

ZABER

A-BLQ-E Product
User's Manual
Firmware 5.00 and up

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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.

Conventions used throughout this document

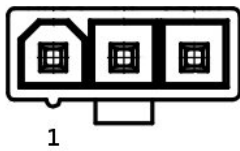
- `Fixed width` type indicates communication to and from a device. The `\r` symbol indicates a carriage return, which can be achieved by pressing enter when using a terminal program.
- An ASCII command followed by (T:xx) indicates a legacy T-Series Binary Protocol command that achieves the same result. Not all ASCII commands have an equivalent legacy counterpart. e.g.:
`move abs 10000 (T:20:10000)` shows that a `move abs` ASCII command can also be achieved with binary command number 20.
- All devices support the Binary Protocol, however the ASCII Protocol is only supported in devices with firmware version (T:51) 6.06 and above.

Device Overview



Connectors

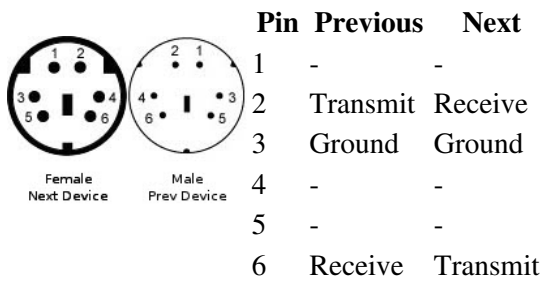
Power



Pin Description

- 1 12 - 48V
- 2 GND
- 3 Chassis

RS232 Communications



Default Settings

- Baud Rate: 9600
- Protocol: Binary

Specifications

- Supported Protocols: Zaber ASCII, Zaber Binary

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

Indicators



PWR (Green) - Power.

- On: Controller is operational.
- Blinking at 2Hz: The power supply voltage or device temperature is out of range.
- Fading in and out slowly: The device is parked. See the [tools parking \(T:65\)](#) command.

ERR (Red) - Error.

- On/blinking: Controller has lost its settings, or an error has occurred. Please contact [Zaber Technical Support](#).

MOT (Yellow) - Communication/Busy.

- On: Device is moving, or data is being transferred.
- Blinking: Device is under manual control via the knob (in Velocity mode). The blinking rate is proportional to movement speed.
- Blinking at fixed rate: Packet corruption has occurred for ASCII commands sent with a checksum.

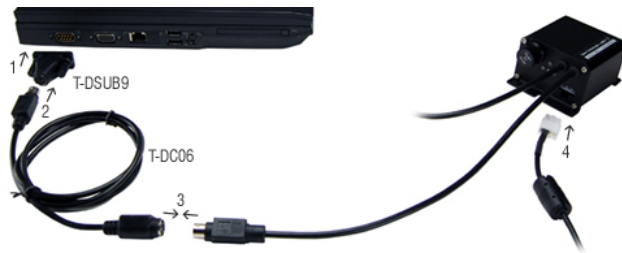
ENC (Blue) - Slip/Stall.

- On: The device is slipping.
- 2 short flashes every 1 sec: The stationary device has been forced out of position.
- On-Off cycle every 2 sec: The device has stalled and stopped.

Installation

The A-BLQ-E can be connected to a computer as follows:

1. Either plug the Mini-DIN to D-Sub serial adaptor ([T-DSUB9](#)) into your computer's serial port, or the Mini-DIN to USB adaptor ([T-USBDC](#)) into one of your computer's USB ports, then plug the device's data cable into the adaptor. For the USB adaptor, new computers will often be able to install the necessary drivers automatically when the cable is plugged in for the first time. If the computer reports that the driver installation was unsuccessful, you can download the drivers for Windows, Mac, or Linux [here](#). Installation instructions and troubleshooting information are available for each operation system [here](#). 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 unit. The green LED should light up indicating the unit has power.
3. Additional devices can simply be daisy-chained to the first. See [Daisy-Chaining Devices](#) below.
4. Install software from <http://www.zaber.com/wiki/Software>. For the initial setup, it is recommended that [Zaber Console](#) is used.



