

# PV Rapid Shutdown system

## MidNite Solar String Level Sunspec PVRSE PVRSS

This manual is for the following models:

<b>MNSSR-600S</b>	600VDC String Level Sunspec PVRSE Receiver
<b>MNSSR-600S-SS</b>	600VDC String Level Sunspec Rapid Shutdown Receiver for Solar Shingles
<b>MNSST-Single</b>	Single Sunspec transmitter with dinrail mount
<b>MNSST-Dual</b>	Dual Sunspec transmitter with dinrail mount
<b>MNSST-Naked</b>	Sunspec transmitter assembled circuit board to be installed as an option

## MNSSR System Overview

### **COMPATIBLE WITH DC CHARGE CONTROLLERS!**

Rapid shutdown is a requirement in NEC 2017 Article 690.12. This requires the PV system to be shut down to a safe voltage level in 30 seconds\*. Together MNSSR and MNSST fulfill the requirements of NEC 2017 690.12.

The MidNite Solar Rapid Shutdown system is a convenient, economical way to help meet the requirements of NEC 690.12 and ensure safety for fire rescue and other emergency aid workers. The system is ready for today's requirement for module level shutdown.

Definition of terms:

**PVRSE** - Equipment intended to be used in a PVRSS to initiate, disconnect, isolate or attenuate the controlled conductors of a PV system.

**PVRSS** - System consisting of PVRSE intended to initiate in addition to disconnect, isolate or attenuate the controlled conductors of a PV system.

Each system consists of a transmitter and one or more receivers. A receiver is connected to each string. This equipment is designed to be used with strings up to 600 volts total string voltage. The transmitter, located at the PV+ entry of a grid tie inverter, generates a signal that causes the receiver to connect each string to the inverter. The receiver attenuates the string in the event of a rapid shutdown. The receiver is powered by the string to which it is attached.

The MNSSR is intended to attenuate the array as part of a rapid shutdown system and does not replace required disconnects. The MNSSR does not initiate shutdown. Removing power to the transmitter either from the service disconnect or from a switch intended for this purpose will cause the MNSSR to attenuate the array.

System Function

The transmitter generates a signal which is inductively coupled into the PV array. This signal is detected by the receivers and, if the received signal is correct, connects the module to the inverter. This ensures that the receivers only respond to a valid signal. In the absence of a valid signal, the receivers shut off. After a valid command to turn on is received, the module is connected to the inverter or charge controller. When the signal goes away, there is a delay of 5 seconds before the receivers shut off.

**MNSSR receivers have been tested and certified by ETL for use in the USA as part of a PVRSS with the following Inverters:**

#### **Growatt models:**

Using APS Sunspec transmitter

MIN3000TL-XH-US  
MIN3800TL-XH-US  
MIN5000TL-XH-US  
MIN6000TL-XH-US  
MIN7600TL-XH-US  
MIN8200TL-XH-US  
MIN9000TL-XH-US  
MIN10000TL-XH-US  
MIN11400TL-XH-US

#### **Solis models:**

USING Solis Transmitter

Solis1P3.6K-4G-US  
Solis1P5K-4G-US  
Solis1P6K-4G-US  
Solis1P7K-4G-US  
Solis1P7.6K-4G-US  
Solis1P8.6K-4G-US  
Solis1P9K-4G-US  
Solis1P10K-4G-US

Definition of terms:

**PVRSE** (Photovoltaic Rapid Shutdown Equipment) - Equipment intended to be used in a PVRSS to initiate, disconnect, isolate or attenuate the controlled conductors of a PV system.

**PVRSS** (Photovoltaic Rapid Shutdown System) - System consisting of PVRSE intended to initiate in addition to disconnect, isolate or attenuate the controlled conductors of a PV system.

