

Rocky Broad Solar Ultimate DIY Guide

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Choosing the Right Products

Hybrid Inverters:

These provide backup power during a utility outage and can be used off grid, but they are also meant to interact with the utility grid. This gives your home the ability to use multiple sources of energy at one time such as grid, solar, batteries, and generators. You can think of this inverter as an intersection of power sources rather than a drawbridge. For someone installing these systems themselves, I would suggest EG4 products due to their industry leading innovation, their experience catering to the needs of DIY enthusiasts, and affordability.

The first step is choosing an inverter depending on your specific needs. Bigger is always better if you plan on expanding in the future or if you have large high demand loads such as electric heating and air conditioning or water heating. The [FlexBoss21](#) is

a great option for whole home backup of the average American household with its impressive 16kW AC output(12kW AC when no solar is present). It can accept up to 21kW of DC input from your solar panels. If this is excessive for your individual needs you can step down to the [FlexBoss18](#) which can accept up to 18kW DC from your solar panels, has 13kW AC of output with solar, and 10kW AC of output when no solar is present. For those of you still interested in the 18k PV or 12k PV, I am sorry to say this inverter is a thing of the past. There is really no circumstance I can think of that I would recommend that inverter over the FlexBoss product line. The only benefit is that the 18k PV is EMP hardened. This was released to the public long after the inverters were truly hardened, so past customers got a nice surprise to learn this about their products. I have personally reached out to EG4 to ask if the Flexboss line will have the same outcome and was not able to get a definitive answer. My gut feeling says yes, but if you absolutely need EMP hardening, you could also add some [EMP Shield products](#) to the Flexboss line of inverters.

Microgrid Interconnect Device:

The [GridBoss](#) microgrid interconnect device is a must-have addition to a Flexboss inverter when connected to the utility grid. The [GridBoss](#) gives you more flexibility in terms of equipment locations if you want to locate your inverter and batteries a distance from your utility meter and service conductors. In this case you can locate the [GridBoss](#) near the utility meter and run only the inverter output circuit from the [FlexBoss21](#) to the [GridBoss](#). This can save thousands of dollars in copper wiring and conduit. The [GridBoss](#) also gives you the ability to easily add more hybrid inverters in the future as well as having 3 smart circuits. Smart Circuits are critical to having your home intelligently manage your heavy draw appliances during a utility outage or during certain times of day/night. You generally want to choose some large “autonomous” loads for the smart ports that tend to turn off and on without human intervention. These loads include AC, electric heat, electric hot water, EV chargers, etc.

EG4 Hybrid inverters are sealed from moisture and dust and have a longer warranty period of 10 years compared to their off-grid line of inverters. Hybrid inverters can still be used in an off grid application if you prefer the sealed inverter with a longer warranty period.

Off Grid Inverters:

These systems are meant to provide power to a location not connected to the grid. That being said, they can use the grid as an additional form of backup. The difference is they

cannot pull from both the solar/batteries and the grid simultaneously. It is either one or the other. They cannot export power back to the grid under any circumstance. They don't usually carry the certifications required to pass an inspection in some of the more stringent parts of the country. This means if you are getting your system permitted and inspected, choosing a hybrid inverter may be the better option. The warranties are generally shorter terms of 5 years.

The best off grid inverter for backing up an average American home is the EG4 [12000XP](#). It can accept up to 24,000 watts of solar panels and has a max continuous output power of 12,000 watts and can serve both 120V and 240V loads. It also contains one single smart port which can be used to shed a heavy draw appliance or AC couple existing solar systems.

The runner up to the [12000XP](#) is the EG4 [6000XP](#). This inverter has a max recommended solar input of 10,000 watts. It can output 6,000 watts continuously and can also serve both 120V and 240V loads.

Batteries:

Next is choosing your batteries. What is most important about this choice is choosing a battery that has closed loop communications with your solar inverter. This ensures that the system will function seamlessly and will ensure longevity of your battery bank. My recommendation is to just choose from the EG4 product line and keep all components under the same umbrella and purchase from the same distributor. This means you have only one place to go to for tech support or warranty claims if they are ever needed. The more batteries, the better your system will perform. Go big or go home.

