ALAR Series

Direct Drive, Large-Aperture, Rotary Stage

- 5 different aperture sizes: 100 mm, 150 mm, 200 mm, 250 mm, 325 mm
- Continuous or limited travel
- Axial load capacity up to 595 kg
- Large bearings provide high payload and moment load capacity
- Excellent accuracy and repeatability
- Superior bearing performance and low tilt error
- Cog free motor provides smooth motion
- No accuracy changes over time from gear wear
- 45-300 rpm continuous rotation speed
- Perfect for applications with payloads that must be at the center of rotation; great for AZ roll gimbal applications
- Vac 10^{-6} torr compatible versions available
- Absolute encoder options

Aerotech's ALAR series direct-drive rotary stages provide superior angular positioning and velocity control with exceptionally large apertures. With the combination of a large aperture and direct-drive motor, the ALAR series makes worm-drive large aperture stages a thing of the past.

Advantage ALAR

Now customers can get large aperture rotary stages with zero backlash, and no gear wear or gear vibration as is commonly seen in worm-drive stages. The other added benefit is that direct drive is significantly faster than worm drive, so testing can be completed in less time. In production settings, this equates to faster testing, lower cost manufacturing, and higher profits. From the standpoint of system accuracy and repeatability, the stage will maintain its performance over time with no need for maintenance because there are no gears to wear out. With higher accuracy and no backlash, customers can produce more accurate products because their test system is now more accurate.

Applications

Applications for the ALAR include single and multiaxis electro-optic sensor testing, missile seeker testing, antenna testing, inertial navigation device testing, photonic component alignment, high-accuracy laser machining, and precision wafer inspection. These include testing in vacuum to 10^{-6} torr. These rotary stages can also be configured as multiaxis gimbals.

High Speed

ALAR stages can operate between 45-300 rpm depending on the particular model selected. This speed range is significantly higher than gear-drive stages of similar size.

Superior Mechanical Design

Angular contact bearings are used to maximize performance with respect to tilt error, moment stiffness and rotating friction. A precision-machined shaft further minimizes tilt error. The design incorporates integral connections that minimize cable issues. The ALAR works especially well in applications that require 360° continuous motion but have limited space. The stage is 65-160 mm tall and provides smooth motion without travel restrictions.

Brushless Direct-Drive

To maximize positioning performance, the ALAR series utilizes Aerotech's brushless, slotless motors. This motor has all of the advantages of a brushless direct-drive motor – no brushes to wear, no gear trains to maintain, and high acceleration and high speeds. Since it is a slotless,

ALAR Series SPECIFICATIONS

ironless design, there is zero cogging, meaning there is absolutely no torque ripple. This makes the ALAR ideal for applications requiring outstanding contoured motion, smooth scan velocity, or precise incremental steps.

High Payload Capacity and Large Moment Load Stiffness

The ALAR comes in two different configurations. The standard profile (SP) unit has high payload capacity and high moment load stiffness so it can handle applications where its rotation axis is parallel or perpendicular to gravity and the payload center of gravity is cantilevered away from the stage. The low profile (LP) unit has high payload capacity and is good for applications where the axis of rotation is parallel to gravity. Both the SP and LP units have the same aperture options and motor options. Either SP or LP stages can handle between 300-1000 lb of axial load.

Accurate Positioning

Performance is assured with encoder line counts from 31000 to 74000 per rev, resulting in resolutions from 0.02 arc-sec/count to 0.009 arc-sec/count. The motor and high-performance rotary encoder are directly coupled to a common shaft. The absence of gear trains and mechanical couplings means no position errors caused by hysteresis, windup, or backlash. As a result, accuracy of ±3.9 arc-sec and bi-directional repeatability of ±0.5 arc-sec is attainable.

Flexible Configurations

Aerotech manufactures a wide range of servo amplifiers and advanced controllers to provide a complete, integrated package.

ALAR Series		ALAR-100-SP	ALAR-100-LP	ALAR-150-SP	ALAR-150-LP
Aperture		100 mm (3.94 in)	100 mm (3.94 in)	150 mm (5.91 in)	150 mm (5.91 in)
Motor		S-180-44-A	Brushless Slotless	S-240-43-A	Brushless Slotless
Continuous Current	A_{pk}	2.7	5.76	6.2	5.41
	A_{rms}	1.9	4.1	4.4	4.1
Peak Current, Stall	A_{pk}	10.8	33.5	24.8	31.4
	A_{rms}	7.6	23.7	17.5	22.2
Bus Voltage		Up to 340 VDC			
Length		250 mm (9.84 in)	250 mm (9.84 in)	300 mm (11.81 in)	300 mm (11.81 in)
Width		250 mm (9.84 in)	250 mm (9.84 in)	300 mm (11.81 in)	300 mm (11.81 in)
Height		100 mm (3.94 in)	65 mm (2.56 in)	100 mm (3.94 in)	65 mm (2.56 in)
Unlimited Travel		Yes			
Maximum Limited Travel		±170°	±170°	±170°	±170°
Maximum Velocity @ 160 V Bus(1)		300 rpm	50 rpm	250 rpm	45 rpm
Maximum Acceleration		1364 rad/s²	1009 rad/s²	1330 rad/s²	829 rad/s²
Resolution(2)		0.1 µrad (0.02 arc-sec)	0.1 µrad (0.02 arc-sec)	0.08 µrad (0.016 arc-sec)	0.09 µrad (0.018 arc-sec)
Maximum Torque		23.9 N·m	17.5 N·m	42.9 N·m	22.9 N·m
Continuous Torque		6.0 N·m	3.0 N·m	10.7 N·m	4.0 N·m
Stage Mass		16.3 kg	8.3 kg	18.6 kg	9.8 kg
Stage Mass with Limits		17 kg	8.9 kg	19.6 kg	10.8 kg
Shaft Inertia		0.022 kg·m²	0.022 kg·m²	0.040 kg·m²	0.031 kg·m²
Shaft Inertia with Limits		0.026 kg·m²	0.026 kg·m²	0.051 kg·m²	0.042 kg·m²
Axial Load		1550 N (348 lb)	1175 N (264 lb)	1950 N (438 lb)	1325 N (298 lb)
Radial Load		1350 N (303 lb)	950 N (214 lb)	1925 N (433 lb)	1275 N (287 lb)
Moment Load		250 N·m	150(3) N·m	450 N·m	225(3) N·m
Repeatability		±2.4 µrad (±0.5 arc sec)			
Accuracy(4)		±9.7 µrad (±2 arc sec)			
Tilt-Error Motion		9.7 µrad (2.0 arc sec)			

Note:
1. Square-wave digital encoder options will limit maximum speed below the listed value. Contact factory for specific stage and encoder speed combination.
2. Resolution assumes -AS encoder with 2000X controller multiplication.
3. The ALAR-LP base must be fully supported by a rigid mounting plate to achieve this moment load.
4. Certified with each stage. Requires the use of an Aerotech controller.

