



# MNPV10-1000 and MNPV12 Combiner



## SAVE THESE INSTRUCTIONS

### Applications:

- PV combiner up to 12 strings using MNPV breakers
- MNPV12 = 600V Combiner using MNTS touch safe fuse holders and fuses rated for 600VDC
- MNPV10-1000 = 1000V Combiner using MNTS touch safe fuse holders and fuses rated for 1000VDC
- DC load center using MNPV breakers

### Features:

- All aluminum powder coated housing. Won't rust or degrade due to sun exposure
- Can be used with transformerless inverters
- 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, 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.

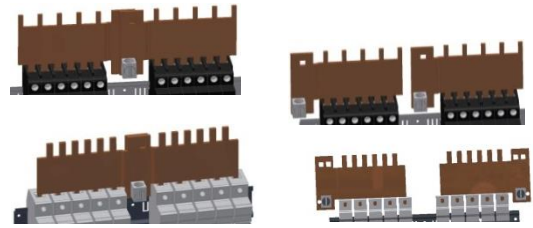
## Configurations:

The MNPV12 combiners are listed for outdoor use. These PV combiners are designed for combing PV strings up to 150 & 300VDC using MNEPVXX circuit breakers, and up to 600VDC (1000VDC on the MNPV10-1000) 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 above to the right show breakers on the top row and fuse holders on the bottom row.

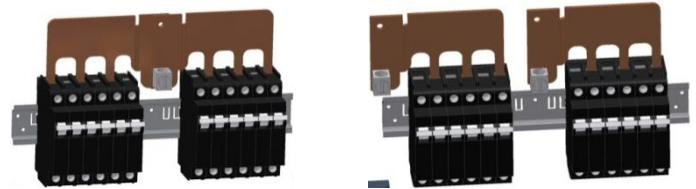


Transformerless systems of up to five strings are supported by the MNPV12 by separating the copper busbars. One set of fuses is used for the negative string inputs and one set is used for the positive string inputs.

**Note:**

The NEC requires that the ungrounded conductor(s) in from the solar panels must be overcurrent protected. Transformerless systems do not ground either the positive or the negative. That is why protection is required for both sides of the input.

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.



**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)



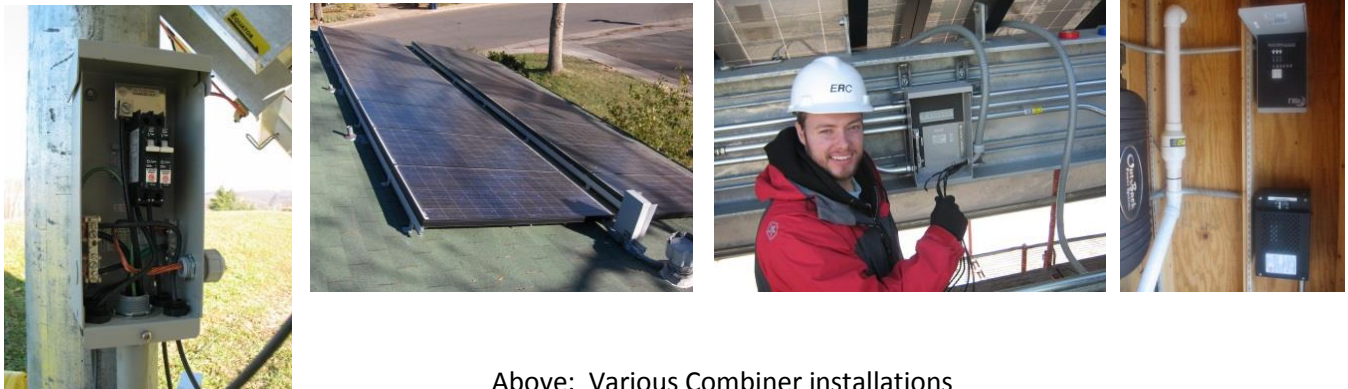
This symbol indicates a ground connection.

## Installation:

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.

**Caution!** Always ensure that the disconnect means is turned off. Never do any wiring or cleaning/maintenance while there is power in the combiner. Death, fire or serious injury can result.



