

# General Installation Manual

© 2007 Sanyo Electric Co., Ltd. All Rights Reserved 7/13/07



General Installation Manual for SANYO HIT<sup>®</sup> Double Photovoltaic (PV) Modules. Please read this manual completely before installation or use of modules. This manual applies to the following products: HIP-200DA3, HIP-195DA3, HIP-190DA3, HIP-186DA3, HIP-180DA3

## INTRODUCTION

Thank you for choosing SANYO HIT<sup>®</sup> Double PV modules. With proper operation and maintenance, SANYO modules will provide you with clean, renewable solar electricity for many years. This manual contains important installation, maintenance and safety information. The word "module" as used in this manual refers to one or more PV modules. **Retain this manual for future reference.**

## Disclaimer of Liability

SANYO does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of, or in any way connected with installation, operation, use, or maintenance by using this manual.

SANYO assumes no responsibility for any infringement of patents or other rights of third parties, which may result from use of modules.

No license is granted by implication or under any patent or patent rights. The information in this manual is believed to be reliable, but does not constitute an expressed and/or implied warranty.

SANYO reserves the right to make changes to the product, specifications, or this manual without prior notice.

The return of any modules will not be accepted by SANYO unless prior written authorization has been given by SANYO.

## General Information

The installation of solar modules requires a great degree of skill and should only be performed by qualified licensed professionals, including, without limitation, licensed contractors and electricians.

## WARNING

All instructions should be read and understood before attempting to install, wire, operate, and/or maintain the photovoltaic module. PV modules generate DC electrical energy when exposed to sunlight or other light sources. Contact with electrically active parts of the module such as terminals can result in burns, sparks, and lethal shock whether the module is connected or disconnected.

The shock hazard increases as modules are connected in parallel, producing higher current, and as modules are connected in series, producing higher voltage.

The installer assumes the risk of all personal injury or property damage that might occur during installation and handling of modules.

To avoid injury or damage:

- Cover the entire front and back surface of the PV modules with a dense, opaque material such as a cardboard box.
- Work only in dry conditions, with dry modules and tools.
- Do not stand or step on a module.
- Do not drop a module.
- Do not break the glass surfaces of modules.
- Do not allow children and unauthorized persons near the installation site or storage area of modules.
- Completely ground all modules according to applicable electric codes.
- Do not disassemble the module, or remove any part installed by the manufacturer.
- Do not open the cover of the junction box.
- Wear suitable protection (gloves, clothes, etc.) to prevent direct contact with 30V DC or greater.
- Carry a module by its' frame with two or more people.
- Do not carry a module by its wires or junction box.
- Wear non-slip gloves.
- Do not drop or place heavy items on the surfaces of a module (such as tools).
- Check that all other system components (inverters, wires, racks, balance of system materials, etc.) are mechanically and electrically compatible.
- Do not install the module where flammable gases or vapors are present.
- Never leave a module unsupported or unsecured.
- Do not use or install broken modules.
- Do not artificially concentrate sunlight on a module.
- Do not touch the junction box terminals.
- Do not change the wiring of bypass diodes.

## CAUTIONS

- Use a module for its intended purpose only.
- Do not treat any portion of the module with paint or adhesives, to avoid damage to the module, inoperable conditions, or reducing the module's functionality.
- Careful attention to the design of the PV system and electrical capacity of system components is required (especially the inverter), because this module may generate more than 120% of its' STC rated power ( $P_{max}$ ).
- This additional power depends upon the level of incident light irradiance (albedo) available to the backside of the module, and can be increased or decreased depending upon site characteristics and installation design.

## GENERAL SAFETY

Follow all permission, installation and inspection requirements.

- Before installing modules, contact the appropriate authorities to determine permissions, installation and inspection requirements to follow that apply to your site and installation.
- Electrically ground modules for all systems of any voltage. If not otherwise specified, it is recommended that requirements of the latest National Electrical Code (USA) or Canadian Electric Code (Canada) or other national or international electrical standards be followed.
- Check applicable building codes to ensure that the construction or structure (roof, façade, support, etc.) where the modules are being installed has enough strength.
- For modules mounted on roofs, special construction or structures may be required to help provide proper installation support.
- Both roof construction and module installation design have an effect on the fire resistance of a building. Improper installation may contribute to fire hazards. Additional devices such as ground faults, fuses, and disconnects may be required.
- Do not use modules of different specifications in the same system.
- Check and follow all safety precautions of other system components used.

