

# LARGE-APERTURE ROTARY STAGES ALAR-SP SERIES



*With clear apertures up to 325 mm, ALAR-SP direct-drive stages deliver smooth, precise rotation for even the largest payloads.*

Aerotech's ALAR family of direct-drive rotary stages provides superior angular positioning and velocity control. ALAR-SP (standard profile) is the flagship of the ALAR product line. It offers a balance of high load capability, torque, and profile height, and is suitable for use in both vertical and horizontal applications. Other members of the ALAR family include the ALAR-LP, with an ultra-low profile, and the ALAR-XP, which delivers the highest levels of torque.

#### **Advantage: ALAR**

ALAR-SP offers numerous advantages over worm-drive stages. Because ALAR stages use direct-drive torque motors, they are free from backlash, vibration, and excessive wear commonly associated with gear-driven stages, and they are also capable of much higher speeds and accelerations. These advantages translate to higher system accuracy, repeatability, and longevity, as well as greater throughput. Users can more precisely manufacture, inspect, or process more parts in less time, leading to lower operating costs and higher profits.

#### **Brushless, Slotless Direct-Drive Motors**

Aerotech's brushless, direct-drive motors are featured in all ALAR

stages. Because there are neither brushes to wear, nor gear trains or couplings to maintain, ALAR stages are capable of high speeds and accelerations, plus consistent, stable performance over time with zero backlash, windup, or hysteresis. Further, ALAR motors are both slotless and ironless, thereby eliminating cogging and torque ripple to deliver exceptionally smooth motion. ALAR stages are ideal for applications requiring outstanding contoured motion, smooth scan velocities, and precise, incremental steps.

#### **High Payload Capacity and Moment-Load Stiffness**

Large-diameter angular contact bearings provide high axial-, radial-, and moment-load capacities, maximizing positioning performance with respect to tilt error, stiffness, and rotating friction. ALAR-SP is capable of achieving the highest performance standards regardless of whether the axis of rotation is vertical or horizontal. Due to its ample moment-load capability, ALAR-SP is especially well-suited to carry cantilevered or offset payloads, when the center of gravity is shifted away from the axis of rotation.

#### **Flexible Configurations for Simplified Integration**

ALAR-SP is offered with features and options that facilitate easy



*ALAR-SP stages shown as a custom azimuth/elevation assembly, ideal for testing electro-optic devices.*

## — PRODUCT HIGHLIGHTS —

Ideal balance of load capability, torque output, and profile height, with clear aperture diameters up to 325 mm

Direct-drive torque motor delivers extremely precise, smooth, cog-free rotation

High axial-, radial-, and moment-load capacities support large payloads and gimbal configurations

Long service life and consistent performance over time

Engineered for easy integration into multi-axis systems and machines

integration into multi-axis motion systems and subsystems. It is available with a range of clear-aperture diameters from 100 mm to 325 mm, and also a variety of feedback options including analog 1 Vpp, digital RS422, and absolute encoders. Continuous 360-degree travel is standard, with available limited-travel options ranging from 10 degrees to 340 degrees. ALAR250SP and ALAR325SP can be configured with an even more powerful motor option for increased torque to more effectively rotate high-inertia payloads. ALAR-SP stages can even be adapted for use in vacuum environments.

### Applications

Common applications for ALAR-SP stages include single- and multi-axis sensor testing, missile seeker testing, antenna testing, inertial navigation device testing, photonic component alignment, high-accuracy laser machining, and precision wafer inspection. ALAR-SP stages can also be configured as multi-axis gimbals. The large-diameter clear aperture and direct-drive motor make ALAR a better-performing alternative to more traditional worm-gear stages, especially in dynamic applications with high payloads.