The two top contenders for batteries paired with any of the above-mentioned inverters are the EG4 [WallMount Indoor Battery](#)(indoor only) and the [EG4 PowerPro WallMount AllWeather Lithium Battery](#)(indoor or outdoor). Both of these batteries have internal heaters if they are mounted in an area that gets below freezing. This keeps the batteries functional and prevents damage to the cells. The outdoor version is also EMP hardened which is a value add. These batteries are very heavy and in most cases will require 2 people to move around and mount on the wall. You will need at least 2 of these batteries in order to get the full continuous output of the Flexboss21, Flexboss18, or 12000XP inverters.

To keep the installation simple and affordable I would pick a location where you can stack the inverter on top of the batteries and utilize 2 of the [EG4 Power Pro Conduit Boxes](#)(PowerPro WallMount AllWeather batteries) or 2 of the [EG4 Indoor Buildable](#)

[Conduit Boxes](#)(WallMount Indoor batteries). This will prevent you from needing to custom make battery cables, conduit runs, or wire gutters and will save you a lot of time and money. You will need a set of [EG4 PowerPro Battery Paralleling Cables](#) if you are installing 2 batteries, or two sets of the [EG4 PowerPro Battery Paralleling Cables](#) if you are installing 3 batteries.

The next option is to use server rack batteries. You will pay more per kWh of storage compared to the wall mount versions listed above and they are not heated or outdoor rated. These have more electrical connections and oftentimes require buying a [battery rack](#) to hold the batteries securely. The benefit of these are they are more easily moved by one person and you can build as you go, easily adding 100ah blocks at a time. If you are on a tight budget and are just trying to get started with some backup power, this might be a good option for you. ***If you are getting one of the above mentioned 48V inverters, make sure to get the 48V server rack batteries(not 12V or 24V).*** The main 2 choices here are the EG4 [LL-S Lithium Battery](#) or the EG4 [LifePower4 V2 Lithium Battery](#). The biggest difference is the [LL-S Lithium Battery](#) has an LCD screen on it. Both have 10 year warranties and are very similar.

Generator integration:

If you want to charge the batteries from a **portable generator** then I would get the [EG4 Chargeverter](#) and some [600A busbars](#) and 2 x [2/O battery lugs](#). You will parallel all of the battery cables and Chargeverter output on the [600A busbar](#) before it terminates in the battery terminals in the inverter. You will also need to replace the ring terminals on the Chargeverter with some [3/8" 4AWG terminal lugs](#). This protects your equipment and sensitive electronics from getting damaged from dirty generator power. It also charges your battery bank directly so the generator does not need to carry the load of your entire home.

If you have a large whole home standby generator you can integrate it right into the GridBoss without the need for the Chargeverter.

Solar Panels:

Next is choosing your [solar panels](#). This is the least important decision in your solar project in my opinion. Just choose a reputable manufacturer. Don't buy used panels. All black panels almost always look better if they are going to be visible. There is no benefit in buying bifacial panels unless you are installing a ground mount or tilt rack where the back of the solar panels are going to be getting some sun exposure. The more panels, the better your system will perform. Go big or go home.

When stringing your solar panels together you will need to determine the max string voltage allowed on your DC inputs. Then you will need to use the open circuit voltage(VOC) of your solar panel to determine the max number of panels that you can string up in series. Exceeding this number will cause irreparable damage to your inverter. Colder climates will require shorter strings since voltage increases as temperature decreases. You will also want to make sure your strings have enough panels in series to meet the minimum MPPT voltage per string. Failure to meet this requirement could cause your strings not to produce power under certain conditions. I recommend using a solar stringing calculator such as [this one](#) to simplify the design process and make sure you are within tolerance.

