

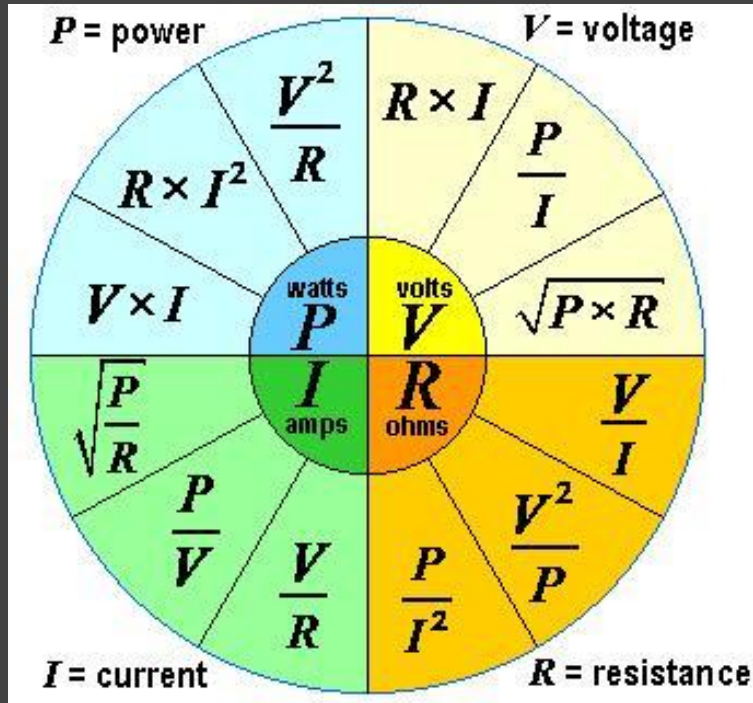


Citrus Circuits Fall Workshop Series

973 Electrical Practices And Implementation

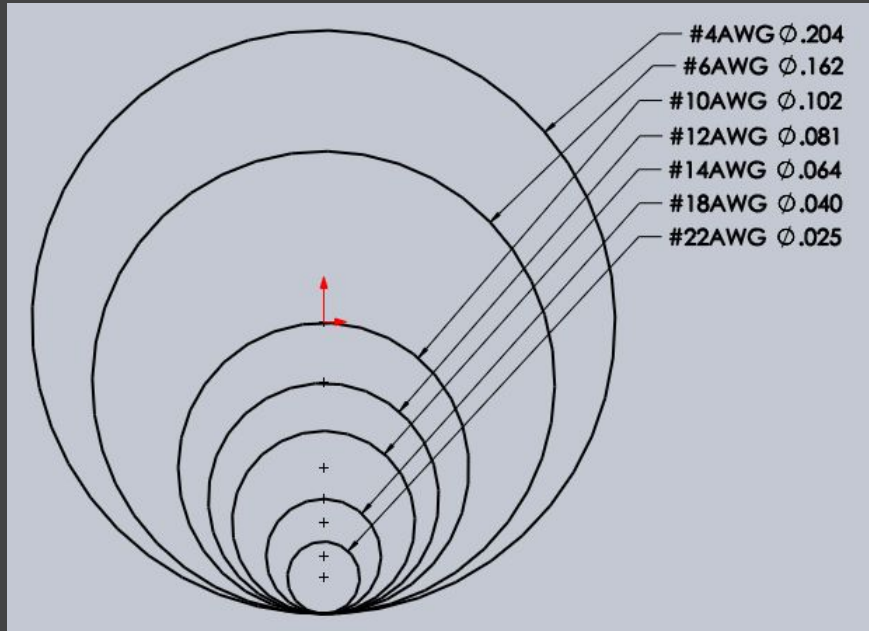
