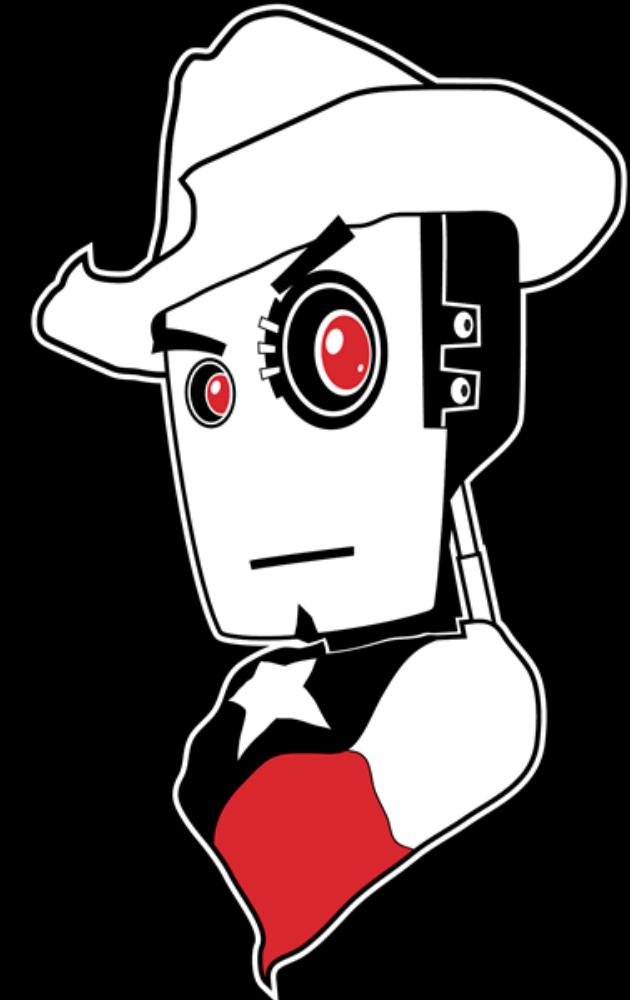


# **2015 Control System Beta**

Presented by Team 148, The Robowranglers  
October 18, 2014



**Hardware**

- New Hardware
- roboRIO
  - Specs
  - I/O
- PDP
- PCM
- VRM
- Victor SP
- Radio

**Software**

- Software Enhancements
- Eclipse IDE
- New Re-Imaging Tool
- Driver Station

**Mechanical Integration**

**Questions?**

# The ROBOWRANGLERS

- Established in 1992
  - One of founding FIRST teams
- Greenville High School
  - Greenville, TX
- 1993 and 2008 Championship Winners

## 2015 Control System Beta

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### Mechanical Integration

### Questions?

# What is Beta Testing?

- Used by FIRST to test new control system hardware and software
  - Done prior to kickoff
- Beta teams work with FIRST to find and fix bugs
  - Code or documentation
- Applicants chosen based on location, strength in controls, communication, and regional mentoring

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### **Mechanical Integration**

### **Questions?**

# **Hardware**

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*Hardware*

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*Mechanical Integration*

*Questions?*

# New Hardware

- roboRIO
- Power Distribution Panel (PDP)
  - CAN Bus Feedback
- Voltage Regulator Module (VRM)
- Pneumatics Control Module (PCM)
  - CAN Bus Feedback
- Victor SP Motor Controller
- Talon SRX Motor Controller

## 2015 Control System Beta

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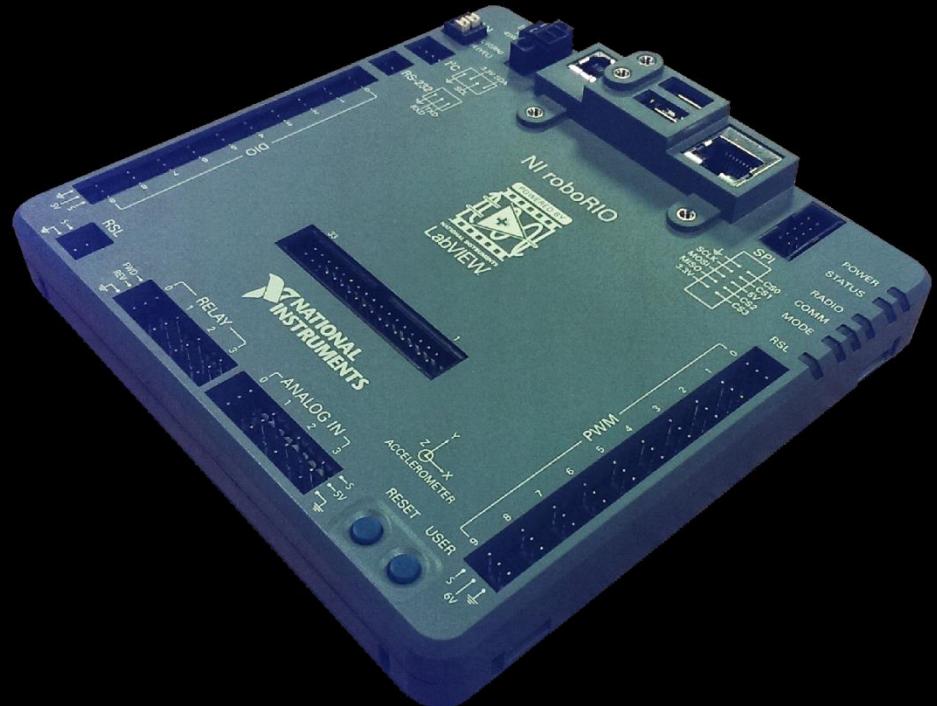
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### Mechanical Integration

### Questions?

# roboRIO

- Replaces cRIO & digital sidecars
- 3 supported languages
  - LabVIEW
  - C++
  - Java



