Electrical Tool Use

Team 1732 Electrical Subteam
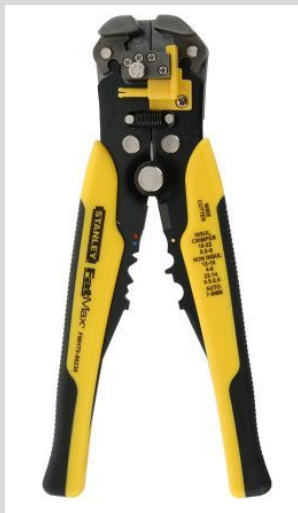
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Stripping

Goal:
- Expose metal portion of wire; prepare wire for connection and electrical use

Tools and Parts:

Wire Stripper/Cutter

Wire Stripper/Cutter (More Common)

Wire

Uses:
- Remove rubber encasing on wire for connections (Power Poles, PWM connections, ferrules, etc.)

Process:

Eyebrow

For More Common Wire Stripper
1. Insert wire sideways into stripper so that the end of the wire pokes out the right side of the open space at the top
2. Line up the desired length of wire with the right eyebrow (about ½-1 inch usually)
3. Squeeze
4. If poor or no results, repeat. If still nothing use a different stripper. Not all strippers are created equal.
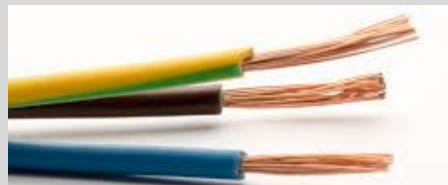
Should look kinda like this Twist frayed wires to create more solid wire.

Crimping - General

Goal:
- Connect a wire to a connector

Tools:

Powerpole Crimper

Ferrule Crimper
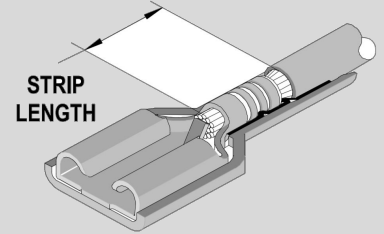

Dupont Crimper
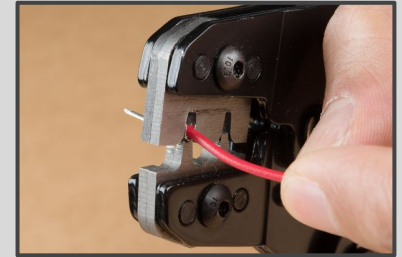

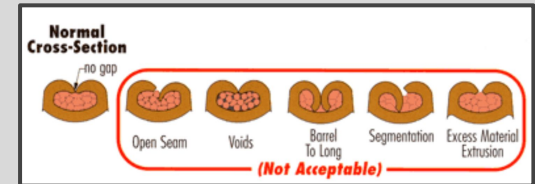Battery Lug Crimper

Process:
1. Strip to the proper length

2. Insert into crimper

3. Crimp

4. Check
   - Tug-test: Try to pull the wire out
   - Cross section: Check for quality

Crimping - Power Poles

Goal:
- Create an easily detachable and changeable connection between a wire and another wire or connector
- Color code wires and connections

Uses:
- Connections between: motors and motor controllers, wires that are too short, splitter wires, battery and battery charger or robot, and other necessary wire connections that may need to be adjusted.

Tools and Parts:

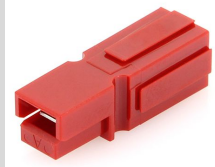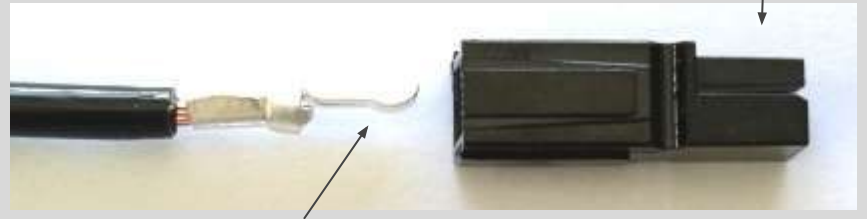Powerpole Crimper

Powerpole Insertion Tool (Optional)

Powerpole Connectors (Full or V)

Powerpole Housing

Process:
1. Follow normal crimping steps
2. Insert crimped end into housing so that the tongue of the crimped connector is facing the direction of the metal tab inside the housing. Tab located here
3. Push until audible click, then Tug-test.

