

ZABER



ZABER TECHNOLOGIES

X-Series Device
Getting Started Guide

Contact Customer Support

1-888-276-8033 (Toll Free Canada/USA)

1-604-569-3780 (Direct)

contact@zaber.com

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Precautions

1. Zaber's devices may produce enough force to cause personal injury. Be careful to keep hair, body parts, jewelry, and clothing from being caught in moving components. Pinch labels are used on our devices to indicate areas of particular concern.
2. During continuous operation, a device's motor may get hot. Some models may reach 90°C or more (this is noted in the manual and heat warning stickers are included on affected surfaces). This is generally expected behaviour; take caution when handling the motors of devices during or after operation. Burnt smells or smoke are not expected during normal operation; if encountered, discontinue operation and contact Customer Support.
3. To reduce the risk of electrostatic damage, avoid touching the electrical contacts of the data cables included with your device(s).
4. Before storing your device(s), retract any extended components in order to keep them clean and to protect them from damage.
5. Do not expose device(s) to vibration or shock.
6. Do not expose device(s) to extreme conditions, such as temperatures exceeding device ratings, radiation, and dusty or humid environments.
7. Do not submerge device(s) in liquid.
8. Do not disassemble. Zaber devices do not contain user-serviceable parts. Please contact Customer Support for service and/or repairs.
9. Check the manual online for any additional precautions and warnings related to your devices.

Maintenance

Most of our positioners do not require regular maintenance. Lead screws and rails do not need to be greased (unless otherwise specified in the user manual). If a component is exposed to dust or dirt, it should be gently wiped with isopropyl alcohol. We do not recommend using stronger solvents, as they can damage non-metal components. Please refer to our online manuals at www.zaber.com/support for maintenance information on your specific positioner.

Returns, Warranty, and Repairs

All of Zaber's standard products (those that appear on our website) are backed by a 30-day satisfaction guarantee. If you are not satisfied with your purchase for any reason, you may return the item(s) in saleable and unmarked condition within 30 days of the purchase date for a refund, less applicable shipping costs.

High vacuum (10^{-6} Torr) devices cannot be returned for refund once they have been removed from their sealed packaging.

All standard products are warrantied against defects in manufacture and design for one full year from the purchase date. This warranty excludes products that have been misused, modified, or disassembled by the customer. Misuse includes operating the devices in abnormal conditions, such as in extreme temperatures, in proximity of radiation or strong magnets, or in wet environments. If you are not sure whether your conditions are acceptable under our warranty, please contact Customer Support.

Aside from issues covered under warranty, we are also happy to inspect any other problems that may arise, and we offer reasonably priced repairs. Simply email contact@zaber.com for assistance.

Please refer to www.zaber.com/policies for more information about our policies.

Common Terminology

Positioner

A motorized product with moving mechanics, such as a linear stage, a rotational stage, or a stepper motor.

Peripheral

A positioner that includes a motor and mechanics but does not include an integrated controller. Peripherals are designed for use with Zaber's motor controllers, but they can also be used with compatible third-party motor drivers and controllers.

Device

A stand-alone controller or a positioner with an integrated controller. Stand-alone controllers are designed for use with Zaber's peripherals, but they can also be used with compatible third-party motors.

Joystick

A product that allows multi-axis manual input and push-button input for positioners. Joysticks do not function as controllers; instead, they are designed to communicate with Zaber's motor controllers when connected in series.

X-Series, A-Series, and T-Series

Devices that share common features, such as connectors, protocols, and power. The series is indicated by the first letter of the device's name. For example, the X-LSM025A model belongs to the X-Series family. This guide specifically relates to X-Series devices. See an older version of the manual for setup instructions for T-Series or A-Series devices at:

www.zaber.com/documents/Getting-started-guide.pdf

Closed-Loop and Servo Devices

For Zaber devices, closed-loop refers to any device where encoder feedback is used to inform the trajectory of the controller. Servo devices refer to a sub-set of these where encoder feedback is also required for the driver. Servo devices include linear motor and direct-drive stages.