## UL Listing Information

To satisfy UL requirements, when installing modules, be sure to:

# General Installation Manual

© 2007 Sanyo Electric Co., Ltd. All Rights Reserved 7/13/07



- Use only stranded or solid copper single-conductor type UF cable or USE cable, rated sunlight resistant, for modules and interconnect wiring that is exposed to weather.
- Observe the requirements described in sections labeled **INSTALLTION** and **SPECIFICATIONS**.
- Grounding of the module frame is required. When ground wires greater than 6mm<sup>2</sup> (No.10 AWG) are required, the installer will need to provide suitable terminal connectors.

## **INSTALLATION**

### **General**

Please read this guide completely before installation or use of the modules. This section contains electrical and mechanical specifications needed before use of the PV modules.

- Modules should be firmly fixed in place in a manner suitable to withstand all expected loads, including wind and snow loads.
- The drilling and addition of ground holes to the module is permitted, but should be avoided when possible, to prevent damage to the module. When needed, it is recommended to add additional ground holes to the outer aluminum lip (rail) area of the module. Caution is advised to avoid accidentally drilling, scratching, or penetrating the glass of the module. The position of additional ground holes must be at least 65mm away from frame corners. Do not leave unused or open ground holes in the frame, as they may allow water to enter the frame cavity, which may freeze, expand, and damage the module during cold weather. Fill all unused ground holes.
- Appropriate materials should be used for mounting hardware to prevent the module frame, mounting structure, and hardware itself from corrosion.
- Install modules where they are not shaded by obstacles like buildings and trees. Especially pay attention to avoid partially shading modules by objects during the daytime.

### **Notes on Installation**

- Clearance between the roof surface and module frame is required to allow cooling air to circulate around the back of the module. This also allows any condensation or moisture to dissipate. Install modules so that air can circulate between the roof and the module.
- Leave 4 inches of clearance between the roof and the module frame.

- SANYO recommends the installation method and mounting profile shown in Figure 1.
- HIT Double modules are bifacial and produce power from both surfaces of the module at the same time.
- Treat the backside of the module the same as the front side and avoid objects that directly shade the solar cells. To optimize power output:
  1. Elevate modules above a surface as much as possible, to allow reflected and ambient light beneath the modules.
  2. Place modules over light-colored surfaces.
  3. Keep the backside of the module open to allow reflected and ambient light to enter the solar cells.
  4. Position support structures and rails along the edges of a module, or between modules, and do not allow rails to shade a module's back surface.

### **Operating Conditions**

SANYO requires that modules be operated within the following Operating Conditions:

- Terrestrial applications only—no outer space or Special Conditions (see below).
- The ambient temperature must be within -20°C (-4°F) to 45°C (113°F). The temperature limits are defined as the monthly average low and high of the installation site.
- The wind pressure load of the installation site should be less than 2,400N/m<sup>2</sup> (50PSF).

### **Special Conditions**

Modules must not be installed nor operated in areas where:

- Salt damage is above normal or excessive.
- Frequent or large hail, ice, and/or heavy snow occur.
- Sand and dust damage is excessive.
- Air pollution, chemically active vapors, acid rain, soot, etc. are above normal.

## **SPECIFICATIONS**

### **Notes on Specifications**

- Rated electrical characteristics are within -5% to +10% of the values measured at Standard Test Conditions (STC). Irradiance of 1000W/m<sup>2</sup>, 25°C cell temperature, and solar spectral irradiance per IEC 60904-3.
- Under normal conditions, a photovoltaic module may experience conditions that produce more current

and/or voltage than reported at Standard Test Conditions. Accordingly, the values of Isc and Voc marked on UL listed modules should be multiplied by a factor of 1.25 when determining voltage ratings, conductor capacities, fuse sizes, and size of controls connected to the module output. **USA: Refer to Section 690-7 of the U.S. National Electrical Code for an additional multiplying factor of 1.25, which may be applicable.**

- The current output for the modules shown in the Specifications is measured at Standard Test Conditions. These conditions may not be frequently observed in actual practice.