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## 2015 Control System Beta

### Hardware

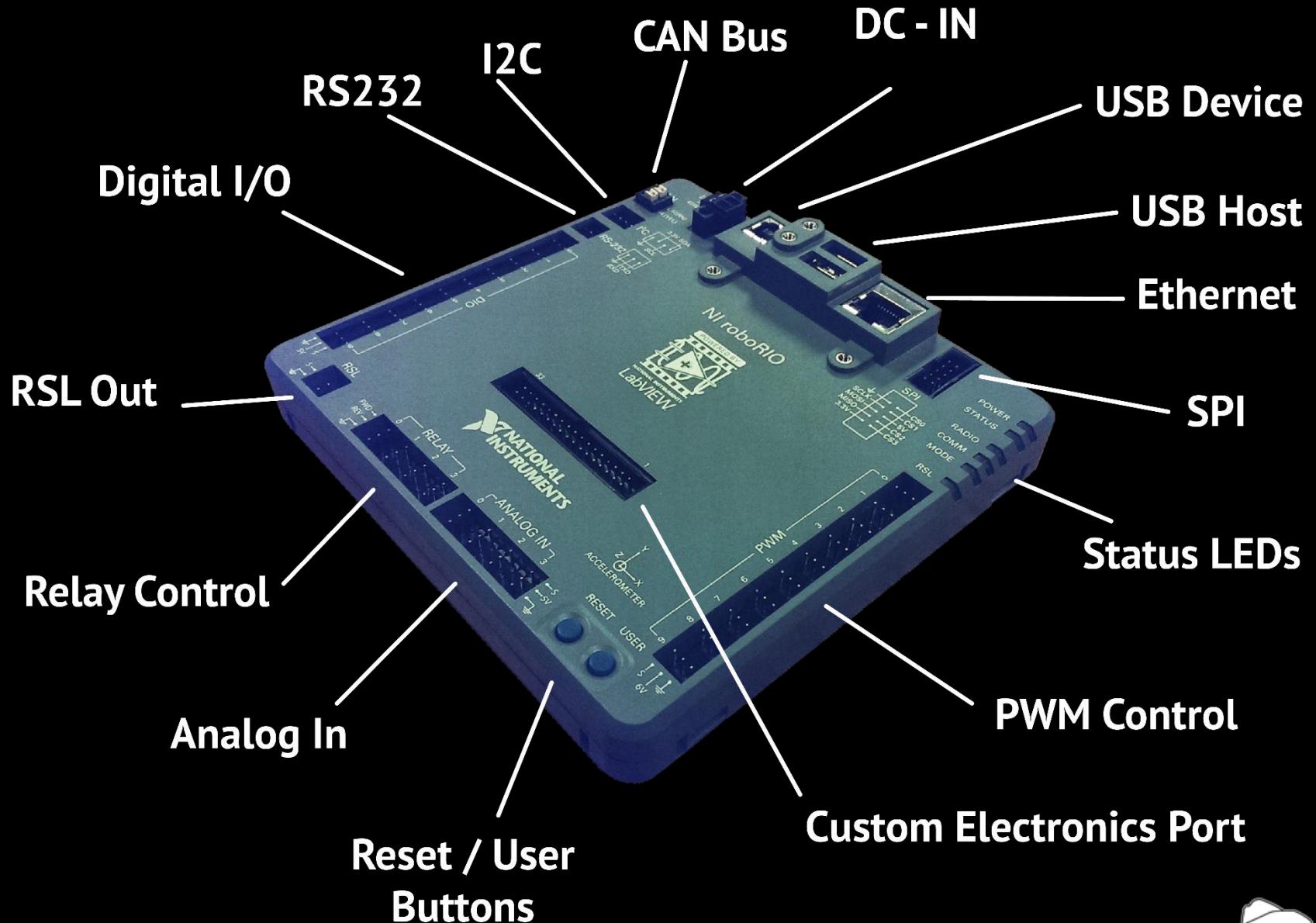
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### Questions?



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Mechanical Integration

Questions?

# **roboRIO: Specs**

- Dimensions: 5.7" x 5.6"
- Weight: < 12oz.
- Platform: Xilinx ZynqTM-7020
- Processor: Dual-Core Arm Cortex TM-A9 @ 667Mhz
- System Mem: 256 MB RAM
- Storage Mem: 256 MB NAND
- OS: Linux with real-time extensions
- Languages: LabVIEW, C++, Java

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### Mechanical Integration

### Questions?

# roboRIO: I/O

- PWM: 20 Channels (10 dedicated, 10 shared)
- DIO: 26 Channels (10 dedicated, 16 shared)
- Relay Control: 4 Dual input channels (FWD / REV)
- SPI Master: 2 Channels (1 up to 4 devices, 1 for 1 device) up to 1MHz
- I2C: 2 Channels (1 & 1) up to 400kHz
- UART: 1 RS232 port, 1 TTL port
- Analog In: 8 Channels, 0-5V, 12-bit, 500 kS/s aggregate
- Analog Out: 2 Channels, 0-5V 12-bit, 340 kS/s simultaneous

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*Mechanical Integration*

*Questions?*

# **roboRIO: I/O**

- USB Host: 2 ports (USB 2.0 High Speed)
- USB Device: 1 port (USB 2.0 High Speed)
- Ethernet: 1 port (10/100 Mbit/s)
- CAN: 1 port (1Mbit/s)
- Accelerometer: Integrated 3-axis, 800 S/s
- Signal Light: 12 V Robot Signal Light (RSL) output
- Custom Port: Allows teams to create own board with extra I/Os
  - DIO / PWM / I2C / SPI / Analog Input / Analog Output / TTL UART / 3.3V & 5V analog

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### Mechanical Integration

### Questions?

# Power Distribution Panel

- Distributes power from FRC Legal Battery
  - Auto-resetting breakers
- 8 x 40A outputs
- 8 x 30A outputs
- Dedicated 12V outputs
  - roboRIO (Protected, 10A)
  - VRM, PCM (Protected, 20A)
- CAN interface for feedback
  - Current, Temperature, Battery Voltage



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### Mechanical Integration

### Questions?

# Power Distribution Panel

- New numbering system
  - 0-15 (16 outputs)
  - Old board used 1-16
- CAN feedback
  - All channels addressable
  - Configurable termination