## ALAR-SP Specifications

Mechanical Specifications	ALAR100SP	ALAR150SP	ALAR200SP
Travel	Continuous (optional 340° max. limited travel)		
Aperture	100 mm	150 mm	200 mm
Resolution (Min. Incremental Motion) <sup>1</sup>	0.1 $\mu$ rad (0.02 arc sec)	0.08 $\mu$ rad (0.016 arc sec)	0.06 $\mu$ rad (0.012 arc sec)
Accuracy <sup>2</sup>	$\pm 9.7 \mu$ rad ( $\pm 2$ arcsec)		
Bidirectional Repeatability	$\pm 2.4 \mu$ rad ( $\pm 0.5$ arc sec)		
Tilt-Error Motion	9.7 $\mu$ rad (2.0 arc sec)		
Maximum Speed <sup>3</sup>	300 rpm	250 rpm	90 rpm
Maximum Torque	23.9 N•m	42.9 N•m	126.8 N•m
Continuous Torque	6.0 N•m	10.7 N•m	19.3 N•m
Axial Load	1550 N	1950 N	4675 N
Radial Load	1350 N	1925 N	4775 N
Moment Load	250 N•m	450 N•m	1600 N•m
Shaft Inertia	0.022 kg•m <sup>2</sup>	0.040 kg•m <sup>2</sup>	0.320 kg•m <sup>2</sup>
Shaft Inertia with Limits	0.026 kg•m <sup>2</sup>	0.051 kg•m <sup>2</sup>	0.359 kg•m <sup>2</sup>
Stage Mass	16.3 kg	18.6 kg	40.4 kg
Stage Mass with Limits	17 kg	19.6 kg	43.1 kg

Mechanical Specifications	ALAR250SP-M1	ALAR250SP-M2	ALAR325SP-M1	ALAR325SP-M2
Travel	Continuous (optional 340° max. limited travel)			
Aperture	250 mm		325 mm	
Resolution (Min. Incremental Motion) <sup>1</sup>	0.05 $\mu$ rad (0.01 arc sec)		0.04 $\mu$ rad (0.009 arc sec)	
Accuracy <sup>2</sup>	$\pm 9.7 \mu$ rad ( $\pm 2$ arcsec)			
Bidirectional Repeatability	$\pm 2.4 \mu$ rad ( $\pm 0.5$ arc sec)			
Tilt-Error Motion	9.7 $\mu$ rad (2.0 arc sec)			
Maximum Speed <sup>3</sup>	140 rpm		150 rpm	
Maximum Acceleration	287 rad/s <sup>2</sup>		185 rad/s <sup>2</sup>	
Maximum Torque	137.8 N•m	206.7 N•m	213.8 N•m	320.8 N•m
Continuous Torque	21.0 N•m	31.5 N•m	35.0 N•m	52.4 N•m
Axial Load	4950 N		5825 N	
Radial Load	5200 N		6650 N	
Moment Load	1825 N•m		2650 N•m	
Shaft Inertia	0.500 kg•m <sup>2</sup>		1.010 kg•m <sup>2</sup>	
Shaft Inertia with Limits	0.573 kg•m <sup>2</sup>		1.2 kg•m <sup>2</sup>	
Stage Mass	51.3 kg		61.2 kg	
Stage Mass with Limits	54.5kg		64.9 kg	

1 Resolution assumes 1 Vpp encoder with 2000x controller multiplication.

2 Certified with each stage. Requires the use of an Aerotech controller.

3 Square-wave digital encoder options will limit maximum speed below the listed value. Contact factory for specific stage and encoder speed combination.

