ASR-E Series User's Manual

Closed-loop motorized XY scanning stages with built-in motor encoders

Disclaimer

Zaber’s devices are not intended for use in any critical medical, aviation, or military applications or situations where a product's use or failure could cause personal injury, death, or damage to property. Zaber disclaims any and all liability for injury or other damages resulting from the use of our products.

Precautions

Zaber's autodetect peripheral axes are designed to be used effortlessly with Zaber's line of autodetect controllers. The ASR-E includes onboard memory that allows Zaber's controllers to autodetect the model and set reasonable parameters. See the Protocol Manual for more information on how to modify the settings. Damage to the axis may result if the settings are not correct. To use your Zaber peripheral with a third-party controller, review the motor, sensor, and encoder specifications and pin-outs carefully.

Zaber’s motion control devices are precision instruments and must be handled with care. In particular, moving parts must be treated with care. Avoid axial loads in excess of the rated thrust load, axial and radial impact, dust and other contaminants and damage to the lead screw thread. These will reduce the performance of the device below stated specifications.

Noise Emissions

The A-weighted emission sound pressure level (SPL) of this device does not exceed 70 dB(A) during intended use.

The A-weighted emission sound pressure level (SPL) of this device may reach up to 79 dB(A) if the stage is stalled.

Conventions used throughout this document

- `Fixed width` type indicates communication to and from a device. The ↵ symbol indicates a carriage return, which can be achieved by pressing enter when using a terminal program.
- An ASCII command followed by (T:xx) indicates a legacy T-Series Binary Protocol command that achieves the same result. For example,

`move abs 10000 (T:20:10000)` shows that a move abs ASCII command can also be achieved with Binary command number 20.
Not all ASCII commands have an equivalent Binary counterpart.

Device Overview

AutoDetect

Your ASR-E peripheral is equipped with AutoDetect, a feature that allows a Zaber controller to automatically configure its settings for the peripheral when it is connected.

Important: The controller should always be powered down before disconnecting or connecting your ASR-E peripheral.

To connect the peripheral to a controller:

1. Power off the controller.
2. Connect the ASR-E peripheral.
3. Power on the controller.
4. The controller will activate the peripheral shortly after it is powered on.

Connectors

Recommended controller(s) for your ASR-E peripheral are provided in the product specifications. Zaber's controllers and peripherals are designed for ease of use when used together. Optimal settings for each peripheral are automatically detected by Zaber's controllers when the device is connected.

For reference, the pinout for the peripheral cable connectors is shown below:

Pinout for D-sub 15 Connectors (peripherals)

T3A Peripheral (male)	
T4A Peripheral (male)	

Pin #	Function
1	+5V for Limits & Encoder
2	AutoDetect Data
3	*reserved*
4	Away Sensor
5	Home Sensor

6	Ground
7	Motor B1
8	Motor A1
9	AutoDetect Clock
10	Encoder A
11	Encoder B
12	Encoder Index
13	Ground
14	Motor B2
15	Motor A2

Not all pins are used for all models

Alternate Controllers

The ASR-E can be controlled by any 2-phase stepper motor controller with limit sensor and appropriate encoder input. **We do not recommend using your own controller unless you are familiar with how to control a stepper motor with hall sensor limit switches.** Damage to the stage due to incorrect wiring is not covered by warranty.

Motors & Encoders

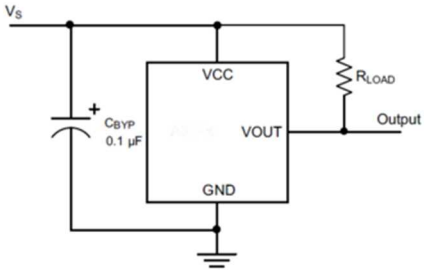
For motor and encoder information see the ASR-E product page

Limit Sensors

Hall effect sensors are used in the ASR-E as home and away sensors. The Hall sensors used are part number A1120LLHLT-T made by Allegro. Click here for data sheet. Your controller should be configured so the stage stops immediately (quick deceleration) when the sensors are triggered.

- PCB wire colour code:
  - 3.6-24 Vdc input - red
  - Home signal - yellow
  - Away signal - white
  - Ground - black

The Hall sensor has an open-collector output. The default output is high impedance when the Hall sensor is not active. When the sensor detects a magnet, the Hall sensor pulls the output low to ground.



If you are not using a Zaber controller, ensure that your controller has a pull-up resistor on the output line of each Hall sensor as shown in the diagram. The bypass capacitor is optional, but may help to eliminate false triggering in

noisy environments. The typical value for the pull-up resistor (R_{LOAD}) is 10 kΩ and for the bypass capacitor is 0.1 uF to 1 uF. The larger the capacitance, the better the noise filtering but the slower the response time.

Installation

Shipping Plate Removal

The ASR205B205B-E and ASR305B305B-E stages are fitted with sheet metal plates to prevent shock loads from the stage during shipping. Follow the instructions below to remove the shipping plates.

