Installation and Safety Manual

SolarMagic™ Powerstring Optimizer

www.solarmagic.com

SM5400

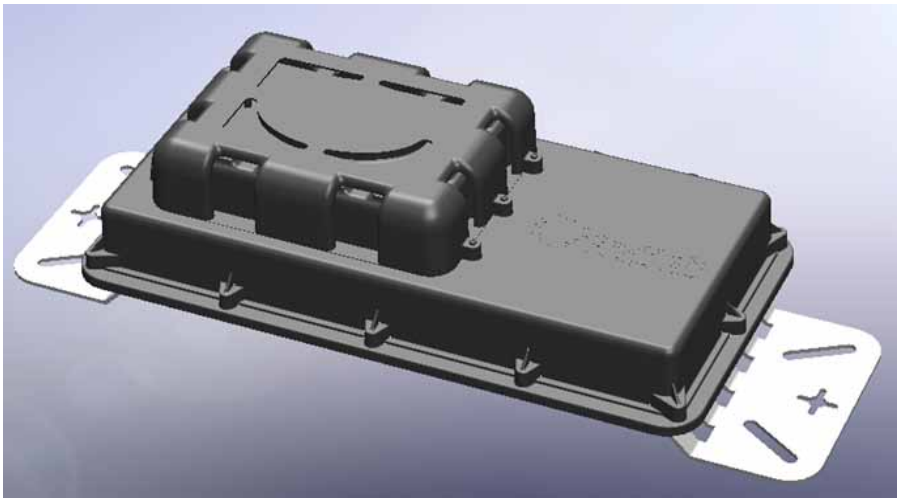
English

Deutsch

Español

Italiano

日本語



UL 1741 Certified

IP65/NEMA 4X

SolarMagic™
by National Semiconductor

Table Of Contents

Important Safety Instructions

Read this first

Before installing and using the SolarMagic powerstring optimizer SM5400, read all instructions and warning markings on the product labels and appropriate sections of your photovoltaic (PV) module, combiner box and inverter manuals.

Review all WARNING and NOTE callouts to ensure safe and proper operation of the SolarMagic powerstring optimizer module.

• Failure to follow these instructions may result in injury or death

• Failure to adhere to these instructions may result in voiding the factory warranty.

Installation *must* be performed by authorized service and installation personnel aware of the procedures required to avoid the risk of electrical shock and general high-voltage safety procedures. National Semiconductor does not assume liability for loss or damage resulting from misuse or improper handling, or injuries caused by improper installation practices.

Symbols used on the product and in this document.

 This symbol is used to indicate **WARNING**

 This symbol indicates **ELECTRICAL SHOCK HAZARD**

 This symbol indicates **HOT SURFACE**.

This manual contains important instructions for the SolarMagic powerstring optimizer SM5400.

 To avoid risk of electrical shock or fire, do not attempt to disassemble or repair the SolarMagic powerstring optimizer. It contains no user-serviceable parts and requires no maintenance. Tampering with or opening the module will void the factory warranty. See warranty for instructions on obtaining service.

 To reduce risk of fire and shock hazard, install this device with strict adherence to the National Electrical Code (NEC) ANSI/NFPA 70, Canadian Electrical Code (CEC) C22.1-09, EU/EEA Electrical Codes and applicable local electrical codes.

 Wear appropriate and suitably rated Personal Protective Equipment (PPE).

Remove all metallic jewelry prior to installing or servicing solar arrays equipped with the SolarMagic powerstring optimizer to reduce the risk of contacting live circuitry.

Do not attempt to install or service during inclement weather such as rain and snow, under windy conditions, or in extreme humidity.

Use only accessories recommended or sold by SolarMagic dealers or distributors. Doing otherwise may result in risk of fire, electric shock, or injury.

 To avoid risk of fire and electric shock, make sure that existing cables and connectors are in good condition and are not undersized. Use only connectors of the same type and rating as present in the installation and insure that they are properly sized for the cable cross section and diameter when making cable splices. Do not operate the SolarMagic powerstring optimizer with damaged or substandard wiring (e.g. non UV resistant) or connectors (e.g.

connectors from a different manufacturer. Check all cable glands to make sure that they are tight.

Do not operate the SolarMagic powerstring optimizer if it has been physically damaged or subjected to forces beyond its design.

 Do not disconnect under load. Authorized service personnel should reduce the risk of electrical shock by disabling and disconnecting all AC and DC power sources from the PV system prior to attempting any maintenance or working on any circuits connected to the SolarMagic powerstring optimizer. Turning off the inverter alone will not reduce this risk. Internal capacitors within the inverter can remain charged for several minutes after disconnecting all power sources. All strings that feed into a common combiner box that is a part of the array being serviced must be covered by an opaque material to disable the DC source. Isolate each string by removing the fuses for all strings that feed into a combiner box.

 To reduce the risk of burns, do not touch the case of the SolarMagic powerstring optimizer during operation. Case temperatures can be in excess of 122°F (50°C).

 The SolarMagic powerstring optimizer is not intended for use as a battery charge controller. Do not attach directly to a battery.

 No equipment ground or protective earth terminal is provided.

All wiring methods and wire gauges shall follow the requirements of the National Electrical Code (NEC) ANSI/NFPA 70, Canadian Electrical Code (CEC) C22.1-09, EU/EEA Electrical Codes and the applicable local electrical codes.
It is recommended that the proper wire sizes be selected for the installation based on calculations to limit the resistive losses to <0.5% within each string.

Care must be taken to keep the wires and wire bundles away from any sharp edges which may damage wire insulation over time.

For ground installations or areas subject to floods and snowpack, the SolarMagic powerstring optimizer must be mounted on a pedestal or structure in a manner that is consistent to allow the product to maintain IP65 and NEMA 4X environmental ratings.

The SolarMagic powerstring optimizer can not be submersed in liquid.

In areas subject to seasonal snow fall and/or freezing conditions, care must be taken to safeguard the units from being covered by snowpack and from being subjected to repeated freeze and thaw cycles.

