

ANT95XY Series

Two-Axis XY Direct-Drive Nanopositioning Stages

- Integrated low-profile XY linear motor stage
- Nanometer-level performance in a large travel format
- High resolution (1 nm), repeatability (75 nm), and accuracy (250 nm)
- In-position stability of <math><1\text{ nm}</math>
- Anti-creep crossed-roller bearings
- High dynamic performance with direct-drive technology
- ULTRA performance grade option

nano Motion Technology



Introduction

Aerotech's ANT series stages are the world's first nanometer-level positioning systems with greater than 25 mm travel. The ANT95XY crossed-roller-bearing, linear motor, dual-axis stage provides an extremely low profile of only 60 mm. The stage comes with proprietary direct-drive motor technology, noncontact linear encoders, limits, integrated cable management system, and three performance grades.

Ultra-Precise Stage Design

The ANT95XY design allows critical elements such as orthogonality, straightness, and flatness to be optimized, resulting in a stage with exceptional geometric tolerances. Aerotech's direct-drive technology has no hysteresis or backlash, enabling accurate and repeatable nanometer-scale motion in both the X and Y dimensions. Both travel options (25 mm x 25 mm and 50 mm x 50 mm) come with the 60 mm profile height. The integrated cable management system is designed for long life and to minimize drag forces.

Noncontact Direct-Drive

Only noncontact direct-drive technology offers the robust, accurate, and high-speed positioning necessary for mass production of precision devices. ANT95XY stages utilize advanced direct-drive technology pioneered by Aerotech to achieve the highest level of positioning performance. This direct-drive technology is high-performance, non-cogging, noncontact, high speed, high resolution, and high accuracy. This unique drive and bearing combination, packaged in an extremely small-profile and footprint, offers tangible

advantages in many applications such as high-precision positioning, disk-drive fabrication, fiber alignment, optical delay element actuation, sensor testing, and scanning processes that demand smooth and precise motion.

Multi-Axis Configurations

The ANT95XY can be combined with other Aerotech ANT series products (vertical lift stages, direct-drive rotaries, and goniometers) to create unique, high performance, multi-axis systems.

ULTRA Performance Grade Option

In order to achieve the highest possible system accuracy from our multi-axis nanopositioning systems, Aerotech has developed an advanced, dynamic trajectory calibration system. To take advantage of this sophisticated calibration system, the mechanical system has to be completely assembled, functionally tested, and calibrated in our best-in-class metrology labs. Nanometer-level system accuracy can only be achieved under stringent environmental conditions, calibrating with the best test equipment, using the highest-precision mechanical elements, and utilizing the ULTRA software capabilities of Aerotech's industry-leading controls. By implementing ULTRA dynamic trajectory calibration with the ANT95XY, we are able to produce guaranteed two-dimensional accuracies of $\pm 250\text{ nm}$ or better.

The plots provided in the specifications illustrate performance differences between a standard ANT95XY and the ULTRA version. Straightness, orthogonality, and accuracy errors caused by stage yawing are virtually eliminated.

