SOLAR WHOLESALE

DIY INSTALLATION PACKET

FOR ADDITIONAL QUESTIONS PLEASE REFER TO OUR YOUTUBE CHANNEL: Solar Wholesale

IF YOU HAVE ANY FURTHER QUESTIONS, FEEL FREE TO CALL US AT: (801) 994-2350

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Solar Terminology

AHJ: Authority Having Jurisdiction. This means any governing body that has laws regarding the installation of solar. This includes the city, county, state, and country.

Array: Describes a grouping of solar panels on a specific section of the roof. Each solar system can have multiple arrays.

Azimuth: The direction that the roof plane is facing. The azimuth normally follows the compass readings. This means 360/0 degrees is due north, and 180 degrees is due south.

Busbar: This is the part of the electrical panel that the breakers attach to.

Electrical Tie- In: The method that is used to connect the solar system with your home's electrical system.

Fire Setbacks: Most AHJ's require that there is a path leading from the base of the roof plane to the ridge. As well as a path along the ridge. This is so in the case of a fire, firefighters can easily access the top of your home. These pathways are normally 18" or 36" wide.

Inverter/ Micro-Inverter: A device that converts DC power into AC power

Mounting Hardware: The devices that will be used to anchor the solar system to your roof or the ground

Mounting Plane/ Roof Plane: This is another way to describe each section of roof. Mounting planes are normally described by their tilt and azimuth

MSP: Main Service Panel. This is your main electrical panel that is fed by the utility meter

PTO: Permission to Operate. This normally is given by the utility company and is their way of saying you may turn on your system.

RIDGE: The highest part of the ridge. Run parallel with the eave. (Not every home has

EAVE: The lowest edge of the roof that is parallel with the ground.

GABLE: The edge of the home that runs perpendicular between the eave and ridge

HIP/ VALLEY: Where two roof planes meet. Usually at an angle close to 45 degrees.

SAFETY NOTES

*****PLEASE READ*****

You must accept that You and You Alone are responsible for your safety and safety of others in any endeavor in which you engage. While the material in this guide is provided in hopes that you build your own system, You are responsible for verifying its accuracy and applicability to your project.

You are responsible for knowing your limitations of knowledge and experience. If you do any work with “main power” such as 120 or 240 VAC power wiring, you should consult a Licensed Electrician.

Some illustrative photos do not depict safety precautions or equipment, in order to show the project steps more clearly. These projects are not intended for use by children. Use of these instructions, kits, projects and suggestions is at your own risk.

Solar Wholesale disclaim all responsibility for any resulting damage, injury, or expense. It is your responsibility to make sure that your activities comply with applicable laws.

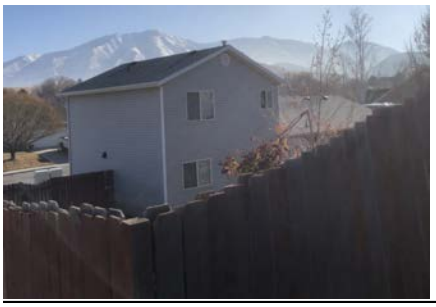
1. Site Survey

A full site survey is required to begin your Solar Design. The design process will not start without these photos.

Project Location

- Minimum of 4 photos
- Front of Home
- 360 degrees around home





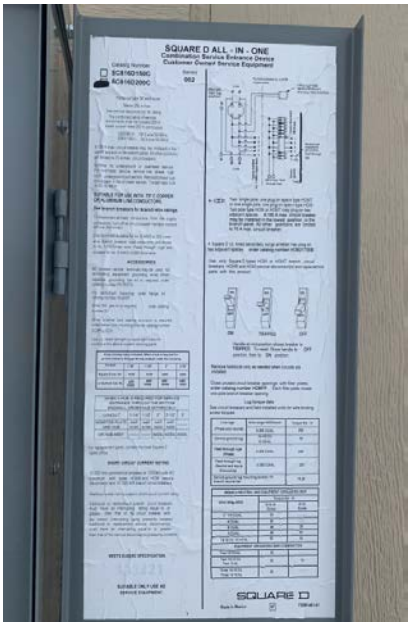

Utility Meter

- Up close photo that is clear enough to see the numbers on the meter
- Photo about 15 feet away from the meter box to see the surrounding location on the wall


Main Service Panel

This is typically on the exterior of the home. **If interior, please notate the EXACT location**

- Clear photos of ALL sticker on the panel
- Door open with the cover ON
- Door open with the cover OFF (You will need tool for this screwdriver/multi tool)

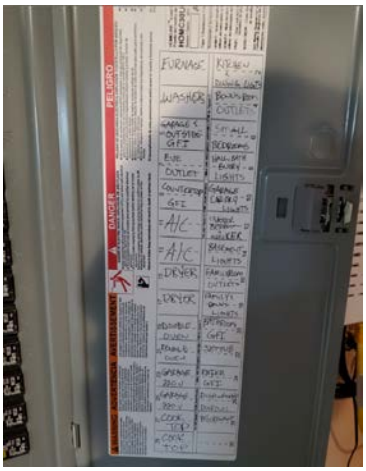


Sub-Panel (Secondary Electrical Panels)