by Ryan Reed

Electrical Basics



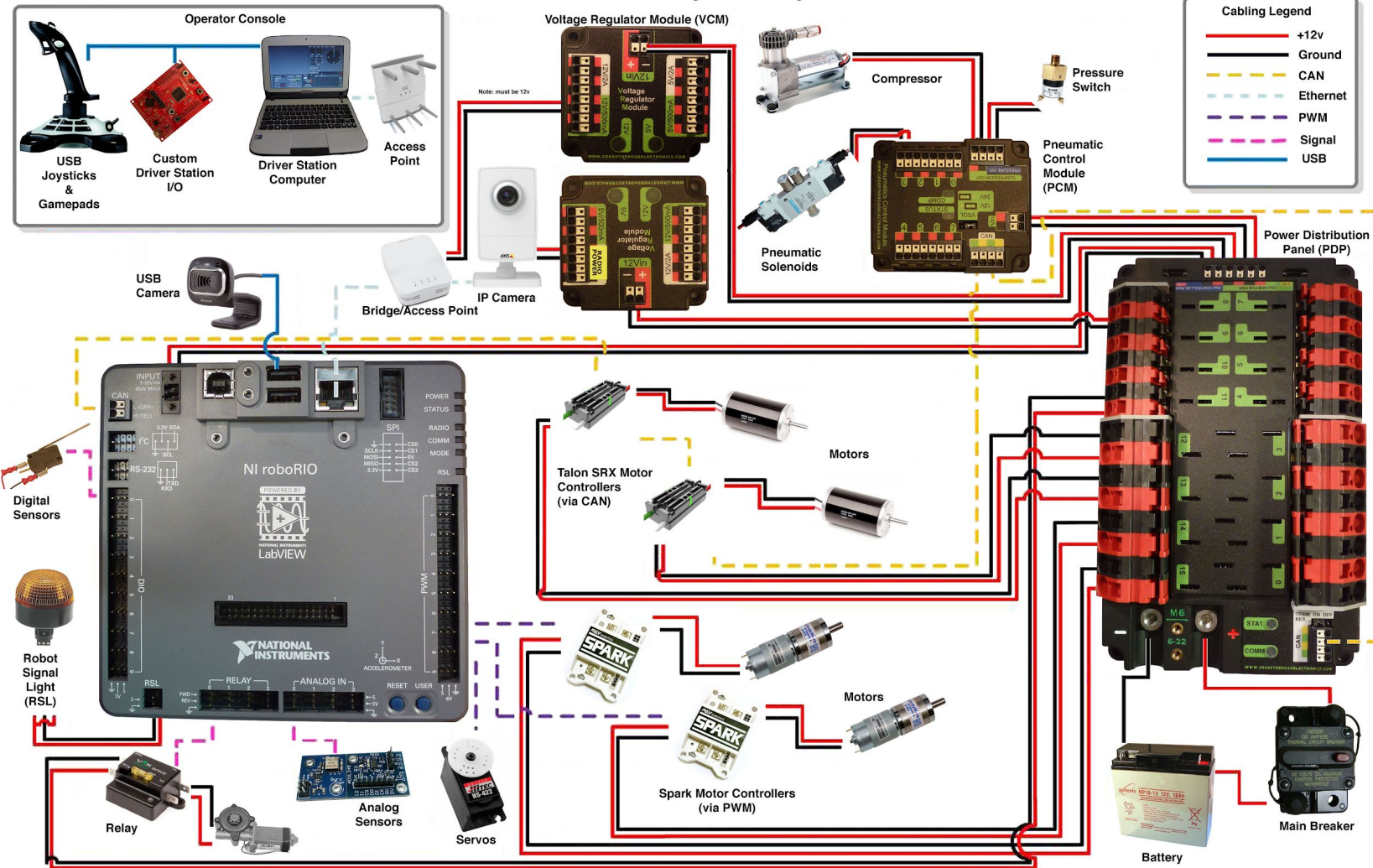
- Terminology
 - Volts, Amps, Ohms, Watts
 - American Wire Gauge (AWG)
- Ohm's Law
 - $V=I \times R$