ELECTRICAL SHOCK HAZARD

Safety requirements mandate that this equipment not be serviced while energized. Authorized service personnel should reduce the risk of electrical shock by disconnecting all AC and DC power sources from the PV system prior to attempting any maintenance or working on any circuits connected to the SolarMagic powerstring optimizer. The terminals of the SolarMagic powerstring optimizer may still be energized if the strings and array are connected. Turning off the inverter alone will not reduce this risk. Internal ca-

pacitors within the inverter can retain their charge for several minutes after disconnecting all power sources. All strings that feed into a common combiner box that is a part of the array being serviced must be covered by an opaque material to disable the DC source. Isolate each string by removing the fuses for all strings that feed into a combiner box.

In EU/EEA installations where the PV systems are floating, both "+" and "-" leads are fused. Remove both fuses to ensure isolation.

 **WARNING – Risk of electric shock and/or electric energy-high current levels.**
To avoid the possibility of a severe electrical shock when disconnecting the Array (+ and -) and the String (+ and -) cables on the Powerstring module, it is advisable to wait 30 seconds before handling the unit. This allows the capacitors in the unit time to discharge to a safe level.

 Mounting bracket edges can be sharp. Use appropriate protective gear to avoid cuts while handling the brackets during both installation and while transporting assembled units for installation.

Do not use the SolarMagic powerstring optimizer's cables to carry the unit. Excessive force can damage the cable glands.

Product Conformance Certifications

Safety

UL 1741 is the recognized standard for Inverters, Converters, Controllers and Interconnect System Equipment for Use with Distributed Energy Resources in the U.S. The SolarMagic powerstring optimizer module complies with the appropriate sections of the

standard and is UL1741 certified. Canada CSA No. 107.1-1 is the standard for Canadian safety requirement.

In addition, the SolarMagic powerstring optimizer complies with the appropriate sections of the following European and international standards to maintain the CE-Marking and the GS Mark:

EN 61558-1: Safety of Power Transformers, Power Supplies, Reactors and Similar Products. General Requirements and Tests

IEC 61010: Standard for Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.

IEC 60529: Degrees of Protection Provided by the Enclosure (IP Code).
NEMA 250-2008: Enclosures for Electrical Equipment (1000 Volts Maximum)

The enclosure meets IP65 and NEMA 4X classification.

Electromagnetic Compatibility (EMC)

The SolarMagic powerstring optimizer has been tested and found to comply with the limits of Class A for radiated emissions and immunity in accordance with FCC Part 15 Subpart B, Radio Frequency Devices, ICES-003, European standards EN 55011 and EN 61000-6-1, EN 61000-6-3 Emissions and Immunity standards.

This equipment Complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada ICES-003 Statements:

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Réglement sur le matériel brouilleur du Canada.

DC power cable of equipment should be < 3M in length.

ISM Radio

The SolarMagic powerstring optimizer has an integrated ISM band radio transmitter and has been tested to comply with FCC Part 15, Subpart C, Intentional Radiators, Industry Canada ICES-001, and meets the EU R&TTE Directive 1999/95/EC.

Certifications

	USA/Canada	EU/EEA
Normative Directive		2004/108/EC
		Electromagnetic Compatibility Directive
Normative Directive		2006/95/EC
		Low Voltage Directive
Normative Directive		1999/5/EC
		Radio Equipment and Telecommunications Terminal Equipment Directive

Emissions	FCC	CE-Marking
	FCC, CFR 47, Part 15, Subpart B, Class A, Radio Frequency Devices, Unintentional Radiators	EN 55011 Class A Industrial, Scientific and Medical (ISM) Radio Frequency Equipment. Electromagnetic Disturbance Charateristics. Limits and Methods of Measurement.
	ICES-003 (Either CSA C108.8-M1983 or CAN/CSA-CISPR22096 is to be used)	EN 61000-6-3 Electromagnetic Compatibility (EMC). Generic Standards. Emission Standards for Residential, Commercial and Light-Industrial Environments

Immunity	CE Marking
EN 61000-4-2 – Electrostatic Discharge EN 61000-4-3 – Radiated Immunity EN 61000-4-6 – Conducted Immunity	EN 61000-6-1 Electromagnetic Compatibility (EMC). Generic Standards. Immunity for Residential, Commercial and Light-industrial Environments

Safety	NRTL mark	CE-Marking
	UL1741 Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources	EN 61558-1 Safety of Power Transformers, Power Supplies, Reactors and Similar Products. General Requirements and Tests
	Canada CSA 107.1-1	IEC 61010-1 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements CB- Scheme Certification + CB- Scheme Test Report per IEC 61010-1

ISM Radio	FCC ID	CE-Marking w/Notified Body ID
	FCC, CFR 47 part 15, subpart C Radio Frequency Devices, Intentional Radiators	ETSI EN 300 220 – 1 ETSI EN 300 220 – 2 Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW. Part 1: Technical characteristics and test methods Part 2: Supplementary parameters not intended for conformity purposes ETSI EN 3014891
	RSS-210 - Low Power License-exempt Radiocommunications Devices (all Frequency Bands): Category 1 Equipment	

About This Manual

Purpose: The purpose of this installation and safety manual is to provide explanations and procedures for installing and maintaining SolarMagic powerstring optimizers.

Scope: This manual provides safety guidelines and procedures for installing SolarMagic powerstring optimizers, blocking diodes and the basic installation of the System Manager. It does not provide details about the PV Modules, Combiner boxes or Inverters. Please consult the appropriate user's manuals for those components.

Users: This manual is intended for anyone who needs to install and maintain SolarMagic powerstring optimizers. Installers should

be certified technicians or electricians.

Product Description

National Semiconductor's SolarMagic powerstring optimizer is the perfect solution to the real-world problems facing PV arrays. These include shading and module-to-module mismatching which could adversely affect the performance and efficiency of the array. Powerstring optimizers provide power optimization and monitoring/ management for a string level solution.

PV arrays are defined as strings of series-connected PV modules, which are then paralleled together -usually via a combiner box- and converted to AC power through an inverter. The key challenge with PV arrays is to prevent a small amount of real-world mismatch within the system from significantly reducing the power output of the entire array. Examples of mismatch causes include module-to-module mismatch, shading (e.g. trees, chimneys, overhead power lines, bird droppings, handrails, etc.), differing module orientation and tilts, and differing string lengths.