ANT95XY Series SPECIFICATIONS

Mechanical Specifications	ANT95XY-025			ANT95XY-050		
	Base	PLUS ^(1,2)	ULTRA ^(1,2)	Base	PLUS ^(1,2)	ULTRA ^(1,2)
Travel	25 mm			50 mm		
Accuracy ^(2,3)	±2.5 µm	±250 nm	±250 nm	±2.5 µm	±250 nm	±250 nm
Resolution (Minimum Incremental Motion)	1 nm					
Repeatability (Bidirectional) ⁽³⁾	±100 nm	±75 nm	±75 nm	±100 nm	±75 nm	±75 nm
Repeatability (Unidirectional)	±25 nm	±25 nm	±25 nm	±25 nm	±25 nm	±25 nm
Straightness ⁽³⁾	±1.0 µm	±1.0 µm	±250 nm	±1.0 µm	±1.0 µm	±250 nm
Flatness ⁽³⁾	±1.0 µm	±1.0 µm	±1.0 µm	±1.0 µm	±1.0 µm	±1.0 µm
Pitch	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)
Roll	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)
Yaw	24 µrad (5 arc sec)	24 µrad (5 arc sec)	24 µrad (5 arc sec)	24 µrad (5 arc sec)	24 µrad (5 arc sec)	24 µrad (5 arc sec)
Orthogonality	49 µrad (10 arc sec)	15 µrad (3 arc sec)	4.8 µrad (1 arc sec)	49 µrad (10 arc sec)	15 µrad (3 arc sec)	4.8 µrad (1 arc sec)
Maximum Speed ⁽⁴⁾	500 mm/s (Upper Axis)					
Maximum Acceleration ⁽⁴⁾	4.5 g - 45 m/s ² (No Load) (Upper Axis)			2.75 g - 27 m/s ² (No Load) (Upper Axis)		
Speed Stability	See graph for typical performance					
Settling Time	See graph for typical performance					
In-Position Stability ⁽⁵⁾	<1 nm					
Maximum Force (Continuous)	7.75 N			9.5 N		
Load Capacity ⁽⁶⁾	Horizontal	4.0 kg			6.0 kg	
	Upper	0.45 kg			0.8 kg	
	Lower	1.13 kg			2.1 kg	
Stage Mass	1.8 kg			3.2 kg		
Material	Aluminum Body/Black Hardcoat Finish					
MTBF (Mean Time Between Failure)	20,000 Hours					

Notes:

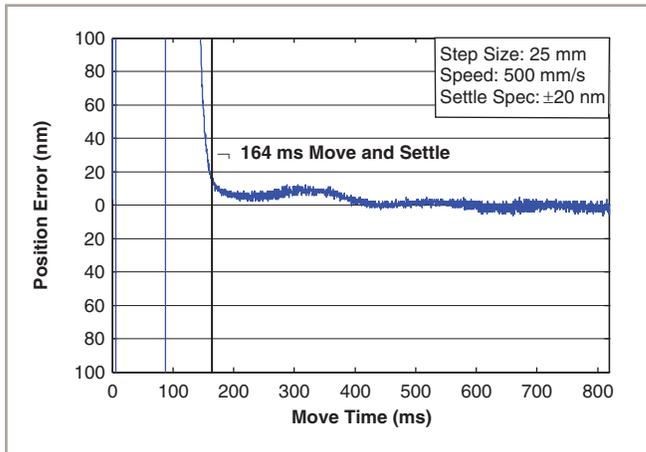
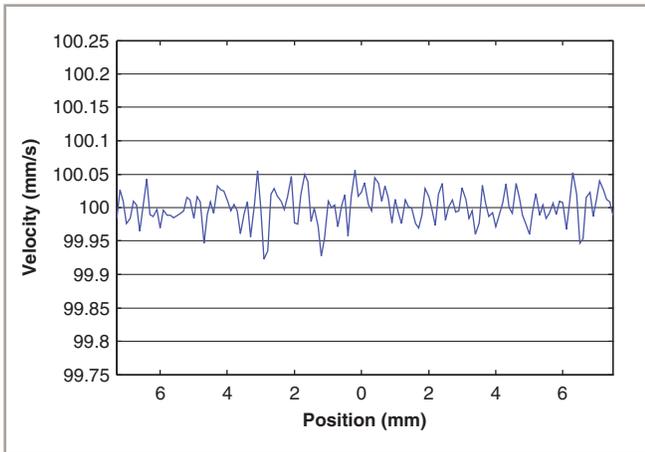
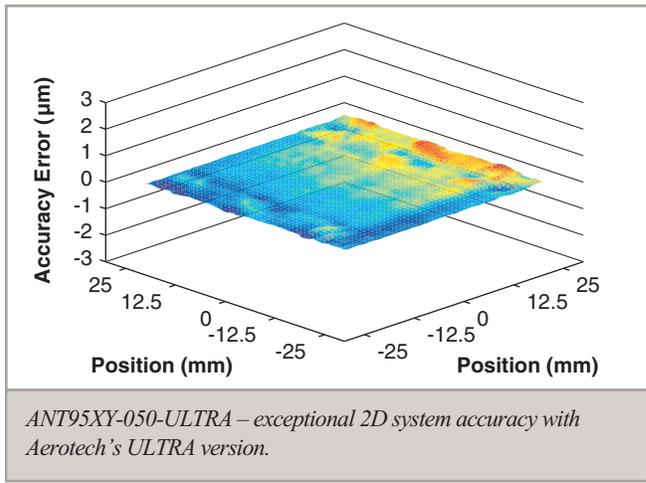
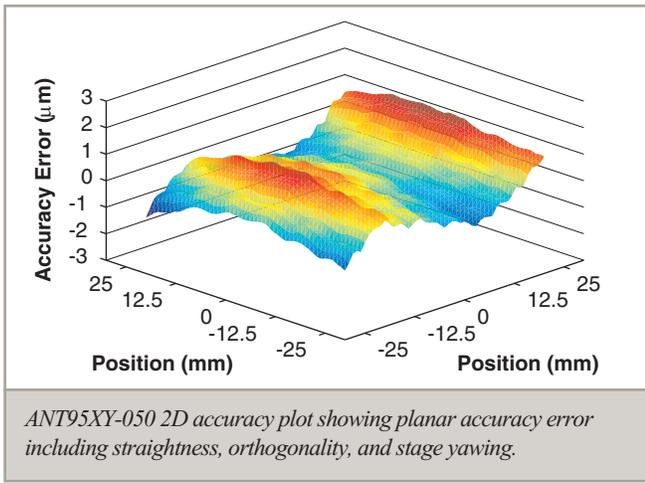
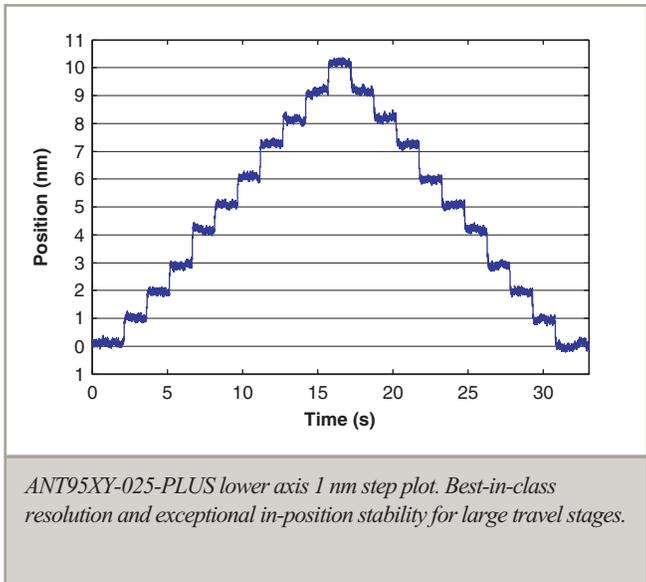
1. -PLUS and -ULTRA require the use of an Aerotech controller.
2. Specifications for -BASE and -PLUS options are per axis measured 25 mm above the tabletop. Specifications for -ULTRA are XY measured 25 mm above the tabletop.
3. Certified with each stage.
4. Requires the selection of an appropriate amplifier with sufficient voltage and current.
5. In-Position Jitter listing is 3 sigma value.
6. Axis orientation for on-axis loading is listed.

Electrical Specifications	
Drive System	Brushless Linear Servomotor
Feedback	Noncontact Linear Encoder
Maximum Bus Voltage	±40 VDC
Limit Switches	5 V, Normally Closed
Home Switch	Near Center

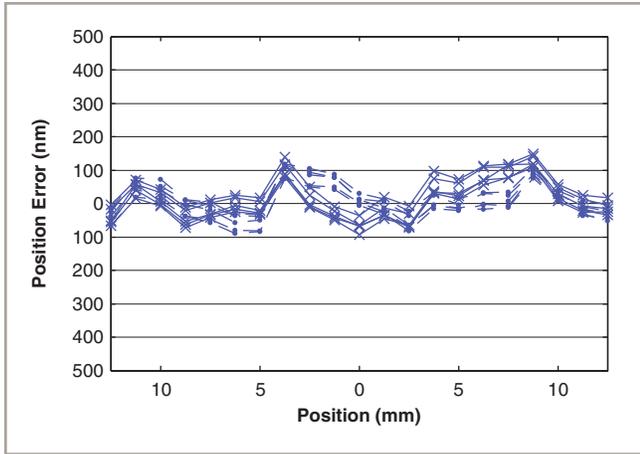
Recommended Controller		
Multi-Axis	A3200	Npaq MXR Npaq MR-MXH Ndrive ML-MXH
	Ensemble	Epaq MXH Epaq MR-MXH Ensemble ML-MXH Ensemble LAB
Single Axis	Soloist	Soloist ML-MXH

Note: Linear amplifiers are required to achieve the listed specifications. Other options are available.