ALAR Series SPECIFICATIONS

ALAR Series		ALAR-200-SP	ALAR-200-LP	ALAR-250-SP-2	ALAR-250-SP-3	ALAR-250-LP
Aperture		200 mm (7.87 in)	200 mm (7.87 in)	250 mm (9.84 in)	250 mm (9.84 in)	250 mm (9.84 in)
Motor		Brushless Slotless				
Continuous Current	A_{pk}	5.3	5.3	5.3	7.95	5.3
	A_{rms}	3.75	3.75	3.75	5.62	3.75
Peak Current, Stall	A_{pk}	34.8	34.8	34.8	52.2	34.8
	A_{rms}	24.6	24.6	24.6	36.9	24.6
Bus Voltage		Up to 340 VDC				
Length		400 mm (15.75 in)	400 mm (15.75 in)	450 mm (17.72 in)	450 mm (17.72 in)	450 mm (17.72 in)
Width		400 mm (15.75 in)	400 mm (15.75 in)	450 mm (17.72 in)	450 mm (17.72 in)	450 mm (17.72 in)
Height		150 mm (5.91 in)	100 mm (3.94 in)	150 mm (5.91 in)	150 mm (5.91 in)	100 mm (3.94 in)
Unlimited Travel		Yes				
Maximum Limited Travel		±170°	±170°	±170°	±170°	±170°
Maximum Velocity[1]		90 rpm	90 rpm	140 rpm	140 rpm	90 rpm
Maximum Acceleration		361 rad/s²	570 rad/s²	287 rad/s²	287 rad/s²	407 rad/s²
Resolution[2]		0.06 µrad (0.012 arc-sec)	0.07 µrad (0.014 arc-sec)	0.05 µrad (0.01 arc-sec)	0.05 µrad (0.01 arc-sec)	0.05 µrad (0.01 arc-sec)
Maximum Torque		126.8 N·m	126.8 N·m	137.8 N·m	206.7 N·m	147.9 N·m
Continuous Torque		19.3 N·m	19.3 N·m	21.0 N·m	31.5 N·m	22.5 N·m
Stage Mass		40.4 kg	28.2 kg	51.3 kg	51.3 kg	35.0 kg
Stage Mass with Limits		43.1 kg	30.1 kg	54.5 kg	54.5 kg	37.4 kg
Shaft Inertia		0.320 kg·m²	0.190 kg·m²	0.500 kg·m²	0.500 kg·m²	0.310 kg·m²
Shaft Inertia with Limits		0.359 kg·m²	0.229 kg·m²	0.573 kg·m²	0.573 kg·m²	0.383 kg·m²
Axial Load		4675 N (1051 lb)	4350 N (978 lb)	4950 N (1113 lb)	4950 N (1113 lb)	4950 N (1113 lb)
Radial Load		4775 N (1073 lb)	4125 N (927 lb)	5200 N (1169 lb)	5200 N (1169 lb)	5050 N (1135 lb)
Moment Load		1600 N·m	1075[3] N·m	1825 N·m	1825 N·m	1475[3] N·m
Repeatability		±2.4 µrad (±0.5 arc sec)				
Accuracy[4]		±9.7 µrad (±2 arc sec)				
Tilt-Error Motion		9.7 µrad (2.0 arc sec)				

Note:
1. Square-wave digital encoder options will limit maximum speed below the listed value. Contact factory for specific stage and encoder speed combination.
2. Resolution assumes -AS encoder with 2000X controller multiplication.
3. The ALAR-LP base must be fully supported by a rigid mounting plate to achieve this moment load.
4. Certified with each stage. Requires the use of an Aerotech controller.

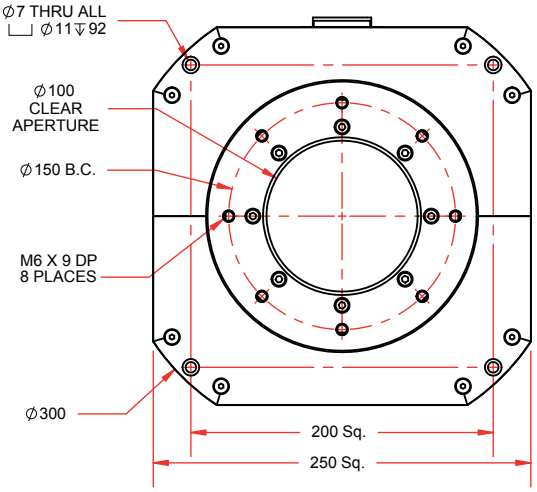
ALAR Series SPECIFICATIONS

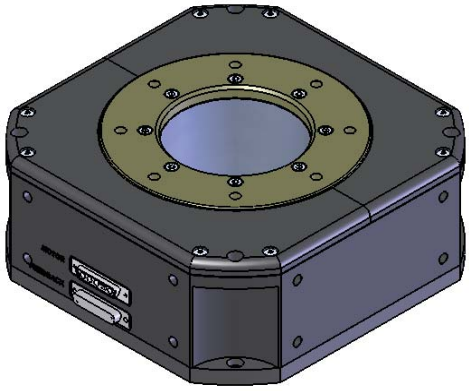
ALAR Series		ALAR-325-SP-2	ALAR-325-SP-3	ALAR-325-LP
Aperture		325 mm (12.80 in)	325 mm (12.80 in)	325 mm (12.80 in)
Motor		Brushless Slotless		
Continuous Current	A_{pk}	5.1	7.65	5.1
	A_{rms}	3.63	5.41	3.63
Peak Current, Stall	A_{pk}	31.2	46.8	31.2
	A_{rms}	22.1	33.1	22.1
Bus Voltage		Up to 340 VDC		
Length		525 mm (20.67 in)	525 mm (20.67 in)	525 mm (20.67 in)
Width		525 mm (20.67 in)	525 mm (20.67 in)	525 mm (20.67 in)
Height		150 mm (5.91 in)	150 mm (5.91 in)	100 mm (3.94 in)
Unlimited Travel		Yes		
Maximum Limited Travel		±170°	±170°	±170°
Maximum Velocity(1)		150 rpm	150 rpm	120 rpm
Maximum Acceleration		185 rad/s^2	185 rad/s^2	339 rad/s^2
Resolution(2)		0.04 µrad (0.009 arc-sec)	0.04 µrad (0.009 arc-sec)	0.04 µrad (0.009 arc-sec)
Maximum Torque		213.8 N·m	320.8 N·m	213.8 N·m
Continuous Torque		35.0 N·m	52.4 N·m	35.0 N·m
Stage Mass		61.2 kg	61.2 kg	44.5 kg
Stage Mass with Limits		64.9 kg	64.9 kg	49.9 kg
Shaft Inertia		1.01 kg·m^2	1.01 kg·m^2	0.55 kg·m^2
Shaft Inertia with Limits		1.2 kg·m^2	1.2 kg·m^2	0.675 kg·m^2
Axial Load		5825 N (1310 lb)	5825 N (1310 lb)	5825 N (1310 lb)
Radial Load		6650 N (1495 lb)	6650 N (1495 lb)	6450 N (1450 lb)
Moment Load		2650 N·m	2650 N·m	2200(3) N·m
Repeatability		±2.4 µrad (±0.5 arc sec)		
Accuracy(4)		±9.7 µrad (±2 arc sec)		
Tilt-Error Motion		9.7 µrad (2.0 arc sec)		