Instructions	ASR305B305B-E
1. Connect the stage to a controller.	
2. Remove the 8 M3 screws securing the shipping plates to the base and mid-plates as shown.	
3. With these screws removed, use the controller to move the upper-axis in order to gain access to the screws on the underside of the top-plate as shown.	
4. Remove the two screws holding the upper-axis shipping plate to the underside of the top plate. Move the upper-axis in the opposite direction in order to access and remove the two screws under the opposite side of the top-plate. Slide the upper-axis shipping plate out and set it aside.	

5. Repeat the same procedure for the lower-axis shipping plate. Move the lower-axis to gain access to the 4 screws holding the lower-axis shipping plate to the underside of the mid-plate. When all 4 screws are removed, remove the plate. The stage is now ready to be installed and used.	

Mounting

The ASR050B050B-E and ASR100B120B-E stages are mounted using adaptor plates. The ASR205B205B-E and ASR305B305B-E mount directly to compatible microscopes and use adaptor plates only for breadboard mounting. The following adaptor plates are currently available:

ASR100B120B-E	ASR050B050B-E	ASR205B205B-E / ASR305B305B-E
AP110 - for mounting to standard M6 or 1/4″-20 breadboards.	AP137 - for mounting to standard M6 or 1/4″-20 breadboards.	AP160 - for mounting to standard M6 or 1/4″-20 breadboards.
AP111 - for mounting to Leica, Zeiss and Olympus microscopes.		
AP114 - for mounting to Nikon inverted microscopes.		
AP125 - for mounting to Olympus BX upright microscopes.		
AP131 - for mounting to Olympus IX inverted microscopes.		

For more details about these adaptor plates, please see our accessory page.

The adaptor plates are attached to the ASR-E using 2 or 3 M3 screws per plate. To install the adaptors, align them as shown in the pictures below and tighten the M3 screws. The stage will need to be plugged into the controller so that you are able to move the lower axis and gain access to the screw holes.

Instructions	ASR100B120B-E
1. Position the lower axis such that you have access to the adaptor plate mounting screw holes.	
2. Place an adaptor plate underneath the ASR base.	

3. Install and tighten the M3 screws.	

The ASR205B205B-E and ASR305B305B-E stages mount directly to the following microscopes:

- Olympus MX51*
- Olympus MX61
- Nikon L200N
- Nikon L300N

* ASR205B205B-E only

Custom adaptor plates are available upon request. Please contact Zaber technical support at 1-888-276-8033 or contact@zaber.com for more information.

Operation

Most of the information you will need to operate the stage using the X-MCC controller can be found in the X-MCC User Manual. The sections below provide some additional information that is specific to the ASR-E stages.

ASR-E Inserts

The different ASR-E stages accept the following size inserts:

Stage	Insert size
ASR050B050B-E	82 x 82 mm
ASR100B120B-E	160 x 110 mm
ASR205B205B-E	219 x 219 mm
ASR305B305B-E	300 x 300 mm

The following inserts are currently available:

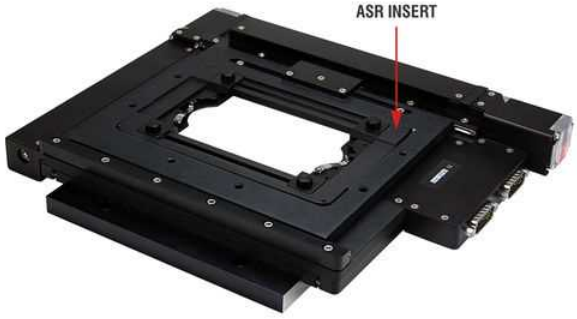
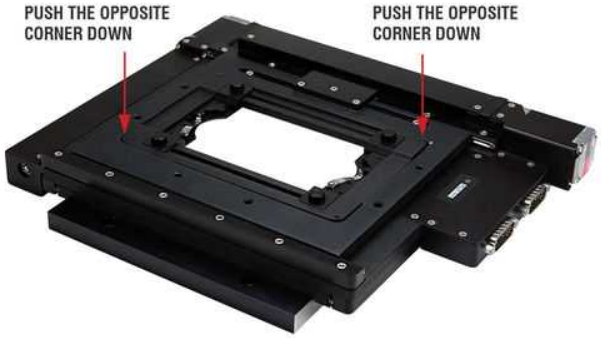
ASR050B050B-E	ASR100B120B-E	ASR205B205B-E	ASR305B305B-E
AM141 – for holding 30–60mm petri dishes	AM108 – for holding various petri dishes or microscope slides	AM152 – solid aluminum insert	AM153 – solid aluminum insert
AM142 – for holding 1″ x 3″ microscope slides	AM109 – for holding various multiwell plates	AM154 – M6 x 50 mm breadboard	AM155 – M6 x 50 mm breadboard
AM143 – M6 x 25 mm breadboard	AM126 – M6 x 25 mm breadboard	AM156 – rotating 125/150/200 mm wafer holder	AM157 – rotating 150/200/300 mm wafer holder
		AM161 – borosilicate glass	AM162 – borosilicate glass

For more details about these inserts, please see our accessory page.

Installation and Removal - ASR050B050B-E and ASR100B120B-E

On the ASR050B050B-E and ASR100B120B-E, the inserts are held in place by a spring clip in one corner of the ASR-E aperture. To install an insert, place the one corner up against the spring first. While holding this corner down, push the insert towards the spring clip and snap the opposing corner into place. Removal is the reverse of this procedure.