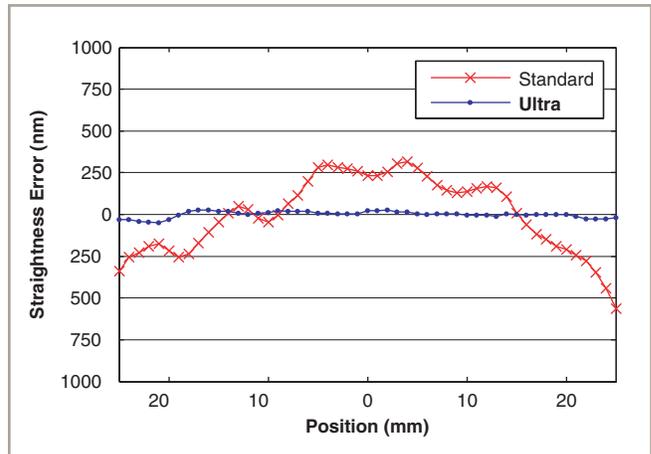
Note: To ensure the achievement and repeatability of specifications over an extended period of time, environmental temperature must be controlled to within 0.25°C/24 hours. If this is not possible, alternate products are available. Please consult Aerotech Application Engineering for more information.



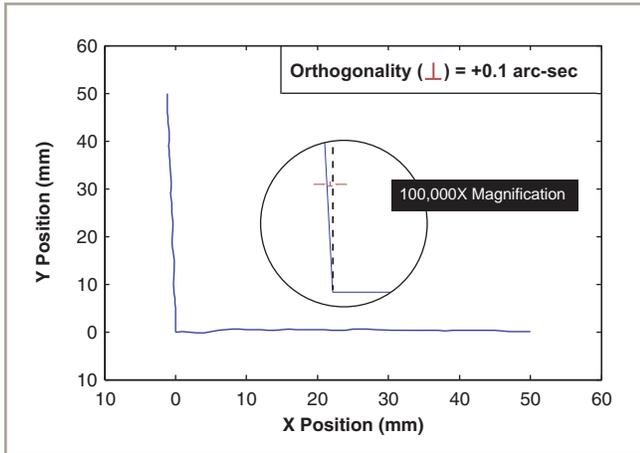
ANT95XY Series PERFORMANCE



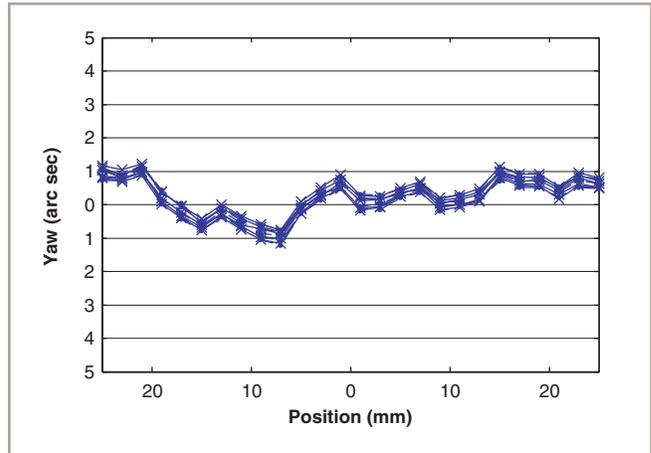
ANT95XY-025-PLUS accuracy and repeatability, five runs, bi-directional for the X (lower) axis. The total accuracy of 240 nm over 25 mm travel is significantly better than other offerings and half of its stated specification.



ANT95XY-025 straightness error comparison between the BASE and ULTRA models shows a dramatic improvement in this specification.