Stepper motor devices with encoders use closed-loop control but are not servo devices, as the driver controls stepping directly without encoder feedback. Encoder feedback is still used to inform the trajectory of the controller on these.

Servo devices require tuning of their control loop to get the best performance (more on page 12). They also use encoder counts as their unit of resolution, as opposed to stepper motors, which use microsteps (more on page 10).

Quick Set-up Checklist

Checklist Item	Page
<input type="checkbox"/> Check for and remove shipping guards or fasteners (select devices)	4
<input type="checkbox"/> Connect to peripheral (if using a peripheral)	5
<input type="checkbox"/> Connect daisy-chain (if using multiple devices)	5
<input type="checkbox"/> Connect to computer	6
<input type="checkbox"/> Connect power	6
<input type="checkbox"/> Install USB drivers (if using USB)	7
<input type="checkbox"/> Install Zaber Console	7
<input type="checkbox"/> Configure communication (optional)	7
<input type="checkbox"/> Move device to home position with knob to confirm set-up	18
<input type="checkbox"/> Fine tune the servo control loop after mounting a load (servo devices only)	12

Shipping Guards

Some devices include guards, such as plates, inserts, covers, or fasteners, which prevent movement of devices during shipping and limit potential damage from shock loads. If they are present for a device, they will either be clearly visible and intuitive to remove or clearly marked with labels and instructions. Following those instructions, remove any such components before powering the device. Read the manual online for more details on shipping security features.

Vacuum Devices

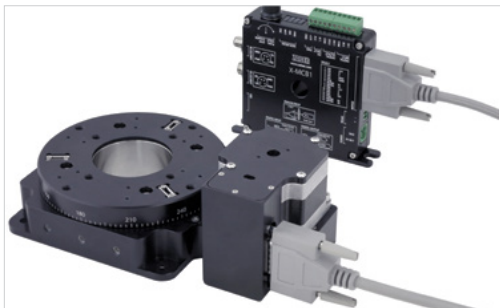
While some of the information covered in this guide applies to our vacuum compatible devices, please refer to the online product manuals for detailed connection recommendations or read our technical article on “Considerations for Vacuum Applications”:
www.zaber.com/VacuumTechnicalArticle

Connect

Most systems will be quick and easy to connect with four steps. Our Quick Set-Up Tool also provides specific connection recommendations, which you can find here: www.zaber.com/QuickSetupTool

Connect Peripherals (if applicable)

If using a stand-alone controller, plug it into the motorized axis.



Depending on the controller and peripheral, the motor cable may be an MC03 (DB-15 M-F), MC10T3 (DB15 to DB26), or MC10 (DB26 M-F) cable. Cables are high-flex with specific wire bundling; using cables from Zaber is recommended.

Connect Daisy-chain (if applicable)

Connect multiple devices in series to create a chain. They will share power and a single computer connection.



X-Series devices can be daisy-chained using an M8 cable, such as the X-DC02.

*Drivers may be required if COM port does not appear. Download and installation instructions here: www.zaber.com/software

†Drivers are required. Download link and installation instructions can be found here: www.zaber.com/USB

Connect USB

Connect the first controller (built into the device or stand-alone) to your computer via USB using the cables included (if you ordered an accessory kit).



X-Series devices can connect to a computer's USB port with an X-USBDC* cable.



Stand-alone controllers also have the option to connect directly to a computer's USB port with a U-DC06* cable.

Connect Power

Connect a power supply to a device in the chain to power the whole chain.



Devices connect to a 24-48VDC power supply. The number of devices you can power will depend on the combined draw of the devices and the current capacity of the power supply.

