X-DMQ-AE Series User's Manual

Direct Drive Linear Stages with Built-in Controllers and Linear 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 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 drive components. These will reduce the performance of the device below stated specifications.

Magnetic Flux Leakage

The X-DMQ-AE series of linear stages contains high-grade Neodymium-Iron-Boron (NdFeB) rare-earth magnets. A strong magnetic field is present at the surfaces of the device, which rapidly decays in strength with distance. Immediately adjacent to some surfaces the peak magnetic field is about 100 mT, decaying to 5 mT at a distance of 25 mm. This magnetic field may be strong enough to interfere with pacemakers or other magnetic-field-sensitive equipment placed sufficiently close to the device, and will gently attract nearby ferromagnetic objects. The accessory [DMQ Flux Shield](#) included with the X-DMQ-AE may be used to reduce the magnetic field for sensitive applications. Use of the DMQ Flux Shield or mounting to ferromagnetic surfaces will slightly reduce the force produced by the X-DMQ-AE.

Prolonged Operation at High Force and Temperature

In voice coil devices the maximum continuous force is limited by heat dissipation. The X-DMQ-AE is rated to produce a continuous force of 12 N under normal operating conditions, and peak forces of 15.5 N. This rating is tested at 20°C environment with the stage mounted to an aluminum surface. Under these conditions, the device

can produce its continuous force indefinitely without suffering damage or exceeding a safe-to-touch temperature of 60°C.

Exceeding the continuous force rating for sustained periods of time (typically 1-5 minutes), or operation at high force outputs in non-standard conditions (such as an elevated-temperature environment, enclosed environment, or mounted to highly insulating surfaces) will result in a high surface temperature that may present a burn hazard. Operation under such conditions may also lead to a permanent reduction in device performance or accelerated failure.

If the X-DMQ-AE detects it is exceeding temperature limits, the controller will set the FD warning and disable the driver. Once the axis has cooled, send system reset to re-enable the driver. See the ASCII protocol manual for details about warning flags.

Servo Tuning

The X-DMQ-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.

Backdrivability

The X-DMQ-AE does not have a brake, and can backdrive. When the device is un-powered or the force against the device exceeds the force that the device can exert (stall condition), the device will move in the direction that the external force is applied until the device reaches the end of its physical travel range. Be sure that harm cannot come to people or equipment if the device backdrives.

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.

Quick Tutorial

We recommend using Zaber Console to communicate with the device(s). For other software options, see the Software page. Please refer to the Protocol Manual for more detailed information on the available commands.

Initial Set-up

MANUAL
CONTROL KNOB

NEXT DEVICE
(OPTIONAL)

COMPUTER
(OR PREVIOUS
DEVICE)

POWER

PUSH
TO
STOP

ORDER OF CONNECTORS AND KNOB LOCATION
MAY VARY BETWEEN DEVICES

1. Daisy chain all integrated devices and controllers together using the RS-232 "Prev" and "Next" connectors (see Daisy-Chaining Devices for more details).
2. Next, supply power to one or more devices. Many products share power through the daisy-chain cables. The green power indicator on each should light up.
3. Turn the knob to move a positioner. Most positioners will only move in one direction until they reach a home sensor at one limit of travel. Then they will move in both directions over full travel.
4. Download and install Zaber Console. Start Zaber Console.
5. Select the communications port the first controller is connected to. For instructions on how to find the available communication ports on your system, please refer to: Appendix A - Available Communications Ports.
6. If multiple devices are detected, Zaber Console may prompt you to renumber (T:2) them. The first device in the chain (closest to the computer) will become Device 1, the next will become Device 2, and so on.

Initialization

Every time the device is powered up or reset, you should return the positioner to the home position. This is achieved by sending the home (T:1) command to the individual device or all devices. Until this is done, most positioners will only allow motion in one direction, towards the sensor.

Using the Device

Several commonly used ASCII commands and their Binary equivalents, are shown below. For a full list of available commands, please refer to the Protocol Manual.

Command	Description
/1 1 get pos↵ (T:60)	Query the current position of Device #1 Axis #1.
/1 1 move abs 10000 ↵ (T:20:10000)	Move Device #1, Axis #1 to position 10000 encoder counts.
/2 1 move rel −12800↵ (T:21:−12800)	Move Device #2, Axis #1 in the negative direction by 12800 encoder counts.
/1 stop ↵ (T:23)	Decelerate and stop ALL axes on Device 1. An axis number of 0 or no axis number implies all axes on the device, or the device itself.

