



MNPV12 & 16 Combiner Instructions



SAVE THESE INSTRUCTIONS

Applications:

- PV combiner up to 16 strings using MNPV breakers rated for 150VDC. 120 amps total output
- PV combiner up to 12 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. Won't rust or degrade due to sun exposure
- Flip up cover that can stay in the open position during installation
- PV Negative bus bar with openings for #14-6 and #1/0-14
- Chassis ground bus bar with #14-6 and #1/0-14 wire openings
- Standard din rail for mounting breakers or fuse holders
- Tin plated copper bus bars to combine breaker and fuse holder outputs
- Dead front cover snaps into place after wiring is complete for safety
- Knock outs for PV in and PV out on bottom and sides
- PV IN knockouts are 1/2" & 7/8" concentric to allow for bulkhead mount MC connectors or strain reliefs
- Top surface is available to bring conduit in from directly above the enclosure

IMPORTANT SAFETY INSTRUCTIONS

Save these instructions – This manual contains important instructions for Models MNPV12, MNPV12-250, MNPV16, MNPV16-250

If you do not fully understand any of the concepts, terminology, or hazards outlined in these instructions, please refer installation to a qualified dealer, electrician or installer. These instructions are not meant to be a complete explanation of a renewable energy system.

GENERAL PRECAUTIONS

WORKING WITH OR IN THE VICINITY OF A LEAD ACID BATTERY, SEALED OR VENTED IS DANGEROUS. VENTED BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION. FOR THIS REASON, IT IS VERY IMPORTANT THAT BEFORE SERVICING EQUIPMENT IN THE VICINITY OF LEAD-ACID BATTERIES YOU REVIEW AND FOLLOW THESE INSTRUCTIONS CAREFULLY.

If service or repair should become necessary, contact MidNite Solar Inc. Improper servicing may result in a risk of shock, fire or explosion. To reduce these risks, disconnect all wiring before attempting any maintenance or cleaning. Turning off the inverter will not reduce these risks. Solar modules produce power when exposed to light. When it is not possible to disconnect the power coming from the Photovoltaics by an external means such as a combiner, cover the modules with an opaque material before servicing any connected equipment.

Never attempt to charge a frozen battery.

When it is necessary to remove a battery, make sure that the battery bank disconnect breaker is in the off position and that the PV breakers, grid breakers and any other sources of power to the inverter are in the off position. Then remove the negative terminal from the battery first.

To reduce risk of battery explosion follow these instructions and those published by the battery manufacturer as well as the manufacturer of any additional equipment used in the vicinity of the batteries. Before installing the battery enclosure, read all instructions and cautionary markings in or on any connected electrical equipment.

Avoid producing sparks in the vicinity of the batteries when using vented batteries. Provide ventilation to clear the area of explosive gases. Sealed AGM and Gel batteries do not under normal conditions create explosive gases. Be especially cautious when using metal tools. Dropping a metal tool onto batteries can short circuit them. The resulting spark can lead to personal injury or damage to the equipment. Provide ventilation to outdoors from the battery compartment when installing vented batteries such as golf cart T-105 batteries. The addition of a spill tray is also a good idea.

Clean all battery terminals. Very high currents are drawn from the batteries; even a small amount of electrical resistance can result in overheating, poor performance, premature failure or even fire.

Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes. Wear complete eye and clothing protection. Always avoid touching eyes while working near batteries. If battery acid or battery terminal corrosion contacts skin or clothing, wash immediately with soap and water. If acid enters the eyes, immediately flood with cool running water for at least 15 minutes and get medical attention immediately. Baking soda neutralizes battery acid electrolyte. Keep a supply near the batteries.

Do not work alone. Someone should be in the range of your voice or close enough to come to your aid when you work with or near electrical equipment.

Remove rings, bracelets, necklaces, watches etc. when working with batteries, photovoltaic modules or other electrical equipment. Power from an illuminated photovoltaic array makes a very effective arc welder with dire consequences if one of the welded pieces is on your person.