## 2015 Control System Beta

### Hardware

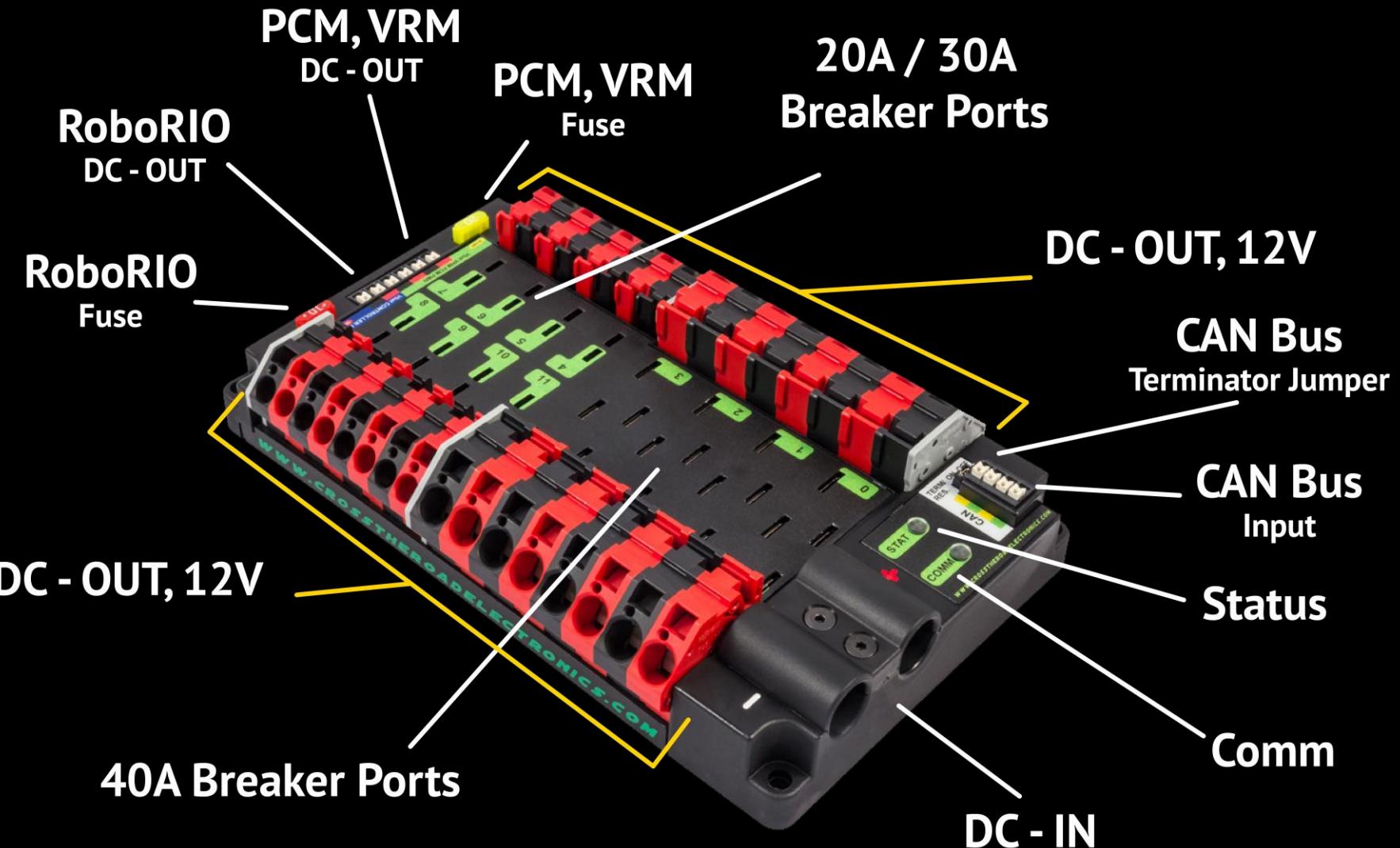
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### Questions?



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**Mechanical Integration**

**Questions?**

# Pneumatics Control Module

- Replaces Solenoid Breakout and Spike Relay
- All-in-one (12V or 24V) pneumatics system control
  - Pressure Switch Input
  - Compressor Relay Output
- 8 Solenoid Outputs
- Controlled by CAN



## 2015 Control System Beta

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### Mechanical Integration

### Questions?

# Pneumatics Control Module

- Uses new numbering system
  - 0-7, Old system was 1-N
- Non-terminating CAN device
  - Must be in-line



## 2015 Control System Beta

### Hardware

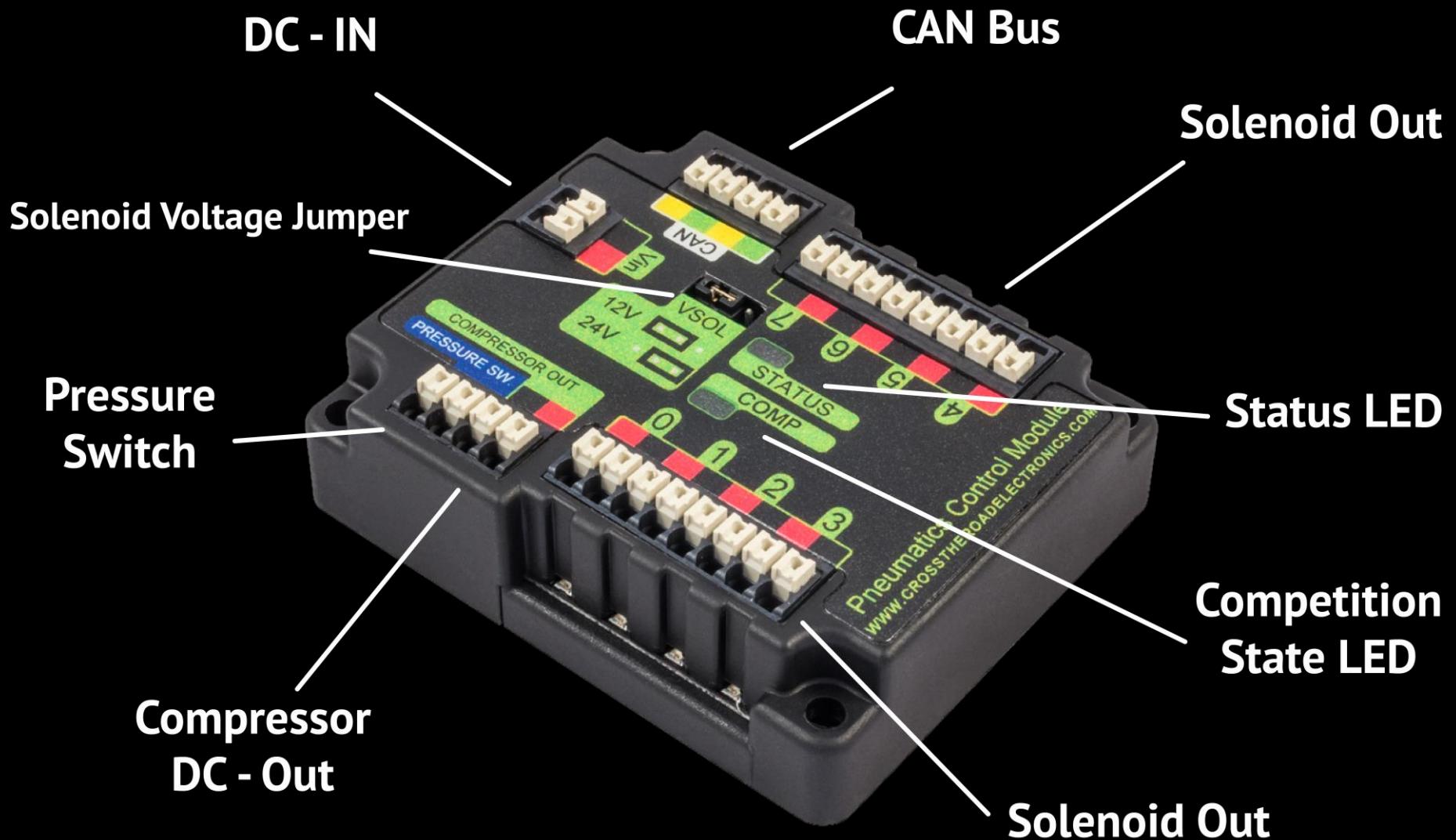
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### Mechanical Integration