Some homes have a secondary sub panel(s) or additional breaker boxes. Please locate and take the following photos.
****Please notate the location of any sub-panel to help with design****

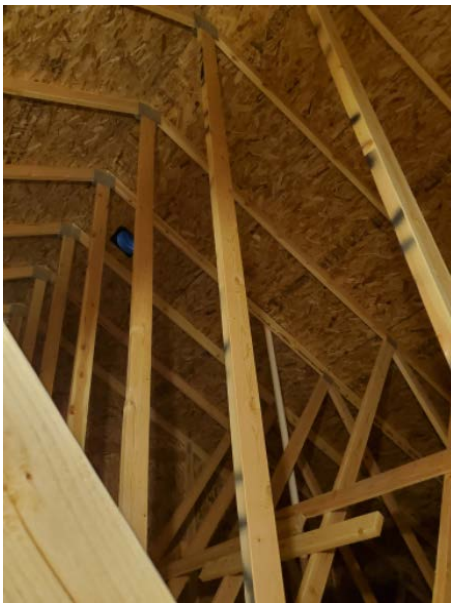
- Clear Photos of any and all STICKERS on door
- Door open cover on
- Door open cover off (You will need tool for this screwdriver/multi tool)





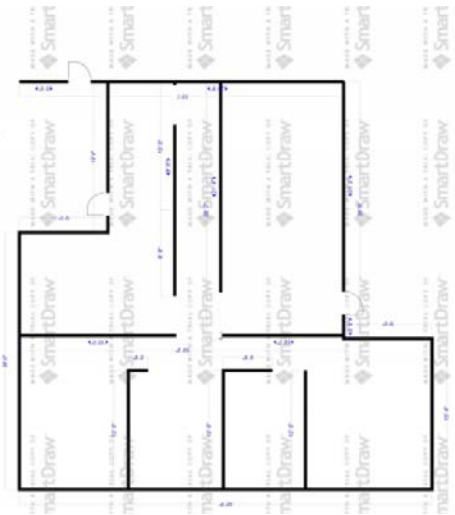
Attic Space

- Attic pictures showing Trusses / Rafters. This information is for the engineers, so the more photos the better. ****If rafters, please see next section****
- At least 2 Photos showing the space in the attic
- At least 2 photos rafters or trusses
- At least 1 photo of plywood or wood above rafters




IF YOU HAVE RAFTERS

- Rafters do not have the metal gusset plate attaching boards together
- Need extra photos showing the supports members of the rafters
- A load bearing wall diagram
    - This is a diagram that shows where the wall below your attic are located, it also should have the measurements of each room
- If there is a room in the attic (pitched ceiling) please try to get the dimensions of this room



Pitched ceiling where it meets the underside of the roof.

8.57

2. Permitting

Most construction projects require that you get a permit from the city, county, state, or whoever has jurisdiction in your area. This is the case for solar as well. In order to submit for permits, the AHJ usually requires the following documents:

Provide by your local jurisdiction:

1. Permit Application
2. Owner Builder Certification Form

Provided by Solar Wholesale

1. Planset
2. Equipment Specification Sheets
3. Structural Engineering Letter

Depending on the AHJ, you may need more/ less than what is on the above list. To confirm what exactly will be required you can go to your city's building depart website and see if they have any information there. Otherwise, you can call them and ask what documentation they will require.
There is usually some standard information that the permit applications require. Below is a small walk through to help you find the information in your solar planset.

AC/ DC System Size: Can be found on the cover sheet of your planset

Inverter Type: Located on the cover sheet of you planset

Inverter Size: Located on Specification Sheets

Inverter Details: Located on Specification Sheets

Legal Description of Plot: Parcel number, City, Subdivision Name (Searchable on County Assessor Website)

3. What You Will Need

In order to complete your solar project, you will need the following tools.

- Measuring Tape
- Chalk
- Chalk line
- Impact Driver
- Electric Screwdriver
- Hand Powered Screwdriver (Phillips and Flathead)
- Multimeter
- Wire Strippers
- Ladder
- Hammer
- Nails
- Sawzall

We also provide in your kit:

- X” Conduit
- AWG THWN-2 Wire that is sized for your system
- #12 AWG THWN-2 Wire
- 12-2 Romex
- Zip Ties
- A/C Disconnect
- Combiner Panel
- Sticker Packet
- Breakers
- 1/4” Drill Bit
- 1/2” Socket