Configure

Zaber Console

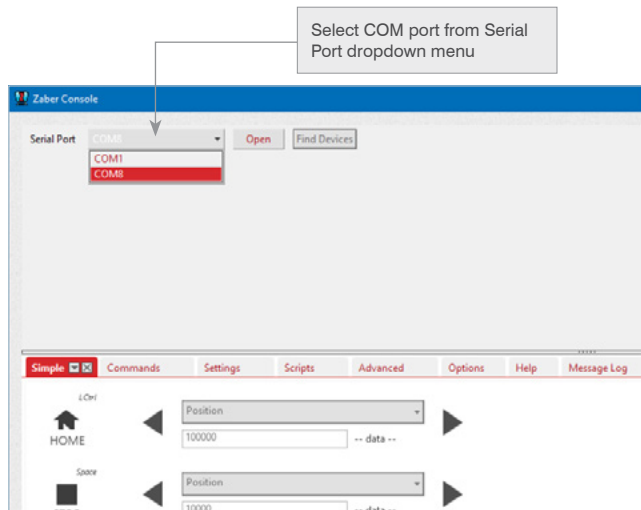
Zaber Console is our free, open-source software. For initial configuration of your device(s), we strongly suggest using Zaber Console for its ease of use.

A download link and installation instructions are available online: www.zaber.com/software/ZaberConsole

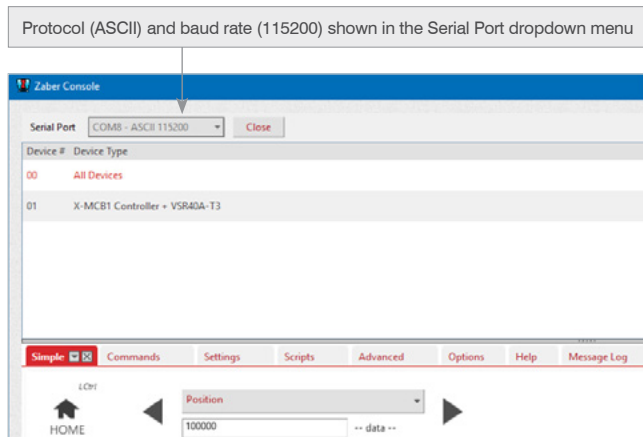
The following configuration sections are based on Zaber Console. Please contact Customer Support if you would like to use any other software. More information about Zaber Console and other software options is included in the **Control** section (page 9) of this guide.

COM Ports

A COM port is a specific serial connection on a computer, such as COM1 or COM3. When connected via USB, your computer should create a virtual COM port that will be available only when the device is connected. To start communication between computer and device, select the appropriate COM port. If you are not sure which to choose, please contact Customer Support.



Zaber Console will detect which devices are connected to that port, and those devices will be displayed in the Device List if they all share the same communication protocol and baud rate. The protocol and baud rate of the found devices are shown in the Serial Port menu.



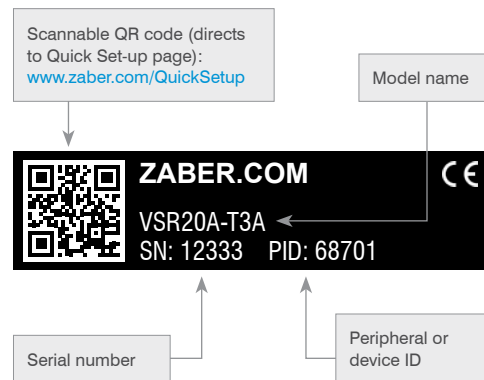
Renumber

If multiple devices are connected in a daisy-chain, Zaber Console will likely ask you if it can renumber the devices. This will set the device numbers such that the one connected to the computer is device 1, the next in the chain is device 2, and so on.

Peripheral IDs

Stand alone Zaber controllers are designed to work easily with Zaber peripherals. Peripherals with the AutoDetect feature, identified by an "A" at the end of the model name, will be automatically recognized and configured by the controller.

If either your Zaber peripheral was purchased before June 2020, or if the peripheral is a vacuum compatible one, enter the peripheral ID (found on the label) in Zaber Console to configure initial settings.



Control

Protocol

Communication protocols dictate the way in which commands are formatted to send to a device. Zaber's devices use two protocol options: **Zaber ASCII** and **Zaber Binary**. Zaber ASCII is the recommended and default protocol for the X-Series.