### Questions?



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**Mechanical Integration**

**Questions?**

# Voltage Regulator Module

- Ensures constant voltage to sensors, camera, radio, etc.
- Regulates 12V input to:
  - 12V, 500mA limit (x2)
  - 12V, 2A limit (x2)
  - 5V, 500mA limit (x2)
  - 5V, 2A limit (x2)
    - Radio



## 2015 Control System Beta

### Hardware

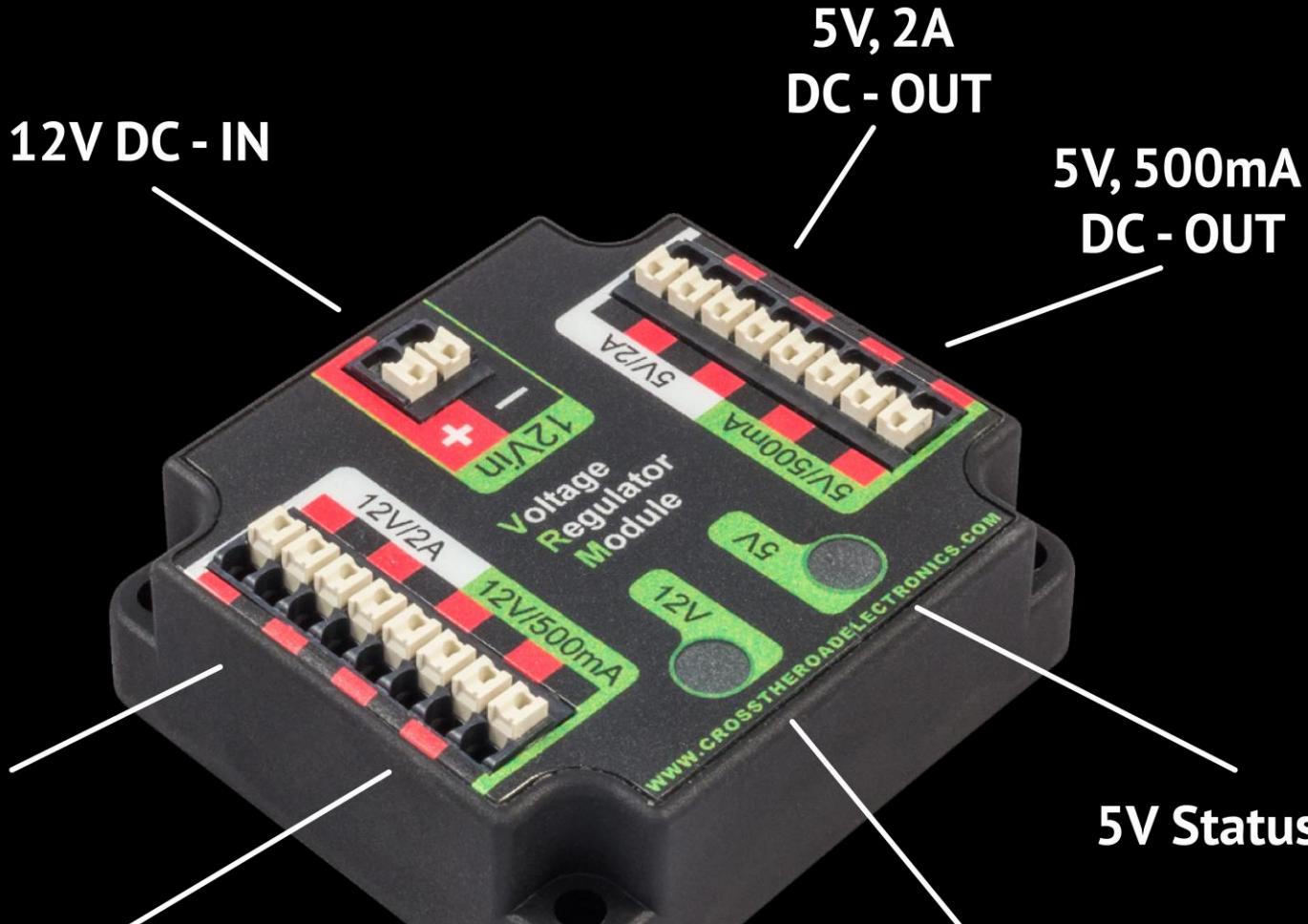
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### Questions?



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## 2015 Control System Beta

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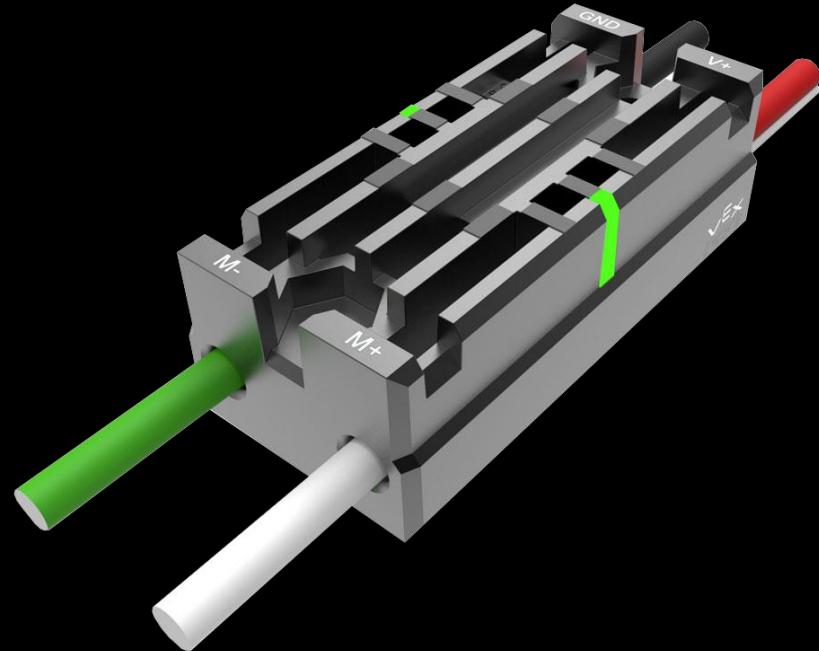
- Software Enhancements
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### Mechanical Integration