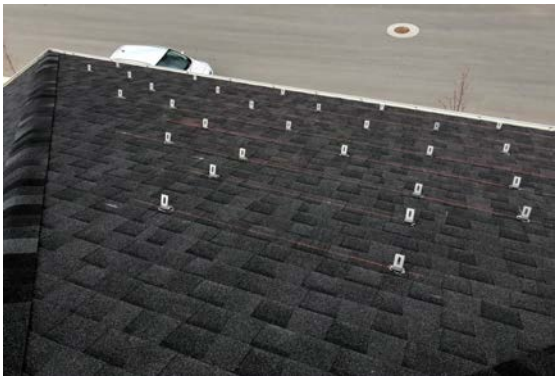
4. Determining Layout

Tools Needed: Measuring Tape, Chalk, Chalk Line

Parts Required: None

The planset that you are provided should have accurate layouts that will be able to fit on your home's roof. However, every once in a while the proposed design does not fit. To avoid having your solar system not fit on your roof, you should take measurements and use chalk to outline where your solar system will be installed. A chalk line can also be used to make sure the rails are placed parallel to the eave of the roof. This ensures the system looks even on your home.

The dimensions of our panels are 39" wide, and 65" tall. Use these measurements to make the rough layout of the arrays. Also be aware that most places require **fire setbacks**. These paths are usually 18" or 36". You should see a note on page PV-3 of your planset that states how much distance you need to keep the edge of the array from the **ridge/ gable/ hip/ valley** of the roof. Be sure to follow this note, so that you do not have issues with the post installation inspection.



5. Roof Penetrations

Tools Needed: Hammer, Nails, Electric Drill, 1/4" Drill Bit, Impact Driver, 1/2" Socket

Parts Required: L-Feet, SnapNRack Flashing and Lag Bolts

This first thing you will need to do is determine your truss/ rafter spacing. It is most commonly 24” on center, but you should get in your attic to confirm this.

After you determine your rafter spacing, you will need to go onto your roof and find the first rafter that you will use as a starting reference point. To find this rafter you will want to start with a general idea of where the rafter is. You can do this by measuring from the edge of the roof. Be sure to account for the gable’s overhang. Once you believe you are close to a rafter, lift up a shingle and get ready to hammer a nail in as far under the shingle as possible. You will have to go by feel to determine if the nail has hit a rafter.

If you hammer the nail and get resistance the whole time there is a good chance that you have hit the rafter.

There will most likely be about an inch of shingle and sheathing to get through, so if you get part way in and then the nail is easy to hammer in the rest of the way, you probably missed the rafter.

With your drill and the 1/4” drill bit, drill a hole where you will be screwing down the L-Foot with the lag bolt and flashing.

Each row of panels needs two rows of rails to support them. The separation between the rails depends on the orientation of the panels.

For Portrait: 15 inches For Landscape: 10 inches

Because of the spacing of the rails, the panel should overhang equally above and below the rails.

For Portrait: 33-36 inches For Landscape: 18-20 inches

For each rail, you will need an L-Foot 12-24” from the end of the array. You will then need to stagger the L-Feet between each row’s rail. This means the top row’s L-Feet should be in between the lower row’s L-Feet. Overall, the L-Feet should be at most every 48” apart. No panel should be cantilevered more than one third of the panel length in any direction

Mark every 48” on the first rack line, then stagger the next line

6. How to Lay Rail

Tools Needed: Impact Driver,

Parts Required: Rail, Saddle Attachment

The rail should go right to the edge of the outside of the panels. The easiest way to lay the rail will be to line one side of the rail up with the outside of the array, then have the extra rail hang off the opposite side. This will ensure that you are using the rail as efficiently as possible and will

require less cuts to get the rail to the appropriate size. Consider your layout when placing panels, and your panel orientation.

To attach the rail to the L-Feet you will need the saddle attachments you were provided. Take the bolt from the saddle and put it through the L-Foot and back through the saddle. Place the rail on top of the saddle. Slide the saddle towards the top of the L-Foot, then tighten the bolt. This should secure the rail, as well as the saddle, to the L-Foot.

Continue this for the rest of the way across the roof until you have reached the other side of the array.

Add a link to video on how to properly level your rails.

7. How to Attach Microinverters

This step will be needed if you are using **AP Systems** for your solar system.

Tools Needed: Impact Driver, 1/2” Socket

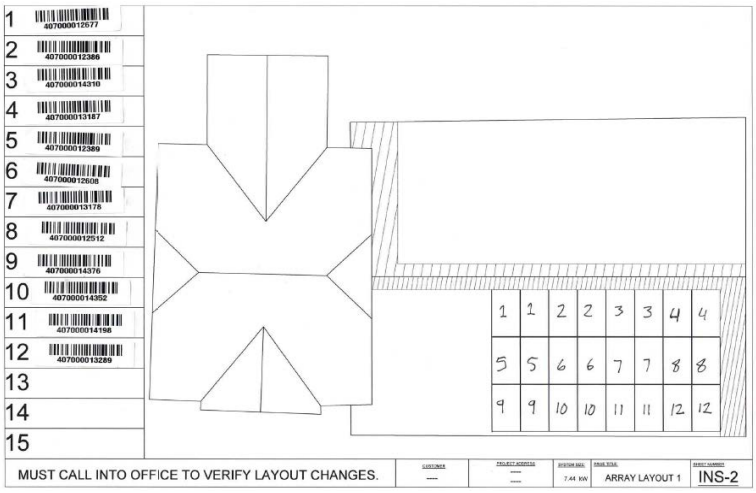
Parts Required: Microinverters, MLPE Attachment (two per microinverter)

There are two types of microinverters you may need to install. The YC600 connects to 2 panels, while the QS1 connects to 4 panels.The location of the microinverters is very important. You want the microinverters placed on a rail that is as close as possible to the center all of the solar

panels that will be connected to it. This will help decrease the amount of equipment you will need, making for an easier install.

