MOTOR XY		
XY TRAVEL		mm	60			60			60			60			100			200		
Z TRAVEL		mm	15			15			15			15			15			15		
PITCH AND ROLL TRAVEL [10]		deg	+/- 10			+/- 10			+/- 10			+/- 10			+/- 10			+/- 10		
YAW TRAVEL		deg	360 deg continuous			360 deg continuous			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	(STD)	ULTRA	NANO	(STD)	ULTRA	NANO
BIDIRECTIONAL REPEATABILITY	XY	nanometers	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70	+/- 100		+/- 70
	Z	nanometers	+/- 100		+/- 70	+/- 100		+/- 70	+/- 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	+/- 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	+/- 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)			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			< 20			< 20		
	Z	nanometers	< 20			< 20			< 20			< 20			< 20			< 20		
	PITCH AND ROLL	arc-sec	< 0.1			< 0.1			< 0.1			< 0.1			< 0.1			< 0.1		
	YAW	arc-sec	< 0.1			< 0.1			< 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			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	15	12	10	15	12	10	15	12	10	15	12	10
	RADIAL RUNOUT	um	15	12	10	15	12	10	15	12	10	15	12	10	15	12	10	15	12	10
	WOBBLE	arc-sec	25	20	15	25	20	15	25	20	15	25	20	15	25	20	15	25	20	15
RESOLUTION	XY	nanometers	~5 nm			~5 nm			~5 nm			~5 nm			~5 nm			~5 nm		
	Z	nanometers	~5 nm			~5 nm			~5 nm			~5 nm			~5 nm			~5 nm		
	PITCH AND ROLL	arc-sec	~0.04			~0.04			~0.04			~0.04			~0.04			~0.04		
	YAW	arc-sec	0.04			0.04			0.04			0.04			0.04			0.04		
MOTION PROFILE SPECIFICATIONS																				
MAX LINEAR VELOCITY [3]	XY	mm/s	100			100			50			150			50			50		
	Z	mm/s	15			15			15			15			15			15		
MAX LINEAR ACCELERATION [3]	XY	G	0.3			0.3			0.1			0.3			0.1			0.1		
	Z	G	0.3			0.3			0.3			0.3			0.3			0.3		
MAX ANGULAR VELOCITY [3]	PITCH AND ROLL	deg/sec	30			30			30			30			30			30		
	YAW	deg/sec	1800			3000			1800			1800			1800			1800		
MAX ANGULAR ACCELERATION [3]	PITCH AND ROLL	deg/sec^2	>1000			>1000			>1000			>1000			>1000			>1000		
	YAW	deg/sec^2	>1800			>7200			>1800			>1800			>1800			>1800		
MAX PAYLOAD (w/ Standard Rotary)		kg	2.5			--			2.5			2.5			2.5			2.5		
MAX PAYLOAD (w/ 56RT Rotary Upgrade)		kg	5			5			5			5			5			5		
PAYLOAD CENTER OF GRAVITY [12]	MAX XY OFFSET	mm	30			100			30			30			30			30		
	MAX Z OFFSET	mm	100			100			100			100			100			100		
COUNTERBALANCE PRESSURE [13]		psi	n/a			n/a			n/a			n/a			n/a			n/a		
ASSEMBLY MASS		kg	5.7			6.0			5.3			7.0			8.6			16.0		
MOVING MASSES	X	kg	4.9			5.2			4.6			6.1			7.1			11.3		
	Y	kg	3.7			4.0			3.4			3.9			4.2			6.2		
	Z	kg	1.00			1.30			1.00			1.00			1.00			1.00		
	YAW	kg	0.25			0.32			0.25			0.25			0.25			0.25		
YAW MASS MOMENT OF INERTIA		kg*mm^2	85			110			85			85			85			85		



ALIO INDUSTRIES PROPRIETARY DOCUMENT
5335 XENON ST, ARVADA, CO 80002 USA
(Tel) 303.339.7500 - WWW.ALIOINDUSTRIES.COM

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. Pneumatic counterbalance supply pressure specified is the estimated pressure required at the max payload.