### Questions?

# Victor SP

- PWM Motor Controller
- Enclosed Aluminum Case
  - Impervious to debris
- Leads pre-installed
  - No terminals
- 0.23 lb (with wiring)
- Used with 40A port on PDP



**Hardware**

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**Software**

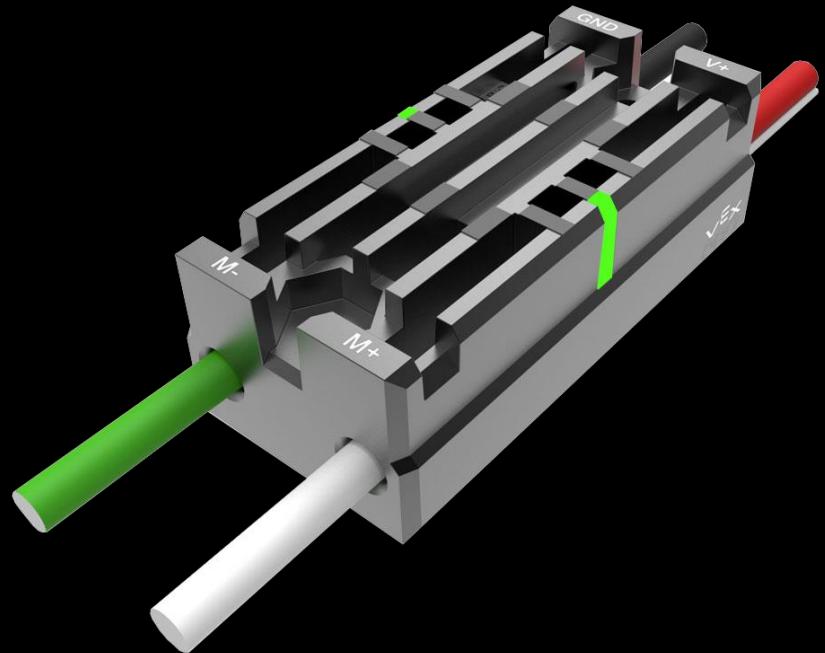
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**Mechanical Integration**

**Questions?**

# **Victor SP**

- 12V Nominal Voltage
- 6-16V Min / Max Voltage
- 60A Continuous Current
- 100A Surge Current (2s)
- 1-2 ms PWM pulse rate
  - 0.6-2.4 ms max



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### Mechanical Integration

### Questions?

# Radio

- D-Link DAP-1522 Rev. B
  - Same as 2014
- Powered through VRM
  - 5V, 2A output
- Data to roboRIO
  - Ethernet



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### **Mechanical Integration**

### **Questions?**

# **Software**

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**Mechanical Integration**

**Questions?**

# **Software Enhancements**

- New roboRIO image tool
- Changes to C++ compiler
- Customizable Smart Dashboard
- Dashboard record / playback feature
- FRC Robot Simulator

**Hardware**

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**Mechanical Integration**

**Questions?**

# **Software Enhancements**

- LabVIEW, **C++**, and Java supported
- Most of WPILib unchanged for **C++** and Java
- Development environment changes
  - C++ : Wind River Workbench → Eclipse
  - Java: Netbeans → Eclipse

## 2015 Control System Beta

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### Mechanical Integration

### Questions?

```
#include "Team148_2014.h"
Team148_2014 :: Team148_2014()
{
#ifndef ReidMobile
/*
motor1 = new Victor(1); //Left Wheels (Y cabled)
motor2 = new Victor(2); //Right Wheels (Y cabled)
KickerMotor = new Victor(3); //This controls two motors (Y cabled)
ShooterMotor = new Victor(4);
IntakeMotor = new Victor(5); //Y cabled
*/
//zero based
motor1 = new Victor(0); //Left Wheels (Y cabled)
motor2 = new Victor(1); //Right Wheels (Y cabled)
KickerMotor = new Victor(2); //This controls two motors (Y cabled)
ShooterMotor = new Victor(3);
IntakeMotor = new Victor(4); //Y cabled
#else
/*
motor1 = new Victor(1); //Front Left
motor2 = new Victor(2); //Rear Left
motor3 = new Victor(3); //Front Right
motor4 = new Victor(4); //Rear Right
*/
motor1 = new Victor(0); //Front Left
motor2 = new Victor(1); //Rear Left

