

Talon FXS User's Guide

Revision 1.0



CTR Electronics

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TO OUR VALUED CUSTOMERS

It is our intention to provide our valued customers with the best documentation possible to ensure successful use of your CTR Electronics products. To this end, we will continue to improve our publications, examples, and support to better suit your needs.

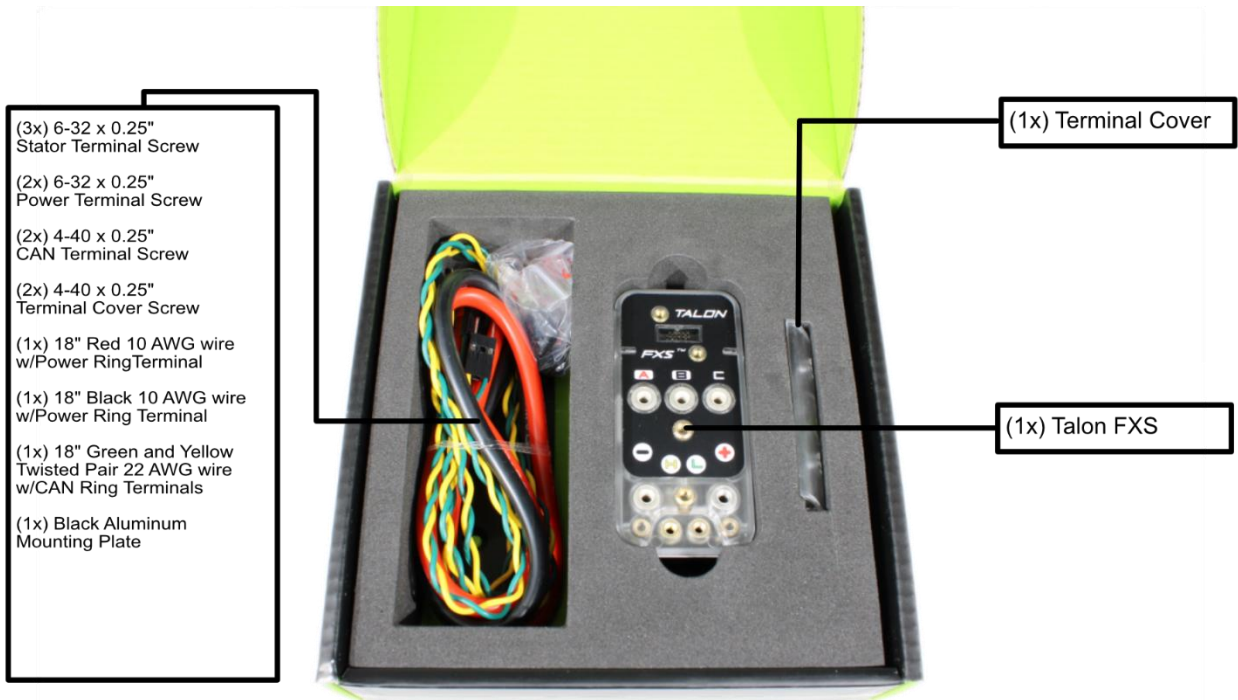
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1. Device description

The CTR Electronics Talon FXS is a versatile motor controller compatible with the Phoenix software ecosystem. This standalone device supports controlling both brushless (BLDC) and brushed (BDC) motors, offering unparalleled flexibility and performance. The Talon FXS features flexible wiring options in the form of ring terminals, a sleek aluminum housing, 2-inch spaced mounting holes, and flexible IO through its onboard data port.

