



SUMMARY

The Servo Commander is a simple, single-channel servo controller with two servo ports that allow two servos to be driven by the same signal. Servos can be driven by simply rotating the knob, or by using four user-defined preset position buttons. These presets work like presets for radio stations on a car stereo - a long press saves a position and a short press recalls that position. The Servo Commander has a voltage input range of 5V to 15V. The output PWM range is configurable up to a maximum range of 500 μ s to 2500 μ s.

Features:

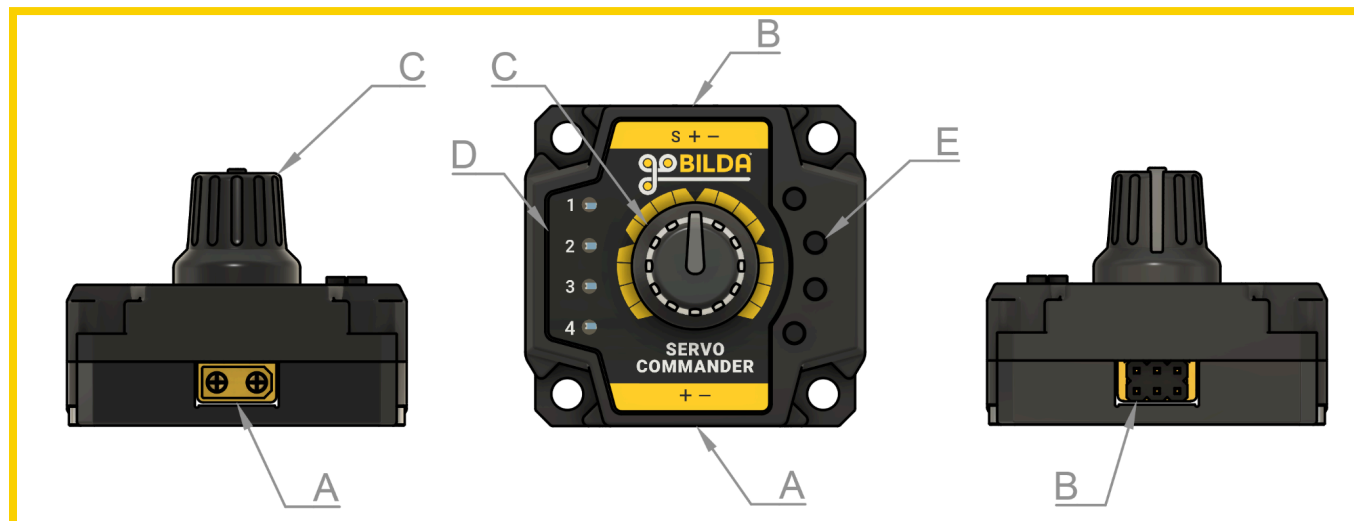
- Reverse Voltage Protection
- Voltage Surge Protection
- Single Channel, Dual Port Servo Output
- User Configurable PWM Range
- Output Reversing
- Fully Encased Rugged Design
- goBILDA® Hole Pattern Compatible
- 4 User-Defined Preset Positions

SUMMARY OF PRODUCT RATINGS				
Input Voltage	5V - 15V		Configurable PWM Ranges	1050µs - 1950µs (Default)
No Load Current Draw	20 mA			850µs - 2150µs
Input Power Connector	XT30 or TJC8			600µs - 2400µs
Potentiometer Rotation	280 Degrees			500µs - 2500µs
Save Positions	4		Servo Output Connectors	Dual TJC8 Servo Headers

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1 Hardware Overview



Hardware Overview		
ID	Name	Description
A	XT30 Input	Main power supply connection
B	Servo Connectors	Dual TJC8 Servo Headers
C	User Input Knob	Knob for the user to control the output signal
D	Status LEDs	LEDs to indicate which of the 4 saved states is being output and which PWM range is selected during boot
E	Programmable Buttons	4 buttons to save and recall PWM positions and configure PWM range

1.1 XT30 Input Connector

The main power connector is an XT30. An XT30 is a keyed connector that prevents the backwards plugin of the mating connector. The Servo Commander can alternatively be powered through the male header pins (+ and - pins) when it is controlling only one servo. When power is applied, a blue LED illuminates and can be seen through the vent holes on the bottom of the Servo Commander. Note: The Servo Commander possesses reverse voltage protection; however, if reverse voltage is applied, it is possible to damage the connected servos, as not all servos have the same level of protection.