Tongue facing up (same directions as tab)

Crimping - PWM

Goal:
- Stands for Pulse Width Modulation
- Create a connection between pins and small wires like on the RoboRIO

Tools and Parts:

PWM Connector and Housing

PWM Crimper

Uses:
- Connections between: REV sensors and other sensors to the roborio, Grayhill encoders.

Process:
1. Follow normal crimping steps except between steps two and three it may be advantageous to use pliers or your fingernail to fold down the metal tabs to ensure that the wire doesn't fall out while crimping.
2. Insert crimped end into housing so that the hole of the housing is facing the direction of the crimped end Hole located here
3. Push until a felt click, then Tug-test.
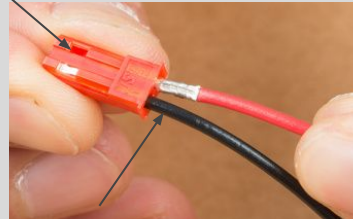
Box facing up

Crimping - Ferrules

Goal:
- Create a sturdier connection between small gauge wires and electrical components
- Create an easy attachment point for small gauge wires

Uses:
- Connections between small gauge wires and parts like VRM, PDP, PCM (with small ports)
- Attach alligator clips to metal end to test wire

Tools and Parts:

Ferrule Crimper
(Will Ferrule)

Ferrule Connectors

Process:
1. Strip wire
2. Insert wire into ferrule connector (into colored end) until end of wire is slightly below the end of the metal
3. Insert metal end of ferrule connector into ferrule crimper and crimp
4. Rotate connector and crimp 2-3 more times for security of connection
5. Tug test

Crimping - Misc. Other (Ribbon)

Goal:
- Connect a wire to a connector

Uses:
- Connections between: Encoder and talon, battery and PDP and Main Breaker.

Tools and Parts:

Ribbon Cable

Press Connectors

Lug Connector

Powerpole Housing

Process:
1. Follow normal crimping steps for big lugs except use Kronkzilla or Da' Crusher. Use progressively smaller crimp sizes

   - OR -

   Use fingers or bench vise to press the press connector on the ribbon cable.

Digital Multimeter
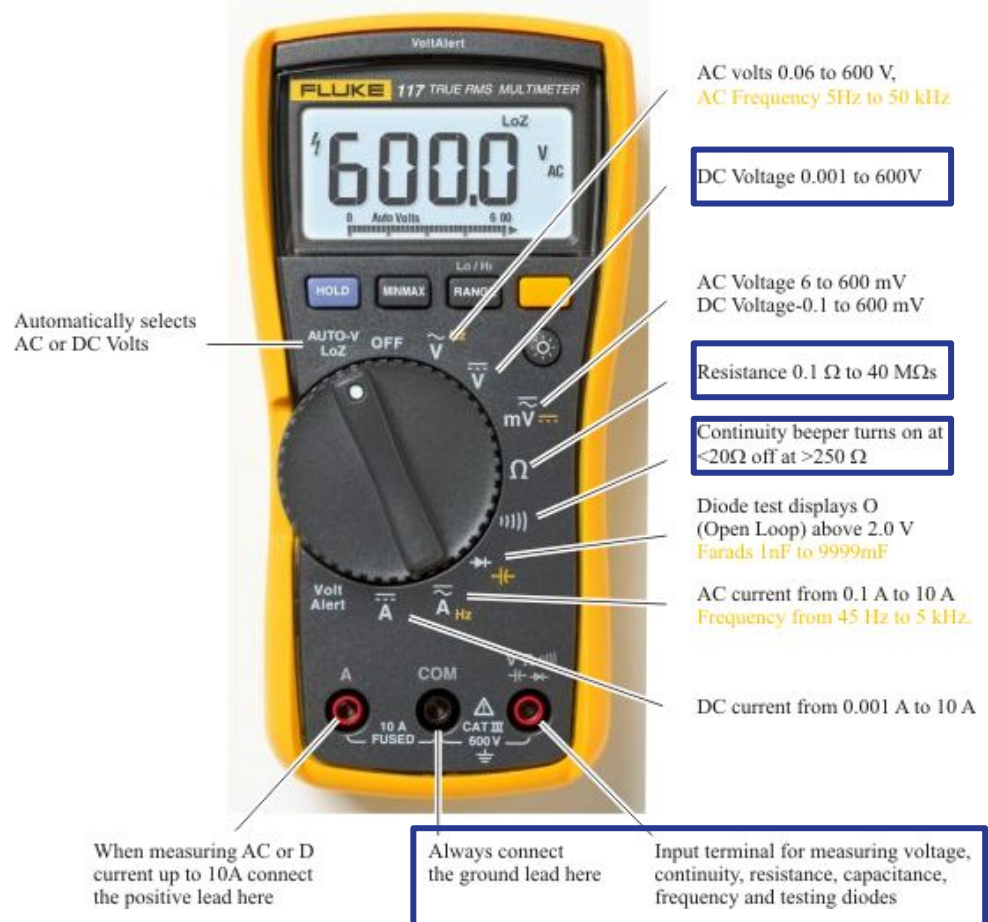
Goal:
- Troubleshoot and test electrical connections (continuity and voltage)
- Test resistance between two points
- Battery Testing

