

## MNPV Installation Instructions



The MNPV6 combiner is rated for outdoor use. Designed for combining PV strings up to 150VDC and 120 amps total using breakers, or high voltage strings using 10mm x 38mm fuses up to 80 amps total. The use of touch safe din rail mount fuse holders and fuses allow operation up to 600 Volts. The MNPV6 combiner comes with two copper bus bars. One for circuit breakers and one for fuses. The MNPV3 busbar is designed for circuit breakers or fuses. The MNPV3 busbar is rated for 60 amps total.

### Applications:

PV combiner up to six strings using MNPV breakers rated for 150VDC. 120 amps total output  
 PV combining up to four strings using 600VDC fuses and MNTS touch safe fuse holders rated for 600VDC  
 DC load center using MNPV breakers

### Features:

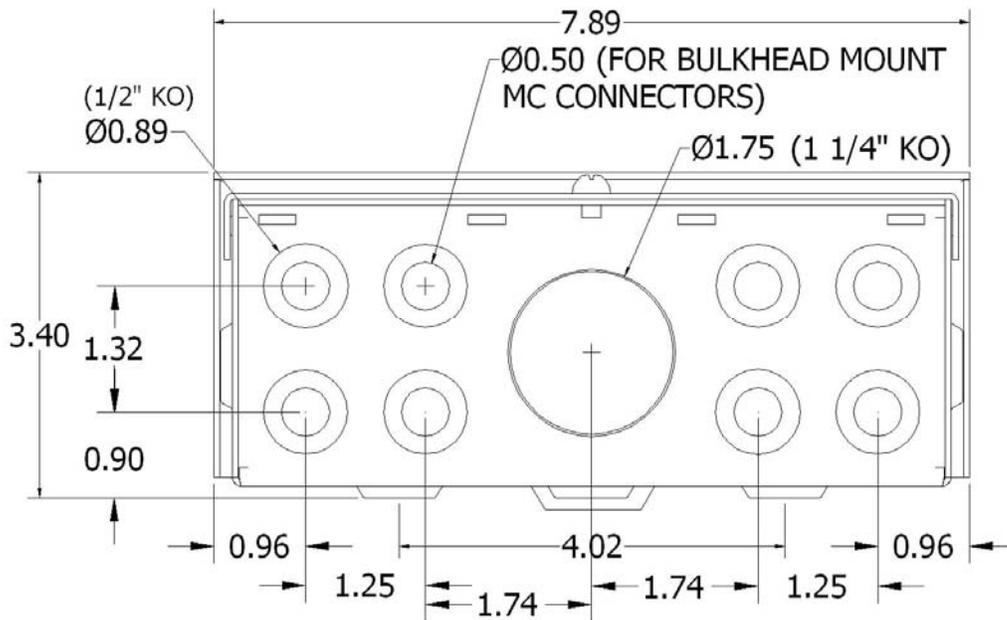
- All aluminum powder coated housing that won't rust
- Flip up cover that can stay in the open position during installation
- PV Negative bus bar with 14 useable openings (10 #14-6 and 4#1/0-14)
- Chassis ground bus bar with 14 useable openings (10 #14-6 and 4#1/0-14)
- Standard din rail to mount up to 6 breakers or 4 fuse holders
- Tin plated copper bus bar to combine breaker outputs (MNPV6 busbar may be split in two)
- Dead front cover snaps into place after wiring is complete for safety
- Knock outs for PV in and PV out on bottom and sides
- Top surface is available to bring conduit in from directly above the enclosure