## **WIRING**

### **General**

- All wiring should be done in accordance with applicable electrical codes.
- Wiring methods should be in accordance with the NEC in the USA or the CEC in Canada.
- A qualified, licensed professional should do all wiring.
- Wiring should be protected to help ensure personal safety and to prevent its damage.
- All modules connected in series should be of the same model number and/or type.
- Do not connect modules in parallel without using a connection box.

### **Module Wiring**

- The number of modules that can be wired in series is recommended at seven (7) or fewer. If connecting eight (8) modules in series, check local temperature conditions and follow the National Electric Code (690.7) to ensure compliance with maximum voltage limitations. Also, be sure to calculate and account for the bifacial effect of the modules.
- In temperatures of -20°C (-4°F) and very strong sunshine (1kW/m<sup>2</sup>) such as a very clear sky on a winter morning, the system voltage may exceed 600V if 8 modules are connected in series. This situation is rare, however, it may cause the inverter to stop functioning, or enter a self-protective mode.
- SANYO solar modules are not designed for "off-grid" or battery charging systems, because of their operating voltage. Therefore, it is not recommended to use them to charge batteries.
- These modules contain factory installed bypass diodes. If these

# General Installation Manual

© 2007 Sanyo Electric Co., Ltd. All Rights Reserved 7/13/07



modules are incorrectly connected to each other, the bypass diodes, cable, or junction box may be damaged.

## Array Wiring

- The term “array” is used to describe the assembly of several modules on a support structure with associated wiring.
- Use copper wire that is sunlight resistant and is insulated to withstand the maximum possible system open circuit voltage.
- Check local codes for requirements.

## Mechanical Loading

- Modules should be mounted at four symmetrical quarter points within the shaded areas shown in Figure 3. This method offers a maximum loading of 2,400N/m<sup>2</sup> (50PSF) in a static state on the module surface.

## Earth Ground Wiring

- Grounding should be carried out by attachment to the module or array frame, to avoid the hazards of electric shock or fire.
- The array frame shall be grounded in accordance with NEC Article 250 (USA) or CEC in Canada.
- Each framed module has a hole in the shorter side frame rail, to connect a grounding conductor to the module’s metal frame (see Figure 2).

## Module Terminations

- A junction box as a terminal enclosure is equipped for electrical connections on SANYO modules.
- Modules are equipped with MC™ plugs as a terminal enclosure. Use these MC™ plugs for electrical connections.

## Junction Box and Terminals

- Modules equipped with one junction box contain terminals for both positive and negative polarity, and bypass diodes.
- One terminal is dedicated to each polarity, with the polarity symbols engraved onto the body of the junction box.

## Conduit

- For applications where wire conduits are used, follow the applicable codes for outdoor installation of wires in conduits.
- Verify that all fittings are properly installed to protect wires against damage and prevent moisture intrusion.

## DIODES

### Bypass Diodes

- When the modules in series strings are shaded partially, it may cause reverse voltage across cells or modules, because the current from other cells in the same series is forced to flow through the shaded area. This may cause undesirable heating to occur.
- The use of a diode to bypass the shaded area can minimize both heating and array current reduction.
- All SANYO modules are equipped with factory installed bypass diodes. The factory-installed diodes provide proper circuit protection for the systems within the specified system voltage, so that you do not need any other additional bypass diodes.

## MAINTENANCE

- Some maintenance is recommended to maintain optimal output performance of the HIT Double solar modules.
- When the module’s front or back surface becomes dirty, power output is reduced.

- It is recommended to clean the front surface of the module with water and a soft cloth or sponge, twice or more per year. It is recommended to clean the back surface as needed.
- A mild non-abrasive detergent may be applied for persistent dirt.
- It is also recommended to inspect the electrical and mechanical connections annually.
- If you need electrical or mechanical inspection or maintenance, it is recommended to have a licensed authorized professional carry out the inspection or maintenance to avoid the hazards of electric shock or injury.

For further information, please visit [www.us.sanyo.com](http://www.us.sanyo.com) or contact your SANYO Authorized Representative.