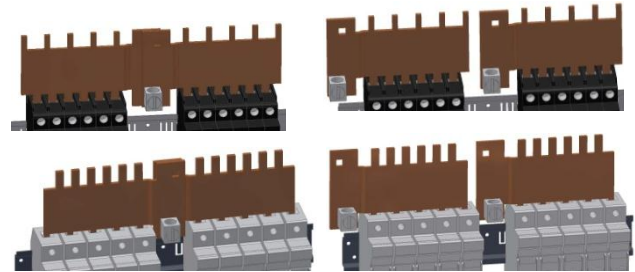
To reduce the risk of injury, connect only deep cycle lead acid type rechargeable batteries. Other types of batteries may leak or burst, causing personal injury or damage.

MNPV12 & 16 Combiner Instructions (continued)

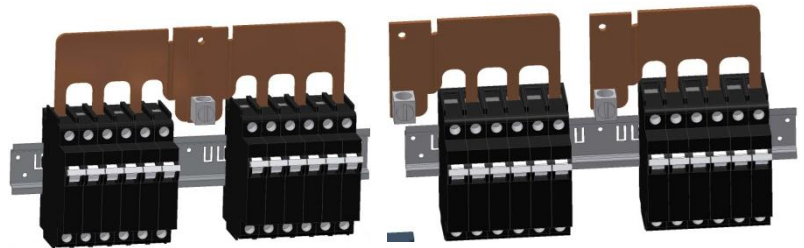
Configurations:

The MNPV12 and MNPV16 combiners are listed for outdoor use. These PV combiners are designed for combing PV strings up to 150 & 300 VDC using MNEPVXX circuit breakers, and up to 600VDC using MNTS touch safe fuse holders.

The **MNPV12** comes with a 200 amp plus busbar that works with up to ten fuse holders or twelve 150VDC circuit breakers. Two busbars can be joined together, or separated to create two systems up to 5 strings of fuse holders or 6 strings of breakers each. The pictures to the right show breakers on the top row and fuse holders on the bottom row.

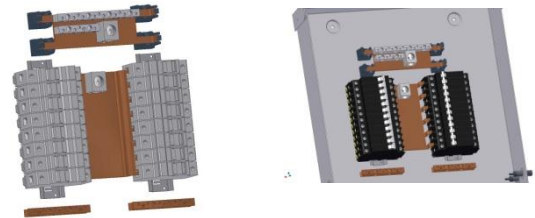


The **MNPV12-250** comes with 168 amp busbars that work with up to six of the MidNite 300VDC breakers. The MNPV12-250 busbars may be joined to accommodate 6 strings or separated for two independent sets of three strings.



The **MNPV16** comes with a 240 amp plus busbar to accommodate up to 16 touch safe fuse holders.

The **MNPV16-250** comes with a 240 amp plus busbar that accommodates up to twelve 300VDC circuit breakers.



Note: The amperage rating of the plus busbars is noted above to help insure that the maximum current rating is not exceeded in any field configuration.

The MNPV series of combiners may be used as a DC load center as well as a PV combiner.

Note: Touch safe fuse holders should never be opened under load! This is not one of those warnings to gloss over! If opened under load, you **WILL** have a fire and it will not stop until the wires burn in half. There is a good reason we make the enclosures out of metal.



Above: An example of why these instructions should be followed.

| Torque – Terminal Bus Bar | |
|---|-------------------|
| Tighten Bus Bar connections as follows: | |
| 10AWG | 20 in-lbs (2.3Nm) |
| 8AWG | 25 in-lbs (2.8Nm) |
| 6AWG | 35 in-lbs (4.0Nm) |
| 4AWG | 45 in-lbs (5.1Nm) |
| 2AWG – 1/0 | 50 in-lbs (5.6Nm) |



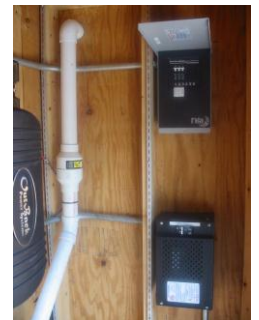
This symbol indicates a ground connection.

