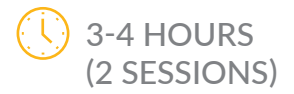




## TOPIC OF STUDY

Solar Installation



## KEY TERMS

MC4  
backing nut  
pin  
connectors  
Wiley clip  
zip tie  
nylon  
terminal block  
din rail  
junction box  
Enphase connector

## LESSON

Connectors, Wire Terminations, and Wire Management for Solar

## BIG IDEA(S)

Connectors are one of the most critical parts of a solar installation and also one of the most common points of failure when improperly installed.

## OBJECTIVES

Students will be able to:

- Explain the importance of connectors, wire termination, and wire management
- Make male and female MC4 & Enphase connectors
- Perform multiple wire termination methods
- Perform multiple wire management techniques

## TASK LIST SUBCATEGORY

- 502 Demonstrate effective assembly of field-made connectors and conductor fabrication
- 503 Demonstrate effective conductor termination and wire management techniques

## OVERVIEW

Students will learn how to make field made connectors and why it's necessary. Students will get hands-on experience making connectors of different types. Additionally, wire termination methods will be demonstrated and explained. Students will get experience terminating wires. Lastly, solar wire management will be demonstrated and explained. Students will have the opportunity to wire manage a solar array.

## STANDARDS

### PA

**3.4.12.B2.** Illustrate how, with the aid of technology, various aspects of the environment can be monitored to provide information for decision making.

**3.4.12.E7.** Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world.

### NGSS STANDARDS

**HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

### COMMON CORE MATH

**HSG.MG.A.3.** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

## INSTRUCTIONAL

### TEXT/REFERENCES

What is a terminal block


<https://www.electriceasy.com/2018/03/terminal-block-types.html>





## TOPIC OF STUDY

Solar Installation

 3-4 HOURS  
(2 SESSIONS)

## INSTRUCTIONAL - CONTINUED

How to crimp an MC4 connector

<https://www.explorist.life/how-to-crimp-mc4-connectors/>

Why is wire management important

<https://www.solarpowerworldonline.com/2018/11/why-wire-management-is-important-to-solar-project-reliability-safety-and-life/>

How to make enphase connectors

<https://www.youtube.com/watch?v=aLMaE8n8KLk>

## MATERIALS NEEDED

**Teacher Prep:** [502 & 503 - Field made connectors, terminations, wire management](#)

### MATERIALS

- MC4 connectors
- Enphase connectors
- Wiley clips
- Zip ties
- Junction box
- Din rail
- Terminal blocks
- Polaris connectors
- Wire strippers
- MC4 crimp tool
- Screw drivers

## IMPLEMENTATION (LESSON PLAN)

### ENGAGE/EXPLORE

- We are at the point in installation where we need to connect components. Lets' look at the materials and tools we need to use to master the skills of connection. Show materials and tools in the lab, explain tool use and safety.
  - a. If you do not have connectors stocked in your classroom you can show presentation: [502 & 503 - Field made connectors, terminations, wire management](#) and videos referenced above.
  - b. Take questions as you go through live.

### EXPLAIN


1. Impress upon the students that field made connectors and wire terminations are a common failure point in solar arrays. This is the number one reason for service and call backs. Performing these tasks is critical to a high quality and safe solar installation.
2. Loose connectors and terminations can cause arcing which can melt components and cause a fire (particularly when near dry leaves).
3. Pro tip: Keep wiley clips on the brim of your baseball hat so that they are easy to grab when you need them.
4. Use resources as needed to demonstrate techniques
  - a. What is a terminal block:  
<https://www.electriceasy.com/2018/03/terminal-block-types.html>
  - b. How to crimp an MC4 connector:  
<https://www.explorist.life/how-to-crimp-mc4-connectors/>





## TOPIC OF STUDY

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## IMPLEMENTATION (LESSON PLAN) - CONTINUED

- c. Why is wire management important:  
<https://www.solarpowerworldonline.com/2018/11/why-wire-management-is-important-to-solar-project-reliability-safety-and-life/>
- d. How to make enphase connectors:  
<https://www.youtube.com/watch?v=aLMaE8n8KLk>

### EXTEND

- After demonstrating crimping techniques, students break into pairs and crimp connectors.
  - One person working and the other performing quality control.
  - Repeat for wire termination and wire management.

### EVALUATE

- Provide roving conferences and demonstrate where needed to assure that students are using techniques properly. If this is a 12th grade Capstone team, provide very specific feedback.

## MEETING INDIVIDUAL NEEDS

- Presentation can be used for students who struggle using tools and hands-on learning.
- Students not comfortable using their hands for work can bring tools to the classroom and can organize tools and materials needed to return them to storage.
- Students can test other students' work by performing tug tests and other quality control tasks.

