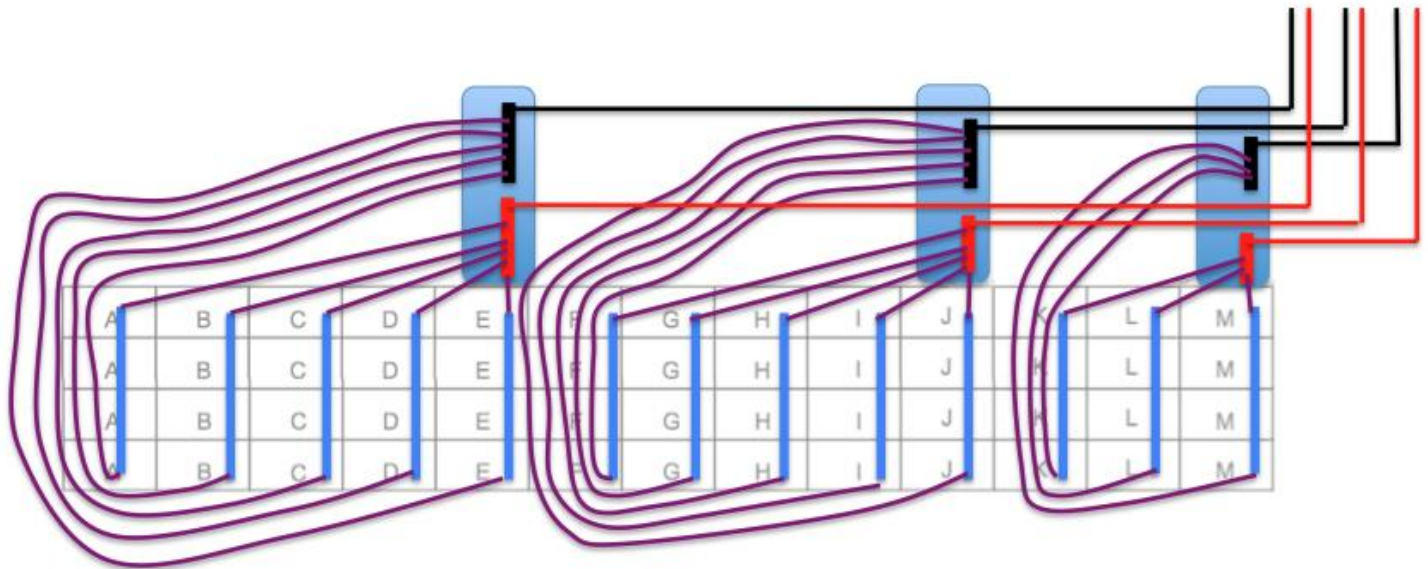


Wiring Diagram

The Blue rectangles are Combiners
 The Blue lines are strings of solar panels.
 The Purple lines are PV (PhotoVoltaic) Wires that have been cut to bring the ends of the strings into the Combiners.
 Black lines are Negative (-) wires run inside conduit.
 Red lines are Positive (+) wires run inside conduit.