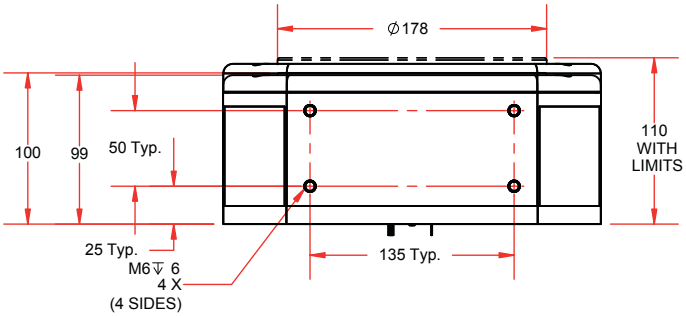
Note:
1. Square-wave digital encoder options will limit maximum speed below the listed value. Contact factory for specific stage and encoder speed combination.
2. Resolution assumes -AS encoder with 2000X controller multiplication.
3. The ALAR-LP base must be fully supported by a rigid mounting plate to achieve this moment load.
4. Certified with each stage. Requires the use of an Aerotech controller.

ALAR Series DIMENSIONS

ALAR-100-SP







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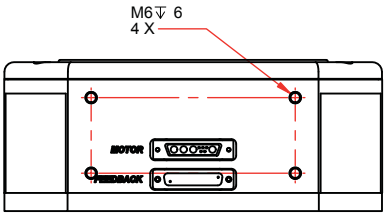
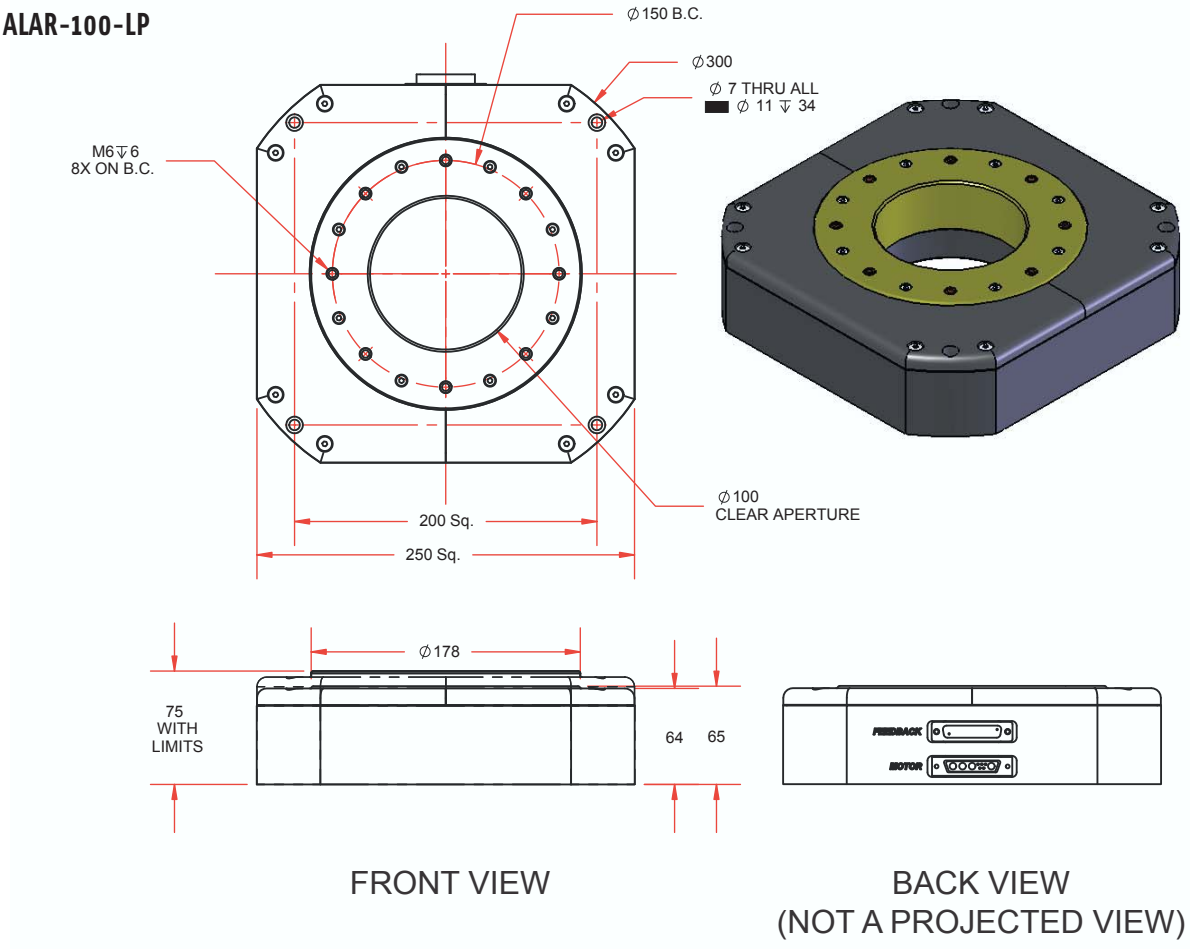


BACK VIEW
(NOT A PROJECTED VIEW)