```

# Eclipse IDE

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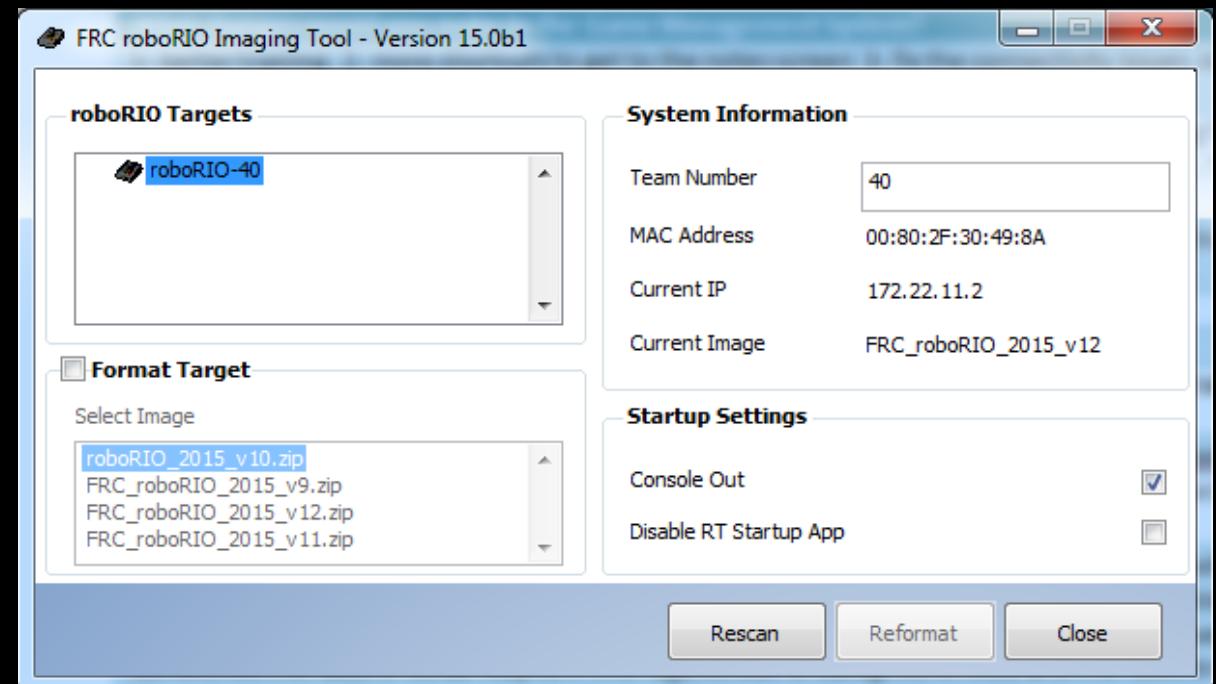
- Software Enhancements
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- *New Re-Imaging Tool*
- Driver Station

### Mechanical Integration

### Questions?

# New Re-Imaging Tool

- Same basic functionality as last year imaging tool.



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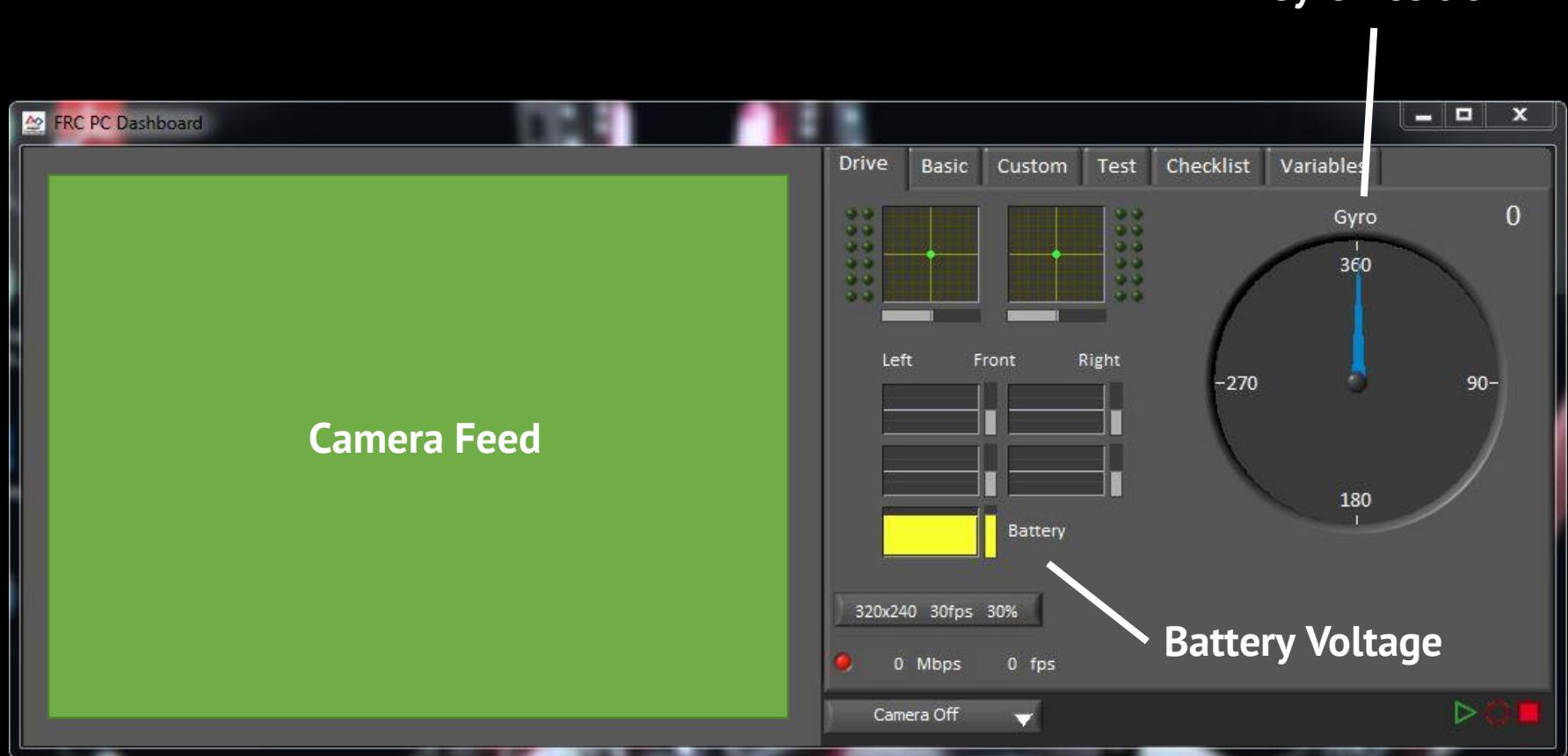
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### Mechanical Integration