For most applications, the spring clip should provide sufficient force to hold the insert in place, while still allowing quick changes between inserts. For applications requiring more secure mounting, custom inserts can be provided that can be secured to the ASR-E using 4 M2 screws.

Instructions	ASR100B120B-E
1. To install an insert, first position the corner next to the spring clip as shown.	
2. While holding down the corner next to the spring clip, push the opposite corner down.	

Installation and Removal - ASR205B205B-E and ASR305B305B-E

On the ASR205B205B-E and ASR305B305B-E, the inserts are held in place by 3 M4 flat head screws. The screws mate with 3 matching chamfers on the insert to kinematically constrain it. Some inserts also allow for mounting using 16 or 24 M3 screws around the perimeter of the insert. The perimeter screws will secure the insert against high loads, but may compromise the flatness of the stage. It is only recommended that these screws be used when the necessary to prevent the insert from shifting under high loads.

Instructions	ASR305B305B-E

1. To install an insert, first line up the 3 insert chamfers with the 3 screw pockets in the ASR-E top plate.	
2. Screw the 3 M4 x 8 flat head screws into the holes in the top plate as shown. Tighten the screws evenly until the insert is held securely.	
3. If required, the insert can be leveled using the 3 M4 set screws adjacent to the flat head screws. Before adjusting the set screws, loosen the flat head screws.	

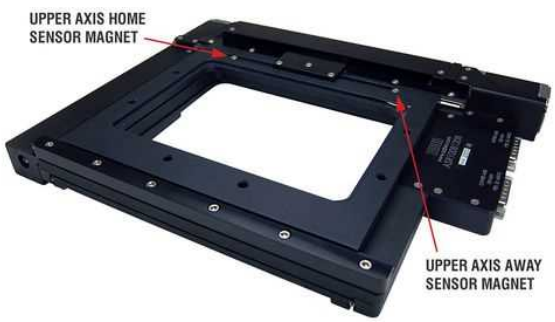
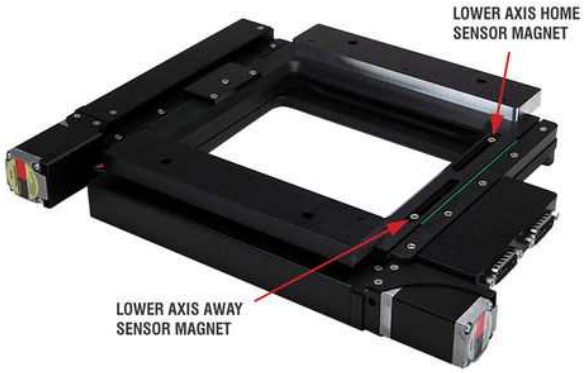
Setting Home and Away Sensors

The ASR-E provides adjustable travel limits for each axis. A home sensor sets the 0 position of each axis and an away sensor determines the maximum travel range. As long as the "limit_auto-detect" setting is enabled, each stage will not be able to move past these limits.

Limit adjustment is performed by moving the magnets which trigger the sensor. The limit switch magnets are attached to the bottoms of the limit adjustment screws shown in the pictures below.

Important: If adjusting the magnets outwards, make adjustments in small increments. Exceeding the nominal factory set travel range by more than 3 mm can cause the device to become stuck at one end of travel.

	ASR100B120B-E

Upper axis limit switch magnets	
Lower axis limit switch magnets	

To adjust the limits, loosen the screws by about 1/2 turn, slide the screw to the desired location and re-tighten. Make sure that the green hall sensor PCB (visible through the magnet adjustment slots) always stays in between the limit screws.

When adjusting the limit switch magnets, ensure that the green sensor PCB remains in between two magnets.

Software

In addition to the regular software options available for all Zaber devices, the ASR-E is supported by Micro-Manager open source microscopy software. Micro-manager can be downloaded for free from the Micro-Manager website.

Warranty and Repair

For Zaber's policies on warranty and repair, please refer to the Ordering Policies.

Standard products

Standard products are any part numbers that do not contain the suffix ENG followed by a 4 digit number. Most, but not all, standard products are listed for sale on our website. All standard Zaber products are backed by a one-month

satisfaction guarantee. If you are not satisfied with your purchase, we will refund your payment minus any shipping charges. Goods must be in brand new saleable condition with no marks. Zaber products are guaranteed for one year. During this period Zaber will repair any products with faults due to manufacturing defects, free of charge.

Custom products

Custom products are any part numbers containing the suffix ENG followed by a 4 digit number. Each of these products has been designed for a custom application for a particular customer. Custom products are guaranteed for one year, unless explicitly stated otherwise. During this period Zaber will repair any products with faults due to manufacturing defects, free of charge.

How to return products

Customers with devices in need of return or repair should contact Zaber to obtain an RMA form which must be filled out and sent back to us to receive an RMA number. The RMA form contains instructions for packing and returning the device. The specified RMA number must be included on the shipment to ensure timely processing.

Email Updates

If you would like to receive our periodic email newsletter including product updates and promotions, please sign up online at www.zaber.com (news section). Newsletters typically include a promotional offer worth at least $100.

