Spike is an H-Bridge relay module custom designed for Robotics applications. The most common use of Spike is to drive small motors in Forward, Reverse or Off. Spike can also be used to turn ON or OFF solenoids and lights. Spike takes input power from a 12V battery (labeled 12V, GND) and provides two outputs (labeled M+, M-). M+ and M- are typically connected to a motor. The unit is controlled via a three-wire interface, which connects to the FRC Robot Controller or the Isacc16 Robot Controller. Spike has a 20A integrated fuse to help protect the unit and it has an indicator to show status.

WARNING. BEFORE APPLYING POWER:
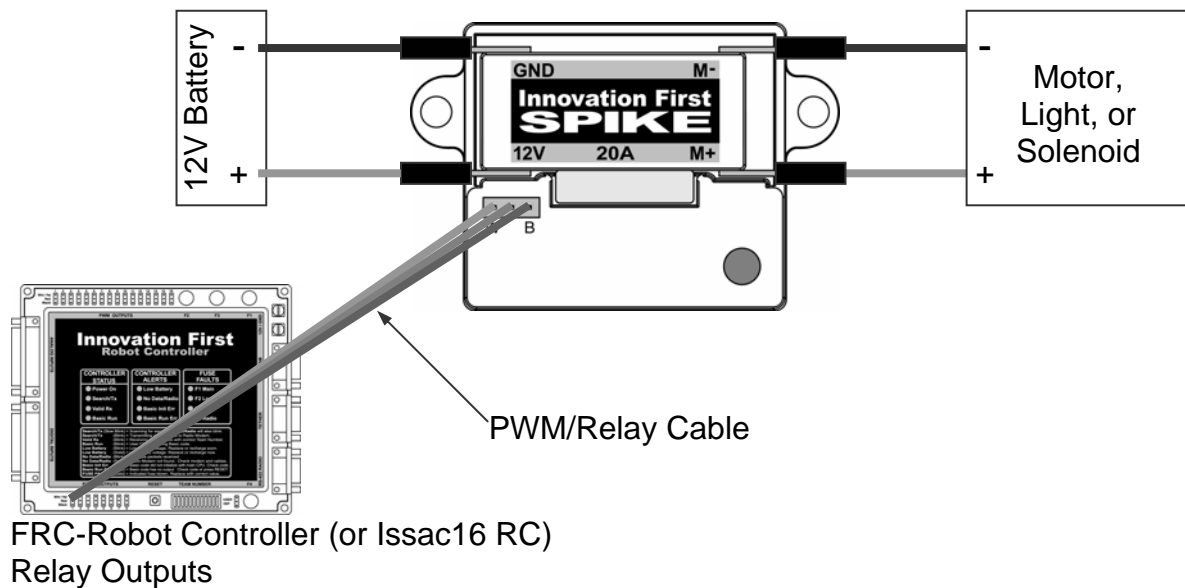1. **Ensure that there is not a short circuit on the output. A short circuit will destroy Spike.**

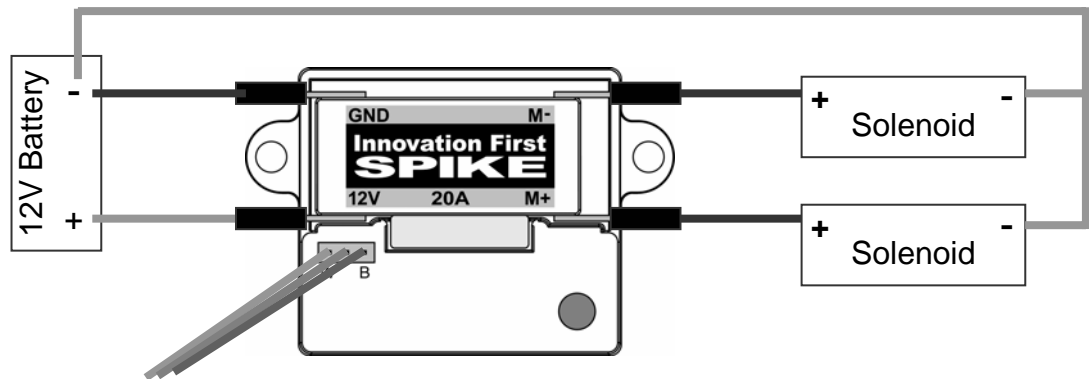**Figure 1: Spike Blue Wiring to One Motor, Light, or Solenoid**

Figure 2: Spike Blue Alternate Wiring for Two Solenoids

Notice: This Manual covers the Spike Blue (Not the Spike Red)

Motor and Solenoid Wiring

The two motor connections can be wired to either of the relay outputs. M+, and M- are only labeled to indicate the polarity of the output versus the control signal and Spike's indicator. If your motor turns opposite of the direction desired, swap the wires connected to M+ and M-. The 3 wire Control(PWM) cable contains a black wire for ground, a red wire for reverse, and a white wire for forward. The table below shows the corresponding output versus the control signal and the indicator.

Table 1: Spike Blue P-BASIC software control, Spike output, Motor function

| INPUTS | | OUTPUTS | | | |
Fwd(Wht)	Rev(Red)	M+	M-	Indicator	Motor Function
0	0	GND	GND	Orange	OFF / Brake Condition (default)
1	0	+12v	GND	Green	Motor rotates in one direction
0	1	GND	+12v	Red	Motor rotates in opposite direction
1	1	+12v	+12v	Off	OFF / Brake Condition

Notes:
1. 'Brake' refers to the dynamic stopping of the motor due to the shorting of the motor inputs. This condition is not optional when going to an off state.
2. The INPUT Fwd and Rev are defined as follows: 0 (Off) and 1 (On).

One or Two Solenoid Wiring

The Spike Relay Module can be used to control solenoids. The easiest method of connection is to wire one side of the solenoid to M+, and the other wire to the ground (GND) side of the Battery. When the relay is sent a Forward (Indicator Green) command, the solenoid will be activated. The same can be done with the M- connector to control another solenoid or the opposite direction of a double solenoid (see Figure 2 on page 1).

Table 2: Spike Blue P-BASIC software control, Spike output, Solenoid function

| INPUT | | OUTPUTS | | | |
Fwd(Wht)	Rev(Red)	M+	M-	Indicator	Solenoid Function
0	0	GND	GND	Orange	Both Solenoids OFF (default)
1	0	+12v	GND	Green	Solenoid connected to M+ is ON
0	1	GND	+12v	Red	Solenoid connected to M- is ON
1	1	+12v	+12v	Off	Both Solenoids ON

Note:
1. The INPUT Fwd and Rev are defined as follows: 0 (Off) and 1 (On).

Notice: This Manual covers the Spike Blue (Not the Spike Red)

Specifications

Control Signal	Hi: 3V min @ 4mA; Lo: open or ground.
Operating Voltage	6V to 16V
Maximum Current	20A continuous
Surge Current	100A for < 2 second
Max Switching Rate	20 operations per second no load, 6 operation per minute for rated life at rated load.
Initial Operate Time	5 ms typical
Initial Release Time	2 ms typical
Expected Mechanical Life	10 million operations
Expected Electrical Life	100K operations at 20A, 14VDC, 1mH
Power Connector	1/4" blade connectors
Signal Connector	Uses a standard non-shrouded PWM cable (3 wires)
Typical Application	Power one motor with variable speed forward, reverse, or off (shunt brake)
Weight	0.12 lbs

Notes

General Notes:
1.   Spike is not a PWM device. It can not be connected to an R/C hobby type receiver. The Spike is designed to plug into the Relay Ports on the FRC-Robot Controller and Isaac16-RC.