1.1. Kit Contents



1.2. Features

- Supports various brushless motors
 - o CTR Electronics Minion
 - o Third-party NEO
 - o Third-party NEO 550
 - o Third-party NEO Vortex
- Supports most third party brushed motors
- High performance aluminum housing
- 2" spaced 10-32 mounting holes (without mounting plate)
- 4" spaced 10-32 clearance holes (with mounting plate)
- Versatile wire connections in the form of ring terminal connectors
- 10-pin gadgeteer port for external encoders, limit switches, etc.
 - o Backwards compatible with most Talon SRX compatible encoders and accessories
- 6-pin JST port for brushless motors
- Reverse polarity protection
- [CAN FD](#) capable
- PWM motor selection and control
- High-fidelity stator and supply current limits
- Improved motor efficiency and reduced velocity noise on supported brushless motors with the Phoenix Pro feature "Advanced Hall Support" enabled
- Advanced thermal protections for brushless motors
- Advanced 1Khz closed-loop onboard control in the form of Motion Magic® and Motion Magic® Expo

1.3. Electrical/Mechanical Specifications

| General Electrical Information | | | | | | |
|--------------------------------|-----------------------|-----------------|-----|------|------|------|
| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
| Tamb | Ambient temperature | | -40 | | +85 | °C |
| I _{supp} | Quiescent Current | DC supply 12.0V | | 70 | | mA |
| V _{dd} | Operating Voltage | | 6.0 | 12.0 | 24.0 | V |
| I _{supp} | Continuous Current | | | | 60 | A |
| I _{supp} | Surge Current (2 sec) | | | | 120 | A |

1.3.1. Absolute Maximum Ratings

Stress above these limits may cause damage to the Talon FXS or affect reliability.

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|------------------------------|---|-----------|-----|------|------|------|
| V _{dd} | Supply Voltage | | 6.0 | 12.0 | 27.0 | V |
| τ | Stator Ring Terminal Torque | | | | 0.9 | Nm |
| τ | Positive and Negative Ring Terminal Torque | | | | 0.9 | Nm |
| τ | CAN H and CAN L Ring Terminal Torque | | | | 0.6 | Nm |
| 10-pin Gadgeteer Port | | | | | | |
| V _{dd} | Analog Input Voltage (G3) | | 0 | | 12 | V |
| V _{dd} | Quadrature A/B Input Voltage (G7, G5) | | 0 | | 12 | V |
| V _{dd} | PWM Input Voltage (G9) | | 0 | | 12 | V |
| V _{dd} | Limit Fwd/Limit Rev Input Voltage (G4, G8) | | 0 | | 12 | V |
| V _{dd} | Reserved G1/G6 Input Voltage | | 0 | | 12 | V |
| I _{supp} | 5V Maximum Output Current (shared with JST) | | 0 | | 100 | mA |
| 6-pin JST Port | | | | | | |
| I _{supp} | Hall A/B/C (J2, J3, J4) Input Voltage | | 0 | | 12 | V |
| I _{supp} | Temp (J5) Input Voltage | | 0 | | 12 | V |
| I _{supp} | 5V Maximum Output Current (shared with Gadgeteer) | | 0 | | 100 | mA |

1.3.2. Operational Ratings

Information regarding requirements when using auxiliary sensors.

| Symbol | Parameter | Min | Typ | Max | Unit |
|----------------------------------|--|------|-----|-----------------------------|------|
| 10-pin Gadgeteer Port | | | | | |
| Quadrature EPR _{MAX} | Max Quadrature Edges Per Rotation ¹ | | | 2,000,000,000 / Peak RPM | |
| Quadrature RPM _{MAX} | Max Quadrature RPM ¹ | | | 2,000,000,000 / EPR | |
| Vdd | Output voltage | | 5.0 | | V |
| Logic High | Logic High Min Input Voltage Quad A/B/PWM/Limit Fwd/Limit Rev | 2.64 | | | V |
| Logic Low | Logic Low Max Input Voltage Quad A/B/PWM/Limit Fwd/Limit Rev | | | 0.66 | V |
| 6-pin JST Port | | | | | |
| Vdd | Output voltage | | 5.0 | | V |
| Logic High | Logic High Min Input Voltage | 2.64 | | | V |
| Logic Low | Logic Low Max Input Voltage | | | 0.66 | V |