1.2 Servo Connectors

The servo connectors are male header pins with 2.54mm (0.100") spacing. The pins provide signal (s), power (+), and ground (-). This servo controller is a single channel servo controller. However, two sets of pins are provided so that two servos can be controlled simultaneously. If the servos are the same, their motions will match. If, however, you're using dissimilar servos, it is possible they will move at different rates and distances. Note: The power supplied to the board via the XT30 input connector or TJC8 servo connector is shared with the servos. Make sure you do not provide a voltage that is outside of the range of the servo(s) you are running.

1.3 User Input Knob

The user input knob controls the PWM signal being sent to the servos in 2 μ s increments.

1.4 Status LEDs

When the Servo Commander is powered on, two LEDs illuminate. An LED on the bottom of the device blinks rapidly and then remains illuminated once the board has initialized. One of four LEDs on the left side of the board also blinks rapidly as the board initializes. This LED indicates which output range has been selected (reference section 4.1).

After initialization, the four buttons and LEDs pertain to the preset positions. When a button is being programmed, the LED directly across from the button will flash. Once the preset has been programmed, the LED remains illuminated. This LED turns off when the knob position is changed or a different preset position is recalled.

1.5 Programmable Buttons

The Servo Commander has four programmable buttons that allow different PWM ranges to be selected during boot. After boot, each can be used to select a customizable servo position that's programmed to that button.

During the booting of the Servo Commander, the buttons can be used to select a PWM range. See section 4.1 for more information on configuring PWM ranges.

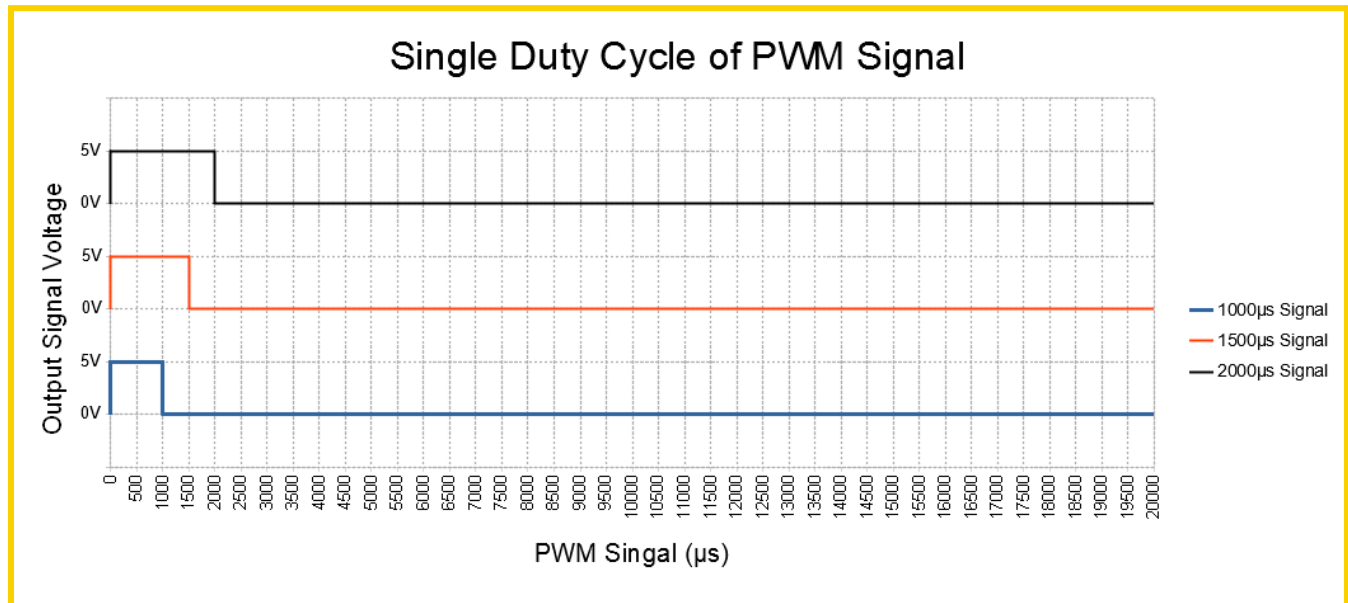
After the Servo Commander is booted, each button can save a servo position anywhere in the PWM range to be recalled at any time. To program a save location, hold its button until the corresponding LED flashes and remains illuminated. To recall a save location, only a short press of the button is required. When a programmed position is recalled, the servo rotates to that position and the corresponding LED illuminates. The programmed positions and current position are saved through power loss. When rebooted, the servos recall the most recent position.