MNPV12 & 16 Combiner Instructions (continued)

| Model | Max VDC | PV Source Circuits | | | | PV Output Circuits | | | Approved Mounting Orientation | Enclosure Type / Material | Listing |
|-------------|---------|----------------------|----------------------|-----------|----------------|-----------------------|------------------------|----------------|-------------------------------|---------------------------|---------|
| | | Max # of Input Circ. | Max OCPD Rating Amps | OCPD Type | Wire Range AWG | Max # of Output Circ. | Max Cont. Current amps | Wire Range AWG | | | |
| MNPV3 (LV) | 150 | 3 | 20 | CB 150V | 14-6 | 1 | 60 | 14-1/0 | 90 to 14° | 3R / Alum | UL1741 |
| MNPV3 (HV) | 600 | 3 | 20 | FUSE | 14-6 | 1 | 60 | 14-1/0 | 90 to 14° | 3R / Alum | UL1741 |
| MNPV6 (LV) | 150 | 6 | 20 | CB 150V | 14-6 | 2 | 120 | 14-1/0 | 90 to 14° | 3R / Alum | UL1741 |
| MNPV6 (HV) | 600 | 4 | 20 | FUSE | 14-6 | 2 | 80 | 14-1/0 | 90 to 14° | 3R / Alum | UL1741 |
| MNPV12 (LV) | 150 | 12 | 30 | CB 150V | 14-6 | 2 | 200 | 14-2/0 | 90 to 14° | 3R / Alum | UL1741 |
| MNPV12 (HV) | 600 | 10 | 40 | FUSE | 14-6 | 2 | 200 | 14-2/0 | 90 to 14° | 3R / Alum | UL1741 |
| MNPV12-250 | 300 | 6 | 50 | CB 300V | 14-6 | 2 | 168 | 14-2/0 | 90 to 14° | 3R / Alum | UL1741 |
| MNPV16 (HV) | 600 | 16 | 15 | FUSE | 14-6 | 1 | 240 | 250MCM | 90 to 14° | 3R / Alum | UL1741 |
| MNPV16-250 | 300 | 12 | 20 | CB 300V | 14-6 | 1 | 240 | 14-2/0 | 90 to 14° | 3R / Alum | UL1741 |

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 building. This is convenient for trouble shooting and upgrading. For longer runs the combiner will be mounted outdoors on a 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 bugs out of the enclosure. It is very common for critters to enter through an unused mounting hole and take up roost. They will eventually degrade the performance of your system to say nothing of the yuk factor upon discovery of their nest.

Be sure to comply with all local and national code requirements including National Electrical Code, ANSI/NFPA 70. Observe Class 1 wiring requirements. Use 14- 1/0 AWM wire in accordance with the National Electric Code based on fuse/circuit breaker protection. Combiners should be mounted with #10 or larger stainless steel hardware.