### Questions?

# Driver Station



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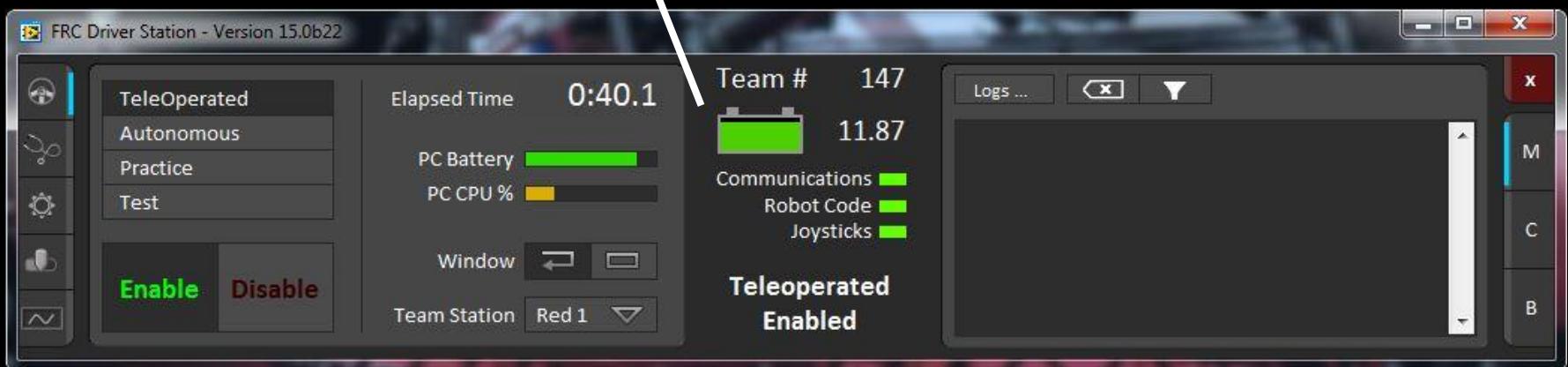
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### Mechanical Integration

### Questions?

# Driver Station

## Battery Capacity



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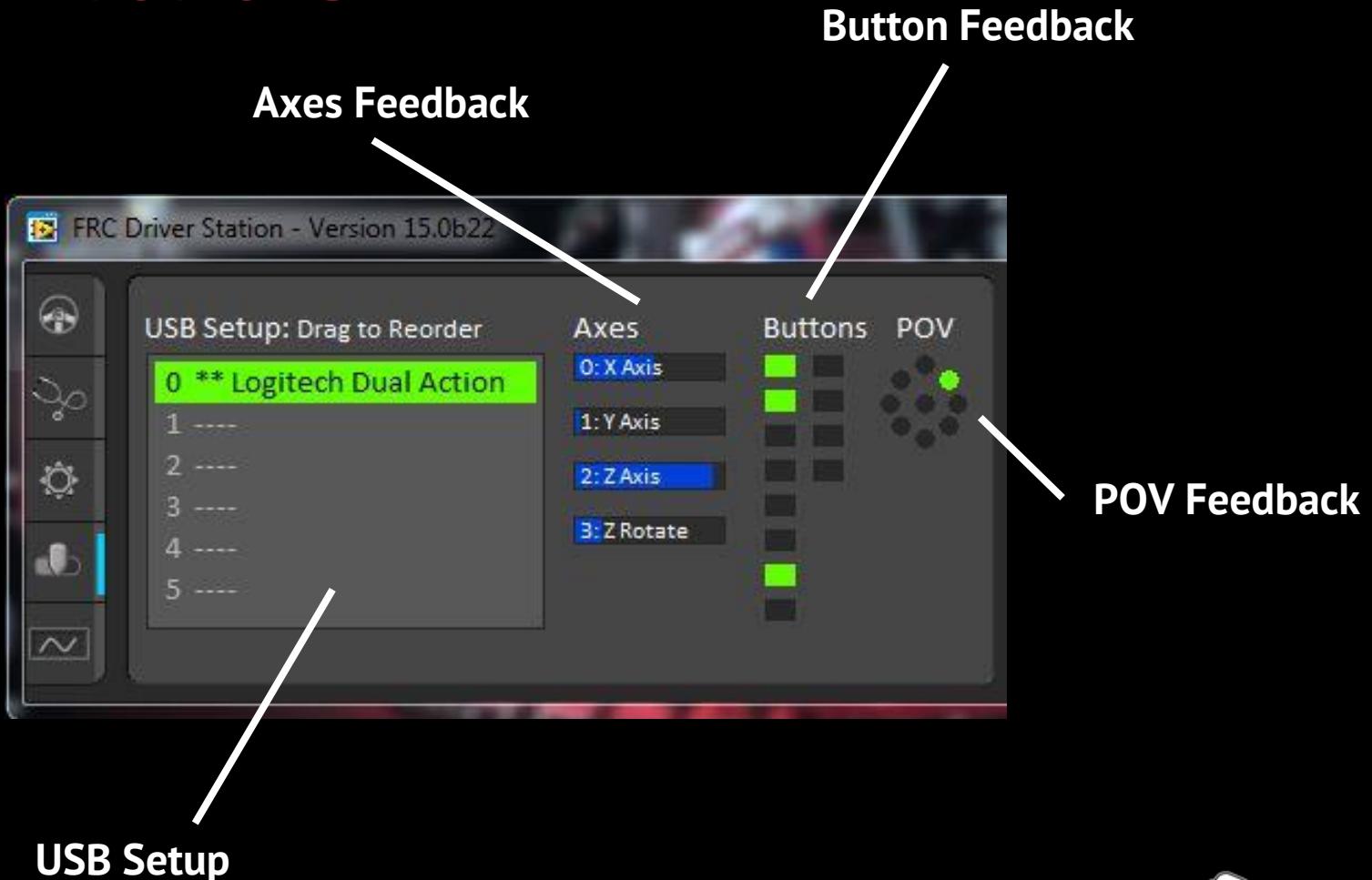
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### Mechanical Integration