2 Main Power Supply

The Servo Commander is designed to accept both a battery or a wall mounted power supply as a power source. When powered from a battery, the Servo Commander recovers some voltage fed back from the servo and stores it in the battery for later use. Alternatively, when a wall mounted power supply is used, these over-voltage events are suppressed and kept from feeding back to the power supply. This can be an issue, as many wall-mounted power supplies have over-voltage protection. If this protection feature is triggered, the power supply will stop delivering power to the system.

3 Control Interface

Servo position is controlled by a PWM signal set by the input knob or recalled by one of the buttons. Typically, this signal is referenced in terms of the time in which its square wave is high. The duty cycle of this signal is adjustable, but the maximum is between 2.5% and 12.5%. This 2.5 to 12.5% duty cycle refers to the maximum range of 500 μ s to 2500 μ s when the signal is high; outside this proportion of time, the signal is low.



4 Features

The Servo Commander is designed to work with any device that will take an RC PWM signal. As such, it has the ability to tailor to the output PWM range for the servo or device. The Servo Commander has four pre-programmed PWM ranges that can be selected by the user. These ranges were selected to run with most hobby and professional grade servos. In setting the correct PWM range for your application, the Servo Commander will use the entire knob range to control your servo with the best possible resolution. The servo direction can also be reversed to adapt to more projects.

4.1 Configurable PWM Range

The Servo Commander provides four pre-configurable PWM output ranges:

- 1050µs - 1950µs (Default)
- 850µs - 2150µs
- 600µs - 2400µs
- 500µs - 2500µs

Note: These ranges are pre-programmed and cannot be changed. The user may only select between them.

The PWM ranges allow control of different servos while utilizing the entire rotational travel of the user input knob. It is important to note that different brands of servos typically have sometimes large variations in the PWM range. Below is a description of these ranges, as well as the servos they are appropriate for.

- **1050µs-1950µs** is the default PWM range. This range allows most servos to rotate 90 degrees. Many servos are able to rotate further if given a wider range. If you purchased a goBILDA® servo, reference its webpage for the maximum PWM range the servo is able to accept, as well as the corresponding rotation. This range is also used with goBILDA® linear servos.
- **850µs-2150µs** is a wider signal range that most servos can utilize for more rotation. This is the typical maximum signal range for Hitec and Savox digital servos.
- **600µs-2400µs** will typically allow an analog servo to rotate 180 degrees. This range is too wide for some servos. If a servo does not recognize the signal while nearing the extremes, reduce the signal range to one of the narrower options. Additionally, if the servo buzzes at either extreme, it is hitting the mechanical limit of the gear train, and the PWM range needs to be decreased.
- **500µs-2500µs** is the max PWM range of the Servo Commander. It allows a goBILDA® servo to achieve a full 300 degrees of travel.

The default PWM output range is 1050µs-1950µs. A PWM output range is configured using one of the four available buttons while the device is booted.

PWM output range configuration procedure:

1. Power off Servo Commander
2. Hold button corresponding to desired PWM output range
3. Power on Servo Commander while button is depressed
4. Wait for corresponding LED to flash then remain illuminated
5. Release button
6. Control servos with configured PWM output range

The configured PWM output range is saved through power loss, and the corresponding LED will flash when the Servo Commander is booted.