To mitigate the effects of mismatch, system integrators are often forced to compromise their installation by reducing the size of the array to avoid shade, thus accepting a lower energy output per square meter, or adding extra modules in a different part of the array, all of which cost money, lower efficiency, and/or compromise aesthetics for the system owner.

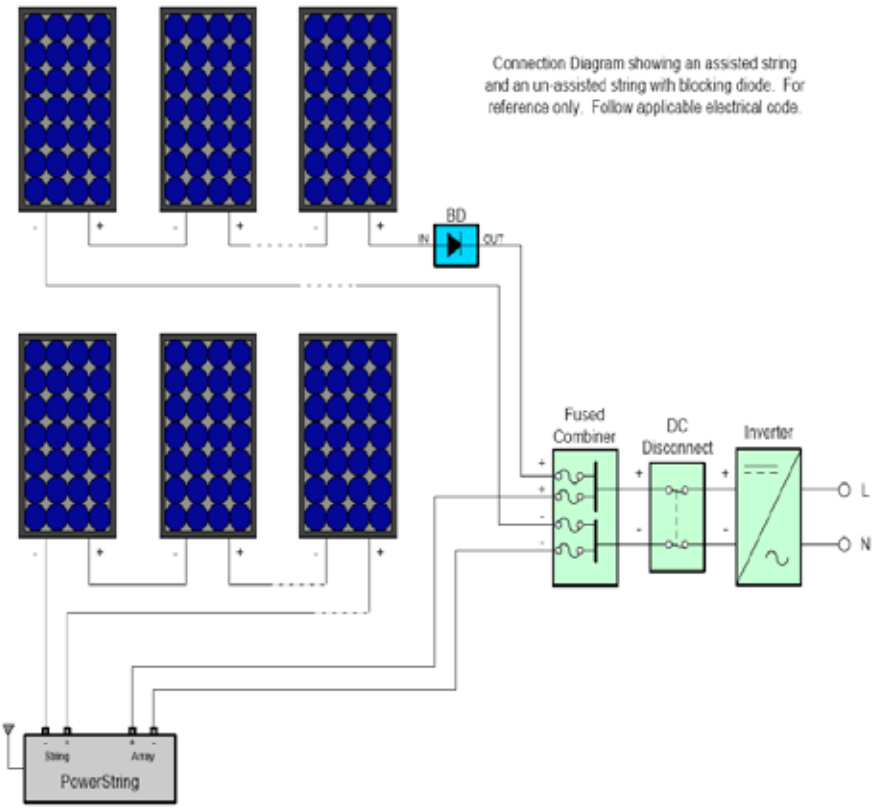
To maximize the energy output of each string in the array, National Semiconductor has developed the SolarMagic powerstring optimizer. SolarMagic Powerstring enables each string with the array to produce the maximum available energy regardless of system mismatch. The SolarMagic powerstring optimizer monitors and maximizes the energy harvest of each string within the array through advanced algorithms combined with leading-edge mixed-

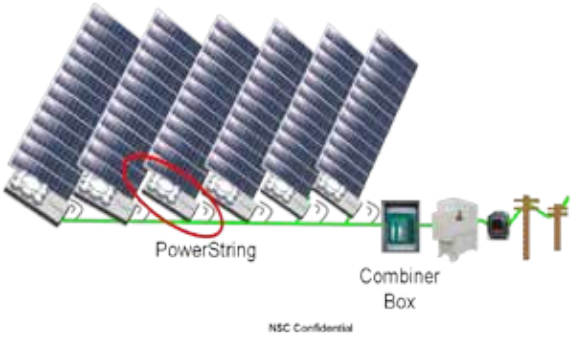
signal technology to recoup energy lost to mismatches.

The SolarMagic powerstring optimizer is designed to be installed quickly and easily within the traditional architecture of a solar array. Each powerstring optimizer comes with a mounting bracket for easy attachment to any permanent structure, pedestal, rack or pole. The negative and positive output cables of each string are simply connected to the string input terminals, while the output terminals on the array side of the powerstring optimizer are connected to the combiner box or array.

Connection Diagrams (EU/EEA)

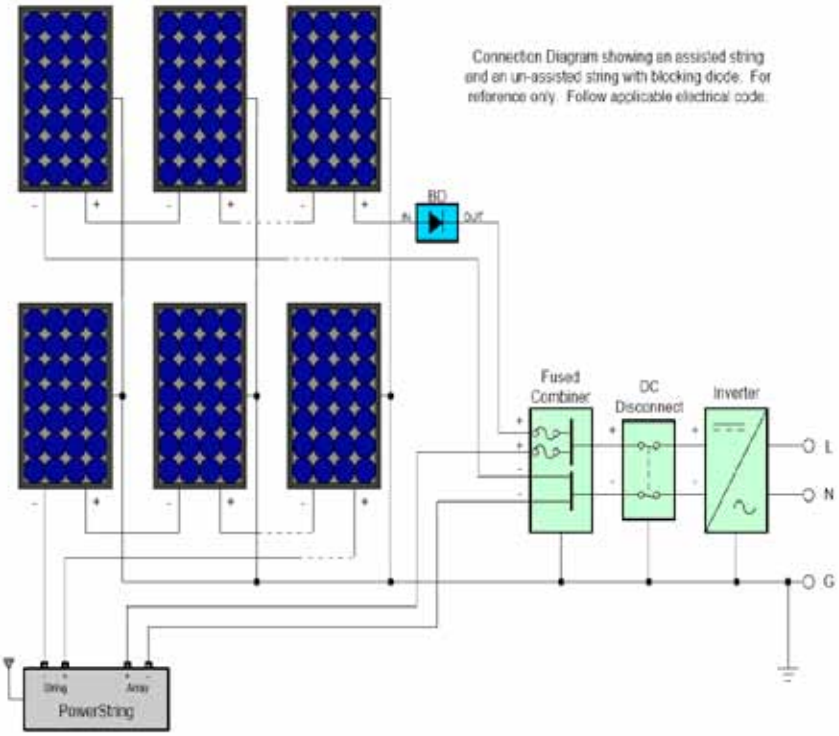
This is for reference only. Follow applicable Electrical codes.