ALAR Series DIMENSIONS

ALAR-100-LP

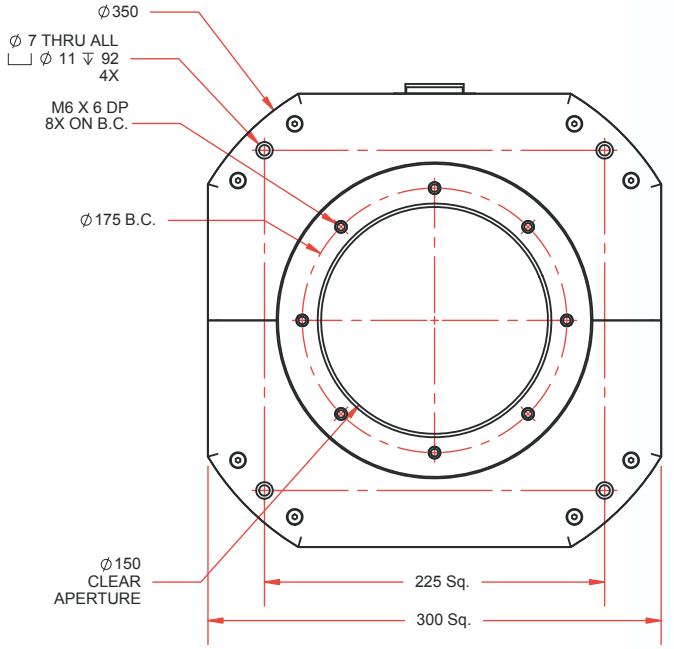


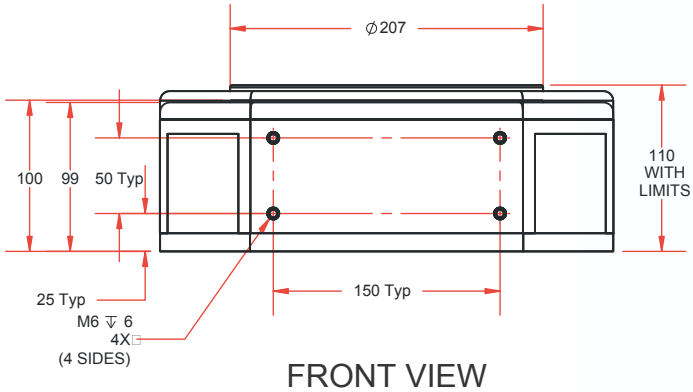
FRONT VIEW

BACK VIEW
(NOT A PROJECTED VIEW)

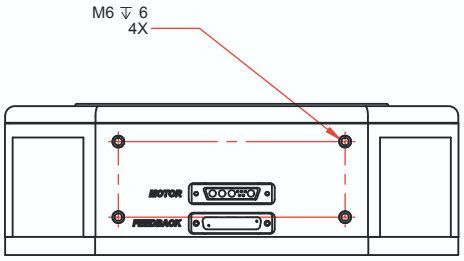
ALAR Series DIMENSIONS

ALAR-150-SP





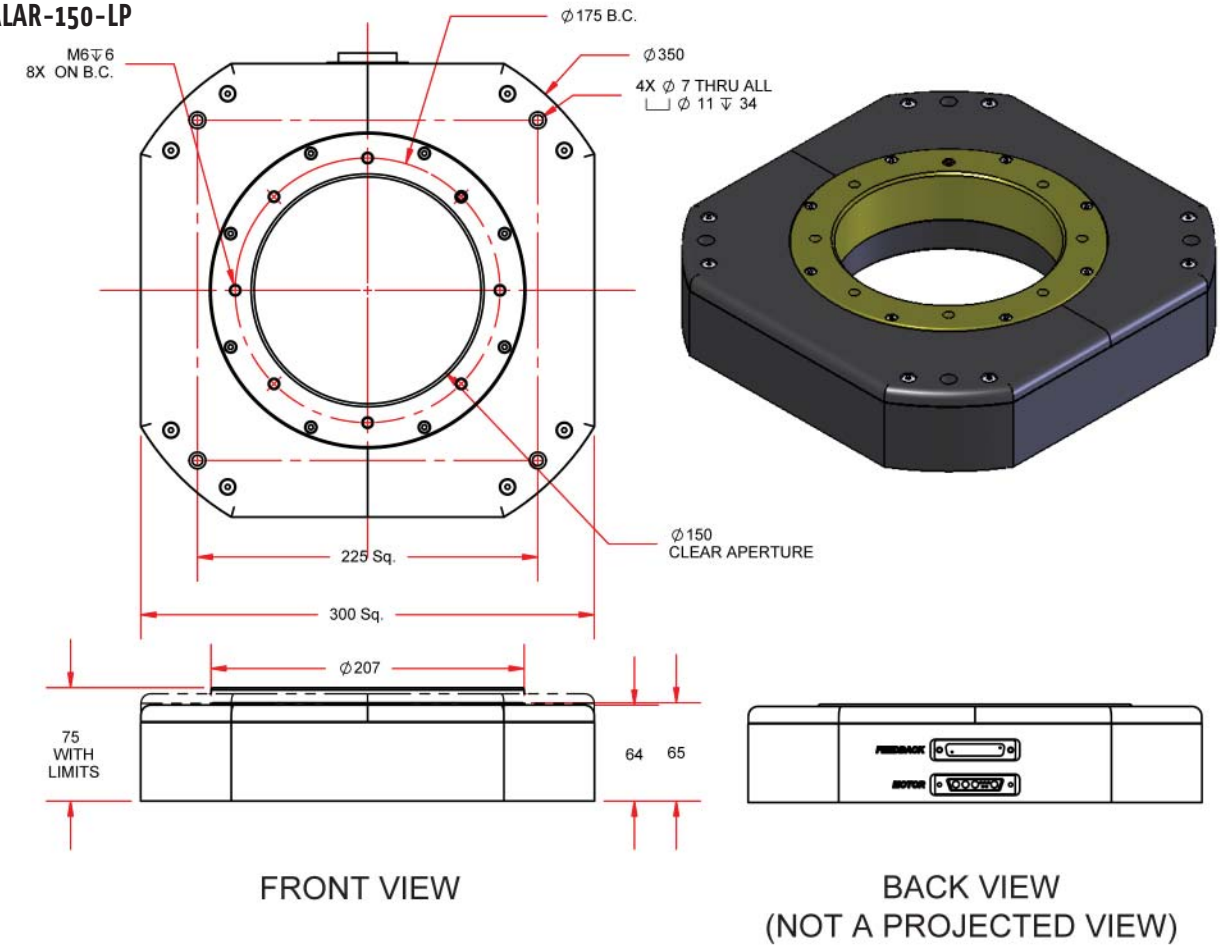
FRONT VIEW



BACK VIEW
(NOT A PROJECTED VIEW)