1.4. General/Mechanical Specifications

| Description | Without Mounting Plate | With Mounting Plate |
|--------------------------------|-----------------------------------|-----------------------------------|
| Outside Dimensions (W x H x L) | 1.43" x 1.16" x 3.06" | 1.43" x 1.29" x 4.5" |
| Weight | .25 lbs | .30 lbs |
| Hole Spacing | 2" (compatible with WCP box tube) | 4" (compatible with WCP box tube) |

1.5. PWM Control Specifications

The Talon FXS supports motor control through two communication protocols: CAN (2.0 and FD) and PWM. The table below can be used to determine the requirements for using the Talon FXS with PWM. It is preferred for the user to utilize CAN over PWM, as most smart motor controller functionality is only available when used with CAN.

| Parameter | Specification |
|--------------------------------------|--|
| PWM Input Pulse (High Time) | 1 – 2ms nominal 0.6 – 2.4ms maximum |
| PWM Input Rate (Period) | 2.9 – 100ms |
| Minimum Throttle (Dead band) | 4% |
| PWM Logic High Min Voltage Threshold | 1V |
| PWM Logic Low Max Voltage Threshold | 0.4V |
| PWM Input Min Current | < 1mA |

¹ Maximum selectable EPR may differ. Consult the API documentation.

1.6. LED States

The Talon FXS has 2 LEDs located on the front of the Talon FXS. These LEDs indicate various states about the device and are useful for diagnostics. The table below can be used to look up what corresponding LED color codes mean.

| LED Color | LED State | Cause | Possible Fix |
|---------------|---|--|--|
| Off | LEDS Off | Device does not have power | Provide 12V to V+ and V- inputs. |
| Red/Off | Blinking alternating red | Device does not have valid CAN or is not receiving a PWM signal. | Ensure good connections from the CAN H and CAN L inputs to the robot, and that the robot controller is turned on. If controlling over PWM, ensure the robot is enabled and PWM is properly connected with signal (white) to CAN H (yellow) and ground (black) to CAN L (green). |
| Orange/Off | Blinking alternating orange | Device detects CAN but does not see Phoenix running on the robot controller. | If Phoenix is running on the robot controller, ensure good connection between the controller and this device. Otherwise, deploy a robot program that uses Phoenix. |
| Orange/Off | Blinking simultaneous orange | Device has a valid CAN signal and is disabled. Phoenix is running in robot controller, and Talon FX has good CAN connection to robot controller. | If robot is enabled, ensure a control request is being sent to the device. |
| Orange/Orange | Both solid orange | Talon FXS is enabled with neutral output. | |
| Red/Red | Blinking simultaneous red | Talon FXS is driving in reverse. Rate of blink corresponds to duty cycle applied. | |
| Green/Green | Blinking simultaneous green | Talon FXS is driving forward. Rate of blink corresponds to duty cycle applied. | |
| Red/Off | Offset alternating red/black | Talon FXS limited (hard or soft limit). Direction of offset determines forward/reverse limit. | |
| Orange/Off | Offset orange/off | Talon FXS in thermal cutoff or the motor sensor cable is unplugged. | See "1.6.1. Troubleshooting Fault LED" for potential solutions. |
| Red/Green | Alternating red/green – LEDs are never off | Talon FXS driven with Pro-only command while unlicensed. | Use non-Pro-only command, or license device for Pro. |
| Orange/Green | Alternating orange/green – LEDs are never off | Talon FXS driven with no motor selected in motor arrangement. | Configure the Talon FXS with the attached motor. |
| Red/Orange | Alternative red/orange – LEDs are never off | Damaged Hardware. | Contact CTR Electronics support. |
| Green/Orange | Single LED alternates green/orange | Talon FXS in bootloader. | Field-upgrade device in Phoenix Tuner X. |

1.6.1. Troubleshooting Fault LED

A Talon FXS fault, as indicated with an “Offset orange/off” blink code, can be triggered for a variety of reasons. The list below can be used to help identify the reason and a potential solution.