Electrical Basics

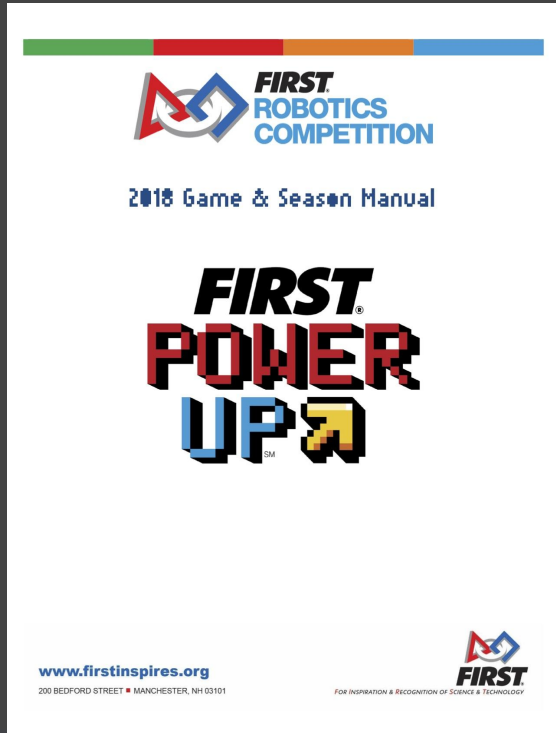


- Wire Comparison
 - $R = \rho L / A$
 - 1ft of 12AWG
 - 4.76in. of 4AWG
 - 2ft of 18AWG
 - 3.25ft of 22AWG

2017 FRC® Control System Layout



FRC Rules



- Things to look for:
 - Motors
 - New components
 - Pneumatics rules



Commonly Violated Wiring Rules

Wrong wire gauge with protected circuit

Application	Minimum Wire Size
31 – 40A protected circuit	12 AWG (13 SWG or 4 mm ²)
21 – 30A protected circuit	14 AWG (16 SWG or 2.5 mm ²)
6 – 20A protected circuit	18 AWG
Between the PDP dedicated terminals and the VRM or PCM Compressor outputs from the PCM	(19 SWG or 1 mm ²)
Between the PDP and the roboRIO	22 AWG
≤5A protected circuit	(22 SWG or 0.5 mm ²)
VRM 2A circuits	24 AWG (24 SWG or .25mm ²)
roboRIO PWM port outputs	26 AWG (27 SWG or 0.14 mm ²)
SIGNAL LEVEL circuits (i.e. circuits which draw ≤1A continuous and have a source incapable of delivering >1A, including but not limited to roboRIO non-PWM outputs, CAN signals, PCM Solenoid outputs, VRM 500mA outputs and Arduino outputs)	28 AWG (29 SWG or .08 mm ²)



Commonly Violated Wiring Rules

- Placement of 120A circuit breaker on the robot
 - R47 (2017)
- More than one connected to each WAGO connector on the PDP
 - R53 (2017)



Wiring IO Spreadsheet

Wiring IO 2017

File Edit View Insert Format Data Tools Add-ons Help Last edit was made 32 minutes ago