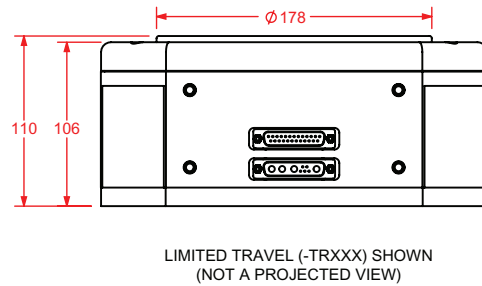
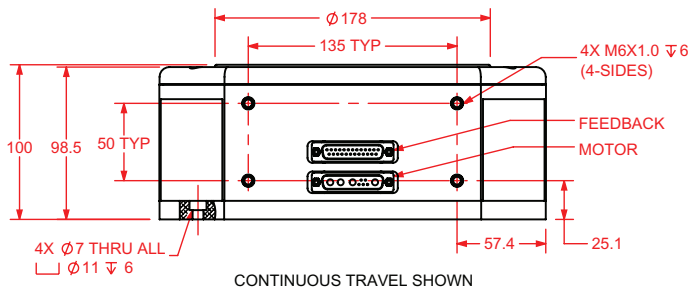
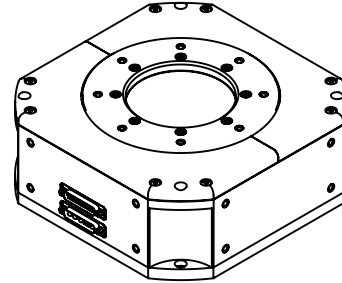
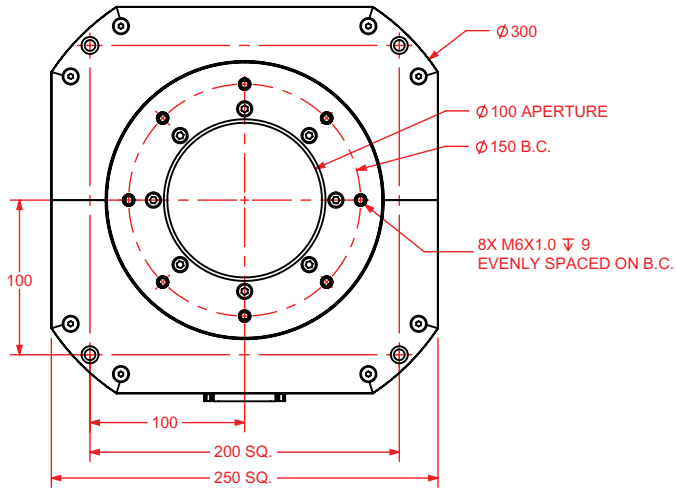
## ALAR-SP Specifications

Electrical Specifications		ALAR100SP	ALAR150SP	ALAR200SP	
<b>Motor</b>		Brushless Slotless			
Continuous Current	$A_{pk}$	2.7	6.2	5.3	
	$A_{rms}$	1.9	4.4	3.8	
Peak Current, Stall	$A_{pk}$	10.8	24.8	34.8	
	$A_{rms}$	7.6	17.5	24.6	
<b>Bus Voltage</b>		Up to 340 VDC			
<b>Incremental Encoder Line Count</b>		31,488 lines/rev	40,000 lines/rev	55,040 lines/rev	
<b>Limit Switches<sup>1</sup></b>		5 V, normally closed			
Electrical Specifications		ALAR250SP-M1	ALAR250SP-M2	ALAR325SP-M1	ALAR325SP-M2
<b>Motor</b>		Brushless Slotless			
Continuous Current	$A_{pk}$	5.3	8.0	5.1	7.7
	$A_{rms}$	3.8	5.6	3.6	5.4
Peak Current, Stall	$A_{pk}$	34.8	52.2	31.2	46.8
	$A_{rms}$	24.6	36.9	22.1	33.1
<b>Bus Voltage</b>		Up to 340 VDC			
<b>Incremental Encoder Line Count</b>		64,800 lines/rev		76,800 lines/rev	
<b>Limit Switches<sup>1</sup></b>		5 V, normally closed			

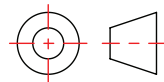
<sup>1</sup> Limited travel options only.