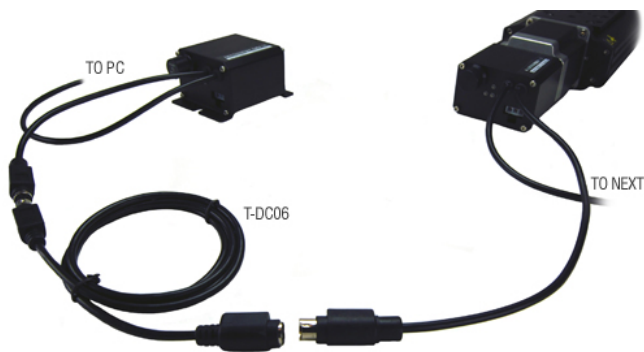
As a simple first test, try entering these instructions:

```
/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 microsteps. To see the microstep size (default resolution) for the device and how it translates to displacement, first go to the [product overview](#) page, find your device, click through to the device's webpage, and click on the "Series Specs" tab. The microstep 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 or USB and Next connectors. This allows any number of devices to be controlled from a single connection to a computer, reducing cabling demands. A power supply needs to be connected to each 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.



Zaber recommends having two separate chains when the connector types differ. To daisy-chain devices with different connectors, the following steps should be followed:

- DSUB9 and MiniDin 6 with firmware version at or below 6.05: (Binary Protocol Chain)
 The DSUB9 devices' comm.protocol (T:123) should be set to 1 (Binary) and the comm.rs232.baud (T:122) set to 9600.
 The DSUB9 devices should be chained together closest to the computer
 A T-DSUB9 connector can be used to connect the two strings of devices together.
- DSUB9 and MiniDin 6 with firmware version at or above 6.06: (ASCII Protocol Chain)
 The Minidin6 devices' comm.protocol (T:123) should be set to 2 (ASCII) and the comm.rs232.baud (T:122) set to 115200.
 The DSUB9 devices should be chained together closest to the computer
 A T-DSUB9 connector can be used to connect the two strings of devices together.

For assistance please contact [Zaber Technical Support](#)

Grounding

To prevent damage to the device due to static buildup, the device should be properly grounded.

Failure to ground the unit may result in the unit shutting down unexpectedly or ceasing to communicate with the computer. This problem can be minimized by not touching the unit during operation. If the unit fails due to static discharge, unplugging it and plugging it back in or sending a system restore (T:36) command will usually fix the problem.

Most Zaber devices are grounded via the shield wire of the data cables. This should normally provide a path to ground via the computer. For units which are being used without a computer, a ground lead should be connected to the chassis pin of the power supply connector.

Note: Encoder-embedded devices are sensitive to electrically noisy environments. Static discharges can affect position calibration and cause unstable behaviour. If the device is behaving strangely, verify that the device is properly grounded, reset the device (either by the system reset (T:0) command or by disconnecting then reconnecting power), then re-initialize the device with the home (T:1) command.

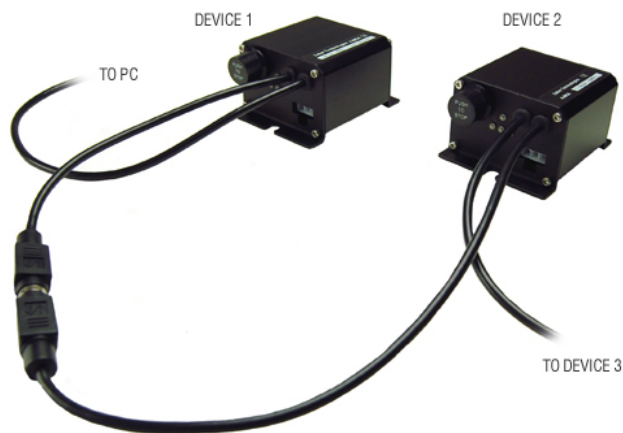
Quick Tutorial

The following tutorial uses Zaber Console to communicate with the device(s). Please refer to the [ASCII Protocol Manual](#) and/or [Binary Protocol Manual](#) for detailed information on the available commands and how to setup and use other software.

Initial Setup

The following steps need to be performed whenever a new unit is being installed.

1. Power up all integrated devices and controllers in the chain. The power indicator on each should light up.
2. Download and install Zaber Console from <http://www.zaber.com/wiki/Software>. Start Zaber Console and 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](#)
3. From the Console, issue a **renumber (T:2)** command to all devices. The first device closest to the computer in the chain will become device 1; the next, device 2 and so on.



Initialization

Every time the device is powered up or reset, the motorized peripheral(s) need to be returned to the home position before they can be used. This is achieved by sending the **home (T:1)** command to the individual unit or all units. Attempting to move the peripheral before it has been homed will result in an error, as shown below:

```
/01 move rel 10000  
@01 0 RJ IDLE WR BADDATA
```

If the device is being used under manual control, the motorized peripherals need to be driven to the minimum (home) position before they will operate over their full range.

Using the Device

Several commonly used ASCII commands, and their Binary equivalents, are shown below. For a full list of the available commands, please refer to the [Command Reference](#) section below.

Command	Description
/1 1 <u>get_pos</u> (T:60)	Query the current position of device #1 axis #1.
/1 1 <u>move_abs</u> 10000 (T:20:10000)	Move device #1 axis #1 to position 10000 microsteps.
/2 1 <u>move</u> <u>rel</u> -12800 (T:21:-12800)	Move device #2 axis #1 in the negative direction by 12800 microsteps.
/1 <u>stop</u> (T:23)	Decelerate and stop ALL axes on device 1. An axis number of 0 or no axis number implies all axes on the devices, or the device itself.
<u>/move_vel</u> 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 settings. Refer to the [ASCII Settings](#) or [Command Reference](#) section for detailed descriptions of each setting.

Command	Description
/1 set <u>maxspeed</u> 100000 (T:42:100000)	Set the speed of the all axes on the device.
/1 get <u>maxspeed</u> (T:53:42)	Query the axes' speed.
/1 <u>system restore</u> (T:36)	Restore all the settings of device 1 to the default.

Built-In Help

Zaber A-Series devices (with ASCII support) feature a built-in help guide, providing a quick and easy reference for all [Commands](#) and [Settings](#) that the device has. To access the help, send: /1 help

The device will respond with a detailed description on how to access specific information about commands and replies, as shown below:

```
@01 0 OK IDLE WR 0
#01 0 COMMAND USAGE:
#01 0 '/stop'      stop all devices
#01 0 '/1 stop'   stop device number 1
#01 0 '/1 2 stop' stop device number 1 axis number 2
#01 0
#01 0 Type '/help commands' for a list of all top-level commands.
#01 0 Type '/help reply' for a quick reference on reply messages.
#01 0 Visit www.zaber.com/support for complete instruction manuals.
```

To access help for a specific command, for example the move command, send:

```
/1 help move
@01 0 OK IDLE -- 0
#01 0 move abs {x}      Move to absolute position
#01 0 move rel {x}     Move by relative position
#01 0 move vel {x}    Move at constant velocity
```

#01 0 move min
#01 0 move max

Move to minimum position
Move to maximum position

Manual Control

The A-Series range of motion control products are integrated with a depressible knob with 20 detents per revolution, allowing devices 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 via configuring the [knob.mode](#) (T:109) setting.

Upon power-up, the device will only travel towards the motor from its start-up position until the home position is reached. Once the device has been manually homed, the full range of travel becomes available.

Velocity Mode

Turn the knob clockwise to move the device 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 device stops and resets the knob upon arriving at the end of travel.

Displacement Mode

Turn the knob clockwise to move the device in the positive direction (extend), counter-clockwise for negative direction (retract). Each detent of the knob moves the device a fixed number of microsteps, specified by the [knob.distance](#) (T:110) setting. The device moves at the speed specified by the [maxspeed](#) (T:42) setting, or the slower of speed and [limit.approach.maxspeed](#) (T:41) if the device has not been homed. If there are fewer than [knob.distance](#) (T:110) microsteps to the end of travel and another move is requested, the device will move to the end of travel and then stop.

Summary of knob functionality

- Turning the knob:
 - Moves the device in the direction of knob turn.
- Pressing the knob:
 - Decelerates and stops the device (identical to a Stop command).
 - Instantly stops the device, if the device is already decelerating.
- Pressing and holding the knob for 1 sec:
 - Toggles between Velocity Mode and Displacement Mode.

Trajectory Control and Behaviour

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

Software Position Limits

The travel range of the device is confined by the Minimum Position and Maximum Position settings. The factory settings for the devices are configured to match the physical travel range. If a customized range is desired, it can be changed via configuring the limit.min (T:106) and limit.max (T:44) settings to appropriate values.

Minimum Position

When Current Position is less than the Minimum Position value, the device cannot move in the negative direction (towards the motor).

Maximum Position

When Current Position is greater than the Maximum Position value, the device cannot move in the positive direction (away from the motor).

Movement Speed

The movement speed of the device depends on device status and various speed settings. If the device has not been initialized by the home (T:1) command or by moving towards the home end of the device, movement speed will be constrained to fail-safe values. The home status of the device can be determined by reading the limit.sensor.triggered (T:53) setting for the home sensor. The binary command additionally requires a value of 103.

Movement speed of the device is specified below:

move vel (T:22)

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

Knob manual movement in Velocity Mode

The device 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 device has not been homed

The device will move at the slower of the maxspeed (T:42) and limit.approach.maxspeed (T:41) settings.

Other movement commands - When device has been homed

The device will move at the speed specified by the maxspeed (T:42) setting.

Quick Command Reference

A-Series devices ship with either the ASCII or Binary protocol enabled by default. Please refer to the [RS232 Communications](#) section above to see the default protocol for the A-BLQ-E.

ASCII Protocol

The following table offers a quick command and setting reference for the A-BLQ-E. Follow the links to view a detailed description of each instruction or refer to the [ASCII Protocol Manual](#).

Quick Commands

Parameters in square brackets, e.g. [clr], indicate that the parameter is optional.

Parameters in italics, e.g. *value*, indicate that data, typically a number, needs to be provided.

Parameters separated by a pipe, e.g. abslrel, indicate that one of the parameters in the set need to be provided.

Command	Scope	Parameter(s)	Returns	Firmware Versions	Description
estop	Axis		0	6.06+	Instantly stops motorized movement.
get	Device and Axis	<i>setting</i>	<i>value</i>	6.06+	Retrieves the current value of the device or axis setting.
help	Device	commands reply <i>command ...</i>	0	6.06+	Displays the help information for the system.