Rapid Shutdown Compliance:

If you live in the United States and are planning on getting your system permitted and inspected, any solar panels that are roof mounted on a habitable building will need to be rapid shutdown compliant. EG4 systems have some great built in RSD functionality but they are not rapid shutdown compliant right out of the box. The easiest way to make a roof mounted solar array RSD compliant is to add Tigo MLPEs to your array. Tigo has many different options depending on your needs. If all of your panels on each string are facing the same direction, with no shading issues, and you do not want panel level monitoring, the Tigo [TS4-A-F](#)(one per solar panel) or Tigo [TS4-A-2F](#)(2 per solar panel) are great options for RSD compliancy only. If you want RSD compliancy, monitoring, and optimization, the Tigo [TS4-A-O](#) is your best option with any of the inverters mentioned above. Any of these Tigos will also require a [Tigo Cloud Connect Advanced - Data Logger Kit](#) and an external [rapid shutdown switch](#) located near your utility meter in order to make it function correctly and fully rapid shutdown compliant. You will also need a roll of [18 AWG 4C Shielded VNTC Tray Cable TC THHN Insulation PVC Jacket 600V](#) to run between the CCA and TAP and potentially to the RSD switch depending on your setup.

Equipment Locations

Choosing an indoor location for your equipment is always going to be the better option when possible. This keeps the equipment protected from heat, cold, weather, theft, or vandalism. This equipment cannot be located in a habitable location per the international building codes. This leaves you with unfinished basements, utility rooms, and garages. If you install your batteries in a garage be aware that many inspectors will require protection from physical damage from an oncoming vehicle. This means they

could make you install bollards or keep the batteries 3' off the ground to protect them from vehicular impact. Some AHJs will require the area to have a fire barrier such as drywall. Some will require hardwired heat and smoke detectors. In some areas you may need to abide by fire access pathways on the roof. This varies greatly depending on your local AHJ and your specific site conditions. It is best to reach out to your local permitting department prior to installation to determine their specific requirements.

Next, you will need to abide by the “working clearance” requirements of the National Electric Code. You need an invisible box in front of all serviceable equipment that is 6.5' tall, 30" wide (or the width of the equipment, whichever is greater), by 3' deep off of the face of the equipment for an electrician to be able to stand in front of the equipment and safely work on it. All equipment doors will need to open at least 90 degrees or more. For more information, research 110.26 of the NEC. You will also want to look at the “dedicated space” requirements of 110.26(e).

In order to utilize the stacked configuration with the FlexBoss line of inverters with the Indoor WallMount batteries and conduit boxes, you will need roughly an area 84.5" tall to accommodate the required equipment clearances. The width will vary depending on the number of WallMount batteries used. A 1 battery system will require 34.28" width, a 2 battery system will require 56.27" width, and a 3 battery system will require 81.06" width to account for the equipment and the required clearances.

The PV Power Source Circuit

The PV power source circuit is the DC wires running between your solar panels and your inverter. If this circuit is running outside only, it can essentially be run in any weather tight conduit. Different types of conduit have different requirements. Once it enters a habitable building it needs to be in a metallic conduit and it needs to be at least 10" below the roof decking if run in the attic. For DIYers that do not have EMT bending skills, the best 2 options are [Flexible Metallic Conduit](#) for an interior run or [Liquid Tight Flexible Metallic conduit](#) for exterior applications. If you only have 2 strings plus the Tigo comms wire, you can get by with ¾". If you have 3 strings plus the Tigo comms wire, you should probably upsize to 1". Make sure to get the [Flex Metal Conduit Connectors](#) or the [Liquid-Tight Straight Connector 3/4-Inch Conduit Fittings](#) for your terminations depending on your conduit choice. One more option some may use is [10/2 Armored Metal Clad cable](#) for each string. This is pre-filled with wire so you do not have to pull the wire through the conduit. This can simplify the installation for many DIYers that don't have a lot of experience pulling wire or people who are working alone.

Rooftop Balance of System Components

500ft 10 AWG Copper PV Wire | Black and Red

<https://signaturesolar.com/500-ft-10-awg-copper-pv-wire-black-and-red-30-amp/?ref=uzUOpPif73O10D>

Wirenco 6 AWG Solid Bare Copper Building Wire (100 FT Cut)

<https://amzn.to/4dNpZFr>

JB-1.XL Rooftop PV Junction Box, Asphalt Shingle, Black

<https://amzn.to/3XmfWjL>

IDEAL Electrical 2006S Crimp Connector (Pack of 100)

<https://amzn.to/41gfZyv>

IDEAL Electrical 2007 Splice Cap Insulator, (100-pack)

<https://amzn.to/43fH33Q>

Staubli MC4 Connectors Male and Female | 12AWG / 10 AWG

<https://signaturesolar.com/staubli-mc4-connectors-male-and-female-12awg-10-awg/?ref=uzUOpPif73O10D>