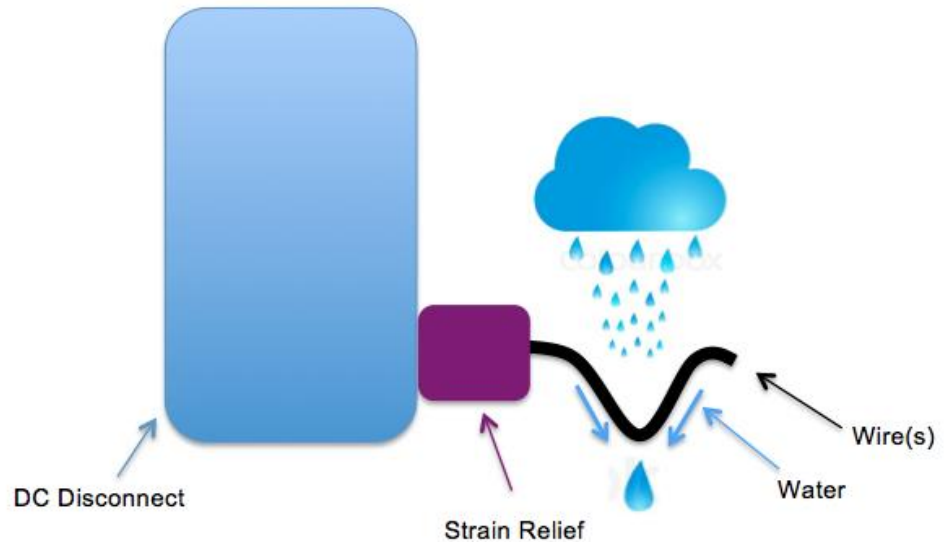


Though it may appear to be a bunch of colored spaghetti at first, following the lines reveals it is basically 5 strings (at the most) per Combiner. The output of each Combiner is run in the same conduit. Please note that the output of each Combiner is NOT attached to any other wires until it reaches the Charge-Controller.

For clarity the Red and Black lines are not crossed-over each other. Of course, they will be run in the same conduit, so the actual install will have them much closer together. The size of the DC Disconnect has been exaggerated and is not to scale.

Drip Loop

Run the wires so the very last section is “uphill” into the Combiner so water clinging to the wires must travel uphill (to prevent water intrusion). This is known as a “Drip Loop”.



For the PV Wires entering the DC Disconnect, use 2-hole strain reliefs; one per string.

<https://www.mouser.com/ProductDetail/836-M3234GAN?R=M3234GANvirtualkey55220000virtualkey836-M3234GAN>



Trench Run

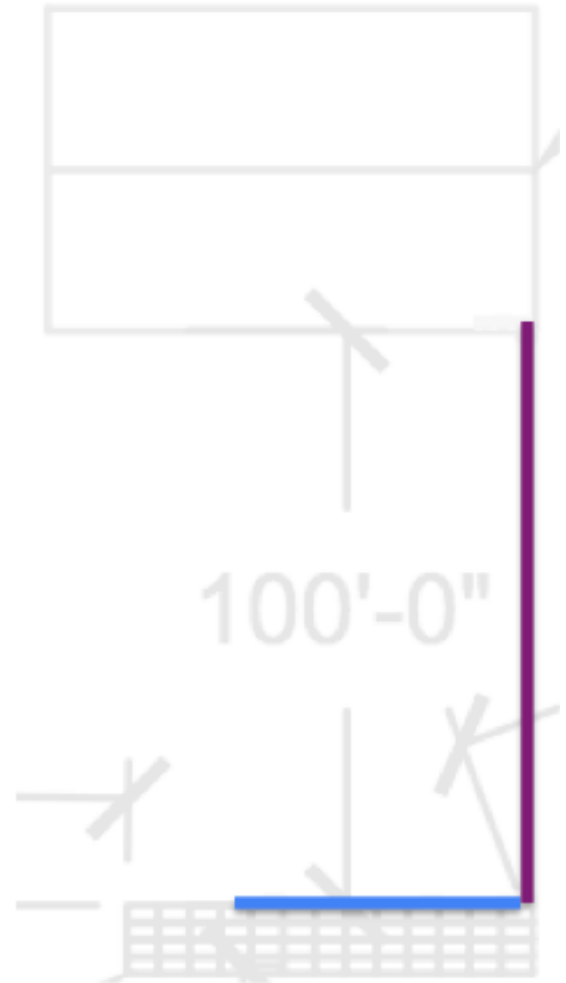
The Purple line is the 2" PVC conduit in the trench.
The Blue line is 1" EMT conduit, above grade.

The trench run is approximately 100'

Get at least 450' of each of these:

#3 THHN Red

#3 THHN Black



The Plans specify the type of wire running from the array inside conduit is THHN. Purchase stranded, NOT solid wire, as solid wire is too stiff to pull through conduit. There is an equivalent wire called THWN-2.