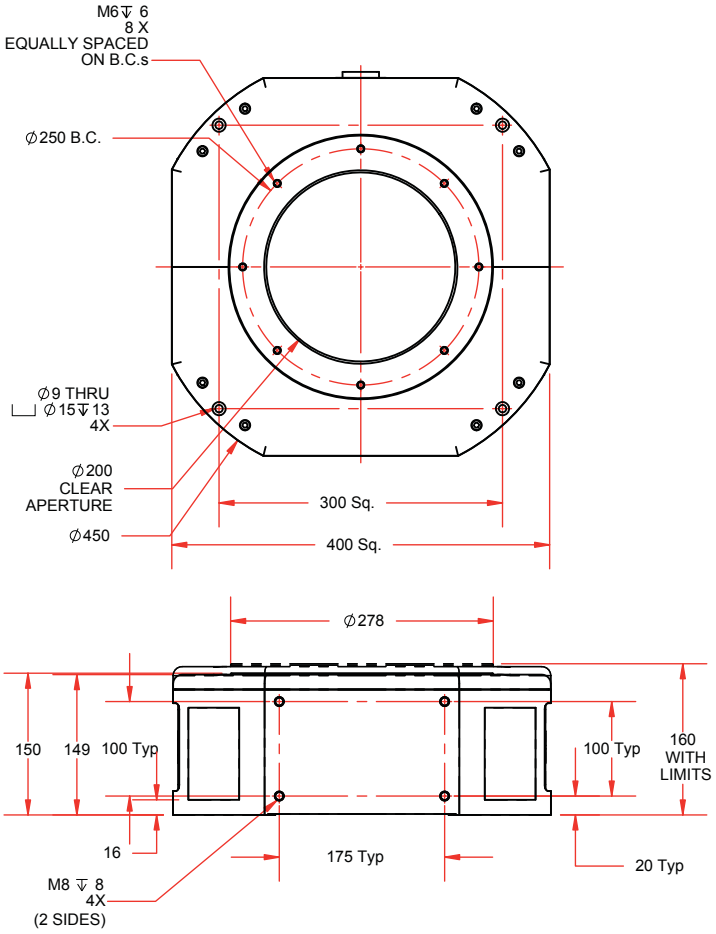
ALAR Series DIMENSIONS

ALAR-150-LP

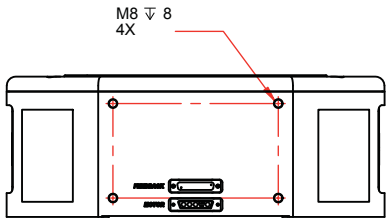


ALAR Series DIMENSIONS

ALAR-200-SP



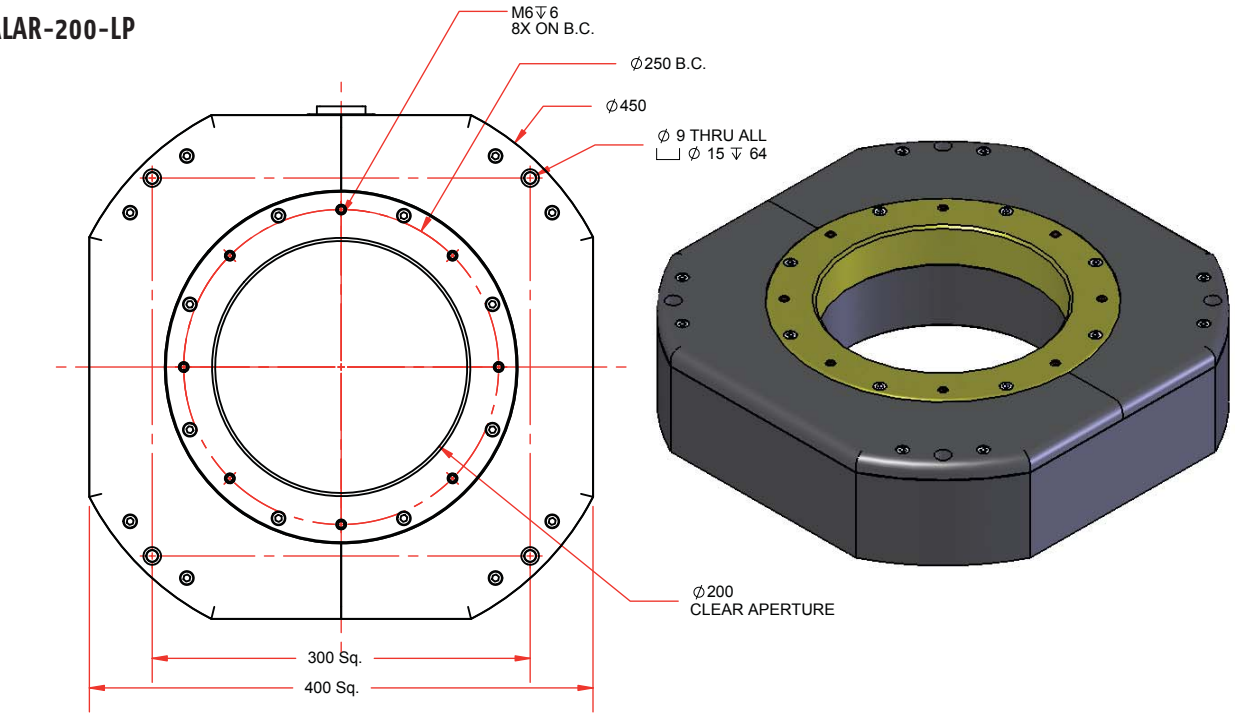
FRONT VIEW

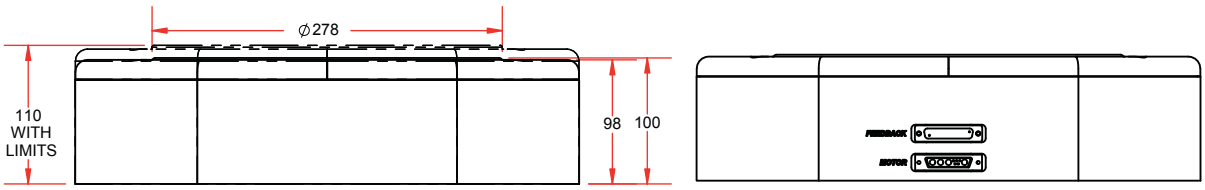


BACK VIEW
(NOT A PROJECTED VIEW)