How to Use:
- Connect the proper leads from the multimeter to the locations where you are testing
- Read and if need be record the digital readout presented.

Tips:
- DC Voltage helps check a battery or sensor output
- Resistance can show whether a connection is damaged
- Continuity can check if a wire is intact or if something connected that shouldn't be

Automatically selects AC or DC Volts

AC volts 0.06 to 600 V,
AC Frequency 5Hz to 50 kHz

DC Voltage 0.001 to 600V

AC Voltage 6 to 600 mV
DC Voltage-0.1 to 600 mV

Resistance 0.1 Ω to 40 MΩs

Continuity beeper turns on at <20Ω off at >250 Ω

Diode test displays O (Open Loop) above 2.0 V
Farads 1nF to 9999mF

AC current from 0.1 A to 10 A
Frequency from 45 Hz to 5 kHz.

DC current from 0.001 A to 10 A

When measuring AC or D current up to 10A connect the positive lead here

Always connect the ground lead here

Input terminal for measuring voltage, continuity, resistance, capacitance, frequency and testing diodes

Heat Gun

Goal:
- Heat materials

Uses:
- Heat Heat Shrink tubing to create a protected electrical connection after soldering or other methods of connection that don't include crimping.
- Smoothing/Solidifying soldering connections

How to Use:
- Hold heat gun away from connection or tubing, and assure that nobody is in range of the heat gun.
- Turn on low but if necessary increase to high and move heat gun across and around thing that is being heated until tubing shrinks around connection.

General Hand Tools

Tools:

- Diagonal Cutters: also known as wire cutters. Used to create a flush cut on wires or solder jobs.

- Screwdrivers: Used to screw or unscrew bolts, screws, or the like.

- Wago Tool: Small bent green screwdriver used to disconnect wires from the PDP

- Cable-Tie Gun (Zip tie gun): used to tighten and cut zip ties

- Hex drivers (nut drivers): Screwdriver like tool used to tighten or loosen bolts and nuts.

- Wrenches: I hope you know what a wrench is

- Drills: Same description as above

Battery Beak

Goal:
- Check if a battery is charged and in good shape

Uses:
- Read battery charge level
- Read battery voltage under different loads
- Read battery internal resistance

Process:
- Plug the Battery Beak into the robot battery
- Press and hold the green button until the splash screen comes up.
- Press again to start the battery test.
- If you're just checking if a battery off the charger is good, you should see:
  - Status is "Good"
  - Charge is above 100%
  - Not much voltage drop across the 3 load levels, and all above 12v
  - Internal resistance less than 0.020 Ohms