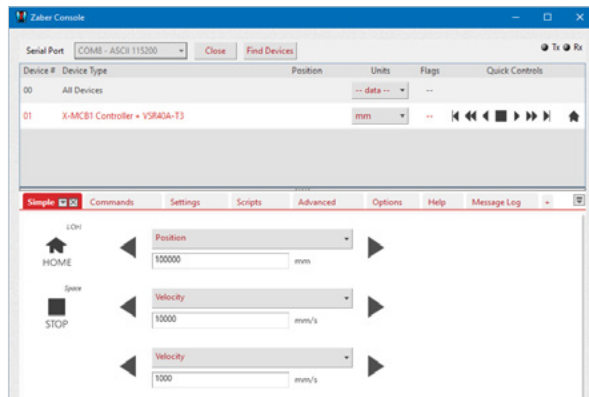
ASCII Manual	www.zaber.com/manuals/ASCIIProtocol
Binary Manual	www.zaber.com/manuals/BinaryProtocol

Software

Once your Zaber device is powered and connected to a computer, you are ready to start controlling it. To begin communicating with your device, you will need to select a software interface. The following sections outline some of the software options available to you.

Zaber Console

Zaber Console is free, open-source software that is designed for ease of use. Zaber Console allows you to manage port communication, identify devices, send commands to devices, and set the units of measure. We strongly recommend using Zaber Console for the initial set-up and troubleshooting of your device. Source code for Zaber Console and a user manual is available online at: www.zaber.com/software/ZaberConsole



Programming Libraries

In order to make working with Zaber devices as easy as possible, Zaber offers fully-featured programming libraries with comprehensive APIs and examples in a number of programming languages.

LabVIEW	www.zaber.com/software/LabVIEWASCII
ASCII	
C#	
C++	www.zaber.com/software/ZML
JavaScript	
Java	
MATLAB	

Our customer service team is also available for further advice, troubleshooting, and support.

Resolution - Stepper & Servo Motors

The resolution of a device is the smallest increment you can command it to move. For example, sending the ASCII protocol command `/move rel 1` instructs a device to move forward by 1 increment. The physical distance corresponding to this increment depends on the type of motor that drives the device. For devices driven by stepper motors, an increment is a microstep of the motor, and the size of an increment is the device's Microstep Size specification. For servo devices, an increment is an encoder count, and the size of an increment is the device's Encoder Resolution specification.

Microstepping

Stepper motors are designed for position control. In a motor revolution, they have a number of equally-spaced full-step positions. Most stepper motors in Zaber devices have 200 steps per revolution.

Zaber's drivers sub-divide each motor step into a number of smaller increments called microsteps. By default, most devices use a resolution of 64 microsteps per step (although this is adjustable), so by default they can move to 12800 microstep positions for every motor revolution.

Many devices use lead screws or gearing to move the actuators or stages, so a motor revolution will move the device a certain distance. That distance can be divided by the number of microsteps per revolution to get the distance moved per microstep. This is the Microstep Size. The Microstep Size will vary from device to device; the value for your device is available on our website under the 'Series Specs' tab for each product.

Encoder Counts

Unlike stepper motors, servo motors are designed with force control in mind; they can be driven using position control, but the resolution is very coarse. To achieve fine-resolution positioning, Zaber's servo devices feature a variety of digital and analog position encoders for feedback. An encoder count is the smallest movement of the encoder that will be registered by the controller.

Speed and Acceleration

While microsteps (for stepper motor devices) or encoder counts (for direct drive devices) are the increments of position on Zaber devices, there are conversion factors required to calculate the increments of speed and acceleration.

A spreadsheet is available for easy conversion:

www.zaber.com/ZaberSpeedSettings.xls.