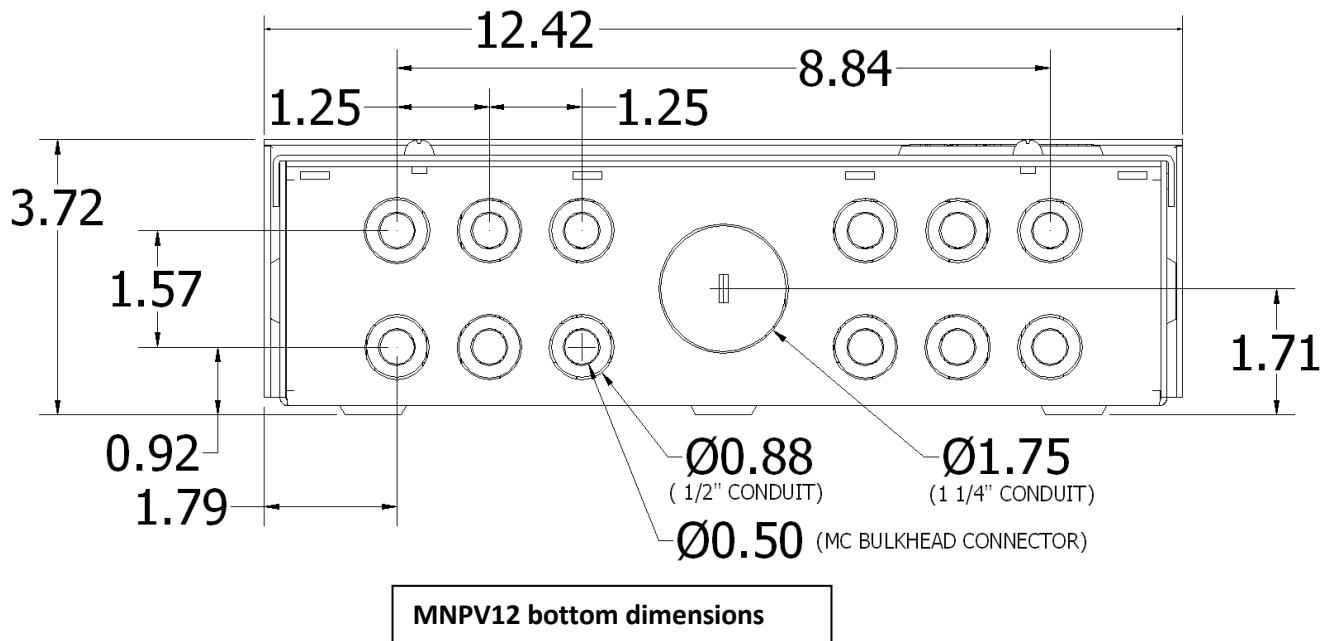
Above: Various Combiner installations



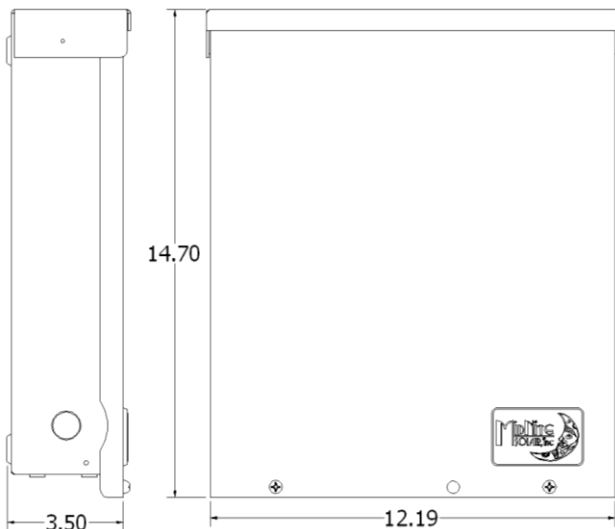
To remove the dead front:  
Pry off the lid as shown using something like a screwdriver as a lever.  
The dead front will then come out easily.

# MNPV10-1000 and MNPV12 Combiner Instructions (continued)

The following dimensioned drawings show the enclosure size and location of knockouts available on the MNPV12. Surge Suppressors 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 surge suppressors. One 1 1/4" conduit knockout is located on the back mounting surface.

