



***FIRST® Robotics Competition***

How to Set Up Your Robot Control  
System  
2011 FRC – *LogoMotion*

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## HOW TO SET UP YOUR ROBOT CONTROL SYSTEM

Veteran teams may skip this step and use their 2009 or 2010 robot in place of the bench top set up when testing the Driver Station set up throughout the rest of this document.

Locate the following control system components and layout their locations on an appropriate nonconductive surface (e.g. plywood or plastic) to permit wiring connections as shown in the power distribution diagram on the FRC Kit of Parts Website. Plan the positions of the components to leave space to access the various connectors.

- Kit Materials:
  - Power Distribution Board
  - cRIO with modules (2x NI 9201 in slots 1,2; 2x NI 9403 in slots 4,6; NI 9472 in slot 8)
  - Analog Breakout (to be installed with the NI 9201 module in slot 1)
  - Digital Sidecar (to be connected to the NI 9403 module in slot 4)
  - Solenoid Breakout (to be installed with the NI 9472 module)
  - Wireless bridge, DAP-1522
  - Circuit breakers
  - Jaguar speed controllers, qty 2 (Team-provided Victor 884 speed controllers may also be used)
  - 2 PWM cables
  - Crossover cable
  - 120-amp circuit breaker (CB3-SM-120 or similar)
  - 12V DC motors, qty 2
  - 6 AWG wire and ring terminal connectors
  - 22 AWG or better wire
  - 18 AWG or better wire
  - Appropriate wire and connectors for size of motors
  - 12V Battery (MK Battery ES17-12 or equivalent)
- Tools Required:
  - Wago Tool (from kit)
  - M6 nut driver (10mm socket)
  - Jeweler's flat-head screwdriver
  - Wire cutters, strippers, and crimpers

An example of a completed bench top setup is shown in Figure 1.

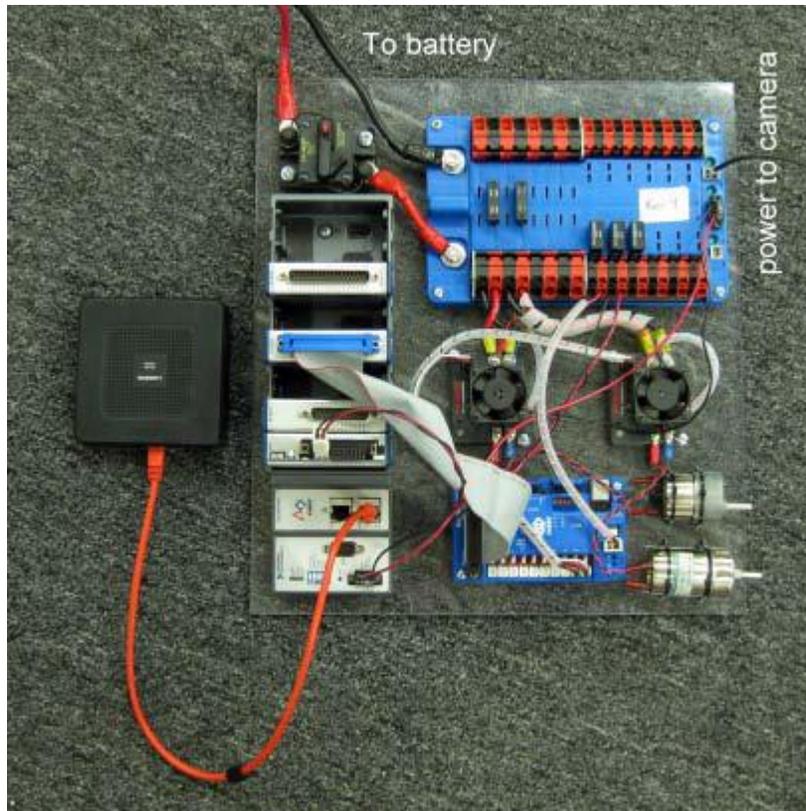


Figure 1: Completed Robot Control System Benchtop Set Up (Note: 2010 Radio Shown)

## Control System Set Up

### Power Distribution Board (PD)

Make each of the following connections. Refer to the Power Distribution Board datasheet in section 3.1 for additional detailed information.