To attach the microinverter to the rail. You will need to slide the MLPE attachment inside the rail, slide the microinverter around the bolt on the attachment piece and tighten the bolt to secure the microinverter.

In order to set up your system's monitoring, we will need a layout of your microinverters. The best way to do this is to take ONE of the serial number stickers (usually begins with '407' or '802') off of the microinverter and place it onto the 'Sticker Map' page and notate its location.



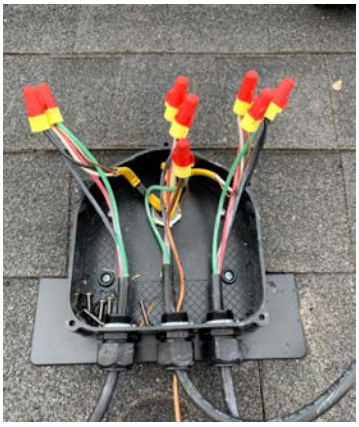
8. Wiring

Tools Needed: Wire Strippers

Parts Required: THWN-2 Wire, 12-2 Romex, EMT Conduit

8.1 Rooftop Junction Boxes

The Soladeck junction box is used to create a waterproof point where the romex wire can be run inside your attic. In order to create a waterproof seal, the Soladeck box needs to be slid underneath the shingles where the hole was cut for the wires to be run through. The microinverter truck cable should run into this rooftop J-Box.

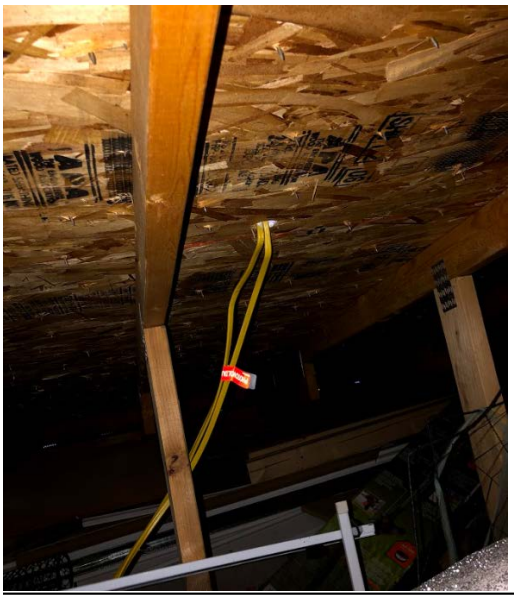


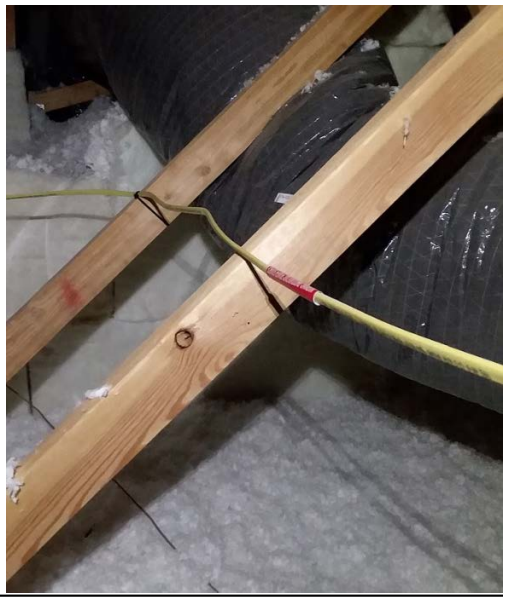
8.2 Conduit Runs

Your plans should call out the size of wire, romex, and conduit you will need for your installation. Be sure to follow these exactly as the plans are written to follow the NEC codebook.

8.3 Romex Runs

12-2 Romex is the wire that will be run through your attic (if this applies). Romex is rated to be run on the interior of your home without the need for conduit or any extra protection.





8.4 Wire Management

Managing the wire runs is very important. It keeps your install clean and also lessens the chance of you mixing up wires. You can use zip ties to secure wire within the rail. Make sure that there are NO WIRE TOUCHING THE ROOF. This is one of the most common things that leads to a failed inspection.

8.5 Exterior Junction Boxes

An exterior junction box will be required when you transition from Romex inside your attic to conduit withTHWN wire on the exterior wall of your home.