home	Axis		0	6.06+	Moves the axis to the home position.
move	Axis	abslrel vel <i>value</i> min max stored <i>number</i>	0	6.06+	Moves the axis to various positions along its travel.
renumber	Device	<i>value</i>	0	6.06+	Renumbers all devices in the chain.
set	Device and Axis	<i>setting value</i>	0	6.06+	Sets the device or axis setting <i>setting</i> to the <i>value</i> .
stop	Axis		0	6.06+	Decelerates the axis and brings it to a halt.
stream	Device	Refer to the documentation	Refer to the documentation	6.12+	Performs an action related to streamed, interpolated multi-axis motion.

<u>system reset</u>	Device		0	6.06+	Resets the device, as it would appear after power up.
<u>system restore</u>	Device		0	6.06+	Restores common device settings to their default values.
<u>tools echo</u>	Device	<i>(message)</i>	0	6.06+	Echoes the provided message (if any) back to the user.
<u>tools gotolimit</u>	Axis	<i>limit dir action update</i>	0	6.06+	Moves the axis to a limit sensor and performs the provided actions.
<u>tools parking</u>	Device	state park unpark	0 1	6.06+	Parking allows the device to be turned off and used at a later time without first having to home.
<u>tools setcomm</u>	Device	<i>rs232baud protocol</i>	0	6.06+	Sets RS232 baud rate and communication protocol for RS232 and USB.
<u>tools storepos</u>	Axis	<i>number [position current]</i>	0 <i>position</i>	6.06+	Stores a number of positions for easy movement.
<u>trigger</u>	Device	Refer to the documentation	0	6.06+	Configures actions to be performed on the device when a certain condition is met.
<u>warnings</u>	Axis	[clear]	0	6.06+	Displays the active device and axis warnings, optionally clearing them if applicable.

Quick Device Settings

The settings listed below can be inspected and modified with the get and set commands described above.

Setting	Scope	Writable	Firmware Versions	Description
<u>accel</u>	Axis	Yes	6.06+	Sets the acceleration used to modify the speed.
<u>cloop.mode</u>	Axis	Yes	6.06+	Sets the closed loop control mode.
<u>cloop.stalltimeout</u>	Axis	Yes	6.06+	The amount of time to wait after a stall/displacement condition, in milliseconds.

<u>comm.address</u>	Device	Yes	6.06+	The device address.
<u>comm.alert</u>	Device	Yes	6.06+	The device will send alert messages when this setting is 1.
<u>comm.checksum</u>	Device	Yes	6.06+	The device includes checksums in its messages if this setting is set to 1.
<u>comm.protocol</u>	Device	Yes	6.06+	The communications protocol used by the device on the current interface.
<u>comm.rs232.baud</u>	Device	Yes	6.06+	The baud rate used by RS232 Prev and Next interfaces.
<u>comm.rs232.protocol</u>	Device	Yes	6.09+	The protocol used by RS232 Prev and Next interfaces.
<u>deviceid</u>	Device	No	6.06+	The device id for the unit.
<u>driver.current.hold</u>	Axis	Yes	6.06+	Current used to hold the motor in position, in 25 mA units.
<u>driver.current.max</u>	Axis	No	6.16+	Maximum legal value of <u>driver.current.hold</u> and <u>driver.current.run</u> .
<u>driver.current.run</u>	Axis	Yes	6.06+	Current used to drive the motor, in 25 mA units.
<u>encoder.count</u>	Axis	Yes	6.06+	The recorded counts of the axis encoder.
<u>encoder.error</u>	Axis	No	6.17+	Position error measured by encoder.
<u>encoder.pos</u>	Axis	No	6.17+	Position measured by encoder.
<u>knob.dir</u>	Axis	Yes	6.06+	Sets the movement direction for the knob.
<u>knob.distance</u>	Axis	Yes	6.06+	Sets how far the device moves with each step of the knob in displacement mode, in units of microsteps.
<u>knob.enable</u>	Axis	Yes	6.06+	Disable the use of the knob when set to 0.
<u>knob.maxspeed</u>	Axis	Yes	6.06+	The maximum speed that can be reached using the knob in velocity mode.
<u>knob.mode</u>	Axis	Yes	6.06+	Sets the mode of the knob. 0 for velocity mode, 1 for displacement mode.
<u>knob.speedprofile</u>	Axis	Yes	6.06+	Sets the profile to be used per increment when in velocity mode.
<u>limit.approach.maxspeed</u>	Axis	Yes	6.06+	Maximum speed used when approaching a limit sensor.
<u>limit.detect.decelonly</u>	Axis	Yes	6.06+	Deceleration used when stopping after a limit sensor has triggered.
<u>limit.detect.maxspeed</u>	Axis	Yes	6.06+	Maximum speed used when moving away from a limit sensor.
<u>limit.home.pos</u>	Axis	Yes	6.06+	The updated position of the sensor, when triggered.
<u>limit.home.posupdate</u>	Axis	Yes	6.06+	Position update to occur when sensor is triggered.
<u>limit.home.preset</u>	Axis	Yes	6.06+	The default position of the home sensor.
<u>limit.home.state</u>	Axis	No	6.06+	The state of the home sensor.
<u>limit.home.triggered</u>	Axis	No	6.06+	Whether the home sensor has been triggered previously.
<u>limit.max</u>	Axis	Yes	6.06+	The maximum position the device can move to, measured in microsteps.

<u>limit.min</u>	Axis	Yes	6.06+	The minimum position the device can move to, measured in microsteps.
<u>maxspeed</u>	Axis	Yes	6.06+	The maximum speed the device moves at.
<u>motion.accelonly</u>	Axis	Yes	6.06+	Sets the acceleration used to increase the speed.
<u>motion.decelonly</u>	Axis	Yes	6.06+	Sets the deceleration used when decreasing the speed.