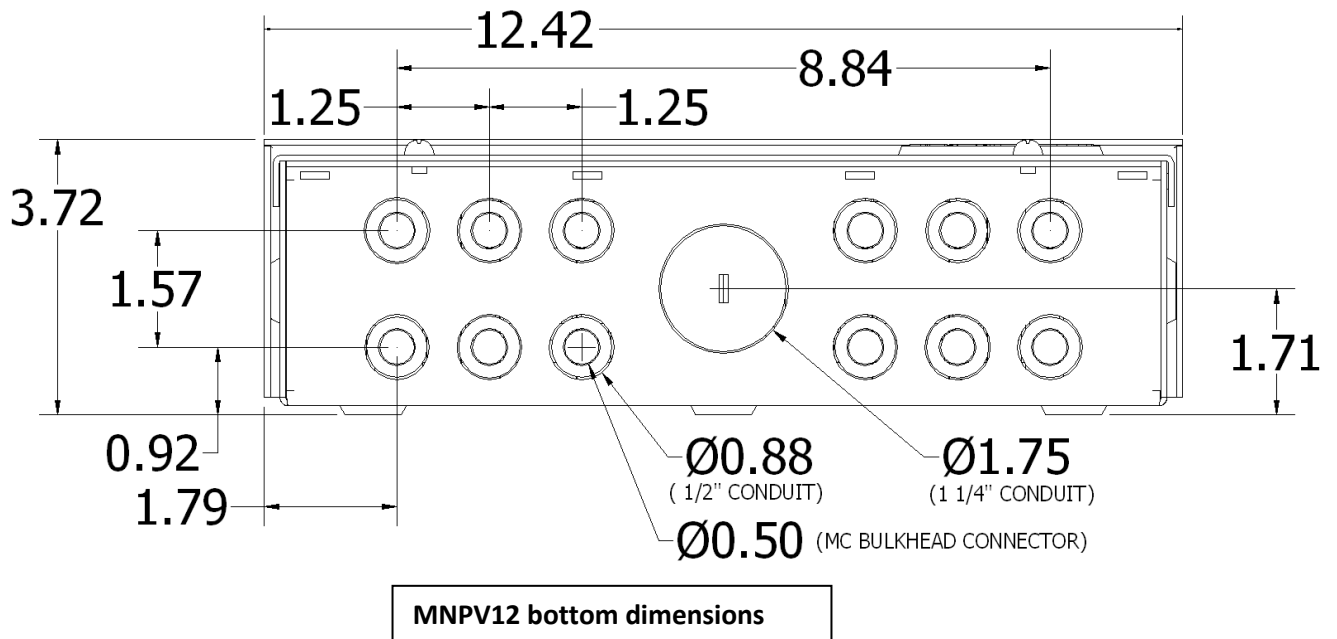
Above: Various Combiner installations



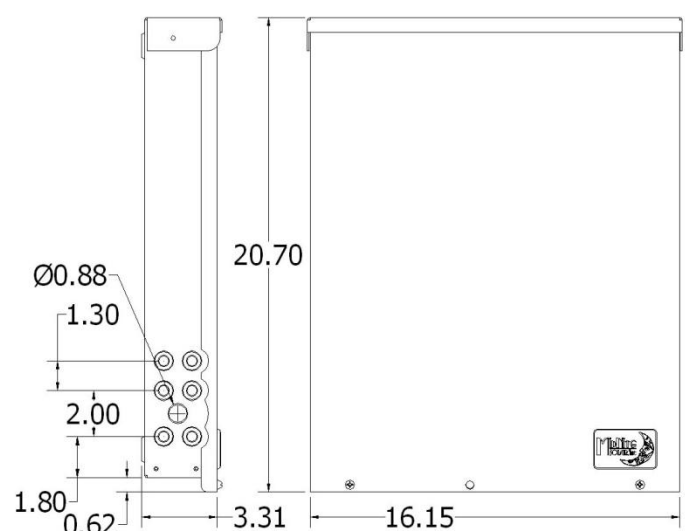
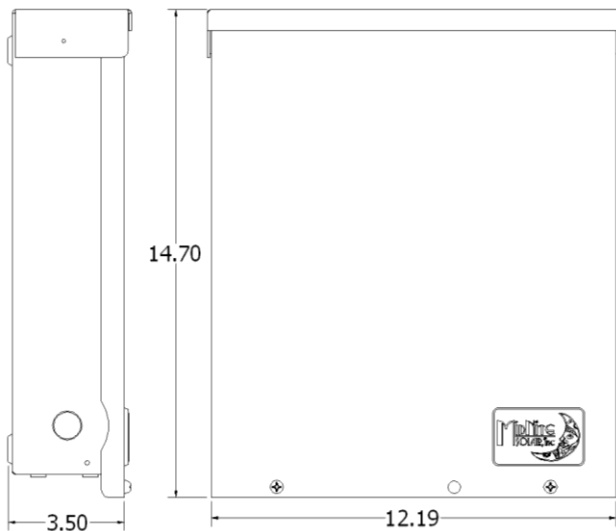
To remove the dead front:
 Pry off the lid as shown using something like a screwdriver as a lever.
 The dead front will then come out easily.

MNPV12 & 16 Combiner Instructions (continued)