DRAWN	NBROWN	01/11/2017
CHECKED	NBROWN	01/11/2017
Tolerances: x.x ± .05 in, x.xx ± .01 in, x.xxx ± .005 in, ANGLES ± 0.5°	Surface Roughness: √ RMS MAX.	
MATERIAL		
FINISH	SEE NOTES	

ALIO 6-D

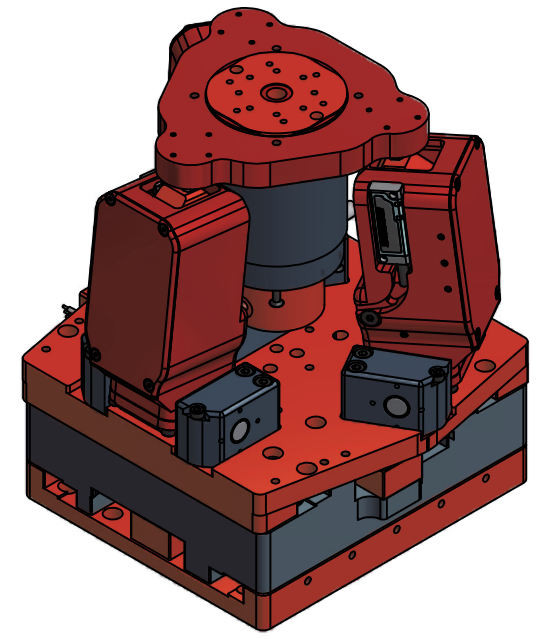
TITLE: AI-HH-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMETER)RT-(OPTION)