NOTE: There is a type of wire with a similar name called THWN, which does NOT have the “-2” at the end. There is a big difference. The “-2” means it has better insulation, so it can handle higher temperatures. Therefore for the same gauge wire it can safely handle more power. Without the “-2”, THWN wire can’t handle the higher temperatures (such as found on a roof or in an attic) and the amount of copper needs to be increased. So to safely carry the same amount of power, THWN would have to be bumped to a larger wire size, increasing the cost. Moreover, if the Inspector is expecting to see THHN or THWN-2, and instead finds THWN wire, that will fail the Inspection; and the THWN will need to be replaced.

Wire can be sold by the foot, or by the reel. By the reel is cheaper per foot. If the local Home Depot doesn't have the wire required, then try a shop that provides wire for electrical contactors. However, they will require purchasing by the reel, but can have several reel sizes available.

Additional Wire

Outback Load Center

Wire is needed for the short trip to and from the FM100 Charge-Controllers, to breakers in the Load Center.

Get at least 30' of each of these:

#4 THHN Red

#4 THHN Black

Battery Bank

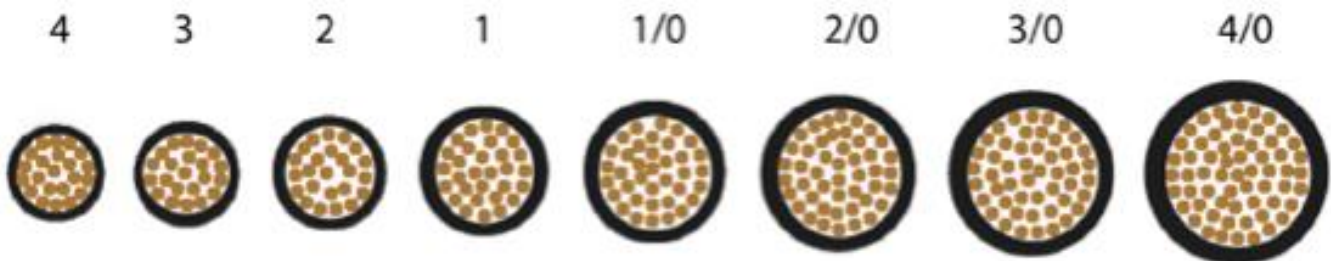
Large wires are needed to carry the power to the battery bank.

Get at least 20' of each of these:

#3/0 THHN Red

#3/0 THHN Black

Please note that the 3/0 (pronounced "Three Ott") wire is NOT the same as #3 gauge wire. Here is a comparison of their relative size.





Custom Install Guide

For Fred Flintstone

Generator

Depending on the location of the Generator, adjust the length of wire as needed.

Get at least 20' of each of these:

- #2 THHN Red**
- #2 THHN Black**
- #2 THHN White**

Service Panel

Depending on the location of the Service Panel, adjust the length of wire as needed.

Get at least 20' of each of these:

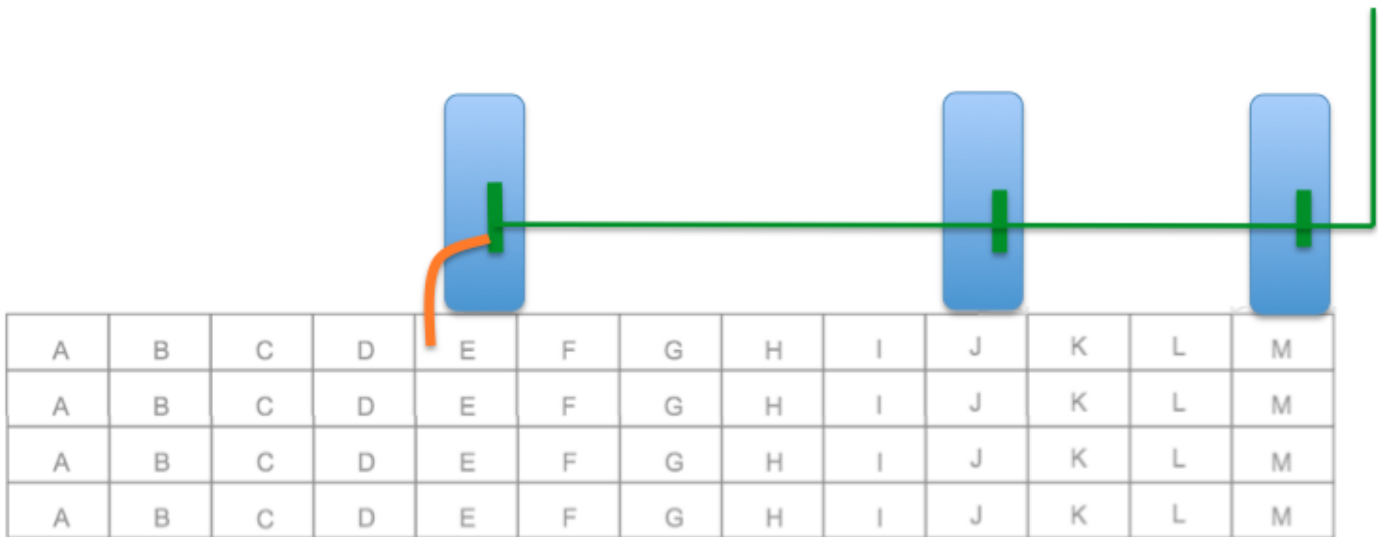
- #1/0 THHN Red**
- #1/0 THHN Black**
- #1/0 THHN White**



Grounding

The Orange line is #6 bare copper wire.

The green line is Green #6 stranded wire in conduit (the same conduit as the Red and Black wires).



**160' of:
#6 THHN Green**

This is the all-important EGC (Equipment Grounding Conductor), commonly called “the ground wire”. It should be kept continuous (not cut) from the Combiners, through the Inverter, into the MSP (Main Service Panel), and finally terminated in the Grounding Terminal Bar (where all the bare copper conductors from the house circuits are terminated) in the MSP. The Inspectors are very finicky about grounding. Use the Terminal Bars and Grounding Bushings along its path and the Inspector will smile. ☺

**10' of:
#6 bare copper wire**

This will connect to a rail, terminating in the DC Disconnect.

NOTE: Only one rail of the array needs to be attached to the #6 bare copper wire with a Grounding Lug. (The pipe structure will provide the metal path to electrically bond all rails.)

Most Inspectors want a supplemental Ground Rod to be installed at the solar array. It is recommended this be done before cement is poured. Drive a Ground Rod next to a post, in the empty footing. With the footing nearly 4' deep, merely place the Ground Rod in the footing and it is halfway to being fully installed. Being near the post it is easy to run the #6 bare copper wire to the

Ground Rod Clamp. Choose a post near the DC Disconnect to keep the wire run to the Ground Rod as short as possible.

Please refer to Page 17 of the Ground Mount InstallGuide:

[Link will be provided when system is purchased](#)

The #6 bare copper wire is terminated in the farthest Combiner in the Grounding Bar. Strip the end of the #6 Green wire, insert it into the other end of the same Grounding Bar, and secure with the set screw.

In the other Combiners and the Inverter use the Mid-Strip technique and Lay-In Lug (like the one used with the Grounding Bushings) that is mounted on top of the Grounding Bar.

It will look similar to this in the Inverter:





Custom Install Guide

For Fred Flintstone

Conduit

When running conduit outside, it must be water-tight. Use PVC from the solar array, down into the trench, along the trench, and then up into the interior of the barn. For the remainder of the conduit run, use metal flex conduit

1" EMT conduit (between Combiners)

100'

These are in 10' lengths.

Use water-tight fittings to connect conduit.