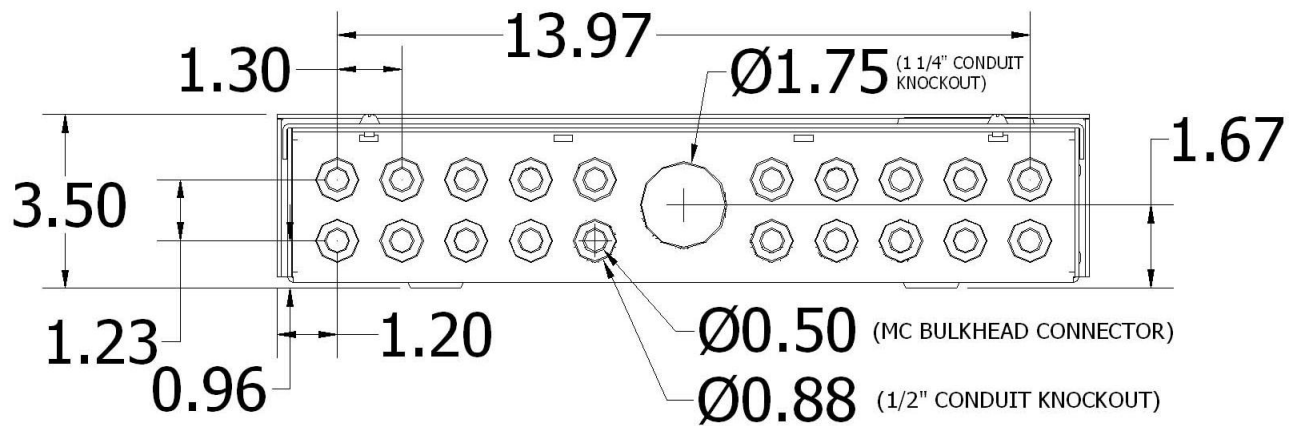
The following dimensioned drawings show the enclosure size and location of knockouts available on the MNPV12&16. Lightning arrestors may require a locknut on the outside in order to clear the lid.



Two 7/8" knockouts (1/2" conduit openings) are located on the sides of the MNPV12. These are primarily intended for lightning arrestors. One 1 1/4" conduit knockout is located on the back mounting surface.

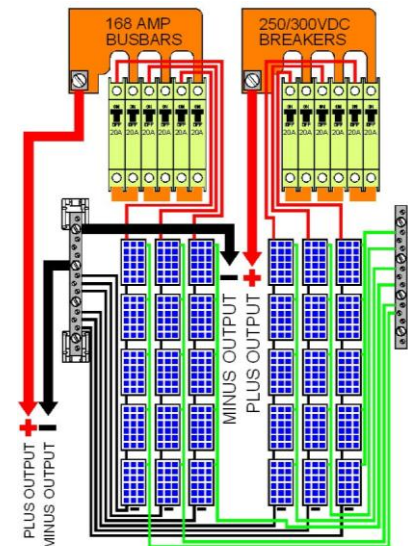
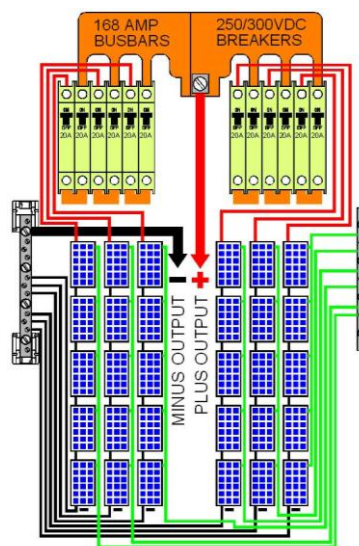
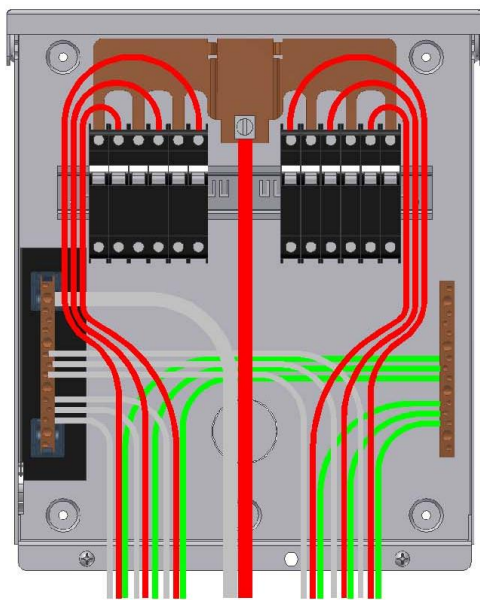
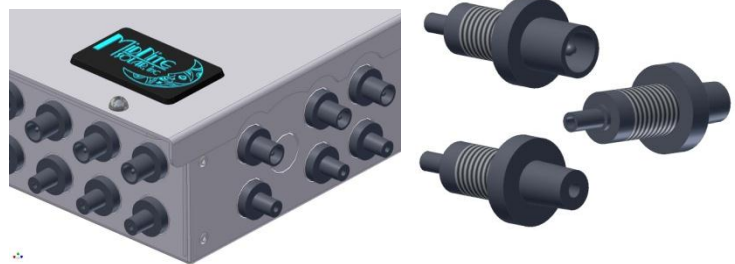


MNPV12 & 16 Combiner Instructions (continued)



MNPV16 bottom dimensions

PV input knockouts for these combiners are a dual concentric knockout that can accept bulkhead mount MC cable connectors. Configuring these enclosures with the bulkhead mount connectors in advance can save time in the field. Several brands will fit the ½" diameter knockouts.