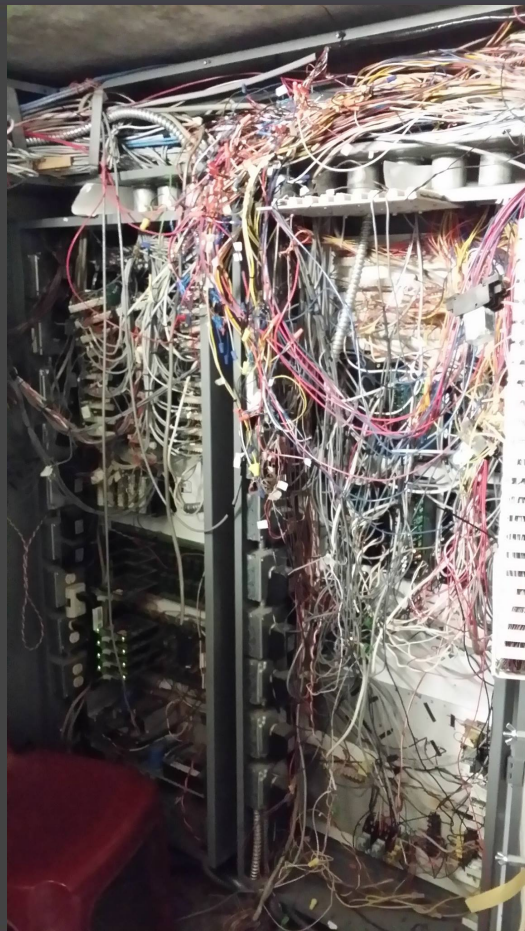
100% \$ % .0 .00 123 Arial 10 B I S

fx Port # on pdb not pwm

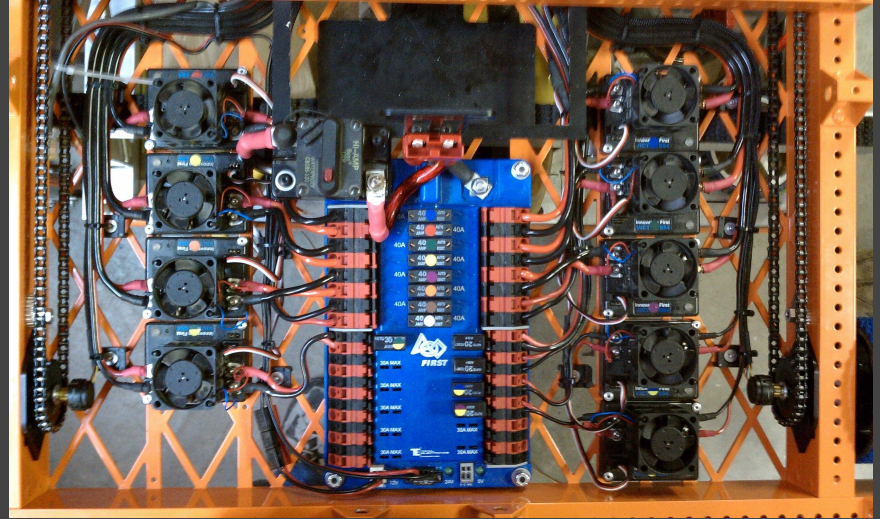
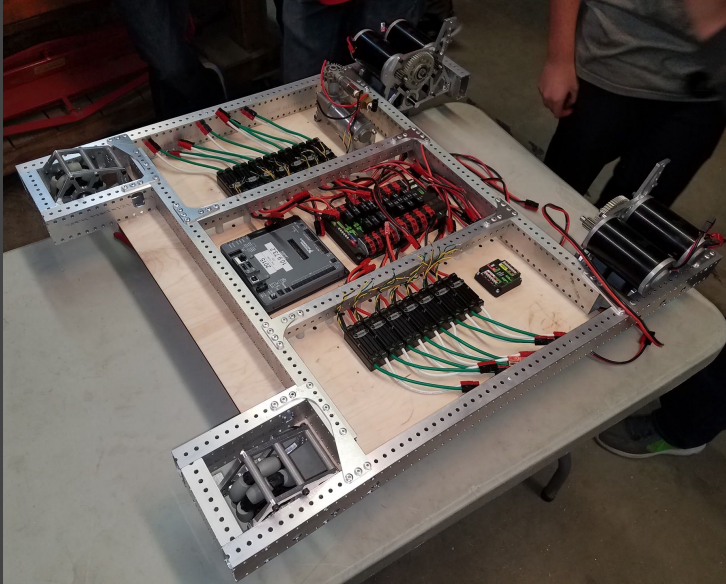
	A	D	F	G
1	Port # on pdb not pwm	Device	CAN address	
2	0	Left Drive 1	1	
3	1	Left drive 2	2	master
4	2	Left shooter	3	
5	3	hang left	4	
6	4	convear	5	
7	5	flail	6	slave
8	6	intake	7	
9	7			
10	8	compressor		
11	9	FLAIL	10	
12	10	CLAW	11	
13	11	CLAW	12	
14	12	right hang	13	
15	13	right shooter	14	
16	14	right drive 2	15	
17	15	right drive 1	16	
18				