- 12V Power connection to the Power Distribution Board from the 120-Amp circuit Breaker
  - WARNING: the shanks on the Power Distribution Board use metric M6 nuts. Use of ¼" nuts will strip the studs on the Power Distribution Board.
  - NOTE: Do not connect a battery to the Power Distribution Board until after all other connections are established and double-checked.
- 24V Power connection to the cRIO
- Power connections to the Analog Breakout, Digital Sidecar, and Solenoid Breakout from the VB3 breaker outputs (use 20A breaker).
- Power connection to the Jaguar Speed Controllers from any of the Maxi Breaker outputs (for 40A circuits).

### cRIO

Make each of the following connections. Refer to the cRIO manual link available in section 3.2 for additional detailed information.

- cRIO Module Positions
- Slot 1: 9201 (with Analog Breakout)
- Slot 2: 9201 (optional)
- Slot 3: Empty
- Slot 4: 9403 (connected to Digital Sidecar)
- Slot 5: Empty
- Slot 6: 9403 (optional)
- Slot 7: Empty
- Slot 8: 9472 (connected to Solenoid Breakout) (optional if needed).
- Connect the 24V cRIO supply from the PD board using the supplied power connector (Part NO CTF040V8)
- Plug the crossover cable from network port 1 to the Driver Station

### Analog Breakout

Make each of the following connections. Refer to the Analog Breakout datasheet in for additional detailed information.

- Plug the Analog Breakout to the NI 9201 module installed in slot 1 of the cRIO
- Connect J3 to the Power Distribution Board using a 20A Circuit
- Install a jumper on the Analog Breakout's "Battery Selection Jumper" in accordance with the Analog Breakout Datasheet to enable battery monitoring.

### Digital Sidecar

Make each of the following connections. Refer to the Digital Sidecar datasheet for additional detailed information.

- Using the supplied DB-37 ribbon cable, connect to the NI 9403 module installed in slot 4 of the cRIO. NOTE: Remove the hex nuts from the female side of the cable.
- Connect J22 to the Power Distribution Board using a 20A Circuit
- Connect PWM cables to Jaguar Speed Controllers (PWM #1 to Jaguar #1; PWM #2 to Jaguar #2).
- Solenoid Breakout – Make each of the following connections. Refer to the Solenoid Breakout datasheet in section 3.5 for additional detailed information.
- Plug the Solenoid Breakout into the NI 9472 module installed in slot 8 of the cRIO
- Connect J3 to the Power Distribution Board using a 20A Circuit

### 120-Amp Circuit Breaker

Make each of the following connections.

- Connect the "BAT" terminal to the "+" terminal of an Anderson connector
- Connect the "AUX" terminal to the "+" terminal on the PD board.

### Jaguar Speed Controllers and 12VDC Motors

Make each of the following connections for each of the two Jaguar speed controllers and associated 12VDC motors. Refer to the parts datasheet for additional information

- Connect the “V-” terminal to the “-” output of either a Maxi or VB3 breaker on the PD board
- Connect the “V+” terminal to the “+” output of the same Maxi or VB3 breaker on the PD board
- Connect the “M-” terminal to one of the motor input leads
- Connect the “M+” terminal to the other motor input lead of the same motor

NOTE: Do not connect the Ethernet cable between the bridge and the cRIO at this time. The first benchtop test will utilize “tethered” operation. Only after completion of the test with tethered operation will the bridge be used for a wireless connection to the Driver Station.

At this point, your electrical wiring for the “robot” portion of the benchtop test should be complete. Before turning the benchtop system on, ensure that all power connections are connected with the proper polarity and that any power cables you manufactured are correct. Applying reversed power will permanently damage many of the control system components (e.g. the wireless adapters and Jaguar speed controllers).

### Confirmation of LED Status on Control System Components

Before powering on either your robot or your “bench top” system, ensure the motors are located in such a way that if they were to become immediately operational, they would not pose a safety hazard. Also ensure the joysticks plugged into the Driver Station are ‘centered’.

1. Connect a battery to the Anderson connector of the “benchtop test” setup. Turn on the power to the “benchtop test” setup at the Hi-Amp 120A circuit breaker.
2. Immediately after turning on the power, confirm that each of the items below is operating correctly:
  - a. On the Power Distribution Board, three green LEDs should be lit: +5V supply, +24V supply, and +12V supply
  - a) On the Digital Sidecar, three green LEDs should be lit: “Power Input,” +5V, and +6V
  - b) On the Analog Breakout, one green LED should be lit.
  - c) On the Solenoid Breakout, one green LED should be lit
  - d) The Jaguar LEDs should be flashing yellow.
  - e) Note that the Driver Station display will provide status on communications with cRIO, code running state, etc.