Command	Description
/move vel 153600 ↵ (T:22:153600)	Move ALL devices and ALL axes in the positive direction at the speed 153600. A device address of 0 or no device address implies all devices in the chain.

Modifying Device Settings

Here are some examples if you would like to customize particular device or axis settings. Refer to the Protocol Manual for detailed descriptions of each setting.

Command	Description
/1 set maxspeed 100000↵ (T:42:100000)	Set the speed of all axes on the device.
/1 get maxspeed↵(T:53:42)	Query the maximum speed of all axes on the device.
/1 system restore↵ (T:36)	Restore all the settings of Device 1 to the default.

Firmware Updates

In order to allow access to new features and bug fixes, this Zaber device can be updated remotely through Zaber Console. Follow instructions here to update: www.zaber.com/FirmwareUpdate

Device Overview

Connectors

All images are shown looking into the device.

Power

Pin	Description
1	24 − 48 V
2	GND (Note: Zaber's power supplies ground this pin to AC Earth)

Note: To prevent damage to the device due to static buildup, the device should be properly grounded. The power supplies Zaber provides for X-Series devices are non-isolated and thus ground the device chassis to Earth via the negative terminal of the power supply. If for any reason you are using an isolated power supply, please ensure your device is grounded by connecting the negative terminal of the power connector to AC Earth.

RS-232 Communications

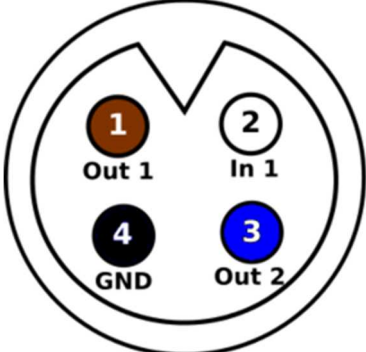| Pin	Previous	Next
1	Power (max 4 A)	Power (max 4 A)
2	Ground	Ground
3	Receive	Transmit
4	Transmit	Receive

Default Settings
- Baud rate: 115200
- Protocol: Zaber ASCII

Specifications
- Supported Protocols: Zaber ASCII, Zaber Binary

- Supported baud rates: 9600, 19200, 38400, 57600, 115200
- Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

D12 IO pinout

Pin	Description
1	Output #1
2	Input #1
3	Output #2
4	Ground

Note: See I/O Usage and Examples for additional information.

Indicators

Green (Device) - Power
- On: Controller is operational.
- Blinking twice per second: The power supply voltage or controller temperature is out of range.

Red (Device) - System Error
- On/blinking: An error has occurred. Please contact Zaber Technical Support.

Yellow (Device) - Communication
- On: Data is being transferred.
- Blinking twice per second: Packet corruption has occurred for ASCII commands sent with a checksum.

Yellow (Axis) - Axis Status
- On: Axis is moving.
- Blinking: Axis is under manual control via the knob (in Velocity mode). The blinking rate is proportional to movement speed.

Blue (Axis) - Warning/Error
- Blinking twice per second: Driver is disabled due to over-temperature, out-of-range voltage or other driver fault; or due to user request. See Fx Warning Flags. *Note: This may occur for a few seconds on power-up as device initializes.*
- Blinking once every 2 seconds: The axis has stalled and stopped.
- Flashes: The stationary axis has been forced out of position (2 short flashes every 1 second), or the encoder has encountered a read error and raised the FQ warning flag (5 short flashes every 2 seconds).

Installation

The X-DMQ-AE can be connected to a computer as follows:

1. Plug the M8 to USB adaptor (X-USBDC) into one of your computer's USB ports, then attach the device to the adaptor. You may need to use a cable extension to reach your computer. There is no need to power down or reboot the computer.
2. Connect the power plug of your power supply to the power connector of the device. The green LED should light up indicating the device has power.
3. Additional devices can simply be daisy-chained to the first. See Daisy-Chaining Devices below.
4. Install software from the Software page. For the initial setup, using Zaber Console is recommended.

As a simple first test, try entering:

> /renumber↵ (T:2)
> /1 home↵ (T:1)
> /1 move rel 10000↵ (T:21:10000)

The parameter of 10000 in the move command above specifies 10000 encoder counts. To see the encoder count size (default resolution) for the positioner and how it translates to displacement, first go to the product overview page, find your product, click through to the product's webpage, and click on the "Series Specs" tab. The encoder count size (default resolution) will be shown in the list of product specs either in the "Group Specifications" section or the "Comparison" section.