Contact Information

Contact Zaber Technologies Inc by any of the following methods:

Phone	1-604-569-3780 (direct) 1-888-276-8033 (toll free in North America)
Fax	1-604-648-8033
Mail	#2 - 605 West Kent Ave. N., Vancouver, British Columbia, Canada, V6P 6T7
Web	www.zaber.com
Email	Please visit our website for up to date email contact information.

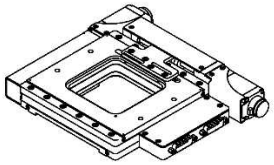
The original instructions for this product are available at https://www.zaber.com/manuals/ASR-E.

Appendix A: Default Settings

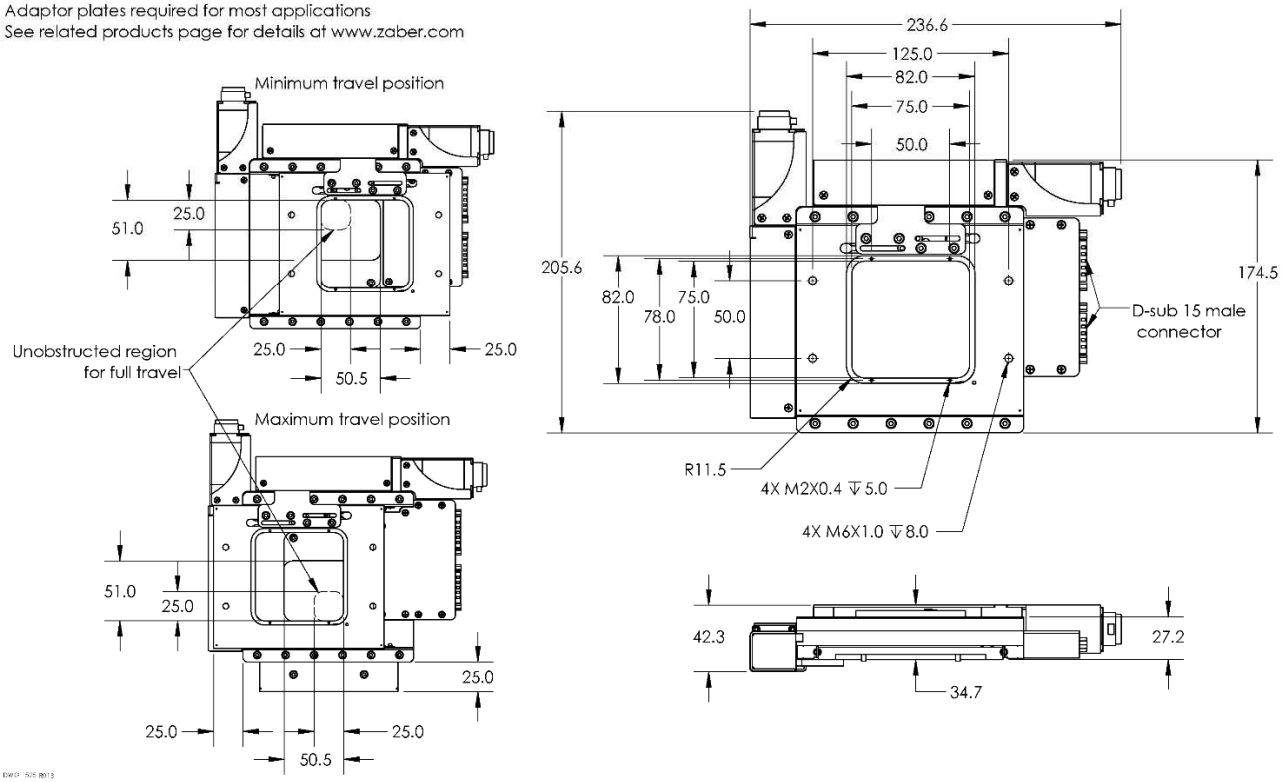
Please see the Zaber Support Page for default settings for this device.

Product Drawings

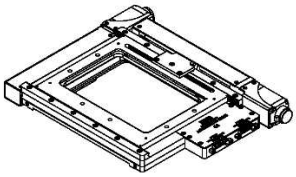
ASR-E Motorized XY Microscope Stage With Encoder
dimensions in mm



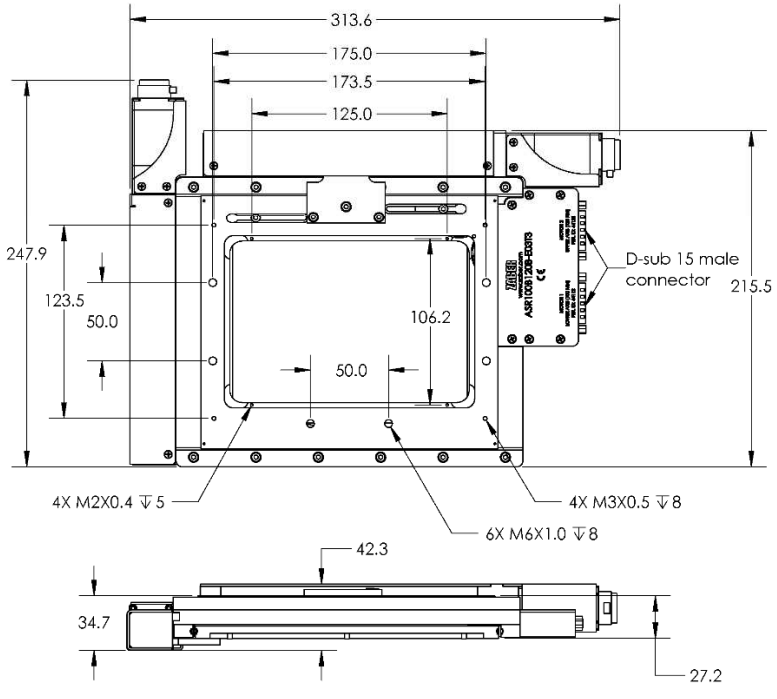
Adaptor plates required for most applications
See related products page for details at www.zaber.com