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# Driver Station



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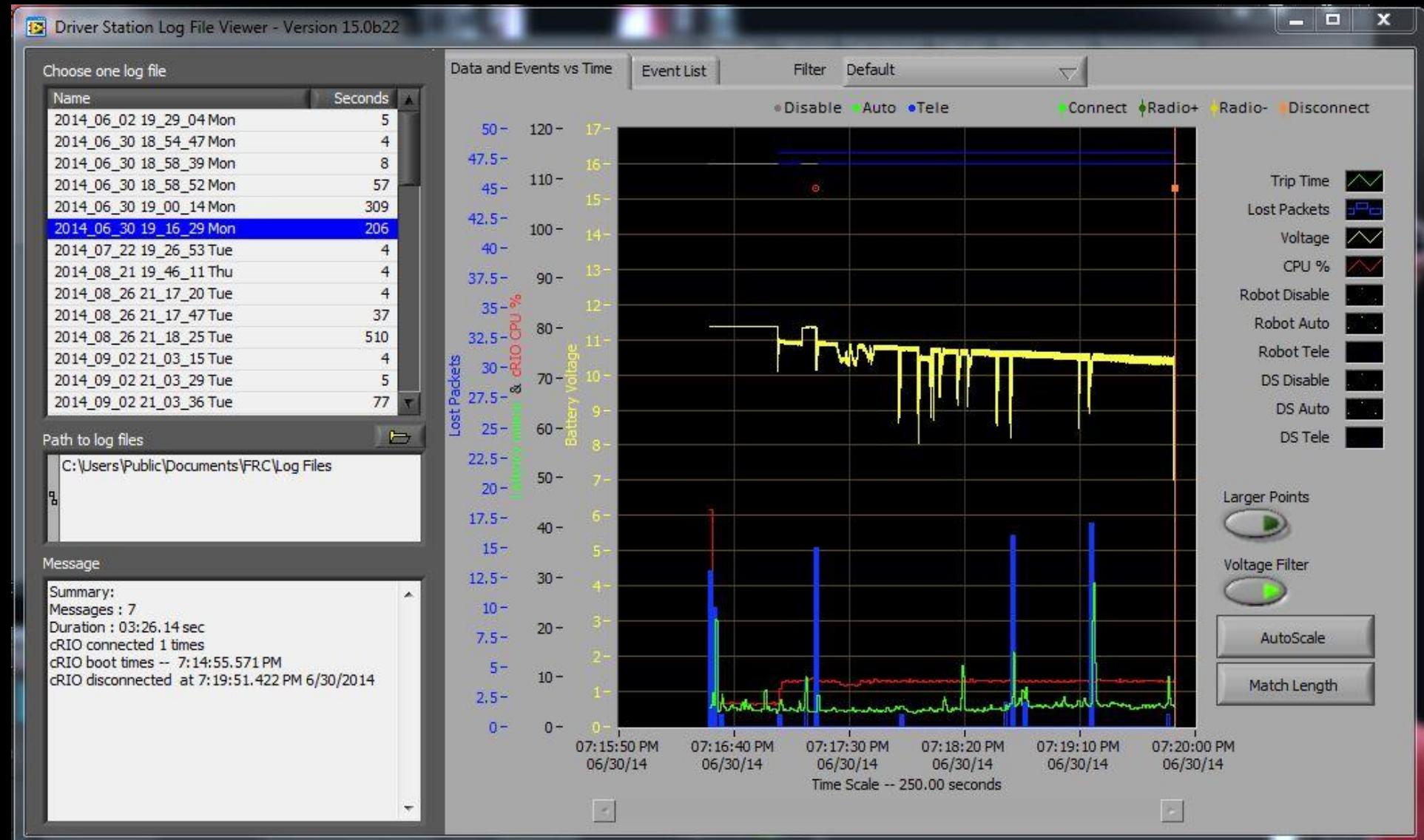
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### ***Mechanical Integration***

### **Questions?**

# **Mechanical Integration**

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**2015 Control  
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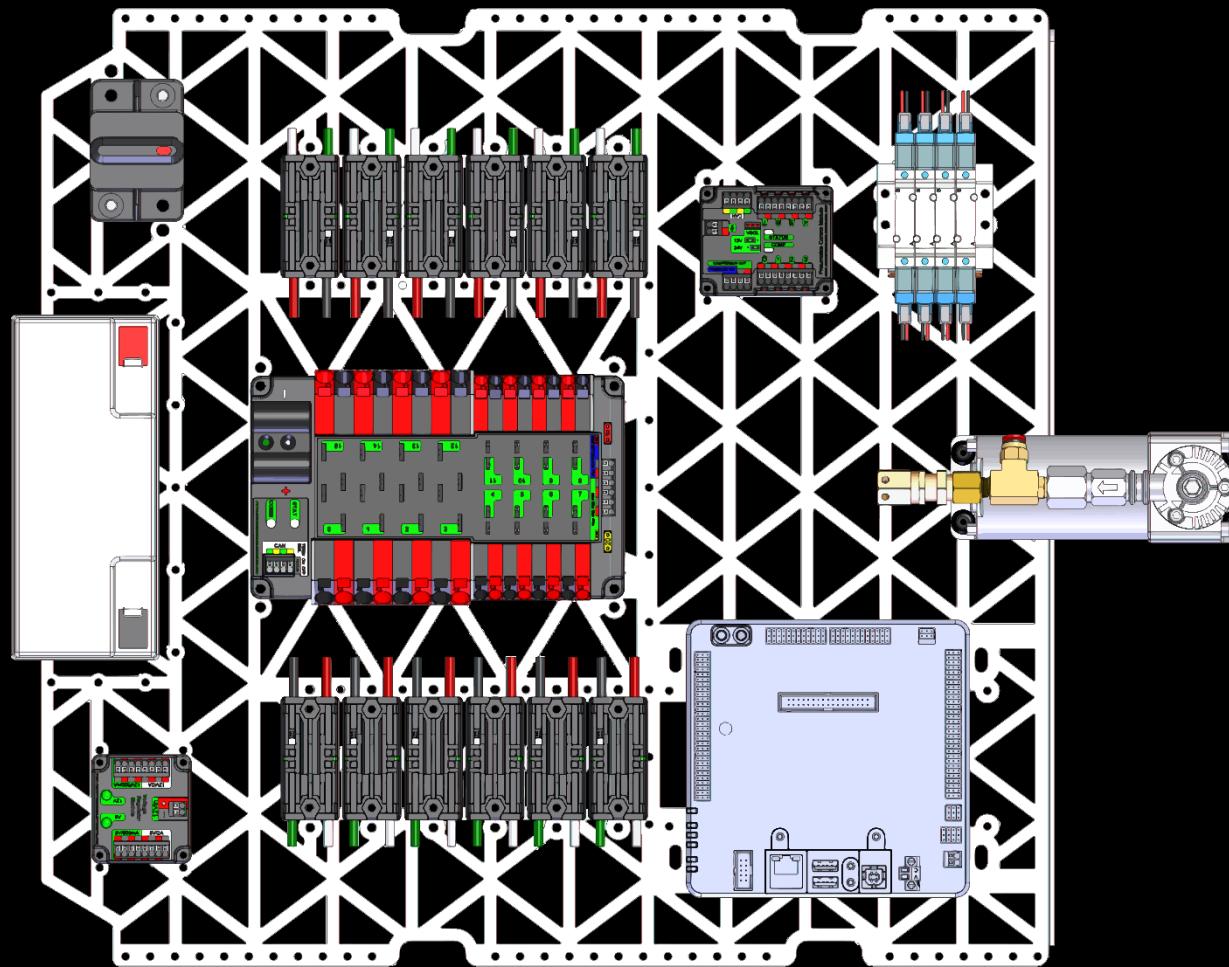
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***Mechanical Integration***

**Questions?**

# **Mechanical Integration**



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*Questions?*

# **Questions?**

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