2 unions (couplings) – for joining conduit to conduit

8 transitions – for joining conduit to an enclosure

2 LB Conduit Bodies - for a tight 90-degree turn

2" PVC Schedule 80 conduit (trench run)

120'

These are in 10' or 20' lengths.

The conduit wall is thicker than Schedule 40 PVC, since it is going to be buried. The run is long, so use as large a diameter as possible to keep the wire-pull resistance reasonable.

2 transitions (slip to threaded)

2 90-degree bends (gentle sweeps)

2 Reducer fittings (to accommodate a smaller knockout hole in the enclosure)

1.5" Metal Flex conduit (between trench run and Outback Load Center)

25'

These are in 25' lengths.

2 unions (couplings) – for joining conduit to conduit

8 transitions – for joining conduit to an enclosure

2 LB Conduit Bodies - for a tight 90-degree turn

Buy slightly more than needed, just to save a return trip for one or 2 more items. Keep the receipt to return any unused conduit supplies.





Custom Install Guide

For Fred Flintstone

Pipe and Concrete

The IronRidge design specifies:

3rd Party Substructure Materials

TOTAL PIPE	308' 4.9"
TOTAL CONCRETE	3.40 yd ³

The pipe comes in 21' lengths. A minimum of:
15 sections of pipe will be required.

Additional sections of 10' pipe may be required. For a more accurate estimate, please refer to Pages 7 and 8 Ground Mounts InstallGuide:

[Link will be provided when system is purchased](#)

When ordering the pipe, here are the specifications:

- 2" pipe
- Galvanized (NOT "black pipe", which is merely painted)
- Schedule 40 (wall thickness)
- Threaded
- 21' length

The horizontal runs will require sections of pipe to be joined. Use 2" galvanized couplings. The pipe supplier will usually have them available. If not, Home Depot carries them:

<https://www.homedepot.com/p/Mueller-Global-2-in-Galvanized-Malleable-Iron-FPT-x-FPT-Coupling-511-208HN/100201526>

A nationwide source for plumbing supplies is Ferguson Plumbing. For further information, please refer to Page 9 of the Ground Mount InstallGuide:

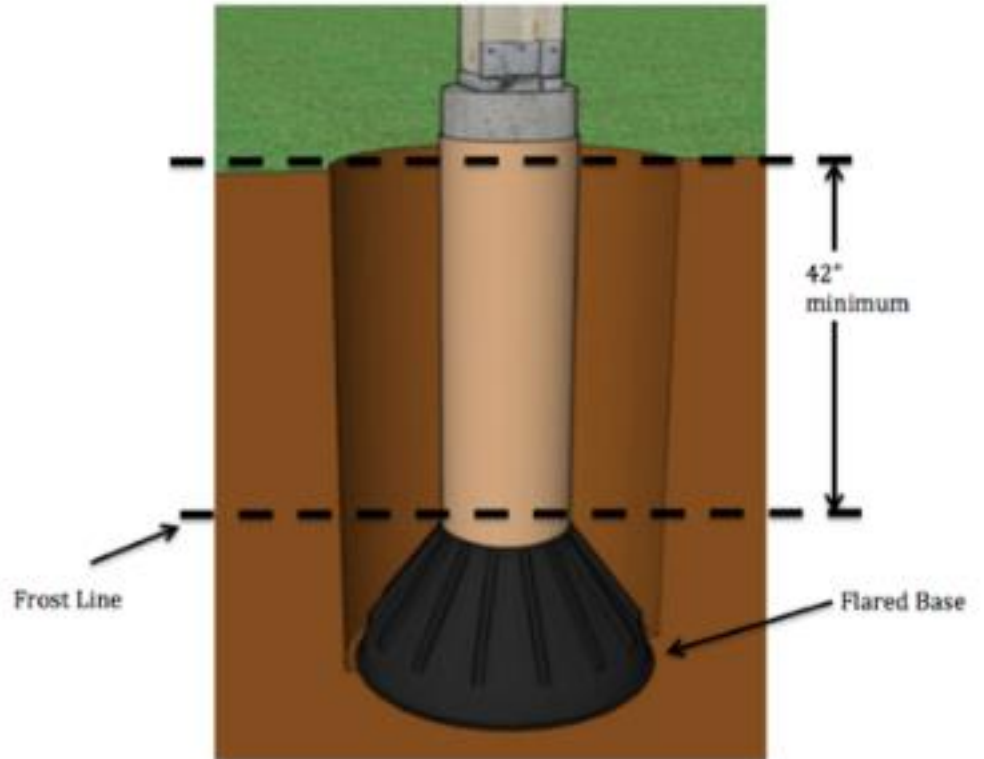
[Link will be provided when system is purchased](#)