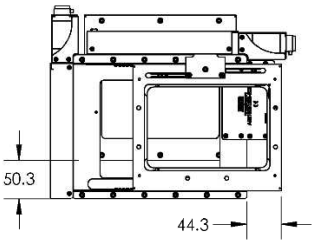
ASR-E Motorized XY Microscope Stage With Encoder
dimensions in mm



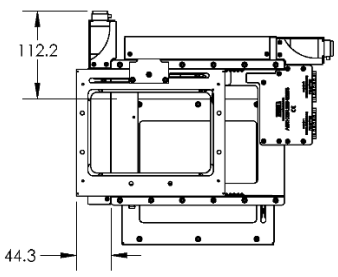
Adaptor plates required for mounting in most applications.
See accessories page for details at www.zaber.com.



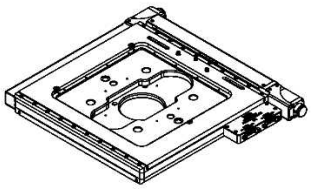
Minimum Travel Position



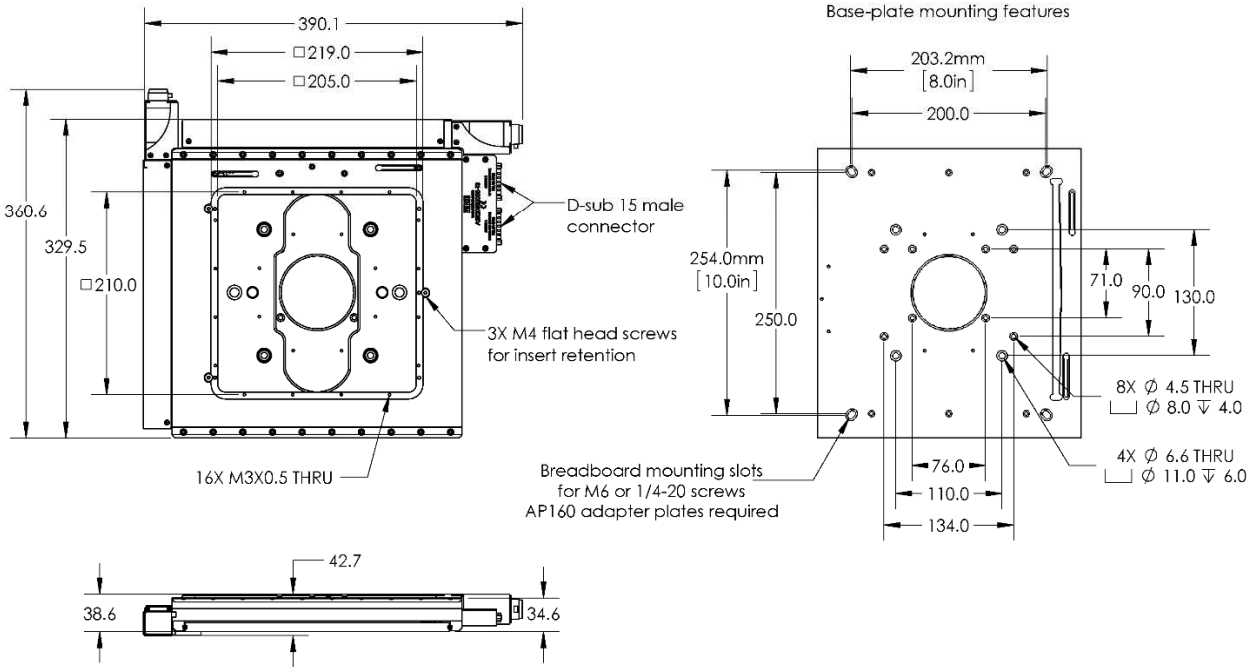
Maximum Travel Position



ASR-E Motorized XY Microscope Stage With Encoder
dimensions in mm

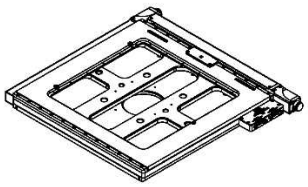


Adaptor plates required for breadboard mounting.
See accessories page for details at www.zaber.com