8.6 Rail Grounding

You will need to run a ground wire along the rail. You should install a ground lug on the second lowest rung of rail. Then every two rails above it. Each row of panel (two rows of rails) only needs one ground lug. The ground wire should be installed between the bolt and raised edge. Then tighten the bolt to secure the wire.

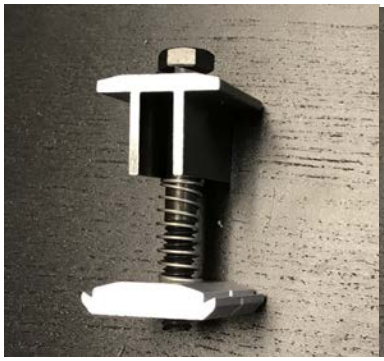
9. Installing Solar Panels

Tools Needed: Impact Driver, 1/2” socket

Parts Required: End Clamp, Mid Clamp

You are almost done on the roof! Before you attach the modules to the rails, you will want to clip the wires on the backside of the modules into the microinverters.

Start at the side you had the rails lined up on in step 6. Slide an end-clamp into each rail, place the module onto the rails. Line the module with the edge of the rails and clip into the end clamps. Then tighten the bolt on the end clamps to secure the module. DO NOT OVERTIGHTEN.


Once the first module is placed, insert a mid-clamp into each rail. Slide them so the vertical section is flush with the module and the upper part is over the module’s frame. Loosely tighten the bolt on each mid-clamp to hold the panel in place. Then grab another panel and slide it flush up against the two mid-clamps. Fully tighten the mid-clamps to secure the first panel and hold the second panel in place while you grab two more mid-clamps. Repeat the process above until you have reached the end of the row. Then use another end-clamp to secure the final module. Repeat until all of your modules have been installed. You should level panels as you go to ensure straight arrays. To do this get off your roof and look at the array from a distance. If you see any ‘waves’ along the panels, note the location. Get back on the roof and adjust the height of the L-Feet to fix it.

10. Installing Balance of System

Tools Needed: Impact Driver, Wire Stripper

Parts Required: Combiner Panel, AC Disconnect, THWN-2 wire

The balance of system describes the electrical equipment you will need to install to have your system be up to NEC and local AHJ codes. Read the parts list closely to determine what you will need to install.

10.1 Combiner Panel

Most systems require a combiner panel to be installed. This combiner panel allows for all of the solar branch circuits coming from the roof to be combined into a single set of conductors. This makes connecting the solar system to your home much more simple.

To attach the Combiner Panel to the wall you will need your impact driver and some the appropriate screws.

Each branch circuit will require a 15A or 20A breaker landed inside the combiner panel. You can find this information on the One Line Diagram page of your planset.

10.2 Non-Fused AC Disconnect

Every system will need some type of AC Disconnect. A non-fused disconnect is the most common one. If you are tying into your home using a breaker, you will need a Non- Fused AC Disconnect.

To attach the AC Disconnect box to the wall you will need your impact driver and the appropriate screws.

Pop out the necessary cut outs on the AC Disconnect box so that you can run your wires. Make sure to attach the wires leading from the solar to the “LINE” side of the disconnect. You should

see this stamped into the back of the box. It is normally the top side. The black conductor should attach to the left lug, while the red conductor attaches to the right lug.

Then the wires that will connect to your home should be installed on the “LOAD” side of the disconnect.

10.3 Fused AC Disconnect

A fused AC Disconnect is usually only required when you are tying into your home using a **Tap**.

To attach the AC Disconnect box to the wall you will need your impact driver and the appropriate screws.

Pop out the necessary cut outs on the AC Disconnect box so that you can run your wires. Make sure to attach the wires leading from the solar to the “LINE” side of the disconnect. You should see this stamped into the back of the box.Then the wires that will connect to your home should be installed on the “LOAD” side of the disconnect.

10.4 New Electrical Sub-Panel

Sometimes a new electrical sub-panel is required in order to tie your solar system into your home’s electrical system.The size of the sub-panel that you should need will be labeled on your

planset. Make sure to follow your planset. It should tell you what size breaker is feeding the panel, as well as if there is a main breaker for the panel.

11. Electrical Tie In

Tools Needed: Screw driver

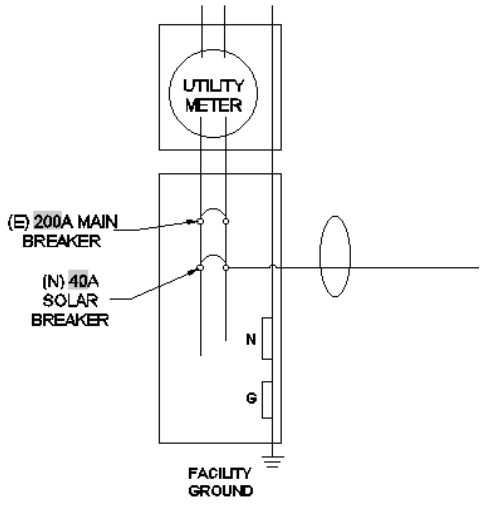
Parts Required: Breaker, Ilsco Kup-L-Taps