ALAR Series DIMENSIONS

ALAR-200-LP

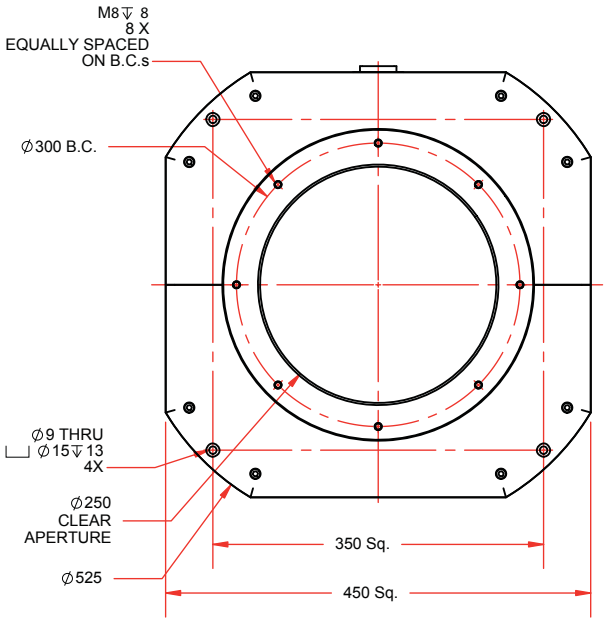


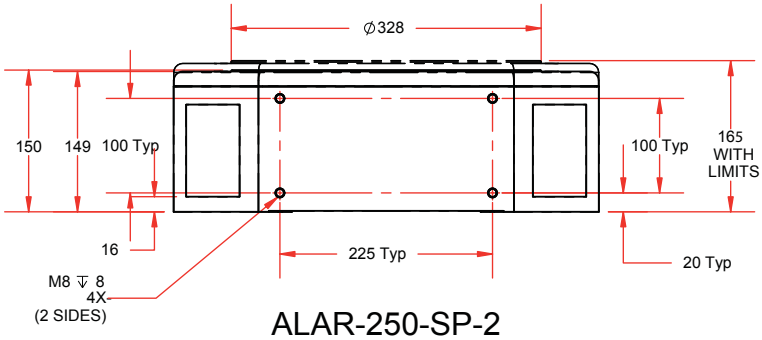


FRONT VIEW

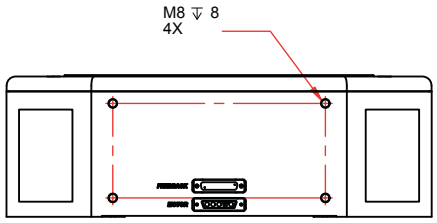
BACK VIEW
(NOT A PROJECTED VIEW)

ALAR-250-SP

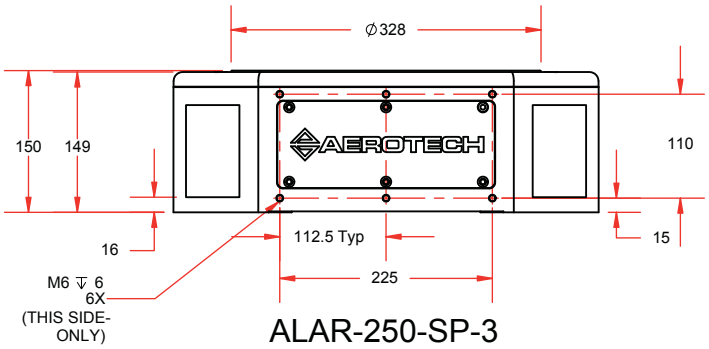




ALAR-250-SP-2
FRONT VIEW



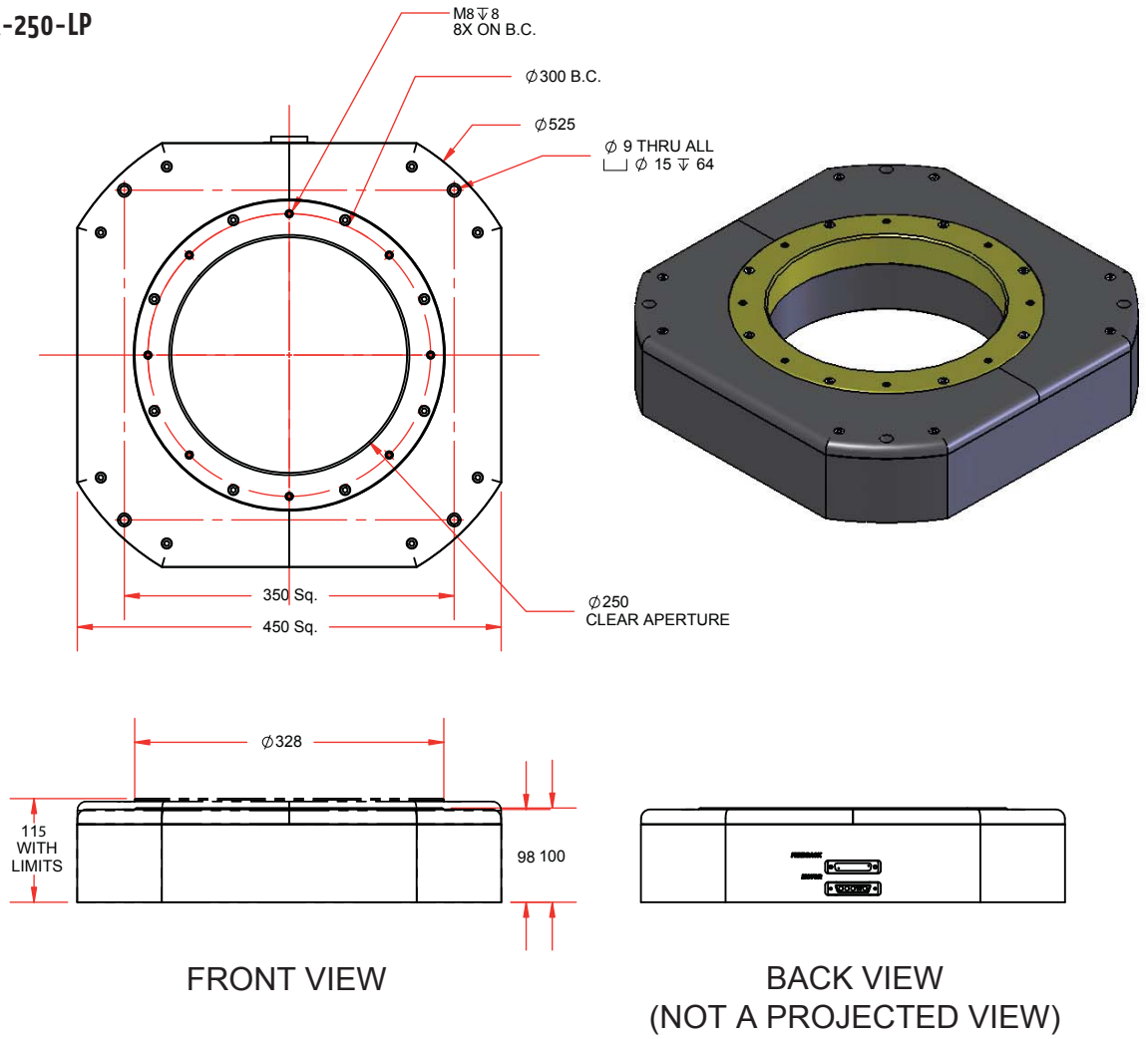
BACK VIEW
ALL MODELS
(NOT A PROJECTED VIEW)