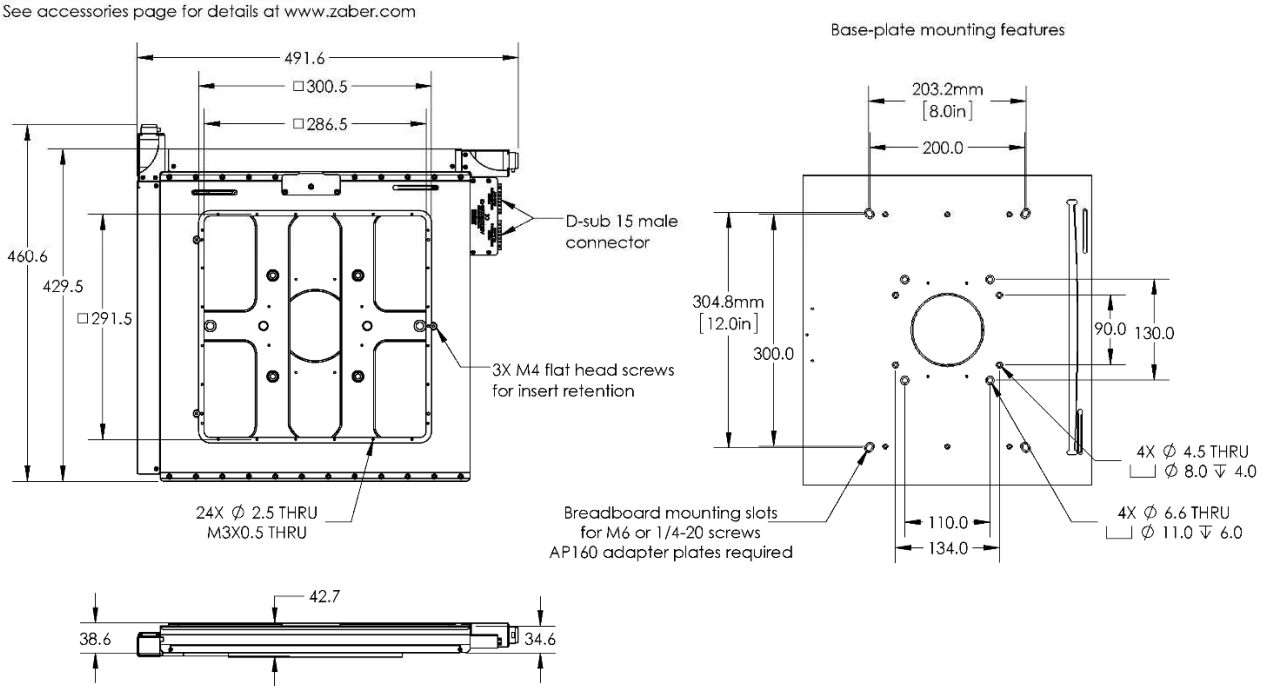


DWG 1791 (B) A

ASR-E Motorized XY Microscope Stage With Encoder
dimensions in mm



Adaptor plates required for breadboard mounting.
See accessories page for details at www.zaber.com



DWG 1795 (B) A

Specifications

Specification	Value	Alternate Unit
Microstep Size (Default Resolution)	0.15625 µm	
Built-in Controller	No	
Recommended Controller	X-MCC2 (48 V) Recommended	
AutoDetect	Yes	
Repeatability	< 2 µm	< 0.000079″
Maximum Speed	85 mm/s	3.346″/s
Minimum Speed	0.000095 mm/s	0.000004″/s
Speed Resolution	0.000095 mm/s	0.000004″/s
Encoder Type	Rotary quadrature encoder	
Peak Thrust	95 N	21.3 lb
Maximum Continuous Thrust	95 N	21.3 lb
Guide Type	Crossed roller bearing	
Linear Motion Per Motor Rev	2.00 mm	0.079″
Motor Steps Per Rev	200	
Motor Type	Stepper (2 phase)	
Motor Rated Current	1500 mA/phase	
Motor Winding Resistance	2.05 ohms/phase	
Inductance	1 mH/phase	
Motor Connection	D-sub 15	
Default Resolution	1/64 of a step	
Mechanical Drive System	Precision lead screw	
Limit or Home Sensing	Magnetic, adjustable home and away sensors	
Axes of Motion	2	
Mounting Interface	Separate mounting adaptors available	
Operating Temperature Range	0 to 50 ° C	
Vacuum Compatible	No	
RoHS Compliant	Yes	
CE Compliant	Yes	