Daisy-Chaining Devices

Multiple devices can be connected together in a chain through the Prev and Next connectors. This allows any number of devices to be controlled from a single connection to a computer, reducing cabling demands. In addition, X-Series devices carry power through the daisy chain, so in most cases a power supply only needs to be connected to one device in the chain. Whenever a device is added or removed from a chain, a renumber (T:2) command should be sent to prevent device-address conflicts.

To daisy-chain X-Series devices with T-Series and A-Series devices:

- Ensure all devices are set to the same communication protocol and baud rate before connecting them. If any T-Series devices will be in the chain, then the communication protocol must be Binary at 9600 baud rate.
- Connect any X-Series devices at the start of the chain (closest to the computer). This configuration will reduce the number of adaptor cables required.
- Connect a T-XDC (or S-XDC for daisy-chaining an A-MCB2) adaptor cable to the Next port of the last X-Series device in the chain, and to the Prev port of the T-Series or A-Series device.
- Power supplied to an X-Series device will not be transmitted to any T-Series or A-Series devices in the chain.
- Contact Zaber Technical Support for assistance selecting connecting cables when daisy-chaining multiple series.

Manual Control

Most X-Series motion control products have an integrated, depressible knob with 20 detents per revolution, allowing axes to be controlled without the use of a computer. There are two manual movement modes available: Velocity and Displacement. Switch between these modes by holding down the knob for 1 second or by configuring the knob.mode (T:109) setting.

On power-up, many axes will only travel towards the controller from their start-up positions until the home position is reached. Once the axis has been homed, the full range of travel becomes available.

Velocity Mode

Turn the knob clockwise to move the axis in the positive direction (extend) or counter-clockwise for negative direction (retract). Each detent of the knob increases the speed of the carriage.

There are 16 speeds in each direction. The velocity profile and maximum speed can be configured via the knob.speedprofile (T:112) and knob.maxspeed (T:111) settings. The axis stops and resets the knob upon arriving at the end of travel.

Displacement Mode

Turn the knob clockwise to move the axis in the positive direction (extend), counter-clockwise for negative direction (retract). Each detent of the knob moves the axis a fixed number of encoder counts, specified by the knob.distance (T:110) setting. If knob.distance (T:110) is set to 0, each detent of the knob will move to the next index position, similar to move index (T:78) movements. The axis moves at the speed specified by the maxspeed (T:42) setting, or the slower of maxspeed (T:42) and limit.approach.maxspeed (T:41) if the axis has not been homed. If there are fewer than knob.distance (T:110) encoder counts to the end of travel and another move is requested, the axis will move to the end of travel and then stop.

Summary of knob functionality

- Turning the knob:
  Moves the axis in the direction of knob turn.
- Pressing the knob:
  Decelerates and stops the axis (identical to a stop (T:23) command).
  Instantly stops the axis, if the axis is already decelerating.
  Warning: Stopping instantly may result in damage to the product and reduced lifespan. Use sparingly if the axis is under heavy load.
- Pressing and holding the knob for 1 second:
  Toggles between Velocity Mode and Displacement Mode.

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 (T:106) and limit.max (T:44) settings to appropriate values. For the Current Position, query pos (T:60).

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 (T:1) 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(T:53:103) setting.

Movement speed of the axis is specified below:

move vel (T:22)
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 (T:112) and knob.maxspeed (T:111) settings.
Other movement commands - when the axis has not been homed
The axis will move at the slower of the maxspeed (T:42) and limit.approach.maxspeed (T:41) settings.
Other movement commands - when the axis has been homed
The axis will move at the speed specified by the maxspeed (T:42) setting.

Servo Tuning

This positioner 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. It comes pre-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 performance is load-dependent, and conditions significantly outside of the intended operating range have the potential for reduced performance or instability. Thus, if the product is to be used operation with a large or unconventional dynamic loads is desired, or if the application demands specific performance characteristics, it may be necessary to tune the servo controller parameters. This is done via the ASCII protocol servo interface.

Tip: Because servo positioners 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.