Make sure you are using the FW 6.xxx/7.xx tab. Enter the microstep size or encoder resolution of your device into the spreadsheet to easily convert from data to speed or acceleration, and vice versa, in mm/s or mm/s².

$$\text{speed (in microsteps or encoder counts/second)} = \text{Data} / 1.6384$$

$$\text{acceleration (in microsteps or encoder counts/second}^2) = \text{Data} / 1638.4$$

I/Os & Triggers

Some Zaber controllers have configurable digital and analog inputs and digital outputs. While these controllers can be used to interact with a variety of devices, care should be taken when setting up the circuit to which they are connected. The product manuals for these controllers on our Support page will include usage instructions and sample circuit diagrams:

www.zaber.com/support

The inputs and outputs can be configured to either trigger actions on the controller or to be triggered by certain conditions. These triggers can also be configured on devices without I/O's available. More information on how to set up these triggers is available in our ASCII protocol manual: www.zaber.com/manuals/ASCIITriggers

Please contact Customer Support if you have any questions about setting up your circuit.

Servo Device Tuning

Servo devices use a control loop in order to drive their motors and use encoder feedback to inform the control loop. The default parameters used in the control loop (which the device uses when it's powered on for the first time) are optimized for good performance with no load added to the stage. These parameters should also work with some load mounted to the stage. You can tune the parameters of the control loop to adjust the smoothness, accuracy, and responsiveness of the performance.

In order to make tuning as simple as possible, Zaber provides a servo tuning tool within Zaber Console. Complete documentation on the tool is available at www.zaber.com/ServoTuning.

To use the tool, first make sure Zaber Console is installed and the device is powered and connected. If a servo device is detected when you open the port in Zaber Console, you will be asked if you want to add the Servo Tuning tool to the Tab Dock (if it's not already present).

Use caution when adjusting parameters; it's possible to enter values that will cause the device to become unstable and move erratically. If this occurs, press the 'Disable Driver' button to stop current to the motor and stop driven motion. The parameters can then be adjusted to be more stable or returned to default values. Press 'Enable Driver' to resume driven motion.

Tuning Methods

The servo tuning tool includes 4 modes for tuning:

Simple

The inertia of the moving load is the minimum information about an application required to choose reasonable tuning parameters. For linear motion this is the moving mass; for rotary motion it is the mass moment of inertia. The simple mode allows you to set parameters using only this information.

The inertia has two components: the inertia of the carriage of the device and the inertia of the load added to the stage. Using the Simple tuning method in Zaber Console, the carriage inertia is automatically set, and the user can enter the contribution from their load.

A slider allows optional adjustment between smoother (less position overshoot) and stiffer (faster and more forceful response to position errors) motion.

Simple PID Import / Export Advanced

Calculate tuning parameters for a simple static load.

Load	Acceleration
Load mass: 2 kg	Current acceleration: 4.50 m/s ²
Stage moving mass: 1500 g	Recommended maximum: 18.29 m/s ²
(Use the default moving mass unless the stage carriage has been customized.)	21.341333333333333 Write

Stiffness

Smooth Stiff

As the mass is changed, the largest reasonable acceleration of the axis also changes. While this is not one of the servo tuning parameters, setting the acceleration too high can also create overshoot or instability in the system. The Simple tuning control also indicates the maximum recommended acceleration you should set based on the load and allows you to adjust it within the tool.

PID

If you have experience tuning a proportional-integral-derivative (PID) controller, this tuning method will allow you to adjust the parameters using familiar gain and filter cutoff frequency values.

Simple PID Import / Export Advanced

Enter Proportional-Integral-Derivative parameters to tune your device. See the [online user guide](#) for information about this formulation.

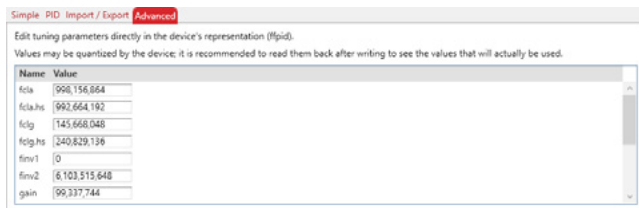
kp	ki	kd	fc
20089.77408 N/m	100.348768 N/m s	9000.000159744 kN s/m	200.000033021971 Hz

Import/Export

Use Import/Export to save sets of parameters to a file on your computer. These parameter sets can be named and will be displayed as long as that file is selected. Use this tool to move parameter sets from computer to computer, or to easily apply parameter sets to multiple devices.