Comparison

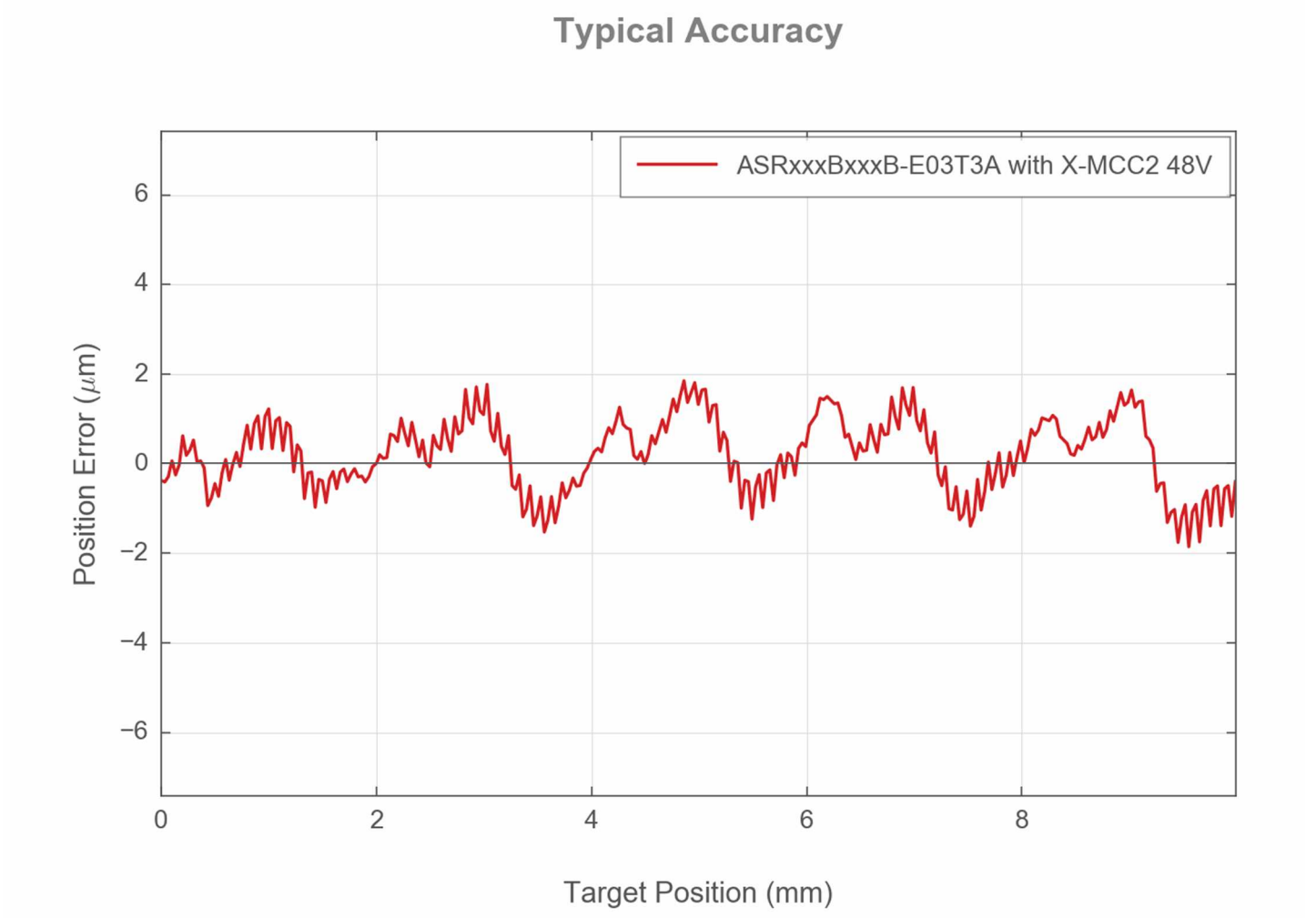
Part Number	X Travel Range	Y Travel Range	Accuracy (unidirectional)	Backlash
ASR050B050B-E03T3A	50 mm (1.969″)	50 mm (1.969″)	12 µm (0.000472″)	< 4 µm (< 0.000157″)
ASR100B120B-E03T3A	120 mm (4.724″)	100 mm (3.937″)	40 µm (0.001575″)	< 4 µm (< 0.000157″)
ASR205B205B-E03T3A	205 mm (8.071″)	205 mm (8.071″)	50 µm (0.001968″)	< 10 µm (< 0.000394″)
ASR305B305B-E03T3A	305 mm (12.008″)	305 mm (12.008″)	80 µm (0.003150″)	< 10 µm (< 0.000394″)

Part Number	Flatness	Maximum Centered Load	Pitch	Roll
ASR050B050B-E03T3A	8 µm (0.0003″)	200 N (44.9 lb)	0.02° (0.349 mrad)	0.02° (0.349 mrad)
ASR100B120B-E03T3A	15 µm (0.0006″)	100 N (22.4 lb)	0.02° (0.349 mrad)	0.02° (0.349 mrad)
ASR205B205B-E03T3A	25 µm (0.0010″)	100 N (22.4 lb)	0.02° (0.349 mrad)	0.01° (0.174 mrad)