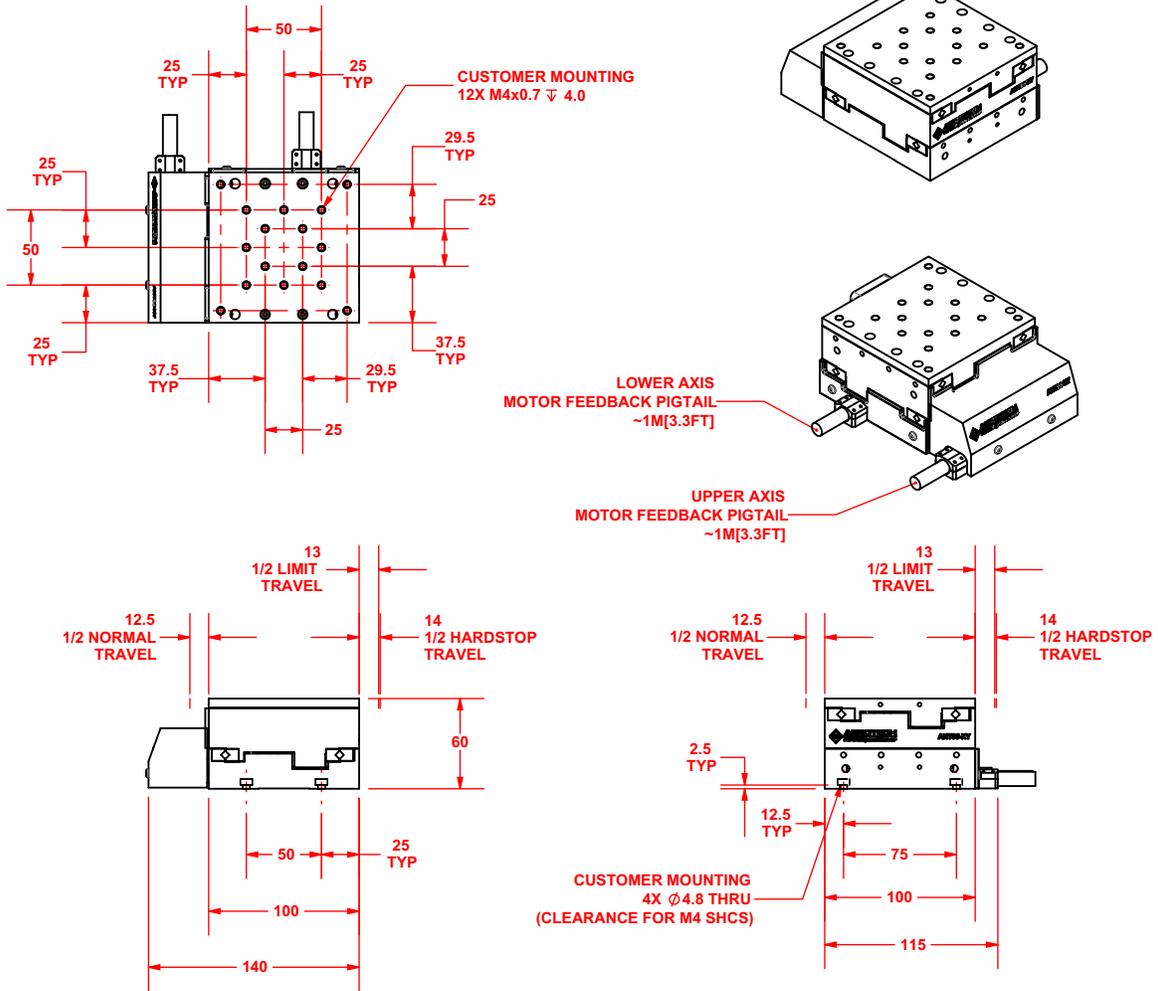


ANT95XY-050-ULTRA orthogonality. The inset is magnified 100,000X for clarity. The ULTRA model orthogonality is a twenty-fold improvement over the BASE model orthogonality.