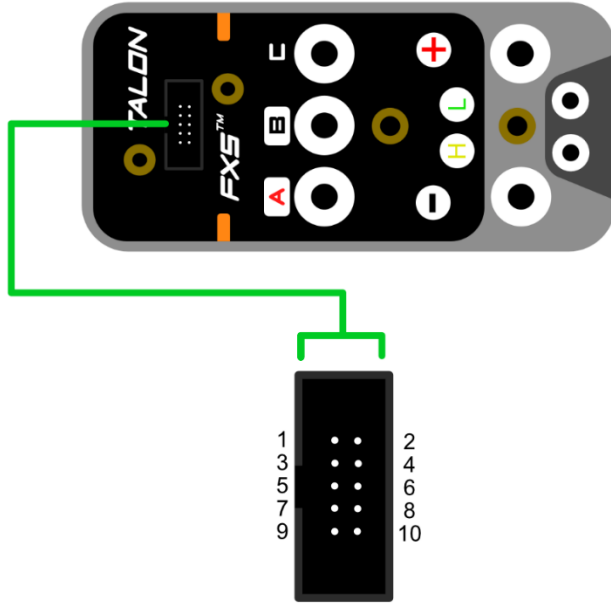
Brushless Motor

- JST is disconnected or damaged. Plug-in the motor JST cable into the JST port and ensure the cable is not damaged.
- Motor arrangement is incorrect. Please configure the selected motor.
- Talon FXS or motor has reached thermal cut-off. Allow time for the device to cool and consider configuring current limits (only available through CAN).

Brushed Motor

- Motor arrangement is incorrect. Please configure the Talon FXS to one of the available brushed options.
- Talon FXS has reached thermal cut-off. Allow time for the device to cool and consider placement of the Talon FXS to improve heat distribution.

1.7. Gadgeteer Port Pinout



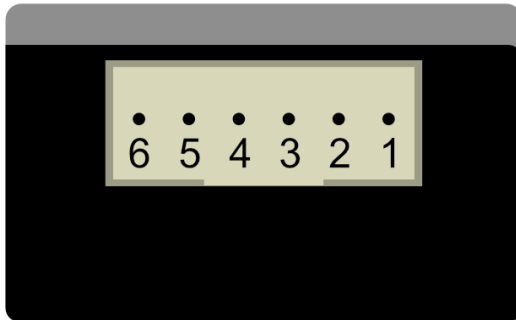
| Pin | Usage |
|-----|---------------------------|
| 1 | Reserved (Do Not Use) |
| 2 | 5V |
| 3 | Analog Input ² |
| 4 | Forward Limit |
| 5 | Quadrature B |
| 6 | Reversed (Do Not Use) |
| 7 | Quadrature A |
| 8 | Reverse Limit |
| 9 | PWM Input |
| 10 | Ground |

It's recommended to use a [gadgeteer breakout module](#) when wiring third-party sensors. This reduces the possibility of damage to the Talon FXS gadgeteer port.



² Analog is supported in hardware. Consult the API documentation to determine availability.

1.8. JST Port Pinout



| Pin | Usage |
|-----|------------------------------|
| 1 | Ground (Black) |
| 2 | Hall C (Green) |
| 3 | Hall B (Yellow) |
| 4 | Hall A (Blue) |
| 5 | Temperature (White) |
| 6 | 5V (Red) |