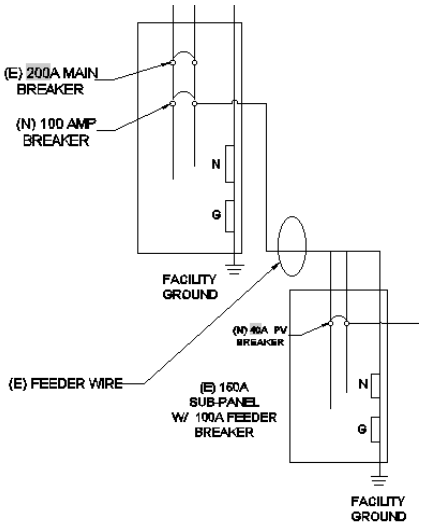
The electrical tie in is how your solar system will connect your homes electrical system. There are a few ways this can be done and we will help you understand which method your planset is calling for.

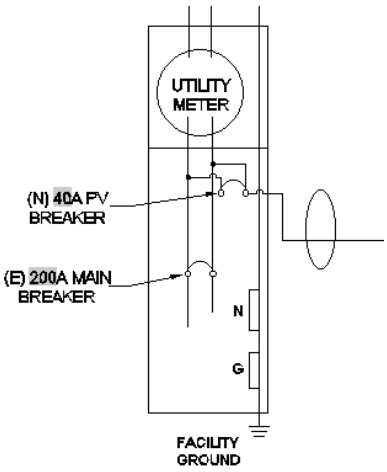
You can find your electrical tie in on the One Line Diagram page of your planset. It should say it in the top left corner. Use the following sections to help determine what tie in was called out for your system and how to install it.

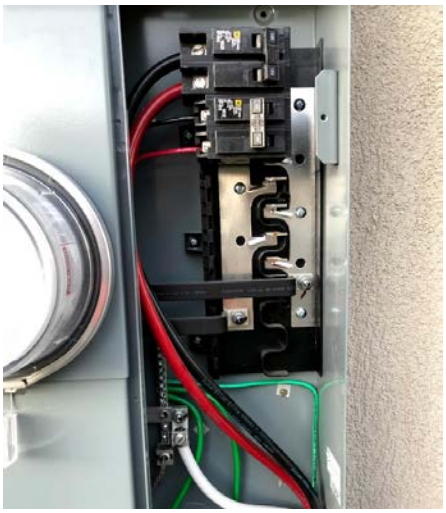
11.1 Breaker Tie In

This is the easiest option. All you need to do is install a breaker into your electrical panel. Make sure to place the breaker at the end of the busbar furthest from the main breaker. This is usually the bottom of the busbar. You can do a breaker tie in to the main panel or a sub panel. An example of what each looks like on the plans is below.