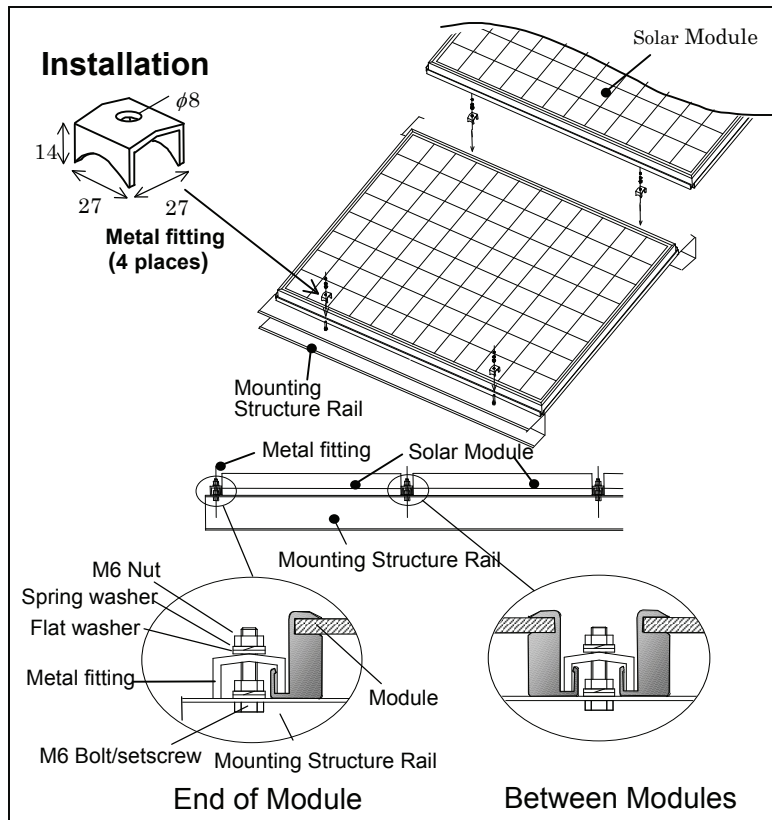


Figure 1. Installation

# General Installation Manual

© 2007 Sanyo Electric Co., Ltd. All Rights Reserved 7/13/07



## SPECIFICATIONS

### HIT Double Bifacial Models—HIP-xxxDA3

#### Electrical Specification

Model	HIP-200DA3	HIP-195DA3	HIP-190DA3	HIP-186DA3	HIP-180DA3
Cell Number in Series [Pieces]	96	96	96	96	96
Maximum Power (Pmax) [W]	200	195	190	186	180
Maximum Power Voltage (Vmp) [V]	56.2	55.8	55.3	54.8	54.4
Maximum Power Current (Imp) [A]	3.56	3.50	3.44	3.40	3.31
Open Circuit Voltage (Voc) [V]	68.8	68.7	68.1	67.5	67
Short Circuit Current (Isc) [A]	3.75	3.73	3.70	3.68	3.62
Cell Type	HIT* (hybrid of a-Si and mono c-Si)				
Maximum System Voltage [V]	600				
Factory Installed Bypass Diode	Yes				

#### Mechanical Specification

Length, mm (inches)	1351 (54)
Width, mm (inches)	898 (36)
Depth (frame), mm (inches)	60 (2.4)
Depth (including j-box), mm (inches)	60 (2.4)
Weight [kg]	23

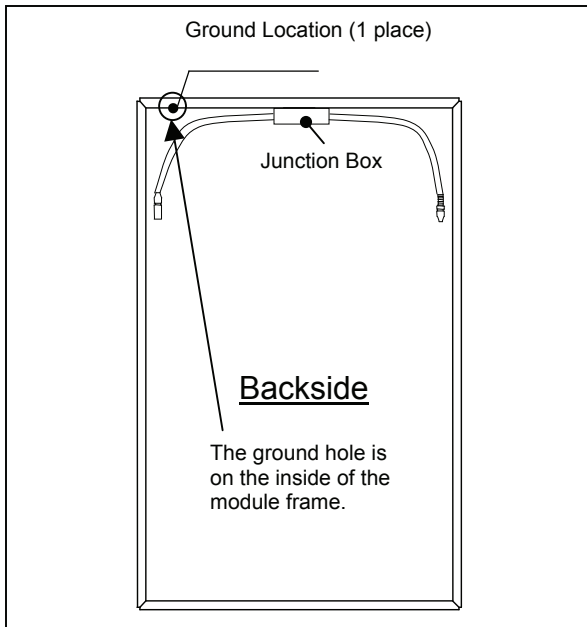


Figure 2. Module Ground Position