Advanced

Servo devices may have different control loops and parameters. Zaber Console's servo tuning tool translates these control loops to the easier Simple and PID tuning methods, and Zaber recommends using these to adjust the performance. The low-level control loop parameters can be adjusted directly using the Advanced tuning method though. Contact Customer Support for assistance with using the low level parameters if needed.



Save and Apply Tuning

The parameters that govern the control loop on a servo device are known as the 'live' parameter set. Devices also store multiple sets of saved parameters that are not active, called 'presets'. These presets could represent sets of optimal tuning under different conditions (for example different loads). Use the Servo Tuning tool to quickly and easily save tuning sets to presets, apply tuning as the live set, or set one of the presets as the live set. Additionally, live or stored presets can be read in PID, Import/Export, or Advanced modes (the inertia input when using Simple tuning cannot be re-calculated based on low-level parameters). In addition to the writable presets, there is also a 'default' preset, which contains the factory tuning values. The default preset can be read or applied, but cannot be overwritten. Restore the defaults at any time to apply safe (but not necessarily optimized) parameters.

Step 1: Choose a tuning method.

Step 2: Enter values.

Step 3: Select a Preset to save the values to, and press **Write**.

Step 4: Select the Preset to make Live, and press **Activate**.

The interface shows a navigation bar with tabs: Simple, Options, Terminal, Commands, Settings, Scripts, Oscilloscope, **Servo Tuning** (selected), and Help. The main content area is divided into two panels: **Tuning method** and **Device management**.

Tuning method panel:

Warning: Some tuning values can cause the device to make loud noise, move erratically, fail to move, or oscillate. It is recommended you start by reading some known-good values from the device and then modifying them. Use the 'Disable driver' button to stop the device if it behaves unexpectedly.

Buttons: **Simple** (selected), PID, Import / Export, Advanced

Calculate tuning parameters for a simple static load.

Load

Load mass: kg

Stage moving mass: g
(Use the default moving mass unless the stage carriage has been customized.)

Acceleration

Current acceleration: 4.50 m/s²
Recommended maximum: 18.29 m/s²

Stiffness

Smooth Stiff

Device parameter set to read/write:

Device management panel:

Live parameter set: Preset 1

Power-on preset: Preset 1

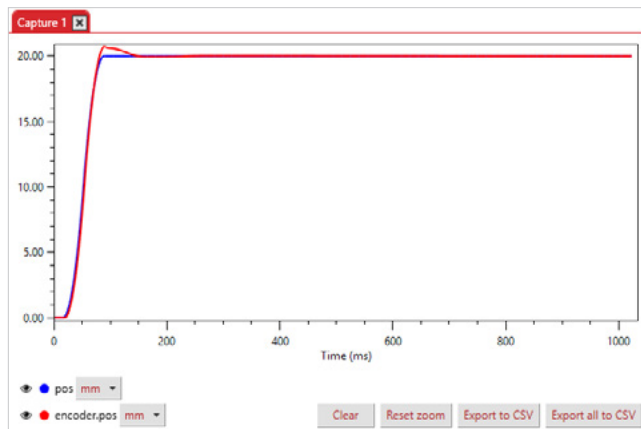
Initial Parameter Set on Power-On

When a servo device is powered on, one of the presets is loaded as the active parameters. This preset is shown as the Power-on Preset. To change which preset is used as the initial parameter set, select from the dropdown, and press Change.

Oscilloscope Tool

The Oscilloscope tool in Zaber Console is used for reading and displaying information from devices over time. A variety of information can be read, such as the expected position based on the trajectory planner, the actual position based on encoder feedback, and the temperature of the motor or driver. Plotting the first two (the expected and measured positions) during a movement can be useful in assessing the effectiveness of different servo tuning parameters; it can show performance such as rise time, overshoot, settling time, and steady-state error.

You can access the Oscilloscope tool by selecting it from Zaber Console's Tab Dock or by pressing the Open Oscilloscope button in the Servo Tuning tool.