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# IMPORTANT SAFETY INSTRUCTIONS

**SAVE THESE INSTRUCTIONS** - THESE INSTRUCTIONS CONTAIN IMPORTANT SAFETY AND OPERATING INSTRUCTIONS FOR PVRSE Rapid Attenuation models: **MNSSR-600S, and MNSSR-600S-SS.**

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. All installations must comply with national and local electrical codes. Professional installation is recommended.

## **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.**

**WARNING – THIS PHOTOVOLTAIC RAPID SHUTDOWN SYSTEM (PVRSS) INCORPORATES ONE OR MORE PIECES OF EQUIPMENT THAT EXERCISE THE RAPID SHUTDOWN CONTROL OF PV SYSTEM CONDUCTORS REQUIRED BY SECTION 690.12 OF THE NEC (NFPA 70). OTHER EQUIPMENT INSTALLED IN OR ON THIS PV SYSTEM MAY ADVERSELY AFFECT THE OPERATION OF THIS PVRSS. IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE COMPLETED PV SYSTEM MEETS THE APPLICABLE RAPID SHUT DOWN FUNCTIONAL REQUIREMENTS. THIS EQUIPMENT MUST BE INSTALLED ACCORDING TO THE MANUFACTURER’S INSTALLATION INSTRUCTIONS.**

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.

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.

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. Refer to the battery manufacturer's documentation. 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.

Wiring methods used shall be in accordance with the Canadian Electrical Code, Part I.

Wiring must be done in accordance with the National Electrical Code Article 690 ANSI/NFPA 70. Use Class 1 wiring methods for field wiring connections to terminals of a Class 2 circuit. Use only 14-10 gauge AWM wire. Select the wire gauge used based on the protection provided by the circuit breakers/fuses. Overcurrent protection must be installed as part of the system installation. Refer to the wiring diagrams provided in this manual for breaker/fuse sizes and model numbers.

Use of attachments or accessories not approved by MidNite Solar could result in damage or injury.

Before making any connections verify that the circuit breakers are in the off position including the inverter breaker. Double check all wiring before applying power.

# INSTRUCTIONS DE SÉCURITÉ IMPORTANTES

**CONSERVER CES INSTRUCTIONS** - CES INSTRUCTIONS CONTIENNENT DES INFORMATIONS IMPORTANTES POUR UTILISER LE PVRSE ARRÊT RAPIDE DE CELLULES SOLAIRES DES MODÈLES: MNSSR-600S, ET MNSSR-600S-SS EN TOUTE SÉCURITÉ.

Avant l'utilisez cet appareil lis et comprends toutes les instructions et avertissements.

Si vous ne comprenez pas l'une des concepts ou des instructions contenu dans cette manuel consulter un agent spécialisé.

Si des réparations sont nécessaires contactez MidNite Solar pour plus des informations. Danger de choc électrique et de risque de brulure. Rien à dépanner à l'intérieure du cette appareil. Ne pas ouvrir le couver. Pour toute réparation ou service d'entretien, consulter un agent spécialisé. Il y'a peut-être plusieurs sources d'alimentation dans cette system. Débrancher toutes les interrupteurs avant toute d'entretien où nettoyage.

Ne travaillez pas seul. Quelqu'un devrait toujours être à proximité pour aider en cas d'une situation d'urgence.

Retirer bagues, bracelets, colliers, montres, et quelles choses comme ça. Il y'a risque des blessures graves s'il y'a un court-circuit. Cela pourrait ruiner votre journée entière.

Cette appareil n'avoir pas un détecteur des fautes de terre. C'est nécessaire de emploi la protection contre des fautes de terre a l'extérieure de cette appareil en conformité avec le National Electrical Code.

Les méthodes de câblage utilisés doivent être conformes au Code canadien de l'électricité, Partie I.

Le câblage doit être fait en conformité avec le National Electrical Code Article 690 ANSI / NFPA 70. Utiliser des méthodes de câblage de catégorie 1 pour les connexions de câblage sur .des terminaux d'un circuit de classe 2. Utilisez uniquement des fils de AWM de calibre 14-1/0. Sélectionnez le type de câble utilisé sur la base de la protection prévue par les disjoncteurs / fusibles.