Servo Tuning with Zaber Console

Zaber Console provides several convenient ways to tune your servo positioner. In Zaber Console, open the Servo Tuning tab and select your X-DMQ-AE from the device list. For most users, the recommended way is to use the Simple tuning method. As the dynamics of most loads are dominated by their inertia (the moving mass), simply enter the total moving mass supported by the axis, and the moving mass of the X-DMQ-AE carriage. Click "Write to Device" and Zaber Console will apply the optimized servo parameters to your device. Servo tuning always represents an optimization that balances different performance tradeoffs. For example, an overly aggressive (high gain, high bandwidth) servo tuning will have very fast reaction to compensate for disturbances, good trajectory following, and a high stiffness. However, it will also overreact to sensor noise, which may result in a "hissing" sound generated by the motor. In contrast, a gentler servo tuning will do a good job of filtering out noise and thus offer smooth performance, but at the cost of a reduced ability to compensate for disturbance forces and weaker trajectory following. The optimal choice of tuning parameters will therefore vary depending on the application: An imaging application will have minimal disturbance forces and benefit from smoother tuning, while a machining application may benefit from the parameters adjusted to a higher stiffness. The Simple tuning method provides a slider that allows you to adjust the servo aggressiveness to suit your application. If you are just getting started or aren't sure what values would work best for you, setting the slider to the middle provides a well-rounded starting point. For more advanced users, Zaber Console provides additional methods of servo tuning, which are discussed in the Zaber Console manual.
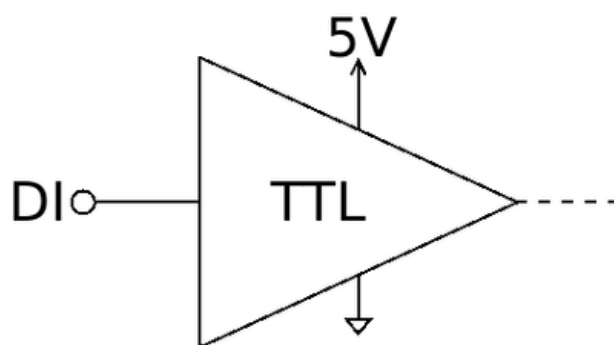
I/O Usage and Examples

The X-DMQ-AE features one digital input and two digital outputs that operate on a +5 V supply are TTL compatible. The input and output capabilities of the X-DMQ-AE can also be used with triggers to perform actions based on the current value of the I/O channel.

Digital Inputs

The input will draw up to 1 mA during operation.

Reading the input is accomplished by sending the unit an io get di command, as shown below.

```
/1 io get di 1
```
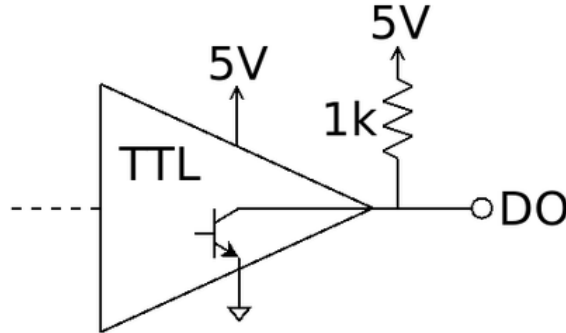
```
@01 0 OK IDLE -- 0
```

This command queries the input on the device, in this case input 1, which is low.

Digital Outputs

The digital outputs use an open collector buffer with a pre-installed 1 kΩ pull up resistor to +5 V. Each output can sink up to 20 mA.

The digital outputs are set through the io set do command, as shown below.

```
/1 io set do 2 1↵

@01 0 OK IDLE -- 0
/1 io set do 1 0↵

@01 0 OK IDLE -- 0
```

The first command sets the second digital output high (5 V). The second command sets the first digital output low (0 V).

Troubleshooting X-Series Motion Devices

The following sections contain tips for troubleshooting common problems. If the device is unable to communicate, and it is operating erratically, a manual factory reset can be performed on most devices using the following steps. Note that this will reset most settings.

1. Power Off the device
2. Push and hold the knob for the first Axis (if applicable)
3. Power On the device
4. Continue to hold the knob in until the blue LED is lit (~5 seconds), then release.

The device has been returned to its factory defaults and can be configured as per the steps in Initial Setup.

Front Panel Indicators

Green LED on.
> The device is powered on and is operating normally.

Green LED flashes slowly.
> The operating conditions of the device are outside of the recommended range.
> This will occur when the supply voltage is either over or under the recommended range or the controller temperature has exceeded the set limit. Check the following:
> - The input voltage is within the operational range of the device. This can be read from the device with the get system.voltage command.

- The device temperature is within range. This can be read from the device with the get system.temperature command.

Green LED off.

The device is not powered.