Connection Diagrams (USA/Canada)

This is for reference only. Follow applicable Electrical codes



Package Contents

SolarMagic powerstring optimizer SM5400
Installation guide
Quick start guide
Warranty card

Installation of the SolarMagic Powerstring Optimizer

Recommended Tools and Equipment

Multi-Contact (MC4/MC3), or appropriate crimping tool
Multi-Contact (MC4/MC3), or appropriate connectors 2,5mm^2, 4mm^2, 6mm^2 and 10mm^2
Appropriate and suitably rated Personnel Protective Equipment for high voltage applications
Digital multi-meter rated for high voltage applications (CAT III, 1000V)
DC clamp ampere meter rated for high current applications
UV-rated cable ties
Metric wrench set
Metric socket set
Electric drill

WARNING:

Before installing the SolarMagic powerstring optimizer, read all instructions and warning markings located in this manual, as well as on the powerstring optimizer, inverter, combiner box, and PV modules. There are lethal levels of voltage and current present within the SolarMagic powerstring optimizer. Be sure to stringently follow all precautions to avoid injury or death.

Mounting the SolarMagic Powerstring Optimizer

During the site survey, identify best possible locations for the SolarMagic powerstring optimizer to minimize exposure to UV by installing the powerstring optimizer in the shade. Insure that the chosen location is also well protected from rain and snow. Take into account the most efficient cable management and run lengths

between the strings and the homeruns to the combiner box or array. In some cases, co-locating the SolarMagic powerstring optimizer next to the combiner box or inverter is the most efficient installation solution.

The SolarMagic powerstring optimizer's mounting bracket has been designed for easy and convenient attachment to any permanent structure, pedestal, rack or pole

For ground or rooftop installations, the SolarMagic powerstring optimizer must be raised off the surface on a pedestal to prevent submersion in liquid or repeated snowpack conditions.

If wall mounting, two screws must be used to securely fasten the bracket to the permanent structure. For systems where wall mounting is not available, the bracket can be affixed to a pole using two U-bolts. For installations where the mounting structure's materials are known to be dissimilar or unknown, insert installer provided isolation material to prevent galvanic corrosion between the SolarMagic powerstring optimizer mounting hardware and the structure or pole.

Figure 1. Showing mounting of SolarMagic powerstring optimizer to a PV array support tower.

Connecting the SolarMagic Powerstring Optimizer to the PV array

Figure 2. Top view of optimizer module

Disable all potential DC sources by covering all PV module strings that feed into the common combiner box with an opaque material. Verify that no DC voltages are present on the strings.

As a best practice safety precaution, it is recommended to disconnect the cables between the first and second modules of the PV string as well as the n and n-1 modules ensuring that at most a single module's worth of energy is attached to the PV string being serviced.

Disable all potential AC sources by disconnecting the inverter from the combiner box or array.

Isolate each string within the combiner box by removing the fuse(s) for each string in the combiner box. It is important to note that floating systems used in the EU/EEA have fuses in the posi-

tive “+” and negative “-” side of each string, so 2 fuses must be removed to safely disconnect a string from the inverter.
Attach the SolarMagic powerstring optimizer to the string by connecting the negative most terminal of the string to the SolarMagic powerstring optimizer input cable designated “String -”

Complete the connection of the SolarMagic powerstring optimizer to the PV string by connecting the positive most terminal of the PV string to the input cable designated “String +”

Attach the SolarMagic powerstring optimizer to the combiner box or array by connecting the output cables of the powerstring optimizer designated “Array -” and “Array +” to the combiner box or array.

When the powerstring optimizer is installed and grounding is to be close to the string, the ground point shall be at the Array (-) terminal for negative ground systems and at the Array (+) terminal for positive ground systems.

Do not tamper with, replace or cut the connectors on the Powerstring module.

In some installations the positive “+” and negative “-” homerun string cables can be cut and 2 male and 2 female connectors for the corresponding cross section and cable diameter can be crimped to the 4 resulting open ends.

Labeling	Connector Type on Powerstring	Connector Type to be Crimped
Array +	**Female connector on powerstring side**	**Male connector on the homerun**
Array -	**Male connector on powerstring side**	**Female connector on the homerun**

Labeling	Connector Type on Powerstring	Connector Type to be Crimped
String +	**Male connector on powerstring side**	**Female connector on the homerun**
String -	**Female connector on powerstring side**	**Male connector on the homerun**

Disconnecting Optimizer Module from the String and Array

Disable all potential DC sources by activating the DC disconnect if one is installed and covering all modules that feed into a common combiner box with an opaque material. Verify that no DC voltages are present on the strings.

As a best practice safety precaution, disconnect the cables between the first and second modules of the string as well as the n and n-1 modules in the same string. This is highly recommended and adds an additional level of safety by limiting the energy that can pass through the string being serviced.

Disable all potential AC sources by disconnecting the inverter from the combiner box or array.

Isolate each string by removing the fuse(s) for each string in the combiner box. It is important to note that floating systems used in the EU/EEA have fuses in the positive "+" and negative "-" side of each string, so 2 fuses must be removed to safely disconnect a string from the inverter.

Complete the disconnection of the SolarMagic powerstring optimizer from the string by disconnecting the positive most terminal of the string from the input cable designated "String +"

Complete the disconnection of the SolarMagic powerstring opti-

mizer from the string by disconnecting the negative most terminal of the string from the input cable designated “String -”.

Complete the disconnection of the SolarMagic powerstring optimizer from the combiner box by disconnecting the output cables designated “Array +” and “Array –”.

Reconnect the wires of the homerun positive and string positive as well as homerun negative and string negative to reconnect the string to the inverter without the powerstring optimizer.

Blocking Diode

The SolarMagic blocking diode is designed to block reverse current flow by allowing current to flow in one direction only. Due to interaction, strings with SolarMagic power optimizers installed, also referred to as assisted strings, will have varying voltage levels during energy production hours. A single blocking diode must be installed in each un-assisted string to prevent reverse current from flowing back into that string.

Clustering Rules for ISM Radio Communication

In order to relay information to the System Manager, each SolarMagic powerstring optimizer is equipped with a radio transmitter to form ad-hoc and self configuring networks capable of monitoring the entire solar array.

For best practices, adjust the placement of the SolarMagic powerstring optimizer to avoid any interference or obstruction. Ideal placement would be off the ground and out of the way of obstructions.