Add 1000 more rows at bottom.

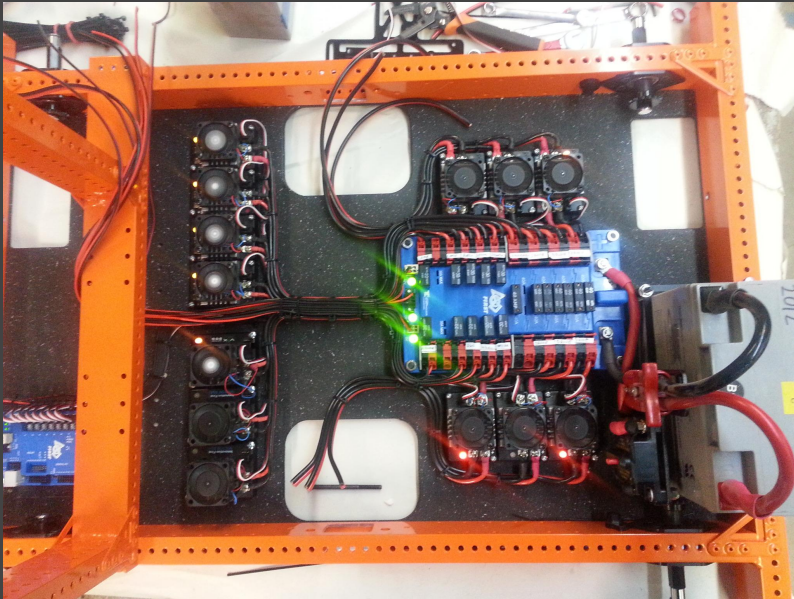
+ ☰ PDB CAN Digital Inputs Solenoid Analog Relays