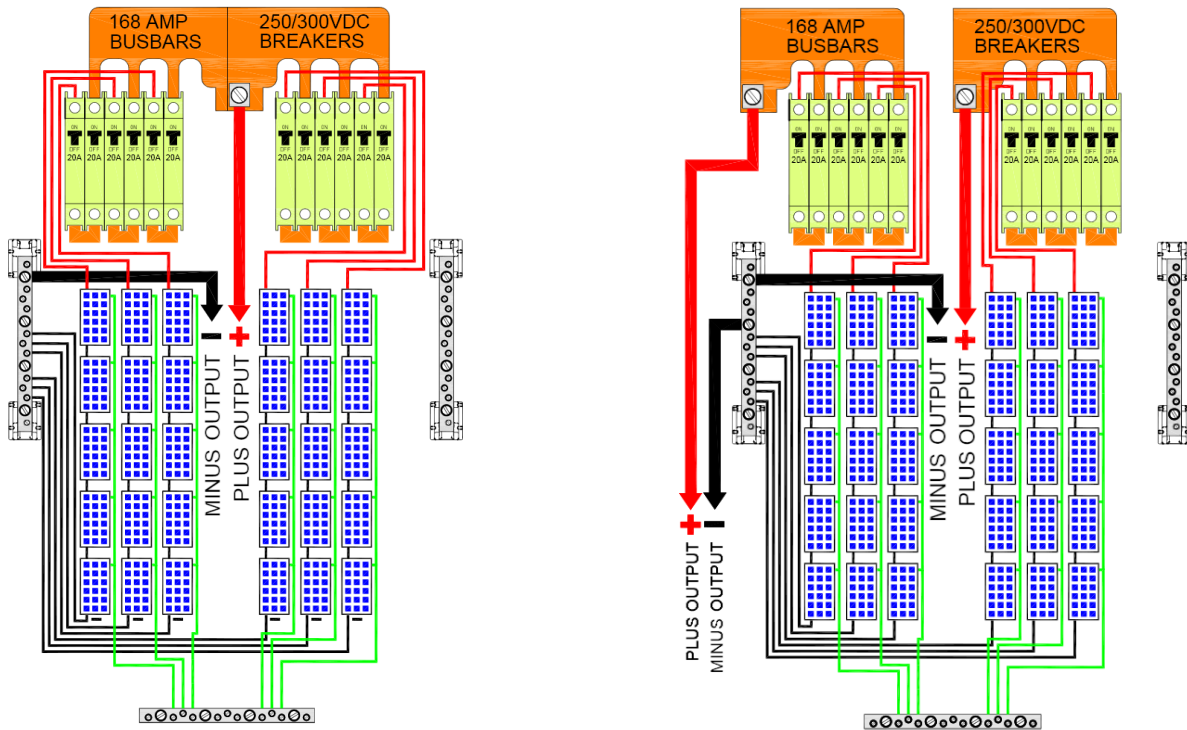


PV input knockouts for these combiners are a dual concentric knockout that can accept bulkhead mount MC cable connectors. Configuring these enclosures with the bulkhead mount connectors in advance can save time in the field. Several brands will fit the 1/2" diameter knockouts.