While complete information on general usage of the Oscilloscope tool can be found at www.zaber.com/Oscilloscope, here are some recommended settings to use for plotting the step response of a servo device:

Trigger – Select Manual mode to capture high resolution information over a limited time period. Automatic mode will capture lower resolution information indefinitely.

Channels – Select the Trajectory Position (pos setting) and Measured Position (encoder.pos setting) to compare the expected and actual trajectories. Choose ‘mm’ from the Unit selector.

Sample Rate –The maximum sample rate depends on the Trigger type. For Manual mode, selecting a higher frequency will give a smaller sample period. Enter 1 kHz for a reasonable mix of resolution and period for capturing a movement.

Signal Generator – Enable this to create a movement during the data capture. We recommend a relative movement with a step of 20 mm as a sample movement, and resetting after the capture is complete.

Start Capture

Trigger **Manual**

Channels

Color	Setting	Unit
<input checked="" type="checkbox"/> Blue	Trajectory Position (p)	mm
<input checked="" type="checkbox"/> Red	Measured Position (e)	mm

Delay 0 s

Sample rate 1 kHz

Signal Generator

Movement **Move relative**

Step size 20 mm

Return to start?

Settings

Press Start Capture to begin reading the information. The device will move, and once all of the data has been collected and transmitted, a plot of the information will be displayed.

After generating a plot, you can evaluate whether the motion is in line with your application requirements. If not, you can adjust the servo tuning and generate a new plot for comparison. Repeat this process until you're content with the performance.

Because performance also relates to the motion trajectory, there are some adjustable trajectory settings. In particular, you may want to try adjusting the maximum trajectory speed (`maxspeed` setting), the trajectory's acceleration (`accel` setting), and how accurate and stable the final position must be at the end of the movement (`clloop.settle.tolerance` and `clloop.settle.period` settings). See the online product manual for more information on these settings.

Manual Knobs

Most Zaber devices include a manual knob for moving the unit without a computer connection. Devices still need to be connected to a power source for the manual knob to work.

Indexed Knob Functionality	
Turning the knob	Moves the device based on the direction the knob is turned (clockwise moves in the positive direction).
Pressing the knob	Decelerates and stops the device (identical to a Stop command). Pressing the knob also instantly stops the device if the device is already decelerating.
Pressing and holding the knob for 1 second	Toggles between Velocity Mode * and Displacement Mode †.

***Velocity Mode**: each knob turn increments the speed of the axis in a continuous movement.

†**Displacement Mode**: each knob turn moves the axis a specific distance, as indicated by the `knob.distance` setting.

Joystick

Zaber's joystick can be used to control up to 3 Zaber devices manually; the joystick's programmable buttons can also save commands for ease of use.

The joystick is designed to connect at the start of a daisy-chain, where it can send instructions to all of the other devices over the chain. However, these joysticks are not intended to act as controllers, so each axis will still require an integrated controller or a stand-alone controller.

Default Key Configuration for X-JOY3

Key	Short Press	Long Press
1	Stop	Home
2	Send alerts* 1, 2	Send alerts* 1, 3, 4
3	Move to saved position	Save position
4	Move to saved position	Save position
5	Move to saved position	Save position
6	Axis 1 low speed	Axis 1 high speed
7	Axis 2 low speed	Axis 2 high speed
8	Axis 3 low speed	Axis 3 high speed

*When `comm.alert` is set to 1.



The X-JOY3 with programmable buttons to control devices manually.