# ALAR-SP Dimensions

ALAR100SP

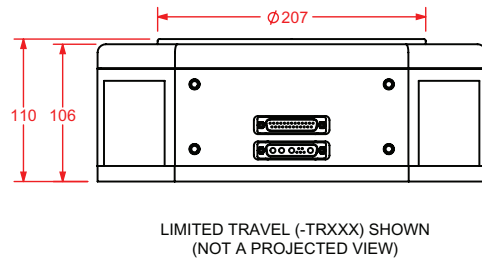
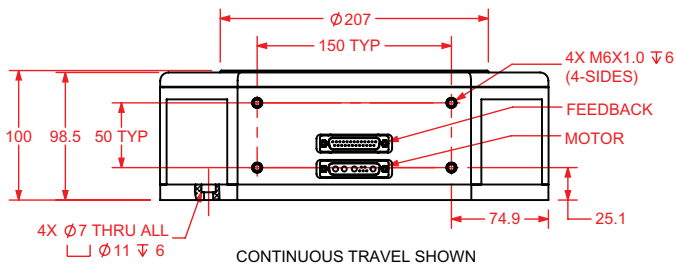
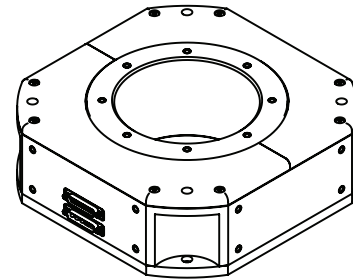
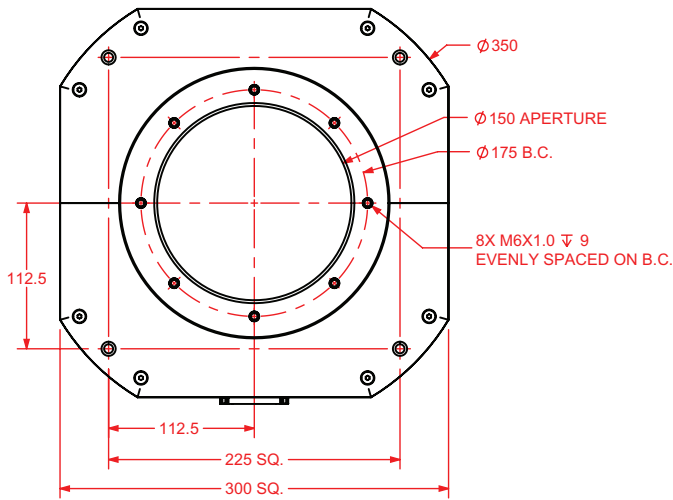


DIMENSIONS: MILLIMETERS

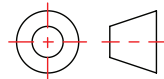


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ALAR150SP

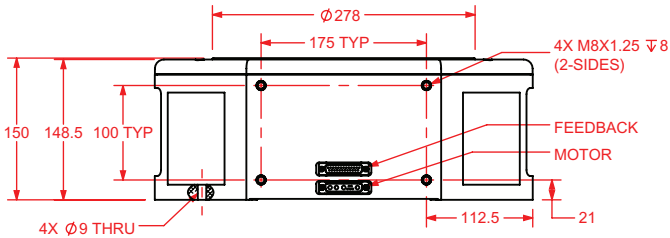
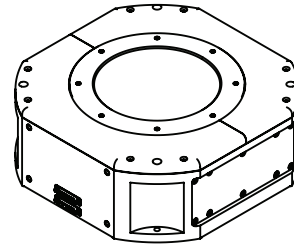
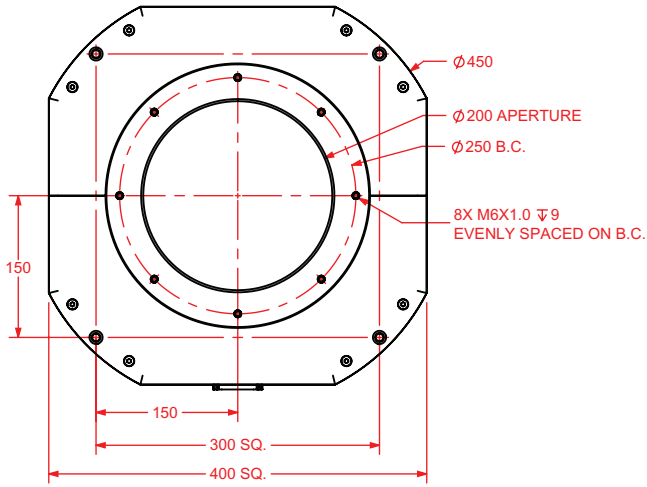


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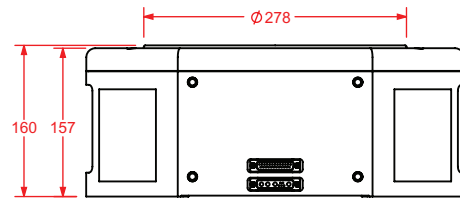