**Note: The plastic dead front fits very tight. You must first remove the lid in order to remove the dead front.**

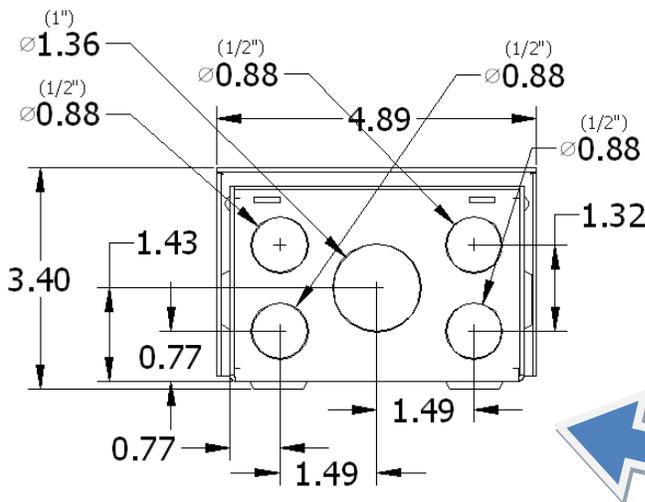
# MNPV Installation Instructions (continued)

The installation of a PV combiner is fairly straight forward. Select the location to install your combiner first. Some systems have the PV modules located close to the inverters and or battery system. If this is the case, you can elect to mount the MNPV inside and run each PV string down to the MNPV inside the house. This is convenient for trouble shooting and upgrading. For longer runs the combiner will be mounted outdoors on the pole for pole mounted PV arrays or similar mounting for rack mounted arrays. The combiner can be mounted in the vertical position or slanted backwards to accommodate up to a 3/12 roof pitch. All unused holes should be blocked using RTV sealant or some similar goop in order to keep rain and insects out of the enclosure. Care must be taken to insure that no water will get on terminal busbars when mounted less than vertical.

The following dimensioned drawings show the location and size of knockouts available on the MNPV3&6. Note that on the MNPV6 the center bottom knock out is sized for a 1 1/4" conduit adapter. The left and right side each have a 1/2" knock out for either wire entry or for lightning arrestors. Follow directions above when using side knockouts. Lightning arrestors may require a locknut on the outside in order to clear the lid.



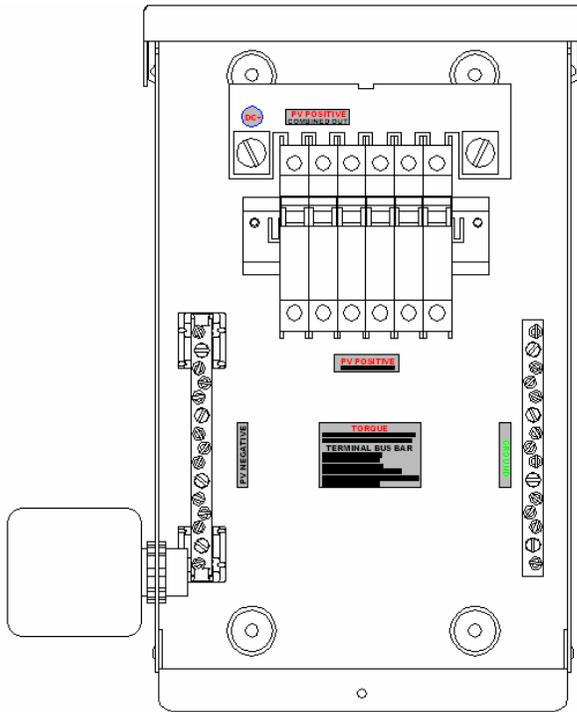
**MNPV6 & MNPV6-250 Bottom conduit locations and sizes**



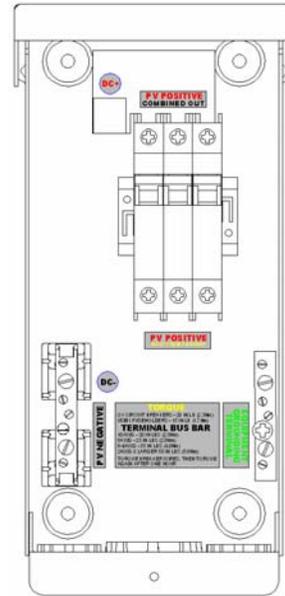
MNPV3 bottom conduit locations



# MNPV Installation Instructions (continued)



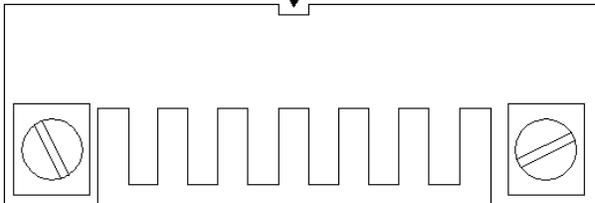
MNPV6 shown with breakers & lightning arrestor