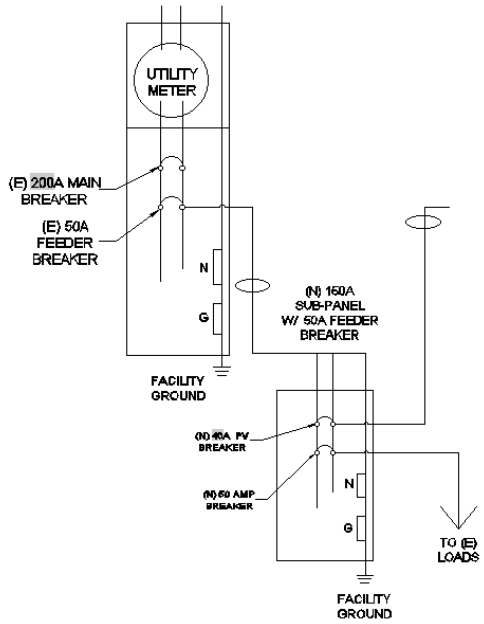






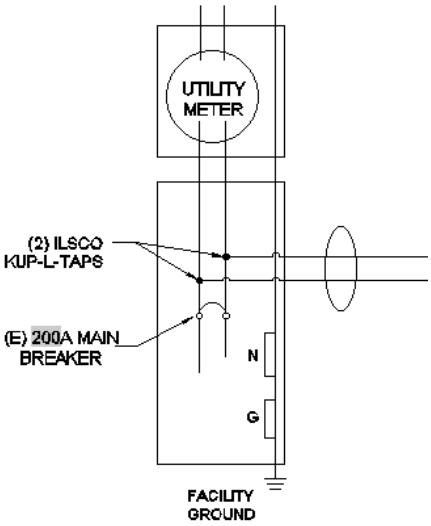
11.2 Sub Panel Insert

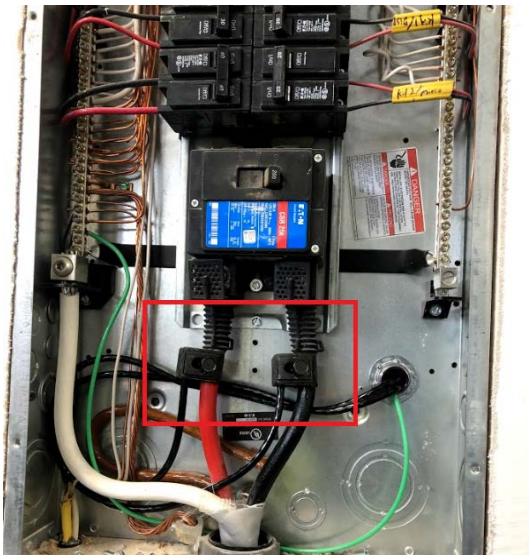
This option requires you to add a new electrical sub-panel in order to tie in your solar system (See Section 10.4). This is usually necessary when your main panel is full, and there is no room to add another breaker.



11.3 Supply SIde Tap

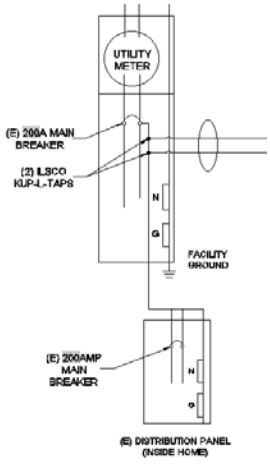
A supply side tap is a method that connects your system directly to the wires on the supply side of your electrical panel. You will clamp two Ilsco Kup-L-Taps to the wires that feed from the meter to the main breaker. For this method you should have been given a Fused AC Disconnect (Section 10.3).

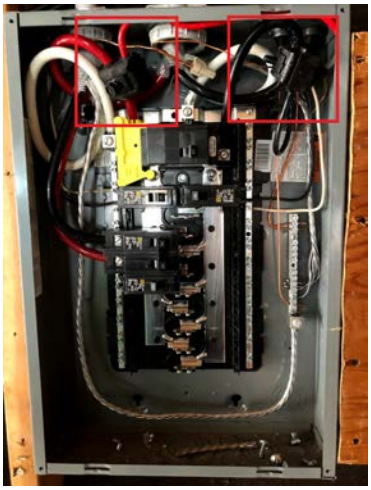




11.4 Load Side Tap

This method is similar to a Supply Side Tap, but it occurs after the main service breaker. You will need to use two Ilsco Kup-L-Taps to clamp onto the wires after the main service breaker. For this method you should have been given a Fused AC Disconnect (Section 10.3).





12. Labels

Tools Needed: None

Parts Required: Label sheet from planset, Labels Package

In your planset there should be a label sheet that describes which labels need to go on each component of the system. Each column is separated and denotes where it should be placed. Placing them should be as easy and peel and stick.

Utility Meter

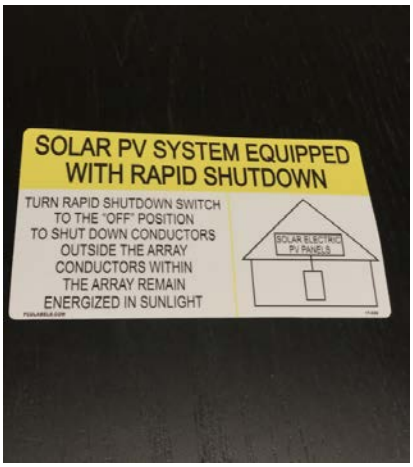
“PARALLEL GENERATION ON SITE”

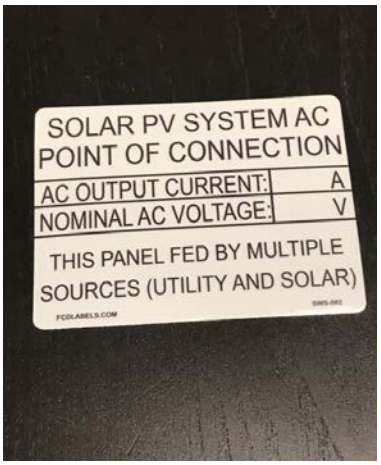
“PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN”

“WARNING DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC SYSTEM”

“SOLAR SYSTEM EQUIPPED WITH RAPID SHUTDOWN” - Yellow placard with a picture of a home

“SOLAR PV SYSTEM AC POINT OF CONNECTION” - Need a label maker to fill in AC Output Current and Nominal AC Voltage.





AC Disconnect

“MANUAL DISCONNECT FOR PARALLEL GENERATION”

“PHOTOVOLTAIC SOLAR AC DISCONNECT”

“RAPID SHUTDOWN SWITCH FOR SOLAR SYSTEM”

COMBINER Panel

“WARNING: PHOTOVOLTAIC SYSTEM COMBINER PANEL. DO NOT ADD LOADS”

Conduit

“PHOTOVOLTAIC POWER SOURCE” Should be labeled every 10 feet.