Check the supply connections and power adaptor for correct operation.

Red LED on or flashing.

A critical error has occurred.

Please contact Zaber Technical Support.

Yellow LED always off or flashes but no reply.

There are communication errors.

Please see the Communication Errors section below.

Blue LED flashing during a move or blinking every two seconds.

The axis has slipped or stalled.

Please see the Slipping and Stalling section below.

Blue LED showing a burst of 2 flashes every 1 second.

A stationary axis has been forced out of position.

Blue LED showing a burst of 5 flashes every 2 seconds.

The encoder has encountered a read error.

Please contact Zaber Technical Support.

Blue LED blinking twice per second. Axis does not move.

Driver may be disabled due to over-temperature, out-of-range voltage or other driver fault; or due to user request.

See Fx Warning Flags.

Once the issue has been resolved, send driver enable.

Manual Control

Turning the knob either way results in no movement.

The knob may have been disabled.

Check that the knob.enable (T:107) setting is correct.

Restore the default parameters through the system restore (T:36) command.

The axis won't cover the full range of travel.

The axis hasn't been homed.

Turn the knob anti-clockwise until the axis reaches the fully retracted position. The axis will home and the full range of travel available.

Unexpected Behaviour

The axis doesn't respond to a move command.

The axis may need to be homed before use.

Send the home (T:1) command.

The axis is moving on its own and running against the ends of travel.

The position encoder has de-synchronized.

Reset the device by power cycling it or sending the system reset (T:0) command, then re-initialize it with the home (T:1) command.

The axis is moving very slowly. It used to move faster.

The speed settings may have been changed inadvertently.

Send a system restore (T:36) command.

The axis makes minor static-sounding noises even when stationary.

This condition happens if the closed-loop position controller is set to an aggressive servo tuning. It does not have an impact on the performance or lifetime of the stage, and is usually a normal operating condition.

Audible noise may be reduced or eliminated by lowering the servo gain. If the noise is very loud, then the gain needs to be reduced.

See the instructions on servo tuning.

The axis oscillates and has difficulty maintaining a fixed position.

The servo tuning may have been set incorrectly, or adjusted for a different load than what the axis is operating with.

See the instructions on servo tuning.

The axis consistently overshoots the target position position an unacceptable amount.

The acceleration setting may be too high for the load mass on the stage, or the servo tuning may be set inappropriately.

See the instructions on servo tuning.

The axis moves freely by hand and does not hold its position.

A setting might have been inadvertently changed.

- Try sending the system reset (T:0) command.

The positioner's motor unexpectedly shuts off. An [Fx warning flag] is present.

The motor over-temperature protection switch has been tripped. This sensor will trip if the positioner's maximum continuous thrust specification is exceeded for too long. To prevent this condition from occurring again, reduce the average force that the motor outputs by reducing acceleration, reducing the load, or lowering the duty cycle.

Send a [driver enable] command. The axis does not require homing.

Communication Errors

There is no communication with the device; the Yellow LED does not come on or flash.

There are several things that should be checked:

- Make sure the correct serial port is selected. Try selecting other serial ports in the software.
- Check the baud rate, hand shaking, parity, stop bit, etc. when configuring the serial communications software. The required settings are listed in the [RS-232 Communications] section above.
- Make sure there are no bent pins in the ends of all the data cables
- Make sure the device is powered. The Green LED should be on.
- If the computer is a laptop running on batteries, try plugging in the power. Some laptops disable the serial ports when running on batteries.
- Make sure a null modem adaptor or cable is not being used.
- Make sure the correct adaptors(if any) are being used. Refer to the pinouts in the [RS-232 Communications] section above.
- If the problem was encountered when trying to control the device with custom software, try using one of the demo programs from the Zaber website to verify that the hardware is functioning properly.

Two or more devices both respond to commands sent to device 1.

Most devices are shipped with their device number set as 1. If you connect the devices through Zaber Console, you will be prompted to renumber them. If you aren't able to install and open Zaber Console, send the [renumber] ([T:2]) command in the software you are using to set all of the device numbers to different values.

The Yellow LED comes on briefly when sending a command, but the axis does not move and does not reply.

Check baud rate, hand shaking, parity, stop bit, etc. are set as per the [RS-232 Communications] defaults. The device numbers may not be what is expected, issue a [renumber] ([T:2]) command. Make sure that the computer does not transmit anything else while the devices renumber.