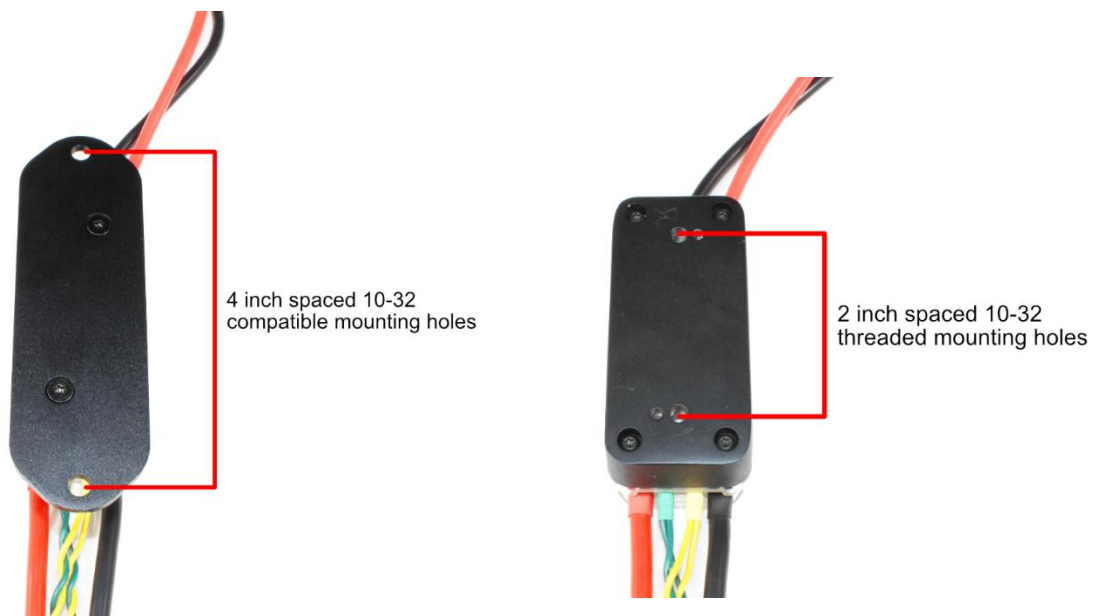
2. Installation

The Talon FXS has 2x 6-32 threaded ring terminals for 12-24V DC power input labeled V+/V-. The Talon FXS can be used for PWM or CAN, with 2x 4-40 threaded ring terminal for CAN H and CAN L.

2.1. Mounting the Talon FXS

The Talon FXS comes with a black aluminum mounting plate with 10-32 4-inch spaced mounting holes. This mounting plate can be screwed onto the back of the Talon FXS and is directly compatible with WCP Box Tube.

Alternatively, there are two 10-32 threaded holes on the back of the Talon FXS that can be used for mounting.