Layout

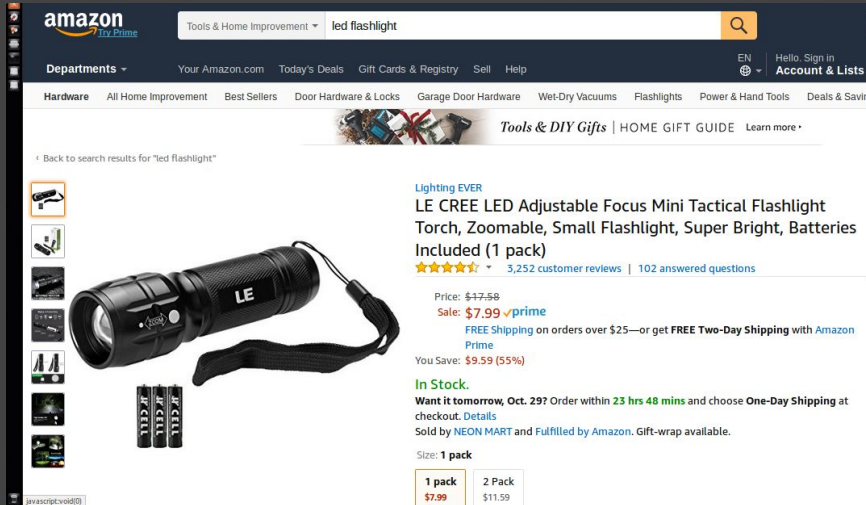


Layout



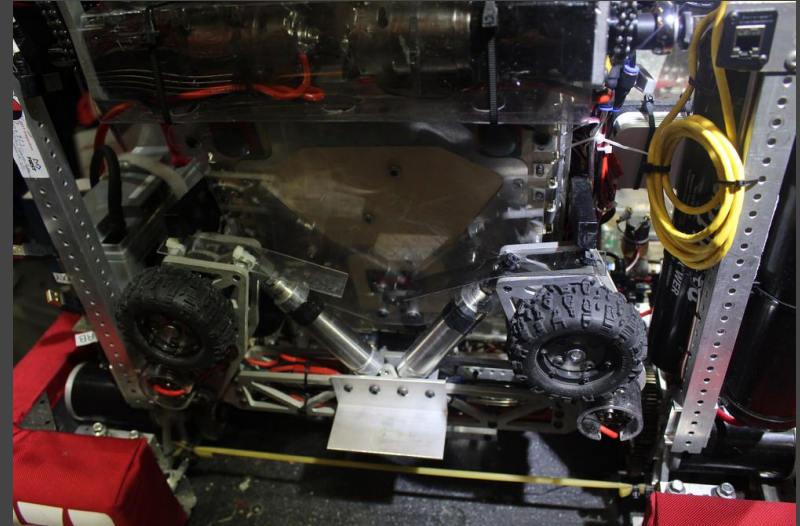
Sensors and Feedback

- Flashlight
- LED's
- Feedback on game actions



The screenshot shows an Amazon product page for a Cree LED flashlight. The search bar at the top contains "led flashlight". The product title is "LE CREE LED Adjustable Focus Mini Tactical Flashlight Torch, Zoomable, Small Flashlight, Super Bright, Batteries Included (1 pack)". The price is listed as \$37.58, with a sale price of \$7.99. The product is in stock and available for one-day shipping. The page also shows a sidebar with navigation options and a table of pricing for different pack sizes.

Size	Price
1 pack	\$7.99
2 Pack	\$11.59



Tools, Crimps, Wire and You

- Have a good SHARP pair of wire strippers that you like
- Use a ratcheting style crimper for all wire terminals



Tricks of the Trade

- Hot glue
- Lots of zip ties/tie downs
- Strain relieve battery cables
- Standardize polarity
- Make sure you understand all robot articulations



Tricks of the Trade


- Zip-tie all disconnects
- Radio power secure(POE)
- Wire orientation
- Offset pairs
- Twisting pairs



Tricks of the Trade

Pneumatics

- Small 5/32 Tubing (weight)
- The less brass the better
- USE THE McMaster Pressure relief valve (48435K714)



PRU14

There are no reviews for this item.
Be the first to [write a review...](#)

NITRA pneumatic push-to-connect inline pressure regulator, technopolymer body, 1/4in tube inlet(s), 1/4in tube outlet(s), 15-120 psi adjustable range.

[Compare](#)

Price: **\$20.25**

Qty. In Cart: 0

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[2 YEAR WARRANTY](#)

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[Media Gallery](#)

<< Previous Item Next Item >>



Tricks of the Trade

- Spend time and check for leaks

(It will save you time in the long run)

- Pneumatic manifolds

- Tight bend radii out of PTC fittings

- ALL Threaded Connections

- CUT TUBING STRAIGHT



Tricks of the Trade

-Batteries

- Preparation

- ABC (Always Be Charging)

- Battery Rotation Plan For Matches

- Tester (Practice) Battery

- Ziptie connection

- Good Battery Strap



Tricks of the Trade

- Non-Rio Ethernet port
- Labeling



Sources for components and connections

Powerwerx.com

Mcmaster.com

Automationdirect.com

Digikey.com



Questions?



Give us Feedback!





Citrus Circuits
Fall Workshop Series
www.greybots.com/contact

Thank You!