If using the Binary Protocol, check the following:

- 6 bytes are transmitted and that the device number and command are valid.
- The software does not transmit any control characters such as line feed and spaces.
- That the serial port is not configured with a termination character (it often defaults to linefeed).

If problems are encountered when using custom software, try using one of the demo programs from the Zaber website to verify that the hardware works.

The device does not behave as expected when software sends it a series of commands.

The computer might be set to Unicode. This is common for languages that use non-Latin based characters. Go to Control Panel/Regional and Language Options/Advanced. Select a language for non-unicode programs. This should be English or another Latin based character language.

Check what is being sent out of the serial port. [stackoverflow.com] has a list of some tools to monitor serial ports.

In Binary mode, the device does not send replies but otherwise works.

Auto-reply might have been disabled via [T:101].

Send a [system restore] ([T:36]) command.

If the problem is encountered when trying to control the device with custom software:

- Use a demo program from the Zaber website to verify that the hardware is functioning properly.
- Make sure that the receiving part of the code or commercial package is correct.
- Check the serial port settings are correct.
- Check connectors for bent or broken pins.

In Binary mode, the device sometimes returns fewer than 6 bytes.

This typically indicates a problem with the serial port settings. Some serial ports are set to automatically recognize and remove specific control characters such as carriage returns when they appear in the RS-232 receive buffer.

Check that the settings are correct and are not removing or replacing characters.

Slipping and Stalling

The axis moves smoothly, but only moves for a short time then stops. The Blue LED is flashing but the axis is not actually slipping or stalling.

The internal encoder counter needs to be re-initialized. Reset the device by power cycling it or sending system reset (T:0) command, then re-initialize it with the home (T:1) command.

Ground the device and avoid operating it under statically noisy environment.

The axis makes noise but does not move. The Blue LED is flashing.

The axis is stalling.

Try removing all external loads. If the axis now extends and retracts normally, the problem is excessive load. Try to reduce the load and ensure the load is less than the maximum thrust. A higher thrust or torque can be achieved by lowering the speed of the axis using the maxspeed (T:42) setting.

If an axis is stalling with no external load at default speed and acceleration settings then it requires servicing.

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/X-DMQ-AE.
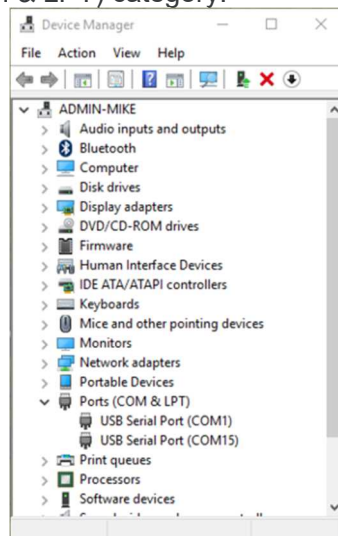
Appendix A - Available Communications Ports

Finding Installed Serial Ports

Windows

1. Open Search or Run from the Start Menu or Taskbar, type "Device Manager" and press enter.

2. Expand the Ports (COM & LPT) category.

o   In this example there are two serial ports available (COM1 and COM15), which are both USB adaptors.

Linux

1. Finding devices
    o   Open a terminal and execute the following command:

    `dmesg | grep -E ttyU¥?S`

    o   The response will be similar to the following:

    ```
    [ 2.029214] serial8250: ttyS0 at I/O 0x3f8 (irq = 4) is a 16550A
    [ 2.432572] 00:07: ttyS0 at I/O 0x3f8 (irq = 4) is a 16550A
    [ 2.468149] 0000:00:03.3: ttyS4 at I/O 0xec98 (irq = 17) is a 16550A
    [ 13.514432] usb 7-2: FTDI USB Serial Device converter now attached
    to ttyUSB0
    ```

    o   This shows that there are 3 serial ports available: ttyS0, ttyS4 and ttyUSB0 (a USB adaptor)
2. Checking port permissions

- o Using the ports found above, execute the following command

```
ls -l /dev/tty{S0, S4, USB0} ↵
```

- o The permissions, given below, show that a user has to be root or a member of the dialout group to be able to access these devices

```
crw-rw---- 1 root dialout 4, 64 Oct 31 06:44 /dev/ttyS0
crw-rw---- 1 root dialout 4, 68 Oct 31 06:45 /dev/ttyS4
crw-rw---- 1 root dialout 188, 0 Oct 31 07:58 /dev/ttyUSB0
```

3. Checking group membership

```
groups ↵
```

- o The output will be similar to the following:

```
adm cdrom sudo dip plugdev users lpadmin sambashare
```
Notice that dialout is not in the list
- o A user can be added to the dialout group with the following command

```
sudo adduser $USER dialout ↵
```

- o Group membership will not take effect until the next logon.