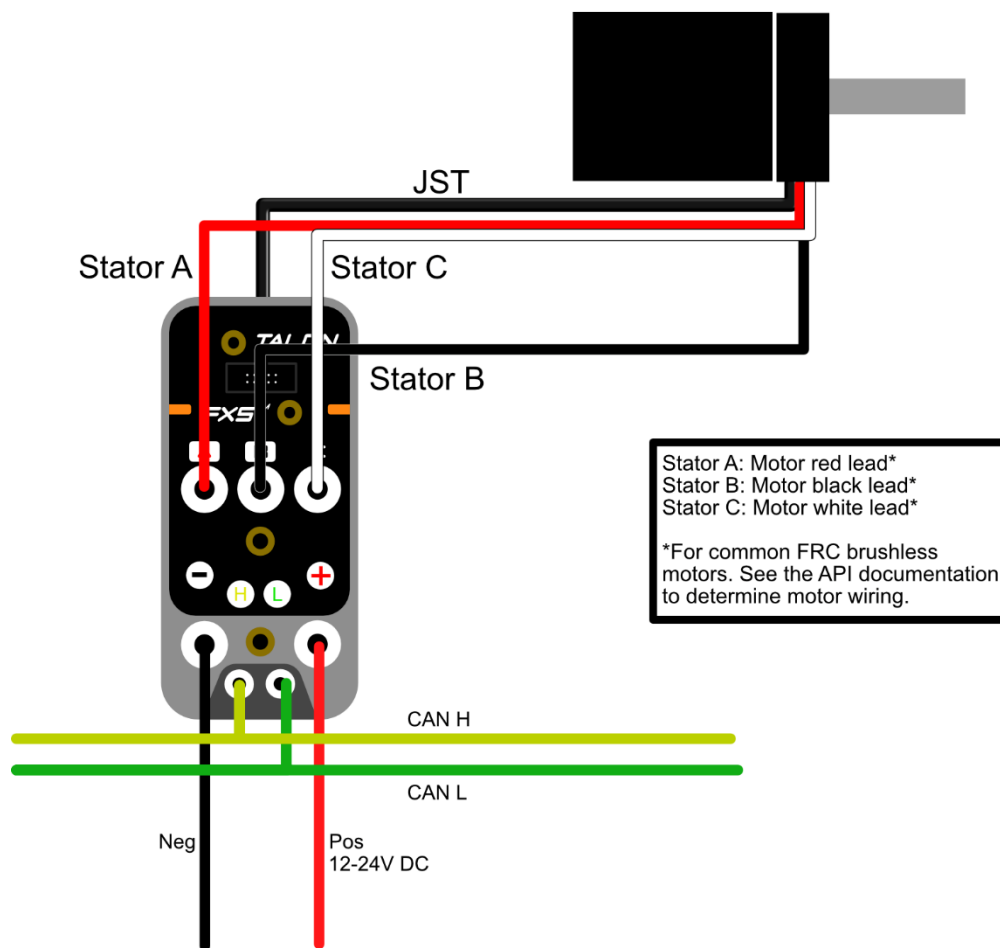
2.2. Wiring the Talon FXS for CAN

An example wiring diagram is shown below. The Talon FXS has an onboard voltage regulator and it's highly recommended that input voltage comes directly from a battery. CAN is wired in a "daisy-chain" where the Talon FXS is located on a stub no longer than 1 foot.

The Talon FXS is compatible with a variety of brushless and brushed motors. For supported brushless motors, see the [API documentation](#) to determine what colors correspond to which terminal. The coloring on the text above the ring terminals can be used as a wiring guide for common FRC brushless motors.

Important!

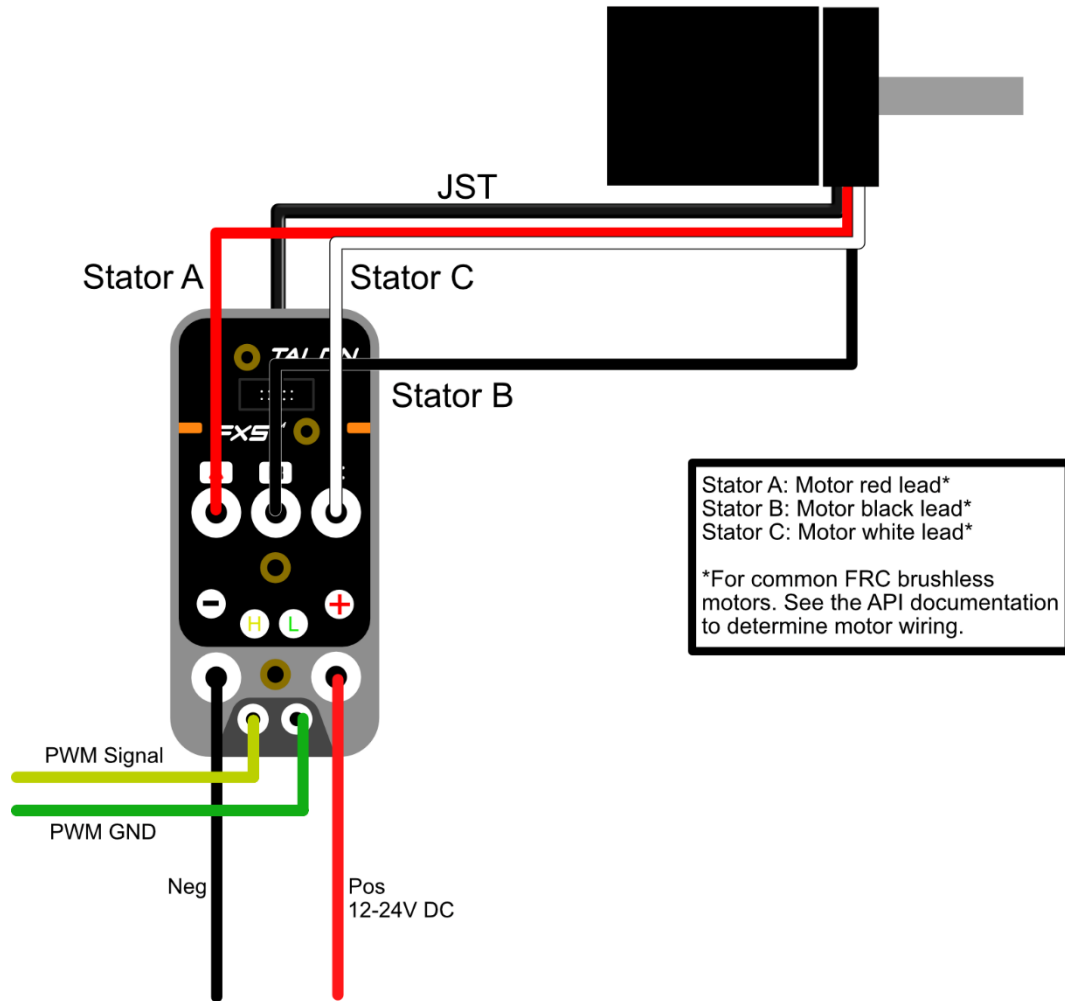
The stator, positive, and negative ring terminals should not exceed 0.9Nm of torque when attaching wires. The CAN H and CAN L terminals should not exceed 0.6Nm.