## Symbols used in this manual



Hazard Symbol  
Hazardous condition may exist.  
Caution required.



High Voltage Symbol  
Hazardous potentially lethal  
voltage



**WARNING:** Cancer and Reproductive Harm - <https://www.p65warnings.ca.gov/>

## Introduction. This document is for the installation and operation of the MNSSR PVRSE

**Important!** The MidNite Solar PVRSS & PVRSE are **NOT** a service disconnect nor is it intended to be used as one. The transmitter stops sending a keep-alive signal to the receiver **ONLY** when power is removed from it. a DC powered transmitter **MUST** have the DC that powers it disconnected. Power from the array will not be disconnected until this power is removed.

## Connection and Use

For the basic installation, connect the system as shown in the wiring diagram on page 8. It is possible to connect the receiver in other positions (e.g; in the middle of the string or at the furthest panel).

Either the plus or minus string wire may go through the transmitter's output coil but not both plus and minus. This would cancel any signal preventing proper operation. See Application Note 1.

Only one transmitter is required per installation. Multiple strings can be controlled by a single transmitter by passing the PV+ wire of each string through the transmitter coupling ring. See Application Note 2.

## Application Notes

### Note 1

It may be more convenient to couple the transmitter using the PV- versus the PV+, depending upon the installation.

The MNSSR receivers must be installed on every string in the system.

### Note 2

If more than one transmitter is used, each transmitter must be on a separate system without interconnections to avoid interference to other transmitters. For example two inverters powered by two separate strings would require two transmitters while a single inverter even with many parallel strings would require only one transmitter.

**To avoid nuisance tripping when multiple transmitters are used, the PV conductors connected to each transmitter should not share the same conduit or wiring enclosure.**

### Note 3

Rapid attenuation is initiated by removing power to the transmitter. The transmitter power should be connected such that when the inverter shuts down the transmitter also shuts down. Fire-fighters frequently pull the power meter to cut power to the building. In a grid tied system this should also cause shutdown of the PV array. A normally closed non-momentary "Panic button" may be installed in line with the transmitter power for manual shutdown. For off grid and other systems connect the transmitter such that removing the main power will also remove power from the transmitter, thus attenuating the PV array.

### Note 4

One or two receivers per string may be used.

**Important!** Restoring power to the transmitter will re-enable output from the PV array. Always ensure that it is safe to restore power before providing power to the transmitter.

**Important!** The Rapid shutdown system should be tested once a year as part of regular system service.

### MNSSR-600S, MNSSR-600S-SS:

MAX INPUT: 600 VDC

MIN INPUT: ~42VDC

MAX MPPT IN: 550 VDC

MAX OUTPUT 600 VDC

MAX CURRENT: 12 ADC @ 70°C |

12ADC @ 80°C | 10ADC @ 85°C

TYPE 4X ENCLOSURE

MAX AMBIENT: -40°C TO +85°C

MAX ALTITUDE: 3500 METERS

### MNSST-SINGLE

MNSST-DUAL

MNSST-NAKED

12 VDC 1 ADC MIN INPUT

12 VDC 1 ADC MIN INPUT

12 VDC 1 ADC MIN INPUT

# PV Rapid Shutdown system

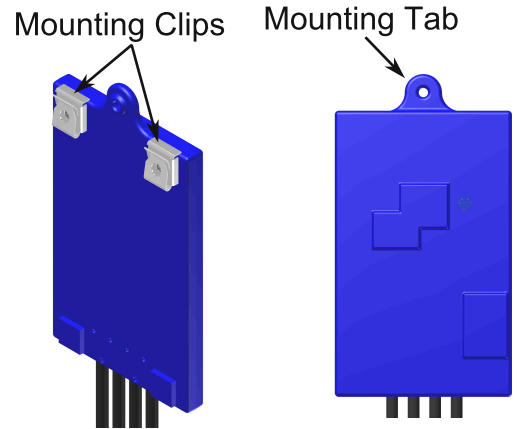
## MidNite Solar String Level Sunspec PVRSE PVRSS

### Installation and Use Guide

#### Mounting the receiver

The receiver may be mounted in two different ways. Directly to the panel by sliding the mounting clips onto the edge of a panel or by removing the mounting clips and securing the receiver with a bolt through the mounting hole on the tab of the receiver.