Point of Interconnection

“PHOTOVOLTAIC SOLAR BREAKER”

“DO NOT RELOCATE THIS OVERCURRENT DEVICE”

“WARNING: POWER SOURCE OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE.”

If you use a breaker to connect your solar to your home you will need to place this label on the deadfront next to the breaker.

13. Inspections

Once your installation is complete, the AHJ will require that the work is inspected by an official.

You will have to call the city/ county/ state to let them know that your project is completed; they will have you schedule a time to have the inspector come out to your home.

Usually, the inspection goes smoothly and there are no changes that need to be made. However, sometimes the inspector will require that you make a change. They will usually provide an inspection report that details the correction that they would like to see made.

If you have any questions on the changes the inspector is asking for, feel free to reach out to us at (801)994-2350 or customercare@solarwholesale.com.

14. Permission to Operate

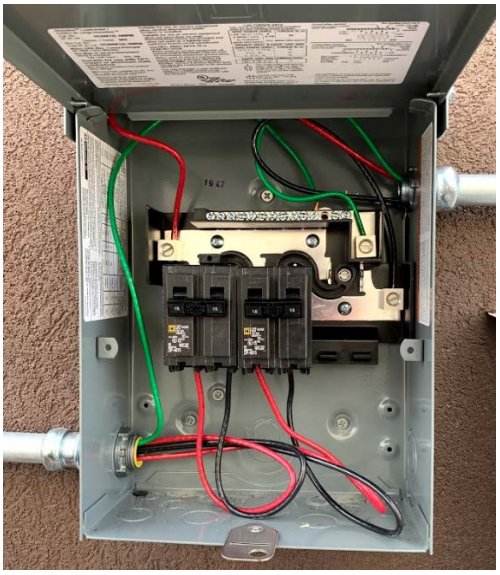
This is the final step before you can turn on your system. In order to receive PTO, the utility company will need to come out and reprogram your existing meter, or install a new one. This needs to be done because the standard meter can only read one direction, from the grid to your home. Since you now have a power source on your home, you need a meter that can read both directions. This ensures that you get accurate measurements of the energy your system puts back into the grid.

Contact your utility company once inspections are passed for your next steps.

15. Activation

Congratulations, you are now ready to turn your system on and begin producing clean energy! Turning on your system should only take 2 or 3 easy steps.

First you want to make sure that all of the breakers in your combiner panel are flipped on. The example below shows the breakers in the ‘OFF’ position, make sure they are flipped up or facing towards the middle.



Next you should flip the handle up on the AC Disconnect to ‘On’.

If your system is tied into your home with a **tap**, then your system should be on and producing now. If not, please follow the step below.

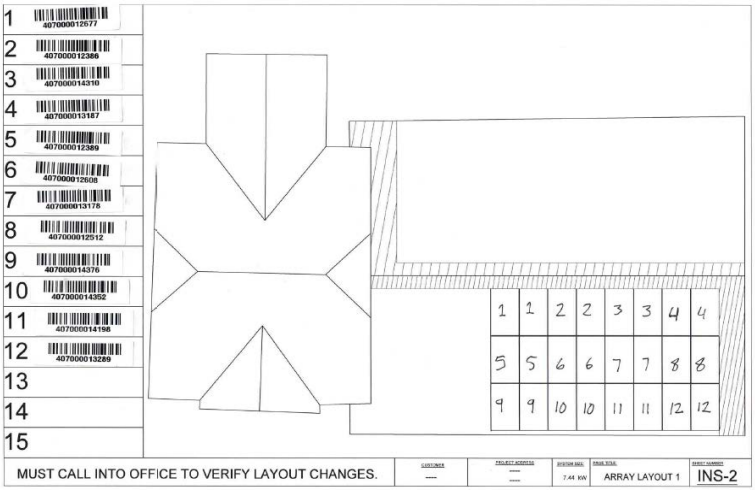
Then the final thing you should have to do is flip the breaker in the main panel/ sub- panel.

16. Monitoring

This will give you the ability to see how your system is performing. It will also give you a quick way to check if everything is working properly.
First, you should plug in your ECU. The ECU is the little white box that we provided that says APSystems on the front of it. There will be a power cord, and then you can decide whether you want to set up the internet with wifi or a lan connection. To set up the internet you will need to download the APSystems **EMA App**. Please make sure you download the **EMA App** and not the ECU App. The ECU App is for contracted installers.

In order for us to set up your monitoring we will need a few details from you. First is we will need a picture or copy of your microinverter layout that you created in Step 7. Then we will need a picture of the front and back of your ECU.

Here is the website that you can use to monitor your solar system: https://apsystemsema.com/ema/exceptionIndex.action



17. NEC Codes

110.3 - Provides requirements for general electrical installations

220 - Provides requirements for calculating branch-circuit, feeder, and service loads

300 - Provides requirements on wiring methods and materials

690 - Provides requirements for specifically Solar Photovoltaic systems

705.12 - Provides requirements for interconnection from production sources.