OSX

1. Finding devices
    - o Open a terminal and execute the following command:

```
ls /dev/cu.*serial*
```

    - o The response will be similar to the following:

```
/dev/cu.usbserial-FTB3QAET
/dev/cu.usbserial-FTEJJ1YW
```

    - o This shows that there are two serial ports available, both of which happen to be USB adaptors.
    - o There may be other devices that match this query, such as keyboards or some web cameras. To determine which one corresponds to your USB serial cable, try repeating the command with and without the cable connected to the computer, to see which one appears and disappears.

Product Drawing

ZABER
X-DMQ-AE Voice Coil Linear Stage
dimensions in mm
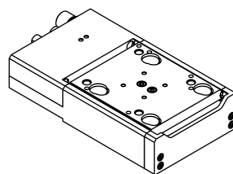
*See product page for complete list of available models at www.zaber.com

DWG 3281 R01
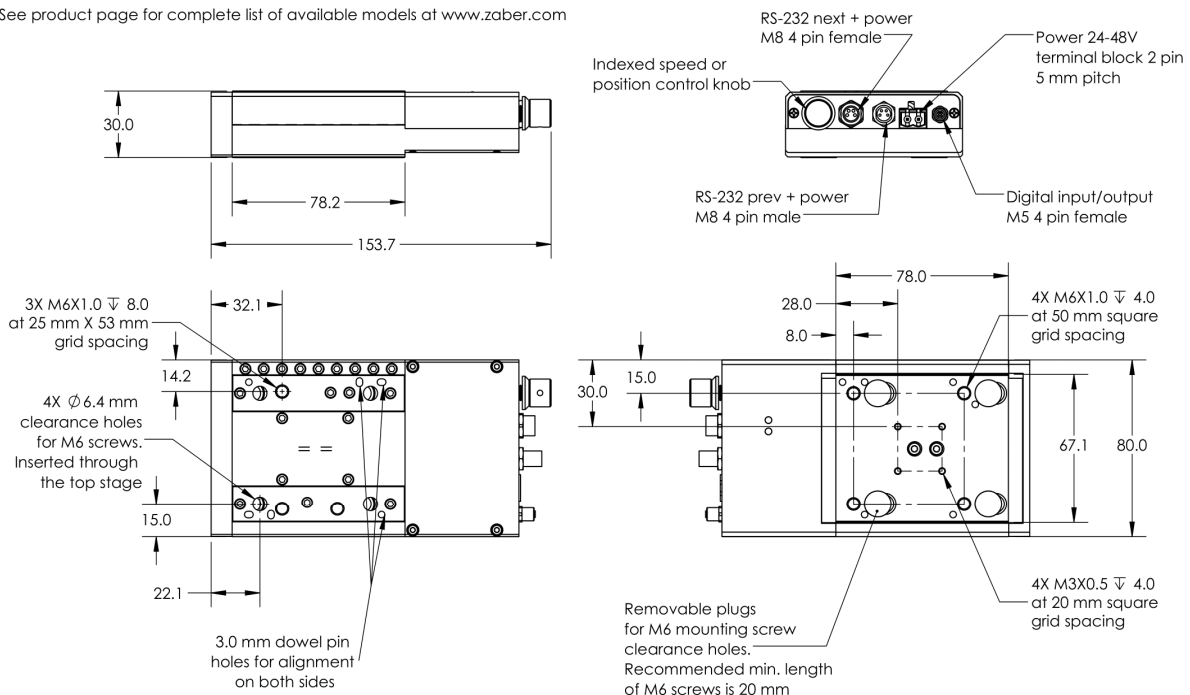
Specifications

Specification	Value	Alternate Unit
Built-in Controller	Yes	
Travel Range	12 mm	0.472″
Accuracy (unidirectional)	4 μm	0.000157″
Repeatability	< 0.5 μm	< 0.000020″
Minimum Incremental Move	200 nm	
Maximum Speed	1400 mm/s	55.118″/s
Minimum Speed	0.000122 mm/s	0.000005″/s
Speed Resolution	0.000122 mm/s	0.000005″/s
Encoder Count Size	1 nm	