The receiver may be installed inside or outside of an enclosure, Indoors or out. Receivers are weather resistant and may be mounted where exposed to weather.



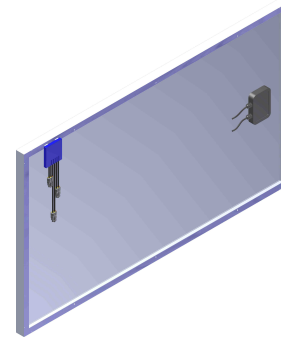
**The receiver works with all Sunspec transmitters, built into the inverter or standalone.**

**If using the MidNite Sunspec transmitter follow the mounting instructions below.**

The MNSST-SINGLE or MNSST-DUAL transmitter may be installed in or near the inverter.

The MNSST-NAKED transmitter is installed as an option on the Hawke's Bay and Barcelona charge controllers from MidNite.

**Important!** The transmitter must be installed in a protected environment such as in the inverter or similar enclosure. Do not allow transmitter wires to be exposed outside of an enclosure.

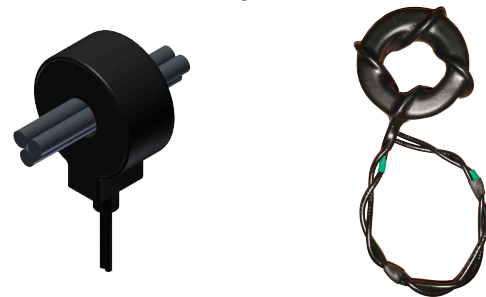


**Example of typical mounting.**



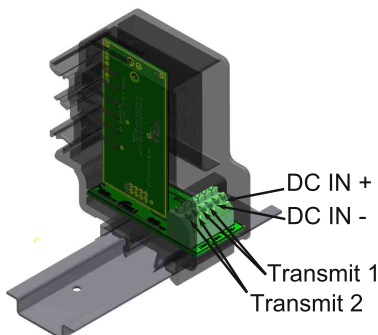
The Din Rail transmitter may be installed vertically or horizontally.

#### Transmitter output coil



**Example of PV IN wires routed through the transmitter output coil.**

See page 8 for wiring instructions.



**Terminal block wiring.**

To connect wires to the terminal block:

Insert stripped wire and push. tug gently to ensure wire is secure.

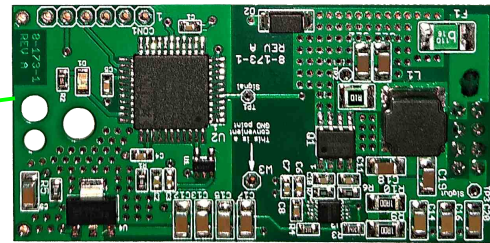
A Din Rail Power supply such as Mean Well HDR-1512 can be used to power the transmitter.

## Sunspec Transmitter Continued:

The MNSST-NAKED transmitter may be installed in a Hawke's Bay or Barcelona charge controller and future products. The MNSST-NAKED plugs into the option board and the signal coupling toroid also plugs into the option board. Then simply run the positive PV wire through the toroid and connect to the charge controller. See Application Note 1.



**Barcelona charge controller  
with option board**



**MNSST-NAKED**  
Mounts in lower position

**Signal coupling Toroid**

MNSST-NAKED uses the same circuit board as the MNSST-SINGLE and MNSST-DUAL.