MNPV12 side and front dimensions

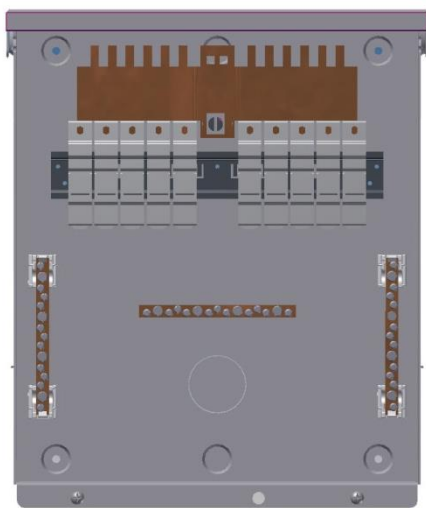


# MNPV10-1000 and MNPV12 Combiner Instructions (continued)

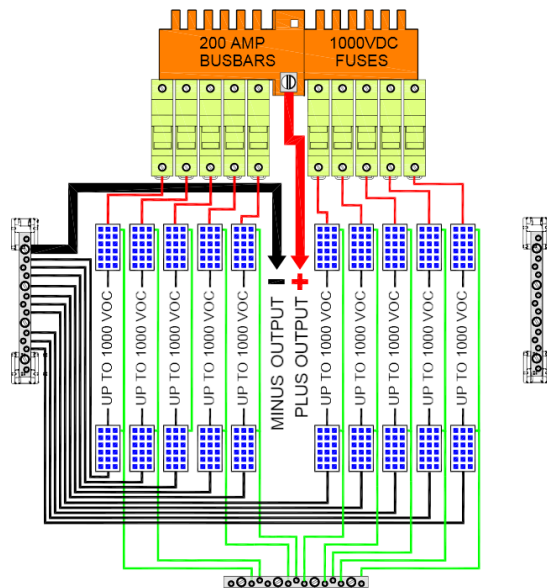


**Wiring diagram for MNPV12-250 (joined & separated)**

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 with MNTS fuse holders**



**MNPV10-1000 wiring diagram with MNTS fuse holders**

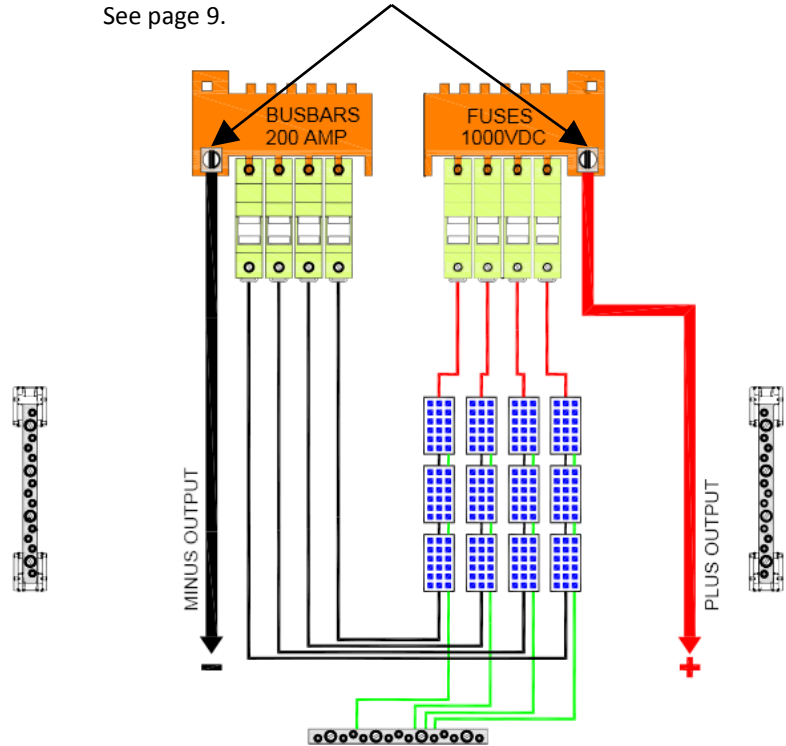


## Non-Isolated / Transformerless configuration.

In this configuration the combiner is separated into two halves. One side combines and fuses the negative and the other side fuses and combines the positive. Overcurrent protection is required by the NEC on both the positive and the negative wires in from the solar panels. The MNPV12 can accomplish this for up to five strings.

**Note:**  
The NEC requires that the ungrounded conductor(s) in from the solar panels must be overcurrent protected. Transformerless systems do not ground either the positive or the negative. That is why protection is required for both sides of the input.

Install box lug in the square hole closest to the fuses  
See page 9.