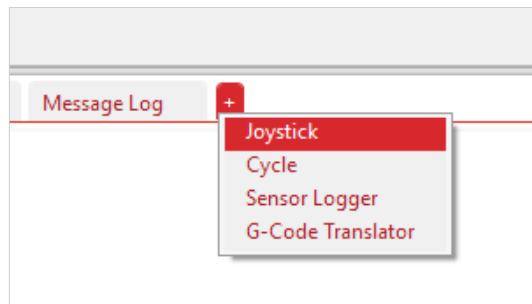
Joystick Start-up Instructions

Connect

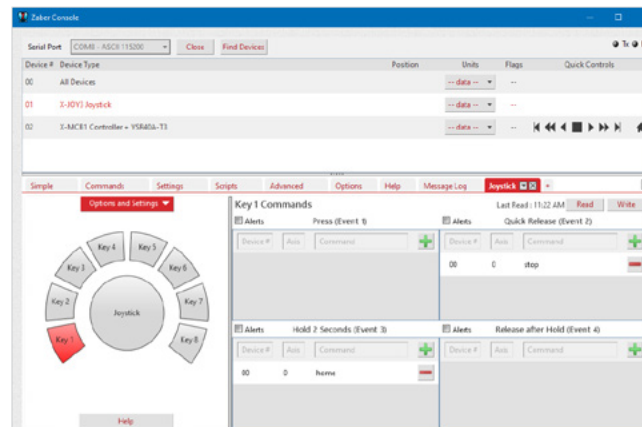
The joystick must be connected to a computer to configure it. Once it is configured, you can operate it with or without a computer connection. The joystick should be the first device in the daisy-chain. Once all devices are connected to the chain, send the `renumber` command to all device. The joystick will be device 1, and the joystick will control devices 2, 3, and 4 (the three devices daisy-chained after it).

Configure

Zaber Console has a useful tool for configuring the joystick settings and the button functions. In order to use this tool, press the + button (shown below) and add the **Joystick** tool.



Highlight the joystick, and go to this tool. Select any of the buttons in the bottom left to view or change the button functions. Highlight the centre button to adjust joystick settings. Additionally, the tool allows you to save and load joystick configurations.



Visit the online manual at www.zaber.com/JoystickTab for complete information on the tools and features available.

Troubleshooting

Some general troubleshooting information is included here. See the online product manual for additional information.

Firmware Update

In order to allow access to new features and bug fixes, Zaber devices (with Firmware Version 6.18 or higher) can be updated remotely through Zaber Console. Follow instructions here to update: www.zaber.com/FirmwareUpdate

Devices can only be updated within their major version. Firmware 6 devices only accept 6.xx versions, and Firmware 7 devices only accept 7.xx versions.

Slipping and Stalling

If the positioner is making unusual noises when in motion, and/or it is not traveling the expected distance or not traveling at all, then the positioner is likely slipping or stalling.

If the positioner is slipping or stalling, and it has encoders, the blue LED on the controller will also flash. To correct the problem, try the following steps:

1. Lower the *maximum speed setting*.
2. Lower the *maximum acceleration setting*.
3. Reduce the load on the positioner.

If the positioner continues to stall with no external load at default speed and acceleration settings, or if the steps above cannot be performed given your application requirements, please contact Customer Support for assistance.

Resetting to Factory Default

If the device is unable to communicate, operating erratically, or performing in unexpected ways, a manual factory reset can be performed through the following steps:

1. **Power Off** the device.
2. Push and hold the knob (use axis 1 knob for a multi-axis device).
3. **Power On** the device.
4. Continue to hold the knob in (for ~5 seconds) until one or more LEDs are fading or the blue LED is lit, then release.

Indicators

Device LED	Green	On	Device is powered
		Off	Device is not powered
		Blinking at 2 Hz	Voltage or temperature outside of acceptable range
	Yellow	Flashing	Device is receiving communication
		Blinking at 2 Hz	Device received a corrupt packet - checksum mismatch
	Red	On or Blinking	A critical error has occurred
Axis LED	Yellow	On	Positioner is moving
		Blinking	Positioner is moving under manual control
		Fading in and out	A peripheral with AutoDetect is plugged in and requires activation
	Blue	On	Peripheral was disconnected and the axis is deactivated
		Fading in and out	Positioner is parked
		Flashing	Positioner is slipping
		Blinking at 0.5 Hz	Positioner has stalled and stopped
		Blinking at 2 Hz	Driver is disabled; see warning flags for explanation
		2 flash burst at 1 Hz	Stationary positioner was displaced
		5 flash burst at 0.5 Hz	Encoder has encountered an error

Customer Support

1-888-276-8033 (Toll Free Canada/USA)

1-604-569-3780 (Direct)

contact@zaber.com

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