<u>pos</u>	Axis	Yes	6.06+	The current absolute position of the device.
<u>resolution</u>	Axis	Yes	6.06+	Microstep resolution
<u>stream.numbufs</u>	Device	No	6.14+	The number of stream buffers provided in the device.
<u>stream.numstreams</u>	Device	No	6.14+	The number of streams provided in the device.
<u>system.access</u>	Device	Yes	6.06+	Sets the access level of the user.
<u>system.axiscount</u>	Device	No	6.06+	The number of axes in the device.
<u>system.led.enable</u>	Device	Yes	6.06+	Enables the front panel LEDs.
<u>system.serial</u>	Device	No	6.15+	The serial number of the device.
<u>system.temperature</u>	Device	No	6.06+	The current temperature of the unit, in degrees Celsius.
<u>system.voltage</u>	Device	No	6.06+	The voltage being applied to the device.
<u>version</u>	Device	No	6.06+	The firmware version of the device.
<u>version.build</u>	Device	No	6.17+	The build number of the device's firmware.

Binary Protocol

The following table offers a quick command reference for the A-BLQ-E. For convenience, you may sort the table below by instruction name, command number, or reply number. Follow the links to view a detailed description of each instruction or refer to the [Binary Protocol Manual](#).

Instruction Name	Command#	Command Data	Command Type	Reply Data
Reset	0	Ignored	Command	None
Home	1	Ignored	Command	Final position (in this case 0)
Renumber*	2	Ignored	Command	Device Id
Read Register	5	Register Address	Command	Data
Set Active Register	6	Register Address	Setting	Register Address
Write Register	7	Data	Command	Data
Move Tracking	8	n/a	Reply	Tracking Position
Limit Active	9	n/a	Reply	Final Position
Manual Move Tracking	10	n/a	Reply	Tracking Position
Manual Move	11	n/a	Reply	Final Position
Slip Tracking	12	n/a	Reply	Tracking Position
Unexpected Position	13	n/a	Reply	Final Position
Store Current Position*	16	Address	Command	Address
Return Stored Position	17	Address	Command	Stored Position
Move To Stored Position	18	Address	Command	Final Position
Move Absolute	20	Absolute Position	Command	Final Position

<u>Move Relative</u>	21	Relative Position	Command	Final Position
<u>Move At Constant Speed</u>	22	Speed	Command	Speed
<u>Stop</u>	23	Ignored	Command	Final Position
<u>Restore Settings*</u>	36	Peripheral Id	Command	Peripheral Id
<u>Set Microstep Resolution*</u>	37	Microsteps	Setting	Microsteps
<u>Set Running Current*</u>	38	Value	Setting	Value
<u>Set Hold Current*</u>	39	Value	Setting	Value
<u>Set Device Mode*</u>	40	Mode	Setting	Mode
<u>Set Home Speed*</u>	41	Speed	Setting	Speed
<u>Set Target Speed*</u>	42	Speed	Setting	Speed
<u>Set Acceleration*</u>	43	Acceleration	Setting	Acceleration
<u>Set Maximum Position*</u>	44	Range	Setting	Range
<u>Set Current Position</u>	45	New Position	Setting	New Position
<u>Set Home Offset*</u>	47	Offset	Setting	Offset
<u>Set Alias Number*</u>	48	Alias Number	Setting	Alias Number
<u>Return Device Id</u>	50	Ignored	Read-Only Setting	Device Id
<u>Return Firmware Version</u>	51	Ignored	Read-Only Setting	Version
<u>Return Power Supply Voltage</u>	52	Ignored	Read-Only Setting	Voltage
<u>Return Setting</u>	53	Setting Number	Command	Setting Value
<u>Return Status</u>	54	Ignored	Read-Only Setting	Status
<u>Echo Data</u>	55	Data	Command	Data
<u>Return Firmware Build</u>	56	Ignored	Read-Only Setting	Build Number
<u>Return Current Position</u>	60	Ignored	Read-Only Setting	Position
<u>Return Serial Number</u>	63	Ignored	Read-Only Setting	Serial Number
<u>Set Park State*</u>	65	Park State	Setting	Position
<u>Set Auto-Reply Disabled Mode*</u>	101	Auto-Reply Mode	Setting	Auto-Reply Mode
<u>Set Message Id Mode*</u>	102	Message Id Mode	Setting	Message Id Mode
<u>Set Home Status</u>	103	Home Status	Setting	Home Status
<u>Set Minimum Position*</u>	106	Minimum Position	Setting	Minimum Position
<u>Set Knob Disabled Mode*</u>	107	Knob Disabled Mode	Setting	Knob Disabled Mode
<u>Set Knob Direction*</u>	108	Direction	Setting	Direction
<u>Set Knob Movement Mode*</u>	109	Movement Mode	Setting	Movement Mode
<u>Set Knob Jog Size*</u>	110	Jog Size	Setting	Jog Size
<u>Set Knob Velocity Scale*</u>	111	Velocity Scale	Setting	Velocity Scale
<u>Set Knob Velocity Profile*</u>	112	Velocity Profile	Setting	Velocity Profile
<u>Set Acceleration Only*</u>	113	Acceleration	Setting	Acceleration
<u>Set Deceleration Only*</u>	114	Deceleration	Setting	Deceleration

<u>Set Move Tracking Mode*</u>	115	Tracking Mode	Setting	Tracking Mode
<u>Set Manual Move Tracking Disabled Mode*</u>	116	Tracking Mode	Setting	Tracking Mode
<u>Set Move Tracking Period*</u>	117	Tracking Period	Setting	Tracking Period
<u>Set Closed-Loop Mode*</u>	118	Closed-Loop Mode	Setting	Closed-Loop Mode
<u>Set Slip Tracking Period*</u>	119	Tracking Period	Setting	Tracking Period
<u>Set Stall Timeout*</u>	120	Timeout	Setting	Timeout
<u>Set Baud Rate*</u>	122	Baud Rate	Setting	Baud Rate
<u>Set Protocol*</u>	123	Protocol	Setting	Protocol
<u>Convert To Ascii*</u>	124	Baud Rate	Command	Baud Rate
<u>Error</u>	255	n/a	Reply	Error Code

* The settings for these commands are saved in non-volatile memory, i.e. the setting persists even if the device is powered down. To restore all settings to factory default, use command 36.