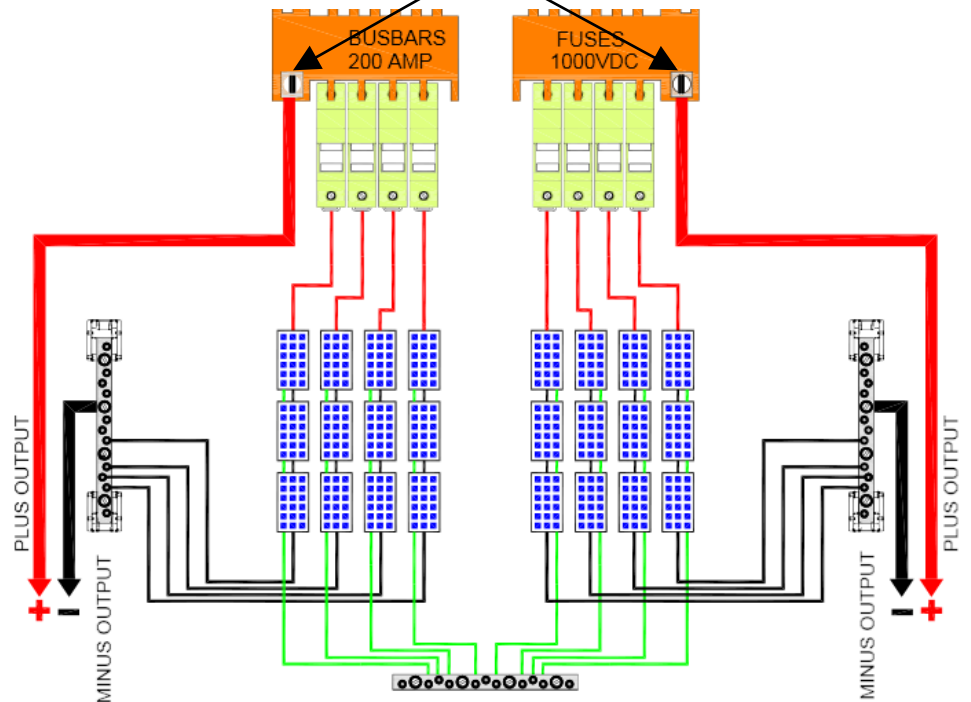


## MNPV12 Wiring for use with transformerless inverters

Install box lug in the square hole closest to the fuses  
See page 9.

### Wiring for two charge controllers.

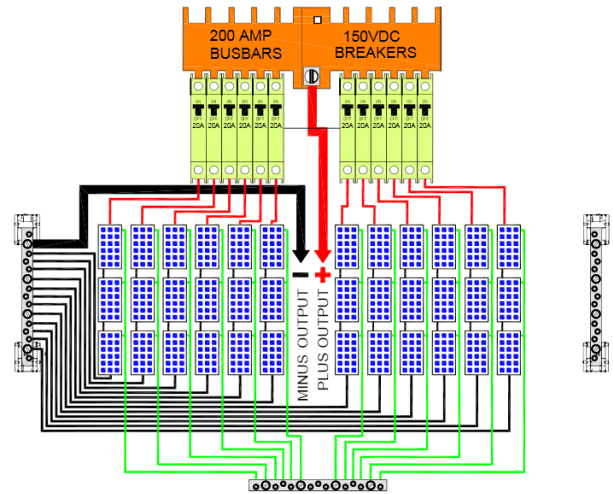
In this configuration the combiner acts as two combiners. Two separate busbars are provided for combining the negatives and the positives are fuse protected then fed into two separate busbars. The ground is common. Each half can have up to five touch safe fuseholders or six 150 Volt fuses or three 300 Volt circuit breakers



## MNPV12 Wiring for use with two charge controllers with separate negatives

# MNPV10-1000 and MNPV12 Combiner Instructions (continued)

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 with breakers combined**

**MNPV12 breaker wiring diagram-combined busbars**

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.

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.

The MidNite MNPV12 can utilize touch safe fuse holders and fuses rated for up to 1000 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 (Mersen). Use MidNite Solar 1000 Volt fuses. 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)



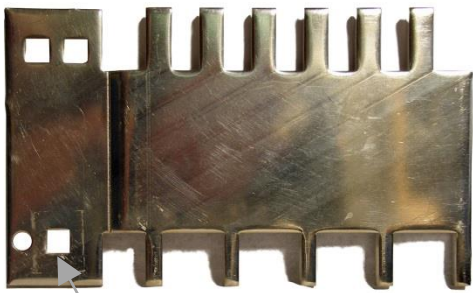


## Important notes for busbars on 1000 Volt units

Extra care must be taken with higher voltage units to ensure that safe spacing is maintained around all connections.

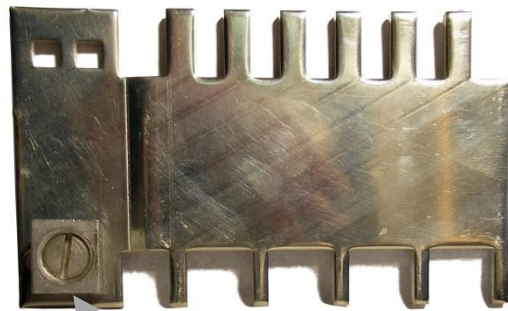
**!Caution!** Never work on a live system. Lethal voltages are present when energized. Lockout and tagout do not take chances with your life.