11-inch Black Zip Ties Heavy Duty UV Resistant Nylon Cable Ties

<https://amzn.to/3SBbJG0>

Weatherproof cord grip strain relief fittings

<https://amzn.to/3QYSw0f>

Assorted Wire Ferrule Kit

<https://amzn.to/4hYeYla>

Photovoltaic Solar System Installer Label Kit

<https://amzn.to/43zrF0y>

SIEMENS EC3GB212 Ground Bar Kit with 21 Terminal Positions and a Ground Lug

<https://amzn.to/4mBDdRB>

Recommended Tools

Makita XBP02Z 18V LXT Lithium-Ion Cordless Portable Band Saw

<https://amzn.to/4IGXZH4>

Makita XDT14Z 18V LXT Lithium-Ion Brushless Cordless Quick-Shift Mode 3-Speed Impact Driver

<https://amzn.to/3Gf6Xez>

Makita XPH16Z 18V LXT® Lithium-Ion Compact Brushless Cordless 1/2" Hammer Driver-Drill

<https://amzn.to/3FxUNgN>

Makita XRJ05Z 18V LXT Lithium-Ion Brushless Cordless Recipro Saw

<https://amzn.to/44zm5gE>

Makita XAG04Z 18V LXT® Lithium-Ion Brushless Cordless 4-1/2" / 5" Cut-Off/Angle Grinder

<https://amzn.to/3Z6wn4u>

BOSCH 11255VSR Bulldog Xtreme 8 Amp 1 Inch Corded Variable Speed SDS-Plus Concrete/Masonry Rotary Hammer

<https://amzn.to/43MMhY>

Greenlee 7238SB Slug-Buster Knockout Punch Kit with Hex Ratchet Wrench

<https://amzn.to/40UHL4I>

Right Angle Drill, 1/2 In, 355/750 RPM

<https://amzn.to/3WFLyFb>

Staubli Open End Spanner Set | 32.6024

<https://signaturesolar.com/staubli-open-end-spanner-set/?ref=uzUOpPif73O10D>

Klein Tools 11069S Automatic Solar Wire Stripper

<https://amzn.to/4iaY3Nj>

Klein Tools 3010CR MC4 Solar Ratcheting Crimper for 10-14 AWG Stranded Copper Wire PV Connectors

<https://amzn.to/43gboz4>

Klein Tools 21051 Large Cable Stripper (2/0-250 MCM)

<https://amzn.to/419Y2BO>

iCrimp ICP-240 Cable Stripper for AWG 12 to 4/0 Round Cables

<https://amzn.to/43iOczS>

IDEAL INDUSTRIES INC. C24 Four-Way Crimp Tool – Spring Loaded, Fingertip Adjustment Wire Crimper for Two Connector Sizes

<https://amzn.to/4iduDNW>

Greenlee 7238SB Slug-Buster Knockout Punch Kit with Hex Ratchet Wrench

<https://amzn.to/40UHL4I>

Right Angle Drill, 1/2 In, 355/750 RPM

<https://amzn.to/3WFLyFb>

LICHAMP Hydraulic Cable Lug Tool

<https://amzn.to/4InnEVd>

Klein Tools 63060 Cable Cutters

<https://amzn.to/3E1r0fJ>

1/2" Drive Master Impact Hex Bit Set

<https://amzn.to/428rl49>

Need More Help? Watch the full series...

[EG4 FlexBoss21, GridBoss, and Indoor WallMount Battery Installation - Part 1](#)

[EG4 FlexBoss21, GridBoss, and Indoor WallMount Battery Installation - Part 2](#)

[EG4 Flexboss21, Gridboss, and Indoor Wall Mount Battery Installation - Part 3](#)

[EG4 FlexBoss21, GridBoss, and Indoor WallMount Battery Installation - Part 4](#)

[EG4 FlexBoss21, GridBoss, and Indoor WallMount Battery Installation - Part 5](#)

[EG4 FlexBoss21, GridBoss, and Indoor WallMount Battery Installation - Part 6](#)

[EG4 Chargeverter Installation for Standby Generator Integration](#)