

DMA-AE Series User's Manual

Direct drive linear stages with built-in linear encoders



Disclaimer

Zaber's products 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 warranty of fitness for a particular purpose. The user of this product agrees to [Zaber's general terms and conditions of sale](#).

Precautions

Zaber's autodetect peripheral axes are designed to be used effortlessly with Zaber's line of autodetect controllers. The DMA-AE 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.

Important Precautions for Use

Contamination could impact the performance of the DMA-AE stage. Avoid introduction of ferro-magnetic particles to the stage.

⚠ Mounting and Maintenance Hazard! For operator safety, the DMA-AE should always be un-powered during all cleaning, maintenance, and stage or load mounting operations. A powered stage could exert high forces and move at high speeds very suddenly if accidentally given a move command.

⚠⚠ Strong Magnets! The DMA-AE stages contain strong magnets that could affect pacemaker function. Pacemaker users should stay at least 20 cm away from the stages. The magnets can also attract nearby magnetic objects.

⚠ Back-driving Hazard! Linear motor stages require current to the motor coils to provide a force to maintain position and/or support a load. If power is removed the carriage may move suddenly or in an uncontrolled manner. The DMA-AE stage is not intended for load lifting operations due to the risk of uncontrolled motion if driver power is removed.

💡 Important: The DMA-AE is a servo device, meaning that its performance is dependent on proper tuning of the servo parameters for the given load. The use of incorrect servo parameters may reduce the device's performance in operation. Incorrect tuning may also result in unstable operation, which can cause unexpected rapid motion of the device, leading to reduced device lifetime and user injury. When the operating load on the device is changed, the tuning parameters should be updated to match. For details see the servo tuning guidelines.

Noise Emissions

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

Bearing Lubrication

Short travel can cause an insufficient distribution of lubricant amongst the rolling elements of the bearing system for the DMA-AE. For crossed-roller bearing guide types used in the DMA-AE, short travel is equal to or less than twice the spacing of the rolling elements (4 mm). If your application is considered short travel, it is recommended to occasionally drive the stage throughout its full travel range to maintain an even lubrication film over the entire guide surface.

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.

Device Overview

AutoDetect

Your DMA-AE 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 DMA-AE peripheral.

To connect the peripheral to a controller:

- Power off the controller.
- Connect the DMA-AE peripheral.
- Power on the controller.
- The controller will activate the peripheral shortly after it is powered on.

See the Zaber controller user manual for more details on peripheral activation and control.

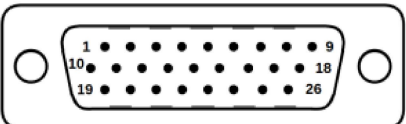
Connectors

Recommended controller(s) for your DMA-AE 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 26 Connectors (peripherals)

Pin	Description	Pin	Description
1	AutoDetect Clock	14	N.C.
2	AutoDetect Data	15	+5V
3	N.C.	16	Ground
4	N.C.	17	N.C.
5	N.C.	18	N.C.
6	N.C.	19	Differential Encoder Sin-
7	Ground	20	Differential Encoder Cos-
8	Motor A2	21	Differential Encoder Index-
9	Motor A1	22	AutoDetect Presence
10	Differential Encoder Sin+	23	N.C.
11	Differential Encoder Cos+	24	N.C.
12	Differential Encoder Index+	25	N.C.
13	N.C.	26	N.C.



Male High Density D-sub26 Connector
Motor and Sensor Interface

NOTE: All hall sensor signals (for limits or motor phase) are open collector and require a pull-up on the controller.

NOTE: All single-ended encoder inputs are non-isolated 5V TTL lines.

NOTE: All differential encoder signals are non-isolated, and must be terminated on the controller with 120 Ω . For -AE peripherals, these signals are sinusoidal with 1 V peak-to-peak differential levels and with the common mode between 1.5 V and 2.5 V.

Alternate Controllers

The DMA-AE can be controlled by alternate controllers with appropriate motor and encoder input. Damage to the device due to incorrect wiring is not covered by warranty.

Motors & Encoders

For motor and encoder information see the [DMA-AE product page](#)

Installation

The DMA-AE can be operated by connecting to the controller/s recommended in the product specifications. Please review the controller's user manual as well.

Physical Installation

⚠ Mounting and Maintenance Hazard! For operator safety, the DMA-AE should always be un-powered during all cleaning, maintenance, and stage or load mounting operations. A powered stage could exert high forces and move at high speeds very suddenly if accidentally given a move command.

Unpacking & Handling

DMA-AE stages are shipped with a travel lock designed to restrict motion of the stage during transport. This lock must be removed prior to mounting the stage.