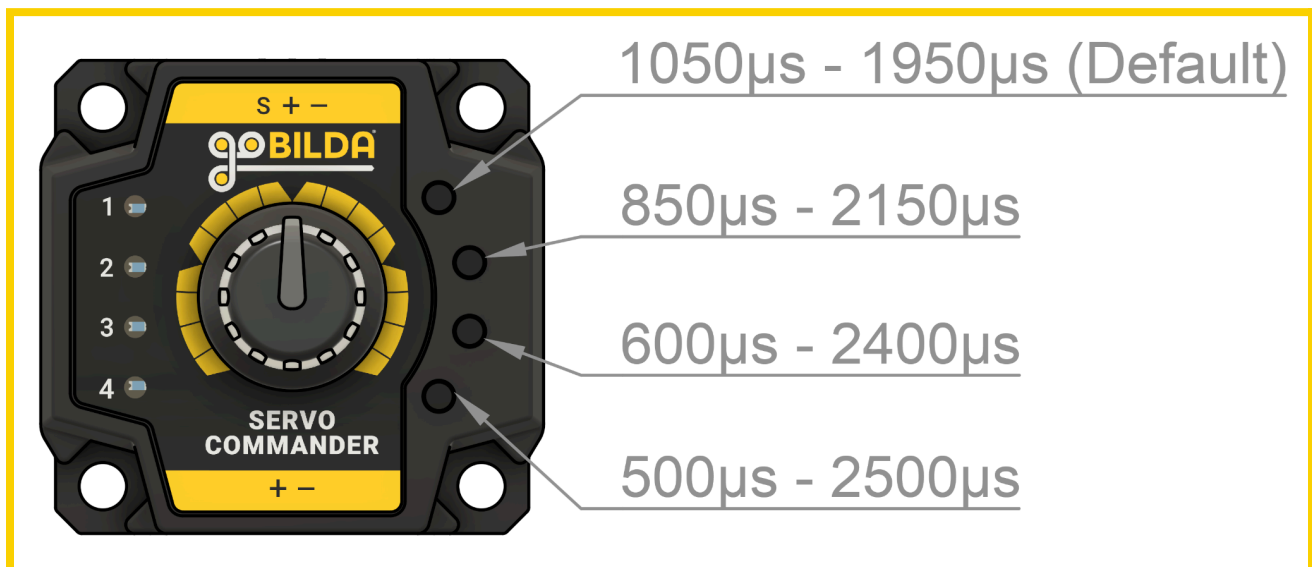
4.2 Reverse Servo Direction

The Servo Commander allows you to reverse the direction your servo travels in relation to the knob. The PWM signal can either decrease or increase as you move clockwise.

Reverse direction procedure:

1. Power off Servo Commander.
2. Hold **two or more buttons**.
3. Power the Servo Commander on while pressing **two or more buttons**.
4. Wait for LEDs to flash from top to bottom or bottom to top. The servo direction is now reversed.
 - a. If LEDs flash from top to bottom, it means the PWM signal will increase as you move clockwise.
 - b. If LEDs flash from bottom to top, it means the PWM signal will decrease as you move clockwise.

Note: The saved positions and set PWM range will not be affected when reversing the servo direction.



4.3 Reverse Voltage Protection

The Servo Commander has reverse-voltage protection that is implemented in two forms. First, the XT30 main power connector is keyed so the mating XT30 connector that is delivering power must be plugged-in with the proper orientation. Reverse voltage protection circuitry that protects the entire board. This circuit will not stop current flow through the Servo Commander and will provide power of the opposite polarity to any servos that are plugged in.

4.4 Voltage Surge Protection

Servos are a closed feedback loop between a motor, controller, and sensor. When reaching a target, the system will reduce speed and dissipate the excess motor energy as electricity that can find its way back into the main power lines. Closed feedback systems often do not provide premium power supply protection. Voltage surges are typically not an issue when using a battery as the main power supply, as a battery will simply absorb this energy, charging it slightly. When using a power supply, however, these voltage surges can damage a power supply or trip its protection features, turning itself off. In both outcomes, these voltage surges need to be reduced