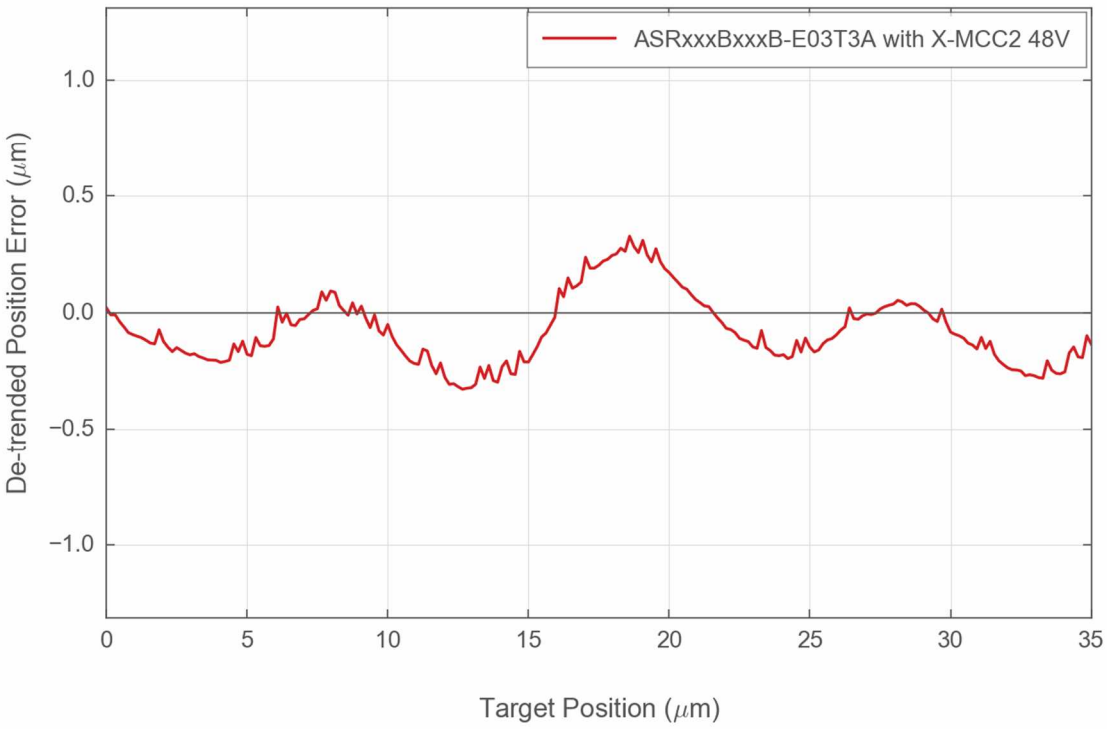
Part Number	Flatness	Maximum Centered Load	Pitch	Roll
ASR305B305B-E03T3A	50 µm (0.0020″)	100 N (22.4 lb)	0.04° (0.698 mrad)	0.015° (0.262 mrad)

Part Number	Yaw	Weight
ASR050B050B-E03T3A	0.005° (0.087 mrad)	1.82 kg (4.012 lb)
ASR100B120B-E03T3A	0.005° (0.087 mrad)	3.0 kg (6.614 lb)
ASR205B205B-E03T3A	0.01° (0.174 mrad)	6.65 kg (14.661 lb)
ASR305B305B-E03T3A	0.015° (0.262 mrad)	10.35 kg (22.818 lb)

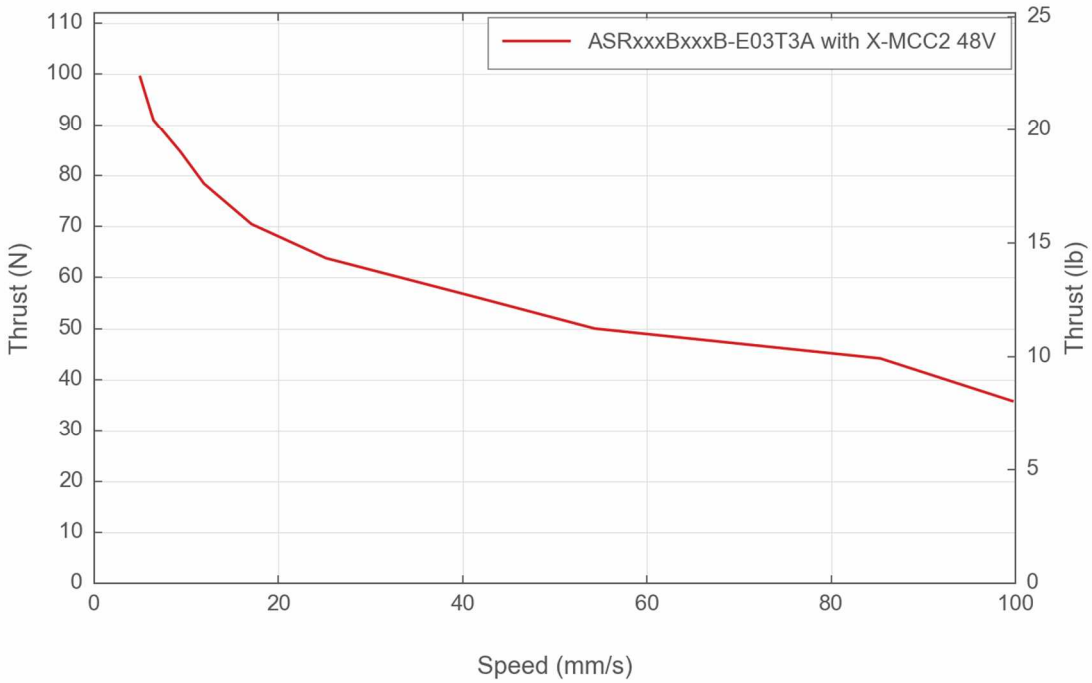
Charts and Notes



Typical Microstepping Accuracy



Thrust Speed Performance



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