The topology of the installation drives the placement of the units based on how the modules are strung to each other. The actual installation site's topology will affect the design of the layout and will determine how many powerstring optimizers and System Manager Devices will need to be deployed.

About SolarMagic by National Semiconductor Corporation

National Semiconductor leverages a 50-year tradition of power management to deliver solar products for the real world. With the capacity to deliver solar innovation at scale, National builds reliability into its products from the ground up. Active power management from National Semiconductor maximizes photovoltaic system efficiency by enabling precise control and performance optimization at the module and string level.

Technical Specifications

Environmental Specifications:

Enclosure Rating:	**IP65/NEMA 4X**
Maximum ambient operating temperature range:	**-40°C to + 50°C**

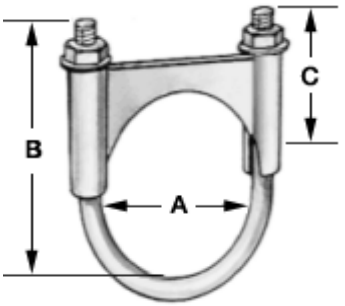
Electrical Operating Specifications:

Maximum Input Voltage UL/CE:	**600/1000 V_{DC}**
Maximum Input Current:	**9.3A**
MPPT Voltage Range:	**200-800V_{DC}**
Maximum Output Voltage:	**1000 V_{DC}**
Maximum Output Current:	**9.3A**
Maximum Power Injection:	**1000W**

Physical Specifications:

Dimensions (W x H x D):	**25 inches x 9.41 inches x 5.87 inches (63.5 mm x 23.9 mm x 14.9 mm)**
Weight	**11 lbs (5 Kg)**

U-Bolt Specifications:



	A	B	C	Thread Size
Min	2″	3-1/16″	1″	5/16″ X 18
Max	4″	5-7/8″	1-1/2″	3/8 ″ X 16

INPUT/OUTPUT Terminals:

String +:	The positive most end of the string
String -:	The negative most end of the string
Array +:	Positive input to the combiner box or array
Array -:	Negative input to the combiner box or array

Glossary: Acronyms and Definitions

CEC - Canadian Electrical Code: C22.1-09
NEC - National Electrical Code: ANSI/NFPA70
PPE - Personal Protective Equipment
PV - Photovoltaic

Limited Warranty

See Warranty Card

English Warning Statement	French Warning Statement	German Warning Statement
Important Safety Instructions	**CONSIGNES IMPORTANTES DE SÉCURITÉ**	**WICHTIGE SICHERHEITSHINWEISE**
Read this first	**Lisez d'abord ceci**	**Bitte zuerst lesen**
Before installing and using the SolarMagic powerstring optimizer SM5400, read all instructions and warning markings on the product labels and appropriate sections of your photovoltaic (PV) module, combiner box and inverter manuals.	Avant d'installer et d'utiliser l'optimiseur de puissance SolarMagic™ Powerstring SM5400, lisez toutes les instructions et les marquages d'avertissements sur l'optimiseur de puissance, ainsi que les sections concernées de vos manuels de modules photovoltaïques (PV) et d'onduleur.	Bevor Sie den SolarMagic™ Powerstring Optimizer installieren und nutzen, lesen Sie unbedingt sämtliche Anweisungen und Warnaufschriften auf dem Powerstring Optimizer sowie die entsprechenden Abschnitte in den Handbüchern zu Ihren Photovoltaik-(PV) Panels, Combiner Boxen und Wechselrichtern.
Review all WARNING and NOTE callouts to ensure safe and proper operation of the SolarMagic Powerstring optimizer module.	Revisez tous les AVERTISSEMENT et NOTES pour garantir un fonctionnement sure et correct de l'unité d'optimisation de puissance SolarMagic PowerString	Beachten Sie insbesondere alle mit WARNUNG und ACHTUNG gekennzeichneten Hinweise, um einen ordnungsgemäßen und sicheren Betrieb Ihres SolarMagic Powerstring Optimizers zu gewährleisten.
Failure to follow these instructions may result in injury or death	Ometre de suivre ces instructions peut entrainer des blessures ou la mort	Nichtbeachtung dieser Anleitungen kann zu Verletzungen oder Todesfällen führen.
Failure to adhere to these instructions may result in voiding the factory warranty.	Ometre de suivre ces instructions peut entrainter l'annulation de la garantie constructeur	Nichtbeachtung dieser Anleitungen kann zum Erlöschen der Werksgarantie führen.
Symbols used on the product and in this document.	**Symboles du produit**	**Produktsymbole**
 This symbol is used to indicate **WARNING**  This symbol indicates **ELECTRICAL SHOCK HAZARD**  This symbol indicates **HOT SURFACE**.	 Ce symbole est utilisé pour indiquer **AVERTISSEMENT.**  Ce symbole indique **RISQUE DE CHOC ELECTRIQUE**.  Ce symbole indique **SURFACE CHAUDE.**	 Dieses Symbol kennzeichnet eine **WARNUNG.**  Dieses Symbol kennzeichnet die **GEFAHR EINES ELEKTRISCHEN SCHLAGS**.  Dieses Symbol kennzeichnet eine **HEISSE OBERFLÄCHE.**
This manual contains important instructions for the SolarMagic powerstring optimizer SM5400.	**CONSERVEZ CES INSTRUCTIONS. Ce manuel contient d'importantes instructions à suivre pendant l'installation et la maintenance de l'optimiseur de puissance, pour les modèles SM5400**	**BEWAHREN SIE DIESE ANLEITUNG UNBEDINGT AUF. Sie enthält wichtige Anweisungen zum SM 5400 SolarMagic Powerstring Optimizer.**
 To avoid risk of electrical	 Pour éviter tous risques de	 Um die Gefahr eines