### LED Meaning:

Visible through clear case of the receiver.

The Blue LED indicates the unit is powered but may not be active.

The Yellow LED shows that the unit is active (the system is enabled).



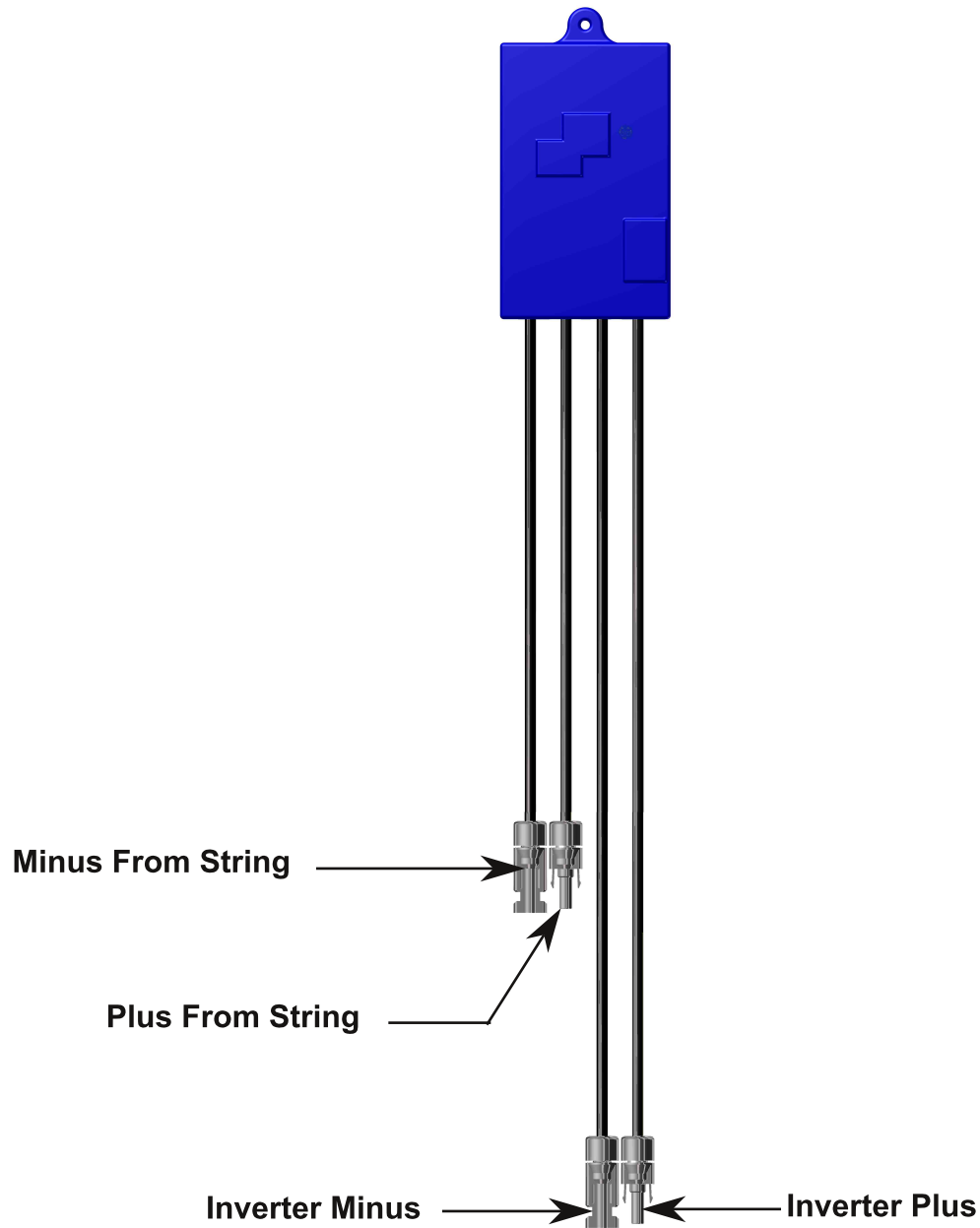
### CAUTION!