ALAR-250-SP-3
FRONT VIEW

ALAR Series DIMENSIONS

ALAR-250-LP

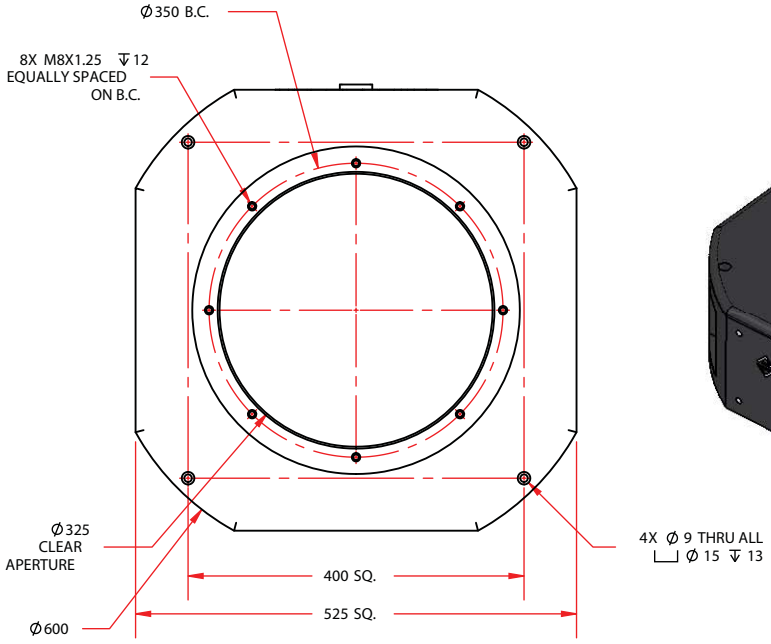


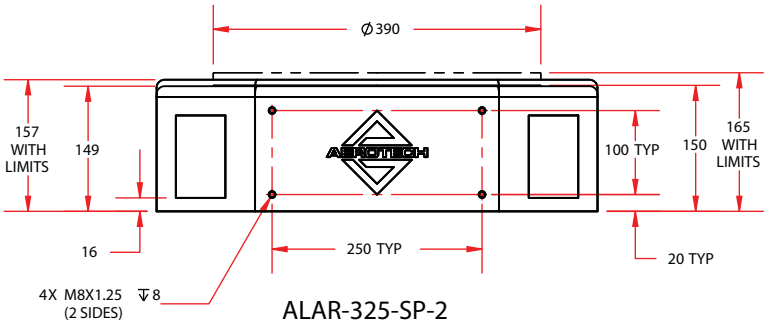
FRONT VIEW

BACK VIEW
(NOT A PROJECTED VIEW)

ALAR Series DIMENSIONS

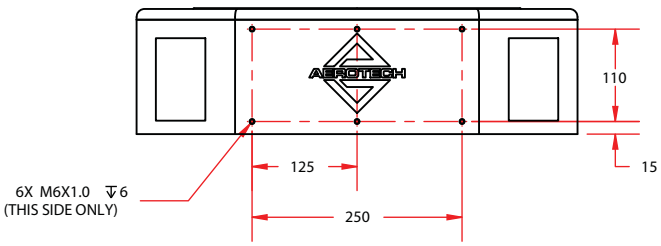
ALAR-325-SP





ALAR-325-SP-2
FRONT VIEW

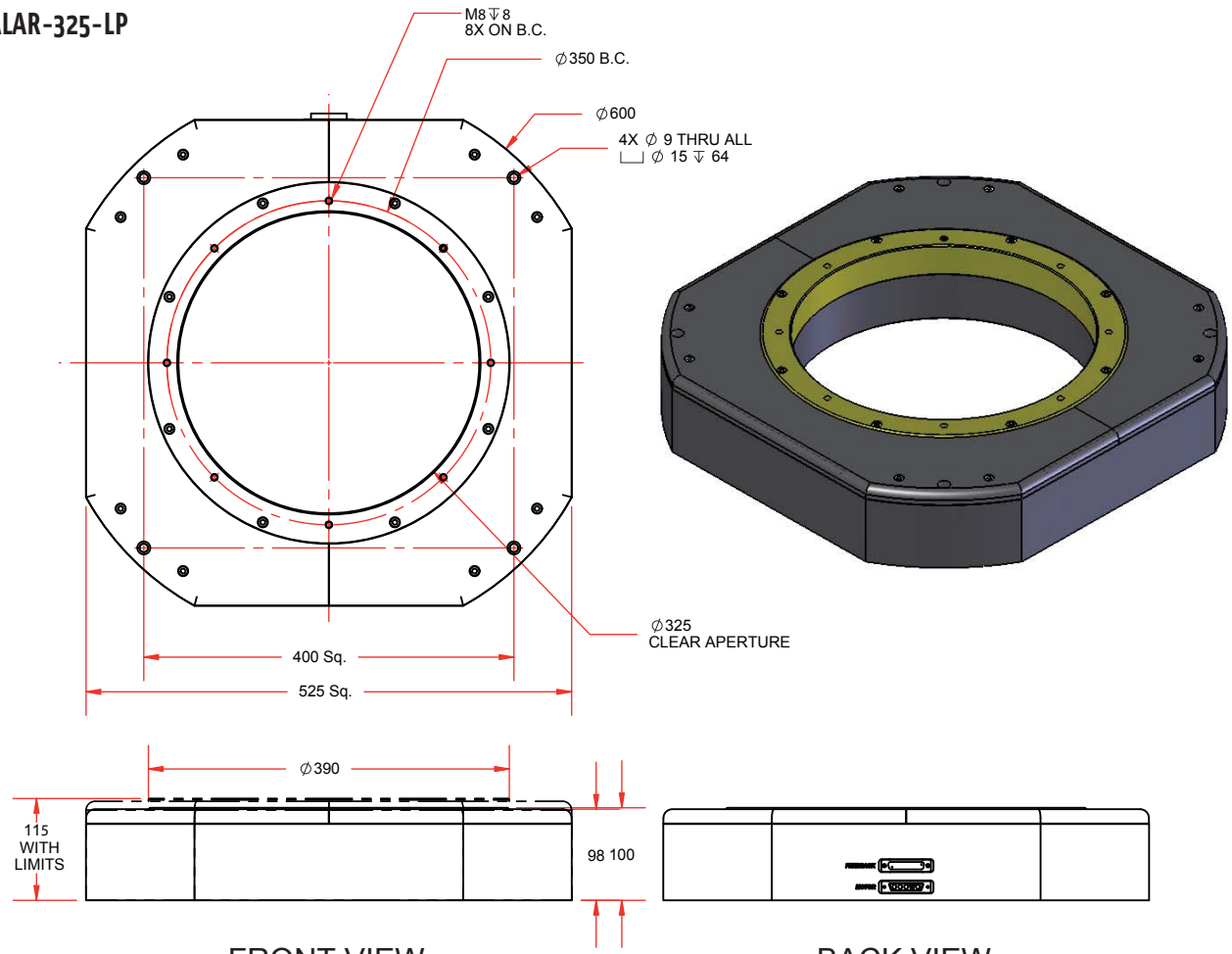
BACK VIEW
ALL MODELS
(NOT A PROJECTED VIEW)