Mounting

💡 Tip: To obtain the best pitch, roll, yaw and runout performance, mount the stage to a known flat, stiff surface.

⚠ Stability Hazard! Ensure the stage is fastened to a secure surface before mounting a load on the carriage. Ensure loads are mounted securely to the carriage of the stage before operating.

DMA-AE stages are designed to be secured using M3 socket cap screws (25 mm or longer) or M4 screws threaded into the stage from the underside (10 mm max depth).

Servo Tuning

This peripheral is a closed-loop positioning servo system. It continuously monitors and corrects its position via the linear encoder. As with any servo system, the behaviour is dependent on the controller tuning. The DMA-AE, when paired with a compatible Zaber controller, such as an X-MCC series Universal Motor Controller, will be appropriately tuned out of the box with settings that are optimized for regular use under a light load. However, as with any closed-loop feedback system, the device performance is load-dependent, and conditions significantly outside of the intended operating range have the potential for reduced performance or instability. Thus, if operation with large or unconventional dynamic loads is desired, or if the application demands specific performance characteristics, it may be necessary to tune the servo parameters. This may be conveniently done by using Zaber Launcher's Servo Tuner App, or [Zaber Motion Library's](#) ServoTuner API.

💡 Tip: Because servo devices continuously monitor and correct position, it is necessary to specify how accurate and stable the final position must be at the end of the movement. Criteria required for the controller to report IDLE status after movement are specified using the [cloop.settle.tolerance](#) and [cloop.settle.period](#) settings. For applications requiring utmost precision, you may want to specify a smaller tolerance and longer period. Note that there is a direct, inverse relationship between settling time and [cloop.settle.tolerance](#), and the controller may never report IDLE status if the tolerance is too small.

Trajectory Control and Behaviour

This section describes the behaviour of the axis trajectory when a movement command is issued.

Software Position Limits

The travel range of the axis is limited by the Minimum Position and Maximum Position settings. The factory settings for the axis are configured to match the physical travel range. If a customized range is desired, it can be changed by configuring the [limit.min](#) and [limit.max](#) settings to appropriate values. For the Current Position, query [pos](#).

Minimum Position

When the Current Position is less than the Minimum Position value, the axis cannot move in the negative direction.

Maximum Position

When the Current Position is greater than the Maximum Position value, the axis cannot move in the positive direction.

Movement Speed

The movement speed of the axis depends on axis status and various speed settings. If the axis has not been initialized by the [home](#) command or by moving towards the home end of the axis, movement speed will be constrained to fail-safe values. The home status of the axis can be determined by reading the [limit.home.triggered](#) setting.

Movement speed of the axis is specified below:

[move vel](#)

The axis will move at the specified speed regardless of home status.

Knob movement in Velocity Mode

The axis will move at the specified speed regardless of home status.

The speed is specified by the [knob.speedprofile](#) and [knob.maxspeed](#) settings.

Other movement commands - when the axis has not been homed

The axis will move at the slower of the [maxspeed](#) and [limit.approach.maxspeed](#) settings.

Other movement commands - when the axis has been homed

The axis will move at the speed specified by the [maxspeed](#) setting.

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.

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/DMA-AE>.

Appendix A: Default Settings

Please see [the Zaber Support Page](#) for default settings for this device.

Product Drawing

[Drawing for the DMA-AE](#)

Specifications

Specification	Value	Alternate Unit
Built-in Controller	No	
Recommended Controller	MCC (48 V) Recommended	
AutoDetect	Yes	
Travel Range	10 mm	0.394"
Accuracy (unidirectional)	8 µm	0.000315"

Specification	Value	Alternate Unit
Repeatability	< 0.05 μm	< 0.000002"
Minimum Incremental Move	10 nm	
Minimum Speed	0.61 nm/s	
Speed Resolution	0.61 nm/s	
Encoder Type	Linear analog encoder	
Encoder Count Size	1 nm	
Peak Thrust	15 N	3.4 lb
Maximum Continuous Thrust	5 N	1.1 lb
Motor Type	Moving Magnet Voice Coil	
Force Constant	2.23 N/A	0.5 lbs/A
Motor Connection	D-sub 26	
Guide Type	Anti-Creep Crossed-Roller Bearing	
Limit or Home Sensing	Optical Index Mark	
Axes of Motion	1	
Mounting Interface	M3 and M6 threaded holes	
Moving Mass	0.18 kg	0.396 lbs
Operating Temperature Range	0-50 $^{\circ}\text{C}$	
Vacuum Compatible	No	
Typical Move and Settle Time (100 nm move, < 15 nm, 250 g load)	< 15 ms	
Typical Move and Settle Time (250 nm move, < 15 nm, 250 g load)	< 15 ms	
Weight	0.48 kg	1.058 lb