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ALAR200SP

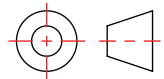


CONTINUOUS TRAVEL SHOWN



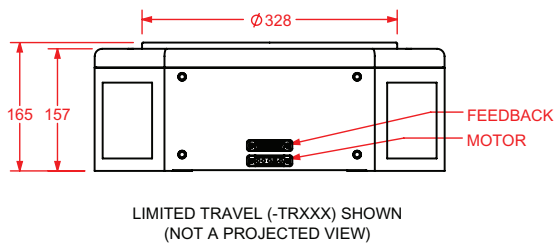
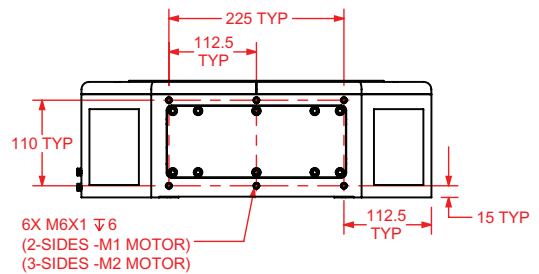
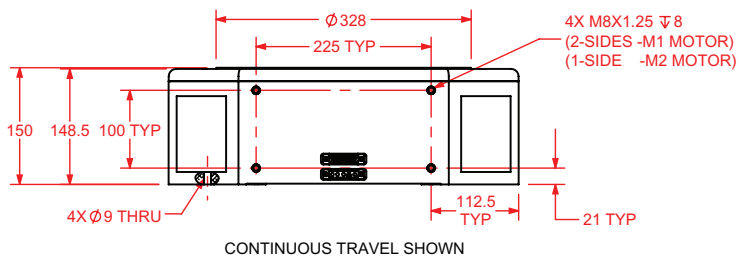
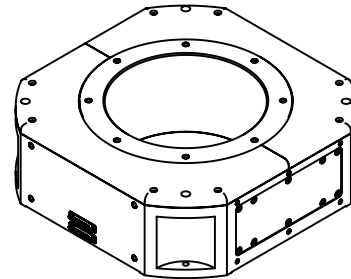
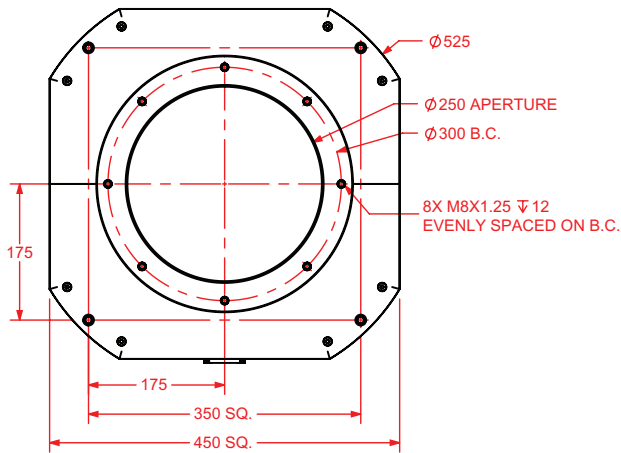
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(NOT A PROJECTED VIEW)