PV systems may have very high voltage.  
Always disconnect all sources of power and cover the solar panels  
before any service or maintenance.



# Installation and Wiring

MNSSR



MNSSR receivers are supplied with Stäubli MC4 connectors on the input and output. Only use MC4 mated connectors made by Stäubli, the use of connectors not originally manufactured by Stäubli may pose a safety risk.

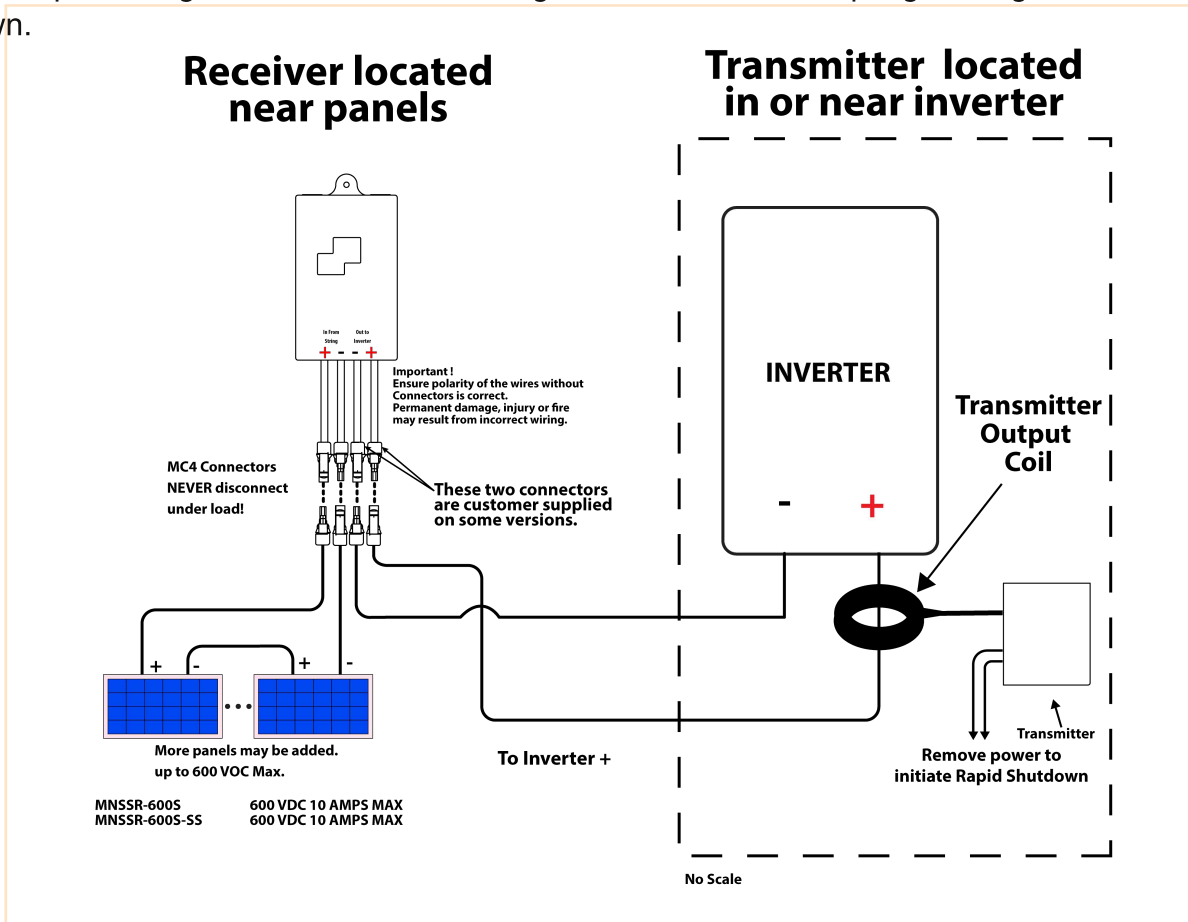
## Receiver Connections

# System Wiring

The wiring diagram below is of a simplified typical installation.