ALAR-325-SP-3
FRONT VIEW

ALAR Series DIMENSIONS

ALAR-325-LP



ALAR Series ORDERING INFORMATION

ALAR Series Direct-Drive, Large Aperture, Rotary Stages

-100-LP	65 mm high direct-drive rotary stage with 100 mm clear aperture, dual precision bearings, 3.0 N·m continuous torque, and 31488 line amplified sine encoder
-100-SP	100 mm high direct-drive rotary stage with 100 mm clear aperture, dual precision bearings, 6.0 N·m continuous torque, and 31488 line amplified sine encoder
-150-LP	65 mm high direct-drive rotary stage with 150 mm clear aperture, dual precision bearings, 4.0 N·m continuous torque, and 36000 line amplified sine encoder
-150-SP	100 mm high direct-drive rotary stage with 150 mm clear aperture, dual precision bearings, 10.7 N·m continuous torque, and 40000 line amplified sine encoder
-200-LP	100 mm high direct-drive rotary stage with 200 mm clear aperture, dual precision bearings, 12.9 N·m continuous torque, and 47200 line amplified sine encoder
-200-SP	150 mm high direct-drive rotary stage with 200 mm clear aperture, dual precision bearings, 19.3 N·m continuous torque, and 55040 line amplified sine encoder
-250-LP	100 mm high direct-drive rotary stage with 250 mm clear aperture, dual precision bearings, 22.5 N·m continuous torque, and 55040 line amplified sine encoder
-250-SP-2	150 mm high direct-drive rotary stage with 250 mm clear aperture, dual precision bearings, 21.0 N·m continuous torque, and 64800 line amplified sine encoder
-250-SP-3	150 mm high direct-drive rotary stage with 250 mm clear aperture, dual precision bearings, 31.5 N·m continuous torque, and 64800 line amplified sine encoder
-325-LP	100 mm high direct-drive rotary stage with 325 mm clear aperture, dual precision bearings, 35.0 N·m continuous torque, and 64800 line amplified sine encoder
-325-SP-2-LT	160 mm high direct-drive rotary stage with 325 mm clear aperture, dual precision bearings, 35.0 N·m continuous torque and 74612-line amplified sine encoder; typically used in applications where the axis of rotation is horizontal or vertical. NOTE: The 325-SP-2-LT is limited travel only. It must include the - LI limit option. Customer must provide hardstops appropriate for their application.
-325-SP-2-CT	160 mm high direct-drive rotary stage with 325 mm clear aperture, dual precision bearings, 35.0 N·m continuous torque and 76800-line amplified sine encoder; typically used in applications where the axis of rotation is horizontal or vertical. NOTE: The 325-SP-2-CT is unlimited travel . If LI limit option is required, customer must provide hardstops appropriate for their application.
-325-SP-3-LT	160 mm high direct-drive rotary stage with 325 mm clear aperture, dual precision bearings, 52.4 N·m continuous torque and 74612-line amplified sine encoder; typically used in applications where the axis of rotation is horizontal or vertical. NOTE: The 325-SP-3-LT is limited travel only. It must include the - LI limit option. Customer must provide hardstops appropriate for their application.
-325-SP-3-CT	160 mm high direct-drive rotary stage with 325 mm clear aperture, dual precision bearings, 52.4 N·m continuous torque and 76800-line amplified sine encoder; typically used in applications where the axis of rotation is horizontal or vertical. NOTE: The 325-SP-3-CT is unlimited travel . If LI limit option is required, customer must provide hardstops appropriate for their application.

Note: -SP is for horizontal or vertical axis applications; -LP is for vertical axis applications.

Encoder Type

-CT	Continuous Travel Internal Encoder

Encoder Output Options

-AS	Standard feedback device; 1 Vpp sine wave output; multiply the selected stage resolution by the encoder multiplier to get final resolution of counts per rev
-X5*	Square-wave digital output which includes a 5-times multiplier; multiply the selected stage encoder lines by 20 to get the final resolution of counts per rev
-X10*	Square-wave digital output which includes a 10-times multiplier; multiply the selected stage encoder lines by 40 to get the final resolution of counts per rev
-X25*	Square-wave digital output which includes a 25-times multiplier; multiply the selected stage encoder lines by 100 to get the final resolution of counts per rev
-X50*	Square-wave digital output which includes a 50-times multiplier; multiply the selected stage encoder lines by 200 to get the final resolution of counts per rev
-RE-ABS	Rotary encoder, absolute – contact factory (compatible with HPe, HLe, CP, CL drives only)

Note: * indicates this includes controller quadrature; X5, X10, X25, X50 square-wave encoder options have limited bandwidth and may not reach stage max speed. Please contact factory to confirm speed per stage.

Limit Options

-UNLIMITED	No travel limits or hardstops; valid only with -CT encoder type
-LIx	Normally-closed limits at x degrees total travel, where x = 10/20/30/60/90/120/180/240/300/340; integrated hardstops 5 degrees past LI limit switch angles; other travel angles available by special order; increases stage height by 10 mm; can be used with -CT or -LT encoder types; ALAR-250 and ALAR-325 hardstops are special order only; contact the factory for pricing