DIMENSIONS: MILLIMETERS

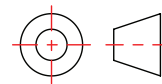


# ALAR-SP Dimensions

ALAR250SP

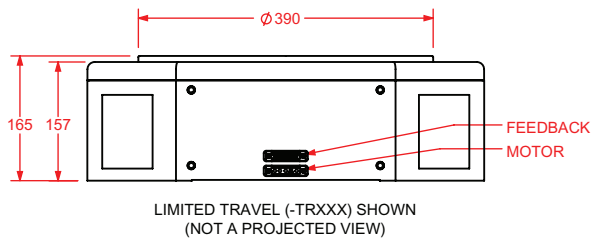
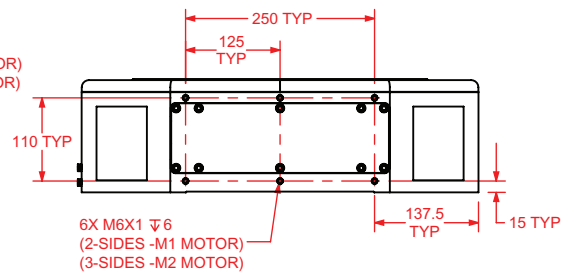
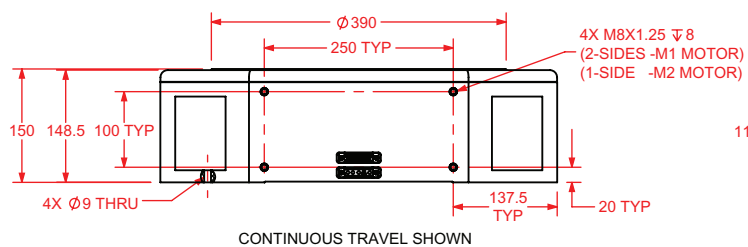
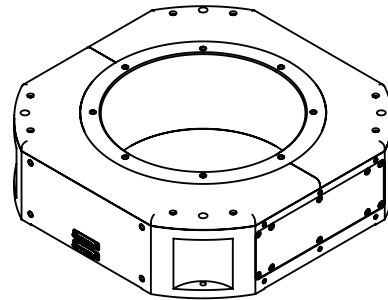
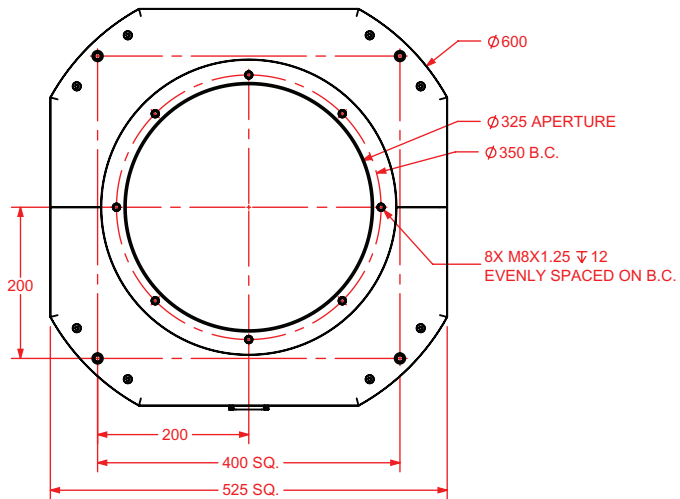


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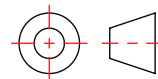


# ALAR-SP Dimensions

ALAR325SP



DIMENSIONS: MILLIMETERS





## ALAR-SP Ordering Information

### ALAR-SP Mechanical-Bearing Direct-Drive Rotary Stage

ALAR100SP	Mechanical-bearing, direct-drive rotary stage, 100 mm aperture
ALAR150SP	Mechanical-bearing, direct-drive rotary stage, 150 mm aperture
ALAR200SP	Mechanical-bearing, direct-drive rotary stage, 200 mm aperture
ALAR250SP	Mechanical-bearing, direct-drive rotary stage, 250 mm aperture
ALAR325SP	Mechanical-bearing, direct-drive rotary stage, 325 mm aperture

### Motor (Required)

-M1	Standard motor
-M2	High-power motor

Motor options (-M1 and -M2) only apply to the ALAR250SP and ALAR325SP stages.

### Travel (Required)

-	Continuous travel
-TR010	Limited travel, $\pm 5$ degrees
-TR020	Limited travel, $\pm 10$ degrees
-TR030	Limited travel, $\pm 15$ degrees
-TR060	Limited travel, $\pm 30$ degrees
-TR090	Limited travel, $\pm 45$ degrees
-TR120	Limited travel, $\pm 60$ degrees
-TR180	Limited travel, $\pm 90$ degrees
-TR240	Limited travel, $\pm 120$ degrees
-TR300	Limited travel, $\pm 150$ degrees
-TR340	Limited travel, $\pm 170$ degrees

### Feedback (Required)

-E1	Incremental encoder, 1 Vpp
-E2	Incremental encoder, digital RS422, x4 interpolation
-E3	Incremental encoder, digital RS422, x20 interpolation
-E4	Incremental encoder, digital RS422, x40 interpolation
-E5	Incremental encoder, digital RS422, x100 interpolation
-E6	Incremental encoder, digital RS422, x200 interpolation
-E7	Absolute encoder

### Integration (Required)

Aerotech offers both standard and custom integration services to help you get your system fully operational as quickly as possible. The following standard integration options are available for this system. Please consult Aerotech if you are unsure what level of integration is required, or if you desire custom integration support with your system.

-TAS	Integration - Test as system Testing, integration, and documentation of a group of components as a complete system that will be used together (ex: drive, controller, and stage). This includes parameter file generation, system tuning, and documentation of the system configuration.
-TAC	Integration - Test as components Testing and integration of individual items as discrete components. This is typically used for spare parts, replacement parts, or items that will not be used or shipped together (ex: stage only). These components may or may not be part of a larger system.