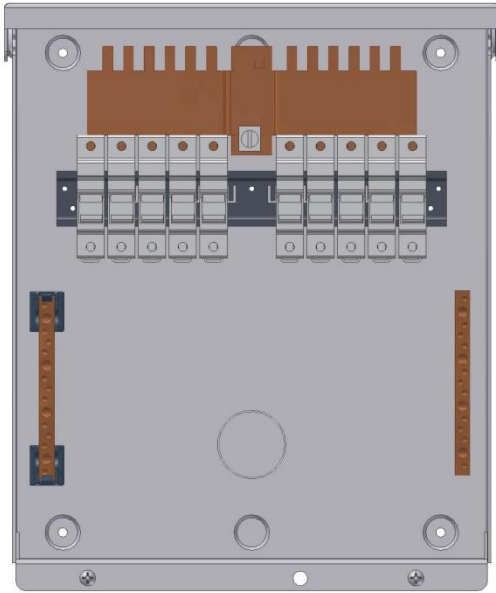


Internal wiring MNPV12-250 busbars joined

Wiring diagram for MNPV12-250 (joined & separated)

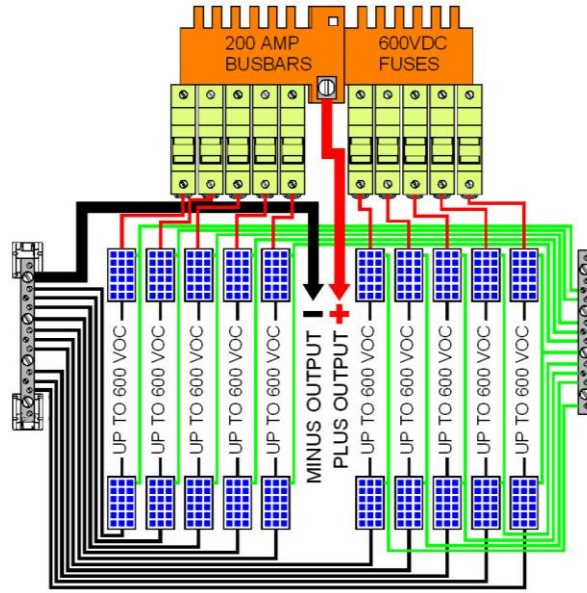
The MNPV12 has 2/0 box lugs for the plus busbars and 1/0 openings on the PV minus and ground. Note: the MNPV12-250 has special busbars that are made exclusively for the MidNite 300 volt breakers. These breakers take up the space of two regular 13mm wide breakers. The 300 volt breakers are used for high voltage off-grid PV arrays that will employ the MidNite Classic 250 MPPT controller. The 250 volt busbar is rated for up to 168 amps continuous.

MNPV12 & 16 Combiner Instructions (continued)



MNPV12 with MNTS fuse holders

The regular MNPV12 comes with a 1/8" thick reversible copper busbar. This busbar may be used with fuse holders above or with 150VDC breakers shown below. The busbars are rated for up to 200 amps.

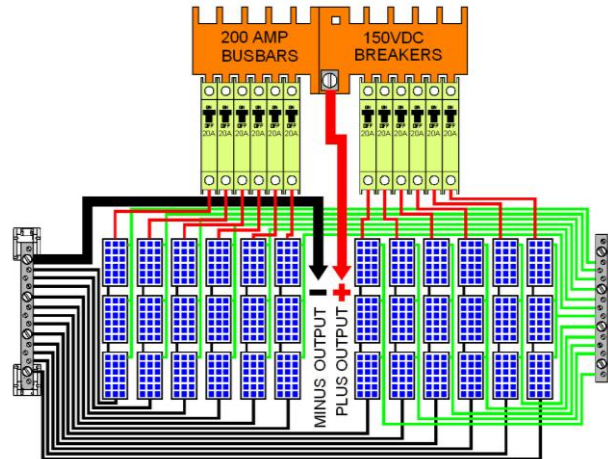


MNPV12 wiring diagram with MNTS fuse holders



MNPV12 with breakers combined

Some PV Panels now require a 20 amp series fuse (breaker). The MNPV12 can support ten high voltage 20 amp fuses or breakers. This combiner can accommodate all twelve positions when using 15 amp or less breakers.