Encoder Type	Linear analog encoder	
Peak Thrust	15.5 N	3.5 lb
Maximum Continuous Thrust	12 N	2.7 lb
Communication Interface	RS-232	
Communication Protocol	Zaber ASCII (Default)	
Maximum Centered Load	100 N	22.4 lb
Maximum Cantilever Load	320 N·cm	453.2 oz·in
Guide Type	Crossed-Roller Bearing	
Vertical Runout	< 6 μm	< 0.000236″
Horizontal Runout	< 5 μm	< 0.000197″
Pitch	0.03°	0.523 mrad
Roll	0.03°	0.523 mrad
Yaw	0.03°	0.523 mrad
Stiffness in Pitch	50 N·m/°	349 μrad/N·m
Stiffness in Roll	70 N·m/°	249 μrad/N·m
Stiffness in Yaw	85 N·m/°	205 μrad/N·m
Maximum Current Draw	1000 mA	
Power Supply	24-48 VDC	
Power Plug	2-pin screw terminal	
Motor Type	Voice Coil Linear Actuator	
Force Constant	12.6 N/A	2.8 lbs/A
Data Cable Connection	Locking 4-pin M8	
Mechanical Drive System	Moving Coil, Direct Drive	
Limit or Home Sensing	Optical Index Mark	
Axes of Motion	1	
LED Indicators	Yes	
Mounting Interface	M6 and M3 threaded holes	
Operating Temperature Range	0-50 °C	
Vacuum Compatible	No	
RoHS Compliant	Yes	
CE Compliant	Yes	
Moving Mass	0.095 kg	0.209 lbs
Digital Input	1	
Digital Output	2	
Weight	0.8 kg	1.764 lb

Charts and Notes

Typical Accuracy
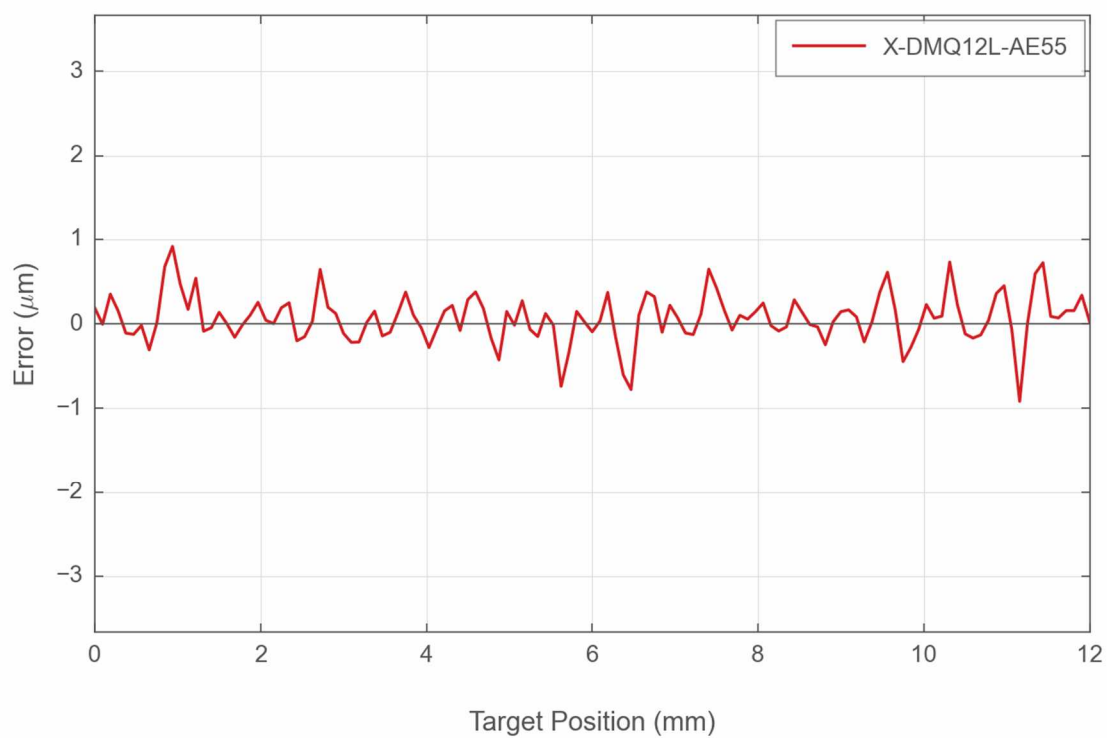
Typical Force Over Travel