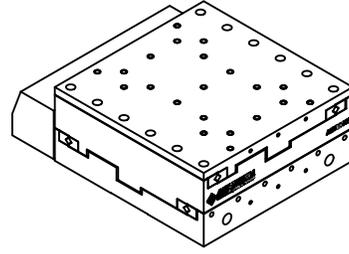
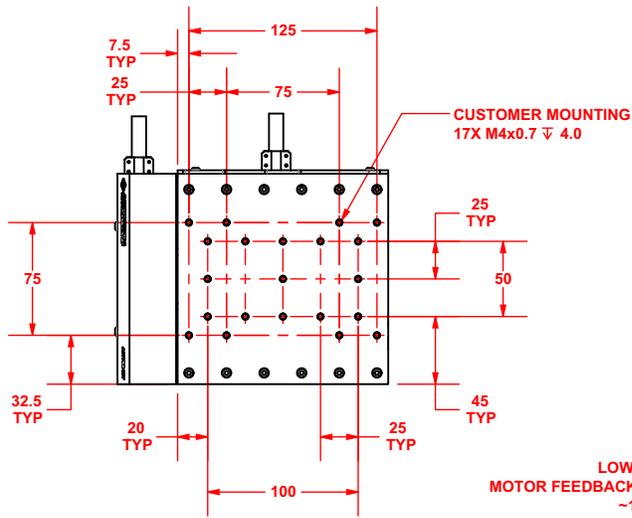


ANT95XY-050-PLUS Y (upper) axis yaw, five runs, bi-directional. Highly repeatable, lowest angular error over full travel.

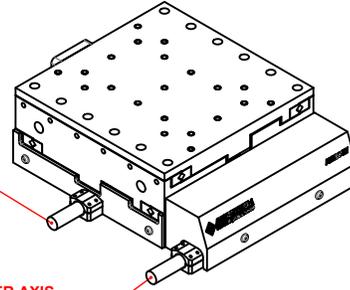
ANT95XY-025 DIMENSIONS



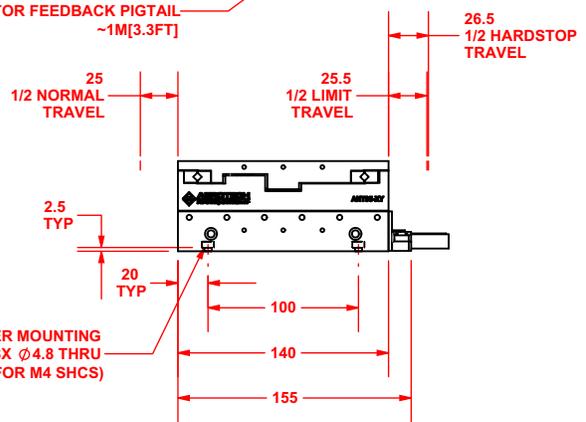
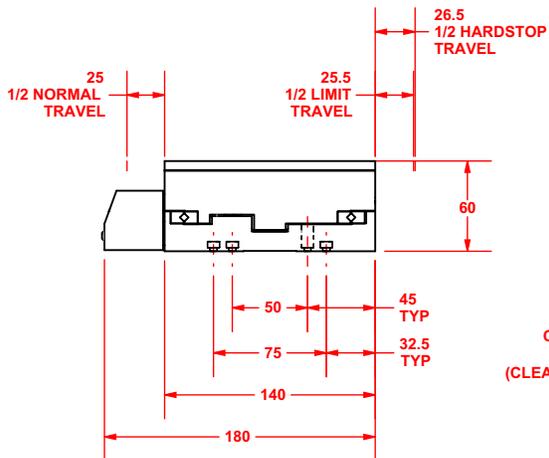
ANT95XY-050 DIMENSIONS



LOWER AXIS
MOTOR FEEDBACK PIGTAIL
~1M[3.3FT]



UPPER AXIS
MOTOR FEEDBACK PIGTAIL
~1M[3.3FT]



MD

ANT95XY Series ORDERING INFORMATION

Travel (Required)

-025	25 mm travel
-050	50 mm travel

Mounting Plate (Optional)

-MP	Mounting plate
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Performance Grade (Required)

-PL1	Base performance
-PL3	High-accuracy performance, PLUS
-PL4	Ultra high-accuracy performance, ULTRA

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	<p>Integration - Test as system</p> <p>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.</p>
-TAC	<p>Integration - Test as components</p> <p>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.</p>