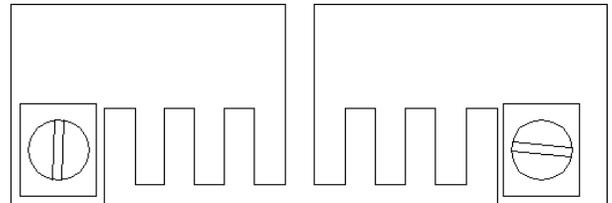
MNPV3 with 3 brkrs

The MNPV6 enclosure can be split into two sections. This is sometimes done in 12 and 24V systems where more controllers are required for additional power. For instance in a 24 volt system using the MX60 charge controller, you are limited to about 1600 watts of PV per controller. If using Kyocera KC130 modules, you can make three strings of 4 modules in series. This adds up to 1560 watts per controller. That is a good match of PV vs. controller capability. The MNPV3 can accommodate this arrangement directly, but the MNPV6 can accommodate two of these systems, thus saving wiring, space and money. See the following figure on splitting the busbar into two systems.

CUT SLICE OUT OF BUSBAR TO ACCOMMODATE TWO CONTROLLERS EACH CONTROLLER CAN HAVE THREE STRINGS OF PV MODULES



THIS PROVIDES TWO SEPARATE PLUS OUTPUTS TO FEED INTO TWO CONTROLLERS. NEGATIVE BUSBAR IS COMMON IN THIS CONDITION. CHECK TO INSURE YOUR CONTROLLER CAN USE COMMON NEGATIVES



When selecting breakers for use with the MidNite combiners, first check with the PV manufacturer to determine the proper “series fuse”. The term fuse is used even though you are probably using breakers. This is a carry over from UL terminology.

# MNPV Installation Instructions (continued)

MidNite Solar offers PV combiner breakers rated at **150VDC and 300VDC**. The 150V breakers come in these amp ratings. 1,2,3,4,5,6,7,8,9,10,12, 15, 20, 30,40,50 and 63. Other sizes are available on special order.

Part numbers for breakers are as follows:

MNEPV10, MNEPV15, MNEPV20 etc.

The 300VDC breakers are twice as wide as the 150 volt versions. The wire input and output are located on the top side. These breakers come in 7,10,12,15,20,30 and 50 amps. Part numbers are MNEPV15-300 etc.

Polarity of the din rail DC breakers **IMPORTANT!** The DC breakers supplied by MidNite Solar are custom manufactured in Lesotho Africa by CBI. These breakers are polarity sensitive. This means that they need to be installed correctly in order to insure that they will be able to trip if called upon to do so. In a PV combiner the + sign marked on the breaker connects to the PV positive output. The same breaker when hooked up to the battery circuit (not in a PV combiner) hooks up a little different. The + sign hooks up to the battery plus. This hook up is not obvious. The + sign designates the highest potential should be connected there. This is an easy one to determine in a PV combiner. Follow the current path through the combiner, into the PV input of a charge controller and out of the controller to an output breaker and then into the battery plus. You would think that the end of the output breaker connected to the controller would be at a higher potential than the battery plus. In normal operation this is true. The main job of this output breaker is to trip when and if there is a catastrophic failure. (Any manufacture of power electronics will tell you that power electronics can fail). If the output breaker fails to trip, you are at risk of fire from the output wires burning up. When a charge controller fails, they always short from positive output to negative output. Since these two terminals inside the charge controller are normally connected up to a very large battery bank, you have a direct short across the battery bank if the controller fails. During this condition, the controller is acting like a piece of wire. The battery positive terminal is the highest potential! Make sure that the plus (line) of the breaker is connected to the battery plus terminal. If the breaker is connected backwards, it can fuse in the closed position as it attempts to open. That could ruin your entire day!