The MNSSR will work with all SunSpec compatible transmitters

The transmitter is located within or near the inverter. Either the positive or negative wire from the string (but not both) is routed through the transmitter's coupling ring. As long as the transmitter is powered, it sends a keep alive signal to the receiver through the PV wire. Interrupting this signal initiates Rapid Shutdown.



Din Rail transmitter shown.

Receivers work with all SunSpec compatible transmitters

The receiver is located near each string that is to have rapid attenuation capability.

The receiver may be installed inside or outside of an enclosure Indoors or outdoors.

During normal operation the receiver passes power. When the transmitter's signal is interrupted the receiver opens the circuit within a few seconds.

Pay close attention to the wiring diagram in this manual. If the receiver is wired incorrectly, damage **will** result!



**MIDNITE SOLAR INC. LIMITED WARRANTY**  
**MidNite Solar Power electronics**

**MIDNITE SOLAR INC. LIMITED WARRANTY**

MidNite Solar Power electronics, **(String level Rapid Shutdown Receivers and transmitters)**

MidNite Solar Inc. warrants to the original customer that its products shall be free from defects in materials and workmanship. This warranty will be valid for a period of ten (10) years for the String Level Sunpec Rapid Shutdown Receivers and Transmitters.

MidNite Solar will not warranty third party inverter components used in MidNites pre-wired systems. Those components are warranted by the original manufacturer.

At its option, MidNite Solar will repair or replace at no charge any MidNite product that proves to be defective within such warranty period. This warranty shall not apply if the MidNite Solar product has been damaged by unreasonable use, accident, negligence, service or modification by anyone other than MidNite Solar, or by any other causes unrelated to materials and workmanship. The original consumer purchaser must retain original purchase receipt for proof of purchase as a condition precedent to warranty coverage. To receive in-warranty service, the defective product must be received no later than two (2) weeks after the end of the warranty period. The product must be accompanied by proof of purchase and Return Authorization (RA) number issued by MidNite Solar. For an RMA number contact MidNite Solar Inc., 19115 62nd Ave NE, Arlington, WA 98223 (360) 403-7207. Purchasers must prepay all delivery costs or shipping charges to return any defective MidNite Solar product under this warranty policy. Except for the warranty that the products are made in accordance with, the specifications therefore supplied or agreed to by customer:

MIDNITE SOLAR MAKES NO WARRANTY EXPRESSED OR IMPLIED, AND ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEEDS THE FOREGOING WARRANTY IS HEREBY DISCLAIMED BY MIDNITE SOLAR AND EXCLUDED FROM ANY AGREEMENT MADE BY ACCEPTANCE OF ANY ORDER PURSUANT TO THIS QUOTATION. MIDNITE SOLAR WILL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES, LOSS OR EXPENSE ARISING IN CONNECTION WITH THE USE OF OR THE INABILITY TO USE ITS GOODS FOR ANY PURPOSE WHATSOEVER. MIDNITE SOLAR'S MAXIMUM LIABILITY SHALL NOT IN ANY CASE EXCEED THE CONTRACT PRICE FOR THE GOODS CLAIMED TO BE DEFECTIVE OR UNSUITABLE.

Products will be considered accepted by customer unless written notice to the contrary is given to MidNite Solar within ten (10) days of such delivery to customer. MIDNITE SOLAR is not responsible for loss or damage to products owned by customer and located on MIDNITE SOLAR'S premises caused by fire or other casualties beyond MIDNITE SOLAR's control. This warranty is in lieu of all other warranties expressed or implied.

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