Troubleshooting A-Series Closed-Loop Motion Devices

The following sections contain tips for troubleshooting common problems with the A-Series devices.

If the device is unable to communicate, and it is operating erratically, a manual factory reset can be performed as a last resort through the following steps:

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), release the knob.

The device has been returned to its factory defaults and can be configured per the steps in [Initial Setup](#).

Front Panel Indicators

Green LED On

The device is powered on and operating normally

Green LED Fades In and Out

The device is parked.

Issue a [tools parking \(T:65\)](#) unpark command, or [home \(T:1\)](#) the device.

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, the internal temperature has exceeded the set limit or the driver has disabled. Check the following:

- ◇ The input voltage 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.
- ◇ The driver is not disabled. If the driver is disabled the result of the [warnings](#) command will contain the `FD` flag.

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](#).

Blue LED On or Flashing.

The device has slipped or stalled.

Please see the [Slipping and Stalling](#) section below.

Yellow LED Always Off or Flashes but No Reply.

There are communication errors.

Please see the [Communication Errors](#) section below.

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 device won't cover the full range of travel.

The device hasn't been homed.

Turn the knob anti-clockwise until the device reaches the fully retracted position (closest to the motor). The device will home and the full range of travel available.

Unexpected Behaviour

The device doesn't respond to a move command.

The device needs to be homed before use.

Send the `home (T:1)` command.

The device 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 `system reset (T:0)` command, then re-initialize it with the `home (T:1)` command. Ground the device and avoid operation under a statically noisy environment.

The device 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 device makes louder than normal noise during travel and is frequently slipping.

This condition happens if the thrust needed is more than the thrust available from the device.

Check the following:

◇ The force on the device is less than the maximum thrust.

◇ The voltage using the `get system.voltage` command. Voltage less than the specified voltage for the device will reduce the device's maximum thrust.

Test the following:

◇ Try a slower target velocity. Stepper motors produce more thrust when moving slowly.

◇ Try a lower acceleration and deceleration.

◇ Clean the screw and lightly re-grease it with a grease that does not degrade plastics.

The device has repeatability errors smaller than 4 full steps.

If steps aren't being skipped, friction or loose parts may still cause some variation when returning to a position.

Please contact [Zaber Technical Support](#).

The device doesn't cover the full range of travel, or runs into the end.

A setting might have been inadvertently changed.

◇ `home (T:1)` the device to see if this corrects the behaviour.

◇ Send a `system restore (T:36)` command.

Communication Errors

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

There are several things 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 [RS232 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 [RS232 Communications](#) section above.
- ◇ If the problem 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.

The yellow light comes on briefly when sending a command, but the device does not move and does not reply.

Check baud rate, hand shaking, parity, stop bit, etc. are set as per the [RS232 Communications](#) defaults.

The device numbers may not be what is expected, issue a [system 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 RS232 receive buffer.

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

Slipping and Stalling

The device moves smoothly, but only moves for a short time then stops. The blue LED is flashing but the device 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 device makes noise but does not move. Blue LED is flashing.

The device is stalling.

Try removing all external loads. If the device 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 device using the maxspeed (T:42) setting.

If a device 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.

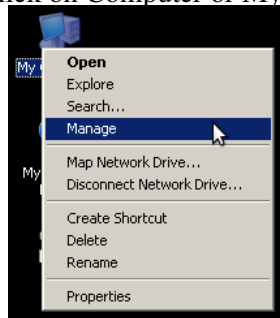
The original instructions for this product are available at <http://www.zaber.com/wiki/Manuals/A-BLQ-E>.

Appendix A - Available Communications Ports

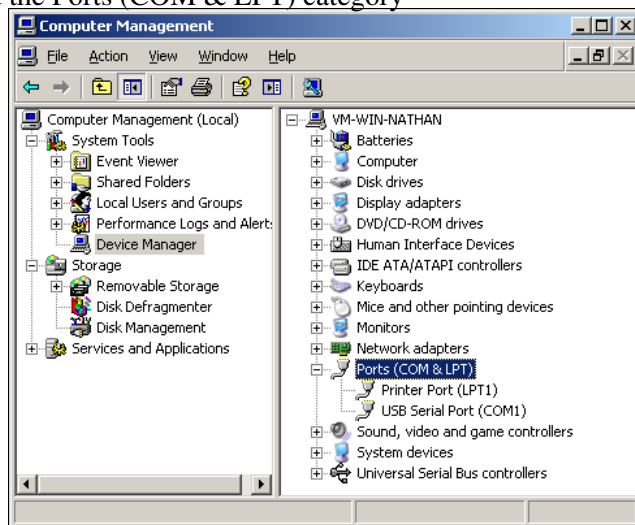
Finding Installed Serial Ports

Windows

1. Right click on Computer or My Computer and select Manage.



2. Select Device Manager from the Computer Management list
3. Expand the Ports (COM & LPT) category



- ◆ In this example there is one serial port installed (COM1), which is a USB adaptor.

Linux

1. Finding devices

- ◆ Open a terminal and execute the following command:

```
dmesg | grep -E ttyU\?S
```

- ◆ 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
```

- ◆ This shows that there are 3 serial ports available: **ttys0**, **ttys4** and **ttyUSB0** (a USB adaptor)

2. Checking port permissions

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

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

- ◆ 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
```

- ◆ The output will be similar to the following:

```
adm cdrom sudo dip plugdev users lpadmin sambashare
```

Notice that dialout is not in the list

- ◆ A user can be added to the dialout group with the following command

```
sudo adduser $USER dialout
```

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

Appendix B - Tensioning The Timing Belt

Although BLQ stages ship with the timing belt properly tensioned, it may at some point become necessary to re-tension it. Maintaining the belt at its proper tension will ensure you are getting the best performance out of the stage. Included with each BLQ stage is a clip-on instrument tuner that, when used as described below, is very effective at setting the belt to a precise tension.

To tension the timing belt:

1. Plug stage into PC and move to absolute position of **68960 microsteps**. If the stage is shorter than 295 mm travel, move the carriage to a position of 34270 microsteps and tune to B (123.5 Hz) instead of C (65.4 Hz) (as described below). For a BLQ0075, move the carriage into contact with the home position bumpers and tune the other side of the belt to G# (207 Hz). The tuning procedure works better if the stage is not bolted down to anything.

2. Attach instrument tuner to motor pulley housing as shown below. Tuner must not be touching the belt.



Position stage to absolute position of 68960 and attach tuner as shown.

3. Make sure the tuner is set to vibration ("VIB") mode. Turn on by pressing the large grey button on the front.



Make sure tuner is set to vibration mode.

4. Pluck the belt in between the motor pulley housing and the carriage. The tuner should register a note. When the belt is properly tensioned, this note should be C2 (65.4 Hz).



Pluck belt to measure tension.



Read the note picked up by the tuner.

5. Make adjustments to the belt tension with the M4 screw loosened about 1/4 turn from tight. The screw and the belt clamp under the stage top need to be able to slide along the slot. To increase the belt tension, turn the setscrew clockwise - pushing the belt clamp towards the middle of the stage top. To decrease belt tension, turn the setscrew counter-clockwise.



Loosen M4 screw then adjust setscrew to tighten or loosen belt.

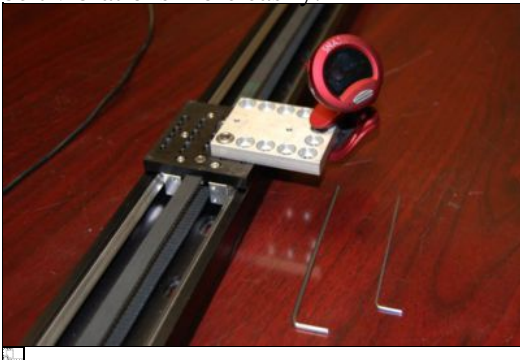
6. Try to set the belt tension to about a B2 note. The tension will increase by about a semitone (e.g. B to C or C to C#) when the M4 screw is tightened. The final tension should be within 25 cents of C2 (1 semitone = 100 cents).



The final tension should be close to C2