MNPV12 busbar as shipped



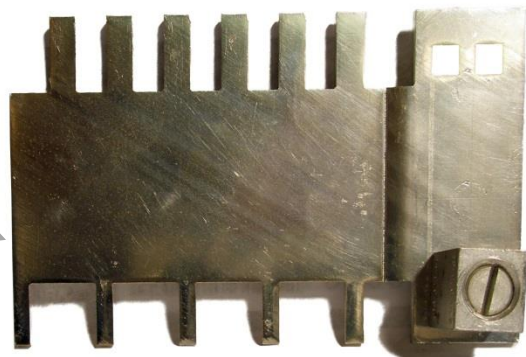
**Important:** Install the box lug in the position closer to the fuses. This is *required* to maintain safe spacing for high voltage units.

MNPV12 busbar configured for the left side of the combiner for a 600 Volt Non-Isolated transformerless installation.



Here the box lug is installed correctly in the square hole closer to the fuses.

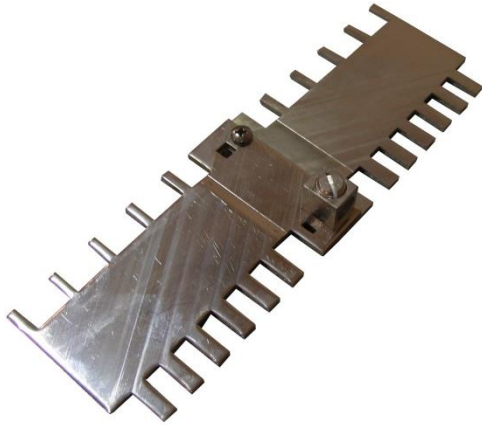
MNPV12 busbar configured for the right side of the combiner. The box lug is still positioned inward toward the fuses.



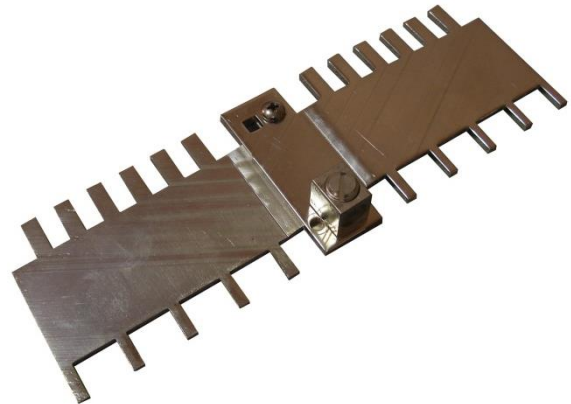
Above is the configuration for a two five string separate combiners or for a non-isolated / transformerless setup. See page 10 for setup as a single fused 10 string combiner or 12 string combiner with circuit breakers.

## MNPV10-1000 and MNPV12 Combiner Instructions (continued)

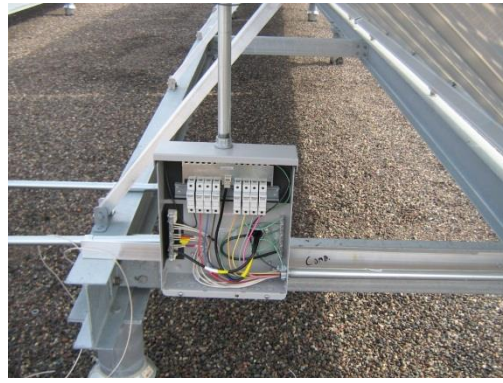
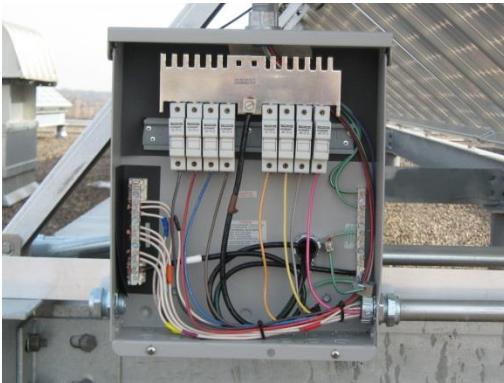
Use the hardware supplied to connect the terminal box lug to the busbars. One 10-32 x 3/8" screw, one star washer and one box lug. Connect the top side of one busbar to the other using one 10-32 x 3/8" screw and one kepnut.



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



MidNite Solar 17722 67<sup>th</sup> Ave NE Arlington, Wa 98223 360.403.7207 [www.midnitesolar.com](http://www.midnitesolar.com)