shock or fire, do not attempt to disassemble or repair the SolarMagic powerstring optimizer. It contains no user serviceable parts and requires no maintenance. Tampering with or opening the module will void the factory warranty. See warranty for instructions on obtaining service.	choc électrique ou d'incendie, n'essayez pas de démonter ou de réparer l'optimiseur de puissance. Il ne contient aucune pièce réparable par l'utilisateur et ne requiert aucune maintenance. La modifi cation non-autorisée ou l'ouverture de l'optimiseur de puissance annulera la garantie d'usine. Consulter la garantie pour les instructions de son application.	Stromschlags oder eines Brandes zu vermeiden, versuchen Sie niemals, den Powerstring Optimizer zu zerlegen oder zu reparieren. Das Produkt enthält keine vom Anwender zu wartenden Teile und erfordert keine Wartungsmaßnahmen. Die Werksgarantie erlischt, wenn Manipulationen am Powerstring Optimizer vorgenommen werden oder das Gerät geöffnet wird. Die Garantiebestimmungen enthalten Anweisungen zu Kundendienstleistungen.
 To reduce risk of fire and shock hazard, install this device with strict adherence to the National Electrical Code (NEC) ANSI/ NFPA 70, Canadian Electrical Code (CEC) C22.1-09, EU/EEA Electrical Codes and applicable local electrical codes.	 Pour réduire le risqué d'incendie et de choc électrique, installez cet appareil en stricte conformité à la norme nationale américaine [National Electric Code (NEC)] ANSI/NFPA 70 et/ou aux normes électriques locales.	 Um das Brandrisiko und die Gefahr eines Stromschlags zu mindern, ist das Gerät unter strikter Einhaltung des National Electric Code (NEC) ANSI/NFPA 70, der VDE-Bestimmungen oder der jeweils geltenden örtlichen Vorschriften zu installieren.
 Wear appropriate and suitably rated Personal Protective Equipment (PPE).	 Portez des Equipement Personel de Protection adéquats.	 Tragen Sie entsprechende und passende Persönliche Schutzausrüstung (PSA).
Remove all metallic jewelry prior to installing or servicing solar arrays equipped with the SolarMagic powerstring optimizer to reduce the risk of contacting live circuitry.	Pour éviter les risques de choc électrique, retirez tous bijoux métalliques avant d'installer l'optimiseur de puissance.	Legen Sie vor der Installation des Powerstring Optimizers jeglichen metallischen Schmuck ab, um die Gefahr eines Kontakts mit unter Spannung stehenden Teilen zu vermeiden.
Do not attempt to install or service during inclement weather such as rain and snow, under windy conditions, or in extreme humidity.	Ne tentez pas l'installation lorsque les conditions météo sont mauvaises ou en cas de vent.	Versuchen Sie nicht, das Gerät bei ungünstigen Wetterverhältnissen oder bei Wind zu installieren.
Use only accessories recommended or sold by SolarMagic dealers or distributors. Doing otherwise may result in risk of fire, electric shock, or injury.	N'utilisez que les accessories recommandés ou vendus par les revendeurs ou les distributeurs de SolarMagic. L'utilisation d'autres accessoires pourrait causer des risques d'incendie, de choc électrique ou de blessure.	Verwenden Sie ausschließlich Zubehör, das von SolarMagic Händlern oder –Distributoren empfohlen oder vertrieben wird. Anderenfalls besteht möglicherweise die Gefahr von Bränden, Stromschlägen oder Verletzungen.
 To avoid risk of fire and electric shock, make sure that existing cables and connectors are in	 Pour éviter les risques d'incendie et de choc électrique, assurez vous que les câbles et les	 Um die Gefahr eines Brandes und eines Stromschlags zu vermeiden, vergewissern Sie sich unbedingt, dass

good condition and are not undersized. Use only connectors of the same type and rating as present in the installation and insure that they are properly sized for the cable cross section and diameter when making cable splices. Do not operate the SolarMagic powerstring optimizer with damaged or substandard wiring (e.g. non UV resistant) or connectors (e.g. connectors from a different manufacturer. Check all cable glands to make sure that they are tight.	connecteurs existants sont en bon état et ne sont pas de dimensions trop petites. Ne faites pas fonctionner l'optimiseur de puissance SolarMagic powerstring avec un câblage ou des connecteurs endommagés ou inférieurs aux normes (par exemple: câbles non résistants aux UV ou connecteurs provenant d'un autre constructeur) . Verifiez tous les presse-étoupes pour s'assurer qu'ils sont serrés	die vorhandenen Kabel und Steckverbinder in einwandfreiem Zustand und nicht unterdimensioniert sind. Verwenden Sie nur Steckverbinder des gleichen Typs und der gleichen Strombelastbarkeit, wie sie auch in der Installation Verwendung finden und stellen Sie sicher, dass diese für den verwendeten Kabeltyp den richtigen Durchmesser und Aderquerschnitt haben, wenn Sie Steckverbinder installieren. Betreiben Sie den SolarMagic Power Optimizer nicht mit beschädigten, falsch dimensionierten oder ungeeigneten Leitungen (z.B. nicht UV stabil) oder Steckverbindern (z.B. Steckverbinder eines anderen Herstellers). Überprüfen Sie alle Kabelverschraubungen, um sicherzustellen, dass diese gut angezogen und dicht sind.
Do not operate the SolarMagic powerstring optimizer if it has been physically damaged or subjected to forces beyond its design.	Ne faites pas fonctionner l'optimiseur de puissance SolarMagic powerstring s'il a été physiquement endommagé ou s'il a été soumis à des forces plus importantes que celles pour lesquelles il a été conçu.	Nehmen Sie den SolarMagic Powerstring Optimizer nicht in Betrieb, wenn er mechanisch beschädigt ist oder Kräften ausgesetzt wurde, für die er konstruktiv nicht ausgelegt ist.
 Do not disconnect under load. Authorized service personnel should reduce the risk of electrical shock by disabling and disconnecting all AC and DC power sources from the PV system prior to attempting any maintenance or working on any circuits connected to the SolarMagic powerstring optimizer. Turning off the inverter alone will not reduce this risk. Internal capacitors within the inverter can remain charged for several minutes after disconnecting all power sources. All strings that feed into a common combiner box that is a part of the array being	 Ne pas débrancher en cours de chargement. Le personnel de maintenance autorisé doit réduire les risques de choc électrique en débranchant à la fois l'alimentation en courant alternatif (CA) et en courant continu (CC) du système PV avant de commencer toute maintenance ou de travailler sur tous circuits connectés à l'optimiseur de puissance. Éteindre uniquement l'onduleur ne réduira pas ce risque. Les condensateurs internes se trouvant à l'intérieur de l'onduleur peuvent rester chargés pendant plusieurs minutes après le débranchement de toutes les sources	 Klemmen Sie das Gerät niemals unter Last ab. Zur Reduzierung der Gefahr eines elektrischen Schlages sollte die Gleich- und Wechselstromverbindung zum PV-System durch autorisiertes Personal getrennt werden, bevor Wartungs- oder andere Arbeiten an Schaltungen durchgeführt werden, die mit dem Powerstring Optimizer verbunden sind. Alleiniges Abschalten des Wechselrichters ist nicht ausreichend, um das Risiko zu reduzieren. Die Kondensatoren des Wechselrichters können auch nach dem Abtrennen sämtlicher Stromquellen mehrere