The MidNite MNPV6 can also utilize touch safe fuse holders and fuses rated for up to 600 volts DC for high voltage strings. The MNPV6 comes with a special busbar that has four legs to accommodate four of these USM1 type fuse holders made by Ferraz Shawmut. Fuses are available from 1 to, 30 amps. (80 amps total) These devices are not polarity sensitive, but do not open them under load. You **WILL** have a fire on your hands!



USM1 Fuse touch safe fuse holder



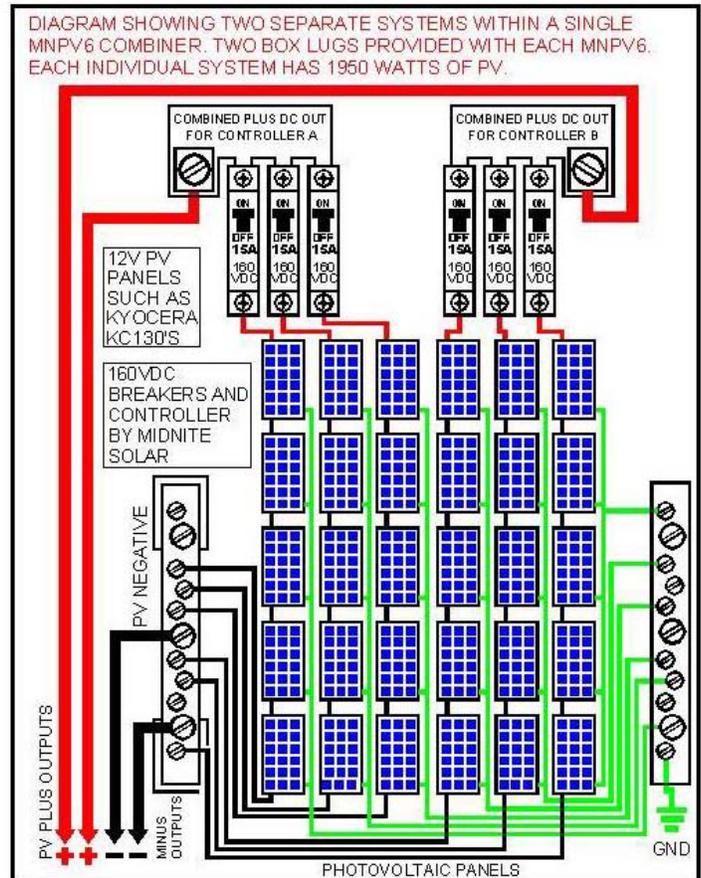
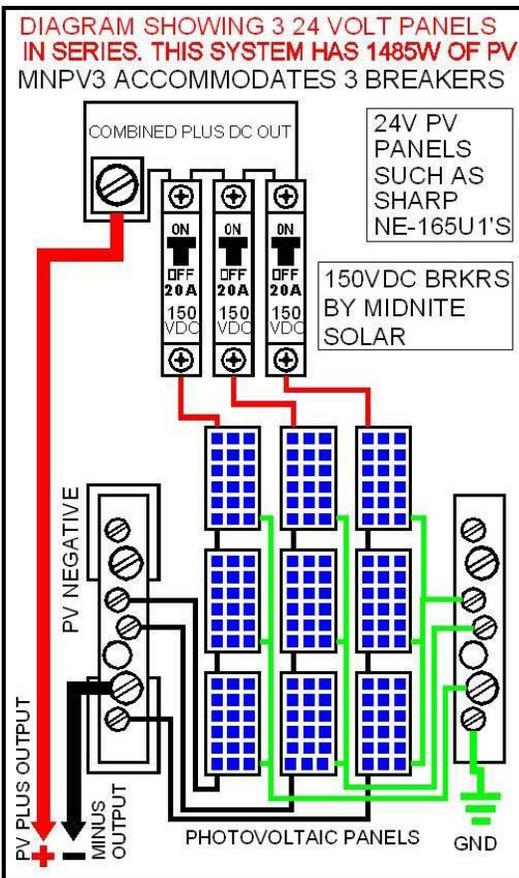
3-079-1 Busbar, Fuse Holder