SIZE	DWG NO	REV
B	0010-08045	002

SCALE | ALIO STD TEMPLATE - REV 006 | SHEET 2 OF 3

ALIO MOTOR SPECIFICATIONS

MODEL	UNITS	AI-HH-60XY-15Z-56R	AI-HH-60XY-15Z-56RT	AI-HH-60XY-15Z-56R-CM	AI-HH-60XY-15Z-56R-LM	AI-HH-100XY-15Z-56R-CM	AI-HH-200XY-15Z-56R-CM
OPTION	--	--	"56RT" =HIGH TORQUE THETA Z AXIS	"CM"=LOW FORCE LINEAR MOTOR XY	"LM"=HIGH FORCE LINEAR MOTOR XY	"CM"=LOW FORCE LINEAR MOTOR XY	"CM"=LOW FORCE LINEAR MOTOR XY
XY MOTOR INFORMATION							
MOTOR TYPE	--	FRAMELESS TORQUE AC SERVO MOTOR		LINEAR BRUSHLESS AC SERVO MOTOR			
MOTOR MODEL	--	WITH PRECISION BALL SCREW		AI-CM-144ASP-D	AI-LM-144ASN-D	AI-CM-144ASP-D	AI-CM-144BSP-D
MAGNETIC PITCH (N-N)	mm			30.48	30.48	30.48	30.48
MAX VOLTAGE (LINE TO LINE) [4]	V			500	500	500	500
ELECTRICAL TIME CONSTANT	msec			0.20	0.19	0.20	0.20
MAX MOTOR TEMP	°C			130	130	130	130
THERMAL SENSOR	--			POS. COEFF. THERMISTOR	NEG. COEFF. THERMISTOR	POS. COEFF. THERMISTOR	POS. COEFF. THERMISTOR
MOTOR CONNECTION	--			DELTA	DELTA	DELTA	DELTA
FORCE CONSTANT	N/Apk	XY MOTOR IS SAME AS TRIPOD MOTOR IN SECTION BELOW	XY MOTOR IS SAME AS TRIPOD MOTOR IN SECTION BELOW	3.5	8.1	3.5	7.1
PHASE RESISTANCE (@25° C) [5]	Ohm			2.9	5.8	2.9	5.8
PHASE RESISTANCE (@130° C) [5]	Ohm			4.2	8.2	4.2	8.3
INDUCTANCE	mH			0.6	1.1	0.6	1.2
CONTINUOUS FORCE [6]	N			10.0	23.0	10.0	19.8
CONTINUOUS CURRENT [6]	Apk			2.8	2.9	2.8	2.8
PEAK FORCE [7]	N			21	75	21	42
PEAK CURRENT [7]	Apk			6.0	9.2	6.0	6.0
BACK EMF CONSTANT	V/m/s			3.5	8.1	3.5	7.1
TRIPOD MOTOR INFORMATION							
MOTOR TYPE	--	FRAMELESS TORQUE AC SERVO MOTOR WITH PRECISION BALL SCREW					
MOTOR MODEL	--	AI-TM-32A8-Y	AI-TM-32A8-Y	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	180	180
MAX VOLTAGE (LINE TO LINE) [4]	VDC	340	340	340	340	340	340
MAX MOTOR TEMP	°C	155	155	155	155	155	155
THERMAL SENSOR	--	NONE	NONE	NONE	NONE	NONE	NONE
MOTOR CONNECTION	--	WYE	WYE	WYE	WYE	WYE	WYE
TORQUE CONSTANT	Nm/Arms	0.030	0.030	0.030	0.030	0.030	0.030
PHASE RESISTANCE (@25° C) [5]	Ohm	2.2	2.2	2.2	2.2	2.2	2.2
INDUCTANCE	mH	1.1	1.1	1.1	1.1	1.1	1.1
CONTINUOUS TORQUE [6]	Nm	0.08	0.08	0.08	0.08	0.08	0.08
CONTINUOUS CURRENT [6]	Arms	2.8	2.8	2.8	2.8	2.8	2.8
PEAK TORQUE [7]	Nm	0.26	0.26	0.26	0.26	0.26	0.26
PEAK CURRENT [7]	Arms	8.8	8.8	8.8	8.8	8.8	8.8
BACK EMF CONSTANT	Vrms/krpm	1.8	1.8	1.8	1.8	1.8	1.8
YAW (ROTARY) MOTOR INFORMATION							
MOTOR TYPE	--	FRAMELESS TORQUE AC SERVO MOTOR					
MOTOR MODEL	--	AI-TM-44AE-Y	AI-TM-44B8-Y	AI-TM-44AE-Y	AI-TM-44AE-Y	AI-TM-44AE-Y	AI-TM-44AE-Y
MAGNETIC PITCH (N-N)	deg	120	120	120	120	120	120
MAX VOLTAGE (LINE TO LINE) [4]	VDC	340	340	340	340	340	340
MAX MOTOR TEMP	°C	155	155	155	155	155	155
THERMAL SENSOR	--	NONE	NONE	NONE	NONE	NONE	NONE
MOTOR CONNECTION	--	WYE	WYE	WYE	WYE	WYE	WYE
TORQUE CONSTANT	Nm/Arms	0.09	0.11	0.1	0.1	0.1	0.1
PHASE RESISTANCE (@25° C) [5]	Ohm	4.5	2.4	4.5	4.5	4.5	4.5
INDUCTANCE	mH	3.2	2.5	3.2	3.2	3.2	3.2
CONTINUOUS TORQUE [6]	Nm	0.2	0.36	0.2	0.2	0.2	0.2
CONTINUOUS CURRENT [6]	Arms	2.3	3.2	2.3	2.3	2.3	2.3
PEAK TORQUE [7]	Nm	0.7	1.16	0.7	0.7	0.7	0.7
PEAK CURRENT [7]	Arms	7.3	10.1	7.3	7.3	7.3	7.3
BACK EMF CONSTANT	Vrms/krpm	5.5	6.9	5.5	5.5	5.5	5.5



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DRAWN	NBROWN	01/11/2017
CHECKED	NBROWN	01/11/2017
Tolerances: x.x ± .05 in, x.xx ± .01 in, x.xxx ± .005 in, ANGLES ± 0.5°	Surface Roughness: √ RMS MAX.	
MATERIAL		
FINISH	SEE NOTES	

ALIO 6-D

TITLE: AI-HH-(XY TRAVEL)XY-(Z TRAVEL)Z-(R DIAMETER)RT-(OPTION)

SIZE	DWG NO	REV
B	0010-08045	002

SCALE | ALIO STD TEMPLATE - REV 006 | SHEET 3 OF 3