serviced must be covered by an opaque material to disable the DC source. Isolate each string by removing the fuses for all strings that feed into a combiner box.	d'alimentation électrique . Touts les panneaux solaires alimentant un même combinateur doivent être couvertes par un materiau opaque pour supprimer la source de courant continu. Isolez toutes les chaines de panneaux solaires en retirant les fusibles pour toutes les chaines alimentant un combinateur.	Minuten lang geladen bleiben (siehe auch Abschnitt **Störungsbehebung**). Alle Strings, die in einem Stringsammelkasten zusammengefasst werden, an dem gearbeitet wird, sollten mit undurchsichtigem Material abgedeckt werden, um die Spannung auszuschalten. Isolieren Sie jeden String, indem Sie alle positiven und negativen Strangsicherungen im Stringsammelkasten entfernen. Weiterhin sollten Strings aufgetrennt werden (zwischen dem ersten und zweiten und dem vorletzten und letzten Modul) um sich vor hohen Spannungen zu schützen. Dieses darf nur dann erfolgen, wenn kein Strom fließt, also die Sicherungen schon getrennt sind.
 To reduce the risk of burns, do not touch the case of the SolarMagic powerstring optimizer during operation. Case temperatures can be in excess of 122°F (50°C).	 Pour diminuer les risques de brûlures, ne touchez pas au boîtier de l'optimiseur de puissance lorsqu'il est en marche. Les températures du boîtier peuvent dépasser 50°C (122°F).	 Um die Gefahr von Verbrennungen zu mindern, vermeiden Sie es, das Gehäuse des Powerstring Optimizers während des Betriebs zu berühren, da es sich auf Temperaturen von mehr als +50 °C erwärmen kann.
 The SolarMagic powerstring optimizer is not intended for use as a battery charge controller. Do not attach directly to a battery.	 L'optimiseur de puissance SolarMagic n'est pas conçu pour être utilisé en tant que contrôleur de charge d'une batterie. Ne le fi xez pas directement à une batterie.	 Der SolarMagic Powerstring Optimizer ist nicht für die Verwendung als Akkuladeregler konzipiert und darf deshalb nicht direkt an eine Batterie angeschlossen werden.
 No equipment ground or protective earth terminal is provided.	 Aucun terminal de protection terre n'est fourni.	 Weder Schutzerde noch Erdungsklemmen werden bereitgestellt.
All wiring methods and wire gauges shall follow the requirements of the National Electrical Code (NEC) ANSI/NFPA 70, Canadian Electrical Code (CEC) C22.1-09, EU/EEA Electrical Codes and the applicable local electrical codes.	Toutes les methodes de cablage doivent suivre les consignes du National Electrical Code (NEC), ANSI/NFPA 70, Canadian Electrical Code (CEC) C22.1-09, EU/EEA Electrical Code et les normes de code électrique locales.	Alle Verkabelungsmethoden und Drahtstärken unterliegen den Anforderungen des National Electric Code (NEC) ANSI/NFPA 70, der VDE-Bestimmungen oder der jeweils geltenden örtlichen Vorschriften.
It is recommended that the proper wire sizes be selected for the installation based on calculations to	Pour l'installation, Il est conseillé de choisir les cables électriques calculés pour limiter les pertes résistives a	Es wird empfohlen, den entsprechenden Kabelquerschnitt und –Durchmesser für die Installation