Servo Commander

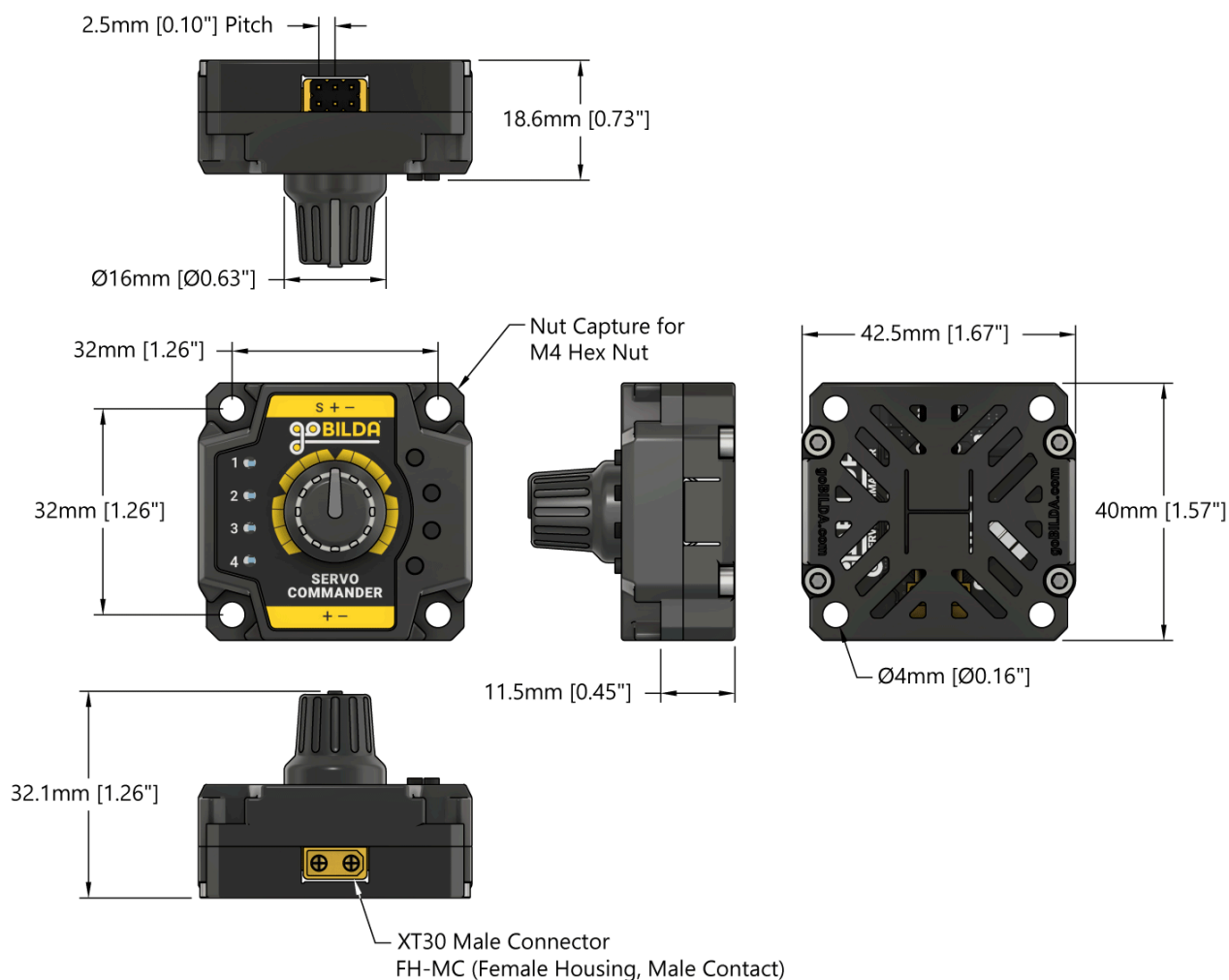
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as much as possible, and thus, a voltage-suppressing circuit is implemented to actively and adaptively suppress any voltage surges and ensure a good user experience with any power application.

This system is adaptive to any input voltage. On boot, the device records a stable input voltage and suppresses any voltage spike. It adapts over time to increase or decrease slowly to follow a clean power supply voltage. It is recommended to not change the input voltage after the Servo Commander has been booted. If a higher voltage is to be implemented, turn off the device and reapply the voltage. This will ensure the proper function of the voltage-suppressing circuit.

5 Schematic/Drill Guide



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