2.3. Wiring the Talon FXS for PWM

When used with PWM, the Talon FXS expects the PWM signal input to be through the CAN H (yellow) ring terminal and GND through the CAN L (green) ring terminal.

Important!
The stator, positive, and negative ring terminals should not exceed 0.9Nm of torque when attaching wires. The CAN H and CAN L terminals should not exceed 0.6Nm.



3. Example Sensor Installation

Talon FXS is backwards compatible with most accessories for the Talon SRX through its gadgeteer port. This section highlights wiring common sensors to the Talon FXS.

Important!

Always consult the manufacturer documentation for your sensor. Different sensors behave differently depending on how they are wired.

3.1. Example: SRX Mag Encoder

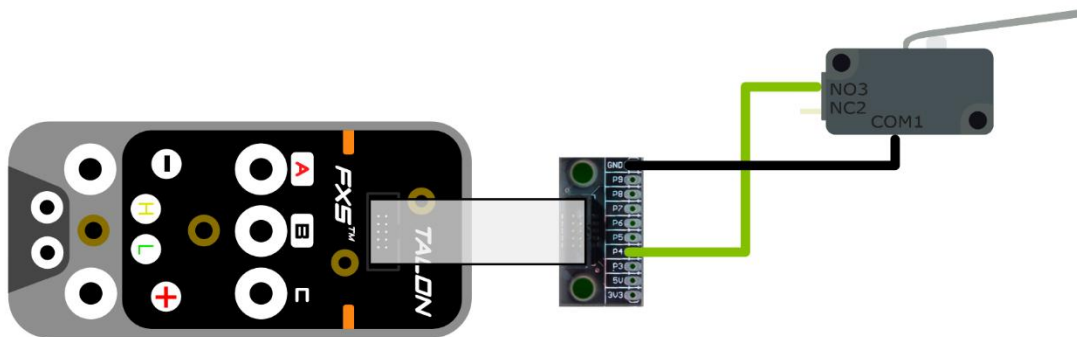
The [SRX Mag Encoder](#) can be connected directly to the Talon FXS using a gadgeteer cable.



3.2. Example: Limit Switch and Third-Party Sensors

The diagram below shows a typical limit switch wired to P4 (forward limit) on the Talon FXS. The limit switch is wired such that forward limit will be closed when the lever is pressed, preventing any positive output duty cycle.

The below diagram can be useful as a reference for wiring other third-party sensors that do not directly integrate a gadgeteer port.