limit the resistive losses to <0.5% within each string.	<0.5% pour chaque chaine.	auszuwählen. Die Auswahl sollte auf Berechnungen, die den Widerstandverlust bis zu <0,5% in jedem String limitieren, basieren.
Care must be taken to keep the wires and wire bundles away from any sharp edges which may damage wire insulation over time.	Veiller à garder les cables et les bobines à distance des bords tranchants qui pourraient endommager l'isolation.	Es muss darauf geachtet werden, Kabel und Kabelbündel von scharfen Kanten fern zu halten, die möglicherweise im Laufe der Zeit, die Kabelisolation beschädigen.
For ground installations or areas subject to floods and snowpack, the SolarMagic powerstring optimizer must be mounted on a pedestal or structure in a manner that is consistent to allow the product to maintain IP65 and NEMA 4X environmental ratings.	Pour l'installation en sol ou dans les zones sujettes aux inondations et enneigements, l'optimisateur de puissance SolarMagic powerstring doit être monté sur un piedestal ou une structure de façon à ce que le produit maintienne les normes environnementales IP65 et NEMA 4X	Für Installationen auf Freiflächen oder Regionen, die von Überschwemmungen und Schneefall betroffen sind, muss der SolarMagic Powerstring Optimizer auf einem Ständer oder einer Vorrichtung so montiert sein, dass er die Vorraussetzung für IP65 und NEMA 4X weiterhin erfüllt.
The SolarMagic powerstring optimizer cannot be submersed in liquid.	L'optimisateur de puissance SolarMagic powerstring ne peut etre submergé dans un liquide	Der SolarMagic Powerstring Optimizer darf nicht in Wasser getaucht werden.
In areas subject to seasonal snow fall and/or freezing conditions, care must be taken to safeguard the units from being covered by snowpack and from being subjected to repeated freeze and thaw cycles.	Dans les zones sujettes aux chutes de neige saisonnieres et/ou au gel, prendre soin d'éviter aux unites d'être recouvertes d'un manteau de neige épaisse et d'être soumises a des cycles repetés de gel et	In Regionen, die von saisonalem Schneefall und/oder frostigen Zuständen betroffen sind, muss gewährleistet werden, dass die Einheiten nicht von einer Schneedecke überzogen werden sowie kontinuierlich Frost- und Tauzyklen ausgesetzt sind.
ELECTRICAL SHOCK HAZARD	**DANGER D'ELECTROCUTION**	**ELEKTRISCHER SCHLAG**
Safety requirements mandate that this equipment is not being serviced while energized. Authorized service personnel should reduce the risk of electrical shock by disconnecting all AC and DC power sources from the PV system prior to attempting any maintenance or working on any circuits connected to the SolarMagic powerstring optimizer. The terminals of the SolarMagic powerstring optimizer may still be energized if the strings and array are connected. Turning off the inverter alone will not reduce this risk. Internal capacitors within the inverter can retain their charge for several minutes after	Les consignes de securité ordonnent qu'aucune operation de maintenance ne soit executé sur cet équipement lorsqu'il est sous tension. Le personnel de maintenance autorisé doit réduire les risques d'électrocution en déconnectant toutes les sources d'énergie continues et alternatives avant d'effectuer une operation de maintenance ainsi que d'opérer sur des systèmes connectés a SolarMagic powerstring. Les connecteurs de l'optimisateur de puissance SolarMagic powerstring peuvent être sous tension si les panneaux solaires sont connectés. La coupure de l'ondulateur seule ne réduit pas ce	Sicherheitsanforderungen ordnen an, dass das Gerät nicht gewartet wird während es unter Spannung steht. Autorisiertes Servicepersonal sollte das Risiko eines elektrischen Schocks reduzieren, in dem es alle Gleichstrom und Wechselstromquellen der PV-Anlage abstellt. Dies sollte passieren bevor jegliche Wartung oder Arbeiten an jenen Schaltkreisen erfolgen, die an den SolarMagic Powerstring Optimizer angeschlossen sind. Die Anschlussklemmen des SolarMagic Powerstring Optimizers könnten noch mit Energie geladen sein, wenn der String und das Array daran angeschlossen sind. Nur den

disconnecting all power sources. All strings that feed into a common combiner box that is a part of the array being serviced must be covered by an opaque material to disable the DC source.	risque. Les capacités a l'interieur de l'ondulateur peuvent retenir leur charges pour plusieurs minutes après que toutes les sources d'énergies aient été deconnectés. Tous les panneaux solaires connectés au combinateur doivent être couvertes par un materiau opaque pour éteindre la source d'énergie continue.	Wechselrichter auszustellen wird das Risiko nicht minimieren. Interne Kondensatoren im Wechselrichter können ihre Ladung für mehrere Minuten aufrechterhalten nachdem sie von allen Stromquellen getrennt wurden. Alle Strings, die Strom in eine Combiner Box einspeisen, die Teil eines Arrays ist, welches gewartet wird, muss mit einem undurchsichtigen Material abgedeckt werden, um die Gleichstromquelle abzuschalten.
Isolate each string by removing the fuses for all strings that feed into a combiner box.	Isoler chaque chaine en retirant les fusibles de chaque chaine alimentant un combinateur	Trennen Sie jeden String, in dem Sie die Sicherungen aller Strings herausnehmen, die in einen Stringsammelkasten einspeisen
In EU/EEA installations where the PV systems are floating, both "+" and "-" leads are fused. Remove both fuses to ensure isolation.	Dans les pays de la zone Europeene où les systèmes. photovoltaiques sont flottant, les extremités "+" et "-" sont chacune protegés par un fusible propre. Retirer les deux fusibles pour s'assurer de l'isolation	In Installationen in Europa, wo Photovoltaik -Anlagen in als „Floating Systems" installiert werden (weder der positive noch der negative Pol sind geerdet) entfernen Sie bitte beide Strangsicherungen, die positive und die negative.
WARNING – Risk of electric shock and/or electric energy - high current levels.	**AVERTISSEMENT - Risque d'électrocution et/ou d'énergie electrique- Niveaux élevés de courant.**	**WARNUNG – Risiko eines elektrischen Schlages und/oder hohen elektrischen Strömen.**
To avoid the possibility of a severe electrical shock when disconnecting the Array (+ and -) and the String (+ and -) cables on the Powerstring module, it is advisable to wait 30 seconds before handling the unit. This allows the capacitors in the unit time to discharge to a safe level.	Pour éviter la possibilité d'une forte électrocution lors de la déconnection de tous les cables (+ et -) connectés au module Powerstring. Il est recommandé d'attendre 30 secondes avant de manipuler l'unité. Ce délai pemet au capacités dans l'unité de se décharger a un niveau ne présentant pas de danger.	Um die Möglichkeit eines ernsthaften elektrischen Schocks während des Abklemmens des Arrays (+ und -) und des Strings zu vermeiden, ist es ratsam 30 Sekunden zu warten bevor Sie mit dem Powerstring weiterarbeiten. Das gibt dem Kondensator im Powerstring die notwendige Zeit, um sich bis auf eine ungefährliche Spannungshöhe zu entladen.
Mounting bracket edges can be sharp. Use appropriate protective gear to avoid cuts while handling the brackets during both installation and while transporting assembled units for installation.	Les extremités des supports de fixations peuvent être tranchants. Utiliser des équipement de protection appropriés pour éviter les coupures lors du transport et de l'installation.	Die Kanten des Befestigungsbügels können scharf sein. Bitte tragen Sie Schutzkleidung, um Schnitte während des Bedienens der Klammern zu vermeiden, sowohl zur Zeit der Installation als auch im Zuge des Transports vormontierter Einheiten für die Installation.

Do not use the SolarMagic powerstring optimizer's cables to carry the unit. Excessive force can damage the cable glands.	Ne pas utiliser les cables de l'optimisateur de puissance SolarMagic powerstring pour porter l'unité. Les tensions et forces excessives peuvent endommager les presse-étoupes des cables.	Bitte benutzen Sie nicht die Kabel des Powerstring Optimizers, um diesen zu tragen. Übermäßiger Zug kann die Kabelverschraubung beschädigen.

SolarMagic by National Semiconductor

Part # 4200113483-001A

Printed in Maylaysia