7. The tuner may not initially register a note if the belt is too loose. As a rough guideline, you can hear what a C2 sounds like at www.tunemybass.com (select 4 string base with drop C tuning, then mouse over the lowest string to hear tone). It is a good idea to get a rough idea of what the tensioned belt will sound like so that you don't try to tune it to a C3 note - an octave higher than C2. This will be much too tight and could damage the belt or tensioning mechanism.

8. If the belt is close to the right tension, but the tuner still does not register a note, try attaching a metal plate or bracket to the stage top and clamp the tuner to that. This mounting should pick up the belt vibrations more easily.



If the tuner is having difficulty picking up the belt vibration, try indirectly attaching it to the stage top as shown.

Specification	Value	Alternate Unit
<u>Microstep Size (Default Resolution)</u>	4.21875 μm	
<u>Integrated Controller</u>	Yes	
<u>Repeatability</u>	< 10 μm	< 0.000394 "
<u>Backlash</u>	< 50 μm	< 0.001969 "
<u>Minimum Speed</u>	0.0026 mm/s	0.00010 "/s
<u>Speed Resolution</u>	0.0026 mm/s	0.00010 "/s
<u>Encoder Resolution</u>	500 CPR	2,000 states/rev
<u>Encoder Type</u>	Motor mounted rotary quadrature encoder	
<u>Peak Thrust</u>	20 N	4.5 lb
<u>Maximum Continuous Thrust</u>	20 N	4.5 lb
<u>Communication Interface</u>	RS-232	
<u>Communication Protocol</u>	Zaber ASCII, Zaber Binary (Default)	
<u>Maximum Centered Load</u>	200 N	44.9 lb
<u>Maximum Cantilever Load</u>	600 N-cm	849.7 oz-in
<u>Guide Type</u>	Roller bearing	
<u>Vertical Runout</u>	< 13 μm	< 0.000512 "
<u>Horizontal Runout</u>	< 13 μm	< 0.000512 "
<u>Maximum Current Draw</u>	1100 mA	
<u>Power Supply</u>	24-48 VDC	
<u>Linear Motion Per Motor Rev</u>	53.97 mm	2.125 "
<u>Motor Steps Per Rev</u>	200	
<u>Motor Type</u>	Stepper (2 phase)	
<u>Inductance</u>	2.8 mH/phase	
<u>Default Resolution</u>	1/64 of a step	
<u>Data Cable Connection</u>	Minidin 6 M/F	
<u>Mechanical Drive System</u>	Synchronous belt	
<u>Limit or Home Sensing</u>	Magnetic home sensor	
<u>Manual Control</u>	Indexed knob with push switch	
<u>Axes of Motion</u>	1	

<u>Mounting Interface</u>	M6 threaded holes and 8-32 threaded holes	
<u>Vacuum Compatible</u>	No	
<u>Operating Temperature Range</u>	0 to 50 degrees C	
<u>Stage Parallelism</u>	< 100 µm	< 0.003937 "
<u>RoHS Compliant</u>	Yes	
<u>CE Compliant</u>	Yes	

Comparison - A-BLQ-E Series

<u>Part Number</u>	<u>Travel Range</u>	<u>Accuracy (unidirectional)</u>	<u>Maximum Speed</u>	<u>Weight</u>
<u>A-BLQ0070-E01</u>	70 mm (2.756 ")	200 µm (0.007874 ")	1100 mm/s (43.307 "/s)	1.62 kg
<u>A-BLQ0145-E01</u>	145 mm (5.709 ")	200 µm (0.007874 ")	1600 mm/s (62.992 "/s)	1.82 kg
<u>A-BLQ0295-E01</u>	295 mm (11.614 ")	400 µm (0.015748 ")	2000 mm/s (78.740 "/s)	2.147 kg
<u>A-BLQ0445-E01</u>	445 mm (17.520 ")	600 µm (0.023622 ")	2000 mm/s (78.740 "/s)	2.25 kg
<u>A-BLQ0595-E01</u>	595 mm (23.425 ")	700 µm (0.027559 ")	2000 mm/s (78.740 "/s)	2.55 kg
<u>A-BLQ1045-E01</u>	1045 mm (41.142 ")	1000 µm (0.039370 ")	2000 mm/s (78.740 "/s)	3.6 kg
<u>A-BLQ1495-E01</u>	1495 mm (58.858 ")	1500 µm (0.059055 ")	2000 mm/s (78.740 "/s)	3.98 kg
<u>A-BLQ2095-E01</u>	2095 mm (82.480 ")	2000 µm (0.078740 ")	2000 mm/s (78.740 "/s)	4.99 kg
<u>A-BLQ3000-E01</u>	3000 mm (118.110 ")	3000 µm (0.118110 ")	2000 mm/s (78.740 "/s)	6.4 kg