4. Software Information

Software information can be found on our documentation landing page at <https://docs.ctr-electronics.com>.

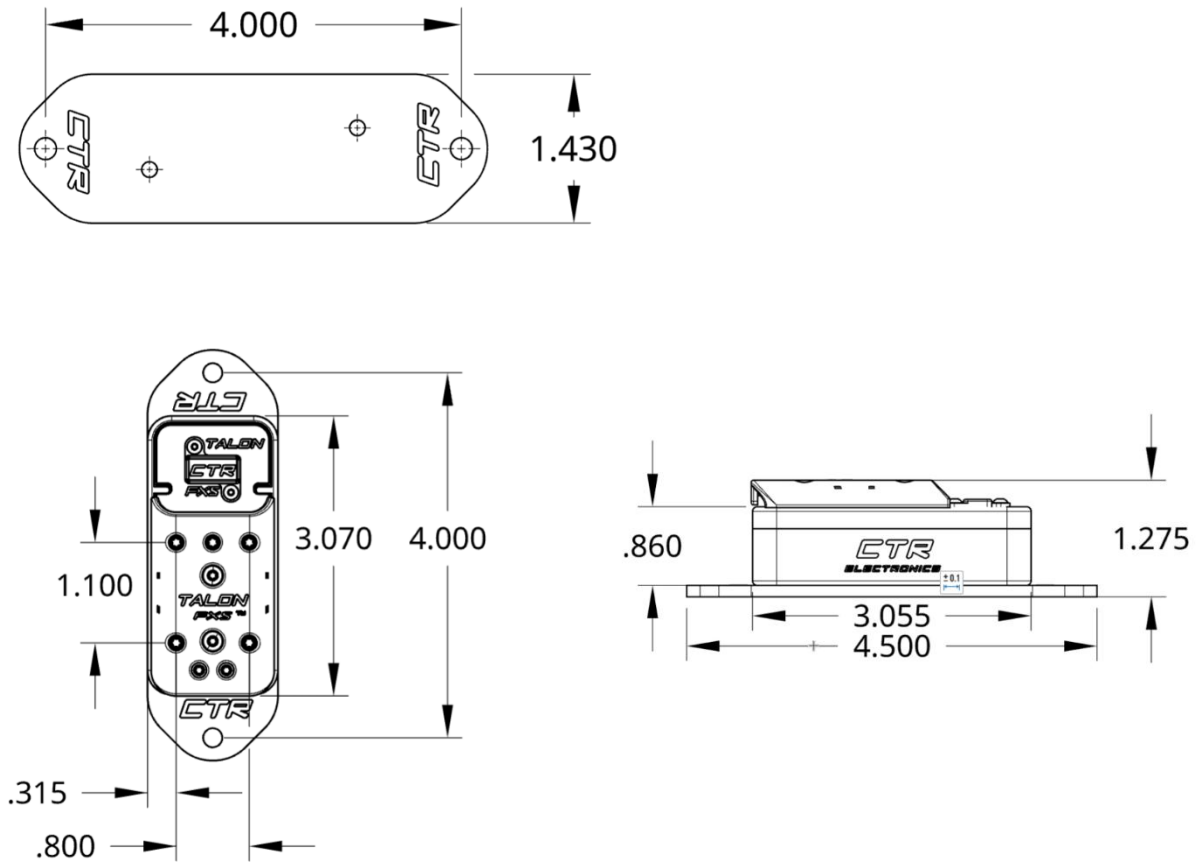
4.1. Example PWM Configuration and Control

Tip!

The requirements for PWM control are documented at <https://store.ctr-electronics.com/pages/pwm-control>

The Talon FXS motor arrangement and certain configs can be configured over PWM. See the [CTR Electronics example repository](#) for a Talon FXS example.

5. Mechanical Drawings



6. Revision History

| Revision | Date | Description |
|----------|-------------|-------------------|
| 1.0 | 27-Jan-2025 | Initial Creation. |