The concrete estimate assumes the footings are perfect cylinders. Of course in the field this rarely happens. Also, having a short section of tube (to make sure the pipe will not have water pooling at the base) extending above grade will increase the amount of concrete required. If mixing concrete by hand, after a few footings, a relatively accurate estimate of the number of bags of cement can be obtained.

However, if a cement truck is to bring the cement, then add at least 15% to the total cubic yards of cement to be ordered.



If the site experiences freezing temperatures, the footings should have a flared base (to compensate for the effects of Frost Heave). This will require additional concrete.



For calculating the amount of concrete required, please refer to Page 16 of the Ground Mount InstallGuide:

[Link will be provided when system is purchased](#)

Home Depot Runs

A project of this scale will require several runs to the electrical supplier of choice. The items in this Shopping List are merely intended to help reduce the number of trips, and is not an all inclusive list. Each installation site is unique and will require different quantities and sizes of components. Moreover, there are many ways to install the equipment, which will affect the accuracy of this Shopping List. It lists major components of the electrical equipment required for this project that are not included in the solar kit being shipped to you. (Generally, if the item can be purchased at Home Depot, it is NOT included in the solar kit.)

Here are some additional items:

Grounding Bushings (10)

<https://www.homedepot.com/p/3-4-in-Rigid-Insulated-Rigid-Grounding-Bushing-2-Pack-29522/100123427>

40A 2-Pole 240v breaker (1)

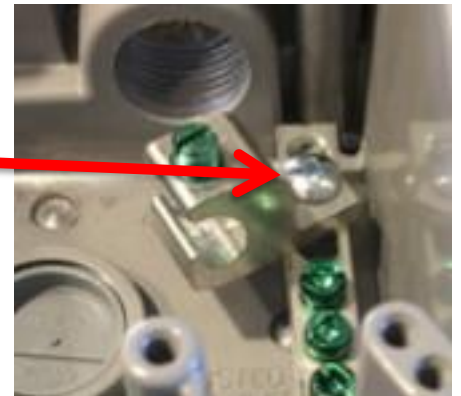
This needs to match the Brand of the MSP.

For example, a Square D “Homeline” MSP needs to have a Square D “Homeline” breaker.

Otherwise it is a Red Flag for the Inspector.

To attach a ground lug (taken from a Grounding Bushing) to a Grounding Bar:

#10 screw, 1” long





Custom Install Guide

For Fred Flintstone

Helpful Links

We have developed several InstallGuides that help “fill-in the blanks” for first-time installers.

Ground Mount

[Link will be provided when system is purchased](#)

Rails – Ground Mount

[Link will be provided when system is purchased](#)

Conduit

[Link will be provided when system is purchased](#)

J-Boxes (Junction Boxes)

[Link will be provided when system is purchased](#)

Outback wiring diagrams

https://www.outbackpower.com/downloads/documents/wiring_diagram/north_america_multi-stack_fp3_fxr_with_load_centers.pdf

String inverters

[Link will be provided when system is purchased](#)

Driving a Ground Rod

[Link will be provided when system is purchased](#)

Non-reversible Crimp

[Link will be provided when system is purchased](#)

Dave Donaldson

Senior Design Engineer

Please submit a new TASK for Support at:

[Link will be provided when system is purchased](#)

Office: (866) 647-1485