MNPV12 breaker wiring diagram-combined busbars

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.

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

Part numbers for breakers are as follows:

MNEPV10, MNEPV15, MNEPV20 etc for 150 volt breakers. Part numbers for 300 volt breakers are MNEPV10-250, MNEPV15-250 etc.

MNPV12 & 16 Combiner Instructions (continued)

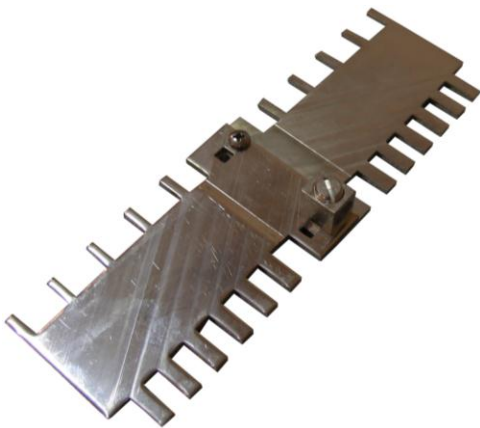
The MidNite MNPV12 can utilize touch safe fuse holders and fuses rated for up to 600 volts DC for high voltage strings. The MNPV12 comes with a special busbar that has reversible legs to accommodate ten of these USM1 type fuse holders made by Ferraz Shawmut. Fuses are available from 1 to 30 amps. Tighten fuse/circuit breaker connections to the torque indicated in the table below.

Important! Re-torque after one hour. Do not skip this step. You may be surprised by how much the connections may loosen after the initial tightening.

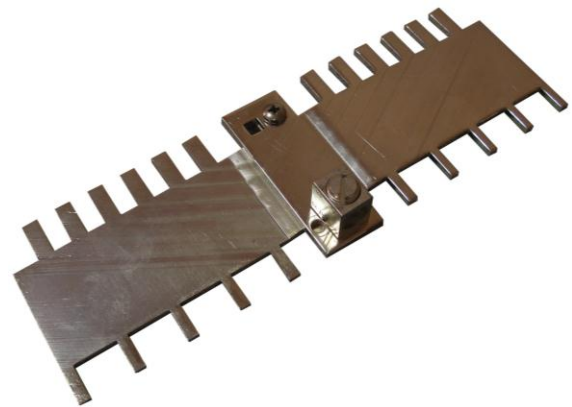


| Torque –Fuseholder / Circuit Breaker | |
|--------------------------------------|-------------------|
| QY Circuit breakers | 20 in-lbs (2.3Nm) |
| USM1 Fuseholders | 15 in-lbs (1.7Nm) |

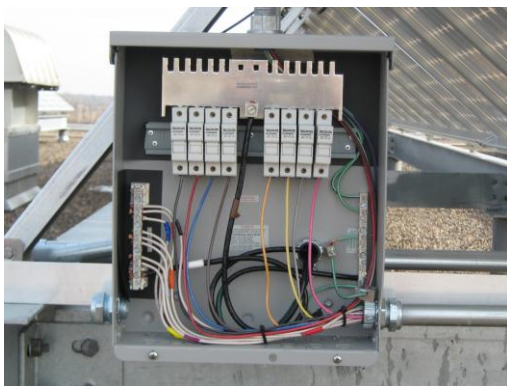
Use the hardware supplied to connect the terminal box lug to the busbars. 1 10-32 x 3/8" screw, one star washer and one box lug. Connect the top side of one busbar to the other using one 10-32 x 3/8" screw and one kepnut.



Box lug and screw placement for circuit breaker configuration



Box lug and screw placement for fuse holder configuration



Photos of the first MNPV12 installation in Minnesota. Photos compliments of Daryl Thayer

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