The following wiring diagrams are intended to help you decide which type of combiner installation to do. There are numerous ways to hook up a PV array. There are no “best” or “correct” ways to accomplish this. They all have merit. For instance if the battery bank is 24 volts and you have six 24 volt PV modules, what

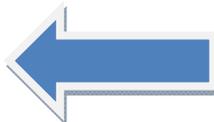
# MNPV Installation Instructions (continued)

would be the best way to wire them? For this installation we will assume an MX60 or similar charge controller that allows the freedom to change PV array voltages.

1. This array could have all 6 panels hooked in parallel using the MNPV6 combiner and 6 MNEPV15 breakers. This array would be ok if situated close to the battery bank. It requires larger wires than higher voltage arrays, but has the advantage of temporarily directly connection to the battery bank in case the controller fails. You can also substitute a PWM controller for the MPPT in the event it becomes necessary.
2. The array could be wired in three strings of two panels in series for a 48 volt nominal array. This is a very common installation and could be made in the MNPV3 with 3 breakers. This hook up is safe from a cold VOC standpoint, but you cannot directly connect it to the battery bank. You cannot easily hook up a PWM controller either. If the PV array is between 30 and 100 feet from the battery bank, this hook up may offer the best power production.
3. The array could also be hooked up in two strings of three modules in series. The MNPV3 and two breakers will accommodate this array. You have room to grow this system without adding another combiner if only three more modules are added later. Combiners can also be combined for additional power, so if six modules or more get added later, you can simply add an additional MNPV3. When putting three 24 V modules in series you must pay attention to VOC during cold spells so that you do not over voltage the controller. MidNite Solar breakers are all rated for 150 volts DC which is higher than any present MPPT controller (2006). This configuration works very well especially when the array is far away from the battery bank. You can sometimes save enough money on reduced wire size to pay for an MPPT charge controller.



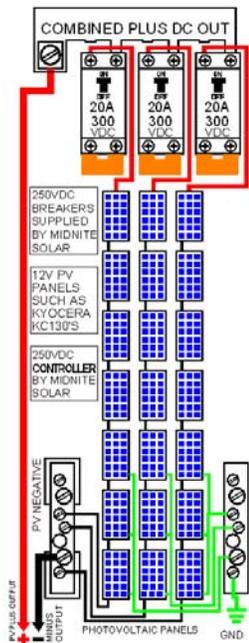
To remove the dead front: Pry off the lid as shown using something like a screwdriver as a lever. The dead front will then come out easily.



# MNPV Installation Instructions (continued)

The picture on the right is from Lance Barker. It shows an MNPV6 with a MidNite Solar DC-GFP installed inside along with two combiner breakers.

This is a novel use of the DC-GFP in the combiner enclosure. The use of din rail mount breakers makes for real flexibility. 18” trenching is reduced to 12” when a DC-GFP is on the PV end of the trench. 2008 NEC article 300-wiring methods 300.5 page 70-129 , table 300.5 minimum cover requirements, 0 to 600 volts, burial in millimeters (inches) column 4: residential branch circuits rated 120 volts or less with GFCI protection and maximum over-current protection of 20 amps or less. Lance’s inspector used the working voltage rather than max voltage in his determination. Lance was digging in a rocky area, so this trick made the job possible. You would not be allowed to reduce the trench depth if using a 200 or 250 volt controller and PV array.



This is a special configuration that is possible with the MidNite Solar Classic charge controller. Note that in order to use 300VDC breakers you will need the MNPV6-250 or the MNPV12-250 combiner. 300VDC breakers take up two spaces. The MNPV6-250 holds three breakers. The MNPV12-250 holds six breakers.



MNPV3 and MNPV6

3 Fuse holders in deadfront shown with the fuse adapter installed



Fuse holders in enclosure